RadioRouter® Base Station Outdoor Installation Guide

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Version 1.3

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LIMITATION OF LIABILITY

WARRANTY DISCLAIMER

Regulatory Compliance Information

The Flarion® RadioRouter® base station complies with the following regulatory compliance requirements:

- **Safety**
    - UL 60950 — Underwriters Laboratories, Inc.
    - CAN/CSA-C22.2 No. 60950 — Canadian Standards Association
    - EN 60950 — European Norm
    - IEC 60950 — International Electrotechnical Commission
- **EMC — Electromagnetic Compatibility**
    - FCC Part 15 (CFR 47) Class A — Federal Communications Commission, Code of Federal Regulations
    - ICES-003 Class A — Interference-Causing Equipment Standard
    - EN55022 Class A
    - CISPR22 Class A
- **Telecom**
    - FCC Part 27 — Miscellaneous Wireless Communications Services
- **Industry/Environmental**
    - GR-63-CORE NEBS Level 3 — Network Equipment Building System
    - GR-1089-CORE NEBS Level 3 — Electromagnetic Compatibility and Electrical Safety
    - ETSI EN 300 019-2-3 V2.1.2 — European Telecommunications Standards Institute
    - GR-487-CORE — Generic Requirements for Electronic Equipment Cabinets

FCC Class A Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. (CFR reference 15.105)

Modifying the equipment without Flarion's authorization may result in the equipment no longer complying with FCC requirements for Class A digital device. In that event, your right to use the equipment may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your own expense. (CFR reference 15.21)

Canadian Class A Statement

This Class 'A' digital apparatus complies with Canadian ICES-003.

Cet appareil numerique de la classe 'A' est conforme á la norme NMB-003 de Canada.

HOW TO USE THIS MANUAL

ABOUT THIS DOCUMENT

This guide is intended for use by qualified engineering personnel only. The *RadioRouter® Base Station Outdoor Installation Guide* covers the information required to install the hardware of an outdoor RadioRouter base station.

INTENDED AUDIENCE

This Guide is intended primarily for qualified engineering personnel who will use it to complete the base station installation process. It can also be used by maintenance personnel after the initial installation is complete.

RELATED DOCUMENTS

This guide focuses on the initial hardware installation. For information on commissioning the base station after hardware installation, see the *RadioRouter® Commissioning Guide*. For information on physical installation of the indoor base station, see the *RadioRouter® Base Station Indoor Installation Guide*. For other documentation or for additional copies of existing documentation, please contact your Flarion representative.

CHANGE HISTORY

- Version 1.0 — Initial release.
- Version 1.1 — Minor changes to power up sequence.
- Version 1.2 — Corrections to Figure 2–2. New ground connector at load center. New ground cable connection point. Pin information for T1 punch-down on 66–block.
- Version 1.3 — Legal notices and edits, FCC reg change.

DOCUMENT CONVENTIONS

The following typographical conventions are used in this document:

- `Screen font` is used to show output from the system in terminal session descriptions.
- *`Italics screen font`* is used for variables the system will supply.
- **`Bold screen font`** is used to show user input in terminal session descriptions.
- ***`Bold italics screen font`*** is used for variables the user must supply.
- **Bold** is used for command names such as **Show**, non-printing characters, and function keys such as **Enter**.
- The plus sign (+) is used for keys that users press and hold together such as **Ctrl**+**Alt**+**Delete**.

WARNINGS, CAUTION STATEMENTS AND NOTES

This document uses certain conventions to indicate supplementary information, of varying degrees of severity and importance. Material marked with a "warning" label is considered critical; failure to observe this information can result in death or serious injury. Information that refers to potential damage to equipment is marked with a "caution" label. Information that is considered additional but useful is marked with a "note" label.

Samples of warnings, caution statements and notes appear as follows:

WARNING:

WARNINGS ARE ALWAYS IN UPPER CASE. WARNINGS RELATE TO POTENTIAL LOSS OF LIFE OR SERIOUS INJURY. YOU MUST OBEY ALL WARNINGS.

CAUTION:

Normal Cautions are in bold type. Cautions relate to potential damage to equipment. You <u>must</u> obey all cautions.

ESD CAUTION:

Electrostatic Discharge (ESD) warnings are in bold type, and are accompanied by the ESD warning symbol. ESD can damage sensitive electronic equipment; ESD warnings should likewise be heeded.

Note:

Notes are displayed in italic. Notes contain information that may be valuable to the reader, but is considered supplementary to the normal text flow.

ABBREVIATIONS

For a list of abbreviations used in this and other Flarion documents, refer to *Appendix C - List of Abbreviations*.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Chapter 1. Overview

The *RadioRouter® Base Station Outdoor Installation Guide* covers all of the necessary information required to physically install the RadioRouter base station hardware. This guide assumes that a suitable site has already been prepared. A checklist is provided to assess the site prior to installation.

Once the physical installation is complete, the base station can be configured and commissioned. Instructions for the configuration process can be found in the *RadioRouter® Base Station Commissioning Guide*.

The RadioRouter base station has the following physical characteristics:

- Standard EIA 19 inch rack mount
- 44 U of electronics mounting height
- 62.5" H x 49.2" W x 42.6" D with door and rear panel installed
- 1133 lbs with 2 hour battery backup
- Inherent forced air cooling heat exchanger system with PAs and filters cooled with direct external air
- Front and rear access provided for maintenance
- Welded aluminum construction
- Antenna and T1 cable entry from rear
- Power cable entry from side
- Vented battery compartment with removable drawer access

WARNING:

THE RADIOROUTER BASE STATION OUTDOOR CABINET WEIGHS APPROXIMATELY 1150 LB AND IS TOP HEAVY. CARE MUST BE TAKEN TO HANDLE THE CABINET PROPERLY WITHOUT DANGER TO THE INSTALLATION PERSONNEL OR OTHER NEARBY EQUIPMENT.

IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT ALL LOCAL, STATE, AND FEDERAL SAFETY REQUIREMENTS ARE FOLLOWED.

ESD CAUTION:

It is the responsibility of the installer to ensure that all necessary precautions are taken to avoid electrostatic discharge damage to the equipment.

Note:

All installation work must be coordinated with the carrier to insure compliance with carrier requirements regarding scheduling work during maintenance windows.

1.1. Installation Equipment

In addition to standard installation tools, you will need the following:

*   Southco® Bellcore 216 key — part number E3–12–1
*   Tamper resistant insert hex bit — Wiha part number 71940
*   Handle hex tool key — Sierra Pacific Engineering and Products part number 392–K or equivalent
*   Conduit pull box with hole diameter 1.375" to 1.50"

It is recommended that special equipment be used to move the RadioRouter base station cabinet. The following list gives examples of equipment which can be used:

*   Pallet jack with 27" width across the jacks. Pallet jack 4YX97 from Dayton or equivalent.
*   Hoist or crane with heavy duty structural straps or chains — 1500 lb load capability.

Chapter 2. Verifying the Site Preparation

Before you begin the physical installation of the base station, confirm that the site preparation is complete. The checklist that follows identifies the items that must be in place before the installation can begin. If any items are incomplete or missing, fill out the Punchlist in *Appendix A - Outdoor Base Station Site Preparation Punchlist*.

