
Genesis

# QUICK START USER GUIDE

## t-Rx7100 Shunt Augmenter System

*t-Rx helps bite through rust and film*

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Thank you for purchasing the t-Rx7100 Shunt Augmenter System.

It is our goal to always provide quality products and service at a fair price, and to deal with every customer in a fair and forthright manner. We are convinced this is the only way to endure in the railroad industry marketplace over the long-term.

We ask for your suggestions, whether they be criticism, product or service improvement ideas, or praise. Your feedback will be taken seriously and in good faith. We will work hard to earn and deserve your business.

The Genesis Team

# Quick-Start User Guide

## t-Rx7100 Shunt Augmenter System

## *Product Orientation*

### Purpose

The Genesis t-Rx7100 (pronounced tee-rex) helps to electrically “bite through” railhead rust and contaminants that prevent reliable wheel/rail shunting required for railroad signal warning systems.

The t-Rx7100 is a self-contained rail shunt augmenter in a single compact enclosure. It is designed to be installed and serviced quickly and easily with front-panel indicators to aid in troubleshooting problems with the augmenter system and the systems required for its support (i.e. AC line and DC battery power).

### How the t-Rx7100 Improves Shunting

The t-Rx7100 applies approximately 7 Volts DC to the rails. This improves wheel/rail electrical conductivity by providing enough potential (voltage) to electrically arc through layers of rust and other railhead contaminants. Once conductivity has been established, the t-Rx7100 has enough power (amperes) to electrically conduct through the resistive layers of rust and other railhead contaminants to maintain conductivity.

It has long been recognized that "whetting" the rail with a DC voltage provides better rail/wheel electrical conductivity. (See Rail-Shunting Research Links Section in this guide). When the t-Rx7100 is used in conjunction with a motion sensor or grade-crossing predictor that offers rusty-rail-shunting software/firmware, both inbound and outbound rail shunting problems can be virtually eliminated.

### t-Rx7100 Familiarization

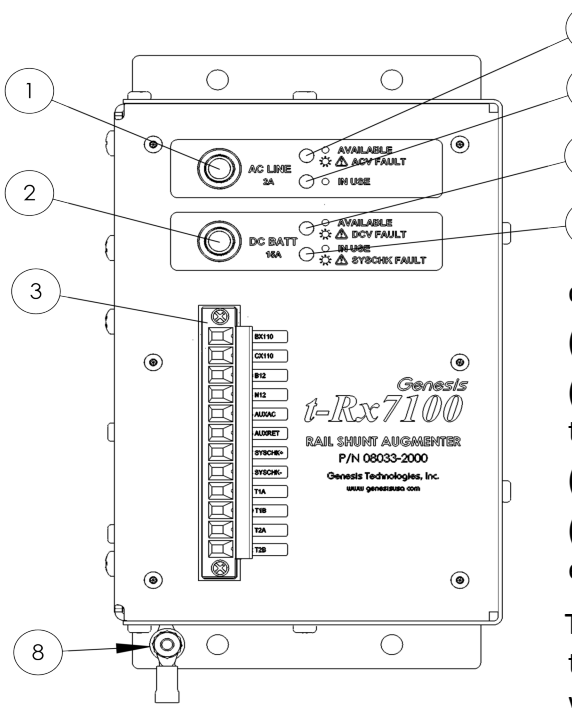
The t-Rx7100 Rail Shunt Augmenter System is in a single enclosure that can be mounted easily on the equipment wall of a signal bungalow or cabinet. The t-RX includes secondary input power surge protection and is totally compatible with motion sensors, predictors, and audio frequency equipment without the addition of resistors or chokes. It can operate on 120VAC line or 12VDC battery power and can automatically switch to battery power when AC line power fails or faults to levels above or below allowable operating thresholds.

The front-panel contains circuit breakers for both AC and DC power inputs. The circuit breakers are intended to protect the unit from severe damage or from causing a fire in the event of an internal failure or incorrect hookup. Please note however, the circuit breakers cannot always act fast enough to prevent damage to the unit if it is hooked-up improperly.

The t-Rx7100 senses overvoltage and undervoltage thresholds for both AC line and DC battery power. When any of these thresholds are crossed the unit ceases to operate using that power source. If the fault is with the AC line voltage, the t-Rx7100 automatically changes input power to DC battery and continues to operate. If DC battery voltage crosses either threshold, operation on DC battery is inhibited. If the t-Rx7100 is operating on DC battery and this happens, it shuts down entirely.

