System Operation Manual

JPS TRP-1000

Transportable Intelligent Interconnect System

Designed and Manufactured by:

JPS Communications, Inc.
5800 Departure Drive
Raleigh, NC 27616

JPS P/N 5603-000200  Revision 1.6  December 2003
Warranty

JPS Communications, Inc. warrants its manufactured equipment to be free from defects in materials and workmanship, and to conform to published specifications for a period of 18 months from the date of shipment from the factory or 12 months from installation, whichever occurs first.

JPS warrants its service work performed in connection with this warranty to be free from defects in materials and workmanship for a period of 90 days from the date the work is performed.

If a defect occurs within the warranty period, the buyer shall notify JPS immediately. JPS will repair or replace the equipment at its option, upon return of the equipment; shipping prepaid, to the JPS facility in Raleigh, North Carolina, USA.

This warranty does not apply to damage caused by accidents, abuse or improper installation.

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### Table 1 Glossary

<p>| <strong>ACU-1000</strong> | The ACU-1000 intelligent interconnect unit is the heart of any TRP-1000 system. It consists of a Eurocard chassis and a number of plug-in modules. Up to 12 interface modules allow up to 12 external devices (such as radios or telephones) to be interconnected. 3U high on front of rack. |
| <strong>ACU Controller</strong> | The ACU Controller is the software supplied with the ACU-1000 that allows setup, control, and monitoring of the ACU-1000 system. |
| <strong>Cable Cache</strong> | Additional cables (beyond those that make up the basic TRP system) may be stocked to facilitate field connection of radios or other devices. The cables may be <em>Radio Interface Cables</em> for field connection of radios to the TRP-1000’s <em>Extended Rear Panel</em>, or they may be <em>Radio Tray Cables</em> to allow the mounting of other radios to one of the TRP-1000’s <em>Radio Trays</em>. |
| <strong>DC Power Distribution Panel</strong> | If TRP-1000 is ordered with DC power capability this panel is included to provide a connection point for DC power input. The panel provides individual MAXI blade type fuses, one for the ACU-1000 and one to each of the system’s Radio Trays. |
| <strong>EIA 19” Rack</strong> | A standard for rackmounted equipment. The front panels of equipment for this type of rack are 19” wide. A standard hole pattern for connecting equipment to the rack repeats each 1.75 inches, or one “U”. |
| <strong>ETS-1</strong> | The ETS-1 (Ethernet To Serial Converter) is a VoIP-based product from JPS that allows the ACU-1000 to be controlled over an Ethernet Network. The ETS-1 converts audio packets and control data from the network into standard audio and RS-232 data that can be used to control an ACU-1000. The ETS-1 allows multiple, simultaneous control and status monitoring of the ACU-1000. |
| <strong>Extended Rear Panel</strong> | This panel is assembled to the rear of the rack and brings the interface connectors, and an external speaker, to the rear face of the rack to simplify connection of cables. 2U high on rear of rack. |
| <strong>Master/Slave System</strong> | An <em>ACU-1000</em> can house up to 12 interface modules. If more are required for the system, two <em>ACU-1000</em> chassis are connected together in the <em>Primary Case</em> using a Master/Slave cable. This allows as many as 24 interface modules to be used. |
| <strong>NXU-2</strong> | The NXU-2 Network Extension Unit allows a radio or other four wire device to be remotely interfaced to an ACU-1000 over an Ethernet link. |
| <strong>Power Outlet Strip</strong> | Contains 115 VAC connections for equipment in the case. The standard outlet strip used with TRP systems allows 6 AC connections, has a 15 foot long cord and a power switch, and takes up 1U on one side of the rack. |
| <strong>Primary Case</strong> | If a system is sufficiently large to require 2 cases, the <em>Transportable Case</em> with the <em>ACU-1000</em> is called the Primary Case. The other case, which will house mainly <em>Radio Trays</em>, is the <em>Secondary Case</em>. |
| <strong>Radio Tray, Standard</strong> | One or two radios can be installed per Radio Tray. Each tray includes a 12 VDC supply to power both of the radios, antenna cables to bring the radio’s antenna ports to the rear of the case, and interface cables to the <em>Extended Rear Panel</em>. Other equipment, such as satellite phones, may also be mounted in a Radio Tray. The radio tray is mounted on rack slides so that it can be slid out for servicing. A swing arm mounted on the rear panel handles cable routing when the tray is pulled out. The radio trays are 2U high at both the front and rear. |</p>
<table>
<thead>
<tr>
<th>Glossary</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Radio Tray with DC Option</strong></td>
<td>If TRP-1000 is ordered with DC power capability the standard Radio Trays will be modified to contain a relay to automatically select the tray’s power source. The DC power is connected to the TRP using the connections provided on the DC Power Distribution Panel. The power is then individually fed to the Radio Trays.</td>
</tr>
<tr>
<td><strong>Radio Tray Cables</strong></td>
<td>Cables that interface the TRP system’s radios to the wiring in the Radio Trays. The radio tray cables are the only part of the wiring not included with the standard TRP system and must be ordered separately, one for each radio. A different version of cable is used for each type of radio. One end mates with the radio and therefore its connector is defined by that radio, the other end has a 9-pin circular CPC connector.</td>
</tr>
<tr>
<td><strong>Secondary Case</strong></td>
<td>If a system is sufficiently large to require 2 cases, the case with the ACU-1000 is called the Primary Case. The other case, which will house mainly Radio Trays, is the Secondary Case. Cables from the Secondary Case connect its radios to the ACU-1000 in the Primary Case via the D15 connectors on the Extended Rear Panel.</td>
</tr>
<tr>
<td><strong>Transportable Case</strong></td>
<td>An EIA standard 19” rack shock-mounted into a rugged case. The case normally includes easily removable castors. Rack depths are 20” or 25”.</td>
</tr>
<tr>
<td><strong>U</strong></td>
<td>The standard unit for height in an EIA 19” rack. The mounting hole pattern is repeated every 1.75 inches, the height of one U. One U is the minimum equipment height, and heights are always multiples of one U: 1.75”, 3.50”, 5.25”, 7”, etc.</td>
</tr>
</tbody>
</table>
1 General Information

1.1 Scope

This instruction manual provides the information necessary to install and operate the TRP-1000 Transportable Intelligent Interconnect System. This manual supplements but does not replace the Operations Manuals for the ACU-1000 and any other equipment installed in the system, including radios, satellite phones, etc. The TRP-1000 is a versatile family of Transportable Interconnect Systems; this manual is intended for use with all TRP-1000s and has some generic content that will not apply to all TRP-1000 versions. Extra information may be added that applies to this specific TRP-1000 (most specifically, information regarding the radios or other optional equipment used with the system).

