**Purchase Specification**

**for a Solar Powered**

**Connected Crosswalk System**

1. **Overview**

**A Connected Crosswalk System (CCS) shall be used to enhance pedestrian conspicuity and increase driver yield rates at locations such as midblock crosswalks, roundabouts and other unsignalized locations. Each CCS shall be modular and available with a self-contained or cabinet-based solar Power Module. Self-contained systems shall have the solar panel integrated into its Power Module enclosure while cabinet-based Power Modules shall have a solar panel mounted separately. Solar panels shall be available with top of pole or side of pole configurations. The self-contained or cabinet solar Power Module houses the charge controller, flash controller, Bluetooth communications, GPS/cellular communications, DC relay, knockdown sensor and battery(s).** **The CCS shall conform to all provisions of the MUTCD, or MUTCDC, Interim Approval IA-21 including WW+S flash pattern. The CCS shall be pre-wired to the maximum extent possible.**

1. **Mechanical and Electrical**

**The CCS shall be modular without a centralized controller. Adding other Flasher Modules or accessories shall not necessitate a change in system configuration.** A solar simulation shall be provided to verify the additional load(s) can be supported by the CCS for reliable year-round operation.

CCS shall be equipped as standard with an integrated knockdown sensor, **purpose-built by the CCS manufacturer**. The sensor shall detect a knockdown or impact if the Power Module is more than 30 degrees off-axis in any direction.

**CCS shall be equipped as standard with an integrated 5 A DC power supply/relay**, **purpose-built by the CCS manufacturer**, **with fault protection against short circuits. This function is intended for accessories such as overhead lighting to be triggered while the CCS rectangular rapid flashing beacons (RRFBs) are actively flashing.**

**CCS shall have an externally mounted Bluetooth antenna for local communications and an externally mounted GPS antenna for remote communications.**

**CCS wiring shall be available off-the-shelf and non-proprietary.**

**CCS shall be capable of** **being wiring via a “centralized” or “distributed” approach:**

* **Centralized – all component wiring from Flasher Modules (RRFBs) or trigger devices (push buttons or passive sensors) shall be terminated to the Power Module circuit board.**
* **Distributed – one Flasher Module shall be terminated to the Power Module circuit board. Additional Flasher Modules or trigger devices may be terminated to any available Flasher Module.**

**CCS Power Module circuit board shall be conformally coated.**

**Self-contained and cabinet Power Modules shall be rated to a minimum of NEMA 3R.**

Fasteners shall be stainless steel.

**Mounting**

Mounting adapter hardware for the CCS Power Module shall be available for the following configurations, for top of pole or side of pole:

* 2**"** – 2.5**"** perforated square post mount
* 2.38**"** – 2.88**"** diameter round pole mount
* 3.5**"** – 4.5**"** diameter round pole mount
* Wooden pole or post

Side of pole configurations shall be available for pole sizes larger than 4.5**". Flat surface mounting shall be available for cabinet-based systems.**

Standard mounting options shall not require specialized tools for installation.

**Solar Charge Controller**

**The solar charge controller shall use maximum power point tracking (MPPT).**

**Charge controller shall be purpose-built by the CCS manufacturer and feature 3-stage charging with temperature-compensation to prevent battery overcharging in hot weather. Charge controller shall not be an external module or device.**

**Charge controller shall be reverse polarity protected on the battery and solar inputs.**

**Charge controller shall be field replaceable.**

1. **Power Modules**

**CCS Power Modules shall** be available **in one of four size and configuration options:**

* **Small self-contained solar Power Module**
* **Large self-contained solar Power Module**
* **Small solar cabinet Power Module**
* **Large solar cabinet Power Module**

**Small Self-Contained Solar Power Module**

The small self-contained solar Power Module shall be constructed from 16-gauge aluminum with an integrated solar panel. No external control cabinet or battery cabinet shall be required.

**Module** shall not exceed 12.6**"** in height from bottom of adapter fitting to top of solar panel. The depth of the module shall not exceed 5.3**"**.

Access to the interior of the module shall be provided by a lid that is hinged on the right edge and is fitted with a foam gasket. The lid shall have an integrated padlockable latch for use with lock shackles up to ¼". Optional industry standard #2 padlock available.

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

Module shall be affixed to the top of pole or side of pole.

Overall module weight [without battery(s)] shall not exceed 5 lb (2.3 kg).

Module shall be available in unfinished aluminum or with black powder coat. Optional yellow, green or custom powder coat colors available.

**Solar Panel**

Module shall include one 18 V solar panel rated at 15 W. Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Module shall be supplied with a fixed tilt angle of 45 degrees and shall have the ability to be oriented toward the equator with no additional mounting hardware.

**Batteries**

**Module shall include up to two 7 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free batteries. Each battery shall be equipped with a 15 A mini blade fuse.**

Batteries, in conjunction with recommended CCS performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Batteries shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Individual batteries shall be supported by foam inserts and separated by a rubber bumper.

**Large Self-Contained Solar Power Module**

The **large self-contained solar Power Module** shall be constructed from 14-gauge aluminum with an integrated solar panel. No external control cabinet or battery cabinet shall be required.

