

PortMaster[®]

**Internetwork Router
Hardware Installation
Guide**

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FCC Class A Notice - United States

Computing devices and peripherals manufactured by Lucent Technologies, Inc. generate, use, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions contained in this manual, may cause interference to radio communications. Such equipment has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against radio interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user — at his own expense — will be required to take whatever measures may be required to correct the interference.

Some components may not have been manufactured by Lucent Technologies, Inc. If not, Lucent Technologies has been advised by the manufacturer that the component has been tested and complies with the Class A computing device limits as described above.

IC-CS03 Notice - Canada

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

European Terminal Marking

CE188X

The PortMaster Communications Server carries the CE188X approval marking in accordance with the CE Marking Directive 93/68/EEC. This marking may be found on the base of the unit.

This equipment has been tested and is compliant with the following European Directives:

- 91/263/EEC (Telecommunications Terminal Equipment)
- 73/23/EEC (Low Voltage Directive)
- 89/336/EEC (ElectroMagnetic Compatibility) as amended by 92/31/EEC

Pan-European Approval

BTZ, the German Notified Body, has issued Pan-European Approval to the PortMaster in accordance with the TTE Directive (91/263/EEC). This approval is valid throughout the European Economic Market.

This approval is valid in the following European Union Countries: Belgium, Denmark, Finland, France, Germany, Great Britain, Greece, Holland, Iceland, Ireland, Italy, Luxembourg, Portugal, Spain, and Sweden.

European CE approvals are automatically recognized by Norway.

In addition to compliance with the ETSI-based European standards, I-CTR 3 (Net 3 + Bridging Measures) NET 3 and ETS 300 047, the PortMaster has been tested and complies with the following National Delta requirements:

- French delta requirements CSE P 10-21 A
- German delta requirements BAPT 223 ZV 25



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About This Guide

This guide is designed to provide you with the information needed to install the PortMaster® Internetwork Router (IRX™). Refer to “PortMaster Documentation” for more information about related documentation.

This guide is designed to be used by qualified system administrators and network managers. Knowledge of basic networking concepts is required to successfully install the IRX.

PortMaster Documentation

The following manuals are available from Lucent Technologies. The hardware installation guides are included with most PortMaster products; other manuals can be ordered through your PortMaster distributor or directly from Lucent.

The manuals are also provided as PDF and PostScript files on the *PortMaster Software CD* shipped with your PortMaster.

In addition, you can download PortMaster information and documentation from <http://www.livingston.com>.

- *ChoiceNet® Administrator's Guide*

This guide provides complete installation and configuration instructions for ChoiceNet server software.

- *PortMaster Command Line Reference*

This guide provides the complete description and syntax of each command in the ComOS command set.

- *PortMaster Configuration Guide*

This guide provides a comprehensive overview of networking and configuration issues related to PortMaster products.

- *PortMaster hardware installation guides*

These guides contain complete hardware installation instructions. An installation guide is available for each PortMaster product line—IRX, Office Router,

Communications Server, and PortMaster 3.

- *PMconsole™ for Windows Administrator's Guide*

This guide covers PMconsole Administration Software for Microsoft Windows, a graphical tool for configuring the PortMaster. The majority of the material in this guide also applies to the UNIX version of PMconsole.

- *PortMaster Routing Guide*

This guide describes routing protocols supported by PortMaster products, and how to use them for a wide range of routing applications.

- *PortMaster Troubleshooting Guide*

This guide can be used to identify and solve software and hardware problems in the PortMaster family of products.

- *RADIUS Administrator's Guide*

This guide provides complete installation and configuration instructions for Lucent Remote Authentication Dial-In User Service (RADIUS) software.

Additional References

RFCs

Use any World Wide Web browser to find a Request for Comments (RFC) online.

RFC 768, *User Datagram Protocol*

RFC 791, *Internet Protocol*

RFC 792, *Internet Control Message Protocol*

RFC 793, *Transmission Control Protocol*

RFC 854, *Telnet Protocol Specification*

RFC 950, *Internet Standard Subnetting Procedure*

RFC 988, *Host Extensions for IP Multicasting*

RFC 1058, *Routing Information Protocol*

RFC 1144, *Compressing TCP/IP Headers for Low-Speed Serial Links*

RFC 1157, *A Simple Network Management Protocol (SNMP)*

RFC 1166, *Internet Numbers*

RFC 1213, *Management Information Base for Network Management of TCP/IP-based Internets: MIB-II*

RFC 1256, *ICMP Router Discovery Messages*

RFC 1321, *The MD5 Message-Digest Algorithm*
RFC 1331, *The Point-to-Point Protocol (PPP) for the Transmission of Multiprotocol Datagrams over Point-to-Point Links*
RFC 1332, *The PPP Internet Protocol Control Protocol (IPCP)*
RFC 1334, *PPP Authentication Protocols*
RFC 1362, *Novell IPX Over Various WAN Media (IPXWAN)*
RFC 1413, *Identification Protocol*
RFC 1490, *Multiprotocol Interconnect Over Frame Relay*
RFC 1552, *The PPP Internet Packet Exchange Control Protocol (IPXCP)*
RFC 1583, *OSPF Version 2*
RFC 1587, *OSPF NSSA Options*
RFC 1597, *Address Allocations for Private Internets*
RFC 1627, *Network 10 Considered Harmful (Some Practices Shouldn't be Codified)*
RFC 1634, *Novell IPX Over Various WAN Media (IPXWAN)*
RFC 1661, *The Point-to-Point Protocol (PPP)*
RFC 1700, *Assigned Numbers*
RFC 1771, *A Border Gateway Protocol 4 (BGP-4)*
RFC 1812, *Requirements for IP Version 4 Routers*
RFC 1814, *Unique Addresses are Good*
RFC 1818, *Best Current Practices*
RFC 1824, *Requirements for IP Version 4 Routers*
RFC 1826, *IP Authentication Header*
RFC 1827, *IP Encapsulating Payload*
RFC 1877, *PPP Internet Protocol Control Protocol Extensions for Name Server Addresses*
RFC 1878, *Variable Length Subnet Table for IPv4*
RFC 1918, *Address Allocation for Private Internets*
RFC 1965, *Autonomous System Confederations for BGP*
RFC 1966, *BGP Route Reflection, An Alternative to Full Mesh IBGP*
RFC 1974, *PPP Stac LZS Compression Protocol*
RFC 1990, *The PPP Multilink Protocol (MP)*
RFC 1994, *PPP Challenge Handshake Authentication Protocol (CHAP)*
RFC 1997, *BGP Communities Attribute*
RFC 2003, *IP Encapsulating Security Payload*
RFC 2138, *Remote Authentication Dial In User Service (RADIUS)*
RFC 2139, *RADIUS Accounting*

Books

Internetworking with TCP/IP, Volume 1: Principles, Protocols, and Architecture. Douglas Comer. Prentice Hall, Inc. 1995. (ISBN 0-13-216987-8 (v.1))

Routing in the Internet. Christian Huitema. Prentice Hall PTR, 1995.
(ISBN 0-13-132192-7)

TCP/IP Network Administration. Craig Hunt. O'Reilly & Associates, Inc. 1994.
(ISBN 0-937175-82-X)

TCP/IP Illustrated, Volume 1: The Protocols. W. Richard Stevens. Addison-Wesley
Publishing Company. 1994. (ISBN 0-201-63346-9)

Internet Routing Architectures. Bassam Halabi. Cisco Press, 1997.