The purpose of sensing thresholds and ceasing operation with low or high AC line voltage or DC battery voltage is to avoid unpredictable operation when input power is outside the specified operating param-

eters. When the t-Rx7100 (or any system) is operated outside of its specified operating parameters, the result may be unpredictable, therefore it is best to cease operation entirely rather than have the unit behave erratically.




The following diagram shows the important features of the t-Rx7100.

**(1)** AC Line 2 Amp Circuit Breaker

**(2)** DC Battery 15 Amp Circuit Breaker

**(3)** 12-position Input/Output Connector

**(4)** AC LINE - AVAILABLE or LO/HI VOLTAGE FAULT Indicator (white)

**(5)** AC LINE - IN USE Indicator (green)

**(6)** DC BATT - AVAILABLE or LO/HI VOLTAGE FAULT Indicator (blue)

**(7)** DC BATT - IN USE or SYSCHK FAULT Indicator (red)

**(8)** EARTH GROUND TERMINAL - Connection to system earth ground

The two circuit breakers (1 and 2) provide overload protection for the t-RX7100 should an overcurrent fault occur within the unit.

The 12-position plug-in connector (3) provides connections for all interface wiring to or from the t-RX7100 except for earth grounding.

The four LED indicators (4, 5, 6 and 7) provide status information regarding the operation of the t-Rx7100 and the status of the power inputs. These indicators are as follows:

The AC LINE – AVAILABLE or LO/HI VOLTAGE FAULT indicator (4) is illuminated steadily when AC line power is available and is within acceptable limits. If the indicator is flashing, the AC line voltage is near either the low or high acceptable limits operating threshold. The indicator extinguishes when the AC line voltage is above or below the allowable operating limits and, if DC battery power is available and within acceptable limits, the system will switch to DC battery power.

The AC LINE – IN USE indicator (5) is illuminated steadily when AC line power is being used by the t-Rx7100.

The DC BATT – AVAILABLE or LO/HI VOLTAGE FAULT indicator (6) is illuminated steadily when DC battery power is available and is within acceptable limits. If the indicator is flashing, the DC battery voltage is near either the low or high acceptable limits operating threshold. The indicator extinguishes when the DC battery voltage is below or above allowable operating limits, and the system will shut down entirely until either AC power is restored or DC battery becomes available and is/are within acceptable operating limits.

The DC BATT – IN USE / SYSCHK FAULT indicator (7) is illuminated steadily when DC battery power is being used by the t-Rx7100. If the indicator is flashing, the SYSCHK output has failed and is no longer supplying a 12VDC output which indicates the t-Rx7100 is no longer supplying DC voltage or amperage to the rails.

The EARTH GROUND TERMINAL (8) provides a connection to the system earth ground buss for lightning and surge protection.

## AC Line LED indicator operation is defined in the following table:

| ACV Input Range or ACV Change | ACV AVAIL* | | ACV IN USE** | |
|---|---|---|---|---|
| | Before Change | After Change | Before Change | After Change |
| < 95V | X | OFF | X | OFF |
| ↗ 100V | OFF | FLASH | OFF | ON |
| ↗ 105V | FLASH | ON | ON | ON |
| ↗ 130V | ON | FLASH | ON | ON |
| ↗ 135V | FLASH | FLASH | ON | OFF |
| > 135V Note 1 | X | OFF | X | OFF |
| ↙ 130V | OFF | FLASH | OFF | ON |
| ↙ 125V | FLASH | ON | ON | ON |
| ↙ 100V | ON | FLASH | ON | ON |
| ↙ 95V | FLASH | OFF | ON | OFF |
| < 95V | X | OFF | X | OFF |

*LED INDICATOR - ACV AVAILABLE (steady ON) or ACV HI/LO VOLTAGE FAULT (flashing)
**LED INDICATOR - ACV IN USE (steady ON) or DELAY TIMER ON (flashing) Note 1
1. When the ACV is greater than the AC high-voltage threshold or is less than the AC low-voltage threshold, the t-RX7100 will switch to DC battery power if available. Input AC voltage should never exceed 145VAC for more than 1 second.
X = DON'T CARE or NOT APPLICABLE
↗ = ACV is increasing in value
↙ = ACV is decreasing in value

