G Series
TRAFFIC BEACON USER MANUAL

For the SC315-G, R820-G, R829-G, and R247-G flashing beacons

87667_MANUAL_TRA_G-Series_RevA

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 G 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.

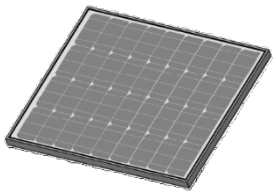
Ensure the equipment is not powered during installation and wiring of the system.

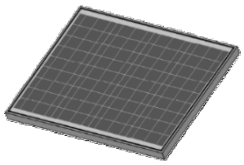
Recheck all completed wiring for proper polarity prior to energizing the system.

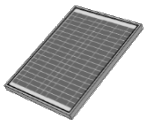
Changes or modifications to Carmanah equipment not expressly approved by Carmanah could void both the user's authority to operate the equipment and the warranty.

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

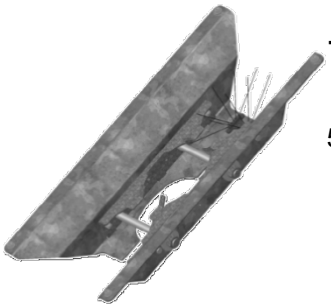






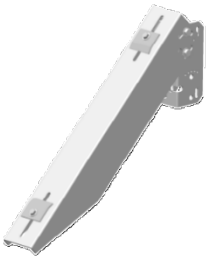
Three sizes of solar panel (20W, 50W, 80W)

Side and top mounting for solar panels



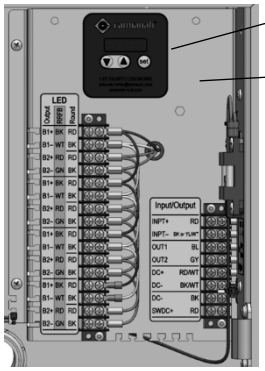
Top of Pole Mount

50W or 80W



Side of Pole Mount

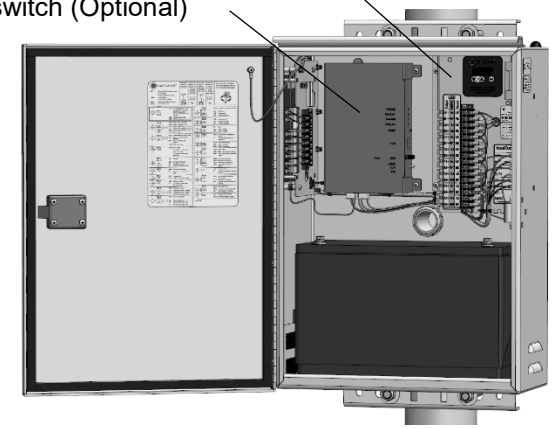
20W, 50W or 80W



Onboard User Interface (OBUI)

EMS

Time switch (Optional)



G Series Cabinet

Three Battery Sizes (35Ah, 55Ah, and 100Ah)

Banding and U-Bolt Mounting Options

RRFB Light Bars, Circular Beacons, LED Signs

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

2.0 Introduction

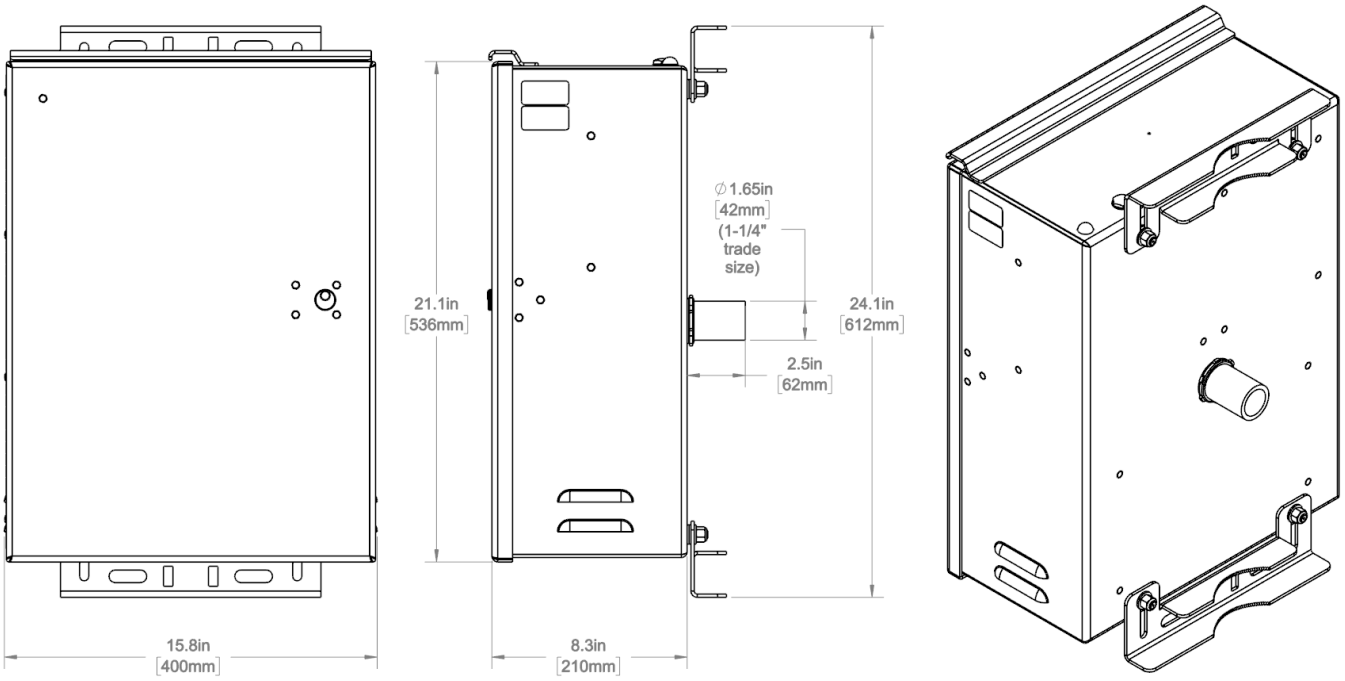
2.1 About the G Series

The Carmanah G Series products consist of the following models:

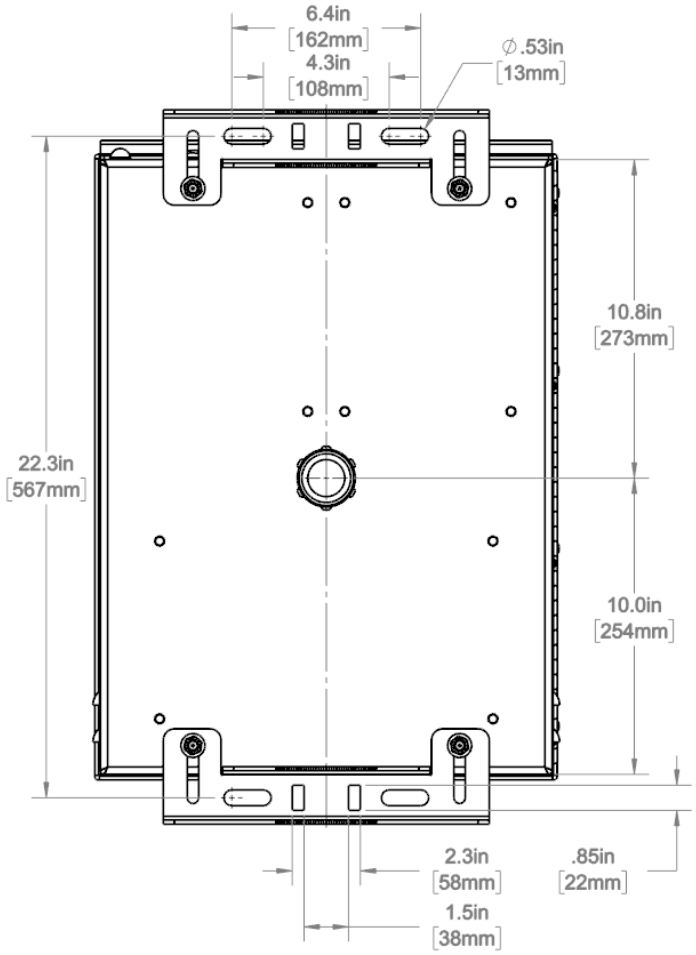
Models	Applications	LED type(s)	Radio Communication
SC315-G	Pedestrian crosswalks	RRFB or LED Enhanced Signs	Standard
R820-G	Pedestrian crosswalks	Circular beacons or LED Enhanced Signs	Standard
R829-G	School zones, calendar-based	Circular beacons or LED Enhanced Signs	Optional
R247-G	Continuous 24-7 operation	Circular beacons or LED Enhanced Signs	N/A

The G Series models are available in solar and AC versions, and all share a common cabinet. Solar models are available with panel wattages of 20, 50, or 80W, and 12V batteries of 35, 55, or 100Ah capacity. The G Series can also accommodate third-party devices. While all G 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.

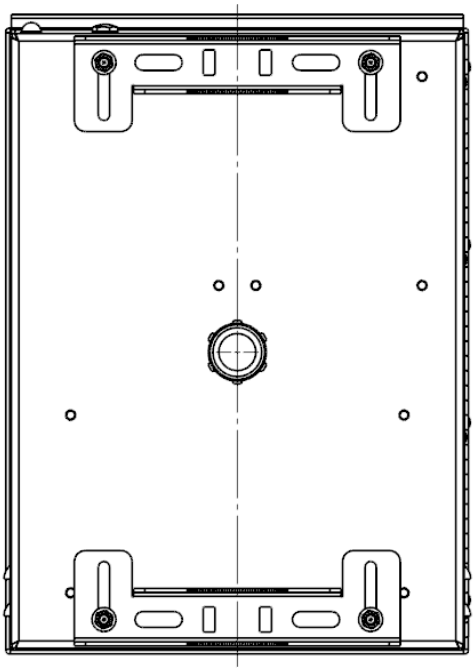
G-Series Cabinet Dimensions



BRACKETS MOVED OUTWARDS
BANDING OR U-BOLT APPLICATIONS

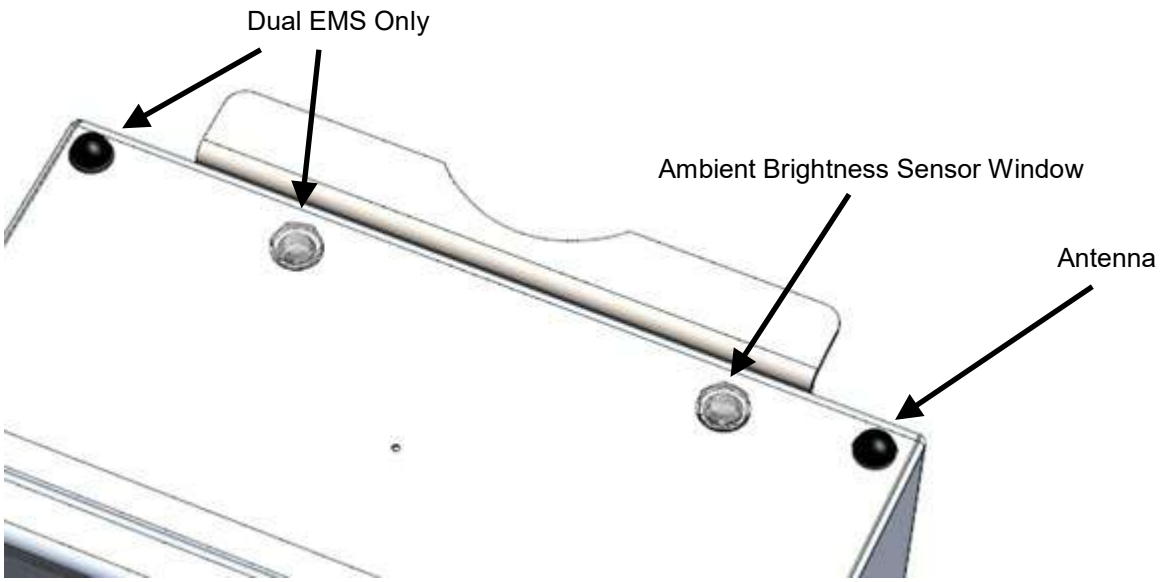


BRACKETS MOVED INWARDS
(BANDING APPLICATIONS ONLY)



2.2 Ambient Brightness Sensor

Each EMS in a G 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 cabinet, the G Series can detect ambient light levels outside the cabinet. The G Series uses that data 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.



Dual EMS G Series systems have a second antenna and ambient brightness sensor window

2.3 Radio Communication

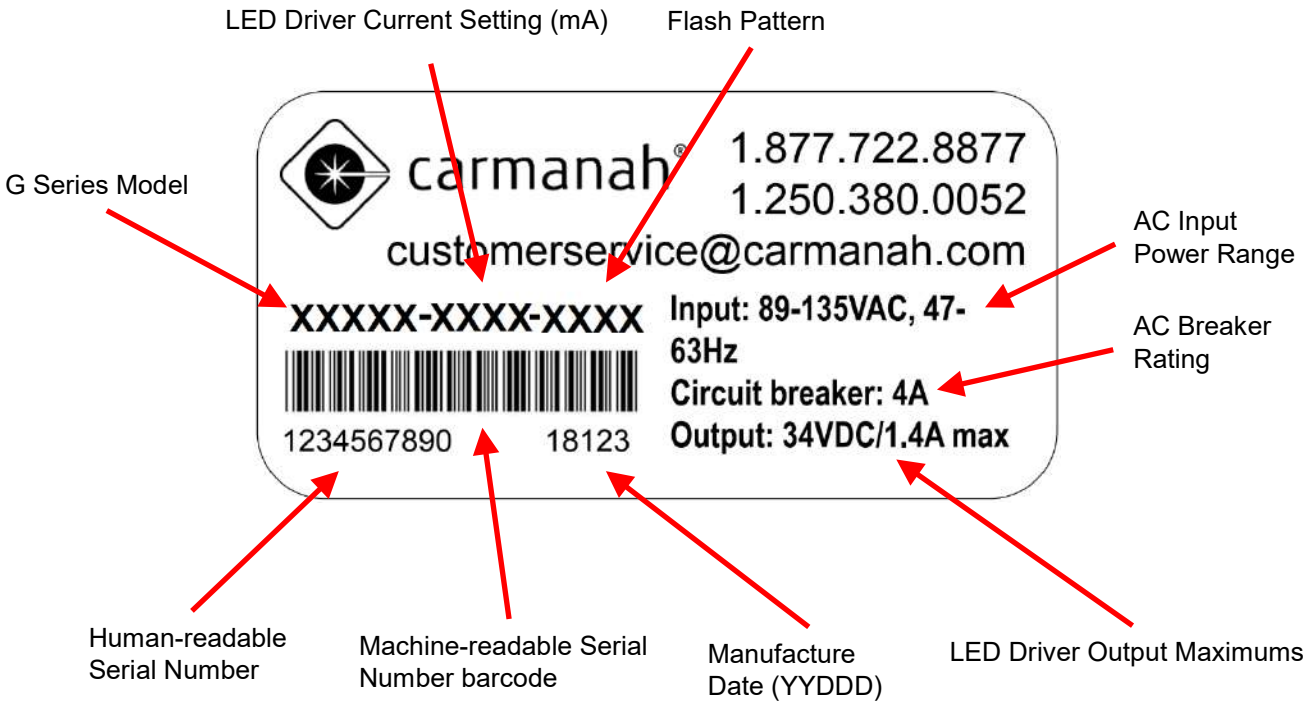
Radio communication between products is standard in R820-G and SC315-G systems and is an option in R829-G systems. In addition to the G Series, Carmanah also manufactures smaller, self-contained E and F Series products in which the solar panel, batteries, EMS, and third-party devices reside together in a “solar engine” enclosure. Wireless communication works seamlessly between products regardless of whether they are E, F, or G Series. R820 and SC315 systems will also activate each other when a pedestrian pushes the push button.

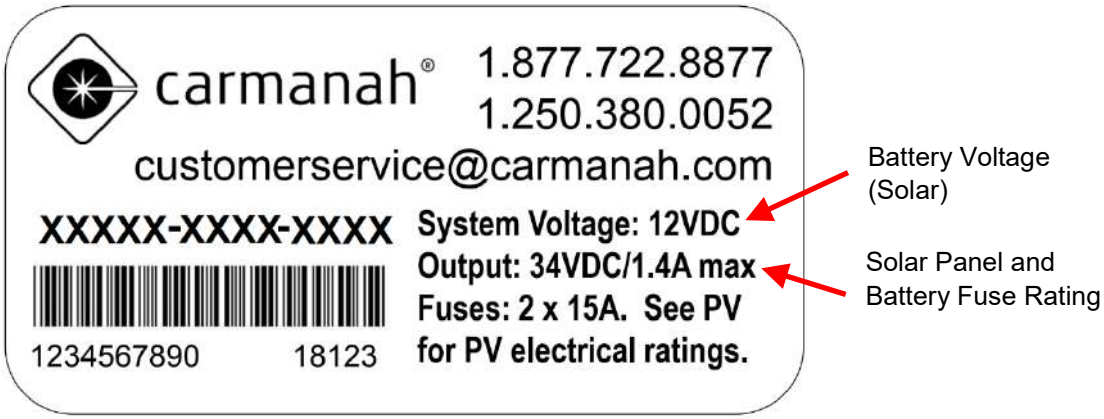
The radio modules use 2.4GHz DSSS (Direct Sequence Spread Spectrum) with an AES128 encrypted signal and have been tested with clear line of sight (with no nearby interference or reflected signals) to 1,000 feet (305 meters). Performance is reduced if clean line of sight is not possible.

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

2.4 Label Explanation

The G Series identification labels appear in two formats—one for solar-powered and one for AC-powered. The information appearing on the labels is described below:





2.5 SC315-G: Pedestrian Crosswalk with RRFB Light Bars

Overview

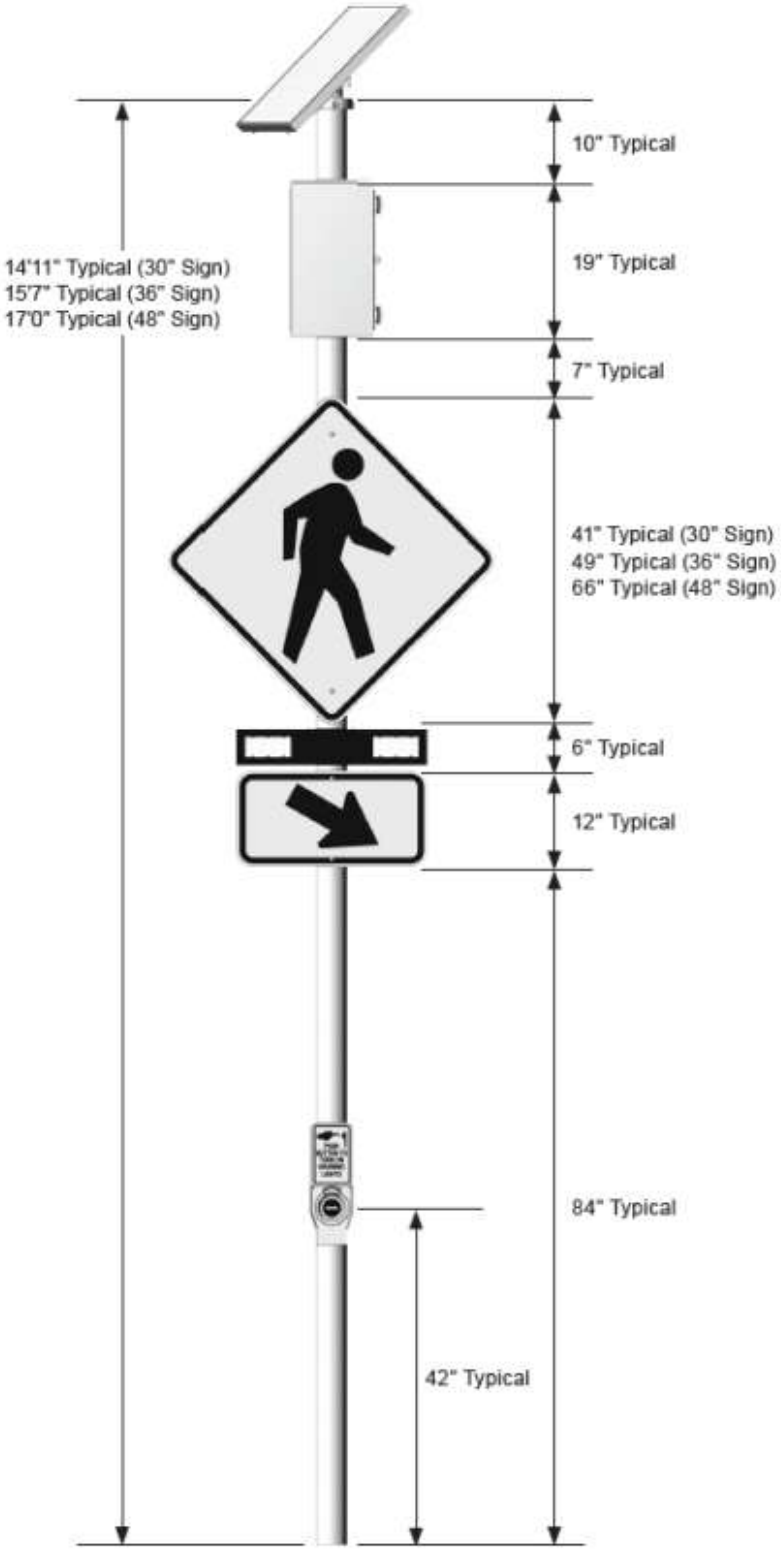
The SC315-G LED Rectangular Rapid Flashing Beacon (RRFB) products are ideal for uncontrolled pedestrian-activated crosswalk applications. Multiple SC315-G units can be combined to create a complete crosswalk set. Each SC315-G is radio-controlled, and each synchronizes flashing with other SC315-Gs and R920-E/Fs or advance R820-E/F/Gs. 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 SC315-Gs require no trenching of cables across the roadway.

