

V-Track™ Automatic Long Range Vehicle ID System

Installation Guide

1.0 System Overview

The Keri V-Track™ System¹ is similar to the highway toll type systems such as *E-ZPass*®² or *FasTrak*®² in that they both operate in the 900 MHz band. However, V-Track™ is much easier to install and far more tolerant of different vehicle types and metal surroundings than the toll-authority type transponder. It is also far less expensive.

The V-Track™ Vehicle Identification System consists of a directional Exciter (EX-10 - consisting of an integrated transmitter and antenna), which sends out a uniquely coded RF signal towards the vehicle. The Transponder (LRT-5) is mounted on the vehicle's windshield. Once the Transponder enters the field and recognizes the coded signal, it "wakes up" and transmits its ID number via a secure RF signal to a Receiver decoder (RXR-10). The Receiver can be located up to 100 feet (30M) away from the vehicle. The Receiver is supplied in a weatherproof enclosure for direct outdoor installation or can be placed indoors, such as in a guardhouse, close to other electronic equipment. The Receiver outputs the decoded data to an access control unit via standard data cabling. Systems are available that output data in either the standard Keri MS format or in 26-bit Wiegand format. A second or exit lane can be added to the system by installing a second Exciter. This Exciter is aimed down the exit lane in the same manner as the entrance lane's Exciter.

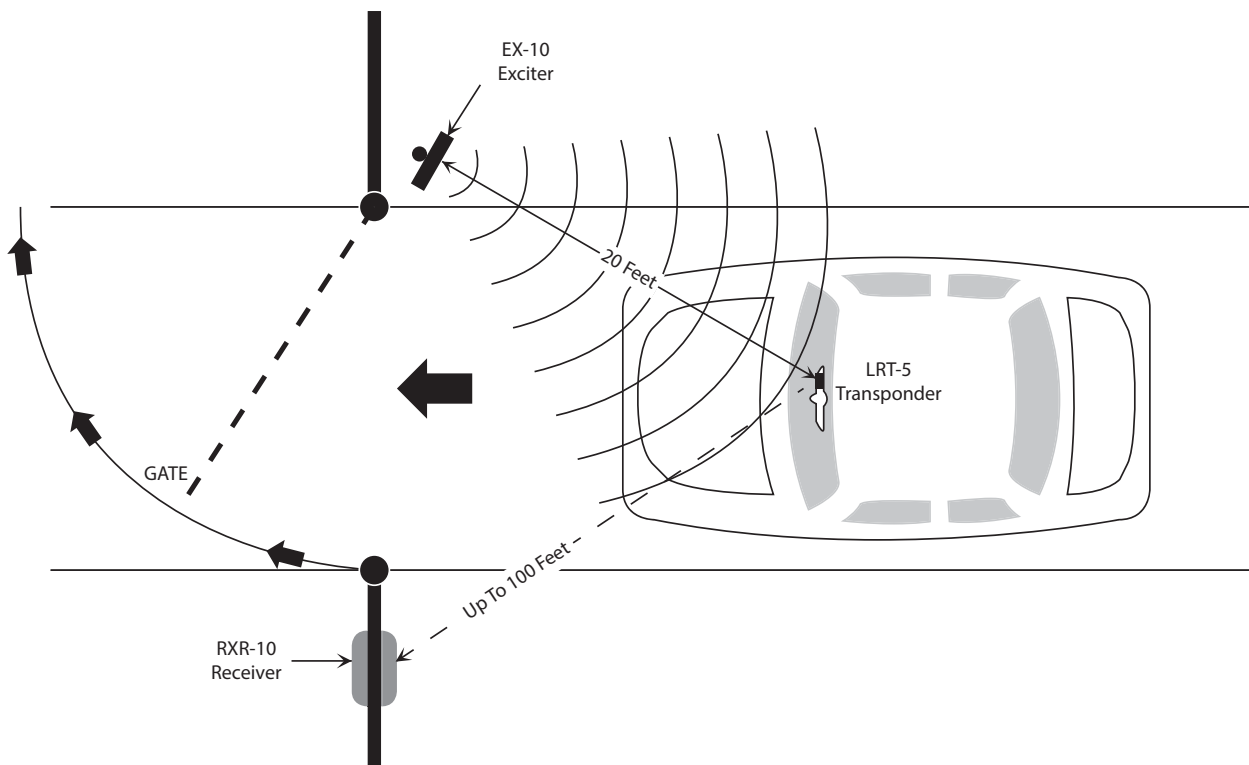


Figure 1: Basic, Single-Lane Gate Controller

Installation and setup is made simple and easy through the use of the LRT-5 Transponder. The LRT-5 is equipped with an LED that flashes Red when in the coverage area of the Exciter. The flashing Red LED indicates that it is in the Exciter field and is shipping data to the RXR-10 Receiver.

1. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
2. *E-ZPass*® and *FasTrak*® are registered trademarks of *E-ZPass*® New York and the Bay Area Toll Authority, respectively.

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2.0 EX-10 Exciter Installation

The EX-10 Exciter should be installed two to four feet (70 to 130 cm) from the edge of the entry lane. A gimbal mount is provided allowing for flexible horizontal and vertical orientation of the Exciter. Antenna horizontal and vertical radiation patterns are shown below. An Exciter height of five to nine feet above the ground is recommended, with six to seven feet (180 to 210 cm) being a typical height. The area between the antenna and the vehicle lane must be clear of shrubbery higher than 3 feet (90 cm). Low growing shrubs are acceptable. Taller plants immediately around the Exciter mounting pole (to hide the pole) are acceptable as long as they are two to three feet below the aimed antenna within the Exciter unit. The antenna housing may also be painted to blend in with its surroundings so long as a NON-metallic paint is used.

The Exciter's response-to-vehicle transponder time is set for typical gate operation use. Contact the factory for high-speed operations.

NOTE: A Yagi antenna may also be used instead of the standard, integrated antenna, if the installation application so dictates. Please contact Keri Systems for additional information and ordering of the Yagi antenna.

2.1 Exciter Orientation

2.1.1 Horizontal Plane

The horizontal orientation of the Exciter is set so that the center of the pattern is directed at the right edge of the road, which permits the left half of the detection pattern to cover most of the entry lane. Refer to Figure 2.

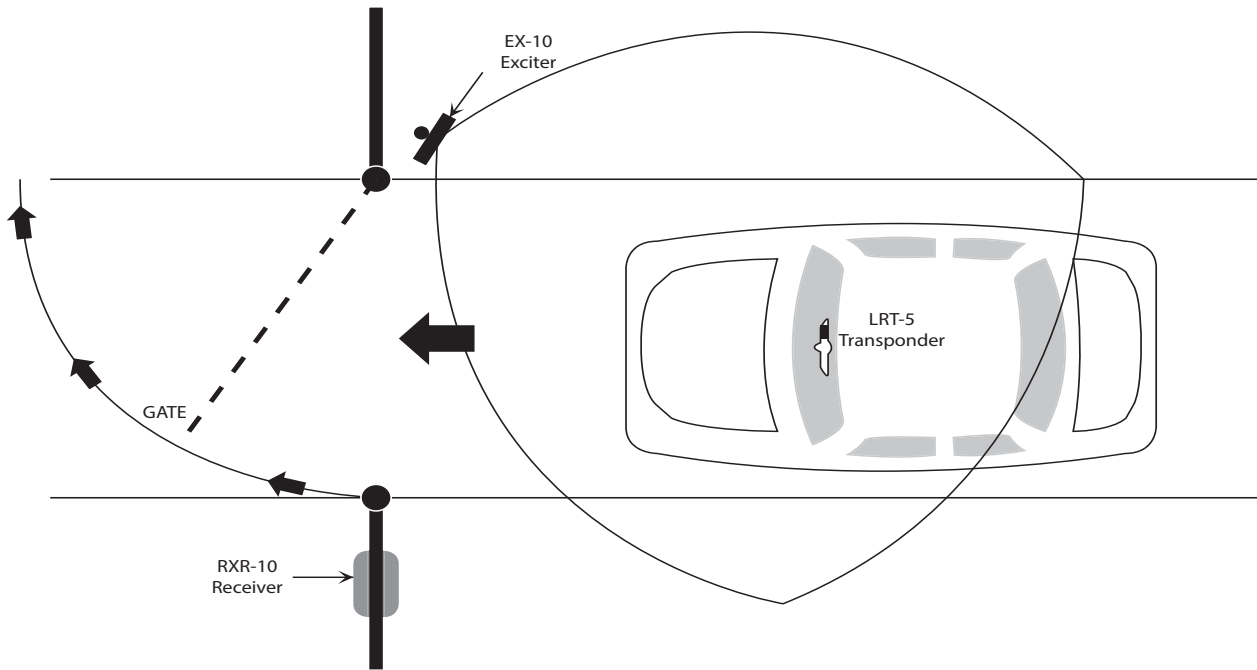


Figure 2: The Horizontal Antenna Coverage Pattern

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2.1.2 Vertical Plane

Vertical orientation is adjusted so as to aim the antenna at a spot about twenty feet (6.5 M) on the road from the Exciter. From this spot forward, the detection area will increase as you get closer to the gate. This is shown in Figure 3.