**Module shall** not exceed 18.3**"** in height from bottom of adapter fitting to top of solar panel. The depth of the module shall not exceed 5.8**"**.

Access to the interior of the module shall be provided by a lid that is secured with four bolts and is fitted with a foam gasket. The lid shall have an integrated padlockable latch for use with lock shackles up to ¼". Optional industry standard #2 padlock available.

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

Module shall be affixed to the top of pole or side of pole.

The overall module weight [without battery(s)] shall not exceed 11 lb (5 kg) for 30 W solar panel or 14 lb (6.4 kg) for the 50 W solar panel.

Module shall be available in unfinished aluminum or with black powder coat. Optional yellow or green powder coat or custom colors available.

**Solar Panel**

Module shall include one 18 V solar panel rated at 30 W. Optional 50 W solar panel available. Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Module shall be supplied with a fixed tilt angle of 45 degrees and shall be oriented toward the equator with no additional mounting hardware.

**Batteries**

**Module shall include up to two 18 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free batteries. Each battery shall be equipped with a 15 A mini blade fuse.**

Batteries, in conjunction with recommended CCS performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Batteries shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Individual batteries shall be supported and separated by standoffs.

**Small Solar Cabinet Power Module**

The small solar cabinet Power Module shall be constructed from 11-gauge aluminum. The battery shall be mounted inside the cabinet with no external control cabinet or battery cabinet required.

Cabinet shall be vented to provide cooling of the electronic system. The vents shall be screened to prevent ingress by insects and other debris.

Cabinet shall have tamper-proof hinged door with an integrated padlockable latch for use with lock shackles up to ¼". Optional industry standard #2 padlock available.

Cabinet shall have integrated mounting brackets to accept industry standard banding. Cabinet may optionally be fastened directly to a square post or other flat surface using through-bolts.

Cabinet shall have exposed spring-loaded push button terminal blocks for final electrical connections.

Cabinet shall include a 1.25**" trade size threaded pipe nipple to facilitate running wiring internal to a pole.**

Cabinet shall include nine drill indentations to facilitate various conduit fitting locations for running wiring external of a pole or post.

The overall cabinet weight (without battery) shall not exceed 10 lb (4.5 kg). Dimensions of the cabinet shall be 16.7**"** H x 11.3**"** W x 7.0**"** D (42.4 cm H x 28.7 cm W x 17.8 cm D).

Cabinet shall be available in unfinished aluminum or with black powder coat. Optional yellow, green or custom powder coat colors available.

**Solar Panel**

Module shall include one external 18 V solar panel rated at 50 W, 80 W or 170 W with mounting hardware and bypass diode(s). Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Solar panel with top of pole mounting shall be supplied with a fixed tilt angle of 45 degrees and shall have the ability to be oriented towards the equator with no additional mounting hardware. Solar panel with side of pole mounting shall have adjustable tilt angle – including 45 degrees, and shall have the ability to be oriented towards the equator with no additional hardware.

**Battery**

**Module shall include one 18 Ah, 35 Ah or 55 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free battery. Battery shall be equipped with a 15 A mini blade fuse.**

Battery, in conjunction with recommended CCS performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Battery shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Battery shall be supported from the sides by rubber bumpers.

**Large Solar Cabinet Power Module**

The large solar cabinet Power Module shall be constructed from 10-gauge aluminum. The battery shall be mounted inside the cabinet with no external control cabinet or battery cabinet required.

Cabinet shall be vented to provide cooling of the battery and electronic system. The vents shall be screened to prevent ingress by insects and other debris.

Cabinet shall have an integrated industry standard #2 lock and tamper-proof hinged door. Optional padlockable latch for use with lock shackles up to ¼".

Cabinet shall have integrated mounting brackets to accept industry standard banding or optional U-bolts. Cabinet may optionally be fastened directly to a square post or other flat surface using through-bolts.

Cabinet shall include a 1.25**" trade size threaded pipe nipple to facilitate running wiring internal to a pole.**

Cabinet shall include three drill indentations to facilitate various conduit fitting locations for running wiring external of a pole or post.

Cabinet shall have industry standard barrier type terminal blocks exposed for final connections.

The overall cabinet weight (without battery) shall not exceed 19 lb (8.6 kg). Dimensions of the cabinet shall be 21.9**"** H x 16.1**"** W x 8.3**"** D (55.6 cm H x 40.9 cm W x 21.1 cm D).

Cabinet shall be available in unfinished aluminum or with black powder coat. Optional yellow, green or custom powder coat colors available.

Optional cabinet door switch available for SMS and/or email notifications of ingress and egress of the system. If module cabinet door is not fully closed and locked a digital alarm shall remain present on the system, which can be viewed locally on-site (see Section 6) and remotely (see Section 7).

**Solar Panel**

Module shall include one external 18 V solar panel rated at 50 W, 80 W or 170 W with mounting hardware and bypass diode(s). Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Solar panel with top of pole mounting shall be supplied with a fixed tilt angle of 45 degrees and shall have the ability to be oriented towards the equator with no additional mounting hardware. Solar panel with side of pole mounting shall have adjustable tilt angle – including 45 degrees, and shall have the ability to be oriented towards the equator with no additional hardware.