2.1. Site Preparation Checklist — Outdoor Base Station

- **Floor Plan**
    - Architectural drawing or sketch of site indicating location of all equipment to be installed including base station cabinet and cables
    - Floor plan with adequate space for cabinet — at least 24" front, 12" side, and 24" rear
- **Environment**
    - Cement slab for mounting cabinet
    - Temperature range −40 °C to 46 °C
- **Electrical system**
    - Split phase 240 VAC (120/240 VAC) or three-wire plus ground 240 VAC service
    - External Service Entrance with main breaker and surge suppressor
- **Antenna plant**
    - Mounting plate with antenna connectors
- **T1 connection**
    - Network interface unit in the demarcation point
    - T1 surge suppressor installed
- **Cables**
    - AC power cabling: #12 AWG or heavier. Sufficient length to reach base station plus 36"
    - Ground cabling to master ground bar: #6 to #2 AWG
    - RF cabling: Andrew 1/2" SuperFlex jumpers or equivalent. Sufficient length to reach base station plus 24". Color Code as described in *Chapter 6. Connecting the Antennas*.
    - T1 cabling: 100 ohm twisted pair cable, Beldin 9570 or equivalent. Sufficient length to reach base station plus 36".

2.2. Preparing the Floor

A concrete slab at the outdoor base station location must be provided for mounting. Install concrete anchors in the slab for 3/8" size bolts, 1" minimum length. Use corrosion resistant anchors.

Locate the anchors to match the mounting hole pattern of the outdoor cabinet assembly. There are a total of six (6) clearance holes in the base of the cabinet, one in each corner and two located centrally. *Figure 2-1: Clearance Hole in Base of Cabinet* shows the clearance hole in the rear right corner of the cabinet near the antenna connections. *Figure 2-2: Clearance Holes in Cabinet Base — Bottom View* shows the location of all six holes.

Figure 2-1: Clearance Hole in Base of Cabinet

FRONT

Ø0.56 [Ø14.2]
6 PLACES

3X23.250 [590.55]

3.38 [85.7]

3.75 [95.3]

2X20.000 [508.00]

2X40.000 [1016.00]
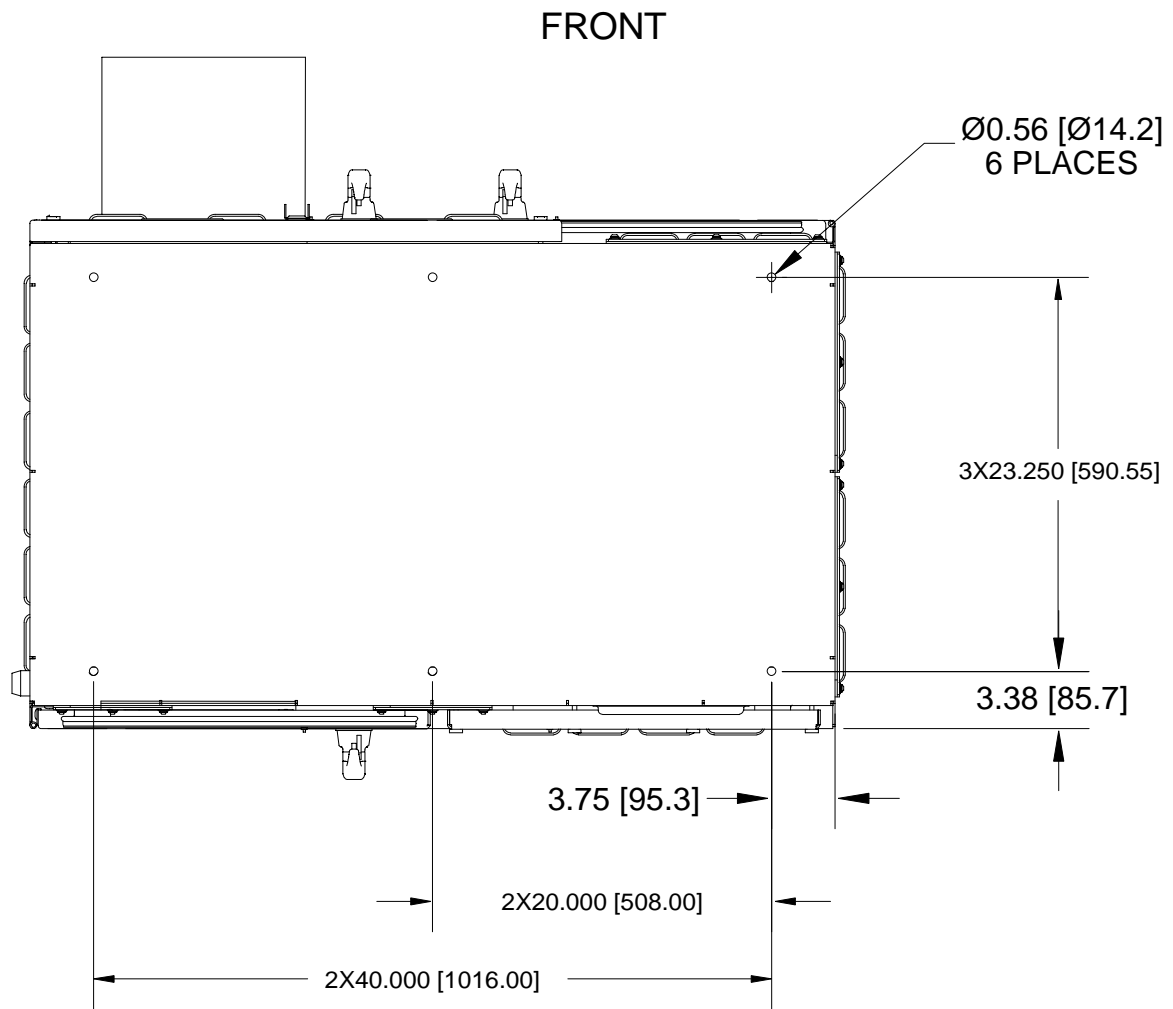
Figure 2-2: Clearance Holes in Cabinet Base — Bottom View

Chapter 3. Installing the Cabinet

The RadioRouter base station cabinet is shipped assembled, shrouded in cardboard, and mounted on a shipping pallet.

WARNING:

⚠ **THE RADIOROUTER BASE STATION OUTDOOR CABINET WEIGHS APPROXIMATELY 1150 LB AND IS TOP HEAVY. CARE MUST BE TAKEN TO HANDLE THE CABINET PROPERLY WITHOUT DANGER TO THE INSTALLATION PERSONNEL OR OTHER NEARBY EQUIPMENT.**

Equipment that can be used to move the base station is described in *Section 1.1. Installation Equipment*.

3.1. Removing the Cabinet from the Pallet

When this procedure is completed, the cabinet will be free to be moved directly into place.

1. Remove the cardboard shroud and discard.

2. Inspect the cabinet for damage. If there is any damage, fill out the Punchlist in *Appendix B - Outdoor Base Station Installation Punchlist*. If the damage is minor and does not prevent continuation of the installation procedures, continue with the installation. If the damage prevents continuation of the installation, contact the Project Manager for instructions.

3. Remove the rear access screw panels. *Figure 3-1: Outdoor Cabinet Rear Screw Panels* shows the location of the panels. A tamper resistant insert hex bit, Wiha part number 71940, is required to remove the tamper-resistant screws.

Note:

Save all removed screws. The rear panel and side panels are replaced after all of the system cables have been routed. Use the same tamper resistant screws that were removed.