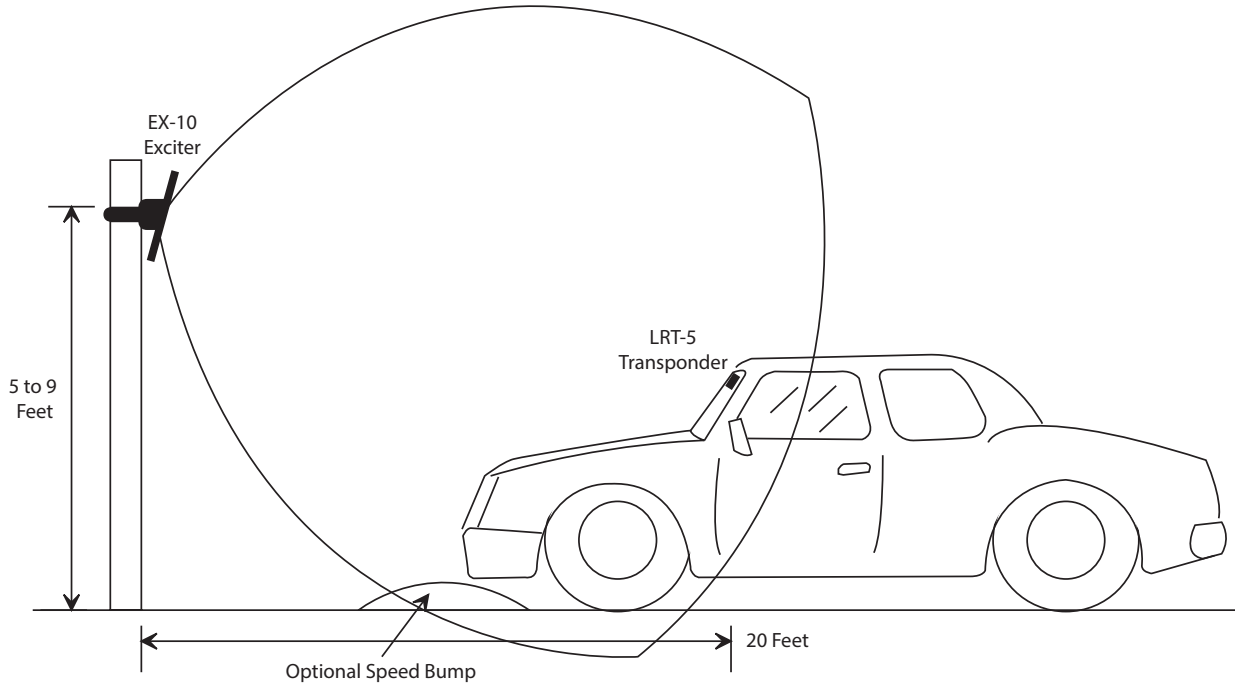


Figure 3: The Vertical Antenna Coverage Pattern

2.1.3 External Arming Input

Some installations prefer that the V-Track not be active until a vehicle approaches. The V-Track system is built with an input for external arming. This allows the use of road loops, IR detectors, pressure sensors, etc. to activate the V-Track system Antenna/Exciter. This system is not active until the loop input wires (brown and blue on the Exciter) are shorted together. This can be accomplished by using the arming devices output; either an open collector or the dry contacts of a relay.

The blue wire is the high input and the brown wire is the low (ground). If there is no external arming device used, these two wires must be connected together and this will turn the Antenna/Exciter on and allow it to function any time a transponder is in range.

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2.2 Exciter Electrical Installation

The Exciter comes configured from the factory for single-lane or for dual-lane entrance/dual-lane exit applications. Make wiring connections as follows:

- In single-lane applications only the Power (red) and Ground/Shield (black/silver) connections are made. Clip off the unneeded Green and White wires.
- In dual-lane applications, connect the A-wire (green) to the LRT Receiver at J3 and connect the B-wire (white) to the LRT Receiver at J3. Then connect the Power (red) and Ground/Shield (black/silver) wires.
- If the Arming Input is not being used, the Arming Input High (blue) and Arming Input Low (brown) wires **MUST** be shorted.

Please refer to Section 6.0 in this Installation Guide for more information on Enter/Exit (two-lane) applications.

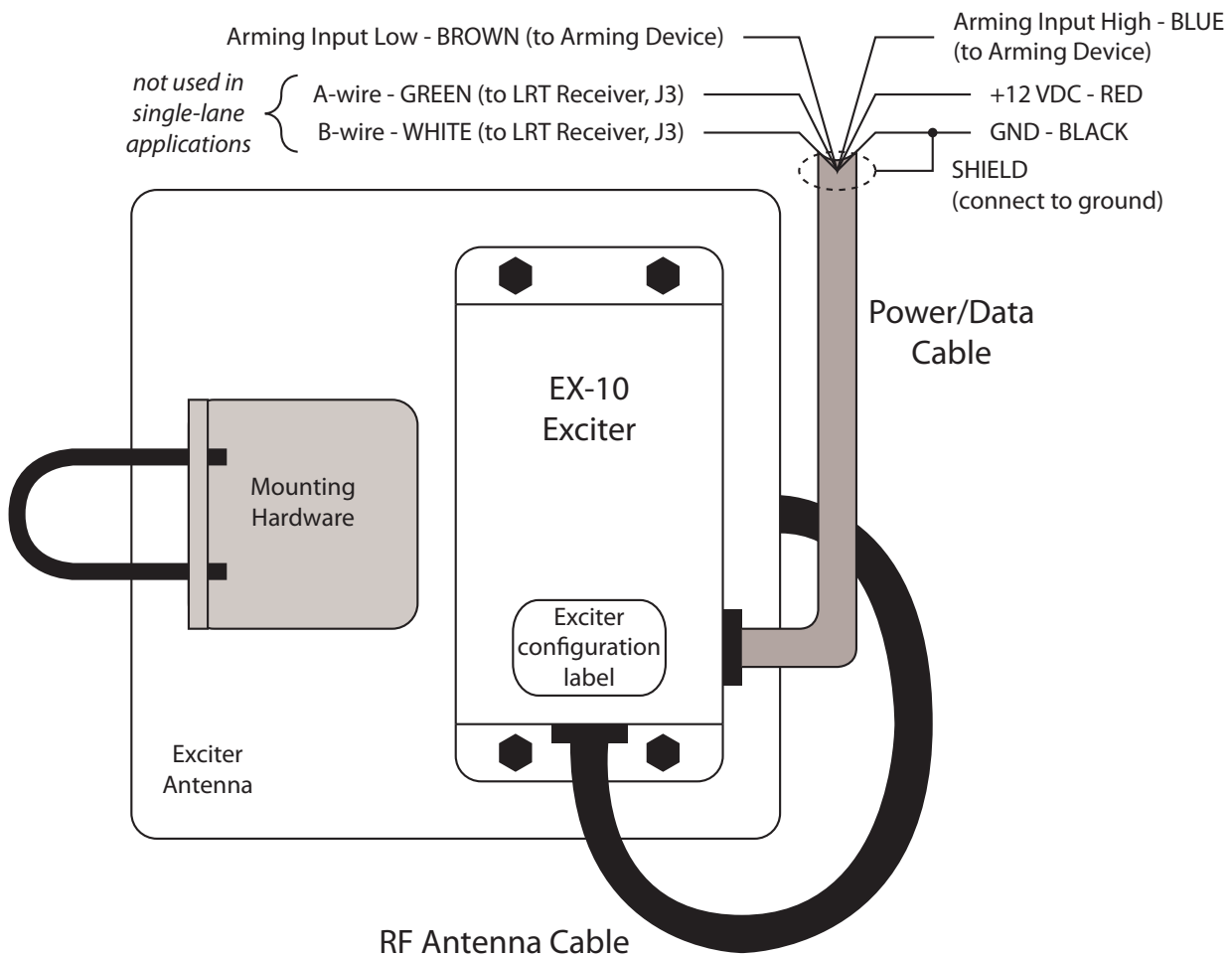


Figure 4: Exciter PCB

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Table 1: EX-10 Exciter Electrical Requirements

Parameter	Requirement
Power Supply Nominal DC Voltage	12.0 VDC
Voltage Range	11.0 VDC to 15.0 VDC
Nominal Current	500 mA
Recommended Power Supply	12 VDC @ 1 A or greater fully regulated
RF Connector Type	RPSMA

Keri recommends the following cable gauges:

- AWG 18 allows up to 500 feet
- AWG 22 allows up to 200 feet
- AWG 24 allows up to 100 feet

2.3 The Exciter's Antenna

The EX-10 Exciter's antenna can have a gain of no more than 8.1 db, per FCC regulations. For best operation the coaxial cable between the antenna and transmitter should be kept as short as practical. We recommend no more than 10 feet. Longer coax lengths than this will reduce the operating range of the system.

NOTE: The cable seals in the body of the Exciter enclosure are designed to accommodate one cable. Forcing more than one cable through these seals compromises the weather-tight seal, allowing water to enter the body of the enclosure.

