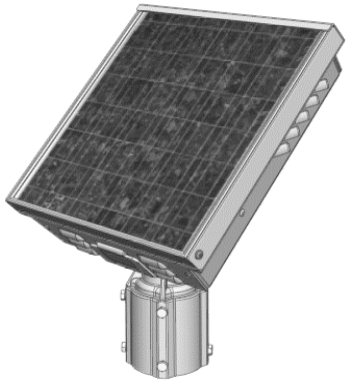
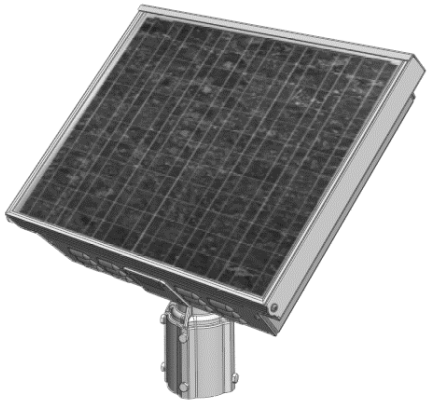
E / F Series
TRAFFIC BEACON USER MANUAL

For the R920-E/F, R820-E/F, R829-E/F, and R247-E/F flashing beacons





E Series

F Series

84323_MANUAL_TRA_E-F-Series_RevB

Table of Contents

1.0 Warnings and Precautions

The following symbols indicate important safety warnings and precautions throughout this manual:

WARNING indicates that serious bodily harm or death may result from failure to adhere to the precautions.

CAUTION indicates that damage to equipment may result if the instructions are not followed.

NOTE suggests optimal conditions and provides additional information.

1.1 Warranty Disclaimer

This manual will familiarize you with the features, operation standards, and installation of Carmanah's E and F Series flashing beacons. Failure to comply with the use, storage, maintenance, installation or placement instructions detailed in this manual could void the warranty.

1.2 Standards

Perform all installation, wiring, grounding and maintenance in conformance with local building and electrical codes. Adherence to the National Electrical Code (NEC) is mandatory to comply with any certification markings. Non-adherence to code may void the warranty.

1.3 Safety and Usage Precautions

Batteries are shipped fully charged. Use extreme caution when handling the batteries as they can generate hazardous short-circuit currents. Remove all jewelry (bracelets, metal-strap watches, etc.) before handling the batteries.

Solar panels produce DC electricity when exposed to light and can therefore produce an electrical shock or burn. To render solar panels inoperative, remove them from sunlight or fully cover their front surface with an opaque material.

Before lifting any heavy or bulky equipment, ensure the load is secured so moving parts do not shift, and that it can be lifted as far as needed without back strain or loss of grip. Installation may require more than one person.

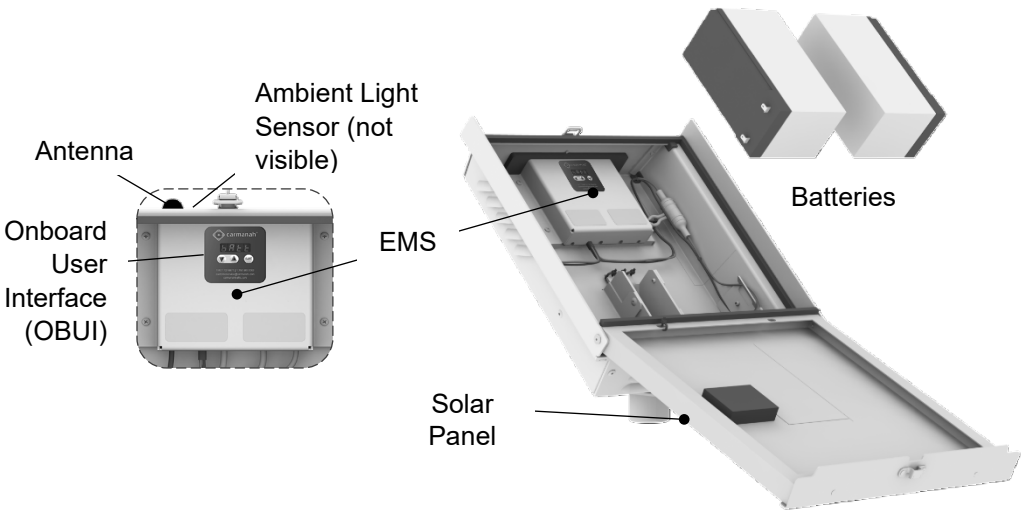
Ensure the equipment is not powered during installation and wiring of the system.

Recheck all completed wiring for proper polarity prior to energizing the system.

Changes or modifications to Carmanah equipment not expressly approved by Carmanah could void both the user's authority to operate the equipment and the warranty.

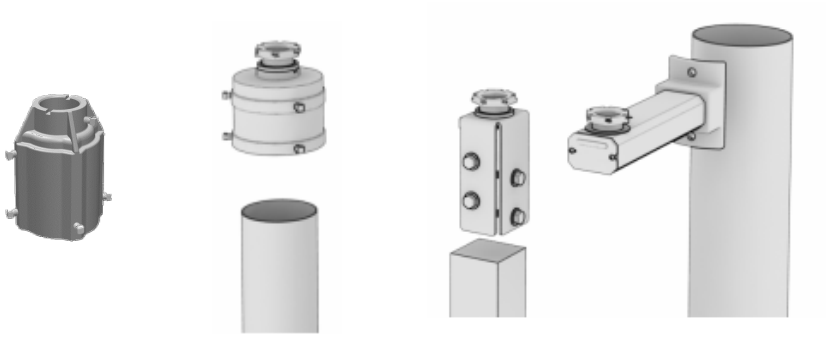
All Carmanah traffic products use a constant-current LED output circuit. Not all traffic beacons are compatible with this output. Please contact Carmanah for additional information and guidance when adding or replacing beacons or other hardware.

1.4 System Components

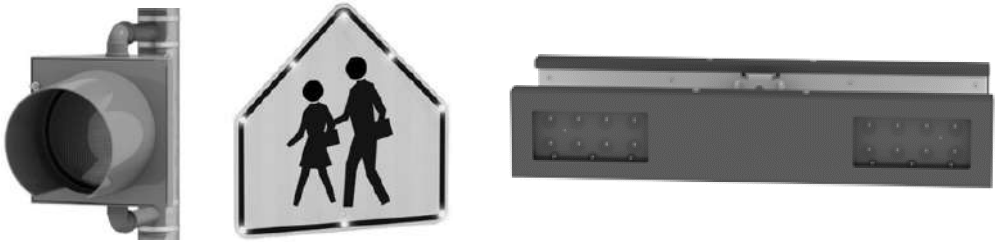


Solar Engine

(E Series shown)



Mounting Adapters



RRFB Light Bars, Circular Beacons, LED Enhanced Signs

Activation Equipment (push buttons, time switches, sensors, etc.)

2.0 Introduction

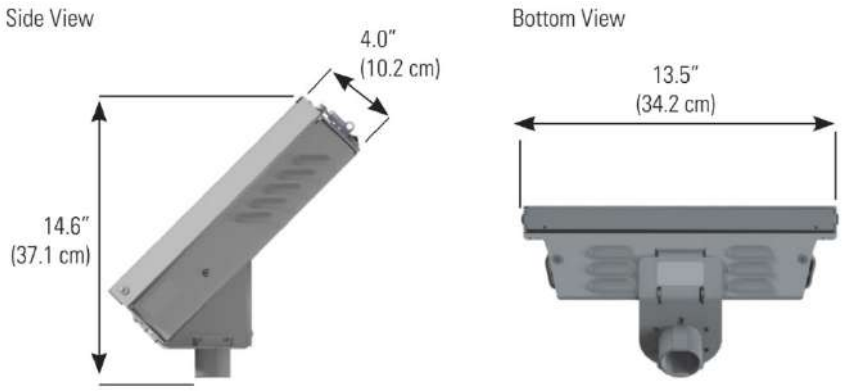
2.1 About the E and F Series

The Carmanah E and F Series products consist of the following models:

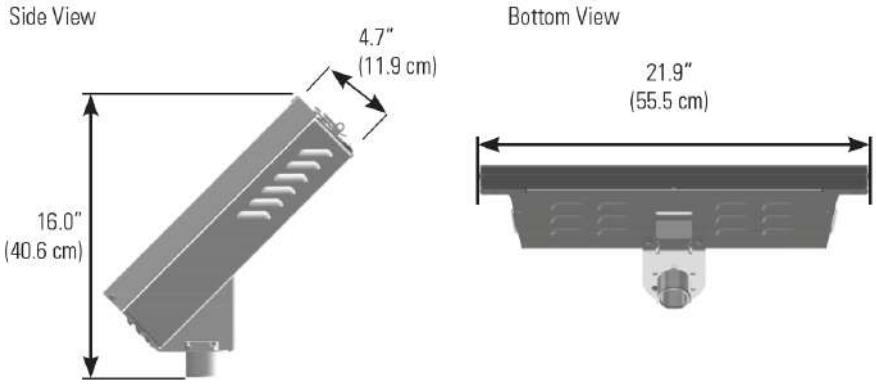
E Series Models	F Series Models	Applications	LED type(s)	Radio Communication
R920-E	R920-F	Pedestrian crosswalks	RRFB or LED Enhanced Signs	Standard
R820-E	R820-F	Pedestrian crosswalks	Circular beacons or LED signs	Standard
R829-E	R829-F	School zones, calendar-based	Circular beacons or LED signs	Optional
R247-E	R247-F	Continuous 24-7 operation	Circular beacons or LED signs	N/A

The E Series models all share a common compact solar engine, while the F Series models share a common, larger solar engine with a more powerful solar panel and higher-capacity batteries. The F Series can also accommodate third-party devices within its larger solar engine. While all E and F Series products share the same user interface on the Energy Management System (EMS) controller, different models and configurations may differ in behavior, types of fixture, fixture harnesses, wireless operation, and other aspects. Contact Carmanah if you would like to repurpose a system from its original model and configuration. Each system will be described in full later in this user manual.

E Series Solar Engine Dimensions



F Series Solar Engine Dimensions



2.2 Ambient Brightness Sensor

The EMS in an E or F Series is equipped with an ambient brightness sensor on its circuit board. Through a combination of a light pipe attached to the circuit board and a window on the top of the solar engine, the E or F Series can detect ambient light levels outside the product. The E or F Series uses that information to determine whether it is day or night, and the amount of AAA (Ambient Auto Adjust) to apply (if enabled). Keep the ambient brightness sensor clean and clear of debris to ensure accurate light measurements.

2.3 Radio Communication

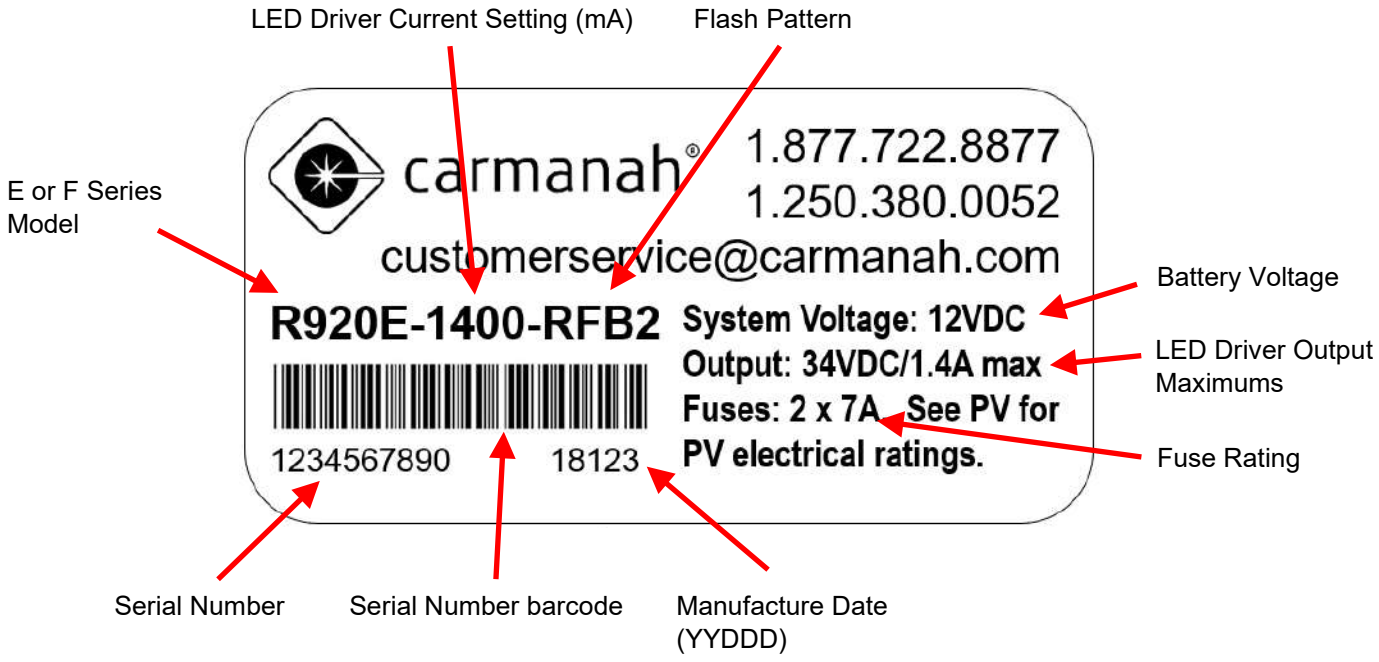
Radio communication between products is standard in R820-E/F and R920-E/F systems and is an option in R829-E/F systems. In addition to the E and F Series, Carmanah also manufactures larger, cabinet-based G Series versions of the R920, R820, R829, and R247 products. Wireless communication works seamlessly between products regardless of whether they are E, F, or G Series. R820-E/F, R920-E/F and SC315-G systems will also activate each other when a pedestrian pushes the push button.

The radio modules use 2.4GHz DSSS (Direct Sequence Spread Spectrum) with an AES128 encrypted signal and have been tested with clear line of sight (with no nearby interference or reflected signals) to 1,000 feet (305 meters). Performance is reduced if clean line of sight is not possible.

The E and F Series products use a low-profile antenna that does not require any special orientation or adjustment and is resistant to vandalism.

2.4 Label Explanation

The information appearing on E and F Series identification labels is described below:



2.5 R920-E and R920-F: Pedestrian Crosswalk with RRFB Light Bars

Overview

The R920-E/F solar LED Rectangular Rapid Flashing Beacon (RRFB) products are ideal for uncontrolled pedestrian-activated crosswalk applications. Multiple R920-E/F units can be combined to create a complete crosswalk set. Each R920-E/F is radio-controlled, and each synchronizes flashing with the other R820-E/Fs, R920-E/Fs and SC315-Gs in the group. The system will flash for a pre-set duration (field adjustable) upon activation of the push button. Spread-spectrum wireless communications activates the light bars across the street or in advance of the crossing. A typical installation consists of two pairs of light bars, with each pair mounted on poles at opposite ends of the crosswalk. Wireless communication between units means that R920-E/Fs require no trenching of cables across the roadway.

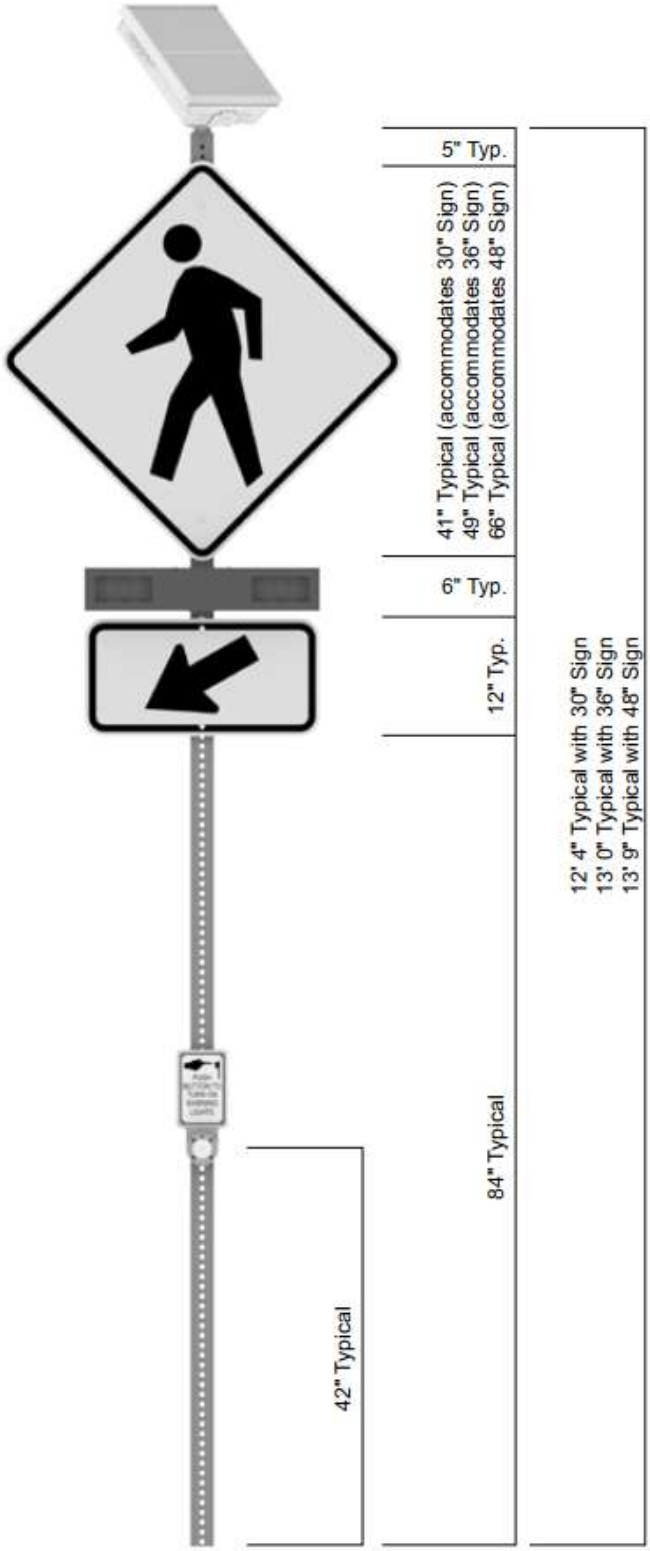
Details on RRFB light bars can be found in Section 2.9 and Section 4.1.

As an alternative to light bars, R920-E/F systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.11 and Section 4.3.

Typical R920-E/F Configurations

		
R920-E with Single Light Bar and Push Button (uni-directional)	R920-E with Dual Light Bar and Push Button (bi-directional)	R920-E Advance Warning with single Light Bar and No Push Button (uni-directional)

Typical R920 Configurations, cont'd



2.6 R820-E and R820-F: Pedestrian Crosswalk with Circular Beacons

Overview

Multiple R820-E/F units can be combined to create a complete crosswalk set. Each R820-E/F is radio-controlled, and each synchronizes flashing with the other R820-E/Fs, R920-E/Fs and SC315-Gs in the group. The system will flash for a pre-set duration (field adjustable) upon activation of the push button. Wireless communication activates the beacons across the street or in advance of the crossing. A typical installation consists of two pairs of flashing circular beacons, with each pair mounted on poles at opposite ends of the crosswalk. Wireless communication between units means that R820-E/Fs require no trenching of cables across the roadway.

R820-E/Fs can also be wirelessly controlled by an R829 master controller. The R820-E/Fs and R829-E/Fs operate together based on the schedule programmed into the R829's internal calendar.

Details on circular beacons can be found in Section 2.10 and Section 4.2.

As an alternative to circular beacons, R820 systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.11 and Section 4.3.

Typical R820 Configuration

2.7 R829-E and R829-F: School Zone Flashing Beacon

Overview

The R829-E/F School Zone Flashing Beacon systems operate on a programmable calendar used to set the days and times when the beacon(s) will flash. There are four ways that an R829-E/F system can follow a calendar schedule:

1) A non-wireless R829-E/F can operate on its own, automatically flashing based on the schedule programmed into its internal calendar.
2) A non-wireless R829-E/F can also be turned on and off through a hard-wired switch. This switching function can be provided by an override box, a third-part time switch, or both.
3) A wireless R829-E/F can operate as the master controller in a group of wireless Carmanah E, F, or G Series traffic products
4) Other Carmanah E, F, or G Series products respond to commands from a wireless R829-E/F/G master controller system and operate according to the master's calendar schedule.

Details on circular beacons can be found in Section 2.10 and Section 4.2.

As an alternative to circular beacons, R829-E/F systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.11 and Section 4.3.

NOTE

E Series products can also operate with an externally mounted time switch, while F Series products feature optional time switch kits that allow various third-party products to be mounted within the solar engine. See Section 2.12 and Section 5.0 for details.

Typical R829-E/F Configuration

Internal Calendar (Standard on R829-E and R829-F, optional on other systems)

The R829-E/F is equipped with an internal calendar that is programmed via USB to automatically activate and deactivate school zone flashers on a user-defined schedule of up to 512 days. The calendar is programmed using an intuitive Microsoft Windows-based graphical user interface. Once the program is established for one system, the settings can be uploaded to other R829-E/F units onsite with a laptop PC. A USB cable is part of the calendar programming kit and is provided coiled up inside the R829-E/F solar engine.

Eight different day schedule types can be defined (including OFF all day). Each day type can be configured for up to eight ON periods of adjustable duration. Refer to the support document “R829 School Zone Calendar Configuration Instructions” for additional information and complete programming instructions.

NOTE

Ensure you obtain the latest copy of the calendar software (Version 1.2.0 as of November 2018). Older versions of the calendar software will not operate correctly with the newest version of traffic firmware. Minimum Windows 7 operating system is required (32-bit or 64-bit). The software can be obtained by contacting Carmanah Traffic Sales. The software is also included on a USB memory stick in the **calendar software programming** kit, which also includes a 32-foot active USB extension harness which can be used to program a system’s calendar from a vehicle.

NOTE

See Section 5.1 for more information about related accessory **calendar upload / override switch kit**.

2.8 R247-E and R247-F: 24-Hour Flashing Beacon

Overview

The R247-E/F Flashing Beacon flashes continuously 24 hours per day 7 days per week and is used for a wide range of warning applications such as stop lights and low bridges.

The R247-E/F can be turned off when required using the optional Override Box kit, see Section 5.1.

Details on circular beacons can be found in Section 2.10 and Section 4.2.

As an alternative to circular beacons, R247 systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.11 and Section 4.3.

Typical R247-E/F Configuration

R247-E with Integrated Signal Head

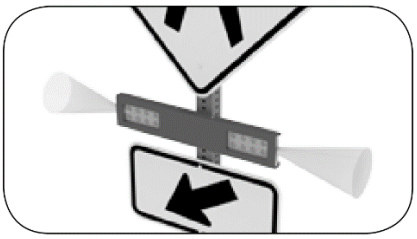
2.9 RRFB Light Bars: Overview

E Series and F Series products support up to four RRFB light bar fixtures. The FHWA Interim Approval 21 March 20th, 2018 defines the flash pattern of the RRFB and specifies the J595 standard for photometrics. Each light bar consists of a left and right module, with each module having eight (8) LEDs connected in series. In addition, each end of a light bar has a single "confirmation" LED that pedestrians can see from across the street and know with confidence that the light bars are flashing in response to their pressing of the pedestrian push button. Opaque adhesive covers are included to optionally cover the confirmation LED if desired.

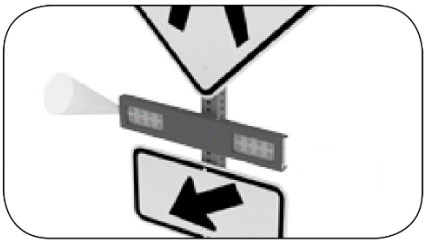
See Section 4.1 for information on installing and aiming light bars.

