



# Patriot MR

INDUSTRIES, INC. Mini UHF Passive RFID Reader



## Instruction Manual

The Patriot MR is an UHF Passive RFID tag reader designed for access control applications. The Patriot MR has a maximum operating range of 6-10 ft (1.8-3.0m) depending on the tag used. The Patriot MR works with EMX 26-bit credentials, and has Wiegand and RS-232 outputs for transmitting credential data. Other features include an indicator LED, an audible buzzer, and a tag read input trigger, as well as user-configurable RF power, read interval, Wiegand buffer period, and Wiegand pulse timing settings.

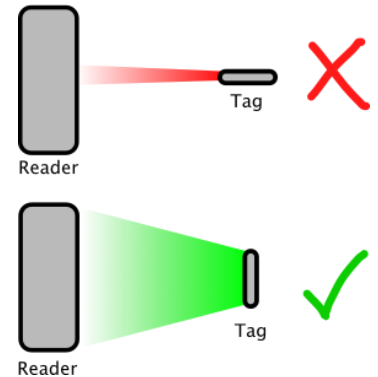
## Specifications

Dimensions	5.4" x 3.5" x 1.3" (137mm x 90mm x 33mm)
Supply Voltage	9 ~ 30V DC (12 ~ 24 VDC recommended)
Typical Operation RMS Current (Tag read active)	(12V) Average: 75mA, Peak: 200mA
	(24V) Average: 45mA, Peak: 115mA
Antenna	Internal 4dBi ceramic, circular polarized
RF Power	2~25dBm (configurable)
Tag Read Zone Range	6-10ft (1.8-3.0m) long, dependent on tag and environment
Tag Read Zone Width	6-10ft (1.8-3.0m) wide, dependent on tag and environment
Radio Frequency	902-928 MHz (USA ISM Band)
Tag/Credential Types	EMX 26-bit UHF EPC Gen2 credentials
Indicators	Flashing blue LED and Audible Buzzer
Data Output Interfaces	26-bit Wiegand, RS-232
Wiegand output format	26-bit Wiegand
Wiegand Timing Parameters	Default: Pulse width 80μs, pulse period 1600μs (configurable)
Serial data output format	ASCII (Hexadecimal); HID simulation
Configuration Interface	RS-232 (USB to RS-232 adapter sold separately)
Tag identification time	<100ms after trigger activation
Controller Functionality	Trigger input
Operating Temperature	-4°F to 158°F (-20°C to +70°C)
Certification	FCC Part 15 (FCC ID: 2BAW3-FM505)
Connection Style	9-conductor flying leads

## Reader and Tag Positioning Guidelines

Before installing the unit, ensure that the unit will be positioned optimally. The following guidelines will help maximize the read range of the Patriot MR reader:

- The reader should be installed at least a few feet above the earth's surface. It's best to install the reader at the same height that tags will be held or mounted.
- The front (lid) side of the reader should point towards the zone of desired coverage, but do not point it downwards.
- Parallel surfaces rule: The longest axis of the tag should not point directly towards the reader. Tags parallel to reader get best performance (see image).
- If you are using the EMX Universal L-Bracket to mount the reader, ensure that the top edge of the bracket and the top edge of the reader are aligned. This typically gives the best performance.



Failure to follow the above guidelines may result in reduced performance and read range.