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3.0 RXR-10 Receiver Installation

The Receiver range pattern is omnidirectional, a large, circular shape with a radius of up to 100 feet (30M). A typical mounting location is in a gatehouse for gated communities, or other enclosure, which makes it convenient to provide a data cable from the Receiver to the control unit. An external antenna can be installed if the Receiver is mounted in a difficult RF signal area. The LRT-5 Transponder sends its signal to the Receiver at 433 MHz so the detection pattern is very similar to that of a garage door opener or the remote unlock on your automobile. Cable type and run length are like any proximity reader and are specified below. The Receiver antenna detection pattern is shown in Figure 5.

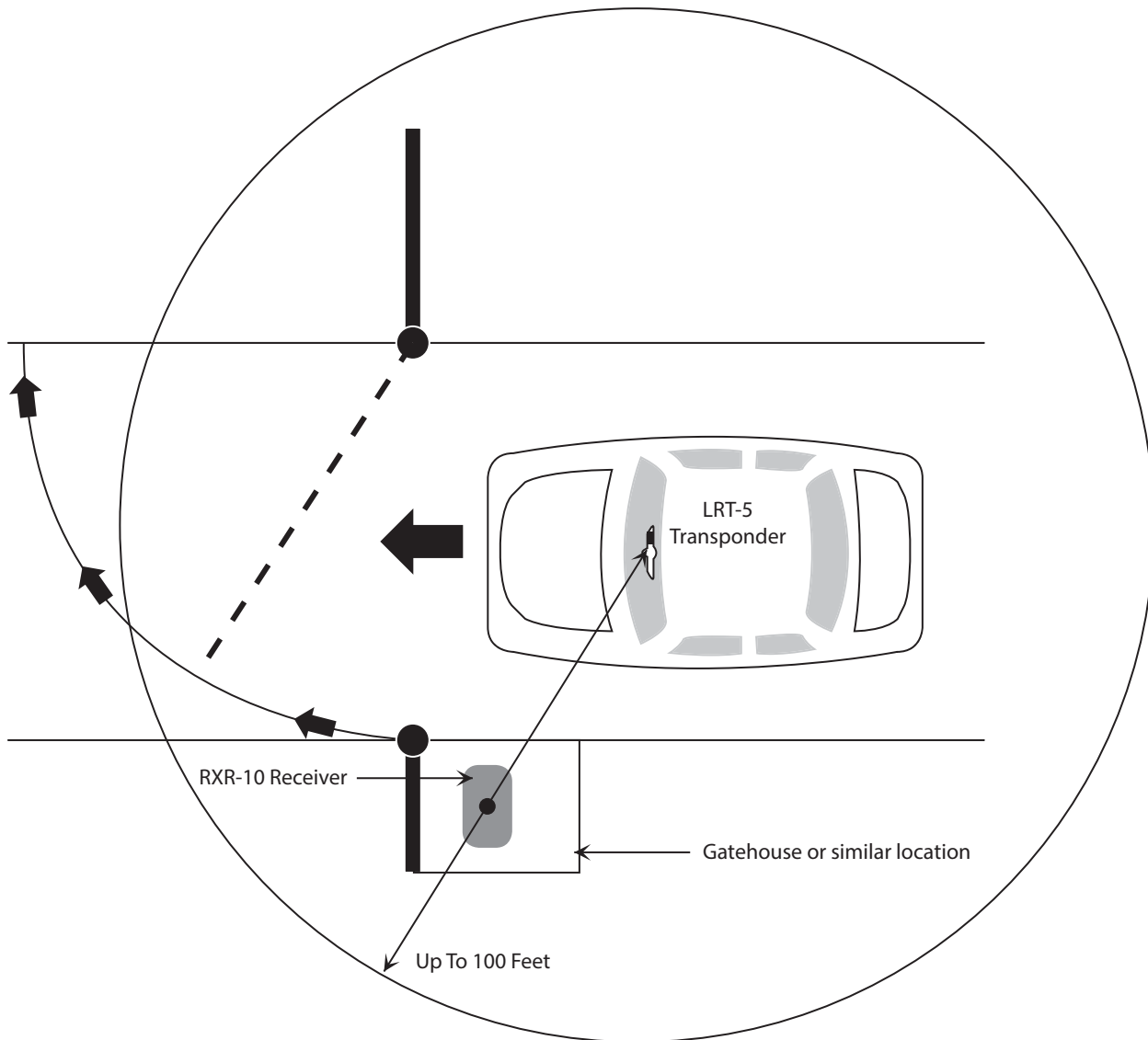


Figure 5: RXR-10 Receiver Detection Pattern – 100 Foot Radius Circle

The PC Board outline for the RXR-10 Receiver is shown in Figure 6 on page 7. The Receiver is equipped with a Range adjustment potentiometer (RV1). For single lane applications the system installer only needs to supply DC power to the Receiver and Exciter. For information on Enter/Exit applications, please refer to Section 6.0 in this Installation Guide.

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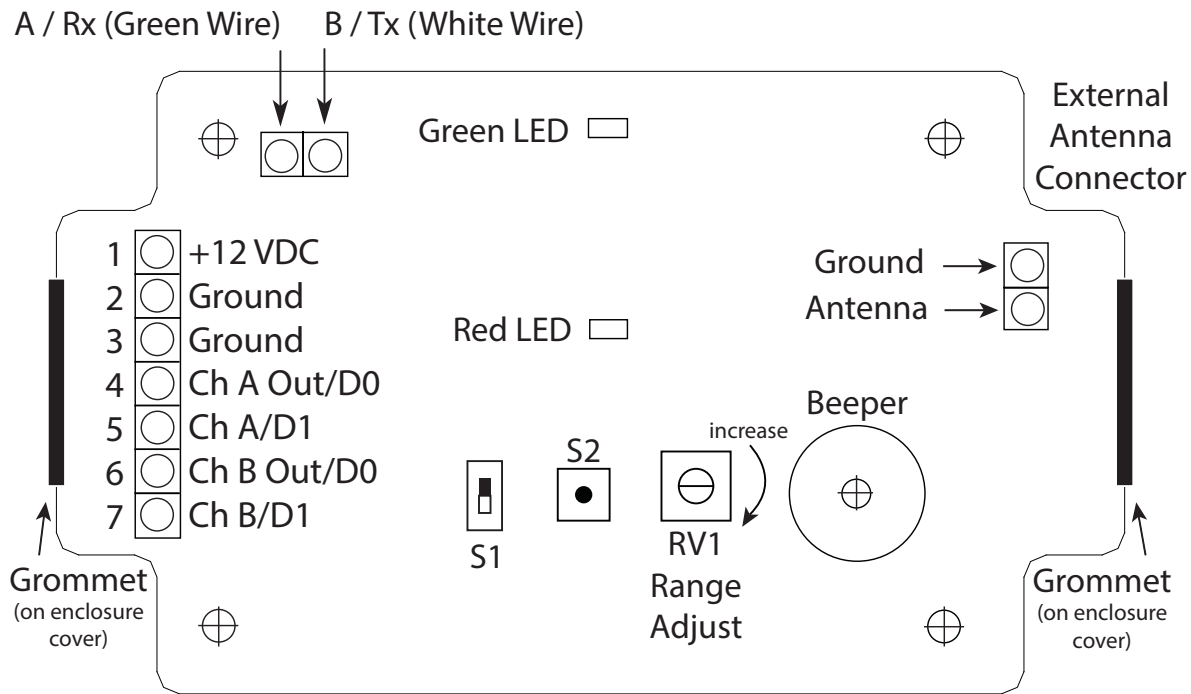


Figure 6: Receiver PCB

Table 2: RXR-10 Receiver Electrical Requirements

Parameter	Requirement
Power Supply Nominal DC Voltage	12.0 VDC
Voltage Range	11.0 VDC to 15.0 VDC
Nominal Current	100 mA
Recommended Power Supply	12 VDC @ 250 mA or greater, fully regulated, - Receiver can be powered by the host controller's 12 VDC supply

Keri recommends the following cable gauges:

- AWG 22 allows up to 500 feet
- AWG 24 allows up to 200 feet

Wire the Receiver to the access panel per the appropriate diagram in Section 7.3.

NOTE: The cable seals in the body of the Receiver enclosure are designed to accommodate one cable. Forcing more than one cable through these seals compromises the weather-tight seal, allowing water to enter the body of the enclosure.

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4.0 V-Track System Setup and Checkout

The Setup and Checkout process requires the use of an LRT-5 Transponder. The LRT-5 is equipped with an LED that flashes Red when in the coverage area of the Exciter. The Red flashing LED indicates that it is in the Exciter field and is shipping data to the RXR-10 Receiver.

Perform the following steps after you have installed and wired the V-Track system equipment:

1. Short together the Arming Input Low and High lines (the Brown and Blue wires) on the EX-10 Exciter.
2. Remove the cover from the RXR-10 Receiver and maximize Receiver sensitivity by rotating the range potentiometer (RV1) fully clockwise (see Figure 6).
3. Power up the Receiver and the EX-10 Exciter.
4. Hold the LRT-5 Transponder in your hand. By walking the area you can quickly determine the area of coverage. When the Red LED is blinking, you are in a covered area. If the LED stops blinking, you are out of the covered area. Proper orientation of the Exciter/Antenna can be quickly accomplished by using the LRT-5 as your test equipment (see Figure 7).
5. Correspondingly, while the Transponder is in the vehicle travel lane, the Receiver's green LED will blink off/on to indicate the Receiver recognizes the Transponder is within range and the Receiver's red LED will flash off every 20 seconds to indicate the Transponder's ID code was transmitted by the Receiver to the access control panel.

