RangeLAN2 Serial Adapter
Models 7910 and 7911

User's Guide

Limited Warranty, Disclaimer, Limitation Of Liability
For a period of one (1) year from the date of purchase by the retail customer, Proxim warrants the RangeLAN2 Serial Adapter against defects in materials and workmanship. Proxim will not honor this warranty if there has been any attempt to tamper with or remove the Adapter's external foil label.

This warranty does not cover and Proxim will not be liable for any damage or failure caused by misuse, abuse, acts of God, accidents, or other causes beyond Proxim's control, or claim by other than the original purchaser.

If, after inspection, Proxim determines there is a defect, Proxim will repair or replace the Adapter at no cost to you. To return defective merchandise to Proxim please call Proxim Technical Support at: (408) 731-2640 to obtain a Return Merchandise Authorization (RMA) Number.

In no event shall Proxim, Incorporated be responsible or liable for any damages arising:

❑ From the use of the product;

❑ From the loss of use, revenue or profit of the product; or

❑ As a result of any event, circumstance, action, or abuse beyond the control of Proxim, Incorporated;

Whether such damages be direct, indirect, consequential, special, or otherwise and whether such damages are incurred by the person to whom this warranty extends or a third party.

Part # 7360.0098
Rev. B

Warranty Return Policy

If you have a problem with your RangeLAN2 product, please call Proxim Technical Support at (408) 731-2640. Proxim Technical Support will assist with resolving any technical difficulties you may have with your Proxim product.

If your product is found to be defective, you may return the product to Proxim after obtaining an RMA (Return Materials Authorization) number from Proxim Technical Support. The product must be returned in its original packaging. The RMA number should be clearly marked on the outside of the box. Proxim cannot be held responsible for any product returned without an RMA number, and no product will be accepted without an RMA number.

FCC WARNING

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ❑ Reorient or relocate the receiving antenna.
- ❑ Increase the separation between the equipment and the receiver.
- ❑ Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- ❑ Consult the dealer or an experienced radio/TV technician for help.

Contents

1. Introduction

Congratulations on your purchase of the RangeLAN2 791x Serial Adapter, the radio module that replaces RS-232 serial cables with wireless RF (Radio Frequency) technology. By attaching a pair of RangeLAN2 Serial Adapters to the serial port of any two devices, you can transmit and receive data without the use of wires.

The RangeLAN2 791x can support several data rates and uses the same patented 2.4 GHz frequency hopping spread spectrum (FHSS) technology as found within Proxim's award-winning RangeLAN2 product line. The Serial Adapter is designed to work with numerous off-the-shelf applications as well as with custom programs. The RangeLAN2 791x may leverage off of an existing RangeLAN2 network, allowing two Serial Adapters to communicate over greater distances.

The Serial Adapter is designed to be a "plug and play" product. External rotary switches allow you to configure your Serial Adapter manually so that in many cases, you will be able to use a Serial Adapter without running any software to configure it.

However, the Serial Adapter supports a wide variety of configurations that can be easily changed to fit your application requirements. All configuration information is stored in non-volatile memory called EEPROM (electronically erasable programmable read-only memory).

Proxim is the leading supplier of spread spectrum radio networking technology for local area environments. Proxim's unmatched spread spectrum networking expertise, combined with the company's extensive experience serving the communication needs of the mobile computing user, has kept Proxim at the forefront of the emerging wireless market.

The RangeLAN2 Family

RangeLAN2 791x Serial Adapter is part of a family of high-performance products that provides a complete wireless networking solution.

- **RangeLAN2 7100** is a wireless LAN adapter that fits into a standard PC/AT ISA bus slot.
- **RangeLAN2 7400** is a wireless LAN adapter which fits into a PCMCIA Type II slot on a portable notebook, laptop, or pen-based computer.
- **RangeLAN2 7510/752x** Access Points allow RangeLAN2 products to seamlessly connect to a wired Ethernet network.
- **RangeLAN2 753x** Access Points allow RangeLAN2 products to seamlessly connect to a wired Token Ring network.
- **RangeLAN2 754x** Extension Point extends the coverage area of an existing RangeLAN2 network.
- There are two models of the RangeLAN2 Serial Adapter, the **7910** and **7911**. The **7910** has 100 mW of output power, while the **7911** has 500 mW of output power.
- **RangeLAN2 792x** Ethernet Adapter converts any Ethernet-ready device into a wireless node on an existing RangeLAN2 network.

System Requirements

To begin using your RangeLAN2 791x Serial Adapter, you need the following minimum system requirements:

- ❑ At least one (1) device with a free RS-232 (serial) port (terminal, PC, etc.).
- ❑ At least one (1) other RangeLAN2 product. If the Serial Adapters are acting as a replacement for a serial cable, this additional RangeLAN2 product must be a second 791x Serial Adapter which will attach to a free RS-232 port on another device.

The Product Package

Each RangeLAN2 791x Serial Adapter comes with:

- ❑ One (1) RangeLAN2 Serial Adapter.
- ❑ One (1) 1 dBi omnidirectional antenna.
- ❑ One (1) 12 Volt, 1 Amp power adapter.
- ❑ One (1) RS-232 serial cable.
- ❑ One (1) switch setting tool.
- ❑ Two (2) plastic plugs to cover the Domain and Station/ Master rotary switches.
- ❑ One (1) RangeLAN2 791x Serial Adapter User's Guide.

If any of these items are missing or damaged, please contact your reseller or Proxim Technical Support.

Figure 1
RangeLAN2 791x Serial Adapter Components

2. Quick Installation

You may follow the quick installation and configuration steps if all of the following conditions are true:

- ❑ You will use all of the software default values.
- ❑ You are using two (2) RangeLAN2 Serial Adapters as a replacement for an RS-232 cable.
- ❑ You are using no more than nine (9) pairs of Serial Adapters in one location.

Follow the steps below to install two RangeLAN2 791x Serial Adapters:

1. Firmly screw the antenna onto its connector in a clockwise rotation. The antenna connector is located on the side of the unit as shown in Figure 2.

Note:
Government regulatory agencies mandate that the antenna not be alterable. Therefore, the RangeLAN2 Serial Adapter uses a custom antenna connector. Do not attempt to use a non-certified Proxim antenna or you may damage the connector and the Serial Adapter.

Figure 2
Attachment of the RangeLAN2 Serial Adapter Antenna

2. Attach one end of an RS-232 cable to the RangeLAN2 Serial Adapter and the other end to a free serial port of a communication device, such as a terminal or a computer. Perform this step with both Serial Adapters.

3. Each RangeLAN2 791x Serial Adapter is preconfigured to operate as a ***Station***. Therefore, before two Serial Adapters will communicate, one must be set as a ***Master***. Using the Station/Master rotary switch on the underside of the RangeLAN2 Serial Adapter, set one unit of each Serial Adapter pair as a Master and leave the second unit as a Station.

4. Each RangeLAN2 791x Serial Adapter is preconfigured to use ***Domain 0***. If you have multiple pairs of Serial Adapters and each pair consists of one Master and one Station, set each pair to a unique Domain number. Using the Domain rotary switch on the underside of the RangeLAN2 Serial Adapter, set each pair to a unique Domain number from 0-8 to ensure minimal interference. If you decide to use Domain 8, refer to Chapter 5 for information concerning this switch setting's role in the Pairing Domain communication feature.

Note:
Do not set the Serial Adapter to use Domain 9 on the Domain rotary switch. Setting the Domain rotary switch to 9 will send the Serial Adapter into a configuration mode, and the unit will not be operational.

5. Plug the power supply into the RangeLAN2 Serial Adapter DC power jack, located on the rear panel, and plug the power supply into an AC outlet. Upon completing this step, the LED indicator on the top panel of the unit will glow yellow and then turn green, indicating that the unit is ready for operation.

6. Your RangeLAN2 Serial Adapters are now ready for use with your desired application. However, if your RangeLAN2 Serial Adapters fail to communicate or fail to exchange information, you may need to compare your application's settings with the RangeLAN2 Serial Adapter's default values. Please consult Chapter 6 for information on how to customize your RangeLAN2 Serial Adapter configuration and Chapter 14 for troubleshooting suggestions.

3. Wireless Topologies

The RangeLAN2 Serial Adapter supports numerous wireless topologies. The following sections describe four (4) basic wireless configurations supported by the RangeLAN2 Serial Adapter: Point-to-Point, Point-to-Multipoint, Point-to-Point using RangeLAN2 Infrastructure, and Point-to-Multipoint using a RangeLAN2 Access Point as a Base Unit.

Point-to-Point

In this topology, a pair of RangeLAN2 Serial Adapters are configured to exclusively communicate with each other.

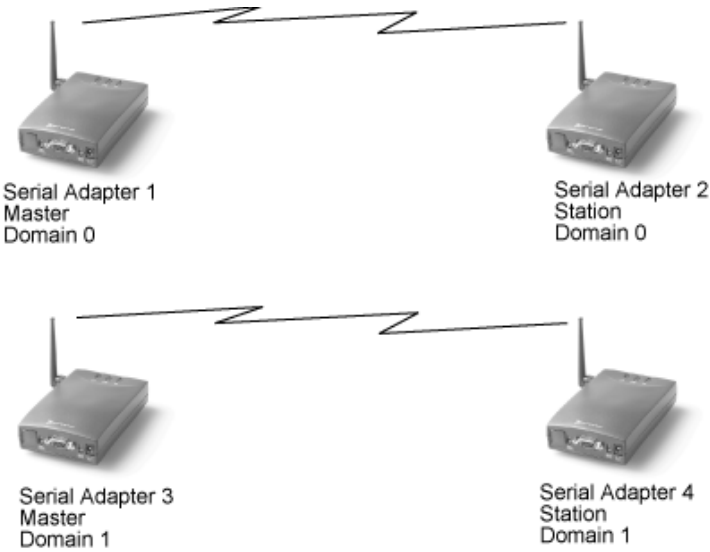


Figure 3
Point-to-Point Topology

In Figure 3 above, Serial Adapters 1 and 2 can communicate with each other, as can Serial Adapters 3 and 4. Even though all four units may be in range of one another and may "hear" the others' messages, each unit will filter out messages not intended for it. Since this topology establishes a one-to-one, Master-Station relationship between two Serial Adapters, it acts as a wireless substitute for an RS-232 cable in a wide variety of applications.

Using the TCP/IP protocol as the transport mechanism for information, a Serial Adapter that receives a message from its serial port will turn the message into a data packet that includes the transmitting unit's IP address and the destination unit's IP address.

The transmitting Serial Adapter will then "listen" on the radio frequency to ensure that the other Serial Adapter is not transmitting a packet. If free, the unit will transmit the packet. It will wait for an acknowledgment from the receiving Serial Adapter that the packet was received without error. If it does not receive such an acknowledgment and it has not exceeded its maximum retry count, the unit will retransmit the packet.

A receiving Serial Adapter will filter packets based on the packet's destination IP address. Only the unit with the correct IP address will save the packet and send an acknowledgment back to the source unit. Upon receiving a packet, the unit will also extract the original message out of the packet and send it out over the serial port. If there is an error in the packet, the unit will ignore it. This guarantees the delivery of only error-free transmissions.

Point-to-Multipoint

The RangeLAN2 Serial Adapter may also operate in a Point-to-Multipoint topology. This configuration provides added flexibility, allowing one centralized unit, operating in Packetized mode, to communicate with multiple units placed in remote locations.

When operating in Packetized mode, a central Serial Adapter may be programmed to send either directed messages or broadcasts to other Serial Adapters, by specifying the appropriate IP address and send mode. The Packetized Mode Command Set allows users to customize Serial Adapter communications to meet their application needs. For more information on Packetized mode, please see Ch. 4 and Appendix A, the Packetized Mode Specification.

A Point-to-Multipoint topology may utilize the Broadcast mode, so that multiple Serial Adapters can receive the same information simultaneously. Note that a broadcasting Serial Adapter does not wait for an acknowledgment of the packet's receipt from any receiving unit. Broadcast mode is an unacknowledged service because it can be extremely inefficient to have every unit acknowledge a message once a packet is received. Since these broadcast packets are unacknowledged, a unit cannot retry transmissions when in this sending mode. You may use the Packetized Mode Command Set or another high-level application in conjunction with the Broadcast mode to guarantee the delivery of error-free transmissions to multiple units.

In Figure 4 below, Serial Adapters 1 through 5 are on Domain 0. Serial Adapter 1 is set to Broadcast mode. Serial Adapter 6 is on Domain 1. Whenever a message is sent from unit 1, it is received by units 2 through 5 and is processed by those units which receive the transmission error-free. Since unit 6 is on a different Domain, it will not process unit 1's broadcast message.

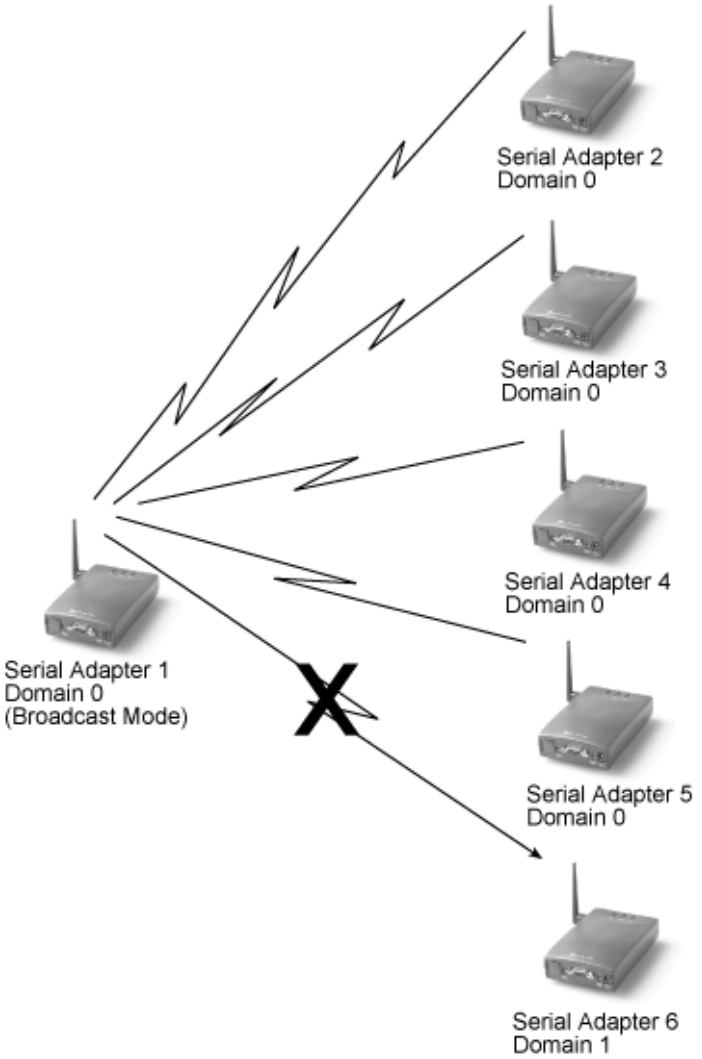


Figure 4
Point-to-Multipoint

Point-to-Point Using RangeLAN2 Infrastructure

You may also use your existing RangeLAN2 infrastructure and network to increase the range and flexibility of communications between Serial Adapters. A Serial Adapter configured as a Station may synchronize to a RangeLAN2 Access Point which has the same Domain and Security ID.

Two Serial Adapters which are positioned out of range of one another, can be set as Stations so that each will synchronize to a RangeLAN2 Access Point. Then, the Access Point(s) will forward the radio signals sent between the units. This allows the units to communicate as if they were actually in range of one another.

For example, in Figure 5 below, Serial Adapter 1 is synchronized to Access Point 1, and Serial Adapter 2 is synchronized to Access Point 2. Access Points 1 and 2 are on the same Ethernet network. Serial Adapters 1 and 2 can engage in Point-to-Point communications, even though they are not in range of one another. Access Point 1 forwards packets from Serial Adapter 1 to Access Point 2, which then transmits the packets to Serial Adapter 2.

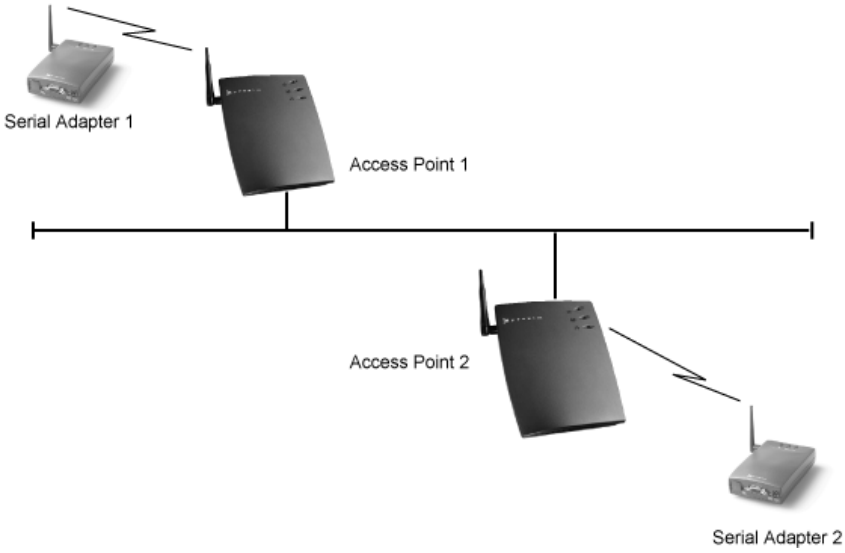


Figure 5
Point-to-Point Using RangeLAN2 Infrastructure

Point-to-Multipoint Using a RangeLAN2 Access Point as a Base Unit

A Serial Adapter may communicate directly with a workstation that has either a RangeLAN2 ISA card, a RangeLAN2 PC card, or is on the same Ethernet segment as a RangeLAN2 Access Point. One configuration that utilizes this feature is Point-to-Multipoint using a RangeLAN2 Access Point to connect a wired desktop computer to a number of remote Serial Adapters.