Figure 3-1: Outdoor Cabinet Rear Screw Panels

4.   Remove the side access screw panels using the tamper resistant insert hex bit. See *Figure 3-2: Side Screw Panels*.

Figure 3-2: Side Screw Panels

5.   Locate the battery tray on the front of the cabinet. See *Figure 3-3: Battery Tray — Front View*.

Figure 3-3: Battery Tray — Front View

6.   Unscrew the two screws in the front of the tray. Use a 7/16" socket for the hex head bolts.

7.   Unlock the tray lock with a Southco Bellcore 216 key part number E3–12–1.

8. Slide the battery tray out as far as it will go. See *Figure 3-4: Battery Tray Open*.

Figure 3-4: Battery Tray Open

9. Remove all four cabinet-to-pallet mounting bolts. You may have to access the front bolts from the rear access panels.

10. Close the battery tray.

11. Lock the tray and replace the two screws.

   The cabinet is now ready to be moved into place.

3.2. Lifting the Cabinet

The cabinet can be lifted by a hoist or crane using heavy duty structural straps or chains with 1500 lb load capability. Attach the straps or chains with hooks to the four eyebolts located at the top of the cabinet. *Figure 3-5: Eyebolts for Lifting Cabinet* shows the location of the eyebolts.

Note:

Before lifting the cabinet into place, make sure all necessary mounting holes have been drilled in the concrete slab. See Section 2.2. Preparing the Floor.

Figure 3-5: Eyebolts for Lifting Cabinet

3.3. Mounting the Cabinet to the Concrete

Once the cabinet has been moved to its final location, it must be bolted to the concrete.

1.   Align the clearance holes in the base of the cabinet to the threaded holes in the concrete.

2.   Bolt the cabinet to the concrete using 3/8" diameter bolts, 1" minimum length, and flat washers. Use corrosion resistant screws and washers.

3.   Tighten the bolts to 180 in-lb +/- 25 in-lb.

Note:

The rear and side access panels are not replaced at this time. They are replaced after all of the system cables have been routed.

Chapter 4. Connecting the Power System

The outdoor base station cabinet requires a connection to AC power. This chapter contains procedures for routing the power cable and connecting to power and ground.

WARNING:

⚠️ **WHEN PERFORMING ANY TASKS INVOLVING THE POWER SYSTEMS, MAKE SURE THAT THE POWER IS NOT LIVE. ALL POWER OPERATIONS SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.**

4.1. Routing the Power Cable

The main power cable is routed into the cabinet from the left rear of the cabinet, through a flexible conduit up to the AC Load Center. See *Figure 4-1: Power Cable Entry — Rear View* and *Figure 4-2: Conduit for Power Cable — Rear View*. Internal cabinet wiring routes the power from the load center to the equipment in the base station.

For this procedure you will need:

- Handle hex tool key — Sierra Pacific part number 392–K or equivalent
- Conduit pull box with hole diameter 1.375" to 1.50"

Figure 4-1: Power Cable Entry — Rear View
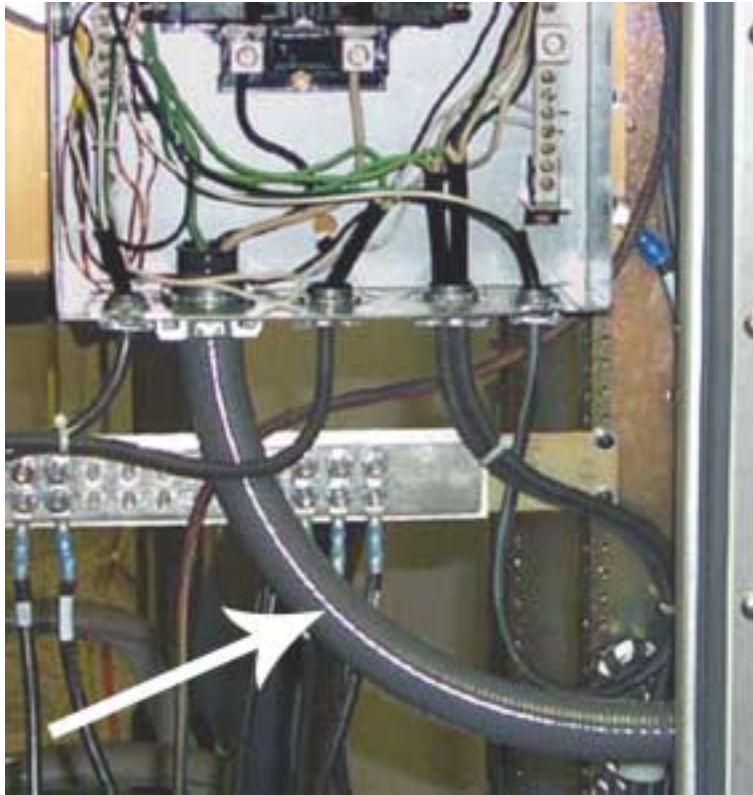
Figure 4-2: Conduit for Power Cable — Rear View

1. Open the rear door of the cabinet using the handle hex tool key.

2. Route the cable through the side conduit connector hole into the 1" flexible conduit provided.

3. Interface to the 1" bulkhead conduit fitting provided on the outside of the cabinet with a conduit pull box with hole diameter 1.375" to 1.50". The interface must be leak tight.

4. Route the cable through the flexible conduit up to the AC load center.

4.2. Connecting the Power Cable

1. Locate the AC power connection points in the Load Center. See *Figure 4-3: Load Center Connections*.
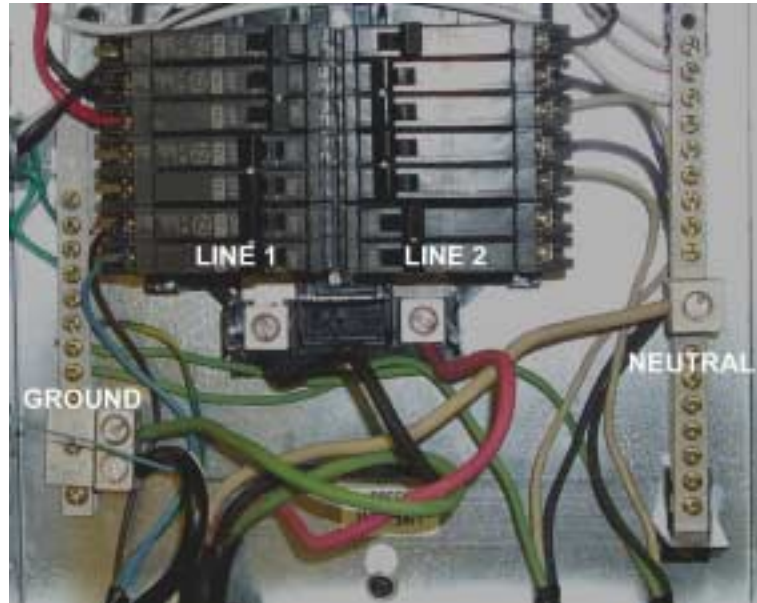
Figure 4-3: Load Center Connections

2. Insert the ground wire into the ground connector and tighten the screw. Use #12 AWG wire or heavier.

3. Connect the power cable to the screw terminals for Neutral, Line 1, and Line 2. Use #12 AWG wire or heavier.

4. Connect the other end of the cable to the AC power source in the Service Entrance.

4.3. Connecting the Ground Cable

The cabinet must be connected to earth ground at the installation site.