1.2 Main Components of a TRP-1000

The individual assemblies and components that make up a TRP-1000 system are (see explanations in the glossary):

- An ACU-1000
- One or two transportable cases
- One or more Radio Trays
- Extended Rear Panel
- One or more outlet strips

Other components and assemblies that can be included:

- Radios and/or Satellite Phones (and associated radio tray cabling)
- Equipment to connect the ACU-1000 to an Ethernet network. The JPS ETS-1 provides an audio link and a control of the ACU-1000 from a remote location. The JPS NXU-2 allows radios, other ACU-1000s, or other four-wire devices to be interfaced to the system remotely via an Ethernet network.
- ACU-1000 options such as the STU-III interface

Other components and accessories that can be used with the TRP-1000 but are not usually installed in the transportable case:

- Computer to control the system using the ACU Controller software
- System Antennas
- Equipment to interface radios or other equipment via a wireless link. The JPS PortaLink can be used as a quick-to-deploy portable wireless solution. Remote controlled video capability is available as an option to the Standard PortaLink System. The PortaLink can be used to remote a radio or other four-wire device, or may be used to allow the ACU Controller computer control software to run the system from a remote location via the wireless link.
The sketch illustrates the main parts of a TRP-1000. In a single case system (or for the Primary Case of a Primary/Secondary system), the ACU-1000 is installed at the top of the ruggedized transportable case. Beneath the ACU-1000, some number of Radio Trays reside. On the back of the rack, an outlet strip is usually located at the top, and just beneath it the Extended Rear Panel. Note that the Radio Trays extend all the way from the front to the back. The ACU-1000 is 3U (5.25”) high. The power strip is 1U (1.75”) and the Extended Rear Panel 2u (3.5”), so these two take up the rack space as the ACU-1000. The Radio Trays are typically spaced 2U apart.

The radio RF connections are shown at the left of each tray on the rear view sketch. Cables from each tray are routed on the swing arm cable guides, carrying each tray’s power cord to the outlet strip, and each radio’s interface cable up to its appropriate mating connector on the Extended Rear Panel. The standard Radio Tray Cable routing would mate the top Radio Tray “A” radio to P1, its “B” radio to P2, and the second tray’s radio to P3, etc.
This figure illustrates a common TRP-1000 configuration. The Primary Case houses the ACU-1000 and a single Radio Tray. There are DSP-1 modules in the first ten interface module slots of the ACU-1000; typically the remaining two have PSTN-1 modules for two-wire connections to phone systems or Sat phones. The casters have been removed from the Primary Case so that it can be set on top of the Secondary Case, which holds four Radio Trays for the radios associated with the 3rd through 10th DSP-1 modules.

The Primary Case can be used by itself or in conjunction with the Secondary Case. Printed on the radio sketches are the associated ACU-1000 extension numbers. When the two cases are used together as shown above, cables from the Secondary Case Radio Trays interface the radios to the ACU-1000 via the Extended Rear Panel. The cables are labeled for easy field setup. For example, the radios in the bottom tray of the Secondary Case are labeled Extension 09 and Extension 10. They are interfaced with the 9th & 10th DSP-1s. The cables are labeled 9 and 10; they simply plug into P9 and P10 on the Extended Rear Panel.
This figure shows a TRP-1000 that includes the DC Power Option. This allows the system to be powered from either a 120 VAC or +12 VDC power source. If both sources are simultaneously applied, the TRP-1000 will use the AC source. If powered individually be either DC or AC, the system automatically accepts the available power source. The DC Power Distribution Panel on each case serves as a power input port and also individually fuses the DC power sent to the ACU-1000 and to each Radio Tray. This minimizes single-point-of-failure potential.
### Table 1-1  Replaceable Parts List

<table>
<thead>
<tr>
<th>Item –Description</th>
<th>JPS P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACU-1000 Chassis</td>
<td>5961-200000</td>
</tr>
<tr>
<td>19” Rack Mount Card Cage with Backplane</td>
<td></td>
</tr>
<tr>
<td>PSM-1 Module</td>
<td>5951-813000</td>
</tr>
<tr>
<td>Power Supply Module</td>
<td></td>
</tr>
<tr>
<td>HSP-2 Module</td>
<td>5962-314000</td>
</tr>
<tr>
<td>Handset/Speaker/Voice Prompt Module with Keypad</td>
<td></td>
</tr>
<tr>
<td>CPM-2 Module</td>
<td>5961-213000</td>
</tr>
<tr>
<td>Control Processor Module</td>
<td></td>
</tr>
<tr>
<td>DSP-1 Module</td>
<td>5961-818000</td>
</tr>
<tr>
<td>Interface Module for Radios &amp; other 4-Wire Devices</td>
<td></td>
</tr>
<tr>
<td>PSTN-1 Module</td>
<td>5961-215000</td>
</tr>
<tr>
<td>Interface Module for 2-Wire PSTN Lines</td>
<td></td>
</tr>
<tr>
<td>Radio Tray with Rack Slides (20” or 25”) Replaceable parts include:</td>
<td></td>
</tr>
<tr>
<td>+12 VDC, 600W Power Supply (with mounting bracket)</td>
<td>5970-806313</td>
</tr>
<tr>
<td>Swing Arm Cable Guide</td>
<td>1800-000007</td>
</tr>
<tr>
<td>Power Supply AC Guard</td>
<td>5990-000021</td>
</tr>
<tr>
<td>Power Supply DC Guard</td>
<td>5990-000022</td>
</tr>
<tr>
<td>Power Supply Terminal Block Guard</td>
<td>5990-000023</td>
</tr>
<tr>
<td>Extended Rear Panel Assembly</td>
<td>0314-009000</td>
</tr>
<tr>
<td>JPS P/N 5020-400200 Includes:</td>
<td></td>
</tr>
<tr>
<td>Cable Assembly, RS-232, D9M-D9F</td>
<td>0314-015000</td>
</tr>
<tr>
<td>Cable Assembly, ACU-1000 Ports P1-P12 to Rear Panel Ports P1-P12, D15F-D15M</td>
<td>0153-080001</td>
</tr>
<tr>
<td>Speaker, 3” square, 8 ohms</td>
<td></td>
</tr>
<tr>
<td>Other TRP-1000 Replaceable Components:</td>
<td></td>
</tr>
<tr>
<td>Power Outlet Strip</td>
<td>5970-800901</td>
</tr>
<tr>
<td>Cable Assembly, Radio RF Output to Rear Panel (Mini UHF to type N)</td>
<td>0314-000020</td>
</tr>
</tbody>
</table>