NOTE: In standard operation the Receiver sends Transponder ID data to the access control system every 20 seconds for as long as a Transponder remains in the Exciter's field. This feature, called Last Card Lock Out (LCLO), prevents the Receiver from overwhelming an access control system with repeated submissions of the same Transponder ID. In standard operation, when a new ID is received (when a new Transponder enters the vehicle travel lane), the Receiver will send the new ID immediately and apply LCLO to the new ID.

6. If the LED functions between Transponder and Receiver are not consistent, there is a problem with signal coverage in the vehicle travel lane. Verify the Receiver is within 100 feet of the desired coverage area (see Figure 5) and the Exciter is properly oriented (see Figure 2 and Figure 3) to cover the vehicle travel lane.
7. If the LED functions between Transponder and Receiver are consistent, you can further verify proper operation by presenting an LRT-5 Transponder into the vehicle travel lane and verifying the ID code being sent by the Receiver to the access control system is correct by comparing the ID code on the Transponder to the ID code displayed by the access control system software.
8. Remove the short between the Arming Input Low and High lines (the Brown and Blue wires) on the EX-10 Exciter.

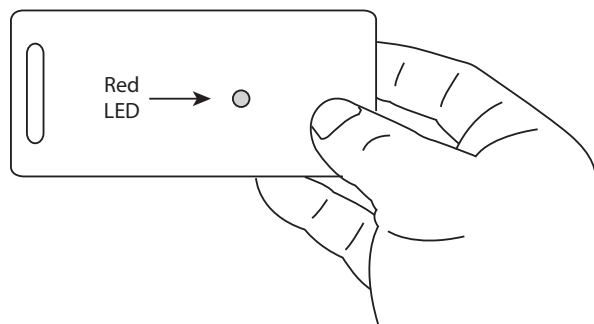


Figure 7: TT-1 Presentation Orientation for Field Test

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4.1 Receiver Sensitivity Adjustment

For installations of a single Receiver, it is typically fine to leave the sensitivity control at maximum (the factory default setting).

Installations that have access points 500 feet or less apart require Receiver sensitivity adjustment. Receivers are designed to be sensitive, long range devices to offer the best possible operation. As a result, if you have access points in reasonably close proximity the Transponder signal may be received by more than one Receiver. This results in incorrect system operation and must not be allowed to happen.

If your site has access points in close proximity, following the System Setup and Checkout procedure Keri recommends the following:

1. Remove the Receiver cover. There two LEDs, one Red and one Green (see Figure 6 on page 7). The Green LED blinks off when a Transponder is in range and the Red LED blinks off when a proper code is detected and data is shipped to the host controller.
2. Place your Transponder in the field of Access Point A. Make certain that the LED on the Transponder is blinking indicating proper operation. Now, look at any nearby Receiver other than that of Access Point A. If its Red LED is blinking, the sensitivity of that Receiver must be reduced by turning the control in a counter clockwise direction. Reduce this setting until the Red LED no longer blinks, then turn an additional 1-2 degrees for a safety margin.
3. This procedure needs to be repeated at all Receivers, until all Access Points have been tested. Of course this means that the Test Transponder will need to be placed at the antenna of each gate and all nearby Receivers checked for proper sensitivity settings.
4. When this is completed, test to make sure the Transponder is still seen on the desired Receiver. If it is not possible to reduce unwanted Transponder reads without degrading the desired signals, then the Receivers will need to be placed further apart.

With multiple gates, this task will take a few minutes per Access Point, but is well worth the time spent as it eliminates the possibility of a vehicle opening an Access Point other than the one it is entering.

4.2 Transponder Enrolling

The V-Track Transponders you receive should be in consecutive ID numbers with no breaks or missing numbers. Keri recommends enrolling these Transponders using the block enrollment feature provided by the Keri software (enrolling all consecutively numbered Transponders into the cardholder database at one time by number range). If you are intending to use learn enrollment (presenting Transponders to a reader one-at-a-time) please contact Keri Technical Support for information.

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5.0 LRT Vehicle Installation

Figure 8 shows the optimal placement of the Transponder in order of signal response performance. Install the Transponder using the provided double-sided tape or Velcro™ (see Figure 9 on page 10). Ensure the label-end of the Transponder is mounted away from the rear-view mirror's mounting post. Prior to installation, make certain the desired location complies with all state and local vehicle code laws. Optimal placement of the Transponder is behind the rear-view mirror, out of the driver's vision (Location 1, below).

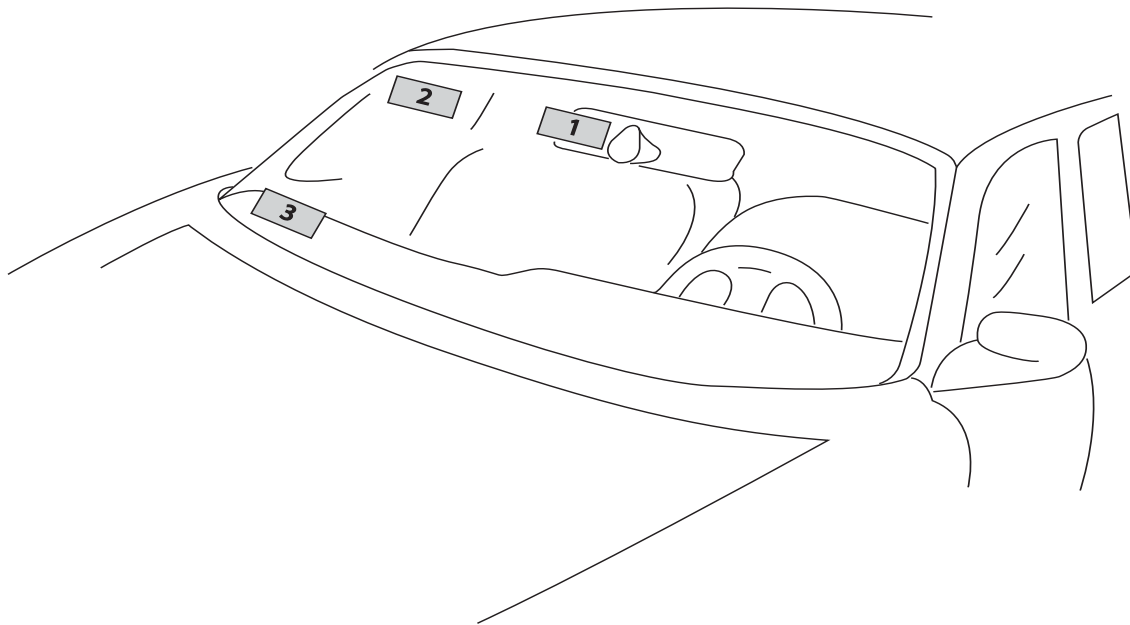


Figure 8: Optimal Transponder Installation Locations

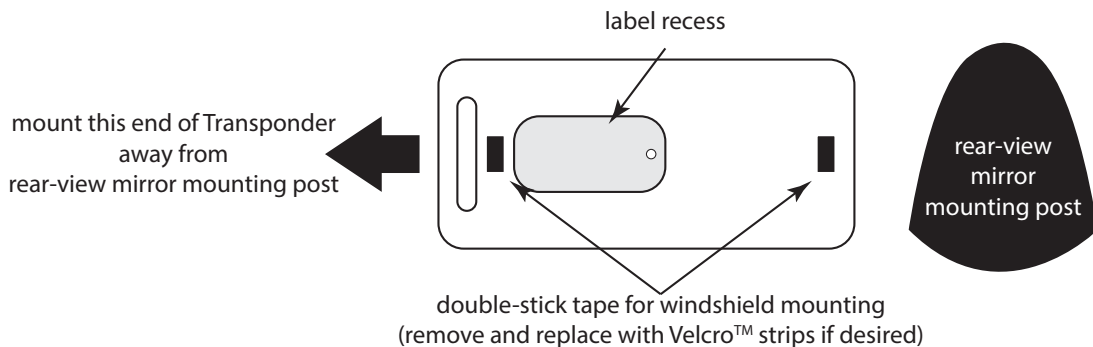


Figure 9: Transponder Mounting Tape

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6.0 Enter-Exit Lane Installation

The Keri RXR-10 receiver has the capability of controlling two EX-10 Exciters for Enter/Exit applications (see Figure 10). The EX-10 Exciter should arrive configured for your application from the factor. Labels on the Exciter cover identify individual units as either Single-Lane, Dual-Lane IN, or Dual-Lane OUT. Refer to Section 9.0 on page 20 should you need to reconfigure an Exciter for a new purpose.

