

# Multiprotocol Rail Reader Quick Start Guide



**TransCore**

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*Driving inefficiencies out of surface transportation through innovative solutions*

# FCC Site Licensing

Because the Multiprotocol Rail Reader (MPRR) radiates more than 3 milliwatts of RF power; its use requires licensing under Federal Communications Commission (FCC) Section 90 (M).

An FCC license provides the user with the legal authorization to operate the MPRR on the licensed frequencies at the site specified in the license. The FCC license also provides the user with protection and authorization to maintain the system should any other RFID product be used in the licensed area after the MPRR equipment is installed.

The FCC ID number is FIH05716.

Access the FCC Web site at [wireless.fcc.gov/index.htm?job=online\\_filing](http://wireless.fcc.gov/index.htm?job=online_filing) to obtain additional information concerning licensing requirements.

**NOTE:** For AAR-formatted tag operation of the MPRR, use continuous wave (CW) frequencies of 902.25 to 903.75 MHz and 910.00 to 921.50 MHz.

For TransCore Super eGo<sup>®</sup> (SeGo) mode operation, the authorized *modulated* frequency band for this product in the United States is 911.75 to 919.75 MHz. Only an authorized installer or service technician should set the RF frequency of the MPRR to the frequency specified in the FCC site license.

**WARNING TO USERS IN THE UNITED STATES  
FEDERAL COMMUNICATIONS COMMISSION (FCC)  
UNITED STATES TABLE OF FREQUENCY ALLOCATION STATEMENT  
47 CFR 2.105**

**NOTE:** This equipment can be set to frequencies NOT permitted for use within the U.S. and thus will not comply with FCC U.S. frequency allocation requirements at those frequencies.

**NOTE:** Users in all countries should check with the appropriate local authorities for licensing requirements.

Only authorized TransCore MPRR dealers, installers, or service personnel should attempt to install MPRRs. Once the system is set up and tested by the authorized installer, MPRR operation requires no end-user intervention.

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# Start with Site Design

You should develop your site plan BEFORE applying for FCC licensing, ordering equipment, and installing the MPRR. Factors to be considered include tag type, reader and tag alignment, reader and antenna mounting requirements, site layout and traffic flow, and electrical and communications requirements. If your site configuration differs significantly from the recommendations below, contact your TransCore sales representative. Reader/tag choice and site planning is discussed in detail in the *Multiprotocol Rail Reader System Guide*, which is available online at <http://www.transcore.com/downloads.shtml>. Select the MPRR System Guide from the RFID PRODUCTS > USER and INSTALLATION MANUALS drop-down menu.

## Reader Placement

MPRRs should be mounted inside an equipment hut or enclosure.

## Tag Placement

Tags should be mounted horizontally on the rail asset. See the *Multiprotocol Rail Reader System Guide* and the Association of American Railroads (AAR) Specification S-918 for tag placement recommendations.

## Site Layout and Traffic Flow

It is important to know the configuration of the site and its proximity to other sites to develop a correct site plan as well as a workable frequency plan.

The number of rail tracks at the site determines the number of antennas required and the distance between them. You must determine the distance between adjacent rail tracks.

## Frequency Plan

For AAR-formatted (CW) tag operation, sites with more than one MPRR in proximity should be configured with a frequency separation of at least 2 MHz from adjacent readers. If more than one MPRR is used in a multiple track application, the frequencies should be staggered. MPRR antennas can face each other across a rail track as long as they are multiplexed and controlled by the same MPRR. For installations where multiple antennas are controlled by a single reader but are not multiplexed, ensure that there is adequate frequency separation between the antennas. Contact TransCore Technical Support with any questions.



### Caution

***TransCore advises to locate antennas controlled by an MPRR at least 24 feet (7.3 meters) away from antennas controlled by another MPRR. There is no minimum spacing for antennas controlled by the same MPRR.***

Table 1 lists staggered reader frequencies.

