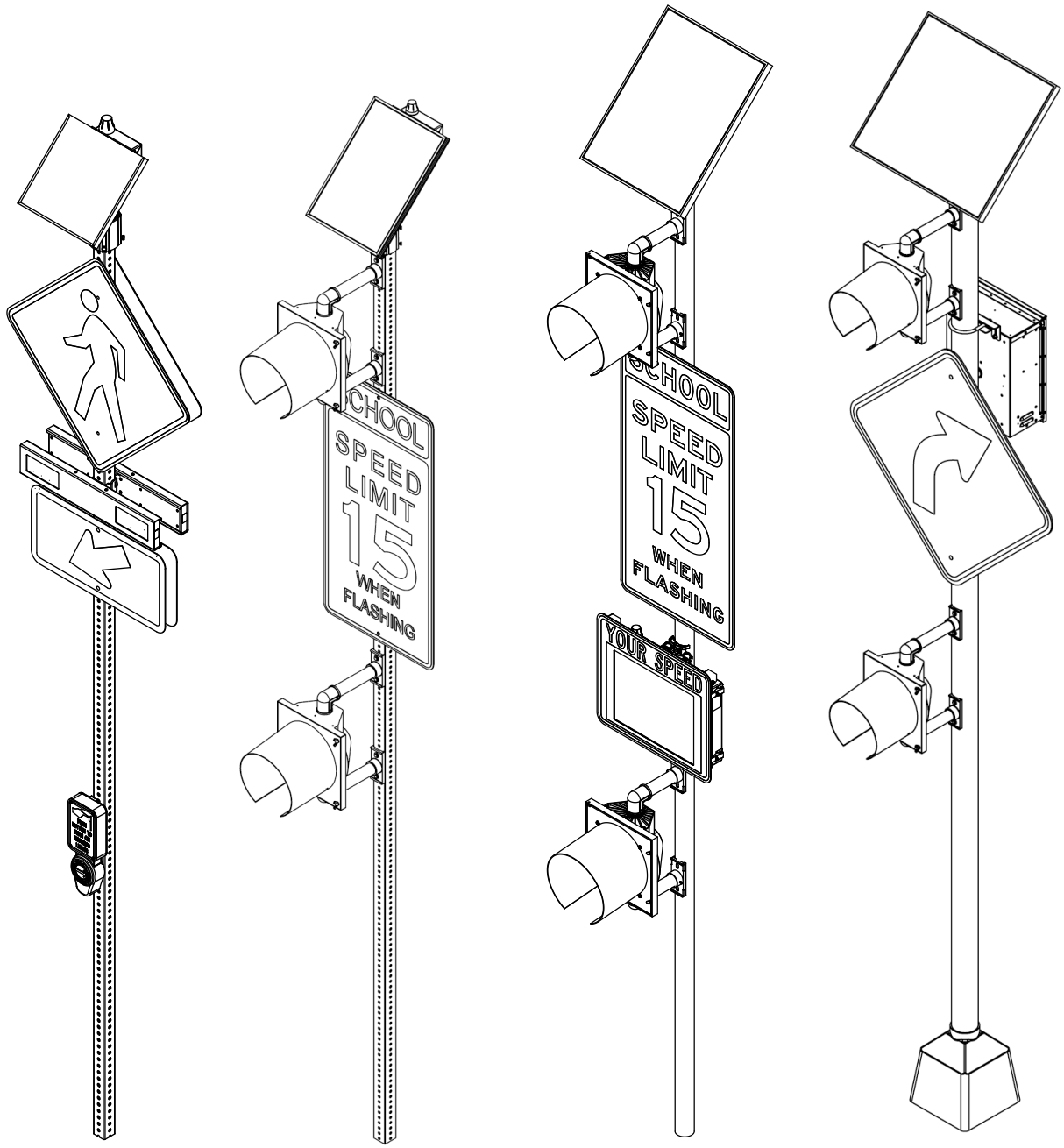
carmanah®
MX Series

MX Series
SYSTEM PLANNER
LEVEL 1



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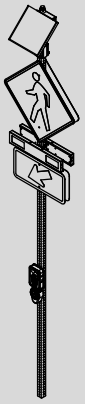
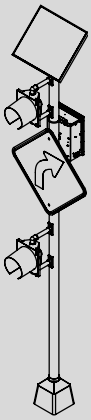
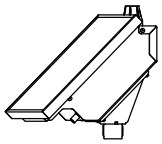
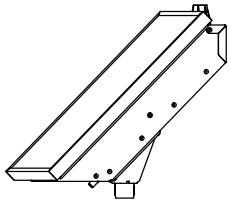
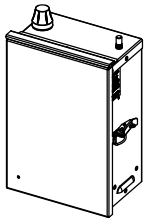
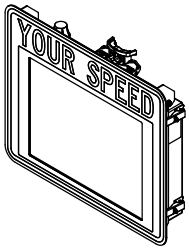
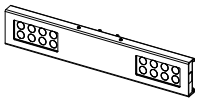
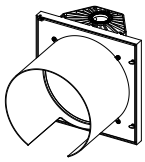
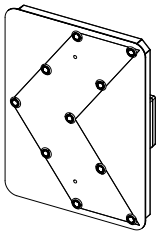
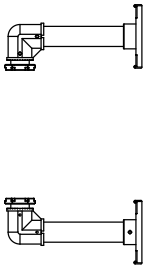
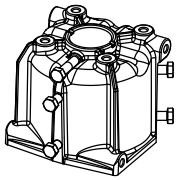
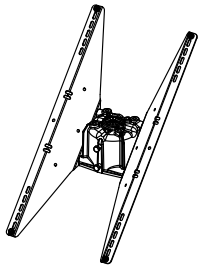
MX Series Product Level Document Overview

LEVEL 1 System Planner	R920-MX 	R829-MX 	R247-MX 	SPEEDCHECK-MX 
LEVEL 2 Power or SpeedCheck Modules	MX 100 	MX 200 	MX 300/400 	MX SpeedCheck 
LEVEL 3 Flasher Modules	MX RRFB Module 	MX Beacon Module 	MX LED Sign Module 	MX Chevron Sign Module 
LEVEL 4 Kits* *Not all kits shown	Push Button Kit 	Beacon Mount Kit 	Large Top of Pole Mount Kit 	Solar Panel Top of Pole Mount Kit 

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1.0 Warnings and Precautions

The following symbols indicate important safety warnings and precautions throughout this manual:

WARNING indicates that serious bodily harm or death may result from failure to adhere to the precautions.

CAUTION indicates that damage to equipment may result if the instructions are not followed.

NOTE suggests optimal conditions and provides additional information.

1.1 Warranty Disclaimer

This manual will familiarize you with the features, operation standards, and installation of Carmanah's MX Series systems. Failure to comply with the use, storage, maintenance, installation, or placement instructions detailed in this System Planner could void the warranty.

1.2 Standards

Perform all installation, wiring, grounding, and maintenance in conformance with local building and electrical codes. Adherence to the National Electrical Code (NEC) is mandatory to comply with any certification markings. Non-adherence to code may void the warranty.

1.3 Safety and Usage Precautions

Batteries are shipped fully charged. Use extreme caution when handling the batteries as they can generate hazardous short-circuit currents. Remove all jewelry (bracelets, metal-strap watches, etc.) before handling the batteries.

Solar panels produce DC electricity when exposed to light and can therefore produce an electrical shock or burn. To render solar panels inoperative, remove them from sunlight or fully cover their front surface with an opaque material.

Before lifting any heavy or bulky equipment, ensure the load is secured so moving parts do not shift, and that it can be lifted as far as needed without back strain or loss of grip. Installation may require more than one person.

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

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

Product can have sharp edges. Accidental movement of hinged components can cause injury.

Certain combinations of settings can result in the system not meeting brightness or intensity specifications (such as ITE or SAE J595). Contact Carmanah for guidance if unfamiliar with system limitations. Modifying settings can significantly affect the solar energy balance of the system which could result in reduced battery life and performance. Contact Carmanah for more information about sustainable settings in your location.

Solar panels can generate substantial bending forces on poles.
Ensure pole strength is sufficient for required wind loading with installed system.