NOTE When programming intensity for **ITE-compliant RRFBs**, minimum current settings must be applied, (see Flash Pattern and Intensity in Section 6.1). Contact Carmanah for guidance.

Dual Confirmation Light – No Opaque Cover



Single Confirmation Light – Using Opaque Cover



2.10 Circular Beacons: Overview

E Series and F Series products support up to four circular beacons. The beacons are industry-standard equipment and comply with MUTCD and ITE flash patterns, color, beam shape, and intensity. Signal heads for integrated mounting of the solar engine are specially reinforced for strength. Beacon wiring is provided with a convenient terminal strip inside the signal head(s) for easy wire connection.

NOTE LED loads driven from one EMS must have the same operating voltage. Do not mix different sizes, colors, or types of LED loads connected to the same EMS. Use a dual-EMS G Series system to drive two different LED load types.

NOTE When an odd number of circular beacons is used, a unison flash pattern must be selected to achieve consistent brightness between beacons.

NOTE All Carmanah traffic products use a constant-current LED output circuit. Not all traffic beacons are compatible with this output. Please contact Carmanah for additional information and guidance when adding or replacing beacons or other hardware.

NOTE When programming intensity for **ITE-compliant circular beacons**, minimum current settings must be applied (see Flash Pattern and Intensity in Section 6.1). Contact Carmanah for guidance.

NOTE Increasing the Intensity setting can affect the solar energy balance of the system. Contact Carmanah to for more information about sustainable settings in your location

See Section 4.2 for information on installing circular beacons.

2.11 LED Enhanced Signs: Overview

In addition to RRFB light bars and circular beacons, E Series and F Series products can power LED Enhanced Signs. LED Enhanced Signs are available in a variety of formats including stop and pedestrian crosswalk signage. LED Enhanced Signs are electrically connected and driven directly by the EMS like other traffic fixtures. LED Enhanced Signs have the same degree of intensity and flash pattern control as other fixtures.

NOTE LED loads driven from one EMS must have the same operating voltage. Do not mix different sizes, colors, or types of LED loads connected to the same EMS. Use a dual-EMS G Series system to drive two different LED loads.

NOTE When an odd number of LED loads is used, a unison flash pattern must be selected to achieve consistent brightness between loads.

NOTE All Carmanah traffic products use a constant-current LED output circuit. Not all traffic beacons are compatible with this output. Please contact Carmanah for additional information and guidance when adding or replacing beacons or other hardware.

See Section 4.3 for information on installing LED Enhanced Signs.

2.12 Third-Party Devices: Overview

A third-party device (3PD) is non-Carmanah equipment that interacts with the system in one or more ways:

- The E/F Series provides a status signal to 3PD (e.g. Digital Output signals when E/F Series fixtures are flashing, allowing 3PD equipment such as overhead lighting to activate)
- The 3PD provides control signal to E/F Series (e.g. time switch, passive pedestrian detection, water level detectors)
- The E/F Series only provides power to 3PD (e.g. radio/communications)

Installation of a 3PD not suited for the available power may cause permanent battery damage by over-discharging them. Contact Carmanah for guidance on the use of 3PDs.

The F Series is available with several optional 3PD kits which allow the installation of the 3PD within the F Series solar engine:

- The F Series **RTC time switch kit** option allows the installation of an RTC time switch and includes a mounting plate, switch mounting hardware, and a pre-wired harness with a connector that plugs into the time switch. (Time switch not included.) For installation information see Section 5.2, and Section 5.4.
- The F Series **Applied Information modem kit** option allows the installation of an AI time switch and cellular modem. It includes mounting hardware, an antenna, and a prewired, connectorized harness to interface between the F Series and the AI time switch and modem. (AI time switch/modem not included.) For installation information see Section 5.3 and Section 5.4. This kit can also be ordered with the AI time switch/model pre-installed, contact Carmanah for details.
- The F Series **Relay kit** option comes with a 10A DC relay prewired to the F Series EMS. For installation information see Section 5.5.
- The F Series **Polara XAV controller kit** option includes the Polara XAV controller prewired for the Polara XAV2E audible push button. Push button station harness length options are 16ft, 36ft, or 75ft. For installation information see Section 5.6.
- The F Series **Campbell Guardian audible push button kit** includes a prewired harness for a Campbell Guardian audible push button. Push button station harness length options are 16ft, 36ft, or 75ft. For installation and more information see Section 5.7.

Contact Carmanah for additional support in connecting and configuring the above the devices or other third-party devices.

3.0 Solar Engine Installation

NOTE

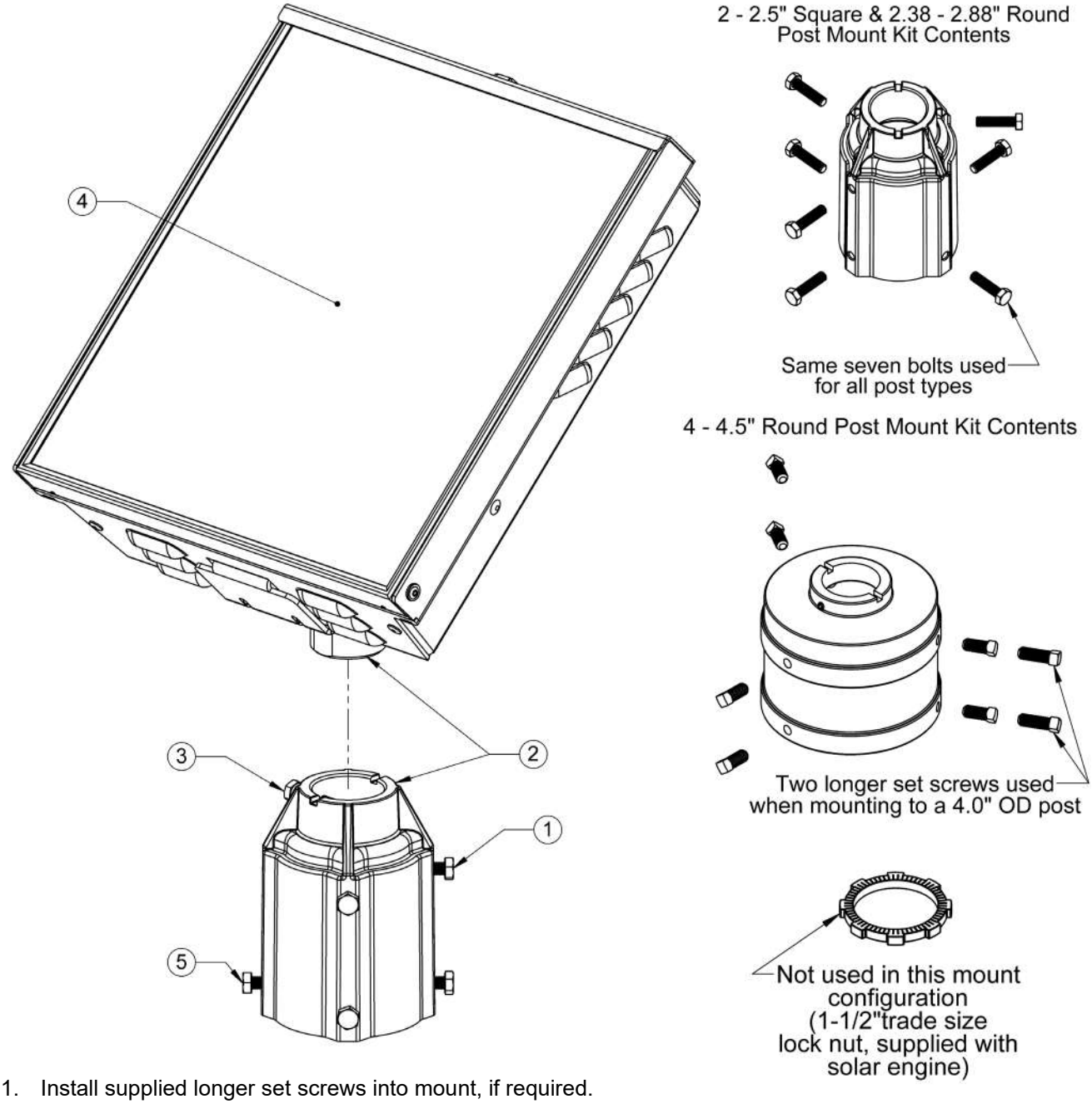
Ensure the installation location has an unobstructed view of the sun's path. Obstructions such as trees or buildings could significantly reduce the amount of sunlight on the solar panel. Shade analysis is highly recommended to understand how shadows will change according to the time of year. Contact Carmanah for a detailed examination and solar simulations for your site.

3.1 Tools and Materials Required

The following tools and materials may be required to mount your Carmanah flashing beacon depending on the model and configuration:

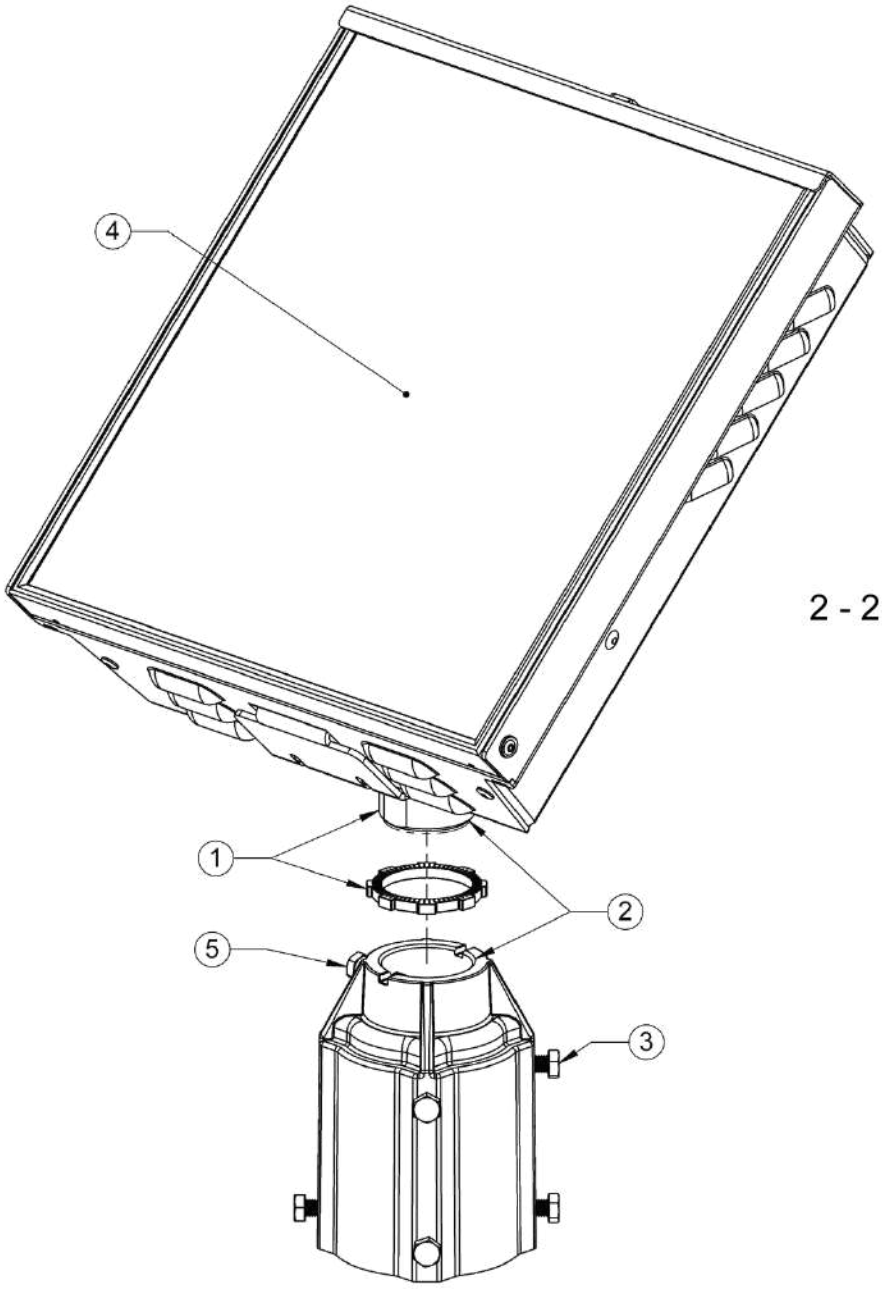
1. Imperial socket set 2. Crescent wrench 3. Tap set 4. Imperial Allen-Wrench set 5. Fish tape 6. Level 7. Compass or pre-determined equatorial direction	8. Drill and drill bits 9. Fine-tip felt marker 10. Multi-bit screwdriver 11. Pelco Roger-Wrench (some configurations) 12. Hook spanner wrench, 1-1/2" trade size (some configurations) 13. Ladder or lift device 14. Lithium grease

1.2 Solar Engine Mounting – Round Post

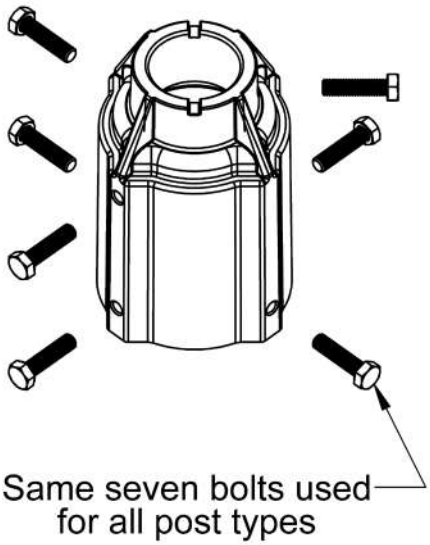


1. Install supplied longer set screws into mount, if required.
2. Thread mount onto solar engine and tighten.
3. Tighten set screw or clamp bolt at top of mount, if present.
4. Install on post and orient solar engine to face south (for northern hemisphere locations).
5. Tighten set screws or bolts onto post.

1.3 Solar Engine Mounting – Square Post

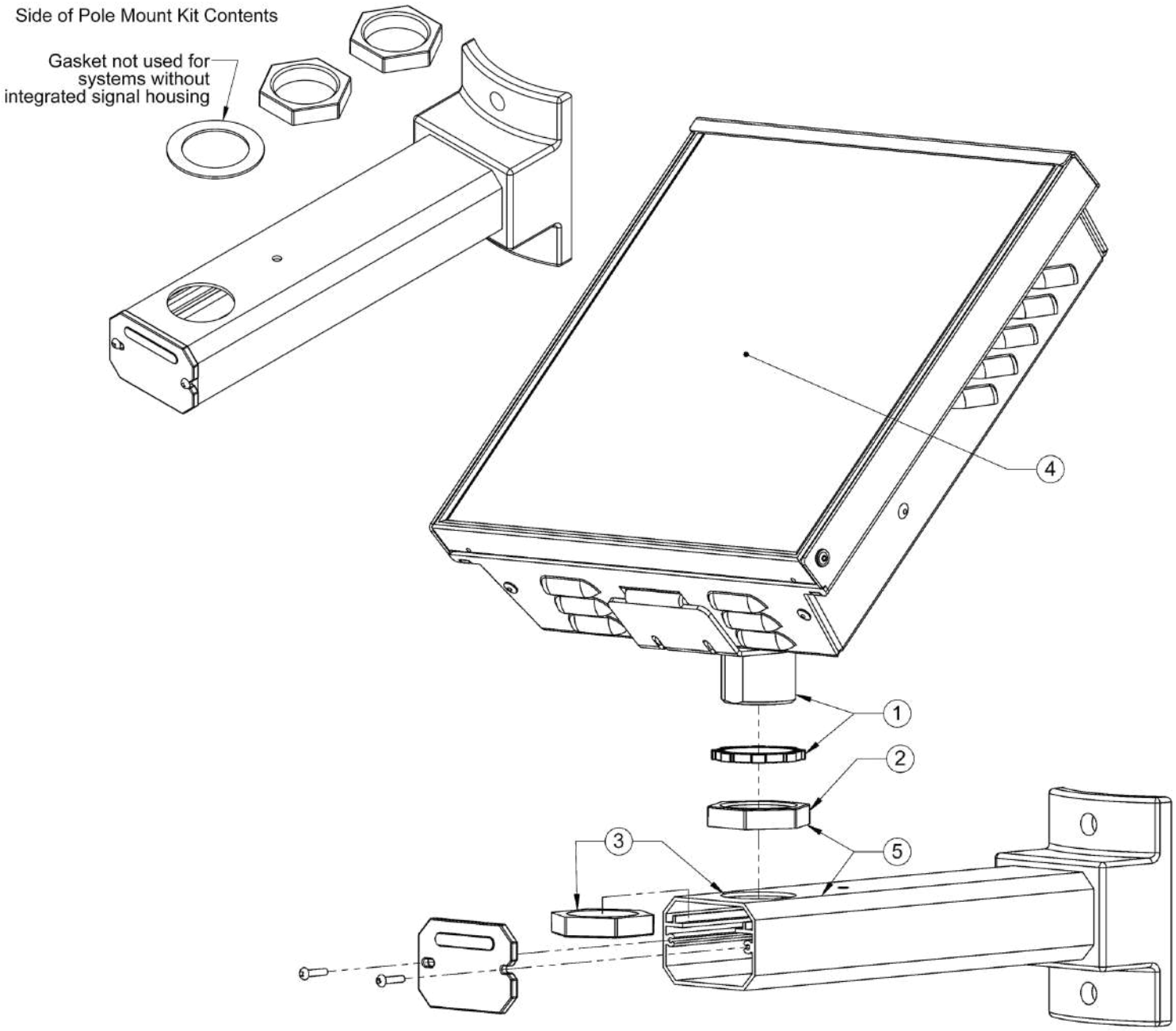


2 - 2.5" Square & 2.38 - 2.88" Round Post Mount Kit Contents



1. Obtain lock nut included with solar engine. Fully tighten against bottom of solar engine.
2. Thread solar engine fully onto mount.
3. Install mount onto square post and tighten bolts onto post.
4. Loosen less than one turn until solar engine faces south (for northern hemisphere locations).
5. Tighten top bolt on mount.

1.4 Solar Engine Mounting – Side of Post



1. Obtain lock nut included with solar engine. Fully tighten against bottom of solar engine.
2. Thread hex nut onto bottom of solar engine.
3. Insert other hex nut into channel inside post mount so it lines up with hole in top of mount.
4. Thread solar engine all the way onto nut in channel. Loosen less than one turn until solar engine faces south (for northern hemisphere locations).
5. Tighten top hex nut down against mount.

1.5 Reinforced Signal Head for Integrated Solar Engine / Signal Head

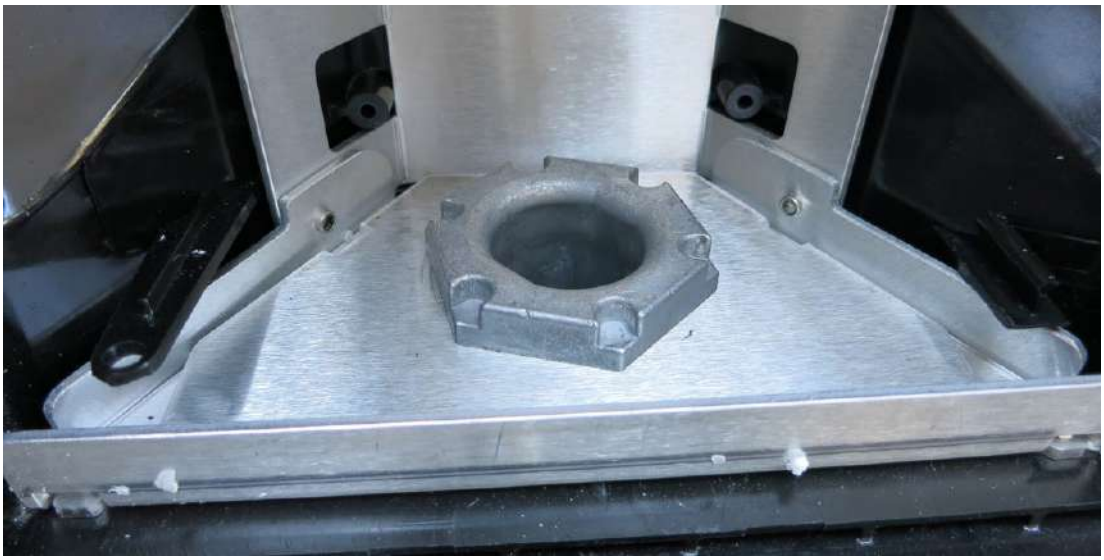
The following sections describe mounting options in which the solar engine is attached directly to the top of a reinforced signal head. This option is available for both 8” and 12” signal heads for E Series, and 12” only for F Series.

NOTE For systems with multiple circular beacons, ensure the solar engine gets mounted to the beacon assembly with the internal reinforcement bracket(s). The following two diagrams show how a reinforced signal head can be identified by its stiffening plate(s).

8" Reinforced Signal Head

12" Reinforced Signal Head and Load Spreader Plate

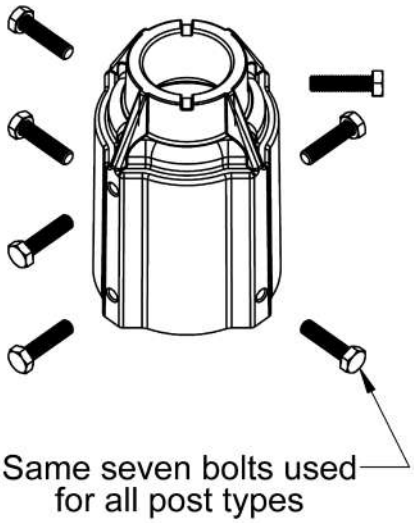
12” reinforced signal heads also include a load spreader plate which provides additional strength. To install the load spreader plate, place it in the bottom of the 12” signal head prior to installing the hex nipple.