CAUTION:

⚠️ **Failure to properly connect the cabinet to ground could result in permanent damage to the equipment.**

1. Locate the main ground connection. It is located inside the lower side panel next to the antenna connections. See *Figure 4-4: Main Ground — Side View*.
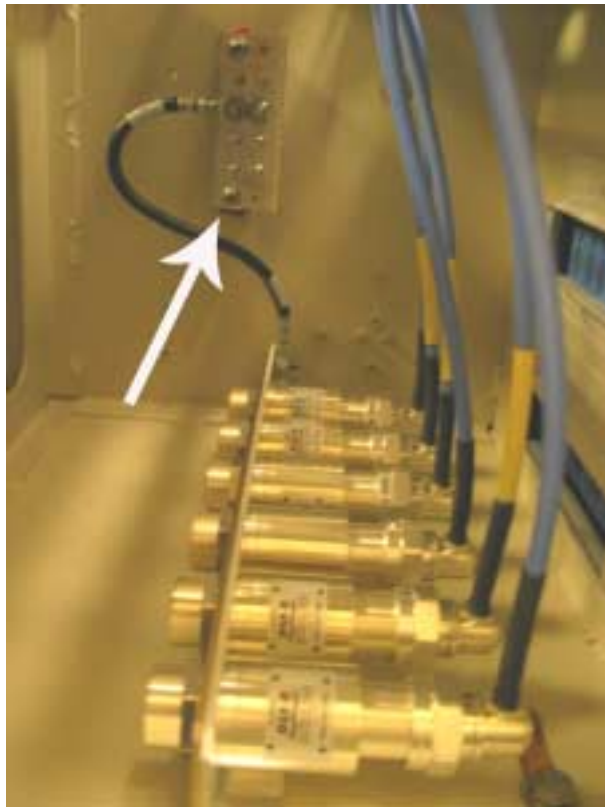
Figure 4-4: Main Ground — Side View

2.   Locate the Roxtec® assembly on the bottom rear of the cabinet. See *Figure 4-5: Roxtec Assembly*.

Figure 4-5: Roxtec Assembly

3.   Remove the outer panel and seal inserts of the Roxtec assembly. Additional information and instructions for the assembly are available on line from Roxtec.

4.   Route the ground cable into the lower compartment through the rectangular opening.

5.   Connect the ground cable to the connectors shown in *Figure 4-6: Main Ground Connection Point*. Use a #6 to #2 AWG wire with a 2–hole lug for a 1/4" diameter stud.
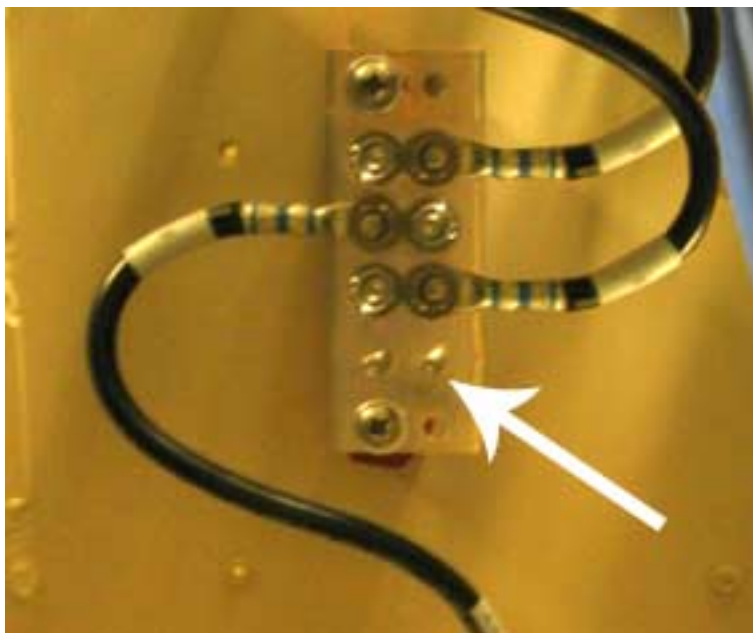
Figure 4-6: Main Ground Connection Point

6.   Fasten the lug onto the stud with the nuts provided. Tighten the nuts to 40–50 in-lb torque.*Figure 4-7: Main Ground with Cable* shows the ground cable attached to the studs.
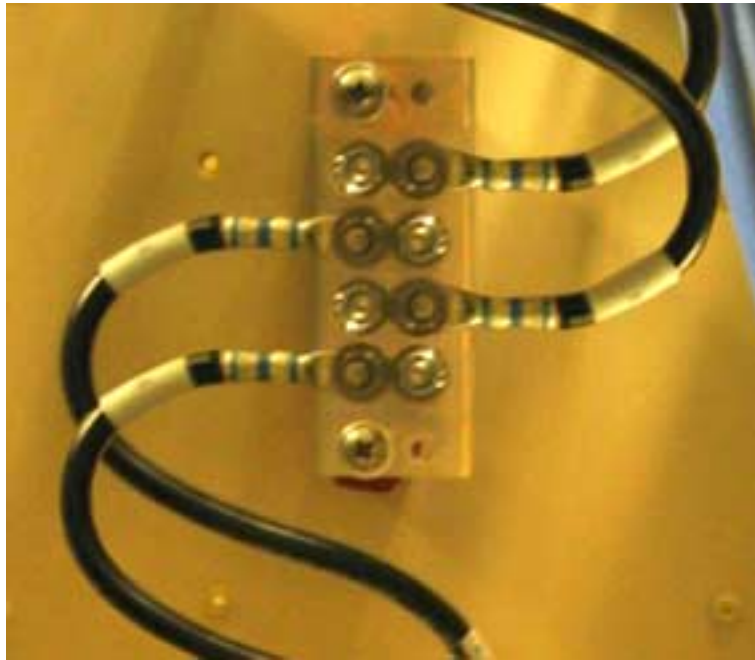
Figure 4-7: Main Ground with Cable

7.   Connect the other end of the cable to the Master Ground Bar or other suitable ground source available at the installation site.

Note:

Reinstall the Roxtec seal inserts and outer panel after all of the system cables have been routed. The seal inserts are installed tight against each cable and are held in place when the outer panel is installed. See Figure 6-4: Cables Installed in Cabinet.

Chapter 5. Connecting the Core Network Cables

The RadioRouter base station accesses the core network through a T1 connection.

5.1. Routing the T1 Cables

1. Remove the rear access panel above the Roxtec cable entry ports. See *Figure 5-1: Access to T1 Connections — Rear View*. Use a 7/8" socket for the hex head bolts.

Figure 5-1: Access to T1 Connections — Rear View

2. If they have not been removed already, remove the outer panel and seal inserts of the Roxtec assembly.

3.   Insert the cables through the rectangular opening into the lower compartment of the cabinet.

4.   Route the cables through the internal cable clearance holes into the electronics compartment. *Figure 5-2: Cable Clearance Holes* shows the clearance holes.

Figure 5-2: Cable Clearance Holes

Note:

Reinstall the Roxtec seal inserts and outer panel after all of the system cables have been routed. The seal inserts are installed tight against each cable and are held in place when the outer panel is installed. See Figure 6-4: Cables Installed in Cabinet.