**Battery**

**Module shall include one 35 Ah, 55 Ah or 100 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free battery. Battery shall be equipped with a 15 A cartridge fuse. Supplemental battery fusing shall include a 15 A mini blade fuse at the Power Module circuit board.**

Battery, in conjunction with recommended CCS performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Battery shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Battery shall be supported from the sides by rubber bumpers.

1. **Flasher Modules**

**The CCS shall come standard with one or more rectangular rapid flashing beacon (RRFB). Optional LED beacons and LED signs shall be available in conjunction with RRFBs or standalone.**

**Rectangular Rapid Flashing Beacon (RRFB)**

**RRFB shall only require an input of 12 VDC nominal for operation and shall contain its own active electronics including an LED driver and flasher. RRFB shall operate out-of-the-box with applicable flash pattern, daytime intensity and nighttime intensity settings.**

**RRFB housing shall be constructed from 10-gauge aluminum and shall be available in black or yellow powder coat. Optional green power coat available. Dimensions shall be approximately 24" L x 1.5" D x 4.5" H (61.0 cm L x 3.8 cm D x 11.4 cm H).**

**RRFB shall conform to all provisions of the MUTCD and FHWA requirements or TAC guidelines within the MUTCDC.**

**RRFB shall contain two modules with 8 LEDs and shall be purpose-built by the CCS manufacturer, including optics. The optics shall be premium, UV-resistant polycarbonate. Module with active electronics shall be field replaceable with common hand tools without having to replace the entire RRFB.**

Each end of an **RRFB** shall include a side-emitting pedestrian confirmation light composed of a single LED. Users shall have the option of using both confirmation lights for median applications, or covering one confirmation light with an included sticker for side-of-road applications.

RRFB shall be mounted to the post or pole using a separate bracket assembly to facilitate mounting two RRFBs back-to-back (bi-directional) and to allow the RRFB(s) to rotate horizontally for aiming.

**RRFB** bracket shall be constructed from stainless steel. Mounting options shall include both banding and bolting to all specified pole types.

**RRFB light bar** assembly shall open for access to the wiring connections for the two LED modules. LED modules shall be rated to a minimum of NEMA 3R.

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections

**RRFB shall meet the minimum photometric specifications of the Society of Automotive Engineers (SAE) standard J595 Class I dated January 2005. A photometric report by a certified third-party testing laboratory shall be provided to demonstrate compliance with J595.**

**The color of the yellow RRFB indications shall meet the specifications of SAE standard J578 (Color Specification) dated December 2006.**

**CCS shall have the capacity to meet a minimum array-to-load (ALR) of 1.2 while meeting the specified daily activations and flash duration year-round using the applicable peak sun hours insolation available at the installation location. Refer to Section 8 for details on insolation data sources.**

**Optional RRFB backplate available for increased conspicuity. Shall be 12-gauge aluminum in black powder coat – with or without fluorescent yellow retroreflective tape.**

**Optional RRFB mast arm mounting kit shall consist of 12-gauge perforated steel tube, RRFB mounting bracket and associated hardware. Kit shall accommodate mast arm diameters between 4.5" and 10.5". Perforated steel tube shall accommodate static signs up to 36" and may be cut shorter for smaller signs.**

**Options**

**LED Beacon**

**The LED beacons shall conform to the Standard of the Manual of Uniform Traffic Control Devices (MUTCD) 2009 with May 2012 Revisions 1 and 2 or TAC guidelines within the MUTCDC.**

**LED beacon shall only require an input of 12 VDC nominal for operation and shall contain its own active electronics including an LED driver and flasher. LED beacon shall operate out-of-the-box with applicable flash pattern, daytime intensity and nighttime intensity settings. Configuration switch shall be available to adjust between unison and alternating flash patterns.**

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

**The CCS shall be capable of driving beacons at ITE-compliant intensities if solar conditions and programming configuration permit.**

**LED beacons shall be available in red and yellow in 12" (305 mm) and 8" (203 mm) diameters.**

**LED beacon optics shall be premium, UV-resistant polycarbonate.**

**Signal Housing**

**The signal housing shall meet the equipment standard of the Institute of Transportation Engineers (ITE) Vehicle Traffic Control Signal Heads (VTCSH) Chapter 2.**

**The signal head’s bracket assembly shall be constructed such that the signal head can be removed easily in the field.**

**The signal housing must be able to rotate** **independently from the Power Module or bracket for lens alignment.**

**The signal housing shall be** **constructed from either UV-resistant polycarbonate or aluminum. The signal housing shall be available in yellow and black with optional green.**

**Signal housing shall be rated to a minimum of NEMA 3R.**

Signal heads shall be capable of being mounted to a post or pole using a separate bracket assembly to facilitate mounting multiple beacons in either vertical, horizontal, or back-to-back (bi-directional) arrangements.