Carmanah MX Series traffic products use a constant-current LED output circuit. Only Carmanah MX Series flasher modules are compatible with this system. Please contact Carmanah for additional information and guidance when adding or replacing beacons or other hardware.

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

Please examine all parts before beginning assembly and installation. If anything is missing or damaged, contact Carmanah or your Authorized Distributor immediately.

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2.0 Introduction

2.1 About the MX Series

The MX Series is a modular, highly configurable, traffic safety signalling product family with remote connectivity. It consists of modules that can be arranged to suit many traffic warning applications such as:

- Pedestrian Crosswalks
- School Zone Beacons
- 24-Hour Beacons
- Radar-Triggered Warning Signs
- Chevron Warning Signs
- Wrong-way Warning Signs
- Radar Feedback Signs

A typical MX system is defined as a power module wired to at least one flasher module or trigger kit. The elements of one system are typically mounted on a single pole.

The minimum components to create a functioning MX system are:

- A power module (MX 100 or MX 200 solar, MX 300 or MX 400 solar or AC, MX SpeedCheck solar or AC)
- A flasher module (MX RRFB, MX Beacon, MX LED Sign Module) or trigger kit (push button, e.g.)
- MX cable
- Mounting hardware

At the core of each MX system is a power module and one or more flasher modules. The MX SpeedCheck Module combines the functions of a power module, flasher module and trigger and can operate as a standalone system. Solar MX Modules provide optimal battery charge management. Flasher module types can be mixed and matched in a system, and any number of systems within radio range (>1000 ft with clear line of sight) can be linked to suit the application. Trigger kits (including push buttons and pedestrian sensors) can be added to activate flasher modules for a pre-set duration.

Flasher modules leave the factory with default settings that meet requirements for most applications. When settings adjustments are necessary, on-site changes can be made using the MX Field App for iOS, iPadOS and Android.

The factory-set flasher module parameters include:

- Flash pattern
- Operation mode
- Night dimming
- Radio operation
- Intensity
- Network settings

For more detail on designing a system, consult carmanah.com/build or contact Carmanah.

Refer to https://carmanah.com/mx-series/ to learn more about the MX Series.

To make changes to the default settings locally, the MX Field App must be used.
Download: carmanah.com/app

FOR REMOTE ACCESS: Log into MX Cloud: MXcloud.live

2.2 Install Guides Overview

Following a specific order for installation of MX Modules is not mandatory. The documents for this product series are organized in a hierarchy, beginning with this guide, and progressing downward:

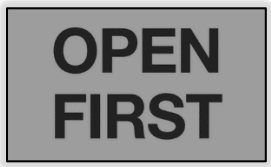
LEVEL 1 – MX Series System Planner (this document)
LEVEL 2 – Power/SpeedCheck module installation guides
LEVEL 3 – Flasher module installation guides
LEVEL 4 – Other kit and accessory installation guides

These instructions assume that construction of the required infrastructure (AC power, poles, sidewalk treatments, etc.) has been completed in advance.

User guides are also available for the MX Field App and MX Cloud platform.

Install each module or kit according to its included instructions.

Look for an "**Open First**" label on the power module packaging to get started with the installation.



2.3 Power Module Dimensions

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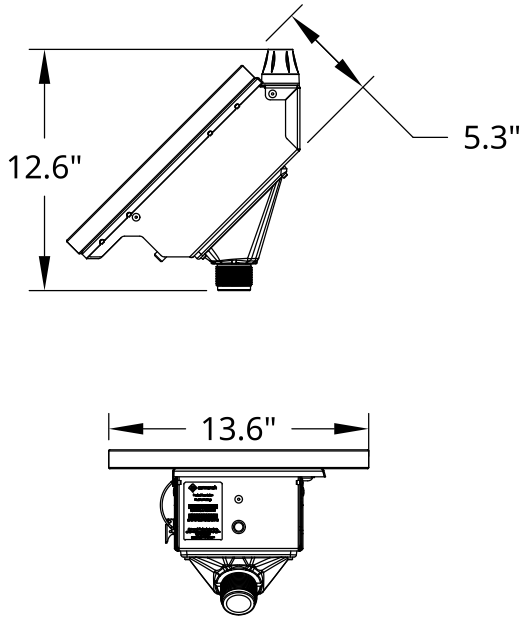

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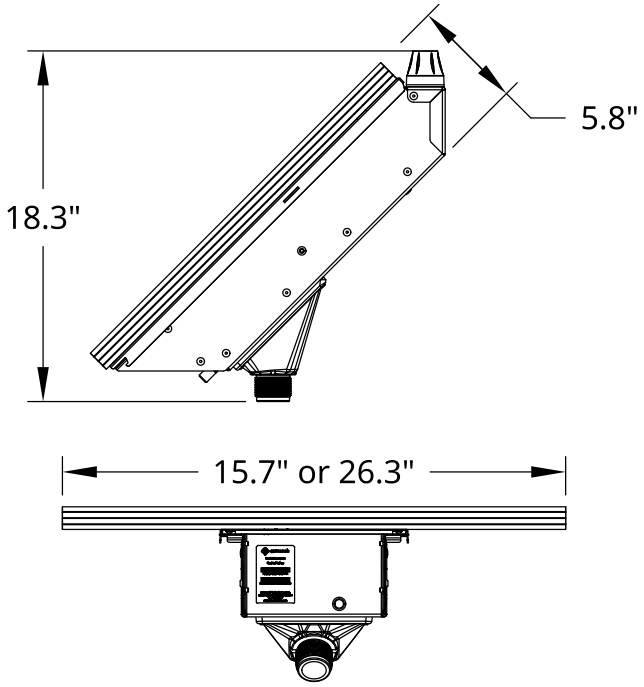
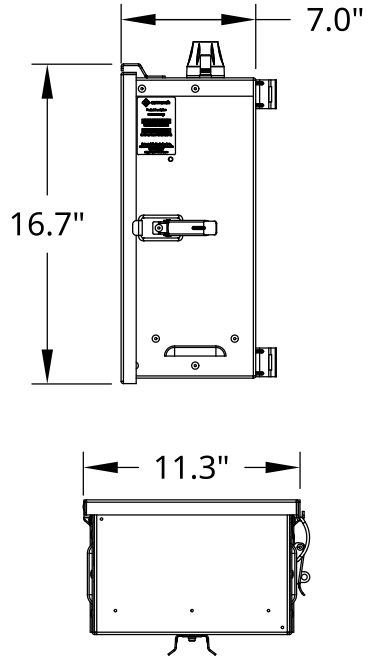


MX 300



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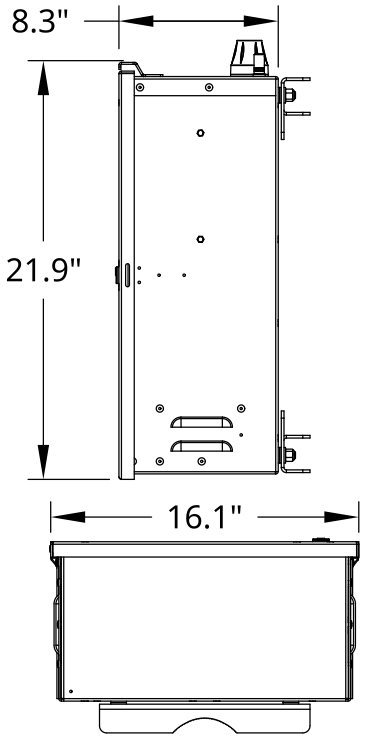
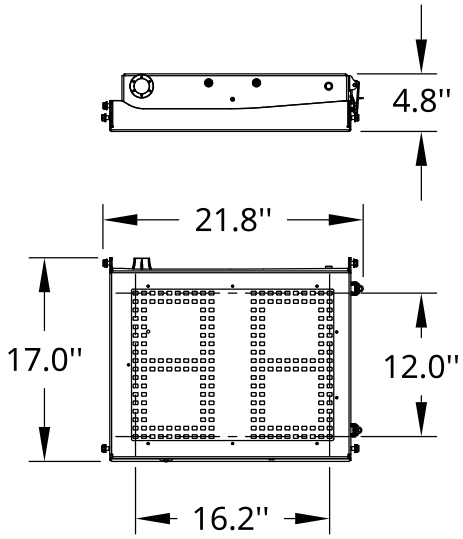
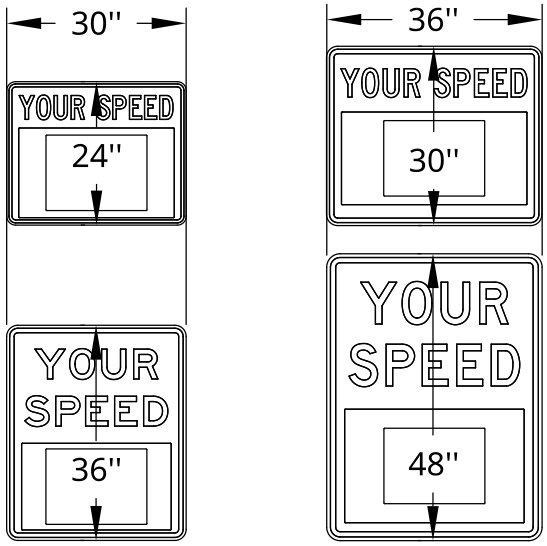


