SmartNode 1000 and 2000 Series
VoIP Media Gateways

Getting Started Guide

Contents

Compliance Information

Radio and TV Interference (FCC Part 15)

This equipment generates and uses radio frequency energy, and if not installed and used properly—that is, in strict accordance with the manufacturer's instructions—may cause interference to radio and television reception. This equipment has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If the equipment causes interference to radio or television reception, which can be determined by disconnecting the cables, try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna, and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches).

CE Declaration of Conformity

We certify that the apparatus identified in this document conforms to the requirements of Council Directive 1999/5/EC on the approximation of the laws of the member states relating to Radio and Telecommunication Terminal Equipment and the mutual recognition of their conformity.

The safety advice in the documentation accompanying this product shall be obeyed. The conformity to the above directive is indicated by the CE sign on the device.

Compliance

EMC
- FCC Part 15, Class B
- EN55022, Class B
- EN55024

Safety
- UL60950-1/CSA C22.2 No. 60950-1 (SN2300 & SN2400)
- IEC/EN 60950-1
- AS/NZS 60950-1 (SN2400

PSTN Regulatory (SN1200 & SN1400)
- TBR 3 (ISDN-BRI)

PSTN Regulatory (SN1200 & SN1400)
- FCC Part 68 (with T1V Card)
- CS-03 (with T1V Card)
- TBR 3 (with 4BRV Card)
- TBR 4 (with 4BRV Card

- TBR 12 & 13 (with E1V Card)
- AS/ACIF S016:2001 (with E1V Card)

FCC Part 68 (ACTA) Statement (SN2300 & SN2400 with T1V Card)

This equipment complies with Part 68 of FCC rules and the requirements adopted by ACTA. On the bottom side of this equipment is a label that contains—among other information—a product identifier in the format US: AAAEQ##TXXXX. If requested, this number must be provided to the telephone company.

The method used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment, for repair or warranty information, please contact our company. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

Connection to party line service is subject to state tariffs. Contact the state public utility commission, public service commission or corporation commission for information.

Industry Canada Notice (SN2300 & SN2400 with T1V Card)

This equipment meets the applicable Industry Canada Terminal Equipment Technical Specifications. This is confirmed by the registration number. The abbreviation, *IC*, before the registration number signifies that registration was performed based on a Declaration of Conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.

This Declaration of Conformity 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 condition may not prevent degradation of service in some situations. Repairs to some certified equipment should be made by an authorized 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 ground connections of the power utility, telephone lines and internal metallic water pipe system, are connected together. This protection may be particularly important in rural areas.

Service

All warranty and non-warranty repairs must be returned freight prepaid and insured to Patton Electronics. For more information about warranty service, refer to "Warranty Service and Returned Merchandise Authorizations (RMAs)" on page 157. All returns must have a Return Materials Authorization number on the outside of the shipping container. This number may be obtained from Patton Electronics Technical Services at:

• Tel: **+1 (301) 975-1007**

• Email: **support@patton.com**

• URL: **http://www.patton.com**

> **Note** Packages received without an RMA number will not be accepted.

About this guide

This guide provides hardware information concerning SmartNode devices and their interface cards. The installation of the cards and the cabling of the devices are also described. The goal is to enable you to install such devices, alone or under supervision.

The information included in this guide consists of:

- Hardware descriptions of the SmartNodes
- Hardware descriptions of the extension interface cards
- Hardware installation instructions
- LED indications
- Cabling and pin-out data

> **Note**   The guide describes three SmartNode models that are similar in functionality, but differ in the number and type of interfaces that they support. Because of this some of the information provided may not apply to your particular SmartNode model.

For software configuration information and initial SmartNode installation refer to the *Software Configuration Guide*.

Audience

The guide is intended for the following audiences:

- Technical staff who are familiar with electronic circuitry, networking theory and have experience as an electronic or electromechanical technician.
- System administrators with a basic networking background and experience, but who might not be familiar with the SmartNode.
- System administrators who are responsible for installing and configuring networking equipment and who are familiar with the SmartNode.

How to read this guide

SmartWare is a complex and multifaceted operating system running on your SmartNode device. Without the necessary theoretical background you will not be able to understand and consequently use all the features available. Therefore we recommend reading at least the chapters listed below to get a general idea about SmartWare and the philosophy of contexts used for IP and circuit switching related configuration.

Structure

This guide contains the following chapters and appendices:

- Chapter 1 provides information about SmartNode features and capabilities
- Chapter 2 contains an overview describing SmartNode operation
- Chapter 3 lists items and information that should be at hand before you begin installing the SmartNode device
- Chapter 4 describes installing the SmartNode 1200
- Chapter 5 describes installing the SmartNode 1400
- Chapter 6 describes installing the SmartNode 2300
- Chapter 7 describes installing the SmartNode 2400
- Chapter 8 describes installing the line power module
- Chapter 9 describes installing interface cards
- Chapter 10 describes how to configure the SmartNode for operation
- Chapter 11 describes SmartNode status LEDs
- Chapter 12 provides information for contacting Patton Electronics
- Appendix A contains specifications for the SmartNode devices
- Appendix B provides cable recommendations
- Appendix C describes the router's ports

For best results, read the contents of this guide *before* you install the router.

Precautions

This section lists safety warnings that you should be aware of before installing a SmartNode or an interface card in a SmartNode.

Notes and cautions, which have the following meanings, are used throughout this guide to help you become aware of potential problems. *Warnings* relate to personal injury issues, and *Cautions* refer to potential property damage.

Note   Calls attention to important information.

The shock hazard symbol and WARNING heading indicate a potential electric shock hazard. Strictly follow the warning instructions to avoid injury caused by electric shock.

WARNING

The alert symbol and WARNING heading indicate a potential safety hazard. Strictly follow the warning instructions to avoid personal injury.

WARNING

CAUTION

The shock hazard symbol and CAUTION heading indicate a potential electric shock hazard. Strictly follow the instructions to avoid property damage caused by electric shock.

CAUTION

The alert symbol and CAUTION heading indicate a potential hazard. Strictly follow the instructions to avoid property damage.

Safety when working with electricity

WARNING

This device contains no user serviceable parts. The equipment shall be returned to Patton Electronics for repairs, or repaired by qualified service personnel.

WARNING

Mains Voltage: Do not open the case when the power cord is attached. For systems without a power switch, line voltages are present within the power supply when the power cords are connected. The mains outlet that is utilized to power the devise shall be within 10 feet (3 meters) of the device, shall be easily accessible, and protected by a circuit breaker.

WARNING

Ensure that the power cable used with this devise meets all applicable standards for the country in which it is to be installed, and that it is connected to a wall outlet which has earth ground.

WARNING

Hazardous network voltages are present in WAN ports regardless of whether power to the unit is ON or OFF. To avoid electric shock, use caution when near WAN ports. When detaching the cables, detach the end away from the device first.

WARNING

Do not work on the system or connect or disconnect cables during periods of lightning activity.

WARNING

Do not work on the system unless telephone network cables are disconnected in order to prevent contact with telephone line voltages.

In accordance with the requirements of council directive 2002/96/EC on Waste of Electrical and Electronic Equipment (WEEE), ensure that at end-of-life you separate this product from other waste and scrap and deliver to the WEEE collection system in your country for recycling.

Preventing Electrostatic Discharge Damage

When starting to install interface cards place the interface card on its shielded plastic bag if you lay it on your bench.

CAUTION

Electrostatic Discharge (ESD) can damage equipment and impair electrical circuitry. It occurs when electronic printed circuit cards are improperly handled and can result in complete or intermittent failures. Do the following to prevent ESD:

- Always follow ESD prevention procedures when removing and replacing cards.

- Ensure that the SmartNode chassis is electrically connected to earth ground.

- Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted surface of the chassis frame to safely channel unwanted ESD voltages to ground.

- To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

General Observations

- Clean the case with a soft slightly moist anti-static cloth
- Place the unit on a flat surface (or optionally in a rack for the SmartNode 2000 Series) and ensure free air circulation
- Avoid exposing the unit to direct sunlight and other heat sources
- Protect the unit from moisture, vapors, and aggressive liquids

Typographical conventions used in this document

This section describes the typographical conventions and terms used in this guide.

General conventions

The procedures described in this manual use the following text conventions:

Table 1. General conventions

Convention	Meaning
Garamond blue type	Indicates a cross-reference hyperlink that points to a figure, graphic, table, or section heading. Clicking on the hyperlink jumps you to the reference. When you have finished reviewing the reference, click on the **Go to Previous View** button ◄ in the Adobe® Acrobat® Reader toolbar to return to your starting point.
Futura bold type	Commands and keywords are in **boldface** font.
Futura bold-italic type	Parts of commands, which are related to elements already named by the user, are in ***boldface italic*** font.
Italicized Futura type	Variables for which you supply values are in *italic* font
Futura type	Indicates the names of fields or windows.
Garamond bold type	Indicates the names of command buttons that execute an action.
< >	Angle brackets indicate function and keyboard keys, such as <SHIFT>, <CTRL>, <C>, and so on.
[ ]	Elements in square brackets are optional.
{a | b | c}	Alternative but required keywords are grouped in braces ({ }) and are separated by vertical bars (|)
blue screen	Information you enter is in blue screen font.
screen	Terminal sessions and information the system displays are in screen font.
node	The leading IP address or nodename of a SmartNode is substituted with ***node*** in ***boldface italic*** font.
SN	The leading **SN** on a command line represents the nodename of the SmartNode
#	An hash sign at the beginning of a line indicates a comment line.

Mouse conventions

The following conventions are used when describing mouse actions:

Table 2. Mouse conventions

Convention	Meaning
Left mouse button	This button refers to the primary or leftmost mouse button (unless you have changed the default configuration).
Right mouse button	This button refers the secondary or rightmost mouse button (unless you have changed the default configuration).
Point	This word means to move the mouse in such a way that the tip of the pointing arrow (referred to as the *cursor*) on the screen ends up resting at the desired location.
Click	Means to press and release the left or right mouse button one time quickly (as instructed in the procedure). Make sure you do not move the cursor while clicking a mouse button.
Double-click	Means to press and release the same mouse button two times quickly. Make sure you do not move the cursor while clicking a mouse button.

Table 2. Mouse conventions

Convention	Meaning
Drag	This word means to place the cursor and then hold down the left or right mouse button (as instructed in the procedure) as you move the mouse to a new location. When you have moved the cursor to the desired location, you can release the mouse button.

Chapter 1   General Information

Chapter contents

Introduction

This guide describes installing the SmartNode 1000 Series and 2000 Series devices.

The SmartNode 1000 series are compact IP access devices for applications in SOHO or branch office environments. Two models are currently available with 2 or 4 voice over IP channels (see figure 1):

- **SmartNode 1200**—Dual Ethernet router, 2-channel ISDN BRI gateway (see "SmartNode 1200 description" on page 22)

- **SmartNode 1400**—Dual Ethernet router, 4-channel ISDN BRI gateway (see "SmartNode 1400 description" on page 25)
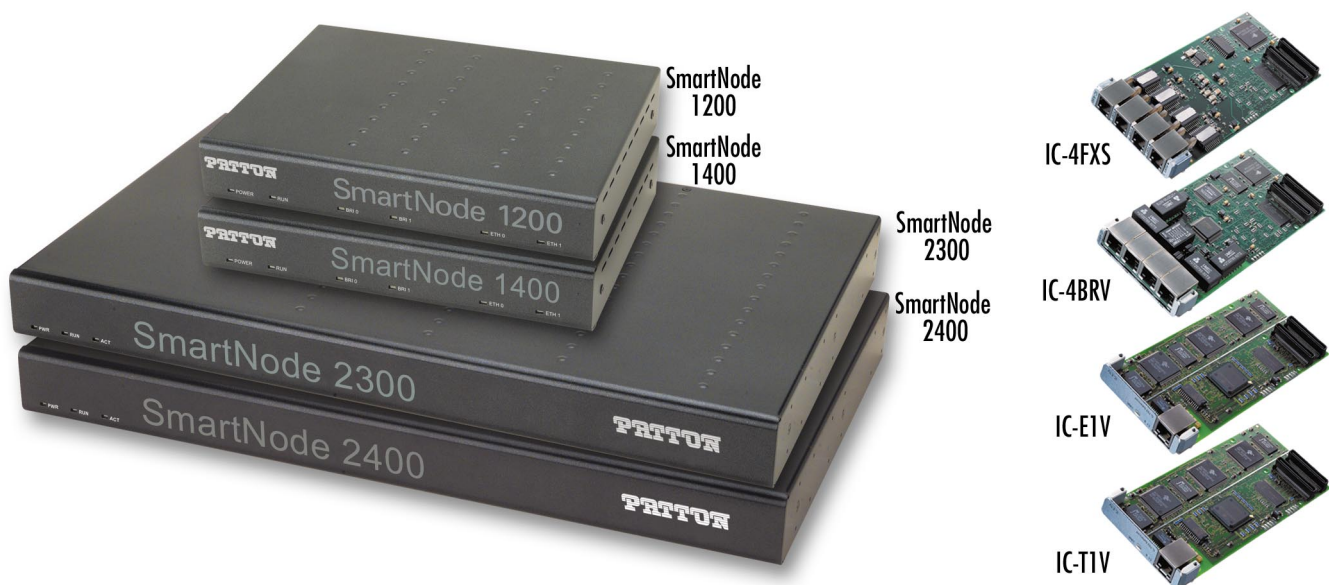
Figure 1. SmartNode 1000 Series and 2000 Series VoIP media gateways, and interface cards

The SmartNode 2000 Series are modular IP network nodes designed for medium and large enterprise applications. The 2000 series features expansion slots for a range of interface cards. Currently available models are (see figure 1):

- **SmartNode 2300**—Serial/Ethernet router with three expansion slots for interface cards (see "SmartNode 2300 description" on page 28)

- **SmartNode 2400**—High performance router with four expansion slots for interface cards (see "SmartNode 2400 description" on page 32)

The following interface cards (see figure 1) are available for use with the SmartNode 2000 Series devices (see "Interface cards descriptions" on page 35):

- **IC-4FXS**—Gateway interface card for 4 analog FXS ports

- **IC-4BRV**—8-channel gateway interface card for ISDN BRI

- **IC-E1V**—30-channel E1 gateway interface card for ISDN PRI

- **IC-T1V**—23-channel T1 gateway interface card for ISDN PRI

SmartNode 1200 description

The SmartNode Model 1200 (see figure 2) is a compact voice/data access device that supports two voice channels. The user interfaces consist of one ISDN BRI port and one Ethernet 10Base-T port. Network access comprises one ISDN BRI port and one Ethernet 10Base-T port. It is suitable for home office or small office applications. The ventilated metal case can be placed on a desktop or be wall-mounted.

Figure 2. Model 1200 (front and rear views shown)

Front panel

The Model 1200 front panel (see figure 3) includes the following LEDs for at-a-glance status display:

- *POWER* and *RUN* LEDs that indicate the device status.

- *BRI0*, *BRI1*, *ETH0*, and *ETH1* LEDs that indicate the status of the interfaces.
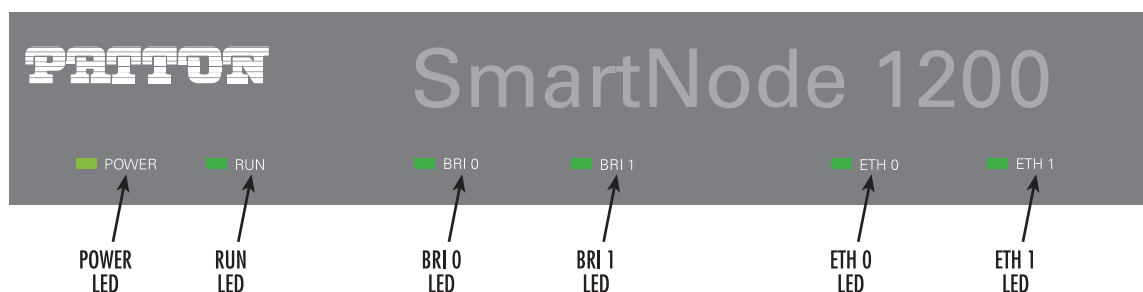
Figure 3. SmartNode 1200 front panel

See chapter 11, "Monitoring Status" on page 151, for more information on LED indications.

Rear panel

The SmartNode 1200 rear panel includes the following LEDs for at-a-glance status display (see figure 4):

• *LINK* LEDs that indicate the status of the Ethernet connections

• *L2* LEDs that show the status of the BRI interfaces

The ports are described in table 3 (see appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data).
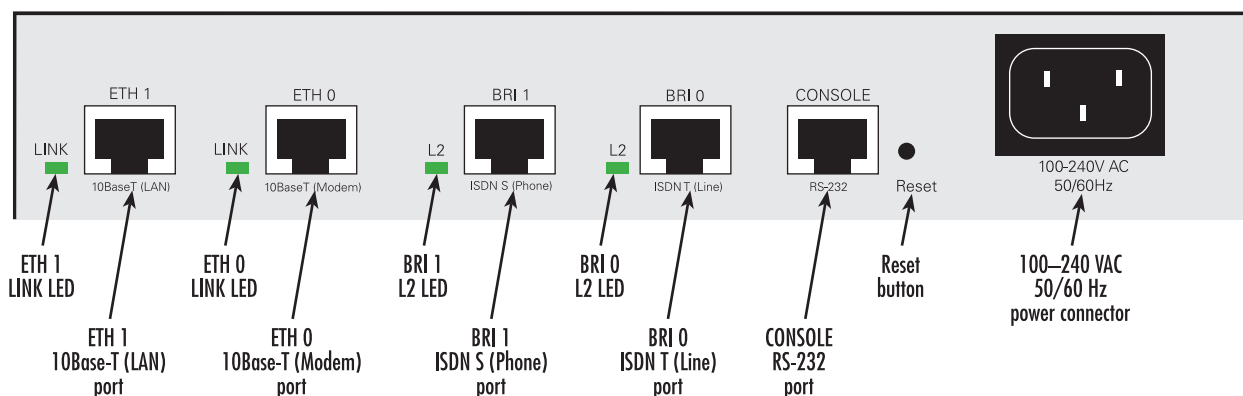
Figure 4. SmartNode 1200 rear panel

Table 3. SmartNode 1200 port description

Port	Description
ETH 0 10Base-T (Modem)	10Base-T Ethernet RJ-45 socket that connects the SmartNode with an Ethernet device (usually a transmission modem, i.e. cable or DSL modem). *ETH 0* is a host port; depending on the pin out of the modem, it can be connected with a straight-through wired cable or a cross-over cable. The *LINK* LED to the left of the connector is lit when the port is connected correctly to an active Ethernet device.
ETH 1 10Base-T (LAN)	10Base-T Ethernet RJ-45 socket that connects the SmartNode with an Ethernet device, usually a LAN hub or switch. *ETH 1* is a host port; it can be connected with a straight-through wired cable to a hub or a cross-over cable to a host (PC) port. The *LINK* LED to the left of the connector is lit when the port is connected correctly to an active Ethernet device.
BRI 0 ISDN T (Line)	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN network termination (NT). The interface may be used as a fallback port. The *L2* LED to the left of the connector is lit when the port is connected correctly to an active ISDN device (Layer 1 is up). The interface is internally terminated at 100 ohm. It may be powered by an external power supply to feed TEs connected to BRI 1. Refer to appendix B, "Cabling" on page 165 for connection details. **Note** External S-Bus power supplies must comply with the voltage and current limits set by ISDN standards, i.e. max. 40 VDC and 200 mA. **Note** The L2 LED indication depends on the connected device.

Table 3. SmartNode 1200 port description (Continued)

Port	Description
BRI 1 ISDN S (Phone)	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN S-Bus, e.g. a PBX. The *L2* LED to the left of the connector is lit when the port is connected correctly to an active ISDN device (Layer 1 is up). The interface is internally terminated at 100 ohm. **Note** The *L2* LED indication depends on the connected device.
Console (RS-232)	RS-232 RJ-45 connector that connects the SmartNode with a serial terminal such as a PC or workstation with an RS-232 interface, with the following settings: • 9600 bps, no parity, 8 bit, 1 stop bit, 1 start bit • The console port is only used for service and maintenance

Do not plug in an ISDN connection. The voltage on the S-Bus may permanently damage the console interface.

CAUTION

In addition, two other elements—the *Reset* button and power input socket—are available on the rear panel of a SmartNode 1200 as described in table 4.

Table 4. SmartNode 1200 Reset button and power line socket on rear panel

Element	Description
Reset button	The button has three different functions: • **Manual Restart**—During normal operation, pressing and releasing the reset button will cause a system reboot. The application will be restarted without any change to the existing SmartWare configuration. • **Restoration**—Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system. **Note** In this case the existing IP SmartWare configuration is lost. • **Boot loader**—Powering the SmartNode while pressing the reset button for 5 seconds will cause the factory-fitted boot loader to start in place of the application. The boot loader uses a minimal set of parameters. In case the application does not start correctly, the boot loader can be used as a fallback to download a new software version.
100–240 VAC 50/60 Hz	Electricity supply socket for mains power cable.

Clock mode configuration (Model SN1200)

The following table shows which clock mode configurations are allowed for the SmartNode 1200 and which port is used as the clock source.

Table 5. Clock-modes and clock-sources for the SmartNode 1200

Port 0 Clock Mode	Port 1 Clock Mode	Clock Source
Slave (User)	Master (Net)	Port 0. This is the only configuration that is supported on the SmartNode 1200. Clock is taken from port 0 if available. Otherwise it is generated internally.
Master (Net)	Slave (User)	Not supported

SmartNode 1400 description

The SmartNode Model 1400 (see figure 5) is a compact voice/data access device that supports four voice channels. The interfaces consist of two ISDN BRI ports and two Ethernet 10Base-T ports. It is suitable for enterprise networking and small office environments. The ventilated metal case can be wall-mounted or placed on a desktop.

Figure 5. Model 1400 (front and rear views shown)

Front panel

The Model 1400 front panel (see figure 7) includes the following LEDs for at-a-glance status display:

• *POWER* and *RUN* LEDs that indicate the device status

• *BRI0*, *BRI1*, *ETH0*, and *ETH1* LEDs that indicate the status of the interfaces

Figure 6. SmartNode 1400 front panel

See chapter 11, "Monitoring Status" on page 151 for more information on LED indications.

Rear panel

The SmartNode 1400 rear panel includes the following LEDs for at-a-glance status display (see figure 4):

- *LINK* LEDs that indicate the status of the Ethernet connections

- *L2* LEDs that show the status of the BRI interfaces

The ports are described in table 6 (see appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data).

Figure 7. SmartNode 1400 rear panel

Table 6. SmartNode 1400 port description

Port	Description
ETH 0 10Base-T (Modem)	10Base-T Ethernet RJ-45 socket that connects the SmartNode with an Ethernet device (usually a transmission modem, i.e. cable or DSL modem). *ETH 0* is a host port; depending on the pin out of the modem, it can be connected with a straight-through wired cable or a cross-over cable. The *LINK* LED to the left of the connector is lit when the port is connected correctly to an active Ethernet device.

Table 6. SmartNode 1400 port description (Continued)

Port	Description
ETH 1 10Base-T (LAN)	10Base-T Ethernet RJ-45 socket that connects the SmartNode with an Ethernet device, usually a LAN hub or switch. *ETH 1* is a host port; it can be connected with a straight-through wired cable to a hub or a cross-over cable to a host (PC) port. The *LINK* LED to the left of the connector is lit when the port is connected correctly to an active Ethernet device.
BRI 0 ISDN S/T	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S/T bus, e.g. a PBX or an NT. The interface may be used as fallback if connected to an NT. The *L2* LED to the left of the connector is lit when the port is connected correctly to an active ISDN device (Layer 1 is up). The pin-out is configurable; see the document Smart-Ware Software Configuration Guide. The interface is internally terminated at 100 ohm. It may be powered by an external power supply to feed TEs connected to BRI 1. Refer to appendix B, "Cabling" on page 165 for connection details. **Note** External S-Bus power supplies must comply with the voltage and current limits set by ISDN standards, i.e. max. 40 VDC and 200 mA. **Note** The *L2* LED indication depends on the connected device.
BRI 1 ISDN S/T	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S/T bus, such as a PBX. The *L2* LED to the left of the connector is lit when the port is connected correctly to an active ISDN device (Layer 1 is up). The pin out is configurable; see the document *SmartWare Software Configuration Guide*. The interface is internally terminated at 100 ohm. **Note** The *L2* LED indication depends on the connected device.
Console (RS-232)	RS-232 RJ-45 connector that connects the SmartNode with a serial terminal such as a PC or workstation with a RS-232 interface, with the following settings: • 9600 bps, no parity, 8 bit, 1 stop bit, 1 start bit • The console port is only used for service and maintenance

> **CAUTION** Do not plug in an ISDN connection. The voltage on the S-Bus may permanently damage the console interface.