Details on RRFB light bars can be found in Section 2.7 and Section 4.1.

As an alternative to light bars, SC315-G systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.9 and Section 4.3.

Typical SC315-G Configurations

Typical SC315-G Configurations, cont'd



2.6 R820-G: Pedestrian Crosswalk with Circular Beacons

Overview

Multiple R820-G units can be combined to create a complete crosswalk set. Each R820-G is radio-controlled, and each synchronizes flashing with other R820-Gs in the crosswalk set. The system will flash for a pre-set field-adjustable duration 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-Gs require no trenching of cables across the roadway.

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

Details on circular beacons can be found in Section 2.8 and Section 4.2.

As an alternative to circular beacons, R820-G systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.9 and Section 4.3.

Typical R820-G Configuration

2.7 R829-G: School Zone Flashing Beacon

Overview

The R829-G 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-G system can follow a calendar schedule:

1) A non-wireless R829-G can operate on its own, automatically flashing based on the schedule programmed into its internal calendar.
2) A non-wireless R829-G 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-G 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 2.8 and Section 4.2.

As an alternative to circular beacons, R829-G systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.9 and Section 4.3.

NOTE F and G Series products feature optional time switch kits that allow various third-party products to be mounted within the solar engine. See Section 2.10 and Section 5.0 for details.

Typical R829 Configuration

Internal Calendar (standard on R829-G, optional on other systems)

The R829-G 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-G units onsite with a laptop PC. A USB cable is part of the calendar programming kit and is provided coiled up inside the R829-G cabinet.

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-G: 24-Hour Flashing Beacon

Overview

The R247-G 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-G 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 2.8 and Section 4.2.

As an alternative to circular beacons, R247-G systems can be configured with LED Enhanced Signs. Details on LED Enhanced Signs can be found in Section 2.9 and Section 4.3.

Typical R247-G Configuration

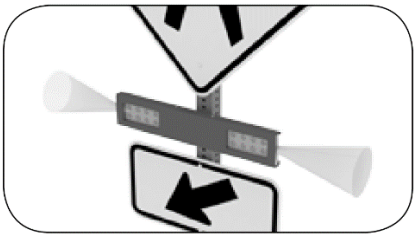
2.9 RRFB Light Bars: Overview

Standard G Series products support up to four RRFB light bar fixtures, or up to eight for dual EMS systems. 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 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.

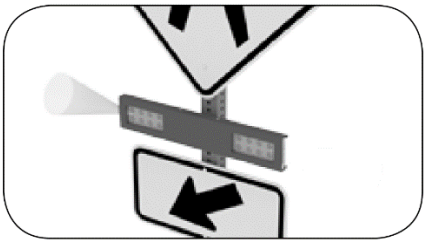
See Section 4.1 for information on installing and aiming light bars.

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

Standard G Series products support up to eight circular beacons, or up to 16 for dual EMS systems. The beacons are industry-standard equipment and comply with MUTCD and ITE flash patterns, color, beam shape, and intensity. Beacon wiring is provided with a convenient terminal strip inside the signal head 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 loads.

NOTE If powering three, five, or seven LED loads from a single EMS, use a “Unison” flash pattern to avoid current imbalance and ensure all loads receive the same amount of current while flashing and therefore produce the same brightness.

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.

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, G 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 If powering three, five, or seven LED loads from a single EMS, use a “Unison” flash pattern to avoid current imbalance and ensure all loads receive the same amount of current while flashing and therefore produce the same brightness.

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

The G Series is available with several optional 3PD kits which allow the installation of the 3PD within the G Series cabinet:

- The G Series **RTC/IDC time switch kit** option allows the installation of an RTC or IDC time switch and includes a mounting plate, switch mounting hardware, and a prewired harness with a connector that plugs into

the time switch. (Time switch not included.) For installation information see Section 5.2, Section 5.3 and Section 5.5.

- The G 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 G Series and the AI time switch and modem. (AI time switch/modem not included). For installation information see Section 5.4 and Section 5.5.
- The G Series **Relay kit for digital output, AC** option comes with a 10A AC relay prewired to the G Series EMS. For installation information see Section 5.6.
- The G Series **Relay kit for digital output, DC** option comes with a 10A DC relay prewired to the G Series EMS. For installation information see Section 5.7.
- The G 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 5.8.
- The G Series **Campbell Guardian kit** option includes a push button harness (16ft, 36ft, or 75ft) prewired to the G Series EMS, along with the Guardian audible push button and an associated sign. For installation information, see Section 5.9.

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

3.0 Solar Panel and Cabinet 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 (some configurations)
4. Imperial Allen-Wrench set
5. Fish tape
6. Level
7. Compass (or smart phone compass app)
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

3.2 Pole Preparation

1. Mark positions of flashing beacons, cabinet, and side of pole mount (if required) on pole.
2. Drill 1-3/4" dia. hole at desired position of cabinet nipple.
3. Drill cable exit/entry points for the flashing beacons and side of pole solar panel mount (if used).
4. Fish solar harness between top of pole (or side of pole mount hole) to cabinet nipple hole.
5. Fish flashing beacon harnesses between cabinet nipple hole and flashing beacon holes.

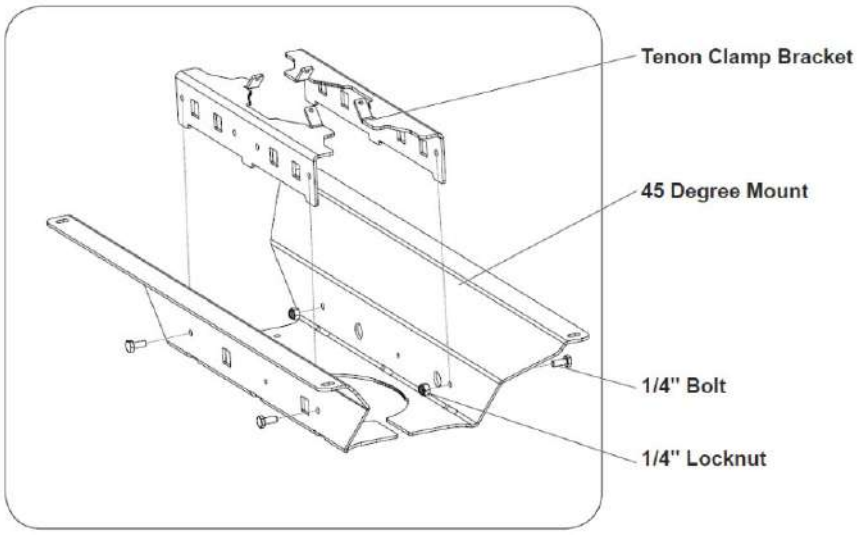
3.3 Solar Panel Installation

There are two options for mounting the G Series solar panel:

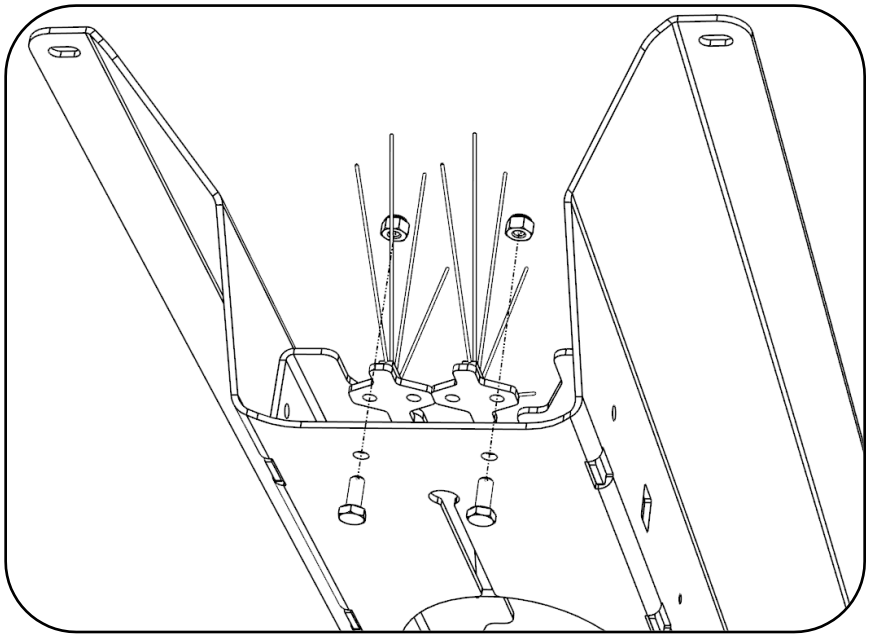
- Top of Pole – Fixed at 45 degrees angle with built-in bird deterrent
- Side of Pole – Adjustable inclination angle. Set it for 45 degrees unless Carmanah has conducted solar simulations that resulted in a recommendation for a different panel inclination angle.

Top of Pole Solar Panel Installation

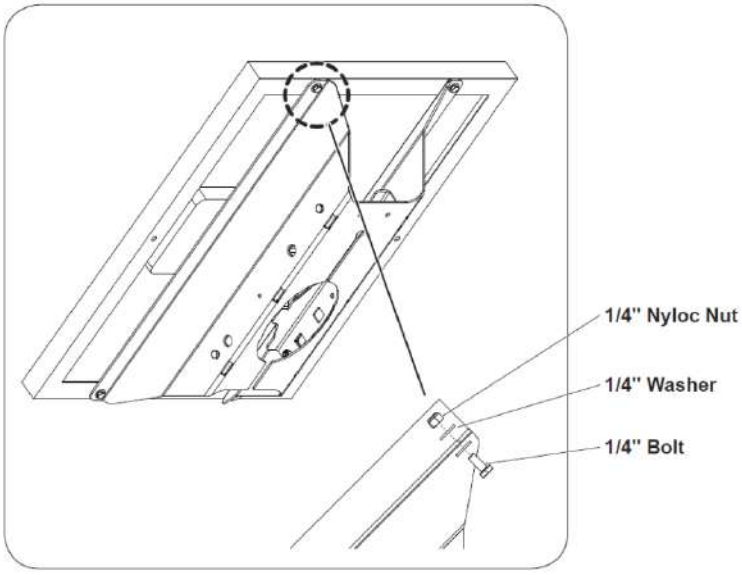
1. Attach tenon clamp brackets to 45-degree mount. Use ¼" bolts and ¼" locknuts supplied. Tighten nuts and bolts securely.



2. If needed, install bird deterrent spikes with ¼” bolts and lock nuts as shown.



3. Attach solar panel (50W, 80W, or 170W) to the 45-degree mount. Use bolts, washers, and locknuts that were supplied. Tighten nuts and bolts loosely—**do not fully tighten** at this stage.



4. Drill 1-3/4” dia. hole in the pole in the desired cabinet location.

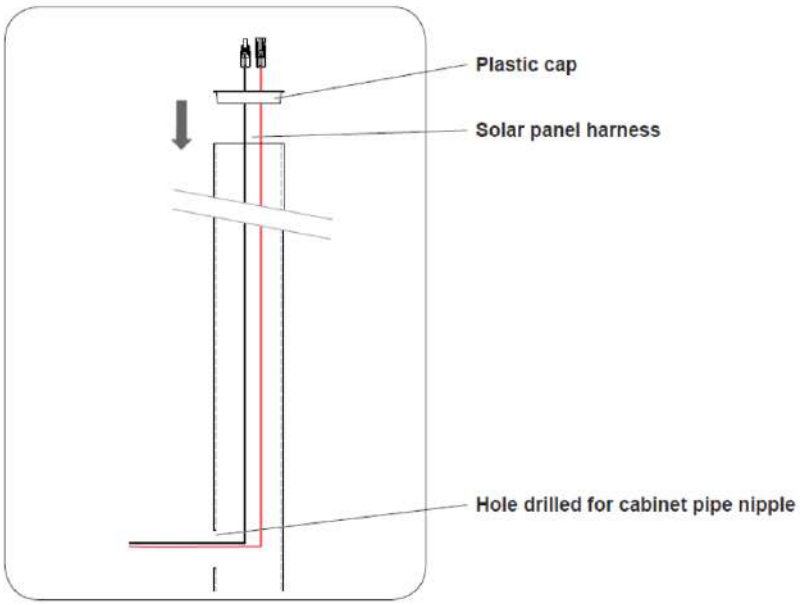
NOTE

Your system includes a cap for the open top of the pole. The cap prevents debris from entering the pole. There are plastic and metal versions of the cap:

- The plastic cap is inserted into the top of the pole prior to attaching the solar mount bracket.
- The metal cap is used by Miami-Dade County and is attached to the solar panel mounting bracket before the solar panel is mounted on the pole. Instructions are provided at the end of this section.

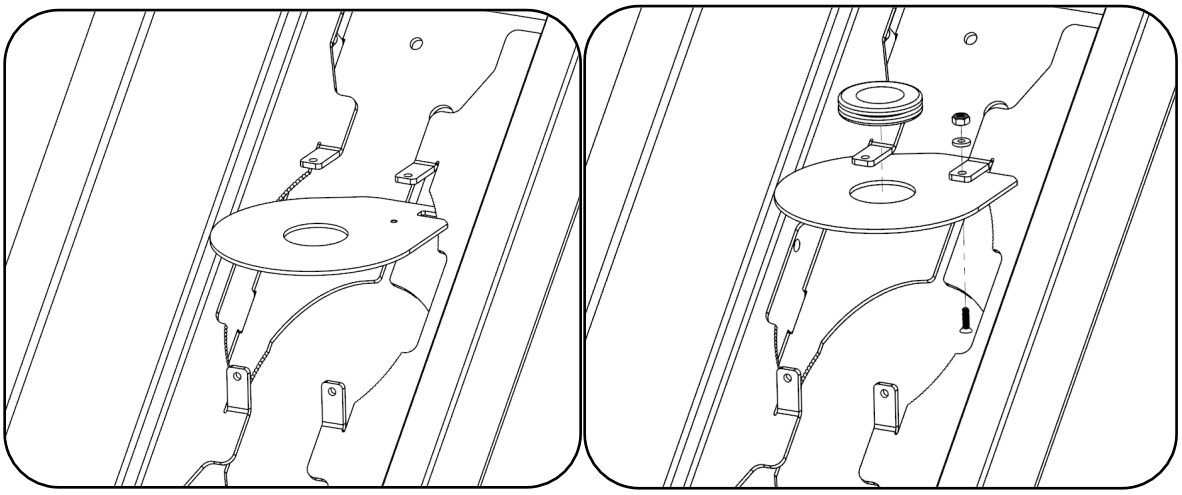
PLASTIC CAP INSTALLATION (FOR LOCATIONS OTHER THAN MIAMI DADE COUNTY):

5. Fish solar panel harness through pole and plastic cap as shown, with black connectors at top.

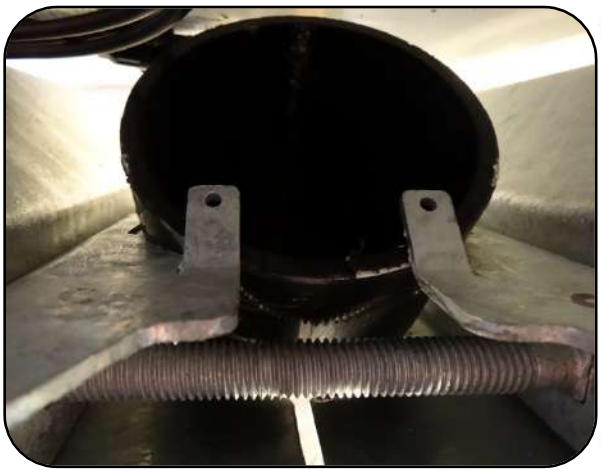


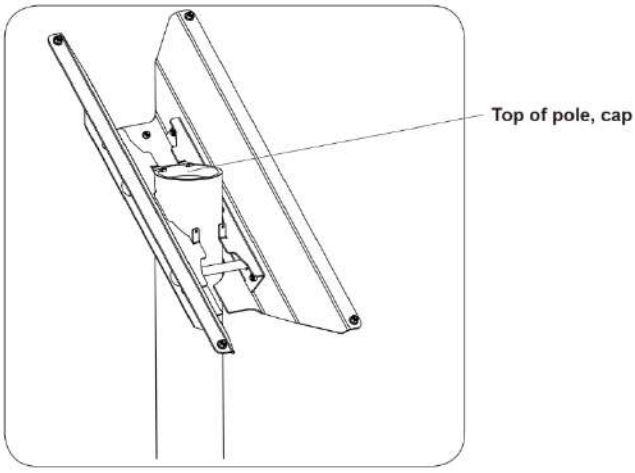
METAL CAP INSTRUCTIONS (MIAMI DADE COUNTY ONLY):

6. Install the metal cap, grommet, and hardware onto the bracket as shown.

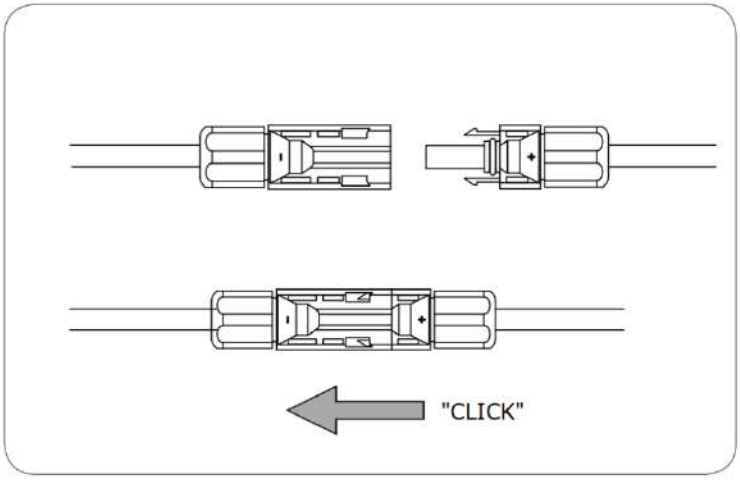


7. Lower solar panel and top of pole bracket down onto pole. For metal caps, route solar cables up through grommet in cap. Make sure panel mount sits securely on top of pole cap as shown below (solar panel not shown to allow visibility of pole top). When setting top of pole mount on pole, ensure two tabs are resting on lip of pole cap. Also, look underneath solar panel to ensure wiring is not pinched.

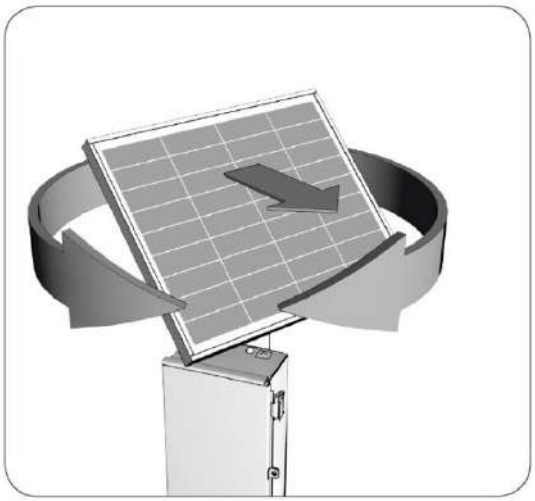




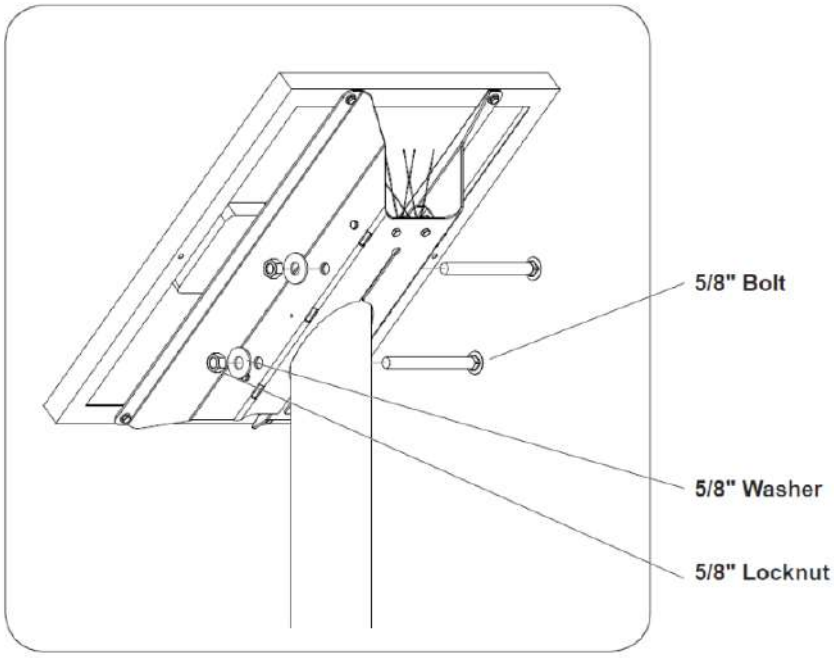
8. Mate black MC4 connectors from solar panel to those from solar harness. A click noise indicates they are fully mated. Tuck excess harness length down into pole or coil up excess harness and cable tie securely, if desired.



