



Where Automation Connects.




RadioLinx®
RLXIB-IESC

802.11a, b, g

RadioLinx® Industrial 802.11abg
Serial and Ethernet Client

July 25, 2013

USER MANUAL

Your Feedback Please

We always want you to feel that you made the right decision to use our products. If you have suggestions, comments, compliments or complaints about our products, documentation, or support, please write or call us.

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RLXIB-IESC User Manual

July 25, 2013

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In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided on the enclosed DVD and are available at no charge from our web site: <http://www.prosoft-technology.com>

Important Safety Information

The following Information and warnings pertaining to the radio module must be heeded.

WARNING – EXPLOSION HAZARD – DO NOT REPLACE ANTENNAS UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

"THIS DEVICE CONTAINS A TRANSMITTER MODULE, FCC ID: . PLEASE SEE FCC ID LABEL ON BACK OF DEVICE."

"THIS DEVICE USES AN INTERNAL COMPACT FLASH RADIO MODULE AS THE PRIMARY RADIO COMPONENT. THE COMPACT FLASH RADIO MODULE DOES NOT HAVE AN FCC ID LABEL. THE COMPACT FLASH RADIO MODULE HAS NO USER SERVICEABLE PARTS."

"THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION."

"CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT."

Industry Canada Requirements

"THIS DEVICE HAS BEEN DESIGNED TO OPERATE WITH AN ANTENNA HAVING A MAXIMUM GAIN OF 24 dB. AN ANTENNA HAVING A HIGHER GAIN IS STRICTLY PROHIBITED PER REGULATIONS OF INDUSTRY CANADA. THE REQUIRED ANTENNA IMPEDANCE IS 50 OHMS."

"TO REDUCE POTENTIAL RADIO INTERFERENCE TO OTHER USERS, THE ANTENNA TYPE AND ITS GAIN SHOULD BE CHOSEN SUCH THAT THE EQUIVALENT ISOTROPICALLY RADIATED POWER (EIRP) IS NOT MORE THAN THAT REQUIRED FOR SUCCESSFUL COMMUNICATION."

"THE INSTALLER OF THIS RADIO EQUIPMENT MUST INSURE THAT THE ANTENNA IS LOCATED OR POINTED SUCH THAT IT DOES NOT EMIT RF FIELD IN EXCESS OF HEALTH CANADA LIMITS FOR THE GENERAL POPULATION; CONSULT SAFETY CODE 6, OBTAINABLE FROM HEALTH CANADA."

Recommended Antennas

A2402S-OS A082503-80-OBH A2410NJ-DY
A5812NJ-OC A5829NJ-DB A2415NJ-DY

Other Antennas with similar specifications may be substituted.

Antenna spacing requirements for user safety

It is important to keep the radio's antenna a safe distance from the user. To meet the requirements of FCC part 2.1091 for radio frequency radiation exposure, this radio must be used in such a way as to guarantee at least 20 cm between the antenna and users. Greater distances are required for high-gain antennas. The FCC requires a minimum distance of $1 \text{ mW} \cdot \text{cm}^2$ power density from the user (or 20 cm, whichever is greater).

If a specific application requires proximity of less than 20 cm, the application must be approved through the FCC for compliance to part 2.1093.

RLXIB: CSA C22.2 213-M1987 and N. American Standard ANSI/ISA 12.12.01 listing

In accordance with Canadian Standard CSA C22.2 213-M1987 and ANSI Standard ISA 12.12.01, the RLXIB series radios have been UL listed for operation in Class I, Division 2, Groups A, B, C, and D Locations.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D OR non-hazardous locations only.

WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.

WARNING – EXPLOSION HAZARD - Substitution of any components may impair suitability for Class I, Division 2. Power must be provided from a Limited Power Source.

AVERTISSEMENT - RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNÉ NON DANGEREUX.

The following label is applied to the radio to indicate that it is listed under ANSI/ISA standard 12.12.01 and CSA standard C22.2 213-M1987.

This Device contains a Radio Transmitter Module
FCC ID: Canada IC:
Conforms to ANSI/ISA Std. 12.12.01 – Certified to CSA Std. C22.2 No. 213-M1987
Class I Division 2 10-24 Volts dc 6 Watts
48 Volts dc using the PoE Injector
Groups A, B, C & D
Max. Ambient: 60°C

RLXIB: ATEX Approval



II 3 G

Ex nA nL IIC X

-30°C ≤ Ta ≤ 60°C

ProSoft Technology, Inc., Bakersfield, CA USA

Model: RLXIB-IESC

S/N: XXXXXXXXXX

Caution:

Read instructions before operating in Hazardous Areas

In North America, the radio must be installed inside an IP54 enclosure which requires a special tool for access.

Explosive Atmosphere

Power, Input, and Output (I/O) wiring must be in accordance with the authority having jurisdiction

- A** Warning – Explosion Hazard – Do not make or break connections in an explosive atmosphere.
- B** Caution – Use only approved recommended power supply.
- C** Warning - Power supply should be installed in a non-hazardous area.
- D** Warning – DO NOT OPEN WHEN ENERGIZED.
- E** These products are intended to be mounted in an IP54 enclosure. The devices shall provide external means to prevent the rated voltage being exceeded by transient disturbances of more than 40%. This device must be used only with ATEX certified backplanes.

United States FCC & Industry Canada rules



Note: 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.

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

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

CAUTION: Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

European CE certification

The radio modem has been approved for operation under the RTT&E directive, passing the following tests: ETS300-826 (EMC), ETS300-328 (Functionality), and EN60950 (Safety).

The following is the appropriate label that is applied to the radio modem product line to indicate the unit is approved to operate with CE certification:



The following is the appropriate label that is applied to the radio modem product line shipping package to indicate the unit is approved to operate with CE certification:

AUS	B	DK	FIN
F	D	GR	IRE
I	LUX	NL	P
E	S	UK	

Note: Member states in the EU with restrictive use for this device are crossed out. This device is also authorized for use in all EFTA member states (CH, ICE, LI, and NOR).

EU Requirements

1. For outdoor use, France has a frequency restriction of 2.4 GHz to 2.454 GHz for an output power greater than 10 mW and below 100 mW.
2. For outdoor use in France, the output power is restricted to 10 mW in the frequency range of 2.454 GHz to 2.4835 GHz.
3. 5.15 GHz to 5.35 GHz is restricted to 200 mW EIRP throughout the European Union.

Power Supply and Accessories Warning

The certifications listed in this document apply to only the radio mentioned herein. These certifications do not extend to any other items, including accessories or any external means of supplying power to the radio. Accessories and power supplies shipped with the radio have not been tested and are not covered by these certifications. Any non-certified items added to the radio, including any means of supplying power, must be located in an area known to be non-hazardous. All wiring to and from the Power-over-Ethernet (PoE) injector supplied with the radio must be routed and installed inside the building or plant and never routed or installed outside of the building or plant.

Location and Use

The Industrial HotSpot radios, such as the RLXIB-IESC are used by professionals in Industrial Applications/installations only and not used by the general consumer. These industrial radios are used for industrial applications such as, water treatment facilities, power plants, factories, railroads, remote oil/gas pipelines, refineries, cargo ships, refueling ships etc....and used for wireless high speed data transmission. All radios are installed and used by professionals in restricted areas.

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For most applications, the installation and configuration steps described in the following topics will work without additional programming. ProSoft Technology strongly recommends that you complete the steps in this chapter before developing a custom application.

1.1 About the RadioLinx Industrial 802.11abg Serial and Ethernet Client

The RadioLinx® Industrial 802.11abg Ethernet and Serial Client (RLXIB-IESC) is a high-speed wireless Ethernet client, with PoE and Serial Encapsulation. The RLXIB-IESC operates at speeds up to 54 Mbps, using the IEEE 802.11b/g (2.4 GHz band) and 802.11a (5 GHz band) standards. Designed for global installations, the RLXIB-IESC offers many Industrial features including hazardous location certifications, OFDM for noise immunity, OPC server diagnostics, extended temperature, high vibration/shock and DIN-rail mounting.

1.1.1 Specifications

Radio

Frequency Band (Varies by country)	802.11b/g: 2.412 GHz to 2.462 GHz (FCC) 2.412 GHz to 2.472 GHz (ETSI) 802.11a: 5.150 GHz to 5.250 GHz (FCC/ETSI) 5.725 GHz to 5.850 GHz (FCC)
Wireless Standards	802.11a, 802.11b, 802.11g, 802.11i
Transmit Power (Programmable) (varies by country)	Up to 50 mW without amplifier Up to 500 mW with optional amplifier. (not applicable for hazardous locations)

Channel data rates (Modulation)	802.11b: 11, 5.5, 2, 1 Mbps (DSSS - BPSK, QPSK, CCK) 802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps (OFDM) 802.11a: 54, 48, 36, 24, 18, 12, 9, 6 Mbps (OFDM)
Receiver Sensitivity (Typical)	-90 dBm @ 1 Mbps -85 dBm @ 11 Mbps -82 dBm @ 24 Mbps -75 dBm @ 54 Mbps
Channels Selection	1 to 13 (802.11b/g) 36, 40, 44, 48, 149, 153, 157, 161, 165 (802.11a)
Security	WPA2 - 802.11i with 128 bit AES-CCM Legacy WPA TKIP, WEP support MAC ID filter Admin password

Physical

Enclosure	Extruded aluminum with DIN and panel mount
Size	114.3 x 116.8 x 44.45 mm (W x H x D) 4.5 x 4.6 x 1.75 inches
Vibration	IEC 60068 2-6 (20g, 3-Axis)
Shock	IEC 60068 2-27 (5g, 10 Hz to 150 Hz)
Ethernet Ports	One 10/100 Base-T connector, shielded RJ45 IEEE 802.3, 802.3u, 802.3x
Antenna Ports	(2) RP-SMA connectors
Weight	1.06 lbs (479g)
Environmental	
Operating Temperature	-30°C to +60°C
Humidity	Up to 100% RH, with no condensation
External Power	10 Vdc to 24 Vdc
PoE Injector	48 Vdc
Average Power	<6W

1.1.2 Regulatory Approvals

Wireless Approvals

Visit our web site at www.prosoft-technology.com for current wireless approval information.

Hazardous Locations

UL	ANSI/ISA 12.12.01 Class I, Division 2, Groups A, B, C, D
cULus	C22.2 No. 213-M1987
CSA/UL	ANSI/EN60950-1
ATEX	EN60079-0/-15 Zone 2 Category 3

1.2 Package Contents

The following components are included with your RLXIB-IESC radio, and are all required for installation and configuration.

Important: Before beginning the installation, please verify that all of the following items are present.

Qty.	Part Name	Part Number	Part Description
1	RLXIB-IESC Radio	RLXIB-IESC	RadioLinx® Industrial 802.11abg Serial and Ethernet Client
1	Cable	Cable #15, RS232	6 foot RS232 null serial cable
1	Cable	RL-CBL025	5 foot Ethernet Straight-Thru Cable
1	Antenna	A2502S-OA	2 dBi Omni RP-SMA articulating, 2.4/5GHz
1	Power Supply	RL-PS007-2	AC Power Adapter, 12V1.6A w/2 pin & 4 plug Set
1	ProSoft Solutions CD		Contains sample programs, utilities and documentation for the RLXIB-IESC module.

If any of these components are missing, please contact ProSoft Technology Support for replacement parts.

1.3 System Requirements

The RadioLinx IH Browser is designed for Microsoft Windows XP, 2000, and 2003. Minimum hardware requirements are:

- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
 - Microsoft Windows XP Professional with Service Pack 1 or 2
 - Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
 - Microsoft Windows Server 2003
 - Microsoft Windows Vista
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- CD-ROM drive
- 100 MB available hard drive space
- Available RS-232 serial port and null modem cable
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 x 768 recommended)
- Ethernet hub with standard RJ45 Ethernet cable
or
Ethernet port with RJ45 crossover cable for direct connection to module
- A web browser, for example Microsoft Internet Explorer or Firefox.

In addition, you will need

- A connection to an existing wired or wireless Ethernet network, with a Static or Dynamic IP address for your computer
- Static IP address, Subnet Mask and Gateway address for each RadioLinx device you plan to install. Obtain this information from your system administrator

1.4 Install the IH Browser Configuration Tool

- 1 Insert the ProSoft Solutions CD in your CD-ROM drive. On most computers, a menu screen will open automatically. If you do not see a menu within a few seconds, follow these steps:
 - a Click the **START** button, and then choose **RUN**.
 - b In the *Run* dialog box, click the **BROWSE** button.
 - c In the *Browse* dialog box, click **MY COMPUTER**. In the list of drives, choose the CD-ROM drive where you inserted the ProSoft Solutions CD.
 - d Select the file **PROSOFT.EXE**, and then click **OPEN**.
 - e On the *Run* dialog box, click **OK**.
- 2 On the *CD-ROM* menu, select **IH BROWSER FOR THE RLX-IHX AND RLXIB-X PRODUCTS**. This action opens the *Setup Wizard* for IH Browser.
- 3 Follow the instructions on the installation wizard to install the program with its default location and settings.
- 4 When the installation finishes, you may be prompted to restart your computer if certain files were in use during installation. The updated files will be installed during the restart process.

1.5 Install ProSoft Wireless Designer

- 1 On the CD-ROM, navigate to the folder containing ProSoft Wireless Designer, and then double-click the file **SETUP.EXE**. This action starts the installation wizard.
- 2 Follow the instructions on the installation wizard to install the program.
- 3 Click **FINISH** to complete the installation. If you are prompted to restart your computer, save your work in any applications that are running, close the applications, and allow the computer to restart.

1.6 Planning the Network

Before you configure and install the network, you should create a plan for it. The following points assume that you are creating a bridge network of masters and repeaters, but you can also set up clients to work with devices on existing wireless LANs. For information, see *Set up a Client*.

The simplest way to design the physical network of radios, antennas, connectors, cables, amplifiers and other accessories, is to use ProSoft Wireless Designer (page 15). This application determines your hardware needs based on your answers to a few questions, and then generates a Bill of Materials specifying all the components you will need for your installation.

- To begin, determine where you need radios and then choose locations for them accordingly. For example, you might decide to install your master radio near a PC in a central plant location (You can use the PC to configure the radios through the Radio Configuration / Diagnostic Utility). If the plant is an oil refinery, for example, you might decide to install radios near the oil tanks.

- The next important issue is how to link the radios. Unless the radios are very close together, you must make sure that each pair of radio antennas in the network has a line of sight between them. In other words, you must be able to see from one antenna to another, either with the naked eye, or with binoculars.
- If a line of sight does not exist between antennas, you must choose a site for installing a repeater radio, which will create a bridge between the radio antennas.
- Choose the appropriate antennas for the network. If an antenna will be connected to the radio by a long cable, you might need to purchase a power amplifier, which is available from ProSoft Technology. The more distance between an antenna and its radio, the more signal loss the radio will have.
- Consider drawing up your network plans on paper. As part of the drawing, you should assign a logical name to each radio. You can use these names later when configuring the radios in the Radio Configuration / Diagnostic Utility.
- As part of your planning, you might want to conduct a site survey. ProSoft Technology can perform this survey, you can do it yourself, or you can hire a surveyor.
- Protect radios from direct exposure to weather, and provide an adequate, stable power source. Make sure that your plan complies with the radio's power requirements and cable specifications.

Important: Radios and antennas must be located at least 8 inches (20 cm) away from personnel.

1.6.1 *Installation Questions*

Answer the following questions to make your installation easier and to familiarize yourself with your system and what you want to do.

How many radios in your network?

Master ID

Repeater ID

Client ID

Locations

Is there a Line of Sight between them?

Selected the appropriate antennas for your network?

1.6.2 *ProSoft Wireless Designer*

ProSoft Wireless Designer simplifies the task of specifying a ProSoft Wireless installation, and provides a variety of views containing an accurate description of each site in a wireless network, including:

- Visual diagram of site layout

- Location (latitude/longitude, based on GPS coordinates)
- Radio type, frequency range, and country-specific channel and power requirements
- Length, type and estimated signal loss for cables
- Required accessories, including lightning protection, cable adaptors and antennas
- Complete parts list

Use *ProSoft Wireless Designer* when conducting a site audit for a customer, and then provide the customer with a complete list of components and a detailed description for each site and link. Customers can use this information to understand and visualize their network, and provide necessary information for technical support and maintenance.

Functional Specifications:

- Contains a database of all currently available RadioLinx radios, antennas, cables, connectors and accessories
- Exports Parts List, Site and Link Details, and Wizard settings into a variety of common file formats, for import into applications such as spreadsheets, databases and word processors
- Checks wireless link feasibility based on path length and recommended accessories
- Predicts signal strength based on distance, local regulations and hardware choices
- Fully documents your ProSoft Wireless network plan

1.6.3 Planning the Physical Installation

A network's performance is affected by attributes specific to the installation site. Consider the following cautions, where possible, to optimize your network installation:

- Design the network to use less than 2048 radios (per network)
- Place radios within the specified 15 miles of each other
- Add repeater to extend distance or where line of sight is limited
- Radios or antennas CANNOT be placed within 8 inches (20 cm) of where people will be

Though radio frequency communication is reliable, sometimes its performance can be affected by intangibles. A good network installation plan includes **time** and **resources** for performance testing and installation changes.

Test the installation plan (page 26) before the network installation is complete.

1.7 Configuring the Radios

To configure the network radios, follow these steps.

Use the RLX-IH Browser to display all radios on the network, and then use a Web browser or SNMP manager to view and change radio settings. The radio package includes the program CD, power supply, Ethernet cable, and a small antenna. You must install the antenna later, but it is not needed to get started.

IMPORTANT: If possible, you should configure all the radios side by side in an office setting and make sure they link before you try to install them in the field.

To configure the radios in a network:

- 1 Start the IH Browser (page 18) configuration application.
The PC must have a wired or wireless Ethernet connection configured with a static or dynamic IP address.
- 2 Plug in the power cable and Ethernet cable (page 19) to the RLXIB-IESC radio, wait a moment for the radio to power up, and then examine the radio's LED display to make sure the radio is working properly.
- 3 Assign a temporary IP address: (page 20, page 64) Double-click the radio listing in the RLX-IH Browser. In the next window, click OK to accept the temporary IP address, subnet mask, and default gateway.
- 4 Double-click the radio listing again in the RLX-IH Browser to open the Radio Configuration / Diagnostic Utility in your web browser. Enter "password" (lower case, no quotes) in the next window and then click Login.
If necessary, you can enter your own password later. For information, see Change Password (page 56).
- 5 Set up the master radio first, using the Radio Settings window in the Radio Configuration / Diagnostic Utility.
- 6 Click Apply Changes to save the master radio settings.
To cancel the settings and start over, click the Cancel Changes button before you click Apply Changes. After they are configured, master radios are preceded by an "M" in the utility window list.

Note: The text shown in yellow at the bottom of the window indicates the status of changes you have made to the configuration.

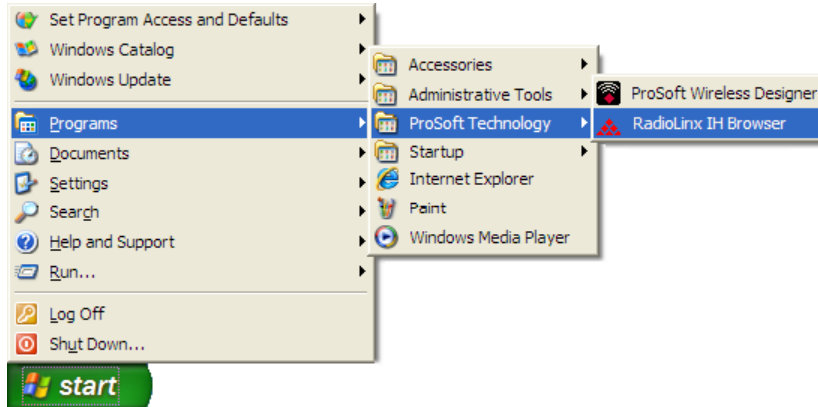
- If the text shows "Changes not saved", click Apply Changes to save your settings.
 - If the text shows "Changes not saved; Will disrupt X s", you can click Apply Changes, however the network will be disrupted temporarily while the changes are applied. The value of "X" indicates the number of seconds the network will be offline.
- 7 Unplug the Ethernet cable from the radio and plug it into the next radio to be configured.
 - 8 Set Up a Repeater. Return to the RLX-IH Browser. To be sure that you are seeing the latest status of the radio(s), go to the toolbar (page 73) and click the "Clear" icon (eraser) followed by the "Scan" icon (binoculars). Double-click the listing of the next radio to be configured, and configure it as a repeater radio.
 - 9 Save the Radio Configuration. (page 23) Save the repeater radio settings by clicking Apply Changes at the bottom of the Radio Settings screen. Repeat steps 7 through 9 to configure each repeater in the network.
 - 10 After configuring the network and its radios, physically label each radio. Labeling eliminates confusion about which radios correspond with which radio configurations in the software. You should identify the radio's name, network SSID, and IP address, if set.