Clock mode configuration (Model SN1400)

The following table shows which clock mode configurations are allowed for the SmartNode 1400 and which port is used as the clock source.

Table 7. Clock-modes and clock-sources for the SmartNode 1400

Port 0 Clock Mode	Port 1 Clock Mode	Clock Source
Slave (User)	Slave (User)	Port 1
Master (Net)	Master (Net)	Clock generated internally

Table 7. Clock-modes and clock-sources for the SmartNode 1400

Port 0 Clock Mode	Port 1 Clock Mode	Clock Source
Slave (User)	Master (Net)	Port 0. Clock is taken from port 0 if available. Otherwise it is generated internally.
Master (Net)	Slave (User)	Not supported

> **Note** The SmartNode 1400 needs to be rebooted twice after changing the clock mode.

In addition, two other elements—the *Reset* button and power input socket—are available on the rear panel of a SmartNode 1200 as described in table 8.

Table 8. SmartNode 1200 Reset button and power line socket on rear panel

Element	Description
Reset button	The button has three different functions: • **Manual Restart**—During normal operation pressing and releasing the reset button will cause a system reboot. The application will be restarted without any change to the existing SmartWare configuration. • **Restoration**—Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system. **Note** In this case the existing IP SmartWare configuration is lost. • **Boot loader**—Powering the SmartNode while pressing the reset button for 5 seconds will cause the factory-fitted boot loader to start in place of the application. The boot loader uses a minimal set of parameters. In case the application does not start correctly, the boot loader can be used as a fallback to download a new software version.
100–240 VAC 50/60 Hz	Electricity supply socket for mains power cable.

SmartNode 2300 description

The SmartNode Model 2300 (see figure 8) is a powerful multi-service access device. The 19-in. aluminum chassis can be rack-mounted and it provides three expansion slots for interface cards.

> **Note** If you will be mounting the SmartNode 2300 in a 19-in. rack, see section "Mounting the SmartNode 2300" on page 93 for details.

Figure 8. Model 2300 (front and rear views shown)

Front panel

The SmartNode 2300 rear panel includes the *PWR, RUN*, and *ACT* LEDs that indicate the status of the device (see figure 9). See chapter 11, "Monitoring Status" on page 151 for detailed information on the LED states.
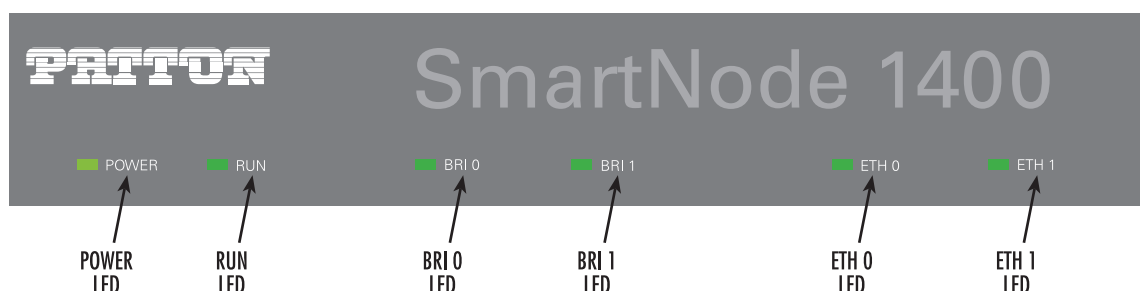

Figure 9. SmartNode 2300 front panel

See chapter 11, "Monitoring Status" on page 151 for more information on LED indications.

Rear panel

The SmartNode 2300 rear panel is depicted in figure 10. There are three expansion slots for optional interface cards, and four board-mounted sockets. The *Status, LINK*, and *100Mb/s* LEDs indicate the status of the on-

board interfaces (see appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data).
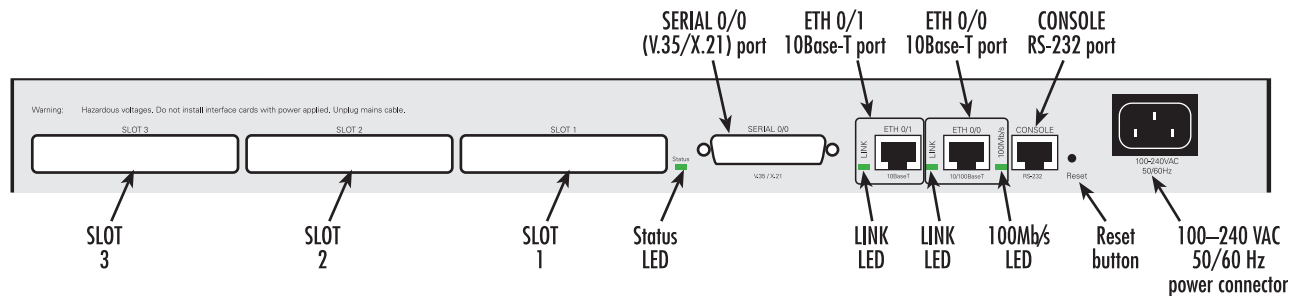
Figure 10. SmartNode 2300 rear panel

Expansion slots

The slots labeled *SLOT 1*, *SLOT 2*, and *SLOT 3* (see figure 10) accept different PMC interface cards to integrate voice and data over IP networks (see "Interface cards descriptions" on page 35 for more information).

On-board ports

Three motherboard-mounted network interfaces are available for use, independent of those that may be included with interface cards mounted in *SLOT 1*, *SLOT 2*, or *SLOT 3*. The motherboard-mounted ports are described in table 9 (see appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data).

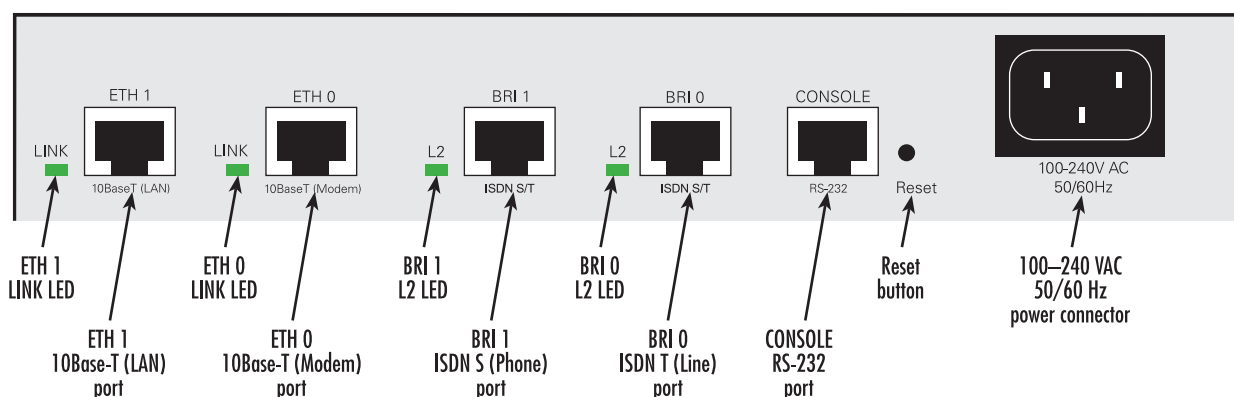Table 9. SmartNode 2300 port description

Port	Description
SERIAL 0/0 (V.35 / X.21)	DB-25 socket providing a V.35 and X.21 interface for leased-lines at up to 2 Mbps. The *LINK* LED to the left of the connector indicates its status.
ETH 0/1 (10BaseT)	10Base-T Ethernet RJ-45 socket that connects the SmartNode with an Ethernet device, such as a wide area transmission modem, Ethernet hub, or switch. *ETH 0/1* is a host port; it can be connected with a straight-through wired cable to a hub, or a cross-over cable to a host port. The *LINK* LED is lit when the port is connected correctly to an active Ethernet device.
ETH 0/0 (10/100BaseT)	10/100Base-T Ethernet RJ-45 socket. The interface is similar in function to ETH 0/1 except that it also supports 100Base-T. The *100Mb/s* LED is lit when the port is connected correctly to an active 100Base-T Ethernet device.
Console (RS-232)	RS-232 RJ-45 connector that connects the SmartNode with a serial terminal such as a PC or workstation with a RS-232 interface, with the following settings: • 9600 bps, no parity, 8 bit, 1 stop bit, 1 start bit • The console port is only used for service and maintenance

Do not plug in an ISDN connection. The voltage on the S-Bus may permanently damage the console interface.

CAUTION

In addition, two other elements the—*Reset* button and power input socket—are available on the rear panel of a SmartNode 1200 as described in table 10.

Table 10. SmartNode 2300 Reset button and power line socket on rear panel

Element	Description
Reset button	The button has three different functions: • **Manual Restart**—During normal operation pressing and releasing the reset button will cause a system reboot. The application will be restarted without any change to the existing SmartWare configuration. • **Restoration**—Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system. **Note** In this case the existing IP SmartWare configuration is lost. • **Boot loader**—Powering the SmartNode while pressing the reset button for 5 seconds will cause the factory-fitted boot loader to start in place of the application. The boot loader uses a minimal set of parameters. In case the application does not start correctly, the boot loader can be used as a fallback to download a new software version.
100–240 VAC 50/60 Hz	Electricity supply socket for mains power cable.

SmartNode 2400 description

The SmartNode Model 2400 (see figure 11) is a powerful multi-service access device. The 19-in. aluminum chassis can be rack-mounted, and provides three expansion slots for interface cards.

> **Note**   If you will be mounting the SmartNode 2400 in a 19-in. rack, see section "Mounting the SmartNode 2400" on page 111 for details.

Figure 11. Model 2400 (front and rear views shown)

Front panel

The SmartNode 2400 rear panel includes the *PWR*, *RUN*, and *ACT* LEDs that indicate the status of the device (see figure 12). See chapter 11, "Monitoring Status" on page 151 for detailed information on the LED states.

Figure 12. SmartNode 2400 front panel

See chapter 11, "Monitoring Status" on page 151 for more information on LED indications.

Rear panel

The SmartNode 2400 rear panel is depicted in figure 13. There are four expansion slots for optional interface cards, and four board-mounted sockets. There are four expansion slots for optional interface cards, and four board-mounted sockets. The *Link*, and *100Mb/s* LEDs indicate the status of the Ethernet ports. See appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data.
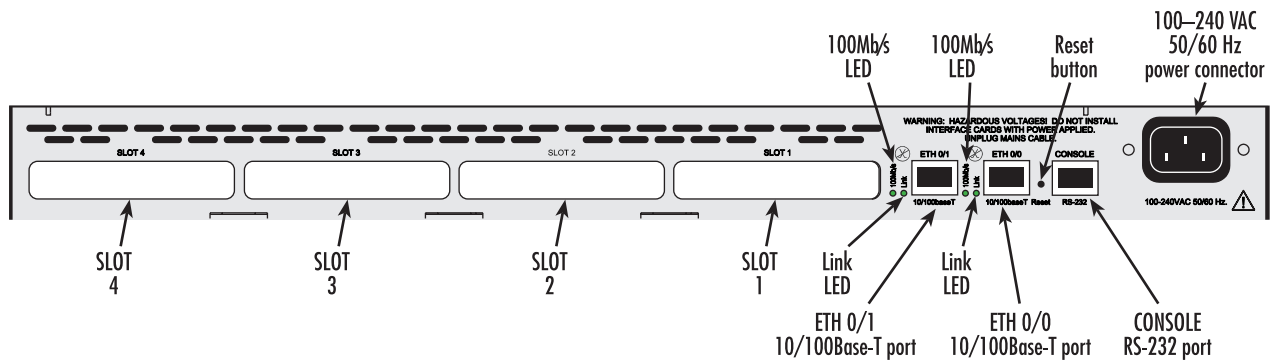
Figure 13. SmartNode 2400 rear panel

Expansion slots

The slots labeled *SLOT 1*, *SLOT 2*, *SLOT 3* and *SLOT* 4 (see figure 13) accept different PMC interface cards to integrate voice and data over IP networks (see "Interface cards descriptions" on page 35 for more information).

On-board ports

Three motherboard-mounted network interfaces are available for use, independent of those that may be included with interface cards mounted in *SLOT 1*, *SLOT 2*, *SLOT 3*, or *SLOT 4*. The motherboard-mounted ports are described in table 11 (see appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data).

Table 11. SmartNode 2400 port description

Port	Description
ETH 0/1 (10/100BaseT)	Ethernet RJ-45 socket that connects the SmartNode with an Ethernet device, such as a wide area transmission modem, Ethernet hub, or switch. *ETH 0/1* is a host port; it can be connected with a straight-through wired cable to a hub, or a cross-over cable to a host port. The *Link* LED is lit when the port is connected correctly to an active Ethernet device. The *100Mb/s* LED is lit when the port is connected correctly to an active 100Base-T Ethernet device.
ETH 0/0 (10/100BaseT)	Ethernet RJ-45 socket that connects the SmartNode with an Ethernet device, such as a wide area transmission modem, Ethernet hub, or switch. *ETH 0/0* is a host port; it can be connected with a straight-through wired cable to a hub, or a cross-over cable to a host port. The *Link* LED is lit when the port is connected correctly to an active Ethernet device. The *100Mb/s* LED is lit when the port is connected correctly to an active 100Base-T Ethernet device.

Table 11. SmartNode 2400 port description (Continued)

Port	Description
Console (RS-232)	RS-232 RJ-45 connector that connects the SmartNode with a serial terminal such as a PC or workstation with a RS-232 interface, with the following settings: • 9600 bps, no parity, 8 bit, 1 stop bit, 1 start bit • The console port is only used for service and maintenance

CAUTION Do not plug in an ISDN connection. The voltage on the S-Bus may permanently damage the console interface.

In addition, two other elements—the *Reset* button and power input socket—are available on the rear panel of a SmartNode 2400 as described in table 12.

Table 12. SmartNode 2400 Reset button and power line socket on rear panel

Element	Description
Reset button	The button has three different functions: • **Manual Restart**—During normal operation pressing and releasing the reset button will cause a system reboot. The application will be restarted without any change to the existing SmartWare configuration. • **Restoration**—Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system. **Note** In this case the existing IP SmartWare configuration is lost. • **Boot loader**—Powering the SmartNode while pressing the reset button for 5 seconds will cause the factory-fitted boot loader to start in place of the application. The boot loader uses a minimal set of parameters. In case the application does not start correctly, the boot loader can be used as a fallback to download a new software version.
100–240 VAC 50/60 Hz	Electricity supply socket for mains power cable.

WARNING The mains supply *must* be secured with an external fuse or circuit-breaker, with a maximum tripping current of 16A.

IC-E1V — Interface Card for ISDN E1/PRI Interface · IC-T1V — Interface Card for ISDN T1/PRI Interface · IC-4BRV — Interface Card with 4 ISDN BRI Interfaces · IC-4FXS — Interface Card with 4 analog FXS ports

Figure 14. SmartNode PMC interface cards

Interface cards descriptions

The following interface cards (see figure 14) are available for use with the SmartNode 2000 Series devices:

- **IC-4FXS**—Gateway interface card for 4 analog FXS ports (see page 35)

- **IC-4BRV**—8-channel gateway interface card for ISDN BRI (see page 37)

- **IC-4BRV-8V**—8-channel gateway interface card for ISDN BRI (see page 43)

- **IC-4BRV-8VR**—8-channel gateway interface card for ISDN BRI with hardware bypass (emergency) relay (see page 46)

- **IC-E1V**—30-channel E1 gateway interface card for ISDN PRI (see page 47)

- **IC-E1V-0**—E1 Gateway interface card for ISDN PRI (circuit switching only) (see page 48)

- **IC-E1V-15**—15-channel E1 gateway interface card for ISDN PRI (see page 48)

- **IC-T1V**—23-channel T1 gateway interface card for ISDN PRI (see page 48)

- **IC-T1V-0**—T1 gateway interface card for ISDN PRI - circuit switching only (see page 50)

- **IC-T1V-15**—15-channel T1 gateway interface card for ISDN PRI (see page 50)

IC-4FXS Gateway interface card for 4 analog FXS ports

The IC-4FXS is a PMC standard compatible interface card for the SmartNode 2000 series. It provides 4 analog FXS ports and connects to the SmartNode base unit through a PCI packet and PCM circuit interface.

The IC-4FXS supports up to 4 simultaneous voice or fax calls. It is a flexible analog telephony card designed to meet the needs of small enterprises that want to connect their analog telephony equipment, such as an analog PBX or analog telephones, to a multi-service IP network.

The on-board dedicated micro-controller and DSPs off-load the CPU of the SmartNode 2000 series base unit enabling the conversion of voice/fax circuits into related IP-packets in real-time with minimal delay and jitter.

Front panel

The front view of the *IC-4FXS* interface card is depicted in figure 15. The individual sockets are labeled on the bezel.
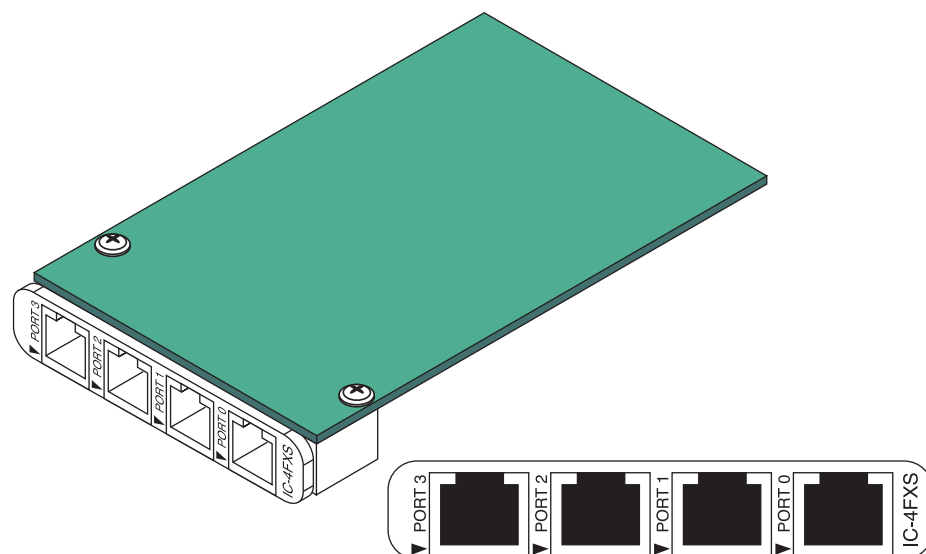
Figure 15. IC-4FXS

Ports

The card provides the four FXS ports whose details are tabulated in table 13. Protector circuits protect the ports from high voltage surges. See appendix A, "Specifications" on page 159 for pin out data.

Table 13. IC-4FXS port description

Port	Description
0 … 3	FXS RJ-11 socket to connect the SmartNode to an analog terminal (subscriber). Only two wires (Ring, Tip) are used. The 'Loop Start' method is used to signal whether the terminal is on- or off-hook (loop closed = on-hook).

Description

The IC-4FXS interface card provides four FXS ports, together allowing up to 4 analog voice channels to work in parallel.

Each ports provides the following the following:

• -48 VDC to the connected terminal

• Ring voltage to the connected terminal (normally 96 VAC at 25 Hz)

• On-hook transmission

• Caller identification (CLIP)

• Metering pulses

• Recognize dialed digits

The FXS ports must be connected to FXO ports.

Note When using the IC-4FXS, an internal line power module must be installed (see chapter 8, "Line power module installation" on

page 125). This line power module provides the loop voltage (-48 VDC) and the input to the ring voltage generator.

IC-4BRV 8-channel gateway interface card for ISDN BRI

The IC-4BRV is a PMC standard compatible interface card for the SmartNode 2000 series. It provides 4 ISDN BRI interfaces and connects through a PCI packet and PCM circuit interface to the SmartNode base unit.

The IC-4BRV supports up to 8 simultaneous voice or fax calls. It is a flexible ISDN networking card designed to meet the needs of small enterprises that want to connect their ISDN equipment, such as an ISDN PBX, via multiple BRI interfaces to a multi-service IP network.

The ISDN interfaces can be configured as user or network side interfaces. Its on-board, dedicated micro-controller and DSPs off-load the CPU of the SmartNode 2000 base unit and hence guarantee the conversion of voice/fax circuits into related IP-packets in real-time with minimal delay and jitter values.

Front panel

The front view of the *IC-4BRV* interface card is depicted in figure 16. The individual sockets are labeled on the bezel.
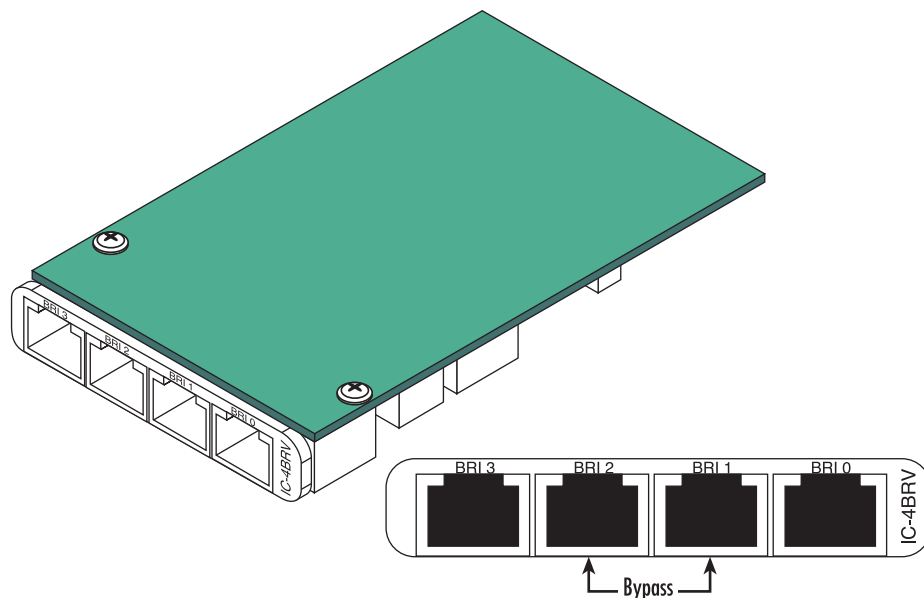
Figure 16. IC-4BRV

Ports

The card provides the four BRI ports whose details are tabulated in table 14. Each one is terminated internally at 100 ohm. See appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data.

Table 14. IC-4BRV port description

Port	Description
BRI 0	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN terminal over an S or S/T interface.

Table 14. IC-4BRV port description

Port	Description
BRI 1	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN terminal over an S or S/T interface. BRI 2 may be used as a fallback in conjunction with BRI 1. See 'Hardware Bypass' below.
BRI 2	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S or S/T interface. The pin out and protocol is software configurable. BRI 1 may be used as fallback in conjunction with BRI 2. See 'Hardware Bypass' below.
BRI 3	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S or S/T interface. The pin out and protocol mode is software configurable.

Description

The IC-4BRV interface card provides four ISDN basic rate interface (BRI) ports, together allowing up to 8 ISDN B-channels to work in parallel.

Operating modes

With the Interface Card IC-4BRV Version 1 and 2, Ports 0 and 1 can only be Master (Net). Ports 2 and 3 can be either Master (Net) or Slave (User). On IC-4BRV Version 3 all four ports can be either Master (Net) or Slave (User).

The four ports can be used in three different modes, which are tabulated in table 15.

- An *X* in the *NET* column of the table means that the port performs network side signaling and that the pin out corresponds to an ISDN NT. A *NET* port is connected to an ISDN terminal, i.e. a telephone or a PBX.

- An *X* in the *USR* column means that the port performs user side signaling and the pin out corresponds to an ISDN terminal. The two ports (2, 3) have configurable pin outs.

- An *X* in the *HW Bypass* column refers to the fallback mode.

The possible BRI port configurations are listed in table 15.

Table 15. BRI Port Configurations

Port	NET	USR	HW Bypass
BRI 0	X		
BRI 1	X		X
BRI 2	X	X	X
BRI 3	X	X	

Hardware bypass

BRI 1 and BRI 2 can be used to provide an emergency service. If a power failure occurs a relay connects these two interfaces with each other.

- BRI 1 must be connected with a telephone terminal or PBX if the bypass is active.

- BRI 2 must be connected to the ISDN network if the bypass is active.