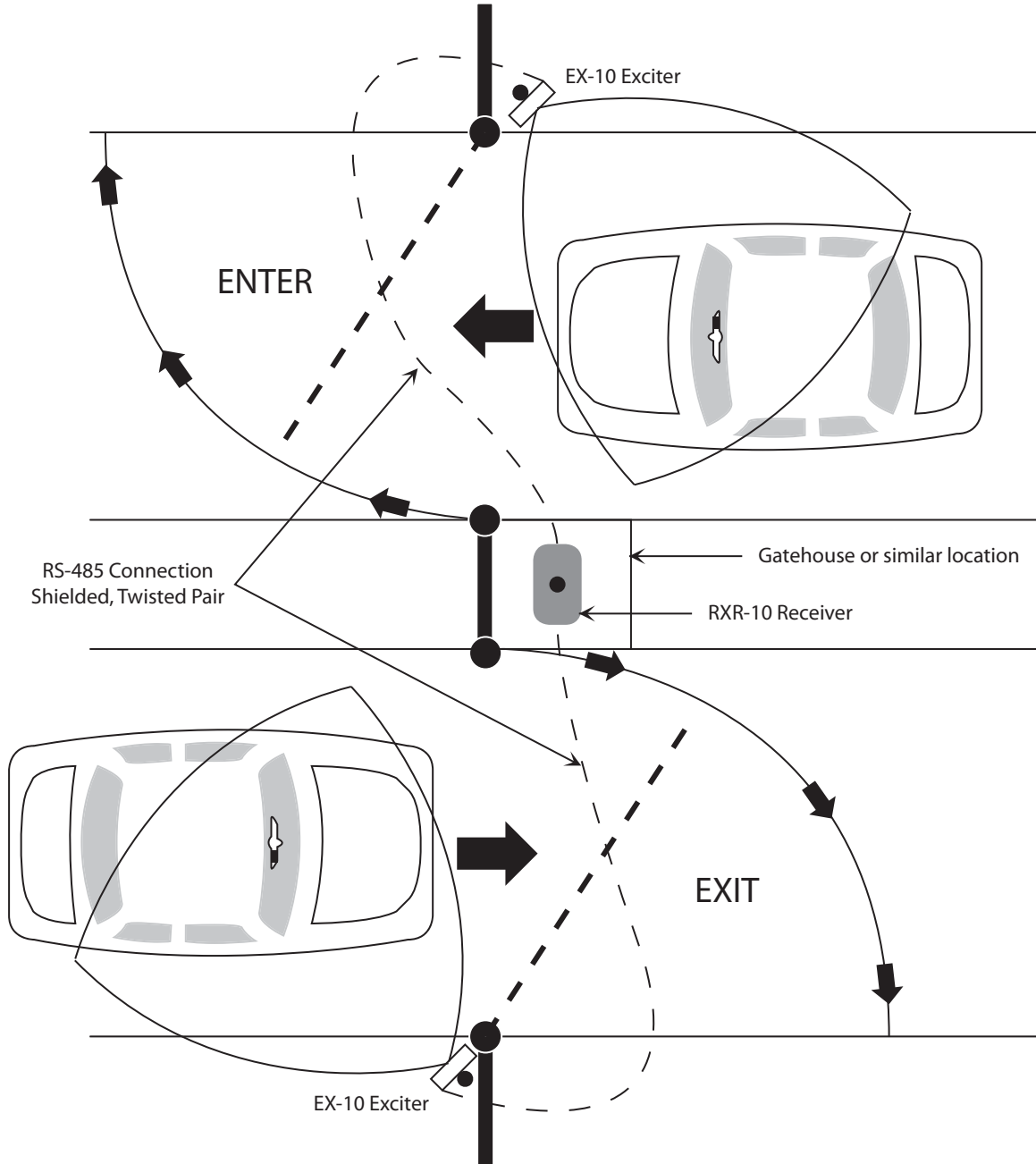


Figure 10: V-Track Enter-Exit Lane Application

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For Enter-Exit applications, the RS-485 electrical interface must be connected between the two EX-10 Exciters and the RXR-10 Receiver (see Figure 11 for a wiring diagram). The total length of the RS485 wiring must be less than 500 feet.

NOTE: The RS485 interface is only required for two-lane operation. Do NOT connect the RS-485 wiring when in single-lane operation.

6.0.1 System Checkout

The instructions provided in Section 4.0 apply for Enter-Exit operation; however, they need to be performed for each vehicle travel lane independently. You may consider reducing each Receiver's sensitivity to minimize interference between the vehicle travel lanes.

7.0 Wiring Diagrams

7.1 Dual-Lane Exciters to Receiver

This wiring connection applies to systems in Dual-Lane In/Out applications.

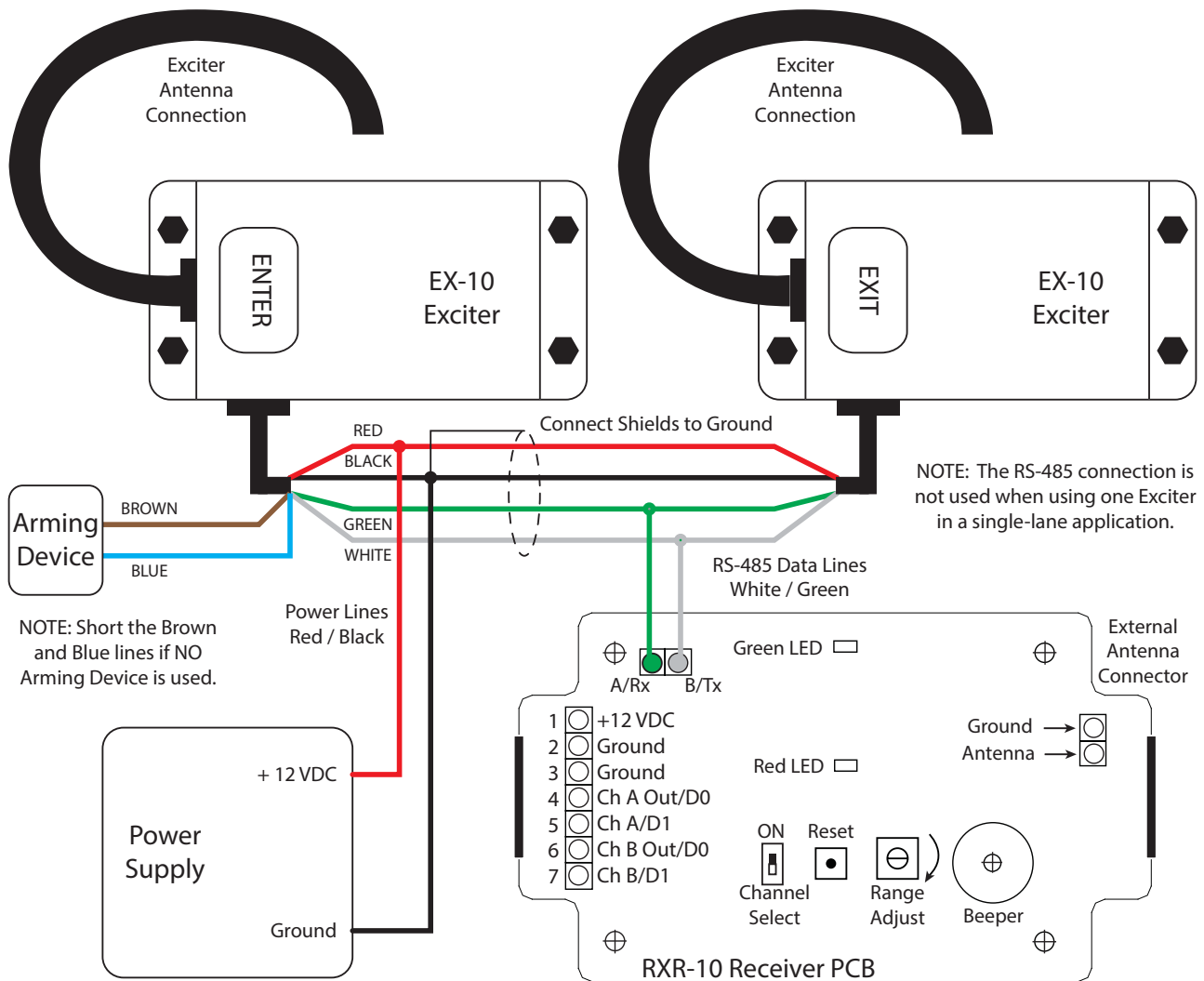


Figure 11: Dual-Lane Exciters to Receiver

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7.2 Single-Lane Exciter Connection

This wiring connection applies to systems in Single-Lane applications.