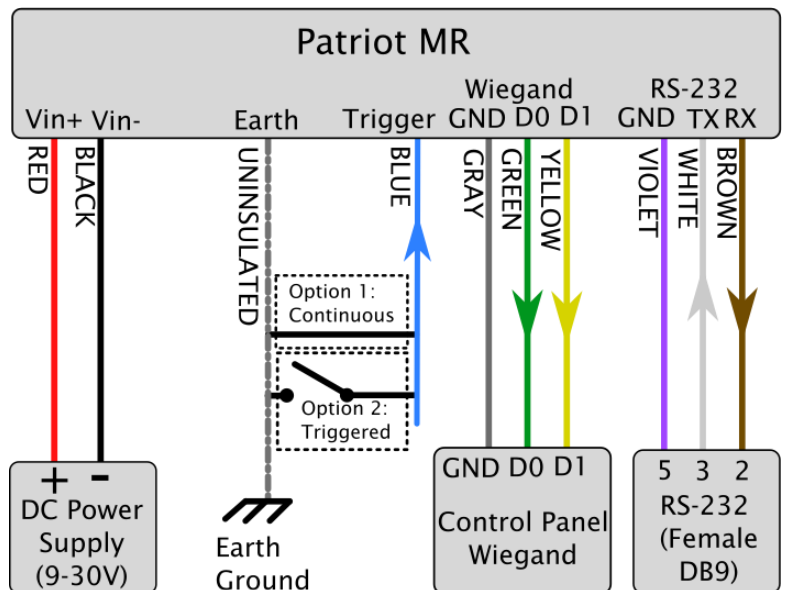
## Wiring Guide

Wire the unit according to the wiring diagram shown here.

The **VIOLET**, **WHITE**, and **BROWN** wires are used for RS232 serial output and for configuration of the reader via the setup software. If neither of these uses are needed, these wires may be left unconnected.

Similarly, if the Wiegand output is not needed, the **GRAY**, **GREEN**, and **YELLOW** wires may be left unconnected.

When using an external trigger, the **BLUE** trigger wire should be connected to any GND (such as the **UNINSULATED** earth wire) via a switch or relay. The tag read will be triggered when the **BLUE** wire to GND wire connection is closed. If the trigger functionality is not needed, the **BLUE** wire should be connected directly to the **UNINSULATED** wire. **The reader will not read unless the BLUE trigger wire is connected to a ground wire.**



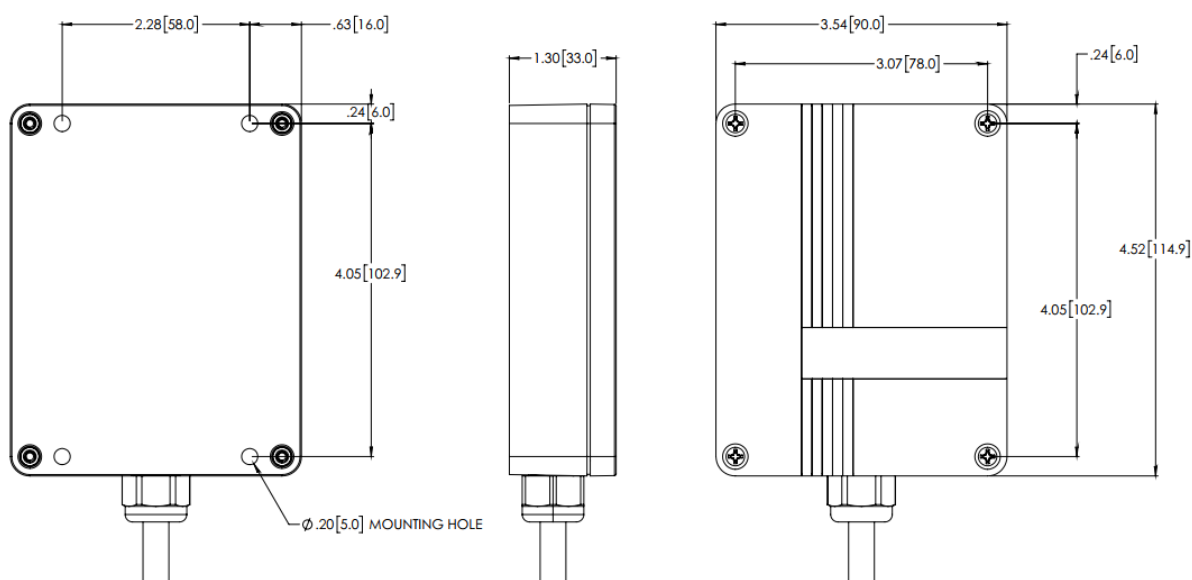
**Note:** Do not wire another manufacturer's Wiegand output to the same terminals as the Patriot MR's Wiegand output. Doing so may damage the unit.

