**Purchase Specification**

**for an AC-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 an AC cabinet-based Power Module. Cabinet-based Power Modules house the AC/DC power supply, flash controller, Bluetooth communications, GPS/cellular communications, internal scheduler, DC relay, knockdown sensor and fuse/circuit breaker. 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 does not necessitate a change in system configuration.**

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.**

**Cabinet Power Modules shall be rated to a minimum of NEMA 3R.**

Fasteners shall be stainless steel.

**Mounting**

CSZF Power Module shall be side of pole mounted and accommodate the following mounting configurations:

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

Side of pole mounting shall be facilitated using one of the following methods:

* Industry standard banding
* Flat surface through-bolting
* Optional U-bolts for 4.0**"** – 4.5**"** round poles

Standard mounting options shall not require specialized tools for installation.

**AC/DC Power Supply**

**CSZF shall include a universal AC/DC power supply that accepts conventional AC power input and outputs 15 VDC. It shall be rated for 150 W; featuring short circuit, overload and overvoltage protection. AC wiring input shall terminate on DIN-rail mounted terminal blocks.**

**Power supply shall have a status LED indicating power is on.**

**Power supply shall be field replaceable.**

1. **Power Modules**

**CSZF Power Modules shall** be available **in one of two size and configuration options:**

* **Small AC cabinet Power Module**
* **Large AC cabinet Power Module**

**Small AC Cabinet Power Module**

The small AC cabinet Power Module shall be constructed from 11-gauge aluminum. The AC/DC power supply shall be mounted inside the cabinet with no external control 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 include a DIN rail fuse holder with a 4 A fuse.

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 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.

**Large AC Cabinet Power Module**

The large AC cabinet Power Module shall be constructed from 10-gauge aluminum. The AC/DC power supply shall be mounted inside the cabinet with no external control cabinet shall be 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 an integrated industry standard #2 lock and tamper-proof hinged door. Optional padlockable latch for use with lock shackles up to ¼".

Cabinet shall include a DIN rail breaker rated at 4 A.

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 electrical connections.

The overall cabinet weight 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 system which can be viewed locally on-site (see Section 6) and remotely (see Section 7).

**Optional surge protection device (SPD) available for equipment protection from short duration transient overvoltage events on the AC input. SPD shall be able to sustain a continuous voltage of 150 VAC and carry a response time of < 25 ns. SPD shall be mountable on a DIN rail. SPD shall have a visual life indicator for quick determination of module replacement status.**

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 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 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 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.**

**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**
* **Fault detected**

**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.**

**The 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 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**
* **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 system voltage**
* **Cellular communication error**
* **Status wire communication error**
* **Flasher Module removed from system**
* **System knockdown**
* **Integrated relay overcurrent/short circuit detected**
* **Accelerometer communication error**
* **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 system voltage**
* **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.**

**8.0 Solar Simulations (If Applicable)**

Not applicable for AC powered system.

1. **Custom Build**

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

|  |  |  |
| --- | --- | --- |
| **Section 2 – Mechanical and Electrical** | Power Module Mounting | Banding (not provided)  Through-bolt (not provided)  Optional U-bolt |
| **Section 3 – Mechanical and Electrical** | Power Modules | Small AC cabinet    Large AC 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** | Small AC Cabinet Option | Optional #2 padlock |
| **Section 3 – Mechanical and Electrical** | Large AC Cabinet Option | Optional padlockable latch  Optional door switch  Optional surge protection device (SPD)  Optional AC relay |
| **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.

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 AC Connected School Zone Flasher

Toll-Free: 1-877-722-8877

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