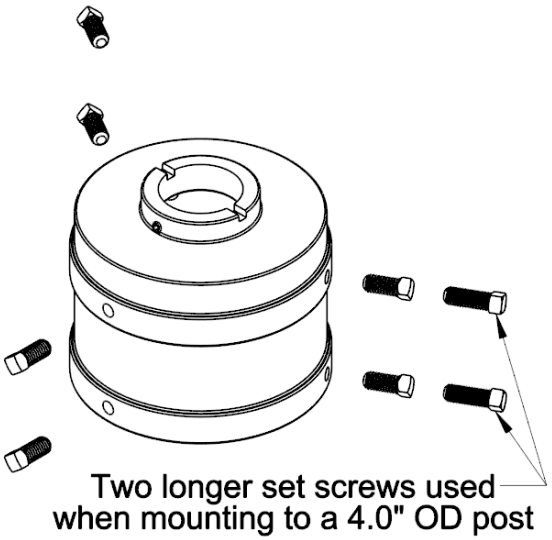
Assembled Hex Nipple and Load Spreader at base of Reinforced 12” Signal Head

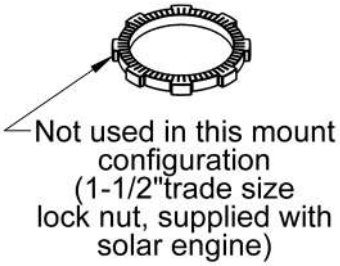
1.6 Integrated Solar Engine with Signal Head – Round / Square Post

2 - 2.5" Square & 2.38 - 2.88" Round Post Mount Kit Contents

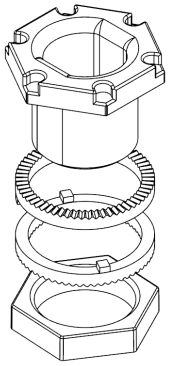


4 - 4.5" Round Post Mount Kit Contents

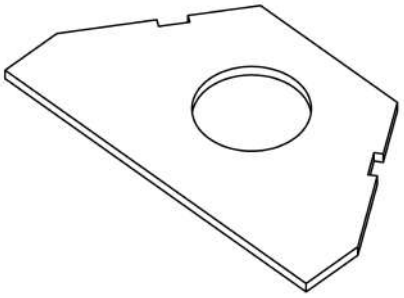




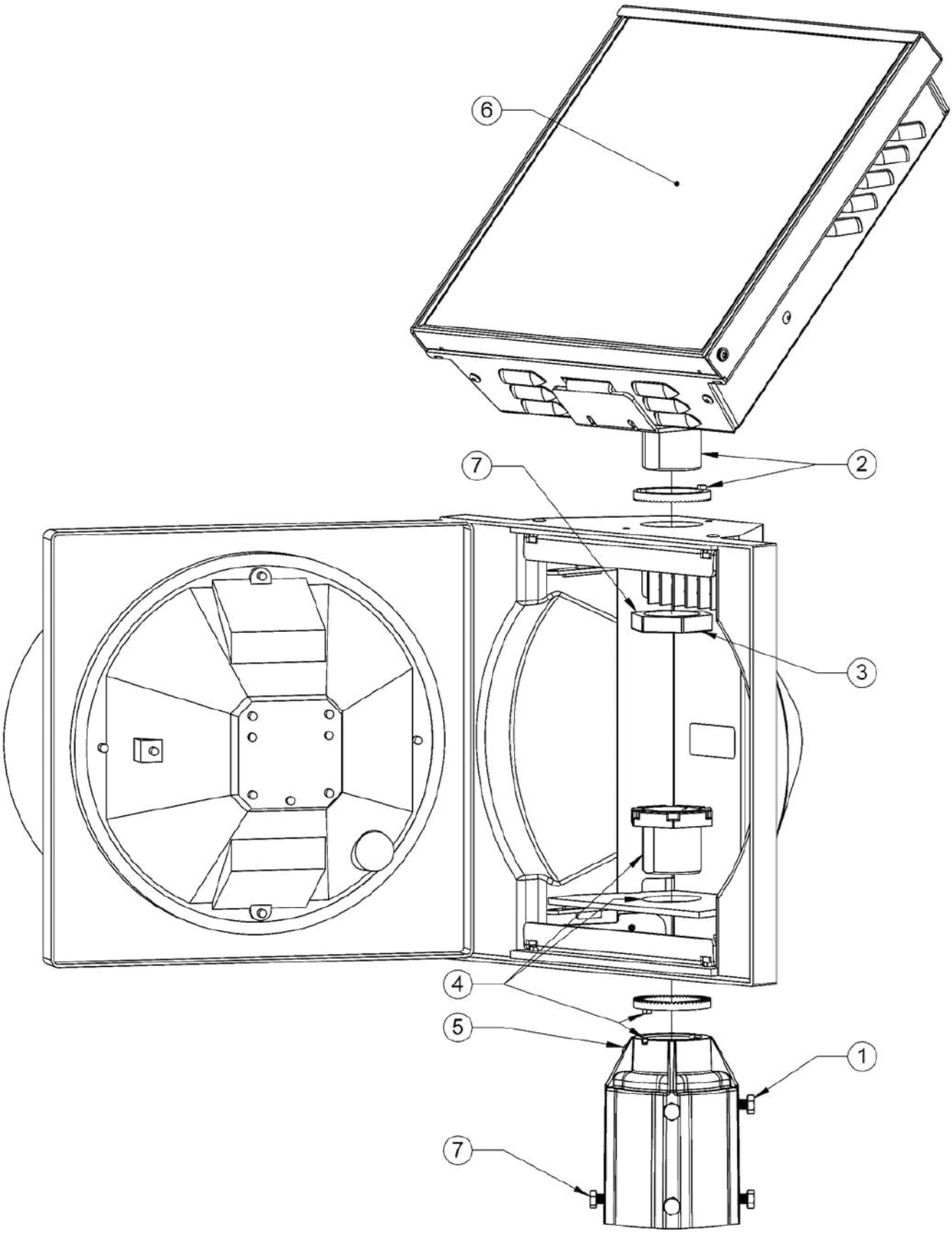
Hardware Provided with Signal Housing



Load Spreader Plate (12" signal housings only)



1. Install supplied longer set screws into mount, if required (4.0” OD posts only, see mount contents above).
2. Align serrated lock ring so that tabs fit into slots in bottom of solar engine.
3. Obtain signal housing with reinforcement bracket(s). Install solar engine through top signal housing hole and into hex nut.
4. Install nipple through load spreader plate (12" signal housings only), bottom signal housing hole, serrated lock ring, and tighten onto mount after aligning lock ring tabs with mount slots.
5. Tighten screw/bolt at top of mount, if present.
6. Install on post, adjust the rotation of the signal head if required and adjust the rotation of the solar engine to face south (for northern hemisphere locations).
7. Tighten mount screws onto post, then tighten hex nut.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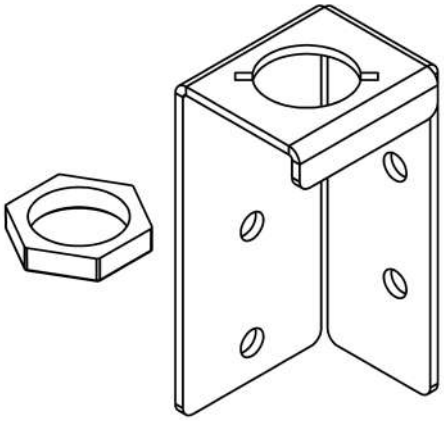
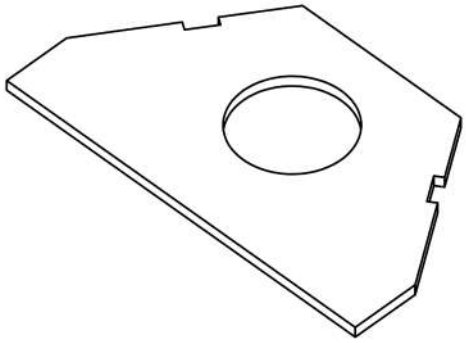
1.7 Integrated Solar Engine with Signal Head – Square Wood Post

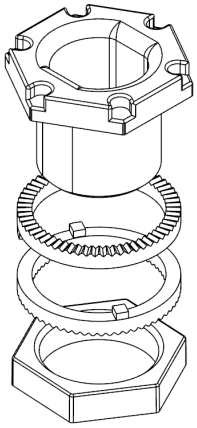
Integrated Signal Square Wood Post Mount Kit Contents

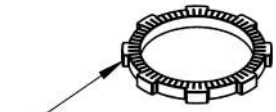


Load Spreader Plate (12" signal housings only)



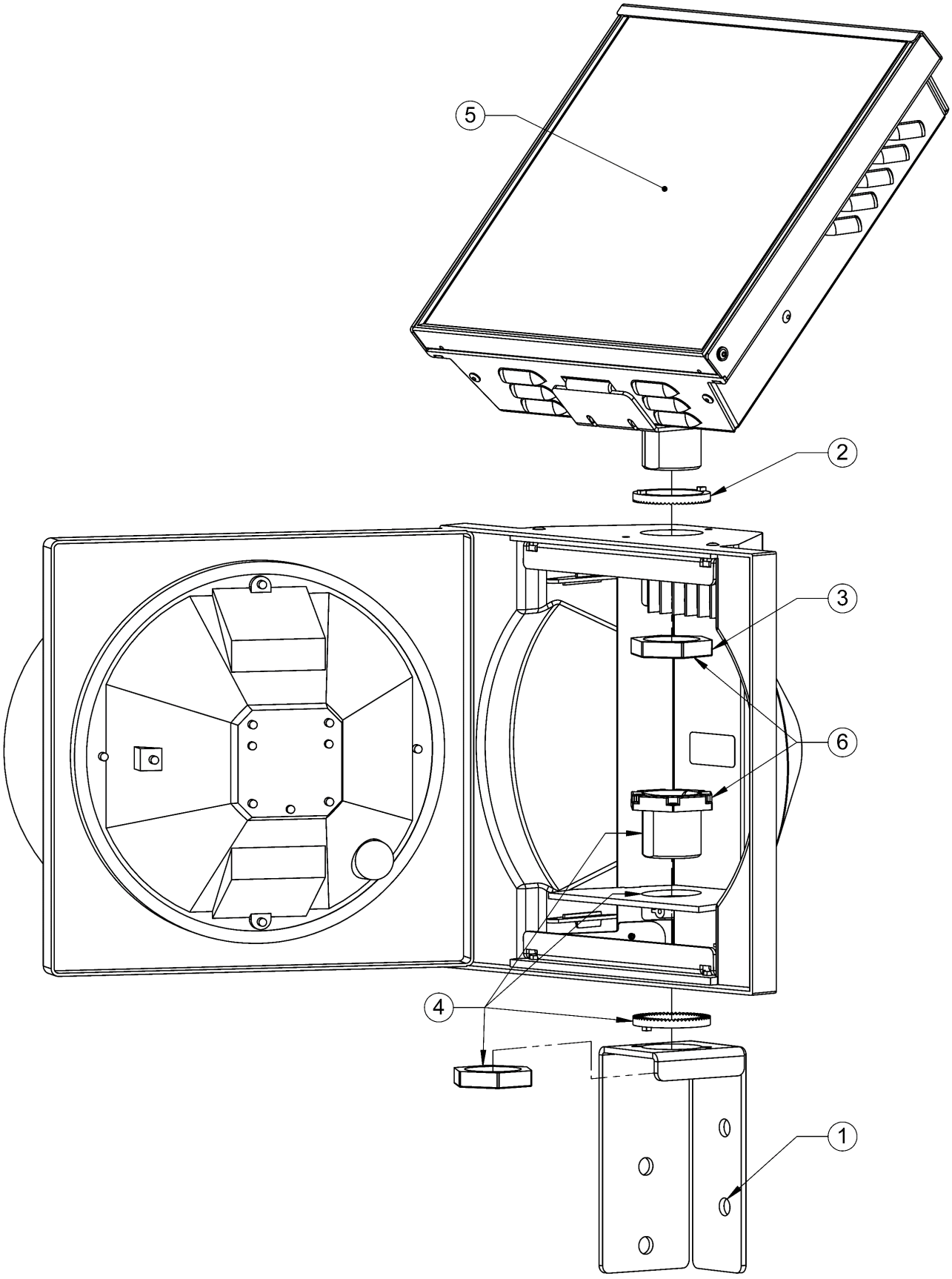
Hardware Provided with Signal Housing



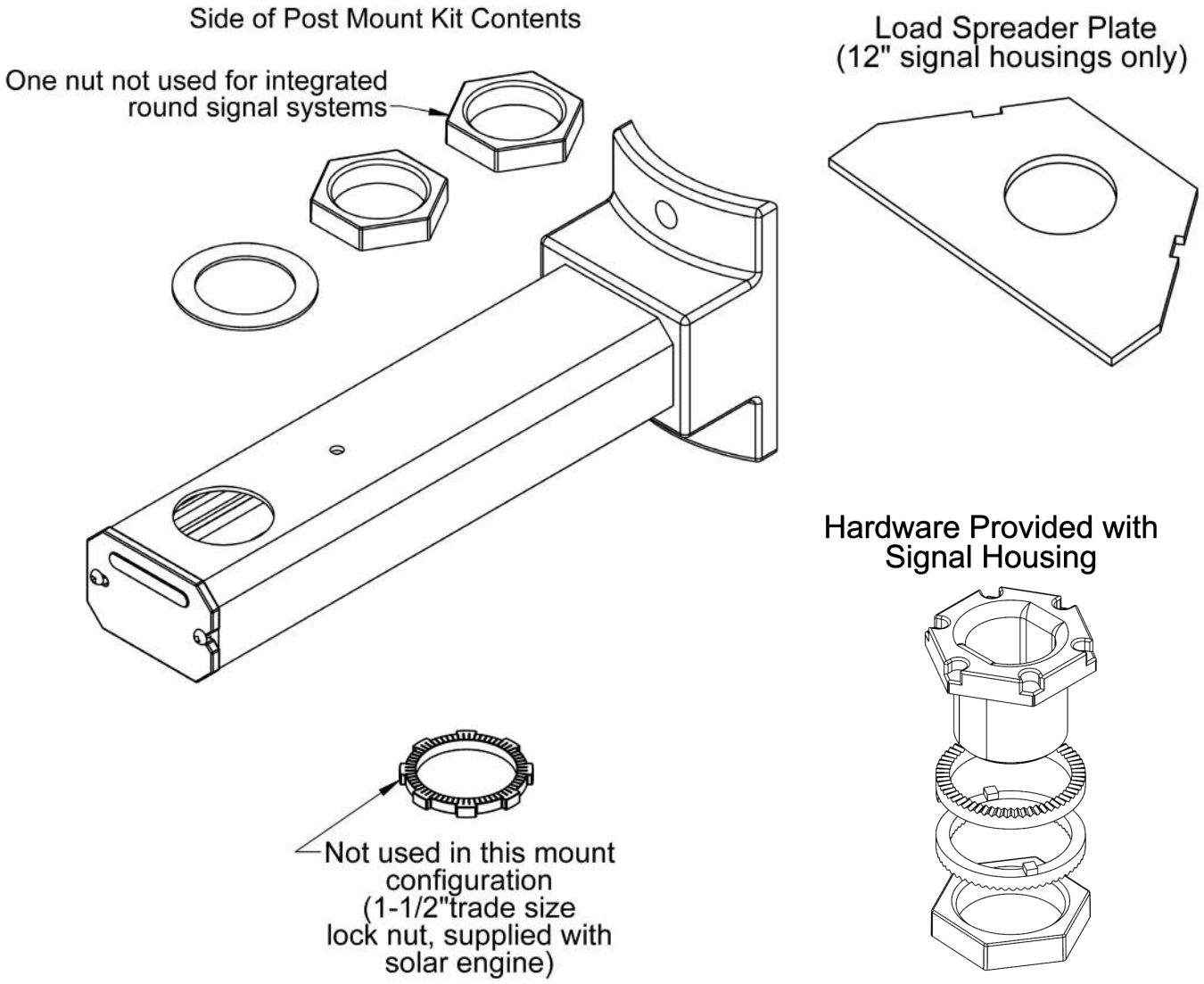


Not used in this mount configuration (1-1/2"trade size lock nut, supplied with solar engine)

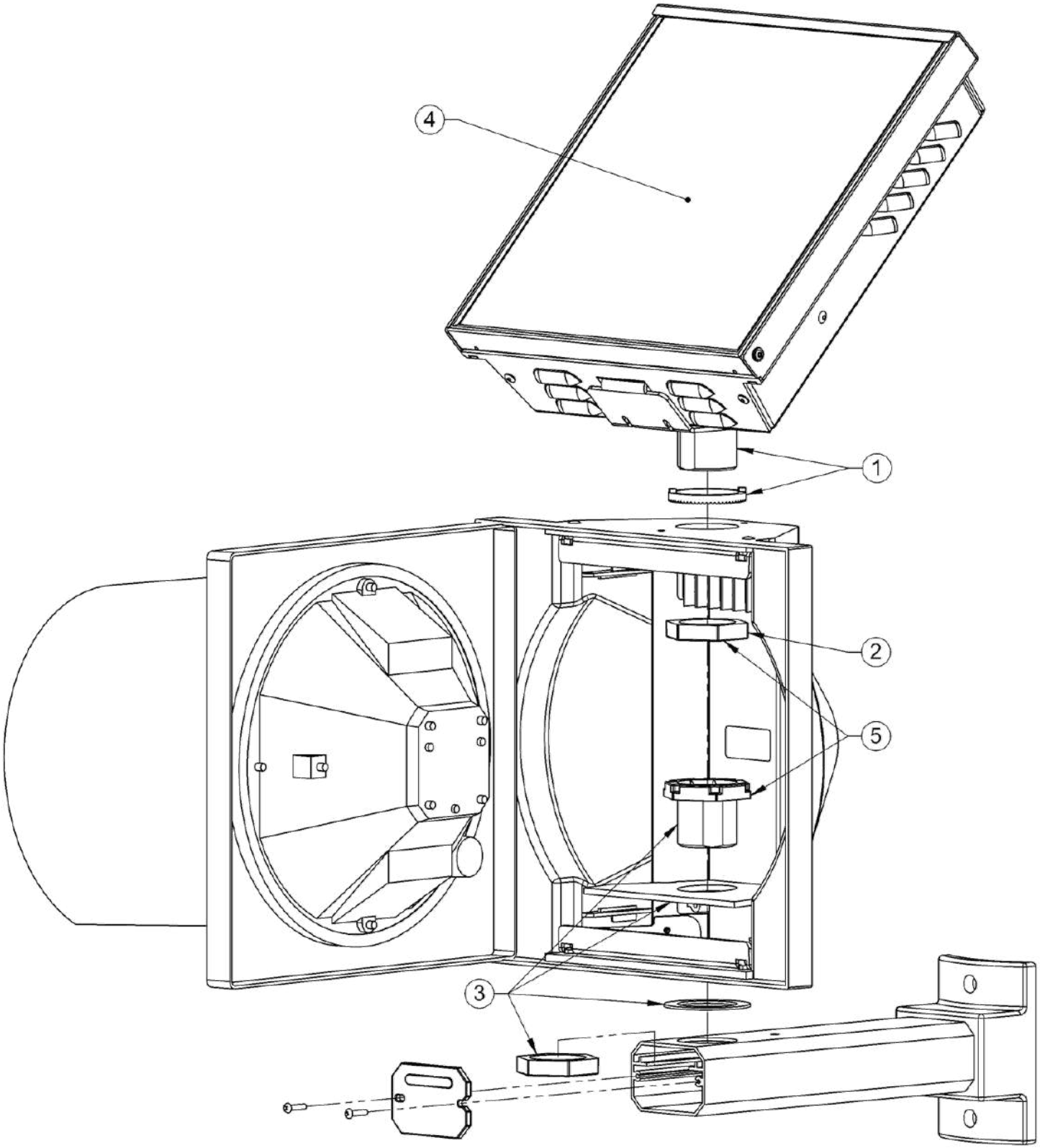
1. Install mount onto post using suitable fasteners (not supplied).
2. Align serrated lock ring so that tabs fit into slots in bottom of solar engine.
3. Obtain signal housing with reinforcement bracket(s). Install solar engine through top signal housing hole and into hex nut.
4. Install nipple through load spreader plate (12" signal housings only), bottom signal housing hole, serrated lock ring, mount hole, and hex nut as shown.
5. Adjust direction of signal if required, and orient solar engine to face south (for northern hemisphere locations).
6. Tighten nipple and top hex nut.


5
2
3
6
4
1

1.8 Integrated Solar Engine with Signal Head – Side of Post



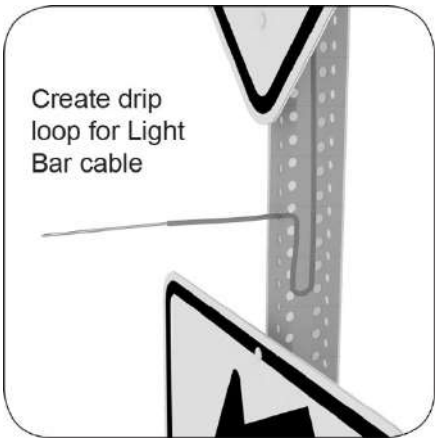
1. Align serrated lock ring so that tabs fit into slots in bottom of solar engine.
2. Obtain signal housing with reinforcement bracket(s). Install solar engine through top signal housing hole and into hex nut.
3. Install nipple with set screw through load spreader plate (12" signal housings only), bottom signal housing hole, gasket, mount hole, and hex nut as shown.
4. Adjust direction of the signal if required, and orient solar engine to face south (for northern hemisphere locations).
5. Tighten nipple and top hex nut.


4
1
2
5
3

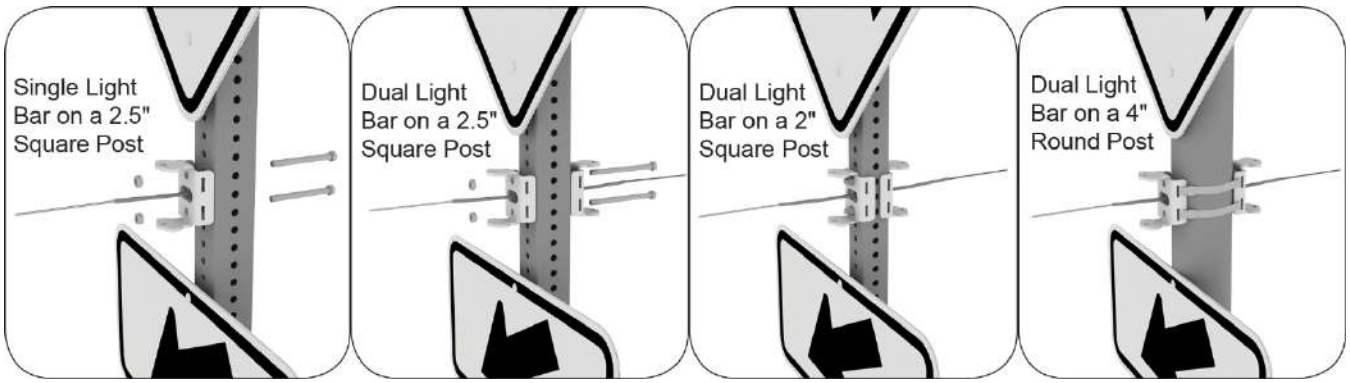
4.0 Fixture, Push Button, & Battery Installation

4.1 RRFB Light Bar Installation

1. Feed the light bar cable(s) through the post, creating a drip loop.

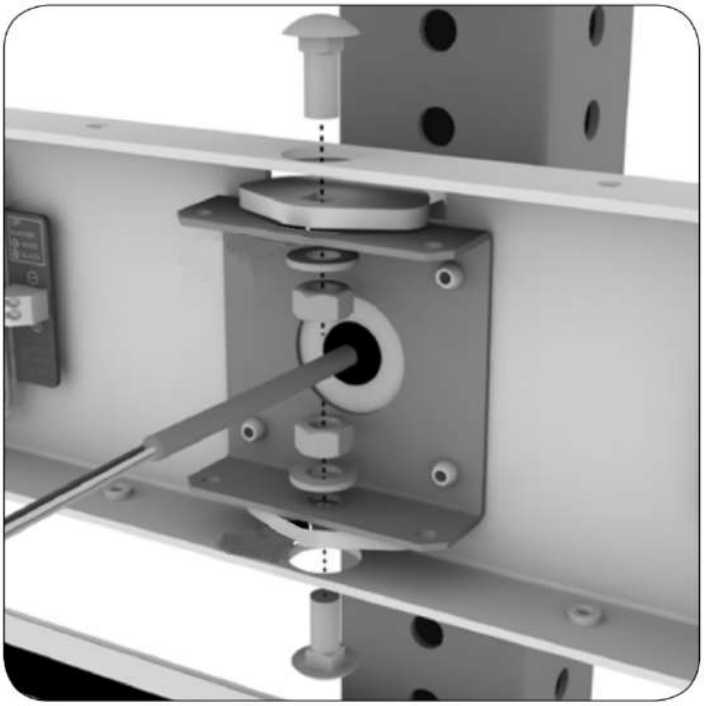


2. Mount the light bar universal bracket(s), feeding the light bar cable through the center of the bracket. Bolts and banding not supplied.