2.4 MX SpeedCheck Module Dimensions

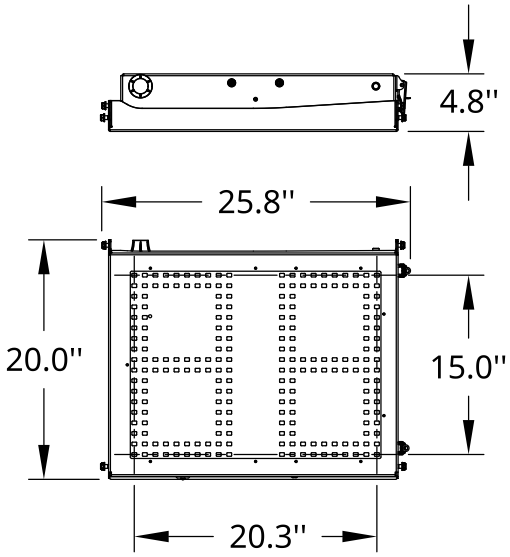
MX SpeedCheck Module 12"



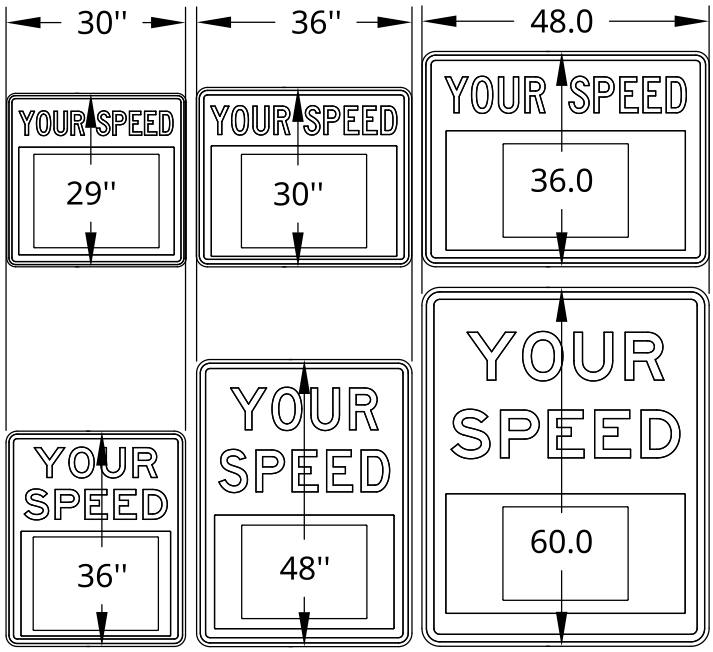
MX SpeedCheck Module 12" Signs



MX SpeedCheck Module 15"



MX SpeedCheck Module 15" Signs



NOTE Not all available signs shown.

2.5 General Recommendations

Read all levels of included documentation before installing	**Connect each trigger to any module**	**Install the batteries fully charged**
Point the solar panel south[1]	**Maintain line of sight between radio antennas for maximum range[2]**	**Follow MUTCD guidelines for flasher mounting height and direction**
Direct flashers and signs toward oncoming traffic	**Hide wiring to reduce vandalism**	**Download the MX Field App & pair to the system**
Link systems to synchronize behavior[3]	**Adjust settings with the MX Field App or MX Cloud**	**Add a padlock for increased security**

[1]Solar requirements (for solar option)

Ensure the installation location has an unobstructed view of the sun's path. Obstructions such as trees or buildings could significantly reduce the amount of sunlight on the solar panel.

The solar panel typically needs to face south in the Northern Hemisphere to receive maximum sunlight, but may be rotated slightly if doing so increases solar collection due to local conditions.

We recommend contacting Carmanah for a complimentary Solar Power Report (SPR). An SPR is an easy-to-read report that describes how the MX system will perform based on local solar and weather conditions, site-specific shading hazards and your requirements for the product's operating settings.

[2]Radio communication

All MX Modules include 2.4 GHz Bluetooth radios that provide seamless communication between systems.

To increase reliability of radio communications, modules should be located and oriented so there is direct line of sight between systems and so structures or sources of interference (large signs, overpasses, powerlines, etc.) are as far away from the communication path as practical.

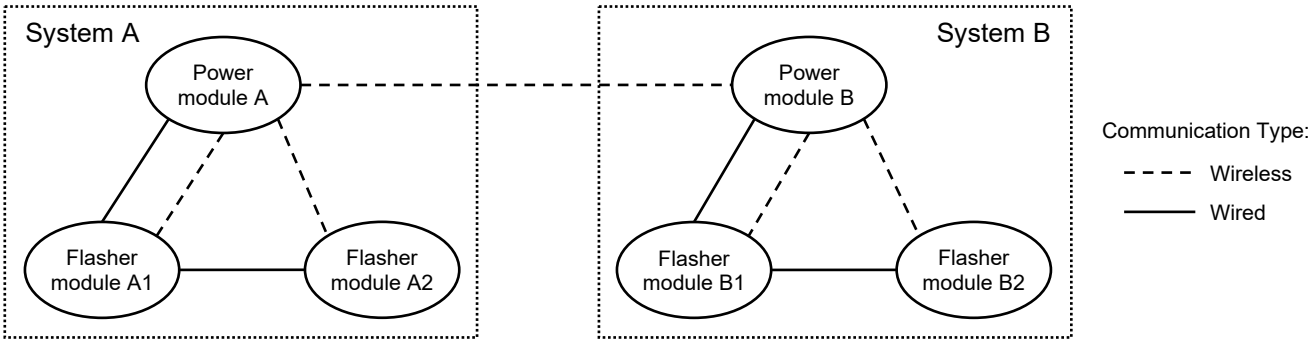
[3]Linking Systems

For MX systems to trigger one another (such as two crosswalk systems installed on either side of a street) they must share network parameters through a process called linking. Linking two or more systems allows any trigger activation to activate the flasher modules of all linked systems, and synchronizes their flashing. Because of their different applications, different flasher module types have different linking behaviours:

- Systems with one or more MX RRFB Modules will automatically link with other RRFB systems within range. When needed, network settings can be adjusted in the MX Field App to isolate systems that should operate independently.
- Systems with MX beacons and MX LED Sign Modules (that don't contain any MX RRFB Modules) won't automatically link with other systems, but can be linked when desired using the MX Field App.

2.6 Local Connectivity

MX Modules communicate with other nearby modules both wirelessly and through the cables that connect them. In the diagram below, System A represents MX Modules on one pole, and System B represents a linked system of MX Modules on another pole:



Wired local communication between MX Modules within a system occurs through the four-conductor inter-module cables. Trigger activation signals are conveyed via the wired interface along with various other system-level messages. Inter-module cables also provide flasher modules with power.

Wireless local communication takes place in MX Modules in several different forms:

- MX Modules **within a system** communicate with one another to convey system settings and module status information. Flasher modules don't communicate wirelessly with other flasher modules.
- MX power modules **from different systems** communicate activation and flash synchronization signals.
- Using the **MX Field App**, an authorized user's mobile device communicates with an MX power module. During firmware upgrades, flasher modules can also communicate with the mobile device.