**Self-contained Power Modules shall also be capable of direct attachment to the top of a signal head.**

**LED Sign**

**The CCS shall be available with optional LED sign(s).**

**LED sign shall only require an input of 12 VDC nominal for operation and shall contain its own active electronics** **including an LED driver and flasher. LED sign shall operate out-of-the-box with applicable flash pattern, daytime intensity and nighttime intensity settings.**

**The purpose-built junction box shall be integrated into the sign mount and shall completely conceal electrical connections to discourage vandalism. The junction box shall be constructed of glass-fiber reinforced plastic for additional impact resistance and shall provide a high degree of weather resistance.**

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

**The LED wiring shall be covered by aluminum channels. There shall be no gaps or exposed wiring between the channels and LED modules or from the sign to the pole. All harnessing must be concealed and vandal resistant.**

**LED sign shall be available as:**

* **S1-1 (School, in 30**" **or 36**" **sizes)**
* **W11-2 (Pedestrian, in 30**" **or 36**" **sizes)**

**The sign sheeting shall be 3M Diamond Grade DG3 retroreflective with 3M anti-graffiti and overlay film (S1-1/W11-2) or High Intensity Prismatic (W11-2) sheeting. Sheeting color shall be fluorescent yellow-green (FYG) for S1-1 and yellow or FYG for W11-2.**

The LED enhanced sign shall consist of eight yellow high-power LEDs in waterproof, polycarbonate impact-resistant housings, rated to a minimum of NEMA 3R, that can be driven at a high intensity. Each individual LED housing shall be tested for shock and vibration as part of the manufacturing process

The LED optics shall be integrated total internal reflection (TIR) for optimal light efficiency and shall be premium, UV-resistant polycarbonate. The optics shall be purpose-built by the **CCS manufacturer** for optimal intensity.

In the event a single LED fails, all other LEDs shall continue to operate.

The LED bezel shall be black and placed within the border of the sign for enhanced LED contrast and increased visibility.

LED signs shall be able to mount in a single or back-to-back (bi-directional) configuration.

Mounting options shall include both banding and bolting to all specified pole types.

**Optional Z-bar mounting kits shall be available for high wind zone regions.**

1. **Operation and Configuration**

**Operation**

**The CCS, once powered up with an RRFB, shall automatically form a network link between all other RRFB CCS’ nearby within wireless range, up to 1000' (304 m). This link ensures all nearby RRFBs shall flash in synchronization once triggered by any CCS in the link.** **CCS shall be operational upon power-up without any on-site configuration required.**

**CCS shall be capable of activation by pedestrian push button with voice message. The push button may be equipped with an optional integrated touchless activation technology.**

**Pedestrian push button shall be an ADA-compliant** **audible information device (AID) and have these accessibility features:**

* Activation area of 2" minimum across in at least one direction
* Shall be operable with a closed fist
* Shall be operated with a maximum of 3.5 lb (15.5 N)
* Shall have a visual contrast with the body background of at least 70 percent
* Voice message with the MUTCD IA-21 approved message “Yellow lights are flashing”, spoken twice by default
* Visible indicator for button press confirmation
* Audible locator tone
* Tactile directional arrow

**Optional touchless push button shall have these accessibility features:**

* **Touchless detection can be enabled or disabled**
* **Adjustable detection range, between 1" to 20"**
* **Adjustable minimum “wave” presence time for activation to occur, between 0 to 500 ms**

**The push button shall be self-contained with no external controller. The push button shall have wireless Bluetooth communication for changing volume, optional touchless activation parameters and other settings** **via a companion mobile application.**

**All RRFBs connected to the CCS shall initiate flashing sequence simultaneously within 50 ms of activation. If an additional activation occurs while the system is activated, the flash duration shall reset. For example, with the flash duration set to 20 seconds, if an additional activation occurs after the RRFB has been activated for 15 seconds the RRFB shall continue for an additional 20 seconds, or 35 seconds in total.**

**If the RRFB has ceased its flashing cycle, any subsequent activation shall activate the RRFB immediately regardless of how recently the RRFB ceased operation.**

**CCS shall have low voltage disconnect (LVD) protection to aid in preventing fully discharging the battery(s). When in LVD the push button voice message shall cease operating and RRFB(s) shall not flash when activated.**

**Configuration**

**The CCS shall contain a button to activate a multi-colored status LED for on-site troubleshooting. Status LED shall be capable of displaying:**

* **No fault detected**
* **System is charging via solar panel**
* **Fault detected**
* **System is in low voltage disconnect (LVD)**

**RRFB flash duration shall be adjustable on-site from 5 to 60 seconds in 1 second increments, 60 to 120 seconds in 5 second increments, 2 minutes to 10 minutes in 60 second increments, and 10 minutes to 60 minutes in 5 minute increments.**

**RRFB flash rate shall be wig-wag plus simultaneous (WW+S) providing 75 flashing sequences per minute. The flash rate of each individual RRFB indication, as applied over the full flashing sequence, shall not be between 5 and 30 flashes per second to avoid frequencies that might cause seizures.**

**CCS RRFB shall exceed SAE J595 Class 1 specifications. Daytime intensity value shall not be user editable to ensure it always meets or exceeds J595 Class 1 specifications.**