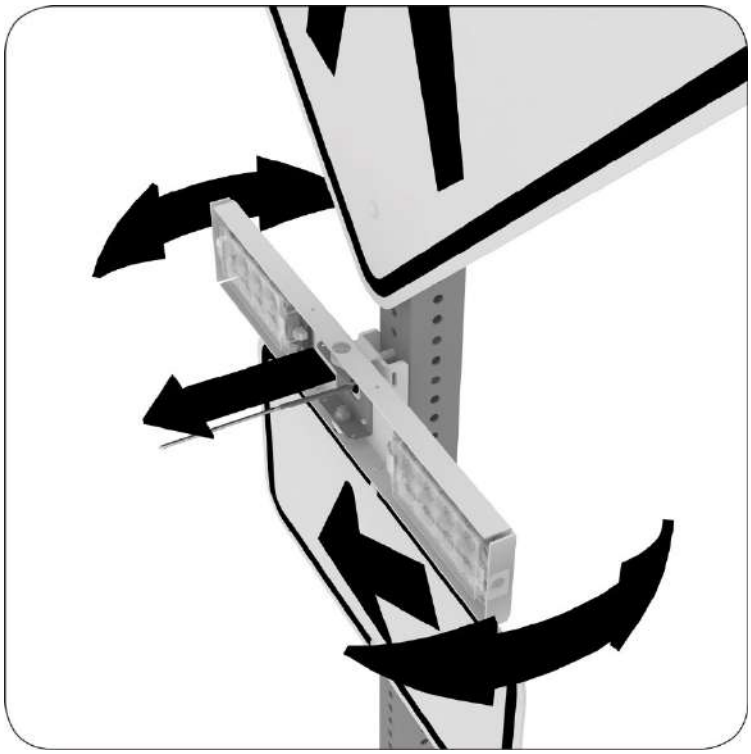


3. Mount the light bar(s) onto the universal bracket(s), feeding the light bar cable through the housing.

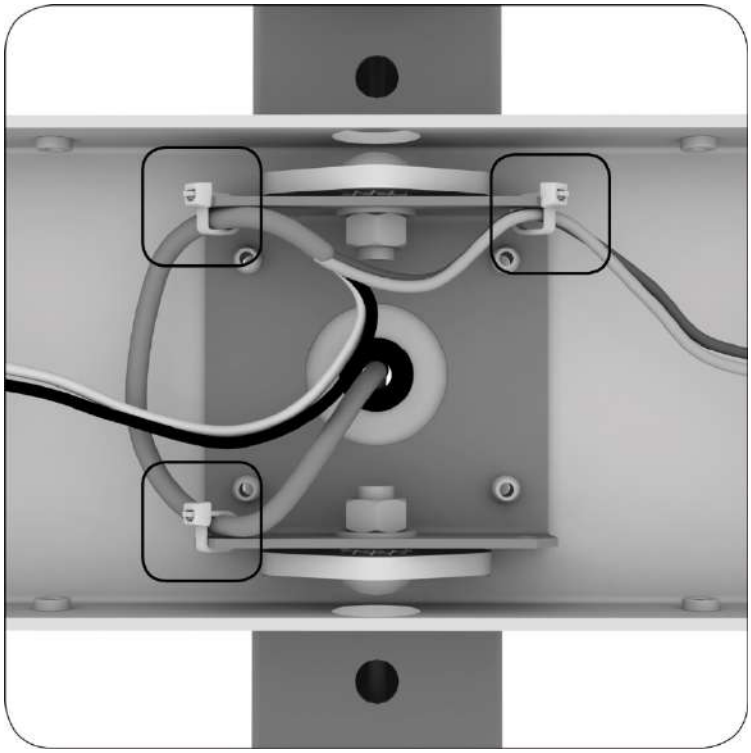
4. Bolt the light bar to the universal bracket as shown below.



5. Align the light bar toward the traffic as required. The angle can be adjusted +/- 3 degrees. Tighten mounting nuts to lock in place.



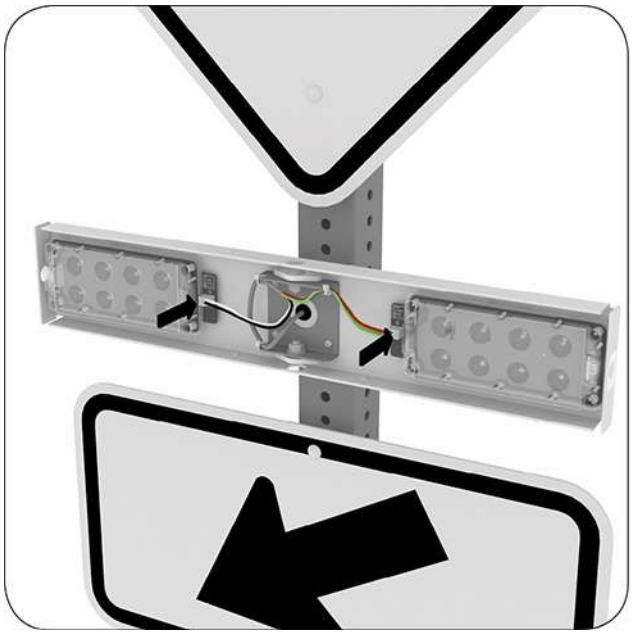
6. Secure the light bar cable using supplied cable ties as shown.

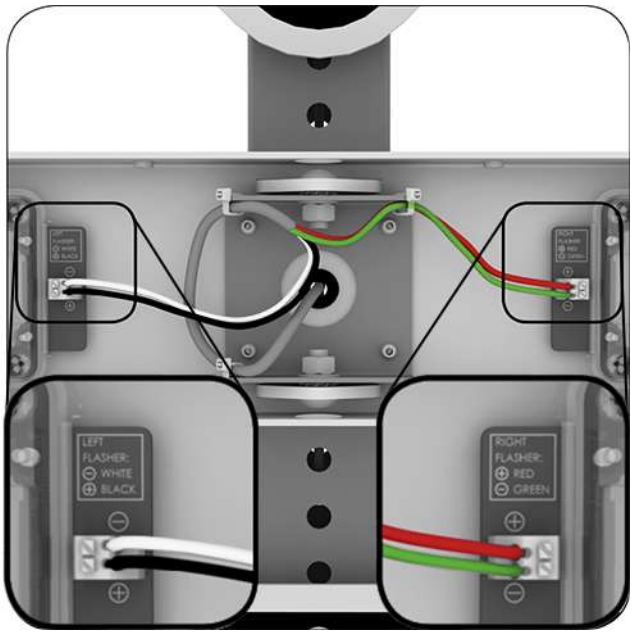


7. Push the light bar wires into the light bar connectors, following the color scheme as noted on the LEDs.

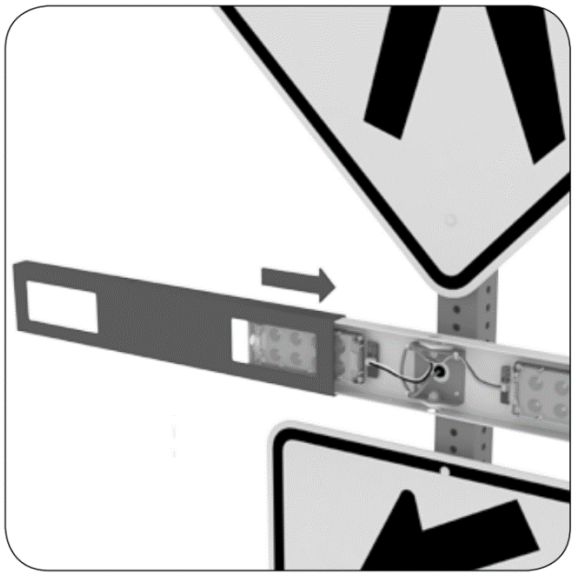
NOTE

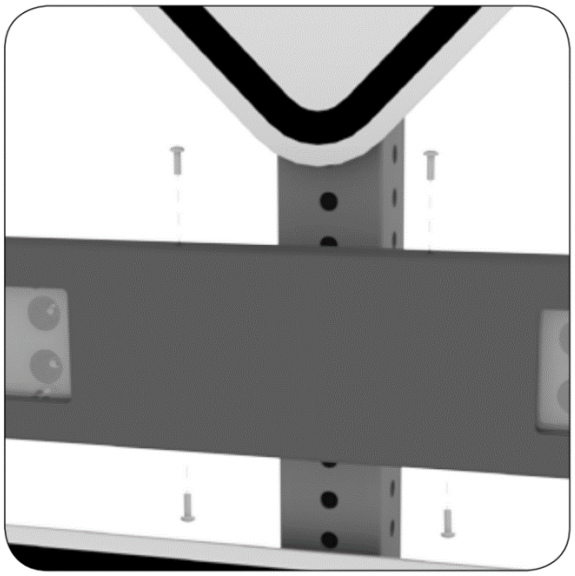
Mount the light bar so that the black and white wires are on the left side. This ensures that the RRFB flash pattern, **which must start on the left**, is compliant with the FHWA requirements.





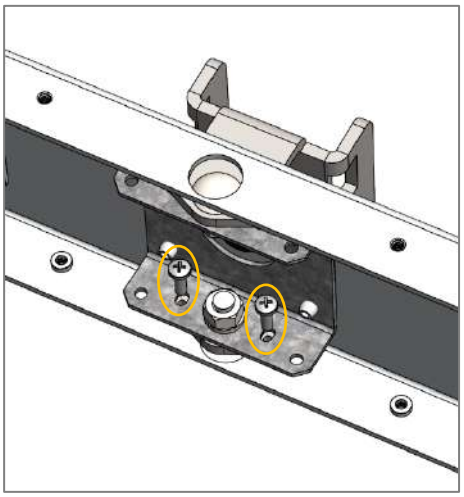
8. Slide on light bar cover and secure with the four provided #8 screws.





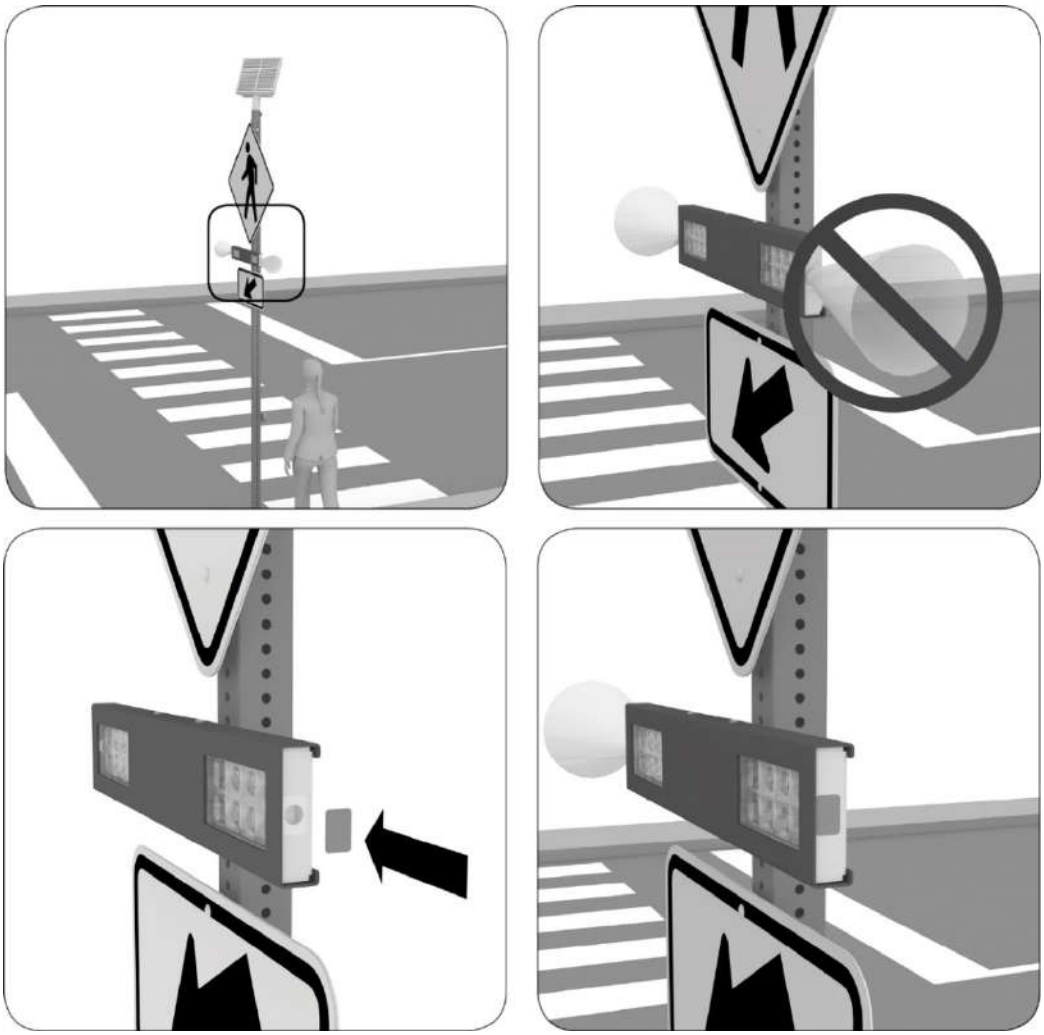
NOTE

Two additional #8 screws are provided to prevent vandals from twisting the light bar grossly out of alignment. These anti-vandal screws are installed through slots in the inner bracket into tapped holes in the outer bracket as shown below.



Locations of Anti-Vandal Screws

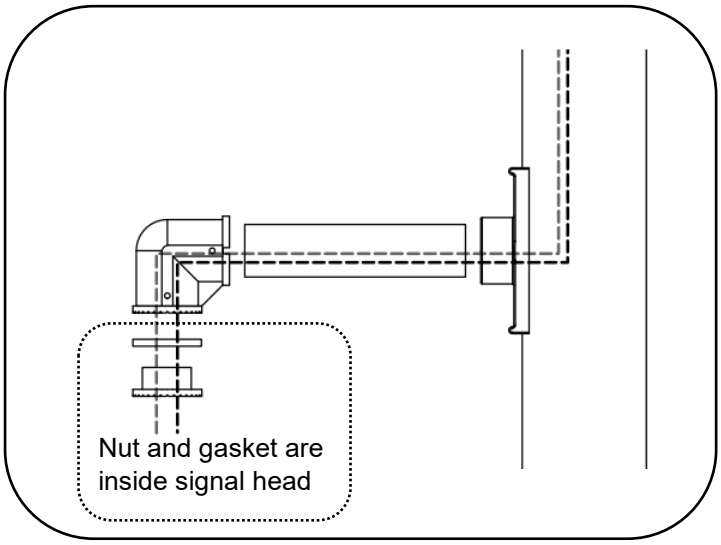
9. If the pedestrian confirmation light is not required in one direction, use the supplied opaque label to cover the indicator light.



4.2 Circular Beacon Installation

The E and F Series provides standard wiring to support up to four circular beacons.

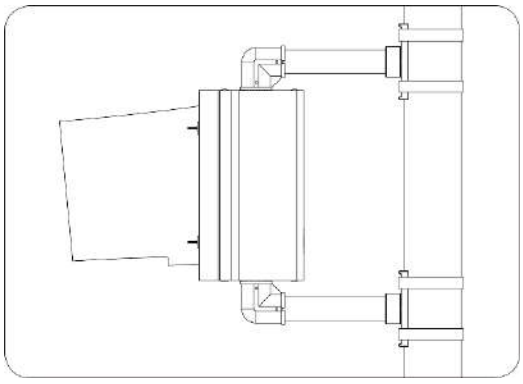
1. Thread the flashing beacon harness through the beacon arms, making a drip loop in the pole (not shown). Mount the top flashing beacon arm to the pole using stainless banding or bolts (not supplied). Use the gasket on the top mounting arm to ensure water doesn't leak past the connection and enter the signal head from the top.



2. Connect the flashing beacon harness to the terminal block inside beacon housing according to the wire connection table below. Complete the flashing beacon assembly and attach the bottom arm mount to the pole using stainless steel banding or bolts (not supplied).

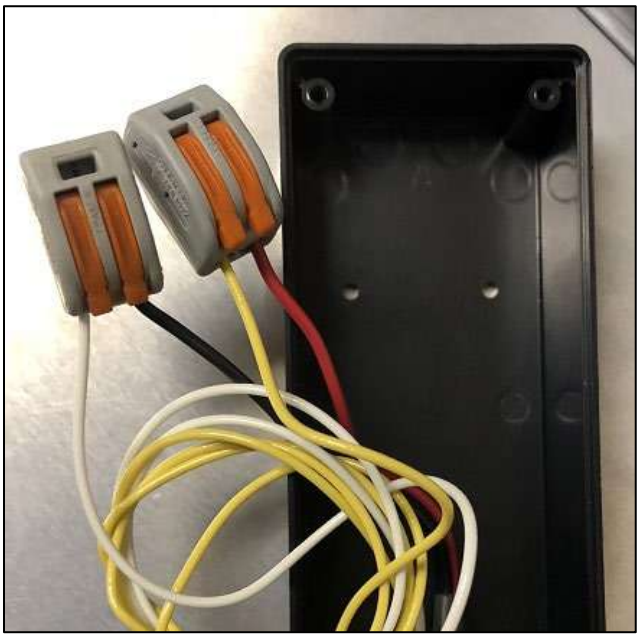
LED WIRE CONNECTIONS

Polarity:	Wire from EMS:	Wire to Yellow LED:	Wire to Red LED:
+	Red	Yellow	Red
–	Black	White	White



4.3 LED Enhanced Sign Installation

1. Use banding and sign brackets (not included) to mount the sign on the pole.
2. Open the junction box on the back of the LED Enhanced Sign. Set the screws safely aside.
3. Loosen the cable gland and feed the LED cable into the junction box far enough that the cable gland can properly seal.
4. Tighten the cable gland.
5. Use two twist-on wire connectors or splice terminals (not included) to attach the LED harness to the yellow and white LED wires inside the connection box. Observe the following polarities:
6. Positive: Red from solar engine to Yellow in LED Enhanced Sign
7. Negative: Black from solar engine to White in LED Enhanced Sign
8. Close the connection box.



4.4 Push Button Installation

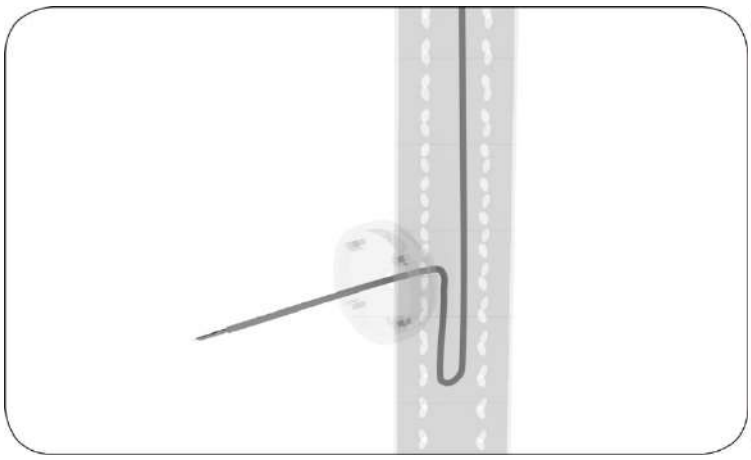
NOTE If the system is wired for a push button but none is needed (such as an advance RRFB), insulate the ends and secure the wires.

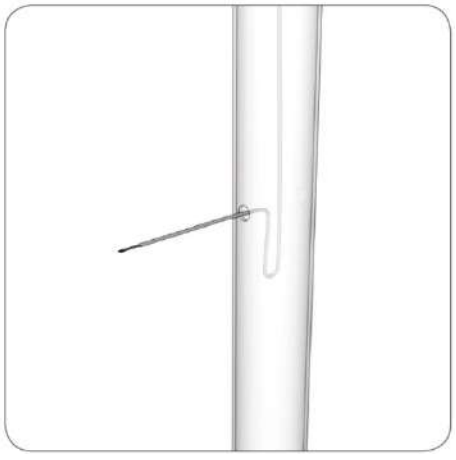
NOTE ADA regulations specify that the button should be 42” from the ground.

NOTE The push button can be connected in either polarity.

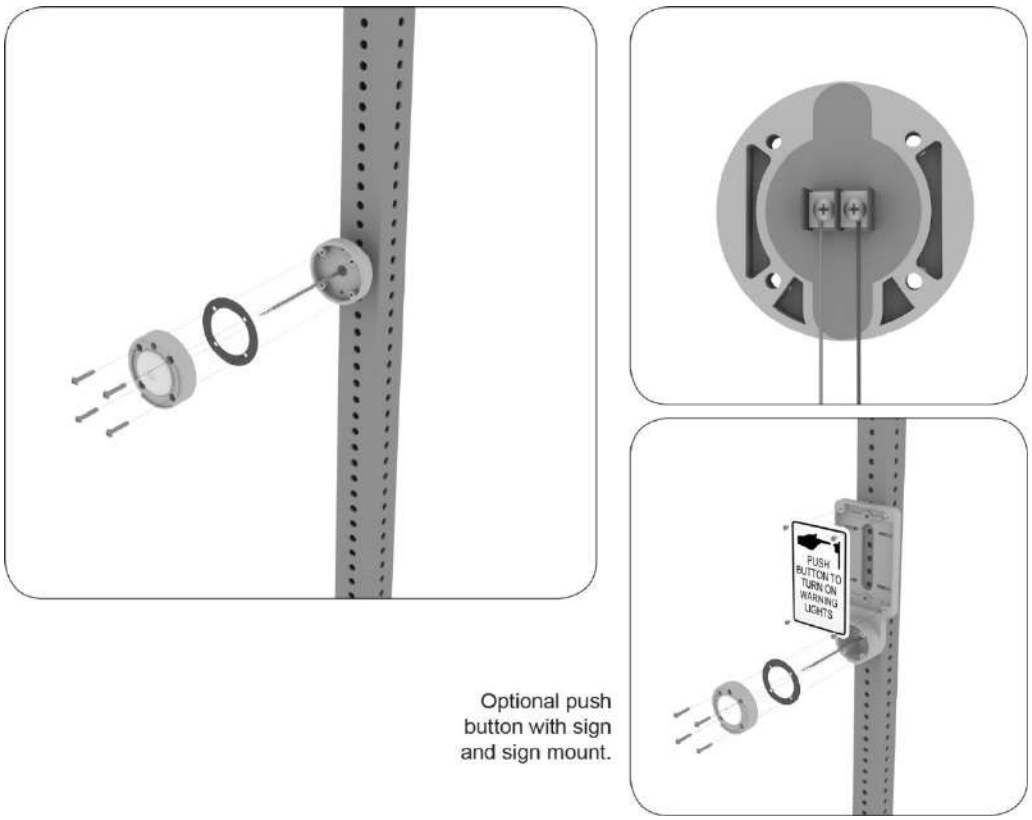
NOTE The recommended maximum number of Polara Bulldog push buttons that can be connected in parallel is 2.

1. Drill and tap post as per button installation instructions. Button assembly should sit flush against post. Deburr hole that push button wiring will pass through.
2. Feed push button cable through pole, creating a drip loop.