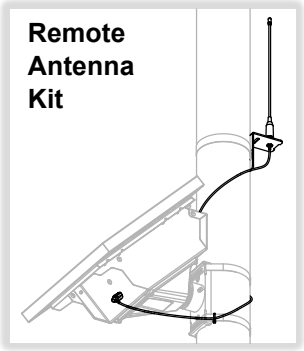
The local communications radio within all MX Modules uses 2.4 GHz DSSS (Direct Sequence Spread Spectrum) with an AES128 encrypted signal. Reliable wireless communication range typically exceeds 1,000 feet (305 meters) between power modules and 75 feet between power and flasher modules but is dependent on local environmental conditions.

NOTE Wireless range between systems can be reduced when power modules' Bluetooth antennas don't have clear line of sight. Though it depends on other environmental conditions, wireless range typically exceeds 500 feet even when Bluetooth antennas don't have clear line of sight.

NOTE Wireless range can also be reduced by the following:

- Interference from other wireless devices
- Objects between modules that block wireless signals
- Nearby objects that reflect wireless signals
- Heavy rain or snow

In rare cases, unforeseen site conditions can result in poor radio communications between linked systems. A simple-to-install remote antenna kit is available to improve local system-to-system radio communications when required. The remote antenna kit includes a remote Bluetooth antenna, a mounting bracket and an extension cable so that the antenna can be ideally positioned.

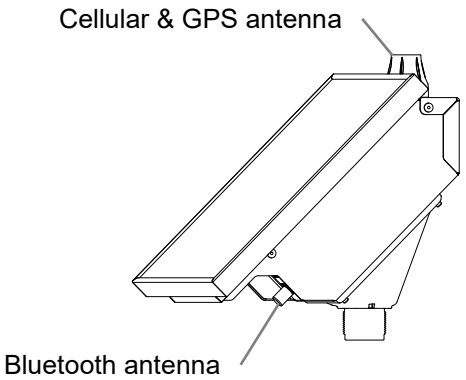


2.7 Remote Connectivity

MX power modules include a cellular modem for remote connectivity to the MX Cloud software, where users can:

- Remotely monitor their systems
- Edit system default settings
- Manage user access
- Download data

MX power modules also contain a GPS module that provides precise device location. The location of the power module antennas are shown below.



A three-year subscription to MX Lite is included with every system. Enhanced features are available through MX Plus and MX Pro paid subscriptions. Learn more about Carmanah's MX Cloud at carmanah.com.

NOTE System owners may need to apply MX Plus and MX Pro subscriptions to desired systems in MX Cloud. See MX Cloud Guide for details.

FOR REMOTE ACCESS: Log into MX Cloud software – MXcloud.live.

2.8 Typical System Configurations

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 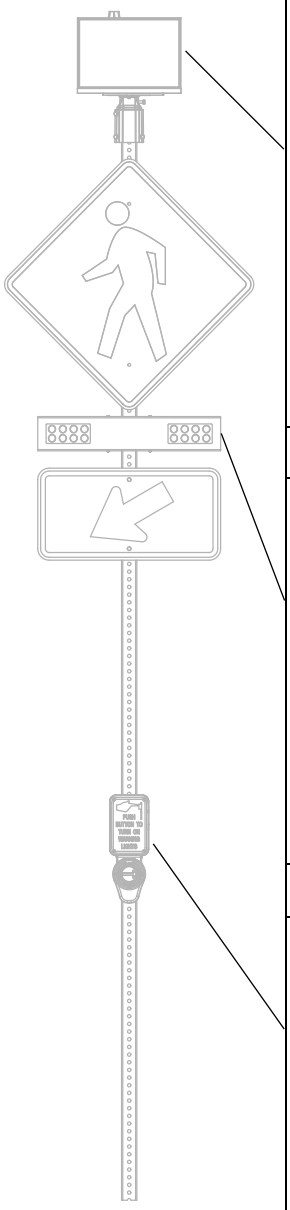 </td><td colspan="4">POWER MODULES</td></tr>
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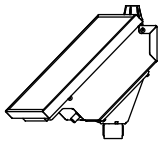
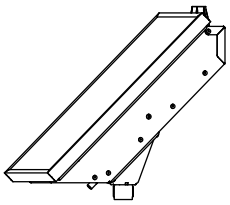
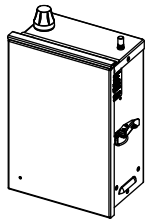
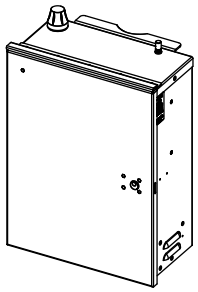
  </td><td>MX 200
  </td><td>MX 300
  </td><td>MX 400
  </td></tr>
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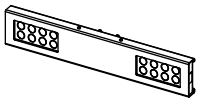
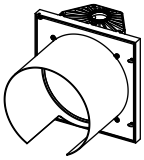
  </td><td>MX BEACON MODULE
  </td><td>MX LED SIGN MODULE
 
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 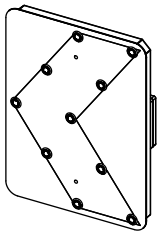 </td></tr>
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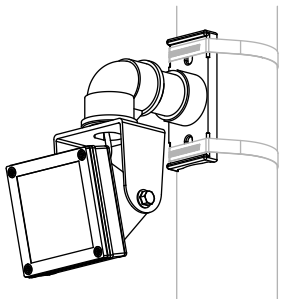
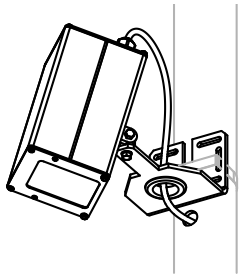
  </td><td>PEDESTRIAN SENSOR
  </td></tr>
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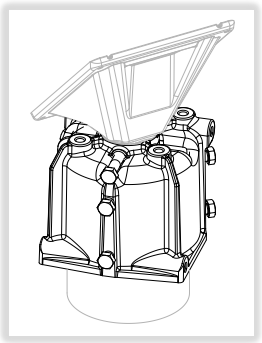
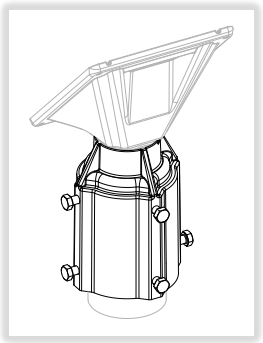
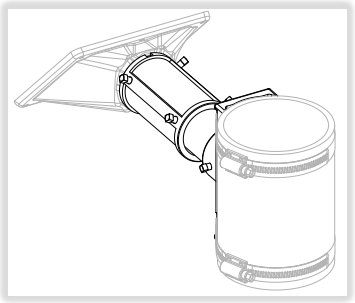
2.9 Mounting Options