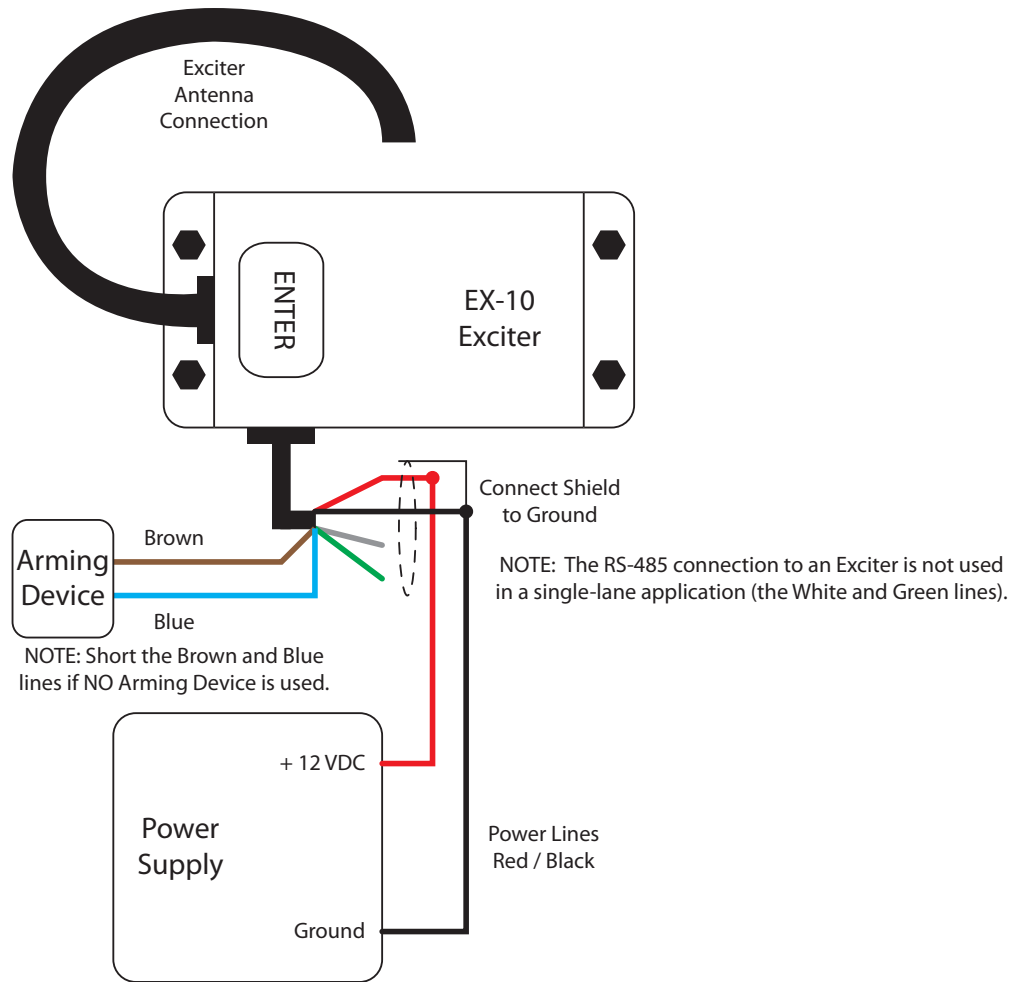


Figure 12: Single-Lane Exciter Connection

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7.3 Single Lane Applications

7.3.1 For PXL-P Controllers – Keri MS-Proximity

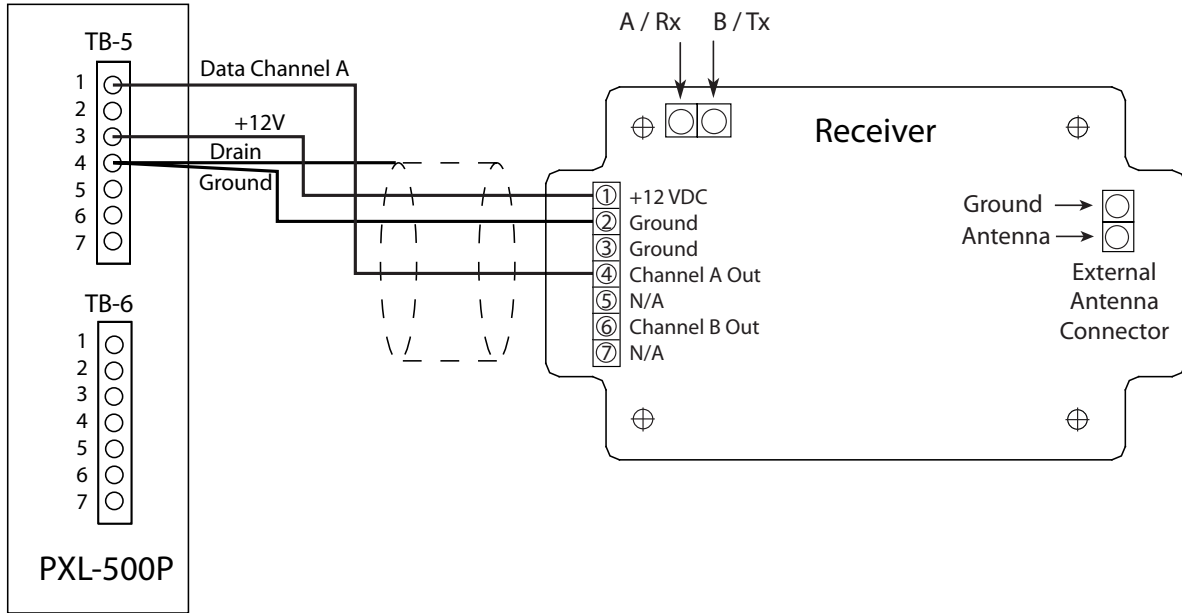


Figure 13: Receiver to PXL-P Controller – Single Lane Application

7.3.2 For PXL-W Controllers – Wiegand

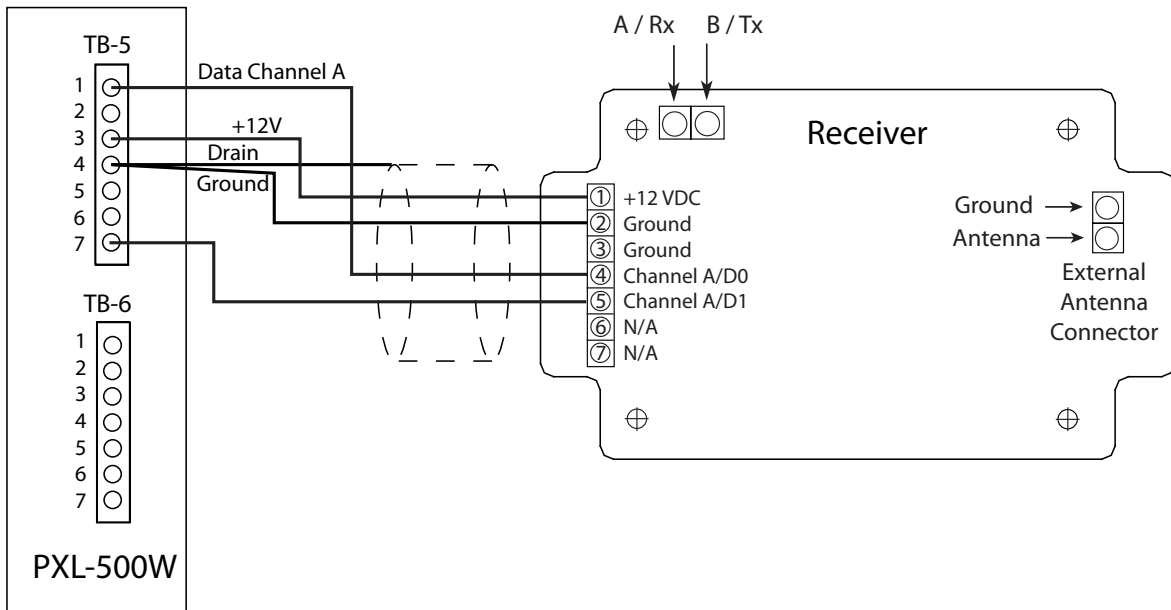


Figure 14: Receiver to PXL-W Controller – Single Lane Application

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7.3.3 For NXT Controllers via RIM – Keri MS-Proximity

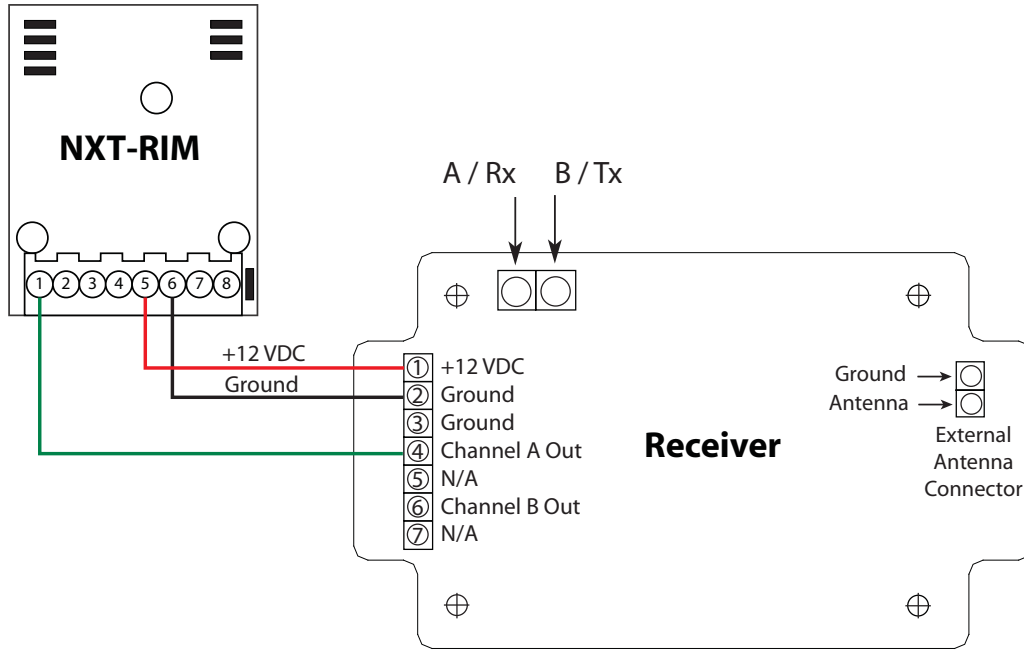


Figure 15: Receiver to NXT Controller via RIM – Keri MS-Proximity – Single Lane Application