## DC Battery LED indicator operation is defined in the following table:

| DCV Input Range or DCV Change | SYSCHK Output | DC AVAIL* | | DCV IN USE** | |
|---|---|---|---|---|---|
| | | Before Change | After Change | Before Change | After Change |
| < 8.5V | 0V | X | OFF | X | OFF |
| ↗10.0V | 12V Note 2 | FLASH | FLASH | OFF | ON |
| ↗10.5V | 12V Note 2 | FLASH | ON | ON | ON |
| ↗ 15.5V | 12V Note 2 | ON | FLASH | ON | ON |
| ↗16.0V | 0V | FLASH | FLASH | ON | OFF |
| > 16.0V Note 1 | 0V | FLASH | OFF | ON | FLASH |
| ↙ 15.5V | 12V Note 2 | FLASH | FLASH | FLASH | ON |
| ↙ 14.5V | 12V Note 2 | FLASH | ON | ON | ON |
| ↙ 10.0V | 12V Note 2 | ON | FLASH | ON | ON |
| ↙ 8.5V | 0V | FLASH | OFF | ON | FLASH |
| < 8.5V | 0V | X | OFF | X | FLASH |

(Note: Indications are with AC line input at < 95VAC)
*LED INDICATOR - DCV AVAILABLE (steady ON) or DCV HI/LO VOLTAGE FAULT (flashing)
**LED INDICATOR - DCV IN USE (steady ON) or SYSCHK FAULT (flashing)
Notes:
1. When the DCV is greater than the DC high-voltage threshold or is less than the DC low-voltage threshold, the t-RX7100 will shut-down. Input DC voltage should never exceed 17VDC for more than 1 second.
2. Output voltage is dependent on load. Output can operate into loads as low as 250 Ohms.
X = DON'T CARE or NOT APPLICABLE
↗ = DCV is increasing in value
↙ = DCV is decreasing in value

LED Indicator switch threshold accuracy is ±3%.

# *Application*

## System Requirements

The t-Rx7100 is intended for use with motion sensors and grade-crossing predictors. It may also be used with audio-frequency crossing protection equipment.

The t-Rx7100 should not be used in signalized territory where coded-pulses are imposed on the rails to operate wayside signals (Electrocode, etc.). It also should not be used with DC or ACDC (Style C / Ring-10) track circuits or other track circuits that utilize a DC wrap.

We strongly recommend that the grade-crossing approach circuits be electrically isolated using an insulated joint just beyond each of the narrow-band shunts that define the ends of the approaches. Although some success has been reported with using rail whetting without insulated joints, the extended length of the circuit tends to absorb much of the energy that would otherwise be used to improve shunting.

Narrow-band shunts that match the operating frequency of the motion sensor or predictor are required to define the ends of the approaches. You must replace any hardwire shunts that are in use within the circuit with appropriate narrow-band shunts.

Lightning protection is absolutely required on AC Line power, DC Battery power and the T1 and T2 track wires. Warranty does not cover lightning damage.

## Recommended Practice

Good ballast conditions will improve shunting by not absorbing energy provided by the t-Rx7100 that would otherwise be used for improving shunting. We recommend that you make sure the approaches are free from dirt and other contaminants that would absorb electrical energy intended to help with shunting.

# *Installation*

## Track Circuit Preparation

If necessary, replace hardwire shunts with appropriate narrow-band shunts.

Install insulated joints one or two rail joints beyond each narrow-band shunt. We recommend both joints be in the same rail. Either rail is suitable.