**Table 1. Examples of Staggered Reader Frequencies for AAR-formatted Tag Operation**

Rail Number	Reader Frequency	Rail Number	Reader Frequency
1	911.5	2	918.5
3	913.0	4	915.0
5	921.5	6	917.0
7	910.0		

Table 1 lists staggered reader frequencies for use outside the U.S.

**Table 2. Examples of Staggered Reader Frequencies for Tag Operation Outside the U.S.**

Rail Number	Reader Frequency	Rail Number	Reader Frequency
1	865.25	2	866.25
3	865.50	4	866.50
5	865.75	6	866.75
7	866.00		

## Causes of RF Interference or Poor Performance

When designing your site plan, you must consider permanent structures and transient factors in the vicinity that may affect RF signals. Metal objects, walls, or even ice can reflect RF signals and degrade system performance.

Interference from RF and electrical sources also can degrade system performance. Fluorescent lights, neon signs, nearby radio stations, or power lines can interfere with the optimal operation of the system.

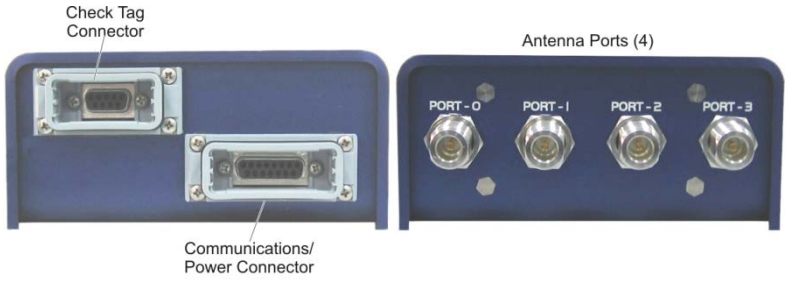
Existing sources of interference at the site should be shielded, removed, or positioned farther from the MPRR.

## Electrical and Communications Requirements

Measured voltage at the MPRR must be 16-20V AC or 16-28V DC for proper operation. RF cable length depends on the physical characteristics of the MPRR installation site. See the *MPRR System Guide* for detailed information.

## MPRR Connectors

The MPRR connects to external devices through Check Tag and Power/Communications connectors at one end of the enclosure and four RF antenna ports at the other end. [Figure 1](#) shows the connectors and ports.



HW-0420

**Figure 1. MPRR External Device Connectors**

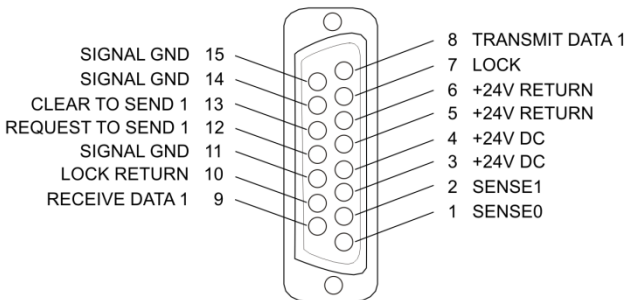
## Pre-Installation Testing

Once you have developed the site plan and frequency plan, you are ready to perform pre-installation testing of MPRR output power and tag read capability. The *Multiprotocol Rail Reader System Guide* discusses pre-installation testing in detail.

## Bench Testing the Reader

To bench test your reader you need an audible circuit tester, a compatible power/communications cable, a power source, an antenna and RF cable connected to PORT-0 on the MPRR, and a terminal. A laptop using a terminal emulation program such as Microsoft HyperTerminal can be used for most diagnostic test and reader command entry.

The MPRR uses a single 15-pin connector to interface to all external components except check tags. Power, input/output (I/O) interface, and communications signals are transmitted through this cable. [Figure 2](#) shows the MPRR power/communications port pin-outs.