### Table 1-2  Optional Equipment (Not Supplied Unless Specifically Ordered)

<table>
<thead>
<tr>
<th>Item –Description</th>
<th>JPS P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna, Dual Band, ¼ Wave, 150-512 MHz (trim to tune)</td>
<td>0130-003002</td>
</tr>
<tr>
<td>RF Extension Cable, 25 Feet</td>
<td>0314-000009</td>
</tr>
<tr>
<td>DC Power Option (not field installable)</td>
<td>consult JPS</td>
</tr>
</tbody>
</table>
1.3 **TRP Radio Tray, Standard**

The TRP-1000 Standard Radio Tray is a rack-slide mounted tray that contains a power supply and all cabling required to interface one or two mobile type radios. The interface to the radios is standardized so that all TRP-1000 Radio Trays are identical, allowing a known procedure for changing radios or moving radios from one tray to another. The standard Radio Tray includes:

- 600 W power supply capable of 40 amps continuous output at +12 VDC (nom), 115 VAC input, switching type.
- AC wiring to the power supply
- DC wiring from the power supply to a dual terminal block for quick connection to mobile radio DC input.
- Audio & control signal wiring that runs from the two standard 9-pin circular CPC connectors on the tray to two “extension” D15 connectors on the ACU-100 Extended Rear Panel.
- A swing-arm cable guide for clean routing of power & audio cables, including when the Radio Tray is extended on its rack slides.
- A pair of RF cables to bring radio RF connectors to a dual RF connector bracket installed at the rear of the TRP rack. The RF connectors are mini-UHF male at the radio end, and type “N” female at the rear panel. Radios or antennas requiring different connectors must use adapters.

Radios and other equipment may be installed on the tray. Radios may be purchased through JPS (if JPS has a supplier agreement with the manufacturer), or supplied by the customer. Most radios are mounted using the dash mount brackets supplied by the manufacturer. All radios require a Radio Tray Cable to interface its audio, PTT and COR signals to the associated CPC connector on the Radio Tray. Other four wire devices may be mounted on the tray, but size and control signal variations may require special considerations for mounting or cabling.

When radios are ordered by JPS, or supplied by the customer to JPS, prior to the initial shipment of the TRP-1000, JPS will install them free of charge. Other equipment may require an NRE charge to create special cabling or mounting brackets and procedures. The customer may also want to install equipment in the TRP-1000. The Radio Tray was designed to make this as easy as possible and this manual (along with the ACU-1000 manual and the manuals for the equipment to be installed) provides all the information required.

The following figures and accompanying text provide detailed information regarding the Radio Tray assembly and wiring.

Figure 1-4 is a top view sketch of the 25” Standard Radio Tray. Radios are mounted at the front of the tray and wired to the TRP-1000 at the rear. Figure 1-5 provides the full Standard Radio Tray Wiring Diagram. The subsequent figures provide wiring details and associated information for the standard radio tray.
Figure 1-4   Top View Sketch of Standard Radio Tray
Figure 1-5    Standard Radio Tray Wiring Diagram
Figure 1-6  Standard Radio Tray Details
Figure 1-7  AC Input Wiring Detail

Figure 1-7 shows the AC power input connections for the main power cable at the side of the switching power supply.

Figure 1-8  DC Output Wiring Detail

Figure 1-8 shows the DC power output connections at the opposite side of the DC Power Supply. The Power Supply is adjusted for 13.8 VDC and should not require readjustment in the field.
Figure 1-9   Terminal Block DC Power Wiring

Figure 1-9 illustrates the wiring connection between the Power Supply and the radios (or other devices) installed on the Radio Tray. The power cables from the radios are the cables that attached to the radio rear panels. Be sure to leave the power fuses installed on these cables.

Figure 1-10   RF Connection to Antennas

Figure 1-10 shows a top view of the RF connector bracket that is attached to the rear of the equipment rack. The full RF cable from the radio rear panel to the rear of the rack is included. The connector at the radio end is a male mini-UHF type, and at the rear of the rack (the antenna end) female type “N” connectors are used. If other connector types are required, adapters must be used. All Radio Tray connectors are standardized so that all trays are identical for ease of assembly, radio mounting, and radio replacement.

RF Extender Cables, 25 feet long, are available from JPS and may be used to provide additional separation between system antennas.
Figure 1-11  Connector Bracket for Radio Tray Cables

This front view of the connector plate where the Radio Tray cables connect to the tray shows the proper orientation of the cables. Cable Connections are as follows:

<table>
<thead>
<tr>
<th>Table 1-3</th>
<th>Radio Tray Cable Pin Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPC Pin #</td>
<td>Signal Description</td>
</tr>
<tr>
<td>1</td>
<td>Ground (cable shield)</td>
</tr>
<tr>
<td>2</td>
<td>/AUX Out 1</td>
</tr>
<tr>
<td>3</td>
<td>TX B</td>
</tr>
<tr>
<td>4</td>
<td>Analog Ground</td>
</tr>
<tr>
<td>5</td>
<td>RX A</td>
</tr>
<tr>
<td>6</td>
<td>PTT Input to Radio</td>
</tr>
<tr>
<td>7</td>
<td>COR Output to ACU</td>
</tr>
<tr>
<td>8</td>
<td>TX A</td>
</tr>
<tr>
<td>9</td>
<td>RX B</td>
</tr>
</tbody>
</table>

