

TRU™ Train Recording Unit

Quick Reference Guide

16-0013-001 Rev D 5/19



This Quick Reference Guide is intended for use by authorized TransCore dealers, installers, and service personnel. After the system is set up and tested by an authorized installer, the TRU is designed to operate without intervention from the user.

This guide covers the installation of a Multi-Protocol Reader Extreme (MPRX) based TRU.

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FCC Site Licensing

Licensing is required for TransCore Readers used with the TRU System that radiate more than 3 milliwatts of RF power under Federal Communications Commission (FCC) Section 90.239.

An FCC license provides the user with the legal authorization to operate the MPRX¹ Reader system 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 TransCore Reader equipment is installed.

The site owner must complete and file form 601, FCC Application for Wireless Telecommunications Bureau Radio Service Authorization. Forms are available on line at <http://www.fcc.gov/forms>.

The authorized frequency band for this product in the United States is 902 to 904 MHz and 910 – 921.5 MHz.

¹ Refer to the MPRX User Guide for information on licensing requirements for the MPRX.

Getting Started

The TRU is a track controller composed of hardware and software that is installed at mainline rail locations as well as yard installations. The TRU system is designed as a direct unit replacement of existing track-side Automatic Equipment Identification (AEI) systems; on-site replacement will be a box-to-box unit swap out. The TRU records detailed information about trains, uses the information to create “consists” for the trains, and then transmits the consists to a host computer system. The TRU can also operate in “real time” mode where traffic is reported as it is read.

TRU LED Indicators

The TRU continuously performs self-diagnostics while the system is turned on (power light on). The TRU has LED indicators that show whether or not the antenna channels are active (Search 1 and Search 2) as well as a Tag Lock indicator that is lit when a valid tag is seen on either antenna channel. An audible signal device (buzzer) sounds whenever the Tag Lock indicators are lit. The TRU also has lights indicating controller (system) status. The front panel LEDs indicate that the TRU has power, and also shows that the wheel detector segments A and B are receiving signals (WDA and WDB) as a train passes by.

In normal operation, one TRU will be configured to cover one track. In this configuration, the TRU will interface to one Multi-Protocol Reader Extreme (MPRX) through the Reader 1 connection on the bottom of the TRU as well as to the track wheel detector and presence detector via the 16-pin Main Block Phoenix connector. In this configuration, all LED indicators will be seen inside the TRACK 1 block on the front panel of the TRU. The LED indicators are shown in [Table 1](#) :

Table 1 TRU Front Panel LEDs - Single Track MPRX (Single MPRX)

Top Panel Lights	Default	Error Condition	What It Means
Power	ON	OFF	TRU is powered up
System	ON	OFF	TRU is operational
TRACK 1 LEDs			
WDA – Track 1	Flashing ON with wheel detect	No flashing during wheel detect	Wheel Detector segment A signal on Track 1
WDB – Track 1	Flashing ON with wheel detect	No flashing during wheel detect	Wheel Detector segment B signal on Track 1
PRES – Track 1	On with track presence	Off with track presence	Track 1 presence detector senses a train
TRACK 1 SRCH AND LOCK LEDs			
Search 1 – Track 1 (SRCH1)	ON with Reader 1 RF On	OFF during Reader 1 RF On	Any Reader 1 Antenna activated
Search 2– Track 1 (SRCH2)	Not Used with MPRX	Not Used with MPRX	Not Used with MPRX
Tag Lock – Track 1	ON with Reader 1 tag read	OFF during Reader 1 tag read	Any Reader 1 antenna is reading a tag

In certain situations such as slower speed track sites, one TRU may be configured to cover two tracks. In this configuration (**Figure 1**), the TRU will interface to one Multi-Protocol Reader Extreme (MPRX) through the Reader 1 connection on the bottom of the TRU as well as to the track wheel detectors and presence detectors via the 16-pin Main Block Phoenix connector. In this configuration, the LED indicators for the Track 1 wheel detector and presence detector will be seen inside the TRACK 1 block on the front panel of the TRU; LED indicators for the Track 2 wheel detector and presence detector will be seen inside the TRACK 2 block.