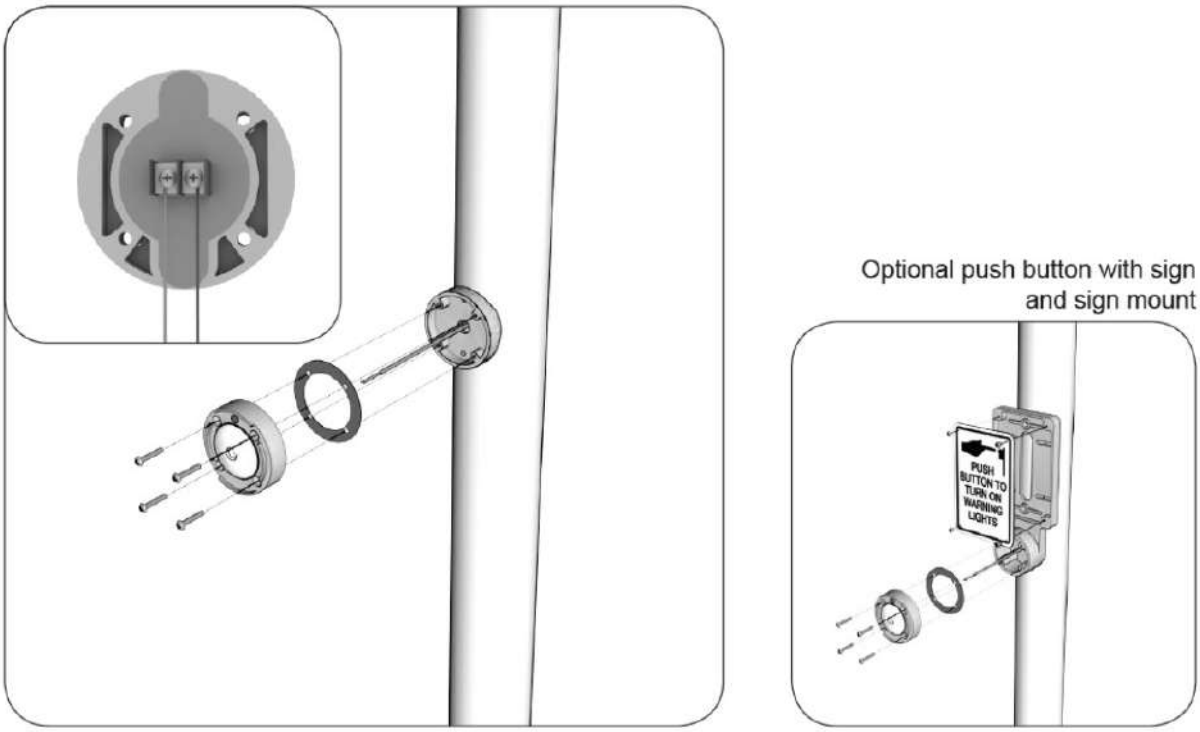


3. Mount the push button to the post, connecting the wires to the push button.



Optional push button with sign and sign mount.

4. Attach the button mounting adapter to the pole, connect the button cable to the button, and attach the button to the mounting adapter.



4.5 Battery Installation

Once the solar engine is secured and the beacons and other devices are in place, the batteries can be installed.

ELECTRICAL SHOCK HAZARD.

DO NOT LET THE BATTERY TERMINALS COME INTO CONTACT WITH ANY EXPOSED METAL.

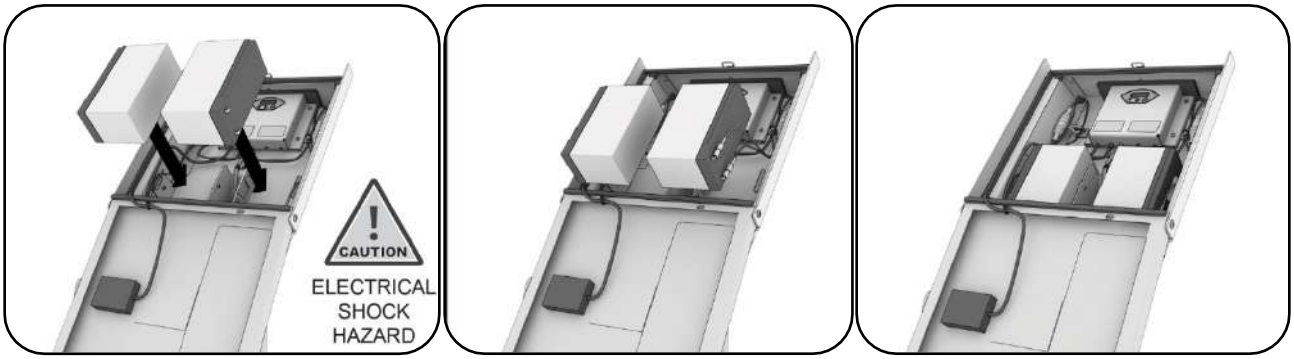
Batteries are shipped fully charged. Use extreme caution when handling the batteries as they can generate hazardous short-circuit currents. Remove all jewelry (bracelets, metal-strap watches, etc.) before attempting to handle the batteries.

Batteries self-discharge over time. Avoid storing batteries for prolonged periods before installation. If storage is necessary, batteries should be stored in a cool, dry place. Check and charge stored batteries regularly using a suitable automatic battery charger.

E Series batteries must be installed with the terminals facing *outward* as shown below.

Battery Installation, E Series

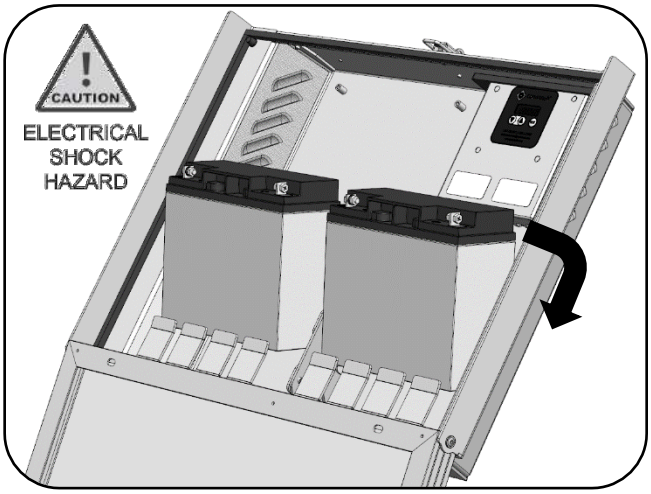
1. Open the solar engine and install the batteries. Connect harness push-on terminals to battery terminals of correct polarity (red to positive, black to negative).



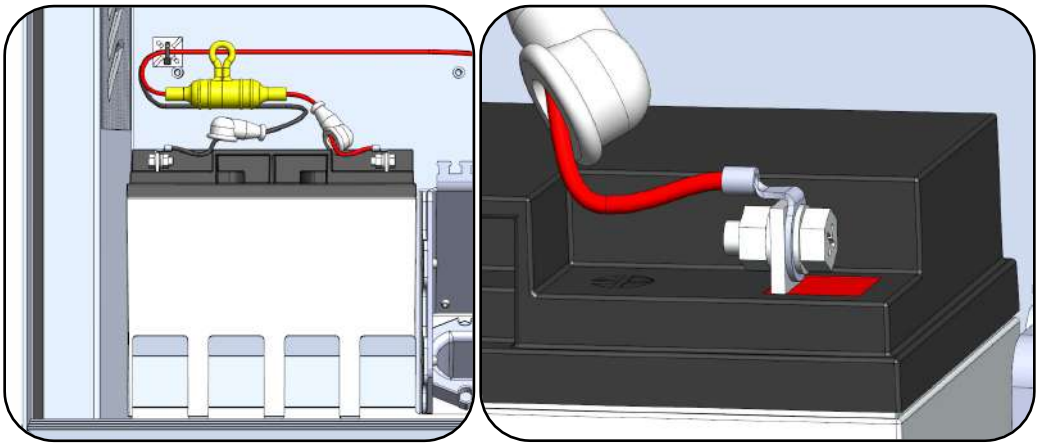
2. Secure batteries with battery strap; note proper routing.

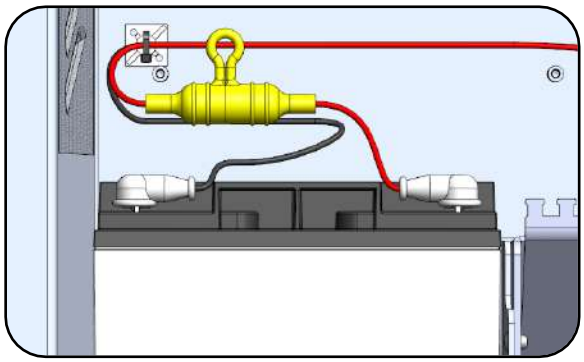
Battery Installation, F Series

1. Open solar engine and install batteries. Tilt batteries behind the sheet metal fingers as shown. Note battery terminals should be at the front.



2. Slide back white boots on harness. Connect battery ring terminals to battery terminals of correct polarity (red to positive, black to negative). Bend ring terminal over battery terminal as shown. Apply dielectric grease or other anti-corrosion product (not included) to terminals. Slide boots back over terminals.

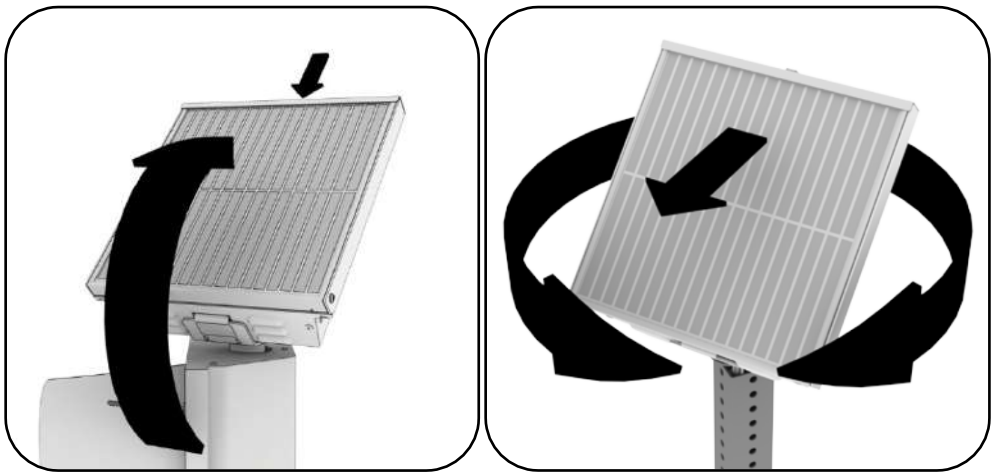




After installing the batteries (E and F Series)

The system will energize, and the user display will become active once one of the batteries/fuses are connected. If it is part of a radio-connected group, all members of the group will now be able to communicate with each other. See the “5.0 EMS Programming and Testing” section to adjust default settings and to perform system testing and commissioning.

1. Close the latch and solar panel to complete installation.



2. Ensure the solar panel is facing the equator (pointing south if you are in the Northern Hemisphere).

5.0 Installation of Optional Accessories

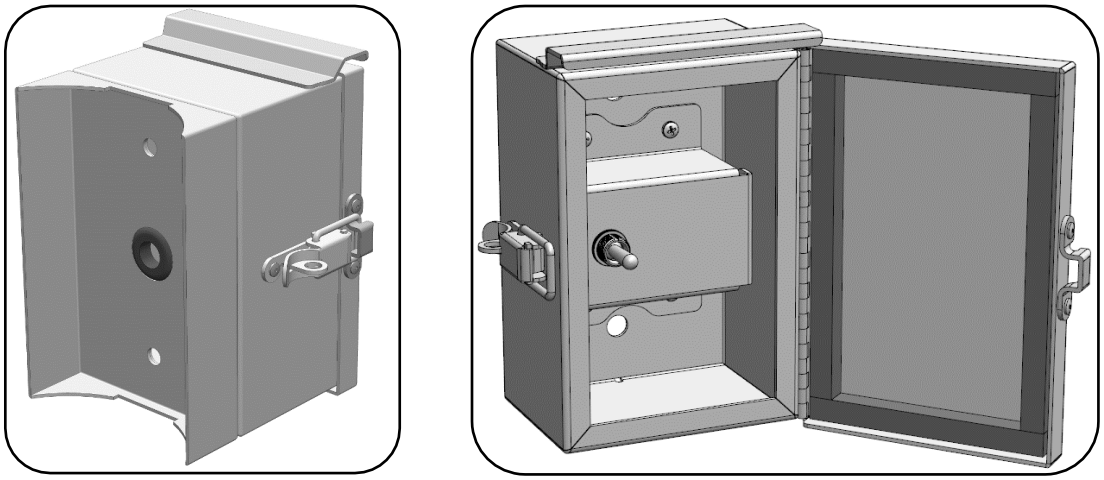
WARNING

Disconnect power by removing system fuses before installing any additional equipment or accessories.

5.1 Calendar Upload / Override Switch Kit Installation

The R829 and R247 are available with a lockable pole-mounted manual override box that is mounted lower down on the mounting structure to allow easy access by individuals on the ground. The override box is used for forcing the R829 to flash regardless of the calendar schedule and for forcing the R247 to temporarily cease flashing. For R829 systems, this box will also contain the USB connection for programming the internal calendar. The USB cable is used to communicate calendar data between the R829 and a windows PC.

The override box can be mounted on 2” square perforated and round poles. Assembly required.



Calendar Upload / Override Switch Kit

NOTE

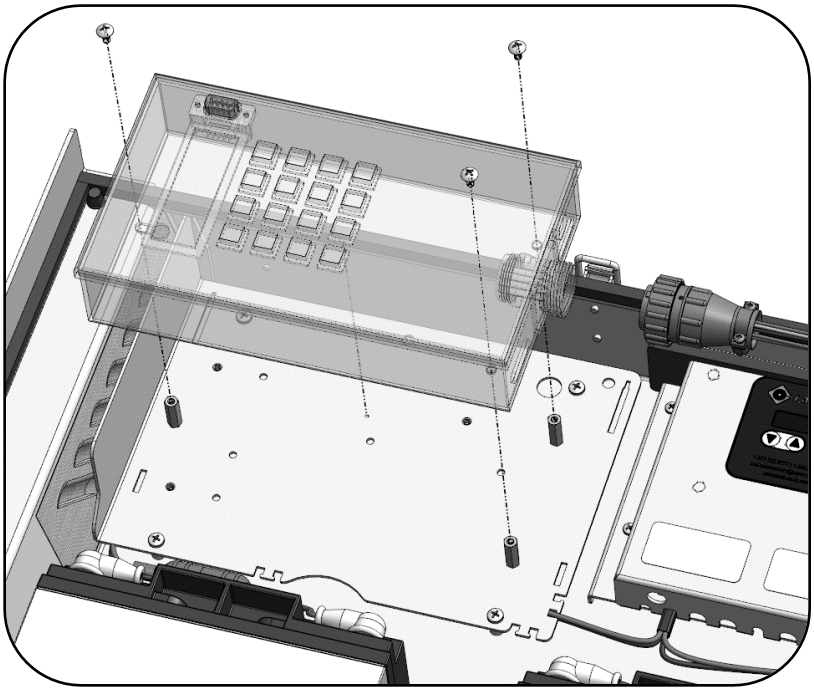
For calendar-equipped systems, another related kit is the **calendar software programming kit**, which includes a USB memory stick containing the Carmanah Calendar Configuration Windows application and a 32-foot active USB extension harness. The USB extension allows programming from a distance from the pole, e.g. from a laptop within a work vehicle parked nearby.

5.2 RTC Time Switch Installation (F Series only)

NOTE

This product configuration requires the optional RTC Time Switch Kit (time switch not included). Contact Carmanah for assistance if the system is being converted from a non-school zone application, or for general information on installing third-party devices.

1. Open solar engine and remove screws from standoffs shown. Ensure standoffs are in the positions shown. Remove lid from time switch. Install onto standoffs with three screws as shown. Replace switch cover. Mate harness from EMS.



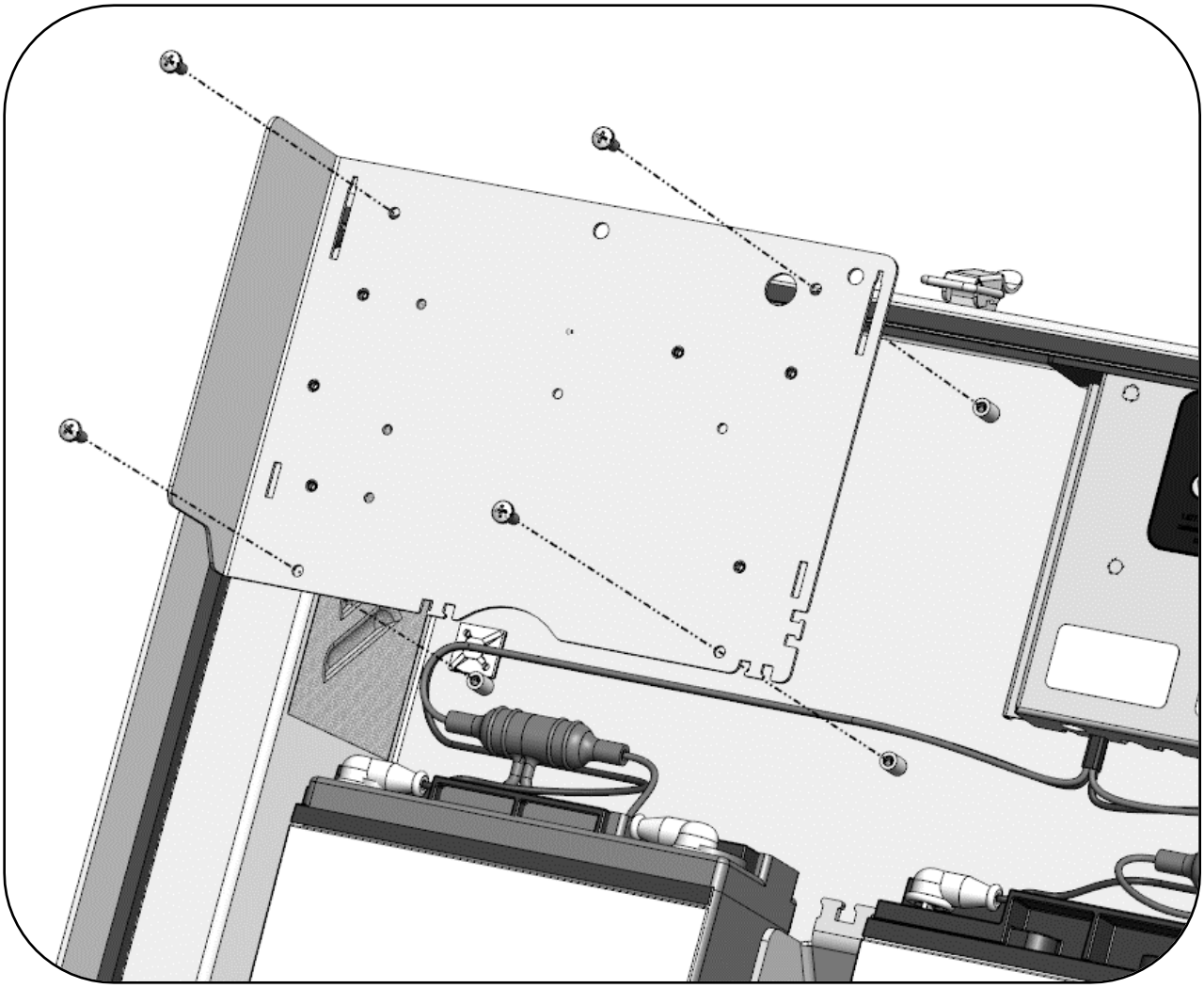
2. Follow manufacturer's instructions for configuration of switch.

5.3 Applied Information or FCU Modem Kit Installation (F Series only)

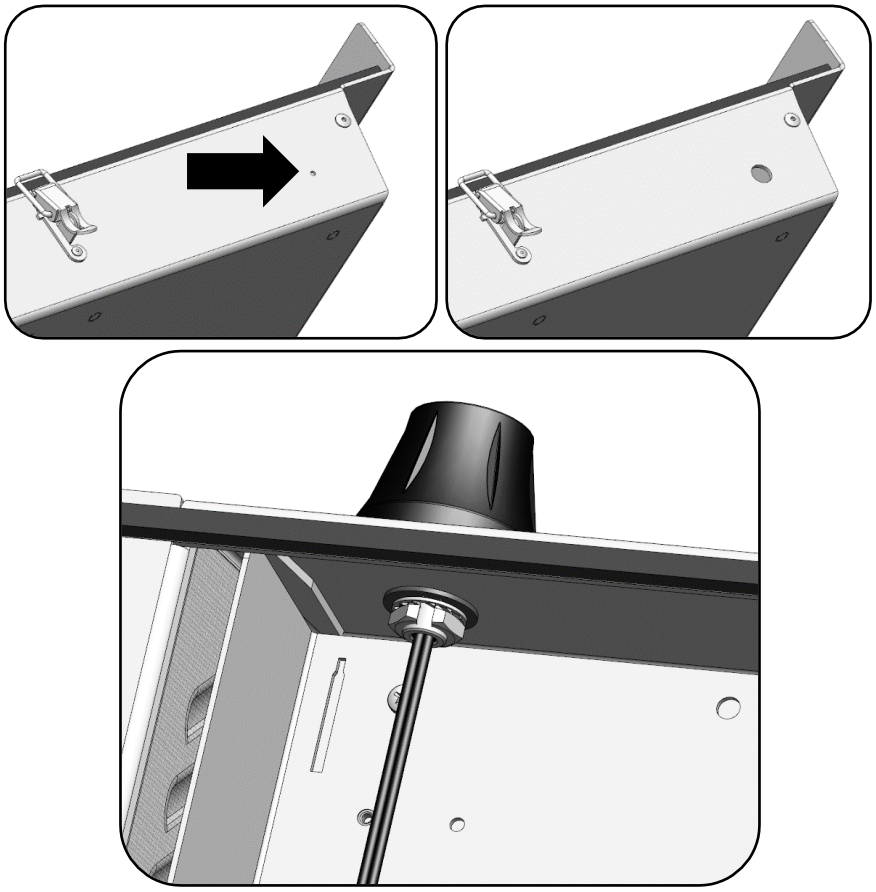
NOTE This product configuration requires the optional Applied Information modem kit (modem not included). Contact Carmanah for assistance if the system is being converted from a non-school zone application, or for general information on installing third-party devices.

NOTE Applied Information models AI-500-070B (not available in Florida) and AI-500-071B (only available in Florida) have been customized specifically for compatibility with Carmanah's F Series and Solar G Series.

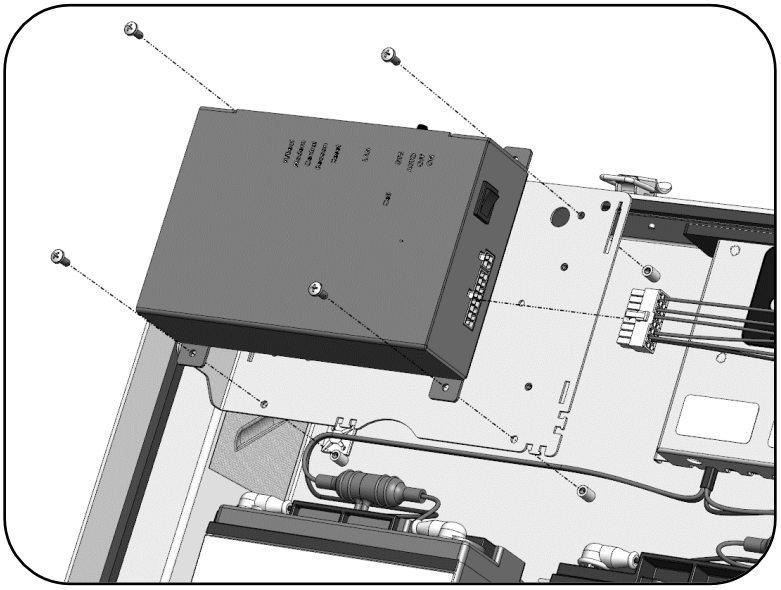
1. Remove four corner screws holding 3PD mount plate to solar engine standoffs. Set aside plate and screws.