## Wire Function Table

Name	Wire Color	Description
V+	RED	(Required) 9V to 30V DC power input.
V- *	BLACK	<i>Note: Internally, V- is connected to Earth wire and other GND wires.</i>
Wiegand GND *	GRAY	Wires used for Wiegand output. When a tag with encoded Wiegand data is read, that data will be output on these wires.  <i>Note: do not wire any other reader devices on the same Wiegand wires as the Patriot MR reader</i>
Wiegand D0	GREEN	
Wiegand D1	YELLOW	
RS-232 GND *	VIOLET	Wires used for RS-232 configuration and tag output.  If using a female 9-pin DB9 connector, the white wire goes to pin 3, the brown wire goes to pin 2, and the violet wire goes to pin 5.
RS-232 RX	BROWN	
RS-232 TX	WHITE	
Trigger	BLUE	The reader will only read when the trigger wire is connected to ground.  If you aren't using the trigger functionality, connect this wire directly to ground to enable constant reading.
Shield/Earth *	UNINSULATED	Earth ground

\* V-, Wiegand GND, RS-232 GND, and Shield/Earth are all connected internally

## Housing Dimensions



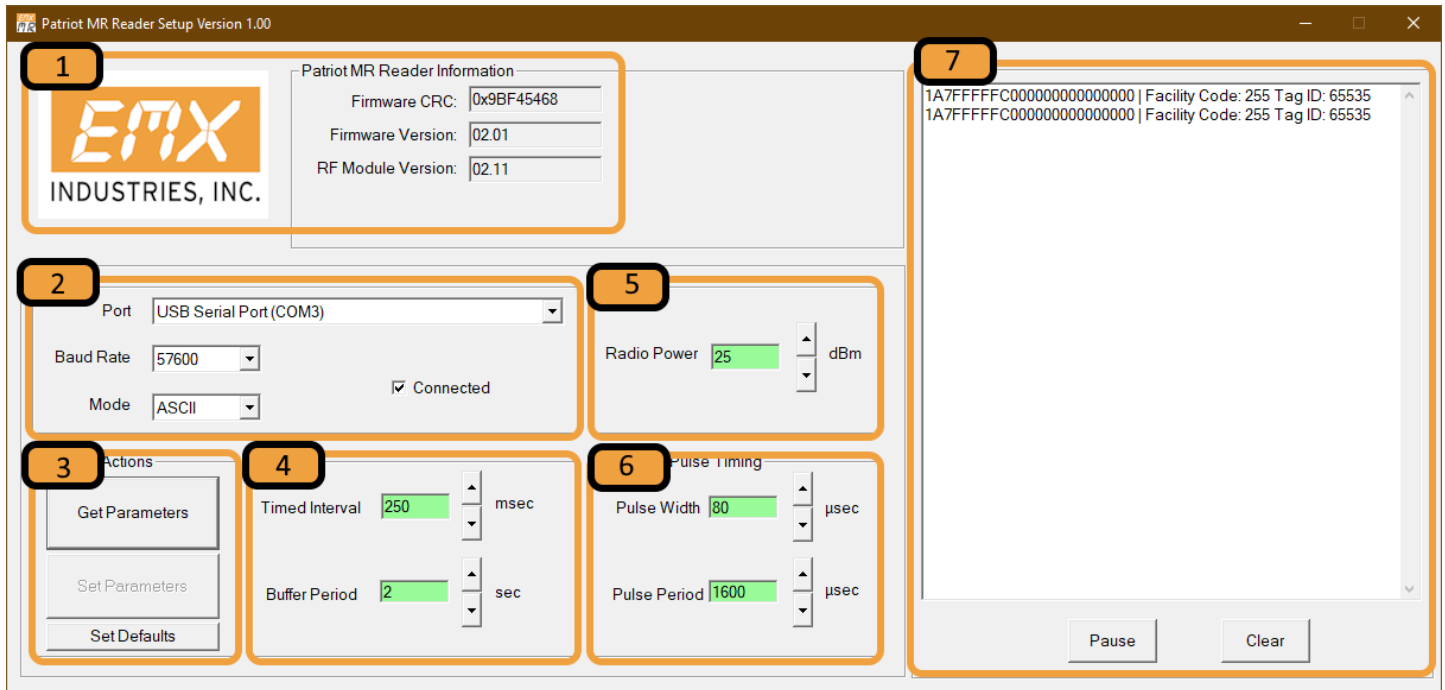
# Reader Mounting Guide

For best practice when mounting the Patriot MR, we recommend using the included EMX universal L-bracket.