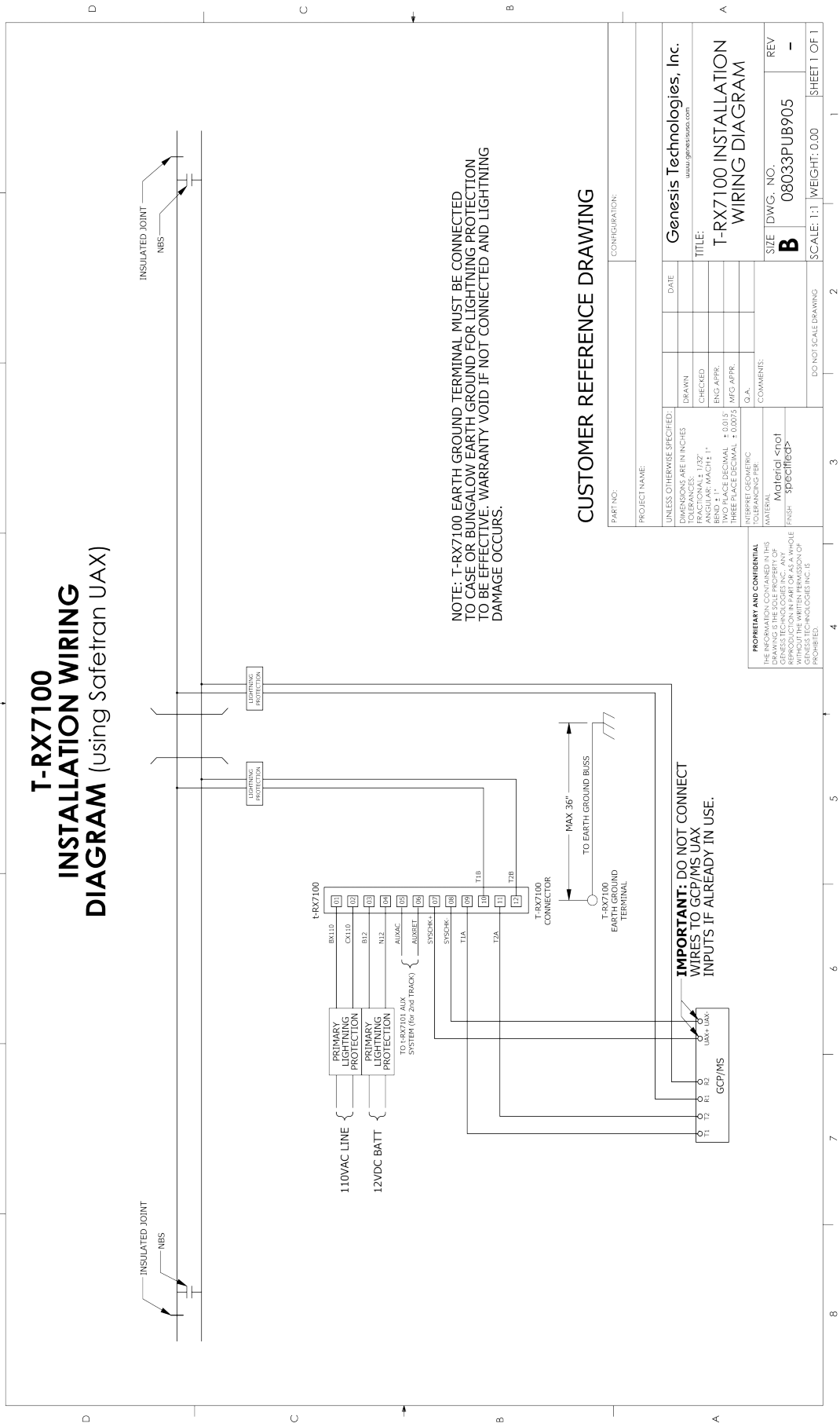
Inspect approaches for good bonds. Replace any questionable bonds.

If the track ballast is filled with dirt, chemicals or other contaminants that absorb and retain moisture, we recommend that you take whatever measures necessary to clean or replace the ballast. Good rail/wheel shunting is dependent on not having current “bleeding” off to ground that would otherwise be available for acquiring a good rail/wheel shunt.

## Wiring and Connections

See separate (provided) wiring diagram for proper hookup.

When wiring the connector that plugs-in to the t-Rx7100 front panel, MAKE CERTAIN your wiring is correct BEFORE PLUGGING IN THE CONNECTOR. Damage to the t-Rx7100 caused by improper hookup is not covered in the warranty.


T-RX7100
INSTALLATION WIRING
DIAGRAM (using Safetran UAX)
INSULATED JOINT
NBS
LIGHTNING PROTECTION
t-RX7100
T-RX7100 CONNECTOR
MAX 36"
TO EARTH GROUND BUSS
T-RX7100 EARTH GROUND TERMINAL
PRIMARY LIGHTNING PROTECTION
110VAC LINE
12VDC BATT
TO t-RX7101 AUX SYSTEM (for 2nd TRACK)
GCP/MS
IMPORTANT: DO NOT CONNECT WIRES TO GCP/MS UAX INPUTS IF ALREADY IN USE.
NOTE: T-RX7100 EARTH GROUND TERMINAL MUST BE CONNECTED TO CASE OR BUNGALOW EARTH GROUND FOR LIGHTNING PROTECTION TO BE EFFECTIVE. WARRANTY VOID IF NOT CONNECTED AND LIGHTNING DAMAGE OCCURS.
CUSTOMER REFERENCE DRAWING
PROPRIETARY AND CONFIDENTIAL
Genesis Technologies, Inc.
www.genesisusa.com
T-RX7100 INSTALLATION WIRING DIAGRAM
DWG. NO. 08033PUB905
SIZE B
REV -
SCALE: 1:1
WEIGHT: 0.00
SHEET 1 OF 1

The front-panel connector should have ONLY ONE WIRE PER INSERTION POINT. It is not designed to securely hold more than one wire.