11 Install the radios and antennas (page 25).

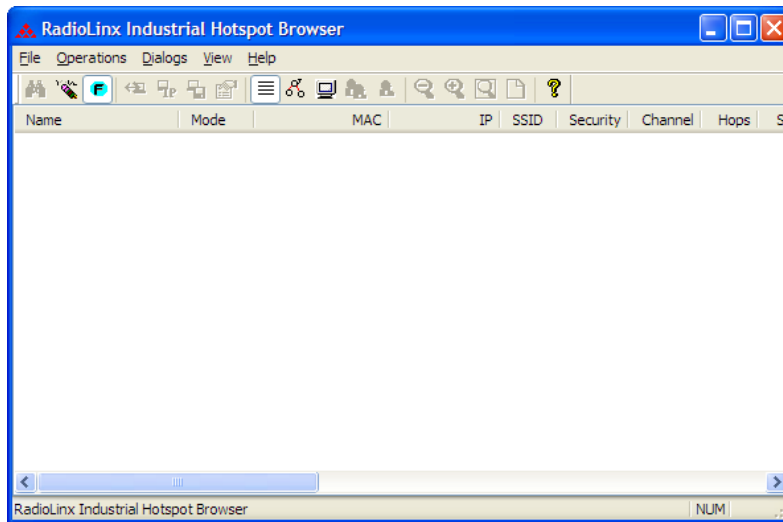
The remainder of the topics in this section describe each of these steps in more detail.

1.7.1 Start IH Browser

- 1 Click the **START** button, and then navigate to **PROGRAMS / PROSOFT TECHNOLOGY**



- 2 Click to start **RADIOLINX IH BROWSER**.



The window lists all the radios your computer can access. The MAC ID number is essentially the serial number of the radio; this number is also printed on the side of the radio. If a radio listing does not appear in the window, select Scan from the File menu. If you still do not see a radio listing, see Troubleshooting.

1.7.2 Plug In the Cables

You can configure the RLXIB-IESC using the Ethernet port on the radio. On the underside are three ports; Ethernet, Serial and Power (10 to 24 VDC 6 W).



From left to right: Power connector, Serial port and Ethernet port.
Use the Ethernet cable to configure the radio for the first time.

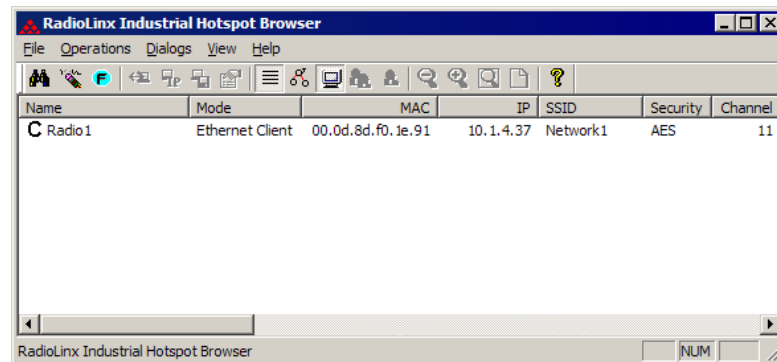
Note: After you plug in the power cable and Ethernet cable, the radio performs a startup procedure that includes a self-test, loading the main program, and initializing the radio. The front panel LEDs will illuminate after approximately two seconds. The entire startup procedure can take up to 90 seconds.

After the startup procedure has completed successfully, the Power LED should be green, meaning that the radio has power. The Ethernet LED should also be green, meaning that the Ethernet connection is working. The RF Transmit and RF Receive LEDs should blink.

For information on making connections, see Radio Power Requirements (page 82) and Cable Specifications (page 83, page 83).

1.7.3 Detecting the Radio

After the radio has completed its startup procedure, the radio will appear in the IH Browser window.



The window lists all the radios your computer can access. The MAC ID number is essentially the serial number of the radio; this number is also printed on the side of the radio. If a radio listing does not appear in the window, select Scan from the File menu. If you still do not see a radio listing, see Troubleshooting.

Tip: If a radio listing does not appear in the window, open the File menu and choose Scan. If you still do not see a radio listing, refer to Diagnostics and troubleshooting in the RLXIB User Guide.

1.7.4 Assign a Temporary IP Address

You need the IP address to log into the Radio Configuration/Diagnostic Utility and configure the radio settings. If the radio is connected to a network with a DHCP server, the radio may already have an IP address assigned to it.

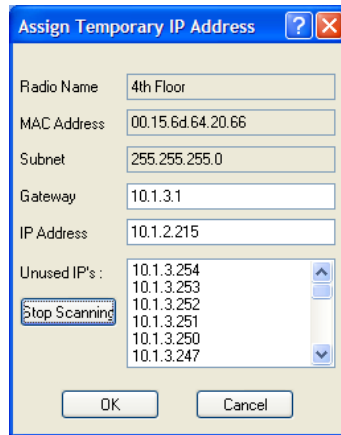
If a DHCP server is not available, or if you prefer to assign a static IP address, you can enter a temporary IP here. You will use the Radio Configuration / Diagnostic Utility (page 34) to assign a permanent IP address.

To assign a temporary IP Address

- 1 In IH Browser, click to select the radio.

Tip: If a radio listing does not appear in the window, open the File menu and choose Scan. If you still do not see a radio listing, refer to Diagnostics and troubleshooting in the RLXIB-IESC User Manual.

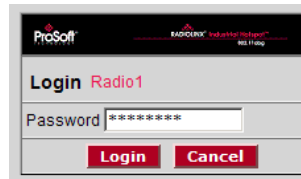
- 1 Open the Operations menu, and choose Assign IP. This action opens the Assign Temporary IP Address dialog box.



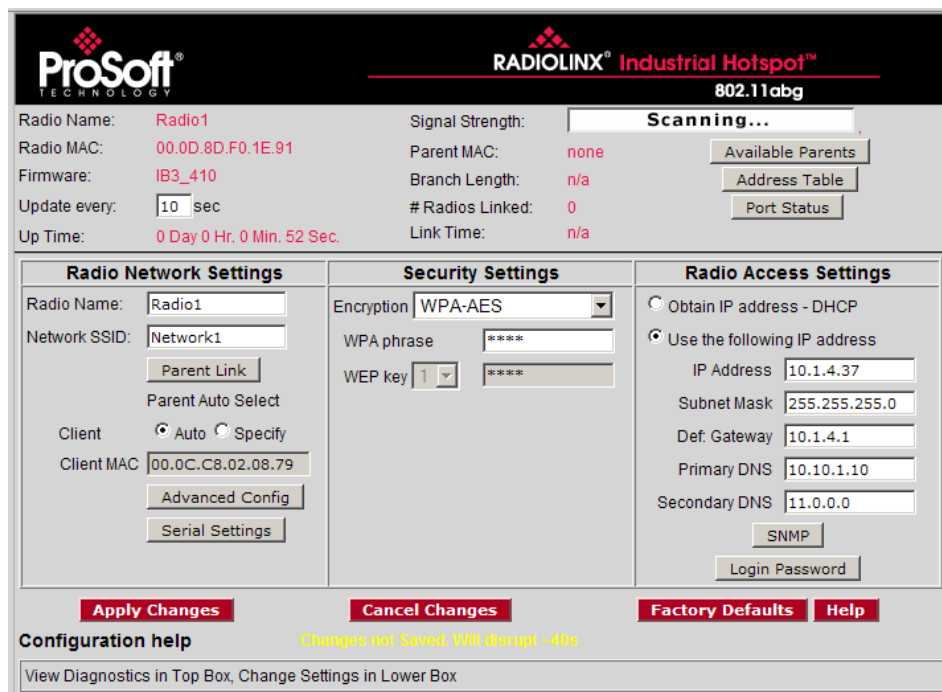
- 2 Select one of the unused IP addresses, and then click OK. For information, see Radio Access settings (page 54).

1.7.5 Set Up the Client Radio

To configure the radio, double click on the radio (Radio1) in the IH Browser window. This action opens a web browser (for example Microsoft Internet Explorer or Firefox) and loads the IH Radio's web configuration interface.



Important: The radio configuration is protected by a login password. The default password for the radio is "password" (lower case, no quotes). To prevent unauthorized access to the radio configuration, you should change the password when you have finished the initial configuration.
Note: The master is the "root" or top-level radio in a network. You must have at least one master radio per network. For redundancy, you can assign more than one master to a network.



Client mode is a special mode in the radio that allows a user to connect an Ethernet device to a wireless network through any 802.11a, b or g access point. Any Ethernet device that has an RJ45 Ethernet port can, in effect, be transformed into an 802.11a, b or g wireless client by attaching the radio. Only a single device can be connected to the radio in client mode. Do not connect to more than one Ethernet device (using a switch or hub).

Client radios are preceded by a 'C' in the list of radios in the RLX-IH Browser.

To configure a Client radio, make the following changes to the web configuration form:

Radio Network Settings

- **Radio Name:** Enter a unique name for the radio.
- **Network SSID:** Assign a network name (SSID) of up to 32 characters. The radio uses this name in all network references. All radios in a network must have the same SSID.
- To connect a device to a radio in client mode, try programming the radio's client mode using the **Auto** setting. To test whether the Auto setting will work:
 - a Connect the cable between the device and the radio.
 - b Turn ON the radio power, or cycle the power if the radio is already on.
 - c Turn ON the device. Watch the radio to see if it initializes. The Auto setting will work if the device advertises its MAC ID to the radio.

If the radio's RF LEDs do not show consistent activity after a few minutes, then you may need to modify the radio's client settings. Click the Specify radio button, determine the MAC ID of the Ethernet device, and type the ID into the Client MAC field.

Security Settings

- **Encryption Type:** Encryption scrambles data so that only intended viewers can decipher and understand it. Although "none" is an available encryption type, ProSoft Technology strongly recommends encrypting all data sent and received from every radio on your network, to help prevent your data from being intercepted and decoded.
- **WPA phrase:** To use WPA encryption on packets sent between the radios, select WPA in the Encryption Type field. Next, in the WPA phrase field, enter a pass phrase of between eight and 63 normal keyboard characters. This phrase automatically generates an encryption key of 128 hexadecimal characters. The default pass phrase is "passphrase" (lower case, no quotes). For more information on encryption, see Security settings.

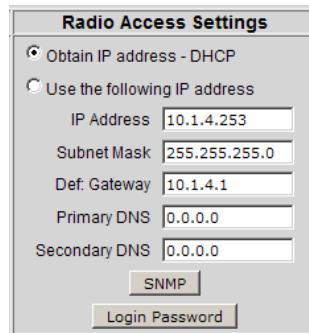
Because you must assign the same Network SSID and WPA phrase to the repeater radios later in this procedure, you should write down the settings.

Note: Network SSID and WPA phrase are both case-sensitive.

Network SSID: _____

WPA phrase: _____

Radio Access Settings



Radio Access Settings

Obtain IP address - DHCP

Use the following IP address

IP Address

Subnet Mask

Def. Gateway

Primary DNS

Secondary DNS

If a DHCP (Dynamic Host Control Protocol) server is configured on your local area network, the DHCP server can assign IP addresses automatically.

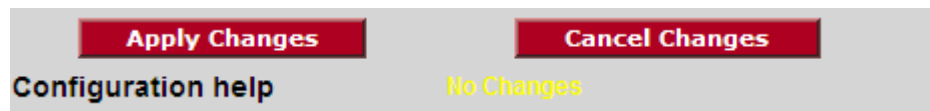
If you prefer to assign a Static (Fixed) IP address, select "Use the following IP address", and then enter the IP Address, Subnet Mask and Default Gateway in the Radio Access Settings area of the IH Radio web configuration form.

Important: If you intend to assign IP addresses manually, you must not duplicate an IP address that is already in use on your network. If you are not sure what IP addresses are available, ask your network administrator for assistance.

1.7.6 Save the Radio Configuration

Before closing the Radio Configuration window, you must apply your changes. Click **APPLY CHANGES** to save your configuration and restart the radio.

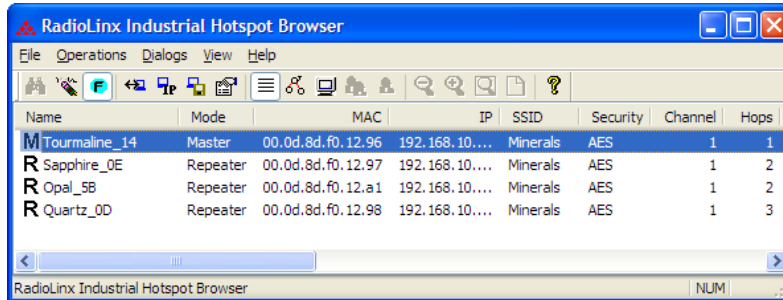
Note: To discard your changes and start over, click **CANCEL CHANGES**.



Configuration help No Changes

1.8 Verify Communication

When configured, the name of each radio is preceded by an M (for Master), an R (for Repeater), or a C (for Client) in the IH Browser window.



Look at the LEDs to ensure good link quality, as explained in LED display (page 30). After a repeater is configured, you can unplug the Ethernet cable from it.

2 Installing the Radios

In This Chapter

- ❖ Connecting antennas26
- ❖ Testing the Network Installation Plan26

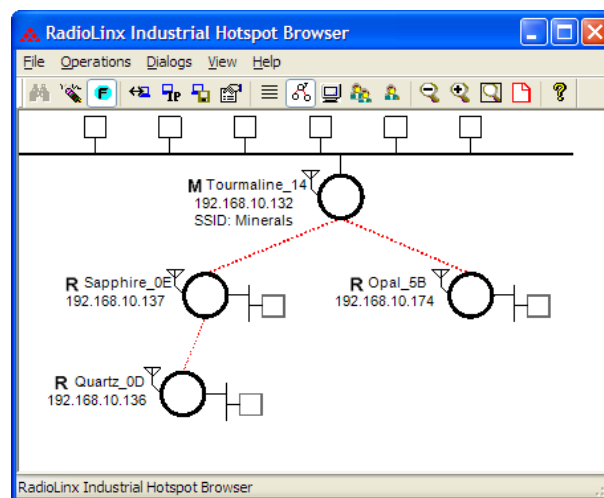
If possible, you should configure all the radios side by side in an office setting and make sure they link before you install them in the field. If feasible, it would be even better if you could set up the entire system in the office and make sure your equipment communicates properly through the radio network.

Important: If the radios are close enough to each other that their received signal strength is greater than -40dBm, performance may be degraded. Disconnect antennas from radios during bench testing, or move the radios further apart from each other.

Tip: To make it easier to physically identify the radios you are configuring, apply a label to each radio indicating the radio name and IP address.

After you have configured each radio using IH Browser and the web configuration form, you can install the radios and test their performance. Install the radios in their proposed permanent locations, then temporarily place each radio's antenna near its proposed mounting location. The temporary placement of the antenna can be by hand; however, with this testing method, one person must hold the antenna while another monitors the radio's signal strength.

To see how a radio is linked in the network, make sure that the radio is connected to a PC, and then select Topology View from the View menu in the RLX-IH Browser.



The Topology view shows a diagram of the network's wireless connections. Use this view to see whether all the radios are linked, and that you approve of the way the radios are linked. A radio that is not linked to a parent will show as a circle outlined by a flashing dashed red line. It may be near the bottom of the window, so scroll down to view all available radios. To change how radios link to the network, see Parent Link settings (page 45).

Refer to Improve Signal Quality (page 33) for more information on overcoming poor connectivity.

2.1 Connecting antennas

Each radio must have an antenna connected to the Main antenna port on the RLXIB radio; without an antenna for each radio, the network will not function.

All antennas for radios that communicate directly with each other should be mounted so they have the same antenna polarity. Small antennas with a reverse-polarity SMA connector can be mounted directly on the radio. Screw the antenna onto the antenna port connector until it is snug.

Larger antennas and antennas that do not have a reverse-gender SMA connector must be mounted separately and connected to the radio using a coaxial antenna cable. Because the antenna cable attenuates the RF signal, use an antenna cable length that is no longer than necessary to ensure optimum performance.

Important: If the radio is to be used in a hazardous location, the radio must be mounted in an enclosure approved for hazardous locations. The radio requires a separate cable connection to the SMA connector that leads to an internal antenna.

2.2 Testing the Network Installation Plan

Test proposed installations before finalizing the installation.

After you have configured the network and the radios:

- install the Master radio in its proposed permanent location
- cable the Configuration PC to the Master radio
- place the Remote radios in their proposed locations
- temporarily place each radio's antenna near its proposed mounting location. The temporary placement of the antenna can be by hand, however, with this testing method, one person must hold the antenna while another monitors the Remote radio's signal strength as displayed on the Configuration PC.

To improve the signal quality of each Remote's communication:

- increase the height of the antenna's placement
- use higher-gain antennas
- increase the radio's transmission power, cable the radio to the Configuration PC, and reconfigure it
- select a new location for the Remote radio and/or its antenna
- decrease the length of antenna cable

- determine and resolve sources of "electrical" noise which may be interfering with the radio transmission
- add a repeater between the radios that are not communicating, or reconfigure an existing radio as a repeater if line of sight is available

3 Diagnostics and Troubleshooting

In This Chapter

❖ Diagnostics.....	29
❖ Check the Ethernet cable	30
❖ LED display	30
❖ Retrieve the default password.....	31
❖ Troubleshoot IH Browser error messages.....	32
❖ Troubleshoot missing radios.....	32
❖ Improving Signal Quality.....	33

Use the program's diagnostic and signal strength settings at the top of the Radio Settings window to make sure the network is working properly.

- **Signal Strength graph:** This setting graphically shows the radio's signal strength. The graph will show the word **Master** if a master radio is selected. The graph will show the word **Scanning** if the radio is scanning to find another radio to which to connect. If the radio is not connected to a network and not currently scanning, the graph will show the words **Not connected**.
- **Update readings every:** If you want to update the diagnostic readings according to a particular interval, specify the interval (in seconds) in this field.
- **Read-only fields** that appear with the diagnostic settings.

You can perform the following troubleshooting routines:

- Check the Ethernet cable (page 30)
- Retrieve the default password (page 31)

For more troubleshooting information, go to the ProSoft Technology web site at www.prosoft-technology.com

3.1 Diagnostics

The Radio Configuration / Diagnostic Utility (the web configuration form for the radio) provides information that can help you troubleshoot problems with the radio.

Use the program's diagnostic and signal strength settings at the top of the Radio Settings window to make sure the network is working properly.

Signal Strength graph: This setting graphically shows the radio's signal strength.

- The graph will show the word **Master** if a master radio is selected.
- The graph will show the word **Scanning** if the radio is scanning to find another radio to which to connect.

- If the radio is not connected to a network and not currently scanning, the graph will show the words **Not connected**.

Update every: If you want to update the diagnostic readings according to a particular time interval, specify the interval (in seconds) in this field. After entering the new value, press Enter only if you want to save the new value; press Tab or click elsewhere to use the new value temporarily.

The following configuration forms in the Radio Configuration / Diagnostic Utility provide information about current radio operation:

- Address table (page 41)
- Port status (page 42)
- Available Parents
- Read-only fields

The following topics describe troubleshooting routines:

- Check the Ethernet cable (page 30)
- Retrieve the default password (page 31)
- Troubleshoot IH Browser error messages (page 32)
- Troubleshoot missing radios in the IH Browser (page 32)

For more troubleshooting information, visit the ProSoft web site at www.prosoft-technology.com

3.2 Check the Ethernet cable

If you connect a radio and the Ethernet LED does not light on the radio, there may be a problem with the Ethernet cable. Verify that the cable is plugged into the radio at one end, and to an Ethernet hub or a 10/100 Base-T Ethernet switch at the other end. If using the PoE injector, verify that the M12 to RJ45 cable is connected between the radio and the injector and also that the Ethernet patch cable is connected between the injector and switch.

Note: The RLXIB-IESC radio auto-detects the Ethernet connection type, and does not require a crossover cable for direct connection to a PC.

3.3 LED display

The RLXIB-IESC front panel includes a set of LEDs that indicate the radio's status:

LED	Description
Power	This green LED indicates that the radio has power.
RF Transmit	This yellow LED indicates RF transmission.
RF Receive	This green LED indicates RF reception.
Serial	Reserved for future use.
Ethernet	If this green LED is lit, the Ethernet cable is connected. If this LED is flashing, an Ethernet packet is being transmitted or received.