Calls from an ISDN terminal are then automatically connected to the LE of the ISDN network. The bypass may also be activated manually. Figure 17 shows a typical fallback situation when the bypass is activated: the numbers in the boxes refer to the IC-4BRV's four BRI port numbers.
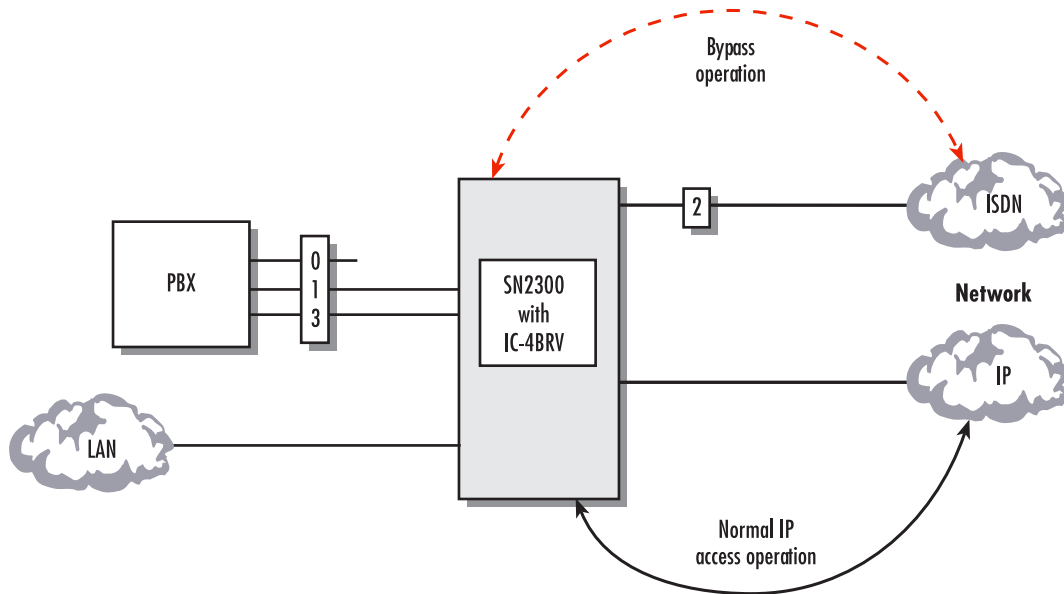
Figure 17. Bypass (fallback) mode

Network integration
With the configuration options tabulated above 4 BRI ports of the IC-4BRV can be connected in one of three network configurations:

- All four ports (ports 0–3) are connected to a subscriber PBX as shown in figure 18 on page 40.

- Three ports (0, 1, 3) are connected to the PBX and one port (2) to the ISDN network (local breakout) as shown in figure 19 on page 40. The local breakout port can be used to route calls from and to the ISDN network. This is the fallback situation described in section "Hardware bypass" on page 38. When power fails or the bypass is manually activated, ports 1 and 2 are inter-connected through the bypass relay, providing a lifeline to the ISDN network.

- Two ports (0, 1) are connected to the PBX and two ports (2, 3) to the ISDN network (see figure 20 on page 41. In this case, both local breakout ports (four B-channels) can be used to route calls to the ISDN network. Only port 1 is protected by the bypass relay.
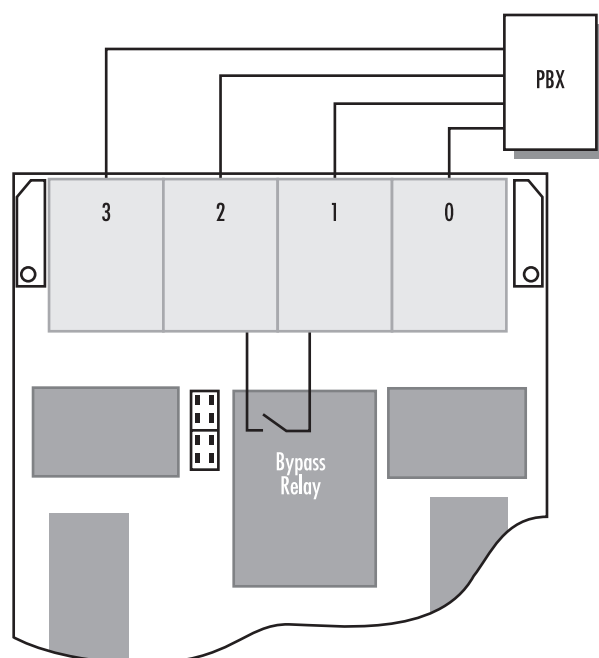
Figure 18. All four ports connected to PBX
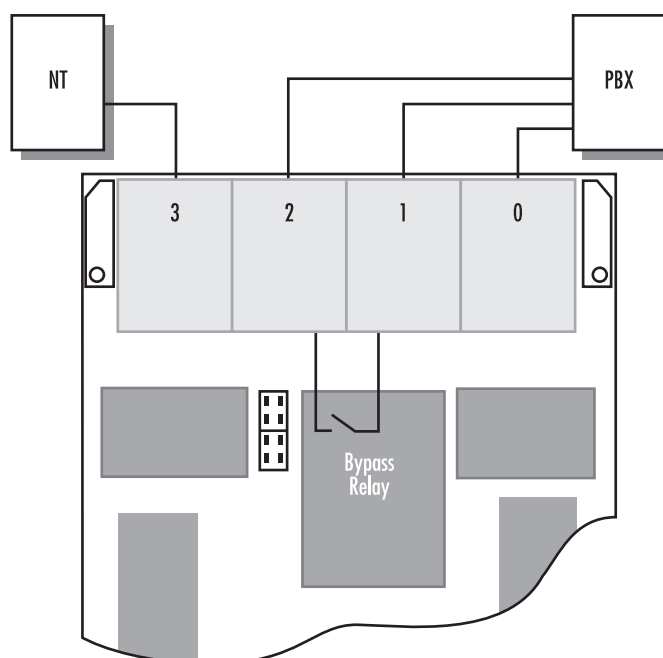
Figure 19. Three ports connected to the PBX and one port to the ISDN network
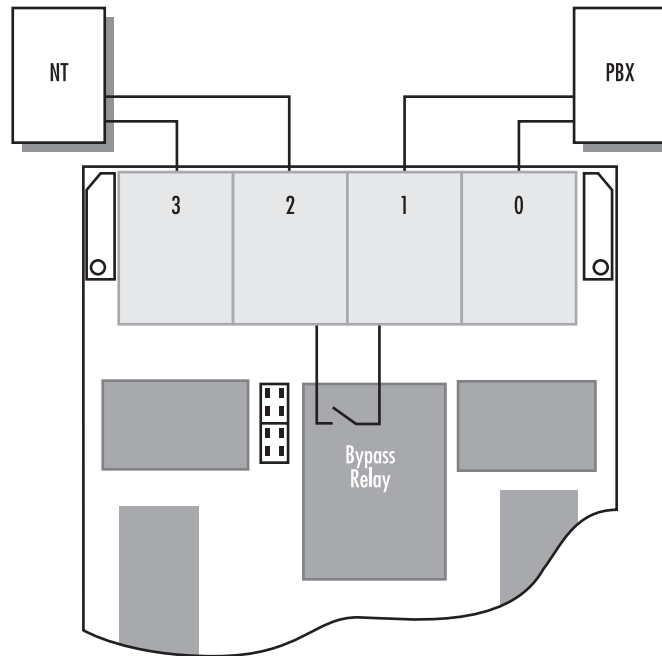
Figure 20. Two ports connected to the PBX and two ports to the ISDN network

S-Bus line power

Some ISDN terminals are powered through the S-Bus. This is usually the case for ISDN phones but not for PBXs. If you want to connect such a terminal directly to a port of the IC-4BRV, you must install a PM-48V-INT (or PM-40V-INT) power supply module. Two steps are required to provide S-Bus line power:

• Install an internal Line Power Module PM-48V-INT (or PM-40V-INT). This is described in section "Internal PM-48V-INT or PM-40V-INT line power module installation" on page 127.

• Configure the IC-4BRV card's jumper settings. This procedure is described in the following paragraphs.

Line power jumper settings

A set of jumper pins determines how power is supplied to the BRI ports. The jumper pin block is located on the IC-4BRV interface card underside. See the series of illustrations, which follow.

> **⚠ CAUTION** When the line power module is installed and operating, ports 0 and 1 are always supplied with 40V power. Power output on ports 2 and 3 is configurable. You must not supply power to a port configured in *USR* mode, i.e. connected to an ISDN NT. Supply power only to those ports configured in *NET* mode where you want to connect line-powered terminals.

Note   The jumpers are not accessible when the IC-4BRV card is installed, you must set the jumpers before installing the card in the SmartNode 2000 Series device.

Jumper settings for IC-4BRV and PM-48V-INT (or PM-40V-INT). The following are possible jumper settings for IC-4BRV and PM-48V-INT (or PM-40V-INT) fitted in SmartNode SmartNode 2000 Series:

• No jumpers are set: this setting is used with ports 2 and 3 configured in *USR* mode and connected to NTs as shown in figure 21.

• Upper four jumper pins bridged: this setting is used with port 2 configured as fallback and connected to a NT as shown in figure 22 on page 43.

• All eight jumper pins bridged: this setting is used with all four ports configured in *NET* mode and connected to line powered terminals as shown in figure 23 on page 43.
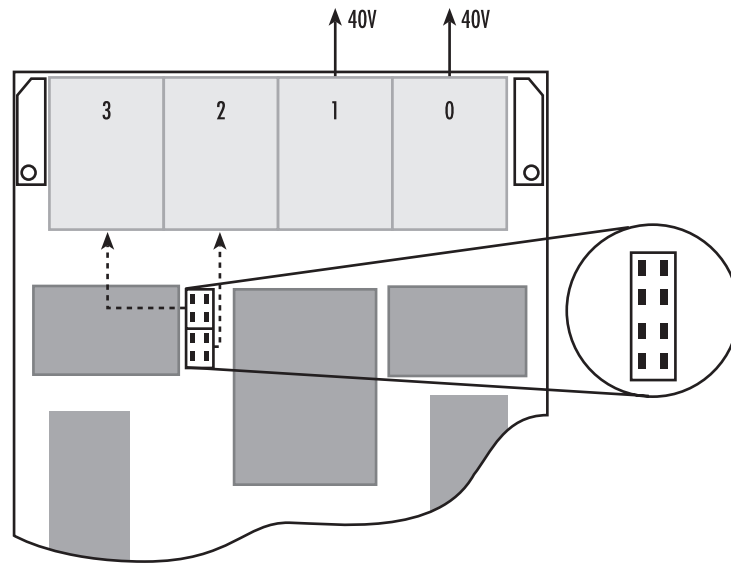
Figure 21. No jumpers set
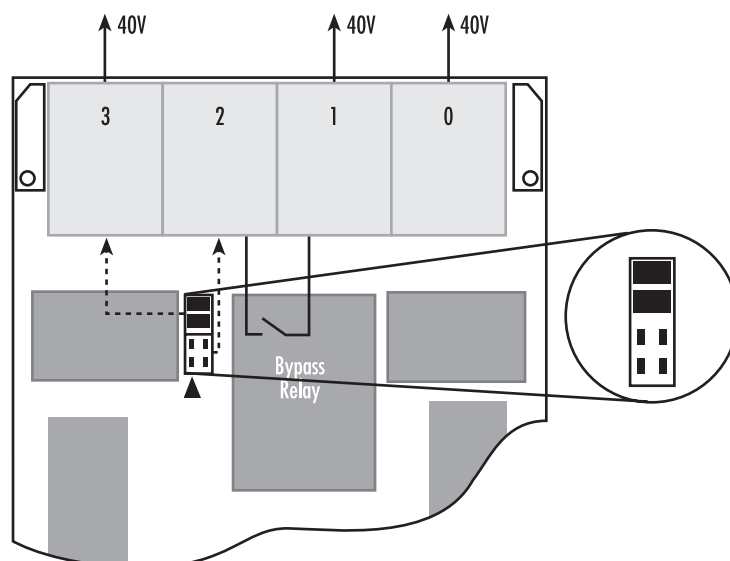
Figure 22. Upper four jumper pins bridged
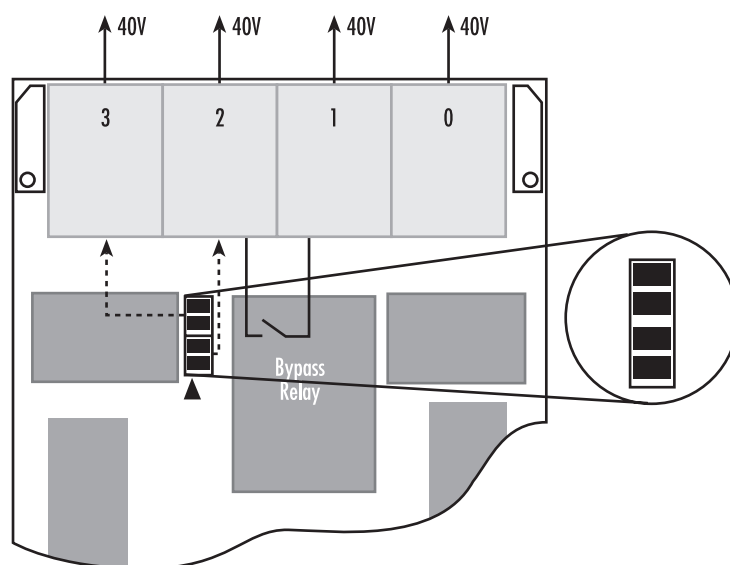
Figure 23. All eight jumper pins bridged

IC-4BRV-8V 8-channel gateway interface card for ISDN BRI

The IC-4BRV-8V is a PMC standard compatible interface card for the SmartNode 2000 series. It provides 4 ISDN BRI interfaces and connects through a PCI packet and PCM circuit interface to the SmartNode base unit.

The IC-4BRV-8V supports up to 8 simultaneous voice or fax calls. It is a flexible ISDN networking card designed to meet the needs of small enterprises that want to connect their ISDN equipment, such as an ISDN PBX, via multiple BRI interfaces to a multi-service IP network.

The ISDN interfaces can be configured as user or network side interfaces. In contrast with the IC-4BRV, all ports can be configured for network or user-side operation. Its on-board, dedicated micro-controller and DSPs

off-load the CPU of the SmartNode 2000 base unit and hence guarantee the conversion of voice/fax circuits into related IP-packets in real-time with minimal delay and jitter values.

Front panel
The front view of the *IC-4BRV-8V* interface card is depicted in figure 24. The individual sockets are labeled on the bezel.
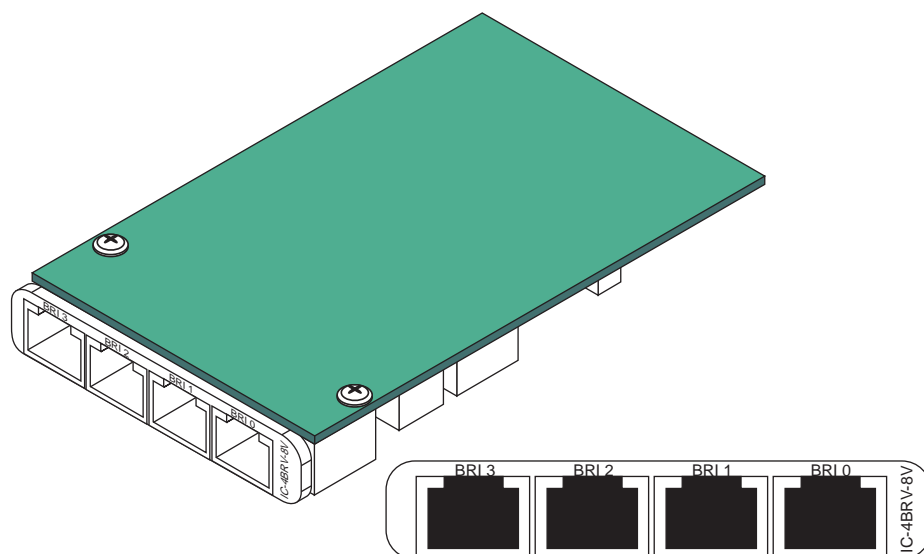
Figure 24. IC-4BRV-8V

Ports
The card provides the four BRI ports whose details are tabulated in table 16. Each one is terminated internally at 100 ohm. See appendix B, "Cabling" on page 165 for connection cable and appendix C, "Port pin-outs" on page 177 for pin-out data.

Table 16. IC-4BRV-8V port description

Port	Description
BRI 0	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S or S/T interface. The pin out and protocol mode is software configurable.
BRI 1	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S or S/T interface. The pin out and protocol mode is software configurable.
BRI 2	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S or S/T interface. The pin out and protocol mode is software configurable.
BRI 3	ISDN BRI RJ-45 socket that connects the SmartNode with an ISDN device over an S or S/T interface. The pin out and protocol mode is software configurable.

Description
The IC-4BRV-8V interface card provides four ISDN basic rate interface (BRI) ports, together allowing up to 8 ISDN B-channels to work in parallel.

Operating modes

All four ports can be used in NET or USR modes.

- A *NET* port is connected to an ISDN terminal, i.e. a telephone or a PBX.

- A *USR* port performs user side signaling and the pin out corresponds to an ISDN terminal.

S-Bus line power

Some ISDN terminals are powered through the S-Bus. This is usually the case for ISDN phones but not for PBXs. If you want to connect such a terminal directly to a port of the IC-4BRV-8V, you must install a PM-48V-INT (or PM-40V-INT) power supply module. Two steps are required to provide S-Bus line power:

- Install an internal Line Power Module PM-48V-INT (or PM-40V-INT). This is described in section "Internal PM-48V-INT or PM-40V-INT line power module installation" on page 127.

- Configure the IC-4BRV-8V card's jumper settings. This procedure is described in the following paragraphs.

Line power jumper settings

A set of jumper pins determines how power is supplied to the BRI ports. The jumper pin block is located on the IC-4BRV-8V interface card underside (see figure 25 on page 46).

CAUTION	Power output on all ports is configurable. BRI ports of the IC-4BRV-8V configured in USR mode **must not** supply line-power. Set the jumpers so that line-power is only supplied on those ports configured in NET mode, i.e. where you want to connect line-powered ISDN terminals.
IMPORTANT	The jumpers are not accessible when the IC-4BRV-8V card is installed, you must set the jumpers before installing the card in the SmartNode 2000 Series device.

Jumper settings for IC-4BRV-8V. The jumpers for each port are located behind the port connector (see figure 25):
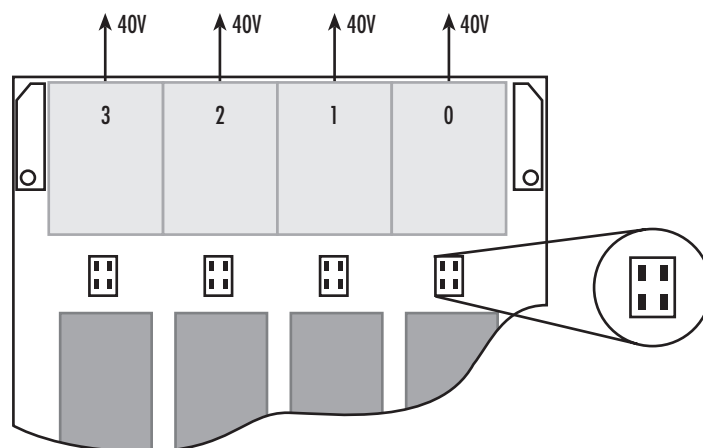
Figure 25. Jumpers

Port jumpers can configured as shown in table 17.

Table 17. Jumper configurations

	No jumpers are set. In this configuration, no line power is fed to port. Use this setting for *USR* ports when connected to an ISDN NT.
	Normal feeding. Use this setting when the port is configured as *NET* and a line-powered terminal is attached.
	Inverse feeding. Same function as in normal feeding, except that the polarity is inverted (required in some countries, Japan, for example).

IC-4BRV-8VR—8-channel gateway interface card for ISDN BRI with hardware bypass (emergency) relay

The IC-4BRV-8VR is a PMC standard compatible interface card for the SmartNode 2000 series. It provides 4 ISDN BRI interfaces and connects through a PCI packet and PCM circuit interface to the SmartNode base unit.

The specifications for the IC-4BRV-8VR are identical with the IC-4BRV-8V (see section ""IC-4BRV-8V 8-channel gateway interface card for ISDN BRI" on page 43), with an additional hardware bypass (emergency) relay. The relay works as follows: If a power failure occurs, the relay connects the interfaces BRI1 and BRI 2 with each other. For this to work as expected:

• BRI 1 must be connected to a telephone terminal or PBX

• BRI 2 must be connected to the ISDN network

IC-E1V 30-channel E1 gateway interface card for ISDN PRI

The IC-E1V is a PMC standard compatible interface card for the SmartNode 2000 series. It provides one ISDN PRI interface and connects through a PCI packet and PCM circuit interface to the SmartNode base unit.

The IC-E1V is a high performance ISDN networking card that supports up to 30 simultaneous voice or fax calls. It meets the requirements of medium and large sized enterprises that want to connect their ISDN equipment, such as an ISDN PBX, via a PRI interface to a multi-service IP network.

The ISDN PRI interfaces can be configured as user or network side interfaces. Its on board dedicated microcontroller and DSPs off load the CPU of the SmartNode 2000 base unit and hence guarantee the conversion of voice/fax circuits into related IP-packets in real-time with minimal delay and jitter values

Front panel

The front view of the *IC-E1V* interface card is depicted in figure 26. The *LINK* LED indicates the status of the interface. See chapter 11, "Monitoring Status" on page 151 on the LED states.
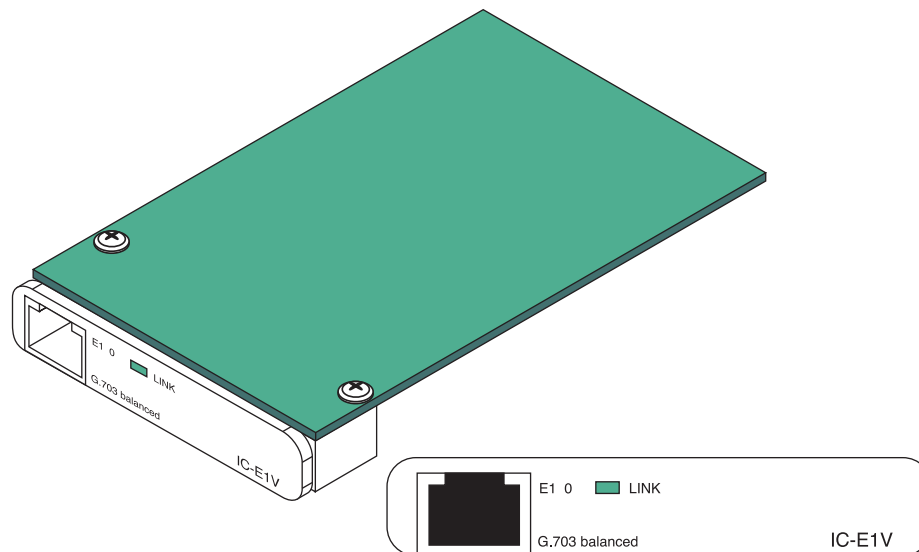
Figure 26. IC-E1V

Interface

The card provides one PRI port, described in table 18. The connector is terminated at 120 ohm.

Table 18. IC-E1V port description

Port	Description
E1 0	RJ-45 connector providing E1 PRI (2.048 Mbps) interface, meeting all requirements of ITU-T recommendations for G.703. Use a shielded E1 interface cable for 120W balanced connections to connect the SmartNode with an NT or ET, e.g. a PBX or LE.

Description

The *IC-E1V* interface card provides an ISDN PRI interface allowing transfer of up to 30 ISDN voice channels in parallel.

Interface modes

The interface can be used in two different modes, namely NET or USR. The NET mode means the interface performs network-side signaling, whereas USR mode means user-side signaling as described in table 19. For cabling, see Appendix B on page 165.

Table 19. Interface modes

Task	NET Mode	USR Mode
Clocking Mode	Master: generates line clocking	Slave: accepts line clocking
Time Slot	Interface responsible for time slot selection	Interface accepts time slot selection

When changing the interface mode from *NET* to *USR*, or *USR* to *NET*, the clock source setting is automatically adjusted. For *NET* the clock becomes *master* and for *USR* the clock becomes *slave*.

You can manually override these default settings of the clock (refer to the *Software Configuration Guide*). The next time that the interface mode is changed the clock source changes back automatically to the default again.

IC-E1V-0 E1 gateway interface card for ISDN PRI (circuit switching only)

IC-E1V-0 E1 gateway interface card for ISDN PRI - circuit switching only

This card is based on the IC-E1V interface card (see section "IC-E1V 30-channel E1 gateway interface card for ISDN PRI" on page 47), but it does not provide VoIP channels. The card supports full ISDN signaling. All B-Channels (64 kbps time slots) can be used for calls that are within the same card, or between this card and other cards installed in the same SmartNode Gateway chassis. No VoIP calls can be made to destinations outside the SmartNode chassis.