Document Conventions

The following table describes the type changes and symbols used in this guide.

Typeface or Symbol	Meaning	Example
AaBbCc123	The names of commands, parameters, and directories; on-screen computer output.	Use <code>version</code> to display the version number.
AaBbCc123	What you type, contrasted with on-screen computer output.	login: !root Password:
<i>AaBbCc123</i>	Command-line placeholder: replace with a real name or value.	To set baud rate, type: set s0 speed 2 <i>baud_rate</i>
[AaBbCc123]	Commands in brackets denote a key to press.	login: !root [Enter]

Document Advisories



Note – means take note. Notes contain information of importance or special interest.



Caution – means be careful. You might do something—or fail to do something—that results in equipment failure or loss of data.



Warning – means danger. You might do something—or fail to do something—that results in personal injury or equipment damage.

Contacting Lucent Remote Access Technical Support

The PortMaster comes with a 1-year hardware warranty.

For all technical support requests, record your PortMaster ComOS version number and report it to the technical support staff or your authorized sales channel partner.

New releases and upgrades of PortMaster software are available by anonymous FTP from **`ftp://ftp.livingston.com.pub/le/`**.

In North America you can schedule a 1-hour software installation appointment by calling the technical support telephone number listed below. Appointments must be scheduled at least one business day in advance.

For the EMEA Region

If you are an Internet service provider (ISP) or other end user in Europe, the Middle East, Africa, India, or Pakistan, contact your local Lucent Remote Access sales channel partner. For a list of authorized sales channel partners, see the World Wide Web at **`http://www.livingston.com/International/EMEA/distributors.shtml`**.

If you are an authorized Lucent Remote Access sales channel partner in this region, contact the Lucent Remote Access EMEA Support Center Monday through Friday between the hours of 8 a.m. and 8 p.m. (GMT+1), excluding French public holidays.

- By voice, dial +33-4-92-92-48-88.
- By fax, dial +33-4-92-92-48-40.
- By electronic mail (email) send mail to **`emeasupport@livingston-ent.fr`**

For North America, Latin America, and the Asia Pacific Region

Contact Lucent Remote Access Monday through Friday between the hours of 6 a.m. and 6 p.m. (GMT -8).

- By voice, dial 800-458-9966 within the United States (including Alaska and Hawaii), Canada, and the Caribbean, or +1-925-737-2100 from elsewhere.

- By fax, dial +1-925-737-2110.
- By email, send mail as follows:
 - From North America and Latin America to **support@livingston.com**.
 - From the Asia Pacific Region to **asia-support@livingston.com**.
- Using the World Wide Web, see <http://www.livingston.com/>.

PortMaster Training Courses

Lucent Remote Access offers hands-on, technical training courses on PortMaster products and their applications. For course information, schedules, and pricing, visit the Lucent Remote Access website at <http://www.livingston.com>, click **Services**, and then click **Training**.

Subscribing to PortMaster Mailing Lists

Lucent maintains the following Internet mailing lists for PortMaster users:

- **portmaster-users**—a discussion of general and specific PortMaster issues, including configuration and troubleshooting suggestions. To subscribe, send email to **majordomo@livingston.com** with **subscribe portmaster-users** in the body of the message.

The mailing list is also available in a daily digest format. To receive the digest, send email to **majordomo@livingston.com** with **subscribe portmaster-users-digest** in the body of the message.

- **portmaster-radius**—a discussion of general and specific RADIUS issues, including configuration and troubleshooting suggestions. To subscribe, send email to **majordomo@livingston.com** with **subscribe portmaster-radius** in the body of the message.

The mailing list is also available in a daily digest format. To receive the digest, send email to **majordomo@livingston.com** with **subscribe portmaster-radius-digest** in the body of the message.

- **portmaster-announce**—announcements of new PortMaster products and software releases. To subscribe, send email to **majordomo@livingston.com** with **subscribe portmaster-announce** in the body of the message. All announcements to this list also go to the portmaster-users list. You do not need to subscribe to both lists.

The Internetwork Routers (IRXes)—IRX-111, IRX-112, IRX-114, IRX-211—are high-speed network routers designed to operate in multi-protocol network environments. They may be used to extend networks over long distances using leased lines, Frame Relay, ISDN, or switched 56K circuits.

All models include one asynchronous port, and one synchronous port that can be configured for RS-232 or V.35 signalling to provide WAN connectivity at speeds up to T1 (1.544Mb/s) or E1 (2.048Mb/s). The IRX-112 also has a second synchronous port that can operate up to 64K speeds. The IRX-114 has two T1/E1 synchronous ports and two 64K synchronous ports.

The IRX comes with lifetime software support and a one-year hardware warranty.

Figure 1-1 shows the front panel of the IRX-114. All models have a similar form factor. Table 1-1 shows the available ports on each model.

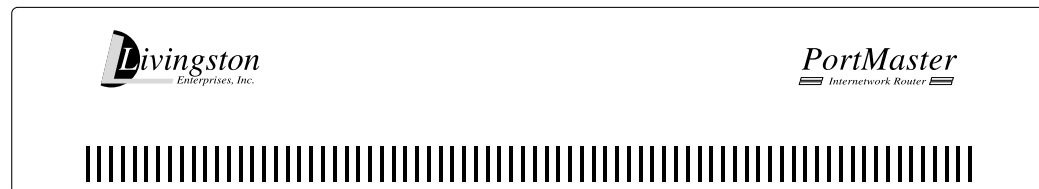


Figure 1-1 IRX-114 Front Panel

Table 1-1 Available Port Types by IRX Model

Product	Ethernet	async	sync T1	sync 64k
IRX-111	ether0	s0	s1	
IRX-112	ether0	s0	s1	s2
IRX-114	ether0	s0	s1,3	s2,4
IRX-211	ether0-1	s0	s1	

The IRX-111 can be upgraded to an IRX-112 by adding a MOD-IRX-1 board, or upgraded to an IRX-114 by adding a MOD-IRX-3 board. The IRX-112 can be upgraded to an IRX-114 by removing the MOD-IRX-1 board and replacing it with a MOD-IRX-3 board.

This Guide

This installation guide contains hardware installation procedures. For configuration information, refer to the *PortMaster Configuration Guide*.