**CCS shall use integrated Global Positioning System (GPS) for determining location and time. GPS shall be used to determine day or night status. The CCS shall determine dusk and dawn times based on location and time of year. Day or night status shall be used for the RRFB to apply daytime or nighttime intensity values.**

**CCS shall provide configurable nighttime intensity settings ranging from 10% to 100% (no dimming) of factory default.**

**Radio System**

**The CCS shall be equipped as standard with a 2.4 GHz radio with externally mounted antenna. Upon detection of a push button, touchless or passive detection, the Power Module shall broadcast an activation to all other nearby CCS’ sharing the same network parameters.**

**CCS, when triggered, shall activate other CCS’ linked with the same network parameters by wireless communication within 1000' (304 m).**

**CCS shall have 16 unique channels that can be configured on-site to avoid local wireless congestion.**

**CCS shall** **have “unlimited” unique network parameter combinations to create a link between more than one system. Linking multiple systems shall avoid inadvertent activations of nearby other CCS’ using default network parameters.**

**The antenna shall be field replaceable without requiring system disassembly or entering the Power Module.**

**Optional remotely mounted antenna shall be available to improve communications with advanced beacon systems and shall have the ability to be installed without system disassembly or entering the Power Module.**

**Options**

**CCS shall be available with optional** passive microwave detection. The passive detection system shall use a short-range microwave sensor providing the necessary range with low power consumption. The passive detection system shall provide pedestrian presence detection within the targeted area of a crosswalk or trail crossing. A solar simulation shall be provided to verify the microwave sensor load can be supported by the CCS for reliable year-round operation.

CCS shall be available with optional overhead lighting fixture. The fixture shall illuminate whenever a pedestrian has activated the CCS and shall remain illuminated for the same preset flash duration as the RRFBs. The CCS shall have the ability to extend the illumination of the overhead lighting fixture for up to 60 seconds after the RRFBs have ceased flashing. A solar simulation shall be provided to verify the overhead lighting fixture can be supported by the CCS for reliable year-round operation.

**Overhead Lighting**

The system shall have the capability to operate the fixture in night-only operation or on a 24-hour basis with each pedestrian activation. Night-only operation shall be controlled by either:

* A photocell mounted on the fixture, or
* System’s integrated GPS

Overhead lighting fixture shall be purpose-built specifically for street and area lighting with the following specifications:

* Form factor: cobra head
* Operation: constant-current, DC
* Maximum power: 50 Watts
* Light output: 5500 lumens
* Optic type: 4ME
* LED arrangement: multiple
* CCT: 4000 Kelvin
* Operating temperature: -40° to 40°C (-40° to 104°F)

Each fixture shall have an integrated LED driver module located within the shell of the fixture.

Each fixture shall have tool-less entry for accessing internal wiring and connections.

Each fixture shall have a receptacle for optional photocell or shorting cap integration.

Each fixture shall accept the following tenon sizes for mounting:

* 1.25" (32 mm) I.D., 1.66" (42 mm) O.D. or 2" (51mm) IP, 2.375" (60 mm) O.D. horizontal tenon (minimum 8" [203 mm] in length)

Each fixture shall be adjustable +/-5° and shall include a two axis T-level to aid in leveling.

The fixture **shall** be dark sky friendly.

The overhead lighting fixture shall be FCC Part 15, Subpart B, Class A limits for conducted and radiated emissions.

**6.0 Local Connectivity**

**The CCS shall have integrated Bluetooth Low Energy (BLE) local communications for on-site configuration and diagnostics via a purpose-built mobile app by the CCS manufacturer.** The mobile app shall be available free of charge on the Apple App Store or Google Play Store for compatible devices.

Mobile app, in conjunction with CCS, shall contain “bank-level” security. The mobile app shall “pair” with the CCS using a “digital key” via one of two methods:

* Pairing button **shall** be pressed inside the Power Module, or
* System has a valid existing remote connectivity plan (see Section 7). Digital key is sent automatically, for authorized account users, to the app with a cellular connection

If the pairing button is used the mobile app shall retain the digital key for 14 days. After 14 days has elapsed the user automatically reacquires the digital key through the login procedure in the mobile app.

Mobile app shall not require a system password, passcode or any default method of security for system access.

Mobile **app shall display all CCS’ within Bluetooth range that are capable of establishing a connection.**

Mobile app shall have the functionality to identify the presently connected system by temporarily activating the RRFB with a unique quick flash. If the RRFB is actively flashing from a pedestrian activation, the RRFB shall temporarily stop and initiate the unique quick flash for system identification before resuming normal operations.