IC-E1V-15 15-channel E1 gateway interface card for ISDN PRI

This card is based on the IC-E1V interface card (see section "IC-E1V 30-channel E1 gateway interface card for ISDN PRI" on page 47). It supports 15 simultaneous VoIP channels. The card supports full ISDN signaling. All B-Channels (64 kbps time slots) can be used for calls within the same card, or between this card and other cards installed in the same SmartNode Gateway chassis. VoIP calls are limited to 15 at a time.

IC-T1V 23-channel T1 gateway interface card for ISDN PRI

The IC-T1V is a PMC standard compatible interface card for the SmartNode 2000 series. It provides one ISDN PRI interface and connects through a PCI packet and PCM circuit interface to the SmartNode base unit.

The IC-T1V is a high performance ISDN networking card that supports up to 23 simultaneous voice or fax calls. It meets the requirements of medium and large sized enterprises that want to connect their ISDN equipment, such as an ISDN PBX, via a PRI interface to a multi-service IP network.

The ISDN PRI interfaces can be configured as user or network side interfaces. Its on board dedicated microcontroller and DSPs off load the CPU of the SmartNode 2000 base unit and hence guarantee the conversion of voice/fax circuits into related IP-packets in real-time with minimal delay and jitter values.

Front panel

The front view of the *IC-T1V* interface card is depicted in figure 26. The *LINK* LED indicates the status of the interface. See chapter 11, "Monitoring Status" on page 151 for detailed information on the LED states.
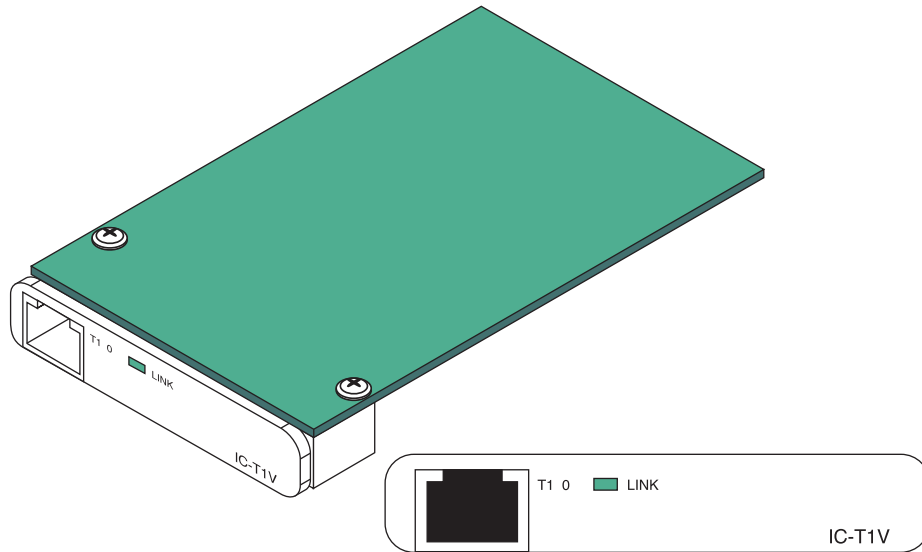
Figure 27. IC-T1V

Interface

The card provides one PRI port, described in table 18. The connector is terminated at 120 ohm.

Table 20. IC-E1V port description

Port	Description
T1 0	RJ-45 connector providing T1 PRI (1.533 Mbps) interface, meeting all requirements of ITU-T recommendations for G.703. Use a shielded T1 interface cable for 120W balanced connections to connect the SmartNode with an NT or ET, e.g. a PBX or LE.

Description

The *IC-T1V* interface card provides an ISDN PRI interface allowing transfer of up to 23 ISDN voice channels in parallel.

Interface modes

The interface can be used in two different modes, namely *NET* or *USR*. The *NET* mode means the interface performs network-side signaling, whereas *USR* mode means user-side signaling as described in table 19. For cabling, see Appendix B on page 165.

Table 21. Interface modes

Task	NET Mode	USR Mode
Clocking Mode	Master: generates line clocking	Slave: accepts line clocking
Time Slot	Interface responsible for time slot selection	Interface accepts time slot selection

When changing the interface mode from *NET* to *USR*, or *USR* to *NET,* the clock source setting is automatically adjusted. For *NET* the clock becomes *master* and for *USR* the clock becomes *slave*.

You can manually override these default settings of the clock: see the documents *Software Configuration Guide*. The next time that the interface mode is changed the clock source changes back automatically to the default again.

IC-T1V-0 T1 gateway interface card for ISDN PRI (circuit switching only)

This card is based on the IC-T1V interface card (see "IC-T1V 23-channel T1 gateway interface card for ISDN PRI" on page 48), but it does not provide VoIP channels. The card supports full ISDN signaling. All B-Channels (64 kbps) can be used for calls within the same card, or between this card and other cards installed in the same SmartNode Gateway chassis. No VoIP calls can be made can be made to destinations outside the SmartNode chassis.

IC-T1V-15 15-channel T1 gateway interface card for ISDN PRI

This card is based on the IC-T1V interface card (see "IC-T1V 23-channel T1 gateway interface card for ISDN PRI" on page 48). It provides 15 simultaneous VoIP channels. The card supports full ISDN signaling, and all B-Channels (64 kbps time slots) can be used for calls within the same card, or between this card and other cards installed in the same SmartNode Gateway chassis. VoIP calls are limited to 15 at a time.

Chapter 2   Product Overview

Chapter contents

Introduction

The SmartNode 1000 and 2000 series aggregate multiple channels of data and voice user-side traffic for transport over a single wide-area network (WAN) uplink. With one or more ISDN BRI or PRI interfaces, the SmartNode 1000 (see figure 28) and 2000 (see figure 29) series can be connected to an ISDN PBX or to a local exchange switch. Moreover, ISDN BRI interfaces can be used to attach ISDN telephones or to connect to an ISDN NT for voice call fallback or call routing to the PSTN.
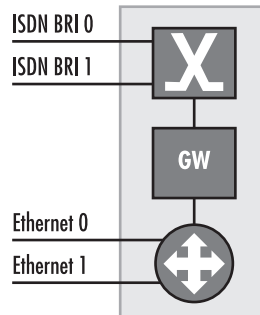
Figure 28. System model, SmartNode 1000 Series
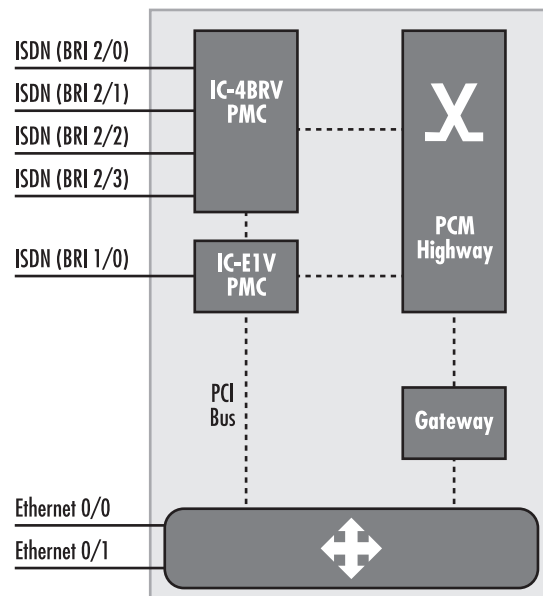
Figure 29. System model, SmartNode 2000 Series

Voice is transported as voice over Internet Protocol (VoIP) using the H.323 standards for sending and receiving audio and data or Patton Electronics' proprietary ISDN over Internet Protocol (ISoIP) on an IP-based network.

Since both of the Ethernet interfaces of a SmartNode 1000 and 2000 series are fully configurable, it is the application which defines whether an interface is used for WAN or LAN connections.

Depending of the deployment scenario, optional interface cards are available for the expansion slots of SmartNode 2000 series.

Note   For information concerning hardware and interface card support see the SmartWare Software Release Notes for your Software Release and Build Number.

This chapter contains the following information about the SmartNode Series devices:

- System model of the SmartNode 1000 and 2000 Series

- Voice routing

- Overview of SmartNode deployment as a customer premises gateway supplied by a multi-service provider, a voice gateway and IP router, or a LAN voice gateway (see page 55)

System model of the SmartNode 1000 and 2000 Series

The system model of Patton SmartNodes is depicted in figure 28 and figure 29 on page 53. The devices have three main components:

- ISDN switching, with two ISDN base rate interfaces (BRI).

- Gateway (GW), which converts ISDN voice data into Internet Protocol (IP) data streams or voice over IP (VoIP) and vice-versa. VoIP speech is supported according the H.323 standard and via Patton Networks' patented ISDN over IP (ISoIP) protocol.

- Router, with on-board Ethernet and other data interfaces which support *quality of service* (QoS) classes and *type of service* (TOS) bit setting. Quality of service enables the router to support multiple traffic classes.

Voice routing

Via its gateway, an Patton SmartNode 1000 and 2000 series device can carry voice data between the ISDN basic rate or primary rate interfaces and Ethernet or other data interfaces. This facility allows a wide variety of voice routing scenarios to be realized.

SmartNode deployment

Customer premises gateway; multi-service providers

Figure 30, figure 31 on page 56, and figure 32 on page 57 show typical deployment scenarios for the Smart-Node 1000 and 2000 series used as a customer premises gateway supplied by a multi-service provider.

Small office or home office (SOHO)

Figure 30 depicts a SmartNode 1200 used as a voice gateway and IP router in a SOHO situation. The voice gateway operates with both H.323 and ISoIP on a call-by-call basis. The SmartNode is connected to the ISDN NT for voice call fallback or exceptional call routing scenarios via port BRI 0. An ISDN telephone is connected to port BRI 1.
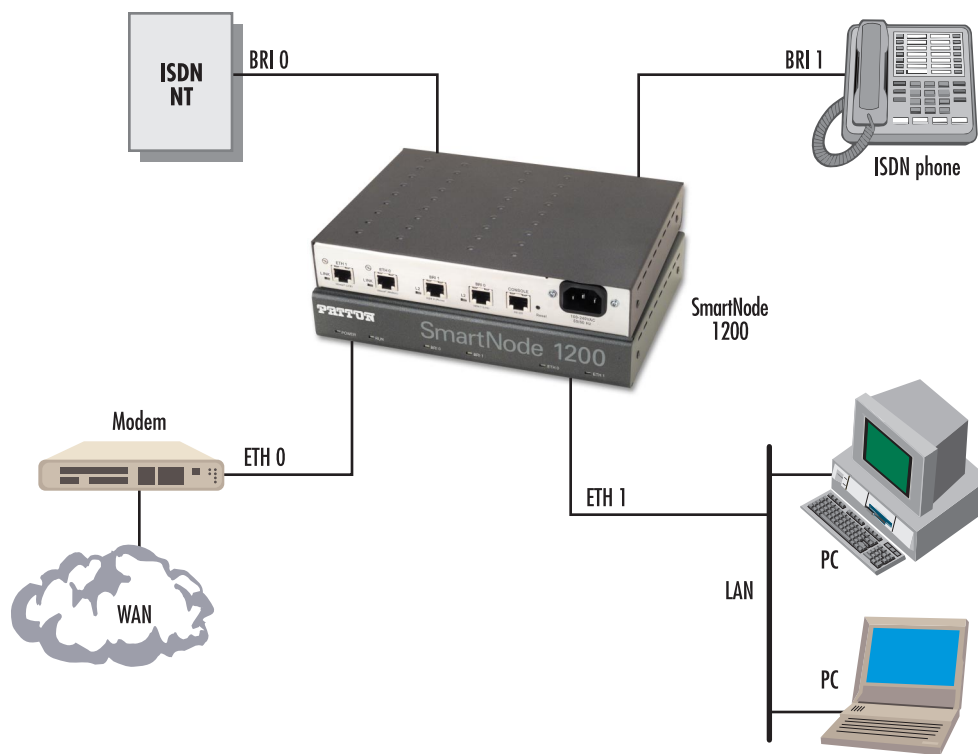
Figure 30. SmartNode 1200 with ISDN phone and ISDN fallback in a SOHO environment

Small and medium enterprise (SME)
The SmartNode 1400 in figure 31 is set up as a voice gateway and IP router in an SME situation. Both BRI
ports are attached to a local PBX, offering up to four simultaneous voice channels to the IP access network that
is connected to the Ethernet port ETH 0.
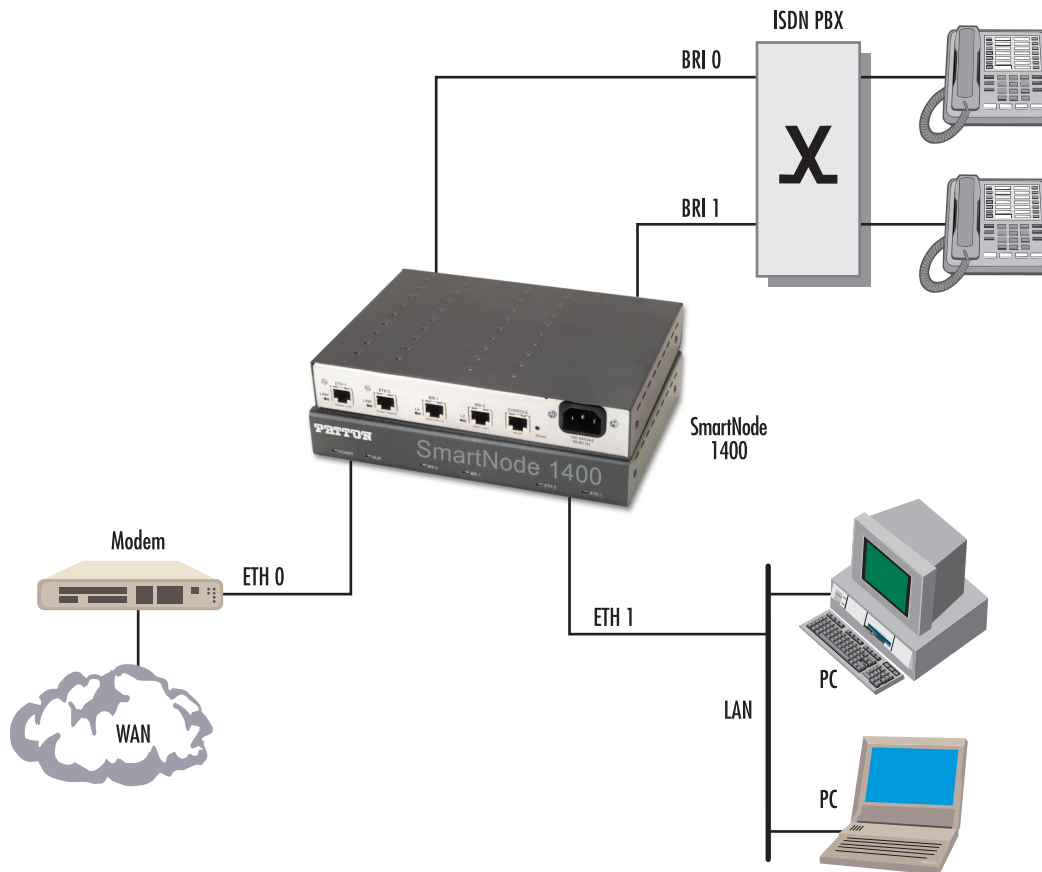
Figure 31. SmartNode 1400 attached to PBX via both ISDN BRIs in an SME environment

Figure 32 depicts a SmartNode 2000 series used as a voice gateway and IP router in an SME situation. The optional IC-4BRV interface card's BRI 2 port is used as an ISDN fallback interface. In case of a power failure, equipment connected to port BRI 1 is bypassed with a relay to interface BRI 2. It remains operational even if the SmartNode 2000 series is not powered. Three ports of the PBX are connected to the remaining BRI ports of the IC-4BRV interface card, providing up to six concurrent ISDN B-channels. The voice data is transferred via the integrated voice gateway in the SmartNode 2000 series over Ethernet port ETH 0/0. Depending on the call procedures defined by the software running in the SmartNode 2000 series, voice data is formatted as H.323 compliant or as ISoIP voice streams.
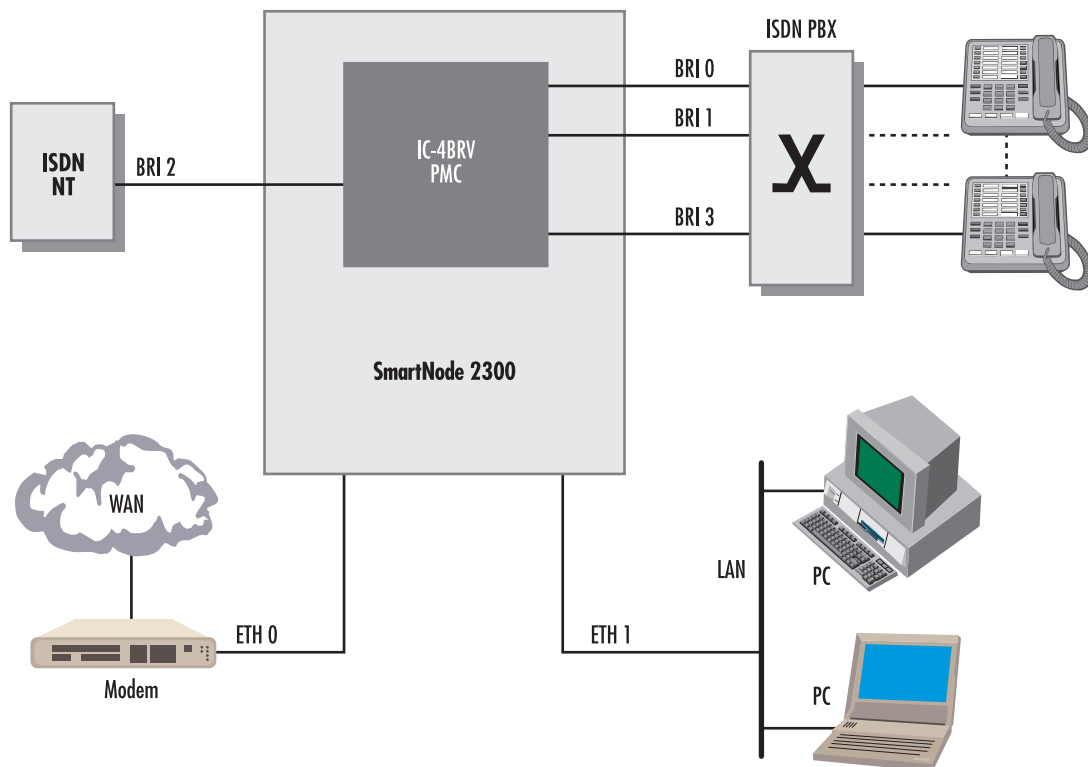
Figure 32. SmartNode 2000 Series device connected to a PBX via three BRI ports with fallback to PSTN with one BRI in an SME environment

Multi-service gateway/router for private enterprise networks

Company branch office

In figure 33 the SmartNode 2000 series with an optional IC-4BRV interface card installed is used as a voice gateway and IP router in a company branch office.
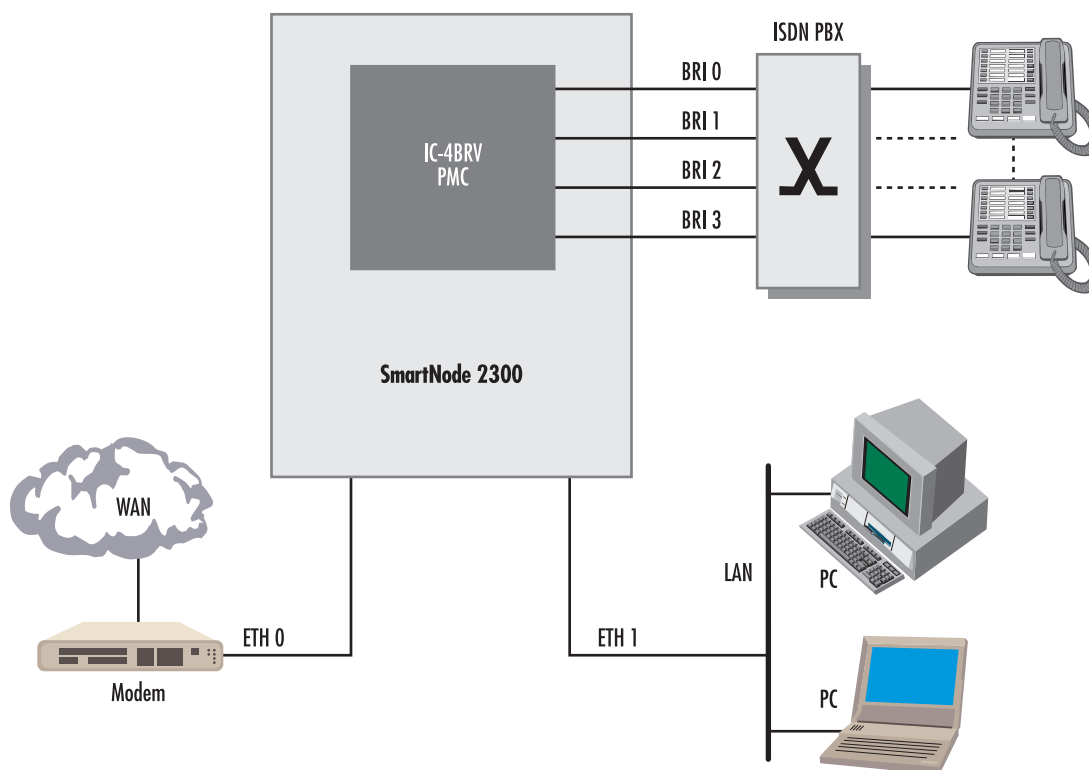
Figure 33. SmartNode 2000-Series device connected to a PBX via four BRI ports

The IC-4BRV interface card provides four ISDN BRI ports and is frequently used to interconnect existing ISDN PBXs over an IP network.

All four ports of the PBX are connected to the IC-4BRV interface card BRIs, providing a maximum of eight concurrent ISDN B-channels. The voice data is transferred via the integrated voice gateway in the SmartNode 2000 series via Ethernet port ETH 0/0. Depending on the call procedures defined by the software running in the SmartNode 2000 series, voice data is formatted as H.323 compliant or ISoIP voice streams.

Company headquarters

In figure 34 the SmartNode 2000 series with an optional IC-E1V interface card installed is used as a voice gateway and IP router in a company headquarters.
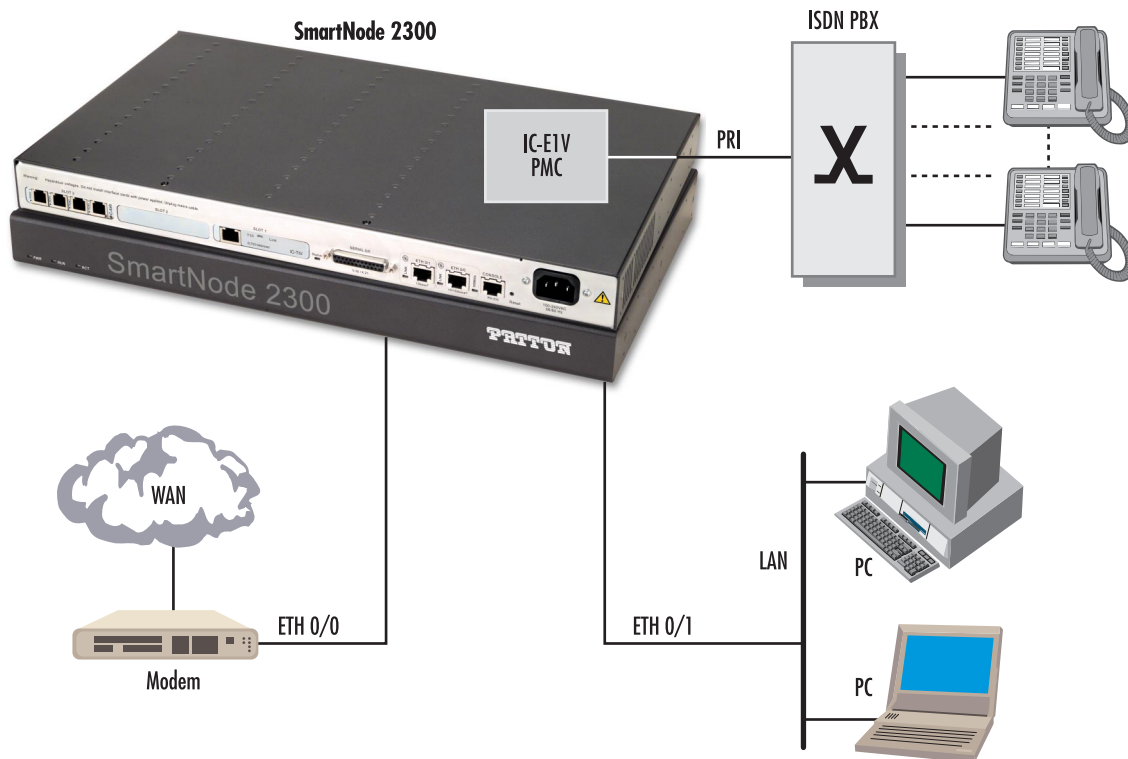
Figure 34. SmartNode 2000 Series device connected to a PBX via one PRI (with IC-E1V card) into an IP network

The PBX is connected to the PRI port of the IC-E1V interface card, providing up to 30 concurrent ISDN B-channels. The voice data is transferred via the integrated voice gateway in the SmartNode 2000 series over Ethernet interface ETH 0/0.