7.3.4 For NXT Controllers via RIM – Wiegand

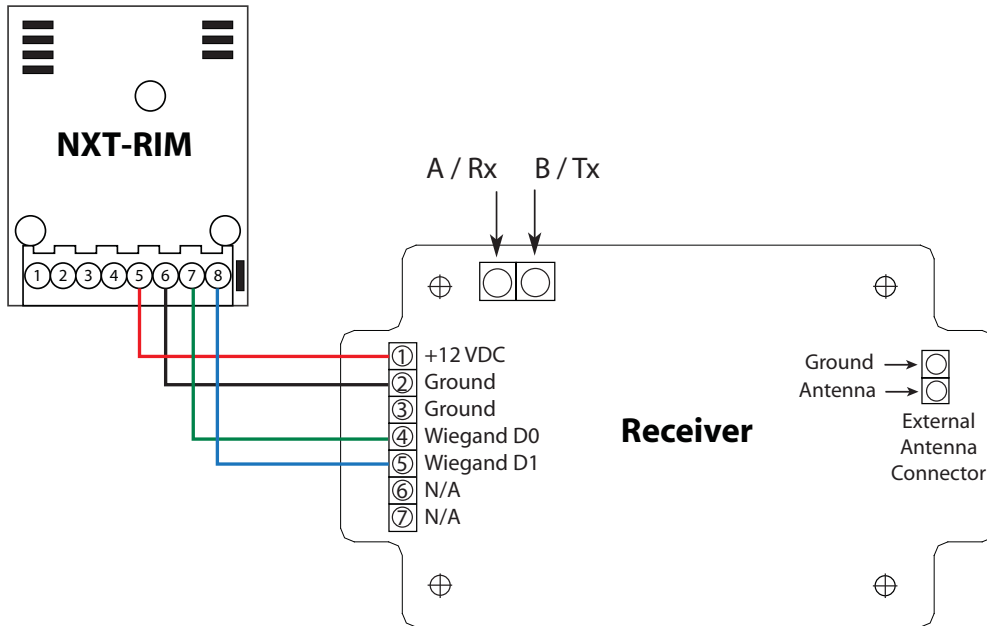


Figure 16: Receiver to NXT Controller via RIM – Wiegand – Single Lane Application

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7.4 Enter/Exit Two Lane Applications

7.4.1 For PXL-P Controllers – Keri MS-Proximity

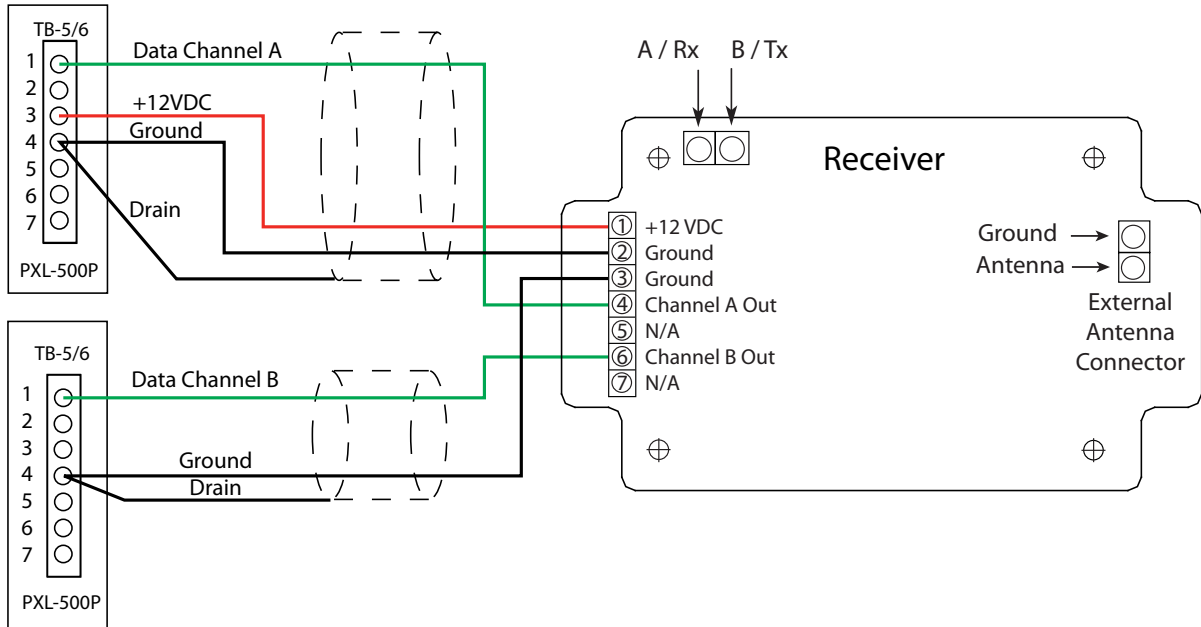


Figure 17: Receiver to PXL-P Controller - Enter/Exit, Two Lane Application

7.4.2 For PXL-W Controllers – Wiegand

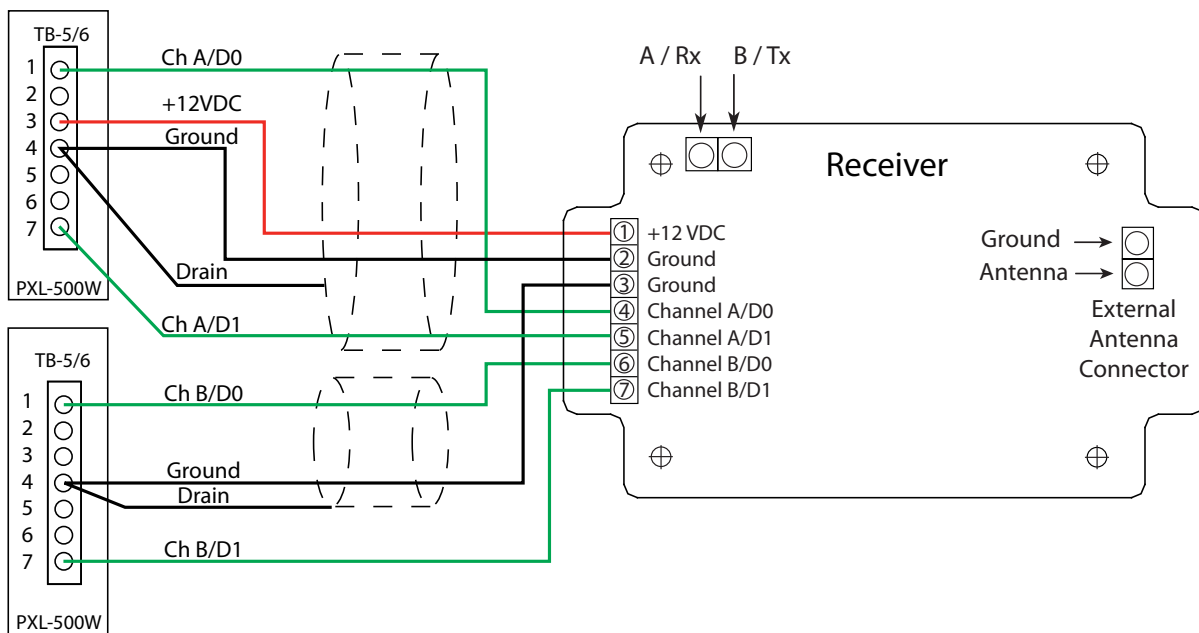


Figure 18: Receiver to PXL-W Controller - Enter/Exit, Two Lane Application

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7.4.3 For NXT Controllers via RIM – Keri MS-Proximity