**Mobile app** shall have the functionality to **perform a system reboot without needing physical access to the system.**

Mobile **app shall report any faults in human readable form. If more than one fault is detected, each fault shall be listed separately. Fault messages shall clear automatically if the fault condition has been resolved.**

Mobile **app, for RRFB equipped CCS’, shall not have a user editable operation mode to anything other than pedestrian activation. CCS shall not be capable of scheduled operation for activation.**

Mobile **app, for RRFB equipped CCS’, shall not have a user editable flash pattern to anything other than WW+S.**

Mobile **app shall be capable of over-the-air software updates.**

Mobile **app shall be capable of over-the-air firmware updates to Power Modules and Flasher Modules.**

Mobile **app shall be capable of modifying the following parameters:**

* **System name for on-site and remote identification**
* **Flash duration**
* **Nighttime intensity**
* **Overhead lighting mode (night-only or 24-hour)**
* **Overhead lighting duration extension (0 – 60 seconds)**
* **Network linking**
* **Network channel (11 – 26)**
* **Door switch alarm (enabled or disabled)**
* **Rotate digital key (for security purposes)**

Mobile **app shall be capable of displaying the following read-only parameters:**

* **System status**
* **Operation mode**
* **System voltage**
* **Solar panel voltage**
* **Charge current**
* **Trigger count** **(previous day’s total and today’s current total)**
* **CPU temperature**
* **System date and time**
* **Power Module part number**
* **Power Module serial number**
* **Power Module first activation date (date Power Module first powered up)**
* **Power Module firmware version**
* **Latitude and longitude of system**
* **Flasher Module part number**
* **Flasher Module serial number**
* **Flasher Module first activation date (date Flasher Module first powered up)**
* **Linked systems**

Mobile **app shall be capable of providing in app fault alerts:**

* **Power Module communication error**
* **Power Module cabinet door switch open**
* **Overcurrent/short circuit detected**
* **Flasher Module open/short circuit detected**
* **No battery detected**
* **Battery voltage very low**
* **Low voltage disconnect (LVD)**
* **Cellular communication error**
* **Status wire communication error**
* **Flasher Module removed from system**
* **System knockdown**
* **Integrated relay overcurrent/short circuit detected**
* **Accelerometer communication error**
* **No charging for >24 hours**
* **High temperature alarm**
* **Synchronize wire short**
* **Memory full error**
* **Internal memory corrupt**
* **External memory corrupt**
* **Flasher memory corrupt**

Mobile **app shall have access to digital user guides and live chat support (during normal business hours).**

1. **Remote Connectivity**

**Overview**

The CCS shall be equipped as standard with integrated remote connectivity. Subscription **shall** include 3 years of enhanced-level features.

Connectivity solution **shall** be purpose-built by the CCS manufacturer, not require any external/third-party control box or device and shall include a SIM card. Remote connectivity shall be cloud-hosted software with web-based user access. Other software or IT infrastructure shall not be required for installation or maintenance.

**Remote connectivity shall use the LTE-M wireless broadband network. SIM card shall be network provider agnostic and support major wireless carriers in the United States and Canada. LTE-M modem shall automatically connect to the best available network for the installation location. If cellular service is interrupted or unavailable, LTE-M modem shall automatically connect to the next available network provider.**

User interface shall be web-based and viewable using any modern browser on a PC, laptop or mobile device with a cellular or Wi-Fi connection. **Remote connectivity shall be mobile friendly and operate without requiring a static IP address.**

**Each CCS shall have an externally-mounted, combination GPS/cellular antenna for geolocation and date/time.**

**Remote connectivity shall be capable of over-the-air software updates without requiring user interaction.**

**The CCS shall be capable of receiving over the air updates for both Power and Flasher Modules.**

**Basic level subscription, with limited feature set, shall be included for 3 years at no cost. Additional enhanced-level subscription plans shall be available.**

**Features, Operation and Configuration**

**Enhanced-level subscription shall include the following additional features:**

* **System performance charting for previous 180 days**
* **System knockdown alerts via SMS and/or email**
* **Enhanced system security with ability to lock out local on-site pairing with mobile app**
* **Remote programming**

The user interface dashboard shall provide an overview of all systems without having to leave the page. Dashboard shall provide the following information:

* System name
* System application identifier
* System serial number
* System status
* Subscription type
* Operation mode
* Local pairing lockout status

Dashboard **shall** have a filter to show:

* All systems
* Systems with alerts only
* Systems with critical alerts only
* Systems with expired subscriptions only

Dashboard shall display a list of uniquely linked crosswalk systems and others that are not linked.

Dashboard **shall** include a scrollable, zoomable map display, with the CCS shown as a representative icon on the map. The map display **shall** have the option of satellite view or standard street view. The map shall include the ability to see the CCS icons using Google Maps, with the ability to view the location with Google Street View. Icons **shall** change color based on system status with green indicating system is operational, yellow indicating an abnormal condition, and red indicating a critical fault. Map shall automatically adjust to show a geofenced area with a view of all systems.

**CCS shall report in once per day with the following information:**

* **Most recent battery voltage**
* **Most recent solar voltage**
* **Most recent charge current**
* **Trigger count (previous day’s total, today’s current total and average over the last 30 days)**
* **Most recent CPU temperature**
* **Most recent cellular signal strength**
* **Most recent cellular signal to noise ratio**
* **Charting with 180 previous days of data for the items above**

**User shall have the ability to request updated system data at any time on a self-serve basis. Dashboard shall reflect the time since last report.**

User shall have the ability to refresh system GPS location or manually override via a map view.