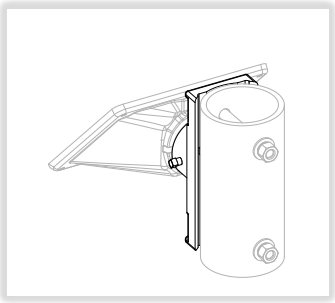
Large Top of Pole



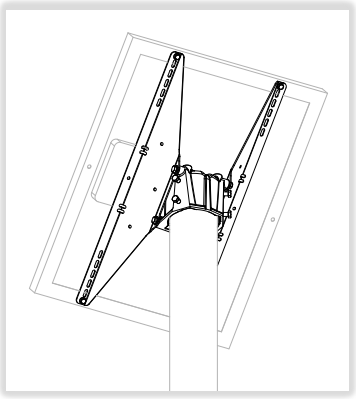
Small Top of Pole



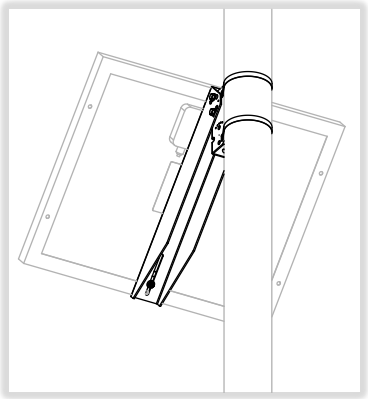
Large Side of Pole



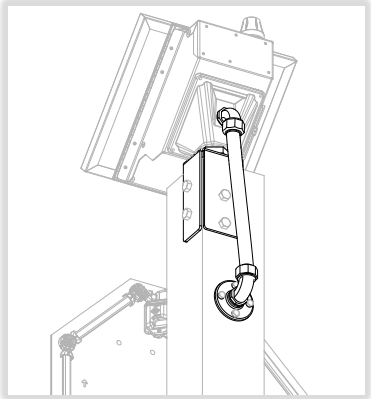
Small Side of Pole



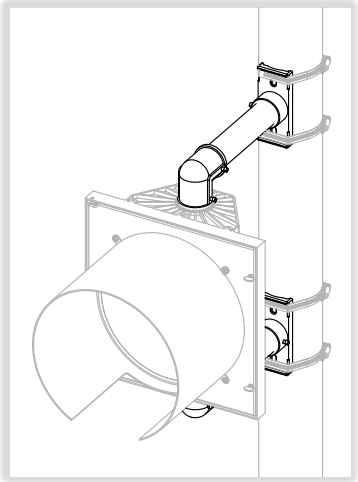
Solar Panel Top of Pole



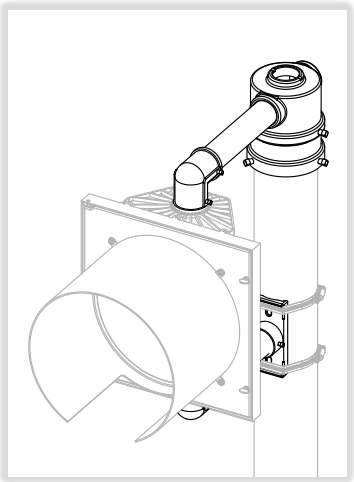
Solar Panel Side of Pole



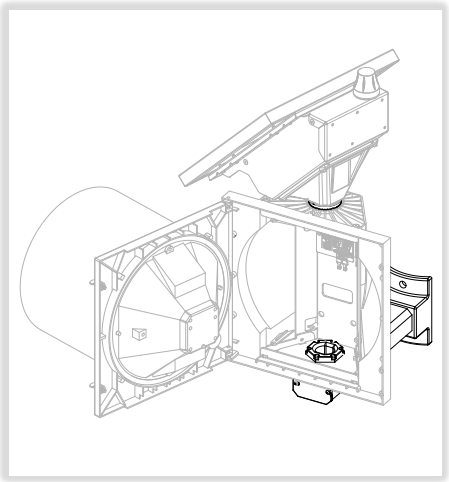
Wood Post Top of Pole



Beacon Side of Pole



Beacon Top of Pole



Integrated Beacon Side of Pole

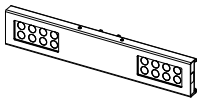
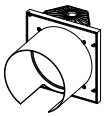
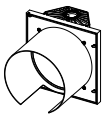
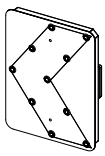
NOTE Not all mounting combinations shown.

3.0 Product Settings and Applications

3.1 Default Flasher Module Settings

In Auto mode, systems operate with default settings that are suitable for most applications. When changes to these default settings are required, the MX Field App can be used to put the system into Manual mode and modify the required settings. Manual mode settings changes always apply to all flasher modules in the system. Note that not all settings can be adjusted when different flasher module types are used in one system.

Table 1: Auto Mode (Default) Flasher Module Operation

Flasher Module	Daytime Intensity and ALC[1] setting	Night Intensity	Flash Pattern	Operation Mode[2]	Duration
MX RRFB Module 	SAE J595 or brighter (MUTCD) Fixed intensity, ALC not available	30% of factory default intensity	WW+S	Trigger/Standby	20 seconds
Yellow MX Beacon Module 	ITE (MUTCD) ALC can reduce intensity	30% of factory default intensity	0.5s ON, 0.5s OFF	Always On	
Red MX Beacon Module 	ITE (MUTCD) ALC can reduce intensity	100% of factory default intensity	0.5s ON, 0.5s OFF	Always On	
MX LED Sign Module 	Maximum Intensity ALC can reduce intensity	10% of factory default intensity	0.25s ON, 0.75s OFF	Always On	
MX Chevron Sign Module 	Maximum Intensity ALC can reduce intensity	10% of factory default intensity	0.25s ON, 0.75s OFF	Always On	

[1]Automatic Light Control (ALC), when enabled, allows solar-powered systems to reduce their beacon brightness in response to low battery states of charge, allowing the battery to recover. When the solar power system is properly sized for its location, ALC will typically only intervene after a prolonged period of unusually poor weather, or in cases of solar panel shading, improper connection of a battery, interconnect corrosion or other component failure. If by reducing the beacon intensity ALC cannot recover the battery, the system will eventually reach Low Voltage Disconnect (LVD) at which point the beacons are kept off to limit permanent battery damage. ALC is enabled by default with all flasher modules except RRFBs, which aren't permitted to dim during the day per MUTCD requirements. If local standards or other requirements don't permit beacon dimming, Manual mode can be used to set a fixed intensity for daytime and nighttime brightness. See MX Field App guide.

[2]The Trigger/Standby operation mode allows a connected push button or other peripheral device to activate the system. For RRFB modules, the operation mode is restricted to Trigger/Standby only and cannot be changed. For other flasher modules the default is to flash continuously and can be changed to suit your application needs.

3.2 Application 1 – R920-MX Crosswalk Systems

Once the systems are installed and energized, they will automatically:

- Connect to the MX Cloud software through the cellular modem.
- Link to other R920-MX systems within wireless range by establishing a local wireless network.
- Flash linked flasher modules at default settings (see Table 1) when activated by a connected trigger.

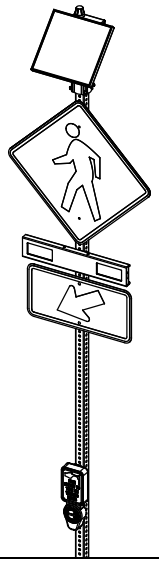
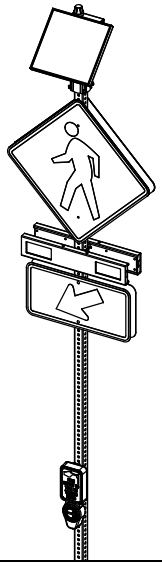
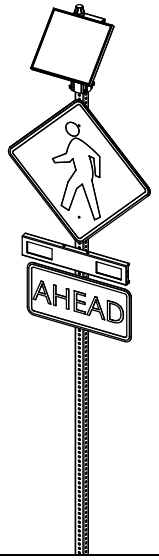
Once a triggered activation has been made, such as from a push button or passive sensor, the flasher modules(s) will commence flashing at the pre-set duration. Each subsequent activation will automatically restart the flash duration.

NOTE If systems establish a link that causes undesired activations, use the MX Field App to isolate the desired crosswalk(s) by creating a new link.