5.2. Connecting the T1 Cables

T1 connections are made using a 66–punch down block or using cables terminated in RJ-48 connectors. Both connectors are located in the T1 termination box shown in *Figure 5-3: T1 Termination Box — Rear View*.

Figure 5-3: T1 Termination Box — Rear View

1.   Loosen the two latch screws on the right of the T1 termination box. Open the box.

2.   Route the cable through the existing cable grip in the T1 termination box as shown in *Figure 5-4: T1 Termination Box Open.* Seal by tightening the cable grip seal nut.

Figure 5-4: T1 Termination Box Open

3.   Choose an installation method. To install using RJ-48 plugs, go to *Step 4*. To install using the 66–block, go to *Step 5*.

4.   To install T1 using RJ-48 plugs:

4.a.   Remove the jumper cables from the 66–block.

4.b.   Insert the plugs in the connectors to the right of the 66–block. Begin with port 1 on top and continue down for additional ports. Up to 4 T1 ports may be connected. Refer to the diagram in *Figure 5-5: T1 Connections on 66–Block.*

	T	R	T	R	
J1P1					J1P1
J1P2					J1P2
J1P3					J1P3
J1P4					J1P4
J2P1					J2P1
J2P2					J2P2
J2P3					J2P3
J2P4					J2P4
J3P1					J3P1
J3P2					J3P2
J3P3					J3P3
J3P4					J3P4
J4P1					J4P1
J4P2					J4P2
J4P3					J4P3
J4P4					J4P4
J5P1					J5P1
J5P2					J5P2
J5P3					J5P3
J5P4					J5P4
J6P1					J6P1
J6P2					J6P2
J6P3					J6P3
J6P4					J6P4
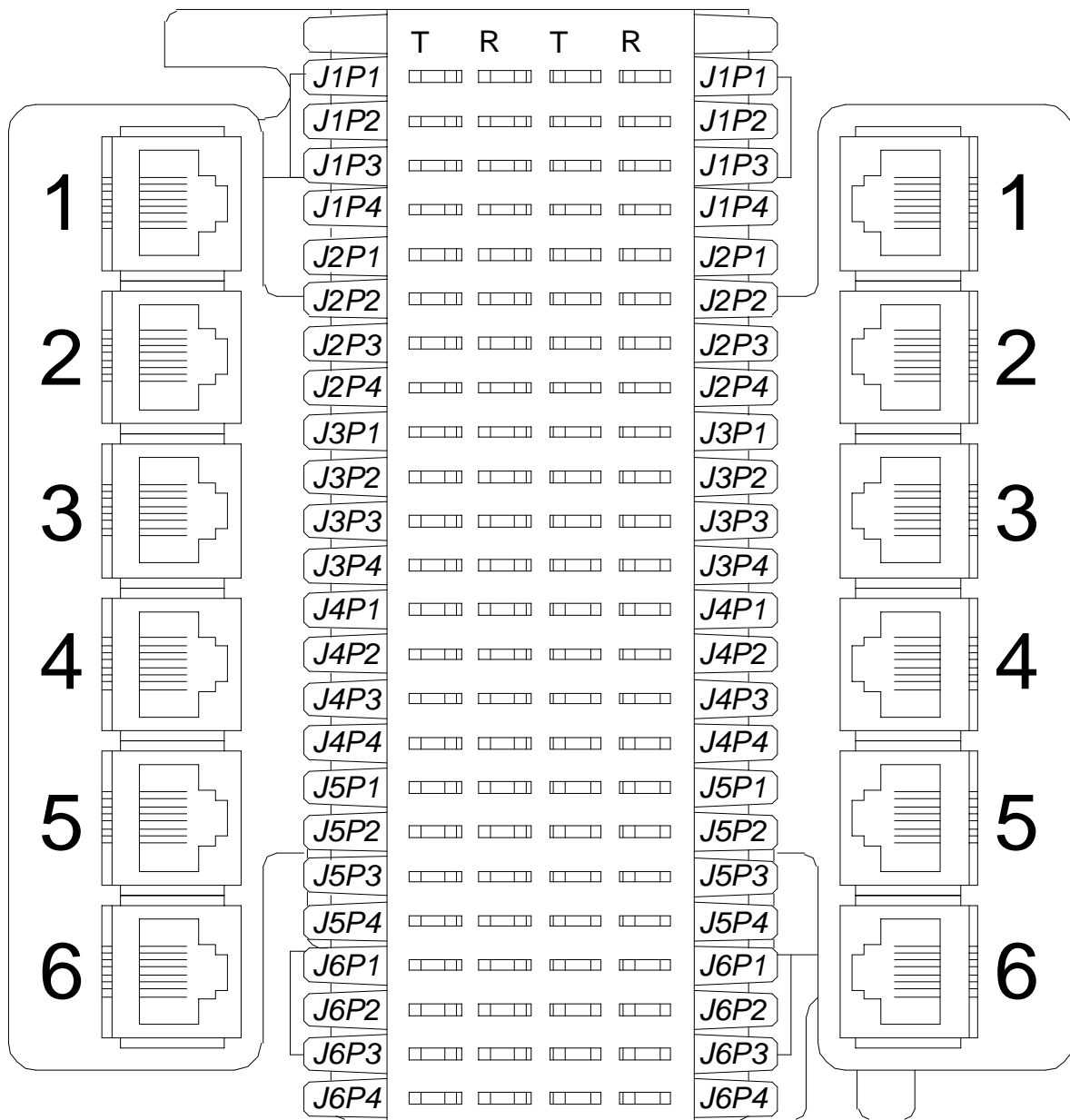
Figure 5-5: T1 Connections on 66–Block

5.   To install T1 using the 66–block:

    5.a.   Make sure that a jumper cable is in place for each connection you plan to make.

    5.b.   Expose an appropriate length of wire.

    5.c.   Attach to the punch-down insulation displacing terminals according to *Table 5.1 Network Connection Pin Placement*.

Table 5-1: Network Connection Pin Placement

Network Connection	Port	Pins
T1 — pairs 1 and 2	1	J1P1 (T,R) J1P2 (T,R)
	2	J2P1 (T,R) J2P2 (T,R)
	3	J3P1 (T,R) J3P2 (T,R)
	4	J4P1 (T,R) J4P2 (T,R)

6.   After all connections are made, close the door of the network termination box. Secure the box with the existing latch screws.

7.   After all connections are made, close the door of the T1 termination box. Secure the box with the existing latch screws.

8.   Replace the rear panel using hex head bolts and cup washers. Torque each bolt until the gasket is completely compressed and a hard stop is achieved.

Chapter 6. Connecting the Antennas

CAUTION:

⚠️ **Antenna cables may be prepared for installation, but do not connect the cables to the cabinet until the completion of RF Commissioning. Instructions for RF Commissioning can be found in the *RadioRouter® Base Station Commissioning Guide*.**

All antenna operations should be performed by qualified personnel only. Installers must meet the requirements of FCC Bulletin OET 65 and coax terminations and have expertise working with RF coaxial cable. Care must be taken not to crimp or damage the cables. Antennas should be installed in accordance with NEC Section 810.