HW-0415

**Figure 2. MPRR Power/Communications Connector Pin-outs**

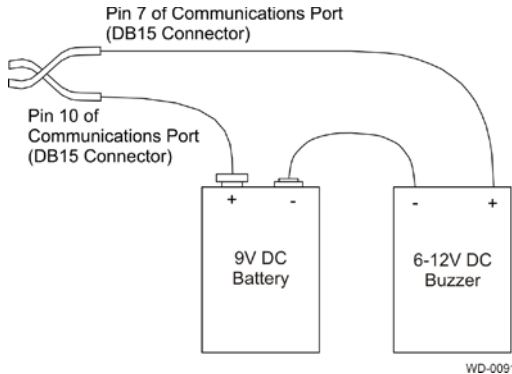
## 1. Connect all hardware as directed here.

- A. Connect the power wires from the cable to the transformer using the pin-outs shown in [Figure 2](#). (Do not apply power to MPRR at this time.)

The MPRR system can be powered by an 18V AC transformer or other external power source.

- B. You must next connect the external antenna(s) using an N-type connector. THE ANTENNA(S) MUST BE CONNECTED before powering up the reader. Any port not connected to an antenna must be terminated by a 50-Ohm ( $\Omega$ ) RF load rate at 10 watts continuous.

- C. Connect the leads from the audible tester to the tag lock wires of the power/communications cable ([Figure 3](#)).



**Figure 3. Wiring for Audible Circuit Tester**

- D. Connect the appropriate communications wires from the cable to a DB-9 connector for PC serial port connection.

## 2. Start the terminal emulation application Microsoft HyperTerminal by selecting Programs>Accessories>Communications>HyperTerminal and pressing ENTER.

In the dialog boxes choose the COM port to which the communications interface is attached and set the properties as follows:

- Bits per second: 9600 baud
- Data bits: 8
- Parity: None
- Stop bits: 1

- Flow control: None

**3. Power up the reader by plugging the transformer into an approved outlet. Verify reader sign-on message appears on laptop/computer display.**

Once the reader has been wired up and turned on (with the laptop connected), a sign-on message will appear signifying that the reader is communicating with the laptop. If startup is successful, the sign-on message appears as follows:

Model E4 Series [software version] SNSSSSSS  
[Copyright notice]

where SSSSSS is the serial number of the MPRR unit being used, skipping the fourth character etched in the reader housing.

At this point, you can input commands to the reader for testing, setup, and tuning.

**4. Input proper commands to test the reader. Commands will include those to set the tag read mode and turn RF ON (Table 3).**

**Table 3. Testing Commands**

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode
#647XXX	#Done <CR/LF>	Sets operating frequency
#6401	#Done <CR/LF>	Turns RF ON
#00 <CR>	#Done <CR/LF>	Returns reader to data mode

**5. Hold a tag in front of the RF PORT-0 antenna and make sure its data is read out on the computer screen.**

**6. If desired, input the following commands to return reader to factory defaults (Table 4).**

**Table 4. Return to Factory Default Commands**

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode
#66F	#Done <CR/LF>	Loads all factory default operating parameters except operating frequency
#00 <CR>	#Done <CR/LF>	Returns reader to data mode

## Installation at the Site

After pre-installation testing, using the site plan and frequency plan previously developed, you are ready to install the reader on site.



## 1. Confirm the following:

- All construction is complete and electrical and communications cables of the appropriate length are in place
- A dedicated power supply of the appropriate voltage is present
- The placement of the readers follows the site plan
- The antennas are the correct distance apart

Normally antennas are installed on either the side of the rail track.

## 2. Mount the MPRR to a solid wall in the enclosure oriented as shown in [Figure 4](#) with the RF antenna ports pointing down.

## 3. Connect all wiring as described in Pre-Installation Testing Step 1 on page 5.

Also connect sense input and sense output circuits using [Figure 2](#) as a guide.