LED	Description
Signal Strength	If only one of these three LEDs is lit, then the radio is linked. If two LEDs are lit, the radio's signal strength is fair. If all three LEDs are lit, the signal strength is good.

If a radio is configured as a master, the middle light of the three Signal Strength LEDs will always be on, and the bottom Signal Strength LED will always be off. The top LED on the master will flash if any radios are linked to this master.

After you first plug in the power cable and Ethernet cable to the radio, the Power/Status LED should be green, meaning that the radio has power. If the Ethernet LED is green, then the Ethernet connection is working. The RF Transmit and RF Receive LEDs should blink.

All three LEDs will blink just after the radio links to the Master's signal but before it has been fully authenticated. Normally you will see this last only a few seconds. If it lasts longer or never turns solid it usually means the encryption keys are not correct.

3.4 Retrieve the default password

If you forget your password, you will be unable to change the radio settings. You can retrieve the default password to use the software again, but you will lose all the settings you programmed before. To retrieve the default password and return the radio to its default settings, follow these steps:

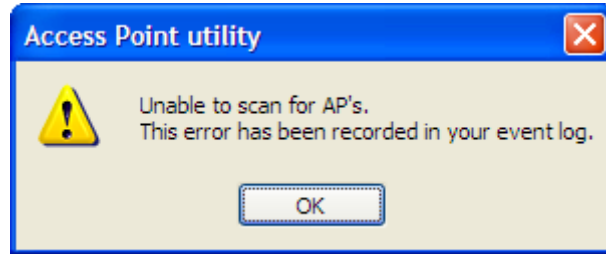
- 1 Turn off power to the radio.
- 2 Locate the reset button hole, located to the left of the power connector.



- 3 Insert the end of a paperclip or similar device into the hole to press the reset button.
- 4 Turn on power to the radio, and hold down the reset button for 30 seconds.
- 5 The radio will be reset to its default settings, including the password. You should now be able to log in using the default password, which is "password".

3.5 Troubleshoot IH Browser error messages

One error message commonly occurs when you use the IH Browser, "Unable to scan for AP's". You can easily remedy this error.



This error occurs when the IH Browser attempts to scan for radios and no valid network connection exists on the PC, wired or wireless.

To correct this error, Confirm that your PC has at least one active network (LAN) connection; it could be a wired Ethernet connection or a wireless 802.11 connection. One way to determine if your network connections are active is to look in the system tray in the lower-right corner of your desktop. The two-PC icon indicates a connection and the icon with a red X indicates an inactive connection. If no connections are visible in the system tray, check Network Connections in the Control Panel.



Confirm that the network connection has a valid IP address. Your network connection might need to have a static IP address assigned to it. Check the IP address of your network connection to determine that one has been assigned.

3.6 Troubleshoot missing radios

If radios are not visible in the IH Browser, try the following:

- First, click the **SCAN** button again. Scans are sent as broadcast messages, which can be dropped in RF connections, requiring the user to scan again.
- Second, disable any software firewall running on your PC (This is most common in Windows XP and newer). Open the **NETWORK CONNECTIONS** folder in your Windows Control Panel, then open the **LOCAL AREA CONNECTION PROPERTIES** window and verify that the check box under **INTERNET CONNECTION FIREWALL** is not checked.
- If the preceding approaches do not help, the PC running the IH Browser and the radios are probably not connected to the same local network. Verify your connections.
- If you are in topological view, any unlinked radios may be at the bottom of the window. Scroll down to see all radios. If you still cannot see radios with the IH Browser, call technical support.

3.7 Improving Signal Quality

If you need to improve a radio's signal quality, try the following steps:

- Adjust the direction of the high-gain antennas.
- Increase the height of the antenna's placement.
- Use higher-gain antennas or external preamplifiers.
- Select a new location for the radio and/or its antenna.
- Decrease the length of the antenna cable.
- Determine and resolve sources of interfering electrical noise.
- Add a repeater between radios that are not communicating.

4 Radio Configuration / Diagnostic Utility

In This Chapter

❖ Radio Status.....	38
❖ Radio Network settings.....	44
❖ Security settings.....	52
❖ Radio access settings.....	54
❖ Apply Changes.....	57
❖ Cancel Changes.....	57
❖ Factory Defaults.....	57

The RadioLinx Industrial Hotspot radio has a built-in Radio Configuration / Diagnostic Utility (radio web configuration form) that allows you to configure the radio from any computer that can connect to the radio, through a wired Ethernet connection, or through a Wireless connection.

You can use a web browser such as Microsoft Internet Explorer or Firefox on your network-enabled desktop computer, laptop or Personal Data Assistant (PDA) to monitor and change the settings within the RadioLinx Industrial Hotspot radio.

To open the Radio Configuration / Diagnostic Utility

- 1 In the RadioLinx Industrial Hotspot Browser, select the radio to configure from the list view or topography view, and then click the right mouse button to open a shortcut menu.
- 2 On the shortcut menu, choose Connect. The Radio Configuration / Diagnostic Utility will open in your web browser.

Or,

Double-click the selected radio to launch the Radio Configuration / Diagnostic Utility.

You can also open the Radio Configuration / Diagnostic Utility directly from your web browser.

Important: Your desktop computer, laptop, or PDA must be connected to the same network as the RadioLinx Industrial Hotspot radio.

- 1 Open your web browser.
- 2 In the address bar, type "http://", followed by the IP address for the radio, and then click the "Go" button. For example,

`http://192.168.6.10`

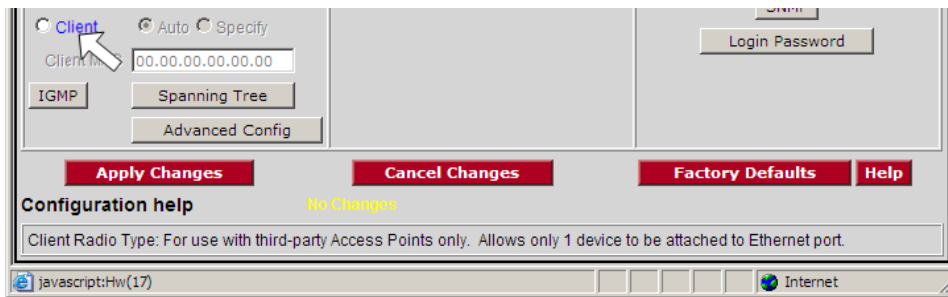
Read-Only fields

Some of the fields on the Radio Configuration / Diagnostic Utility form are read-only, meaning that the content of the field is provided for information only, and cannot be directly modified. Notice also that depending on the way the radio is configured, some fields and buttons may be unavailable because they do not affect the configuration you have selected. Review the topics in this section for more information on when and how to use each configuration option.

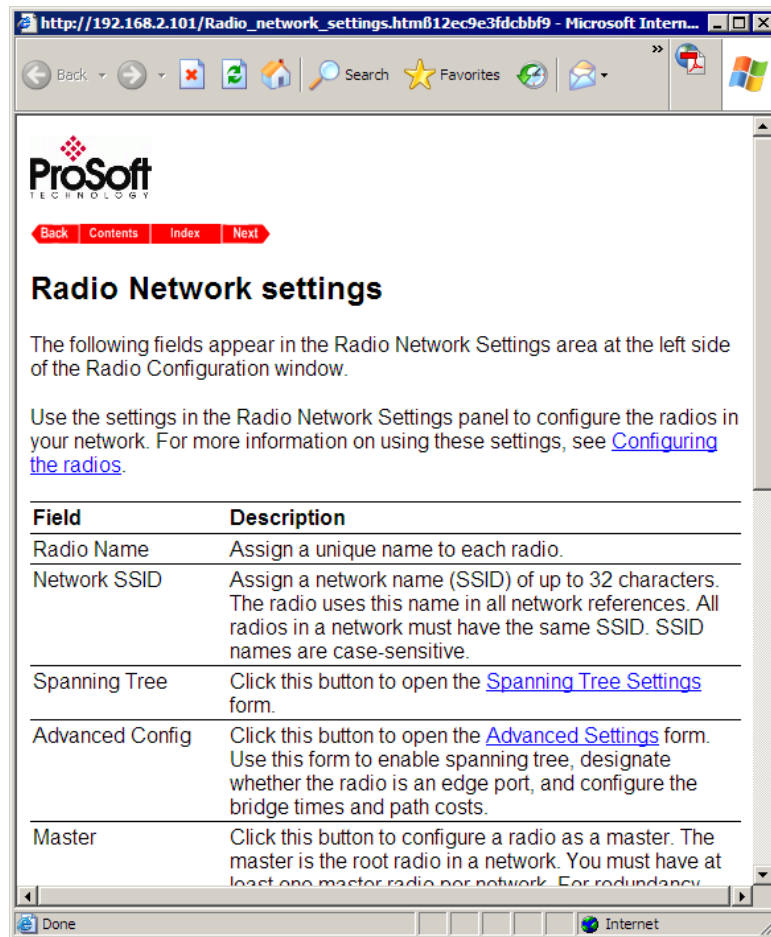
Configuration Help

Help is available for each item in the Radio Configuration / Diagnostic Utility.

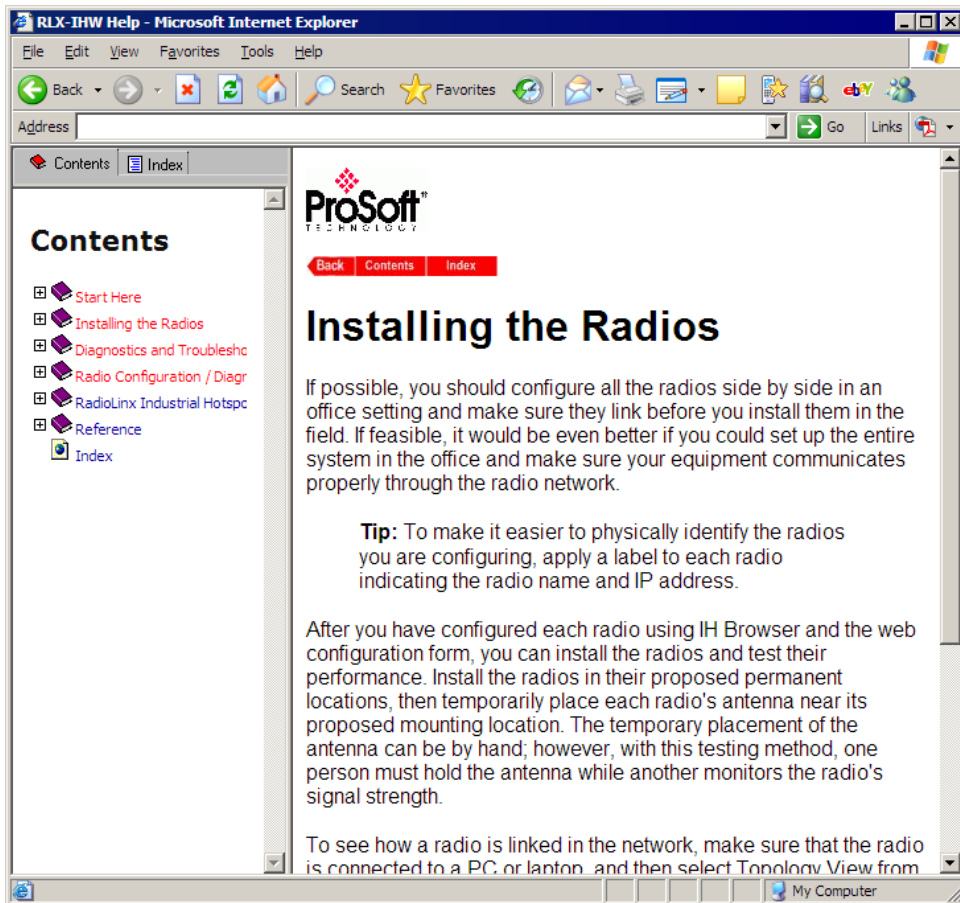
- To view a brief help message about any field on the screen, move your mouse pointer over the field, or use the **[Tab]** key, and refer to the text that appears at the bottom of the screen.



- To view more help about the selected field, click the field name. This action opens a help page in a new browser window.

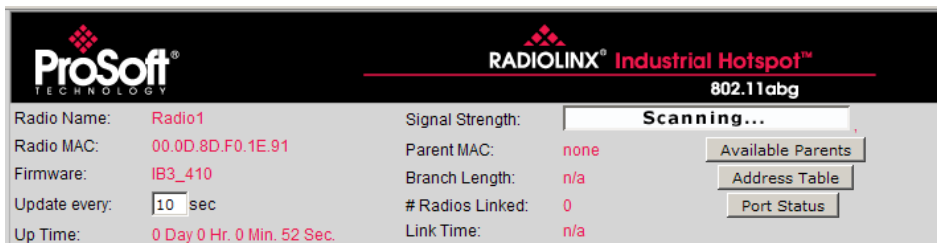


- To view the complete online documentation for your RLXIB-IESC Radio, click the **Help** button. This action opens the online documentation in a new browser window. Use the Contents, Index and Search tabs in the left frame to navigate the help system.



4.1 Radio Status

The following fields appear in the status area at the top of the Radio Configuration window.



Use the settings in the Radio Status panel to view the current settings for this radio.

Field	Description
Radio Name	The name of the selected radio.
Radio MAC	The MAC address of the selected radio. The MAC ID is also printed on the side of the radio.
Firmware	The version of firmware currently installed. All radios on the network must have the same firmware versions installed. For more information on firmware versions, refer to Update firmware (page 65).
Update every	This value in seconds controls how often the web configuration form automatically refreshes. To change the value temporarily, enter the new value and press the [Tab] key. To change the value permanently, enter the new value and press the [Enter] key.
Up Time	The length of time the radio has operated since the last system power-up or last system reset.
Signal Strength	Strength of the signal from the Parent radio.
Parent MAC	The MAC address of the parent radio to which the selected radio is linked.
Branch Length	The number of RF links from the radio to the master radio.
# Radios Linked	The number of other radios that are linked to this radio.
Link Time	The length of time the radio has been continuously connected to a parent radio.
Available Parents	Click this button to view the list of Access Points (Parents) from which this radio can detect beacons. This button is only available when the radio type is Repeater.
Address Table	Click this button to view a list of MAC addresses for devices entered in the radio's address table.
Port Status	Click this button to view spanning tree status of each switch port, for RF ports and the RJ45 (Ethernet) port.

4.1.1 Available Parents

Note: The Available Parents form is not available when the radio type is Master.

Available Access Points Radio1		Only Show Same SSID: <input type="checkbox"/>		Refresh				
MAC ID	SSID	Channel	RSSI	Security	Speed	Cost	Age(s)	Hops
00:0D:8D:F0:12:AF	Network1	Radio1	<i>Click on column header to sort</i>					
02:00:e1:8f:ab:e0	PAIR_2	10	-88	none	b	602	11	na
02:00:49:1e:59:49	TestIBSS1	10	-80	none	b	430	1	na
02:00:56:a6:46:f1	TestIBSS1	10	-80	none	b	430	6	na
02:00:54:92:44:c5	TestIBSS1	10	-80	none	b	430	18	na
02:00:54:26:44:71	TestIBSS1	10	-80	none	b	430	28	na
8e:bb:79:21:bb:a1	WANetwork	10	-80	none	g	430	0	na
02:00:53:82:43:d5	TestIBSS1	10	-79	none	b	411	40	na
02:00:6e:36:7e:61	TestIBSS1	10	-79	none	b	411	63	na
02:00:46:32:56:65	TestIBSS1	10	-78	none	b	394	52	na
02:00:65:7f:4e:e1	TestWAEIP	10	-78	none	b	394	0	na
02:00:6c:77:79:1c	PAIR_1	1	-77	none	b	376	4	na
02:00:54:f2:44:a5	TestIBSS1	10	-74	none	b	329	74	na

This page is helpful for viewing:

- Possible parents for a repeater. The current parent should normally be the radio with the lowest cost and a matching SSID.
- Other 802.11 networks in the area.

Field	Description
Only Show Same SSID	Select (check) this box to restrict the list of available parents to those with the same SSID as the radio you are configuring.
Refresh	Click this button to re-scan the network and update the devices in the list.
Mac ID	A unique hexadecimal number that identifies any Ethernet device.
SSID	Network Name (Service Set Identifier).
Channel	The radio channel on which the device is transmitting. The channel list indicates the channel number as well as the frequency (2.4 GHz or 5 GHz).
	Important: The RadioLinx RLXIB radio is supplied with a dual-band antenna that supports both frequency ranges. If you use a different antenna with the RLXIB radio, you must choose a channel and frequency range supported by the antenna.
RSSI	Received Signal Strength Indication.
Security	The encryption type enabled for the device.
Speed	The IEEE 802.11 connection speed (a, b, or g). The RadioLinx RLXIB radio supports all three 802.11 connection speeds.
Cost	Parent selection cost.
Age	The length of time (in seconds) since the radio last saw a packet from this MAC address
Hops	The number of hops to the Master. A value of 0 (zero) is shown for non-ProSoft devices.

This list contains both 802.11 devices that are part of the same SSID as the RLXIB itself (for example, "Minerals") as well as devices that belong to different SSIDs (for example, "Network1" and "ProSoftInternal"). This list is updated continuously and can be used for many purposes.

The IH radio updates this list with each 802.11 packet that is received, whether from a radio of the same network or one that belongs to another SSID. It can also see radios from other vendors.

Once per second the IH radio evaluates the link it has to its parent to determine if this link is the best parent to use. A cost is calculated for each entry and can be seen in the column labeled "Cost" in the preceding table. The cost calculation is based not only on the strongest signal, but on several other factors to provide optimum network communication.

4.1.2 Address table

Index	MAC Address	Connection	Age (s)
1	00.14.38.97.78.5D	Ethernet Port	2977
2	00.10.49.03.09.DC	Ethernet Port	2977
3	00.10.49.03.0B.F5	Ethernet Port	2977
4	00.10.49.03.0C.96	Ethernet Port	2977
5	00.10.49.03.0A.94	Ethernet Port	2977
6	00.10.49.03.08.2F	Ethernet Port	2977
7	00.10.49.03.3C.5F	Ethernet Port	2977
8	00.10.49.03.0A.92	Ethernet Port	2977
9	00.10.49.03.0A.F0	Ethernet Port	2977
10	00.10.49.03.02.C2	Ethernet Port	2977

The Address Table shows the port through which each MAC address is connected, along with the age in seconds since the radio last saw a packet from this MAC address.

Field	Description
Radio MAC	The MAC address of the selected radio. The MAC ID is also printed on the side of the radio.
Show Addresses for the Following	Use this dropdown list to filter the address list. Options are: <ul style="list-style-type: none"> ▪ Devices Out Ethernet Port ▪ Directly Linked Radios/Clients ▪ Devices beyond Direct RF Links When the table is filtered to show only Directly linked radios/clients, an additional RSSI column is listed, showing the Received Signal Strength from each radio or client linked to the radio.
Number of Rows to Display	Use this field to choose how many MAC addresses to display on this page. Use the Next and Prev buttons to scroll through the available MAC addresses.
Index	Position in the list. Each page shows up to 10 devices. Use the Next and Previous buttons to move up and down through the table.
MAC Address	The MAC address for the device.
Connection	The connection type
Age (s)	The length of time (in seconds) since the radio last saw a packet from this MAC address
Top	Click the Top button to see the top of the table. The radio will display updated data in the table entries.
Next / Prev	If the table has more MAC addresses than it can display in the window, use the Next and Prev buttons to move up and down through the table.
Refresh	Click Refresh to update the table.

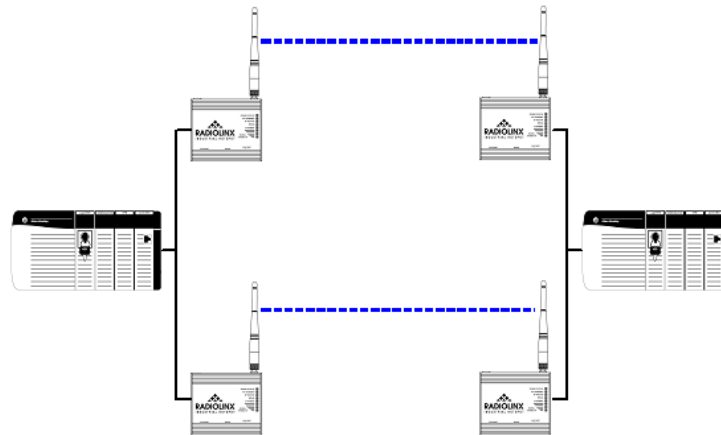
4.1.3 Port status

This configuration page opens when you click the Port Status button on the Radio Configuration form.