Radio Tray Cables may be ordered from JPS or are created by the customer. Consult JPS for information regarding the radio models that JPS has designed cables for, or for information detailing how to request a new design. JPS also sells a cable that is terminated at the CPC connector end, and is left unterminated at the radio end, to facilitate Radio Tray Cable designs by the customer. This cable is P/N 5961-291207-00.
1.4 **TRP Radio Tray with DC Power Option**

The DC Power Option allows the TRP-1000 to be operated from a +12 VDC (nominal) DC Power Source, as well as the standard AC source. The DC Power Option, like the basic TRP-1000 itself, is designed to minimize single-points-of-failure. If TRP-1000 is ordered with the DC power option each of the standard radio trays will contain power-routing relay to automatically select the power input source. If AC power is available the relay routes DC power tray-mounted power supply to the radios, otherwise the radio supply inputs are wired to a rear panel power distribution panel (2U high) with separate fuses for each Radio Tray.

The ACU-1000 power supply automatically accepts power from its DC input terminals when no AC source is connected, so no relay or other changes to the ACU-1000 are required with the DC option. The ACU-1000, along with each Radio Tray, has its own fuse in the power distribution panel.

Figure 1-12 shows the top view of the radio tray with DC option. The changes are the addition of the relay (F), and that the DC terminal block (C) has been relocated to make room. Figure 1-13 provides the Wiring Diagram for the DC Power Option version of the Radio Tray. The relay switches both the positive and return lines of the DC input; this isolates ground currents to ensure that the system radios do not affect each other. A diode across the relay coil prevents reverse-emf from affecting the DC power supply. A capacitor at the relay output ensures that the power does not drop out momentarily if the system is jarred hard enough so that the relay contacts are instantaneously opened.
Figure 1-12  Radio Tray with DC Option
ALL EQUIPMENT AND CABELING SUPPLIED EXCEPT:
RADIOS & RADIO TRAY CABLES ORDERED SEPARATELY
RADIO POWER CABLES SUPPLIED WITH RADIOS
DC SOURCE CABLE 1/0 TO CONNECT TO DC POWER DISTRIBUTION PANEL.

Figure 1-13   Radio Tray Wiring Diagram (with DC Power Option)
1.4.1 DC Power Distribution Panel (TRP-1000 with DC Option)

When the TRP-1000 is ordered with the DC power capability each case will contain a DC power distribution panel. The panel provides a connection point for the DC power input, and distributes the DC power through independent fuse and wiring to each tray, as well as the ACU-1000 itself. The independent fuses and wiring ensure that a single point-of-failure (such an accidental short circuit of the DC input to a radio) is isolated and does not disrupt the rest of the system.

Primary/Secondary TRP systems with the DC option have DC Power Distribution Panels on the rear of each of the two cases, and separate DC power input connections are required. Wire sizes from 2/0 to #14 AWG can be accepted in the power input terminal block. Its two terminals are labeled +12V Input and GND.

Note that for best performance of the ACU-1000 system (due to the close proximity of numerous radio transmitters), it is recommended that all radios be set in low power transmit mode (5-15 Watts). This also helps to limit the DC current requirements of the system. If the DC cable selected is 1/0 gauge its current carrying capability will be between 100 Amps to 155 Amps; this is sufficient at all times if radios are set to low power, and is most likely sufficient even with some higher power radios, even if all transmit at the same time. The only way to know the overall current drain is to measure the current required by the radios installed in the system. If the radios are factory-installed by JPS, the current drain during TX will be measured and this information will be supplied in Section 3 of this manual.

A 3/16 Allen wrench is required to tighten the DC input cable in the terminal. The proper torque levels required for the connections on Line Side of DC Distribution terminal block are given on the top of its data label. The panel contains a six-position fuse holder for MAXI blade type fuses. The Radio Tray 1 through Radio Tray 5 fuse holders use 40 Amp fuses, and there is a single 20 Amp fuse position for connection to the ACU-1000. Fuses and the internal terminals to hold the fuses are present only as required for the specific case configuration and therefore some positions will remain unpopulated. Figure 1-14 shows the layout of the power distribution panel.

![Figure 1-14 DC Power Distribution Panel](image-url)
1.5 **Extended Rear Panel**

The TRP-1000 Extended Rear Panel brings the relevant ACU-1000 rear panel connections to the back face of the rack for ready access. Connections are supplied for each of the ACU-1000’s twelve Interface Module fifteen-pin D-sub connectors (P1-P12), corresponding to the ACU-1000 extensions 01 through 12, and for the D-9 RS-232 port of the ACU-1000. These cables are all simple extension cables, i.e. the D15 cables include 15 wires, pin 1 at one end to pin 1 at the other, etc.

Cable P/Ns from the ACU-1000 to the Extended Rear Panel are as follows:

- D15 cables- 0314-015000
- D9 RS-232 cable- 0314-009000

Also included are an external speaker (wired to the external speaker output of the ACU-1000’s HSP-2 module), and a speaker jack. This jack allows the speaker output to be connected to a customer supplied speaker that can then be situated for optimum system operation. The cable jack accepts a standard 3.5mm monaural plug. When the plug is installed, the speaker on the Extended Rear Panel is switched off.

Also included are a grounding lug and a DC terminal block that will allow the ACU-1000 to be powered by a +12 VDC (nominal) source. This terminal block brings the ACU-1000 DC input terminals to the Extended Rear Panel Terminal Block. The ACU-1000 power supply provides for trickle charging of a backup battery, as well as automatic switchover to DC operation. See the ACU-1000 manual for details. This terminal block powers only the ACU-1000 in a standard TRP-1000. If the system has the TRP-1000 DC Option installed, all DC power connections are made via the DC Power Distribution Panel and the Extended Rear Panel’s DC terminal block is removed.