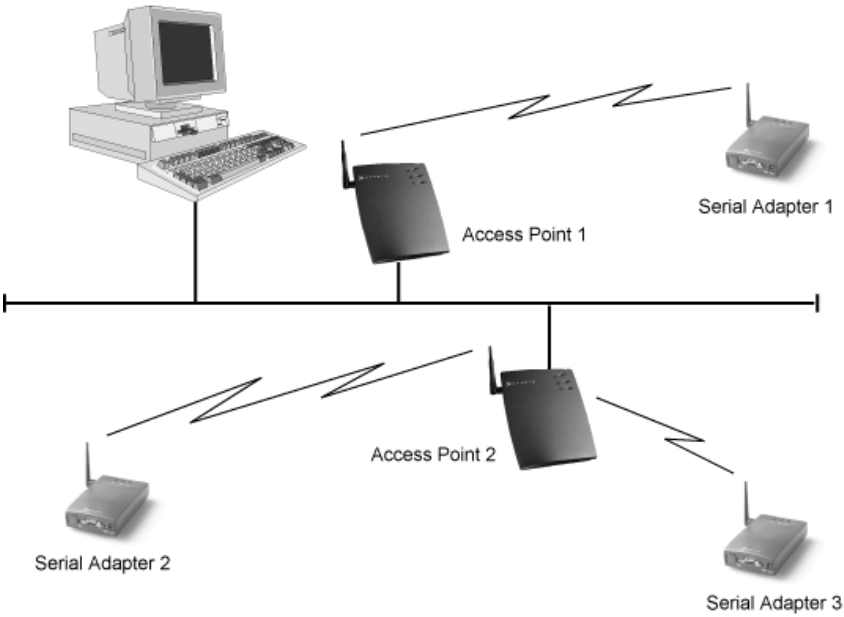


Figure 6
Point-to-Multipoint Using a
RangeLAN2 Access Point as a Base Unit

Figure 6 above shows a simple configuration of this topology. Desktop 1 is on the same network as a RangeLAN2 Access Point. Serial Adapters 1 and 2 are configured as Stations and are synchronized to the Access Point, which is configured as a Master. Desktop 1 is running a custom-made application written in a programming interface, such as Windows Sockets, which uses TCP/IP to communicate with either or both Serial Adapters.

For more information about how to write a custom TCP/IP sockets program which will interface with the RangeLAN2 Serial Adapter, see Appendix B, the Serial Adapter TCP/IP Specification.

The topologies discussed above display only a small number of the simplest configurations available with the RangeLAN2 Serial Adapter. You may also design more complicated custom topologies that meet your own communication requirements and that build upon the principles presented within these simpler configuations.

Note:
When using the Serial Adapters in conjunction with an Ethernet backbone, note that you can not send a broad-cast message through a router.

4. Pass-through and Packetized Modes

The Serial Adapter's serial interface can be set for two kinds of operating modes: Pass-through mode and Packetized mode. The format of the information presented to the unit's serial port is dramatically different depending on which of these modes is selected.

You should use the Pass-through mode for applications where a pair of RangeLAN2 Serial Adapters replace an RS-232 cable without changing the existing serial application. In Pass-through mode, the unit accepts a stream of serial data at its RS-232 port and passes it over the radio network to a receiving unit or units. The data arrives at the receiving unit that then sends this information to its attached computer or terminal over the serial port. Pass-through mode is the default setting for the Serial Adapter.

In Packetized mode, the Serial Adapter accepts a set of commands from an external computer. This allows the external computer to control the unit. In addition to commands that cause the unit to transmit messages over the radio, the unit also accepts configuration commands such as "switch radio to Channel 2" or "switch baud rate to 9600 baud." Packetized mode has the advantage that it permits an external computer to control the more advanced features of the unit "on the fly."

A unit operating in Packetized mode can communicate with another unit operating in either Pass-through or Packetized mode.

Note:
Please review Appendix A, the Packetized Mode Specification, before attempting to operate the Serial Adapter in Packetized mode.

5. Understanding the Hardware

Rotary Switches

The RangeLAN2 Serial Adapter is designed for easy configuration by setting two rotary switches located on the bottom of the unit. The rotary switches are shown in Figure 7 below. Use the switch setting tool, enclosed in the product package, to change the position of the rotary switches.

- ❑ The Station/Master Switch allows the user to externally set the unit as either a Master or a Station within a wireless network. The Serial Adapter is pre-configured so that the switch is set as a Station.

- ❑ The Domain Switch allows the user to set the Domain number to a value between 0 and 8. The Serial Adapter is pre-configured to operate using Domain 0. If you want to set the Domain to a number between 9 and 15, you must use the software configuration menu. See Chapter 6 for information on how to access the Serial Adapter's software configuration menu.

Note:

Setting the RangeLAN2 Serial Adapter to Domain 9 will cause the unit to exit from operating mode and enter the configuration menu at 9600 bps, 8N1. Also, when the Domain Switch is set to 9, each time the RangeLAN2 Serial Adapter is turned on, it will boot up into the configuration menu.

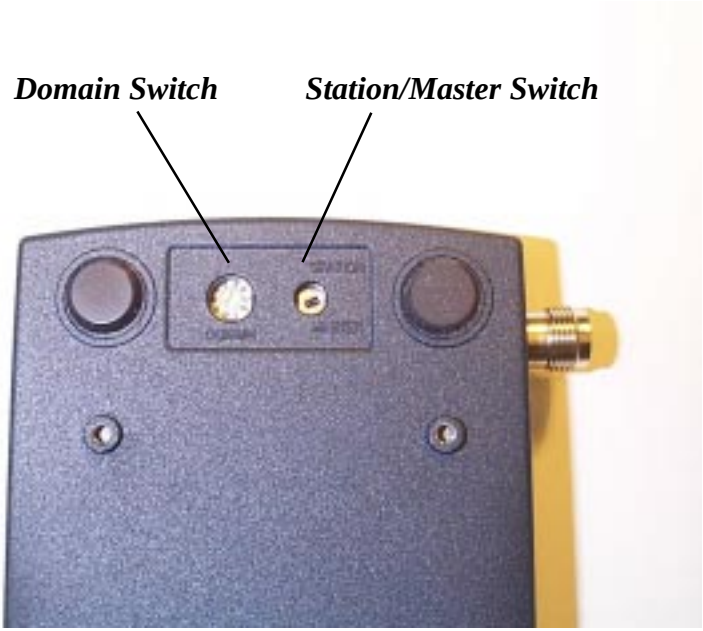


Figure 7
Rotary Switches

The Pairing Domain

There is an additional feature associated with Domain 8 on the Domain Switch called the Pairing Domain. When the Pairing Domain is not used, two Serial Adapters will each send out a series of handshaking messages and exchange IP addresses to enable communication during boot-up. This information is lost each time the Serial Adapter is powered off; therefore, the Serial Adapter performs this handshaking procedure each time the unit is reset.

However, the Pairing Domain feature stores the communication information permanently within the unit so that it is not lost

when the unit is reset. This allows the user to permanently configure a pair of Serial Adapters to communicate exclusively with one another. Follow these steps to permanently bind a pair of Serial Adapters:

1. Ensure that both units are turned off.

2. Using the switch setting tool, turn the Domain Switch to 8 on both units. The units may be configured with one as a Master and with the other as a Station or with both set as Stations synchronized to the same RangeLAN2 Access Point, which is also configured for Domain 8.

3. Power up both units. The Serial Adapters will perform the handshaking procedure and exchange IP addresses. This information is then permanently stored within each unit.

4. Using the switch setting tool, change the Domain Switch from 8 to another value between 0 and 7. The two Serial Adapters will now exclusively communicate with each other.

5. Each unit will retain the other's IP address until the Domain Switch is set back to 8 and power is recycled. The user may also override this feature by manually configuring a Destination Address from within the software configuration menu.

Note:

If you intend to use the Pairing Domain feature to bind together two Serial Adapters, Proxim recommends that you do not set any pair of units to communicate on Domain 8, in order to avoid unintended pairings.

To reset the unit back to the default setting, manually set the Destination Address to 0.0.0.0 or reset the unit to factory defaults from within the software configuration menu.

When using this feature, have only two Serial Adapters configured to Domain 8 on the rotary switch at any point in time. If only one unit is configured for Domain 8, the Pairing Domain will not change the unit's configuration. If three Serial Adapters are set to Domain 8 and then powered on, the outcome will be unpredictable and may not result in a successful pairing of two of the units.

The Pairing Domain feature is only available when the Domain Switch is in use. This feature is not operational when a Serial Adapter has been configured to Domain 8 from within the software configuration menu or when the Domain Switch setting has been overridden by the software configuration menu.

LED Indicators

There are three LEDs on the top panel of the RangeLAN2 791x Serial Adapter:

- The Status LED on the right side (with the unit orientated so that you can read the Proxim logo), changes colors from yellow (initializing) to green (operational). This LED blinks red in a repeating pattern when a problem occurs with the unit. See Chapter 14 for a further discussion of these patterns.

- The Radio LED in the center blinks yellow when the Serial Adapter is transmitting data packets over its radio.

- The Serial LED on the left side blinks green when the Serial Adapter is transmitting data over the serial connection.

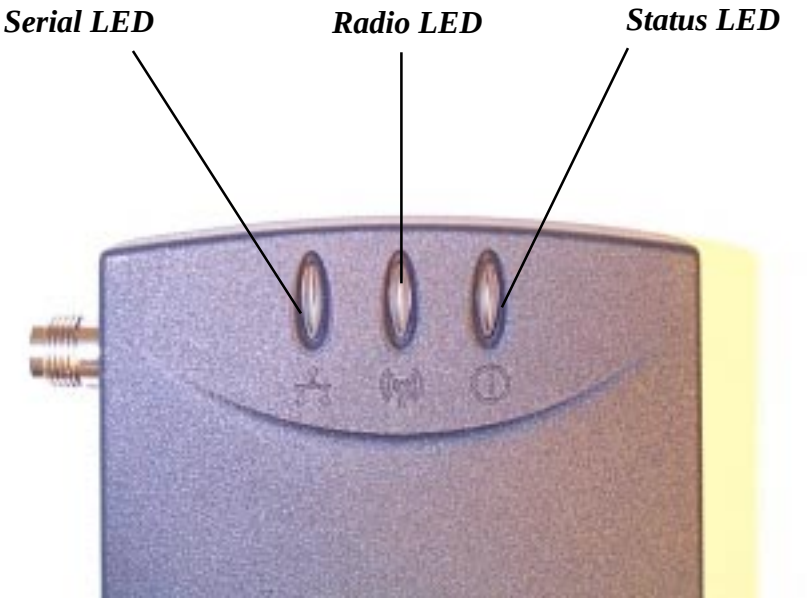


Figure 8
Top Panel LEDs

There are also four LEDs on the back panel of the RangeLAN2 791x Serial Adapter:

- ❑ The green Master LED, located between the DC power jack and the serial interface, is on steady when the unit is set as a Master.

- ❑ The yellow Sync LED, located between the DC power jack and the serial interface, is on steady when the unit is set as a Station and is synchronized to a Master.

- ❑ The yellow Override LED, to the left of the serial interface, is on steady when the Serial Adapter is using a value for Station Type, Domain, or both which was configured from within the software interface. When this LED is on, the Serial Adapter is not using the Station/Master and/or Domain value(s) set by the rotary switches.

- ❑ The green LED, to the left of the serial interface, is reserved for future use.

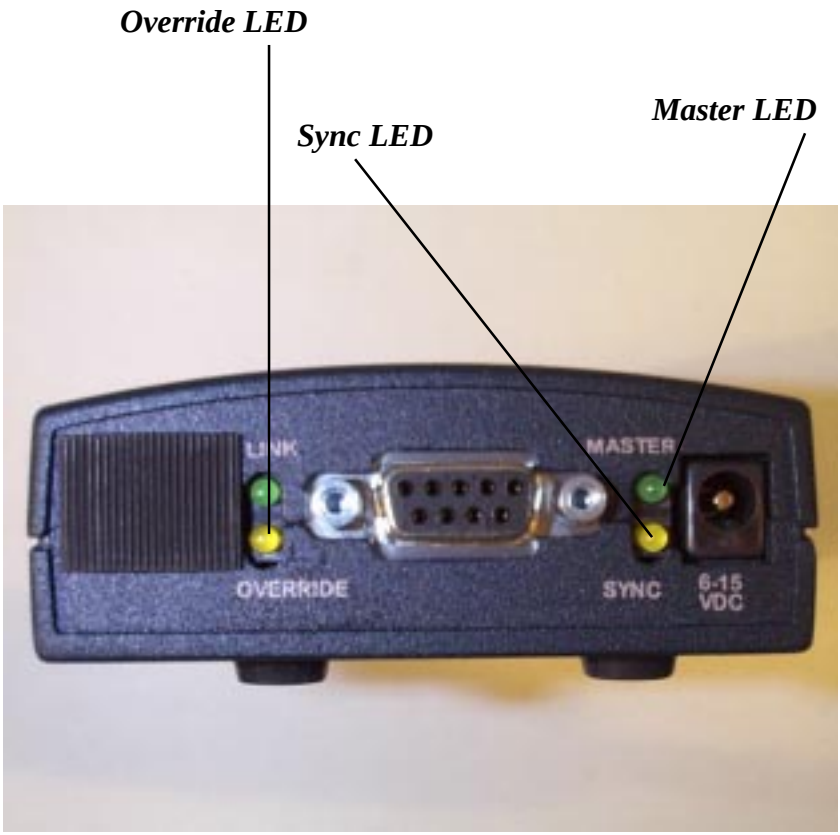


Figure 9
Back Panel LEDs

Serial Port Specification

Figure 10 and the table below provide the specification of the 9-pin serial port located on the RangeLAN2 Serial Adapter. The Serial Adapter is wired as a DCE (Data Communication Equipment), like a modem.

The unit is designed to connect directly to a DTE (Data Terminal Equipment), such as a computer or dumb terminal, using a straight-through RS-232 cable. If your application requires that the Serial Adapter be connected to another DCE, use a null modem cable or a straight-through cable with a null modem adapter, which will cross the transmit and receive pins so that the DCEs can communicate with one another.

Pin Number	Serial Pin Function
pin 1	CD (Carrier Detect)
pin 2	TXD (Transmit Data)
pin 3	RXD (Receive Data)
pin 4	DTR (Data Terminal Ready)
pin 5	SG (Ground)
pin 6	DSR (Data Set Ready)
pin 7	RTS (Request to Send)
pin 8	CTS (Clear to Send)
pin 9	RI (Ring Indicator)

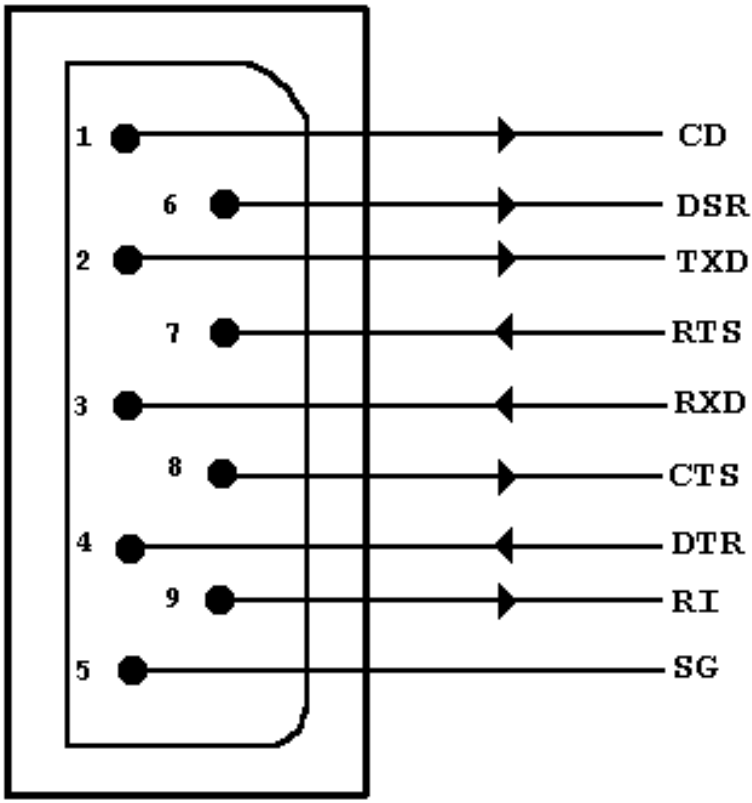


Figure 10
Serial Port Specification

Antenna Options

The Serial Adapter is shipped with a standard directly-connected antenna. To install the antenna, screw it clockwise onto the antenna connector. Proxim sells several antenna alternatives, including higher gain omnidirectional and directional antennas. Each of these antennas ship with installation and mounting instructions. For information on additional antenna options, please contact your Proxim Sales Representative.

Mounting Options

The Serial Adapter was designed to sit on a flat surface. However, there are four pre-threaded holes on the underside of the unit so that it may be mounted on any surface. The mounting holes are shown in Figure 11. These holes are a #6-32 tap and 0.175" deep. Screws and mounting tools are not provided by Proxim.

Note:

When mounting the Serial Adapter onto a flat surface, you may need to remove the plastic feet from the underside of the unit so that the mounting holes are flush against the mounting surface. The plastic feet are glued onto the underside of the unit and can be removed with a small flat-head screwdriver.

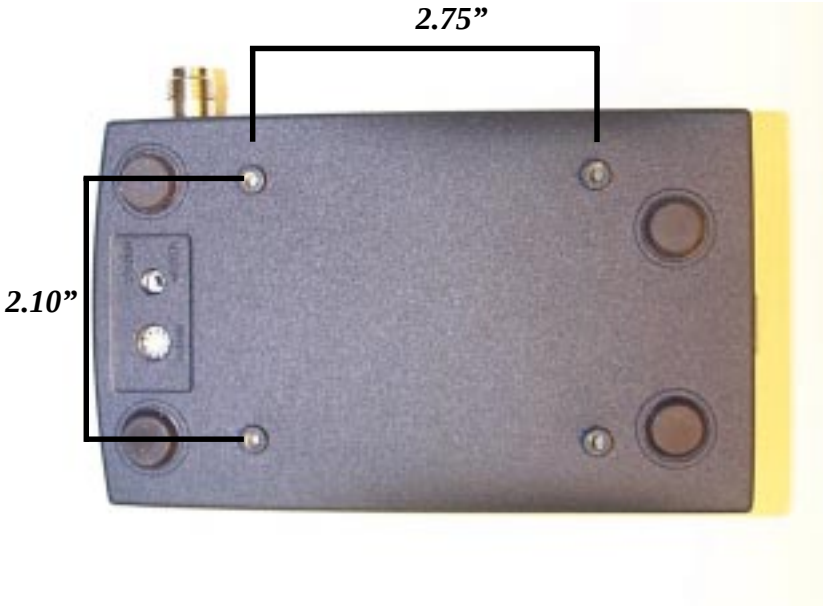


Figure 11
Mounting Holes

6. Configuration

You need to configure the RangeLAN2 Serial Adapter using the software menus if any of the following conditions apply:

- ❑ You plan to operate a Serial Adapter in broadcast mode.
- ❑ You want to set Security IDs on your Serial Adapters.
- ❑ You want to operate in Packetized mode.
- ❑ You need to change the software default values, including IP addresses.