Port Status <i>Amethyst_BD</i>					
Spanning Tree Protocol: Wireless Ports <i>Rapid STP</i> Ethernet Port <i>Rapid STP</i>					
Spanning Tree Root: MAC <i>00.15.C5.26.DA.1C</i>					
Priority <i>32768</i> Max Age <i>20s</i> Hello Time <i>2s</i> Forward Delay <i>15s</i>					
#	Connection	State	Designation	Path Cost	Designated Bridge
1	Ethernet-Disconnected	Forwarding	Designated	600	00.05.87.01.00.BD
2	RF Parent 00.05.87.01.01.14	Forwarding	Root	500	00.05.87.01.01.14
11	RF Child 00.05.87.01.01.5C	Forwarding	Designated	700	00.05.87.01.00.BD
12	RF Child 00.0D.8D.F0.00.4F	Forwarding	Designated	700	00.05.87.01.00.BD
Top Next Prev Refresh					

When you click the Port Status button, you can see information about all the active ports on the radio. Above the table, you can see information about the current Spanning Tree, including the MAC address of the "root" device, and the timing parameters that are set for the current Spanning Tree. Each radio can have up to 34 active ports—one Ethernet cable, one parent RF link, and up to 32 child RF links.

The primary reason for creating a Spanning Tree is that it allows you to create fully redundant paths. If any single radio in a redundant path loses its connection, another path still exists, and the connection will be updated and communication restored.

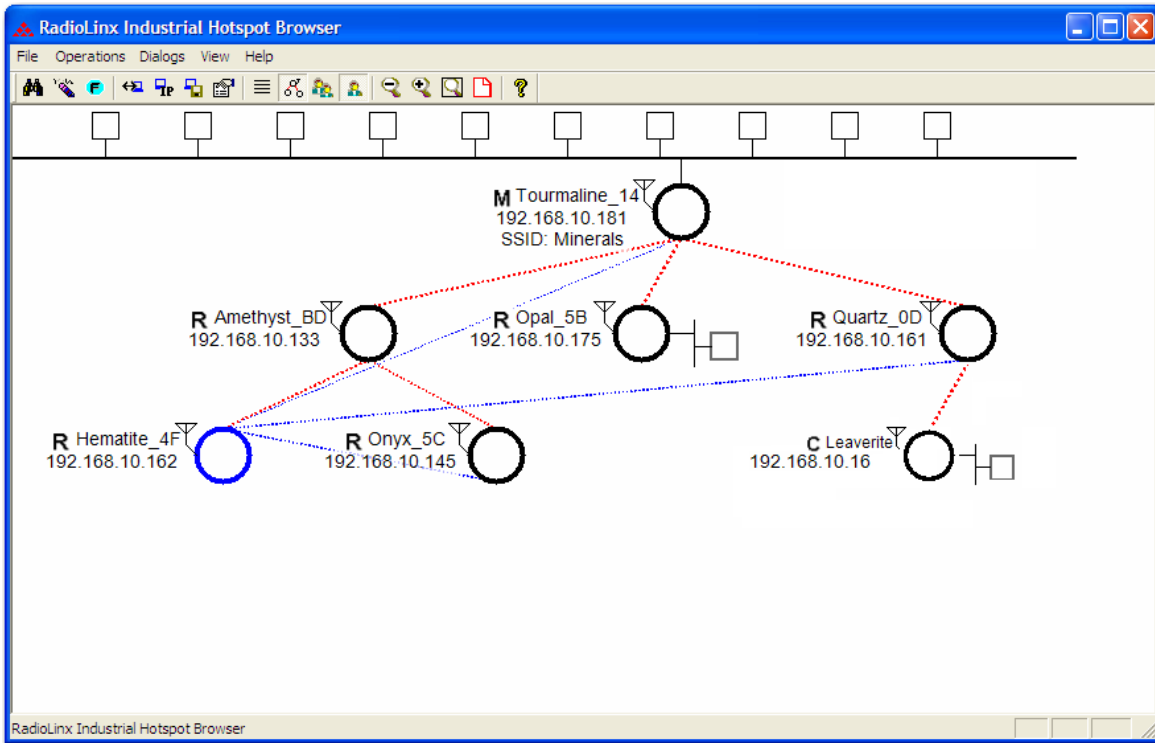


Field	Description
Spanning Tree Protocol: Wireless Ports	The Spanning Tree Protocol level for the wireless port (Rapid STP or STP).
Ethernet Port	The Spanning Tree Protocol level for the Ethernet port (Rapid STP or STP).
Spanning Tree Root MAC	The MAC ID of the root device in the spanning tree.
Priority	The Spanning Tree device with the lowest-priority value is elected the root of the tree

Field	Description
Max Age	The length of time a port can stay enabled without any new spanning updates.
Hello Time	The length of time between the transmission of spanning update packets.
Forward Delay	The length of time a port must listen for spanning information before being activated.
#	Position in the list. Each page shows up to 10 ports. Use the Next and Previous buttons to move up and down through the table.
Connection	This field indicates what the port represents: Ethernet, a parent radio, or a child radio.
State	The current Spanning Tree state of the port. Possible states are Blocking, Learning, Listening, and Forwarding. Forwarding packets can be transferred.
Designation	The Spanning Tree designation for the branch off the port. Possible designations are Root (ports going to the root), Designated (ports going to a branch), or Normal.
Path Cost	The cumulative cost of all wired and wireless links from the port to the Spanning Tree root.
Designated Bridge	The next bridge toward the Spanning Tree root for this port.
Top	Click the Top button to see the top of the table.
Next / Prev	If the table has more ports than it can display in the window, use the Next and Prev buttons to move up and down through the table.
Refresh	Click Refresh to update the table.

The following illustration shows the RadioLinx Industrial Hotspot Browser (page 58) application provided with the radios. Notice it shows the radio named Hermatite_4F, linked to Amethyst_BD. This link is shown with a red dotted line. Also visible is the level of redundancy in their network. Each of the blue lines represents an alternate parent. From this view, you can easily tell how much redundancy exists in their network.

To display the redundant paths, select the toolbar button denoting two "parents."
To view the redundancy on a per-radio basis, select the single "parent" button,
and then click on the radio to view its available redundancies.



4.2 Radio Network settings

The following fields appear in the Radio Network Settings area at the left side of the Radio Configuration window.

The 'Radio Network Settings' dialog box contains the following fields and controls:

- Radio Name: Radio1
- Network SSID: Network1
- Parent Link button
- Parent Auto Select checkbox
- Client: Auto Specify
- Client MAC: 00.0C.C8.02.08.79
- Advanced Config button
- Serial Settings button

Use the settings in the Radio Network Settings panel to configure the radios in your network. For more information on using these settings, see Configuring the radios (page 16).

Field	Description
Radio Name	Assign a unique name to each radio.
Network SSID	Assign a network name (SSID) of up to 32 characters. The radio uses this name in all network references. All radios in a network must have the same SSID. SSID names are case-sensitive.
Parent Link settings	Click this button to specify how a repeater radio connects to the network. For information, see Parent Link settings.
Client	This is a special mode that allows you to connect an Ethernet device to any 802.11 a, b or g access point. You would only use this mode in the special event that you wanted to connect a device to another brand access point. For information on setting up a client, see Configuring clients.
Auto / Specify	Only choose "specify" if device does not send out any unsolicited Ethernet packets. Try Auto first.
Client MAC	The MAC ID of the device connected to the radio, only if the device does not advertise its MAC address.
Advanced Config	Click this button to open the Advanced Settings form.
Serial Settings	Click this button to open the Serial Settings form.

4.2.1 Parent Link Settings

Repeater Settings Radio1

Parent MAC: 00.0D.8D.F0.07.21

Parent Selection Method

Automatically Choose Best

Parent Branch Length

Preferred Parent

00.00.00.00.00.00

00.00.00.00.00.00

00.00.00.00.00.00

00.00.00.00.00.00

00.00.00.00.00.00

00.00.00.00.00.00

00.00.00.00.00.00

00.00.00.00.00.00

Parent Selection Parameters

Signal Strength Threshold:

Bands: 2.4 only 5 only 2.4 or 5

Rate to Parent Mb/s

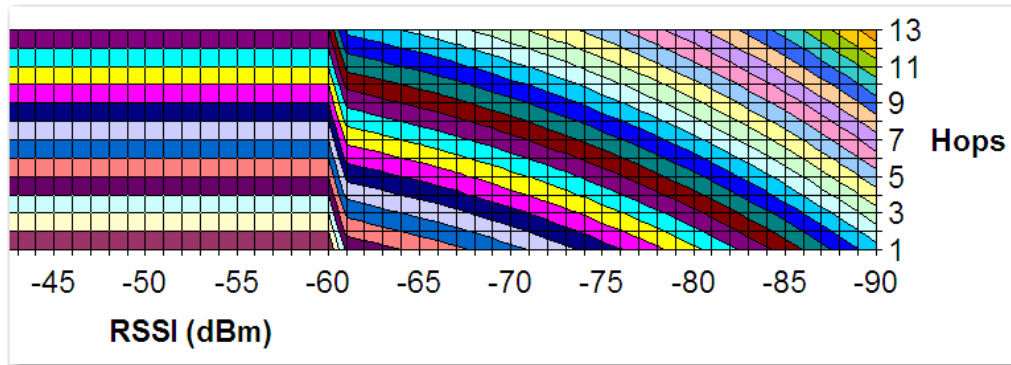
Save Cancel

Field	Description
Parent MAC	The MAC Address of the radio's Parent node.

Field	Description
Parent Selection Method	
Automatically Choose Best	<p>The Automatic Parent Selection algorithm uses a calculation to create a cost for each possible parent radio that it detects.</p> <p>In the calculation the radio includes,</p> <ul style="list-style-type: none"> ▪ RSSI - Stronger signals receive a better cost. ▪ Hop Count - Fewer hops from the Master radio is given preference and therefore a lower cost <p>Choose this setting to allow the radio to determine the best parent to select.</p>
Parent Branch Length	<p>With the branch length setting the IH will choose its parent strictly by the number of repeaters between it and the Master radio. If Branch Length of 1 is chosen, the IH will link only to the Master radio. If Branch Length of 2 is chosen, the IH will link only to an IH that is linked to the Master radio, and so on.</p>
Preferred Parent	<p>With the preferred parent setting the IH radio will select its parent from a list of possible parents specified by the user. The user can list up to eight radios to choose from.</p> <ul style="list-style-type: none"> ▪ Best in List When Best in List is selected the IH will select its parent using the "Automatic Parent Selection" algorithm, but it will limit the selection to the list of radios in the list. Therefore, the radio in the list with the lowest cost according to the algorithm will be chosen as its parent. ▪ Follow List Priority When Follow List Priority is chosen the IH will select its parent from the list giving preference to the 1st entry followed by the 2nd entry and so on.
Parent Selection Parameters	
Signal Strength Threshold	<p>When the signal from a parent reaches a high enough value, a stronger signal will not improve the quality of the link any further. For signals that are above that threshold, only fewer hops from the Master give preference. You can adjust that threshold here.</p>
Bands	<p>This setting controls which bands a Repeater will scan to look for a possible parent. It will scan the 2.4 GHz band only, the 5 GHz band only, or both 2.4 GHz and 5 GHz bands.</p>
Rate to Parent	<p>The default setting is auto which allows the radio to select the best rate to use to the parent radio, and adapt over time. You might specify a fixed rate rather than auto for example if the link to the parent has a low signal strength in which case fixing a lower rate can improve performance. The actual rate used between this radio and its parent is the lower value of this setting and the Max Data Rate setting in the parent (see Max Data Rate). So use these two controls in conjunction if desired to tailor the rate of each parent link.</p>
Save	Saves your changes and updates the radio configuration.
Cancel	Discards your changes without updating the radio configuration.

When you save a selection and return to the Radio Network Settings panel, notice that your selection is indicated under the Parent Link button.

The Automatic Parent Selection algorithm uses a calculation to create a cost for each possible parent radio that it detects. The following graph describes how the cost is calculated when the signal strength threshold is set to -60 dBm.



Once per second, the RLXIB-IESC radio evaluates the link it has to its parent to determine if this link is the best parent to use. A cost is calculated for each entry and can be seen in the column labeled "Cost" in the preceding table. The cost calculation is based not only on the strongest signal, but on several other factors to provide optimum network communication.

Prioritized Parent Selection

If you need more control than the automatic algorithm allows, you can also define a priority list of parents for the IH Radio to choose.

Prioritized Parent by Branch Length

Parent Settings Radio1

Parent MAC: 00.00.00.00.00.00

Parent Selection Method

Automatically Choose Best

Parent Branch Length 1

Preferred Parent Best

1

2

3

4

5

6

7

8

9

10

11

12

13

14

Parent Selection Parameters

Signal Strength Threshold: -70

Rate to Parent Auto Mb/s

Allow Children Yes No

With **Parent Branch Length**, the IH will choose its parent strictly by the number of repeaters between it and the Master radio. If Branch Length of 1 is chosen, the IH will link only to the Master radio. If Branch Length of 2 is chosen, the IH will link only to an IH that is linked to the Master radio, and so on.

Prioritized Parent by Preferred Parent List

Parent Settings Radio1
Parent MAC: 00.00.00.00.00.00
Parent Selection Method
 Automatically Choose Best
 Parent Branch Length 1
 Preferred Parent Best in List
00.00.00.00.00.00
00.00.00.00.00.00
00.00.00.00.00.00
00.00.00.00.00.00
00.00.00.00.00.00
00.00.00.00.00.00
00.00.00.00.00.00
Parent Selection Parameters
Signal Strength Threshold: -70
Rate to Parent Auto Mb/s
Allow Children Yes No
Save Cancel

With **Preferred Parent**, the IH radio will select its parent from a list of possible parents that you specify. You can list up to eight radios to choose from.

- **Best in List**

The IH will select its parent using the "Automatic Parent Selection" algorithm described above but it will limit the selection to the radios in the list. The radio in the list with the lowest cost according to the algorithm will be chosen as its parent.

- **Follow List Priority**

The IH will select its parent from the list giving preference to the first entry, followed by the second entry, and so on.

4.2.2 Advanced Settings

It is important to allow many industrial protocols to communicate properly over the RLXIB-IESC radios. The standard 802.11 AP operation for transmitting broadcast messages is to accumulate them and transmit them only on specific time intervals. This allows clients that are in power-save mode to wake up at the synchronized time interval and receive the broadcast packets. However, the power-save mode is rarely used in industrial networks. Additionally, many industrial protocols utilize multicast traffic, which is sent as broadcast messages over the wireless network. By enabling immediate broadcasting, these multicast messages are not delayed by the wait for the next time interval to occur before they can be transmitted. This results in improved network performance.

The settings on this form also allow you to configure the transmission rate and broadcast mode to optimize this radio's use on an industrial network.

Field	Description
Max Data Rate	The maximum data transmission rate, in megabits per second, for this radio. Available settings range from 1 to 54.
Max Basic Rate	In addition to the Data Rate setting which controls generic data traffic, the Basic Rate setting adjusts the rate at which control packets such as Beacons and Acks are sent at as well as packets that need to go to the whole network such as Broadcasts. Because these packets are intended for the whole network, the Max Basic Rate setting of the Master is advertised to each of the radios in the network through Beacons. Each radio, other than the Master, then inherits the Max Basic Rate setting of the Master. Therefore the setting only needs to be made in the Master radio. The setting in each of the other radios is disregarded.
Immediate Broadcasting	Forward multicast traffic immediately, rather than waiting for specific time intervals.
Block General Probe Requests	Do not respond to general probe requests that are not specific to the radio's SSID.
Range	The Range setting allows the radios to account for round trip delays. The Range settings should be the same in all radios in the network and should be at least large enough to account for the length of any links. However, increasing the Range beyond what is necessary can cause a slight decrease in throughput.
TX Power	This sets the output power of the radio.

Field	Description
Save	Saves your changes and updates the radio configuration.
Cancel	Discards your changes without updating the radio configuration.

4.2.3 Serial Port Settings

This configuration page opens when you click the Serial Settings button on the Radio Configuration form.

Use this page to configure the way serial data packets are encapsulated and transmitted over an Ethernet network.

Field	Description
Serial Encapsulation Mode	<p>None: No serial data encapsulation.</p> <p>UDP: In UDP mode, programs on networked computers can be used to send short messages or Datagrams. Once enabled, the serial port will be used to transmit and receive packets.</p> <p>NOTE: In UDP mode if a multicast group address is entered in this field then packets are sent to that address.</p> <p>TCP Server: In TCP Server mode, only connections from this address will be accepted. Once the session is established, the serial port is enabled to transmit and receive packets.</p> <p>NOTE: To accept connections from any IP address the field should be set to 0.0.0.0.</p> <p>TCP Client: In TCP Client mode, a TCP connection will be established with this address.</p> <p>When the session is established, the serial port is enabled to transmit and receive packets.</p>
Single IP Address	Enter the IP Address or URL of the radio that should receive encapsulated serial protocol packets.

Field	Description																																
Range of IP Addresses	Enter up to 4 IP Address ranges for radios that should receive encapsulated serial protocol packets.																																
Remote Port Number	Enter the remote UDP port number to use for encapsulated serial data transmission.																																
Local Port Number	Enter the local UDP port number to use for encapsulated serial data transmission.																																
Delineation Method	<p>None: All data received between packet delineation events is sent to the remote node in a single network frame.</p> <p>Time Gap: The minimum time gap between characters that is to be interpreted as a delineator for a packet. Configure this value in the EOL Time Gap field.</p> <p>Character: The particular character sequence in the stream of characters that indicates the delineator for the packet. Configure this value in the EOL Delineator field.</p>																																
EOL Delineator	<p>This field is available when the selected Delineation Method is Character. Choose the type of delineator to use from the dropdown list:</p> <p>Available delineation types are:</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Decimal</th> <th>Hex</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Use Text</td> <td></td> <td></td> <td>Any string of characters</td> </tr> <tr> <td>CR</td> <td>13</td> <td>0D</td> <td>Carriage Return</td> </tr> <tr> <td>ESC</td> <td>27</td> <td>1B</td> <td>Escape</td> </tr> <tr> <td>LF</td> <td>10</td> <td>0A</td> <td>Line Feed (New Line / nl)</td> </tr> <tr> <td>Null</td> <td>00</td> <td>00</td> <td>Null</td> </tr> <tr> <td>Spacebar</td> <td>32</td> <td>20</td> <td>Space</td> </tr> <tr> <td>Tab</td> <td>09</td> <td>09</td> <td>Horizontal Tab</td> </tr> </tbody> </table>	Type	Decimal	Hex	Description	Use Text			Any string of characters	CR	13	0D	Carriage Return	ESC	27	1B	Escape	LF	10	0A	Line Feed (New Line / nl)	Null	00	00	Null	Spacebar	32	20	Space	Tab	09	09	Horizontal Tab
Type	Decimal	Hex	Description																														
Use Text			Any string of characters																														
CR	13	0D	Carriage Return																														
ESC	27	1B	Escape																														
LF	10	0A	Line Feed (New Line / nl)																														
Null	00	00	Null																														
Spacebar	32	20	Space																														
Tab	09	09	Horizontal Tab																														
EOL Time Gap	<p>This field is available when the selected Delineation Method is Time Gap; This value configures the length of time in milliseconds that must elapse after a character is received (from the local attached device) before that character marks the end of a packet.</p> <p>NOTE: the smallest value this field can be set to will be limited by the device and is platform dependent.</p>																																
Packet Rate (milliseconds)	This parameter sets the minimum time gap that will be interpreted as an inter-packet space. When detected the characters received up to that point will constitute a single packet and will be sent to the remote node. Units: microseconds. Values: 1,000 to 500,000.																																
Baud Rate	Select the baud rate from the dropdown list. The baud rate on the radio must match the baud rate on the connected serial device.																																
Data Bits	Select the number of data bits (5, 6, 7 or 8) from the dropdown list. The data bits on the radio must match the data bits on the connected serial device.																																
Parity	Select the parity (None, Even, Odd, 1 or 0) from the dropdown list. The parity on the radio must match the parity on the connected serial device.																																
Flow Control	Select the flow control (handshaking) mode (None or Hardware) from the dropdown list. The handshaking mode on the radio must match the handshaking mode on the connected serial device.																																

Field	Description
Stop Bits	Select the number of stop bits (1 or 2) from the dropdown list. The stop bits on the radio must match the stop bits on the connected serial device.
Save	Saves your changes and updates the radio configuration.
Cancel	Discards your changes without updating the radio configuration.

4.3 Security settings

The following fields appear in the Security Settings area in the middle of the Radio Configuration window.



