**Purchase Specification**

**for a Solar Powered**

**Connected School Zone Flasher (CSZF)**

1. **Overview**

**A Connected School Zone Flasher System (CSZF) shall be used to lower vehicle speeds in school zones, during designated times, when reduced speeds are in effect. Each CSZF 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,** **internal scheduler, DC relay, knockdown sensor and battery(s).** **The CSZF shall conform to all provisions of the MUTCD, or MUTCDC, where applicable. The CSZF shall be pre-wired to the maximum extent possible.**

1. **Mechanical and Electrical**

**The CSZF 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 CSZF for reliable year-round operation.

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

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

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

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

**CSZF shall be capable of being wired via a “centralized” or “distributed” approach:**

* **Centralized – all component wiring from Flasher Modules (LED beacons or LED signs) 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 may be terminated to any available Flasher Module.**

**CSZF 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 CSZF 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

Top of pole configurations shall allow direct mounting to top of signal housing when using self-contained Power Modules.

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 CSZF 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**

**CSZF 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 CSZF 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 have the ability to 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 CSZF 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 CSZF 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 CSZF 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 CSZF shall come standard with one or more LED beacons. Optional LED sign(s) shall be available in conjunction with LED beacon(s) or standalone.**

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

**LED beacons shall be available in yellow and 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.**

**Option**

**LED Sign**

**The CSZF 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 a school area sign S5-1 (School Speed Limit When Flashing) in 24 x 48" size with speed values of 15, 20 or 25. The sign sheeting shall be 3M Diamond Grade DG3 retroreflective with 3M anti-graffiti and overlay film sheeting. Sheeting color shall be fluorescent yellow-green (FYG) and white.**

The LED enhanced sign shall consist of a combination of eight white and 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 **CSZF 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 CSZF, once powered up, will immediately begin flashing in a 24-7 mode until an operational schedule is uploaded to the system, either via local connectivity (Section 6) or via remote connectivity (Section 7). If a schedule is not programmed during commissioning an “always off” operating mode shall be available to turn the beacon(s) off until a schedule is uploaded.**

**CSZF shall have low voltage disconnect (LVD) protection to aid in preventing fully discharging the battery(s). When in LVD the beacon(s) shall not flash when scheduled.**

**Configuration**

**The CSZF 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)**

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

**CSZF shall use time acquired by GPS for its internal scheduling purposes. System shall not require manual updating of its date or time settings. If power is lost to the system, it will re-acquire a new GPS fix on start-up.**

**CSZF beacon(s) shall flash using an MUTCD-compliant flash pattern at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall not be less than one-half and not more than two-thirds of the total cycle (for beacon equipped CSZFs).**

**CSZF shall provide configurable daytime and nighttime intensity settings ranging from 10% to 100% of factory defaults.**

**Option**

**CSZF shall be available with optional** external weather-proof box, including harnessing, for manual activation. Box shall include a toggle switch for continuous activation or scheduled activation.

**6.0 Local Connectivity**

**The CSZF shall have integrated Bluetooth Low Energy (BLE) local communications for on-site configuration, scheduling and diagnostics via a purpose-built mobile app by the CSZF 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 CSZF, shall contain “bank-level” security. The mobile app shall “pair” with the CSZF 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 CSZFs within Bluetooth range that can establish a connection.**

Mobile app shall have the functionality to identify the presently connected system by temporarily activating the beacon with a unique quick flash. If the beacon is actively flashing, the beacon 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 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**
* **Operation mode, typically set for scheduling purposes**
* **Schedule**
* **Daytime intensity**
* **Nighttime intensity**
* **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**
* **System voltage**
* **Solar panel voltage**
* **Charge current**
* **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)**

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).**

**Local Scheduling**

**Local scheduling shall allow for management of schedule-based programming.** Schedules shall be based on a seven-day period from Sunday to Saturday. Schedules shall not be date restricted and shall run in perpetuity when assigned to a system.

**Schedules shall be able to be created, edited and deleted at any time without requiring on-site access to the CSZF.**

**Schedule dashboard shall provide:**

* **List of created schedules**

**Local scheduling shall be available regardless of whether the system** has a valid existing remote connectivity plan.

**Schedule Creation**

**Schedules shall be created from scratch or downloaded from a system that has an existing schedule. Once a schedule has been created it shall be able to be renamed or deleted.**

**For each day of the week, a “timetable” consisting of a collection of “events” shall be created to designate periods of time when the beacon(s) are flashing.**

**Timetables shall be assignable to each day of the week.**

**Exceptions**

**Exceptions shall be available to designate two functions:**

* **A period of time when the beacons are not flashing. This lasts for the entirety of the selected day or date range.**
* **An alternate schedule which runs a different timetable that differs from the standard weekly schedule.**