2. If an antenna is to be used, locate indentation near top corner of solar engine and use it to locate and drill a ½" dia. hole. Deburr hole, clean chips, and install antenna, plastic washer, lock washer and nut as shown.



3. Install 3PD plate, AI unit and four screws into solar engine standoffs as shown. Mate rectangular EMS connector. Install supplied 90° coax adapters and mate coax connectors from antenna (if used).



4. Follow manufacturer's instructions for unit configuration.

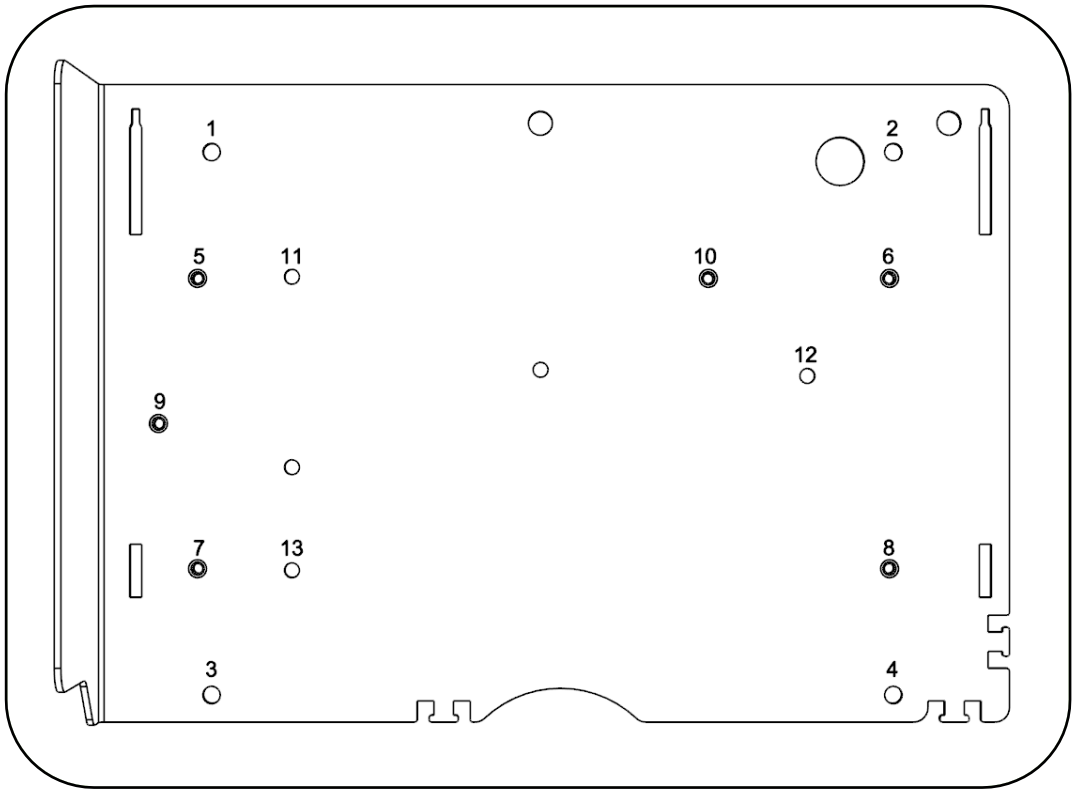
5.4 3PD Time Switch Supplementary Information

The F Series 3PD adapter mounting plate included with the various 3PD kit options has holes to accommodate a variety of third-party devices. These are summarized in the table and diagram below.

Application	Holes Used	Installation and Wiring Notes
3PD adapter mounting plate to solar engine	1, 2, 3, 4	
AI FCU 500	1, 2, 3, 4	Four provided screws go through holes in AI unit, then through holes in 3PD plate and into standoffs in F Series solar engine.
RTC AP21, CPR2102, AP22	9, 6, 8	Standard wiring versions. TxDOT version requires removal of several contacts from provided harness connector using TE extraction tool 305183 and reinstallation into different positions: Relay pins 4 and 10 are reversed. DC+ moves from pin 15 to pin 11. DC− moves from pin 13 to pin 12.*
Encom WBCU	5, 6, 7, 8	
Eltec TC-18	9, 6, 8	Requires removal of several contacts from provided harness connector using TE extraction tool 305183 and reinstallation into different positions: DC+ moves from pin 15 to pin 11. DC− moves from pin 13 to pin 12.*
DC Relay	10, 6	Used to mount relay in F Series DC Relay Kit option.
Polara XAV	5, 6, 7, 8	Controller comes preinstalled and prewired with F Series Polara XAV controller kit option.

*Consult manufacturer's documentation to confirm.

3PD Adapter Mounting Plate



Pin Assignments of Connectors Provided with RTC and AI 3PD Kits

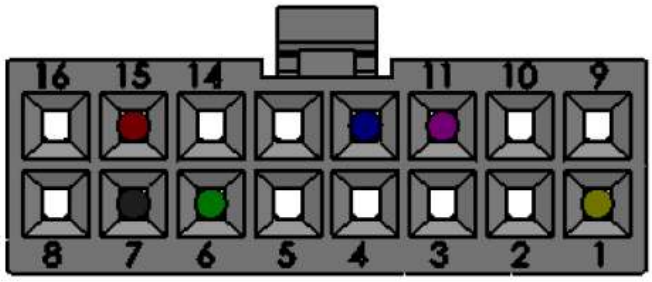
Pin Assignment in TE Circular Connector provided with RTC time switch kit:

POSITION #	WIRE COLOR	FUNCTION
3	GREEN	CHASSIS GROUND
4	SLATE	RELAY 1 COMMON
10	VIOLET	RELAY 1 N/O
13	BLACK	DC NEGATIVE
15	RED	DC POSITIVE

CONNECTOR VIEW FROM
WIRE ENTRY SIDE

Pin Assignment in Rectangular Connector provided with AI time switch and modem kit:

POSITION #	WIRE COLOR	FUNCTION
1	YELLOW	PV POSITIVE
6	GREEN	CHASSIS GROUND
7	BLACK	DC NEGATIVE
11	VIOLET	BEACON CONTROL
12	BLUE	ALARM
15	RED	DC POSITIVE



CONNECTOR VIEW FROM
WIRE ENTRY SIDE

5.5 DC Relay Kit Installation (F Series only)

NOTE

It's important to discuss your application with a Carmanah representative to ensure your load will operate sustainably in your location. Shade analysis is highly recommended to understand how shadows will change according to the time of year. Contact Carmanah for a detailed examination and solar simulations for your site.

The F Series DC Relay Kit option includes a pre-installed DC/DC relay. The relay input is prewired to the digital output of the EMS. The relay load positive side is wired to the left side battery positive harness through a 7A fuse. When the EMS LED output turns on, the digital output on the EMS is enabled and the output terminals of the relay close to operate a DC load.

CAUTION

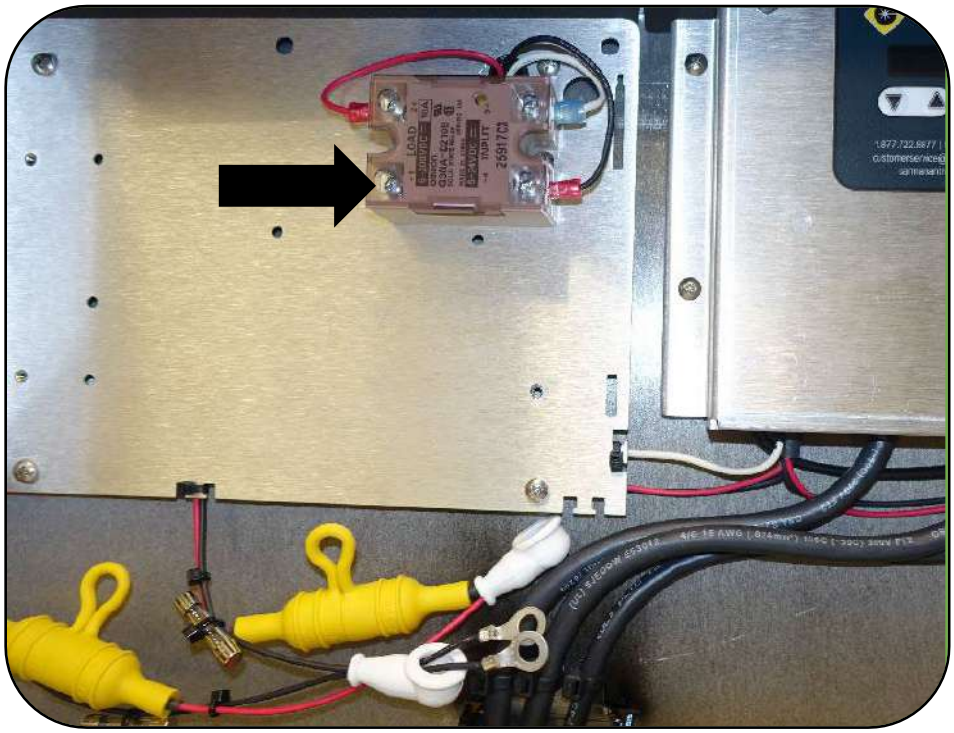
ELECTRICAL SHOCK HAZARD.

NOTE

The relay model supplied with the DC Relay Kit is Omron part number G3NA-D210B-DC5-24. Please see Omron's datasheet for more information.

To install a DC load:

1. Remove the fuses from the three yellow rubber fuse holders in the solar engine.
2. Install a suitable M4 or #8 stud-size terminal onto the positive wire of the load and connect it to the empty Load – terminal on the relay (arrow in image below).
3. Thread the negative wire of the load through the white boot of the left side negative battery terminal harness (see image below). Install a suitable ¼" stud-size terminal onto the load negative wire. Stack the negative terminals together and connect to the left side negative battery terminal. Bend the terminals to permit the white boot to slide over them.
4. Replace the fuses into the fuseholders.

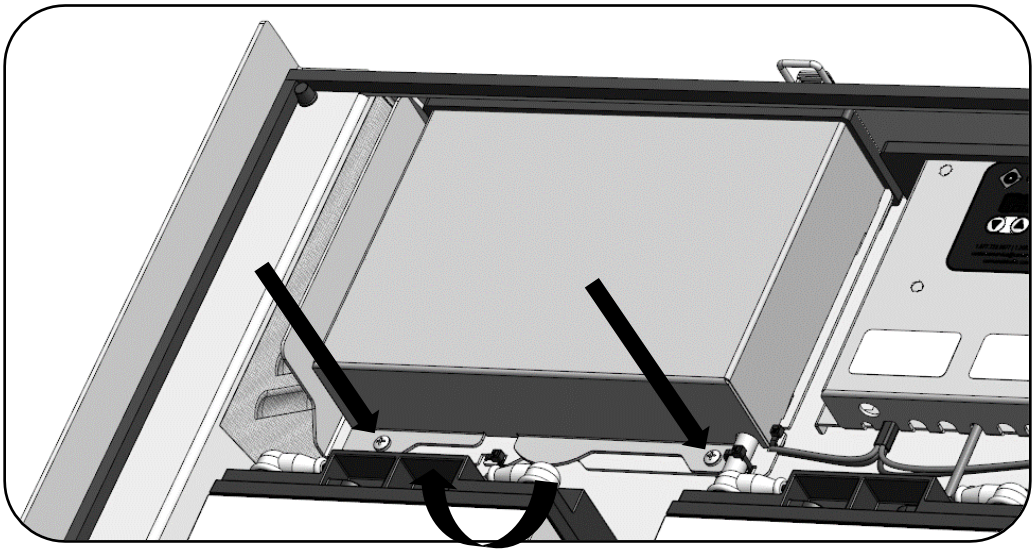


5.6 Polara XAV Controller Kit Installation (F Series only)

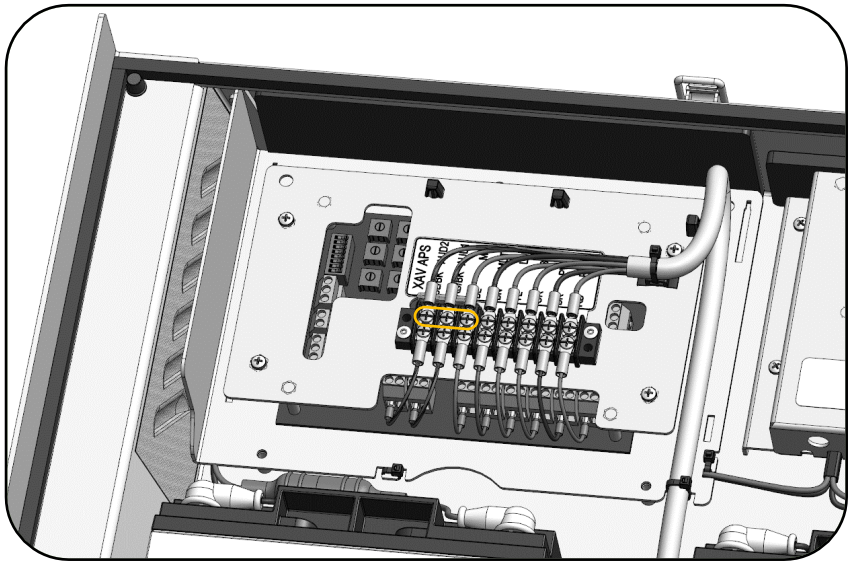
The Polara XAV Controller Kit includes the Polara XAV controller pre-wired to the EMS. Power to the XAV controller is from the left battery, through a 7A fuse. The XAV-to-button harness (available in 16ft, 36ft or 75ft lengths) is also pre-wired to the controller. Please see Polara's installation documentation for installation details for the audible push button station.

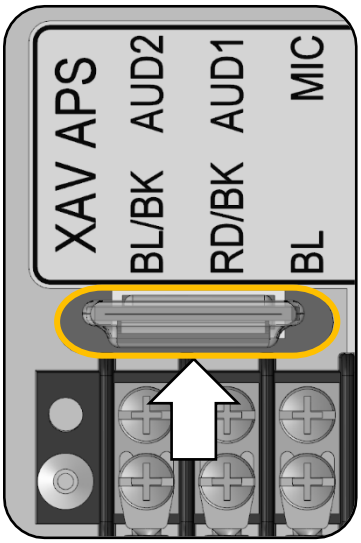
To gain access to the XAV control board to configure the device, follow the instructions below:

1. Open solar engine and remove two screws bottom screws of XAV cover plate. Lift tab at bottom center of cover and remove.



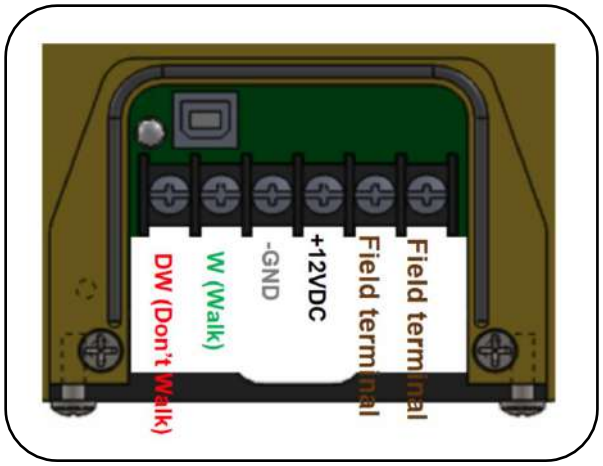
2. If access to voice chip is required, remove AUD2, AUD1 and MIC terminals on XAV-to-button harness and remove voice chip through slot in chassis. Remove four chassis screws to further access XAV module, if required (see image below).





5.7 Campbell Guardian Audible Push Button Kit Installation (F Series only)

The Campbell Guardian audible push button kit includes a push button harness (16ft, 36ft, or 75ft) pre-wired to the F Series EMS, the Guardian audible push button, and an associated sign. The audible button is powered by a harness connected to the right battery through a 7A fuse. Please consult Campbell's installation documentation for more information.



Campbell Terminal	Wire Color from F Series Solar Engine	Function
Field terminal	Orange	1 of 2 push button inputs to EMS from Guardian
Field terminal	Brown	2 of 2 push button inputs to EMS from Guardian
+12VDC	Red	Positive side of 12-volt power supply for Guardian
-GND	Black	Negative side of 12-volt power supply for Guardian
W (Walk)	Yellow	Guardian sense line for triggering recorded message when fixture flashing is detected
DW (Don't Walk)	Not used	

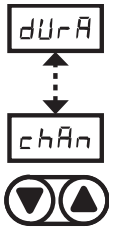
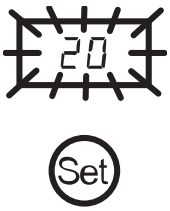
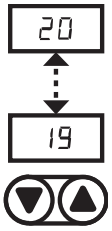
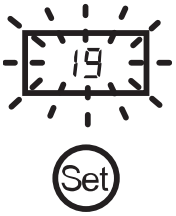
6.0 Energy Management System Programming and Testing

The E and F Series' Energy Management System (EMS) has several programming functions and settings. These are accessed through the On-Board User Interface (OBUI). Specific products will use a subset of the complete OBUI settings, which will be covered in this manual's sections specific to each product.

6.1 EMS On-Board User Interface Operation

Three buttons on the EMS OBUI are used to navigate and change settings and activate functions as required. The Up arrow, Down arrow, and SET button are used to scroll through menus, access and change settings, and accept new settings.

EMS On-Board User Interface (OBUI)

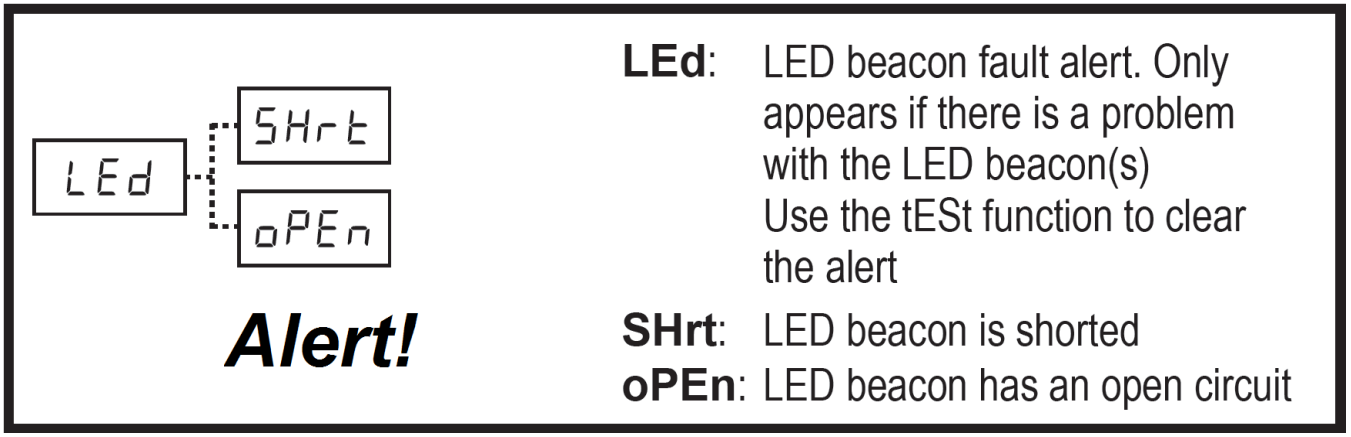
Use the Up and Down arrow buttons to scroll through the menu.	Press and hold the SET button to edit a setting. The display will blink when the setting is ready to edit.	Use the Up and Down arrow buttons to adjust the setting when in edit mode.	Press and hold the SET button to accept the new setting. The display will flash 3 times to indicate the setting has been accepted.
			

Using the Up or Down buttons on the OBUI, the following menu items will appear:

Menu Item	User-adjustable?	Broadcast to other systems?*
LED Fault	No	No
Battery Status	No	No
Solar Status	No	No
Flash Pattern	Yes	No
Input Type	Yes	No
Flashing Duration	Yes	Yes
Intensity (LED Driver Current)	Yes	No
Night Dimming	Yes	Yes
Ambient Auto-Adjust	Yes	Yes
Automatic Light Control (ALC)	Yes	No
LED Temperature	Yes	No
Internal Calendar	Yes	No
Radio Enable	Yes	No
Radio Channel	Yes	No
Radio Detection Status	No	No
Digital Output	Yes	No
Push Button Input Status	No	No
LED Fixture Text	Yes	No
Built-In Self-Test	Yes	No
Firmware Version	No	No

*No indicates that changing the setting on one system will not broadcast the change to other wireless systems.

LED Fault



The LED Fault message does not normally appear in the OBUI menu, and only appears when the EMS has detected that one or more fixture connections are shorted or disconnected. When the problem has been corrected and flashing is triggered, the LED Fault menu item will disappear.

NOTE

In addition to fixtures not being connected properly, the EMS may also display the LEdoPEn fault message when:

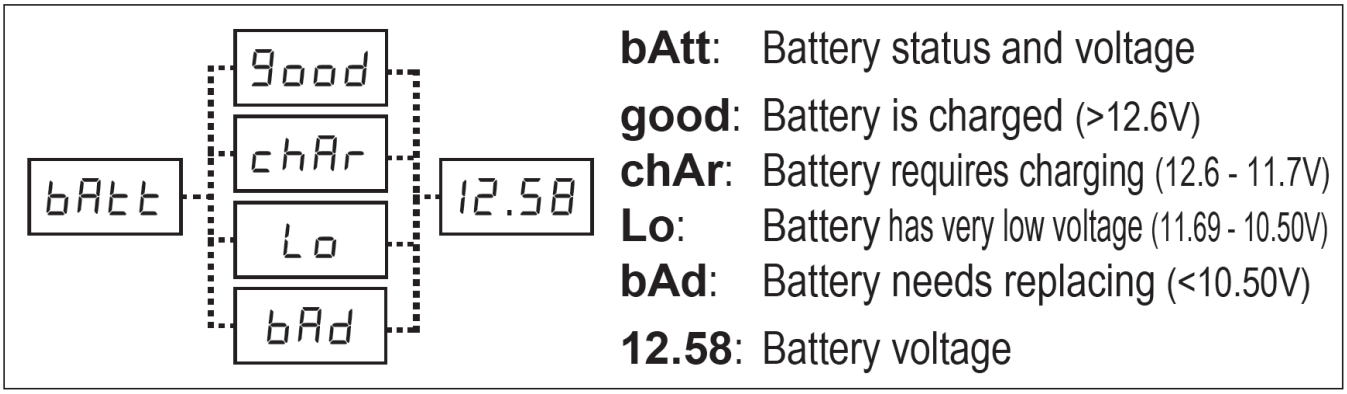
- a fixture with too high an operating voltage is connected
- a very long LED harness is combined with a high intensity setting
- a single LED sign or beacon is used with an alternating flash pattern

NOTE

The LED Fault alarm:

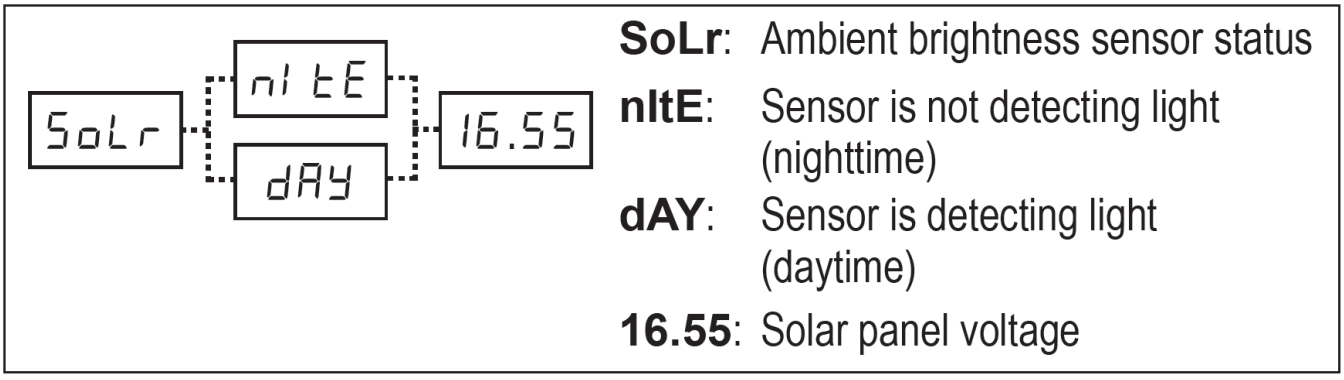
- will not detect a disconnected fixture when more than one beacon/sign or any number of light bars are installed with a Unison flash pattern
- will not detect a disconnected fixture when more than one lightbar or more than two beacons/signs are installed
- may not detect a fixture short circuit or disconnection when a rapid or quick flash pattern is used. Temporarily changing to flash pattern QSA can assist in troubleshooting.