1		<p>Remove the four screws from the cover of the Patriot MR. Remove the front cover, exposing the four mounting holes.</p>
2		<p>Use two to four #8 machine screws with nuts and washers to mount the reader in its desired location. For best performance, we recommend mounting the top two mounting holes to the top row of slots on the provided bracket as shown.</p>
3		<p>Replace the front cover using the four screws removed in step 1.</p>
4	<p>Wire the Patriot MR according to the Wiring Guide. If desired, use RS-232 connection to configure reader settings.</p>	

# Software Configuration

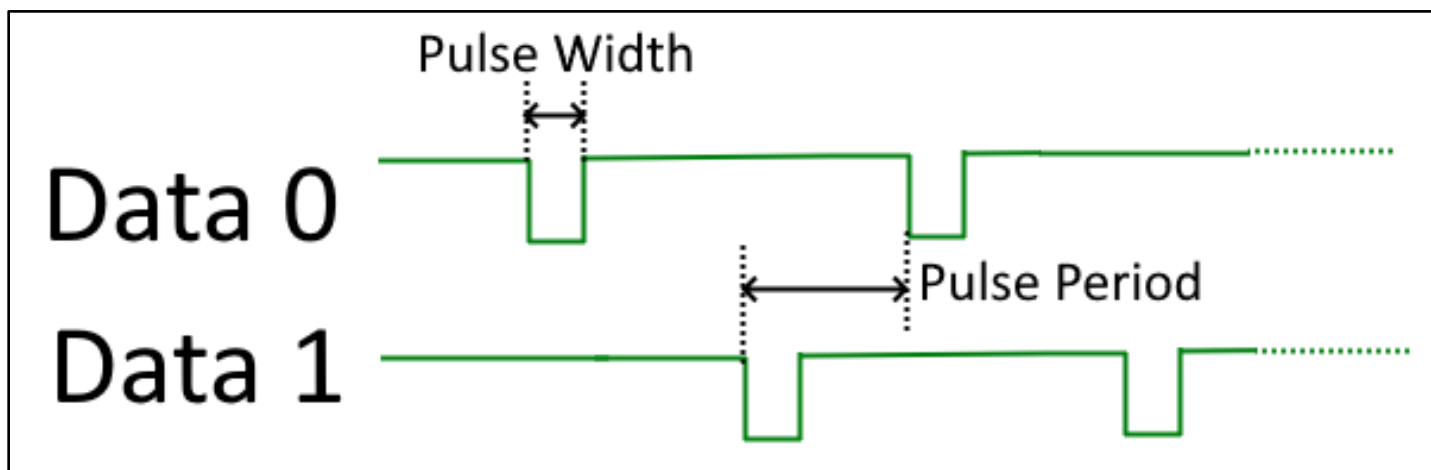
Patriot MR units come pre-configured with the optimal factory settings for maximum range and fastest response time. However, EMX also provides software to change these settings for applications with different needs. Various parameters of the Patriot MR software can be changed using the Patriot MR Reader Setup Software, available on the EMX Access Controls website. To use the software, connect to the Patriot MR using an RS-232 to USB adapter (sold separately). Upon opening the software, the following options are available:



1. **Reader Information** - Information on the version of the setup software and the reader firmware.
2. **Communications** - Parameters for the RS-232 communications of the reader, including baud rate and output data mode. These options are used to initially connect to the reader.
3. **Reader Actions** - When parameters are changed, the “Set Parameters” button causes the changes to take effect. “Set Defaults” resets the device to factory settings.
4. **Reader Settings** - Changes how often the reader searches for a tag, and how long the buffer period is for a tag.
5. **Radio Power** - Adjusts the RF power of the reader, 2-25dBm (default 25dBm)
6. **Wiegand Pulse Timing** - Changes the timing of the Wiegand output pulses.
7. **Log** - Displays the RS-232 data being sent to the setup program by the Patriot MR. The pause and clear buttons pause and clear the software’s data log.

To change any configuration settings, first click “Get Parameters” so that the software shows the current values. Change any values that need changed, and then click “Set Parameters”. The unit will beep to indicate that parameters have changed.