In order to configure a Serial Adapter, you need a terminal or terminal emulation program, such as Hyperterminal or Quarterdeck's Procomm Plus, to access the Serial Adapter configuration menu. Hyperterminal is shipped with Microsoft Windows 95.

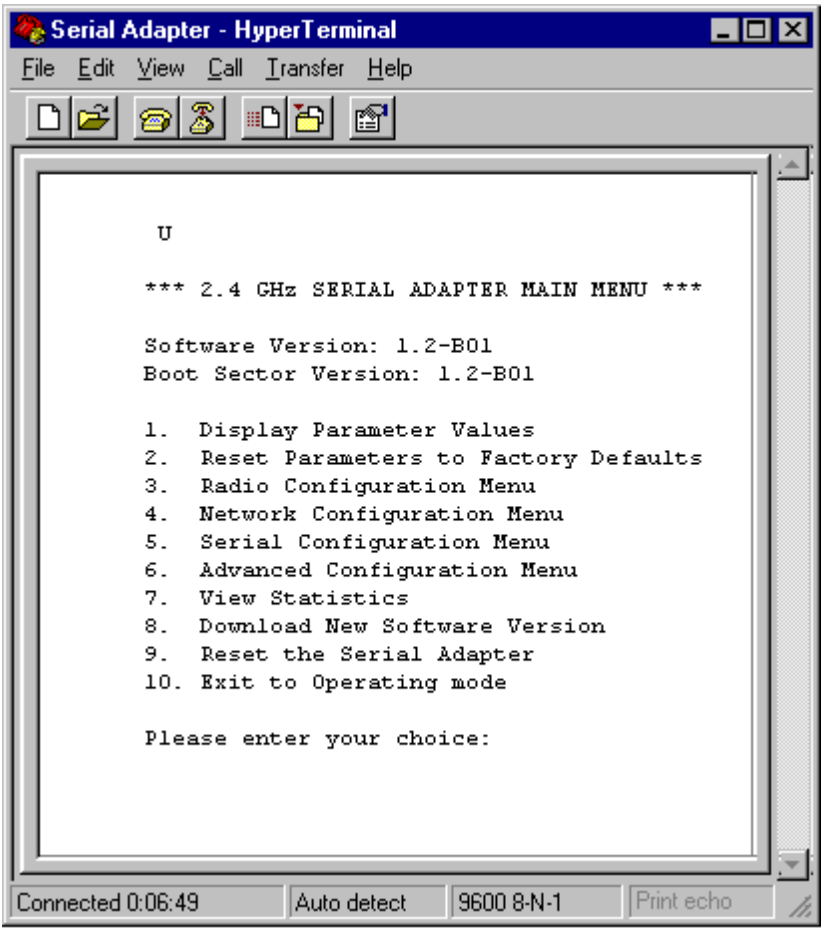
Displaying the Configuration Menu

1. Attach one end of an RS-232 cable to the Serial Adapter and the other end to a free serial port on your terminal or PC.

2. Configure the terminal or terminal emulation package to a baud rate of 9600 bps, no parity, 8 data bits and 1 stop bit. Set the terminal flow control to either "Hardware" or "None." These settings are the default values for the Serial Adapter; if you change any of these parameters, your terminal or terminal emulation package must match those values in order to view the configuration menu. If you do not know to what values your Serial Adapter is set, change the Domain rotary switch to "9" to bring up the configuration menu at 9600 bps, no parity, 8 data bits and 1 stop bit.

3. Apply power to the Serial Adapter. When the unit is ready for operation, the letter “U” will be displayed on the terminal screen.

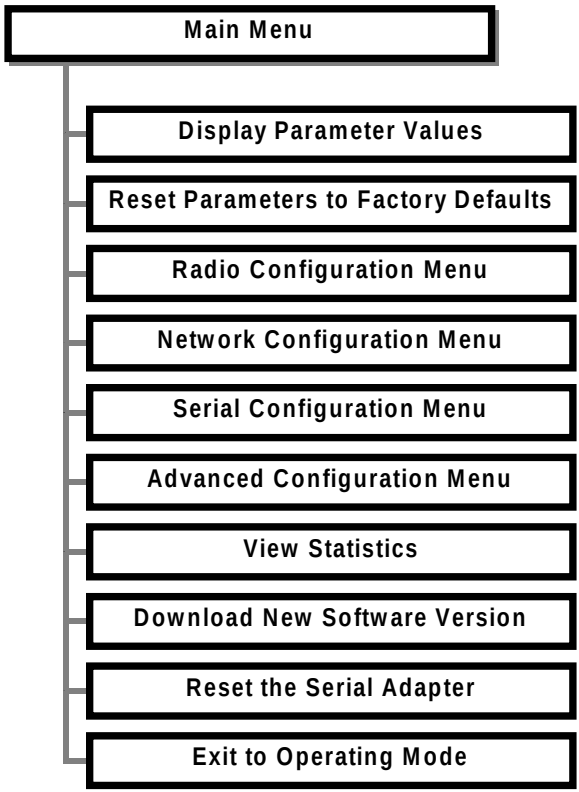
Let the unit sit idle for one second and type “$$$”. The configuration menu should then appear and look like this:



Type the number of the menu option and <ENTER> to view the sub-menus. Hit <ESC> at any time to back up one menu.

To simplify the menu options, all of the configuration menus will appear in a tree diagram format within this manual.

The tree diagram for the Main Menu, shown in the screen shot above, looks like this:

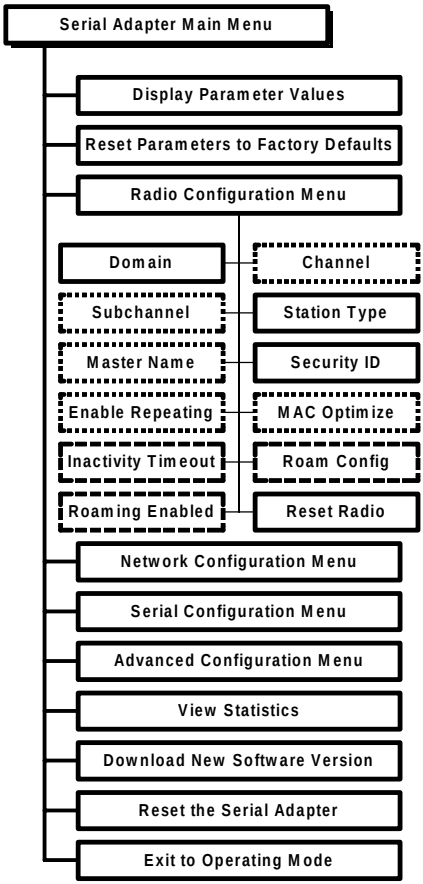


The following six chapters detail the sub-menus, shown above.

7. Radio Configuration Menu

This section discusses the Radio Configuration values that can be manually configured by the user.

The software tree below shows the options available in the Radio Configuration Menu:



Dotted Line - Visible when configured as a Master
Dashed Line - Visible when configured as a Station

Radio Parameters

The table below shows the range and default values for each of the Radio parameters:

Parameter Name	Range	Default
Domain	0-15, and "U" for Use Switch	Use Switch
Channel *	1-15, and 0 for automatic selection	0
Subchannel *	1-15	1
Station Type	Master, Station, and "U" for Use Switch	Use Switch
Master Name *	11 characters	MASTER
Security ID	20 characters	blank
Enable Repeating *	Y/N	N
MAC Optimize *	Normal, Light, Very Light, and Auto	Auto
Inactivity Timeout [t]	0 for no timeout and 1, 2, 3, ... to designate intervals of 10 seconds	0
Roam Config [t]	Slow, Normal, and Fast	Normal
Roaming Enabled [t]	Yes/No	Yes
Reset Radio	-	-

* Only visible when configured as a Master

[t] Only visible when configured as a Station

Note that changes to these parameters will not take effect until either the radio or the Serial Adapter is reset.

A RangeLAN2 Serial Adapter may be set as either a Master or a Station using the **Station Type** parameter within the configuration menu. You may also choose "U" for Use Switch to use the value specified by the Station/Master Switch. The rotary switch is set to Station by default.

Proxim's RangeLAN2 products are frequency hopping spread spectrum radios which communicate in the 2.4 GHz frequency band. This means that several times every second, the frequency at which the units are communicating changes.

In order for the units to communicate, in each subnetwork there must be one unit that coordinates the frequency hops. This unit is called the Master. It might help you to think of the Master as the conductor of a frequency hopping orchestra. The Master keeps time so all units know when to hop and to what frequency.

Units classified as Stations synchronize to the Master and follow its signal to learn what frequency in the pattern the Master is currently using.

There must be at least one unit in a given topology designated the Master. When using two units in a Point-to-Point topology, one RangeLAN2 Serial Adapter will be the Master and the other will be set as a Station. In a Point-to-Multipoint topology, there will be one Master and all other units are configured as Stations.

However, if you are using a topology that connects a RangeLAN2 Serial Adapter to a RangeLAN2 Access Point, the RangeLAN2 Access Point will be the Master and each Serial Adapter should be set as a Station.

In order to establish communications, all Stations and the Master must be configured with the same **Domain** number. Radios on different Domains cannot communicate with each other. The Domain is a software filter which does not affect the actual radio frequency or the frequency hopping sequence.

You typically want to set each Serial Adapter in a given network to the same Domain. However, if you have two sets of Serial Adapters in two distinct pairs which you do not want to communicate with one another, you should set each pair to a different Domain to avoid confusion.

The Domain is a number between 0 and 15. Choose "U" for Use Switch in order to use the number specified by the Domain Switch. The default setting is the Domain Switch value, which is pre-configured to Domain 0 at the factory.

Note that while the Domain Switch allows the user to set the Serial Adapter to operate on any Domain value between 0 and 8, the software configuration menu allows the user to set the Domain to a value between 0 and 15. Also, if you choose to override the Domain Switch, the Pairing Domain feature, described in Chapter 5, will not be operational.

While you may set the Domain number to 9 in the configuration menu, choosing Domain 9 on the external rotary switch will cause the Serial Adapter to enter the configuration menu at the default parameters of 9600 bps and 8N1.

Note:

If the Serial Adapter is reset at any time while the external rotary Domain Switch is set to 9, it will immediately enter the configuration menu and will not be ready for operation.

Each Master can select one of 15 **Channels** to establish communication with its Stations. Each Channel number sets a unique frequency hopping sequence allowing for multiple subnetworks with higher data rate transmission capability in the same air space.

You may think of the Channel as a pipe. In order to communicate, radios must be on the same Channel and there must be one (and only one) Master that provides the timing for that Channel.

There are 15 independent Channels available for use with RangeLAN2 products. This means that there are 15 different sequences of frequency hops. Each Channel is at a different frequency at a different time. To minimize interference, set each Serial Adapter acting as a Master within the same vicinity to a different Domain and Channel.

The Serial Adapter's Channel may be set to a value between 0 and 15, and 0 is the default setting. When set to Channel 0, a Serial Adapter automatically selects a Channel upon boot-up based on the configured Domain number. The Channel selected is the Domain number plus 1. Therefore, if the Domain is set to 0, the Channel is 1. Note that the automatic selection procedure will choose Channel 15 when set to either Domain 14 or 15.

This parameter is visible only when the Serial Adapter is set as a Master. All Stations will determine their Channel by the Master to which they are synchronized.

The **Subchannel** is a software code that is appended to each radio packet. It does not affect the frequency hopping sequence like a Channel does. Use a Subchannel if you need more than 15 Masters in the same area and, therefore, all of the Channels are in use.

For example, you can use Channel 1, Subchannel 1 for Adapter Pair A and Channel 1, Subchannel 2 for Adapter Pair B. The two pairs will not communicate with one another. However, they are still sharing the 1.6 Mbps pipe since they are both using Channel 1.

The Subchannels are designated 1 through 15, and 1 is the default setting. This parameter is visible only when the Serial Adapter is set as a Master.

The optional **Master Name** parameter of up to 11 characters specifies an alphanumeric name to simplify the identification of each Master in your wireless topology. This parameter is visible only when the Serial Adapter is set as a Master.

To further improve the security of a wireless topology, each unit requires the same **Security ID** to establish communication. The Security ID may be set on both Masters and Stations. This ID is encrypted and stored within the RangeLAN2 Serial Adapter itself, not in software. It cannot be accessed, but you may change it. However, if you do change it, then you will need to change the Security ID on all of the other radios to the same new value to reestablish communication.

The Security ID parameter can be up to 20 characters and is an empty string by default. There are 1,048,576 unique choices for the Security ID.

Note:

The Security ID value is not a software parameter but is stored within the Serial Adapter's radio. Therefore, if you choose the Reset Parameters to Factory Defaults option from within the Serial Adapter Main Menu, the Security ID will ***not*** *be reset to its default value.*

The **Repeating Enabled** parameter gives the ability to enable or disable the RangeLAN2 repeating feature. When enabled, a Serial Adapter, acting as a Master, may repeat signals coming from one Station and destined for another Station. These two Stations must be out of range of one another, but both in range of the Master Serial Adapter for repeating to occur. However, be aware that by enabling the repeating feature, the network throughput will drop by as much as one-half when repeating occurs.

This parameter is only visible when the Serial Adapter is configured as a Master. By default, Repeating is disabled.

The **MAC Optimize** parameter can help improve throughput for small networks. The default setting of Auto causes the RangeLAN2 Serial Adapter to determine the number of units synchronized to it and adjust this parameter accordingly.

Alternatively, you may set this parameter to one of the other settings. If you have 0 or 1 wireless nodes communicating with a RangeLAN2 Serial Adapter, set this parameter to Very Light. If you have between 2 and 7 wireless nodes communicating with a RangeLAN2 Serial Adapter at the same time, set this parameter to Light. In networks with more than 7 concurrent wireless users, set the parameter to Normal.

This parameter is visible only when the Serial Adapter is set as a Master.

To conserve battery life, the RangeLAN2 Serial Adapter has an **Inactivity Timeout** sleep mode. The sleep mode is automatically engaged when a certain period of time has elapsed since the computer has sent or received data over the network. Once the adapter is asleep, it can be awakened by a Master attempting to send data to it.

There is no inactivity timeout set by default, but you may change this to any interval of 10 seconds. This parameter is visible only when the Serial Adapter is set as a Station. A Master unit does not have a sleep mode.

Note:

Configuring a Serial Adapter with an Inactivity Timeout may cause data loss if any of your units are operating in UDP or UDP Broadcast mode.

The **Roam Config** parameter allows you to determine how quickly a Serial Adapter set as a Station will roam from one RangeLAN2 Access Point to another. Ignore this parameter if you have any Serial Adapter set as a Master within your wireless network. This parameter is only of use in topologies where the Serial Adapter repeats a signal through an existing RangeLAN2 network with multiple Access Points that provide overlapping coverage.

In a topology with many RangeLAN2 Access Points that provide heavy overlapping coverage, set this parameter to Fast to maintain high throughput for each of the wireless radios.

In most wireless networks, set the Roam Config parameter to Normal. Wireless node throughput will not change noticeably, and an overabundance of RangeLAN2 Access Points is not required.

If the wireless coverage area provided by RangeLAN2 Access Points is sparse, set the Roam Config parameter to Slow. Wireless nodes will not roam until they are nearly out of range of a RangeLAN2 product. This parameter is visible only when the Serial Adapter is set as a Station.

You may choose to disable a Serial Adapter's ability to roam with the **Roaming Enabled** parameter. This feature is enabled by default; however, if you want a RangeLAN2 Serial Adapter to communicate with one and only one other RangeLAN2 product, you may disable this feature.

This parameter is visible only when the Serial Adapter is set as a Station.

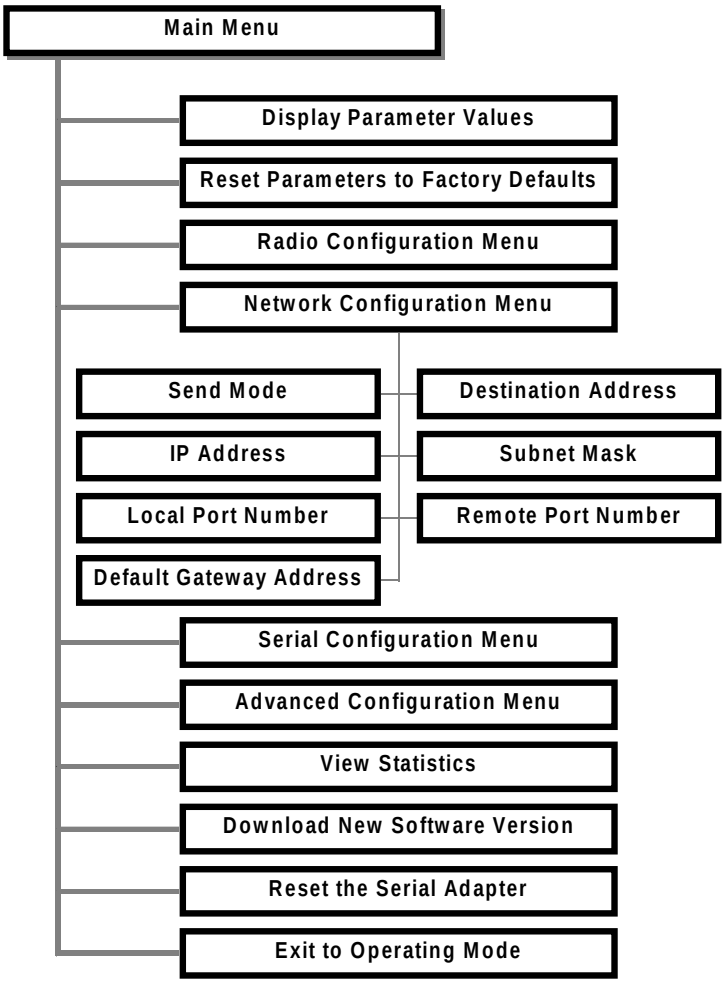
Note:

A Station Serial Adapter can roam only between Proxim RangeLAN2 Access Points or RangeLAN2 Extension Points connected to the same Ethernet or wireless backbone.

8. Network Configuration Menu

This section describes the network configuration parameters for the RangeLAN2 Serial Adapter.