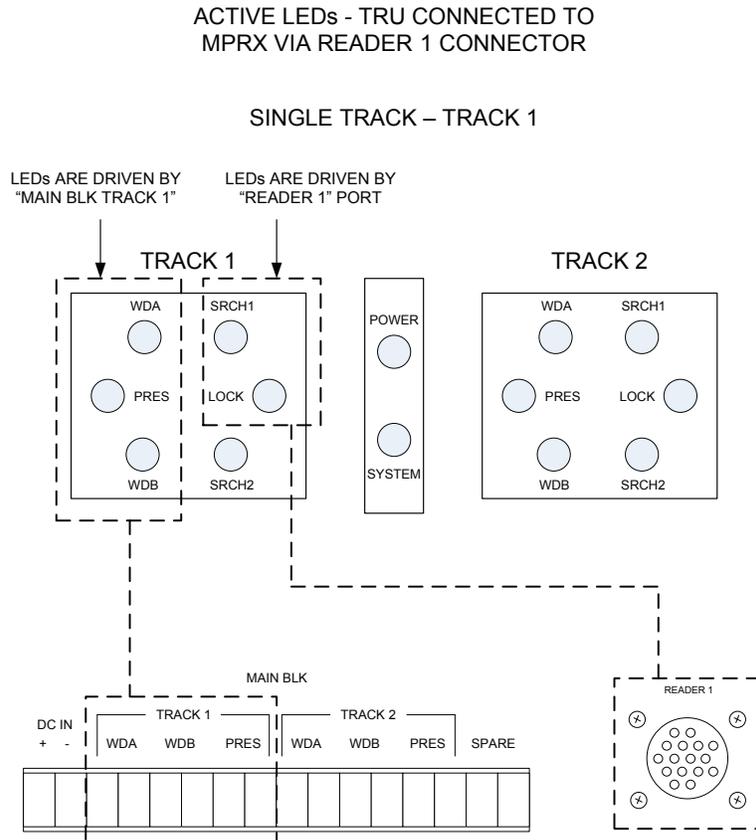


Figure 1 Single Track – Track 1

NOTE: Since a single MPRX is used in this two track scenario, the TRU will route all RF signals from the MPRX to the Search 1 (SRCH1) and Lock LEDs in the TRACK 1 block, independent of whether the RF signal is coming from Track 1 or Track 2. The TRACK 1 SRCH 1 and LOCK LEDs will illuminate for activity on either track. The TRACK 2 SRCH and LOCK LEDs will not illuminate. These LEDs are for used for a different application.

The LED indicators are shown in [Table 2](#).

Table 2 TRU Front Panel LEDs - Dual Track MPRX (Single MPRX)

Top Panel Lights	Default	Error Condition	What It Means
Power	ON	OFF	TRU is powered up
System	ON	OFF	TRU is operational
TRACK 1 LEDs			
WDA – Track 1	Flashing ON with wheel detect	No flashing during wheel detect	Wheel Detector segment A signal on Track 1
WDB – Track 1	Flashing ON with wheel detect	No flashing during wheel detect	Wheel Detector segment B signal on Track 1
PRES – Track 1	On with track presence	Off with track presence	Track 1 presence detector senses a train
TRACK 2 LEDs			
WDA – Track 2	Flashing ON with wheel detect	No flashing during wheel detect	Wheel Detector segment A signal on Track 2
WDB – Track 2	Flashing ON with wheel detect	No flashing during wheel detect	Wheel Detector segment B signal on Track 2
PRES – Track 2	On with track presence	Off with track presence	Track 2 presence detector senses a train
SRCH AND LOCK LEDs (TRACK 1 LEDs COVER BOTH TRACKS)			
Search 1 – Track 1 (SRCH1)	ON with Reader RF On (Track 1 and/or Track 2)	OFF during Reader RF On	Any Reader Antenna activated (Track 1 and/or Track 2)
Search 2– Track 1 (SRCH2)	Not Used with MPRX	Not Used with MPRX	Not Used with MPRX
Tag Lock – Track 1	ON with Reader valid tag read (Track 1 and/or Track 2)	OFF during Reader tag read	Any Reader antenna is reading a valid tag (Track 1 and/or Track 2)
TRACK 2 SRCH AND LOCK LEDs ARE NOT USED FOR MPRX.			

External Interfaces

The TRU interfaces with a Multi-Protocol Reader Extreme (MPRX) via the 16-pin multi-conductor circular connector (named Reader 1) on the bottom of the unit (Figure 2).