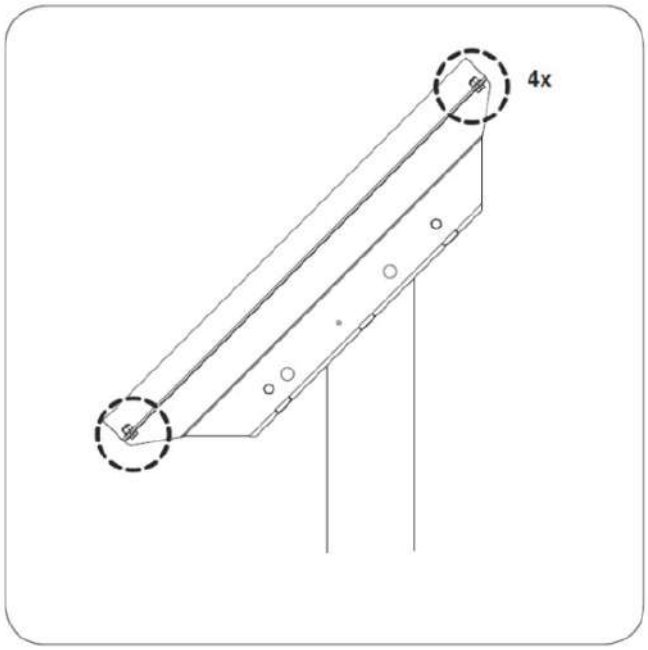
9. Ensure solar panel is facing equator (pointing south if you are in the Northern Hemisphere).



10. Install and tighten 5/8” bolts, washers, and nuts to secure top of pole bracket to pole as shown.

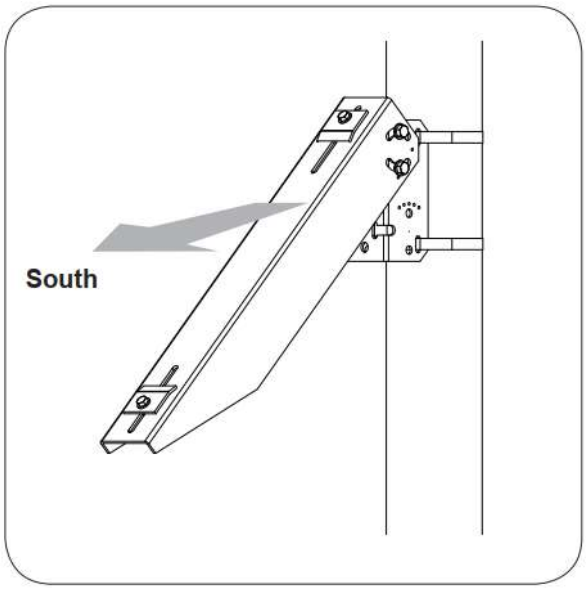


11. Tighten four nuts and bolts securing solar panel to bracket.



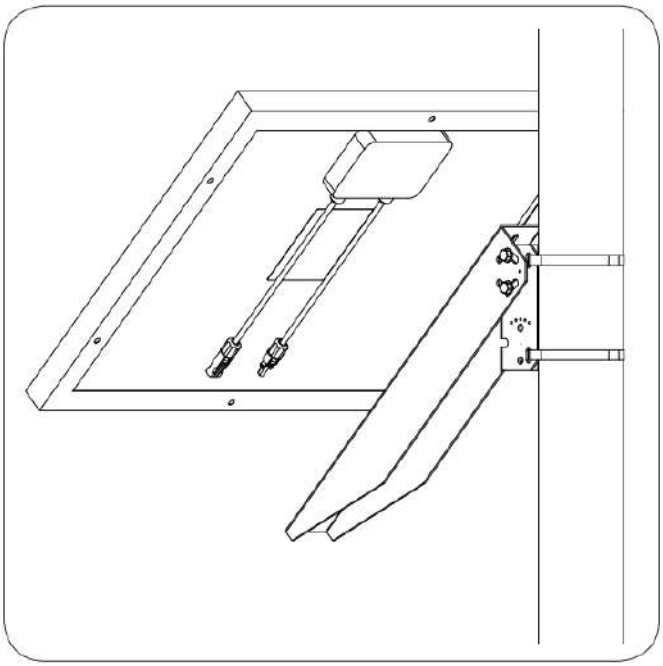
Side of Pole Solar Panel Installation

1. Assemble side of pole mount using instructions provided. Install at 45° tilt angle unless advised otherwise by Carmanah. Orient mount so panel will face the equator (pointing south if in the Northern Hemisphere).



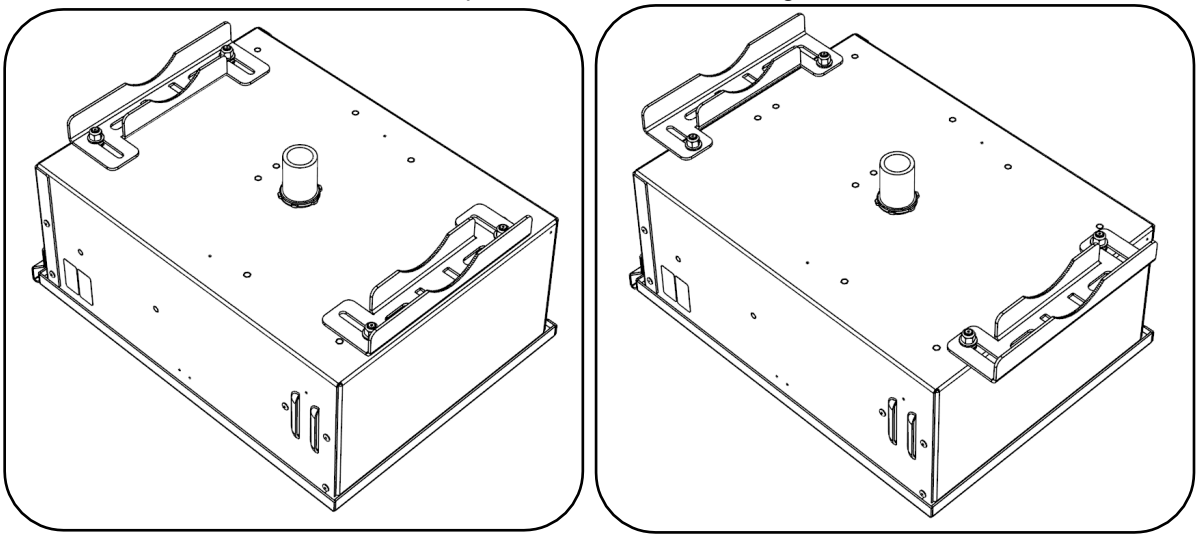
Follow assembly and torque specifications provided with side of pole mount.

2. Attach solar panel (20W, 50W, 80W, or 170W) to mount using direct bolt option or clamps provided.

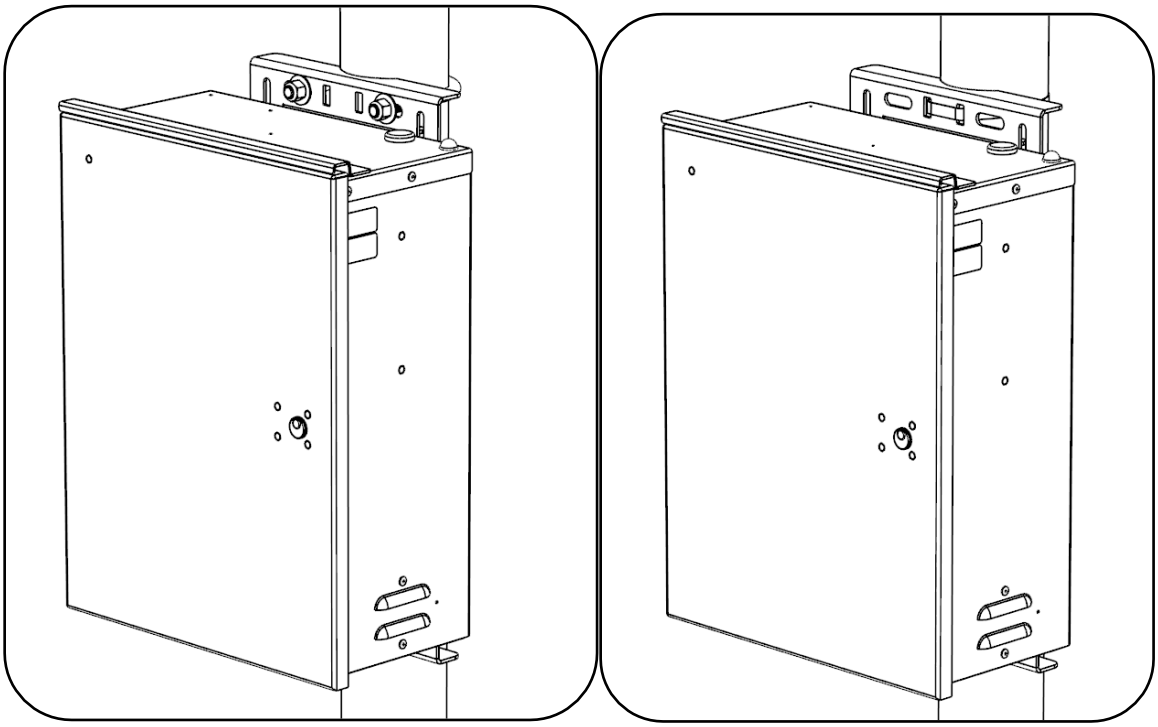


3.4 Cabinet Installation

1. Loosen 4 nuts on back of cabinet and spread brackets outward. Tighten nuts to 20 ft-lb.



2. Route cables from pole into cabinet and temporarily fixture cabinet against the pole. For U-bolt mount, install U-bolts, washers, and nuts and torque to 30 ft-lb. For banding, install banding through openings in brackets.



3. If desired, before tightening banding, brackets and banding can be adjusted inboard again. Tighten banding as per banding manufacturer's instructions.

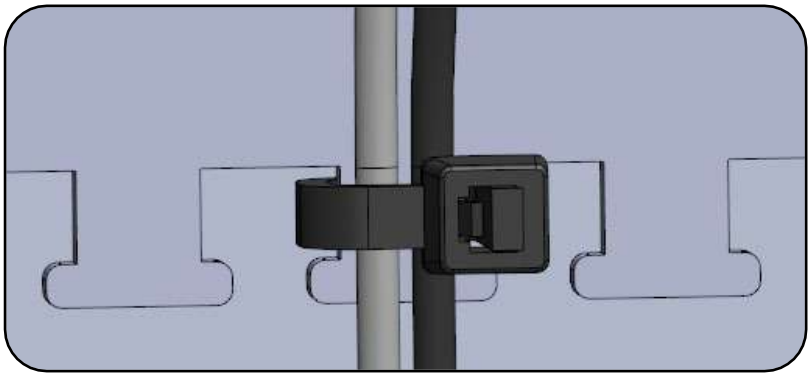
3.5 Overview of Cabinet Terminals

The G Series provides complete access to all electrical connection points that the installer will require when connecting power, fixtures, and other equipment. Each terminal block is introduced below.

NOTE Except for the battery and solar harness (unless an optional longer solar harness is ordered), all other harnesses (light bars, talking push button, etc.) will not be prewired by Carmanah.

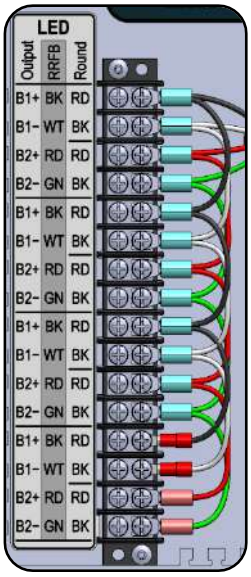
NOTE Use ring terminals when connecting two or more wires to the same screw on a terminal block. For highest reliability of the electrical connection, do not stack spade terminals.

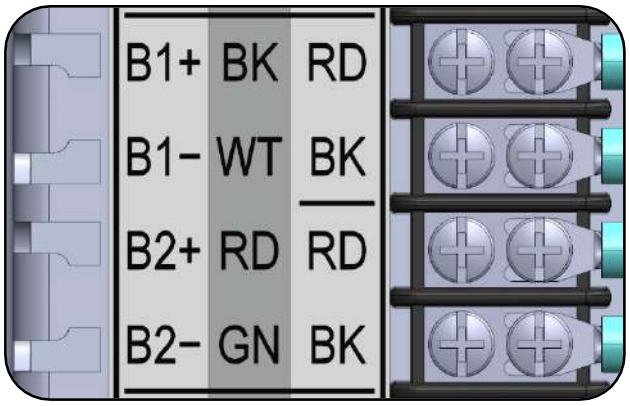
Harnesses are attached within the cabinet at various points using cable ties for strain relief and cable management. Attachment points may include adhesive cable tie bases, cabinet wall openings, and “dog bones.”



LED Terminal Block

The LED terminal block is a 16-position connector for attaching the G Series light bars, circular beacons, and LED signs. The 16 connections are arranged in four “LED Groups” of four connections per group.





An LED Group can be used to wire one light bar, two circular beacons or two LED signs. Each LED Group has a Bank 1 pair (positive and negative) and a Bank 2 pair. Alternating flash patterns cycle back and forth between Bank 1 and Bank 2. If the flash pattern is set for unison and there are fixtures attached to both Bank 1 and Bank 2, both fixtures will flash in unison even though they are on different banks.

All four LED Groups are wired in parallel. That is, all B1+ are wired together, all B1− are wired together, and so on.

NOTE The bottom four crimped terminals differ in appearance but there is no functional difference between these fixture connection points and the others above.

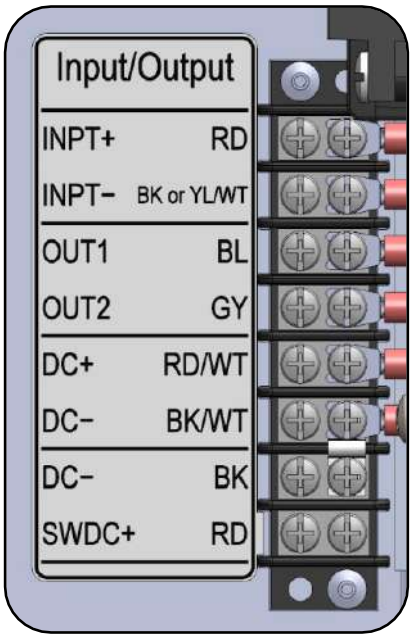
NOTE Because of the parallel connections between the four LED Groups, when a given bank is flashing, the current from the EMS LED driver will divide up among the fixtures attached to that bank.

The LED terminal block label provides the colors of the fixture wires that are to be connected at each terminal:

Fixture	Label Marking	Wire Color	Bank
Light Bar	BK	Black	B1+
	WT	White	B1−
	RD	Red	B2+
	GN	Green	B2−
Circular Beacon	RD	Red	B1+ / B2+
	BK	Black	B1− / B2−
LED Sign	RD	Red	B1+ / B2+
	BK	Black	B1− / B2−

Input/Output Terminal Block

The Input/Output terminal block is where input/output signal, switched control voltage, and unswitched supply voltage connections are made. The top six positions on the Input/Output terminal block are always prewired to the EMS by Carmanah. Position six and seven (DC−) are connected in parallel via a jumper. Position 8 is prewired only when the optional DC Relay Kit is ordered.



Related functions within the Input/Output terminal block are grouped together:

INPT+ **INPT−**	These are the hardware push button or switch inputs that are referenced in the INPT (Input) section of the user interface instructions. Multiple connections are made in parallel. For information on configuring the behaviour of the INPT terminals, see Input Type in Section 6.1.
OUT1	Used for Applied Information time switches only. Pulsed signaling information appears on this terminal to provide alarm monitoring. References to DC−. As long as pulses are present, no fault is triggered. The left-hand side of the OUT1 terminal is pre-wired to the AI harness at time of manufacture.
OUT2	12 volts DC is present when the fixtures are flashing. The 12 volts is referenced to DC−, which is the battery negative terminal. See note below regarding OUT2 load voltage and current considerations. For information on configuring, see Digital Output in Section 6.1.
DC+ **DC−**	The DC+ / DC− terminals provide 12V battery power for devices such as third-party time switches.
DC−	The DC− terminal is jumpered to the DC− terminal above.
SWDC+	Wired to output of DC solid state relay for units with optional DC Relay Kit, see Section 5.7 DC Relay Kit.

Due to the diversity of devices that can be connected at the Input/Output terminal block, the label's wire color assignments aren't correct for every installation scenario.

The push button input (INPT+, INPT-) is not a dry contact type. There is always 12-15VDC present between these terminals, regardless of input configuration (NO, NC, or Button, see Section 6.1). When connecting input devices other than standard traffic push buttons, consideration must be given to electrical compatibility. Failure to isolate input signals operating at different voltages or connection of devices that are designed to operate in a different voltage range could result in poor performance or equipment damage. Please contact Carmanah for additional support on connection of non-standard input devices.

The voltage available at the OUT2 terminal changes depending on the current flowing through OUT2. The voltage available at OUT2 can be approximated by the formula:

$$V_{OUT2} = V_{battery} - (I_{OUT2} \times 470) - 1.4$$

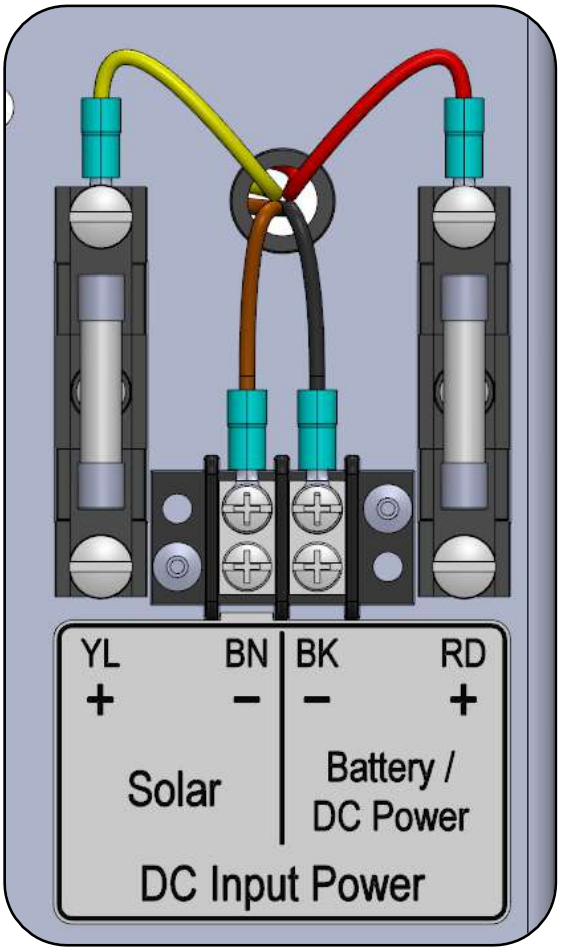
Where:

V_{OUT2} is the voltage at the OUT2 terminal in Volts,
$V_{battery}$ is the battery voltage in Volts, and
I_{OUT2} is the current drawn by the load connected to OUT2 (in Amperes)

For proper load operation, ensure there is sufficient voltage available at the OUT2 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.

DC Input Power Terminal Block

The DC Input Power terminal block is where input power arrives within the G Series cabinet, passes through fusing, and then continues on to the EMS through 15A fuses. The G Series operates on nominal 12-volts DC power, which is provided either by a battery and solar panel in solar-powered systems, or an AC/DC power supply in AC-powered systems. Note the polarity of the terminals which have been laid out to maximize the distance between positive and negative and prevent accidental shorting.