Depending on the call procedures defined by the software running in the SmartNode 2000 series, voice data is formatted as H.323 compliant or ISoIP voice streams.

IP access to the WAN

In the following figures, a wide-area transmission modem is shown as attached to the IP access network of the operator via Ethernet port ETH 0 for SmartNode 1000 series or ETH 0/0 for SmartNode 2000 series.

Data traffic from the LAN attached to ETH 1 for SmartNode 1000 series or to ETH 0/1 for SmartNode 2000 series is routed to the WAN via Ethernet ports ETH 0 or ETH 0/0 respectively. Either standard IP routing or *network address port translation* (NAPT) can be configured on the SmartNode according to requirement.

ISDN Gateway; LAN-based PBX or call center applications

LAN-based telephony gateways (GW)

The SmartNode 1400 GW depicted in figure 35 is utilized as a LAN voice gateway. On the local LAN that is shown connected to Ethernet port ETH 0, H.323 compliant voice applications are installed on hosts acting as H.323 terminals. An H.323 terminal is an endpoint in the network that provides for real-time, two-way communications with another H.323 terminal or gateway.

Outbound voice traffic is forwarded via the integrated voice gateway of the SmartNode 1400 to the PSTN. Inbound voice traffic from the PSTN is terminated on the respective host running the H.323 compliant client application according to the dialed calling number.

The H.323 gatekeeper is responsible for the translation of IP addresses into E.164 phone numbers (and phone numbers into IP addresses).

> **Note**   Hosts on the LAN need to be connected to Ethernet port ETH 0 using a hub.
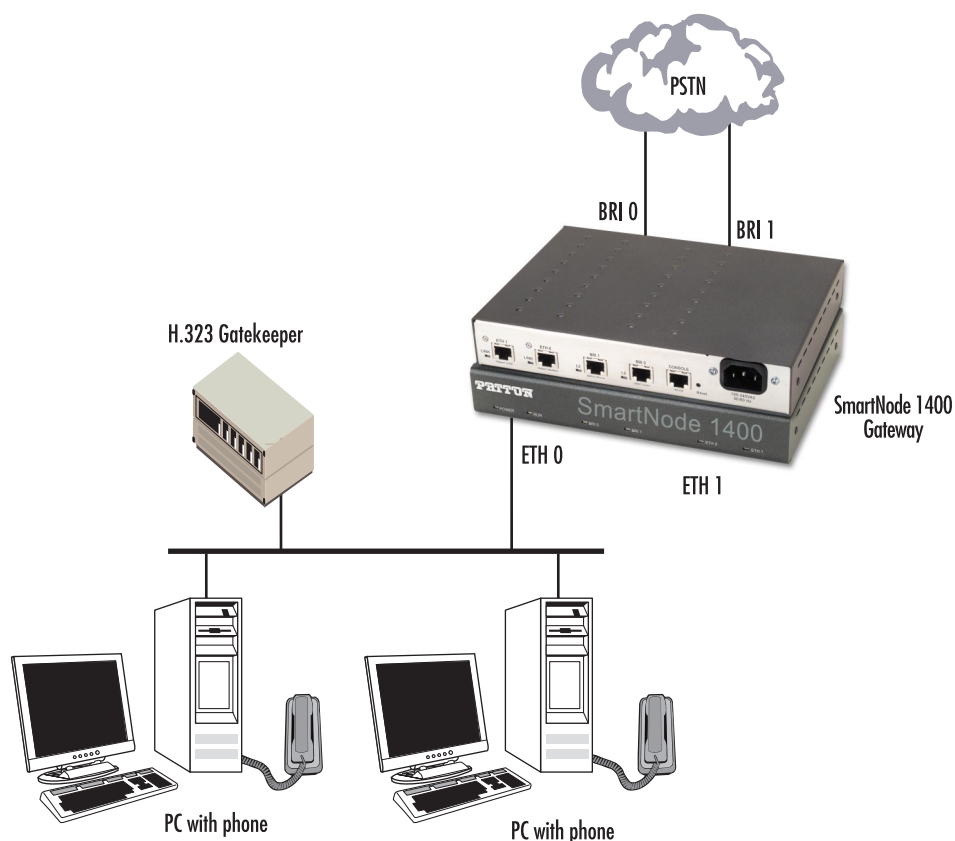
Figure 35. SmartNode 1400 GW used as LAN voice gateway with H.323 software clients on PCs and H.323 gatekeeper

Chapter 3 Planning the installation

Chapter contents

Introduction

Before you start the actual installation, it is strongly recommended that you gather all the information needed to install and set-up the device. See section "Installation checklist" on page 64 for an example of what pre-installment checks you might need to carry out. Having carried out the pre-installation checks enables you to install and set up your SmartNode 1000 or 2000 series into an existing IP or an ISDN infrastructure with confidence.

> **Note** The chapter covers a variety of SmartNode models that are similar in functionality but which differ in the number of interfaces that are supported. Therefore, some of the information provided may not apply to your particular SmartNode model.

> **Note** When setting up your SmartNode consider cable length limitations, and potential electromagnetic interference (EMI) as defined by the applicable local and international regulations. Ensure that your site is properly prepared before beginning installation.

Before installing the SmartNode device, the following tasks should be completed:

* **Create a network diagram** (see section "Network diagram" on page 65)

* **Gather IP related information** (see section "IP related information" on page 65 for more information)

* **Collect ISDN related information** (see section "ISDN related information" on page 65)

* **Gather synchronous serial interface information** (SmartNode 2300 only) (see section "Synchronous serial interface" on page 66 for more information)

* **Install the hardware and software needed to configure the SmartNode**. (See section "Synchronous serial interface" on page 66)

* **Verify power source reliability** (see section "Power source" on page 67).

When you finish preparing for SmartNode installation, go to the appropriate section to install the device:

* Installing the SmartNode 1200 (see chapter 4, "SmartNode 1200 installation" on page 69)

* Installing the SmartNode 1400 (see chapter 5, "SmartNode 1400 installation" on page 81)

* Installing the SmartNode 2300 (see chapter 6, "SmartNode 2300 installation" on page 91)

* Installing the SmartNode 2400 (see chapter 7, "SmartNode 2400 installation" on page 109)

Installation checklist

The installation checklist in table 22 lists the tasks for installing a SmartNode 1000 or 2000 series. Make a copy of this checklist and mark the entries as you complete each task. For each SmartNode 1000 or 2000 series, include a copy of the completed checklist in your site log.

Table 22. Installation checklist

Task	Verified by	Date
Network information available & recorded in site log		
Environmental specifications verified		
Site power voltages verified		
Installation site pre-power check completed		
Required tools available		
Additional equipment available		
All printed documents available		
SmartWare release & build number verified		
Rack, desktop, or wall mounting of chassis completed		
Initial electrical connections established		
ASCII terminal attached to console port		
Cable length limits verified		
Initial configuration performed		
Initial operation verified		

Site Log

Patton recommends that you maintain a site log to record all actions relevant to the system, if you do not already keep such a log. Site log entries might include information as listed in table 23.

Table 23. Site log entries

Entry	Description
Installation	Make a copy of the installation checklist and insert it into the site log
Upgrades and maintenance	Use the site log to record ongoing maintenance and expansion history
Configuration changes	Record all changes and the reasons for them
Maintenance;	Schedules, requirements, and procedures performed
Comments	Notes, and problems
Software	Changes and updates to SmartWare software

Network information

Network connection considerations that you should take into account for planning are provided for several types of network interfaces are described in the following sections.

Network diagram

Draw a network overview diagram that displays all neighboring IP nodes, serial connected elements and ISDN components. It is recommended that you keep a copy in the site log (see "Site Log" on page 64 for more information on keeping a site log).

IP related information

Before you can set up the basic IP connectivity for your SmartNode 1000 or 2000 series you need to have the following information:

- IP addresses used for Ethernet LAN and WAN ports

- Subnet mask used for Ethernet LAN and WAN ports

- Lengths of Ethernet cables

- IP addresses of central H.323 gatekeeper

- IP addresses of central PSTN gateway for H.323 and/or ISoIP-based calls

- IP addresses of central TFTP server used for configuration upload and download

ISDN related information

To set up basic ISDN connectivity for your SmartNode 1000 or 2000 series you need to do or know the following:

- Check whether an additional line power is necessary and if an optional Phantom power supply or line power module needs to be installed

- Clock source for ISDN E1 interface

- Length of the ISDN S-Bus or E1 interface cables

- The block of sequential numbers assigned by your telecom operator that are used for the direct dial inwards (DDI) numbering plan to be used together with your PBX

- Define a multiple subscriber numbering (MSN) schema to give your individual endpoint a unique phone number that can be dialed directly

- Check whether an ISDN port is to be configured in USR (TE) or NET (NT) mode

- Check whether an ISDN port is to be configured as point-to-point or point-to-multipoint link

S-Bus installation

When installing an ISDN S-bus and up to eight connected devices, bear in mind that the relevant ITU-T, ETSI and ANSI standards for your equipment must be met. Your ISDN provider will help you to ensure that you comply with the relevant standards.

An S-Bus must be terminated at both ends with 100 ohm; such termination should be at the extreme ends of the bus.

Note   Only the one device at the end should be terminated: SmartNode interfaces are internally terminated at 100 ohm.

It is recommended that a screened cable be used of a type that has been tested to at least ISO/IEC 11801 Category 3.

According to ITU-T the maximum length of flex connecting the bus with terminal equipment may not exceed 33 feet (10 meters). Some ISDN providers or devices may require a lesser distance, so consult your suppliers. In accordance with ITU-T the maximum length of the S-bus depends on the delay constant of the cable. If this is too great, the time sequence of the equipment signals attached to it may be corrupted. The maximum distance between NT1 and TE is theoretically 656 feet (200 meters), but in practice 492 feet (150 meters) is the usual maximum.

SmartNode BRI port configured in USR mode and connected to an S-Bus
The SmartNode acts as TE on the S-Bus: usually no other TE are connected on the S-Bus between the NT1 and the SmartNode. The general S-Bus conditions apply, the maximum recommended bus length is 492 feet (150 meters).

Note   SmartNode BRI interfaces are internally terminated at 100 ohms.

SmartNode BRI port configured in NET mode
The SmartNode acts as NT1. The general S-Bus conditions apply, the maximum recommended bus length is 492 feet (150 meters).

Note   SmartNode BRI interfaces are internally terminated at 100 ohms.

Installing an S-Bus power supply
If your SmartNode 2000 series needs to be equipped with an optional line power module refer to chapter 8, "Line power module installation" on page 125 for a more detailed description of this procedure. Check that the jumper pins are correctly set for your method of using the IC-4BRV interface card (see section "IC-4BRV 8-channel gateway interface card for ISDN BRI" on page 37.

> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**
>
> CAUTION

Synchronous serial interface
The SmartNode 2300 supports the V.35 and X.21 standard for synchronous serial interfaces at speeds up to 2 Mbps. Devices that communicate over a serial interface are divided into two classes:

• Data terminal equipment (DTE): the device at the user end of the user-to-network interface. The DTE connects to a data network via data DCE, and typically uses clocking signals generated by the DCE.

• Data communications equipment (DCE): the device at the network end of the user-to-network interface. The DCE provides a physical connection to the network, forwards traffic, and provides a clocking signal used to synchronize data transmission between DCE and DTE devices.

The most important difference between these two types of device is that the DCE device supplies the clock signal that paces the communications on the interface.

> **Note**   A SmartNode 2300 functions as a DTE.

The synchronous serial port is labeled *SERIAL 0/0* on the SmartNode 2300. Before you connect a device to it you need to check the following:

- Confirm that the device that you are connecting the SmartNode to is a DCE that provides a clock signal on the synchronous serial port

- Type of connector, male or female, required when connecting to the device port

- Signaling protocol; the device requires X.21 or V.35

Software tools

You will need a PC computer with HyperTerminal or equivalent VT-100 emulation program, or an ASCII terminal (also called a *dumb terminal*) to configure the software on your SmartNode device.

Power source

If you suspect that your AC power is not reliable, for example if room lights flicker often or there is machinery with large motors nearby, have a qualified professional test the power. Install a power conditioner if necessary.

Where to go next

When you finish preparing for SmartNode installation, go to the appropriate section to install the device:

- Installing the SmartNode 1200 (see chapter 4, "SmartNode 1200 installation" on page 69)

- Installing the SmartNode 1400 installation (see chapter 5, "SmartNode 1400 installation" on page 81)

- Installing the SmartNode 2300 installation (see chapter 6, "SmartNode 2300 installation" on page 91)

- Installing the SmartNode 2400 installation (see chapter 7, "SmartNode 2400 installation" on page 109)

Chapter 4 SmartNode 1200 installation

Chapter contents

Hardware installation

SmartNode 1200 installation consists of the following:

- Placing the device at the desired installation location (see section "Mounting the SmartNode 1200" on page 71)

- Installing the interface and power cables (see section "Connecting cables" on page 73)

When you finish installing the SmartNode 1200, go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Mounting the SmartNode 1200

The SmartNode 1200 should be placed in a dry environment with sufficient space to allow air circulation for cooling.

> **Note** For proper ventilation, leave at least 2 inches (5 cm) to the left, right, front, and rear of the SmartNode 1200.

The SmartNode 1200 can be installed as follows:

- Placed on a desktop or similar sturdy, flat surface that offers easy access to the cables

- Mounted on a wall

Desktop installation

Do the following to install the SmartNode 1200:

1. Remove one of the rubber pads from the adhesive strip (included in the SmartNode installation kit pack) and place it on a corner on the bottom of the SmartNode 1200 (see figure 36).
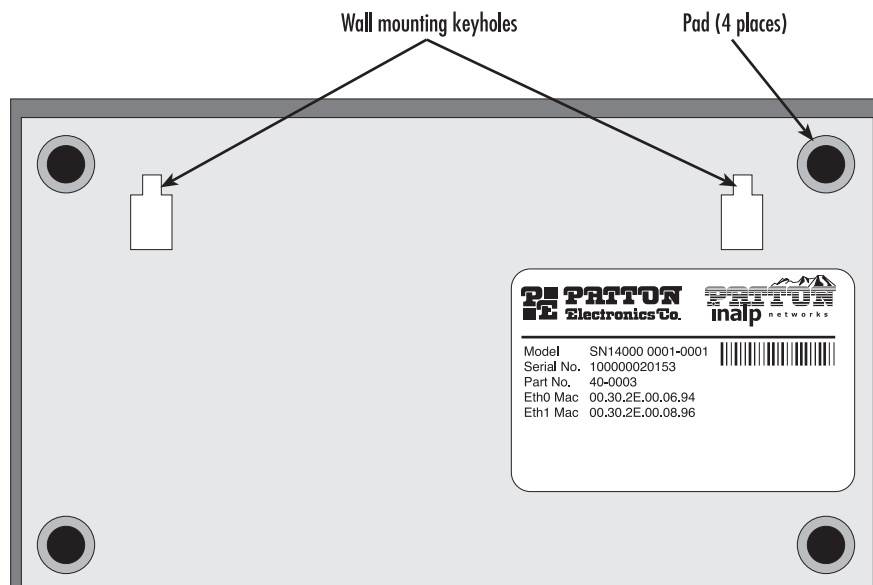
Figure 36. Pads and wall-mounting keyholes locations

2. Repeat step 1 to install pads on the remaining three corners on the bottom of the SmartNode 1200.

3. Place the unit on a desktop, shelf or other flat, hard, and secure surface.

> **Note**   Allow sufficient space at the rear of the chassis for cable connections. In addition you should consider the need to access the chassis for future upgrades, maintenance and troubleshooting. Multiple SmartNodes can be stacked one atop the other.

Wall-mounted installation

Do the following to install the SmartNode 1200:

1. Using figure 37 as a guide, determine the positions of the mounting holes on the wall and mark the locations of the mounting holes.
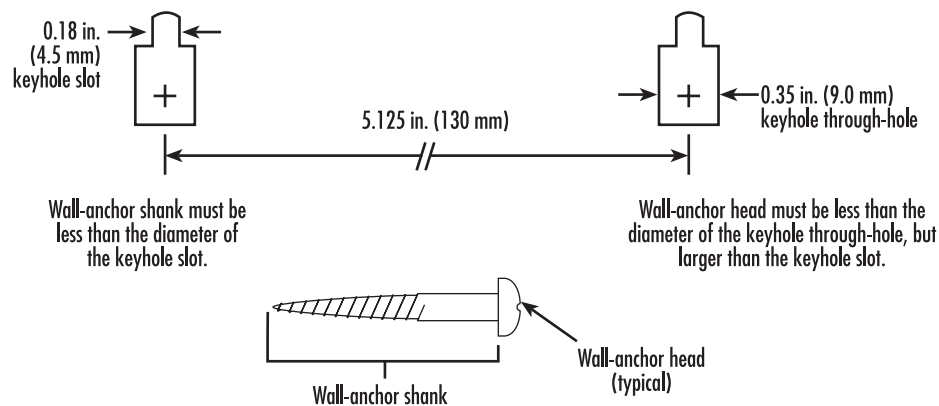
Figure 37. Wall-mounting hole dimensions

> **Note**   Mounting hardware is not provided. The installer must determine which fastener is appropriate for that particular application.

2. Install the (user-provided) wall anchors. Any standard anchoring method may be used, such as wood screws; butterfly anchors/molly bolts (for installation into a sheetrock/drywall or plasterboard surface); or expansion bolts (for installation into a concrete or masonry surface). The anchor screw heads must have just enough clearance to allow the wall-mounting key holes (see figure 36 on page 71) to slip onto them when hanging the SmartNode 1200.

3. Hang the SmartNode 1200 on the wall-anchor mounting screws.
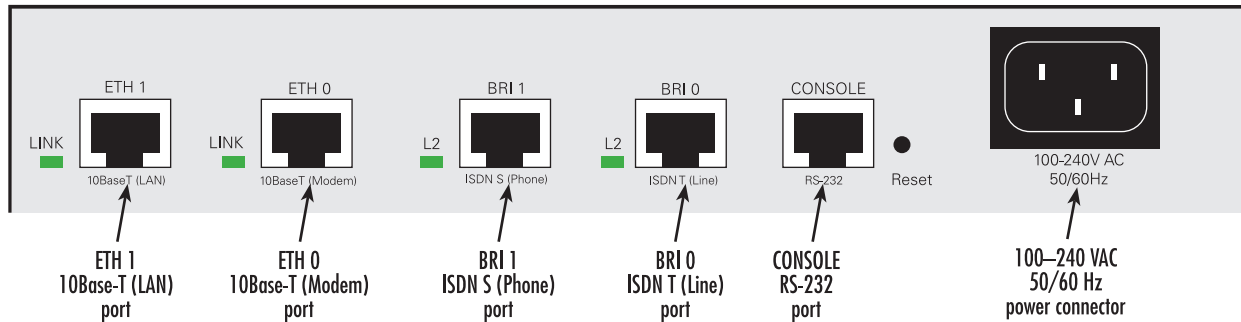
Figure 38. SmartNode 1200 connectors

Connecting cables

Installing SmartNode 1200 cables takes place in the following order:

⚠️ **WARNING**	**Do not work on the system or connect or disconnect cables during periods of lightning activity.**

⚠️ **CAUTION**	**The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

1. Installing the 10Base-T Ethernet cable into ports *ETH 0* and *ETH 1* (see figure 38) (see "Installing the Ethernet cables" on page 73).

2. Installing the BRI 0 and BRI 1 cables (see "Installing the BRI cables" on page 74).

3. Installing the power cord (see "Installing the power cord" on page 79).

Installing the Ethernet cables

Ethernet devices (10Base-T) are connected to the SmartNode's Ethernet ports (see table 24 for port pin-out listing) via a cable terminated with RJ-45 plugs. Use a cross-over cable to connect to a host (see figure 39 on page 74), or a straight-through cable to connect to a hub (see figure 40 on page 74).

Table 24. Ethernet 10Base-T (RJ-45) port pin-outs

Pin	Signal
1	TX+
2	TX-
3	RX+
6	RX-

Note   Pins not listed are not used.

Cross-over cable

RJ-45, male   **RJ-45, male**

Tx+   1 ———————————————————————— 1
Tx-   2 ——————————————————╲   ╱—————— 2
Rx+   3 —————————————————— ╳ —————— 3
Rx-   6 ——————————————————╱   ╲—————— 6
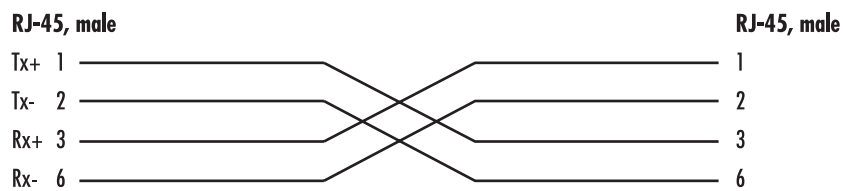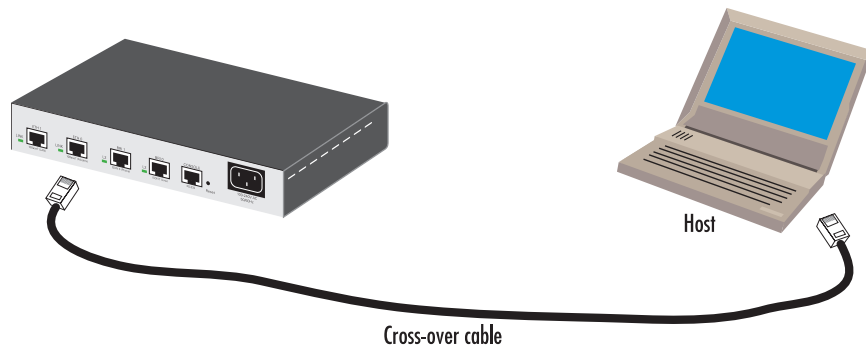
Figure 39. Connecting to a host

Straight-through cable

RJ-45, male   **RJ-45, male**

Rx+   3 ———————————————————————— 3
Tx-   4 ———————————————————————— 4
Tx-   5 ———————————————————————— 5
Rx-   6 ———————————————————————— 6
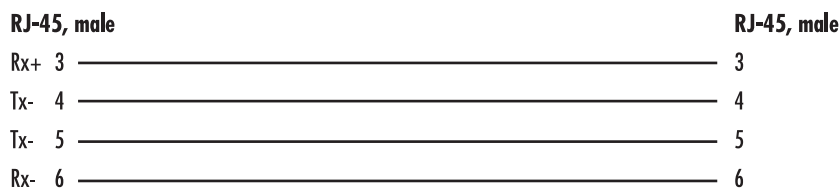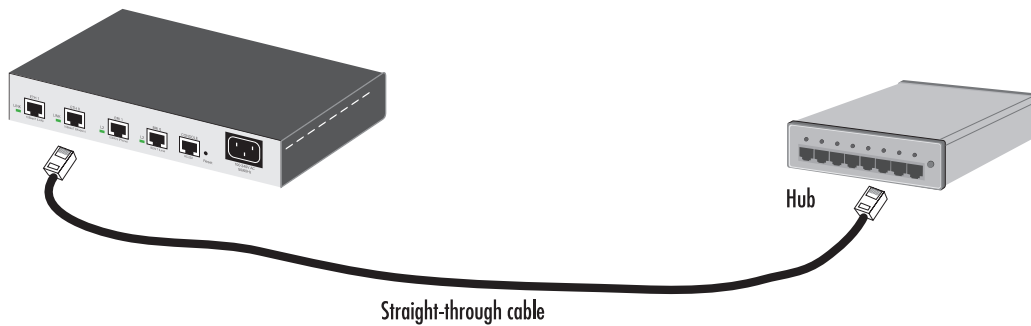
Figure 40. Connecting to a hub

Installing the BRI cables

⚠ **CAUTION**

The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability

A straight-through S-Bus cable terminated with RJ-45 plugs is used to connect an ISDN NT or TE to the SmartNode 1200 BRI ports (see table 25 for port pin-out listing). If you are connecting a BRI to an ISDN

telephone, see figure 41, or see figure 42 on page 76 if you are connecting a BRI to an NT. For BRI ports with configurable pin outs ensure that the appropriate mode (NET or USR) is configured.