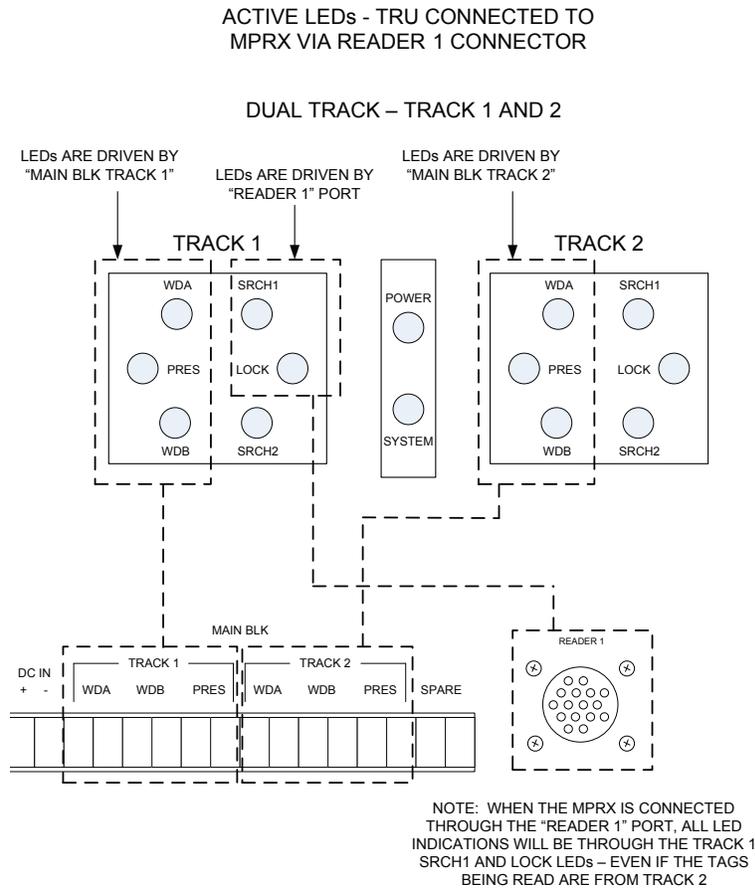


Figure 2 Active LEDs – Dual Track – Track 1 and 2

The TRU is configured with four (4) serial ports and one (1) Ethernet port (Table 3). The Ethernet port is a dedicated port that is always connected, and is the main interface between the TRU and the outside world. The serial ports include two (2) auxiliary data ports for interfacing to peripheral equipment at the site, as well as a local bidirectional COM port for direct on site interface to the TRU and an output only serial port for monitoring data traffic.

Table 3 Communications Ports

Port	What It Does
AUX RDR 1	Output only – echo of the main serial data output – Reader 1
AUX RDR 2	Output only – echo of the main serial data output – Reader 2
CONSOLE	Local Laptop Port for direct on-site laptop connection to TRU
EXT. RS-232	Auxiliary serial port for communication between TRU and external devices
Ethernet	10/100Mbps port for connection to a local network or to other TRU units

The TRU also provides three 16-Pin Phoenix-type connectors for digital input/output (D I/O) for wheel detector inputs, AC voltage monitor, and track presence detectors (Table 4).

Table 4 External Device Ports

Port	What It Does
Reader 1	Direct connection to MPRX 1
MAIN Terminal Block	Inputs from Track 1 and Track 2 – WDA, WDB and Presence; +24VDC in from Battery Charger
AUX Block 1	Auxiliary Inputs 3 through 6 from external devices
AUX Block 2	Auxiliary outputs 2 through 4 to external devices; Sense Output, +12VDC out

Electrical and Communications Requirements

The TRU operates off the same battery charger-generated voltage (24VDC) as does existing track-side AEI equipment. Communication to the TRU is via Ethernet (network connection).

Installing the TRU

The TRU is designed to be a direct replacement of existing track-side AEI equipment. As wiring and connectors are removed from the existing equipment, they will be reconnected to the TRU.

Required Tools

To install the TRU, you need standard tools and fasteners for installing the unit on the wall (drill, bolts, wrenches, etc.), an audible circuit tester, a compatible power/communications cable, and a PC. A laptop using a terminal emulation program such as Microsoft HyperTerminal can be used for most diagnostic test and TRU command entry.

Confirm the Following:

Confirm that all necessary pre-existing wiring is accounted for, in place and in good working order. Check external wiring for any kinks, frayed wires or any other defects.

Mounting the TRU

The TRU will normally be placed in the spot where the existing AEI equipment was removed.

To mount the TRU

1. Using the back of the TRU as a guide, mark the placement of the four (4) mounting holes. Once the hole placement is determined, use a 3/8 inch drill bit to drill four (4) holes for mounting the TRU.
2. Mount the TRU by screwing it directly to the existing plate using 3/8 inch bolts or screws.

Connecting the Multi-Protocol Reader Extreme(s)



Caution

Before making any connections between the TRU and the MPRX, verify that the MPRX is connected to the external antennas via its N-type connectors. Failure to verify this connection may result in damage to the MPRX.

To connect the MPRX

1. Verify that the MPRX is connected to the appropriate track-side antennas via coaxial cable.
2. Connect the MPRX to the TRU Reader 1 port using the supplied TRU-to-MPRX cable.

Connecting Power

The TRU uses the existing +24VDC power as wired from the +24V battery charger output.

To connect the power

1. Connect the cable as follows:
 - MAIN Block Pin 1: +24VDC in
 - MAIN Block Pin 2: +24VDC return
2. Power up the TRU and confirm that the front panel POWER and SYSTEM LEDs are on (green). It may take a couple of minutes for the SYSTEM light to come on.

Connecting the Wheel Detector Segments

During passage of a train over the TRU site, the system uses information from the wheel detectors to recognize the presence of a car or a locomotive, and discriminate between various types of equipment. For wheel detection, the TRU uses the Tiefenbach G84/97/24 wheel detector amplifier, connected to the MAIN Terminal Block.

Connect the G84/97/24 wheel detector amplifier

1. Connect the cable as follows:
 - MAIN Block Pin 3: WDA+ wheel detector input
 - MAIN Block Pin 4: WDA- wheel detector input
 - MAIN Block Pin 5: WDB+ wheel detector input
 - MAIN Block Pin 6: WDB- wheel detector input
2. Once powered up, amber LEDs on each designated wheel detector input channel of the G84 will come on, showing that the selected channel is operational.