This chapter includes the following pre-installation topics: safety recommendations, general site requirements, cable requirements, power guidelines, tools and equipment.

Safety Recommendations

When using the IRX, always follow these safety guidelines:

- Keep the chassis area clear and dust-free during and after installation.
- Disconnect all power before doing the following:
 - Changing the Ethernet connection
 - Removing a chassis
 - Working near power supplies
 - Changing a fuse
 - Installing or removing an expansion board
- Never assume power is disconnected from a circuit. Always check.
- Before applying power:
 - Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, and missing safety grounds.
 - Locate the emergency power-off switch for the room in which you are working.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.



Warning – The IRX contains no user-serviceable parts. Therefore the chassis should never be opened, except when adding an expansion board.

When working on the IRX, follow these additional guidelines:

- Keep tools away from walk areas where you and others could fall over them.
- Do not wear loose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves.
- Wear safety glasses when working under any conditions that might be hazardous to your eyes.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.



Warning – Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the conductors.

- Locate the emergency power-off switch for the room in which you are working; then, if an electrical accident occurs, act quickly to turn the power off.
- Before working on the system, unplug the power cord.
- Do not work alone if potentially hazardous conditions exist.
- If an electrical accident occurs, proceed as follows:
 - Use caution; do not become a victim yourself.
 - Unplug power to the system.
 - If possible, send another person to get medical aid; otherwise, assess the condition of the victim and then call for help.
 - Determine if the person needs rescue breathing or external cardiac compression, then take appropriate action.



Caution – If the internal components of the IRX are handled, electrostatic discharge can occur, resulting in damage to its circuitry and followed by complete or intermittent failures. Use an anti-static strap when installing or removing expansion boards.

Prevent Electrostatic Damage

Electrostatic Discharge (ESD) can damage equipment and impair circuitry. To avoid ESD damage, always use an anti-static strap when installing or removing expansion boards.

General Site Requirements

This section describes the requirements your site must meet for safe installation and unimpeded operation of the IRX. Prepare your site properly before beginning installation.

Site Environment

Choose a clean, dust-free and (preferably) air conditioned location. Avoid direct sunlight, proximity to heat sources, and areas with high levels of electromagnetic interference (EMI).

Chassis Accessibility

Leave at least three (3) inches (8 cm) clearance at the rear of the IRX for cabling.

Cooling and Airflow

To prevent overheating, the operating environment for the IRX should not exceed 113°F (45°C). For proper airflow, allow at least three (3) inches (8 cm) clearance around the vent openings.

Cable Requirements

The required cables for the IRX are described in the following sections.



Note – For cabling specifications, refer to Appendix B, “Cabling Specifications.” To order any of these cables from Lucent Remote Access, specify the product code indicated or consult the price list.

Console Cable (S0)

The S0 console port is an asynchronous (async) DTE port with a female RS-232 connector. To connect to a terminal (DTE), use a null modem cable, typically male-to-female. To connect to a modem (DCE), use a male-to-male straight-through cable.

For cabling specifications, refer to Appendix B, “Cabling Specifications.”

Synchronous Cable

Ports S1 and S3 are capable of speeds up to T1/E1. Ports S2 and S4 are capable of speeds up to 64K. Each port has a switch which selects RS-232 (when UP) or V.35 (when DOWN) signalling. One V.35 cable is provided.

The synchronous ports always require an external clock signal.

For cabling specifications, refer to Appendix B, “Cabling Specifications.” To order additional V.35 cables from Lucent Remote Access, specify product code DC-6.



Caution – The synchronous port does not function as an async port. Do not attempt to connect an async device to this port.

Ethernet 10BaseT Cable

The Ethernet 10BaseT port accepts a modular RJ-45 connector. 10BaseT requires a minimum Category 3 twisted pair cable, as specified by the EIA/TIA-568-B wiring standard. The distance limitation for 10BaseT is a maximum of 328 feet (100m).

This is a standard 10BaseT cable, which can be ordered from Lucent Remote Access.

Ethernet AUI Cable

The Ethernet AUI port accepts a standard AUI cable with a DB-15 female connector, or a standard AUI Ethernet transceiver.

This is a standard AUI cable, which can be ordered from Lucent Remote Access.

Ethernet BNC Cable

The Ethernet BNC port accepts a standard 10Base2 (thin Ethernet) coaxial cable, which should be terminated at both ends. Use the BNC T-adaptor included with the IRX to connect the thin Ethernet cable to the IRX.

This is a standard 10Base2 cable, which can be ordered from Lucent Remote Access.

Power Guidelines

Before applying power, read the following power guidelines carefully:

- Inspect the IRX to verify that:
 - Cables are installed correctly
 - Ventilation is adequate
 - Power is coming from a building branch circuit
- Before you connect to a power source, verify that the source is properly grounded and falls within the (internal) power supply rating. The IRX operates correctly at any AC voltage from 100V to 260V and frequencies from 50 to 60 Hz.

Tools and Equipment Required

The IRX has no internal user-serviceable parts, except for changing the fuse or adding an expansion board.

A 3/16" flat-blade screwdriver is required to change the fuse, and a phillips-head screwdriver is required for adding an expansion board. The same phillips-head screwdriver can be used for rack installation.



Caution – Consult “Fuses” on page 3-6 before changing the IRX fuse. Consult “Installing an IRX Expansion Card” on page 3-13 before adding an expansion board and “Removing an IRX Expansion Card” on page 3-14 before removing an expansion board.

This chapter includes the following installation topics: desktop installation, rack-mount installation, overview of LEDs, overview of connectors and DIP switches, connecting to the network and console, configuring the Ethernet IP address of the IRX, and adding or removing expansion cards.



Caution – Before you install an Internetwork Router (IRX), read Chapter 2, “Preparing for Installation.”

Desktop Installation

For desktop installation, place the IRX on a desktop, bookshelf or other flat secure surface. Your location should provide clearance of three (3) inches (8 cm) for cabling and airflow.

Rack-mounting

The IRX can be rack-mounted. Order the kit “RACK-1” from Lucent Remote Access.

RACK-1 Rack-mount Installation

To rack-mount an IRX, order the kit RACK-1 from Lucent Remote Access and install as follows:



Note – Included with the rack mount unit are four (4) 12-24x1/2" pan head screws and four (4) #4x3/4" sheet metal screws.

- 1. Lay the IRX upside down on a protected table surface, with the front of the IRX approximately 1/4" over the front edge of the table.**
- 2. Unscrew (counter-clockwise) the black plastic screws that secure the feet to the bottom of the IRX.**

Retain the feet (and the center expansion sleeve in each foot) in place on the bottom of the IRX.

- 3. Turn the rack mount unit upside down and align its four holes with the centers of the holes in the IRX feet.**

The front of the IRX case sits about 1/8" in front of the mounting shelf flanges.