Table 25. BRI (RJ-45) port pin-outs

Pin	Signal (USR)	Signal (NET)
3	TX+	RX+
4	RX+	TX+
5	RX-	TX-
6	TX-	RX-

Note   Pins not listed are not used.

WARNING   **Hazardous network voltages are present in the BRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the BRI port, regardless of when power is turned OFF.**

CAUTION   To prevent damage to the system, make certain you connect the BRI cable to the BRI port only and not to any other RJ-45 socket.

ISDN phone

S-Bus cable

RJ-45, male   **RJ-45, male**

Rx+ 3 ———————————————————————————————— 3
Tx-   4 ———————————————————————————————— 4
Tx-   5 ———————————————————————————————— 5
Rx- 6 ———————————————————————————————— 6

Figure 41. Connecting a BRI to an ISDN telephone

RJ-45, male   **RJ-45, male**
Rx+ 3 ———————————————————————— 3
Tx-   4 ———————————————————————— 4
Tx-   5 ———————————————————————— 5
Rx-   6 ———————————————————————— 6
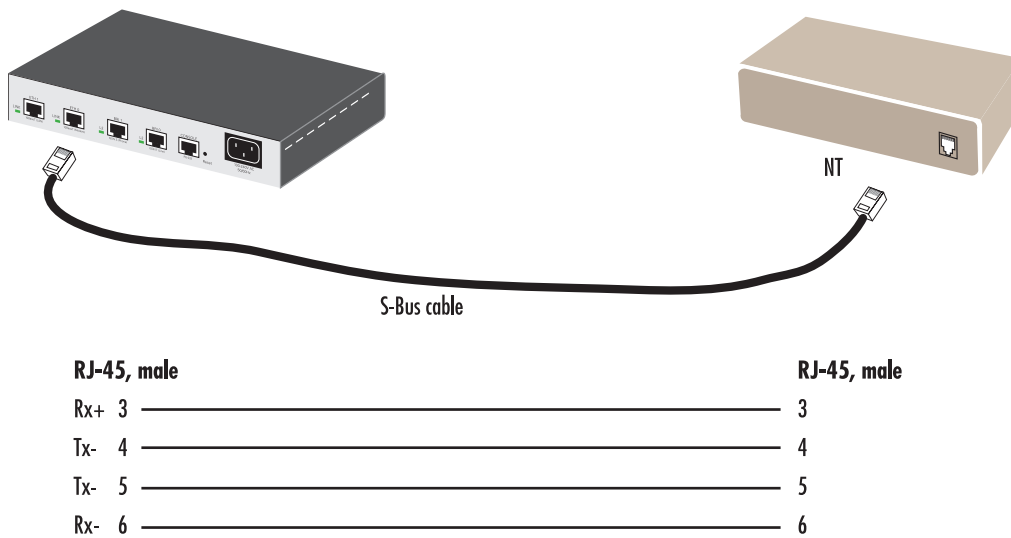
Figure 42. Connecting a BRI to an NT

External S-Bus power supply
Many ISDN telephone handsets require that 40-VDC power be supplied via the S-Bus connection. In other words, they have no separate or built-in power supply. In general, point-to-multipoint ISDN BRI NTs supply line power to the S-Bus. Point-to-point NTs connected to a PBX generally do not supply line power.

The SmartNode 1200 does not supply S-Bus line power on the BRI ports, however, there are two options to provide S-Bus line power:

• If one of the BRI ports is connected to an ISDN NT, the power supplied by the NT is fed through to the other BRI port.

• If line power is not available from the NT, but required for connected terminals, the PM-BRI-EXT S-Bus Phantom power supply can be used.

Table 26. PM-BRI-EXT S-Bus 40V power supply

Item	Phantom Power Supply; PM-BRI-EXT
Voltage Specifications	Input 230VAC, Output 40VDC

WARNING The PM-BRI-EXT power supply unit is equipped with a transformer that is specially designed for S-Bus line power. The use of a general purpose DC power transformer may cause equipment damage.

WARNING If you use a Phantom power supply other than that supplied by Patton Electronics Co., you must ensure that it conforms to ITU I.430 Section 9.7.3.2.2. which specifies that the maximum current delivered shall not exceed 200mA.

Note   The following installation options are available:

- In the absence of an NT the PM-BRI-EXT may be connected directly to the BRI 0 port on the SmartNode (see figure 43). The terminals are connected to the BRI 1 port.

- The PM-BRI-EXT is connected to the S-Bus via an S-Bus multi-socket (see figure 44 on page 78).

CAUTION   **Do not plug the Phantom power supply directly into any other port than BRI 0. Installing it on the Ethernet ports or Console port could result in serious equipment damage.**
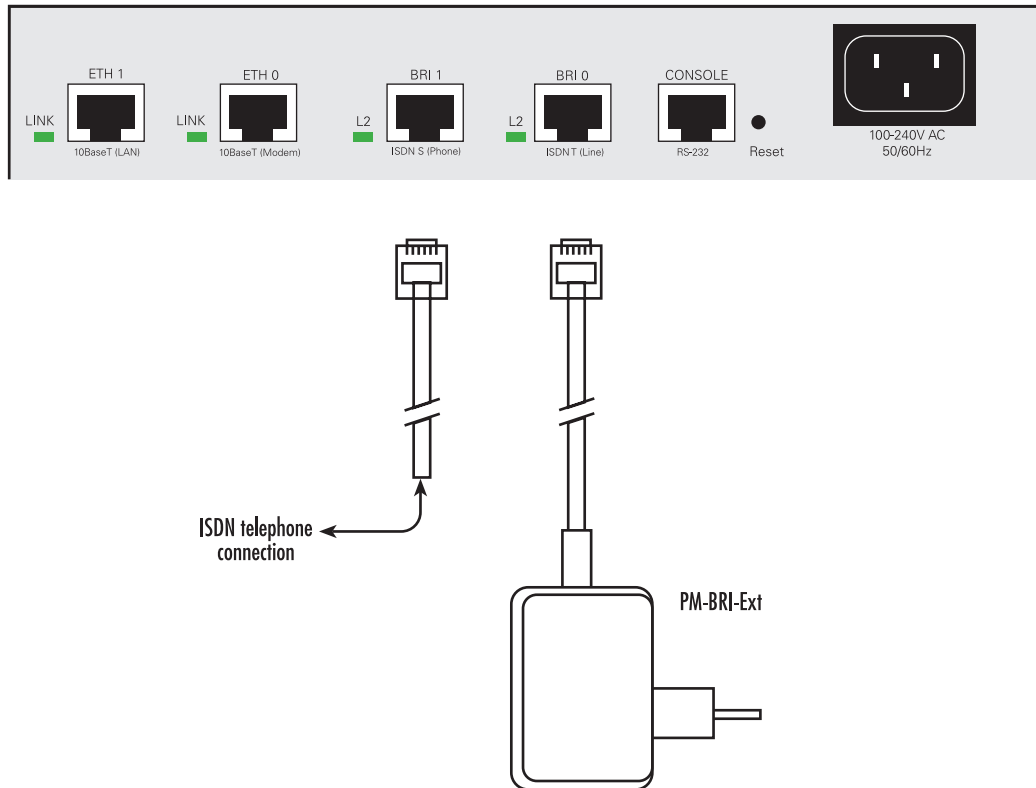
Figure 43. SmartNode 1200 external 40-VDC power supply
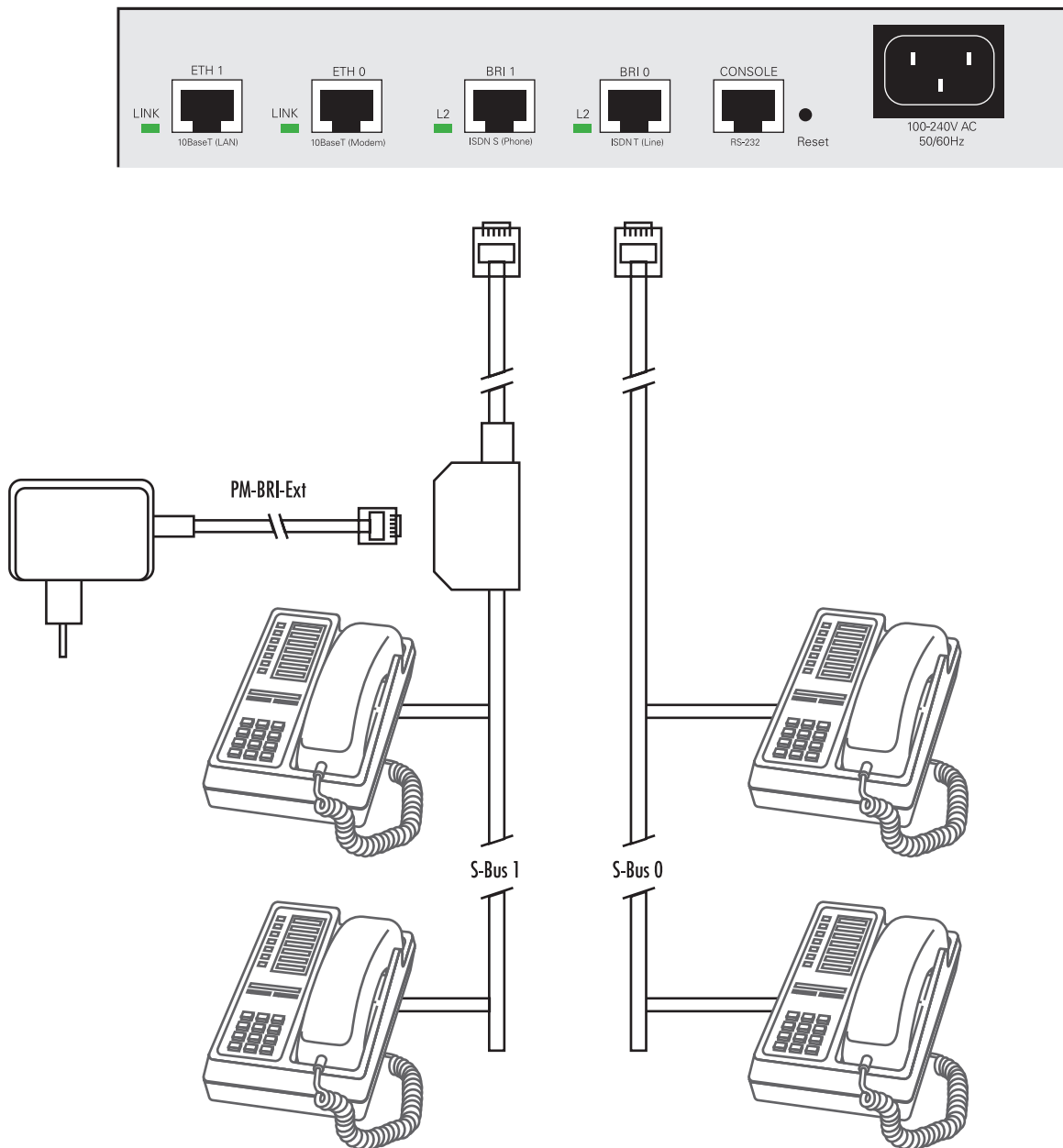
Figure 44. SmartNode 1200 external 40-VDC power supply

Installing the power cord

Do the following:

1.   Insert the barrel type connector end of the AC power cord into the 100–240 VAC power connector (see figure 38).

> ⚠
> CAUTION
>
> The SmartNode 1200 power supply automatically adjusts to accept an input voltage from 100 to 240 VAC (50/60 Hz).
>
> Verify that the proper voltage is present before plugging the power cord into the receptacle. Failure to do so could result in equipment damage.

Note   *Do not connect the other end of the power cord to the power outlet at this time.*

2.   Verify that the AC power cord included with your router is compatible with local standards. If it is not, refer to chapter 12, "Contacting Patton for assistance" on page 155 to find out how to replace it with a compatible power cord.

3.   Connect the male end of the power cord to an appropriate power outlet.

4.   Verify that the green *Power* LED is lit (see figure 45).

5.   Unplug the power cord from the router to power down the unit.
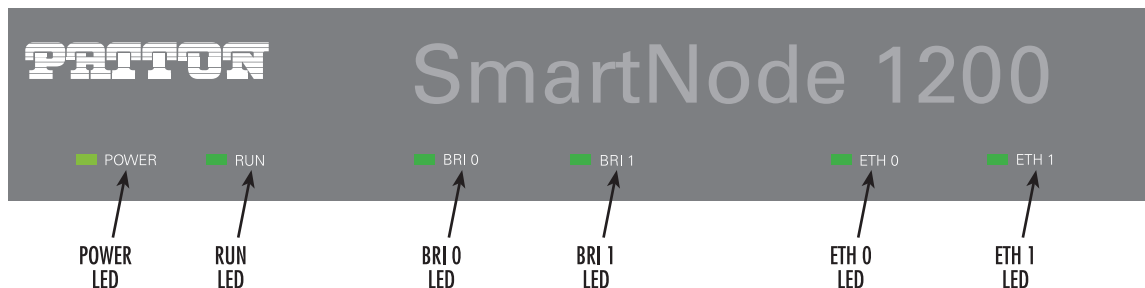
Figure 45. SmartNode 1200 front panel LEDs

Congratulations, you have finished installing the SmartNode 1200! Now go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Chapter 5   SmartNode 1400 installation

Chapter contents

Hardware installation

SmartNode 1400 installation consists of the following:

• Placing the device at the desired installation location (see section "Mounting the SmartNode 1400" on page 83)

• Installing the interface and power cables (see section "Connecting cables" on page 85)

When you finish installing the SmartNode 1400, go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Mounting the SmartNode 1400

The SmartNode 1400 should be placed in a dry environment with sufficient space to allow air circulation for cooling.

> **Note** For proper ventilation, leave at least 2 inches (5 cm) to the left, right, front, and rear of the SmartNode 1400.

The SmartNode 1400 can be installed as follows:

• Placed on a desktop or similar sturdy, flat surface that offers easy access to the cables

• Mounted on a wall

Desktop installation

Do the following to install the SmartNode 1400:

1. Remove one of the rubber pads from the adhesive strip (included in the SmartNode installation kit pack) and place it on a corner on the bottom of the SmartNode 1400 (see figure 46).
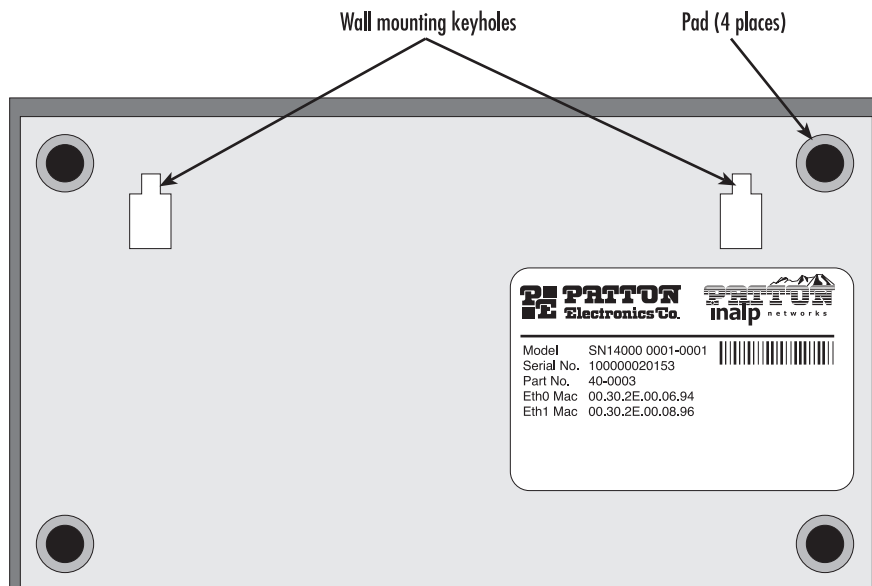
Figure 46. Pads and wall-mounting keyholes locations

2. Repeat step 1 to install pads on the remaining three corners on the bottom of the SmartNode 1400.

3. Place the unit on a desktop, shelf or other flat, hard, and secure surface.

> **Note** Allow sufficient space at the rear of the chassis for cable connections. In
> addition you should consider the need to access the chassis for future
> upgrades, maintenance and troubleshooting. Multiple SmartNodes can be
> stacked one atop the other.

Wall-mounted installation

Do the following to install the SmartNode 1400:

1. Using figure 47 as a guide, determine the positions of the mounting holes on the wall and mark the locations of the mounting holes.
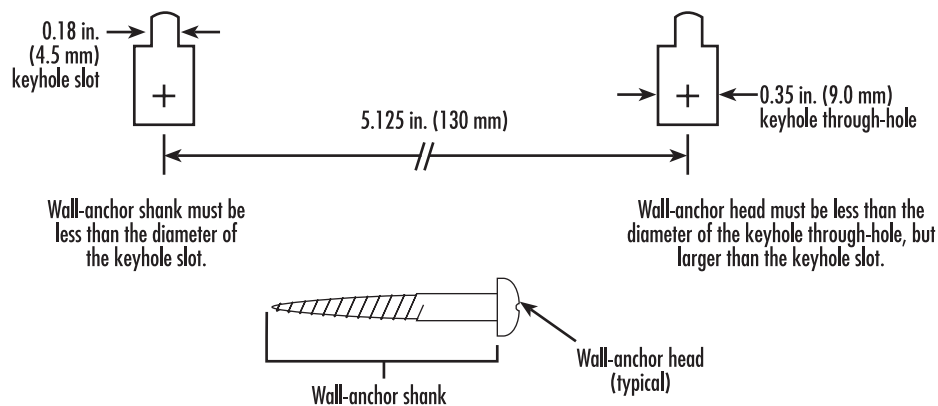
Figure 47. Wall-mounting hole dimensions

> **Note** Mounting hardware is not provided. The installer must determine
> which fastener is appropriate for that particular application.

2. Install the (user-provided) wall anchors. Any standard anchoring method may be used, such as wood screws; butterfly anchors/molly bolts (for installation into a sheetrock/drywall or plasterboard surface); or expansion bolts (for installation into a concrete or masonry surface). The anchor screw heads must have just enough clearance to allow the wall-mounting key holes (see figure 46 on page 83) to slip onto them when hanging the SmartNode 1400.

3. Hang the SmartNode 1400 on the wall-anchor mounting screws.
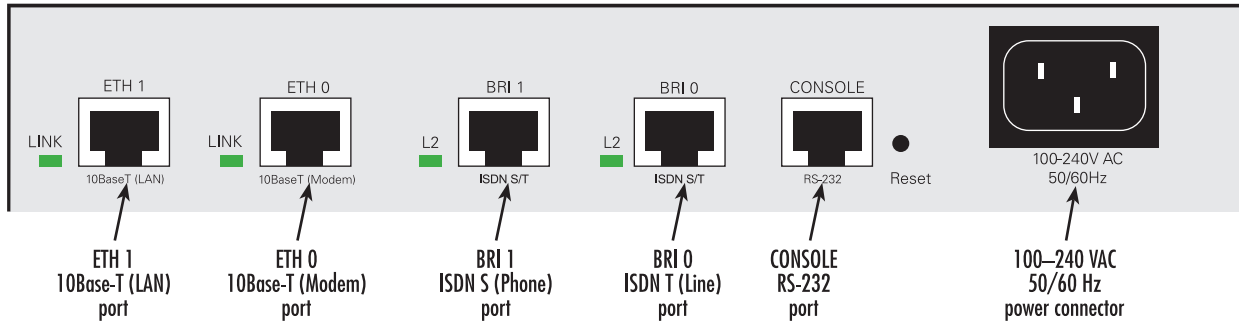
Figure 48. SmartNode 1400 connectors

Connecting cables

Installing SmartNode 1400 cables takes place in the following order:

⚠️ **WARNING**

Do not work on the system or connect or disconnect cables during periods of lightning activity.

⚠️ **CAUTION**

The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability

1. Installing the 10Base-T Ethernet cable into ports *ETH 0* and *ETH 1* (see figure 48) (see "Installing the Ethernet cables" on page 85).

2. Installing the BRI 0 and BRI 1 cables (see "Installing the BRI cables" on page 86).

3. Installing the power cord (see "Installing the power cord" on page 90).

Installing the Ethernet cables

Ethernet devices (10Base-T) are connected to the SmartNode's Ethernet ports (see table 27 for port pin-out listing) via a cable terminated with RJ-45 plugs. Use a cross-over cable to connect to a host (see figure 49 on page 86), or a straight-through cable to connect to a hub (see figure 50 on page 86).

Table 27. Ethernet 10Base-T (RJ-45) port pin-outs

Pin	Signal
1	TX+
2	TX-
3	RX+
6	RX-

Note   Pins not listed are not used.

Cross-over cable

RJ-45, male   **RJ-45, male**

Tx+ 1 ————————————————╲ ╱———————————— 1
Tx-   2 ———————————————— ╳ ———————————— 2
Rx+ 3 ———————————————— ╳ ———————————— 3
Rx-   6 ————————————————╱ ╲———————————— 6
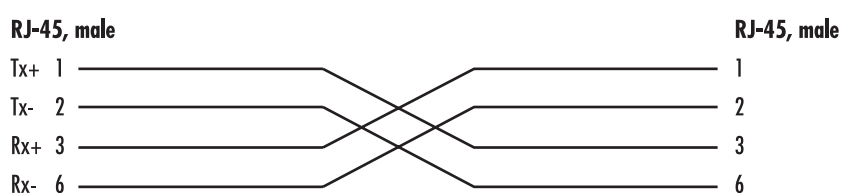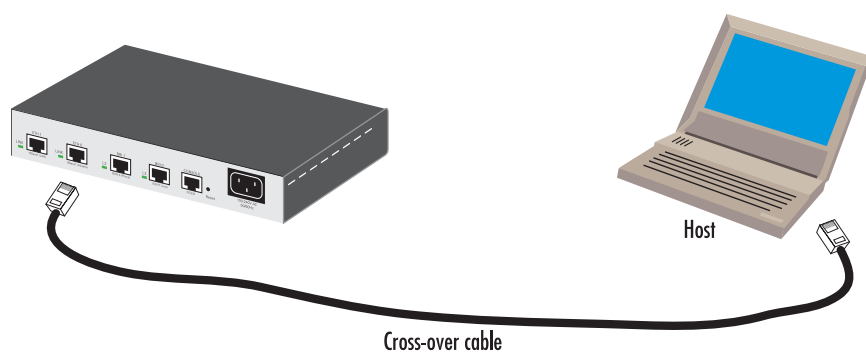
Figure 49. Connecting to a host

Straight-through cable

RJ-45, male   **RJ-45, male**

Rx+ 3 ——————————————————————————— 3
Tx-   4 ——————————————————————————— 4
Tx-   5 ——————————————————————————— 5
Rx-   6 ——————————————————————————— 6
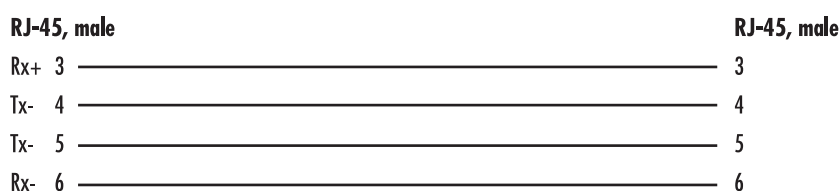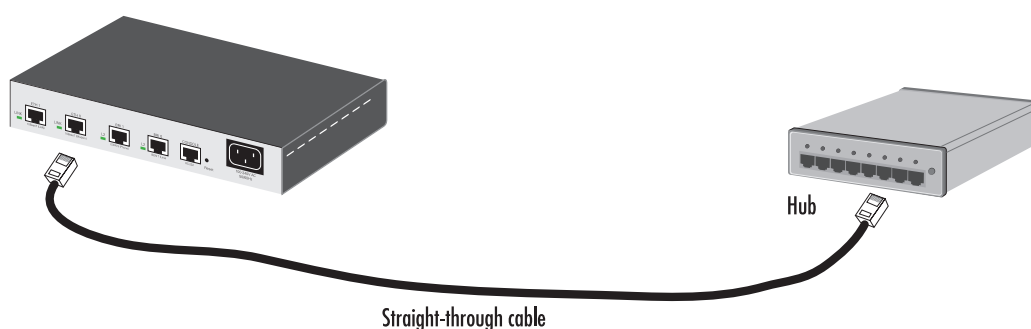
Figure 50. Connecting to a hub

Installing the BRI cables

> ⚠ **CAUTION** The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability

A straight-through S-Bus cable terminated with RJ-45 plugs is used to connect an ISDN NT or TE to the SmartNode 1400 BRI ports (see table 28 for port pin-out listing). If you are connecting a BRI to an ISDN

telephone, see figure 51, or see figure 52 on page 88 if you are connecting a BRI to an NT. For BRI ports with configurable pin outs ensure that the appropriate mode (NET or USR) is configured.