There are six 7/16" DIN female antenna connectors. See *Figure 6-1: Antenna Connectors — Side View* and *Figure 6-2: Antenna Connectors Schematic — Top View*. When viewed from the front of the cabinet from left to right, the connectors are:

1. Alpha sector Tx/Rx
2. Beta sector Tx/Rx
3. Gamma sector Tx/Rx
4. Alpha sector Rx only
5. Beta sector Rx only
6. Gamma sector Rx only

It is recommended that the antenna cables that attach to the connectors be clearly labeled with color-coded bands. For example:

1. Alpha sector Tx/Rx — 1 white band
2. Beta sector Tx/Rx — 1 blue band
3. Gamma sector Tx/Rx — 1 green band
4. Alpha sector RX only — 2 white bands
5. Beta sector Rx only — 2 blue bands
6. Gamma sector Rx only — 2 green bands

Figure 6-1: Antenna Connectors — Side View

ANTENNA ENTRY SEAL

REMOVEABLE
SIDE PANEL

ALPHA | BETA | GAMMA | ALPHA | BETA | GAMMA
TX/RX | TX/RX | TX/RX | RX | RX | RX

ANTENNA CONNECTION
THIS SIDE

FRONT
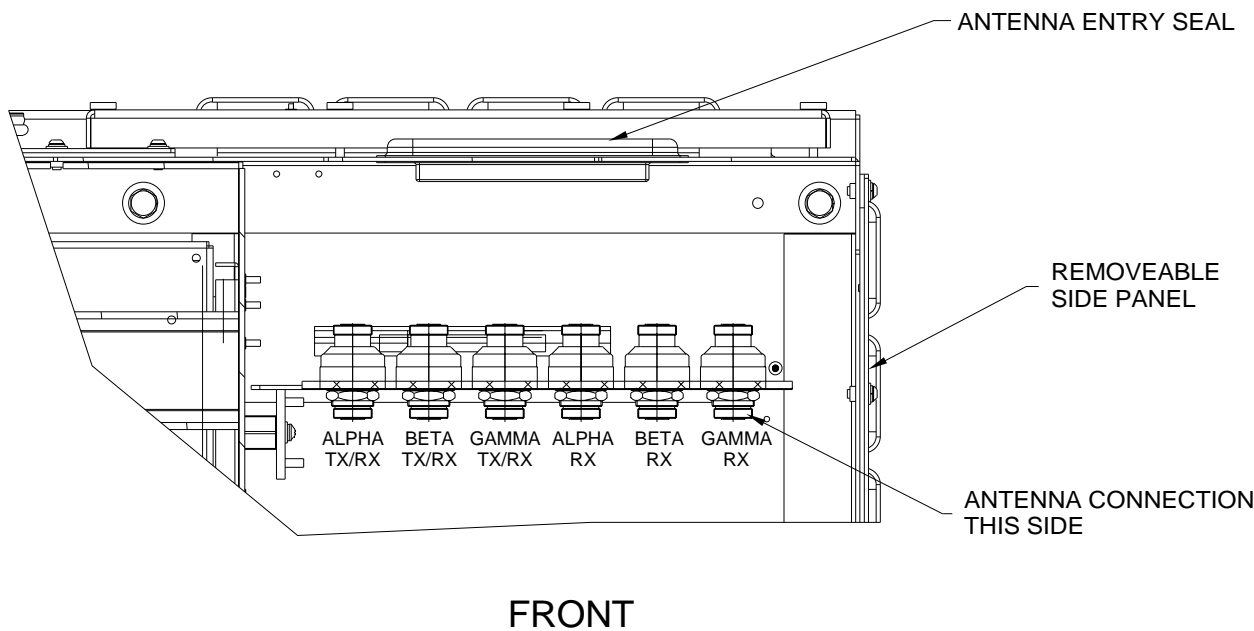
Figure 6-2: Antenna Connectors Schematic — Top View

6.1. Connecting the Antenna Cables

1. If they have not been removed already, remove the side access screw panels using a tamper resistant insert hex bit. See *Figure 3-2: Side Screw Panels*.

2. If they have not been removed already, remove the outer panel and seal inserts of the Roxtec assembly on the rear of the cabinet. See *Figure 4-5: Roxtec Assembly*.

3. Route the antenna cable through the rectangular opening in the rear of the cabinet.

4. Route the cable with the proper bend radius and connect it to the lightning suppressors shown in *Figure 6-3: Antenna Cable Installed*.

Figure 6-3: Antenna Cable Installed

5. Fully seat the connector and hand tighten with an appropriate tool. The cable connector nut is 1 1/4" hex across flats.

6. Repeat *Step 3* through *Step 5* for all antenna cables.

7.   Reinstall the Roxtec seal inserts and outer panel after all of the system cables have been routed. The seal inserts are installed tight against each cable and are held in place when the outer panel is installed as shown in *Figure 6-4: Cables Installed in Cabinet*.

Figure 6-4: Cables Installed in Cabinet

Chapter 7. Powering Up the Cabinet

The cabinet requires AC power to operate. Before attempting to power up the cabinet, verify that AC power is available. It may be necessary to wait for a maintenance window to connect the cabinet to AC power and perform this procedure.

WARNING:

ALL POWER OPERATIONS SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY. BEFORE ATTEMPTING TO POWER UP THE SYSTEM, CONFIRM THAT ALL POWER CONNECTIONS HAVE BEEN MADE PROPERLY.

The base station is powered up using the AC circuit breakers shown in *Figure 7-1: AC Load Center— Rear View* and the DC circuit breakers shown in *Figure 7-2: DC Power Distribution Panel — Front View*.
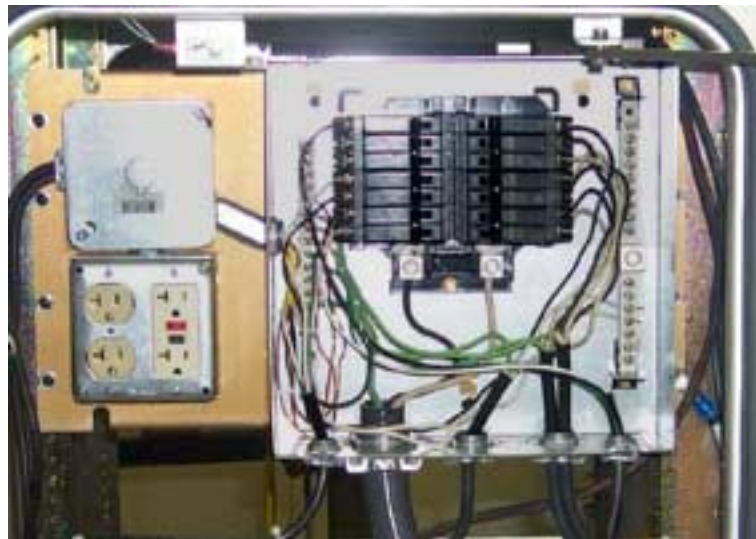
Figure 7-1: AC Load Center— Rear View

Figure 7-2: DC Power Distribution Panel — Front View

7.1. Powering Up the Cabinet

The cabinet is powered up using the AC circuit breakers in the Load Center at the rear of the cabinet and the DC circuit breakers on the distribution panel on the front of the cabinet.

For this procedure you will need a volt meter.

1.   Before turning on the power, confirm the AC voltage:

    1.a.   Connect the leads of the volt meter across the screws as shown in *Figure 7-3: Load Center 240 VAC Test Points*. The voltage across should be 240 VAC.

    1.b.   Connect the leads of the volt meter across the screws as shown in *Figure 7-4: Load Center 120 VAC Test Points — Test 1*. The voltage across should be 120 VAC.