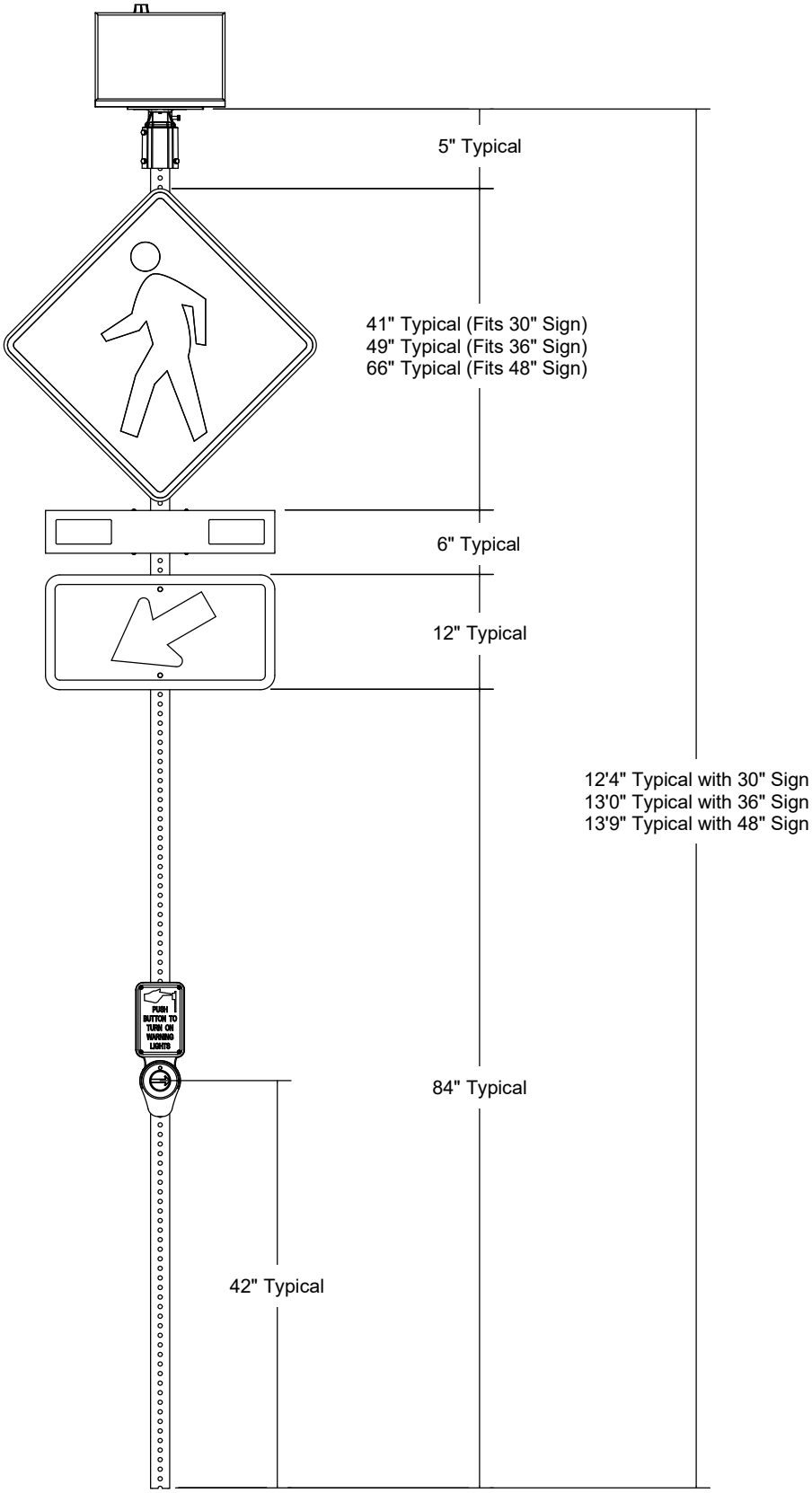
NOTE Beacon or LED sign equipped systems will require creating a new link to establish synchronized flashing for these systems.

See the MX Field App Guide for more information and other adjustable settings.

Typical R920-MX Configurations

		
R920-MX with Single Light Bar and Push Button (uni-directional)	R920-MX with Dual Light Bar and Push Button (bi-directional)	R920-MX Advance Warning with single Light Bar and no Push Button (uni-directional)

Typical R920-MX (shown with MX 100)



3.3 Application 2 – R829-MX School Zone Systems

Once the system is installed and energized, it will automatically:

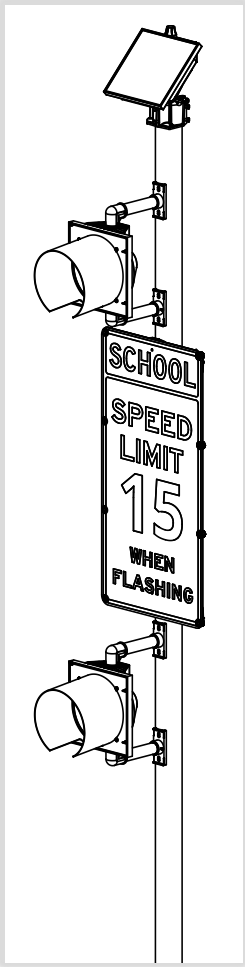
- Connect to the MX Cloud software through the cellular modem.
- Flash wired beacon modules continuously at default settings (see Table 1).

To set up a system for a school zone application, in the MX Field App:

1. Change operation mode to Schedule.
2. Select or create a new schedule.
3. Upload schedule to system.

NOTE Schedules are not shared between linked systems. Each system's schedule must be set independently.

See the MX Field App Guide for more information and other adjustable settings.

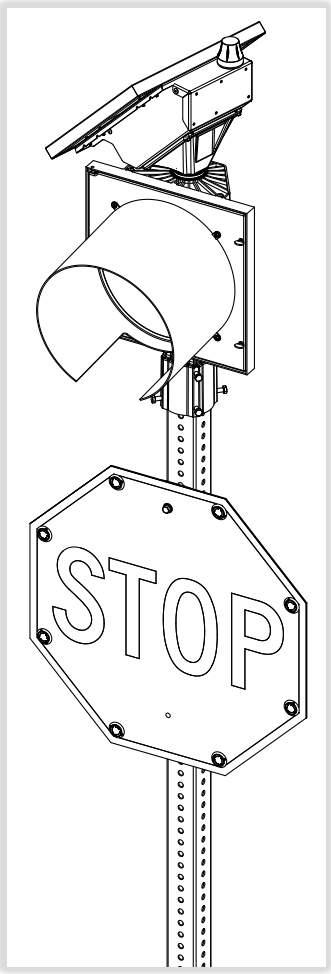


3.4 Application 3 – R247-MX 24-Hour Beacon Systems

Once the system is installed and energized, it will automatically:

- Connect to the MX Cloud software through the cellular modem.
- Flash wired beacon modules continuously at default settings (see Table 1).

See the MX Field App Guide for more information and other adjustable settings.



3.5 Application 4 – R247-MX Radar-Triggered Warning Signs

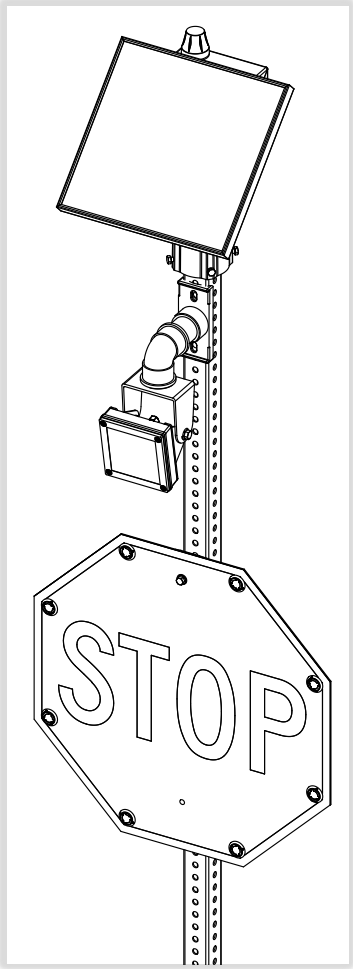
Once the system is installed and energized, it will automatically:

- Connect to the MX Cloud software through the cellular modem.
- Flash wired sign modules continuously at default settings (see Table 1).

To set up one or more systems for a radar-triggered warning sign application:

1. If multiple systems are to flash together when activated by one or more radar modules, use the MX Field App to link those systems.
2. Set operation mode to Trigger/Standby.
3. Ensure the radar has been programmed accordingly. Refer to the appropriate **LEVEL 4** install guide for more information.

See the MX Field App Guide for more information and other adjustable settings.