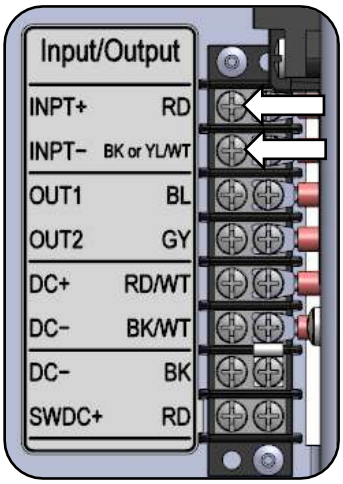
Use the following table when connecting the solar panel harness to the Power Terminal Block:

Polarity	Solar Panel Harness	DC Input Power Terminal Block
Positive (+)	Red wire with yellow heat-shrink	YL+ (Yellow wire to EMS)
Negative (−)	Black wire with brown heat-shrink	BN− (Brown wire to EMS)

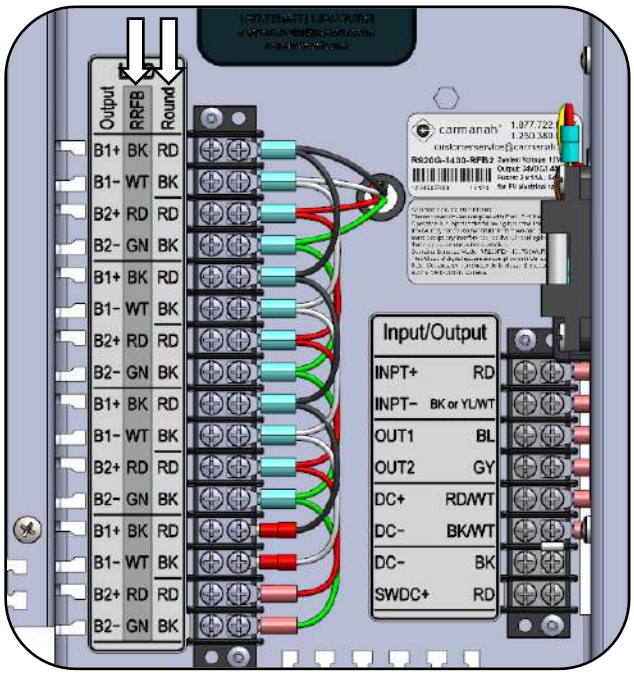
NOTE The Battery/DC Power side of the DC Input Power terminal block comes prewired from Carmanah.

3.6 Installation of Cabinet Terminals

1. Install push button harness: connect red push button wire terminal to INPT+, black push button wire to INPT−, torque terminal screws to 12 in-lb.



2. Install flashing beacon harnesses:
   - For round beacons and LED enhanced signs, match the red/black wires to the RD/BK text in the Round column of the LED label.
   - For RRFBs, match the black/white/red/green wires to the BK/WT/RD/GN text in the RRFB column of the LED label.
   - Torque screws to 12 in-lb and secure cable jackets to chassis with cable ties.



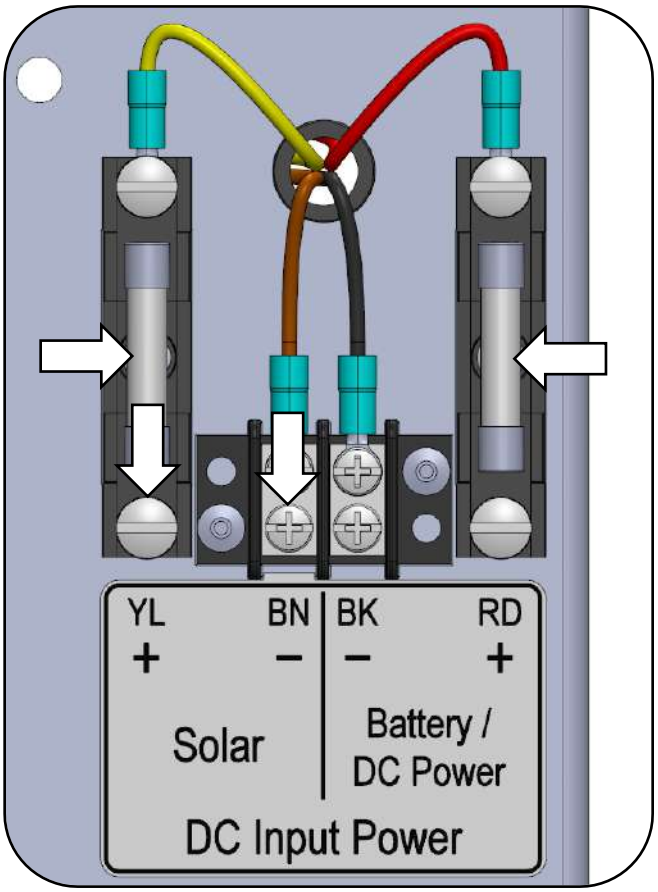
NOTE

All B1+ terminals are wired in parallel. Similarly, all B1−, B2+, and B2− terminal are also wired in parallel with their identically-named counterparts. As a result, all beacons wired to B1+/− terminals will flash together; beacons wired to B2+/− will flash together etc. etc.

3. For **Solar** systems: remove Solar and Battery/DC Power fuses from fuse holders on right side of cabinet and connect solar panel harness terminals: red wire with yellow heat shrink to YL +, black wire with brown heat shrink to BN−. (Battery harness comes 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.



4. For **Solar** systems: install battery into cabinet with terminals toward you. Install ring terminal on red battery wire to positive (+) battery terminal. Install ring terminal on black battery wire to negative (−) battery terminal.

Do not reinstall battery and solar fuses until all system wiring is completed.

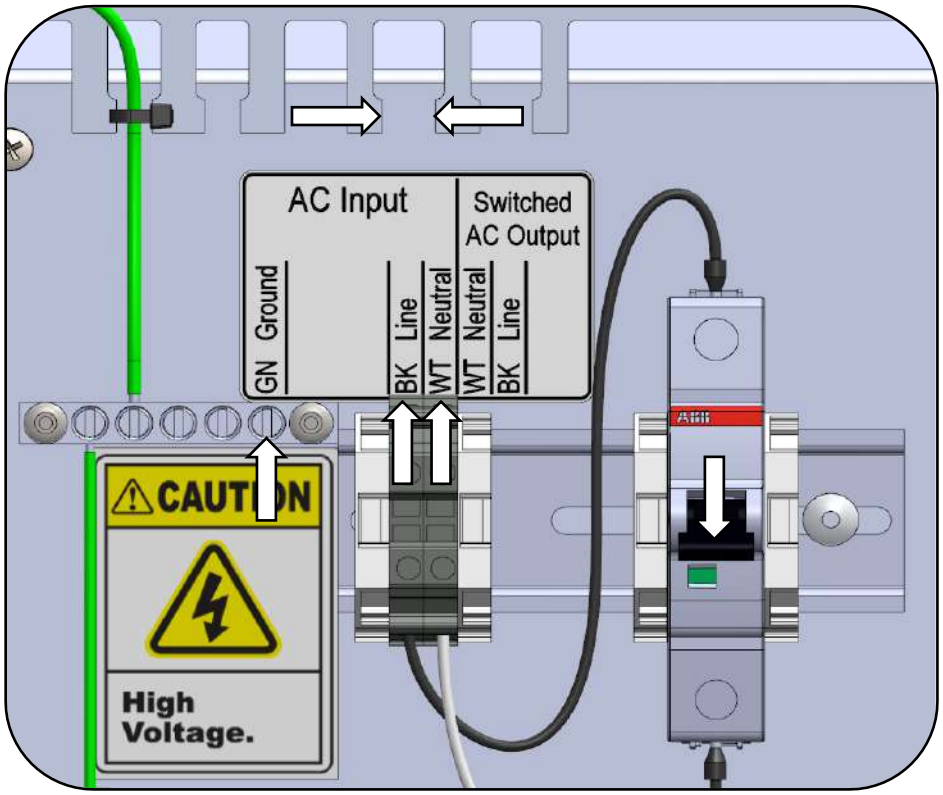
5. For **AC** systems, ensure AC supply power is off.
6. For **AC** systems: turn breaker in cabinet off. Install supply ground into bus bar terminal shown, torque to 20 in-lb. Install supply line and neutral wires into AC Input terminals, torque to 6 in-lb. Secure cable jacket to chassis with cable tie.

CAUTION

ELECTRICAL SHOCK HAZARD. DO NOT ENERGIZE AC SUPPLY OR TURN CABINET BREAKER(S) ON UNTIL ALL SYSTEM WIRING IS COMPLETED.

NOTE

The ground bus bar accepts 4-14AWG copper wire.
The DIN rail terminal blocks accept 10 – 26AWG copper wire.

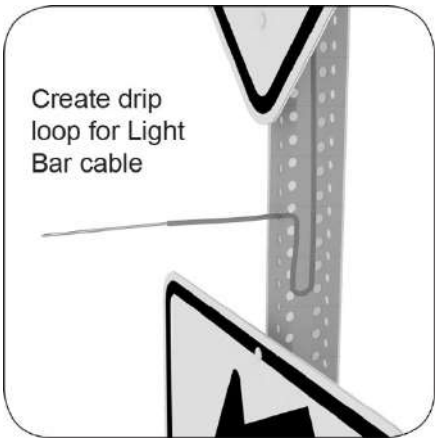


7. Proceed with installation of other system elements described in Section 4 and Section 5.

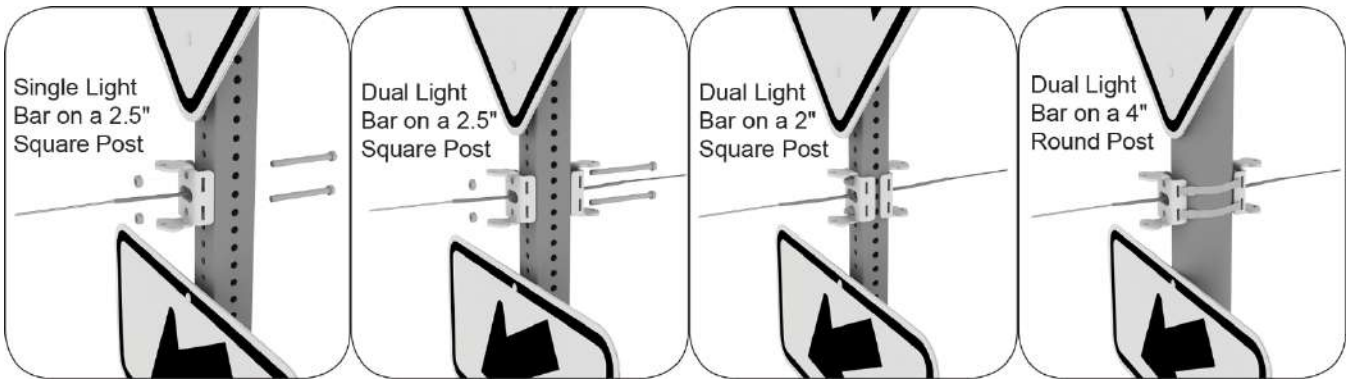
4.0 Fixture and Push Button Installation

4.1 RRFB Light Bar Installation

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

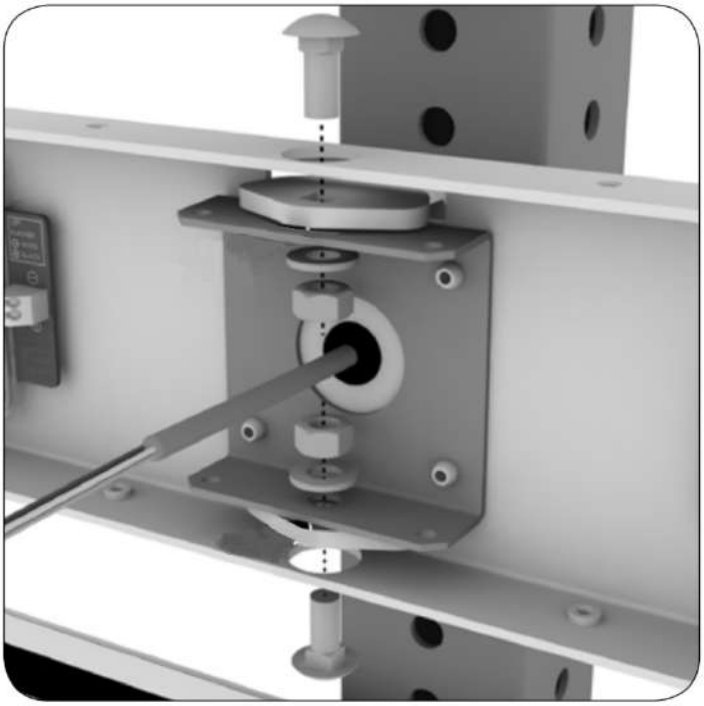


2. Mount the light bar universal bracket(s), feeding the light bar cable through the center of the bracket. Bolts and banding not supplied.

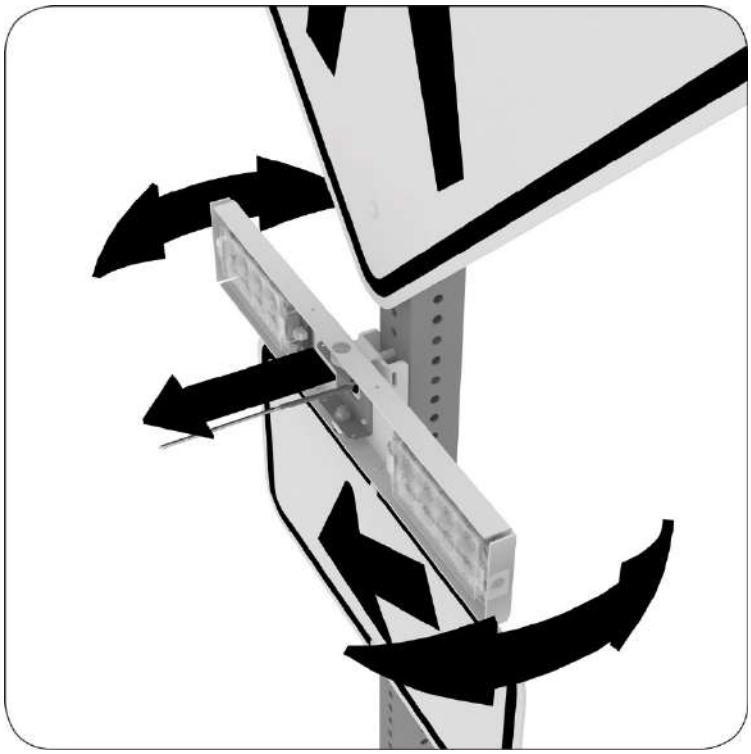


3. Mount the light bar(s) onto the universal bracket(s), feeding the light bar cable through the housing.

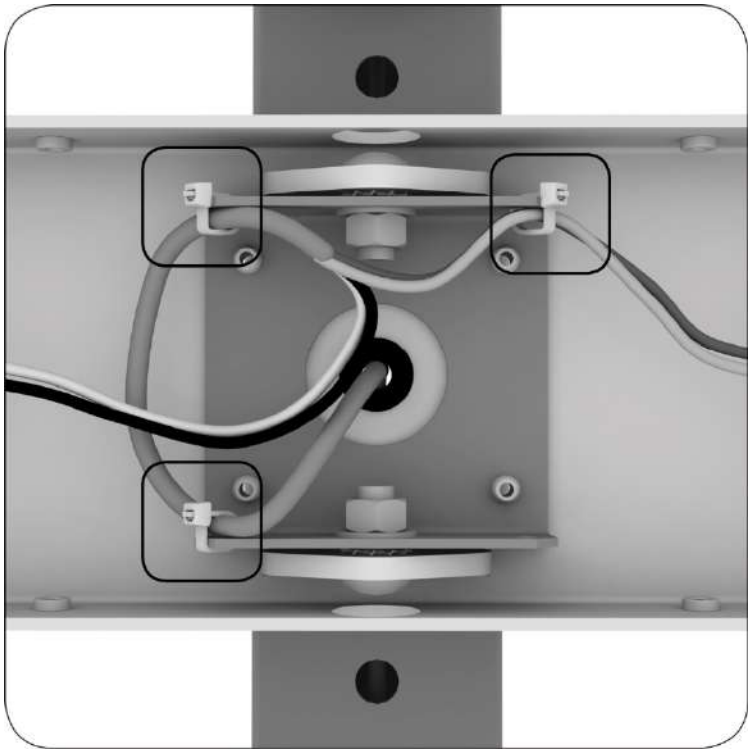
4. Bolt the light bar to the universal bracket as shown below.



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



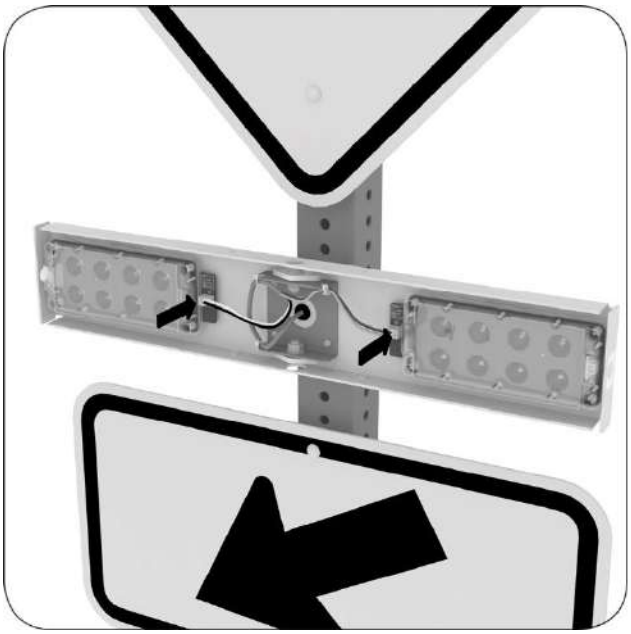
6. Secure the light bar cable using supplied cable ties as shown.

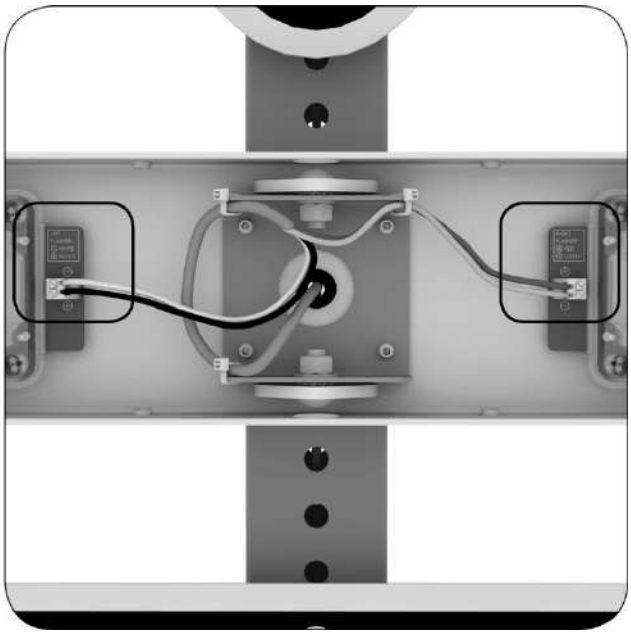


7. Push the light bar wires into the light bar connectors, following the color scheme as noted on the LEDs.

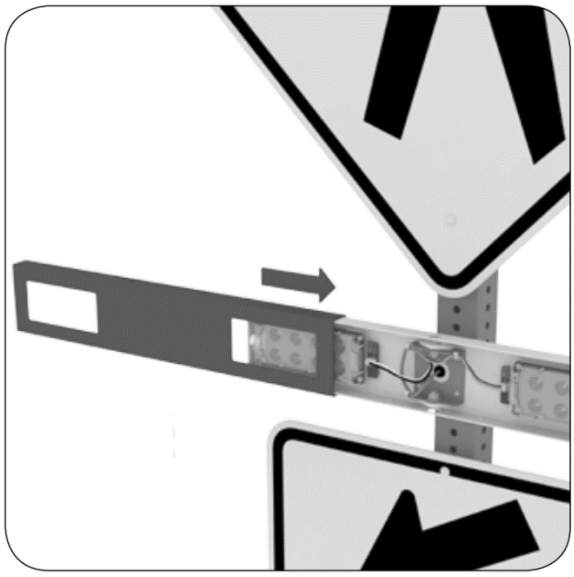
NOTE

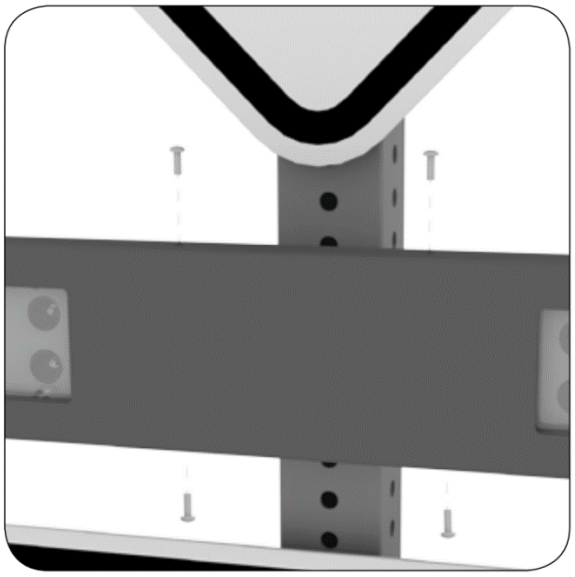
Mount the light bar so that the black and white wires are on the left side. This ensures that the RRFB flash pattern, **which must start on the left**, is compliant with the FHWA requirements.





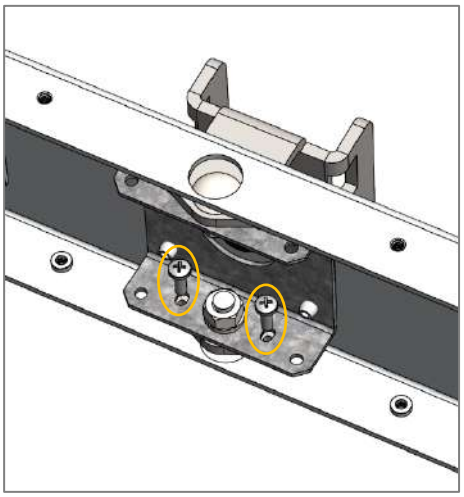
8. Slide on light bar cover and secure with the four provided #8 screws.