- 4. Press (do not screw) each of the #4x3/4" sheet metal screws into the four mounting shelf holes.**
- 5. Turn the unit right side up by lifting from the front and rear of the IRX.**
- 6. Install the unit in the rack with the four 12-24x1/2" pan head screws.**

Overview of LEDs

Figure 3-1 shows the back-panel of the IRX-114, with pointers to the three LEDs described in Table 3-1. To verify proper operation, compare the LED descriptions to actual LED behavior. The three LEDs are adjacent to the same ports on all models. In addition, the IRX-211 has a second Link and Network LED next to the second Ethernet.

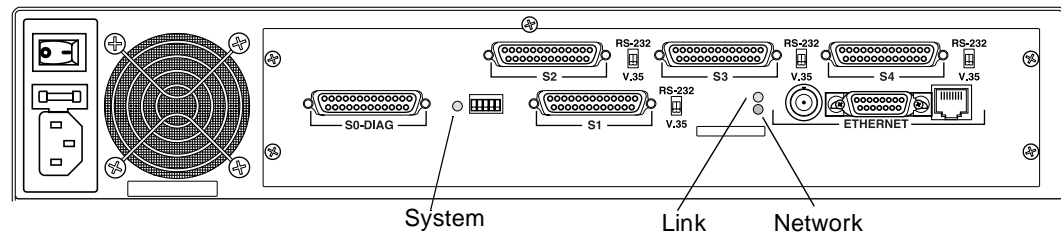


Figure 3-1 IRX-114 LEDs

Table 3-1 LED Descriptions

LED	Description
System	<p>This LED (adjacent to the five-section DIP switch) provides three types of diagnostic information:</p> <ul style="list-style-type: none"> • During initial hardware self-test, the LED blinks three times per second. • After the power-on self-test is successfully completed, and while the operating system is loading, the LED blinks at one-second intervals. • When the system is fully operational, the LED remains on, blinking off once every five seconds.
Link	<p>This LED (the top of two LEDs adjacent to the Ethernet port) is on when the system has link integrity to a 10BaseT hub.</p>
Network	<p>This LED (the bottom of two LEDs adjacent to the Ethernet port) blinks to indicate Ethernet traffic. During heavy traffic, this light may appear solid, due to its rapid blinking.</p>

Overview of Connectors and DIP Switches

The rear panel of the IRX provides (left to right and top to bottom):

- Power switch, user-serviceable fuse, and AC power receptacle.
- An asynchronous serial port, also usable as a console port (S0)
- Five-section DIP switch.
- One to four synchronous serial ports, each with a switch for RS-232 or V.35 signalling.
- Ethernet port (ether0) with connectors for 10BaseT, AUI or BNC cabling. The IRX-211 also has a second Ethernet port (ether1).

Figure 3-2 shows the IRX-114 rear panel, with pointers to ports and DIP switches. The IRX-111 and IRX-112 are similar.

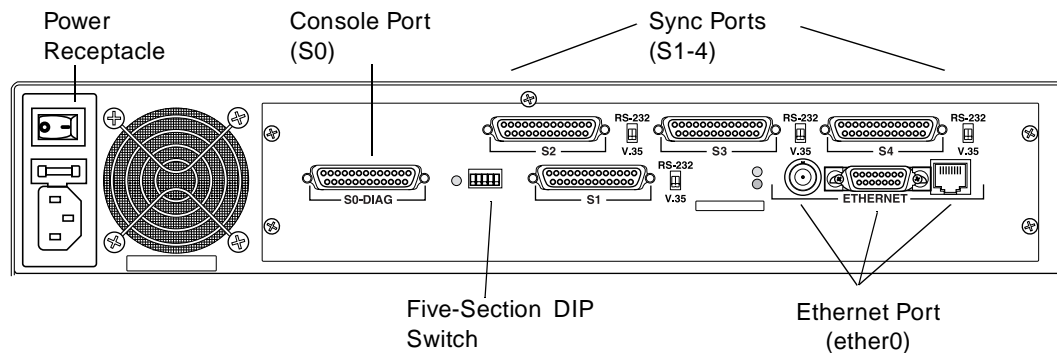


Figure 3-2 IRX-114 Rear Panel

Figure 3-3 shows the IRX-211 rear panel, with pointers to ports and DIP switches.

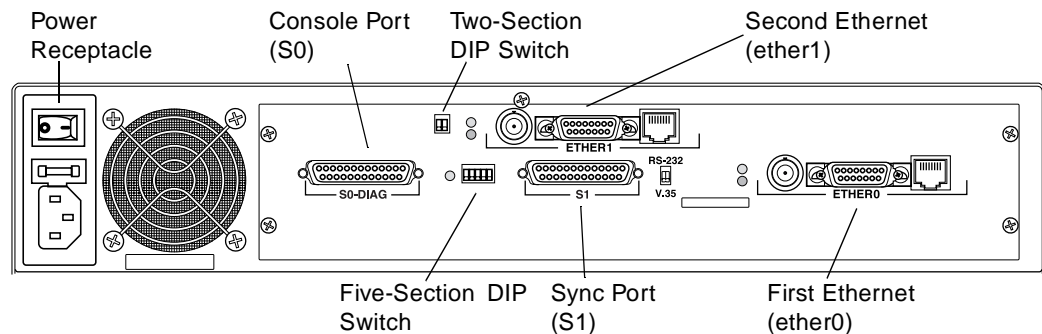


Figure 3-3 IRX-211 Rear Panel

Power Receptacle

AC power to the IRX is connected using a standard power cable. The IRX uses an auto-sensing, auto-ranging power supply that automatically adjusts to match the input voltage without setting a switch. The IRX operates correctly at any AC voltage from 100V to 260V and frequencies from 50 to 60 Hz.



Caution – Before you apply power, refer to “Safety Recommendations” on page 2-1 and “Power Guidelines” on page 2-4.