Battery Status



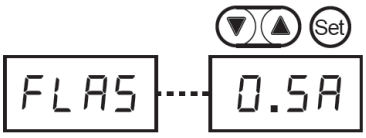
Battery Status reports general battery state as well as actual battery voltage. When the Battery Status reads chAr (charge), the voltage is lower than normally desirable, but the system will continue to operate normally. When the Battery Status reads Lo, the system is in Low Voltage Disconnect (LVD). LVD is a safety mechanism that the EMS invokes to prevent over-discharge of the battery. When in LVD, the fixtures will *not* flash and the digital output signal (if used) is also turned off.

Solar Status



The Solar Status indicates whether the system has determined it is night or day based on the photosensor located in the top of the body near the antenna. The second value that is displayed is the output voltage of the solar panel and is useful for troubleshooting. Solar panel voltage in sunlight will typically be between 15 and 20 volts.

Flash Pattern



FLAS: Flash pattern

rfb1, rfb2, 0.1U, 0.25U, 0.5U, 0.5A, 0.1UF, 0.1AF

See manual for flash pattern descriptions

The EMS can be programmed for 8 different flash patterns.

- 0.5A MUTCD-compliant alternating flash 0.5 second pulse 60 flashes per minute. Carmanah default.
- 0.5U MUTCD-compliant unison flash 0.5 second pulse 60 flashes per minute
- rFb2 WSDOT custom pattern for circular rapid flashing beacons
- rFb1 Standard FHWA RRFB WW+S (Wig Wag and Simultaneous) flash pattern
- 0.1AF Alternating quick flash. Burst of three 0.1 second pulse flashes. 60 bursts per minute.
- 0.1UF Unison quick flash. Burst of three 0.1 second pulse flashes. 60 bursts per minute.
- 0.25U Unison flash 0.25 second pulse 60 flashes per minute
- 0.1U Unison flash 0.1 second pulse 60 flashes per minute

The flash pattern is pre-set at the factory based on your requirements and installation location, which are typically discussed at the time of ordering. Should the installation location or situation change, you can adjust this setting. Please contact Carmanah Customer Service prior to making any adjustments.

NOTE

If a single fixture is being used, a unison flash pattern must be selected. If a single fixture is set to an alternating pattern, the EMS will attempt to turn on a second fixture and generate an LED fault when it can't. The EMS uses a single LED driver that toggles two "banks" on and off. For alternating flashing, fixtures are attached to different banks. An RRFB light bar uses both banks to achieve its mix of alternating and simultaneous flashing.

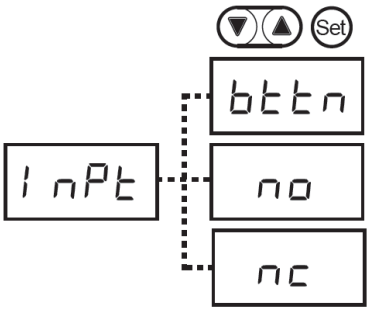
NOTE

When an odd number of circular beacons is used, a unison flash pattern must be selected to achieve consistent brightness between beacons.

NOTE

When programming intensity for **RRFBs or ITE-compliant circular beacons**, minimum current settings must be applied (see the Intensity section). Contact Carmanah for guidance.

Input Type



InPt: Input type

bttn: Momentary push button

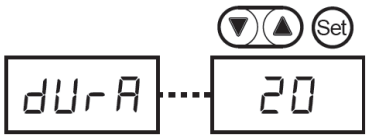
no: Normally open switch

nc: Normally closed switch (24/7)

The Input Type setting determines a key difference between the EMS acting as a pedestrian crosswalk system, a 24/7 flasher, or a school zone flasher. Set Input Type according to the following options:

bttn	"Push Button". Used for pedestrian crosswalks (R920, R820). A push button is wired to the push button input terminals of the EMS, and when the button is pushed, a momentary short-circuit across the input terminals occurs, causing the fixtures to flash for the duration set in the "Duration" setting. Carmanah default.
no	"Normally Open". Used for School Zone Flashers (R829) or any application where the flashers must activate on demand. The usual state of the push button input terminals is to be open and not have a short-circuit across them. While the terminals are open, fixtures do not flash. If a short-circuit is applied across the terminals - provided by a time switch, override switch, or some other device - the fixtures will begin to flash and will continue to flash for as long as the short-circuit is applied.
nc	"Normally Closed". Used for 24X7 flashers (R247). The flashers will flash continuously, day and night, unless a short-circuit is applied to the push button input terminals. The override switch can be used to turn the beacons off by short-circuiting the button input terminals.
NOTE	If radio-enabled systems configured with different input types are within communication range of one another, radio channel settings should be used to avoid unintended operation. See Radio Channel section.

Flashing Duration



dUrA: Duration of the flashing

20: Duration in seconds from 5 to 3600

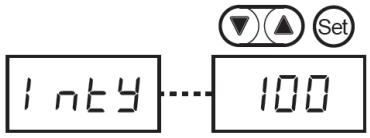
Flashing Duration is used for pedestrian crosswalks and sets the amount of time the fixtures will flash before extinguishing. The available settings are:

- 5 to 60 seconds in 1 second steps
- 60 to 1200 seconds (20 minutes) in 60 second steps
- 3600 seconds (one hour)

The Carmanah default duration is 20 seconds. Longer duration flash periods are useful for applications such as warning traffic of heavy equipment on logging and mining haul roads.

NOTE Extending the Flashing Duration setting significantly can affect the solar energy balance of the system. Contact Carmanah to for more information about sustainable settings in your location.

Intensity (LED Driver Current)



IntY: Output current

100: Output in mA, from 20 to 1400

The value shown in the user interface is the total current being provided to the fixtures. This current is divided among the fixtures, depending on how many fixtures are connected and whether they are flashing in unison or alternating.

When RRFB flash patterns (rFb 1 or rFb2) are used, the programmed Intensity value is the total current during the simultaneous portion of the flash pattern, when both left and right modules of a light bar (or both circular beacons) are on simultaneously. During portions of the RRFB flash pattern when only one module or beacon is illuminated, the EMS automatically reduces the current to half the programmed value because it knows that the current will be flowing through one module/fixture.

The following table provides some examples of EMS intensity settings and the fixture currents that result with different flash pattern types:

Fixtures	Flash Pattern	EMS Intensity Setting	Resulting Fixture Current
Two Circular Beacons	Alternating	340mA	340mA
Two Circular Beacons	Unison	340mA	170mA
One Light Bar	RRFB 1	260mA	During the **simultaneous portion** of the flash pattern, 260mA is provided to the light bar and is split equally between the left and right modules, resulting in **130mA** per module. During the **wig-wag portion** of the pattern, the EMS automatically reduces the current by half to **130mA**, which flows through one side of the light bar or the other side.
Two Light Bars	RRFB 1	520mA	During the **simultaneous portion** of the flash pattern, **520mA** is split equally between the two light bars, and again between left and right modules in each light bar, resulting in 130mA per module. During the **wig-wag portion** of the pattern, the EMS automatically reduces the current to one half (260mA) which flows through one side of both light bars or the other side of both light bars. The current splits equally between the light bars, so each module receives **130mA**.

The intensity is pre-set at the factory based on your requirements and installation location, which are typically discussed at the time of ordering. Should the installation location or situation change, you can adjust this setting. Please contact Carmanah Customer Service prior to making any adjustments.

Intensity adjustments are 20mA per step.

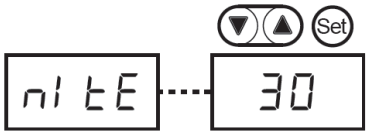
NOTE The maximum output current of the LED driver is 1400mA.

NOTE The minimum output current of the LED driver is 20mA. AAA, ALC and Night Dimming features cannot bring LED current below this value.

NOTE As mentioned in the Flash Pattern section, odd numbers of round beacons must be set to a unison flash pattern to ensure all LEDs are powered equally.

NOTE When programming intensity for **RRFBs or ITE-compliant circular beacons**, minimum current settings must be applied. Contact Carmanah for guidance.

Night Dimming



nItE: Nighttime dimming

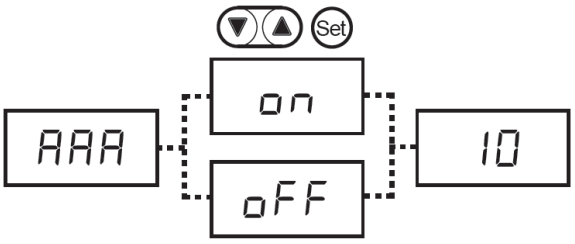
30: Percentage of daytime level, from 10 to 100%

Night Dimming sets the night intensity as a percentage of the programmed Intensity setting. It is set in 10% steps. For no night dimming (equal to 100% of daytime level), this is set to oFF.

NOTE If using night dimming and your system must meet intensity compliance such as ITE or RRFB's J595, ensure that a worst-case night dimming does not dim the fixtures below the required current needed to achieve compliance.

Carmanah Night Dimming default is 30% for all fixtures except red beacons which are not dimmed at night per FHWA.

Ambient Auto-Adjust



AAA: Ambient auto-adjust

on: Ambient auto-adjust is enabled

oFF: Ambient auto-adjust is disabled

10: Ambient auto-adjust dim level

AAA automatically adjusts fixture intensity between 50% and 100% of the programmed Intensity setting depending on ambient brightness. This reduces brightness on overcast days to prevent glare. AAA can be set either on or off. When AAA is on, it reports a value from 1 to 10 corresponding to the instantaneous ambient light level measured by the EMS photosensor. A reading of 1 means ambient light levels are ~1,000 lux and the daytime intensity is currently being dimmed to 50%. A reading of 10 means ambient light levels are at least 27,000 lux and 100% daytime intensity is being applied.

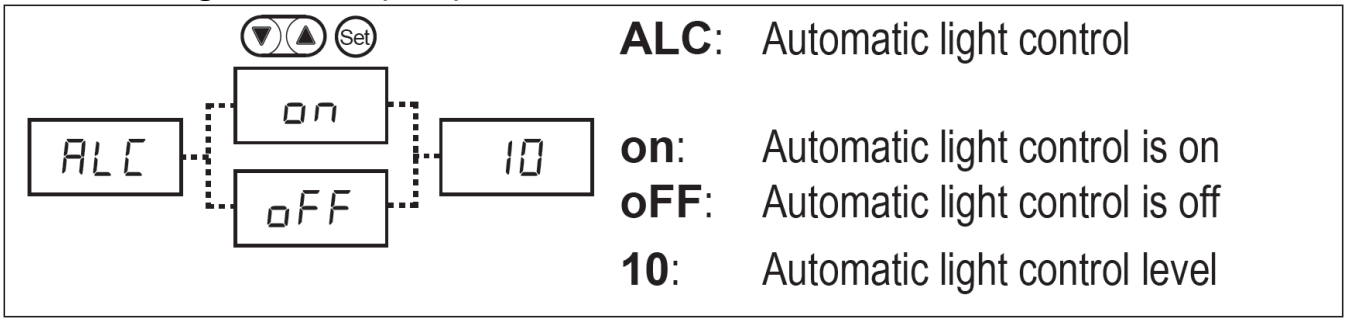
With AAA on, the dim level value (1 – 10) is displayed in real time, so it is a good feature to use for troubleshooting the photosensor operation. A flashlight can be used to shine bright light into the photosensor and invoke a "10" value.

NOTE If using AAA for circular beacons, and if ITE compliance is required, ensure that a minimum value of 50% does not dim the beacons below the level required for compliant operation. For RRFB applications, ensure that a minimum value of 50% does not dim the fixtures below the mandatory SAE J595 specification as per the FHWA. Please contact Carmanah for additional information.

NOTE With AAA off, the ambient auto-adjust dim level value reported (1 – 10) is not updated. The value reported corresponds to the ambient brightness detected when the feature was last on.

Carmanah Ambient Auto Adjust default is on.

Automatic Light Control (ALC)

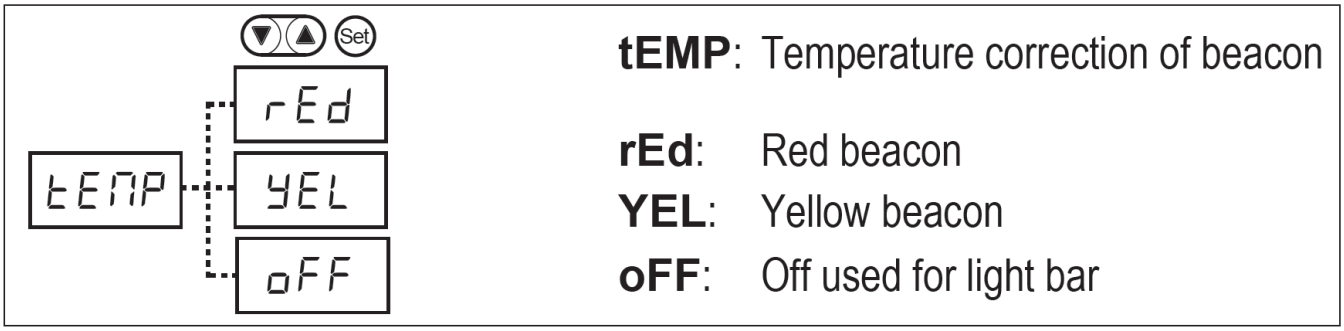


Automatic Light Control (ALC) is a Carmanah patented energy management system. ALC allows the EMS to reduce the fixture brightness in response to low battery states of charge. ALC activates if battery charge gets below 70%, which doesn't occur in normal circumstances when the system is properly sized for its location.

When ALC is set to on, the UI will report the amount of ALC being applied as a percentage. A reading of 70 means that ALC is reducing the fixture current to 70% of its normal value. If battery voltage continues to decrease, the ALC value will also decrease until LVD (Low Voltage Disconnect) is eventually reached.

Carmanah default is "on."

LED Temperature

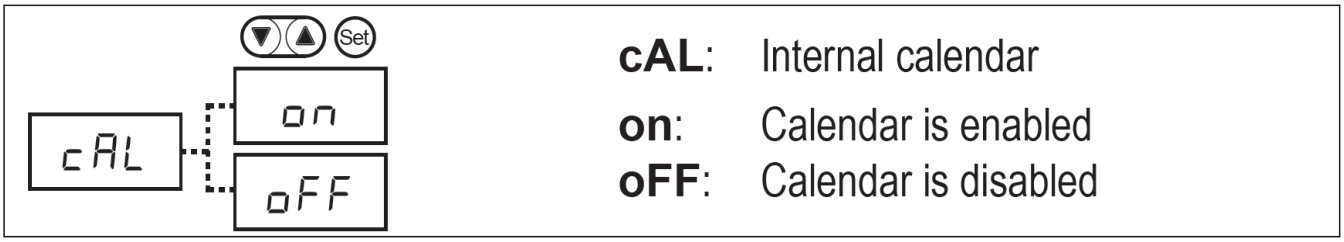


LED Temperature is set according to the color of the LED in the fixture. The EMS uses this information to apply fine adjustments to the fixture current to account for changes in LED efficacy with changing ambient temperature, ensuring consistent brightness regardless of ambient temperature.

NOTE Although the E and F Series light bars contain yellow LEDs, LED Temperature should be set to OFF for systems using light bars.

The LED Temperature setting is correctly pre-configured in the factory.

Internal Calendar



If a system is equipped with the optional internal calendar module, it will be provided with a USB cable that allows users to program the calendar to schedule when the fixtures flash. When Calendar is set to on, the fixtures will flash according to the schedule programmed in the calendar. The calendar accounts for Daylight Savings Time (DST) and leap years and has a maximum schedule length of 512 days. The software to communicate with the R829 E and F Series calendar system is available from Carmanah.

Where a group of radio-equipped R829s are used, setting CALENDAR to “On” will make an R829 a “Master” system in the group. The other R829 “Slave” systems should have their calendars turned off, and they will flash only whenever the Master system broadcasts on or off signals as it turns on and off itself.

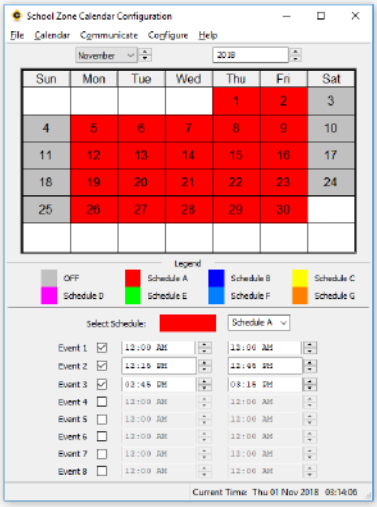
NOTE Even if the Calendar setting is oFF, a calendar can still be programmed into the EMS using the USB cable, but the R829 won’t follow the programmed schedule until the calendar setting is turned on.

NOTE To program the internal calendar using a PC with the Carmanah PC Calendar software, the software version must be 1.2 or higher.

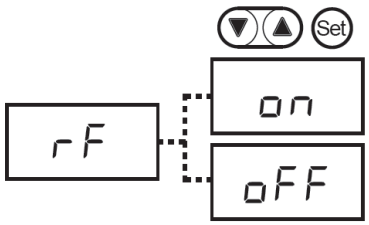
NOTE See separate calendar programming guide for comprehensive programming and operation of the internal calendar feature.

Carmanah Internal Calendar default is on for systems equipped with the optional internal calendar module, and oFF for systems without it.

Screenshot of Carmanah Calendar software:



Radio Enable



rF: Radio

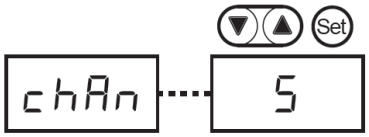
on: Radio is enabled

oFF: Radio is disabled

Radio Enable is used to turn the radio module on or off. This feature can be used for troubleshooting. The EMS will automatically disable the radio if Low Voltage Disconnect activates. A system without a radio will still show the Radio Enable entry, but it will not have any effect on behavior.

Carmanah Radio Enable default is on for systems containing the radio module, and oFF for systems without it.

Radio Channel



chAn: Radio channel for synchronized systems

5: Selected channel from 1 to 14 (default is 5)

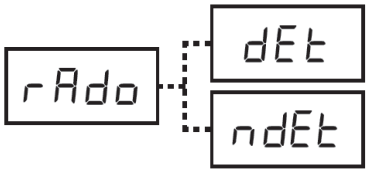
For radio-equipped systems, the Radio Channel setting is used to configure the channel that is used for communication with other systems in the same group. Groups near to each other will have their channels set to different values to ensure there is no accidental cross-activation between them. Changing the channel is a useful troubleshooting step if some systems are experiencing intermittent issues. The 2.4GHz band that the E and F Series radio module uses is public spectrum; reception problems can be the result of nearby interference from other sources.

NOTE Channel changes are not broadcast to adjacent systems.

NOTE Systems without radios will still show a channel assignment, but it will not have any effect on behavior.

Carmanah default Radio Channel is 5.

Radio Detection Status



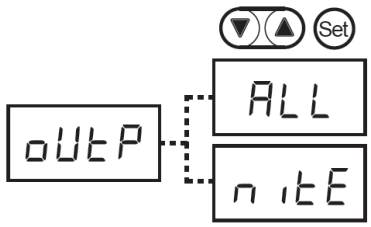
rAdo: Radio detection status

dEt: Radio is detected

ndEt: Radio is not detected

Radio Detection Status indicates whether the EMS has detected a radio module. Radio Detection involves more than sensing the physical presence of the radio; the EMS interacts with the radio and tests several things before declaring the radio “detected”.

Digital Output



outP: Digital output

ALL: Digital output enabled when flashing

nitE: Digital output enabled when flashing at night

The Digital Output feature of the EMS provides a steady 12-volt output signal at the Ext2 PCBA terminal (see diagram in Section 8.3) whenever the system fixtures are flashing. This is a useful feature for signaling the flashing state to other equipment such as overhead lighting. When set to ALL, Digital Output will provide a steady 12-volt output signal whenever the fixtures are flashing day or night. When set to nitE, the 12-volt output signal will appear only when the fixtures are flashing at night (as determined by the photosensor). The 12-volt signal is intended to control external relays. The voltage available at the Ext2 terminal decreases with increasing terminal current, see note below.

Contact Carmanah Sales for support on how to use the Digital Output feature. The Digital Output feature is pre-wired during the factory assembly and is not intended to be wired by end users after purchase.

Carmanah Digital Output default is ALL.

NOTE

The voltage available at the Ext 2 terminal changes depending on the current flowing through Ext 2. The voltage available at Ext 2 can be approximated by the formula:

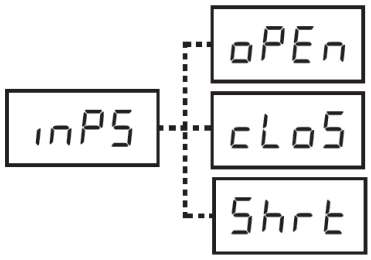
$$V_{Ext2} = V_{battery} - (I_{Ext2} \times 470) - 1.4$$

Where:

V_{Ext2} is the voltage at the Ext2 terminal in Volts,
$V_{battery}$ is the battery voltage in Volts, and
I_{Ext2} is the current drawn by the load connected to Ext2 (in Amperes)

For proper load operation, ensure there is sufficient voltage available at the Ext2 terminal to operate the load at its rated current when battery voltage is 11.7V (the LVD threshold). It is recommended that you contact Carmanah for assistance with custom I/O applications.

Push Button Input Status



inPS: Push button input status
oPEn: No button press detected
cLoS: Button press was detected
Shrt: Short detected in button or harness

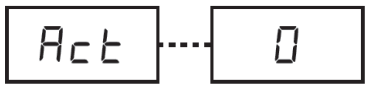
Push Button Input Status reports different states depending on the product configuration.

Pedestrian Crosswalk: Input Status will normally read oPEn. During the time that the push button is held down, Input Status will report cLoS (for closed). If the push button is held down or shorted for at least 20 seconds, Input Status will show Shrt (for short-circuit).

School Zone Flasher: Input Status will read oPEn whenever the internal calendar or the attached time switch is not activating the fixtures. When the fixtures are flashing due to activation of either of these two sources, Input Status will read cLoS.

24-Hour Flasher: Input Status will normally read cLoS. Although there is no physical wire across the input terminals, the system considers the terminals to be connected to invoke constant flashing. If a short is applied to the input, 24-hour flashing will cease, and the Input Status will change to oPEn.