The software tree below shows the options available:



Network Parameters

Parameter Name	Range	Default
Send Mode	TCP (Point to Point), UDP (Point to Point), and Broadcast	TCP(Point to Point)
Destination Address	-	-
IP Address	-	Default address
Subnet Mask	-	255.0.0.0
Local Port Number	-	5000
Remote Port Number	-	5000
Default Gateway Address	-	0.0.0.0

Send Mode indicates the method which a RangeLAN2 Serial Adapter will use to communicate with other RangeLAN2 units. Point-to-Point mode allows a Serial Adapter to transmit packets to only one other unit whose IP address is configured as the transmitting unit's Destination Address.

There are two transport layer protocols supported in Point-to-Point mode: TCP and UDP. TCP offers reliable message delivery but may slow down performance. UDP offers less reliable message delivery than TCP and may be selected to improve speed at the cost of reliability.

When a RangeLAN2 Serial Adapter is set to Broadcast mode, every Serial Adapter which receives the signal error-free and which is set to the same Domain and Security ID will process the

broadcast message. Broadcast mode uses the UDP transport layer protocol to send data. As stated above, UDP is faster than TCP but does not ensure reliable message delivery. However, if your application ensures the reliability of data transmission, there should be no negative side effects to using the UDP protocol in either Point-to-Point or Broadcast mode. See Chapter 3 for a detailed discussion of the suggested Wireless Topologies.

The **Destination Address** identifies the IP address to which the Serial Adapter will send packets. Typically, the Destination Address will be the IP address of a second Serial Adapter. If two Serial Adapters are configured as a Master/Station pair, then each unit will automatically configure its Destination Address with the other's IP address, each time the units are powered on. Two Serial Adapters, both set as Stations and synchronized to the same RangeLAN2 Access Point or Extension Point, will also obtain the IP address of the other unit automatically.

As described above, the Destination Address is typically configured automatically by the RangeLAN2 Serial Adapter during each boot-up. However, the Destination Address may be set permanently using the Pairing Domain feature, as described in Chapter 5, or from within the Network Configuration Menu. Both methods will override the automatic configuration process.

If you have written a custom program to allow a wired workstation to communicate directly with a Serial Adapter, as described in Appendix B, then you must manually configure the Destination Address with the IP address of the wired workstation. The IP address of a wired workstation will not be obtained automatically and can not be set using the Pairing Domain feature.

By default, a RangeLAN2 Serial Adapter assigns itself an unassigned Class A **IP Address** based upon its unique MAC address. In cases where the Serial Adapter is used to communi-

cate with the wired infrastructure, it will be necessary to change the default address to one which is on the same subnet as the wired stations so that IP packets are routed correctly. You can override the default address using the IP Address option in the configuration menu. This parameter will not change unit the Serial Adapter is reset.

Subnet Mask indicates the mask that will be used to determine on which network the RangeLAN2 Serial Adapter is located.

Local Port Number signifies the port number on which the unit will receive packets from another Serial Adapter. The default port number is 5000. Do not change this parameter unless you experience a port number conflict in your application.

Remote Port Number signifies the port number on which the unit will send packets to another Serial Adapter. The default port number is 5000. Do not change this parameter unless you experience a port number conflict in your application.

If a packet is destined for an IP host or node that belongs to a different IP subnet, the RangeLAN2 Serial Adapter will send IP packets to the **Default Gateway Address** (usually a router) for the packets to be routed to the proper destination. This parameter will not change until the Serial Adapter is reset.

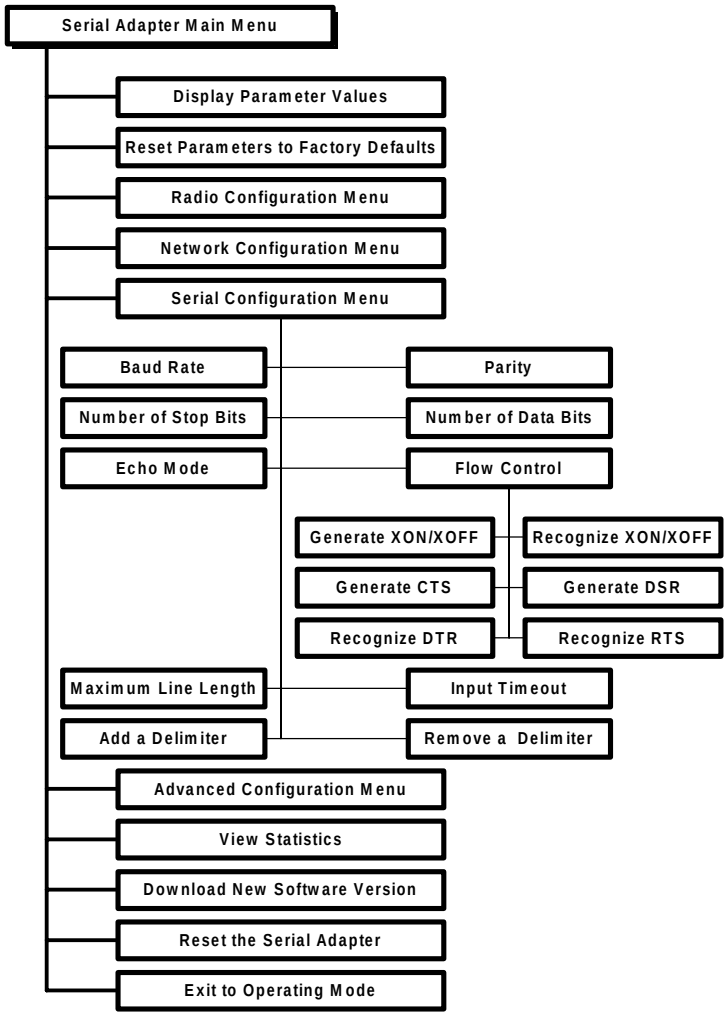
Note:

If a pair of Serial Adapters are communicating with one another across a router, you must manually assign each unit a valid IP address within its subnet and set the Default Gateway Address and appropriate Destination Address. You may not use the Pairing Domain feature to assign Destination Addresses in this scenario.

9. Serial Configuration Menu

This section describes the serial configuration parameters for the RangeLAN2 Serial Adapter.

The software tree below shows the options available:



Serial Parameters

Parameter Name	Range	Default
Baud Rate (bps)	300,1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200	9600
Parity	Even, Odd, Mark, Space, and None	None
Number of Stop Bits	1-2	1
Number of Data Bits	7-8	8
Echo Mode	None, Simple, and Terminal	None
Flow Control	Generate or Recognize XON/XOFF, Generate CTS, Generate DSR, Recognize DTR, and Recognize RTS	Generate CTS and Generate DSR
Max Line Length	1-1456	1456
Input Timeout	50 ms - 300,000 ms, 0 = no timeout	100 ms
Delimiters	ASCII Characters	None

The Serial Adapter allows the user to select a **Baud Rate** of 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200 bps. The default value is 9600 bps. The baud rate controls the rate of data transfer between the Serial Adapter and an RS-232 serial port.

You may also change the default settings for **Parity**, **Number of Stop Bits**, and **Number of Data Bits** to match the settings of your RS-232 application. The Serial Adapter will support any combination of 7 or 8 data bits, 1 or 2 stop bits, and one of the following parity settings: even, odd, mark, space, and none.

The Serial Adapter supports three **Echo Modes**: None, Simple, and Terminal. When no Echo is selected, the unit will not Echo the characters typed to the terminal screen. In the Simple Mode, all characters typed are echoed to the screen, including carriage returns. The Terminal Echo Mode specifies that the unit should behave like a terminal by removing the most recent character from the input stream upon encountering a backspace character or beeping if backspace is pressed at the beginning of a line.

The Serial Adapter supports several **Flow Control** options: Generate XON/XOFF, Recognize XON/XOFF, Generate CTS, Generate DSR, Recognize DTR, and Recognize RTS.

A Serial Adapter will pass flow control pin values over the radio to a remote Serial Adapter in order to simulate the activity of the control pins of a null modem cable.

The Serial Adapters will pass control pin values as follows:

Local Serial Adapter			**Remote Serial Adapter**
(initiated by host) RTS		→	CTS
(initiated by host) DTR		→	DSR
CTS	←		RTS (initiated by host)
DSR	←		DTR (initiated by host)

For example, when the attached RS-232 host asserts the RTS pin, the Serial Adapter will send this information to the remote Serial Adapter. In turn, the remote Serial Adapter will assert the

CTS pin, notifying the remote RS-232 host that data may be sent over the connection. This function regulates the data exchange between two RS-232 hosts.

In addition to this basic function, the Serial Adapter's flow control options regulate the data exchange between the Serial Adapter and its attached RS-232 host. Below is a short description of how each flow control option operates when enabled:

Generate XON/XOFF: When its buffers are full, the Serial Adapter will send an XOFF character to the attached host as a signal for the host to stop transmitting data to the unit. Once space becomes available within its buffers, the Serial Adapter will send an XON character to the host as a signal to begin transmission.

Recognize XON/XOFF: If the Serial Adapter receives an XOFF character from the host, it will stop sending data to the host. When it receives an XON from the host, the Serial Adapter will resume transmission.

Generate CTS: The Serial Adapter will inhibit the CTS pin if its buffers become full, and assert CTS if there is room in its buffers.

Generate DSR: The Serial Adapter will inhibit the DSR pin if its buffers become full, and assert DSR if there is room in its buffers.

Recognize DTR: The Serial Adapter will not send data to the host unless the DTR pin is asserted.

Recognize RTS: The Serial Adapter will not send data to the host unless the RTS pin is asserted.

The **Maximum Line Length** refers to the maximum number of characters the Serial Adapter must receive before transmitting the message. The maximum value for this parameter is 1456, which corresponds to the maximum size of an Ethernet packet minus the space required for the transport layer and other headers.

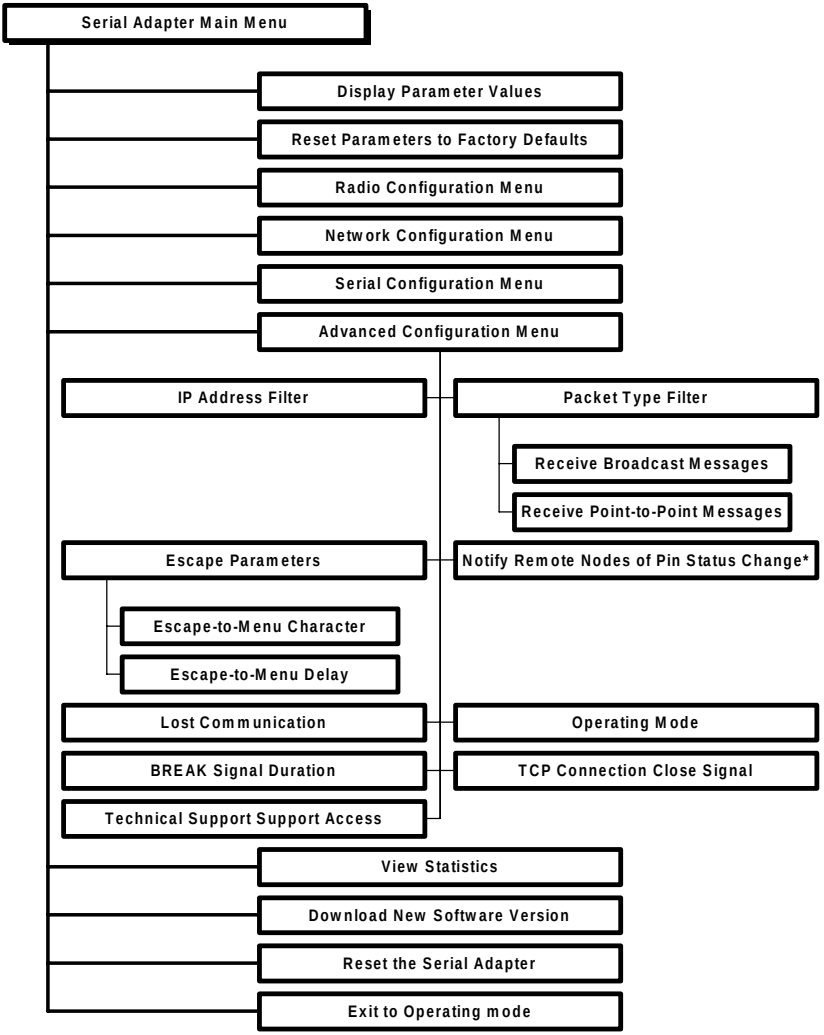
Setting this parameter to 1 will cause the unit to transmit each character as a separate packet as soon as the unit receives it. Since there is time and memory overhead associated with sending each packet, it is best to keep this number as high as is reasonable for the application. However, in an environment where many packets are damaged due to some form of interference, it may be more prudent to keep this value from being set too large.

The **Input Timeout** specifies the length of time the Serial Adapter will wait after it has received a character before sending the accumulated characters as a packet. This value may be set to between 50 and 300,000 milliseconds. A value of 0 indicates that no input timeout is set.

The Serial Adapter allows a user to select up to four different **Delimiter** characters. The unit looks for the delimiters in the input stream and sends out a packet upon receipt of one of these characters. The Serial Adapter will accept any printing ASCII character (letters, numbers, or punctuation) as a delimiter, along with blank space and carriage return. Delimiter characters are transmitted with the data.

A Serial Adapter will accumulate characters until it receives a Delimiter, reaches the specified Maximum Line Length, or the length of time specified by the Input Timeout has elapsed. When one of the these three conditions is met, the Serial Adapter will transmit the accumulated characters as a packet.

10. Advanced Configuration Menu



* For use while in packetized mode only

Advanced Parameters

Parameter Name	Range	Default
IP Address Filter	-	-
Accept Broadcast Packets	Yes/No	Yes
Accept Point-to-Point Packets	Yes/No	Yes
Escape-to-Menu Character	-	$
Escape-to-Menu Delay	Increments of 0.1 sec	1 sec
Notify Remote Nodes of Pin Status Change*	Yes/No	Yes
Lost Communication	Continue/Halt	Continue
Operating Mode	Pass-through/ Packetized	Pass-through
BREAK Signal Duration	50 ms - 10 sec in increments of 50 ms	100 ms
TCP Connection Close Signal	Yes/No	No
Technical Support Access	N/A	No

* For use in Packetized Mode only

The **IP Address Filter** parameter allows you filter out packets received by the Serial Adapter from any IP Address other than one specified IP Address. You may specify only one IP Address from which to accept messages. The default for this parameter is to receive packets from any IP Address.

The configuration menu allows you to apply **Packet Type Filters** to limit the type of messages the unit receives. You may chose to filter either Point-to-Point or Broadcast messages. By default, the Serial Adapter will accept all packet types.

The **Escape Parameters** option allows you to customize when the configuration menu will appear by changing the **Escape-to-Menu Character** from "$" and by changing the **Escape-to-Menu Delay** settings to an interval of 0.1 of a second. Note that when entering a value for the Escape-to-Menu parameter, a value of 1 corresponds to a delay of 0.1 second. Likewise, a value 10 corresponds to a 1 second delay.

The Escape-to-Menu Delay parameter sets the length of time which must elapse, with no additional keystrokes, both before and after the three identical Escape-to-Menu Characters are sent to the Serial Adapter. By default, the configuration menu appears when "$$$" is sent to the Serial Adapter and the unit has not received any characters for 1 second before or after the receipt of "$$$".

The **Notify Remote Nodes of Pin Status Change** parameter is only relevant when the Serial Adapter is in Packetized mode. When enabled, the Serial Adapter will pass changes in the status of the RTS, CTS, DTR, DSR, RI, and CD pins to the remote side of the connection. This information is not visible to the user.

The **Lost Communication** parameter allows you to set the behavior of the Serial Adapter when it is in Pass-through mode

and loses communication with its destination unit. You may set the unit to either reestablish the connection and continue transmissions or to halt communications to provide an alert that the connection has been lost.

If the Serial Adapter loses communication while set to Continue, the unit will try to reestablish communication. If the unit loses communication when set to Halt, the Status LED on the top of the unit will blink once in a repeating pattern until the unit is reset.

The **Operating Mode** parameter allows you to set the Serial Adapter to either Pass-through or Packetized mode. See Chapter 4 for a detailed discussion of these operating modes.

Some applications use a BREAK signal, sent for a specified length of time, to control the flow of data between two RS-232 devices. When a pair of Serial Adapters receive a BREAK command from an attached serial device, the units cannot determine for what length of time the BREAK signal should be sent to the other serial device. The **BREAK Signal Duration** parameter allows you to configure the duration of the BREAK signals the receiving Serial Adapter will transmit to the second RS-232 device when a BREAK command is sent by the first RS-232 device. Note that most applications do not use a BREAK signal to communicate, but refer to your application's documentation to determine if it uses a BREAK signal.

The BREAK signal may be between 50 ms and 10 seconds. This value is defined in intervals of 50 ms. Within the configuration menu, a value of 1 corresponds to 50 ms and a value of 200 corresponds to 10,000 ms or 10 seconds. By default, the BREAK signal duration is set to a value of 2, which corresponds to 100 ms.

If you have written, or plan to write, a custom application to allow communication between the RangeLAN2 Serial Adapter and an Ethernet device, set the **TCP Close Connection Signal** parameter to "Yes." When this parameter is enabled, the Serial Adapter will close an existing TCP connection upon receipt of the "$QUIT" command from a remote workstation.

For more information on the "$QUIT" command and for a discussion of how to establish communication between a Serial Adapter and an Ethernet device, see Chapter 3 and Appendix B, the Serial Adapter TCP/IP Specification.

By default, the TCP Close Connection Signal is disabled and set to "No."

The Serial Adapter configuration menu contains several parameters that are not needed for normal operation. A password is required to enable **Technical Support Access** to view these additional parameters.