Setting	Description	Options	Default
Port	Serial port used for reader configuration Select a port to connect to the reader	-	-
Baud Rate	Baud rate used for serial communication.	9600, 14400, 19200, 38400, 57600	57600
Mode	Formatting for tag data outputted on RS-232 output	ASCII, HID	ASCII
Radio Power	Power used for tag reads. Higher power leads to higher read range and higher power consumption.	2 ~ 25dBm	25dBm
Timed Interval	Timing interval between tag read attempts	250ms ~ 5000ms	250ms
Buffer period	Controls the minimum amount of time between consecutive reports of the same tag.	0 ~ 60 seconds	2 s
Pulse Width	Timing parameters for wiegand output data. (See image below)	20 ~ 100 $\mu$ s	80 $\mu$ s
Pulse Period		200 ~ 20,000 $\mu$ s	1600 $\mu$ s



# Troubleshooting

Symptom	Possible Cause	Solution
Buzzer does not make any sound upon power up	Faulty power supply connection	Ensure that the DC power supply voltage is in the 9-30V range, and that it is connected to the <b>RED (V+)</b> and <b>BLACK (V-)</b> wires of the Patriot MR
Reader beeps repeatedly, around 3x per second without outputting tag data	Insufficient reader power	Ensure that the DC power supply is in the 9-30V range, and capable of delivering the peak current (e.g. 100 mA for 24V)
Reader does not recognize a <b>specific</b> tag (no beep, no output)	Damaged tag Incompatible tag format	Test the reader with a tag that is known to be functional, and check for any visible damage to the tag. The Patriot MR is only compatible with 26-bit EMX RFID tags.
Reader does not read <b>any</b> tags (no beep, no tag data)	Faulty trigger wire connection	The Patriot MR will only read tags when the <b>BLUE</b> trigger wire is connected to ground. If using trigger functionality, ensure that the trigger is connecting the <b>BLUE</b> wire to earth when a tag should be read, and disconnected otherwise. If not using trigger, ensure that the <b>BLUE</b> trigger wire is connected directly to the earth wire so that the Patriot MR reads constantly.
Tag reads, but control panel reports incorrect or invalid Wiegand tag data	One or more of the reader's wiring connections is incorrect.	Verify the wiring connections. Check that Data 0, Data 1 and ground are properly attached. Also make sure that the Data 0 and Data 1 wires have not been swapped or shorted together.
(RS232) Tag data to panel or setup program is missing or scrambled, and reader unresponsive to setup software	Reader data wiring is incorrect RS232 incorrect baud rate	Verify the wiring connections and their wiring lengths, paying special attention to the wiring for the RS232 interface. Try swapping the RX and TX wires. Ensure that the baud rate set in the reader parameters is the same as the baud rate of the terminal or program it is connected to.
Unexpected behavior after parameter change	Reader not restarted after parameter change	Disconnect and reconnect the DC power supply to the unit for changes to take effect.
Read range is too short for a specific tag	Tag detuned by incompatible material (metal, skin, liquid) Poor tag placement	Ensure tag is mounted on a material it is designed for, typically glass or open air. Tags will have decreased range when mounted near metal or liquid, or when near skin. If you are holding the tag in your hand, hold it by the edges so that your skin does not detune the tag's antenna. Tag should be facing the reader antenna (Parallel Surface Rule) for maximum performance and distance.
Read range is too short for all tags	RF power too low Poor reader placement Reader antenna detuned by nearby material Ground loop	Increase the RF power using the reader setup software. Consult the reader mounting guide section of this manual for guidance mounting the reader. Make sure that the front of the reader is positioned far (18" recommended) from any nearby body parts, metals, or liquids, then restart the reader. Check by powering reader without <b>BLACK (V-)</b> wire connected. If the Reader turns on, Earth GND and V- must be tied together elsewhere in the system. Find this point and disconnect the two. Earth ground should terminate only at the Reader.
Reader reads a tag that it isn't supposed to	Tag detected in side / rear lobe RF power too high	Sometimes, the reader is able to read a tag positioned behind the reader. Decrease the RF power to lower the chance of tags outside of the desired read zone being read.



		Decrease the RF power of the reader. This will decrease the size of the read zone, and may help prevent erroneous reads.
--	--	--

## Warranty

EMX Industries, LLC dba EMX Industries, Inc. and its subsidiaries and affiliates (collectively, “EMX”) warrants to the original purchaser (“you”, “your” or “Purchaser”) that its products (“Products”) are free from material defects in material and workmanship for a period of two (2) years from the date of manufacture of the Products (evidenced by EMX’s product manufacture date code) (the “Limited Warranty Period”).