Make sure to use wire of adequate size for the current it must carry. The B12, N12, AUXAC, AUXRET, T1B, and T2B outputs may be required to carry 7 to 13 amperes under certain conditions. The following table specifies the minimum recommended wire size. Larger wire sizes are acceptable, up to and including AWG #10, which is the maximum wire size the connector will accommodate.

| WIRING CONNECTIONS & MINIMUM WIRE SIZE | | | |
|---|---|---|---|
| **PIN / TERM** | **NAME** | **FUNCTION** | **MINIMUM WIRE SIZE** |
| 01 | BX110 | 110 VAC LINE INPUT | AWG #14 |
| 02 | CX110 | 110 VAC LINE RETURN | AWG #14 |
| 3 | B12 | 12VDC BATTERY POSITIVE | AWG #12 |
| 04 | N12 | 12VDC BATTERY NEGATIVE | AWG #12 |
| 05 | AUXAC | AUXILLARY AC OUTPUT | AWG #12 |
| 6 | AUXRET | AUXILLARY AC RETURN | AWG #12 |
| 07 | SYSCHK+ | SYSTEM CHECK OUT (+) | AWG #16 |
| 08 | SYSCHK- | SYSTEM CHECK OUT (–) | AWG #16 |
| 09 | T1A | T1 GCP/HXP/MS/MD | AWG #12 |
| 10 | T1B | T1 TRACK OUTPUT (+) | AWG #12 |
| 11 | T2A | T2 GCP/HXP/MS/MD | AWG #12 |
| 12 | T2B | T2 TRACK OUTPUT (–) | AWG #12 |
| EGND | EARTH GND | TERMINAL TO EARTH GND BUSS | AWG #12 (see text below) |

Each wire should be stripped of insulation to 5/32” or 7mm. Make certain the wire clamp inside the connector is gripping the bare wire itself and not the insulation. It is also important that no bare wire is exposed after it is inserted into the wire clamp inside the connector.

DO NOT OVERTIGHTEN THE SCREWS on the connector. It is best to use a screwdriver with a handle diameter no larger than about ½”. Test the wires after tightening the screw by pulling on them to make sure they are securely fastened. If you have tools to measure torque when tightening the screws, tighten to between 4.4 and 5.3 inch-pounds.

**CAUTION! DO NOT WORK ON THE CONNECTOR WITH POWER APPLIED.** The wire tightening screws are at the same potential as the wire clamp, thus when tightening the screw, your screwdriver shaft is at the same potential as the wire. Avoid getting accidentally shocked or inadvertently causing a short by turning off power or disconnecting the other end of the wire.

The SYSCHK outputs may be connected to the UAX (Safetran GCP/MS) or AUX (GE HXP/PMD-3) inputs of the motion sensor or predictor in order to cause the signals to activate should the t-Rx7100 fail to output the rail whetting voltage.

If you hook up the SYSCHK outputs to the UAX or AUX inputs, be sure to observe proper polarity. You must also program the motion sensor or predictor for a short delay for signal activation once the 12VDC SYSCHK signal is present.

**CAUTION!! DO *NOT* CONNECT WIRES TO THE UAX OR AUX INPUTS IF THESE INPUTS ARE ALREADY IN USE.**

If the UAX inputs are in use and you still wish to cause the signals to activate when SYSCHK fails, please contact Genesis for how to wire your system.

## Earth Ground Terminal Connection

The **Earth Ground Terminal** on the bottom left mounting flange **MUST** be connected to the case or bungalow earth ground buss with an AWG #12 or larger wire that is no longer than 36" (91cm). This is required for the t-RX7100 internal secondary lightning and surge protection to be effective.

Warranty is void if not connected or connected improperly.

## SYSCHK Operation and Programming

The SYSCHK output is provided to indicate the "health" of the t-Rx7100 track output voltage or current. If the T1/T2 track output is providing voltage or current, the SYSCHK outputs +12VDC. If the track output fails, the SYSCHK signal is removed in less than one second. Once the track output is restored, or upon initial power-up, the SYSCHK signal becomes active and ouputs +12VDC after a 5-second delay.[1]

The SYSCHK output is typically connected to either the UAX or AUX input of the motion sensor or predictor. If the motion sensor or predictor is programmed to require a +12VDC input before the GCP/MS relay output is energized, the signals will activate if the t-Rx7100 output fails.