Test the TRU Wheel Detector LEDs (Track 1/Reader 1)

1. With the TRU turned on, lay a coin on the SII side of the Tiefenbach wheel detector transducer. The WDA+ output channel LED on the G84 amplifier and the Track 1 WDA LED on the TRU should light.
2. Remove the coin. The Track 1 WDA LEDs on the TRU and G84 amplifier will extinguish.
3. Lay a coin on the SI side of the wheel detector transducer. The WDB+ output channel LED on the G84 amplifier and the Track 1 WDB LED on the TRU should light.
4. Remove the coin as in step 2 and verify that the LEDs go off.

For Track 2/Reader 2 (if installed), repeat steps 1-4 for that track.

Connecting and Testing the Presence Loop

The AEI system can provide a digital input consisting of an active “low” (GND) on a designated terminal to indicate a train presence to the TRU. The TRU begins to collect data for a train as soon as the presence detector indicates that a train is present or a wheel detector indicates that a wheel has been detected. The TRU determines that a train is no longer present when the presence detector indicates that a train is no longer present (GND removed), or after a configurable amount of time has passed with no new wheel detector data, if there is no input from a presence detector.

Connect the presence detector (loop type)

Connect the cable as follows:

- MAIN Block Pin 7: PRES IN presence detector input
- MAIN Block Pin 8: GND Chassis Ground

Test the loop using standard digital loop detectors

1. Set the loop detector to a sensitivity value of “9” and lay a piece of metal on the track loop wire. The LED on the loop detector and the TRU Search LEDs should light indicating train presence.
2. Remove the metal piece. The LEDs should turn off indicating that train presence has cleared.
3. Reset the loop detector sensitivity to “1” for normal operation.

Connecting Communications

The TRU supports both remote and local communications.

Ethernet Connection

The TRU has an Ethernet port for connection to a local network to enable communication between the TRU and the back office.

Local Communications

For local communications (direct to a laptop computer) the TRU has a bi-directional serial COM port designated “CONSOLE”. Using a laptop, the technician can access the TRU user interface in real time. This port is a nine (9) pin “D” type connector.

Correct Grounding

The TRU is designed to be installed in the existing track-side HUT and uses the existing earth ground resident in the HUT. The TRU has grounding lugs and loops for this purpose. Ground the TRU following the recommended grounding shown in [Figure 3](#). The actual HUT at a specific site may differ from this illustration.

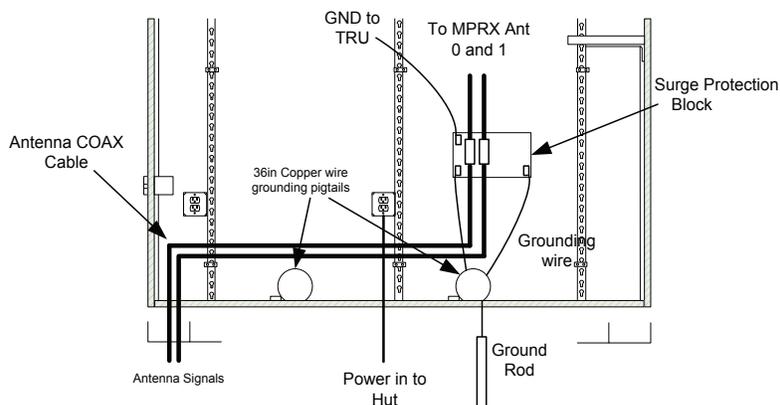


Figure 3 Grounding Diagram

Figure 4 shows a typical HUT exterior.

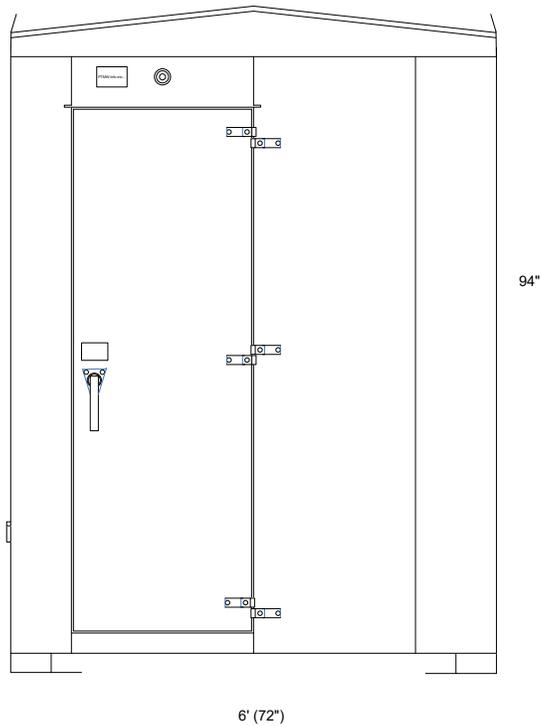


Figure 4 TRU Trackside Hut Exterior

Figure 5 shows the interior of a typical HUT.