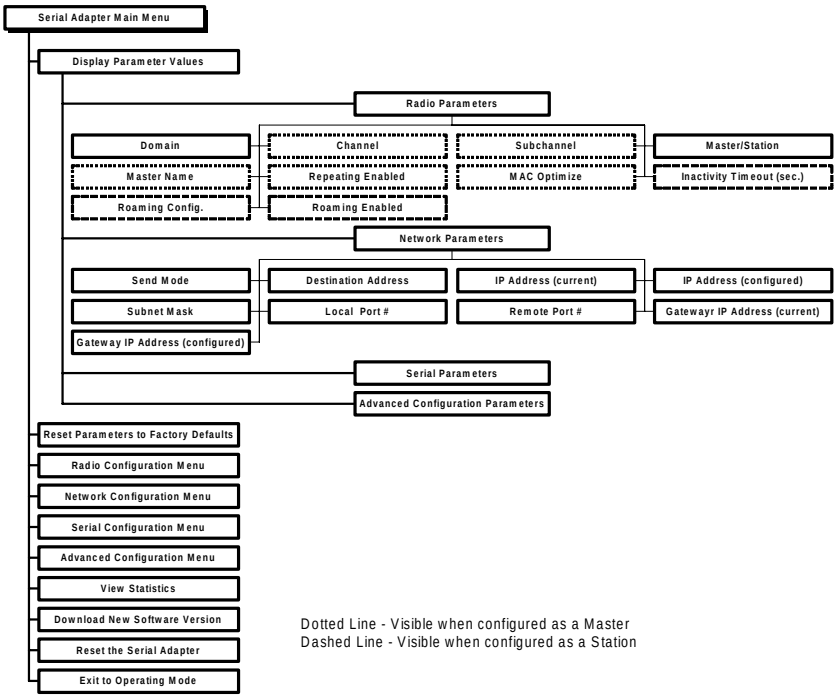
If you call Proxim Technical Support, they may ask you to enable the Support parameters, but, in general, you will not need to view or change these parameters during normal operation.

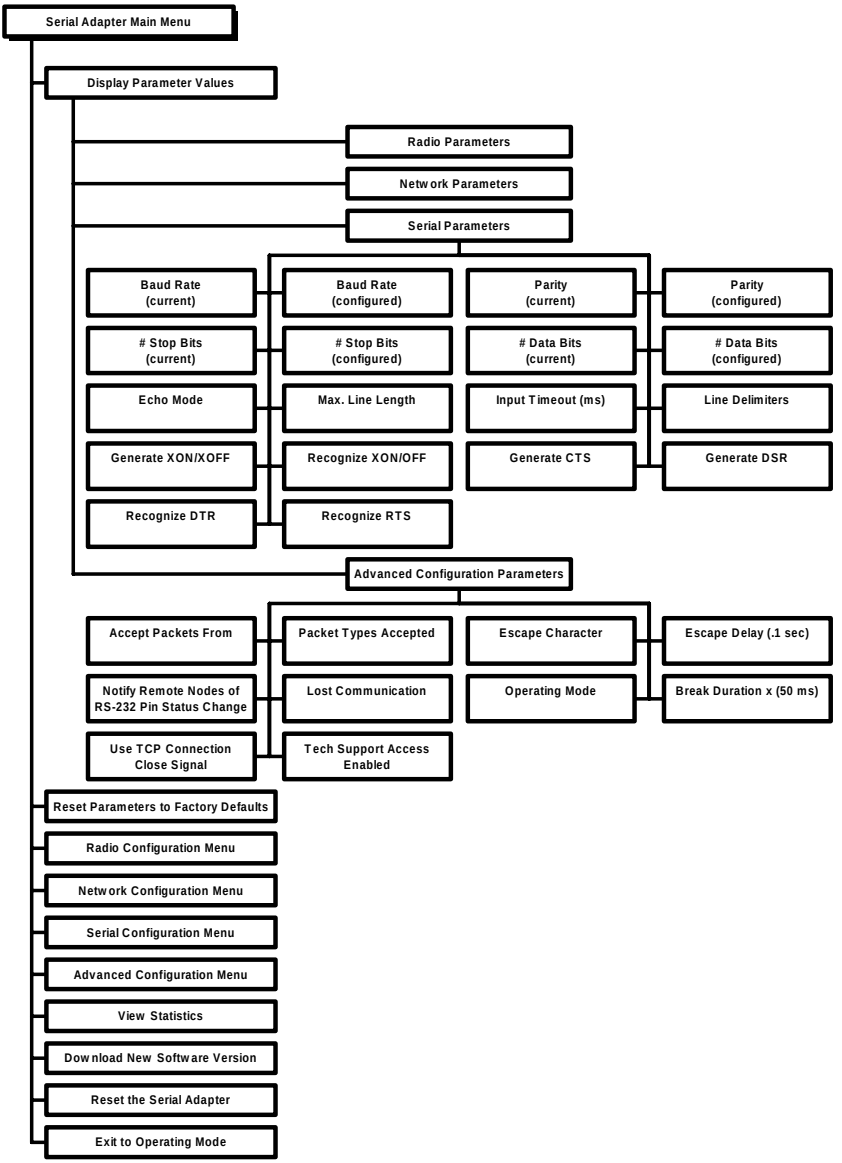
11. Display Parameter Values

The Serial Adapter displays all of the relevant parameters in one centralized location. By choosing "Display Parameter Values," you can view the current and configured values for the Radio, Network, Serial, and Advanced parameters.

Current values are already in use by the Serial Adapter. If the configured value is different from the current value, the Serial Adapter must be reset before the configured value takes effect. At that time, the configured value becomes the new current value.

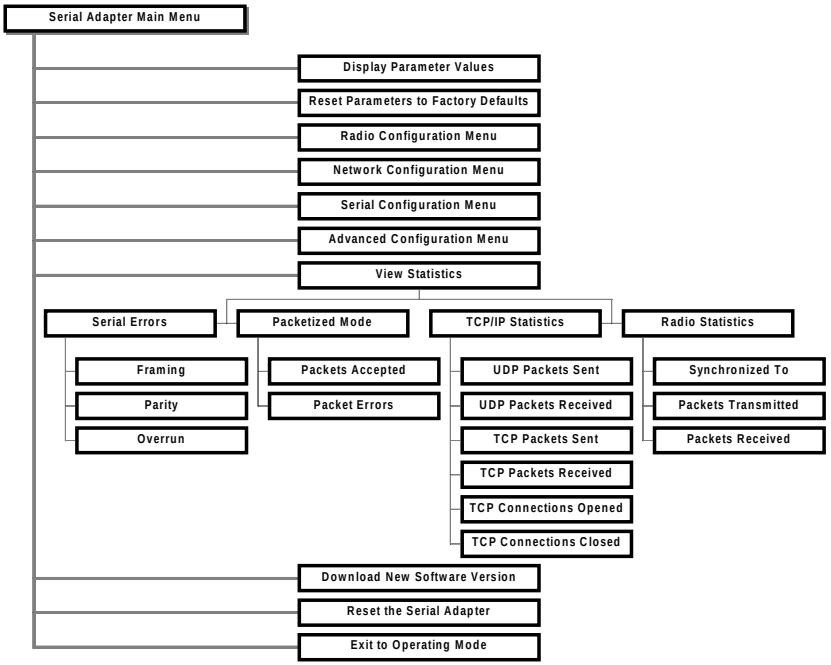
The following diagrams show the software trees associated with the Display Parameter Values menu:




Serial Adapter Main Menu
Display Parameter Values
Radio Parameters
Network Parameters
Serial Parameters
Baud Rate (current)
Baud Rate (configured)
Parity (current)
Parity (configured)
Stop Bits (current)
Stop Bits (configured)
Data Bits (current)
Data Bits (configured)
Echo Mode
Max. Line Length
Input Timeout (ms)
Line Delimiters
Generate XON/XOFF
Recognize XON/OFF
Generate CTS
Generate DSR
Recognize DTR
Recognize RTS
Advanced Configuration Parameters
Accept Packets From
Packet Types Accepted
Escape Character
Escape Delay (.1 sec)
Notify Remote Nodes of RS-232 Pin Status Change
Lost Communication
Operating Mode
Break Duration x (50 ms)
Use TCP Connection Close Signal
Tech Support Access Enabled
Reset Parameters to Factory Defaults
Radio Configuration Menu
Network Configuration Menu
Serial Configuration Menu
Advanced Configuration Menu
View Statistics
Download New Software Version
Reset the Serial Adapter
Exit to Operating Mode

12. View Statistics

You can view statistics about the RangeLAN2 Serial Adapter from the View Statistics menu. The following diagram illustrates the software tree:



Serial Errors Statistics

This category displays the number of errors occurring in the serial interface of the Serial Adapter during operation.

The Serial Adapter will record the number of framing errors that occur when a character is received over the serial line without a valid stop bit.

A parity error occurs when the parity check (i.e., even, odd, mark, or space) failed for a received character.

An overrun error occurs when the serial chip's receive buffer overflows due to an excessive number of received characters.

Packetized Mode Statistics

This category displays the number of packets accepted and the number of errors encountered by the Serial Adapter while operating in Packetized mode.

TCP/IP Statistics

This category displays information regarding the number of TCP and UDP packets sent and received by the Serial Adapter and the number of TCP connections opened and closed.

Radio Statistics

This category displays information about the packets sent and received through the radio interface and the Serial Adapter's sychronization status with a RangeLAN2 Master.

13. Performance Hints

This section provides the user with ideas for how to increase performance with Proxim wireless products.

Microwave Ovens

Microwave ovens operate in the same frequency band as RangeLAN2 products. Therefore, if you use a microwave within range of RangeLAN2 equipment, you may notice network performance degradation. However, both your microwave and your RangeLAN2 network will continue to function.

Range

Every environment is unique with different obstacles, barriers, materials, etc. and, therefore, it is difficult to determine the exact range that will be achieved without testing. Proxim has developed some guidelines to estimate the range that users will see when the RangeLAN2 7910 Serial Adapter is installed in their facility, but there are no hard and fast specifications. Note that the RangeLAN2 7911 Serial Adapter will have greater range.

Radio signals may reflect off of some obstacles or be absorbed by others depending on their construction. For example, with two RangeLAN2 radios, you may achieve up to 1000' in open space outdoors where the two antennas are line of sight, meaning they see each other with no obstacles. However, the same two units will only achieve up to 500' of range when they have to travel through the cubicles usually used in modern offices. If there are office walls to penetrate, the signal range may decrease even further to up to 300'.

If you are interested in antenna options, contact your Proxim Sales Representative about antenna kits.

Proper antenna placement can help improve range. Here are some guidelines:

- ❑ The antenna should be placed in a vertical position.
- ❑ Do not place a sheet of metal (like a filing cabinet) between two antennas.
- ❑ Two antennas that are communicating should be in the same plane. For example, do not lie one antenna on its side and have its partner standing upright.

14. Troubleshooting

The RangeLAN2 791x Serial Adapter is designed to be very easy to install and operate. If you do experience difficulties, however, use the information in this chapter to help diagnose and solve the problem. If you cannot resolve the problem, contact Proxim, as described in Appendix G, "How to Reach Technical Support."

How to Obtain Help with Your Installation

If you require assistance to install your Serial Adapter, Proxim can put you in touch with a RangeLAN2 Reseller in your area. The reseller is an expert in the design, installation, and maintenance of wireless communication products and will be able to examine your needs and recommend the most cost-effective wireless solution for your needs. For the location of the RangeLAN2 reseller nearest you, contact Proxim at 800-229-1630 and ask for the Sales Department.

LED Error Codes

The Status LED, located on the top of the Serial Adapter, will blink red in a repeating pattern to indicate an error has occurred. If you see any of the repeating flashing sequences listed below, first attempt to reset the Serial Adapter. If the flashing sequence persists after you have reset the unit, make a note of which of the above patterns you see and call Proxim Technical Support.

The Status LED will flash red to indicate the following errors:

1 brief flash: There was a buffer overflow and the buffers were flushed; no reset is required

1 blink : Lost communication with the destination

2 blinks: Memory check failed

3 blinks: Software error

4 blinks: Failed to initialize the radio

5 blinks: Memory full

6 blinks: Miscellaneous error

7 blinks: Failed to initialize the TCP/IP stack

Commonly Asked Technical Support Questions

Problem/Symptom Question	Possible Solution/Answer	Chapter in User's Guide
The Serial Adapters are not communicating.	1. Check to ensure that the Domain Switch is not set to 9 on either unit. 2. Verify that neither unit is set in the configuration menu. 3. Verify that you have the same Domain and Security ID set for both units. 4. Ensure that there is one and only one Master set in your wireless topology. 5. Verify that each Serial Adapter has the other unit's IP Address set as its Destination IP Address in the Network Configuration Menu.	3, 5, 7, 8
One of my Serial Adapters will not accept broadcast packets.	1. Verify that you do not have Packet Type Filters set to receive only point-to-point packets. 2. Ensure that you do not have the IP Address Filter set. 3. The Serial Adapter can not broadcast through a gateway or router.	8, 10
Will the Serial Adapter communicate with Proxim's other RS-232 replacement devices, like the ProxLink?	The RangeLAN2 Serial Adapter will only communicate with other RangeLAN2 Serial Adapters and other RangeLAN2 products; it will not communicate with the 900Mhz ProxLink family of products.	1

Problem/Symptom Question	Possible Solution/Answer	Chapter in User's Guide
I can't bring up the Configuration Menu.	1. Verify that your terminal settings match those set on the Serial Adapter. 2. Ensure that you are using a RS-232 cable to connect the Serial Adapter that conforms to the Serial Adapter Pin Specification as shown in Chapter 5. 3. Be sure to only type only three "$" symbols in rapid succession. Typing two or four characters will not bring up the menu. 4. Changing the Domain Switch to 9 will bring up the configuration menu at 9600 bps 8N1.	5, 6, 7
The throughput seems slow.	To achieve maximum throughput, verify your antennas are well-placed, not behind metal, and there are not too many obstacles.	13
Why are there 16 Domain choices in the configuration menu but only 10 on the Domain rotary switch?	The rotary switches are designed to allow users to configure the Serial Adapters without running the configuration software. Domains 0-8 on the dial correspond to Domains 0-8 in the software configuration menu. If your wireless environment requires more than 9 Domains, you should use the software configuration tool to set a unit to Domains 9-15. Do not use Domain 9 on the Domain Switch in normal operation because it will bring up the software configuration menu.	5, 7
Why do all of the characters appear twice on my computer screen?	You may have set one or more Serial Adapters to Simple or Terminal Echo Mode. Check your units to ensure that Echo Mode is set to None.	9

A. Packetized Mode Specification

Overview

The purpose of the Serial Adapter is to accept information from a serial line and transmit it reliably via radio to another RangeLAN2 station, or to a wired station through a RangeLAN2 Access Point. Serial Adapters receiving information transfer it to an external computer ("External Computer") via their own serial lines. The Serial Adapter contains a sophisticated radio protocol which permits orderly and reliable flow of information over the radio network in the presence of an unknown (and possibly varying) population of RangeLAN2 units.

This document does not explore the details of the radio protocol. Instead, it focuses on the protocol used to exchange information with an External Computer via the Serial Adapter's serial line.

Pass-through Versus Packetized Mode

On the surface, it would appear that the radio protocol used by Serial Adapters to communicate with one another is the only protocol necessary. Information passing into the serial line should simply be captured by the Serial Adapter, and forwarded to the destination Serial Adapter using the radio protocols built into the Serial Adapter. Each Serial Adapter should transparently forward any information coming into its serial line onto the radio network. The serial line would effectively have no protocol; all data would simply be passed through to the radio network.

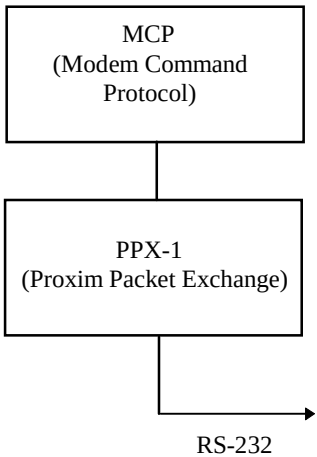
Proxim does provide a mode in the Serial Adapter which behaves in this way, called the Pass-through mode. Because the Pass-through mode does not require data sent into its serial line to be formatted in any way, it is an excellent choice for applications where the Serial Adapter is used to replace a wire or in applica-

tions where developing special software to interact with the Serial Adapter is undesirable.

For some applications, the Pass-through mode of operation is not ideal. For example, because the Pass-through Serial Adapter takes all information arriving at its serial line as data to be sent out over the radio network, it is not possible to change the Serial Adapter's configuration on the fly by sending it commands over the serial line.

For the External Computer to be able to send both data and commands to the Serial Adapter, both the Serial Adapter and the External Computer must agree on some rules of order for distinguishing data packets from command packets. Proxim has defined a simple serial protocol which performs this function. This protocol is incorporated into the packetized mode of the firmware. The remainder of this document is devoted to an explanation of the Packetized mode serial protocol.

The figure below illustrates the protocol architecture of the Packetized mode.



The Modem Command Protocol (MCP) is an application layer protocol by which an External computer may exchange commands, status information, and data with the Serial Adapter over the Serial Adapter's RS-232 serial line. Since the protocol is an application layer protocol, it contains no provision for error recovery over the serial line. This problem of error recovery is a layer 2 problem and is handled by the Proxim layer 2 serial protocol, the PPX-1.

The MCP protocol consists of a set of commands which cause the Serial Adapter to transmit data, change an operating parameter, or respond with status information. The MCP protocol is conveyed over the serial line using the PPX-1 layer two protocol. The details of the PPX-1 protocol are unrelated to the details of the MCP protocol.

The PPX-1 protocol used by the Serial Adapter is very similar to what is used by Proxim's 900 MHz ProxLink. The MCP protocol is designed to be compatible with the 900 MHz product wherever possible, but because the 2.4 GHz Serial Adapter contains additional features, uses a different radio, and handles networking differently, there are significant changes.

PPX-1 is a very simple, unacknowledged protocol. No provision is made within PPX-1 for error correction (retries, etc). PPX-1 does provide simple error detection through the use of a check code. The most significant attribute of PPX-1 is it simplicity.

The table below summarizes the features of the PPX-1 layer 2 protocol:

Error Detection	16-bit Checksum
Error Correction	None
Suitable Applications	Serial line to Serial Adapter is short Higher layer error correcting protocol is in use above PPX-1

PPX-1 Protocol

The following is the format of the PPX-1 packet:

```
BYTE      SOH          ;Start of header for synchronization
                       (ASCII 01H)
BYTE      LEN H        ;High byte of length
BYTE      LEN L        ;Low byte of length
BYTE      HEADER       ;= NOT(LEN L) +
          CHECK        ;NOT(LEN H), this is an
                       ; arithmetic sum
BYTES     DATA         ;This is where the MCP COMM-
                       ;AND is contained (see section 3)
BYTE      CHECK-        ;16 bit check sum of data
          SUM H
BYTE      CHECKSUM L
```

Note that the LEN field is the length of the DATA section, not including the CHECKSUM field.

The purpose of the header is to make frame synchronization easier. In asynchronous communications where the data field may have any ASCII value, this is a difficult problem. The HEADER CHECK field is intended to provide a fairly secure way of making sure that a header has actually been found.

The maximum permissible packet length is 1456 bytes (not including the header and checksum).