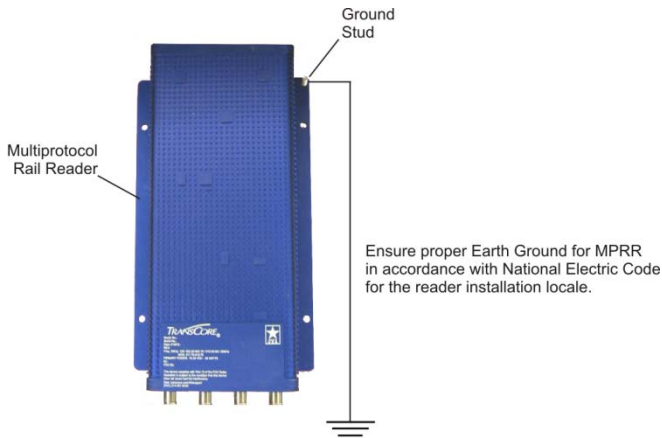
## 4. Start the terminal emulation application Microsoft HyperTerminal by selecting Programs>Accessories>Communications>HyperTerminal and press ENTER as described in Pre-Installation Testing Step 2 on page 5.

## Correct Reader Grounding

*For reliable reader operation, ensure that the reader is connected to Earth Ground. Do this by connecting the ground stud of the MPRR to Earth Ground. TransCore strongly advises that you follow the National Electric Code for surge protection for the locale where you are installing the MPRR.*



## 1. Ground the reader following the recommended grounding shown in [Figure 4](#).



WD-0093

**Figure 4. Correct MPRR Grounding**

- 2. Apply power and verify reader sign-on message appears on laptop/terminal display as described in Pre-Installation Testing Step 3 on page 6.**
- 3. Use reader commands to query status and set up the system to ensure the following:**
  - If multiple readers are used, ensure that the frequency separation between readers is sufficient and make sure that each reader is set to the proper settings.
  - Adjust antenna angle/reader power to optimize read zone for each reader.
  - Check for interference by each reader (or by the environment).
- 4. Enable MPRR mode (command #837).**
- 5. Enable the RF multiplexing ports that are to be used (commands #850 through #853).**
- 6. Disconnect the laptop and connect reader to back end devices and recheck the read zone and check for interference between readers.**
- 7. System-test the reader.**

Once all in-track testing is complete, perform a system test by walking past the front of the antennas holding a test tag that is mounted to a metal backplane to simulate a tagged rail asset passing by the antennas. The tag reads are sent to the back end system and evaluated for validity.

## Interface to Train Recording Unit (TRU™)<sup>1</sup>

The MPRR is designed to be used in conjunction with a rail wayside automatic equipment identification (AEI) controller, such as TransCore's TRU. The MPRR connects to the TRU via an RS-232 communication port at the bottom of the TRU (Figure 5).