To apply power:

1. **Attach the power cord to the IRX and to a properly grounded electrical outlet.**
2. **Set the power switch to the ON position.**

To disconnect power:

1. **Set the power switch to the OFF position.**
2. **Detach the power cord from the outlet and the IRX.**

Fuses

To change the fuse:

1. **Set the power switch to the OFF position.**
2. **Detach the power cord from the IRX.**
3. **Insert a 3/16" flat-head screwdriver between the fuse door and the chassis and gently pry the door open, as shown in Figure 3-4.**

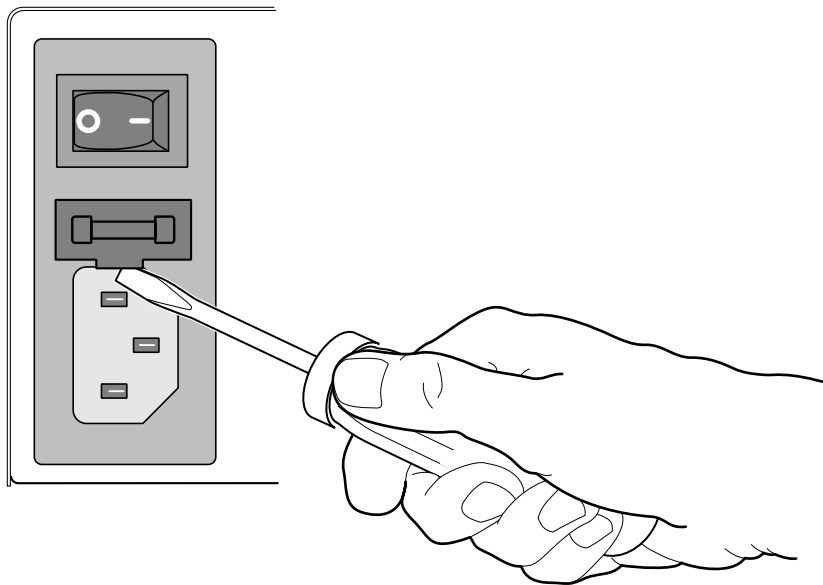


Figure 3-4 Changing Fuses on the IRX

4. **Replace the 250V, 2A fuse.**
The fuse is easily removed and replaced and has no “wrong end.”
5. **Press the fuse door shut until it clicks.**
6. **Reattach the power cord to the IRX.**
7. **Set the power switch to ON.**

Five-Section DIP Switch

The IRX has a five-section DIP switch, shown in Figure 3-5:

- DIP switch #1 controls the diagnostic mode.

When UP, the IRX boots in diagnostic mode. When DOWN, the IRX boots in normal mode. Default is DOWN. For information about the diagnostic mode, refer to “Boot Sequence in Diagnostic Mode” on page 4-5.

- DIP switch #2 controls the boot mode.

When UP, the IRX boots from the network using RARP and TFTP. When DOWN, it boots from internal flash memory. Default is DOWN.

For more information about using TFTP to boot the IRX, refer to the *PortMaster Configuration Guide*.

- DIP switch #3 is reserved for future use and should be left DOWN.
- DIP switches #4 and #5 select the Ethernet network type for ether0.

When both DIP switches are UP, the IRX connects through the 10BaseT Ethernet port. When both DIP switches are DOWN, it connects through the BNC Ethernet port. When DIP switch #4 is DOWN and DIP switch #5 is UP, the IRX connects through the AUI port.



Note – The IRX-211 has two additional DIP switches next to the ether1 port, which select the Ethernet network type for ether1 in the same way DIP switches #4 and #5 do for ether0.



Warning – When changing the position of the Ethernet DIP switches, power must be off.

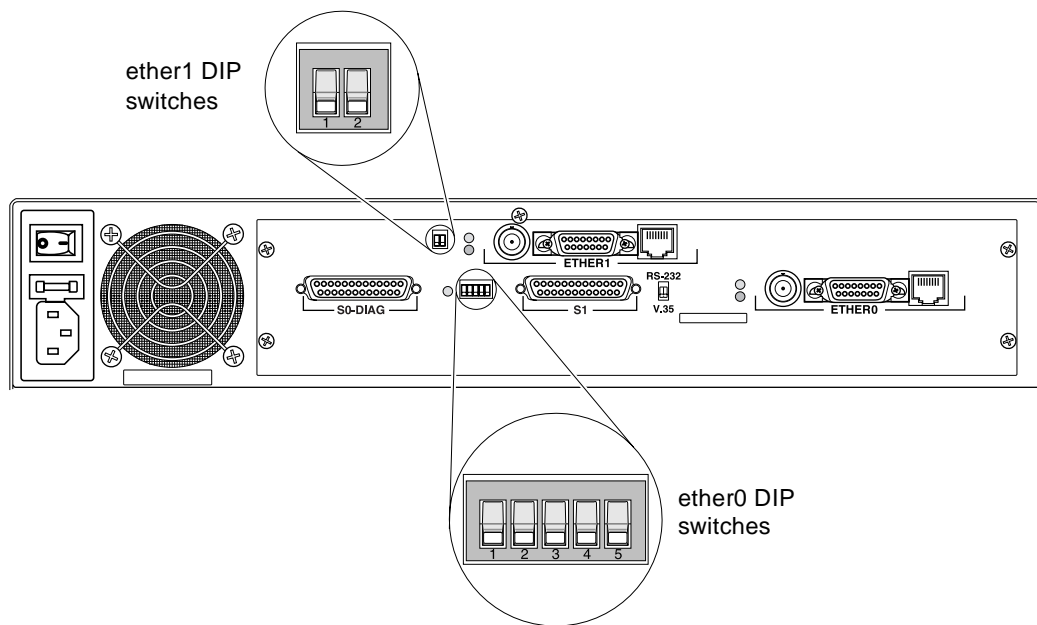


Figure 3-5 IRX-211 DIP Switches



Note – As shown in Figure 3-5, DIP switches #4 and #5 are DOWN, selecting the BNC port for connection to ether0.

S0 (Console) Port

The S0 console port is an asynchronous (async) DTE port with a female RS-232 connector:

- To connect to a terminal (DTE), use a null modem cable, typically male-to-female.
- To connect to a modem (DCE), use a male-to-male straight-through cable.

When connecting a console to port S0, with DIP switch #1 UP, the console should be set to 9600 baud, 8 data bits, 1 stop bit, no parity, Xon/Xoff software flow control.

When DIP switch #1 is DOWN, the S0 port operates as an async port, using its configured settings.

The async port (S0) uses a 25-pin D-type female connector, providing all RS-232 signals under the enhanced RS-423 standard. The connection is configured as a DTE (Data Terminal Equipment).

For cabling specifications, refer to Appendix B, “Cabling Specifications.”

Synchronous Port

Ports S1 and S3 are capable of speeds up to T1/E1. Ports S2 and S4 are capable of speeds up to 64Kbps. Each port has a switch which selects RS-232 (when UP) or V.35 (when DOWN) signalling.

- RS-232 signalling supports speeds up to 56K. If the device at the other end of the cable supports RS-423 signalling, speeds up to 128K can be used.
- V.35 signalling supports speeds up to T1/E1.

This port is always synchronous and requires an external clock.

For cabling specifications, refer to Appendix B, “Cabling Specifications.”



Caution – The synchronous ports will not function as asynchronous ports. Do not connect asynchronous devices to these ports.

Ethernet 10BaseT Port

The Ethernet 10BaseT port allows you to connect your IRX to a network 10BaseT hub using a straight-through twisted-pair cable with RJ-45 connectors. In order to connect to a 10BaseT network, DIP switches #4 and #5 must both be set to the UP position.