Modem Command Protocol (MCP)

This section describes the Modem Command Protocol. All of the commands which the Serial Adapter will accept are listed below. Each command begins with a command byte which tells the Serial Adapter which command the message contains.

Some commands cause the Serial Adapter to produce a response packet at a later time. The format of all possible Serial Adapter responses is listed in the section entitled "MCP Response from the Serial Adapter." The first byte of each response generated by the Serial Adapter also contains a "command" byte which the External Computer can use to distinguish different responses from each other.

When the External Computer sends a command to the Serial Adapter which will cause the Serial Adapter to generate a response, the External Computer need not wait until the response is sent by the Serial Adapter before sending the Serial Adapter another command. In other words, the External Computer may have multiple commands outstanding to the Serial Adapter at once. If the Serial Adapter has been sent multiple commands, it will not, in general, respond to the commands in the same order that they are received. The reason for this is that some commands take much longer to execute than others. The Serial Adapter attempts to respond to each command as rapidly as possible.

If the External Computer elects to take advantage of this feature, the software in the External Computer must be able to unambiguously associate responses with their corresponding commands. The Serial Adapter Command Protocol contains a feature that makes this process easier.

Each Serial Adapter command for which there is a Serial Adapter response contains an extra field known as the seqno field. When

the External Computer creates a command packet, it should place a unique number (from 0 to 127) into the seqno field of the packet. When the Serial Adapter later generates a response to that packet, it will place this same value in the seqno field of the response. In this way, the External Computer can match responses with commands.

MCP Command Messages to the Serial Adapter

This section describes each of the messages which may be sent to the Serial Adapter via its RS-232 serial line by an External Computer. The first byte of each command specifies the command that the Serial Adapter is to perform. It is followed by data bytes which are actually arguments to the command. The data format is 8 data bits, no parity, 1 stop bit.

Transmit Data Packet

Purpose: To send a data message over the radio to the specified Serial Adapter.

Response Expected from Serial Adapter: "Status Indication of Transmitted Packet"

Message Format:

```
BYTE    command (ASCII 'T', 54H)
BYTE    seqno
BYTE    len H          ; Length of data field below
BYTE    len L
BYTE    destaddr H
BYTE    destaddr 3
BYTE    destaddr 2
BYTE    destaddr L
BYTES   data
```

The four byte address field is the IP address of the destination node. Broadcast addresses (for example, x.y.z.255) can also be used.

Request Radio Signal Strengths

Purpose: To request the Serial Adapter to measure the strength of RF energy on its current radio channel and report the signal strength. The signal strength is reported as an 8-bit value from 00H (minimum signal value) to FFH (maximum signal value).

Response Expected from Serial Adapter = "Signal Strength Report"

Message Format:

BYTE	command (ASCII 'R', 52H)
BYTE	seqno

Request Serial Adapter Version

Purpose: To request the physical address and version number of the Serial Adapter. The address is reported as a 4 byte value, only the lower 28 bits of which are meaningful. The version number is reported as a 7 character string.

Response Expected from Serial Adapter = "Serial Adapter Version Report"

Message Format:

BYTE	command (ASCII 'V', 56H)
BYTE	seqno

Go To Standby

Purpose: The purpose of this command is to place the Serial Adapter in Standby mode in order to conserve current. For this command to work properly, the RTS line at the Serial Adapters serial connector must be inactive. The Serial Adapter can be removed from Standby mode by asserting the RTS line.

Response Expected from Serial Adapter = None.

Message format:

BYTE	command (ASCII 'G', 47H)

Initialize Serial Adapter

Purpose: To initialize the Serial Adapter.

Response Expected from Serial Adapter: "Initialization Confirmation"

Message Format:

BYTE	command (ASCII 'I', 49H)
BYTE	seqno

Set Radio Channel

Purpose : To set the Serial Adapter's radio channel.

Response Expected from Serial Adapter: "Radio Channel Confirmation"

Message Format:

BYTE	command (ASCII ‘C’, 43H)
BYTE	seqno
BYTE	Radio Channel (1 to 15)

Set Network Subchannel

Purpose: To set the subchannel of the Serial Adapter’s network protocol.

Response Expected from Serial Adapter: “Subchannel Confirmation”

Message Format:

BYTE	command (ASCII ‘S’, 53H)
BYTE	seqno
BYTE	subchannel (1 to 15)

Set Baud Rate

Purpose: To set the baud rate of the Serial Adapter serial line. When the command is received, the Serial Adapter generates the Baud Rate Confirmation message. After that, it then switches to the new baud rate.

Response Expected from Serial Adapter: “Baud Rate Confirmation”

Message Format:

BYTE	command (ASCII ‘B’, 42H)
BYTE	seqno
BYTE	baudrate (HEX 02 through 0A)

The meaning of the baud rate argument is as follows:

Value of baudrate field	Baud rate
2	300
3	1200
4	2400
5	4800
6	9600
7	19200
8	38400
9	57600
A	115200

Station Search

Purpose: To send a broadcast message asking any station receiving the message to reply with its IP address.

Response Expected from Serial Adapter: “Station Search Reply”

BYTE	command (ASCII ‘A’, 41H)

Get RS-232 Pin Status

Purpose: To get the pin status of the specified destination node.

Response Expected from Serial Adapter: “RS-232 Pin Status Reply”

BYTE	command (ASCII ‘P’, 50H)
BYTE	seqno
4 BYTES	IP address of remote node, 0.0.0.0 acceptable for default destination.

Call up Configuration Menu

Purpose: To invoke the Serial Adapter configuration menu from packetized mode.

Response Expected from Serial Adapter: None

BYTE	command (ASCII 'M', 4DH)

Override RangeLAN2 Parameters

Purpose: To allow a Serial Adapter application to set the Domain, Security ID, and MASTER/STATION status. The new values will not be written to EEPROM, and therefore will go away when the Serial Adapter is powered off. The Serial Adapter must be re-initialized for the changes to take effect.

Response Expected from Serial Adapter: "RangeLAN2 Parameter Confirmation"

BYTE	command (ASCII 'O', 4FH)
BYTE	seqno
BYTE	Function number: 1= Set Domain 2= Set Security ID 3= Set MASTER/STATION
BYTE	data (functions 1 and 3 only) Function 1: Domain number (0-15) Function 3: 0= MASTER, 1= STATION
20 BYTES	data (Function 2 only) Security ID string. If the string is less than 20 bytes, pad with NULL characters.

MCP Responses From Serial Adapter

This section describes the format of MCP response messages passed from the Serial Adapter to an External Computer.

Data Packet Received

Purpose: This is the message used by the Serial Adapter to deliver packets to the External Computer which have been received by the Serial Adapter over the radio.

Message Format:

BYTE	response (ASCII ‘d’, 64H)	
BYTE	rssi	;Radio signal strength of received :packet
BYTE	pinstat	;RS-232 pin status of sending node
BYTE	len H	;Length of the user message
BYTE	len L	
BYTE	srcaddr H	;IP Address of source
BYTE	srcaddr 3	
BYTE	srcaddr 2	
BYTE	srcaddr L	
BYTES	user message	

Status Indication of Transmitted Packet

Purpose: This message informs the External Computer of the status of the most recent data message sent to the Serial Adapter with the Transmit Data Packet command. The response contains a duplicate of the sequence number provided in the original Transmit Data Packet message, as well as the length and destination address. In addition, a StatusInd code is provided which indicates whether the message was sent successfully to the TCP/IP stack or not.

The StatusInd field does not show whether the destination node has received the message.

Message Format:

BYTE	response (ASCII ‘t’, 74H)	
BYTE	seqno	(from original command)
BYTE	len H	(from original command)
BYTE	len L	(from original command)
BYTE	destaddr H	(from original command)
BYTE	destaddr 3	(from original command)
BYTE	destaddr 2	(from original command)
BYTE	destaddr L	(from original command)
BYTE	StatusInd	

The valid values of the StatusInd field are as follows:

00H: Successful Transmission to the TCP/IP stack
01H: Transmission Error

Signal Strength Report

Purpose: This packet is generated by the Serial Adapter in response to a Request Radio Signal Strength command. The packet contains the signal strength value for the Serial Adapter’s current radio channel. The signal strength value range from 00H to FFH. A value of FFH signifies maximum signal strength.

Message Format:

BYTE	response (ASCII ‘r’, 72H)
BYTE	seqno (from original command)
BYTE	Signal strength on current channel

Serial Adapter Version Report

Purpose: This packet is generated by the Serial Adapter in response to a Request Serial Adapter Version command. The packet contains the 4-byte IP address of the Serial Adapter, along with the Version string and a code indicating the radio type.

Message Format:

BYTE	response (ASCII 'v', 76H)
BYTE	seqno (from original command)
BYTE	IPaddr H ;Serial Adapter's IP Address
BYTE	IPaddr 3
BYTE	IPaddr 2
BYTE	IPaddr L
7 BYTES	string (7 byte ROM version number string)
BYTE	Radio Type(03= RangeLAN2 Extended Range)

Standby Confirmation

Purpose: This packet is generated by the Serial Adapter after a Go To Standby command is received from the External Computer. Immediately after generating this response, the Serial Adapter enters standby mode. The Serial Adapter can only be removed from standby mode by asserting the RTS input signal.

Message Format:

BYTE	response (ASCII 'g', 67H)

Initialization Confirmation

Purpose: This packet is generated by the Serial Adapter after an Initialize Serial Adapter command is received from the External Computer. For convenience, the packet contains the physical address of the Serial Adapter.

Message Format:

BYTE	response (ASCII ‘i’, 69H)
BYTE	seqno (from original command)
BYTE	IPaddr H (Serial Adapter’s IP Address)
BYTE	IPaddr 3
BYTE	IPaddr 2
BYTE	IPaddr L
7 BYTES	string (7 byte ROM version number string)
BYTE	Radio Type: 03= RangeLAN2 Extended Range, 04= RangeLAN2 Extended Range, 100mW (Europe)

Radio Channel Confirmation

Purpose: This packet is generated by the Serial Adapter after a Set Radio Channel command is received from the External Computer. The radio channel provided in the original command is included in the response.

Message Format:

BYTE	response (ASCII ‘c’, 63H)
BYTE	seqno (from original command)
BYTE	Radio Channel (1 to 15, from original command)

Subchannel Confirmation

Purpose: This packet is generated by the Serial Adapter after a Set Network Subchannel command is received from the External Computer. The subchannel provided in the original command is included in the response.

Message Format:

BYTE	response (ASCII ‘s’, 73H)
BYTE	seqno (from original command)
BYTE	subchannel (1 to 15, from original com mand)

Baud Rate Confirmation

Purpose: This message is sent after a Set Baud Rate command is received by the Serial Adapter. Note that this message is sent **at the old baud rate**. The Serial Adapter switches to the new baud rate immediately after this response is sent.

Message Format:

BYTE	response (ASCII ‘b’, 62H)
BYTE	seqno (from original command)
BYTE	baud rate (02H to 0AH, from original command)

Station Search Reply

BYTE	response (ASCII ‘a’, 61H)
4 BYTES	Serial number (IP address) of responding station

RangeLAN2 Parameter Confirmation

BYTE	response (ASCII ‘o’, 6FH)
BYTE	seqno
BYTE	Function number
BYTE	status 0= success 1= error

RS-232 Pin Status Reply

BYTE	response (ASCII ‘p’, 70H)
BYTE	seqno
BYTE	status 0= success 1= error
4 BYTES	IP address of remote node
BYTE	pin status

The pin status byte b will consist of the following fields:

b0: 1 if DTR is asserted
b1: 1 if DSR is asserted
b2: 1 if RTS is asserted
b3: 1 if CTS is asserted
b4: 1 if CD is asserted
b5: 1 if the destination has sent a BREAK
b6: reserved and always 0
b7: reserved and always 0

B. Serial Adapter TCP/IP Specification

The fundamental obstacle to allowing a Serial Adapter to communicate with a wired workstation is that the two units communicate in different ways. To address this discrepancy, the user must have a custom application programmed by someone familiar with TCP/IP networks. This custom TCP/IP program will allow the wired workstation to communicate in the same manner as the Serial Adapter.

Below is a broad overview of the steps necessary to establish communications between a Serial Adapter and a station on a wired Ethernet network.

This procedure is written for the case where one Serial Adapter is talking to a workstation on an Ethernet network; it can easily be expanded to have multiple Serial Adapters communicating with a single wired workstation.

1. Connect a RangeLAN2 Access Point to the wired network.

2. Set the Serial Adapter as a Station and have it synchronize to the Access Point by setting the Domain and Security ID on the Serial Adapter to match the values used by the Access Point.

3. Ensure that the wired workstation is running the TCP/IP protocol.

4. The user must write a custom program to run on the wired workstation in order to communicate with the Serial Adapter. This program must use a library that interfaces with the TCP/IP protocol to send and receive data.

For example, Windows Sockets is the most commonly used interface on a PC and is a standard part of Windows 95. Note

that Windows Sockets programs require a compiler, such as Visual C++, in order to be executed. On UNIX machines, Berkeley Sockets is available on most of the common platforms.

5. The data sent to the Serial Adapter must be formatted appropriately. A four-byte header precedes the user data that is sent. The contents of the four header bytes is as follows:

BYTE 1: Packet type

0= point-to-point (UDP or TCP), or 1= broadcast

BYTES 2 and 3: Packet length.

This is the length of the user data to be sent in this packet. The allowable range of lengths is 1-1456 bytes. The length bytes are arranged in network byte order.

BYTE 4: This byte is used to communicate RS-232 pin status to other Serial Adapters. Use a value of 0F (Hex) to ensure that the wired workstation and the Serial Adapter will communicate without interruption.

The pin status byte includes the following information:

Bit 0 is set if DTR is asserted on the sending side; set this to a value of 1 so that the Ethernet workstation will appear to have DTR asserted.

Bit 1 is set if DSR is asserted on the sending side.

Bit 2 is set if RTS is asserted on the sending side; set this to a value of 1 so that the Ethernet workstation will appear to have RTS asserted.

Bit 3 is set if CTS is asserted on the sending side.

Bit 4 is set if CD is asserted on the sending side.

Bit 5 is set if the sending host has sent a BREAK; this bit should be set to 0.

Bit 6: Reserved and always set to 0.

Bit 7: Reserved and always set to 0.

Messages received from the Serial Adapter will contain the four-byte header before the actual data. Note that the header size and format is the same whether the Serial Adapter is in Pass-through or Packetized mode.

6. The port numbers, IP Address, Destination Address, and Send Mode need to be set up on the Serial Adapter to match what your program on the wired workstation is using.

The Remote Port Number must match the port number on which your workstation program is listening.

The IP Address and Local Port Number must match the port number and address to which your workstation program is sending.

If the Serial Adapter is in Pass-through mode, the destination address must be set to the IP address of the wired workstation. If the Serial Adapter is in Packetized mode, your Packetized mode program must set the Destination Address of the data packets it sends to the IP address of the wired workstation.

The Send mode of the Serial Adapter must match the protocol that your workstation program is using to receive messages (TCP or UDP).

7. The Default Gateway Address and Subnet Mask parameters on the Serial Adapter must be set to the appropriate values for your network. See your Network Administrator for details.

8. It is also possible to do a station search from a wired workstation to determine the IP Address of any Serial Adapters within range. The station search is a one byte packet (value of the byte is 2), sent as a UDP broadcast.

Each Serial Adapter that receives the search packet will send the following response:

1 BYTE: packet type (= 3)

4 BYTES: IP address of responding Serial Adapter

The response is sent by the Serial Adapter using a directed UDP message.

Many reference books are available on Sockets programming, both for Windows and UNIX. Suggested reference books include:

Comer, Douglas E., *Internetworking with TCP/IP*, Vol. 1-3, 3rd ed. Prentice-Hall, Englewood Cliffs, New Jersey, 1995.
Stevens, W. Richard, *TCP/IP Illustrated*, Vol. 1-3, Addison-Wesley, Reading, Mass., 1994.

Stevens, W. Richard, *UNIX Network Programming*: *Networking APIs: Sockets and XTI*, 2nd ed., Prentice-Hall, Englewood Cliffs, New Jersey, 1997.

Sample TCP/IP Communication Programs

On the following pages are four pieces of sample code written in Berkeley Sockets as an example of the type of custom code which must be written so that the Serial Adapter can communicate with nodes on an Ethernet network.

Note:

If your custom program makes use of the "$QUIT" command so that the Serial Adapter will close open TCP connections, set the TCP Close Connection Signal parameter to "Yes" within the Serial Adapter's Advanced Configuration Menu.