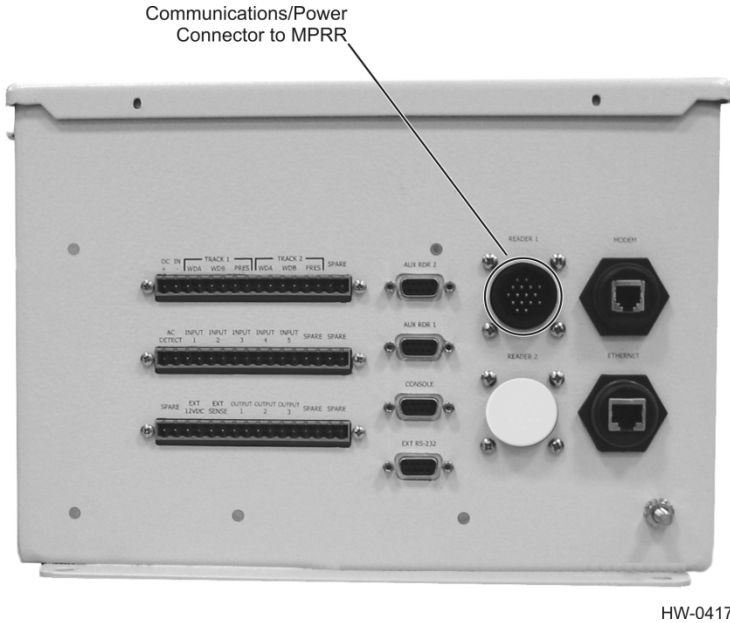


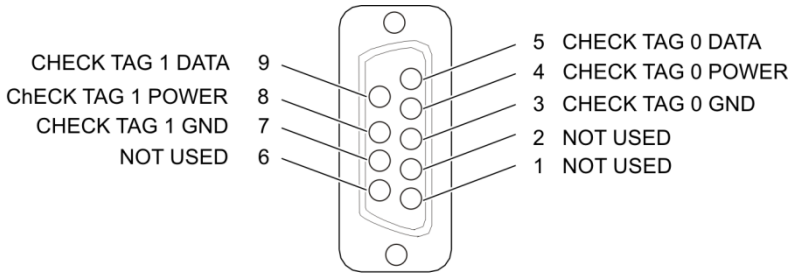
Figure 5. TRU Interface to MPRR

## Interface to Check Tag

The MPRR can power up to two AT5720 Check Tags through the Check Tag connector (see Figure 1). Figure 6 shows the pin-outs for this connector.

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<sup>1</sup> TransCore's TRU is available for use within the U.S. only.



HW-0421

**Figure 6. MPRR Check Tag Connector Pin-outs**

For detailed check tag cable assembly instructions, see the *Multiprotocol Rail Reader System Guide*, which is available online at <http://www.transcore.com/downloads.shtml>. Select the MPRR System Guide from the RFID PRODUCTS > USER and INSTALLATION MANUALS drop-down menu.

## Reader Commands

Table 5 provides the commands frequently used in testing, setting up, and tuning the MPRR. For a complete list of commands see the *Multiprotocol Rail Reader System Guide*.

**NOTE:** An “Error” reader response indicates that the command was entered incorrectly.

**Table 5. Frequently Used Reader Commands**

Enter	Reader Response	What It Does
#00	Done	Returns reader to data mode
#01	Done	Switches to command mode
#1005	Done	Set baud rate = 9600
#1010	Done	Use one stop bit
#1020	Done	Disable parity
#40	Done	Transmits all tag IDs without regard for uniqueness
#48N	Done	Select tag mode N = following numerical codes 0 = disable ATA 1 = enable ATA 4 = disable SeGo 5 = enable SeGo

Enter	Reader Response	What It Does
		8 = disable eATA 9 = enable eATA  <b>NOTE:</b> <i>MPRR will have tag modes specific to your model only</i>
#505	Model [model] Ver [version no.] SN [serial no.]	Display version
#520	PWRB Px R0 P0 = no power fail has occurred P1 = power fail has occurred	Display power fail bit
#521	RDID xx xx = 00–FF	Display reader ID number
#527	RFST Cx Ox Tx Fxxx Rxx Gxx Axx I04 C0 = RF controlled by host C1 = RF-by-input control O0 = RF off O1 = RF on T1 = uniqueness timeout of 2 min T2 = uniqueness timeout of 15 sec T3 = uniqueness timeout of 30 sec Fxxx = RF output frequency, 000 to 118 Rxx = ATA RF output range, 00 to 1F Gxx = SeGo RF output range, 00 to 1F Axx = RF power attenuation, 00 to 0A I04 = fixed	Display RF status
#570	ATA:_ eGo: _ SeGo: _ IAG: _ SORT: _ TMM0 I = ID (64 bits) E = enabled F = full transaction (eATA) D = disabled TMM0 = fixed	Display tag mode status
#610	Done	Select basic protocol
#6140	Done	Disable flow control
#63	Model [model] Ver [version no.] SN [serial no.] Copyright [date] TransCore	Reset reader
#6400	Done	Turn RF off
#6401	Done	Turn RF on
#641	Done	Select RF-by-input control
#643NN	Done	Set operating range for ATA protocol (distance); 00 = shortest