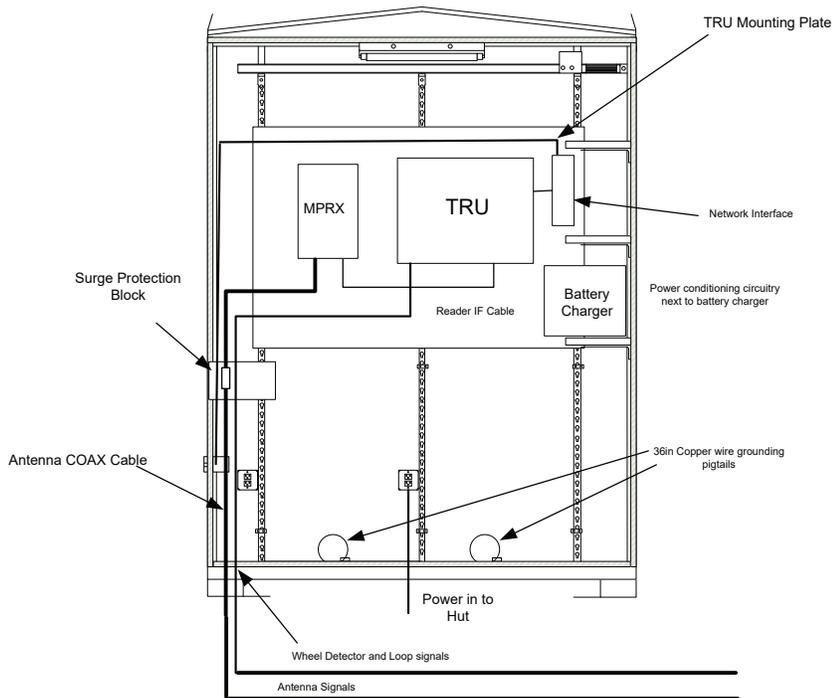


Figure 5 TRU Trackside Hut Interior

Figure 6 provides an interface wiring diagram for the TRU.

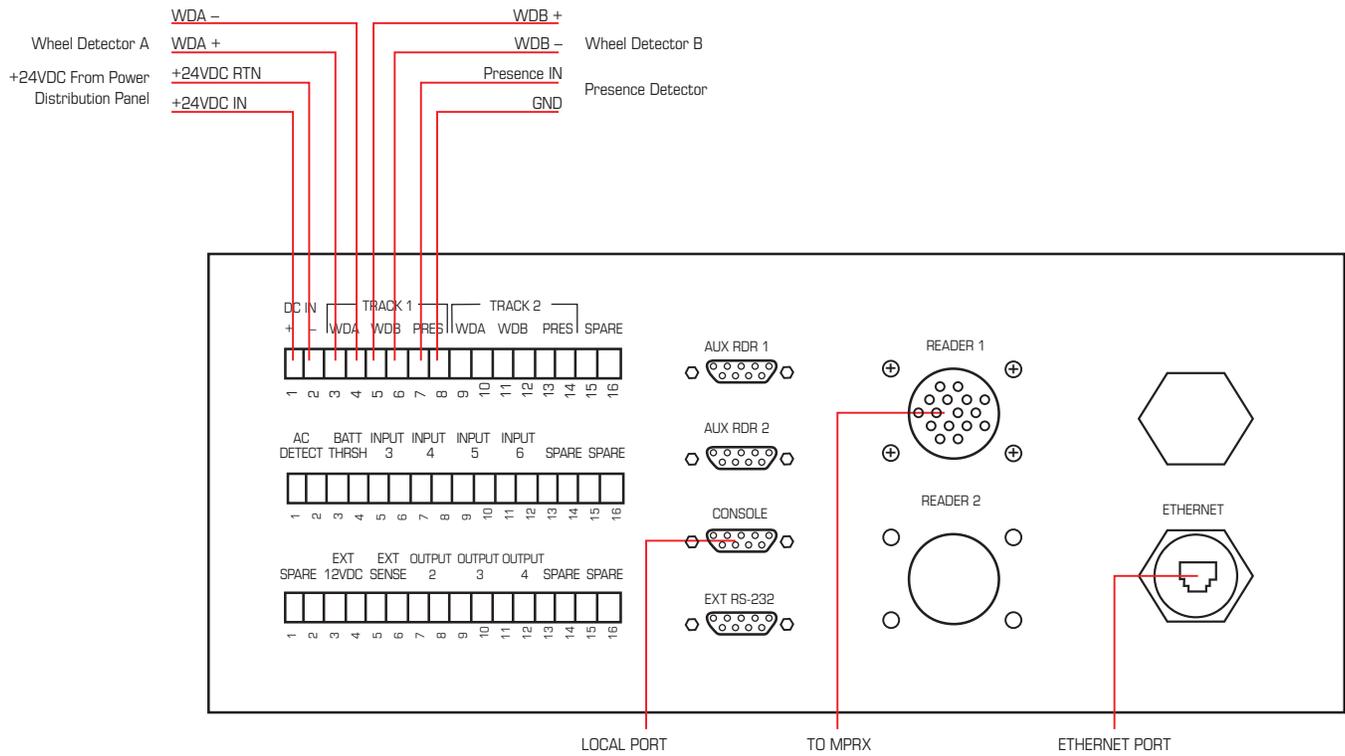


Figure 6 TRU Interface Wiring Diagram

Installing the Optional TRU Switch

The optional TRU switch offers the capability to manually disable the reporting function. When the switch is in the ENABLE position, all trains that pass through are reported. When the switch is in the DISABLE position, no trains are reported.