On the IRX-211, ether1 uses the RJ-45 jack if both switches of the two-section DIP switch are UP.

Ethernet AUI Port

The Ethernet AUI port allows you to connect your IRX to a 10BaseT, 10Base5 or 10Base2 transceiver using a DB-15 connector. In order to connect to a transceiver, DIP switch #4 must be DOWN and DIP switch #5 must be UP.

On the IRX-211, ether1 uses the AUI port if the left switch of the two-section DIP switch is DOWN and the right switch of the two-section DIP switch is UP.

Ethernet BNC Port

The Ethernet BNC port provides a BNC (round barrel) connector for use with 10Base2 (thinwire Ethernet). In order to connect using the BNC, DIP switches #4 and #5 must be set to the DOWN position.

On the IRX-211, ether1 uses the BNC connector if both switches in the two-section DIP switch are DOWN.

Connecting to the Network and Console

The following procedure walks you step-by-step through the installation of the IRX.

1. **Set the power switch on the IRX to OFF.**
2. **Attach a RS-232 null modem cable to IRX port S0 and the serial port of a PC or ASCII terminal.**



Warning – Before you apply power, refer to “Safety Recommendations” on page 2-1 and “Power Guidelines” on page 2-4.

3. **Attach the power cord to the IRX and to a properly grounded electrical outlet.**
4. **Connect the 10BaseT, AUI, or BNC Ethernet port on the IRX to an Ethernet hub or transceiver, using the appropriate cable. For information on switching the Ethernet DIP switches, refer to “Five-Section DIP Switch” on page 3-7.**

If using an IRX-211, also connect ether1 and set the two-section DIP switch. The Ethernet cable does not come with the IRX.

5. **Set the power switch to ON.**
6. **Verify that the System LED is active.**

While the IRX is booting, the LED blinks three times per second, then once per second. The LED blinks OFF once every five seconds during normal operation.

If the System LED does not behave in this way, refer to “Hardware Problems and Solutions” on page 4-1.

7. **Verify that the Link LED is ON.**

The Link LED comes on blinking once for AUI and twice for 10BaseT. Solid ON indicates 10BaseT link integrity exists. Solid OFF indicates link error for 10BaseT. Link LED is not used for the AUI or BNC connectors.

If the Link LED does not behave in this way, refer to “Hardware Problems and Solutions” on page 4-1.

8. **Verify that the Network LED is ON when Ethernet traffic is present.**

The Network LED comes on blinking once for every packet transmitted or received. In heavy traffic situations, the LED may appear solid.

If the Network LED does not behave in this way, refer to “Hardware Problems and Solutions” on page 4-1.

9. Once the IRX has booted, the console (PC or terminal) displays a login prompt.

```
login:
```

10. Enter the address of the Ethernet interface.

- a. If you are entering an IP address, type the following, pressing [Enter] after each line. Replace the *italicized* values with the appropriate values for your network.

```
login:      !root
Password: [Enter]
Command>   set ether0 address 172.168.200.1
Command>   save all
Command>   quit
login:
```

- b. If you are entering an IPX address, type the following:

```
login:      !root
Password: [Enter]
Command>   set ether0 ipxnet AFAF0808
Command>   set ether0 ipxframe ethernet_802.2
Command>   save all
Command>   quit
login:
```

11. If you are planning to use the command prompt interface to configure your IRX, do so now. If you are planning to use PMconsole to configure your IRX, you can disconnect the terminal from the S0 port now.

For configuration information, refer to the *PortMaster Configuration Guide*.

Installing an IRX Expansion Card



Caution – Do not unpack components or open the case of the IRX without using a wrist strap for control of static electricity. Review “Safety Recommendations” on page 2-1.

1. **Set the power switch to the OFF position and disconnect the IRX from the AC power source.**

2. **Open the IRX case.**

Remove the screw at the center of the top rear edge, then slide the top of the IRX case forward 1/2" horizontally and lift straight up. If difficulty is encountered in separating the top and bottom sections of the IRX case, try pressing down on the top edge sides and exerting a sudden push.

3. **Remove the Dsub cover plate(s). If this is a 1-port expansion, remove only the plate covering the S2 port. Otherwise, remove the cover plates for the S2, S3, and S4 ports.**

4. **Insert the expansion card at a slight angle into the empty Dsub port holes.**

Align the 40-pin connector projecting from the bottom of the expansion board with the corresponding connector on the main board. When inserting the 40-pin connector, support the free edge of the board (the side closest to the front) with your hand, so that the main board does not bend excessively.

5. **Attach the Dsub connectors to the rear face plate with the screws provided.**

Screw(s) should be partially screwed in and the face plate(s) aligned before tightening any of the screws.

6. **Close the IRX case by reversing the procedure described in step 2.**

7. **Connect the IRX to the AC power source and set the power switch to the ON position.**

Removing an IRX Expansion Card



Caution – Do not unpack components or open the case of the IRX without using a wrist strap for control of static electricity. Review “Safety Recommendations” on page 2-1.

1. **Set the power switch to the OFF position and disconnect the IRX from the AC power source.**

2. **Open the IRX case.**

Remove the screw at the center of the top rear edge, then slide the top of the IRX case forward 1/2" horizontally and lift straight up. If difficulty is encountered in separating the top and bottom sections of the IRX case, try pressing down on the top edge sides and exerting a sudden push.

3. **Remove the expansion card.**

4. **Install the blank cover plates with the original screws.**

The screws, which mount the expansion face plate(s), should be partially screwed in and the expansion face plate(s) aligned before tightening any of the screws.

5. **Place the expansion board into an ESD bag.**

Place the bag between foam in a box. The expansion board can now be shipped or stored.

6. **Close the IRX case by reversing the procedure described in step 2.**

7. **Connect the IRX to the AC power source and set the power switch to the ON position.**

This chapter includes the following troubleshooting topics: hardware problems, solutions, and boot sequence in diagnostic mode.

Hardware Problems and Solutions

Hardware problems during installation can be identified by certain LED indications. Table 4-1 identifies these behaviors, the likely cause, and the likely solution. If the solution requires contacting Technical Support, refer to “Contacting Lucent Remote Access Technical Support” on page xiii.

Table 4-1 Hardware Problems and Solutions

LED Indication	Likely Cause	Solution
System LED fails to light.	Lack of power.	Check power switch, power cable, outlet, and fuse.
During power-on, the System LED fails to light, becomes solid ON, or becomes stuck at blinking three times per second.	Hardware problem.	Contact Lucent Remote Access Technical Support.