### 1.5.1 Extended Rear Panel as Front of Rack Connector Panel

It’s also possible to mount the Extended Rear Panel on the front of the TRP-1000. This will bring all of the important connections to the front of the case for easy access. Installing the panel here may be helpful if the TRP-1000 is going to be located such that its rear side is inaccessible. Note that this will require that the TRP-1000 transportable case be 2U (3.5 inches) higher.
End of Section One
2 Installation

2.1 General

This section provides the instructions for unpacking, inspection, installation and set-up. Also included are directions for reshipment of damaged parts or equipment.

2.2 Unpacking and Inspection

After unpacking the unit, retain the carton and packing materials until the contents have been inspected and checked against the packing list. If radios are installed by JPS, and were shipped to JPS in boxes that are required for return shipment of the radios, the boxes are included with the overall TRP-1000 shipment. If there is a shortage or any evidence of damage, do not attempt to use the equipment. Contact the carrier and file a shipment damage claim. A full report of the damage should also be reported to the JPS Customer Service Department. The following information should be included in the report:

- Order Number
- Equipment Model and Serial Numbers
- Shipping Agency
- Date(s) of Shipment

The JPS Customer Service Department can be reached by phone at (919) 790-1011, by fax at (919) 790-1456. Upon receipt of this information, JPS will arrange for repair or replacement of the equipment.

2.3 Reshipment of Equipment

If it is necessary to return the equipment to the manufacturer, a Returned Material Authorization (RMA) number must first be obtained from JPS. This number must be noted on the outside of the packing carton and on all accompanying documents. When packing the unit for reshipment, it is best to use the original packaging for the unit; if this is not possible, special attention should be given to providing adequate packing material around connectors and other protrusions, such as front panel controls. If individual rack-mount units are returned, rigid cardboard should be placed at the corners of the unit to protect against corner damage during shipment. Failure to protect the corners of the front panel causes the most common type of shipping damage experienced on returned rack-mounted equipment.

When applicable, individual original boxes, marked by serial numbers, are provided and must be used if any of the factory-installed radios must be returned for repair.

If any of the ACU-1000 modules must be returned, place them individually in a non-conductive wrapper and provide sufficient protective packing material.
Shipment should be made prepaid consigned to:

JPS Communications, Inc.
Customer Service Department
5800 Departure Drive
Raleigh, North Carolina 27616
USA

Plainly mark with indelible ink all mailing documents as follows:

GOODS RETURNED FOR REPAIR

Mark all sides of the package:

FRAGILE - ELECTRONIC EQUIPMENT

Inspect the package prior to shipment to be sure it is properly marked and securely wrapped.

2.4 Installation Overview

The following steps must be performed to ready the system for use (assumes Primary & Secondary Cases- ignore unneeded instructions if TRP is single case only):

1) If it’s desirable to be able to easily move the system, install casters to the bottom of the case. For a Primary/Secondary system, initially install the casters only on the Secondary Case. When preparing the system for shipping, it may be beneficial to remove the castors.

2) For single-case systems, skip to step 5.

3) Set the Primary Chassis on top of the Secondary Chassis, with all of the radios facing the same direction.

4) Connect the two cases together with the Chassis Interface Cables. There are 2 cables from each of the Secondary Case Radio Trays. One end of each is laced into the swing arm cable guide for connection to a radio via the CPC connector and Radio Tray Cable. The free end has a D-15 connector at the loose end for connection to the Primary Case Extended Rear Panel. A label on the cable identifies the proper connection point on the Extended Rear panel, matching its silk-screened identifiers 1 through 12 for connection to P1 through P12.

5) If access to the local telephone network is desired, connect to L1 on the ACU-1000 PSTN-1 module(s).

6) Apply primary power (115 VAC) to all chassis. If TRP-1000 was purchased with DC capability, the system may be powered by 12 VDC. DC power input connections are made to a rear panel DC Power Distribution Panel. Multiple-case systems require separate DC connections on each case.

7) Connect the system computer (if one is used) to P15 on the extended rear panel.

8) Program the radios to desired frequencies and other parameters. See Section 3 of this manual for any special notes from JPS regarding the radios (if installed by JPS).

9) Install system antennas per Section 2.9.

The system is then ready to begin operation.
2.5 Installation Considerations

Careful attention to the following installation suggestions should result in the best unit/system performance.

The TRP-1000 must be installed in an area that provides protection from the weather and assurance of ambient temperatures between -20 and +60 degrees C. Since the system is neither splash proof nor corrosion resistant, it must be protected from exposure to salt spray. When choosing an installation site, be sure to take into account the need for proper spacing and ground planes for the system antennas.

2.6 AC Power Requirements

The standard TRP-1000 is designed to operate from a 115V, 47 to 63 Hz, single-phase AC power source (see next section for operation with the DC Power Option). The system will meet all of its specifications over a voltage range of +/- 15% from nominal. When idling (no radios in transmit mode), the typical system power consumption of a fully loaded system (with 10 radios installed) is 200 VA, 250 VA max. Actual power consumption will depend on the type and number of radios installed. Note that JPS recommends that all radios be set to their low RF Power setting to prevent desensing of the other radios, as all are located in close proximity to each other. Typical maximum draw of the power supply mounted on the trays is 11A from 100-120VAC, and 7A from 200-240VAC.

2.7 DC Power Requirements (With DC Power Option)

DC power input requirements depend on the configuration of the TRP-1000; how many radios are installed in the case and the power requirements of the individual radios (which vary according to their RF Power Output settings). For Primary Cases, the DC power requirement of the ACU-1000 is found in Section 2.7 of the ACU-1000 Installation and Operations Manual; this power requirement varies with the number of modules installed. The gauge of wire required to supply the DC power will depend on the DC current requirements of the system. If the radios are factory-installed by JPS, a measurement of each radio’s current draw, during TX, will be supplied in Section 3 of this manual.

For an accurate understanding of the DC Power requirement of the TRP-1000, the current drain of each of the radios contained in the Primary Case should to be measured while in transmit mode. If the TRP-1000 is a primary/secondary system each case it will have its own DC Distribution Panel and DC cables must be supplied for each case.