You can assign the following security settings:

Field	Description
Encryption type (page 53)	WPA-AES is the preferred encryption method. It contains the latest updates to the 802.11 standards for best security. However, some legacy devices do not yet support these updates. Therefore, you can choose combinations of legacy methods. Available encryption types are: <ul style="list-style-type: none"> ▪ None (not recommended) ▪ WPA-AES - Latest security setting using WPA (pre-shared key) authentication and AES encryption. ▪ WPA-TKIP - Security setting using WPA (pre-shared key) authentication and TKIP encryption. ▪ WEP128 - Legacy security setting using a 128-bit key and WEP encryption. ▪ WEP64 - Legacy security setting using a 64-bit key and WEP encryption.
WPA phrase (page 53)	Enter a WPA pass phrase of between eight and 63 normal keyboard characters.
WEP key (page 53)	Enter five normal text characters in the WEP key field

The following topics describe each security setting in more detail.

4.3.1 Encryption type

The preferred encryption type is WPA (WiFi Protected Access). You should only select WEP (wired equivalency protocol) for use with an older client radio that only has WEP encryption. For compatibility with clients that do not support WPA, you can select WPA+WEP128 (bits) or WPA+WEP64 (bits) as the encryption type. Then the older clients can connect to an access point using the WEP setting, but new clients will use WPA and the RLXIB-IESC radios will still use WPA among themselves.

IMPORTANT: If WPA+WEP is selected, some clients using WPA might not be able to connect unless you use a WEP key other than number 1, due to limitations in these clients. In such cases, you should set a WEP key other than key 1 and set this same key in all clients that are using WEP. See WEP key (page 53).

WEP is the original security protocol used by 802.11 networks, but WPA offers better protection against attacks, for several reasons: WPA distances the encryption key from the actual data by performing several algorithms to the key before generating the encrypted data, it performs dynamic key management by changing keys frequently, and it performs message integrity checks to prevent forgery and replay.

You can also select WEP 128, WEP 64, or None (no encryption) as the encryption type, but none of these settings are recommended.

Note: If an RLXIB-IESC is set to use WPA+WEP, it will connect to other radios set to WPA only or WPA+WEP, but it will not communicate with radios set to WEP only. Likewise, an RLXIB-IESC in client mode with WPA+WEP selected will not connect to an access point with WEP only selected.

4.3.2 WPA phrase

To use WPA encryption on packets sent between the radios, enter a WPA pass phrase of between eight and 63 normal keyboard characters. This phrase automatically generates an encryption key of 128 hexadecimal characters. This field is only available if you select WPA as the encryption type.

The default WPA-AES Phrase when a module ships is 'passphrase'.

4.3.3 WEP key

A key is a set of hexadecimal (hex) or ASCII characters used to encrypt data. This field is only available if you select WEP as the encryption type. Write down your WEP encryption key as you create it, because you must enter the same key on your client.

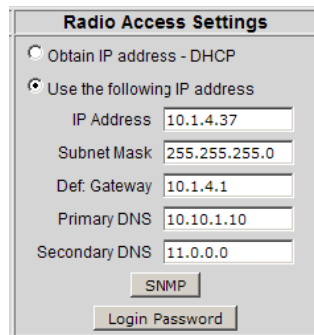
To create a 64-bit WEP key, enter five normal text characters in the WEP key field, which converts the characters automatically to 10 hex digits. Alternatively, you can enter 10 hex digits (0 to 9, a to f, A to F) directly in the WEP key field. To create a 128-bit key, enter 13 normal text characters, which convert to 26 hex digits, or enter 26 hex digits (0 to 9, a to f, A to F) directly.

Note: Clients often support more than one WEP key. Packets received can be decrypted using any one of the keys if programmed, but packets are always transmitted with the "default" WEP key number. If you set a transmit key number on the RLXIB-IESC, make sure all other radios and clients have this key programmed. To set keys other than key 1 on some clients using Windows, you might have to use the Advanced settings.

Programming more than one key on the RLXIB-IESC requires setting the key number to the key you want to program, entering the key, and saving your changes. Repeat these steps for each key you want to program, saving after each one; finally, change to the desired transmit key number if necessary and save again (If "*****" remains in the key field, the previously programmed key will not be changed when changes are applied)

4.4 Radio access settings

The following fields appear in the Security Settings area on the right side of the Radio Configuration window.



In order to configure or diagnose a radio using its built-in Web server or SNMP agent, both your computer and the radio must have IP addresses, and these IP addresses must be on the same subnet. An IP address is only needed so you can configure the radio and view its diagnostic settings. Otherwise, the address is unnecessary.

Field	Description
Obtain IP address - DHCP	Select this option to allow the radio to obtain its IP address from a DHCP server.
Use the following IP address	Select this option to specify a Static IP address to the radio. Enter the IP address information in the following fields.
IP Address	Enter an IP address that will not interfere with any other devices on the network. Request a block of IP addresses you can use from your Network Administrator.
Subnet Mask	Enter the Subnet Mask provided by your Network Administrator.
Default Gateway	Enter the Default Gateway address provided by your Network Administrator.
Primary DNS	Enter the Primary DNS address provided by your Network Administrator.

Field	Description
Secondary DNS	Enter the Secondary DNS address provided by your Network Administrator.
SNMP button	Click this button to open the SNMP (Simple Network Management Protocol) Agent settings form. Use this form to configure access to radio network settings through an SNMP agent.
Login Password button	Click this button to change the Login Password for the radio. The default password is "password". You should change this password, and keep a record of it in a safe place, to protect the radio from being reconfigured by unauthorized users.

DHCP (Dynamic Host Control Protocol) is a service provided by a server (typically a router or a firewall) on a local area network. Devices on a network that supports DHCP can request and receive an IP address from the DHCP server. RLXIB-IESC radios support DHCP; by default, they attempt to obtain an IP address from a DHCP server.

If a DHCP server is not available, the radio will not be able to acquire an IP address automatically, therefore you must assign an IP address, subnet mask and default gateway to the radio so that it can communicate on the network.

You can also assign a Static (fixed or permanent) IP address to the radio to make it easier to identify and configure the radio. Static IP addresses are particularly useful when configuring radios to serve as Access Points, or for radios that must be accessible through a firewall.

A detailed discussion of TCP/IP networking is beyond the scope of this manual. Refer to the following Microsoft knowledgebase article for more information: <http://support.microsoft.com/kb/164015>

4.4.1 SNMP Agent settings



SNMP is a network management protocol that is often used with TCP/IP and Ethernet. As an alternative to using the Radio Configuration / Diagnostic Utility, you can change radio settings and view diagnostics in an SNMP manager application, if necessary.

Field	Description
Enable	Click this button to enable the following SNMP Agent settings.
Allow Any Manager	Select this option to allow any user to change the radio settings from any computer using SNMP.

Field	Description
Allow IP	Select this setting to restrict access to an SNMP manager with a particular IP address, then enter the IP address in the Allow IP field.
Community String	Enter a "community string" (essentially a password) that a manager must use to access the radio's SNMP agent.
Permission	Select the permission level to assign to this radio.
Read only	An SNMP Agent can view but cannot modify radio settings.
Read/Write	An SNMP Agent can view and modify radio settings.
Save	Saves your changes and updates the radio configuration.
Cancel	Discards your changes without updating the radio configuration.

The RLXIB-IESC SNMP agent supports SNMP protocol version 1.4 and 2 MIBs: RFC12133-MIB (partial; internet.mgmt.MIB-2.system, .interfaces, .snmp) ROMAP-MIB (included on the CD; internet.private.enterprises.romap) It also supports a selection of standard SNMP traps, including Cold Start, which is sent when the radio initializes.

4.4.2 Change password

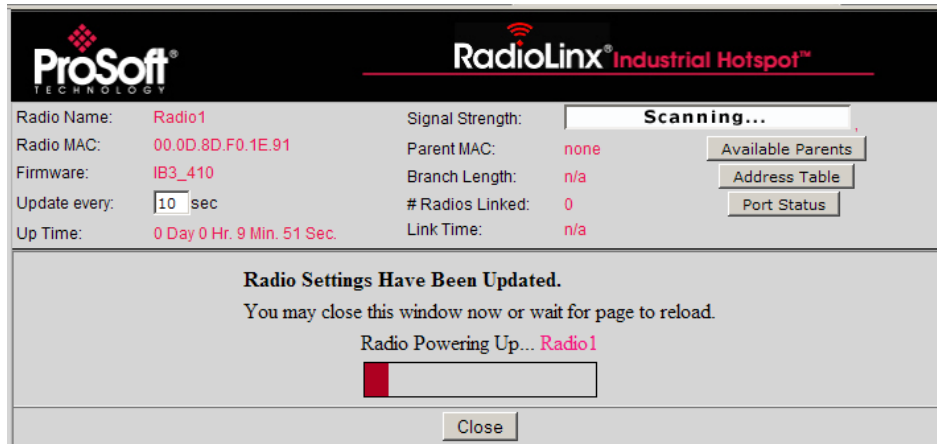
Field	Description
Old	Enter the current password in this field. The default password is "password" (lower case, no quotes). This entry must exactly match the current password, otherwise the change will be rejected.
New	Enter the new password in this field. Passwords are case sensitive.
Repeat	Confirm the new password in this field. This entry must exactly match the password you entered in the "New" field, otherwise the change will be rejected.
Save	Saves your changes and updates the radio configuration.
Cancel	Discards your changes without updating the radio configuration.

You can enter any alphanumeric value between one and 31 characters. The password is case-sensitive.

If you forget your password, you will be unable to change the radio settings. To get the default password again, see Troubleshooting.

4.5 Apply Changes

Click the Apply Changes button to save your changes after editing radio configuration in order for those changes to take effect. When you apply changes, the radio will shut down and restart using the new settings.



4.6 Cancel Changes

Click Cancel Changes to discard any settings you made during this session.

Note: This button only applies to changes made in the Radio Configuration / Diagnostic window. Changes made to individual configuration forms (for example, Spanning Tree, Parent Link, and SNMP Agent settings) take effect when you click the Save button on each of those forms.

4.7 Factory Defaults

Click the Factory Defaults button to reset the radio to the default settings.

Important: This action discards all your radio configuration settings.

You will be prompted to confirm this action before it takes effect.

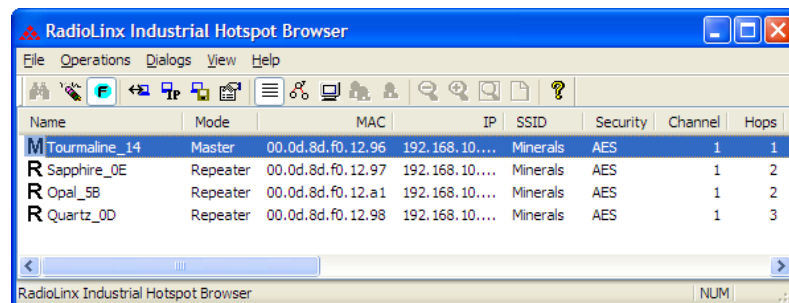
5 RadioLinx Industrial Hotspot Browser

In This Chapter

- ❖ Primary radio functions..... 60
- ❖ File Menu..... 61
- ❖ Operations Menu..... 63
- ❖ Dialogs Menu 67
- ❖ View Menu..... 73
- ❖ Help Menu 79

The RLX-IH Browser allows you to find any radios connected to your network, see some of their basic settings, and change the IP address so you can access the radio's Web page. For more information, see Primary radio functions (page 60).

When you run the program, the List view (shown in the illustration) appears with a list of any radios on the same network as the computer running the RLX-IH Browser. If you do not see a radio you expect to see, click the Scan (page 62) button in the tool bar or select Scan from the File menu.



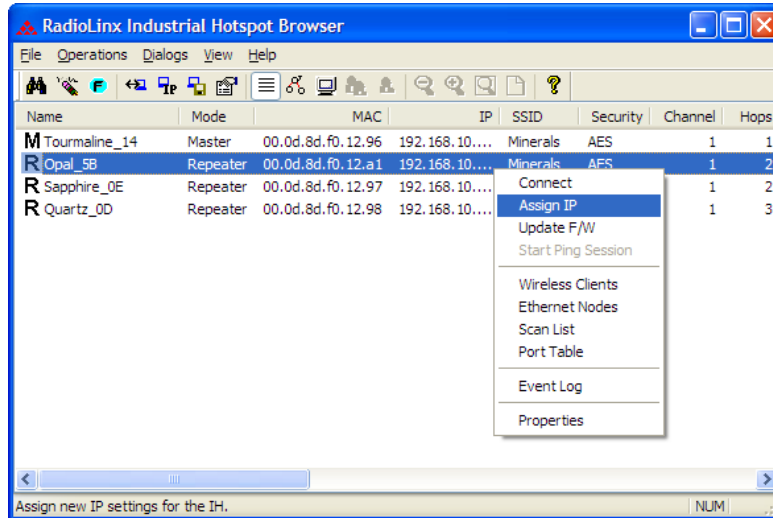
The preceding illustration shows the List View. Refer to Topology view (page 74) to see alternate views.

To clear all the radios from the list, click the Erase button in the tool bar or select Clear from the File menu. You can then refresh the list by clicking Scan.

If you have trouble viewing radios in the RLX-IH Browser, see Troubleshoot missing radios (page 32).

5.1 Primary radio functions

You can perform the following primary functions on any radio in the list by right-clicking the radio name.



Connect (page 64): Log in to the Radio Configuration / Diagnostic Utility to configure a radio or check diagnostics.

Assign IP (page 20, page 64): Assign a temporary IP address to a radio.

Update Firmware (page 65): Update the version of firmware the radio uses.

Start Ping Session (page 66):

Wireless Clients (page 67): View a list of client radios

Ethernet Nodes (page 68): View a list of wired Ethernet nodes connected to the network

Scan List (page 69): View a list of all the radios detected on the network (including those from other vendors)

Port Table (page 70):

Event Log (page 70):

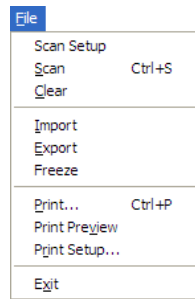
Properties (page 71): View the selected radio's properties.

In addition, there are more options in the File menu.

- You can print either a list of the radios' properties or a topology view.
- Change how the RLX-IH Browser scans for radios.

5.2 File Menu

The following commands are available on the File menu:

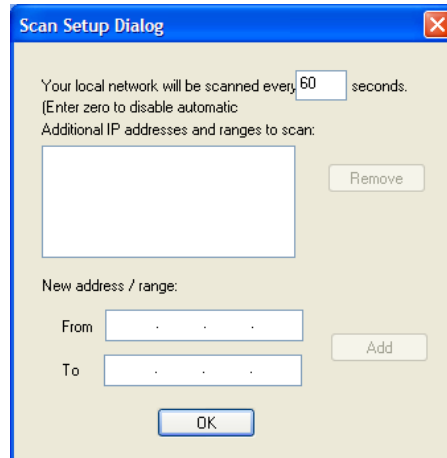


- Scan Setup (page 61)
- Scan (page 62)
- Clear (page 62)
- Import (page 62)
- Export (page 62)
- Freeze (page 63)
- Print (page 63)
- Print Preview (page 63)
- Print Setup (page 63)
- Exit (page 63)

5.2.1 Scan Setup

The Scan Setup command allows you to change some settings that govern how the RLX-IH Browser scans for radios. In the top field of the Scan Setup dialog box, you can adjust how often the program automatically scans for radios. Enter a value (in seconds) to have the RLX-IH Browser scan at that rate.

In the New address/range fields, you can adjust how the program scans for radios. By default, the program sends a broadcast message to all the radios at the same time, looking for a response. Broadcasts are limited to a local network, and will not be passed through a router. If there is a router between the PC running the RLX-IH Browser and the radio to be scanned, the IP address of the radio or a range of addresses can be added to the scan list. At each interval determined by the scan rate, each IP address is individually queried.



5.2.2 Scan

The RLX-IH Browser automatically scans for all active radios on the network at a regular interval, but you can use the Scan command in the File menu to look for active radios at any time.

5.2.3 Clear

This command clears (deletes) all entries from the IH Browser window.

5.2.4 Import

This command imports an XML file created by the Export command in the RadioLinx IH Browser.

5.2.5 Export

This command creates and saves an XML file containing the current configuration and status of all radios discovered by the RadioLinx IH Browser. Use this command under the direction of ProSoft Technical Services, for troubleshooting purposes.

5.2.6 Freeze

Use this command to temporarily stop the display from updating. This command is useful for studying network topology and performance without the distraction of radios and other devices appearing and disappearing from the screen.

5.2.7 Print

Use this command to print the contents of the RadioLinx IH Browser window. Depending on the view you selected, you can print either a list of the radios' properties, or a topology view.

5.2.8 Print Preview

Displays a preview of the contents of the RadioLinx IH Browser window. You can use this to adjust the placement of elements so that they do not span page boundaries.

5.2.9 Print Setup

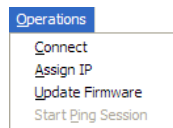
Displays the standard Window Print Setup dialog box.

5.2.10 Exit

Closes RadioLinx IH Browser.

5.3 Operations Menu

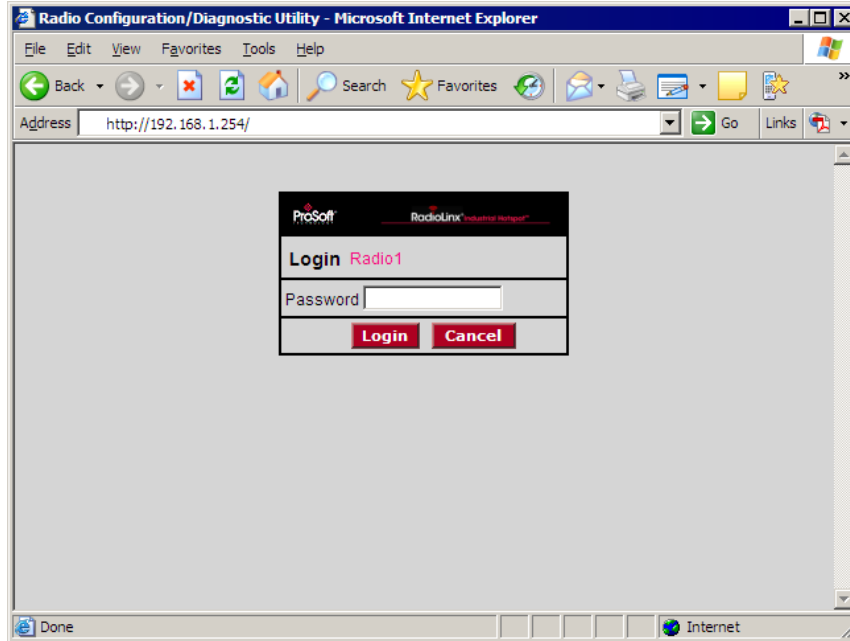
The following commands are available on the Operations Menu:



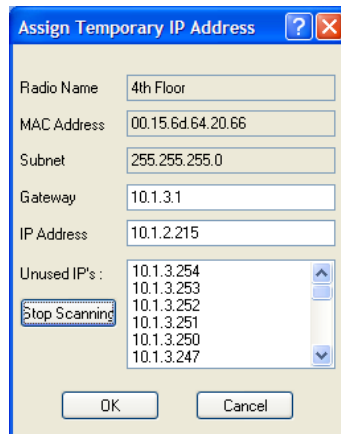
- Connect (page 64)
- Assign IP (page 20, page 64)
- Update Firmware (page 65)
- Start Ping Session (page 66)

5.3.1 Connect

To connect to the Radio Configuration / Diagnostic Utility and change radio settings, double-click the radio listing in the RLX-IH Browser after it has been assigned an IP address (either manually or with DHCP). Alternatively, you can select the Connect option in the AP Operations menu. Enter your password to log in to the radio.



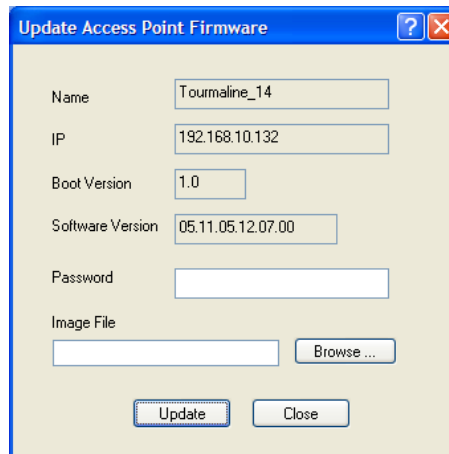
5.3.2 Assign IP



If the radio is connected to a network with a DHCP server, the radio may already have an IP address assigned to it. If no address appears, double-click the radio listing in the RLX-IH Browser or select Assign IP in the AP Operations menu. In the next window, click OK to accept the temporary IP address, subnet mask, and default gateway. If necessary, you can enter a particular IP address (see Radio Access settings (page 54)). After an IP address is assigned, you can configure radios through the Radio Configuration / Diagnostic Utility (page 34).

