**Purchase Specification**

**for an AC-Powered**

**Connected Wrong-Way Driver Flasher (WWDF)**

1. **Overview**

**A Connected Wrong-Way Driver Flasher System (WWDF) shall be used to deter drivers of potential wrong-way entry on exit ramps and other areas. Each WWDF 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, DC relay, knockdown sensor and fuse/circuit breaker. The WWDF shall conform to all provisions of the MUTCD, or MUTCDC, where applicable. The WWDF shall be pre-wired to the maximum extent possible.**

1. **Mechanical and Electrical**

**The WWDF shall be modular without a centralized controller. Adding other Flasher Modules or accessories does not necessitate a change in system configuration.**

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

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

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

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

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

* **Centralized – all component wiring from Flasher Modules (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 Flasher Module available.**

**WWDF 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**

WWDF 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**

**WWDF 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**

**WWDF 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 WWDF shall come standard with one or more LED signs.**

**LED Sign**

**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:**

* **R5-1a (Wrong Way, in 42**" **x 30**"**)**

**The sign sheeting shall be 3M High Diamond Grade DG3 retroreflective with 3M anti-graffiti and overlay film or High Intensity Prismatic sheeting. Sheeting color and color combinations will vary by applications but will include yellow and red options.**

The LED sign shall consist of eight red 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 **WWDF manufacturer** for optimal intensity.

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

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

LED signs 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 WWDF, once powered up, will immediately begin flashing in a 24-7 mode. WWDF shall be operational upon power-up without any on-site configuration required. Operating mode shall be adjustable for triggered operation** **when using optional vehicle detection radar. Upon detection of a vehicle** a real-time alert 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 (see Section 7.0).

**Configuration**

**The WWDF 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**

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

**The WWDF LED sign(s) shall flash using an MUTCD-compliant flash pattern at a rate of not less than 50 nor more than 60 times per minute.**

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

**Radio System**

**The WWDF shall be equipped as standard with a 2.4 GHz radio with externally mounted antenna.**

**WWDF shall synchronize with other WWDFs linked with the same network parameters by wireless communication within 1000' (304 m).**

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

**WWDF shall have “unlimited” unique network parameter combinations to create a link between more than one system.**

**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 WWDF systems and shall have the ability to be installed without system disassembly or entering the Power Module.**

**Options**

**WWDF shall be available with optional external radar for vehicle detection. The LED sign(s) shall begin flashing, for a programmed duration, whenever a vehicle is detected.** **Upon detection of a vehicle, the Power Module shall broadcast an activation to all other nearby WWDFs sharing the same network parameters.**

**Vehicle Detector Radar**

Detector shall be Doppler radar. Detector shall meet specifications for an FCC part 15 Low Power Device - 24.150 GHz (K-band) and shall not require an operating license.

Detector shall have a reporting accuracy of ±1 mph and shall be set to detect approaching vehicles only.

Detector shall be capable of detecting vehicles from 1 mph to 206 mph.

Detector shall have a detection range of up to 2000 ft., output power of 20 dBm, and a beam angle of 9 x 18 degrees.

Detector shall operate on voltages from 5 VDC to 24 VDC and shall consume less than 0.33 A at 12 VDC, typically <0.10 A.

Detector shall a be self-contained unit, housed in impact-resistant, outdoor-rated plastic, with a single multi-conductor cable connecting it to the Power Module.

* Detector dimensions: 4.1" x 3.7" x 1.1"
* Weight: 0.6 lb (0.27 kg).

Detector shall be furnished with a mounting bracket that will enable aiming of the radar beam in the direction of approaching vehicles independent of the Power Module or mounting pole orientation. Detector can be adjusted left-to-right and up-and-down to suit the roadway.

The system shall be configurable such that the detector can be mounted remotely from the system controller and Power Module via a wired connection.

Detector shall be IP68 with an operating temperature range of -40° to 185°F (-40° to 85°C).

Detector shall be field-configurable with the following attributes:

* Speed units (mph, kph, fps, mps)
* Minimum detectable speed
* Maximum detectable speed
* Detection sensitivity
* Detection direction
* Range boost
* Slow speed target filtering

A suitable interface cable shall be provided for the purpose of on-site configuration and connection between the system controller and a local computer.

Radar shall have the ability to be programmed by a standard laptop or PC with a Windows 7/10/11 operating system and shall support 32- and 64-bit operation.

**6.0 Local Connectivity**

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

Mobile app shall have the functionality to identify the presently connected system by temporarily activating the **LED sign** with a unique quick flash. If the **LED sign** is actively flashing, the **LED sign** 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**
* **Daytime intensity**
* **Nighttime intensity**
* **Network linking**
* **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)**
* **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 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).**

1. **Remote Connectivity**

**Overview**

The WWDF 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 WWDF 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 WWDF 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 WWDF 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 separate a list of uniquely linked systems and others that are not linked.

Dashboard shall include a scrollable, zoomable map display, with the WWDF 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 WWDF 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.

**WWDF shall report in once per day 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**
* **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.

**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 WWDF 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 WWDF 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.**

**8.0 Solar Simulations (If Applicable)**

Not applicable for AC powered system.

1. **Custom Build**

**Fill out the table below to create a WWDF 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** | LED Sign Option | Optional U-bolts |
| **Section 5 – Operation and Configuration** | Options | Optional External Radar |
| **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 WWDF shall be FCC certified to comply with all 47 CFR FCC Part 15 Subpart B Emission requirements.

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

The WWDF shall be manufactured by Carmanah Technologies.

Manufacturer: Carmanah Technologies Inc.

Model: WWD-MX AC Connected Wrong-Way Driver Flasher

Toll-Free: 1-877-722-8877

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