Enter	Reader Response	What It Does
#644NN (00 – 0A)	Done	Set attenuation in 1.0 dB increments; 0 to 10 dB
#645NN	Done	Set operating range for SeGo protocol
#647XXX (000 – 118)	Done	Set frequency from 860 to 930 MHz in new 0.25-MHz steps. The FCC approved <i>modulated</i> range is from OCF = 911.75 MHz to OEF = 919.75 MHz
#66F	Done	Load default operating parameters (except RF operating frequency)
#693F	Done	Set RF timeout = infinite
#836	Done	Disable MPRR mode
#837*	Done	Enable MPRR mode
#850	Done	Antenna port 0 only, no muxing
#851	Done	Antenna ports 0 and 1 muxing
#852	Done	Antenna ports 0, 1, and 2 muxing
#853	Done	Antenna ports 0, 1, 2, and 3 muxing

\*Sense lines must be used to turn on RF if MPRR mode is enabled.

For AAR-formatted tag operation of the MPRR, use the CW frequencies of 902.25 to 903.75 MHz and 910.00 to 921.50 MHz.

## Common Problems – Potential “Gotchas”

### Frequency interference between readers

Frequency interference may be caused by incorrect spacing and angle of antennas, incorrect frequency assignment, objects or changes in the environment, incorrect RF power settings, etc. See pages 2 and 3.

### Communications problems between the reader and back end host

These problems may be caused by incorrectly wiring the communications cable, using the wrong cable, having a cable run that is too long, or incorrectly setting communications parameters between host and reader. See pages 5 and 6.

### Cable run for RS–232 exceeds 20 feet in length

Twenty feet is the recommended length for RS–232 interface. If in a noisy environment, you may need to reduce the baud rate. For installations requiring RS-232 cables longer than 20 feet, contact TransCore Technical Support.

### **Long RF cable runs to antennas**

Long RF cable runs between the reader and the antenna may cause signal degradation or loss. This scenario may be site-specific. The *Multiprotocol Rail Reader System Guide* provides a table that summarizes reader-to-antenna coaxial cable performance.

### **RF is not on**

The technician must verify that RF is on by presence or on continuously. Command #527 may be used to verify RF status.

### **Reader not programmed correctly**

The technician must verify that all parameters are set appropriately for the reader location. Command #527 may be used to verify reader parameters.

### **Antennas pointed toward each other**

Antennas can be aimed directly facing each other or can be in close proximity; however, the antennas must be multiplexed by the same MPRR. For installations where multiple antennas are controlled by a single reader but are not multiplexed, ensure that there is adequate frequency separation between the antennas. Contact TransCore Technical Support with any questions.

### **Tag presentation**

Tags must be properly mounted in a location determined by the antenna placement.

### **Tag-to-antenna polarization**

Tag polarization must match antenna polarization. Tag and antenna must be installed horizontally polarized.

## **More Troubleshooting**

### **When performing a quick test of the MPRR, the buzz box does not buzz.**

Check all your wiring connections, and ensure that your buzz box is functioning. Connect the correct wire pair to the leads from the battery. Verify that RF is on (#6401).

### **When testing the MPRR, all the wires are connected correctly but the unit does not respond.**

Check that the MPRR communication cable is connected to the correct COM port. The MPRR echoes all keys that are typed on the PC keyboard. Verify that the reader is in the correct tag read mode (#48N). Contact Technical Support.

### **Strange signal responses come from the MPRR when tested with the PC.**

Ensure that the baud rate and parity setting on the host PC match the reader.

### **Nothing happens when the test tag is passed in front of the MPRR.**

Verify that the reader is in the correct tag read mode (#48N). Verify that the reader is set to RF ON (#6401).

### **The MPRR came from another site and does not work the way the factory defaults indicate that it should.**

Different commands were probably used to support the other site. You can restore the defaults by issuing command #66F. All factory defaults, except for RF operating frequency, will be restored.

Two easy ways to contact us:

- Call Dealer Technical Support at 505 856 8007
- Visit us on the Web at [www.transcore.com](http://www.transcore.com)

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