Be sure to use a DC Power Cable of proper size to handle the current required. Tables to determine the allowable ampacities of copper conductors with various insulation types should be consulted and can be found at www.norantel.com, www.nfpa.org (National Electrical Code) and www.csa.ca (Canadian Electrical Code). Use proper connections of the Power Cable to the selected DC power source. If connecting to a battery or alternator, “Starter Cable” type connections are not adequate; proper connections to the battery post or associated terminal are necessary. The torque required for the connections on Line Side of DC Distribution terminal block are given on its data label. 120 Inch Pounds is recommended for wire sizes of 2/O to #6 AWG. 40 Inch Pounds is recommended for #8 AWG.
2.8 **Radio Selection**

The TRP-1000 is designed with the expectation that mobile radios will be installed in the Radio Trays. The trays will accept two radios with a maximum size approx 13 inches long by 7 1/4 inches wide by 3 3/8 inches tall (this leaves room for standard size mounting brackets and hardware). It may be possible to mount larger radios by either mounting only one radio per tray, or for taller radios, increasing the separation between trays. The total available mounting space on the tray is 15.6 inches wide by 13 inches deep by 3.4 inches high. All radios should be run at their low power settings. The 600W power supply on the tray can supply 40 amps continuous at 13.8 VDC.

Handheld radios may be connected to the ACU-1000 but it is not advisable to try to mount them in the Radio Trays. The main problem is that handheld radio antennas are connected directly to the radios, and are vertically polarized for best reception and transmission when held vertically. Handheld radios can only be installed horizontally on the tray. Since there is no cable between the handheld radio and its antenna, there is no way to properly orient the antenna or create vertical or horizontal separation between it and other system antennas (see Section 2.9). Furthermore, the antenna is likely to be sandwiched between two metal plates: the Radio Tray that it is installed on and the tray above it.

2.9 **Proper Use of System Antennas**

The TRP-1000 Optional Equipment Table lists antennas and RF extension cables that may be purchased from JPS. The extension cables allow antennas to be placed further from the system, providing additional separation.

Be sure to observe the following antenna placement considerations for optimal system performance.

2.9.1 **Antenna Location and Desensing**

System antennas should be placed as far apart as necessary to prevent the desensing of the radios, currently in the receive mode, by the radios that are transmitting. Use RF extension cables to separate the antenna locations. When selecting antenna locations, the antennas that require the widest spacing from each other are those connected to radios that operate at similar frequencies. Vertical separation can be more important than horizontal separation. Note that receiver damage can occur if one antenna transmits at a high power level into a nearby antenna of a radio operating at a similar frequency.

Desensing occurs when the antenna of a transmitting radio is too close to the antenna of a radio in the receive mode at a similar frequency (or at a frequency that is a harmonic of the transmitting antenna). Desensing can cause a receiver to unsquelch when receiving a signal outside of the frequency band that the receiver is tuned to. There are two cures for this. The first is to provide the maximum possible separation between the antennas of the problem radios. Different placement schemes can be tested as part of the system setup procedure. The second cure is to reduce the power of the transmitting radio; this will also reduce its coverage area.
2.9.1.1 How Desensing Affects the TRP-1000 System

If sufficient desensing is being caused by some combination of similar operating frequencies and tight antenna placement, some system receivers will inappropriately unsquelch (exhibit an active COR) when one of the other system radios is transmitting on a different frequency. This invalid COR, if it occurs in radios that are currently in use and cross-connected to other system radios, can cause audio signals to be diverted to an improper net. The desensing condition can be easily diagnosed by observing the ACU-1000 front panel while keying up system radios. When desensing is occurring, the COR LEDs of one or more DSP-1s will be lit at the same time that the PTT LED of the DSP-1 associated with offending transmitter is lit. It will be necessary to place that transmitter’s antenna farther away from the antennas of the radios that are becoming unsquelched, or reduce its transmit power.

2.9.2 Proper Use of RF Extension Cables

Do not attach an extension cable unless antenna separation is needed. If the extension cables are used, do not leave them coiled. Long antenna cables create RF loss, and a coiled cable acts as inductor, creating standing wave loss.

2.9.3 Proper Use of Ground Planes

Most antennas (and in particular, the convenient mag-mount version) work best with a good ground plane. A readily available example is the roof or hood of a vehicle. The size of the ground plane must be at least 1/2 wavelength in all directions under the base of the antenna. This can be accomplished, for example, by a metal plate approx. 24” x 24” for a UHF radio and approx. 48” x 48” for a VHF radio. An antenna placed on the ground or on a non-metallic surface such as a wooden table will have a much higher VSWR than an antenna with a good ground plane. The result is less power delivered to the antenna, and therefore a smaller coverage area. The first choice recommended for mag-mount antennas is a vehicle roof or hood. The second choice is on an elevated metal plate. The next best choice is on a metal plate on the ground. FM transmission is line-of-sight, so the higher an antenna is located, the wider the radio’s coverage area will be. The option that results in the smallest coverage area is placing the antenna directly on the ground. This placement, without a ground plane, will result in much of the RF power being transmitted straight upwards.

2.9.4 Antenna Options

The mag-mount dual-band (UHF & VHF) whip antennas listed in Table 1-2 should be trimmed to match the TRP system’s operating frequencies. Instructions are included with each antenna. If the frequencies used will vary depending on the situation, trim the antennas to the midpoint of the range of frequencies expected.

When untrimmed, this type of antenna will safely function at all possible radio frequencies throughout the UHF and VHF range. They will provide a reasonably good VSWR across all frequencies but have minimal gain.

Other antennas may be purchased from a local LMR supplier, and once properly tuned or otherwise adjusted for the type of radio used, will provide more gain and/or directionality. (Note that directionality is not a desired characteristic if you don’t always know where systems users will be located relative to the antenna.)
Note that mobile and hand-held radio antennas are vertically polarized, so to reach them best, the antennas used with the TRP-1000 should be vertically polarized also. The use of directional antennas only makes sense if one knows in advance what direction points to the radios to be communicated with. In many cases, these radios are moving about with the people who use them, so a nondirectional (low gain) antenna is best.