Refer to **Figure 7** for a diagram of the switch and TRU terminal.

1. Connect **Pin 1** of the switch to **Pin 3 (EXT 12VDC +)** on the lowest terminal block found on the TRU.
2. Connect **Pin 2** of the switch to **Pin 9 (INPUT 5+)** on the middle terminal block found on the TRU.
3. Connect **Pin 10 (INPUT 5-)** on the middle terminal block found on the TRU to **Pin 4 (EXT 12VDC-)** on the lowest terminal block found on the TRU.

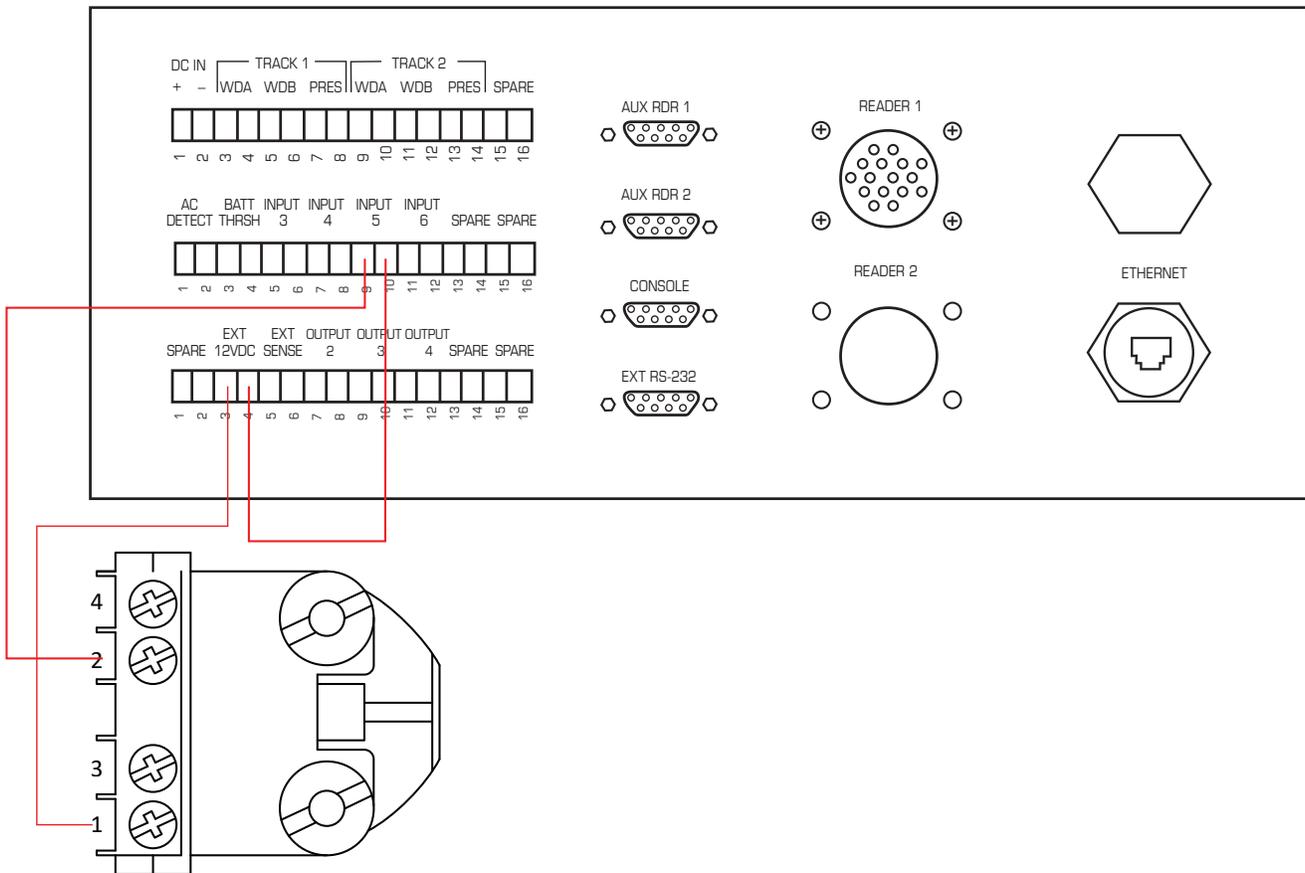


Figure 7 TRU Terminal and Switch Diagram

Accessing the TRU User Interface Main Menu

The following describes the steps to communicate with the TRU User Interface.