**Exceptions shall be generated by selecting a date or date range and choosing the appropriate timetable.**

**Uploading Schedule**

**Completed schedules shall be available to upload to an individual system. Schedules that are assigned to systems via local scheduling function shall override a remotely programmed schedule, if applicable (see Section 7).**

1. **Remote Connectivity**

**Overview**

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

Connectivity solution **shall** be purpose-built by the CSZF 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 CSZF 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 CSZF 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 premium-level subscription plans shall be available.**

**Features, Operation and Configuration**

**Premium level subscription shall include the following additional features:**

* **Remote scheduling**
* **System performance charting for previous 180 days**
* **5-year historical raw data for system performance that can be downloaded, shared, and analyzed**
* **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
* Upcoming scheduled events

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** include a scrollable, zoomable map display, with the CSZF 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 CSZF 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.

**CSZF shall report in every fifteen minutes with the following information:**

* **Most recent battery voltage**
* **Most recent solar voltage**
* **Most recent charge current**
* **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**
* **Operation mode, typically set for scheduling purposes**
* **Schedule**
* **Daytime intensity**
* **Nighttime intensity**
* **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.

**Remote Scheduling**

**Remote scheduling shall allow for management of schedule-based programming.** Schedules shall be based on a seven-day period from Sunday to Saturday. Schedules shall not be date restricted and shall run in perpetuity when assigned to a system.

A sample schedule shall always be present in the account to use as an example. This sample schedule shall be able to be cloned for use as a template when creating new schedules.

Schedule dashboard shall provide:

* **List of created schedules, how many systems are assigned to each schedule and when they were last modified**
* **Schedule details with each day’s events**
* **List of created exceptions (days when beacons are off) with each start date and end date**
* **List of systems assigned to each schedule**

**Schedule Creation**

**Schedules shall be created from scratch or cloned from an existing schedule. Once a schedule has been created it shall be able to be cloned, renamed or deleted.**

**For each day of the week, “events” shall be created to designate periods of time when the beacon(s) are flashing. Daily events shall be able to be cloned and copied to another day or cleared to start over.**

**Schedules that have no systems assigned shall be modifiable. If a schedule has at least one system assigned, its daily event table shall become read-only, and the schedule cannot be deleted.**

**Exceptions**

**Exceptions shall be available to designate a period of time when the beacons are not flashing. This lasts for the entirety of the selected day or date range.**

**Exceptions shall be generated in two ways:**

* **A two-click exception for the same day. A name for it will automatically be generated**
* **A manual entry to select name and date range**

**Exceptions, once created, will automatically be applied to each system that is assigned to the schedule.**

**Exceptions shall be able to be “shared” with all existing schedules created, eliminating the need to manually create exceptions for each individual schedule.**

**Alternate Schedules**

**Alternate schedules shall be available to use in conjunction with the standard weekly schedule. An alternate schedule is date-based and is chosen for a single date or range of dates. Alternate schedules contain a single day of programmed events that differ from the standard weekly schedule.**

**When an alternate schedule is assigned to a schedule it will supersede the weekly schedule on the dates selected.**

**Alternate schedules shall be generated via manual entry in order to select schedule name and date range/dates required.**

**Assigning Systems**

**Unassigned systems shall be able to be assigned to any available schedule. Systems with a premium-level subscription shall be able to be added to an available schedule.**

**Systems shall be individually, or bulk selected, for assigning to a schedule.**

**Schedules that are assigned to systems via the remote scheduling function shall override a locally programmed schedule, if applicable (see Section 6).**

**Once assigned to a schedule, systems shall be individually or bulk selected to move to a different available schedule. Assigned systems may be individually removed from a schedule.**

**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 CSZF shall continue normal operation without interruption or change in performance. Local connectivity shall remain available for on-site configuration and diagnostics.**

**User Management**

**The initial account administrator shall be automatically assigned by the CSZF 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, schedule 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 beacon 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 beacon, 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 four hours per day/five days per week, including:

* Controller quiescent draw (daytime and between flashes)
* Wireless quiescent draw calculated over 24 hours
* Operating load of beacon at rated intensity per activation. The number of beacons 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 100% of flashing occurs during daytime

**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 CSZF 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)

CSZF 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 CSZF 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 | 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** | LED Sign Option | Optional U-bolts |
| **Section 5 – Operation and Configuration** | Option | Optional Manual Switch Box |
| **Section 7 – Remote Connectivity** | Premium 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 CSZF shall be FCC certified to comply with all 47 CFR FCC Part 15 Subpart B Emission requirements.

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

The CSZF shall be manufactured by Carmanah Technologies.

Manufacturer: Carmanah Technologies Inc.

Model: R829-MX solar Connected School Zone Flasher

Toll-Free: 1-877-722-8877

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