Table 28. BRI (RJ-45) port pin-outs

Pin	Signal (USR)	Signal (NET)
3	TX+	RX+
4	RX+	TX+
5	RX-	TX-
6	TX-	RX-

Note   Pins not listed are not used.

WARNING   **Hazardous network voltages are present in the BRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the BRI port, regardless of when power is turned OFF.**

CAUTION   To prevent damage to the system, make certain you connect the BRI cable to the BRI port only and not to any other RJ-45 socket.

ISDN phone

S-Bus cable

RJ-45, male   **RJ-45, male**

Rx+ 3 ———————————————————— 3
Tx- 4 ———————————————————— 4
Tx- 5 ———————————————————— 5
Rx- 6 ———————————————————— 6

Figure 51. Connecting a BRI to an ISDN telephone

RJ-45, male   **RJ-45, male**

Rx+ 3 ————————————————————————— 3
Tx-   4 ————————————————————————— 4
Tx-   5 ————————————————————————— 5
Rx-   6 ————————————————————————— 6
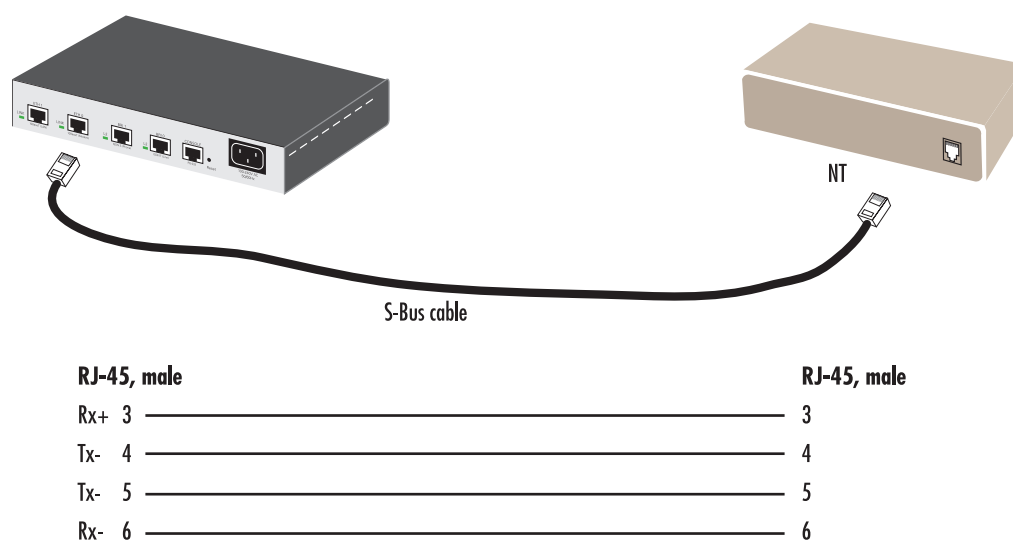
Figure 52. Connecting a BRI to an NT

External S-Bus power supply

Many ISDN telephone handsets require that 40-VDC power be supplied via the S-Bus connection. In other words, they have no separate or built-in power supply. In general, point-to-multipoint ISDN BRI NTs supply line power to the S-Bus. Point-to-point NTs connected to a PBX generally do not supply line power.

The SmartNode 1400 does not supply S-Bus line power on the BRI ports, however, there are two options to provide S-Bus line power:

- If one of the BRI ports is connected to an ISDN NT, the power supplied by the NT is fed through to the other BRI port.

- If line power is not available from the NT, but required for connected terminals, the PM-BRI-EXT S-Bus Phantom power supply can be used.

Table 29. PM-BRI-EXT S-Bus 40V power supply

Item	Phantom Power Supply; PM-BRI-EXT
Voltage Specifications	Input 230VAC, Output 40VDC

⚠️ **WARNING**   The PM-BRI-EXT power supply unit is equipped with a transformer that is specially designed for S-Bus line power. The use of a general purpose DC power transformer may cause equipment damage.

⚠️ **WARNING**   If you use a Phantom power supply other than that supplied by Patton Electronics Co., you must ensure that it conforms to ITU I.430 Section 9.7.3.2.2. which specifies that the maximum current delivered shall not exceed 200mA.

Note   The PM-BRI-EXT is connected to the S-Bus via an S-Bus multi-socket.(see figure 53).

⚠ **CAUTION**   **Do not plug the Phantom power supply directly into any other port than BRI 0. Installing it on the Ethernet ports or Console port could result in serious equipment damage.**
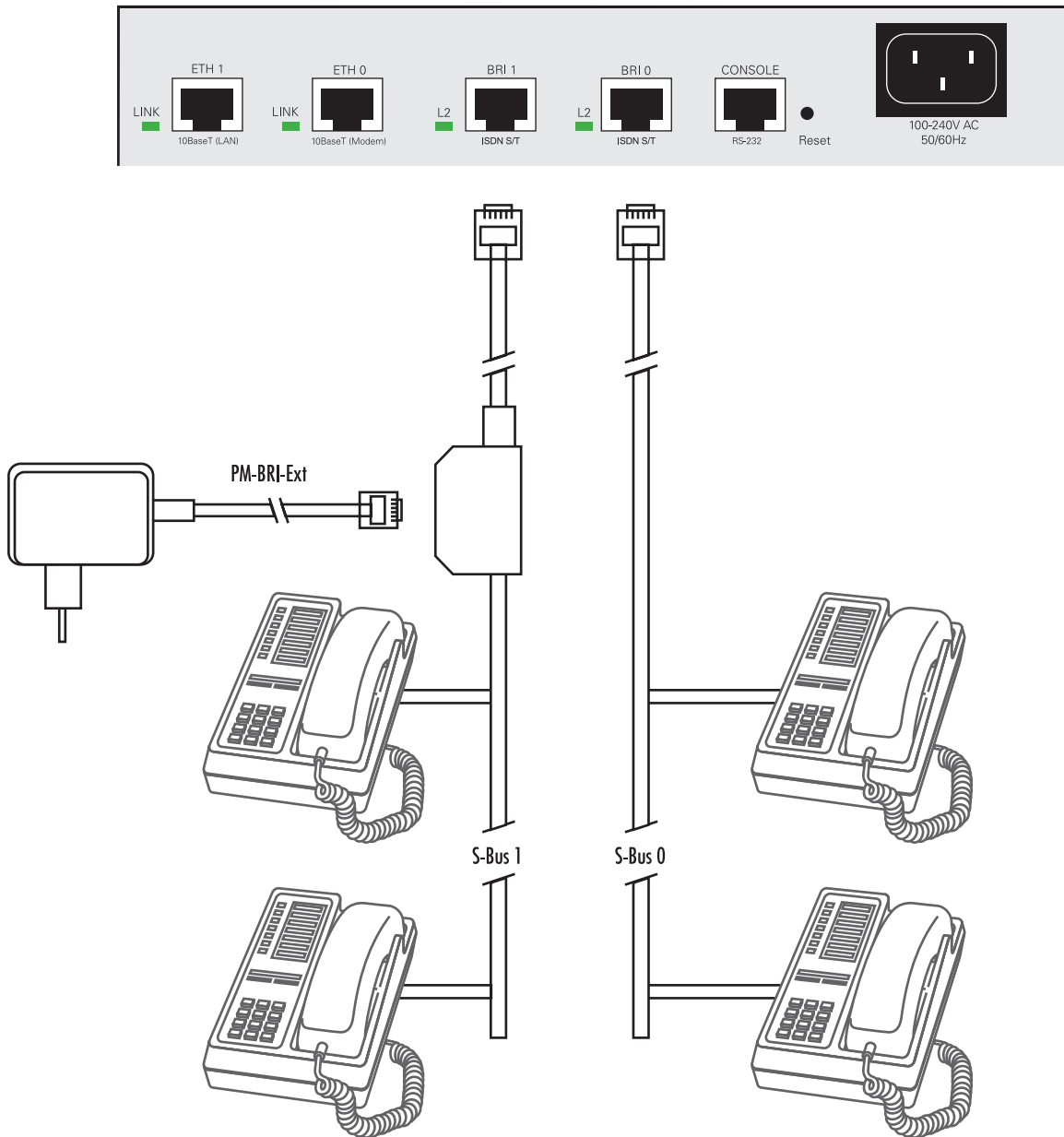
Figure 53. SmartNode 1400 external 40-VDC power supply

Installing the power cord

Do the following:

1. Insert the barrel type connector end of the AC power cord into the 100–240 VAC power connector (see figure 48).

> ⚠ **CAUTION**
> The SmartNode 1400 power supply automatically adjusts to accept an input voltage from 100 to 240 VAC (50/60 Hz).
> Verify that the proper voltage is present before plugging the power cord into the receptacle. Failure to do so could result in equipment damage.

Note   *Do not connect the other end of the power cord to the power outlet at this time.*

2. Verify that the AC power cord included with your router is compatible with local standards. If it is not, refer to chapter 12, "Contacting Patton for assistance" on page 155 to find out how to replace it with a compatible power cord.

3. Connect the male end of the power cord to an appropriate power outlet.

4. Verify that the green *Power* LED is lit (see figure 54).

5. Unplug the power cord from the router to power down the unit.
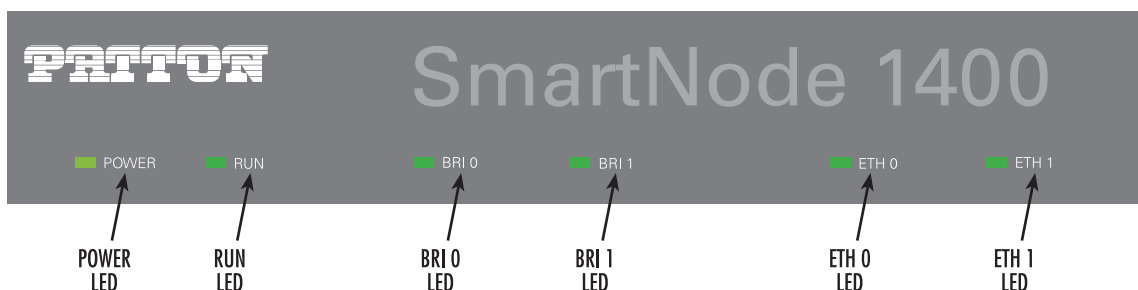
Figure 54. SmartNode 1400 front panel LEDs

Congratulations, you have finished installing the SmartNode 1400! Now go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Chapter 6 SmartNode 2300 installation

Chapter contents

Hardware installation

SmartNode 2300 installation consists of the following:

> **Note**   If you will be installing the 48V line power module prior to installing an interface card or ISDN S-Bus, refer to chapter 8, "Line power module installation" on page 125.

- Installing an interface card (if the card was not installed at the factory). Refer to chapter 9, "Interface card installation" on page 133 to install the card, then return to this chapter.
- Placing the device at the desired installation location (see section "Mounting the SmartNode 2300" on page 93)
- Installing the interface and power cables (see section "Connecting cables" on page 96)

When you finish installing the SmartNode 2300, go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Mounting the SmartNode 2300

The SmartNode 2300 should be placed in a dry environment with sufficient space to allow air circulation for cooling.

> **Note**   For proper ventilation, leave at least 2 inches (5 cm) to the left, right, front, and rear of the SmartNode 2300.

The SmartNode 2300 can be installed as follows:

- Placed on a desktop or similar sturdy, flat surface that offers easy access to the cables
- Mounted inside a 19-inch equipment rack

> **Note**   To prevent overheating we recommend that the SmartNode 2300 not be installed in a closed rack or in a room that is not properly ventilated or air-conditioned.

Desktop installation

Do the following to install the SmartNode 2300:

1. Remove one of the rubber pads from the adhesive strip (included in the SmartNode installation kit pack) and place it on a corner on the bottom of the SmartNode 2300 (see figure 55).
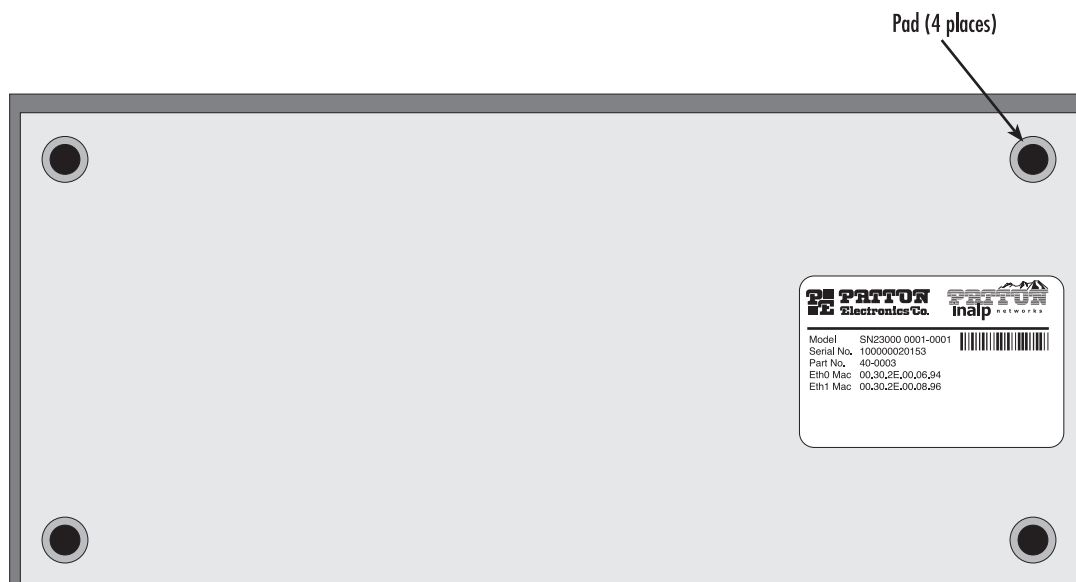
Figure 55. Pad locations

2. Repeat step 1 to install pads on the remaining three corners on the bottom of the SmartNode 2300.

3. Place the unit on a desktop, shelf or other flat, hard, and secure surface.

> **Note**   Allow sufficient space at the rear of the chassis for cable connections. In addition you should consider the need to access the chassis for future upgrades, maintenance and troubleshooting. Multiple SmartNodes can be stacked one atop the other.

Rack-mounted installation

For rack-mounting, screw holes are provided at standard mounting positions for industry-standard 19-inch equipment racks.

> **Note**   The SN2300 requires AC power 100–40V, 50/60Hz. Its power dissipation is 10W. It should be installed in an open rack wherever possible. If cabinet installation is unavoidable then ensure that the cabinet has adequate ventilation.

Install the rack-mount brackets before you install the SmartNode 2300 in the rack. When installing multiple SmartNode 2300s in one rack, we recommend that you leave one height unit (2.54 cm/1 inch) of clear space between two devices. Two rack mounting brackets and eight screws for attaching the brackets to the chassis are provided. The screws for installing the chassis in a rack are not included.

Do the following to mount a SmartNode 2300 in a 19-inch rack:

1. Locate the two angled mounting brackets included in the installation kit pack. The bracket (see figure 56) is designed so you can have the 1.5 cm flange facing to the front or to the rear. There are four holes for countersunk screws on the long side of the bracket.

Position C mounting holes

Position B mounting holes

Position A mounting holes

Self-tapping screws

Mounting bracket (2 places)
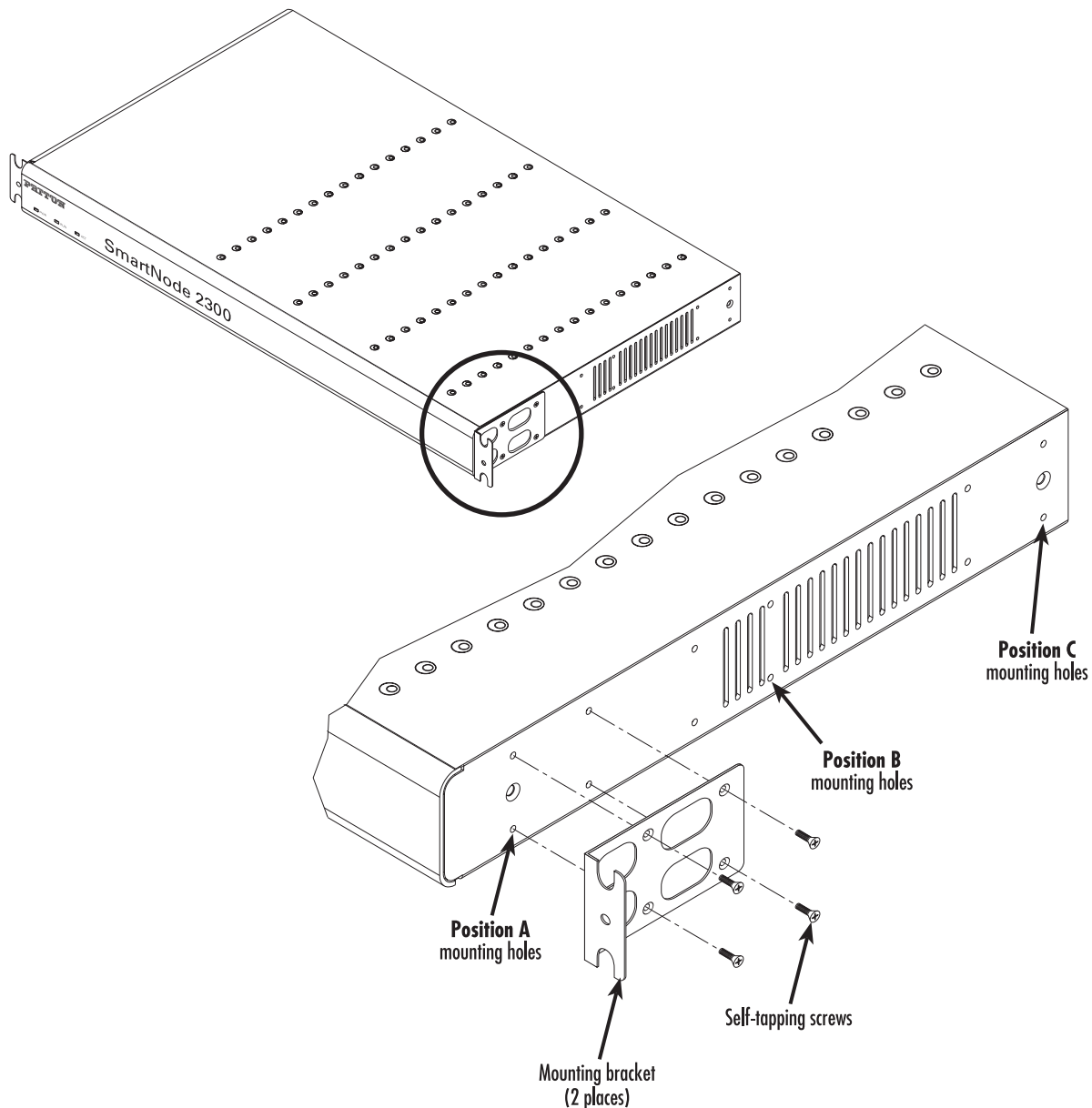
Figure 56. SmartNode 2300 rack mounting bracket location holes

2. Attach a bracket to each side of the SmartNode 2300 with the four self-tapping screws provided. There are three mounting positions for the brackets (positions A, B, and C as shown in figure 56 on page 95), so choose the one that best suits your requirements.

3. Install the unit into the rack using the user-provided rack mounting hardware.
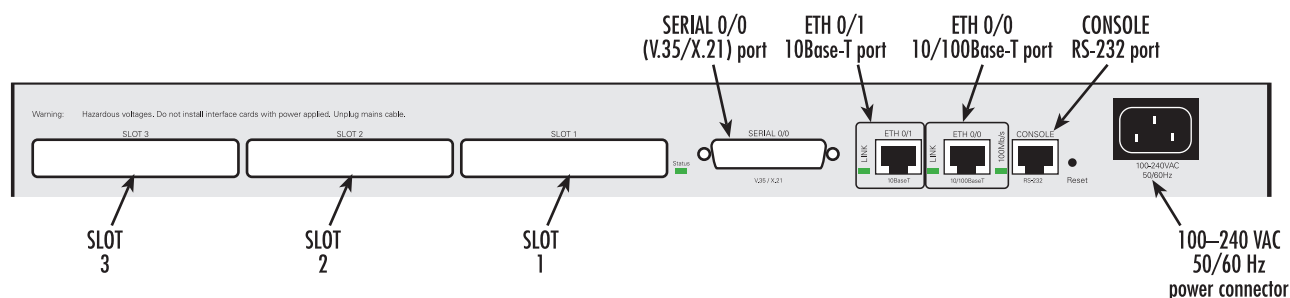
Figure 57. SmartNode 2300 connectors

Connecting cables

Installing SmartNode 2300 cables takes place in the following order:

⚠️ **WARNING**

> **Do not work on the system or connect or disconnect cables during periods of lightning activity.**

⚠️ **CAUTION**

> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

1. Installing the 10Base-T Ethernet cable into port *ETH 0/1* or 10/100Base-T Ethernet cable into port *ETH 0/0* (see figure 57) (see "Installing the Ethernet cables" on page 97)

2. Installing the serial interface cable into port *SERIAL 0/0* (see "Installing the serial interface cable" on page 98)

3. Installing the interface card cables (see "Installing the interface card cables" on page 101)

4. Installing the power cord (see "Installing the power cord" on page 107)

Installing the Ethernet cables

> ⚠️ **CAUTION**
>
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

Ethernet devices (10Base-T and 100Base-T) are connected to the SmartNode's Ethernet ports (see table 30 for port pin-out listing) via a cable terminated with RJ-45 plugs. Use a cross-over cable to connect to a host (see figure 58), or a straight-through cable to connect to a hub (see figure 59 on page 98).

Table 30. Ethernet 10Base-T (RJ-45) port pin-outs

Pin	Signal
1	TX+
2	TX-
3	RX+
6	RX-

Note   Pins not listed are not used.