When connecting SYSCHK to a Safetran GCP or MS unused UAX input, you must program the GCP/MS to a value other than zero seconds delay before the UAX input will activate the signals. A typical total delay time is 5 or 6 seconds, of which the t-Rx7100 provides 5 seconds delay, so for 6-seconds total delay, you would program the UAX delay to be 1-second.

When connecting SYSCHK to a HXP-3 or PMD-3 unused AUX input, no programming is required. This input has direct control of the MD relay output and is normally wired to B+. This will result in a 5-second delay after the t-Rx7100 track outputs become normal before SYSCHK is restored.

**CAUTION: DO *NOT* CONNECT WIRES TO THE UAX OR AUX INPUTS IF THESE INPUTS ARE ALREADY IN USE.**

1. The 5-second delay function is available only with unit serial numbers R1027 or higher.

## Pre-cutover Testing and Cutover

Once you have the t-Rx7100 operating, check the voltage to the rails. In dry weather conditions with good ballast you should see 6.5 VDC or more at the rails.

Recalibrate the motion sensor or grade-crossing predictor. The t-Rx7100 appears as a slight "load" to the MS, HXP or GCP. This requires recalibration.

Complete a disarrangement test as required by your railroad's procedures.

Be sure to shunt both approaches and the island to verify proper signal operation. Adjust the island if necessary. Verify the signals will recover when the approach is shunted for more than 30 seconds or so.

If possible, watch a train through the approaches. Have the train stop within the approach but not in the island to confirm the signals recover.

# *Rail-Shunting Research Links*

http://www.rtri.or.jp/publish/qr/2008/49_3/p04_49_3.pdf

http://ntl.bts.gov/lib/42000/42700/42701/ord9704.pdf

http://ntl.bts.gov/lib/42000/42800/42865/rr0713.pdf

## SPECIFICATIONS

### OUTPUTS

| | | |
|---|---|---|
| Track Voltage (approximate) | 7.1 | VDC |
| Track Current Maximum (approximate) | 6.8 | Amps |
| System Check (SYSCHK) | 12.0 | VDC |
| Auxillary (AUXAC) | 7.0 | VAC |

### INPUTS (absolute maximum)

| | | |
|---|---|---|
| AC Line | 95 - 135 | VAC |
| DC Battery | 9.5 - 16 | VDC |
| DC Idle Current (no track load, input = 13.5VDC & 0VAC) | 0.65 | Amps |
| AC Line Overcurrent Circuit Breaker | 2 | Amps |
| DC Battery Overcurrent Circuit Breaker | 15 | Amps |

### ENVIRONMENT

| | | |
|---|---|---|
| Operating Temperature | -40 (-40) - 160 (71) | ˚F (˚C) |
| Humidity (non-condensing) | 95% | Relative |

### MEASUREMENTS (see reference drawings for details)

| | | |
|---|---|---|
| Height | 9.5 (24.13) | in (cm) |
| Width | 5.56 (14.12) | in (cm) |
| Length (including connector) | 9.9 (25.15) | in (cm) |
| Weight | 24.1 (10.93) | lbs (kg) |
| Mounting Hole Centers - Width | 2.5 (6.35) | in (cm) |
| Mounting Hole Centers - Height | 8.75 (22.23) | in (cm) |

### CONNECTOR WIRING

| | | |
|---|---|---|
| Wire size range | 10 - 24 | AWG |
| Screw tightening torque - minimum | 4.4 (.5) | in lbs (Nm) |
| Screw tightening torque - maximum | 5.3 (.6) | in lbs (Nm) |

## *Three-Year Limited Warranty*

All new products are warranted for three-years against failure for parts and workmanship, unless the warranty terms are specifically stated otherwise on the invoice and packing slip for that product when shipped. Warranty is explicitly for parts and workmanship and not for design or function.

Any products we manufacture found to be faulty in any way may be returned for rework, shipping pre-paid. If found to be in warranty, we will correct the fault or failure and return to you at no charge, shipping prepaid.

Warranty does not apply to damage caused by lightning, voltage surges, water, inappropriate storage, handling, misuse or if the product has been modified or repaired by others.