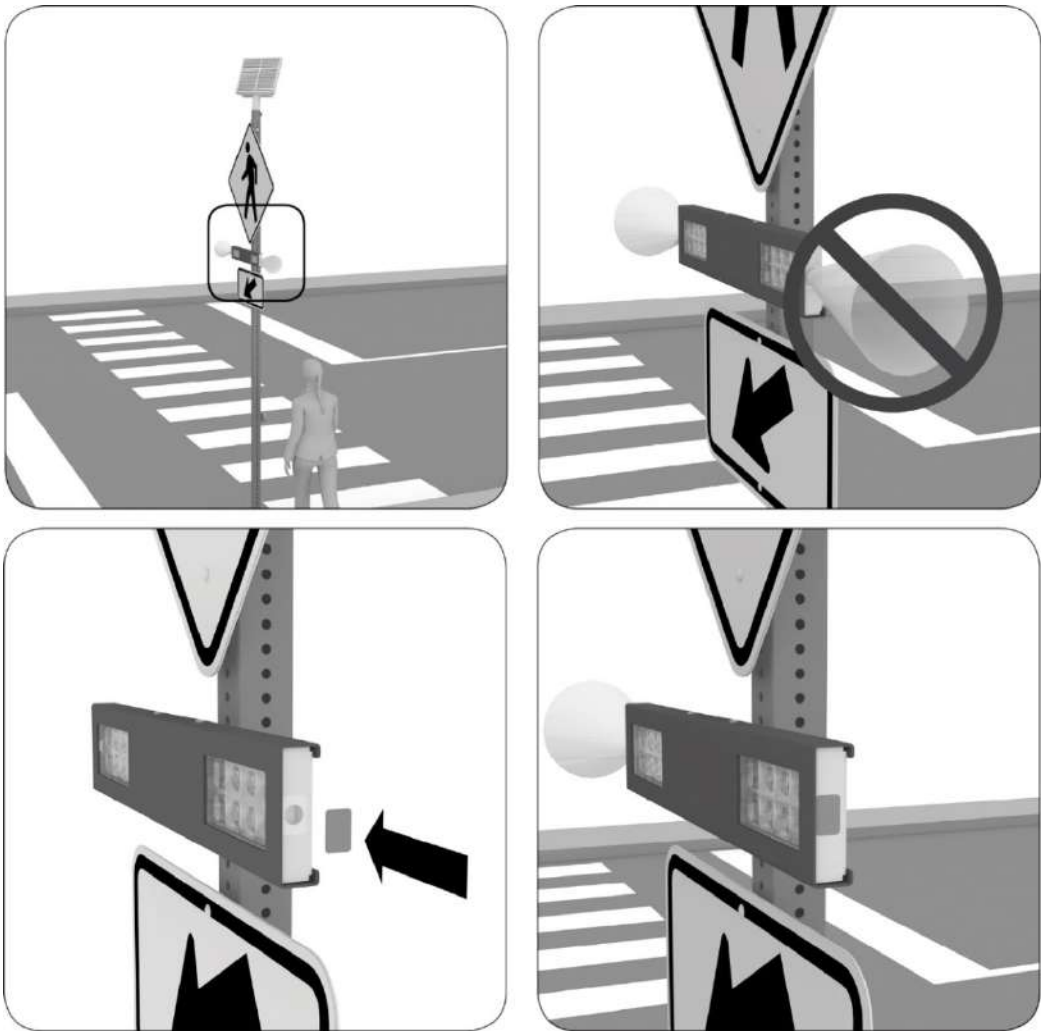
NOTE

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.



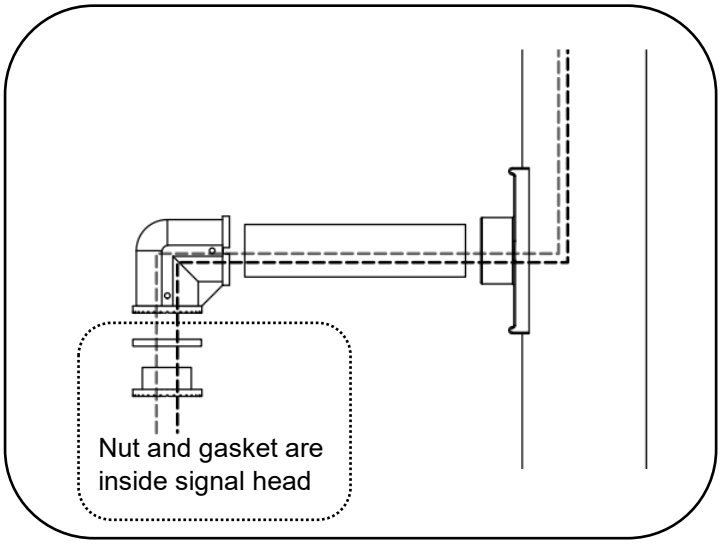
Locations of Anti-Vandal Screws

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

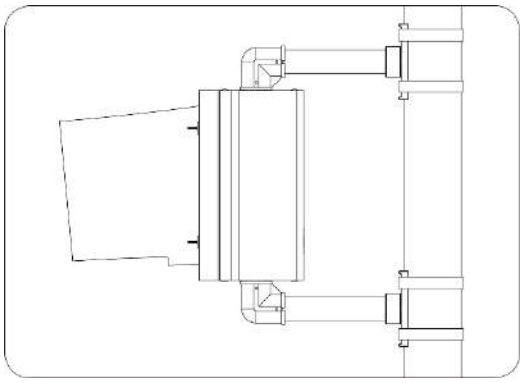
1. Thread the flashing beacon harness through the beacon arms. Then, mount the top flashing beacon arm to the pole using stainless banding or bolts (not supplied). Use the gasket on the top mounting arm to ensure water doesn't leak past the connection and enter the signal head from the top.



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).

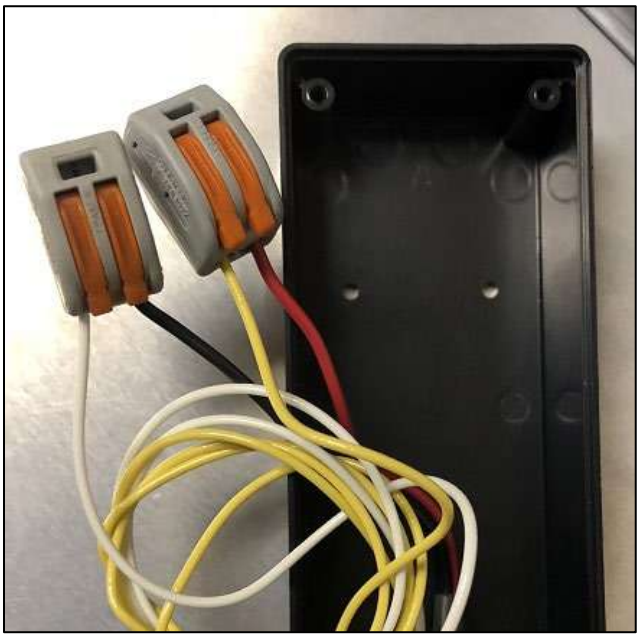
LED WIRE CONNECTIONS

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

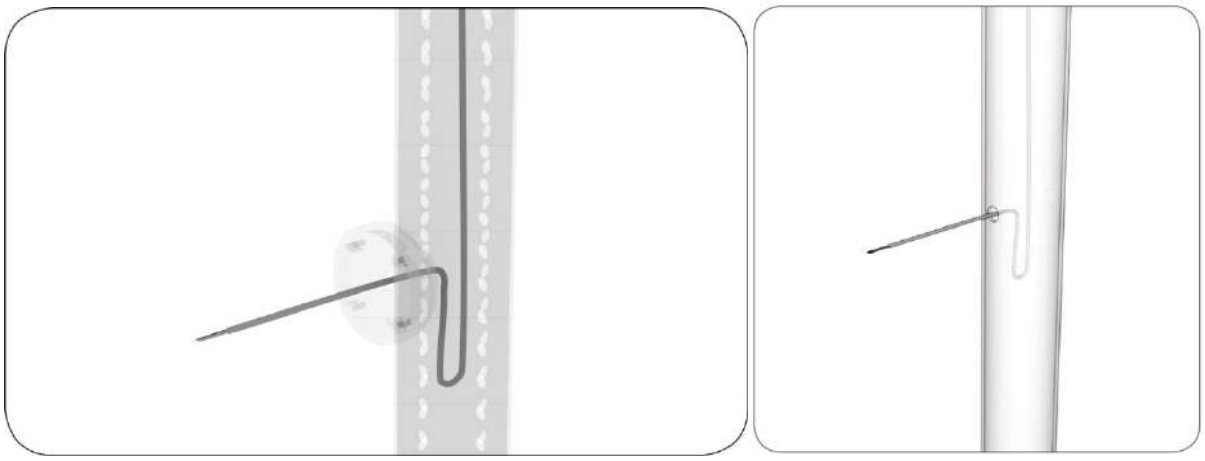
NOTE If the system is wired for a push button but none is needed (such as an advance RRFB), insulate the ends and secure the wires.

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

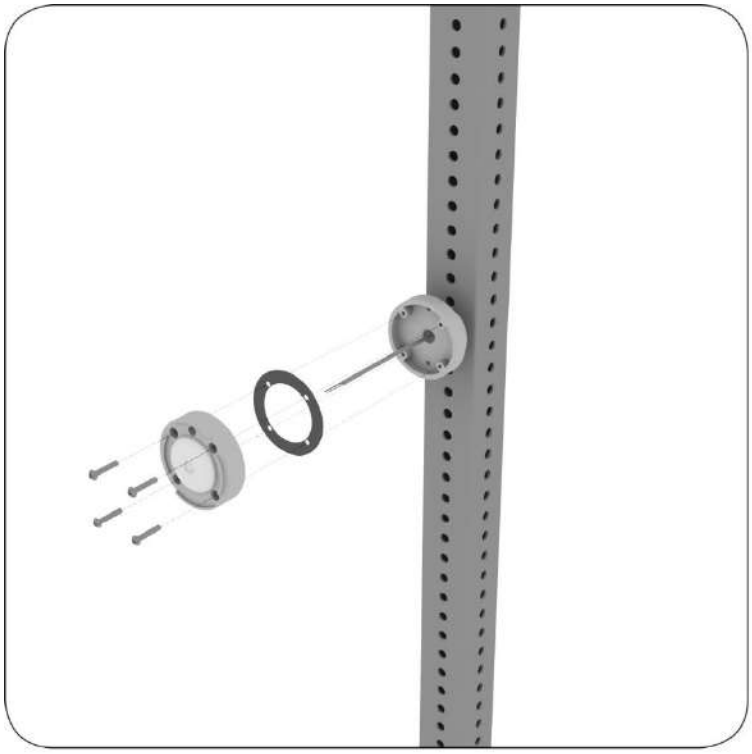
NOTE The push button can be connected in either polarity.

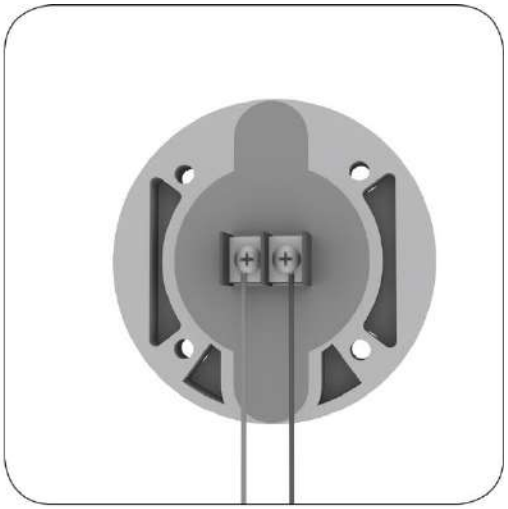
NOTE The recommended maximum number of Polara Bulldog push buttons that can be connected in parallel is 2.

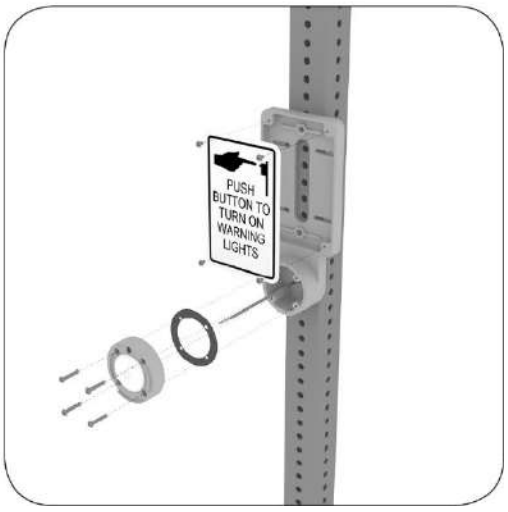
1. Drill and tap post as per button installation instructions. Button assembly should sit flush against post. Deburr hole that push button wiring will pass through.
2. Feed push button cable through pole, creating a drip loop.



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

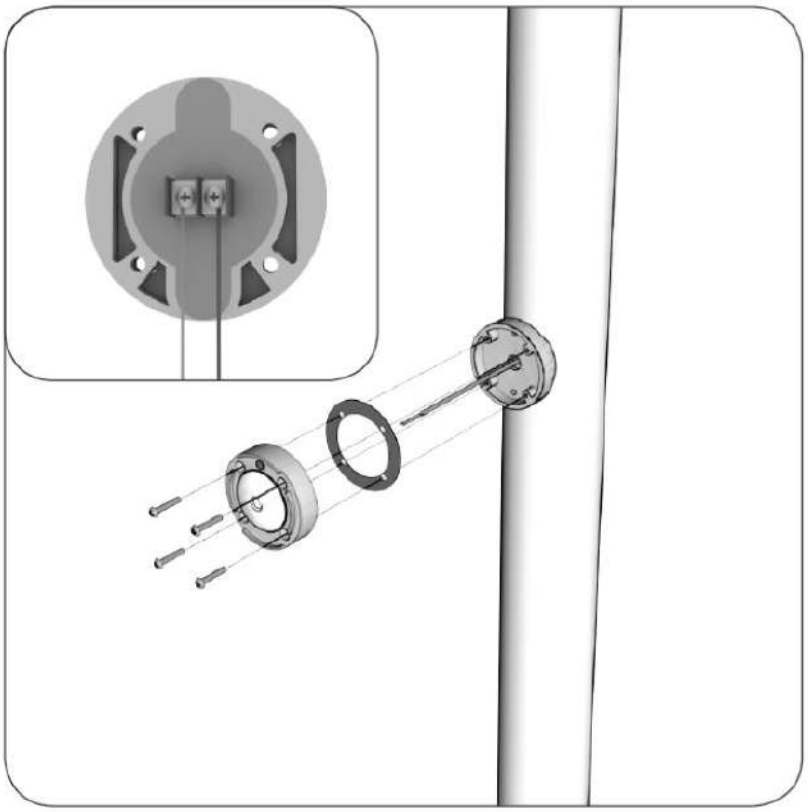




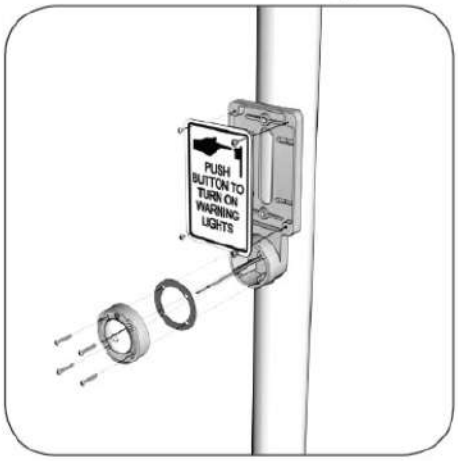


Optional push button with sign and sign mount.

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



Optional push button with sign and sign mount

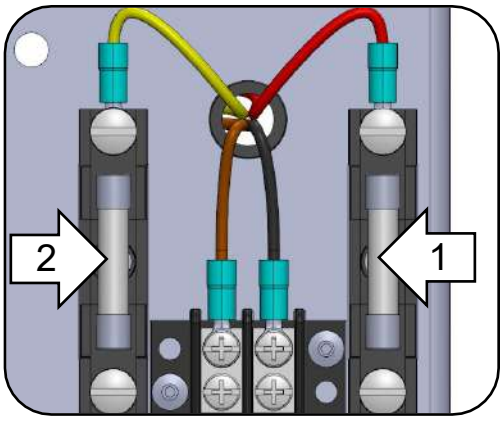


4.5 Turning the System On

Once all the system elements and harnesses are installed, the system can be turned on.

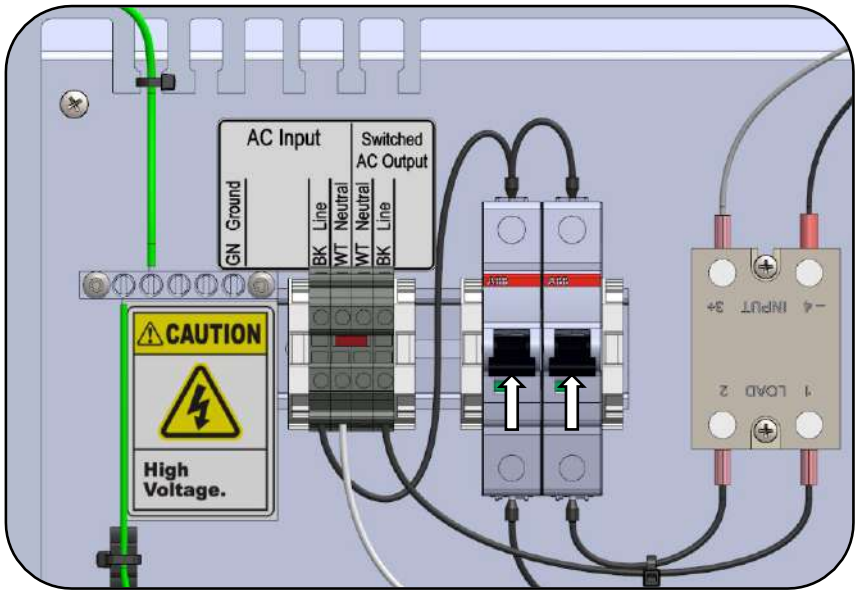
Solar Systems:

1. Install the battery fuse.
2. Install the solar fuse.



AC Systems:

1. Turn on the supply power.
2. Turn on the breaker(s) in the cabinet.



Solar and AC Systems:

3. The system will energize and the user display will become active. 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.
4. Close the cabinet to complete installation. Ensure the solar panel is facing the equator (pointing south if you are in the Northern Hemisphere).

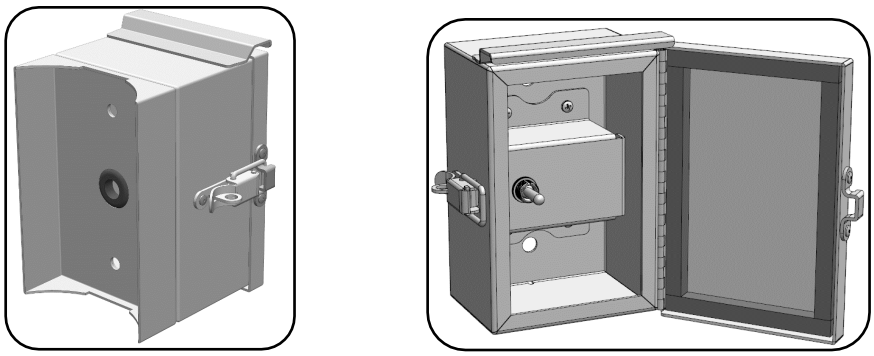
5.0 Installation of Optional Accessories

WARNING

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

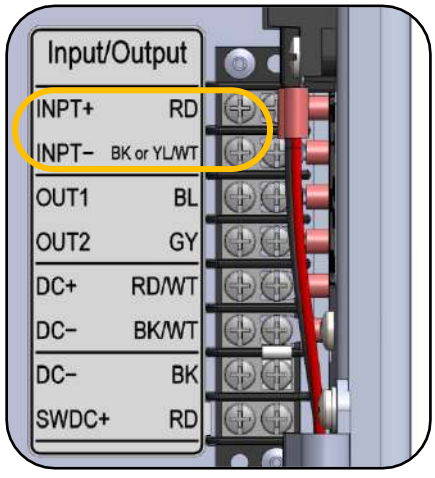
5.1 Calendar Upload / Override Switch Kit Installation

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

When used with the G Series, the Override Switch Kit comes with a harness that connects to the INPUT+ and INPUT− terminals of the EMS and the switch terminals at the override box end.