**Your sole and exclusive remedy and EMX’s sole obligation for any Products that are nonconforming when delivered to you, or are found to be defective during the Limited Warranty Period, will be, in EMX’s sole discretion, to replace the nonconforming or defective Product or provide you with a credit equal to the purchase price of the nonconforming or defective Product. This warranty does not cover labor or other costs or expenses to remove or install any defective, repaired, or replaced Products.**

Except as provided under Section 3 of EMX’s Terms and Conditions of Sale (which can be found at <https://www.emxaccesscontrolsensors.com/terms>) (the “Terms”), which Terms are incorporated herein by reference, all sales of Products to Purchaser are made on a one-way basis and Purchaser has no right to return Products to EMX. This warranty extends only to the original Purchaser and is not transferable under any circumstances. If the Products are gifted or resold, all warranty claims must be resolved through the original Purchaser. EMX will not handle claims from end-users directly.

1. You must notify EMX in writing within the Limited Warranty Period if you discover that a Product is nonconforming or defective, and you must also contact EMX technical support staff at 216-518-9889 and provide a description of the nonconformity or defect together with written evidence or other documentation as required by EMX. If EMX determines that the Product is nonconforming or defective and the claim is made within the Limited Warranty Period, EMX will instruct you to either dispose of or return the nonconforming or defective Product to EMX together with the EMX RMA number. No Product returns will be accepted without an EMX approved RMA number. Returned Products must be sent to EMX’s designated facility at Purchaser’s expense and risk of loss. If EMX exercises its option to replace nonconforming or defective Products, EMX shall, after receiving Purchaser’s shipment of such returned nonconforming or defective Products, deliver the replacement Products in accordance with Section 4 of the Terms.
2. This limited warranty does not cover and EMX will have no obligation to replace any Product if (i) Purchaser or any end-user makes any further use of such Products after giving notice that such Product is nonconforming or defective, (ii) replacement is required as a result of normal wear and tear, or causes external to the Product, (ii) the Product has been altered other than by an authorized EMX representative, (iii) the Product has not been properly installed, handled, used, maintained, modified or adjusted; or (iii) the replacement is requested after the Limited Warranty Period has expired.
3. EMX shall not be liable for a breach of the warranty set forth in paragraph a. unless: (i) Purchaser gives written notice of the defect, reasonably described, to EMX within five (5) days of the time when Purchaser or any end-user discovers or ought to have discovered the defect; (ii) EMX is given a reasonable opportunity after receiving the notice to examine such Products and Purchaser (if requested to do so by EMX) returns such Products to EMX’s place of business at Purchaser’s cost for the examination to take place there; and (iii) EMX reasonably verifies Purchaser’s claim that the Products are defective.
4. **EXCEPT FOR THE WARRANTY SET FORTH IN SUBPART (a) ABOVE, EMX MAKES NO REPRESENTATION OR WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCTS, WHETHER EXPRESS OR IMPLIED BY LAW, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, NON-INFRINGEMENT, OR ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE, ALL OF WHICH EMX HEREBY EXPRESSLY DISCLAIMS.**
5. EMX reserves the right to change, modify or improve the design of the Product without assuming any obligations or liabilities relating to any Product previously manufactured by EMX.
6. Products manufactured by a third party (“Third Party Product”) may constitute, contain, be contained in, incorporated into, attached to or packaged together with, the Products. Third Party Products are not covered by the warranty in subpart (a) above. For the avoidance of doubt, **EMX MAKES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER WITH RESPECT TO ANY THIRD PARTY PRODUCT, WHETHER EXPRESS OR IMPLIED BY LAW, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE, NON-INFRINGEMENT, OR ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE, ALL OF WHICH EMX HEREBY EXPRESSLY DISCLAIMS.]**

EMX’s full Terms and Conditions of Sale can be found at <https://www.emxaccesscontrolsensors.com/terms>) and are incorporated herein by reference.



## Compliance

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications that are not expressly approved by EMX could void the user's authority to operate this equipment.