1.c.   Connect the leads of the volt meter across the screws as shown in *Figure 7-5: Load Center 120 VAC Test Points — Test 2*. The voltage across should be 120 VAC.
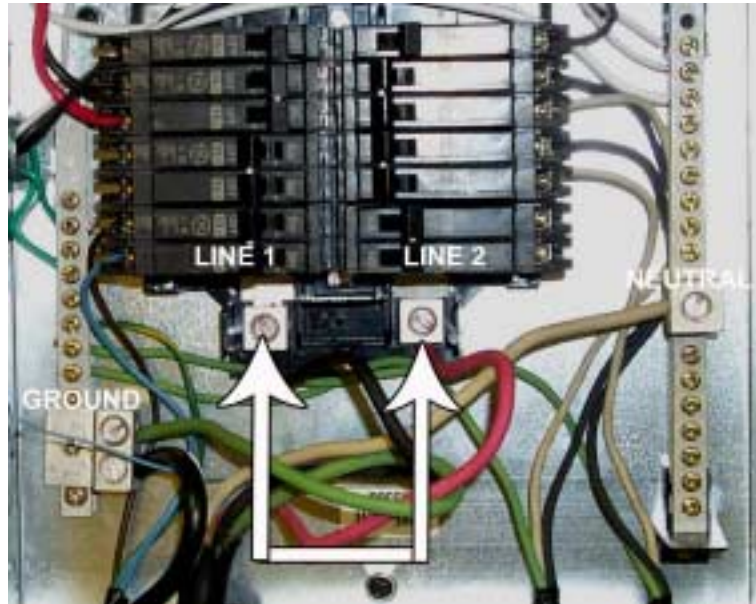
Figure 7-3: Load Center 240 VAC Test Points
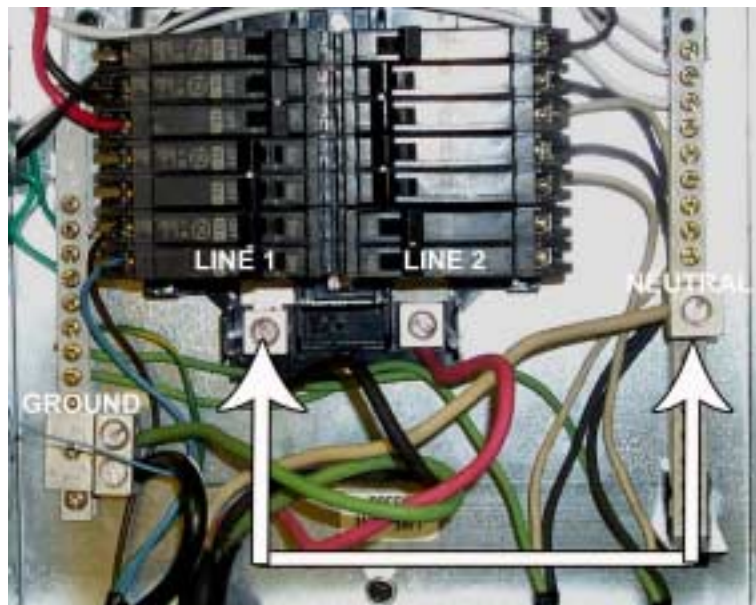
Figure 7-4: Load Center 120 VAC Test Points — Test 1
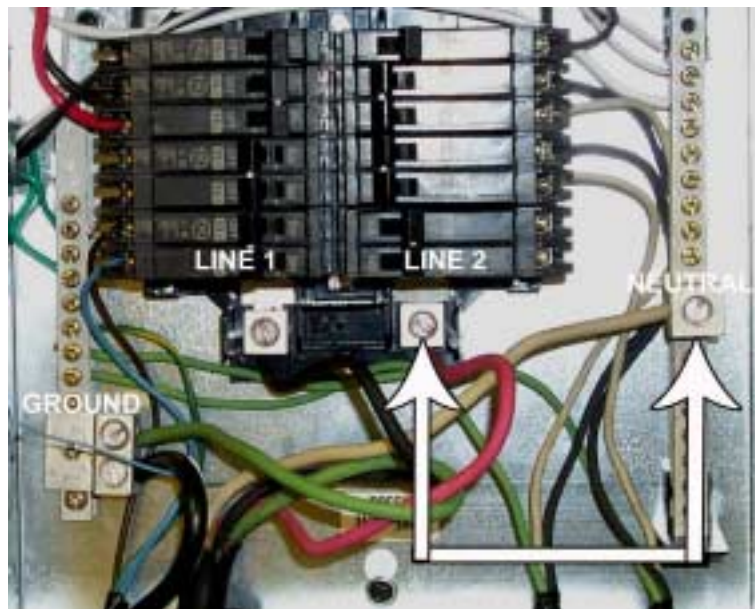
Figure 7-5: Load Center 120 VAC Test Points — Test 2

2.   Turn all of the DC circuit breakers to the Off position. Make sure that the Low Voltage
       Disconnect switch is set to AUTOMATIC.

3.   Turn on the AC circuit breakers in the following order. Begin with the top, left breaker, go
       down the column, and then continue with the top right breaker. See *Figure 7-6: Turning AC
       Breakers On*.
       • Utility Outlet
       • Surge Suppressor — dual position breaker
       • Heater — dual position breaker
       • Heat Exchanger — dual position breaker
       • Continuing with the top right breaker: Battery Heater
       • Rectifier #1 — dual position breaker
       • Rectifier #2 — dual position breaker
       • Rectifier #3 — dual position breaker

Figure 7-6: Turning AC Breakers On

4. On the DC power distribution panel, make sure that the Low Voltage Disconnect switch is set to AUTOMATIC. See *Figure 7-7: Low Voltage Disconnect*.

Figure 7-7: Low Voltage Disconnect

5. Turn on the Battery Disconnect breaker. The Battery Disconnect breaker is on the left as you face the front of the cabinet. See *Figure 7-8: DC Battery Breakers*.
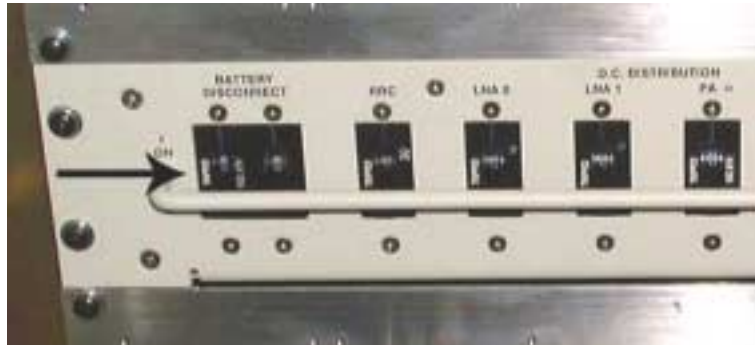
Figure 7-8: DC Battery Breakers

6. Turn on the RRC breaker. The RRC breaker is to the right of the Battery Disconnect breaker. See *Figure 7-9: DC Circuit Breakers*.
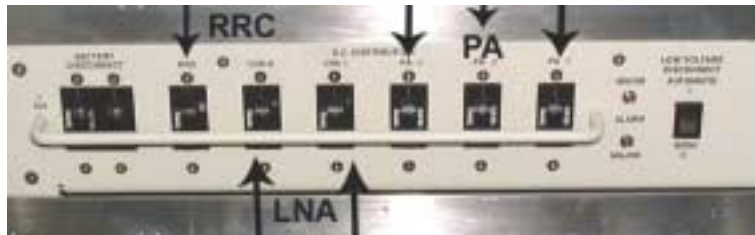
Figure 7-9: DC Circuit Breakers

7. Turn on both LNA breakers which are located next to the RRC breaker.

8. Turn on all three PA breakers. The PA breakers are on the right of the LNA breakers.

9. Verify that the LEDs on the front of the cabinet match *Table 7.1 Power On Expected LEDs*. If the LEDs do not match the table, power the system down and check the wiring.