1. Connect a laptop computer to the TRU via the CONSOLE port and start the terminal emulation application Microsoft HyperTerminal or equivalent.

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
2. Power up the TRU and verify reader sign-on message appears on laptop/computer display.
 3. Once the TRU has been wired up and turned on (with the laptop connected to the CONSOLE port), a sign-on message will appear signifying that the reader is talking to the laptop.
 4. At the login prompt enter your Username and Password.
 5. For access to all of the menus within the Main Menu you will need to login as a super-level user. To login as a super-level user type in Username: super1 and Password: Super1. Letter case is important.
 6. At this point, you can enter commands into the reader for testing, set up, and tuning.
 7. Input proper commands in order to access the TRU.
 8. The TRU Main Menu consists of four user commands (1 – 4) and two navigation commands; “X” and “CMD?” (Figure 8).

```

TRAIN RECOGNITION UNIT
MAIN MENU

Site:          UNKNOWN
Welcome:       Oz
Login time:    Wed 01/06/10  11:01:31

Software Version: V0.08
Reader Status:  Status here
Host Reporting Status:  Status here
Last Login:
Train Recording Message:  Message here

1.  SITEMNT      Site Maintenance Menu
2.  FILEEXCH    File Exchange Menu
3.  CONFIG      Configuration Menu
4.  RPTS        Reports Menu
   X            Exit TRU
   CMD?        Help

Enter> █

```

Figure 8 TRU Main Menu

Entering the Site Maintenance Menu (SITEMNT)

The Site Maintenance Menu is entered from the Main Menu by either typing “SITEMNT” or the number “1”. This command, as well as many others, is also accessible from any other menu when typed out (Table 5).

Table 5 Testing Commands

Enter	Reader Response	What It Does
SITEMNT or “1”	Site Maintenance Menu	Takes the user to the System Maintenance Menu (SYSMNT) and Device Maintenance Menu (DEVMNT)
SYSMNT	System Maintenance Menu	Allows the user to Simulate a Train (SIMTRN), Backup and Restore Data (BACKUP, RESTORE) and Reboot the TRU (RBUNIT)
DEVMNT	Device Maintenance Menu	Allows the user to initialize the MPRX (IR), turn RF on (RFON), fire the antenna check tag (CTSEQ), toggle sensor power (TGPOWR) and self test the modem (MDMSTST). The user can also input and monitor MPRX commands in real time (PAS2RDR).

Configuration Menu (CONFIG)

The Configuration Menu is entered from the Main Menu by either typing “CONFIG” or the number “3”. This command, as well as many others, is also accessible from any other menu when typed out.

Use TRU commands to query status and set up the system as shown in Table 6.

Table 6 Commands Used in System Configuration

Command	Description	What It Does
CONFIG OR “3”	Configuration Menu	Allows the user to configure tenant parameters (TNTPRM) as well as site parameters for each tenant (SITEPRM)
TNTPRM	Tenant Parameters Menu	Allows the user access to site information (SITEINFO) as well as access to AEI (AEIRPTO) and maintenance (MNTRPTO) report options
SITEINFO	Site Information Parameters	Includes site name (TSITENAME), owner ID (OWNERID), station number and milepost (STNUM, MILPOST), railroad initials (RRINI), track designation, orientation and direction (TRKDSGN, TRKORIENT, TRKDIRECT)

Table 6 Commands Used in System Configuration

Command	Description	What It Does
AEIRPTO	AEI Report Options Menu	Includes direction report, minimum axle and car count, and tag read confidence levels
NMTRPTO	Maintenance Report Options Menu	Enables the maintenance report as well as sets report parameters
SITEPRM	Site Parameters Menu	Allows access to the site administration menu (SITEADM), the track configuration menu (TRKCONFIG) and Reader/Antenna configuration menu (RDR)
SITEADM	Site Administration Menu	Allows editing of the site primary and secondary phone numbers (PPHNUM, SPHNUM) and primary and secondary IP addresses (PIP, SIP). Allows the creation of and access to the user (UMAINT), track (TRKMAINT) and tenant (TENMAINT) maintenance menus for password and user ID maintenance
UMAINT	User Maintenance Menu	Allows creation, editing or deletion of user information including user Name, Password, Privilege and Status
TRKMAINT	Track Maintenance Menu	Allows listing of tracks to tenant, allows adding a tenant to a track or deleting a tenant from a track
TENMAINT	Tenant Maintenance Menu	Allows creation, editing or deletion of a tenant. The local time menu and consist report definition is also in this menu.
TRKCONFIG	Track Configuration Menu	Allows access to the menus that control the acquisition of wheel and tag events; the operating menu (OPERATE), the auxiliary device menu (AUXDEV), wheel detector menu (WDETECT), presence loop menu (PRLOOP), and antenna menu (ANTENNA)
OPERATE	Operating Menu	Includes wheel detector orientation and separation (WDORNT, WDSEPAR), external presence override (PRESEOV), presence timeout (PRESTO), minimum wheel events (MAXWEVT) and stopped axle distance (STOPAXD)