NOTE

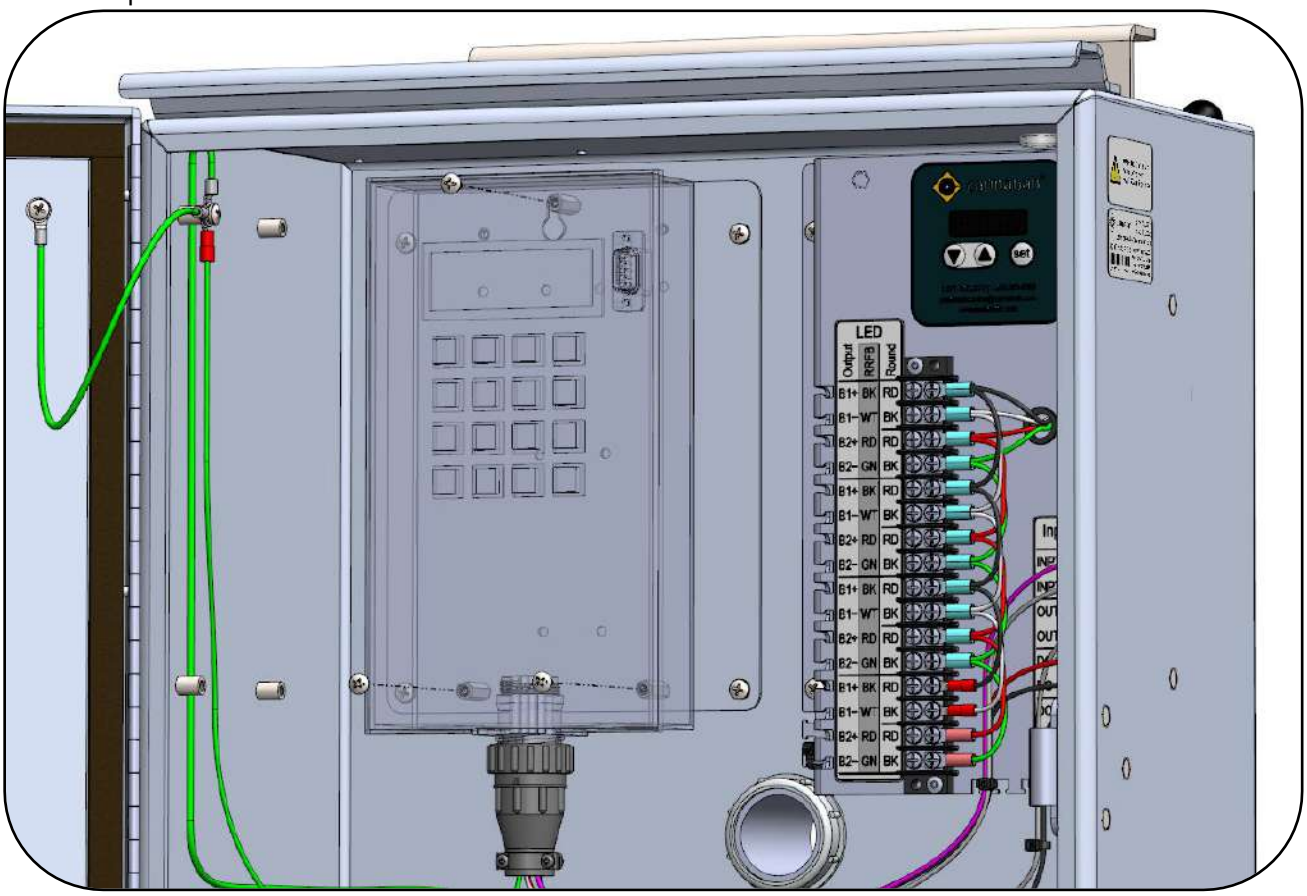
For calendar-equipped systems, another related kit is the **calendar software programming kit**, which includes a USB memory stick containing the Carmanah Calendar Configuration Windows application and a 32-foot active USB extension harness. The USB extension allows programming from a distance from the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

5.2 RTC Time Switch Installation

NOTE

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

1. Open cabinet and remove screws from three standoffs shown. Remove fourth standoff if present. 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.

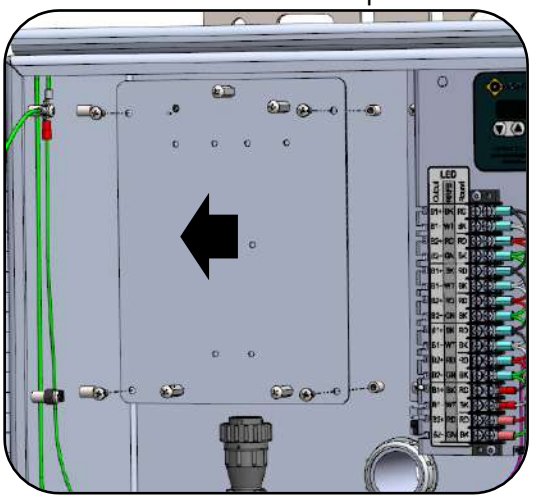


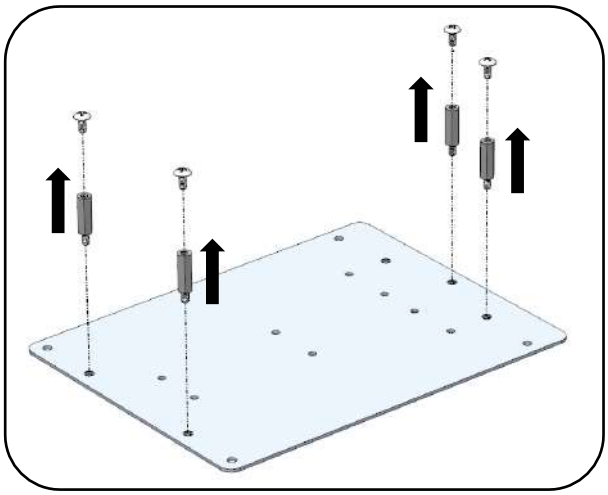
2. Follow manufacturer's instructions for configuration of switch.

5.3 Information Display Company Time Switch Installation

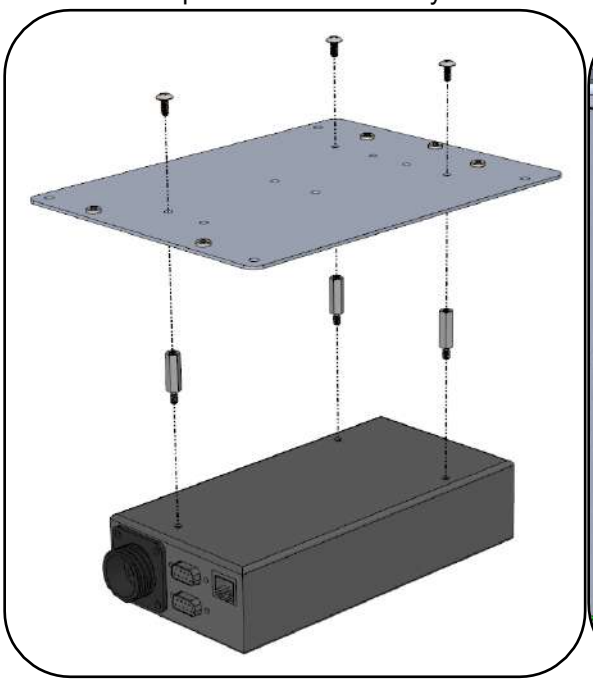
NOTE This product configuration requires the optional RTC/IDC Time Switch Kit (time switch not included). Contact Carmanah for assistance if the system is being converted from non-school zone application, or for general information on installing third-party devices.

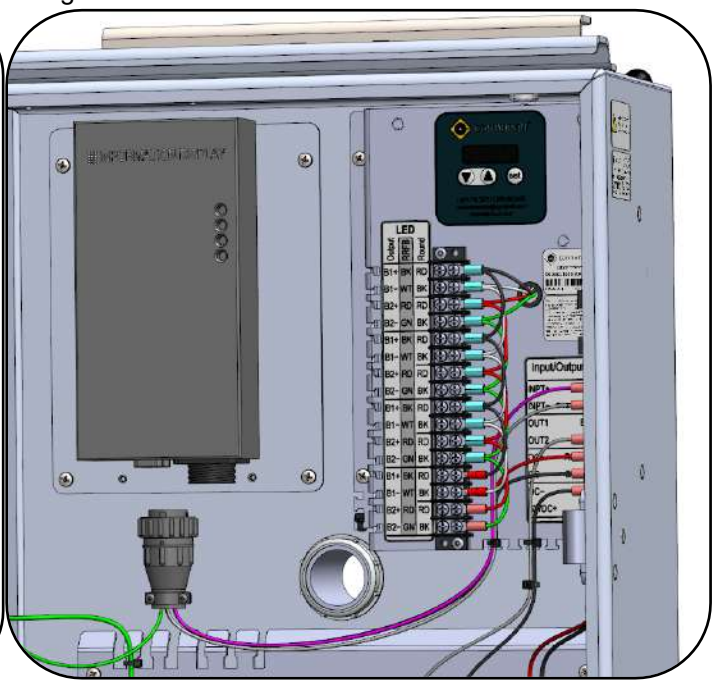
1. Open cabinet and remove four screws holding time switch plate to back of cabinet. Remove screws from standoffs and remove standoffs from plate.





2. Thread three standoffs into bottom of IDC switch. Fasten IDC switch with standoffs to plate with screws as shown. Fasten plate/switch assembly into cabinet using 4 screws. Mate harness from EMS.





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

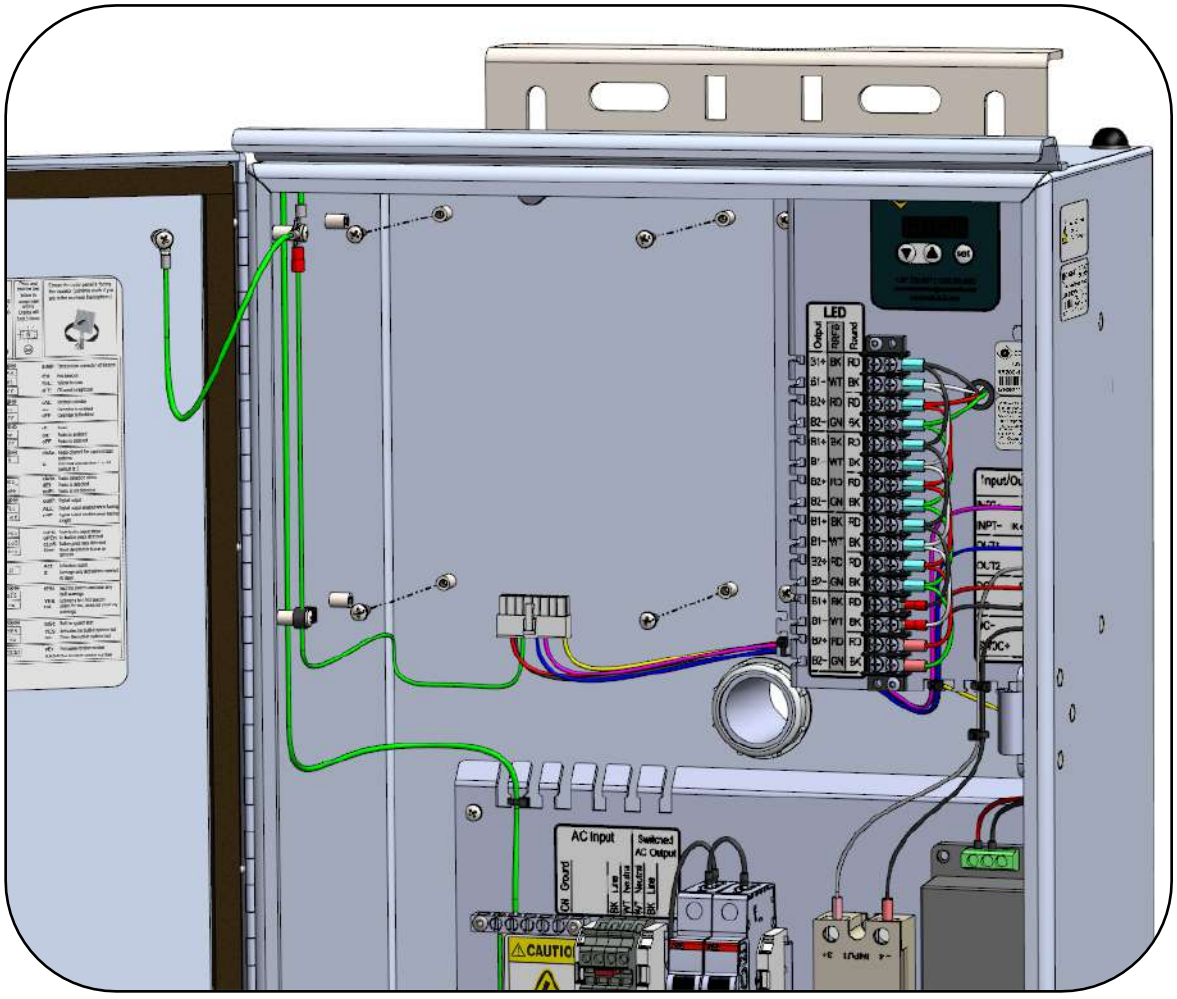
5.4 Applied Information or FCU Modem Kit Installation

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 non-school zone application, or for general information on installing third-party devices.

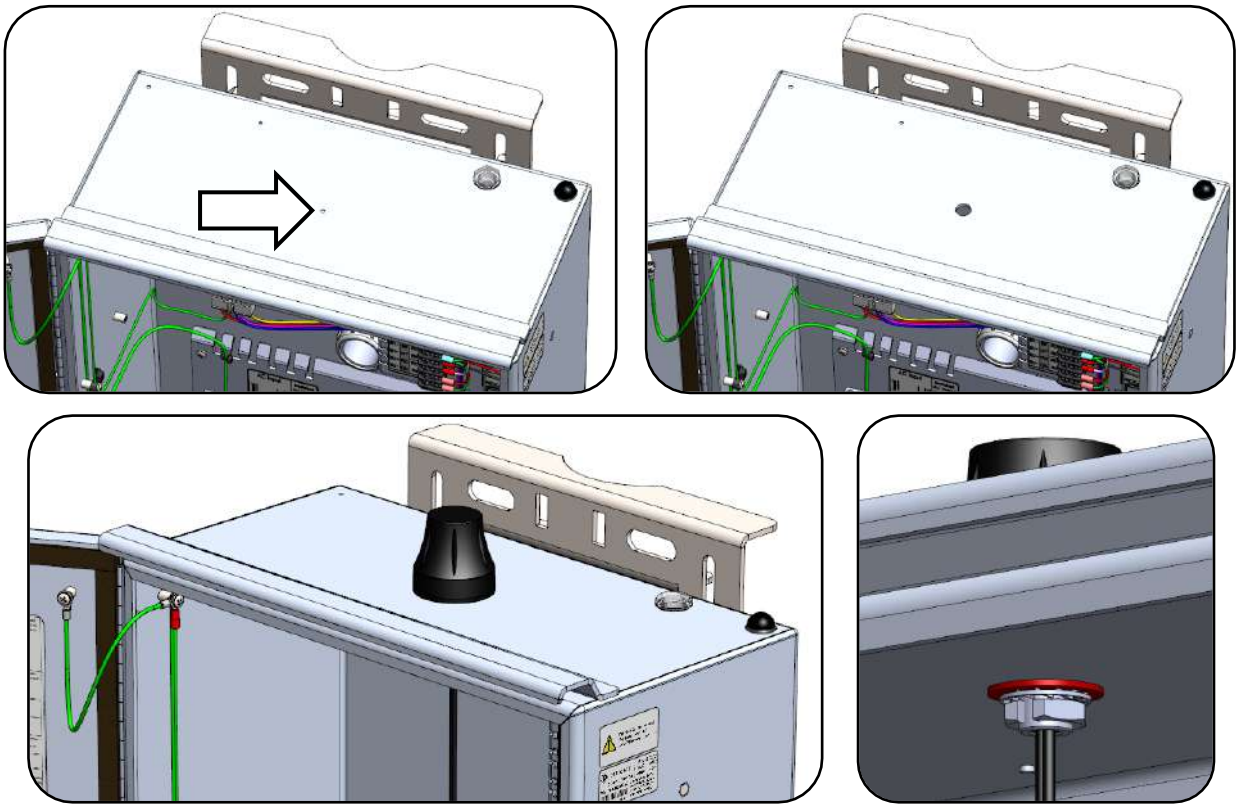
NOTE Applied Information models FCU-500-070B (not available in Florida) and FCU-500-071 (only available in Florida) have been customized specifically for compatibility with Carmanah's G Series.

G Series systems ordered with the Applied Information time switch option will have a compatible harness prewired to the terminal blocks. The Applied Information time switch can measure the solar panel voltage and battery voltage and remotely report the values to a network operations center.

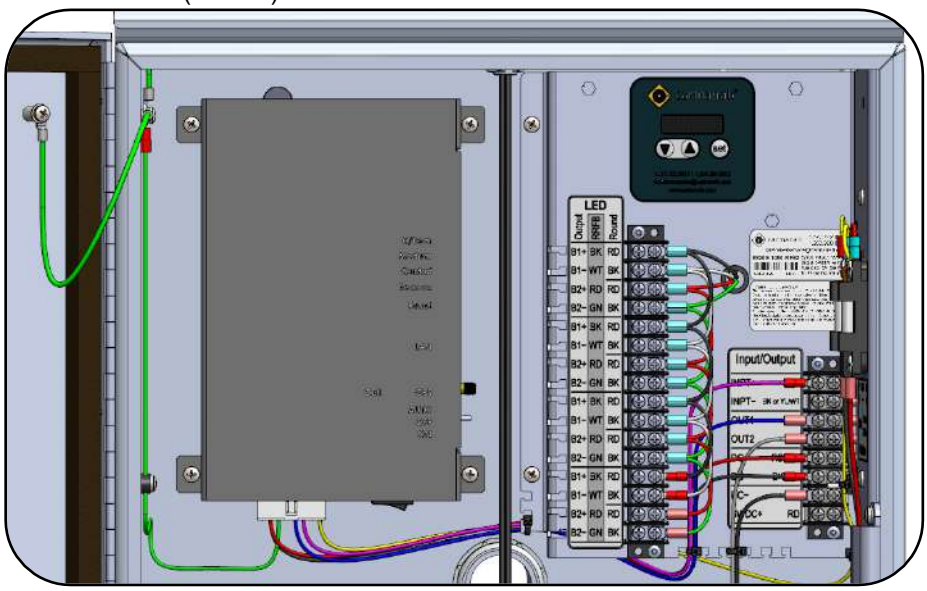
1. Remove four screws from cabinet standoffs as shown. Set aside.



2. If an antenna is to be used, locate indentation near center of top surface of cabinet 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. Fasten AI unit into cabinet using four screws removed in step 1. Mate rectangular connector from EMS and coax connectors from antenna (if used).



4. Follow manufacturer's instructions for unit configuration.

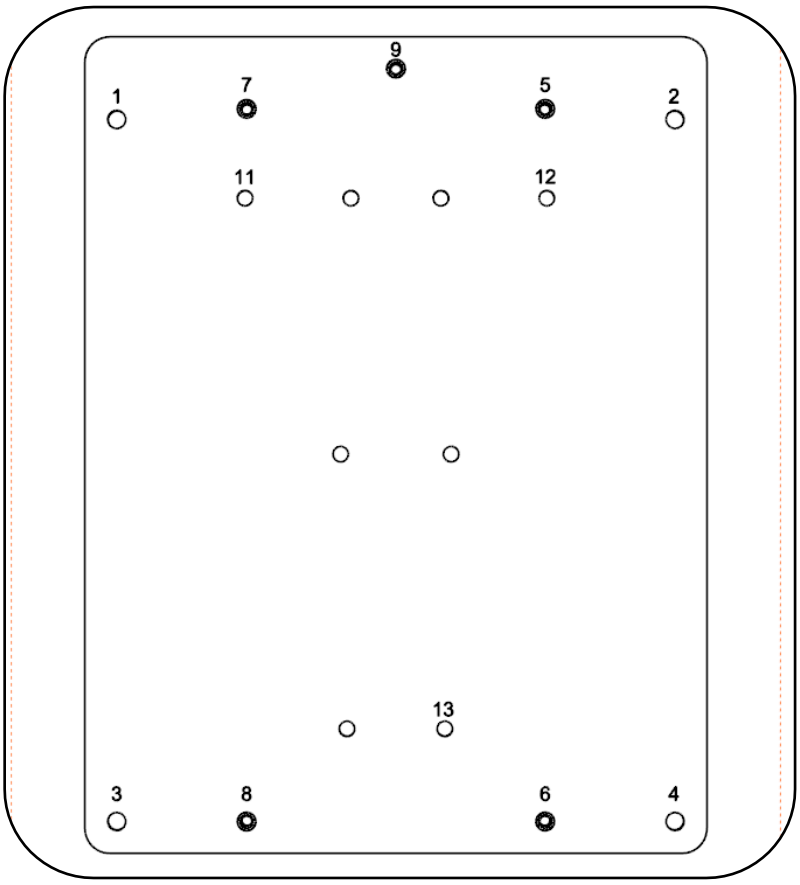
5.5 3PD Time Switch Supplementary Information

The G 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 cabinet	1, 2, 3, 4	
AI FCU 500	1, 2, 3, 4	Four provided screws go through holes in AI unit and into standoffs in cabinet. No adapter mounting plate needed.
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.*
IDC DC-FB (BT 5000)	11, 12, 13	Standoffs go into switch, screwed onto plate from below.
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.*

*Consult manufacturer's documentation to confirm.