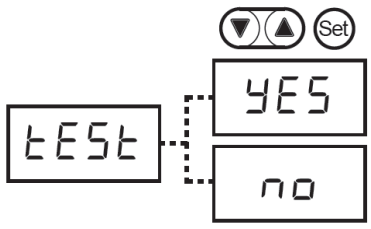
Activation Count



Act: Activation count
0: Average daily activations over last 90 days

Activation Count keeps track of the average number of daily pedestrian push button activations over a 90-day window. Activation Count is stored in volatile RAM memory and is erased if power is removed. If it has been fewer than 90 days since the last bootup, Activation Count is averaged over the number of days since bootup. For this feature, the EMS considers a “day” as 24 hours passing, rather than using day/night transitions detected by the photosensor.

LED Fixture Test

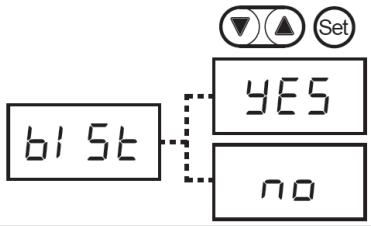


tESt: Test the system and clear any fault warnings
YES: Activates the LED beacon
no: Skips the test, does not clear any warnings

The LED Fixture Test function causes the fixture(s) to flash independently of an activation input from a physical push button, time switch, internal calendar or external control. The test will activate the fixture for 5 seconds. “Test” is a good way to determine whether a problem is caused by the fixtures.

Installers can do this from the EMS without having to climb down to the push button or override box to test.

Built-In Self-Test (BIST)



bISt: Built in system test
YES: Activates the built-in system test
no: Skips the built-in system test

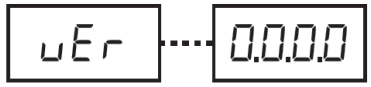
The Built-In Self-Test (BIST) runs a self-test on the system. BIST results are used for troubleshooting the system. After the BIST has been started by selecting “Yes”, the display will flash tESt for the duration of the test and will then display hexadecimal information that can represent one or more issues. The BIST can be used for troubleshooting remotely with Carmanah Customer Service.

Refer to Section 9.1 for BIST Error Code hexadecimal interpretation table.

NOTE The BIST may report an ambient brightness sensor error (0080) because it is expecting a bright light that tests the sensor during manufacturing. Shining a flashlight on the ambient brightness sensor during the test or running the BIST on a sunny day should result in no error being generated.

NOTE The BIST checks that temperature is between 15° C and 35° C. With installation sites frequently having temperatures outside of this range, a temperature check code (0002) will often be generated while there is no real issue with temperature.

Firmware Version



vEr: Firmware version number
0.0.0.0: The firmware version number

The Firmware Version menu item provides the current version of firmware in the EMS.

NOTE Firmware cannot be updated in the field.

6.2 R920-E/F Programming

To configure the EMS as an R920:

- ✓ Set FLAS (Flash Pattern) to rFb 1 (for RRFB) or rFb2 (for WSDOT circular rapid flashing beacons)
- ✓ Set inPt (Input Type) to btn
- ✓ Set durA (Flashing Duration) as desired
- ✓ Set tEMP (LED temperature) to oFF
- ✓ Set cAL (Internal Calendar) to oFF
- ✓ Set rF (Radio Enable) to on

6.3 R820-E/F Programming

To configure the EMS as an R820:

- ✓ Set FLAS (Flash Pattern) as desired
- ✓ Set inPt (Input Type) to btn
- ✓ Set durA (Flashing Duration) as desired
- ✓ Set tEMP (LED temperature) to either rEd or YEL to match the circular beacon color
- ✓ Set cAL (Internal Calendar) to oFF
- ✓ Set rF (Radio Enable) to on

6.4 R829-E/F Programming

To configure the EMS as an R829:

- ✓ Set FLAS (Flash Pattern) as desired
- ✓ Set inPt (Input Type) to no (normally open)
- ✓ Set tEMP (LED temperature) to either rEd or YEL to match the circular beacon color
- ✓ Set cAL to on unless it's a Slave in a group of wireless R829s, in which case set cAL to oFF
- ✓ Set rF (Radio Enable) to on if the system is in a group of wireless R829s. Otherwise, set rF to oFF

6.5 R247-E/F Programming

To configure the EMS as an R247:

- ✓ Set FLAS (Flash Pattern) as desired
- ✓ Set inPt (Input Type) to nc (normally closed)
- ✓ Set tEMP (LED temperature) to either rEd or YEL to match the circular beacon color
- ✓ Set cAL (Internal Calendar) to oFF
- ✓ Set rF (Radio Enable) to oFF

7.0 Commissioning Checklist

After installing and programming the system, the following commissioning verification checklist helps ensure that everything is working as it should be and that your flashing beacon is ready to serve the public for many years of reliable and sustained operation.

- ☐ All EMS settings are correct.
- ☐ No LED fault message on the EMS.
- ☐ For single or triple fixture systems, ensure the flash pattern is set for unison
- ☐ Fixtures flash properly:
- ☐ Press push button, use “TEST” at the EMS user interface at EMS, or activate override switch
- ☐ Light fixtures are tightened and pointed in the correct direction toward oncoming traffic lanes.
- ☐ Retrieved calendar from R829-E/F is confirmed to be accurate.
- ☐ Solar panel pointed south (or wherever custom instructions required).
- ☐ Override box (if equipped) correctly activates or deactivates the flashing (depending on product configuration).
- ☐ The solar panel is properly latched, and the solar engine body is secured tightly and unable to spin.
- ☐ No debris covering the photosensor window on top of the solar engine.
- ☐ Vents are clear, and screens are intact.
- ☐ Sealing gaskets on door are intact.
- ☐ Solar panel is producing voltage in sunlight (use EMS “Solar” menu item).
- ☐ System has clear sky access and no removal of obstructions is required.
- ☐ Note the possibility for nearby foliage to eventually shade the solar panel. If so, set a reminder to inspect later.
- ☐ Battery voltage is healthy (use either a voltmeter or EMS “Battery” menu item).
- ☐ Verify both fuses are intact so that the system doesn't just run off a single battery (use voltmeter to confirm fuse continuity or disconnect each fuse individually and confirm the other fuse still allows EMS to operate).
- ☐ Yellow fuse holders are tightly sealed to prevent water ingress.
- ☐ RRFB light bar flashing starts with left module first.
- ☐ Remote systems are turning on and off correctly via wireless control.
- ☐ Verify the indicator LEDs on the ends of light bars can be seen by pedestrians across the street.

8.0 Maintenance and Product Care

The E and F Series solar engines are designed to operate reliably for years with virtually no need for maintenance. Carmanah recommends routine inspections of the solar panels to ensure that they are unobstructed by anything that may prevent effective solar charging, including:

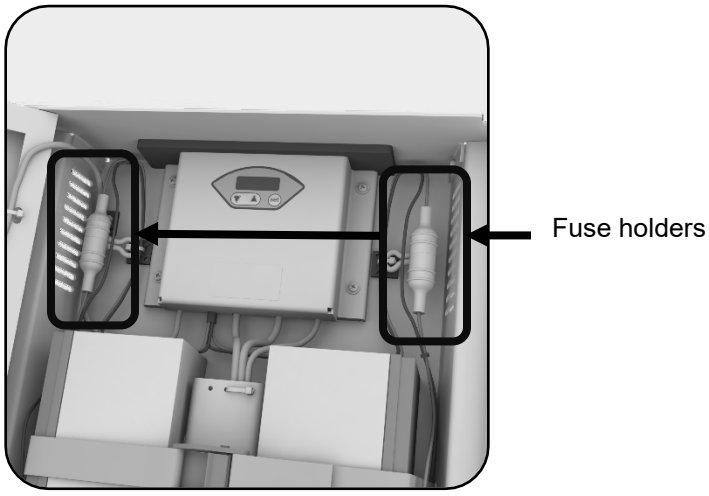
- Dirt and dust
- Snow
- Leaves
- Debris
- Shade that may have developed after installation due to adjacent plant growth.

The frequency of the inspections depends on location and local weather patterns. A yearly visual inspection of the solar engine is typically enough. The system is designed to be maintenance free, but maximum system performance is achieved when the LED lenses and solar panels are clean. When inspecting the interior, ensure that the vent screens are undamaged and that the vents are clear and allow airflow.

8.1 Fuse Replacement

It is important to ensure both fuses are working. With two fuses in the system, it is possible for one fuse to be blown while the system continues to operate normally using the remaining battery. In this event, the available battery capacity, and therefore system autonomy, will be half of what it should be, and the single working battery will be working harder and cycling deeper than it should be, which will shorten its service life. To replace the fuse:

1. Remove any metal jewelry and keep any tools or other conductive objects away from the exposed fuses or battery terminals.
2. Check all wiring for any faults that may have caused the fuse to blow.



3. Pull the yellow rubber fuse holders apart and check the fuses.
4. Replace a blown fuse with an identical 3AG (1/4" x 1-1/4") fast-acting 7A fuse, Littelfuse part number 0312007.MXP (or equivalent).

8.2 Battery Replacement

When the system's batteries require replacement, it is recommended that the original manufacturer and model of battery be used. Always replace both batteries at the same time.

The general health of the battery is tracked by the system in a form of "odometer." If battery status is reported as "Bad", this odometer function has determined the battery health is too poor to operate reliably and the batteries should be replaced. Battery health is evaluated by considering such things as the total number of charge and discharge cycles and the amount of time spent in a low state of charge.

The health odometer is reset by powering up the system **while the Set button is pressed** using the following procedure:

1. Install the new batteries as described in 4.5 Battery Installation
2. Twist and pull apart yellow rubber fuse holder leading to **left-side** battery
3. Ensure fuse holder leading to **right-side** battery is connected
4. Disconnect **positive terminal** of **right-side** battery
5. Press and hold down EMS "Set" button
6. While continuing to hold down "Set" button, connect **positive terminal** of **right-side** battery (in F Series, it is sufficient to hold positive ring terminal against positive battery terminal)
7. While continuing to hold down "Set" button, wait for 2Ero (zero) to appear
8. Release the "Set" button
9. Reinstall the right-side positive battery terminal and reassemble the left side fuse holder

The battery health meter inside the system is now reset (i.e. it knows that new, healthy batteries have been installed). The battery status should read Good (good) if the new batteries are 12.6V or higher, or chAr (charge) if they are between 11.7 and 12.6 volts.

Battery replacements should not be carried out in windy conditions. In all cases, the area at the base of the post must be roped off to prevent people from being injured or killed by falling batteries.

8.3 EMS Replacement

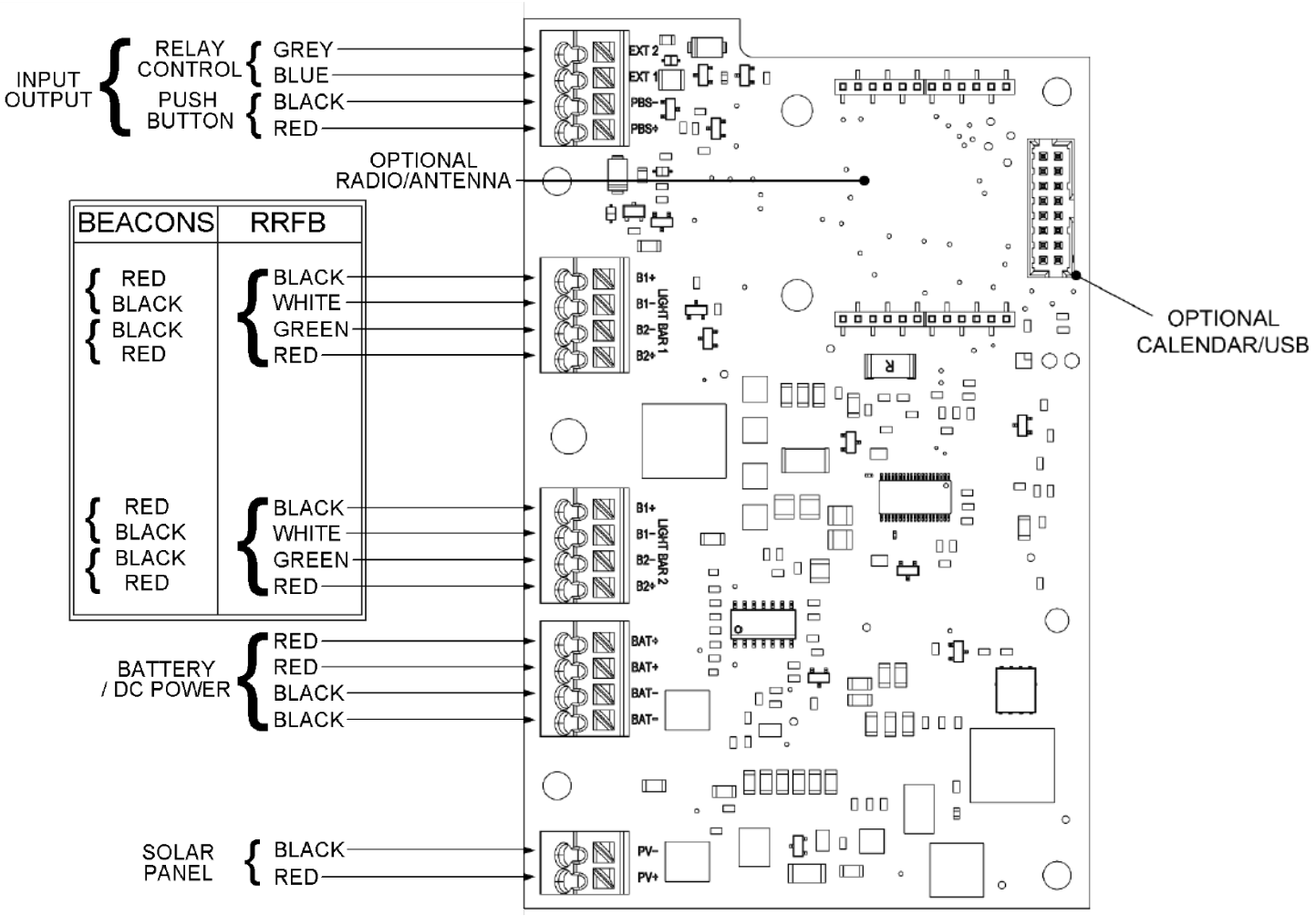
The solar panel may still be producing energy if it is exposed to light. Cover the solar panel or ensure it is not exposed to sunlight to prevent risk of injury.

Sensitive electronics can be damaged by electrostatic discharge. Observe proper ESD precautions when installing the new EMS.

1. Open the solar panel.
2. Disconnect the battery fuses.
3. Remove the 4 screws securing the metal housing containing the EMS PCB (Energy Management System Printed Circuit Board). Carefully unscrew and remove the coax connector leading to the antenna if present.
4. Turn the metal housing over to reveal the circuit board and review the wire positions on the existing EMS. Photograph the existing wire terminations if convenient.
5. Remove the wires from each terminal block connector: with a small screwdriver, press down firmly on the wire release button above the wire and pull the wire out.

6. Secure the bare ends of the solar panel wires with electrical tape. The solar panel wires may still have voltage on them that could damage the electronics if they contact the circuit board.
7. Remove the 4 screws securing the old EMS PCB to the metal housing and set the old EMS PCB aside.
8. Remove the new EMS PCB from its antistatic bag and secure it to the metal housing with the same 4 screws.
9. Beginning with the solar panel wires, check that the wire strands are straight and that all the strands will go into the terminal. This will avoid short circuits created by stray strands. Twist the wire strands as necessary to keep the strands together.
10. With a small screwdriver, press down firmly on the wire release button and insert each wire into its terminal. Reconnect the solar panel power wires in the correct polarity as they were originally found.
11. Reconnect the remaining wires as they were originally found. Carefully pull on all wires to ensure they are secure.
12. If a radio module is present, carefully thread the antenna connector to the module. Do not damage the circuit board with tools.
13. Replace any cable ties that were removed to ensure wires have proper strain relief.
14. Secure the EMS enclosure into the cabinet with the supplied screws.
15. Reconnect battery fuses.
16. The system should now be operating and the front display on the EMS should light up.
17. The replacement EMS should be pre-programed from the factory for your location and installation requirements. You may review the settings if necessary. See the information decal on the back of the solar panel and the user manual for additional information.

NOTE Depending on your system, not all terminals on the EMS PCBA will be populated.



EMS PCBA - Connections Overview

8.4 EMS Recycling

Production of the EMS required the extraction and use of natural resources. The EMS may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle the EMS in an appropriate way that will ensure most of the materials are reused or recycled appropriately. Contact local recyclers for more information.

9.0 Troubleshooting

Symptom	Possible Cause and What to Check
The EMS does not activate or display any information.	This is typically caused by low or no voltage from the batteries. Check both battery fuses. See the “Maintenance and Product Care” section of this manual for fuse information. Using a voltmeter, measure the battery voltage. Battery voltage should be a minimum of 12 volts, with 12.6 volts being nominal normal voltage. If the voltage is very low, charge or replace the batteries and monitor the system for proper operation. Ensure that the solar panel is clean, clear of debris, and is not shaded by buildings or vegetation. If the solar panel is covered or shaded, this will prevent proper battery charging. Once the batteries have proper voltage, check the EMS by running the BIST test and lookup the error codes in the “BIST Error Codes” section of this manual.
LEDs won't flash when push button on the same post is pressed.	This can be caused by either button failure, a wiring issue, low battery voltage, or the unlikely event of an EMS failure. Check that the button is functioning, and it is providing the typical feedback. If the button has an LED or audio feedback, ensure that these are working. Check the wiring to the button for continuity and make sure the wires are not pinched anywhere along their length. Check the wiring to the LED fixtures for continuity and make sure the wires are not pinched anywhere along their length. Check that the wiring pattern (polarity) is correct on the LED fixtures. Check the battery voltage, either through the OBUI or with a voltmeter (see item above). Test the system using the “Test” function. If the LEDs flash using the OBUI functions, then the problem is in the button or wiring to the button.
LEDs on same post flash, but other systems in the wireless group won't flash.	If one system is activated, but the other systems in the group are not turning on, this points to a radio issue. Ensure that all the units are set to the same radio channel using the OBUI. See the EMS Programming and Testing section of this manual. Ensure that the units are not too far apart. The maximum distance for proper radio communication is 1,000 unobstructed feet (305m), but real-world effects and signal path can limit range to less than half that value. There can be no barriers or obstructions between systems, such as buildings or billboards.
One LED fixture flashes, but other fixtures on the same post does not flash.	This is likely caused by improper wiring of the fixtures. Ensure that the wire colors and polarities match the instructions in this manual. Check that the electrical connections are secure.

The LEDs are dim when flashing.	The battery voltage may be too low for proper operation and the system has activated Automatic Light Control (ALC). Check the OBUI for ALC status and battery voltage. Ensure that the solar panel is clean, clear of debris, and is not shaded by buildings or vegetation. If the solar panel is covered or shaded, this will prevent proper battery charging and drive the system into ALC. Check for debris covering the ambient light sensor on top of the solar engine and confirm the photosensor is correctly detecting day and night. A flashlight can be shone into the photosensor to simulate day, and the photosensor can be covered to simulate night. Confirm the intensity is set correctly to a value that has been confirmed to be sustainable using a solar simulation. Check the Ambient light Auto-Adjust (AAA) setting on the OBUI. Turn off the AAA to see if this corrects the dim LEDs.
The LEDs appear too bright when flashing	Settings on the EMS can affect the apparent brightness of the LEDs. The intensity setting on the user interface can be turned down to a more suitable brightness level. Verify all fixtures are working. If a fixture stops working, the current that would normally flow through it is redirected into the remaining fixtures, which increases their brightness.
Fixtures flash when no button is pressed	This is likely caused by another nearby system on the same radio channel activating the system. Ensure that all units in a group are set to the correct radio channel using the OBUI while also ensuring that nearby systems at a different location are using a different channel.
LED Open Fault is showing on User Interface	This is likely caused by using a single fixture with an alternating flash pattern. The EMS is looking for the other fixture in the alternate pattern and declares an “LED Open” fault when it doesn’t find one. Set flash pattern to unison.

9.1 BIST Error Codes

The BIST (Built-In Self-Test) is a useful feature of the EMS for troubleshooting. After the BIST has finished, a code will be displayed on the user interface, which will correspond with one or more results.

NOTE

If the BIST is run in a low-light environment, it will generate a 0080 error. This does not indicate an issue with the ambient brightness sensor. Shine a flashlight on the window above the EMS to avoid this error.

The hexadecimal number that will be displayed after the BIST test is created by adding together the individual error codes. For example, if there were a charger problem (4000) and a problem with the fixture LED (8000), the hexadecimal sum would be C000. 4 + 8 =12, which is “C” in hexadecimal.

The BIST codes can be used to assist Carmanah technical support in solving product configuration or performance issues. Please contact Carmanah technical support if the issue you encounter is not easily solved be reviewing the information provided in this document.

Code	Error
0002	**Temperature check.** Checks that temperature is between 15°C and 35°C. With installation sites frequently having temperatures outside of this range, code 0002 will often be generated while there is no real issue with temperature.
0008	**Battery check.** Checks that battery voltage is between 11.7V and 17.268V (max charge voltage at -40°C). Nominal is 12.6 volts when unloaded and not charging.
0010	Checks that V supply on EMS control board is between 3.2V and 3.4V. Nominal is 3.3 volts.
0020	**Keypad check.** Checks all push buttons on user interface (up, down and enter).
0080	**Ambient Brightness Sensor (ABS) check.** Checks that the current lux measured by the ABS is above the minimum (90lux).
4000	**Charger check.** Runs charger at two set points. Checks that the charge current stays within allowed range (10mA to 4.5A). Checks that the solar voltage is stable (less than 50mV change between set points).
8000	**LED fixture check.** Enables one bank at a time. Checks that the LED voltage is between 6V and 28V. Checks that the current is close to the set intensity. If a single fixture is used, and an alternating flash pattern is programmed, the system will generate an error because it expecting to see current flowing through two fixtures in alternation.

10.0 Customer Service and Warranty

The E Series and F Series products are covered by a limited warranty for the product excluding batteries, and a separate limited warranty for the batteries.

Visit www.carmanahtraffic.com for additional information or contact the customer service department.

Before contacting Carmanah's customer service department, please have the serial number of your system available, a brief description of the problem, as well as all details of the installation (location, pole type, type and quantity of fixtures, etc.) The serial number can be found on the inside of the solar panel, and on the outside of the system just below the solar panel hinge.

To contact Carmanah's Customer Service Department:

Mail: Carmanah Technologies Corporation
250 Bay Street
Victoria, BC Canada V9A 3K5

Phone: 1.250.380.0052
1.877.722.8877 (Toll Free in U.S. and Canada)

Fax: 1.250.380.0062

Email: customerservice@carmanah.com

Web: carmanahtraffic.com

10.1 Additional Products

Carmanah offers a variety of solar-powered and energy-efficient LED lighting products. In addition to the E and F Series, the larger, cabinet-based G Series products are fully compatible with the E and F Series. Carmanah also provides cabinet-based AC-powered systems for applications that may require third-party devices, longer autonomy, more activations per day, or have poor solar availability. Along with traffic products, Carmanah also manufactures solar LED outdoor lighting products. For more information, please visit our website at carmanahtraffic.com.

10.2 Glossary

3PD:	Third-Party Device, typically an accessory module that provides expanded functions to the product. Examples include time switches, modems, and detection systems.
Autonomy:	The number of days or nights the system can continue to operate normally without any battery charging from the solar panels.
EMS:	Energy Management System. The electronic controller inside the product that is responsible for managing the solar input energy, battery charging, LED drivers, and other power and operational functions
Solar Engine:	The complete, self-contained assembly of solar panel, batteries, EMS control module, wiring, fuses, and mechanical enclosure
UI/OBUI:	User Interface/On-Board User Interface. The 4-digit display and 3-button interface on the EMS that allows users to interact with the system programming.