Table 6 Commands Used in System Configuration

Command	Description	What It Does
AUXDEV	Auxiliary Device Menu	Displays the valid parameters for the selected com port; baud rate (AUXBAUD), word length (AUXWORDLEN), stop bits (AUXSTOPBIT), parity (AUXPARITY) and flow control (AUXFLOWCTL)
WDETECT	Wheel Detector Menu	Controls the way presence, speed and direction are detected by the wheel detectors
PRLOOP	Presence Loop Menu	Controls the presence loop performance.
ANTENNA	Antenna Menu	Controls values that control antenna performance
RDR	Reader Selection Menu	Lists the valid readers for which parameters may be viewed or edited. This menu allows enabling of the reader and antennas for each assigned track.

Reports Menu (RPTS)

The Reports Menu is entered from the Main Menu by either typing “RPTS” or the number “4”. This command, as well as many others, is also accessible from any other menu when typed out.

Use TRU commands to view reports as shown in [Table 7](#).

Table 7 Commands Used to Generate and View Reports

Command	Description	What It Does
RPTS or “4”	Reports Menu	Provides access to TRU system summary reports (SYSRPTS) or train reports (TRNRPTS)
SYSRPTS	System Reports Menu	Allows the user to check software system managers (MGRSTAT), directory listings (DIRLST), file types (TYPE), system health (HEALTH) and Status Monitor information (IO) for a selected tenant
MGRSTAT	System Status Information	Displays the status of each embedded manager and reports if the manager is not running
DIRLST	Directory Listing	Displays the contents of a specified directory
TYPE	Display Contents of File	Displays the contents of a specific file on the TRU

Table 7 Commands Used to Generate and View Reports

Command	Description	What It Does
HEALTH	System Health Summary	Displays any trains flagged by the TRU as having potential problems. Displays hardware related warning and failure messages written during the recording of trains.
IO	Status Monitor	Displays status of the Input/Output (I/O) pins in real time. Information displayed includes train and track presence, wheel detector detection, RF ON, train direction of travel, sensor power on, reader power on, AC Power status, tag activity and adjacent track status.
AUDIT	Display Audit Log Info	The Audit Log screen displays tenant and site parameters whose configuration has been changed through the MUI.
TRNRPTS	Train Reports Menu	Tenant specific menu including train directory (DIRECT), Dump Data Summary (DDSUM), Dump Data Full (DDFULL), S918A Clean Consist (CCNSS918A), Train Summary (TRNSUM) and Train Events (TRNLOG).
DIRECT	Train Directory	Shows the most current trains that have passed by the site. The number of trains is user selectable. Directory includes train sequence number, date and time of passage, whether the train was okay, identifies the lead locomotive, indicates direction, speed, number of axles, number of rail cars, number of tags and train length.
DDSUM	Dump Data Processing Summary	Summarizes the raw train data into axle and speed summaries, axle and tag correlation to recognized rail car summary, tagged equipment summary and reader handshake summary by antenna.

Table 7 Commands Used to Generate and View Reports

Command	Description	What It Does
DDFULL	Dump Data Full Composite Listing	Summarizes the raw train data into tag specific and non-tag specific information for each car on the train. Includes the site information header, train summary and detail headers as well as the composite AEI listing for all recorded cars in the train. Listing information includes car number, EGC, car IDs, A or B side lead in, number of axles and platforms, length, speed and tag data for each car.
CCNSGEN	Clean Consist – Generic Format	Summarizes the train data into the generic format of a clean consist. Includes the site information header, train summary and detail headers as well as the generic consist information. Information includes EGC, car number (location in train), car ID, direction and number of handshakes for both tags.
CCNSFULL	Clean Consist – Full Consist Format	Displays the train consist data in the Full Consist format. Includes the site information header, train summary and detail headers as well as the Full Consist information. Information includes car number (location in train), EGC, car ID, tag status, A or B side lead in, axle count, length, speed, platform count and tag handshake data for each car.

Table 7 Commands Used to Generate and View Reports

Command	Description	What It Does
CCNSS918A	Clean Consist – S918A Format	Displays the train data in the S918A format as defined by the AAR AEI Site-To-Host Consist Format Standard S918A. Includes the site information header, train summary and detail headers as well as the S918A consist information. The consist information begins with the AEM heading and contains railroad-specific fields including (but not limited to) RRE, RTD, EOT, etc.
TRNSUM	Train Summary	Displays the site information header, train summary and detail headers but without the consist information.
TRNLOG	Train Events	Displays hardware related maintenance messages written during the recording of a specific train. Includes warning and failure messages which may affect the consist.
TRNLOGCNS	Consist Host Transaction Events	Displays maintenance messages written during the process of uploading a specific train consist to the host.
TRNLOGMNT	Maintenance Host Transaction Events	Displays maintenance messages written during the process of uploading maintenance reports around the time of a specific train.



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