3PD Adapter Mounting Plate



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

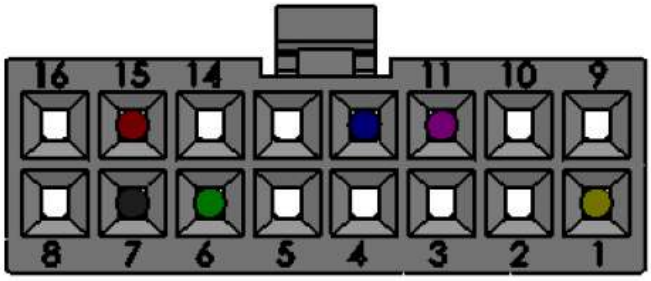
Pin assignment in circular connector provided with RTC/IDC time switch kit:

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

5.6 AC Relay Kit Installation

NOTE

It is 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 G Series AC Relay Kit option includes a pre-installed AC/DC relay. The relay input is prewired to the OUT2 output of the EMS. The relay AC load side is wired to the Switched AC Output terminals through a 4A breaker. 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 an AC load.

CAUTION

ELECTRICAL SHOCK HAZARD.

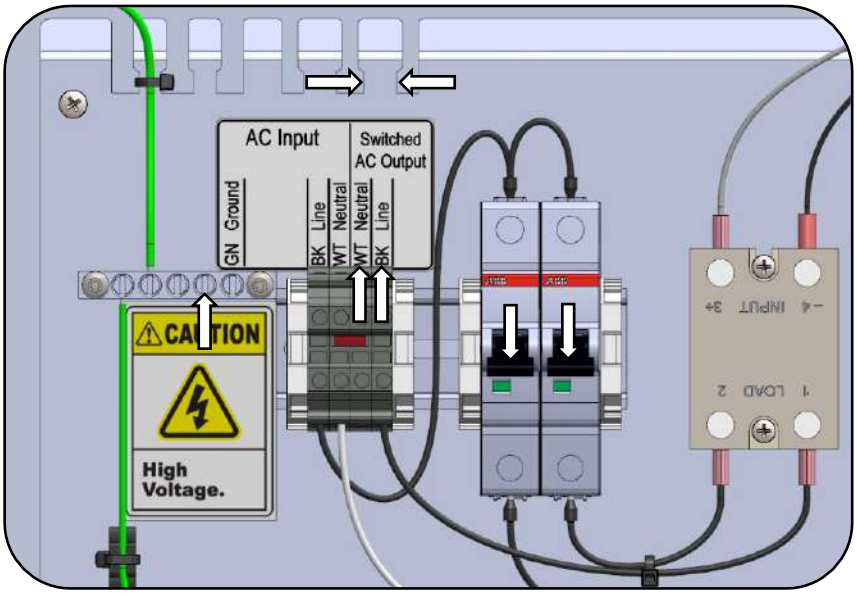
DO NOT ENERGIZE AC SUPPLY OR TURN CABINET BREAKER(S) ON UNTIL ALL SYSTEM WIRING IS COMPLETED.

NOTE

The relay model supplied with the AC Relay Kit is Omron part number G3NA-210B-DC5-24. Please see Omron's datasheet for more information.

To install an AC load:

1. Turn off the AC supply to cabinet.
2. Turn off breakers in cabinet. Install ground from AC load cable into bus bar terminal shown, torque to 20 in-lb. Install line and neutral wires from AC load cable into Switched AC Output terminals, torque to 6 in-lb. Secure cable jacket to chassis with cable tie.
3. Ensure other system wiring is complete before turning on the AC supply and cabinet breakers.



5.7 DC Relay Kit Installation

NOTE

It is 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 G Series DC Relay Kit option includes a pre-installed DC relay. The relay input is prewired to the OUT2 output of the EMS. The relay DC load side is wired to the bottom two Input/Output terminals (DC− and SWDC+) on the EMS. 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

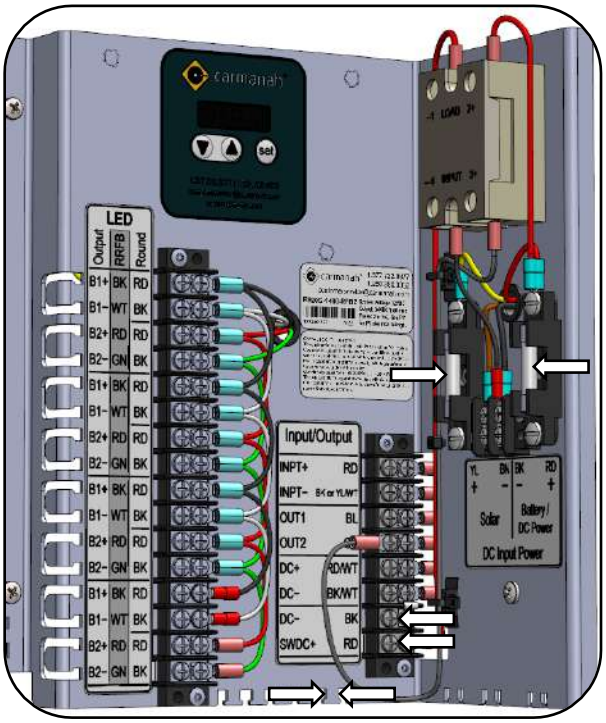
ELECTRICAL SHOCK HAZARD.

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 solar fuse, and then battery fuse from right side cabinet.
2. Install suitable #6 stud fork spade terminals onto DC load wires (recommended).
3. Install DC negative (−) load terminal into second-from-bottom DC− terminal on EMS, torque to 12 in-lb.
4. Install DC positive (+) load terminal into bottom SWDC+ terminal on EMS, torque to 12 in-lb.
5. Secure DC load cable jacket to chassis with cable tie.
6. Ensure other system wiring is complete before replacing the fuses.

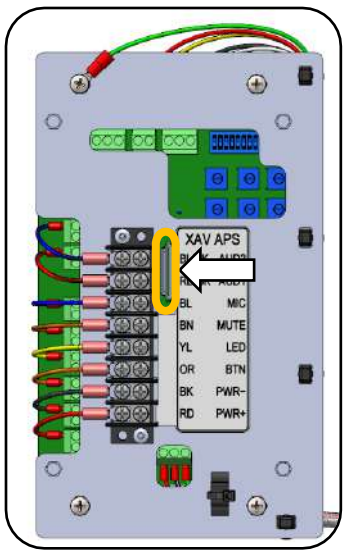


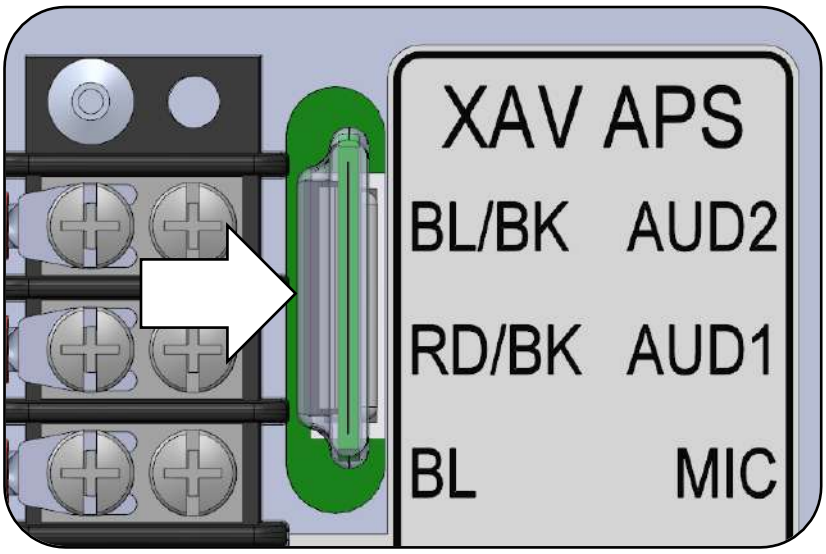
5.8 Polara XAV Controller Kit Installation

The Polara XAV Controller Kit includes the Polara XAV controller prewired to the EMS. The XAV-to-button harness (available in 16ft, 36ft, or 75ft lengths) is also prewired to the controller. Please see Polara's installation documentation for installation details for the audible push button station.

To access the XAV voice chip module, follow the instructions below:

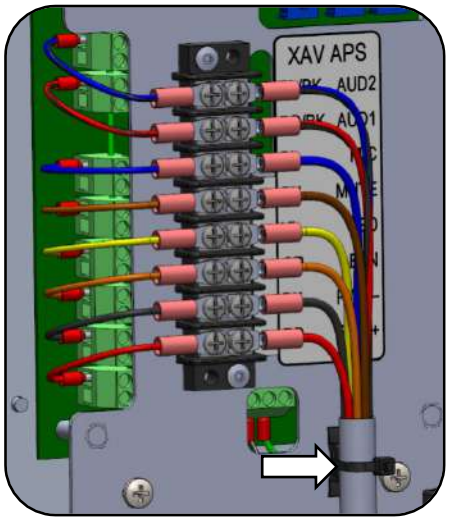
1. The voice chip module is located beside the top three XAV APS terminals as shown below. It can be removed by gently pulling it out of its connector on the XAV circuit board.
2. To reinstall the voice chip module, ensure the chip IC is oriented on the left, and insert the module through the slot in the XAV chassis so it aligns with the connector on the XAV PCB. Push until fully seated.





To install the XAV-to-button harness (available in 16ft, 36ft or 75ft lengths), following the instructions below:

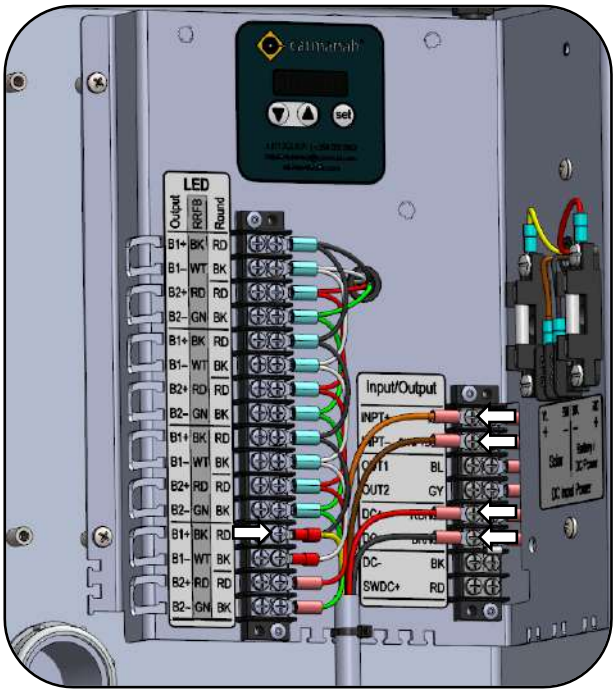
1. Match 8 wires from XAV-to-button harness to XAV APS terminals. Torque to 12 in-lb.
2. Secure harness to cable tie mount.

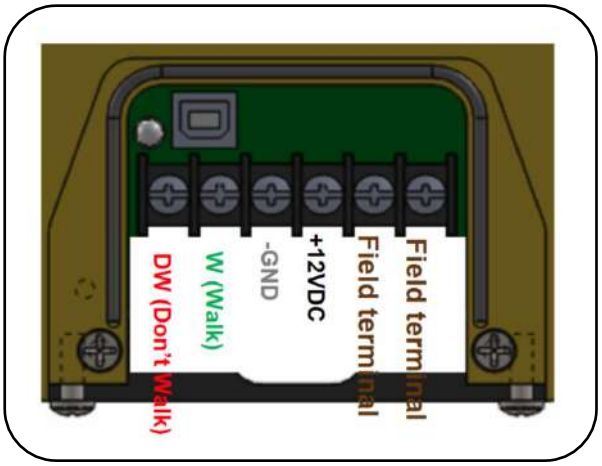


Wire Colour	Function
Blue/Black	AUD 2
Red/Black	AUD 1
Blue	Mic
Brown	Mute
Yellow	LED
Orange	Button
Black	DC−
Red	DC+

5.9 Campbell Guardian Audible Push Button Kit Installation

The Campbell Guardian audible push button kit includes a push button harness (16ft, 36ft, or 75ft) prewired to the G Series EMS (as shown below), along with the Guardian audible push button, and an associated sign. Please consult Campbell's installation documentation for more information.





Campbell Terminal	Wire Color (terminal type)	Terminal Block Connection	Function
Field terminal	Orange (spade)	INPT+	1 of 2 push button inputs to EMS from Guardian
Field terminal	Brown (spade)	INPT−	2 of 2 push button inputs to EMS from Guardian
+12VDC	Red (spade)	DC+	Positive side of 12-volt power supply for Guardian
-GND	Black (spade)	DC−	Negative side of 12-volt power supply for Guardian
W (Walk)	Yellow (ring)	Fixture Group 4, Bank 1 Positive (4th from bottom)	Guardian sense line for triggering recorded message when fixture flashing is detected
DW (Don't Walk)	Not used		

5.10 MS Sedco SmartWalk™ Pedestrian Sensor Installation

MS Sedco SmartWalk™ pedestrian sensors can be connected to G Series systems to operate the system when a pedestrian is detected.

WARNING

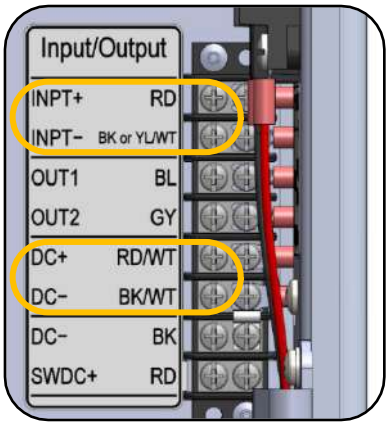
For solar G Series systems, a "-S" model SmartWalk™ sensor must be used. SmartWalk™ "-S" sensor models consume less operating power and are required for sustainable solar system performance. AC-powered G Series systems can use the standard or "-S" models.

WARNING

Ensure Fail Safe switch #4 on the SmartWalk™ is set to the OFF position. This conserves power by only energizing its internal relay when a pedestrian is detected.

NOTE

Push buttons can be used in conjunction with SmartWalk™ sensors by wiring the push button in parallel to the INPT+ and INPT− EMS terminals.



Fail Safe Off wiring (Solar or AC G Series):

SmartWalk™ Terminal (Fail Safe Off, SW #4 off)	Wire Color	G Series EMS Input/Output Terminal	Function
Pin 1	Red	DC+	DC+ power from G Series EMS to SmartWalk™
Pin 2	Black	DC−	DC− (ground) from G Series EMS to SmartWalk™
Pin 6	Orange	INPT+	Relay Normally Open signal from SmartWalk™ to EMS
Pin 5	Green	INPT−	Relay Common signal from SmartWalk™ to EMS

For more information on installation or configuration, refer to the Smartwalk™ installation manual or contact MS Sedco.

5.11 Dual EMS

Dual EMS G-Series systems are available for cases when:

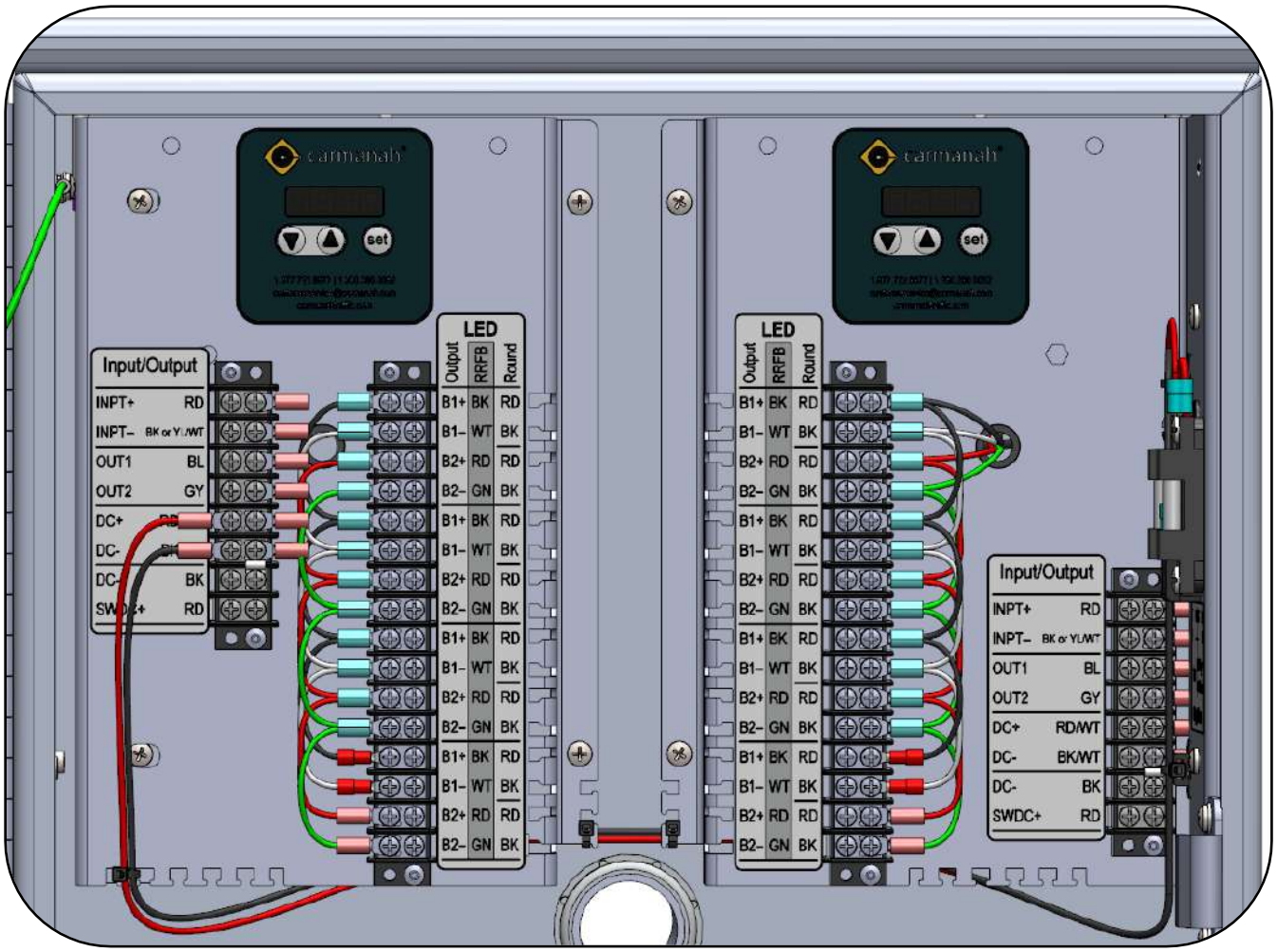
- There are LED loads with different operating voltages
- There is a need to operate different LED load at different settings (for example two different flash patterns, intensities, or flash durations)
- There are more LED loads to operate than can be accommodated with one EMS (this is rare, since one EMS can drive up to 8 circular beacons or LED enhanced signs or 4 RRFBs)

The second EMS is located on the left side of the cabinet and is programmed separately from the first EMS.

NOTE When dual EMS units are ordered, Carmanah programs both EMS units identically. Different settings for the second EMS can be completed after delivery as required.

NOTE Ensure both EMS units in a dual-EMS G Series have radio communications enabled and are on the same channel. This will ensure the second EMS responds to activation signals that are applied to the first EMS.

Dual EMS units are always configured with wireless communication, which is how one EMS signals the other that it has received a momentary or steady activation signal. Dual EMS systems cannot have a time switch because the second EMS occupies the space inside the cabinet which the time switch would normally occupy.