Table 4-1 Hardware Problems and Solutions (Continued)

LED Indication	Likely Cause	Solution
During power-on, the System LED continues blinking once per second for more than a minute.	DIP switch #2 UP and no boot server present.	If you have no boot server, verify that DIP switch #2 is in the down position; otherwise, refer to the “Network Booting” procedure in the <i>PortMaster Configuration Guide</i> .
	Flash RAM contents corrupt.	Follow the <i>PortMaster Configuration Guide</i> procedure for “Network Booting” and rewriting the contents of Flash RAM.
Immediately after booting, the System LED becomes stuck at solid ON or solid OFF.	Flash RAM problem.	Contact Lucent Remote Access Technical Support.
During operation, the System LED becomes stuck at solid ON or solid OFF.	Hardware failure (possibly caused by an external device).	If still solid ON or OFF after removing all external devices (except the diagnostics terminal), contact Lucent Remote Access Technical Support.
No console login prompt.	Incorrect terminal settings, bad connection, or bad cable.	Verify that cable is plugged into S0, not S5. Verify terminal is set for 9600, 8N1. Verify DIP switch #1 is UP. Verify that you have a working null modem cable and that it is properly connected at both ends. Refer to Appendix B, “Cabling Specifications.”

Table 4-1 Hardware Problems and Solutions (Continued)

LED Indication	Likely Cause	Solution
Link LED is solid OFF.	<p>If you are connected to an AUI or BNC Ethernet transceiver, this is not a problem.</p> <p>If you are connected to a 10BaseT Ethernet hub, you do not have link integrity.</p>	<p>Verify that both DIP switches #4 and #5 are UP (for 10BaseT), that you have a working 10BaseT cable, and that it is properly connected at this end and at the hub.</p> <p>For ether1 on the IRX-211, verify the setting of the two-section DIP switch.</p>
Network LED is solid ON.	<p>If traffic is heavy, this may only be an illusion.</p> <p>If no packets are being passed, you may have an incorrectly cabled network.</p>	<p>Verify correct network cabling.</p>
Network LED is solid OFF.	<p>If there is no traffic, this is normal.</p> <p>If packets cannot be passed, you may have an incorrectly cabled network.</p>	<p>Verify correct network cabling.</p>

Table 4-1 Hardware Problems and Solutions (Continued)

LED Indication	Likely Cause	Solution
Undefined difficulty with power-up and you are not able to isolate the problem by observing LED behavior.	Unknown	Boot in Diagnostic Mode. For information about diagnostic mode, refer to “Boot Sequence in Diagnostic Mode” on page 4-5. If the displayed diagnostics do not suggest a solution, record the information and contact Lucent Remote Access Technical Support.

Boot Sequence in Diagnostic Mode

If you are having difficulty with booting and are unable to isolate the problem by observing LED behavior, you may wish to boot in diagnostic mode, as follows:

- 1. Set the power switch on the IRX to the OFF position.**
- 2. Set the terminal to 9600 baud, 8 data bits, no parity, 1 stop bit, Xon/Xoff software control.**
- 3. Set DIP switch #1 to the UP position.**
- 4. Attach the terminal (or PC) to the console port (S0) using a null modem cable. Refer to Table B-1 in Appendix B for pinouts.**



Caution – Before you reapply power, refer to “Safety Recommendations” on page 2-1 and “Power Guidelines” on page 2-4.

- 5. Set the power switch to the ON position.**
- 6. Observe the boot diagnostics displayed on the console screen. Refer to Figure 4-1 for a sample boot screen in diagnostic mode and Table 4-2 for a description of displayed messages.**

```

Livingston Enterprises, Inc. Boot Prom Rev G

Testing Low Memory ....
Testing System Clock ....
Testing System Memory .... 1024K
Checking Boot Rom ....
Starting FLASH Boot .....
Loading Image at 0fff0000
340592 flash copy complete
Verifying Load Module Checksum ...
Starting Load Module ...
Sizing Physical Memory ... 1MB
Testing High Memory ... . 1024K
Found 5 ports....
ether0 active ... 64K burst-IO
Running ComOS...
PortMaster Console login:
    
```

Figure 4-1 IRX Boot Screen in Diagnostic Mode

Table 4-2 Interpreting the Diagnostics Boot Screen

Field	Possible Message	What it Means
Boot Prom Rev	G	Version number of the boot prom installed
Testing Low Memory	ERROR	Message only on failure. Record all information to this point and contact Lucent Remote Access Technical Support.
Testing System Clock	ERROR	Message only on failure. Record all information to this point and contact Lucent Remote Access Technical Support.

Table 4-2 Interpreting the Diagnostics Boot Screen (Continued)

Field	Possible Message	What it Means
Testing System Memory	ERROR at <i>failed memory address</i>	Message only on failure. Record all information to this point and contact Lucent Remote Access Technical Support.
Checking Boot Rom	ERROR	Message only on failure. Record all information to this point and contact Lucent Remote Access Technical Support.
Starting FLASH Boot	N/A	N/A
Loading Image at	0fff0000	RAM Address
flash copy complete	340592	Counter for Flash bytes transferred to RAM. If the counter freezes, record all information to this point and contact Lucent Remote Access Technical Support.
Verifying Load Module Checksum	Invalid Length for Flash at <i>RAM address</i>	Message only on failure. Record all information to this point and contact Lucent Remote Access Technical Support.
Starting Load Module	N/A	N/A
Sizing Physical Memory	1MB	Amount of RAM installed, either 1, 4 or 16 megabytes
Testing High Memory	ERROR at <i>failed memory address</i>	Message only on failure. Record all information to this point and contact Lucent Remote Access Technical Support.
Found 5 Ports	N/A	Number of serial ports found, including s0.
ether0 active	N/A	Ethernet interface found. IRX-211 also prints a message for ether1.

Table 4-2 Interpreting the Diagnostics Boot Screen (Continued)

Field	Possible Message	What it Means
Running ComOS	N/A	If system hangs at this point and does not print the next message, the configuration flash memory has been corrupted. Refer to the <i>PortMaster Troubleshooting Guide</i> .
PortMaster Console login:	N/A	System up and running.

This appendix includes the physical, electrical/electronic, and environmental specifications for the PortMaster Internetwork Router (IRX).

Physical Specifications

Table A-1 provides physical specifications for the IRX-111 and IRX-112. Table A-2 provides physical specifications for the IRX-114 and IRX-211.