User shall have the ability to manually log system notes for record keeping purposes.

User shall have the ability to change the following system parameters on a self-serve basis:

* **System name for on-site and remote identification**
* **Flash duration**
* **Nighttime intensity**
* **Overhead lighting mode (night-only or 24-hour)**
* **Overhead lighting duration extension (0 – 60 seconds)**
* **Local pairing lockout**

When a fault occurs, real-time alerts shall be published via SMS and/or email. The alert shall be immediately sent to all users who have opted into one or both delivery methods.

**System, Subscription and User Management**

**System Management**

**System Management shall be restricted to administrators only and provide the following functions:**

* **View a list of all systems by system name/serial number showing status,** local pairing lockout status and last checked in date. System and serial number shall be searchable.
* **Transfer system ownership to another account’s administrator.**
* **Reset system “digital key”, which shall remove local on-site mobile app access to anyone who is not an authorized account user.**
* **Enable a lockout for local pairing, which disables the on-site pairing button for local access. Mobile app users will need to be an authorized user in order to receive the “digital key” to connect to the system.**
* **Disable a lockout for local pairing, which enables the on-site pairing button for local access. Mobile app users require access to pairing button to receive the “digital key” to connect to the system.**
* **Download a log of all system alerts and events from the past 180 days.**

**Subscription Management**

**Subscriptions shall be self-serve managed with the following functions:**

* **View a list of all systems with their current subscription level and expiry date**
* **View all available subscriptions that have yet to be applied to a system**
* **Apply an available subscription of the same level or higher to a system**
* **Transfer available subscriptions from one account to another**

**User shall have full access to the state of their system, which system subscriptions are expiring soon and inventory of available subscriptions.**

**User shall be able to procure additional subscriptions in advance of knowing specially to which systems the subscriptions may be applied to in the future.**

**Administrators shall receive an automated email notification for upcoming pending expiring subscriptions.**

**Upon expiration of connectivity subscription, the CCS shall continue normal operation without interruption or change in performance. Local connectivity shall remain available for on-site configuration and diagnostics.**

**User Management**

**T****he initial account administrator shall be automatically assigned by the CCS manufacturer. Additional users shall be invited by the administrator for account access. Administrators shall have the ability to invite additional users with the following roles:**

* **Administrator – highest level of account authority. Can manage all account aspects including adding/removing users and transferring system ownership**
* **Operator – can manage and edit all systems**
* **Field Technician – can access the system on-site with a “digital key” and without need to “pair” with the system, for use with mobile app (see Section 6). Field Technician role shall not have the ability to view systems remotely.**
* **Observer – read-only access**

**All user roles, aside from Field Technician, shall have the following functions:**

* **Self-serve password change**
* **Self-serve SMS and/or email alert preferences**
* **Two-factor authentication**

**User Management shall be restricted to administrators only and shall provide the following functions:**

* **View a list of all user’s names, emails, user’s roles and last login date**
* **Change user’s role**
* **Invite a user**
* **Delete a user**

**Providing an invitation to new user shall require only a valid email address and required user role.**

1. **Solar Simulations (If Applicable)**

Detailed solar simulations shall be provided as evidence that the system is capable of year-round performance at a specific location. Solar simulations shall be composed of three calculations: Energy Balance, Array-to-Load Ratio (ALR), and Autonomy. The manufacturer or bidder shall provide a detailed analysis of these three calculations in a “Solar Power Report” (SPR).

Monthly average sunlight (insolation), night length and temperature data for a specific location shall be from recognized public sources such as the NASA Atmospheric Sciences Data Center.

**Energy Balance**

During a normal 24-hour cycle of operation, a system shall take energy in from the sun and consume energy through the flashing of the RRFBs, radio communication, and general quiescent power draw. Energy Balance refers to the evaluation of these energy values to determine system sustainability with respect to variances in sunlight and system load.

Energy Balance compares Energy-In and Energy-Out. Calculations shall be performed for the “worst month” of the year where worst month is determined by the lowest value of Energy-In divided by Energy-Out.

**Energy-In**

Energy-In is the total amount of sunlight energy in watt-hours *available* to the system over a 24-hour period. Energy-In is available to operate the RRFB, charge the battery(s), or both. Energy-In shall be determined as follows:

* Insolation X panel wattage X shading X charging efficiency X battery charge acceptance
  + The energy from the solar panel shall be based on available solar radiation at the installation location for the panel’s inclination angle. The solar radiation (insolation) values used shall be for the worst-case month of the calendar year.
  + Shading from nearby trees, buildings, or other structures unique to a particular location are to be factored-in and the calculations shall clearly show and justify the de-rating of the solar panel energy input. A photograph showing the sun’s path and obstructions it encounters shall be included.
  + Battery(s) shall be returned to full or close to full charge by sunset at the end of each day.

**Energy-Out**

Energy-Out is the total amount of energy in watt-hours consumed by the system in a 24-hour period of normal operation.