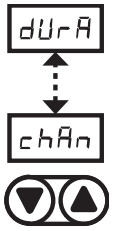
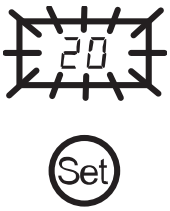
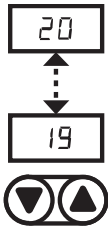
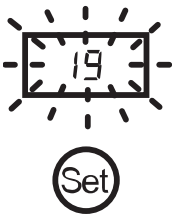
6.0 Energy Management System Programming and Testing

The G 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)

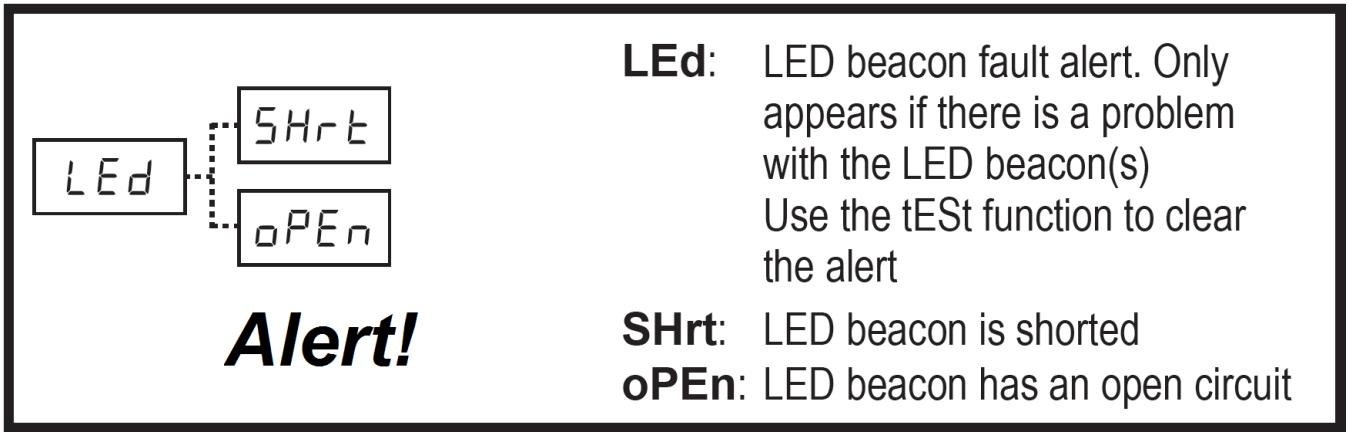
Use the Up and Down arrow buttons to scroll through the menu.	Press and hold the SET button to edit a setting. The display will blink when the setting is ready to edit.	Use the Up and Down arrow buttons to adjust the setting when in edit mode.	Press and hold the SET button to accept the new setting.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



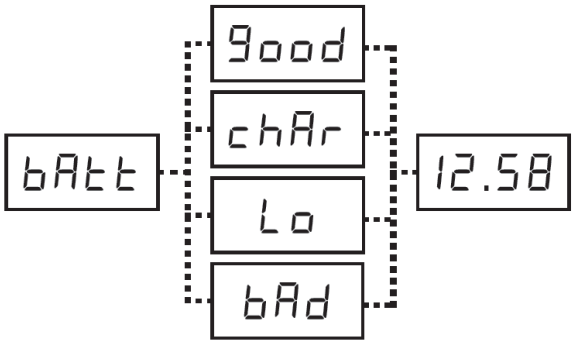
The LED Fault message does not normally appear in the OBUI menu, and only appears when the EMS has detected that *at least one* fixture is shorted, or *all* fixtures are not properly connected (open circuit). When the problem has been corrected and flashing is triggered, the LED Fault menu item will again disappear.

NOTE

In addition to all fixtures not being connected properly, the EMS may also display the LEd oPEn 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

Battery Status



bAtt: Battery status and voltage
good: Battery is charged (>12.6V)
chAr: Battery requires charging (12.6 - 11.7V)
Lo: Battery has very low voltage (11.69 - 10.50V)
bAd: Battery needs replacing (<10.50V)
12.58: Battery voltage

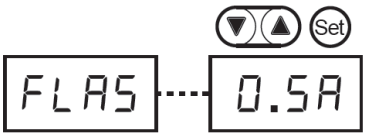
Battery Status reports general battery state as well as actual battery voltage. When the Battery Status reads chAr (charge), the voltage is lower than normally desirable, but the system will continue to operate normally. When the Battery Status reads Lo, the system is in Low Voltage Disconnect (LVD).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

Solar Status

SoLr: Ambient brightness sensor status
nItE: Sensor is not detecting light (nighttime)
dAY: Sensor is detecting light (daytime)
16.55: Solar panel voltage

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.

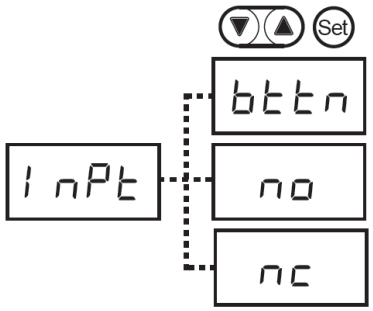
NOTE

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

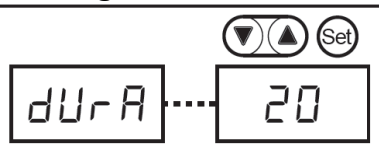
no: Normally open switch

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 24/7 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

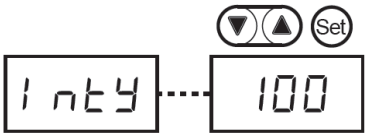
Flashing Duration is used for pedestrian crosswalks and sets the amount of time the fixtures will flash before extinguishing. The available settings are:

- 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 Flash 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 (rFb1 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	rFb1	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	rFb1	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.

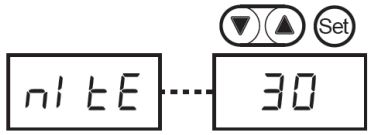
NOTE The maximum output current of the LED driver is 1400mA.

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, 3 round beacons must be set to a Unison flash pattern.

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

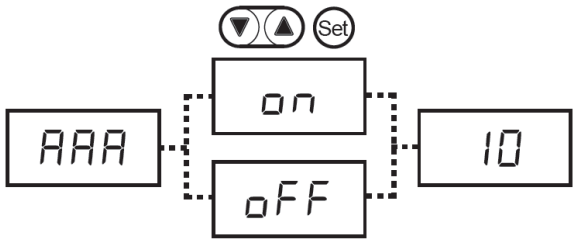
30: Percentage of daytime level, from 10 to 100%

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

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.

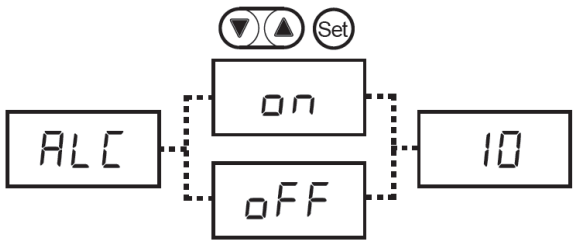
With AAA on, the dim level value (1 – 10) is displayed in real time, so it is a good feature to use for troubleshooting the photosensor operation. A flashlight can be used to shine bright light into the photosensor and invoke a "10" value.

NOTE If using AAA for circular beacons, and if ITE compliance is required, ensure that a minimum value of 50% does 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 ITE, 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)



ALC: Automatic light control

on: Automatic light control is on
oFF: Automatic light control is off

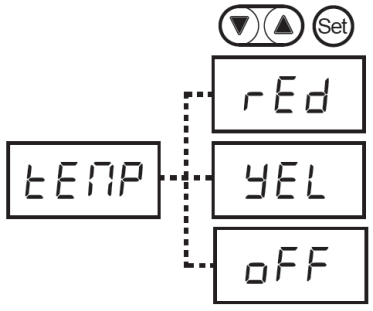
10: Automatic light control level

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 as 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



tEMP: Temperature correction of beacon

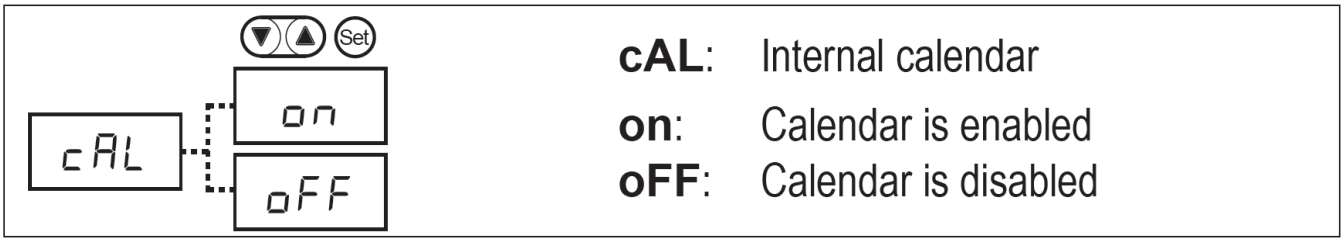
rEd: Red beacon
YEL: Yellow beacon
oFF: Off used for light bar

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 G 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 G 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.

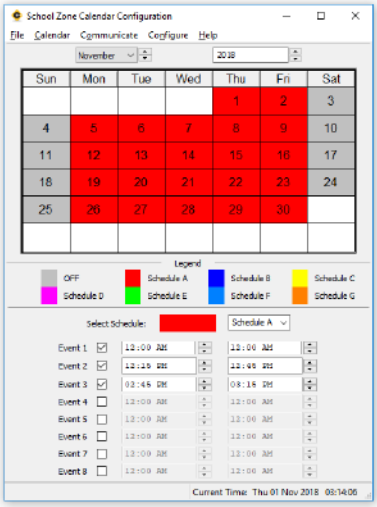
NOTE Even if the Calendar setting is oFF, a calendar can still be programmed into the EMS using the USB cable, but the R829 won’t follow the programmed schedule until the calendar setting is turned on.

NOTE The internal calendar function requires users to update their PC software to the latest version before it can be used.

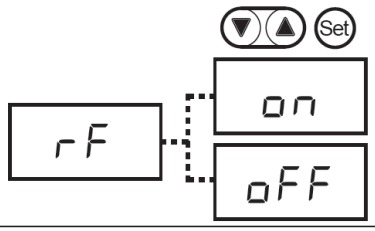
NOTE See separate calendar programming guide for comprehensive programming and operation of the internal calendar feature.

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

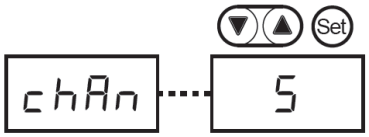
on: Radio is enabled

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)

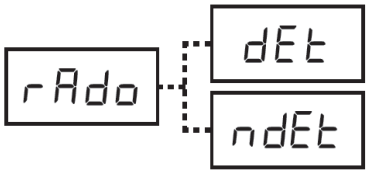
For radio-equipped systems, the Radio Channel setting is used to configure the channel that is used for communication with other systems in the same group. Groups near to each other will have their channels set to different values to ensure there is no accidental cross-activation between them. Changing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

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



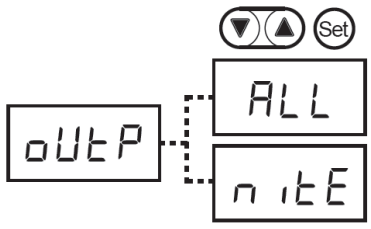
rAdo: Radio detection status

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



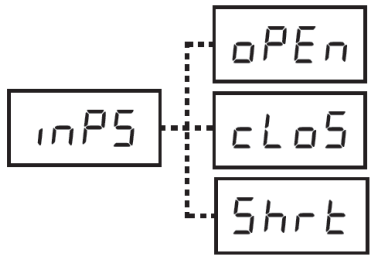
outP: Digital output
ALL: Digital output enabled when flashing
nitE: Digital output enabled when flashing at night

The Digital Output feature of the EMS provides a steady 12-volt output signal at the OUT2 EMS Input/Output terminal 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 OUT2 terminal decreases with increasing terminal current, see the note in the Input/Output Terminal Block Section.

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

Carmanah Digital Output default is ALL.

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

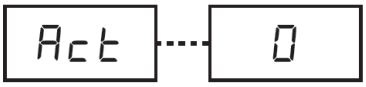
Push Button Input Status reports different states depending on the product configuration.

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

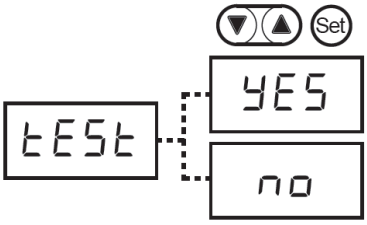


Act: Activation count

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

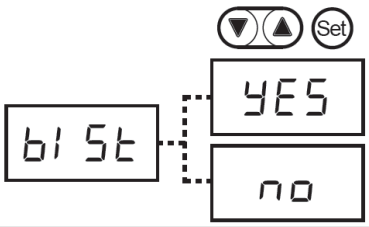
YES: Activates the LED beacon

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 or not 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

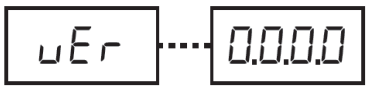
The Built-In Self-Test (BIST) runs a self-test on the system. BIST results are used for troubleshooting the system. After the BIST has been started by selecting “Yes”, the display will flash bESt for the duration of the test and will then display hexadecimal information that can represent one or more 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 SC315-G Programming

To configure the EMS as a SC315-G:

- ✓ 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-G 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-G 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-G 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 settings are correct, particularly the LED driver current (“Intensity” in EMS user interface), flash pattern and flash duration (if applicable)
- ☐ 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-G and computer time used to set clock were 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 fuses are intact (use voltmeter to confirm fuse continuity).
- ☐ 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 G 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:

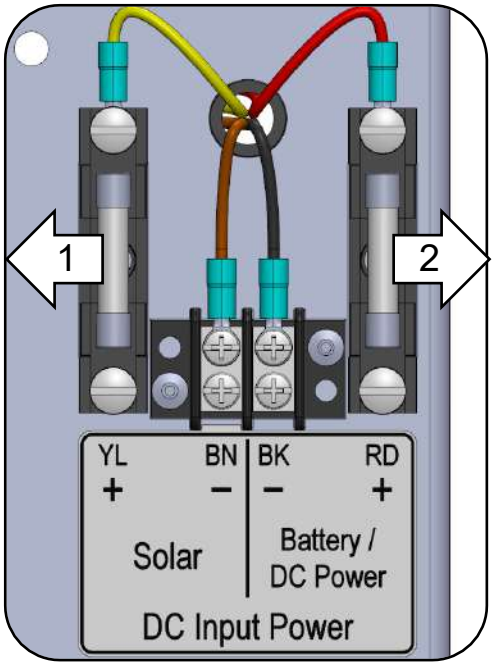
- Dirt and dust
- Snow
- Leaves
- Debris
- Shade that may have developed after installation due to adjacent plant growth.

The frequency of the inspections depends on location and local weather patterns. A yearly visual inspection of the solar engine is typically sufficient. 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.

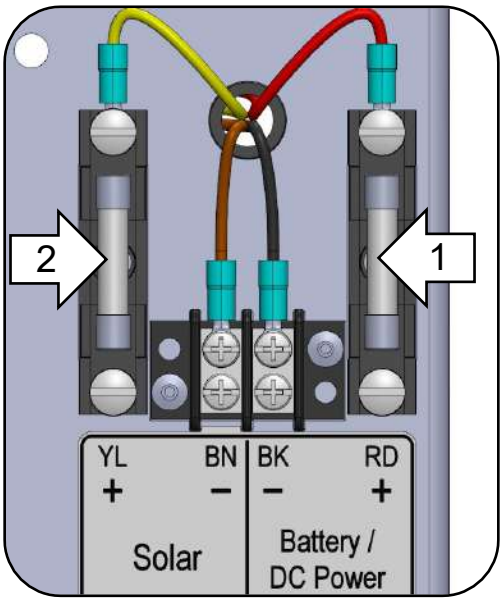
8.1 Fuse Replacement

To replace the fuses:

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 a fuse to blow.
3. Identify the battery and solar fuses on the right side of the cabinet. Carefully pry out the solar fuse first, then the battery fuse.



4. Replace a blown fuse with an identical 3AB (1/4" x 1-1/4") fast-acting 15A fuse, Littelfuse part number 0314015.MXP (or equivalent).
5. Install the battery fuse first, then the solar fuse.



8.2 Battery Replacement

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.

When the system's battery requires replacement, it is recommended that the original manufacturer and model of battery be used.

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. Remove the solar fuse and then the battery fuse and install the new battery.
2. Press and hold down EMS "Set" button
3. While continuing to hold down "Set" button, reinstall the battery fuse
4. While continuing to hold down "Set" button, wait for 2Ero (zero) to appear
5. Release the "Set" button
6. Reinstall the solar fuse.

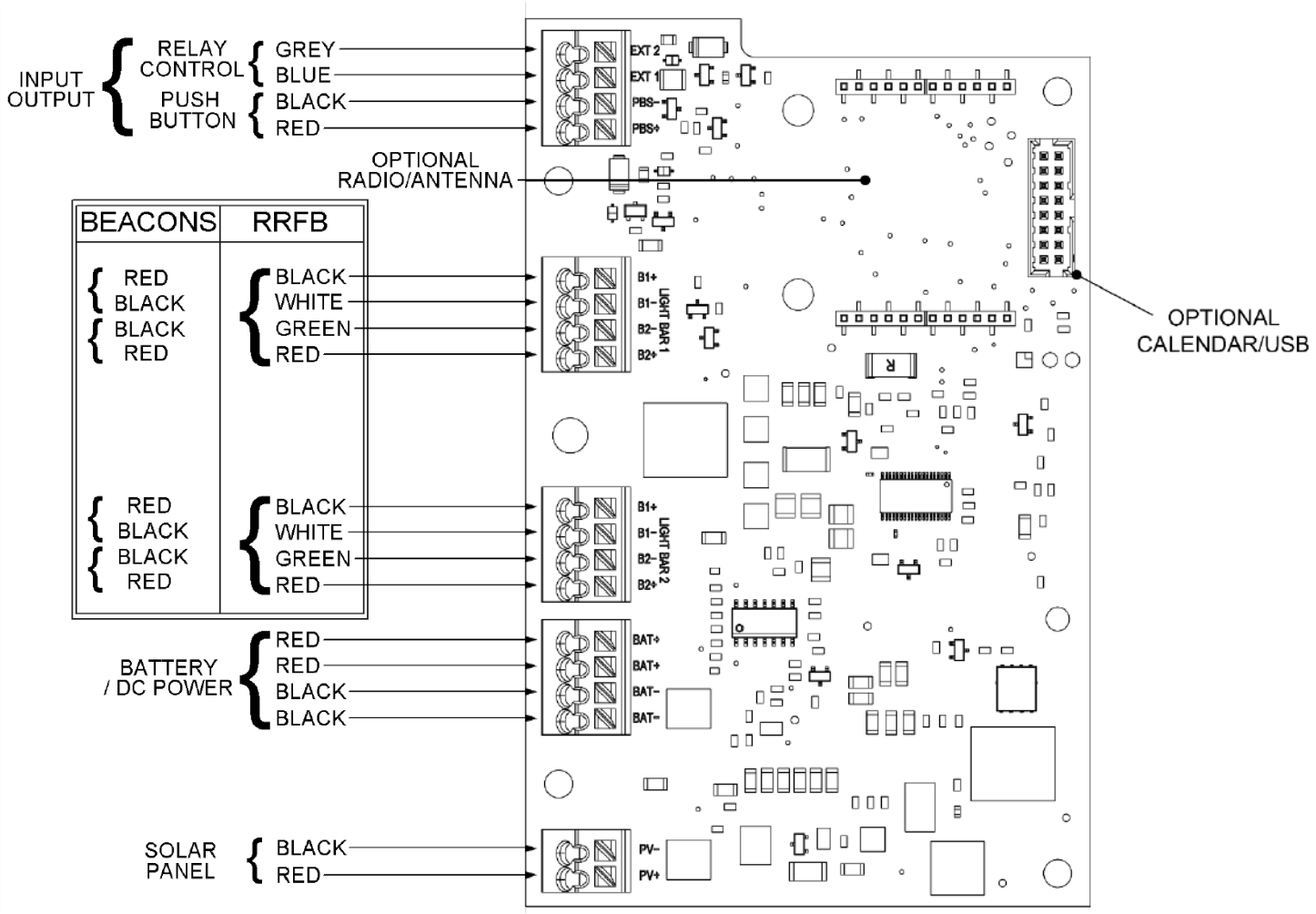
The battery health meter inside the system is now reset (i.e. it knows that new, healthy batteries have been installed). The battery status should read Good (good) if the new batteries are 12.6V or higher, or chAr (charge) if they are between 11.7 and 12.6 volts.

8.3 EMS Replacement

Caution - The solar panel may still be producing energy if it is exposed to light. Remove the solar fuse and then the battery fuse prior to replacing the EMS.

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

1. Disconnect the solar fuse, and then the battery fuse.
2. Remove the four screws securing the metal EMS chassis to the cabinet. Carefully unscrew and remove the coax connector leading to the antenna if present.
3. 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.
4. 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.
5. Remove the 4 screws securing the old EMS PCB to the metal chassis and set the old EMS PCB aside.
6. Remove the new EMS PCB from its antistatic bag and secure it to the metal housing with the same 4 screws.
7. Check that the wire strands are straight and that all the strands will go into each terminal. This will avoid short circuits created by stray strands. Twist the wire strands as necessary to keep the strands together.
8. With a small screwdriver, press down firmly on the wire release button and insert each wire into its terminal, referring to the picture taken in Step 3.
9. If a radio module is present, carefully thread the antenna connector to the module. Do not damage the circuit board with tools.
10. Secure the EMS enclosure into the cabinet with the screws.
11. Reinstall the battery fuse, then the solar fuse.
12. The system should now be operating and the front display on the EMS should light up.
13. 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.



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

The BIST is used during manufacturing to test a fully assembled system. In manufacturing, the ambient brightness sensor is tested by applying varying light levels and measuring response. When BIST is run on a system deployed in the field, the BIST will not detect a variation in ambient light and will generate a 0080 error. This does not indicate an issue with the ambient brightness sensor.

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 G 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 label on the right side of the cabinet near the top, and on a label inside the cabinet on the EMS.

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 beacons and signs for the transportation industry. In addition to the G Series, the compact, self-contained E and F Series products are fully compatible with the G 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. 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.