5.3.3 Update Firmware

"Firmware" is the program that runs in the RadioLinx® Industrial 802.11abg Serial and Ethernet Client that allows it to communicate and exchange data between devices, using the radio as a network connection. Different versions of the firmware communicate with other radios in different ways, and provide different levels of functionality.



In order for your RadioLinx Industrial Hotspot radio to communicate with other RLXIB-IESC devices, all radios on the network must use the same firmware version.

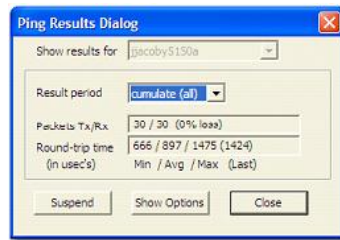
To change the firmware version of the radio:

- 1 Start RadioLinx Industrial Hotspot Browser.
- 2 Open the Operations menu, and then choose Update Firmware.
- 3 Enter the password for the radio. This is the same password you use to log into the radio from the Radio Configuration / Diagnostic Utility (page 34).
- 4 Click the Browse button to locate the Image File (firmware version) to update. Both versions of firmware are available both on the CD that came with in the box with the radio, and at our web site at www.prosoft-technology.com
- 5 Click Update to begin copying the new firmware to the radio. Do not disconnect the cable or turn off power to the radio during this operation.

5.3.4 Start Ping Session

A Ping Session allows you to run traffic over the radio network between any two computers running the IH Browser. With it the user can monitor their network over time.

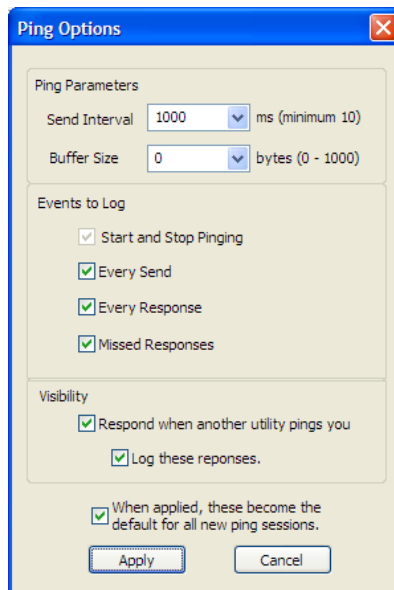
To start the ping session, enable "Show Ping Stations" on the View menu, and then highlight one of the other computers visible in the IH Browser. The session then starts automatically and the Ping Results dialog box opens.



This dialog box displays statistics on the minimum, maximum and average latency between two points on the network.

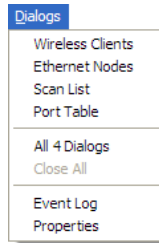
Ping Options dialog box

The Ping Options dialog box opens when you click the Show Options button on the Ping Results (page 66) dialog box. Use this dialog box to choose ping parameters, logging options, and response to other stations.



5.4 Dialogs Menu

The Dialogs menu contains the following commands:

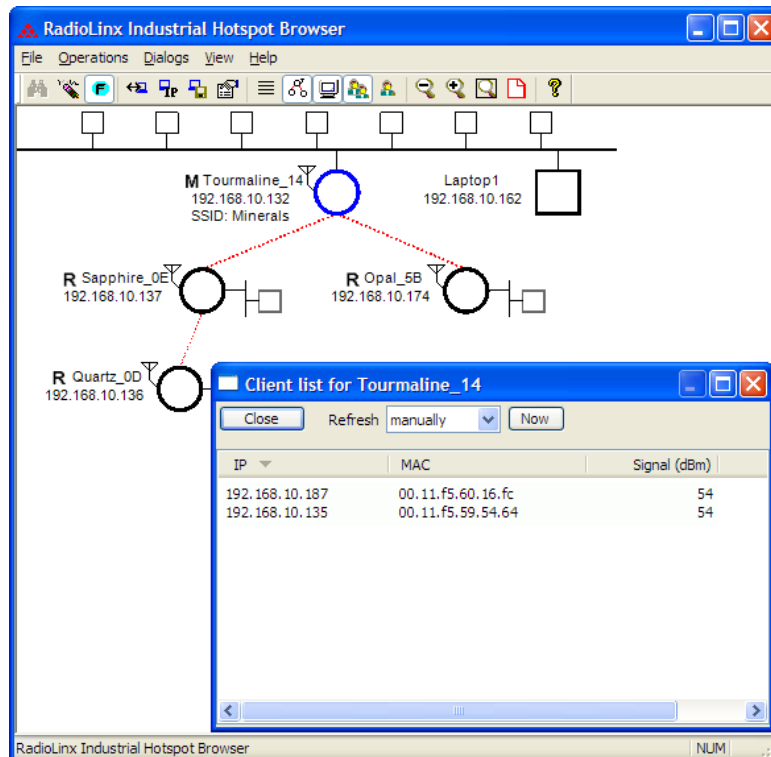


- Wireless Clients (page 67)
- Ethernet Nodes (page 68)
- Scan List (page 69)
- Port Table (page 70)
- Event Log (page 70)
- Properties (page 71)

5.4.1 Wireless Clients

This dialog box opens when you open the AP Dialogs menu and choose Wireless Clients.

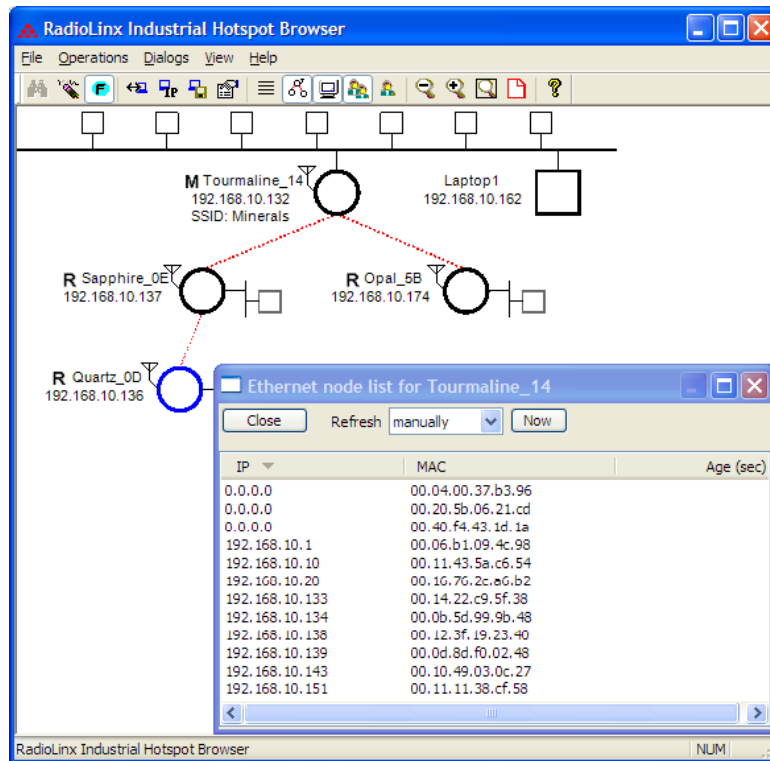
Use this dialog box to see information about wireless clients attached to the radio.



5.4.2 Ethernet Nodes

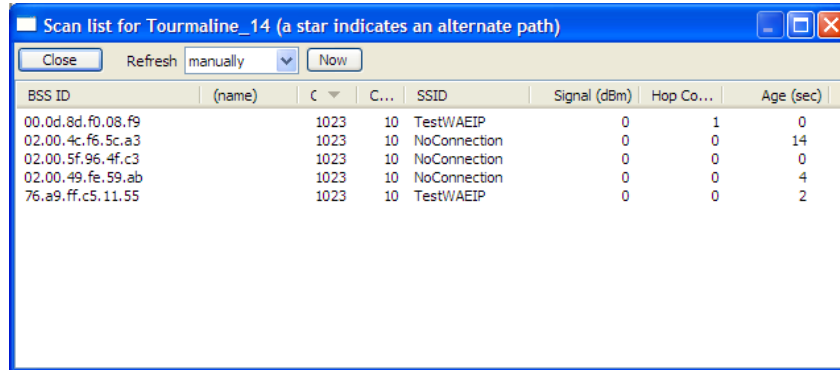
This dialog box opens when you open the AP Dialogs menu and choose Ethernet Nodes.

Use this dialog box to see information about Ethernet devices attached to the radios. The following illustration shows a list of Ethernet devices (by IP address and MAC ID) attached to the Ethernet port of Tourmaline_14. In addition to the IP and MAC ID it gives an age for each entry, which is the amount of time since a packet has been heard from that device.



5.4.3 Scan List

This dialog box opens when you open the AP Dialogs menu and choose Scan List.



BSS ID	(name)	C	C...	SSID	Signal (dBm)	Hop Co...	Age (sec)
00.0d.8d.f0.08.f9		1023	10	TestWAEIP	0	1	0
02.00.4c.f6.5c.a3		1023	10	NoConnection	0	0	14
02.00.5f.96.4f.c3		1023	10	NoConnection	0	0	0
02.00.49.fe.59.ab		1023	10	NoConnection	0	0	4
76.a9.ff.c5.11.55		1023	10	TestWAEIP	0	0	2

The scan list is a list of all the radios that this particular radio "hears" on this channel (via beacons) even if it is not linked to it (different SSID or encryption). This list shows the same information as the Available Parents list in the Radio Configuration / Diagnostic Utility.

List entries marked with a "*" indicate the entry is an alternate path, which can also be seen if the 'parents' button is selected in the menu bar (blue lines will link the radio to its alternate parents).

802.11 Access Point Detector

The RLXIB-IESC Radio can be used as an installation tool to analyze the 802.11 environment and provide the user with information on choosing antenna location and channel selection.

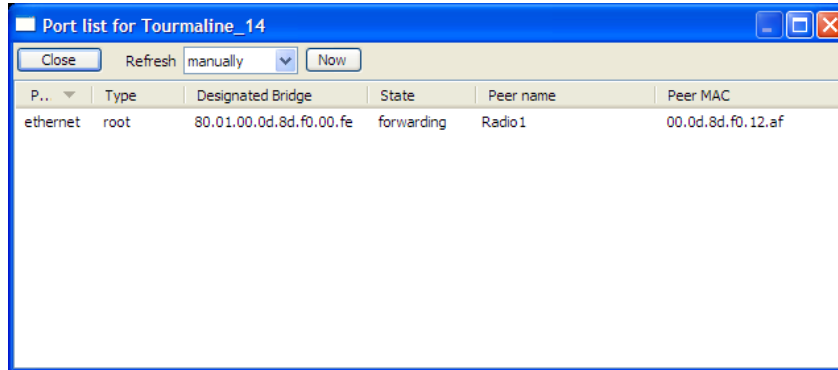
By using the table in the radio, you can mount an RLXIB-IESC Radio with its actual antenna and use it to report information on every active 802.11 radio in the area. It will report

- Each 802.11 AP heard including SSID
- Actual RSSI from each given in dBm
- Channel of each radio

Use this information to help choose a channel that is least utilized, or to select appropriate antenna types and alignments to minimize interference.

5.4.4 Port Table

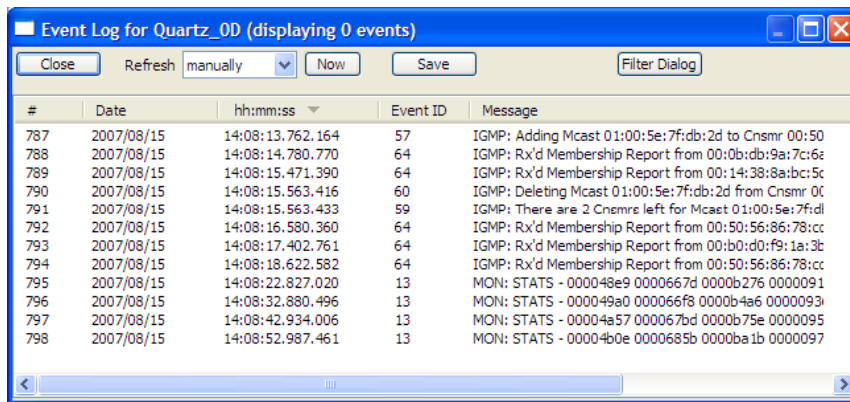
This dialog box opens when you open the AP Dialogs menu and choose Port Table.



The port table is a list of all the active ports on the radio. This list shows the same information as the Port status (page 42) list in the Radio Configuration / Diagnostic Utility. Each radio can have up to 34 active ports—one Ethernet cable, one parent RF link, and up to 32 child RF links.

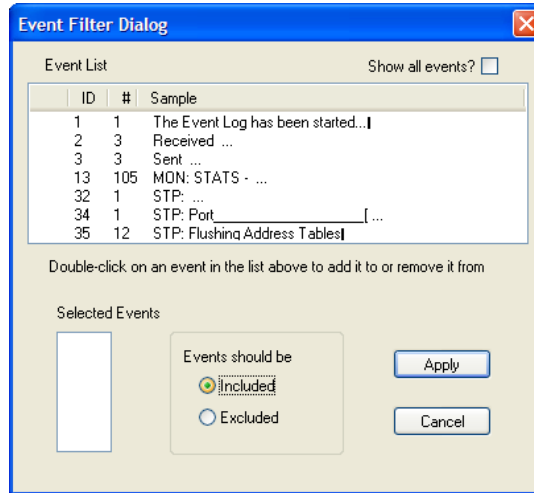
5.4.5 Event Log

The event log allows you to extract a log from the selected radio. The log shows a history of the radio. You can save the event log to a file for troubleshooting purposes.



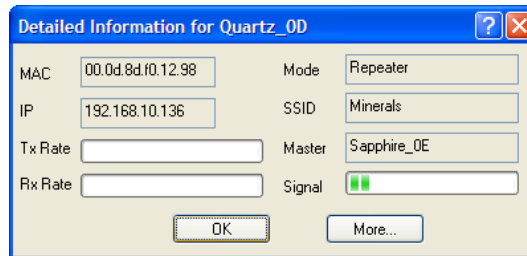
Event Filter

The Event Filter dialog box allows you to include or exclude specific event types from the event log.



5.4.6 Properties

This dialog box opens when you select a radio, and then open the AP Dialogs menu and choose Properties.



To see additional properties, click the More button.

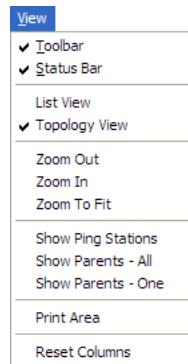


Field	Description
Radio Name	The name of the selected radio.
MAC	The physical media access control address for the network interface.
IP, Mask, and Gateway	The radio's IP address, subnet mask, and default gateway. For information, see Radio Access settings (page 54).
IP State	Indicates whether a radio's IP address has been set—"Uninitialized" or "OK".
SSID	A name that identifies a wireless network. You assign this name when you configure the radio. The SSID must be the same for all radios on the same network.
Mode	Indicates whether you designated the radio as a master, repeater, or client.
Connection	The status of the wireless connection.
Signal	The signal strength, which in this field is a number from 0 to 15.
Hops	The number of wireless connections a radio is from the closest master radio.
Master	The MAC address of the selected radio's master radio.
Associations	The number of network elements to which a radio has a wireless connection.
Bridges	The number of repeaters to which a radio has a wireless connection.
Tx and Rx	The transmission throughput rate and the received throughput rate. Both rates are measured in kilobytes per second (KB/s).
Software Version and Boot Version	The versions of the radio's firmware and its boot code.
Image	The image type can be Primary or Secondary.
Compression	Indicates whether the radio's firmware images are compressed or not.
Ethernet	The Ethernet connection status, either Attached or Detached.

Field	Description
Channel	The channel that the radio is using, if connected. The channel list indicates the channel number as well as the frequency (2.4 GHz or 5 GHz). Important: The RadioLinx RLXIB radio is not supplied with an antenna. When choosing an antenna for use with the RLXIB radio, you must choose one that supports the frequency range set in the configuration for the radio.
Security	Indicates the encryption setting on the radio. See Security settings for information.

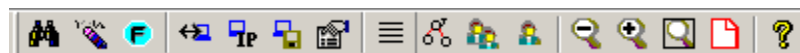
5.5 View Menu

The View menu contains the following commands:



- Tool Bar (page 73)
- Status Bar (page 74)
- List View (page 74)
- Topology View (page 74)
- Zoom In (page 76)
- Zoom Out (page 77)
- Zoom to Fit (page 77)
- Show Ping Stations (page 78)
- Show Parents (page 78)
- Print Area (page 79)
- Reset Columns (page 79)

5.5.1 Tool Bar



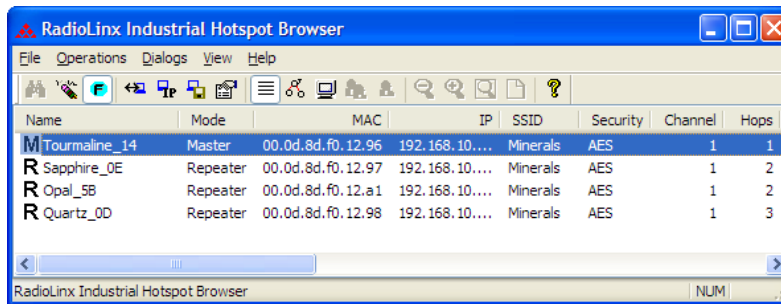
The Tool Bar near the top of the IH Browser window contains buttons to access frequently used commands. Hold the mouse button over each button to view a brief "Tool Tip" explaining the button's use.

5.5.2 Status Bar



The Status Bar at the bottom of the RLX IH Browser displays additional information about the currently selected menu command or tool bar button. On the right side of the Status Bar, you can see the status of the Caps Lock and Num Lock keys on your computer keyboard. Use the corner of the status bar to drag and resize the RLX-IH Browser window.

5.5.3 List View



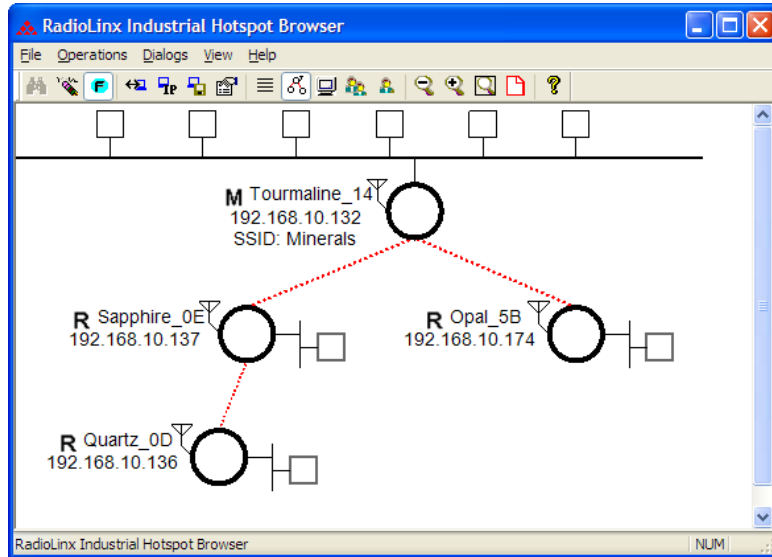
List View shows a list of all the connected radios in a grid, arranged similarly to data in a spreadsheet. Resize the window or scroll across to see all of the available columns. Click between column headers and drag to the left or right to resize columns. Click on column headers and drag to the left or right to re-order columns.

Tip: Use the Reset Columns command to restore the column size and order to their default values.

5.5.4 Topology View

To see how radios are connected together in the network, select Topology View from the View menu. The Topology view shows a diagram of the network's wireless connections. If a radio does not appear in the view, it is not connected to the network. To change the way a radio is linked to the network, connect to it and make changes through its Web page. For information on these settings, see Parent Link settings (page 45).

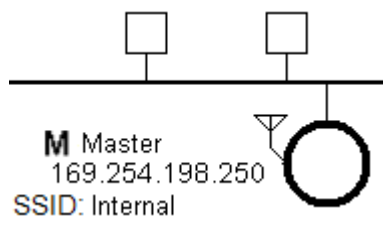
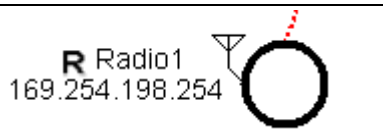


In the topology view, you can double-click a radio to log in to the Radio Configuration / Diagnostic Utility and change the radio's settings. To view a radio's properties, right-click on a radio representation in the topology view and then select Properties from the resulting menu.