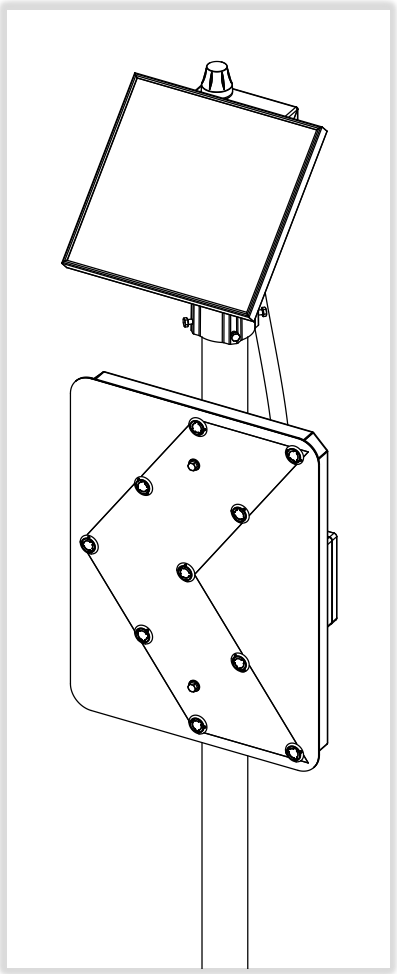
3.6 Application 5 – CHEVRON-MX Chevron Warning Signs

Once the chevron system is installed and energized, it will automatically:

- Connect to the MX Cloud software through the cellular modem.
- Flash wired sign modules continuously at default settings (see Table 1).

Synchronized or sequential flashing with multiple systems linked together is available through the MX Field App. See the MX Field App Guide for full programming and commissioning steps.

NOTE For radar equipped systems, ensure the radar has been programmed accordingly. Refer to the appropriate **LEVEL 4** install guide for more information.



3.7 Application 6 – WWD-MX Wrong-Way Warning Signs

Once the system is installed and energized, it will automatically:

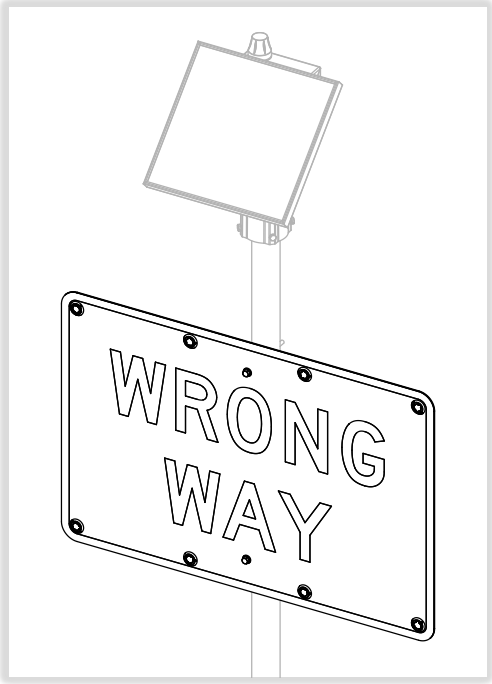
- Connect to the MX Cloud software through the cellular modem.
- Flash wired sign modules continuously at default settings (see Table 1).

If multiple systems are to flash together, use the MX Field App to link those systems.

To set up one or more systems for a radar-triggered warning sign application:

1. If multiple systems are to flash together when activated by one or more radar modules, use the MX Field App to link those systems.
2. Set system(s) with radar to operation mode Trigger with Notification. Set any advanced systems linked to the radar system to Trigger/Standby.
3. Ensure the radar has been programmed accordingly. Refer to the appropriate **LEVEL 4** install guide for more information.

See the MX Field App Guide for more information and other adjustable settings.



NOTE Trigger with Notification will send an SMS and/or email alert after a wrong-way vehicle has been detected to all opted-in users on the MX Cloud account. Ensure you are opted-in to notifications from within MX Cloud. Requires an active MX Plus/Pro subscription. Contact Carmanah for more information.

3.8 Application 7 – SPEEDCHECK-MX Connected Radar Speed Sign

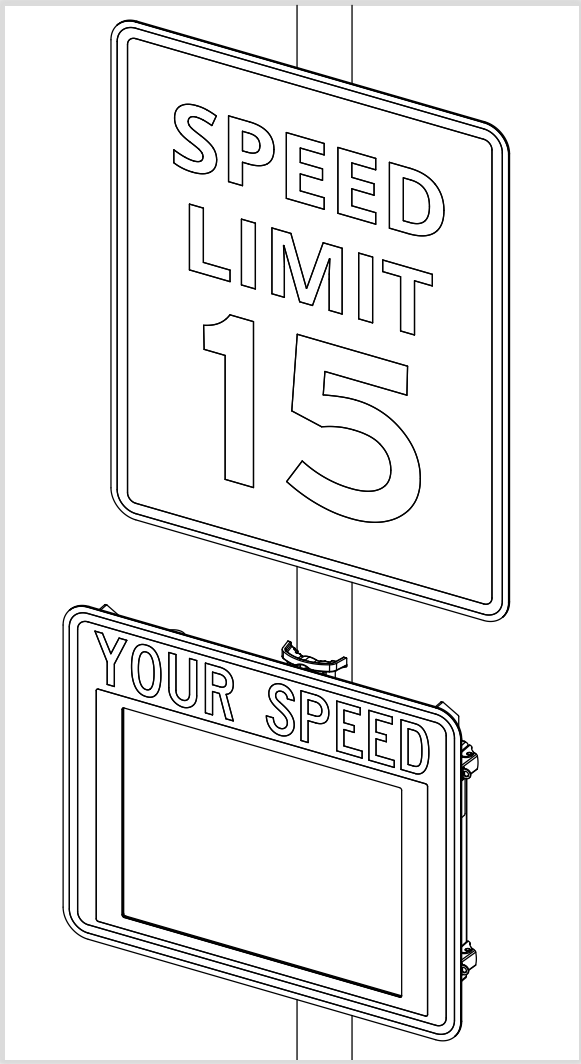
Once the system is installed and energized, it will automatically:

- Connect to the MX Cloud software through the cellular modem.
- Display speed of passing vehicles in default units.

To set up a radar speed sign, in the MX Field App:

1. Check Unit of Speed setting is correct and change if required (default is MPH).
2. Enable any desired functionality such as violation alert speed, Slow Down message, and strobe(s).
3. Adjust default speed units as required.

See the MX Field App Guide for more information, and for other adjustable settings.



3.9 Application 8 – SPEEDCHECK-MX School Zone Connected Radar Speed Sign

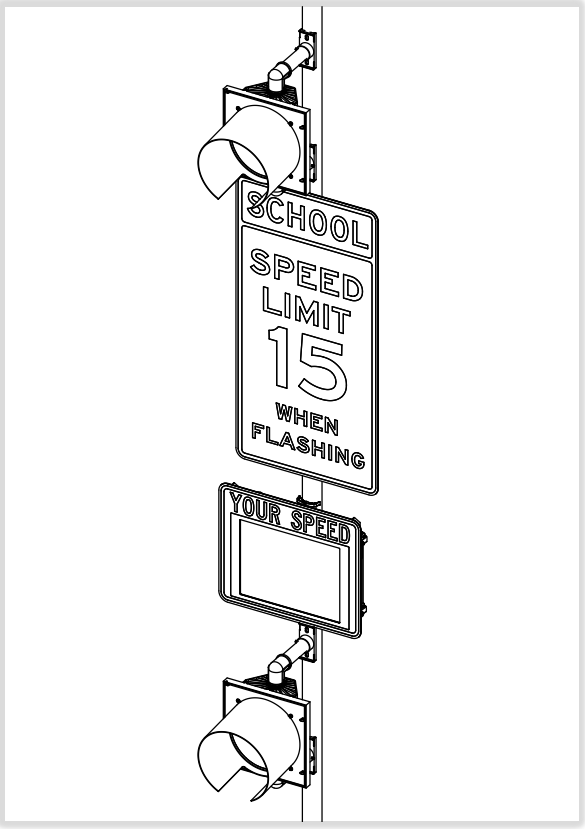
Once the system is installed and energized, it will automatically:

- Connect to the MX Cloud software through the cellular modem.
- Display speed of passing vehicles in default units.

To set up a system for a school zone application, in the MX Field App:

1. Check Unit of Speed setting is correct and change if required (default is MPH).
2. Change sign mode to Schedule.
3. Select or create a new schedule.
4. Upload schedule to system.