Table A-1 IRX-111 and IRX-112 Physical Specifications

Description	IRX-111	IRX-112
Dimensions (HxWxD)	3.2" x 16.8" x 11.5" (8.1cm x 42.7cm x 29.2cm)	3.2" x 16.8" x 11.5" (8.1cm x 42.7cm x 29.2cm)
Weight	11.8 lb. (5.4 kg)	11.8 lb. (5.4 kg)
Ethernet Interface	1—10BaseT (RJ-45), AUI (DB-15), or BNC	1—10BaseT (RJ-45), AUI (DB-15), or BNC
Asynchronous Serial Interface	1—RS-232/423, with data rates up to 115,200 bps	1—RS-232/423, with data rates up to 115,200 bps
Synchronous Serial Interface	1—capable up to T1/E1	1—capable up to T1/E1 1—capable up to 64Kbps

Table A-2 IRX-114 and IRX-211 Physical Specifications

Description	IRX-114	IRX-211
Dimensions (HxWxD)	3.2" x 16.8" x 11.5" (8.1cm x 42.7cm x 29.2cm)	3.2" x 16.8" x 11.5" (8.1cm x 42.7cm x 29.2cm)
Weight	12.0 lb. (5.5 kg)	11.8 lb. (5.4 kg)
Ethernet Interface	1—10BaseT (RJ-45), AUI (DB-15), or BNC	2—10BaseT (RJ-45), AUI (DB-15), or BNC
Asynchronous Serial Interface	1—RS-232/423, with data rates up to 115,200 bps	1—RS-232/423, with data rates up to 115,200 bps
Synchronous Serial Interface	2—capable up to T1/E1 2—capable up to 64Kbps	1—capable up to T1/E1

Electrical/Electronic Specifications

Table A-3 provides electrical/electronic specifications for the IRX.

Table A-3 Electrical/Electronic Specifications

Description	Design Specifications
Input Voltage	110 VAC +/-10%, 47 to 63 Hz, 1.0A 220 VAC +/-10%, 47 to 63 Hz, 0.6A
Power Dissipation	23 Watts
Memory	512KB NVRAM, 1MB RAM expandable to 4MB or 16MB

Environmental Specifications

Table A-4 provides environmental specifications for the IRX.

Table A-4 Environmental Specifications

Description	Design Specifications
Operating temperature	41 to 113°F (5 to 45°C)
Storage temperature	-40 to 185°F (-40 to 85°C)
Operating humidity	20 to 80%, noncondensing

Cabling Specifications B

This appendix provides pinouts for the IRX console cable, asynchronous serial cable, synchronous (RS-232 and V.35) serial cables, and the pin numbering sequence for RJ-45 10BaseT cables and Ethernet cabling specifications.

Asynchronous Serial Cable Pinouts

Port S0 is an asynchronous DTE port with a female RS-232 connector. To connect to a terminal or other DTE, use a null modem cable, typically male-to-female, as shown in Table B-1. To connect to a modem or other DCE, use a male-to-male straight-through cable, as shown in Table B-2. Directions (input/output) are with respect to the IRX.

Table B-1 Null Modem Cable

Pins (port)	Name	Definition	Direction	Pins (terminal)
2	TXD	Transmit Data	Output	3
3	RXD	Receive Data	Input	2
4	RTS	Request to Send	Output	5
5	CTS	Clear to Send	Input	4
6	DSR	Data Set Ready	Input	20
7	SGND	Signal Ground		7
8	DCD	Data Carrier Detect	Input	8
20	DTR	Data Terminal Ready	Output	6

Table B-2 Straight-through Cable

Pins (port)	Name	Definition	Direction	Pins (modem)
2	TXD	Transmit Data	Output	2
3	RXD	Receive Data	Input	3
4	RTS	Request to Send	Output	4
5	CTS	Clear to Send	Input	5
6	DSR	Data Set Ready	Input	6
7	SGND	Signal Ground		7
8	DCD	Data Carrier Detect	Input	8
20	DTR	Data Terminal Ready	Output	20



Note – A 6' male-to-male straight-through cable can be purchased from Lucent Remote Access, using product code MC-6.

Synchronous Serial with RS-232 Cable Pinouts

Table B-3 provides the pinouts for the IRX DTE synchronous RS-232 serial port connection. The directions, input/output, are with respect to the IRX. Pins not listed have no connection. To connect to this port, you can use a straight-through 25-pin RS-232 cable.



Note – RS-232 only supports signalling at speeds up to 56Kbps. If the device at the other end of the cable supports RS-423 signalling, speeds up to 128Kbps can be obtained.

Table B-3 Synchronous Serial Port Pinout with RS-232

Pin	Name	Definition	Direction
2	TXD	Transmit Data	Output
3	RXD	Receive Data	Input
4	RTS	Request to Send	Output
5	CTS	Clear to Send	Input
6	DSR	Data Set Ready	Input
7	SGND	Signal Ground	
8	DCD	Data Carrier Detect	Input
15	ST	Send Timing	Input
17	RT	Receive Timing	Input
20	DTR	Data Terminal Ready	Output

Synchronous Serial with V.35 Cable Pinouts

Table B-4 provides the pinouts for the IRX DTE synchronous V.35 serial port connection, capable of speeds up to T1/E1. The directions, input/output, are with respect to the IRX. Pins not listed have no connection.



Note – To connect with this port, use the V.35 cable included with your IRX. To order additional cables from Lucent Remote Access, use product code DC-6.

Table B-4 Synchronous Serial Port Pinout with V.35

Pin	V.35 Pin	Name	Definition	Direction
2	P	TXD	Transmit Data	Output
14	S	TXD-		
3	R	RXD	Receive Data	Input
16	T	RXD-		
4	C	RTS	Request to Send	Output
5	D	CTS	Clear to Send	Input
6	E	DSR	Data Set Ready	Input
7	B	SGND	Signal Ground	
8	F	DCD	Data Carrier Detect	Input
15	Y	ST	Send Timing	Input
13	AA	ST-		
17	V	RT	Receive Timing	Input
19	X	RT-		
20	H	DTR	Data Terminal Ready	Output

RJ-45 Connector Numbering

The 10BaseT Ethernet port uses a female RJ-45 connector. Figure B-1 shows pin numbering for female RJ-45 connectors.

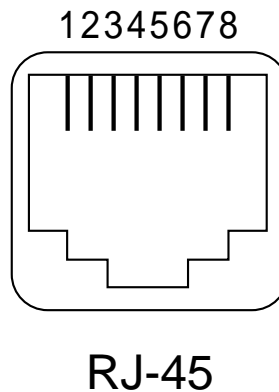


Figure B-1 Pin Numbering for RJ-45 Female Connector

Ethernet Cabling

Specifications for the 10Mbps Baseband IEEE 802.3-compatible Ethernet interface are provided in Table B-5.

Table B-5 Network Interface Cabling

Ethernet Type	Connector Type	Cable Type	Transmission Distance
AUI	15-pin DIX for connection to external transceiver	RG-11 50 Ω coaxial	Trunk segment - 1,640 ft/500 m max Transceiver cable - 164 ft/50 m max Network trunk - 8,200 ft/2,500 m max
BNC	BNC T-Connector	RG-58 A/U 50 Ω coaxial	Trunk segment - 984 ft/300 m max Station distance - 1.5 ft/0.5 m max Network trunk - 3,035 ft/925 m max
RJ-45	RJ-45 for 10BaseT	Unshielded Twisted Pair	Hub distance - 328 ft/100 m max Repeaters - 4 max

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