Some antenna types and their characteristics:

a) **Yagi** Tuned, directional, high gain. Can be mounted for either vertical or horizontal polarization.

b) **Discone** Very good VSWR across a large frequency range, non-directional, low gain, vertical polarization.

c) **Log Periodic** Good VSWR throughout a large portion of the UHF or VHF spectrum, directional, moderate gain. Can be mounted for either vertical or horizontal polarization.

d) **Tuned Whip** Excellent VSWR at the tuned frequency, non-directional, low gain, vertical polarization.

e) **Dual-Band Whip** Good VSWR, minimal gain, may be used across both the UHF and the VHF spectrums, vertical polarization. The Dual-Band Whip antenna listed in Table 1-2 should be tuned to the midpoint of the operating frequency range.

*End of Section 2*
3 Special Equipment

3.1 General
This section is reserved for information related to special equipment or build practices involved
with the TRP. Information regarding radios, Sat Phones, VoIP equipment or any other devices
mounted in the TRP-1000 is located here. When the special equipment has its own manual and
its use with the TRP-1000 is fully defined by that manual, this section will list what the
equipment is, where it is installed in the rack, and that its manual is included in the shipment.

3.2 Primary Case Worksheet
Use the figure at the top of the page and the spaces below it to identify the equipment installed
in the Primary Case. For the purposes of these worksheets, any TRP-1000 with an ACU-1000
is considered a Primary Case.

3.2.1 ACU-1000 Module Complement:
Starting from the left side, the standard, required modules are the PSM-1A, HSP-2, and CPM-
2. List the Serial Numbers, Assembly Revisions and Software Revisions of these modules,
plus the type of Interface Module and corresponding revisions in spaces provided. Mark N/A
for vacant slots.

3.2.2 Primary Case Radios Or Other Equipment Installed On Radio Trays:
List the equipment installed in the Primary Case, along with any JPS P/Ns for cables or other
equipment, in the spaces provided. List the Serial Number of the power supply installed on the
tray. If a tray is installed but has no radio mounted in one or both of the available spaces, mark
the unused space “empty”. If there is no tray installed, mark N/A. (For example, a for Primary
Chassis with a single Radio Tray but no radios, mark both Primary Radio Tray A and Primary
Radio Tray B “empty”. Mark trays 2, 3, & 4 “N/A”.

3.3 Secondary Case Worksheet
Use the figure at the top of the page and the spaces below it to identify the equipment installed
in the Secondary Case. For the purposes of these worksheets, any TRP-1000 without an ACU-
1000 is considered a Secondary Case.
**ACU-1000 Configuration:**

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| Radio or Other Equipment Installed: |                                 |
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Special Notes:
4 TRP-1000 Operation

4.1 General
Most of the TRP-1000 operation details are covered in the ACU-1000 manual and the manuals of any radios or other equipment installed in the Radio Trays or otherwise connected to the ACU-1000. Proper operation assumes that all radios and other equipment have already been adjusted for proper operation as described in their equipment manuals or any Applications Notes provided by JPS.

4.2 Power Up
Once the TRP-1000 is installed as explained in Section 2, all that remains is to power up the unit. Be sure that antennas are properly connected before any radios are keyed.

For Primary / Secondary systems, the AC power cord from the Primary Case may be plugged into the power outlet strip of the Secondary Case, as long as the total AC requirement is less than 12 Amps. The total AC power depends on the radios installed in the system, but if all are set as recommended to their low TX power settings, the current draw will be less than 15 amps even if all radios are keyed at the same time. The AC cable(s) is then connected to the AC mains. The power switches on the outlet strips may then be turned on, followed by the power switches of the ACU-1000 and other equipment. Note that if the power outlet switches are used to turn the entire TRP-1000 off and on, some radios will still require that their power switches be cycled to turn them on.

TRP-1000 systems with the DC option require separate DC connections to each case. Note that the cases are still capable of being powered by a 115 VAC (nominal) source. The unit automatically uses whichever power source is available. If both are simultaneously applied, the AC source will be used.

4.3 Operation
Once all TRP-1000 equipment is powered up, system interconnections can be made using the ACU Controller program, the HSP-2 keypad, or by system users via their DTMF keypads. These operations are all covered in the ACU-1000 and ACU Controller manuals.
End of Chapter Four
5 Maintenance

5.1 Scope
The TRP-1000 is a modular system made up of the ACU-1000, radios (and/or other four-wire communication devices), and DC power antennas, with interconnect cabling to interface these components. The section explains how to replace fuses or remove and replace any one of these basic assemblies. Individual assemblies should be returned to JPS for repair (see Section 2.3 Reshipment of Equipment). Repair of individual assemblies is beyond the scope of this manual.

5.2 Spare Modules, Radios, and Power Supplies
Spare ACU-1000 modules or DC power supplies may be purchased from JPS and kept on hand to replace failed components and quickly bring the TRP-1000 back to full operation in critical applications. See Table 1-1 Replaceable Parts List, for JPS part numbers for these items. It may be advisable to have spare radios on hand if the TRP-1000 is going to be used for critical missions.

5.3 ACU-1000

5.3.1 Module Replacement
Individual modules may be removed and returned for repair. The modules (other than the PSM-1A power supply module) may be hot-plugged without damage (that is, removed or replaced with the main power left on). The PSM-1, HSP-2, and CPM-2 modules are critical to system operation and the TRP-1000 will not function without them. If any of the interface modules (DSP-1 or PSTN-1 modules) are removed, the remainder of the system will continue to function normally. It is also possible to move locations of interface modules to maintain operation of critical parts of the system. Assume that radio #3 is critical to an ongoing operation, while radio #10 is not. If the DSP-1 module that controls this radio #3 fails, it’s possible to remove the DSP-1 module that is controlling the non-critical #10 and plug it into the slot that the failed DSP-1 module had occupied (if a different type of radio is associated with #3, some setup changes may be required for optimal operation. To remove any module other than the PSM-1, simply loosen the captive screws at the corners of the module front panels, grasp the module handle and pull it out of the ACU-1000 Chassis. Reverse this procedure to replace a module. To remove the PSM-1A power supply module, remove the TRP-1000 main power source before pulling the module from the chassis. There is a connector that must be removed from the module before it is completely freed from the ACU-1000 chassis.
5.3.2 ACU-1000 Fuse Replacement

This section identifies the three fuses used in the ACU-1000 chassis. Be sure to remove all AC & DC input cabling prior to removing or servicing the PSM-1A. F1 fuses the unfiltered low level DC bus voltage from the PSM-1A that powers the +5V DC switching supplies on each of the other chassis modules. It can be replaced if the PSM-A1 is removed from the chassis. F1 prevents damage to the PSM-1A if a short circuit or other unusual load is applied to this bus. If AC is applied and the AC LED is lit, the +12V and –12V LEDs should light when the PSM-1A front panel pushbutton power switch is pushed in. If they do not, this is an indication that Fuse F1 is blown or possibly another type of fault in the PSM-1A. Similarly, if the unit is running off of a 12 VDC supply source and the DC LED is lit, the +12V and –12V LEDs should light when the main power pushbutton is pressed.