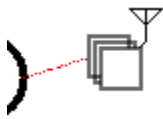


Refer to Topology View key (page 75) for an explanation of the symbols that appear in this view.

Topology View key

For information on other options that appear when you right-click a radio representation, see RLX-IH Browser options (page 58).

 <p>M Master 169.254.198.250 SSID: Internal</p>	<p>Master; always shown at the top</p>
 <p>R Radio1 169.254.198.254</p>	<p>Radio linked to the network</p>
 <p>R Radio1 169.254.198.254</p>	<p>Radio not linked; no parent</p>
	<p>An Ethernet connection exists to the radio; does not indicate the number of devices on the connection</p>



Wireless clients (PCMCIA cards) are linked to this radio; the number of clients linked is indicated by the number of boxes

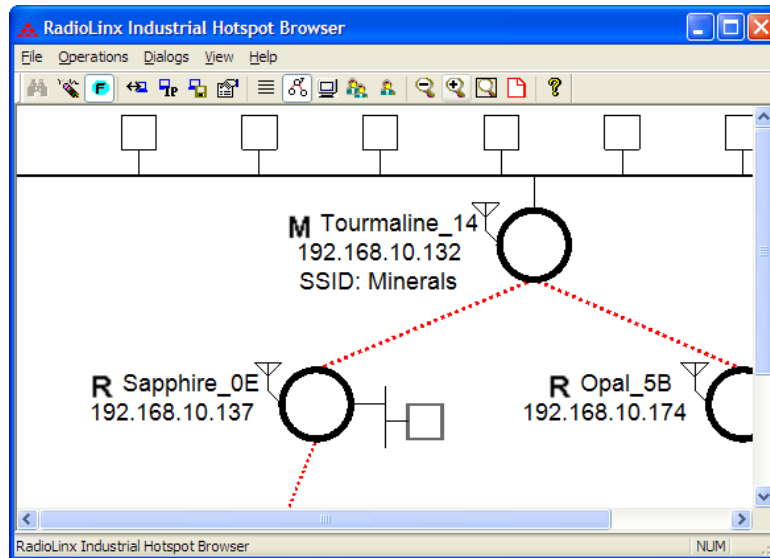


Signal strength; the width of the line is not calibrated



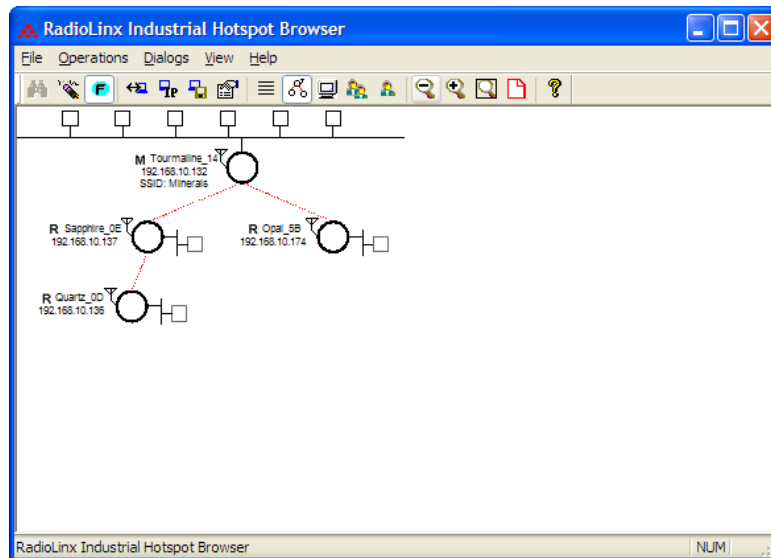
Alternate parents.

5.5.5 Zoom In



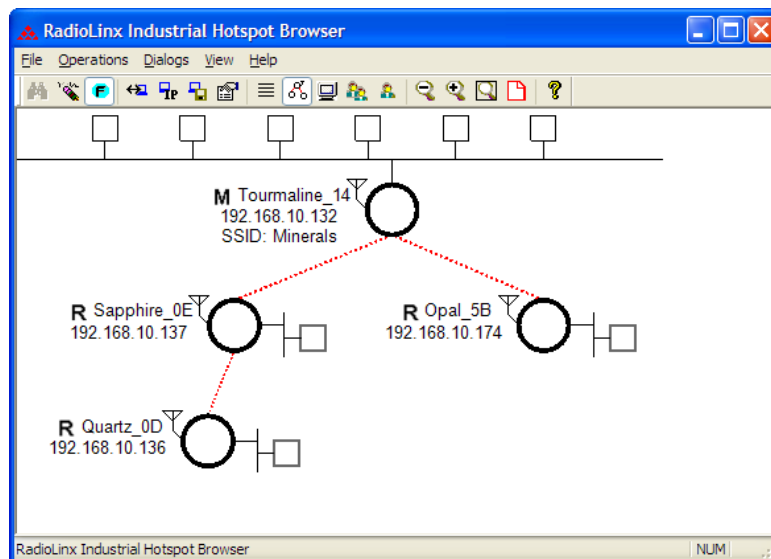
Use the **ZOOM IN** command in Topology View to enlarge the size of the items in the RadioLinx IH Browser window.

5.5.6 Zoom Out



Use the **ZOOM OUT** command in Topology View to to reduce the size of the items in the RadioLinx IH-Browser window.

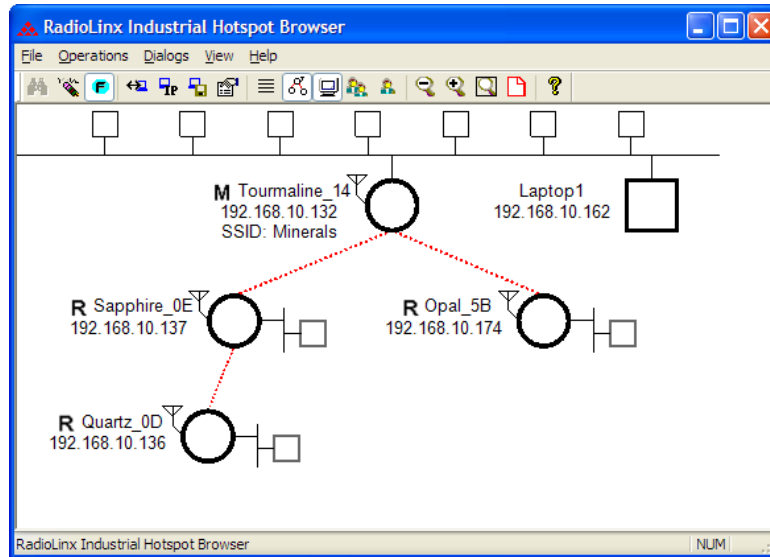
5.5.7 Zoom to Fit



Use the **ZOOM TO FIT** command in Topology View to change the size of the items so that the entire network fits within the RadioLinx IH-Browser window.

5.5.8 Show Ping Stations

Ping Stations are other computers running an instance of RadioLinx IH Browser. To test latency between points on the network, select a ping station, open the Operations menu, and then choose Start Ping Session.

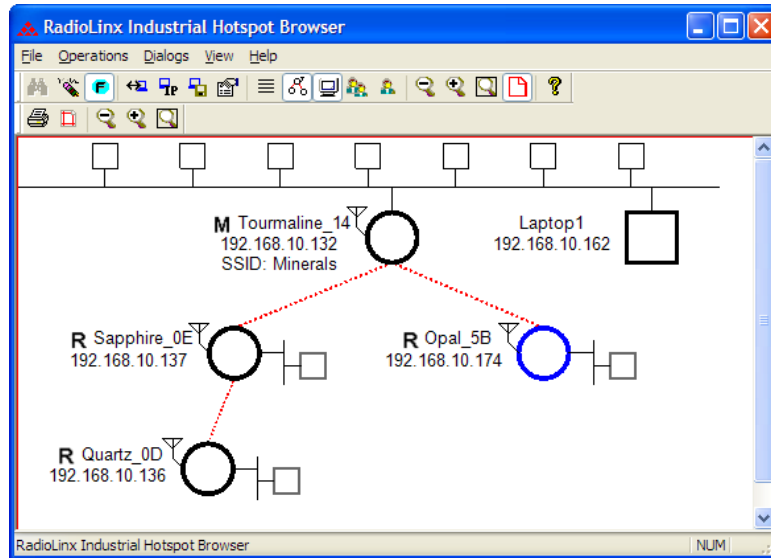


5.5.9 Show Parents

The show parents function allows you to display the possible alternate parents for a repeater graphically in the topology view. The link from the repeater to its current parent will be shown in red. If the repeater can hear other radios in the network, links to those radios will be shown in blue. This gives a graphical representation of the number of alternate paths available to a radio should its parent link go down. A detailed list of each of the alternates can be seen by right-clicking and selecting 'Scan List'. This list, though, shows not only radios in the same network but also 802.11 radios on other networks.

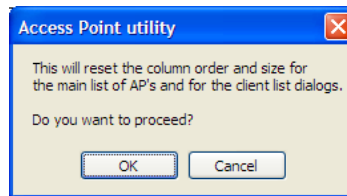
By selecting All, alternate paths for all repeaters in the network will be shown. By selecting One, alternate paths will be shown only for the one repeater that is currently selected.

5.5.10 Print Area



Use the Print Area command to show the border around the area of the IH Browser window that you can print using the Print command on the File menu.

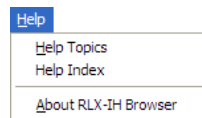
5.5.11 Reset Columns



Use the Reset Columns command to restore the column size and order to their default values. You will be prompted to confirm this action.

5.6 Help Menu

The Help menu contains the following commands:



- Help Topics (page 80)
-
- About RLX-IH Browser (page 80)

5.6.1 Help Topics

Most of the information needed to help you use the RadioLinx IH Browser is provided in an online help system that is always available whenever you are running the application.

To view the online help, start the RadioLinx IH Browser, open the Help menu, and then choose Help Topics.

The RadioLinx IH Browser Help System

The RadioLinx IH Browser has an online help system that works like a web browser. Each dialog box has its own page in the help system, which explains each item on the dialog box.

To view the online help, open the Help menu and choose Help Topics.

Many help pages have **links** that lead you to more information if you need it. Links are always **underlined**. Use your mouse to click the underlined text to "follow a link" and open a help page with more information.

You can use the Search tab to search for words or phrases inside a help file. The help system shows you a list of help topics that contain the words you typed in the Search field. Click a topic from the list to view the help page.

You can also use the Index button to see an index of keywords. You can type the first few letters of a keyword to jump directly to the part of the index you would like to view. Each keyword is linked to one or more help topics. Click a keyword to see a list of topics, and then click a topic from the list to view the help page.

5.6.2 About RLX-IH Browser



Use this command to view version information about the RadioLinx IH Browser. You may be asked to provide this information if you contact ProSoft Technical Services.

6 Reference

In This Chapter

- ❖ Product Overview 81
- ❖ Radio hardware 82

6.1 Product Overview

The RLXIB-IESC is an industrial high-speed Ethernet radio with Serial Client. You can use it in place of Ethernet cables to save money, extend range, and make connections that may not otherwise be feasible. The radio operates as a wireless Serial client, so any data that you can send over a wired network can also be sent over the radio.

The RLXIB-IESC is certified for unlicensed operation in the United States, Canada and Europe at 2.4 and 5 GHz. With an output power of a 50mW (typical) approved high-gain antennas, the radios can achieve distances of 5 miles line-of-sight between them. You can use multiple repeaters to extend this range to far greater distances.

The RLXIB-IESC operates in a special client mode that allows connection of any Ethernet device to any existing 802.11 a, b or g access point, regardless of the brand (An example of an 802.11 client is a laptop with a WLAN card)

Note: WiFi is a brand name originally issued by the WiFi Alliance, used to describe the underlying technology of wireless_local area networks (WLAN) based on the IEEE 802.11 specifications.

A high level of security is inherent with AES (Advanced Encryption Standard) encryption. You also can choose TKIP (Temporal Key Integrity Protocol), and if necessary add WEP128 or WEP64 (Wired Equivalent Protocol) encryption in addition to AES or TKIP for clients that do not support AES. A simple Media Access Control (MAC) filter table restricts the radios or clients that can link to a selected radio according to the MAC IDs you enter in the table.

The radio is designed for industrial applications with a metal enclosure, DIN-rail mounting, ISA 12.12.01 Class I Div II safety rating, and shock and vibration tested to IEC 60068.

The RLXIB-IESC is easy to use. Use the Radio Configuration / Diagnostic Utility, which runs in your web browser, to configure the radio; optionally, you can use an SNMP manager for configuration. The radio comes with a utility that runs in Microsoft Windows, called RLX-IH Browser, that finds all the radios on the network and lists information about them. A topology view in the RLX-IH Browser shows how the wireless network is linked together at any point in time. You can update firmware at any time from anywhere on the network, even over the wireless link or over the Internet.

ProSoft Technology radios can easily be installed into new or existing systems. The software and manuals can be downloaded from the CD or ProSoft Technology's web site at www.prosoft-technology.com.

6.2 Radio hardware

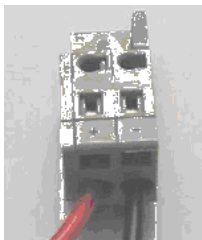
The RLXIB-IESC radio consists of the following components:

- 1 Two antenna ports (AUX and MAIN) (page 26)
- 2 LEDs (page 30) that indicate the status of the radio
- 3 Ethernet and serial cable ports (page 83, page 83)
- 4 Power connection (page 82)

6.2.1 Radio power requirements

The RLXIB-IESC radio accepts voltages between 10 and 24 VDC, with an average power draw of less than 6 watts. A detachable power connector comes with the radio, as shown. The connector terminals are labeled + (positive DC connection) and - (DC ground connection). You can use the provided AC-to-DC power supply adapter that is pre-wired with a power connector, or you can use power from another source, for example the power supply for the PLC or the networked devices.

The DC power wires must be less than 3 m to meet regulatory requirements.



Label	Connect to...
+	10 to 24 VDC
—	DC Ground

The RLXIB-IESC radio accepts 802.3af PoE, with an average power draw of less than 6 watts. You can also order an optional DC PoE Injector if AC is not available. The DC power wires must be less than 3 m to meet regulatory requirements.

The radio shall be installed by trained personnel only, as outlined to the installation instructions provided with each radio.

The equipment shall be installed by a qualified installer/electrician. The installer/electrician is responsible for obtaining a secured ground connection between the lug terminal on the surge protector to a verified common ground point using a minimum 6 AWG gauge wire. This must be done when attaching power lines to the radio during installation.

A solid ground connection should be verified using a meter prior to applying power to the radio. Failing to secure a proper ground could result in serious injury or death as a result of a lightning strike.

Using Power over Ethernet (PoE) to power remote devices has several advantages including:

- "Carrier Class" Power Over Ethernet System.
- Power can be supplied over long distances, up to 300 feet.
- Power can be available wherever network access is available.
- The power supply can be centrally located where it can be attached to an uninterruptible power supply.
- The user has the ability to easily power on reset the attached equipment from a remote location.
- There is no need to run additional power cabling to the device as power can be supplied over the CAT5 Ethernet cable.
- Used for remote mounted radios to save on cost of coax and reduce RF losses.
- Built-in Ethernet Surge protection to prevent equipment damage.
- Overload and Short Circuit protection.

6.2.2 Ethernet Cable Specifications

The recommended cable is Category 5 or better. A Category 5 cable has four twisted pairs of wires, which are color-coded and cannot be swapped. The module uses only two of the four pairs.

The Ethernet ports on the module are Auto-Sensing. You can use either a standard Ethernet straight-through cable or a crossover cable when connecting the module to an Ethernet hub, a 10/100 Base-T Ethernet switch, or directly to a PC. The module will detect the cable type and use the appropriate pins to send and receive Ethernet signals.

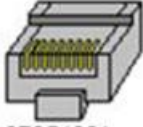
Ethernet cabling is like U.S. telephone cables, except that it has eight conductors. Some hubs have one input that can accept either a straight-through or crossover cable, depending on a switch position. In this case, you must ensure that the switch position and cable type agree.

Refer to Ethernet cable configuration (page 83) for a diagram of how to configure Ethernet cable.


6.2.3 Ethernet Cable Configuration

Note: The standard connector view shown is color-coded for a straight-through cable.

Crossover cable		Straight-through cable	
RJ-45 PIN	RJ-45 PIN	RJ-45 PIN	RJ-45 PIN
1 Rx+	3 Tx+	1 Rx+	1 Tx+
2 Rx-	6 Tx-	2 Rx-	2 Tx-
3 Tx+	1 Rx+	3 Tx+	3 Rx+
6 Tx-	2 Rx-	6 Tx-	6 Rx-



87654321



12345678

7 Module Configuration

The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

Because this is a text-based menu system, you enter commands by typing the command letter from your computer keyboard in the diagnostic window in ProSoft Configuration Builder (PCB). The module does not respond to mouse movements or clicks. The command executes as soon as you press the **[COMMAND LETTER]** — you do not need to press **[ENTER]**. When you type a command letter, a new screen is displayed in the PCB window.

7.1 Antennas

When you are ready to connect antennas to the radio, see [Connecting antennas](#) (page 26).

You must also consider three important electrical characteristics when selecting antennas:

- Antenna pattern (page 85)
- Antenna gain (page 86)
- Antenna polarity (page 86)
- Antenna location, spacing, and mounting (page 91)

7.1.1 Antenna Pattern

Information between two wireless devices is transferred via electromagnetic energy radiated by one antenna and received by another. The radiated power of most antennas is not uniform in all directions and has varying intensities. The radiated power in various directions is called the pattern of the antenna. Each antenna should be mounted so that its direction of strongest radiation intensity points toward the other antenna or antennas with which it will exchange signals.

Complete antenna patterns are three-dimensional, although often only a two-dimensional slice of the pattern is shown when all the antennas of interest are located in roughly the same horizontal plane, along the ground rather than above or below one another.

A slice taken in a horizontal plane through the center (or looking down on the pattern) is called the azimuth pattern. A view from the side reveals a vertical plane slice called the elevation pattern.

An antenna pattern with equal or nearly equal intensity in all directions is omnidirectional. In two dimensions, an omnidirectional pattern appears as a circle (in three dimensions, an omnidirectional antenna pattern would be a sphere, but no antenna has true omnidirectional pattern in three dimensions). An antenna is considered omnidirectional if one of its two dimensional patterns, either azimuth or elevation pattern, is omnidirectional.

Beamwidth is an angular measurement of how strongly the power is concentrated in a particular direction. Beamwidth is a three dimensional quantity but can be broken into two-dimensional slices just like the antenna pattern. The beamwidth of an omnidirectional pattern is 360 degrees because the power is equal in all directions.

7.1.2 Antenna Gain

Antenna gain is a measure of how strongly an antenna radiates in its direction of maximum radiation intensity compared to how strong the radiation would be if the same power were applied to an antenna that radiated all of its power equally in all directions. Using the antenna pattern, the gain is the distance to the furthest point on the pattern from the origin. For an omnidirectional pattern, the gain is 1, or equivalently 0 dB. The higher the antenna gain is, the narrower the beamwidth, and vice versa.

The amount of power received by the receiving antenna is proportional to the transmitter power multiplied by the transmit antenna gain, multiplied by the receiving antenna gain. Therefore, the antenna gains and transmitting power can be traded off. For example, doubling one antenna gain has the same effect as doubling the transmitting power. Doubling both antenna gains has the same effect as quadrupling the transmitting power.

7.1.3 Antenna Polarity

Antenna polarization refers to the direction in which the electromagnetic field lines point as energy radiates away from the antenna. In general, the polarization is elliptical. The simplest and most common form of this elliptical polarization is a straight line, or linear polarization. Of the transmitted power that reaches the receiving antenna, only the portion that has the same polarization as the receiving antenna polarization is actually received. For example, if the transmitting antenna polarization is pointed in the vertical direction (vertical polarization, for short), and the receiving antenna also has vertical polarization, the maximum amount of power possible will be received. On the other hand, if the transmit antenna has vertical polarization and the receiving antenna has horizontal polarization, no power should be received. If the two antennas have linear polarizations oriented at 45° to each other, half of the possible maximum power will be received.

7.1.4 Whip antennas

You can use a 1/2 wave straight whip or 1/2 wave articulating whip (2 dBi) antenna with RLXIB-IESC radios. These antennas are the most common type in use today. Such antennas are approximately 5 inches long, and are likely to be connected to a client radio (connected directly to the radio enclosure). These antennas do not require a ground plane. Articulating antennas and non-articulating antennas work in the same way. An articulating antenna bends at the connection.