See the MX Field App Guide for more information, and for other adjustable settings.



3.10 Cable & Wiring Information

The MX Series was designed for simple, flexible field wiring using cables with specific insulation colors that match color code markings on the modules' spring-cage terminals, which offer a reliable connection without the need for crimped terminals. Cut-and-stripped cables are available in several common lengths. Bulk cable is also available for installers who prefer to tailor each cable length individually; the following table describes the basic cable requirements. We recommend in all cases to use only tinned, stranded copper wire rated for the application according to all applicable building and electrical codes.

Function	Conductors & Wire Gauge	Terminal Markings & Insulation Colors									
		A	B	C	D	E	F	1	2	3	4
Push button	2c 20 AWG	WH	GN								
Pedestrian sensor & radar	4c 20 AWG	WH	GN	RD	BK						
Talking push button	6c 20 AWG	WH	GN	RD	BK	BU	BN				
MX module-to-module	4c 18 AWG							YE	WH	RD	BK

NOTE

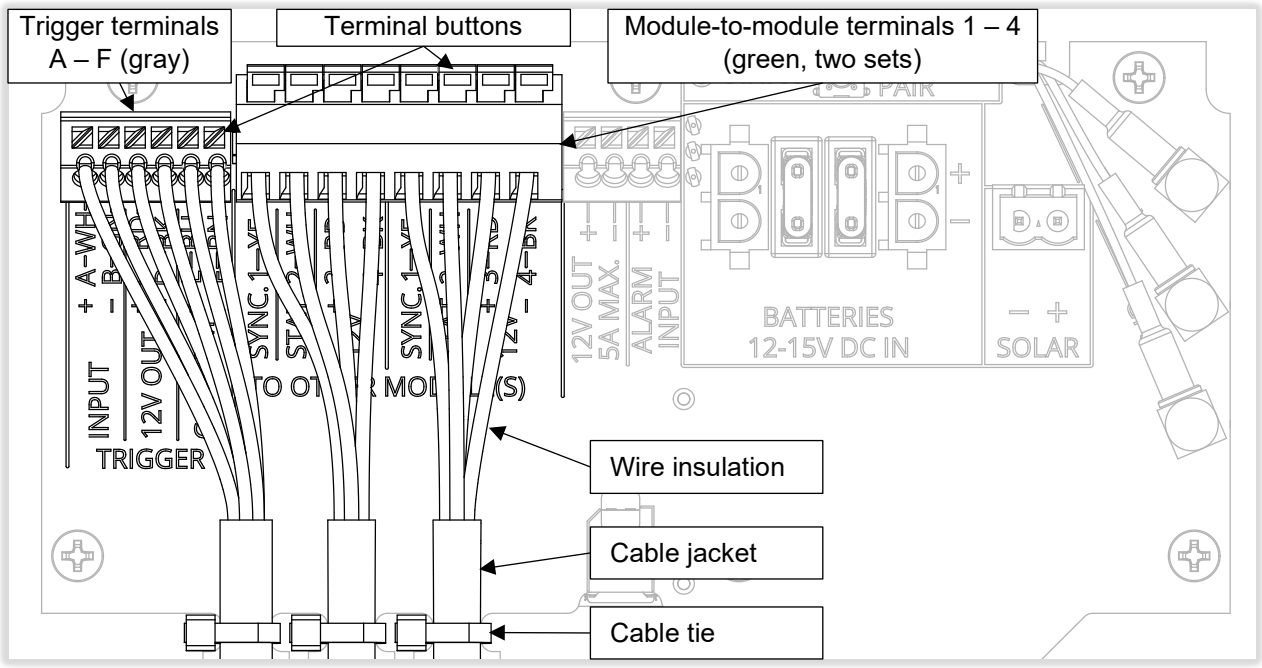
Power modules, RRFB modules and beacon modules all have:

- One set of trigger terminals A – F
- Two sets of module-to-module terminals 1 – 4 in parallel

LED sign and SpeedCheck modules have only one set of module-to-module terminals 1 – 4. SpeedCheck modules do not include trigger terminals.

To prepare cables for wiring to the circuit board terminals in MX Modules:

- Strip cable jacket so that cable tie will land near end of jacket (typically 2.5 – 3.0")
- Strip insulation:
  - Trigger wires (gray terminals A – F) to 0.35"
  - Module-to-module wires (green terminals 1 – 4) to 0.30"
- Use a 0.138" (or similar) slotted screwdriver to press the terminal button and insert the wire
- Take care to avoid stray strands
- Secure wires with cable ties



Inter-module cables don't all have to be routed to a power module; flasher modules can be wired to one another, which is often more convenient. Triggers can also be wired to any flasher module or the power module.

The table below shows the maximum recommended cable length between the power module and the farthest flasher module.

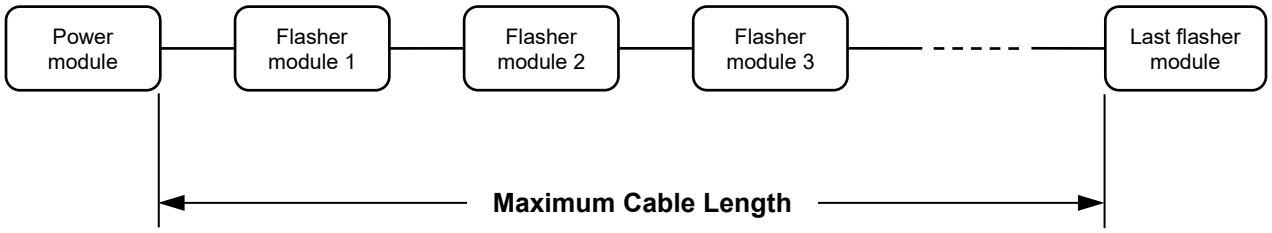


Table 2: Maximum Cable Lengths

	Number of Flasher Modules									
Flasher Type & Intensity Setting	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
12" yellow beacon, 1.7 X ITE (Florida)	100	65	40	30	25	20	15	15	10	10
12" yellow beacon, ITE	100	100	75	55	45	35	30	25	25	20
8" yellow beacon, ITE	100	100	100	100	90	75	60	55	50	45
12" red beacon, ITE	100	100	100	100	100	100	85	75	65	60
8" red beacon, ITE	100	100	100	100	100	100	100	90	80	70
Yellow light bar, SAE J595	100	100	80	60	45	40	35	30	25	20
LED sign, maximum	100	100	100	100	100	100	90	75	70	60
	Maximum Cable Length (ft)									

NOTE

To maintain reliable wireless communications between power module and flashers, the recommended maximum distance between power module and the farthest flasher module is 75 ft.

4.0 Commissioning & Troubleshooting

Each **LEVEL 2** Install Guide includes a commissioning checklist and troubleshooting section.

To fully commission an MX system, the MX Field App is required.

The MX Field App wirelessly communicates with MX systems for programming, configuration and diagnostics. It utilizes the Bluetooth connection between your mobile device and the MX system. Once you download the app, a cellular or Wi-Fi connection is required to create and sign into your Profile.

The MX Field App allows for system programming, scheduling, firmware updates and diagnostics from the ground without having to manually access the system.

The MX Field App is available free of charge on the Apple App Store and Google Play Store for compatible mobile devices. For more information see carmanah.com/app.

Refer to the MX Field App guide for more details at support.carmanah.com.

5.0 Customer Service and Warranty

MX Series products are covered by a limited warranty for the product excluding batteries, and a separate limited warranty for the batteries.

Visit carmanah.com for additional information or contact the customer support department.
Before contacting Carmanah's customer support department, please have the serial number of your system available, a brief description of the problem, as well as all details of the installation (location, pole type, type and quantity of fixtures, etc.) and any troubleshooting steps already performed. The serial number can be found on the label on the right side of the cabinet near the top, and on a label inside the cabinet.

carmanah®
MX Series

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Technical Support:

Email: customersupport@carmanah.com
Toll Free: 1.877.722.8877 (US & Canada)
Worldwide: 1.250.380.0052
Fax: 1.250.380.0062
Web: carmanah.com