The other fuses are located on the ACU-1000 rear panel. To access, remove the four mounting screws of the Extended Rear Panel and gently lower it out of the way so that the back of the ACU-1000 can be reached. If AC is applied but the AC LED on the PSM-1A is not lit, then the AC Input Fuse, F2, is probably blown (or there is another fault in the PSM-1). If DC is applied but the DC LED on the PSM-1 is not lit, then the DC Input Fuse, F3, is probably blown (or less likely, there is another fault in the PSM-1). Both of these fuses may be accessed at the rear of the unit.

See the ACU-1000 manual for more complete information.

<table>
<thead>
<tr>
<th>Table 5-1</th>
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</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>F2</td>
<td>3AT 250V, 5x20mm</td>
</tr>
<tr>
<td></td>
<td>1.6AT 250V, 5x20mm</td>
</tr>
<tr>
<td>F3</td>
<td>20AF 32V, 3AG</td>
</tr>
</tbody>
</table>

5.3.3 DC Option Fuse Replacement

The DC Power Distribution Panel uses standard MAXI blade type fuses typical of low voltage, high amperage automotive applications. The radio trays each have a MAXI 40 Amp 32 Volt fuse while the ACU-1000 wiring is protected by a MAXI 20 Amp 32 Volt fuse. All fuses are located on the Power Distribution Panel at the rear of the TRP case. A blown fuse gives visual indication by obvious discoloration. The fuse function and size is listed adjacent to its location in the fuse block, listed by Radio Tray number, with one fuse position reserved for the ACU-1000. Some fuse positions may contain fuses; this will depend on TRP configuration (for example, a secondary case will not contain a fuse for the ACU-1000).
5.3.4 ACU-1000 Chassis Replacement

Since most of the ACU-1000 circuitry is located on its various plug-in modules, it is very unlikely that the chassis will ever require replacement. If however, it must be removed from its transportable case, follow these steps.

- Turn off the ACU-1000 main power switch and disconnect the TRP-1000 system AC power cord from the main power source.
- If the TRP has the DC Option, disconnect the unit from the DC power source.
- To gain access to the ACU-1000 mounting brackets at the rear of the transportable case, remove the Extended Rear Panel mounting screws and leave the assembly dangling. Similarly, unscrew the power outlet strip mounting screws and move it out of the way. Then reach in and disconnect the D-sub cables from the back of the ACU-1000, allowing the Extended Rear Panel assembly to be set aside.
- Disassemble the ACU-1000 rear support brackets from the top rails of the case.
- Remove the ACU-1000 front panel rack mount screws.
- Pull the ACU-1000 out of the chassis.

To re-install, reverse this procedure.

5.4 DC Power Supply

The DC Power Supplies are not user-serviceable, other than fuse replacement. Failed units must be returned to JPS for replacement or repair. See Section 2.3 Reshipment of Equipment.

5.4.1 Replacement Of DC Power Supply

To remove a DC Power Supply, first disconnect the power cord of the tray that houses the supply. Slide the tray out fully (push in the tabs on either side of the rack slides) and remove the guards over the AC input and DC output connections on either side of the supply. These connections can be undone either now or after the supply has been disassembled from the Radio Tray. Remove the four nuts that connect the power supply (with its mounting bracket still attached), to the Radio Tray. Spare DC Power Supplies, with the mounting bracket attached, are listed in the Replaceable Parts List, Table 1-1. To replace, simply reverse this procedure. See Section 2.3 Reshipment of Equipment, for further information regarding the return of equipment to JPS for repair or replacement.

5.4.2 DC Power Supply Fuse Replacement

To change a DC Power Supply fuse, first follow the steps in the section above to remove the supply, with bracket attached, from the Radio Tray. The AC power cord must be unplugged from the AC mains before beginning disassembly, and the power supply must be removed completely from the tray (and all wiring) before its cover is removed.

First disassemble the mounting bracket from the power supply. Then remove all of the screws that hold on the power supply top cover. Place the cover aside, upside down, without removing the AC connections from the upper right corner. (See Figure 5-1). Replace the faulty fuse and reverse this procedure to re-install the DC Power Supply in the Radio Tray.
5.5 **Extended Rear Panel Assembly**

The Extended Rear Panel Assembly contains some components (speaker, cable assemblies) that may be replaced in the field. See Table 1-1 Replaceable Parts List. Entire Rear Panel Assemblies may also be returned to JPS for repair or replacement (see Section 2.3 Reshipment of Equipment).

First turn off the ACU-1000 and AC power outlet strips and disconnect the system AC power cord. Then remove all exterior cabling from the Extended Rear Panel. Next, remove the panel mount screws from the four corners and pull the panel out of the chassis. If one of the 12 P1-P12 cables must be replaced, disconnect from each end. Similar procedure can be used to replace the RS-232 cable.

Note that an expected failed cable can be tested by:

- Disconnect the panel assembly from the rear of the case as described above.
- Remove the “suspect” cable from the back of the ACU-1000.
- Connect what would have been plugged into this cable at the face of the Extended Rear Panel.
- If the failed feature now works, the suspect cable was indeed bad; if not, the failure is elsewhere.
5.6 Periodic Maintenance

There are no periodic maintenance requirements for the basic ACU-1000. There may be requirements for the radios or other equipment installed on the Radio Trays. See the individual Operations & Maintenance Manuals for this equipment for details.
End of Chapter Five
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