Table 7-1: Power On Expected LEDs

Unit	LED Name	Condition
PDU	FAULT	Green
PDU	Service	Green
PDU Fan Tray	FAN	Green
RRC	FAN STATUS	Green
RRC	FAN STATUS	Green
PCU1	ON (GREEN) FAIL (RED)	Green
PCU2	ON (GREEN) FAIL (RED)	Green

10. Replace all side and rear panels using the original tamper-resistant screws. Close all doors.

Chapter 8. Powering Down the Cabinet

The base station is powered down using a PC or terminal connected to the COM1 port on the Master Control Unit (MCU) board. This helps ensure that all system files are closed before the power is shut off. Attach the PC or terminal using a serial cable with a null-modem adapter. The PC should be running a terminal emulation such as Microsoft® Windows® HyperTerminal.

Connect the 9–pin female RS-232 connector (DB9F) to the COM1 port located on the MCU. Connect the 9–pin female cable connector (DB9F) on the other end of the cable to the connector of the VT-100 terminal or to the PC serial port. Either COM1 or COM2 of the PC may be used.

The following settings should be used for HyperTerminal sessions:

* Bits per second: 9600
* Data bits: 8
* Parity: None
* Stop bits: 1
* Flow control: None

WARNING:

ALL POWER OPERATIONS SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

8.1. Powering Down the Cabinet

1. Connect a PC to the serial port of the MCU. See *Figure 8-1: COM Port on the MCU*.
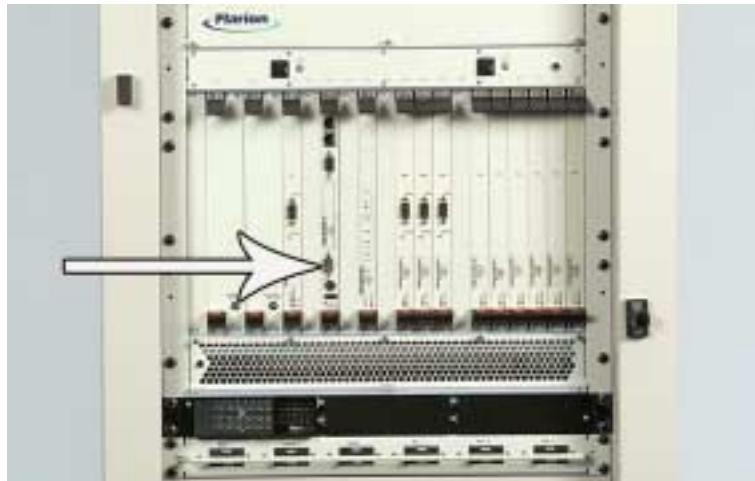
Figure 8-1: COM Port on the MCU

2. Run a terminal emulator such as Microsoft Windows HyperTerminal.

3. At the `Login:` prompt, type **root** and press **Enter**.

4. At the `Password:` prompt, type the root login password and press **Enter**.

5. At the `BS_Name#>` prompt, type **halt** and press **Enter**.

    The system displays the message `System Halted` followed by the message `Press any key to reboot.`

    Be careful not to touch any keys or the system will restart.

6. Turn off the DC breakers in reverse order to how they were turned on. See *Figure 7-9: DC Circuit Breakers* through *Figure 7-7: Low Voltage Disconnect*.
    *   PA breakers
    *   LNA breakers
    *   RRC breaker
    *   Battery breakers

7. Turn off the AC breakers beginning with the bottom right breaker. Go up the right column and then up the left column as follows. See *Figure 7-6: Turning AC Breakers On*.

   • Rectifier #3
   • Rectifier #2
   • Rectifier #1
   • Battery Heater
   • Heat Exchanger
   • Heater
   • Surge Suppressor
   • Utility Outlet

Chapter 9. Verifying the Installation

Verifying the proper installation of the cabinet must be done before the installation can be considered complete.

Verify that all of the following requirements are met:

- Clearance requirements are met — at least 24" front, 12" side, and 24" rear. There must be room to open the cabinet doors for service.
- The base station is powered up. All the LEDs in *Table 7.1 Power On Expected LEDs* must reflect the states listed in the table. The system should remain in the powered up state. If it is necessary to power down the base station, do so *only* in accordance with the instructions in *Chapter 8. Powering Down the Cabinet*.
- Correct terminations have been made on all T1 cables.
- No kinks are present in the RF cables.
- RF cable markings match those specified in *Chapter 6. Connecting the Antennas*.

APPENDIX A. Outdoor Base Station Site Preparation Punchlist

Site Preparation Items	If Okay ✓ or Describe Outage
Environment	
Clearance: 24" front, 12" side, 24" rear	
Cement slab for mounting cabinet	
Electrical system	
240 VAC Service	
External Service Entrance w/main breaker and surge suppressor	
Antenna plant	
Mounting plate with antenna connectors	
T1 connection	
Network Interface Unit in Demarc point	
Surge suppressor installed	
Cables	
AC power cabling: #12 AWG THHN or THWN — length to reach cabinet plus 36"	
Ground cabling to master ground bar: #6 to #2 AWG THHN or THWN	
RF cabling — Andrews 1/2" SuperFlex jumpers — length to reach cabinet plus 24". Color coded.	
T1 cabling — 100 ohm twisted pair — length to reach cabinet plus 36"	

Signatures:

_____

(Name, Title)   Company   Date

_____

Witness: (Name, Title)   Company   Date

APPENDIX B. Outdoor Base Station Installation Punchlist

Installation Items	If Okay ✓ or Describe Outage
Cabinet is physically intact	
RadioRouter Base Station Chassis	
MCU	
BHU	
PCU	
BBU	
TXU	
RXU	
AIU	
LNA/Duplexers	
Power Subsystem	
T1	
Antenna Connections	
Battery	
Other	

Signatures:

_____

(Name, Title)   Company   Date

_____

Witness: (Name, Title)   Company   Date

APPENDIX C. List of Abbreviations

AA .... Authentication and Authorization
ADC .... Analog-to-Digital Converter
BBU ....Baseband Unit
BHU .... Backhaul Unit
DAC .... Digital-to-Analog Converter
DNS...Domain Name Server
DSX.. Digital Signal Cross-Connect
FA... Foreign Agent
FFT...Fast Fourier Transform
LNA ....Low Noise Amplifier
MCU .... Master Control Unit
MLPPP ....Multi-Link Point-to-Point Protocol
NTP..Network Termination Point
OCXO.. Oven-Controlled Crystal Oscillator
PA.. Power Amplifier
PCU .... Power Conditioning Unit
RADIUS ....Remote Authentication Dial In User Service
RRC ....Radio Router Chassis
SNMP ....Simple Network Management Protocol
TXU ....Transmit Unit