Sample TCP Receive Program

```
1     /*********************************************************
2   * tcprecv.c
3   * Receives messages from one or more Serial Adapters using TCP
4   *
5       *********************************************************/
6
7    #include <sys/types.h>
8    #include <sys/socket.h>
9    #include <netinet/in.h>
10   #include <netdb.h>
11   #include <stdio.h>
12
13   #define TRUE  1
14
15   main()
16   {
17      int i, sock, length;
18      struct sockaddr_in server;
19      int msgsock;
20      char buf[1024];
21      int rval;
22      FILE *logfile;
```

```
23
24
25      /* Open the log file */
26      logfile= fopen("proxlink.log", "wb");
27     if (!logfile) {
28         printf("Error: Couldn't open log file\n");
29         exit(1);
30     }
31
32      /* Create socket */
33    sock= socket(AF_INET, SOCK_STREAM, 0);
34     if (sock < 0) {
35         perror("opening stream socket");
36         exit(2);
37     }
38
39      /* Create a name with wildcards */
40     server.sin_family= AF_INET;
41    server.sin_addr.s_addr= INADDR_ANY;
42     server.sin_port= 0;
43     if (bind(sock, (struct sockaddr *)&server, sizeof(server)) < 0) {
44         perror("binding stream socket");
45         exit(3);
46     }
47
48      /* Find assigned port number and print it out */
49     length= sizeof(server);
50     if (getsockname(sock, (struct sockaddr *)&server, &length) < 0) {
51         perror("getting socket name");
52         exit(4);
53     }
54
55     printf("Socket port #%d\n", ntohs(server.sin_port));
56
57      /* Start accepting connections. Listen() will return when it
58        determines that a remote machine is trying to open a
59        connection. The second parameter to listen() is a queue
60        length, which is the maximum number of pending connections
61        allowed on that socket at any given time.
62      */
63     do {
64         listen(sock, 5);
```

```
65        /* Establish the TCP connection. Accept() returns a new
66           socket number for the connection, allowing listen() to
67           (if desired) continue to listen on the old socket.
68
69           Parameters to accept() are: the socket that the
70           previous listen() call was using, a sockaddr structure,
71           and the length of the sockaddr structure. The second
72           and third parameters are zero here, but can be used to
73           get the IP address and port number of the remote end of
74           the connection. */
75        msgsock= accept(sock, (struct sockaddr *)0, (int *)0);
76        if (msgsock==-1) {
77          perror("accept");
78        }
79        else do {
80          memset(buf, 0, sizeof(buf));
81          if ((rval= read(msgsock, buf, 1024)) < 0)
82          {
83                    perror("reading stream message");
84                    exit(5);
85          }
86          else if (rval==0) {
87                    printf("Read zero bytes. Exiting...\n");
88              exit(6);
89          }
90          else {
91                    /* Print out data on screen and log it to the logfile.
92                       Note we are skipping the Serial Adapter header bytes. */
93                    printf("Read %d bytes\n", rval);
94              buf[rval]= '\0';
95                    if (rval > 4)
96                       printf("Data: —> %s\n", buf+4);
97                    for (i= 0; i< rval; i++)
98                       fputc(*(buf+i), logfile);
99              fclose(logfile);
100                   logfile= fopen("proxlink.log", "ab");
101         }
102       } while (TRUE);
103
104     } while (TRUE);
105   }
```

Sample TCP Send Program

```
1       /*********************************************************
2    * tcpsend.c
3    * Sends a message to a Serial Adapter using TCP
4    *
5         *********************************************************/
6
7    #include <sys/types.h>
8    #include <sys/socket.h>
9     #include <netinet/in.h>
10    #include <netdb.h>
11    #include <stdio.h>
12
13    #define DATA “Half a league, half a league...”
14    #define DATA1 0
15
16    main(argc, argv)
17     int argc;
18    char *argv[];
19    {
20       int sock;
21        short dataLength;
22       struct sockaddr_in server;
23        struct hostent *hp, *gethostbyname();
24       char buf[1024];
25
26       if (argc < 3) {
27          printf(“Usage: tcpsend  hostname  port#\n”);
28          exit(3);
29       }
30
31        /* Create socket. */
32      sock= socket(AF_INET, SOCK_STREAM, 0);
33       if (sock < 0) {
34          perror(“opening stream socket”);
35          exit(1);
36       }
37
38        /* Connect socket using name specified on command line */
39      server.sin_family= AF_INET;
```

```
40      hp= gethostbyname(argv[1]);
41     if (hp==0) {
42        fprintf(stderr, "%s: Unknown host\n", argv[1]);
43        exit(2);
44      }
45      memcpy( (char *)&server.sin_addr, (char *)hp->h_addr, hp-h_length);
46      server.sin_port= htons(atoi(argv[2]));
47
48       /* Use the connect() socket call to initiate a TCP connection with
49         the remote machine. */
50       printf("Connecting...\n");
51      if (connect(sock, (struct sockaddr *)&server, sizeof(server)) < 0 ) {
52        perror("Connecting stream socket");
53        exit(1);
54      }
55       printf("Connected.\n");
56
57       /* Construct message, including Serial Adapter header bytes */
58      buf[0]= DATA1;
59       buf[3]= 0xf0;
60       dataLength= strlen(DATA);
61      memcpy(&buf[1], &(htons(dataLength)), sizeof(short));
62     strcpy(&buf[4], DATA);
63      printf("%s\n", &buf[4]);
64
65       /* Send message */
66      if(write (sock, buf, dataLength+4) < 0)
67        perror("Sending stream message");
68
69       /* Send $QUIT string to the serial adapter to tell it to close its
70         side of the TCP connection. */
71       dataLength= 5;
72      memcpy(&buf[1], &(htons(dataLength)), sizeof(short));
73     memcpy(&buf[4], "$QUIT", 5);
74      if(write (sock, buf, dataLength+4) < 0)
75        perror("Sending $QUIT message");
76
77       close(sock);
78       exit(0);
79
80   }
```

Sample UDP Receive Program

```
1     /*********************************************************
2    * udprecv.c
3    * Receives a series of messages from a Serial Adapter using UDP.
4    *
5         *********************************************************/
6
7      #include <sys/types.h>
8      #include <sys/socket.h>
9      #include <netinet/in.h>
10    #include <stdio.h>
11
12    main()
13    {
14       int sock, length, nbytes;
15       struct sockaddr_in name;
16       char buf[1024];
17       FILE *logfile;
18
19       /* Open the log file */
20       logfile= fopen("proxlink.log", "wb");
21      if (!logfile) {
22          printf("Error: Couldn't open log file\n");
23          exit(4);
24       }
25
26       /* Create socket from which to read */
27      sock= socket(AF_INET, SOCK_DGRAM, 0);
28       if (sock < 0) {
29          perror("opening datagram socket");
30          exit(1);
31       }
32
33       /* Create a name with "wildcards": The machine will assign its
34          IP address and a port number. */
35      name.sin_family= AF_INET;
36      name.sin_addr.s_addr= INADDR_ANY;
37       name.sin_port= 0;
38
39       /* The bind() call associates a local IP address and port number
40          with the socket */
```

```
41     if (bind(sock, (struct sockaddr *)&name, sizeof(name)) < 0) {
42        perror("binding datagram socket");
43        exit(1);
44     }
45
46     /* Find assigned port value and print it out. Getsockname() gets
47        the local IP address and port number associated with a socket. */
48     length= sizeof(name);
49     if (getsockname(sock, (struct sockaddr *)&name, &length) < 0) {
50        perror("getting socket name");
51        exit(1);
52     }
53
54     printf("Socket port #%d\n", ntohs(name.sin_port));
55
56     while(1) {
57        /* Read from the socket */
58        if ((nbytes= read(sock, buf, 1024)) < 0) {
59           perror("Receiving datagram packet");
60           exit(2);
61        }
62        /* Print data to screen, not including Serial Adapter header */
63        buf[nbytes]= '\0';
64        printf("Data: —> %s\n", buf+4);
65     }
66
67  }
```

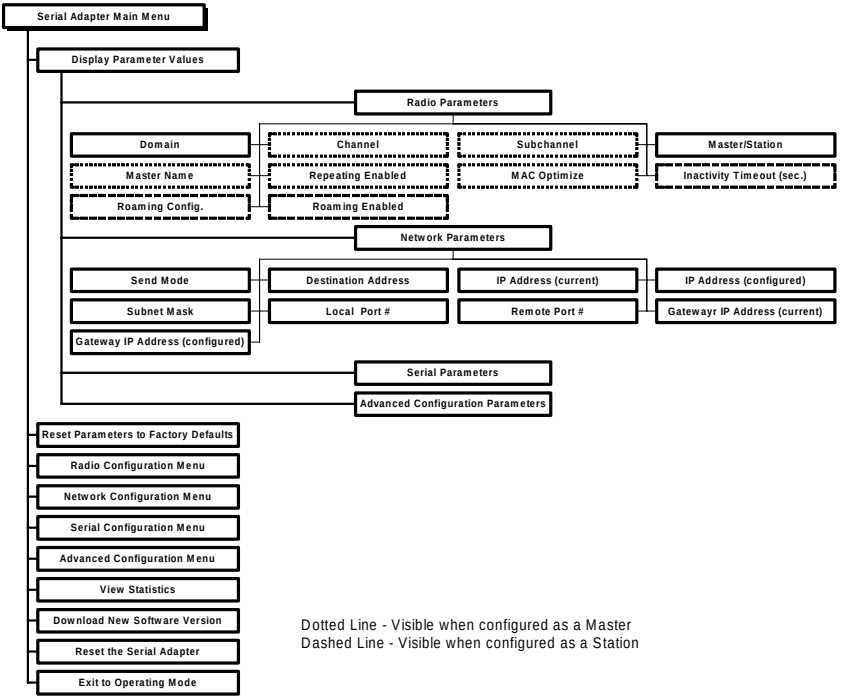
Sample UDP Send Program

```
1     /*************************************************************
2    *  udpsend.c
3    *  Sends a series of messages to a Serial Adapter using UDP.
4       *************************************************************/
5
6     #include <sys/types.h>
7     #include <sys/socket.h>
8     #include <netinet/in.h>
9     #include <netdb.h>
10   #include <stdio.h>
11
12   #define DATA "The sea is calm, the tide is full..."
```

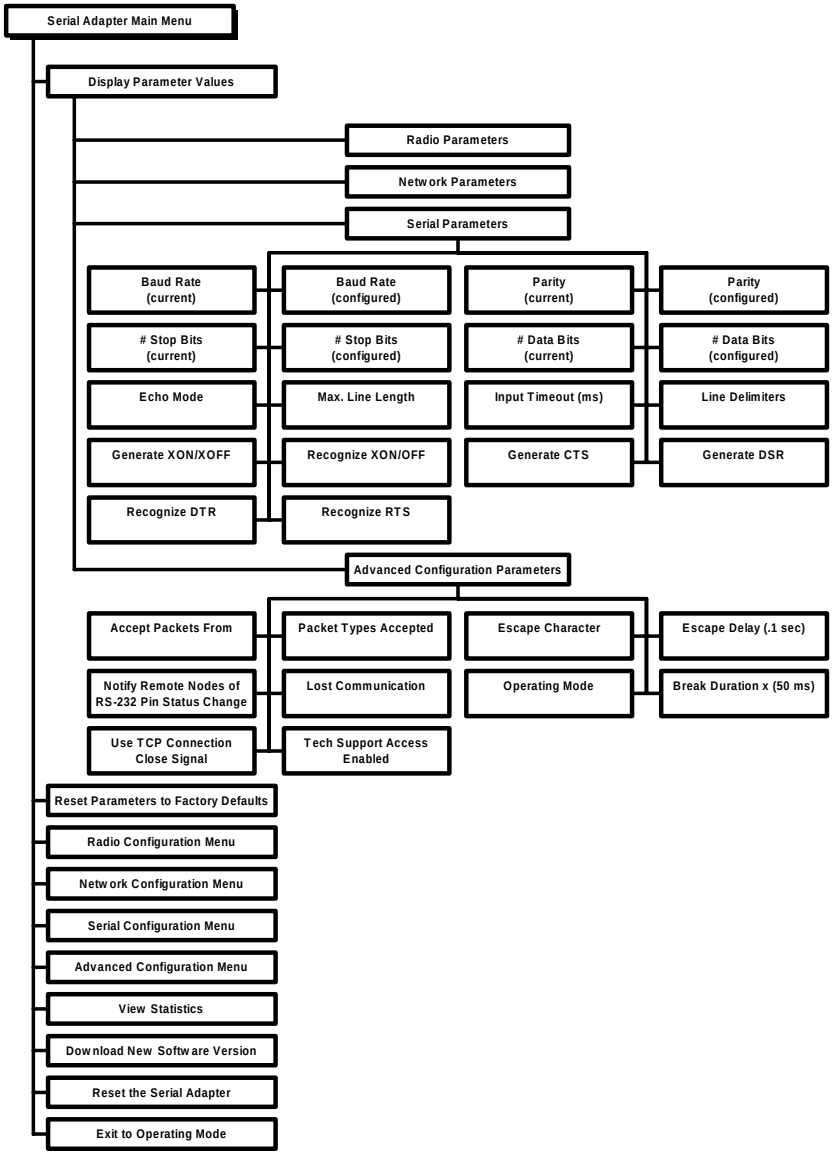
```
13  #define DATA1 0
14
15  main(argc, argv)
16   int argc;
17  char *argv[];
18  {
19     int i, sock;
20     short dataLength;
21     short networkDataLength;
22     long npackets= 0;
23     char buf[1024];
24     struct sockaddr_in name;
25     struct hostent *hp, *gethostbyname();
26
27    if (argc < 3) {
28        printf("Usage: udpsend  hostname  port#\n");
29        exit(3);
30     }
31
32     /* Create socket on which to send:
33        Protocol family= Internet (AF_INET)
34        Type = UDP (SOCK_DGRAM)
35        Protocol = 0: This field is not used
36      */
37    sock= socket(AF_INET, SOCK_DGRAM, 0);
38     if (sock < 0) {
39        perror("opening datagram socket");
40        exit(1);
41     }
42
43     /* Create a name, with no wildcards, of the destination socket.
44       Gethostbyname() returns an IP address, given a host name.
45      */
46     hp= gethostbyname(argv[1]);
47    if (hp==0) {
48        fprintf(stderr, "%s: Unknown host\n", argv[1]);
49        exit(2);
50     }
51
52     /* Fill in socket data structure with destination IP address,
53        socket protocol family, and port number. */
54     memcpy( (char *)&name.sin_addr, (char *)hp->h_addr, hp->h_length);
```

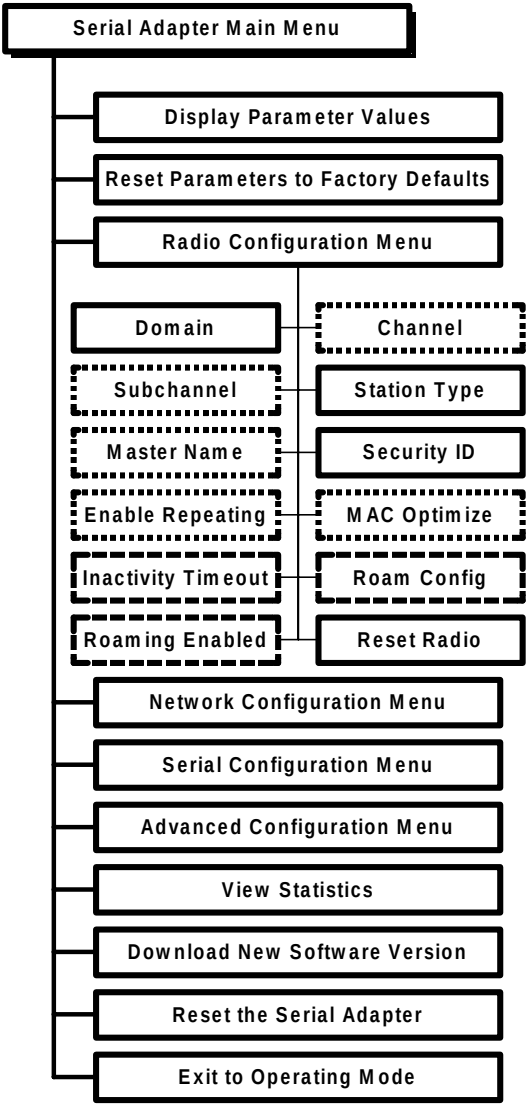
```
55    name.sin_family= AF_INET;
56     /* htons() converts a 16-bit integer from host to network byte order */
57     name.sin_port= htons(atoi(argv[2]));
58
59     /* Construct message, including Serial Adapter header. */
60    buf[0]= DATA1;
61     buf[3]= 0x1b;
62    dataLength= strlen(DATA);
63     networkDataLength= htons(dataLength);
64    memcpy(&buf[1], (char *)&networkDataLength,  sizeof(short));
65    strcpy(&buf[4], DATA);
66    printf("%s\n", &buf[4]);
67
68     /* Repeatedly send message to serial adapter */
69    for(i=0; i< 10; i++)
70    {
71       sleep(1);
72       /* Sendto() parameters:
73          1. Local socket which will handle the data.
74          2. Pointer to buffer containing data to be sent.
75          3. Number of bytes of data to be sent.
76          4. Flags (ex. MSG_OOB for TCP urgent data)
77          5. Destination IP address and port number.
78          6. Length of data structure containing destination
79            IP Address/port info.
80       */
81       if(sendto(sock, buf, dataLength+4, 0,
82                   (struct sockaddr *)&name, sizeof(name)) < 0)
83                   perror("Sending datagram message");
84       npackets++;
85       if (!(npackets % 1000))
86                   printf("%ld packets sent\n", npackets);
87    }
88    close(sock);
89    exit(0);
90
91
```