Energy-Out is the sum of quiescent and operating loads, measured in watt-hours, in all circuitry over 24 hours with an operating capacity of 300 20-second activations, including:

* Controller quiescent draw (daytime and between flashes)
* Wireless quiescent draw calculated over 24 hours
* Operating load of push button at rated operating capacity per activation (where applicable)
* Operating load of RRFBs including pedestrian indicators at rated intensity per activation The number of RRFBs and their electrical load details (voltage, current and power when lit) shall be clearly indicated
* Energy adjustments due to LED drive circuit efficiency
* The simulations shall clearly detail the flash pattern being used and calculate the duty cycle of the pattern
* Calculations shall assume the ratio of day to night activations is 9:1

**ALR (Array-to-Load Ratio)**

System Array-to-Load (ALR) ratio shall be calculated as:

* Daily Available Energy-In divided by daily Energy-Out, as defined above

Solar simulations shall be calculated demonstrating a minimum Array-to-Load (ALR) ratio of 1.2:1 (1.2).

**Autonomy**

Autonomy is the number of days that the CCS can continue to operate normally in the absence of any solar charging. Autonomy shall be calculated as follows:

* (Nominal battery capacity de-rated for temperature minus battery capacity unavailable due to Low Voltage Disconnect) divided by (daily total energy consumption at the specified number and duration of activations)

CCS autonomy shall be determined based on regional requirements – at a minimum of 7 consecutive days.

1. **Custom Build**

**Fill out the table below to create a CCS custom build:**

|  |  |  |
| --- | --- | --- |
| **Section 2 – Mechanical and Electrical** | Power Module Mounts | 2" – 2.5" perforated square post mount  3.5" – 4.5" diameter round pole mount  2.38" – 2.88" diameter round pole mount  Wooden Pole |
| **Section 2 – Mechanical and Electrical** | Power Module Orientation | Top of pole  Side of pole |
| **Section 3 – Mechanical and Electrical** | Power Modules | Small self-contained solar  Small solar cabinet    Large self-contained solar  Large solar cabinet |
| **Section 3 – Mechanical and Electrical** | Power Module Colors | Unfinished aluminum  Green powder coat  Black powder coat  Custom \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Yellow powder coat |
| **Section 3 – Mechanical and Electrical** | Solar Panels  (self-contained solar only) | 15 W (small only)  30 W (large)  50 W (large) |
| **Section 3 – Mechanical and Electrical** | Solar Panels (solar cabinet only) | 50 W  80 W  170 W |
| **Section 3 – Mechanical and Electrical** | Batteries  (self-contained solar only) | 1x 7 Ah (small only)  1x 18 Ah (large only)    2x 7 Ah (small only)  2x 18 Ah (large only) |
| **Section 3 – Mechanical and Electrical** | Batteries  (small solar cabinet only) | 1x 18 Ah  1x 35 Ah  1x 55 Ah |
| **Section 3 – Mechanical and Electrical** | Batteries  (large solar cabinet only) | 1x 35 Ah  1x 55 Ah  1x 100 Ah |
| **Section 3 – Mechanical and Electrical** | Option (small/large self-contained solar only) | Optional #2 padlock |
| **Section 3 – Mechanical and Electrical** | Option  (small solar cabinet only) | Optional #2 padlock |
| **Section 3 – Mechanical and Electrical** | Large Solar Cabinet Options | Optional padlockable latch  Optional door switch |
| **Section 4 – Flasher Modules** | Flasher Modules | RRFB  Optional LED Beacon  Optional LED Sign |
| **Section 4 – Flasher Modules** | Flasher Module Colors | Black powder coat  Yellow powder coat  Green powder coat |
| **Section 4 – Flasher Modules** | Flasher Module Options | RRFB backplates  RRFB mast arm mounting kit |
| **Section 5 – Operation and Configuration** | Trigger Options | ADA-compliant Audible Information Device (AID)  ADA-compliant Audible Information Device (AID) w/ touchless activation  Passive sensor |

|  |  |  |
| --- | --- | --- |
| **Section 5 – Operation and Configuration** | Additional Options | Passive microwave detection  Overhead lighting |
| **Section 7 – Remote Connectivity** | Enhanced Subscription Plans | 1 year  6 years    2 years  7 years  3 years  8 years    4 years  9 years  5 years  10 years |

1. **Packaging**

Packaging shall consist of only recyclable corrugated cardboard and soft plastic bags.

1. **Qualifications**

The CCS shall be FCC certified to comply with all 47 CFR FCC Part 15 Subpart B Emission requirements.

The CCS shall be manufactured in the USA and shall be Buy American and Build America, Buy America (BABA) compliant.

The Manufacturer shall provide a 3-year Limited Warranty, with the exception of the battery(s) which shall be covered by a 1-year warranty.

The Manufacturer shall be ISO 9001 certified.

The CCS shall be standard configuration and ship within 10 business days from receipt of order.

The CCS shall be manufactured by Carmanah Technologies.

Manufacturer: Carmanah Technologies Inc.

Model: R920-MX solar Connected Crosswalk System

Toll-Free: 1-877-722-8877

[www.carmanah.com](http://www.carmanah.com)