7.1.5 Collinear array antennas



A collinear array antenna is typically composed of several linear antennas stacked on top of each other. The more stacked elements it has, the longer it is, and the more gain it has. It is fed in on one end.

The antenna pattern is torroidal. Its azimuthal beamwidth is 360° (omnidirectional). Its vertical beamwidth depends on the number of elements/length, where more elements equal narrower beamwidth. The antenna gain also depends on the number of elements/length, where more elements produce higher gain. Typical gain is 5 to 10 dBi.

The antenna polarity is linear, or parallel to the length of the antenna.

7.1.6 Yagi Array Antenna

A yagi antenna is composed of an array of linear elements, each parallel to one another and attached perpendicular to and along the length of a metal boom. The feed is attached to only one of the elements. Elements on one side of the fed element are longer and act as reflectors; elements on the other side are shorter and act as directors. This causes the antenna to radiate in a beam out of the end with the shorter elements. The pattern depends on the overall geometry, including the number of elements, element spacing, element length, and so on. Sometimes the antenna is enclosed in a protective tube hiding the actual antenna geometry.

The antenna pattern (page 85) is a beam pointed along the boom toward the end with the shorter elements. The beamwidth varies with antenna geometry but generally is proportional to the length (where longer length produces a narrower beam).

The antenna gain (page 86) varies with antenna geometry but generally is proportional to the length (where longer length produces higher gain). Typical values are 6 to 15dBi.

The antenna polarity is Linear (parallel to the elements, perpendicular to the boom).



Refer to the Antenna Types overview section for other types of approved antennas (page 89).

7.1.7 Parabolic reflector antennas

A parabolic reflector antenna consists of a parabolic shaped dish and a feed antenna located in front of the dish. Power is radiated from the feed antenna toward the reflector. Due to the parabolic shape, the reflector concentrates the radiation into a narrow pattern, resulting in a high- gain beam.

The antenna pattern is a beam pointed away from the concave side of the dish. Beamwidth and antenna gain vary with the size of the reflector and the antenna construction. Typical gain values are 15 to 30 dBi.

The antenna polarity depends on the feed antenna polarization.



7.1.8 *RLXIB-IESC Approved antennas*

In the U.S. and Canada, you can only use antennas that are specifically approved by the U.S. Federal Communications Commission (FCC) and Industry Canada for use with the RLXIB-IESC radio. Contact ProSoft Technology or visit www.prosoft-technology.com for a current list of approved antennas.

- Whip
- Collinear array
- Yagi array (page 88)
- Parabolic reflector (page 88)

Antenna selection depends on whether the bi-directional amplifier is being used or not. For each approved antenna, there is a specified minimum distance the antennas must be separated from users for safe exposure limits, according to FCC part 2.1091.

Approved antennas in Europe and other countries accepting CE (page 90)

Approved antennas in Mexico (page 90)

Approved antenna table

You can use the following approved antennas when the radio module is connected directly to an antenna. Refer to Approved antennas with power amp (page 90) for a table of approved antennas with bi-directional power amplifiers.

Type	Pattern	Gain	Connector	Size (cm)	Min. distance from Body
1/2 Wave	Omni	2 dB	SMA-RP	7H x 1.5	20 cm
1/2 Wave art.	Omni	2 dB	SMA-RP	10H x 1.0	20 cm
Collinear Array	Omni	3 dB	SMA-RP	6H x 3.0	20 cm

Type	Pattern	Gain	Connector	Size (cm)	Min. distance from Body
Collinear Array, art.	Omni	5 dB	SMA-RP	19H x 1.0	20 cm
Collinear Array	Omni	5 dB	SMA-RP	19H x 1.0	20 cm
Collinear Array	Omni	8 dB	N-RP	43H x 1.6	20 cm
Collinear Array	Omni	9 dB	N-RP	43H x 1.6	20 cm
Collinear Array	Omni	12 dB	N-RP	106H x 4.0	25 cm
Patch	Directional	8 dB	SMA-RP	15.0H x 15.0	20 cm
Patch	Directional	11 dB	SMA-RP	22H x 12.7	22 cm
Patch	Directional	13 dB	N-RP	22H x 22	28 cm
Patch*	Directional	19 dB	N-RP	15.5 x 15.5	57 cm
Yagi	Directional	14 dB	N-RP	81L x 9.0	28 cm
Parabolic*	Directional	15 dB	N-RP	40H x 51W x 25D	36 cm
Parabolic*	Directional	19 dB	N-RP	58H x 66W x 26D	57 cm
Parabolic*	Directional	24 dB	N-RP	78H x 96W x 29D	100 cm

* Only allowed in a point-to-point network.

Approved antennas in Europe/CE

The gain of the antenna connected to the main antenna port, minus the antenna cable loss, must be less than 4 dB to stay below the 100-mW EIRP transmit power limit.

The AUX port is only used to receive; it never transmits.

Note: In France, the user is responsible for ensuring that the selected frequency channels comply with French regulatory standards. At the time of this printing, only channels 10 through 13 can be used in France.

Approved antennas in Mexico

The gain of the antenna connected to the main antenna port, minus the antenna cable loss, must be less than 12 dB to stay below the 650-mW EIRP transmit power limit.

Note: In Mexico, the user is responsible for ensuring that the selected frequency channels comply with Mexican regulatory standards. At the time of this printing, only channels 9 through 11 can be used outdoors (1 through 8 cannot); however, channels 1 through 11 can all be used indoors.

Approved antennas with power amp

When the radio is used in conjunction with the amplifier, the antennas are limited to antennas listed in the following table.

Type	Pattern	Gain	Connector	Size (cm)	Min. distance from Body
1/2 Wave	Omni	2 dB	SMA-RP	7H x 1.5	20 cm
1/2 Wave art.	Omni	2 dB	SMA-RP	10H x 1.0	20 cm

Type	Pattern	Gain	Connector	Size (cm)	Min. distance from Body
Collinear Array	Omni	3 dB	SMA-RP	6H x 3.0	20 cm
Collinear Array, art.	Omni	5 dB	SMA-RP	19H x 1.0	20 cm
Collinear Array	Omni	5 dB	SMA-RP	19H x 1.0	20 cm
Collinear Array	Omni	8 dB	N-RP	43H x 1.6	20 cm
Collinear Array	Omni	9 dB	N-RP	43H x 1.6	20 cm
Collinear Array*	Omni	12 dB	N-RP	106H x 4.0	25 cm
Patch	Directional	8 dB	SMA-RP	15.0H x 15.0	20 cm
Patch*	Directional	11 dB	SMA-RP	22H x 12.7	20 cm
Patch*	Directional	13 dB	N-RP	22H x 22	28 cm
Yagi*	Directional	14 dB	N-RP	81L x 9.0	28 cm

* Only allowed in a point-to-point network.

7.1.9 Antenna location, spacing, and mounting

Consider the following points regarding antenna location, spacing, and mounting:

- When placing antennas, ensure a clear line of sight between the master radio's antenna and all of the other radio antennas.
- If the site base contains obstructing terrain or structures, mount the antenna on a tower or rooftop to provide a line-of-sight path. The line-of-sight consideration becomes more important as the transmission path becomes longer.
- Mount the antennas as high off the ground as is practical. The higher an antenna is above the ground, the greater its range.
- Mount the antennas away from massive structures. Radio signals bounce off metal walls, for example, which can compromise a clear signal.
- Mount antennas to minimize the amount of nearby metal structures in the antenna pattern.
- Mount the antennas and install radios away from sources of RF interference.
- Use the shortest possible antenna cable length. Signals lose power over the cable's distance.
- Choose antennas that are appropriate for the network's intended function.
- If antennas are on radios on the same network, mount them so they have the same polarity. If the antennas are on separate networks, mount them so they have a different antenna polarity—for example, mount one antenna vertically and the other horizontally.
- Space radios at least three feet (one meter) apart so they do not overload each other. If antennas must be near each other:
 - Mount omnidirectional antennas directly above each other.
 - Position directional antennas so they do not point at nearby antennas. Place antennas side by side if they point in the same direction. Place antennas back to back if they point in opposite directions.

8 Support, Service & Warranty

In This Chapter

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❖ Return Material Authorization (RMA) Policies and Conditions.....	94
❖ LIMITED WARRANTY.....	96

Contacting Technical Support

ProSoft Technology, Inc. (ProSoft) is committed to providing the most efficient and effective support possible. Before calling, please gather the following information to assist in expediting this process:

- 1 Product Version Number
- 2 System architecture
- 3 Network details

If the issue is hardware related, we will also need information regarding:

- 1 Module configuration and associated ladder files, if any
- 2 Module operation and any unusual behavior
- 3 Configuration/Debug status information
- 4 LED patterns
- 5 Details about the serial, Ethernet or fieldbus devices interfaced to the module, if any.

Note: For technical support calls within the United States, an emergency after-hours answering system allows 24-hour/7-days-a-week pager access to one of our qualified Technical and/or Application Support Engineers. Detailed contact information for all our worldwide locations is available on the following page.

Internet	Web Site: www.prosoft-technology.com/support E-mail address: support@prosoft-technology.com
Asia Pacific (location in Malaysia)	Tel: +603.7724.2080, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Asia Pacific (location in China)	Tel: +86.21.5187.7337 x888, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Europe (location in Toulouse, France)	Tel: +33 (0) 5.34.36.87.20, E-mail: support.EMEA@prosoft-technology.com Languages spoken include: French, English
Europe (location in Dubai, UAE)	Tel: +971-4-214-6911, E-mail: mea@prosoft-technology.com Languages spoken include: English, Hindi
North America (location in California)	Tel: +1.661.716.5100, E-mail: support@prosoft-technology.com Languages spoken include: English, Spanish
Latin America (Oficina Regional)	Tel: +1-281-2989109, E-Mail: latinam@prosoft-technology.com Languages spoken include: Spanish, English
Latin America (location in Puebla, Mexico)	Tel: +52-222-3-99-6565, E-mail: soporte@prosoft-technology.com Languages spoken include: Spanish
Brasil (location in Sao Paulo)	Tel: +55-11-5083-3776, E-mail: brasil@prosoft-technology.com Languages spoken include: Portuguese, English

8.1 Return Material Authorization (RMA) Policies and Conditions

The following Return Material Authorization (RMA) Policies and Conditions (collectively, "RMA Policies") apply to any returned product. These RMA Policies are subject to change by ProSoft Technology, Inc., without notice. For warranty information, see Limited Warranty (page 96). In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

8.1.1 Returning Any Product

In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Return Material Authorization (RMA) number from ProSoft and comply with ProSoft shipping instructions.

In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above in Section A. A Technical Support Engineer will request that you perform several tests in an attempt to isolate the problem. If after completing these tests, the Product is found to be the source of the problem, we will issue an RMA.

All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft, and be accompanied by proof of purchase and receipt date. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft using a shipment method other than that specified by ProSoft, or shipped without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.

A 10% restocking fee applies to all warranty credit returns whereby a Customer has an application change, ordered too many, does not need, etc. Returns for credit require that all accessory parts included in the original box (i.e.; antennas, cables) be returned. Failure to return these items will result in a deduction from the total credit due for each missing item.

8.1.2 Returning Units Under Warranty

A Technical Support Engineer must approve the return of Product under ProSoft's Warranty:

- a. In-Warranty returns will be repaired and returned to the customer within 8 weeks of receipt of product at ProSoft's designated repair location. If upon evaluating the product it is deemed to be non-repairable due to manufacturing defect, a replacement will be sent. Should this be the case, a purchase order will be required prior to shipment. If returning the product to ProSoft for repair has an adverse affect on customer's production, ProSoft encourages the customer purchase a remanufactured unit, if available at discounted pricing to use as a spare now and in the future.
- b. Credit for a product under warranty will be issued upon ProSoft completing test and evaluation of product at designated location referenced on the Return Material Authorization. If a defect is found and is determined to be customer generated, or if the defect is otherwise not covered by ProSoft's Warranty, there will be no credit given. Customer will be contacted and can request module be returned at their expense.
 - i.

8.1.3 Returning Units Out of Warranty

Customer sends unit in for evaluation to location specified by ProSoft, freight prepaid.

If no defect is found, Customer will be charged the equivalent of \$100 USD, plus freight charges, duties and taxes as applicable. A new purchase order will be required.

If unit is repaired, charge to Customer will be 30% of current list price (USD) plus freight charges, duties and taxes as applicable. A new purchase order will be required or authorization to use the purchase order submitted for evaluation fee.

ProSoft will attempt to repair Products that have transitioned to End of Life and will be based on availability of components needed to repair the unit(s).

The following is a list of non-repairable units:

1500 – All
1550 – Can be repaired, only if defect is the power supply
1560 - Can be repaired, only if defect is the power supply
2100-AGA – Can be evaluated, but no guarantee for repair
3150 – All
3170 - All
3250 – All
3300 – All
3350 – All
3600 – All
3700 – All
3750 – All
3800 – All
3850-DNP
4XXX Series – All

8.2 LIMITED WARRANTY

This Limited Warranty ("Warranty") governs all sales of hardware, software, and other products (collectively, "Product") manufactured and/or offered for sale by ProSoft Technology, Incorporated (ProSoft), and all related services provided by ProSoft, including maintenance, repair, warranty exchange, and service programs (collectively, "Services"). By purchasing or using the Product or Services, the individual or entity purchasing or using the Product or Services ("Customer") agrees to all of the terms and provisions (collectively, the "Terms") of this Limited Warranty. All sales of software or other intellectual property are, in addition, subject to any license agreement accompanying such software or other intellectual property.

8.2.1 What Is Covered By This Warranty

- a) *Warranty On New Products:* ProSoft warrants, to the original purchaser, that the Product that is the subject of the sale will (1) conform to and perform in accordance with published specifications prepared, approved and issued by ProSoft, and (2) will be free from defects in material or workmanship; provided these warranties only cover Product that is sold as new. This Warranty expires three (3) years from the date of shipment for Product purchased **on or after** January 1st, 2008, or one (1) year from the date of shipment for Product purchased **before** January 1st, 2008 (the "Warranty Period"). If the Customer discovers within the Warranty Period a failure of the Product to conform to specifications, or a defect in material or workmanship of the Product, the Customer must promptly notify ProSoft by fax, email or telephone. In no event may that notification be received by ProSoft later than 39 months from date of original shipment. Within a reasonable time after notification, ProSoft will correct any failure of the Product to conform to specifications or any defect in material or workmanship of the Product, with either new or remanufactured replacement parts. ProSoft reserves the right, and at its sole discretion, may replace unrepairable units with new or remanufactured equipment. All replacement units will be covered under warranty for the 3 year period commencing from the date of original equipment purchase, not the date of shipment of the replacement unit. Such repair, including both parts and labor, will be performed at ProSoft's expense. All warranty service will be performed at service centers designated by ProSoft.
- b) *Warranty On Services:* Materials and labor performed by ProSoft to upgrade previously purchased firmware, repair a verified malfunction, or defect are warranted in the terms specified above for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of ninety (90) days from the date of invoice.
- c) *Software and Firmware:* Unless otherwise provided in a ProSoft or third party license, ProSoft warrants that standard ProSoft branded software or firmware Products furnished hereunder, when used with ProSoft-specified hardware, will perform in accordance with published specifications prepared, approved, and issued by ProSoft for a period of three (3) years from the date of invoice from ProSoft or its appointed distributor, as the case may be. ProSoft makes no representation or warranty, express or implied, that the operation of the software or firmware Products will be uninterrupted or error free, or that the functions contained therein will meet or satisfy Buyer's intended use or requirements.

- d) *"Refurbished" Products*: ProSoft warrants that hardware Products sold as "Refurbished" (e.g., customer and distributor returns, factory repaired or reconditioned, etc.) will be free from defects in material and workmanship for a period of six (6) months from the date of invoice from ProSoft or its appointed distributor, as the case may be. Repaired or replacement Products provided as a result of this warranty subparagraph are similarly warranted for a period of three (3) months from the date of shipment to Buyer or the remainder of the original warranty term for that particular Product, whichever is longer.
- e) *Buyer Specifications/Compatibility*: ProSoft does not warrant and will not be liable for any design, materials, construction criteria or goods furnished or specified by Buyer (including that sourced from other manufacturers or vendors). Any warranty applicable to such Buyer-specified items will be limited solely to the warranty, if any, extended by the original manufacturer or vendor directly or indirectly to Buyer. ProSoft does not warrant the compatibility of its Products with the goods of other manufacturers or Buyer's application except to the extent expressly represented in ProSoft's published specifications or written quotation.
- f) *Recycleable Materials*: In keeping with environmental policies and practices, ProSoft reserves the right to utilize in its product manufacturing, repair and remanufacturing processes certain recyclable materials (e.g., fasteners, plastics and the like) or remanufactured parts equivalent to new in performance or parts which may have been subject to incidental use. However, such utilization will not affect any provided Product warranty or published reliability statistics.

8.2.2 What Is Not Covered By This Warranty

- a) ProSoft makes no representation or warranty, expressed or implied, that the operation of software purchased from ProSoft will be uninterrupted or error free or that the functions contained in the software will meet or satisfy the purchaser's intended use or requirements; the Customer assumes complete responsibility for decisions made or actions taken based on information obtained using ProSoft software.
- b) This Warranty does not cover the failure of the Product to perform specified functions, or any other non-conformance, defects, losses or damages caused by or attributable to any of the following: (i) shipping; (ii) improper installation or other failure of Customer to adhere to ProSoft's specifications or instructions; (iii) unauthorized repair or maintenance; (iv) attachments, equipment, options, parts, software, or user-created programming (including, but not limited to, programs developed with any IEC 61131-3, "C" or any variant of "C" programming languages) not furnished by ProSoft; (v) use of the Product for purposes other than those for which it was designed; (vi) any other abuse, misapplication, neglect or misuse by the Customer; (vii) accident, improper testing or causes external to the Product such as, but not limited to, exposure to extremes of temperature or humidity, power failure or power surges; or (viii) disasters such as fire, flood, earthquake, wind and lightning.

- c) The information in this Agreement is subject to change without notice. ProSoft shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. The user guide included with your original product purchase from ProSoft contains information protected by copyright. No part of the guide may be duplicated or reproduced in any form without prior written consent from ProSoft.

8.2.3 Disclaimer Regarding High Risk Activities

Product manufactured or supplied by ProSoft is not fault tolerant and is not designed, manufactured or intended for use in hazardous environments requiring fail-safe performance including and without limitation: the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines or weapons systems in which the failure of the product could lead directly or indirectly to death, personal injury or severe physical or environmental damage (collectively, "high risk activities"). ProSoft specifically disclaims any express or implied warranty of fitness for high risk activities.

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Remedies under the above warranties will be limited, at ProSoft's option, to the replacement, repair, re-performance or modification of, or issuance of a credit for the purchase price, of the Products involved, and only after the return of such Products pursuant to ProSoft's instructions. Replacement Products may be new, remanufactured, refurbished or reconditioned at ProSoft's discretion. Costs in connection with or as a result of such defective or nonconforming Products, including, cost to transport the Products from Buyer to ProSoft and return shipment to Buyer, will be borne by ProSoft. The foregoing will be the exclusive remedies for any breach of warranty or breach of contract arising there from.

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** Some areas do not allow time limitations on an implied warranty, or allow the exclusion or limitation of incidental or consequential damages. In such areas, the above limitations may not apply. This Warranty gives you specific legal rights, and you may also have other rights which vary from place to place.

8.2.7 Time Limit for Bringing Suit

Any action for breach of warranty must be commenced within 39 months following shipment of the Product.

8.2.8 No Other Warranties

Unless modified in writing and signed by both parties, this Warranty is understood to be the complete and exclusive agreement between the parties, suspending all oral or written prior agreements and all other communications between the parties relating to the subject matter of this Warranty, including statements made by salesperson. No employee of ProSoft or any other party is authorized to make any warranty in addition to those made in this Warranty. The Customer is warned, therefore, to check this Warranty carefully to see that it correctly reflects those terms that are important to the Customer.

8.2.9 Allocation of Risks

This Warranty allocates the risk of product failure between ProSoft and the Customer. This allocation is recognized by both parties and is reflected in the price of the goods. The Customer acknowledges that it has read this Warranty, understands it, and is bound by its Terms.

8.2.10 Controlling Law and Severability

This Warranty shall be governed by and construed in accordance with the laws of the United States and the domestic laws of the State of California, without reference to its conflicts of law provisions. If for any reason a court of competent jurisdiction finds any provisions of this Warranty, or a portion thereof, to be unenforceable, that provision shall be enforced to the maximum extent permissible and the remainder of this Warranty shall remain in full force and effect. Any cause of action with respect to the Product or Services must be instituted in a court of competent jurisdiction in the State of California.

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