C. Menu Structure

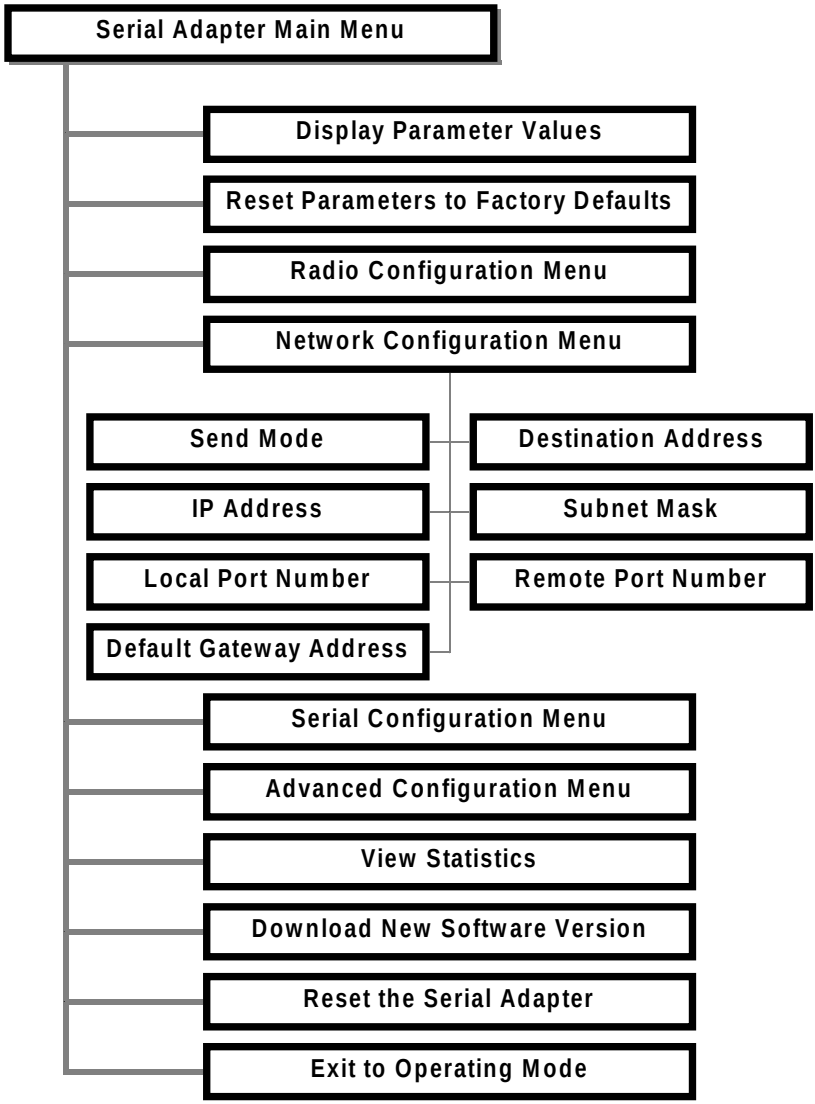


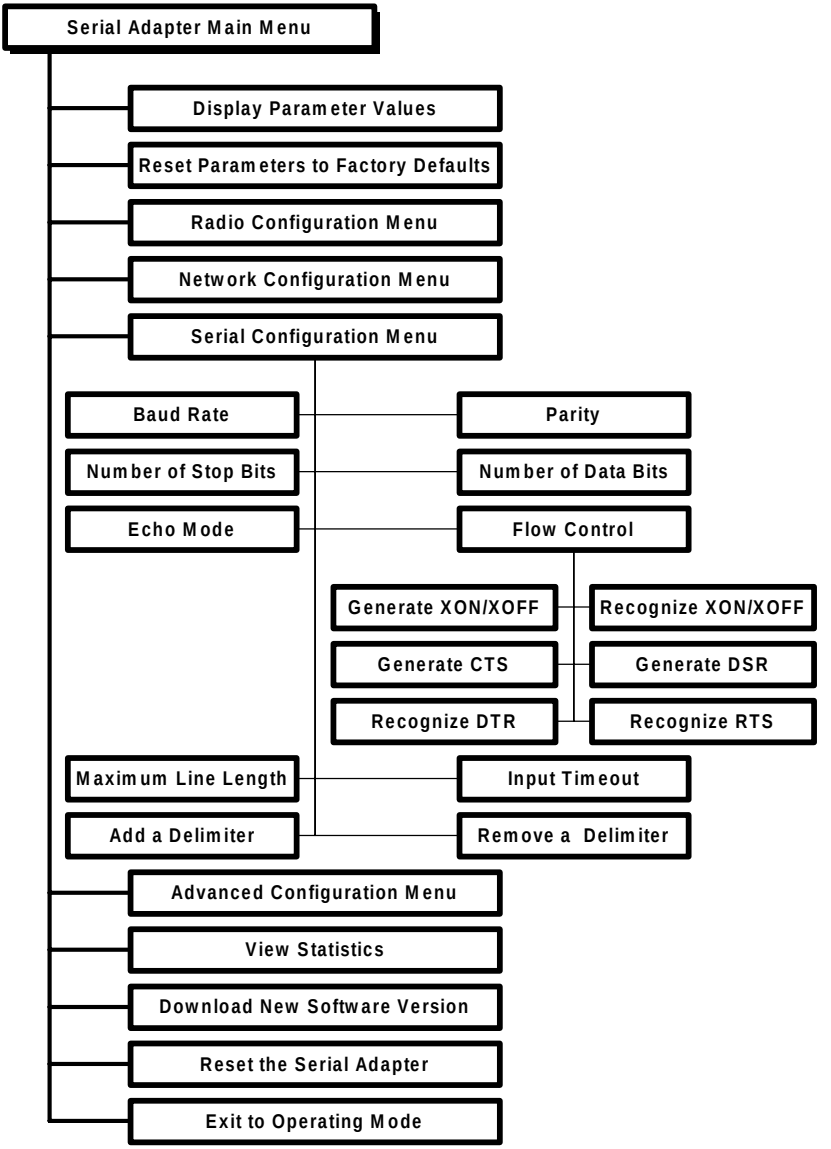
Dotted Line - Visible when configured as a Master
Dashed Line - Visible when configured as a Station

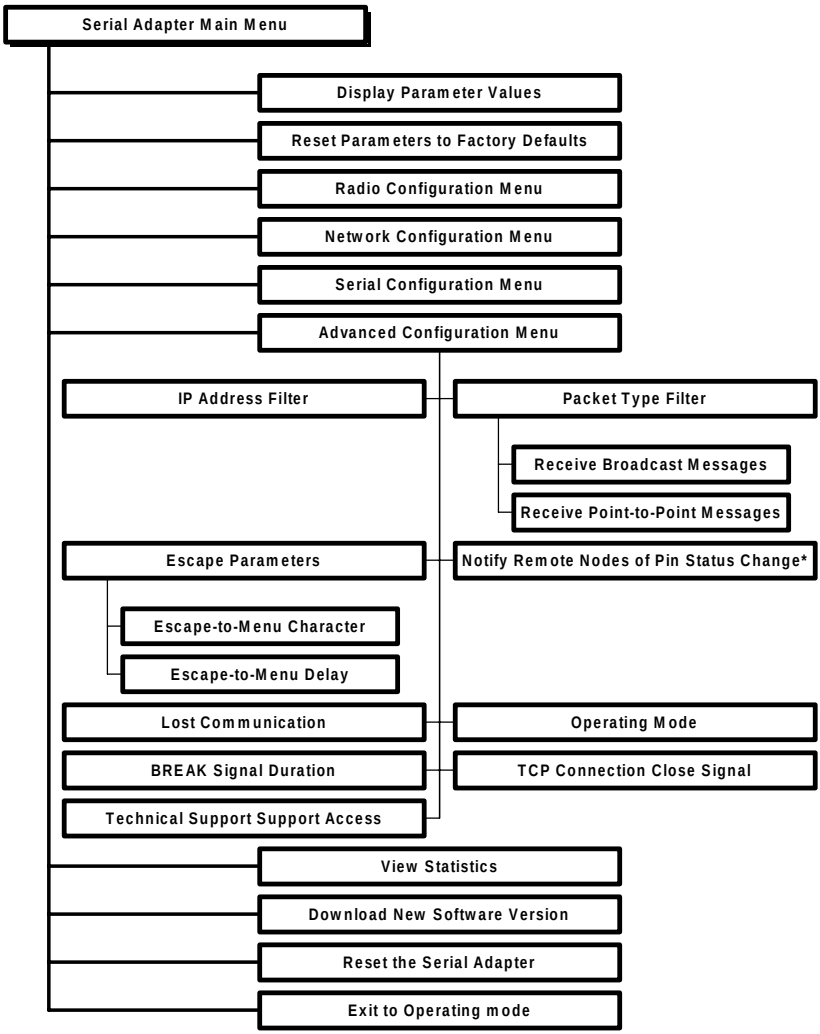

Serial Adapter Main Menu
Display Parameter Values
Radio Parameters
Network Parameters
Serial Parameters
Baud Rate (current)
Baud Rate (configured)
Parity (current)
Parity (configured)
Stop Bits (current)
Stop Bits (configured)
Data Bits (current)
Data Bits (configured)
Echo Mode
Max. Line Length
Input Timeout (ms)
Line Delimiters
Generate XON/XOFF
Recognize XON/OFF
Generate CTS
Generate DSR
Recognize DTR
Recognize RTS
Advanced Configuration Parameters
Accept Packets From
Packet Types Accepted
Escape Character
Escape Delay (.1 sec)
Notify Remote Nodes of RS-232 Pin Status Change
Lost Communication
Operating Mode
Break Duration x (50 ms)
Use TCP Connection Close Signal
Tech Support Access Enabled
Reset Parameters to Factory Defaults
Radio Configuration Menu
Network Configuration Menu
Serial Configuration Menu
Advanced Configuration Menu
View Statistics
Download New Software Version
Reset the Serial Adapter
Exit to Operating Mode



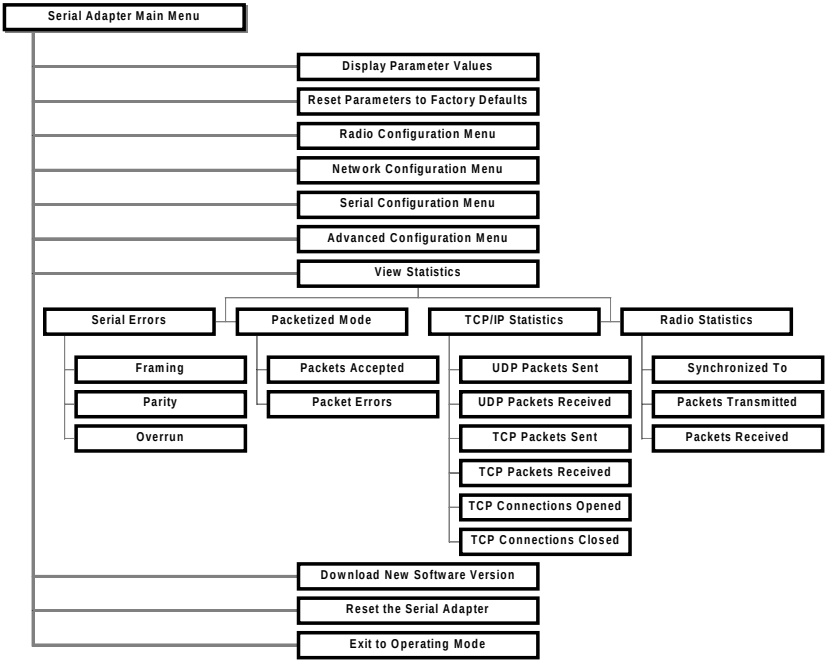
Dotted Line - Visible when configured as a Master
Dashed Line - Visible when configured as a Station


Serial Adapter Main Menu
Display Parameter Values
Reset Parameters to Factory Defaults
Radio Configuration Menu
Network Configuration Menu
Send Mode
Destination Address
IP Address
Subnet Mask
Local Port Number
Remote Port Number
Default Gateway Address
Serial Configuration Menu
Advanced Configuration Menu
View Statistics
Download New Software Version
Reset the Serial Adapter
Exit to Operating Mode


Serial Adapter Main Menu
Display Parameter Values
Reset Parameters to Factory Defaults
Radio Configuration Menu
Network Configuration Menu
Serial Configuration Menu
Baud Rate
Parity
Number of Stop Bits
Number of Data Bits
Echo Mode
Flow Control
Generate XON/XOFF
Recognize XON/XOFF
Generate CTS
Generate DSR
Recognize DTR
Recognize RTS
Maximum Line Length
Input Timeout
Add a Delimiter
Remove a Delimiter
Advanced Configuration Menu
View Statistics
Download New Software Version
Reset the Serial Adapter
Exit to Operating Mode



* For use while in packetized mode only


Serial Adapter Main Menu
Display Parameter Values
Reset Parameters to Factory Defaults
Radio Configuration Menu
Network Configuration Menu
Serial Configuration Menu
Advanced Configuration Menu
View Statistics
Serial Errors
Framing
Parity
Overrun
Packetized Mode
Packets Accepted
Packet Errors
TCP/IP Statistics
UDP Packets Sent
UDP Packets Received
TCP Packets Sent
TCP Packets Received
TCP Connections Opened
TCP Connections Closed
Radio Statistics
Synchronized To
Packets Transmitted
Packets Received
Download New Software Version
Reset the Serial Adapter
Exit to Operating Mode

D. Parameters

Radio Parameters

Parameter Name	Range	Default
Domain	0-15, and "U" for Use Switch	Use Switch
Channel *	1-15, and 0 for automatic selection	0
Subchannel *	1-15	1
Station Type	Master, Station, and "U" for Use Switch	Use Switch
Master Name *	11 characters	MASTER
Security ID	20 characters	blank
Enable Repeating *	Y/N	N
MAC Optimize *	Normal, Light, Very Light, and Auto	Auto
Inactivity Timeout [t]	0 for no timeout and 1, 2, 3, ... to designate intervals of 10 seconds	0
Roam Config [t]	Slow, Normal, and Fast	Normal
Roaming Enabled [t]	Yes/No	Yes
Reset Radio	-	-

* Only visible when configured as a Master

[t] Only visible when configured as a Station

Network Parameters

Parameter Name	Range	Default
Send Mode	TCP (Point to Point), UDP (Point to Point), and Broadcast	TCP(Point to Point)
Destination Address	-	-
IP Address	-	Default address
Subnet Mask	-	255.0.0.0
Local Port Number	-	5000
Remote Port Number	-	5000
Default Gateway Address	-	0.0.0.0

Serial Parameters

Parameter Name	Range	Default
Baud Rate (bps)	300,1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200	9600
Parity	Even, Odd, Mark, Space, and None	None
Number of Stop Bits	1-2	1
Number of Data Bits	7-8	8
Echo Mode	None, Simple, and Terminal	None
Flow Control	Generate or Recognize XON/XOFF, Generate CTS, Generate DSR, Recognize DTR, and Recognize RTS	Generate CTS and Generate DSR
Max Line Length	1-1456	1456
Input Timeout	50 ms - 300,000 ms, 0 = no timeout	100 ms
Delimiters	ASCII Characters	None

Advanced Configuration Parameters

Parameter Name	Range	Default
IP Address Filter	-	-
Accept Broadcast Packets	Yes/No	Yes
Accept Point-to-Point Packets	Yes/No	Yes
Escape-to-Menu Character	-	$
Escape-to-Menu Delay	Increments of 0.1 sec	1 sec
Notify Remote Nodes of Pin Status Change*	Yes/No	Yes
Lost Communication	Continue/Halt	Continue
Operating Mode	Pass-through/ Packetized	Pass-through
BREAK Signal Duration	50 ms - 10 sec in increments of 50 ms	100 ms
TCP Connection Close Signal	Yes/No	No
Technical Support Access	N/A	No

* For use in Packetized Mode only

E. Procedure for Downloading New Software

At some point in the future, you may need to upgrade the RangeLAN2 Serial Adapter software. To do this, choose the Download New Software Version option from the Main Menu. You need to use the XMODEM protocol to complete the download. Commonly used serial communication programs, such as Hyperterminal and Procomm Plus, support the XMODEM protocol.

The steps for downloading a new image are:

1. Place the new software file on the computer's hard drive, a floppy disk, or a network server.

2. Attach the Serial Adapter to a free serial port on the computer using the Serial Adapter cable.

3. Open a terminal screen and set the serial port settings to 9600 bps, 8 data bits, 1 stop bit, no parity.

4. Bring up the Serial Adapter configuration menu by typing "$$$" in a terminal screen. If your Serial Adapter is not currently set to 9600 bps, 8 data bits, 1 stop bits, no parity, then set the Domain Switch to 9 to bring up the configuration menu at these settings.

5. Choose Download New Software Version from the Main Menu.

6. You will be prompted to send a file containing the software version using the XMODEM protocol.

7. When the download is successful, the Serial Adapter will automatically reboot and load the new software.

Note:

Do not choose the "Download New Software Version" menu item unless you are prepared to perform a software download to the device. Once you proceed past the warning messages, there is no way to exit the download process. The unit will not become operational again until after a download of software to the Serial Adapter has been successfully completed.

F. Glossary

Access Point — An internetworking device that seamlessly connects wired and wireless networks together.

Assert — To set a flow control pin to the "on" position.

Bandwidth — The size (in Hertz) of the frequency range that a signal transmission occupies. Typical narrow band signals occupy a 25 KHz bandwidth. The RangeLAN2 signal occupies a 1 MHz bandwidth.

Channel — In RangeLAN2 networks, the channel refers to the frequency hopping sequence the card follows.

CSMA/CA — (Carrier Sense Multiple Access/Collision Avoidance) — CSMA is a protocol in which each node senses whether or not a channel is in use before attempting to transmit information. CA is an optimization by which channel time is reserved to avoid collisions.

DCE — (Data Communication Equipment) — A device, such as a modem, which connects to a DTE with a serial cable, that allows a DTE to send and receive data with remote locations.

DTE — (Data Terminal Equipment) — A device, such as a computer or dumb terminal, which connects to a DCE from its serial port in order to send and receive data with remote locations.

Download Image — A software file that is used to upgrade the software code running on the Serial Adapter.

Frequency Hopping — A spread spectrum technique by which the band is divided into a number of channels and the transmissions hop from channel to channel in a pre-specified sequence.

Inhibit — To set a flow control pin to the "off" position.

Interference — A situation that occurs when an unwanted RF signal occupies the same frequency band as a desired signal.

IP Address (Internet Protocol Address) — A 32-bit address assigned to TCP/IP hosts.

MAC Address (Media Access Control Address) — A unique 48-bit address assigned to each network device by the manufacturer.

Narrow Band — A channel of about 25 KHz bandwidth in the RF spectrum. The FCC allocates Narrow Band channels and issues a license to the user. Each user of a specific narrow band frequency range must obtain a site license from the FCC.

Spread Spectrum — A radio data transmission modulation technique by which the transmitted signal is spread over a bandwidth wider than the information bandwidth. Spread Spectrum bands are designated by the FCC and require no user license.

TCP/IP (Transmission Control Protocol/Internet Protocol) — A suite of protocols developed under DARPA sponsorship for internetworking.

TCP (Transmission Control Protocol) — A reliable transport layer that runs over IP on a TCP/IP network.

UDP (User Datagram Protocol) — An unreliable transport layer that runs over IP on a TCP/IP network.

G. How to Reach Technical Support

If you're having a problem using RangeLAN2 791x Serial Adapter and can't resolve it with the information in Chapter 14, gather the following information and contact Proxim Technical Support:

- ❑ What are the configuration settings?
- ❑ What were you doing when the error occurred?
- ❑ What error message did you see?
- ❑ Can you reproduce the problem?
- ❑ What version of the Serial Adapter software are you using?

You can reach Proxim Technical Support by voice, fax, email BBS, or mail:

Tel: 800-477-6946 or 408-731-2640
Fax: 408-731-3676
Web: http://www.proxim.com
Email: support@proxim.com

Proxim, Inc.
Attn: Technical Support
510 DeGuigne Drive
Sunnyvale, CA 94086

H. U.S. Specifications

The following technical specification is for reference purposes only. Actual product's performance and compliance with local telecommunications regulations may vary from country to country. Proxim, Inc. will only ship products that are type approved in the destination country.

Serial Interface	16C550 Industry Standard UART
Data Rate	1.6 Mbps
Serial Rate	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps
Media Access Protocol	RangeLAN2 CSMA/CA
Frequency Band	2.4-2.483 GHz (in the U.S.) (spread spectrum frequency hopping)
Independent Channels	15
Output Power	100 mW or 500 mW, depending on the country
Operating Temperature	-20°C to +60°C
UL Listed Power Supply	The Serial Adapter requires an external power supply. If you have elected not to purchase the external supply from Proxim or need a replacement, you must use only a UL listed, Class 2 power supply, rated between 6 and 15V DC and 1A.
FCC Notice	Warning! It is the responsibility of the installer of the antenna, as well as the responsibility of the user of this product, to guarantee that the antenna is operated at least 15 cm (6 inches) from any person. This is necessary to ensure that the product is operated in accordance with the RF Guidelines for Human Exposure which have been adopted by the Federal Communications Commission.

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