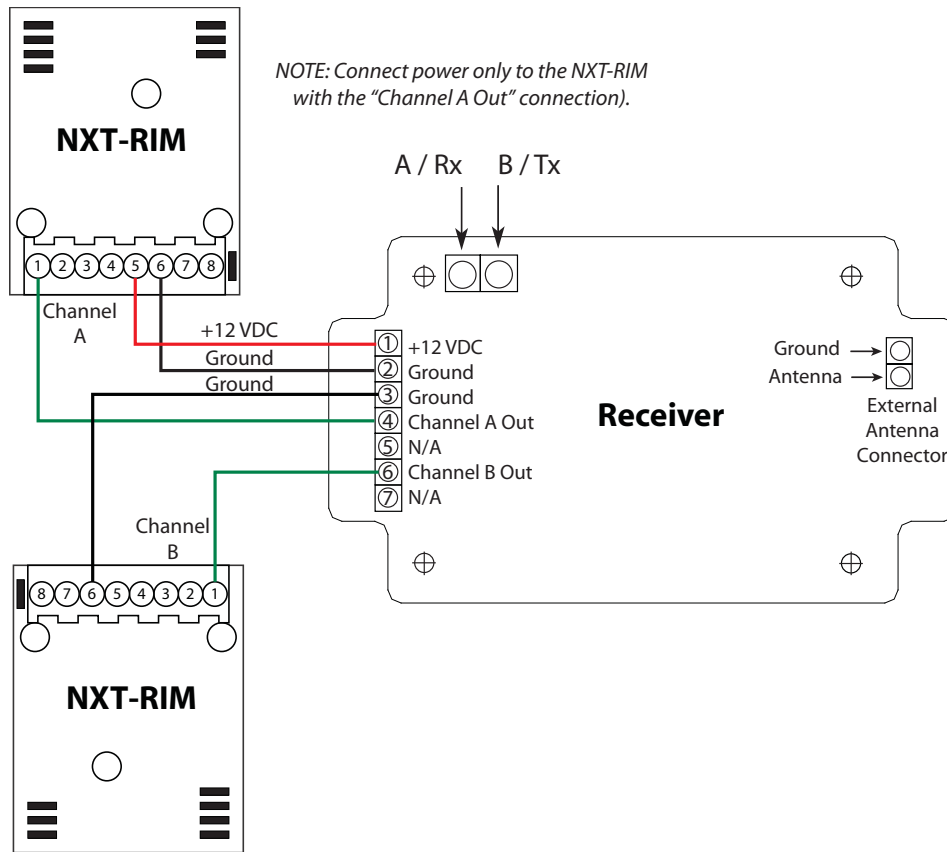


Figure 19: Receiver to NXT Controller via RIM – Keri MS-Proximity – Enter/Exit, Two Lane Application

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7.4.4 For NXT Controllers via RIM – Wiegand

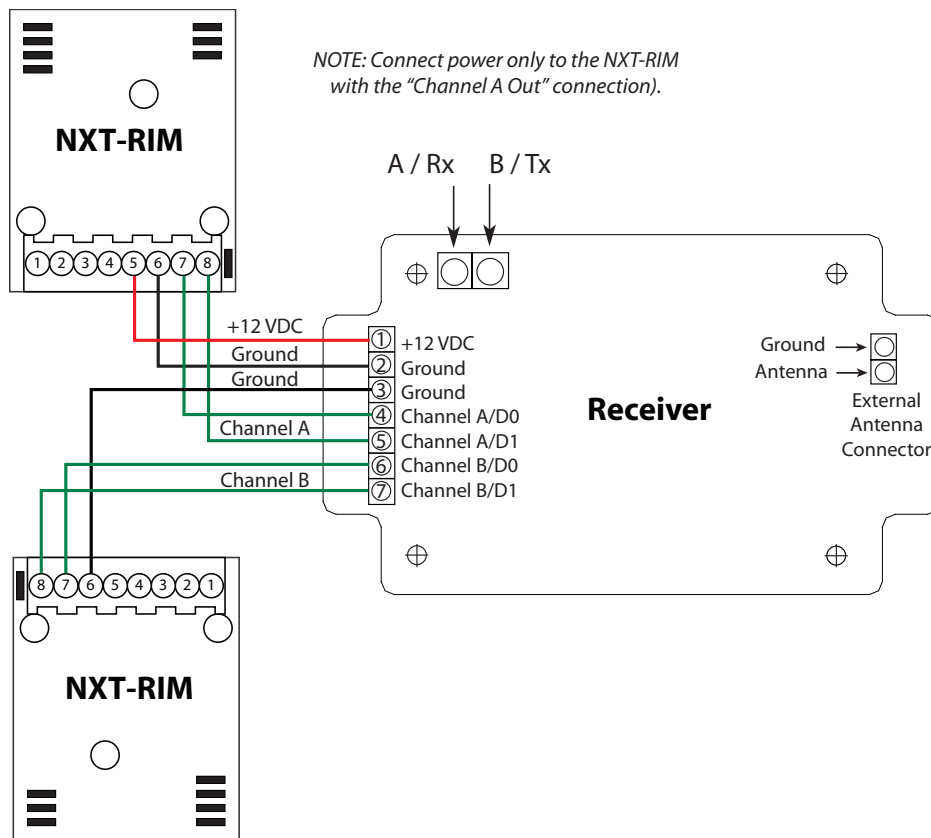


Figure 20: Receiver to NXT Controller via RIM – Wiegand – Enter/Exit, Two Lane Application

8.0 Troubleshooting Read Range Issues

This section will help you troubleshoot read range issues with the V-track system. You will need an LRT-5 Transponder to perform these steps. In order to resolve these issues it helps to understand the basic operation of the V-Track system. It consists of three parts:

- Antenna/Exciter
- Receiver
- Vehicle Tag

The antenna/exciter operates as a remote “switch” that activates the tag. Whenever the tag is in the field, it will transmit data. This is easily proven with the use of the provided test tag. For this portion of testing, no receiver is required.

When the tag is activated it will transmit the encoded ID number via an RF signal to the receiver.

The receiver can be located up to 100 ft from the vehicle being detected. When a signal with correct data is received, the receiver processes this and ships it to the host controller through the connecting data cable.

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8.1 Antenna/Tag Orientation

We sometimes encounter complaints that the read range varies widely – sometimes acceptable and sometimes almost useless. On several occasions it was determined that the antenna was installed in the vertical plane. The tags were being presented in the horizontal plane. While this does work with somewhat reduced range, it can easily become impossible for the installer to orient the antenna to provide the desired coverage area. Before starting we want to ensure that the antenna and tag are both oriented in the same polarity.

Orient the antenna in the horizontal plane. This is when the white coaxial cable exits the square antenna on the side. If it exits top or bottom it is polarized in a vertical mode. The tag is also horizontally polarized when held in the horizontal position.

Ignore the receiver and controller for now, our first concern is with the Exciter/Antenna and LRT-5 tag.

USE THE TAG! As explained in the installation instructions, you orient the antenna in the approximate direction of required coverage. Then you take the test tag and walk the area while watching for the LED blinking. So long as the LED is blinking you are in the “read” area. When the LED stops, you are outside the area. It may be necessary to adjust the antenna orientation a few times until you have the desired area of coverage.

NOTE: If the receiver output is used for this purpose, there is a 20 second delay between responses. This delay makes it almost impossible to rely on the receiver for orientation and testing purposes. This is why we recommend that you forget about the receiver until later in the testing process. This delay is a lockout function to prevent multiple reads from the same vehicle from unnecessarily filling the data base. If the vehicle has to wait a few seconds for the gate to open you would see many reads without the last card lockout. It is explained in more detail in the Installation Guide.

8.2 Using the Receiver as a Tester

When you are comfortable that you have the optimum area of coverage for this job, it is time to move on to the receiver. Place the test tag in an area where it is being activated by the exciter. Remove the cover from the receiver housing. You will see that the receiver is mounted on the cover. There is a red LED and a green LED. These are both illuminated constantly when the power is applied. They will blink off under the following conditions:

- Green LED blinks off when a signal from a tag is received.
- The Red LED will blink off when the receiver receives this signal and determines that it is a valid V-Track code. When the Red LED blinks off, the encoded data has been shipped to the receiver output port and will be transmitted over the connecting cable to the host controller.
- With the tag in the field the Green LED should blink quite often. The Red LED should blink every 25 seconds.

Each time the Red LED blinks, you should see the response at the controller. If there is no data received at the controller, you have an installation related problem, such as:

- Bad cable connection
- Data lines reversed
- Wrong wiring of data cable, crossed wires, etc
- Wrong type data output, Wiegand as opposed to Keri MS reader format
- Data cable connected to the wrong receiver output port
 - Channel A output is for single lane systems
 - Dual lane systems will transmit on both A and B outputs, corresponding to the lane in which it the tag was located

Once you are sure that the data is being received and seen at the controller, place a tag in the desired location of a vehicle. A quick test should show that it also works in the vehicle.

You should now have a working V-Track system.

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8.3 Points to Remember

The “Range” control on the receiver has absolutely no impact on the antenna power or its coverage area. This is a receiver sensitivity control that allows the receive range to be reduced to eliminate unwanted signals from other V-Track systems in the same general area. It only affects the usable distance between the vehicle tag and the receiver. It is recommended to set it at maximum if there are no other systems in the vicinity.

If it is necessary to mount the receiver in a housing, we recommend using a non-metallic box. Radio frequencies (RF) will not travel through metal. If it is necessary to use a metal housing, then an external antenna must be attached to the receiver.

9.0 Contact Keri Systems

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Web: www.kerisys.com	Web: www.kerisystems.co.uk
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