Cross-over cable

RJ-45, male			RJ-45, male
Tx+	1		1
Tx-	2		2
Rx+	3		3
Rx-	6		6
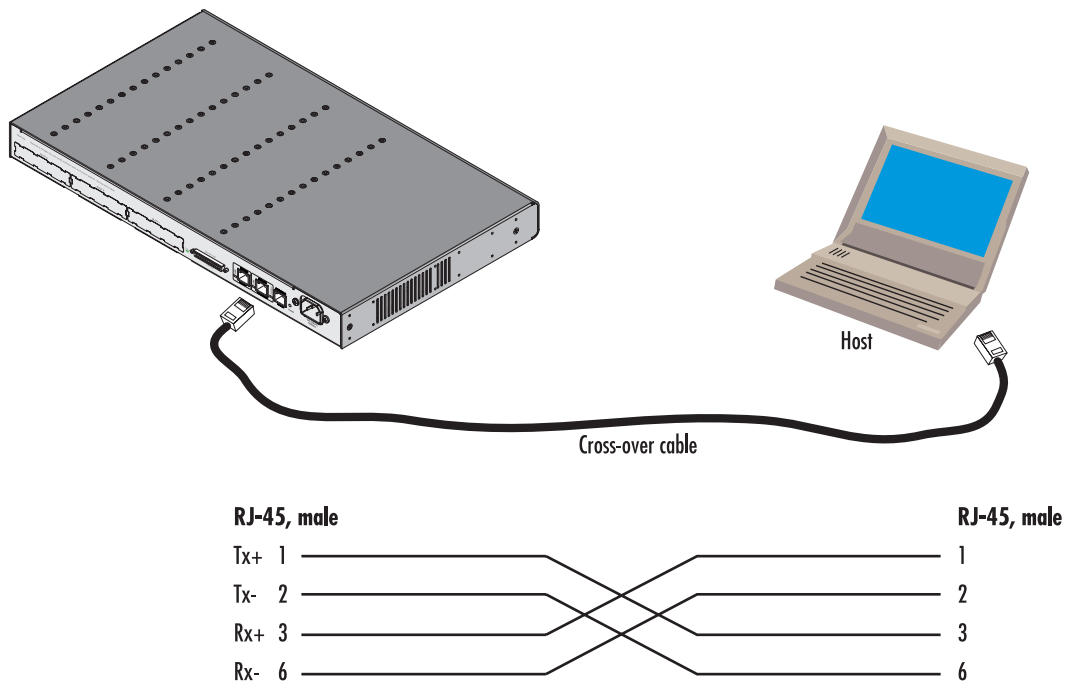
Figure 58. Connecting to a host

Straight-through cable

RJ-45, male   **RJ-45, male**

Rx+ 3 ———————————————————————————— 3
Tx-   4 ———————————————————————————— 4
Tx-   5 ———————————————————————————— 5
Rx-   6 ———————————————————————————— 6
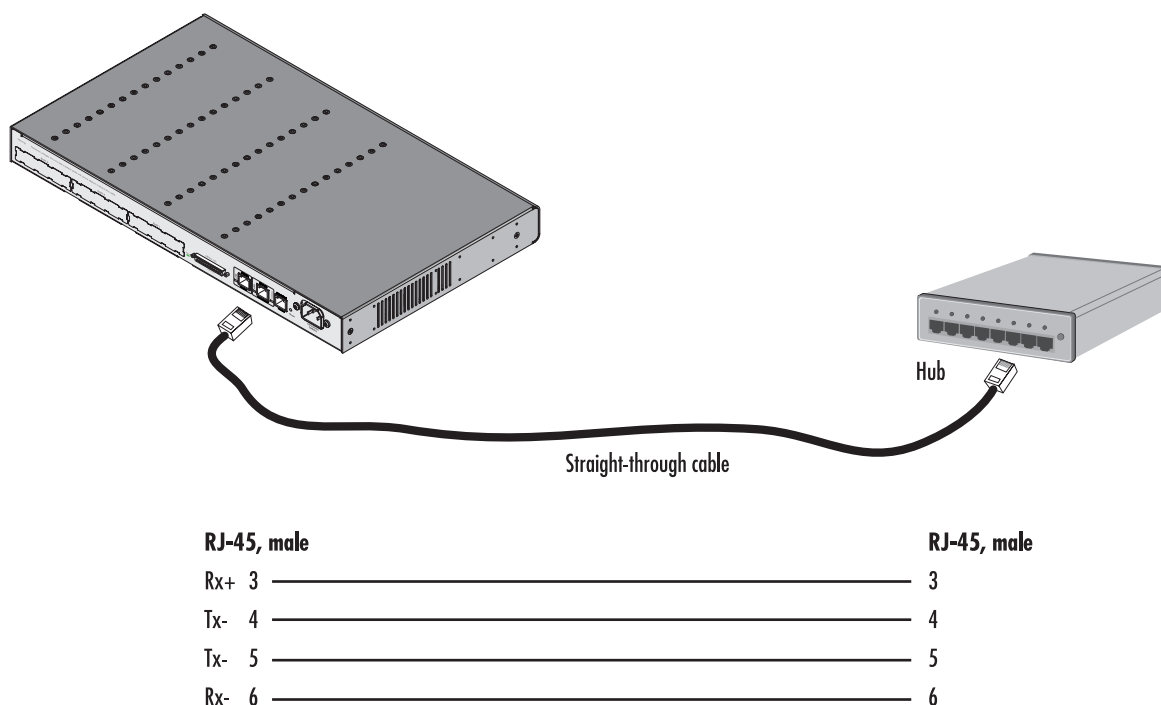
Figure 59. Connecting to a hub

Installing the serial interface cable

> **⚠ CAUTION**
>
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

Serial devices (V.35 or X.21) are connected to the SmartNode's serial ports (see table 31 for port pin-out listing) via a cable terminated at the SmartNode 2300 with a DB-25 connector.

Table 31. Serial port V.35 and X.21 signals

Signal V.35		Signal X.21	
Pin	**Description**	**Pin**	**Description**
1	Frame Ground	7	Signal Ground
4	DCD	9	RXDa
6	DTR	10	RXDb
7	Signal Ground	11	TXDb
8	RTS	12	TXDa
9	RXDa	13	CNTb
10	RXDb	14	CNTa
11	TXDb	16	INDb

Table 31. Serial port V.35 and X.21 signals

Signal V.35		Signal X.21	
Pin	Description	Pin	Description
12	TXDa	21	SETb
16	TXCb	22	SETa
21	RXCb	23	INDa
22	RXCa		
23	TXCa		
25	CTS		

Figure 60 shows the cables that are required to connect the serial port of a SmartNode 2300 to a standard X.21 or V.35 network termination unit (NTU).

Leased-line modem

X.21

DB-25, male

TXDa	12	2	TXDa
TXDb	11	9	
RXDa	9	4	
RXDb	10	11	
SETa	22	6	
SETb	21	13	
INDa	23	5	
INDb	16	12	
CNTa	14	3	
CNTb	13	10	
RTSa	8		
CTSb	25		
SIGNAL GROUND	7	8	
DTR	6		
DCD	4		

SmartNode 2300   **Modem NTU**

V.35

DB-25, male

TXDa	12	P
TXDb	11	S
RXDa	9	R
RXDb	10	T
RXCa	22	V
RXCb	21	X
TXCa	23	Y
TXCb	16	a
RTS	8	C
DTR	6	H
DCD	4	F
CTS	25	D
SIGNAL GROUND	7	B
FRAME GROUND	1	A

SmartNode 2300   **Modem NTU**
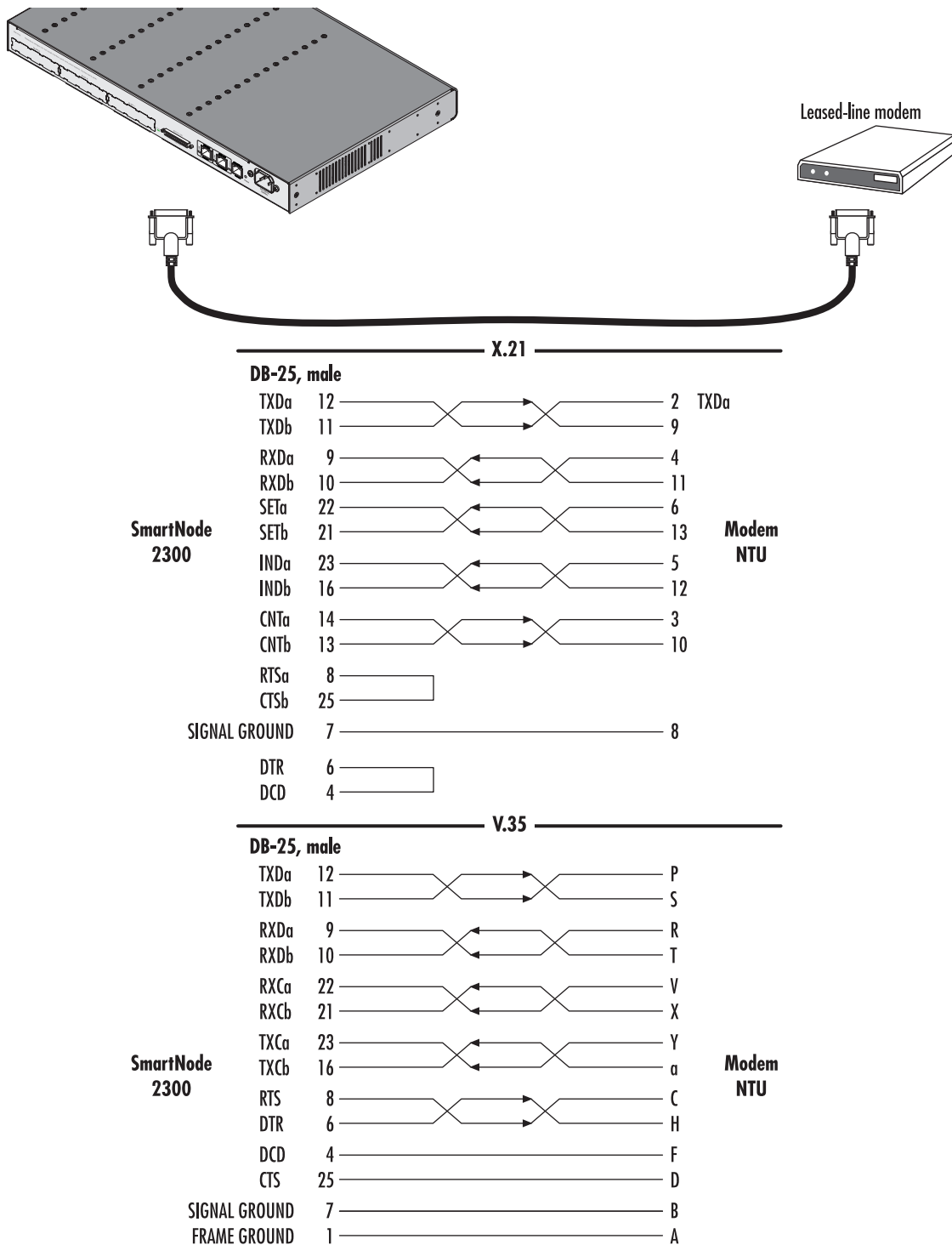
Figure 60. V.35 and X.21 modem connection

Note   Some NTUs have non-standard or mirrored connections and require special cables. Consult the NTU maker's product documentation.

Installing the interface card cables

⚠️ CAUTION **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The following interface cards are available for use with the SmartNode 2300:

- **IC-4FXS**—Gateway interface card for 4 analog FXS ports (see section "Installing the IC-4FXS interface card cables")

- **IC-4BRV-8V**—8-channel gateway interface card for ISDN BRI (see section "Installing the IC-4BRV-8V interface card cables" on page 102)

- **IC-E1V**—30-channel E1 gateway interface card for ISDN PRI (see section "Installing the IC-E1V interface card cables" on page 105)

- **IC-T1V**—23-channel T1 gateway interface card for ISDN PRI (see section "Installing the IC-T1V interface card cables" on page 106)

Determine which cards are installed in your SmartNode 2300, then go to the appropriate section to install the device.

Installing the IC-4FXS interface card cables
The IC-4FXS supports up to four analog connections (see table 31 for port pin-out listing) via cables terminated with RJ-12 plugs (see figure 61 on page 102).

Table 32. RJ-12 socket

Pin	Signal
3	Ring (-)
4	Tip (+)

Note   The IC-4FXS is actually equipped with RJ-11 sockets. An RJ-11 socket is similar to an RJ-12 socket but pins 1 and 6 are omitted.

Note   Pins not listed are not used.

RJ-12, male   **RJ-12, male**

Ring (-)   3 ─── 3   Ring (-)

Tip (+)   4 ─── 4   Tip (+)
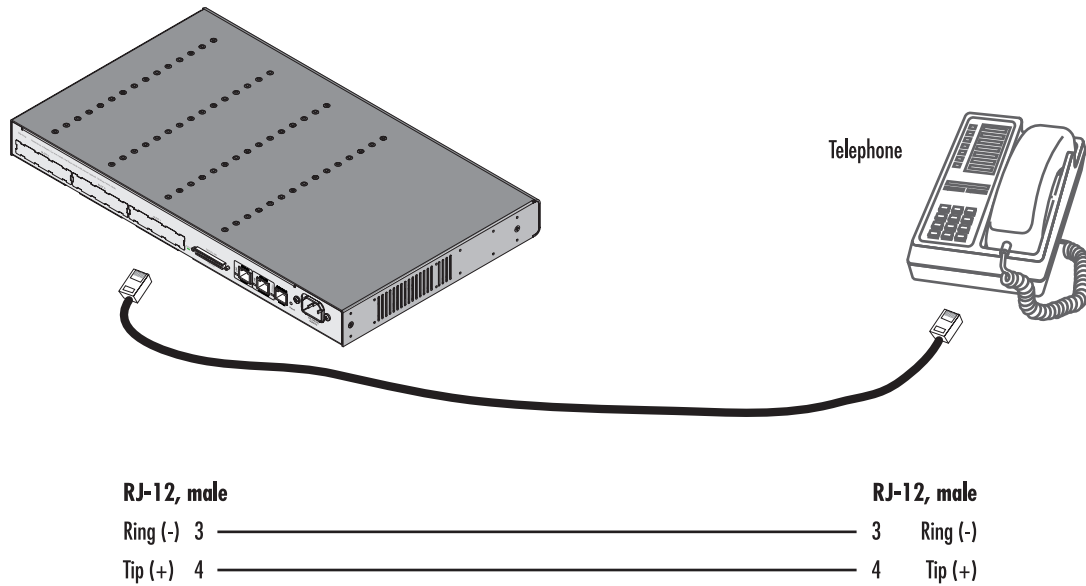
Figure 61. Analog FXS connection

Installing the IC-4BRV-8V interface card cables

⚠ **CAUTION**   The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability

A straight-through S-Bus cable terminated with RJ-45 plugs is used to connect an ISDN NT or TE to the interface card ports (see table 33 for port pin-out listing). If you are connecting a BRI to an ISDN telephone, see figure 62; or see figure 63 on page 103 if you are connecting a BRI to an NT. For BRI ports with configurable pin-outs ensure that the appropriate mode (NET or USR) is configured.

Table 33. BRI (RJ-45) port pin-outs

Pin	Signal (USR)	Signal (NET)
3	TX+	RX+
4	RX+	TX+
5	RX-	TX-
6	TX-	RX-

Note   Pins not listed are not used.

⚠ **WARNING**   Hazardous network voltages are present in the BRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the BRI port, regardless of when power is turned OFF.

CAUTION

To prevent damage to the system, make certain you connect the BRI cable to the BRI port only and not to any other RJ-45 socket.

ISDN phone

S-Bus cable

RJ-45, male   **RJ-45, male**

Rx+   3 ——————————————————— 3
Tx-   4 ——————————————————— 4
Tx-   5 ——————————————————— 5
Rx-   6 ——————————————————— 6

Figure 62. Connecting a BRI to an ISDN telephone

NT
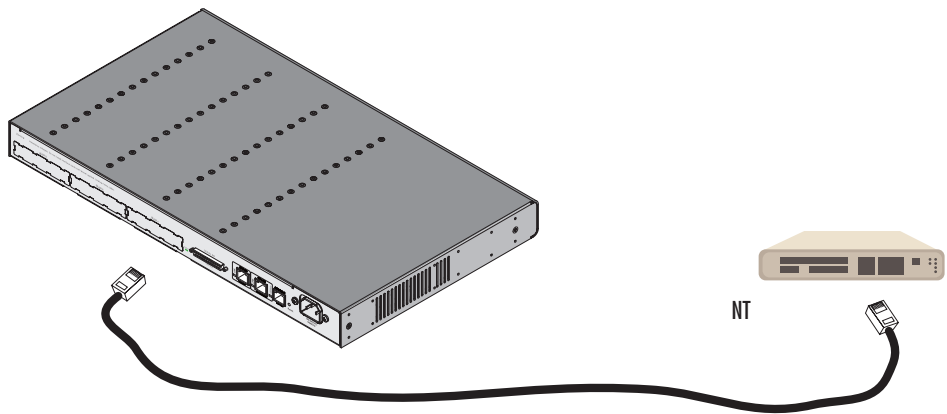
Figure 63. Connecting a BRI to an NT
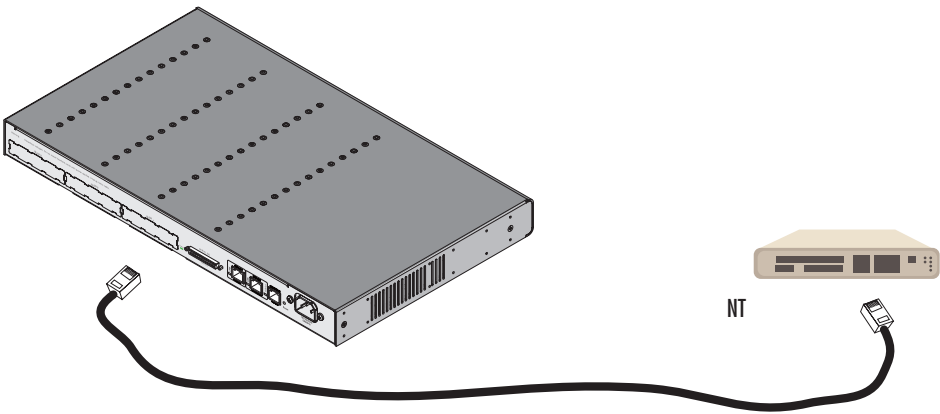
Figure 64. Connecting an E1 PRI port to an NT

RJ-48C, male   **RJ-48C, male**

TX Ring	1		1	
TX Tip	2		2	
TX Shield	3		3	
RX Ring	4		4	
RX Tip	5		5	
RX Shield	6		6	
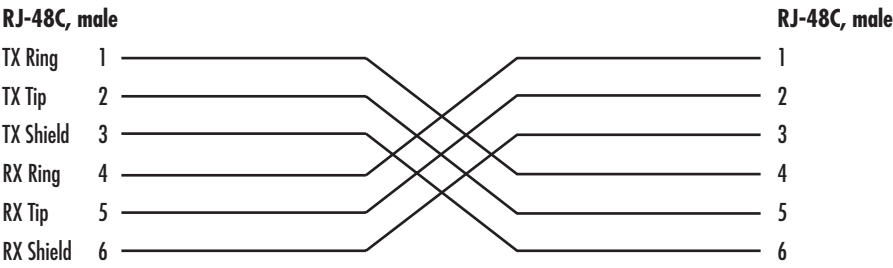
Figure 65. E1 crossover cable

Installing the IC-E1V interface card cables

> ⚠ **CAUTION**
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The PRI is usually connected to a PBX or telco switch (local exchange (LE)). Type and pin-outs of these devices vary depending on the manufacturer. In most cases, a straight-through RJ-45 to RJ-45 can be used to connect the PRI (see table 34 for IC-E1V card port pin-out listing) with a PBX (an NT). (See figure 64). A cross-over cable is required to connect to an LE, as illustrated in figure 65.

Table 34. RJ-48C socket

Pin	USR
1	TX Ring
2	TX Tip
3	TX Shield
4	RX Ring
5	RX Tip
6	RX Shield

Note   Pins not listed are not used.

> ⚠ **WARNING**
> **Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of when power is turned OFF.**

> ⚠ **CAUTION**
> To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ-45 socket.

Installing the IC-T1V interface card cables

> ⚠ **CAUTION**
>
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The PRI is usually connected to a PBX or telco switch—local exchange (LE). The type and pin outs of these devices vary depending on the manufacturer. In most cases, a straight-through RJ-45 to RJ-45 can be used to connect the PRI (see table 35 for IC-T1V card port pin-out listing) with a PBX (an NT). (See figure 66). A cross-over cable is required to connect to an LE, as illustrated in figure 67.

Table 35. RJ-48C socket

Pin	USR
1	TX Ring
2	TX Tip
3	TX Shield
4	RX Ring
5	RX Tip
6	RX Shield
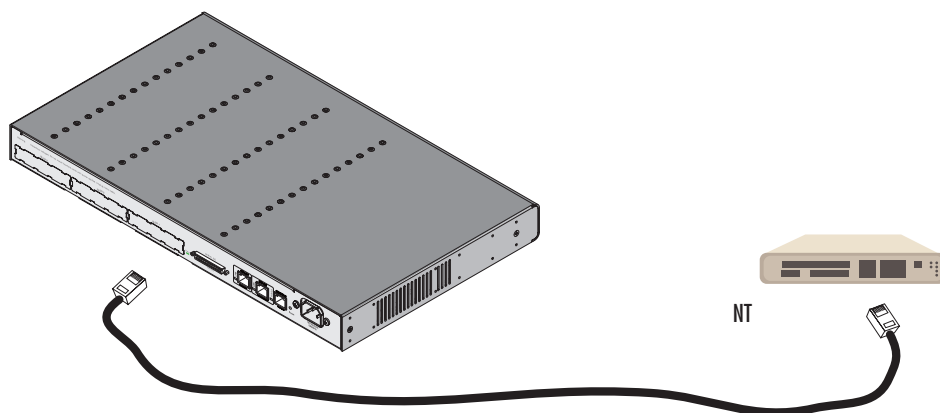
Figure 66. Connecting an T1 PRI port to an NT

RJ-48C, male   **RJ-48C, male**

TX Ring   1 ————————————————————————— 1
TX Tip   2 ————————————————————————— 2
TX Shield   3 ————————————————————————— 3
RX Ring   4 ————————————————————————— 4
RX Tip   5 ————————————————————————— 5
RX Shield   6 ————————————————————————— 6

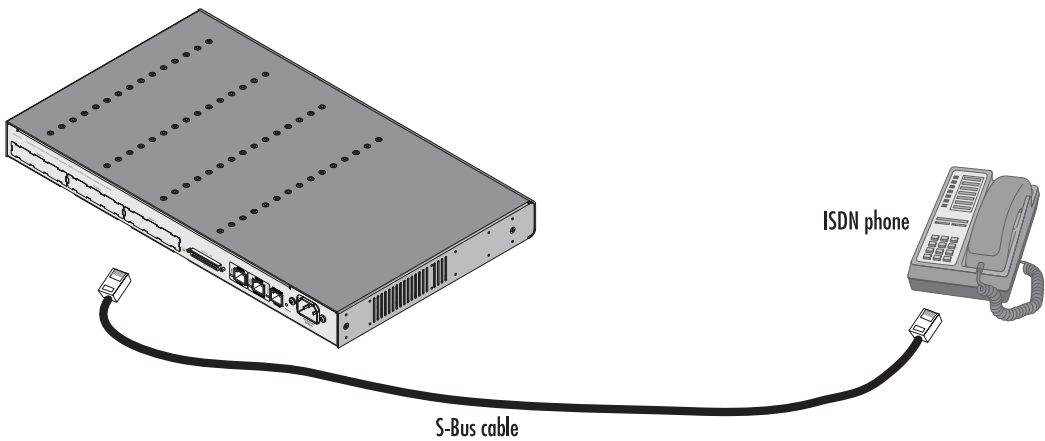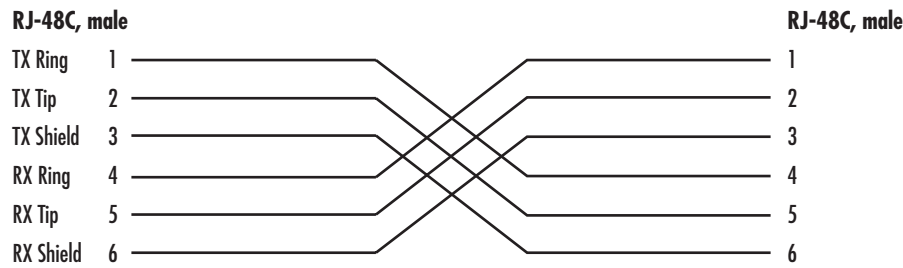Figure 67. T1 crossover cable

Note   Pins not listed are not used.

WARNING   **Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of when power is turned OFF.**

CAUTION   To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ-45 socket.

Installing the power cord

Do the following:

1. Insert the barrel type connector end of the AC power cord into the 100–240 VAC power connector (see figure 57).

CAUTION   The SmartNode 2300 power supply automatically adjusts to accept an input voltage from 100 to 240 VAC (50/60 Hz).

Verify that the proper voltage is present before plugging the power cord into the receptacle. Failure to do so could result in equipment damage.

Note   *Do not connect the other end of the power cord to the power outlet at this time.*

2. Verify that the AC power cord included with your router is compatible with local standards. If it is not, refer to chapter 12, "Contacting Patton for assistance" on page 155 to find out how to replace it with a compatible power cord.

3. Connect the male end of the power cord to an appropriate power outlet.

4. Verify that the green *PWR* LED is lit (see figure 68).

5. Unplug the power cord from the router to power down the unit.

Figure 68. SmartNode 2300 front panel LEDs

Congratulations, you have finished installing the SmartNode 2300! Now go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Chapter 7   SmartNode 2400 installation

Chapter contents

Hardware installation

SmartNode 2400 installation consists of the following:

> **Note** If you will be installing the 40V line power module prior to installing an interface card or ISDN S-Bus, refer to chapter 8, "Line power module installation" on page 125.

- Installing an interface card (if the card was not installed at the factory). Refer to chapter 9, "Interface card installation" on page 133 to install the card, then return to this chapter.
- Placing the device at the desired installation location (see section "Mounting the SmartNode 2400" on page 111)
- Installing the interface and power cables (see section "Connecting cables" on page 114)

When you finish installing the SmartNode 2400, go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Mounting the SmartNode 2400

The SmartNode 2400 should be placed in a dry environment with sufficient space to allow air circulation for cooling.

> **Note** For proper ventilation, leave at least 2 inches (5 cm) to the left, right, front, and rear of the SmartNode 2400.

The SmartNode 2400 can be installed as follows:

- Placed on a desktop or similar sturdy, flat surface that offers easy access to the cables
- Mounted inside a 19-inch equipment rack

> **Note** To prevent overheating we recommend that the SmartNode 2400 not be installed in a closed rack or in a room that is not properly ventilated or air-conditioned.

Desktop installation

Do the following to install the SmartNode 2400:

1. Remove one of the rubber pads from the adhesive strip (included in the SmartNode installation kit pack) and place it on a corner on the bottom of the SmartNode 2400 (see figure 69).
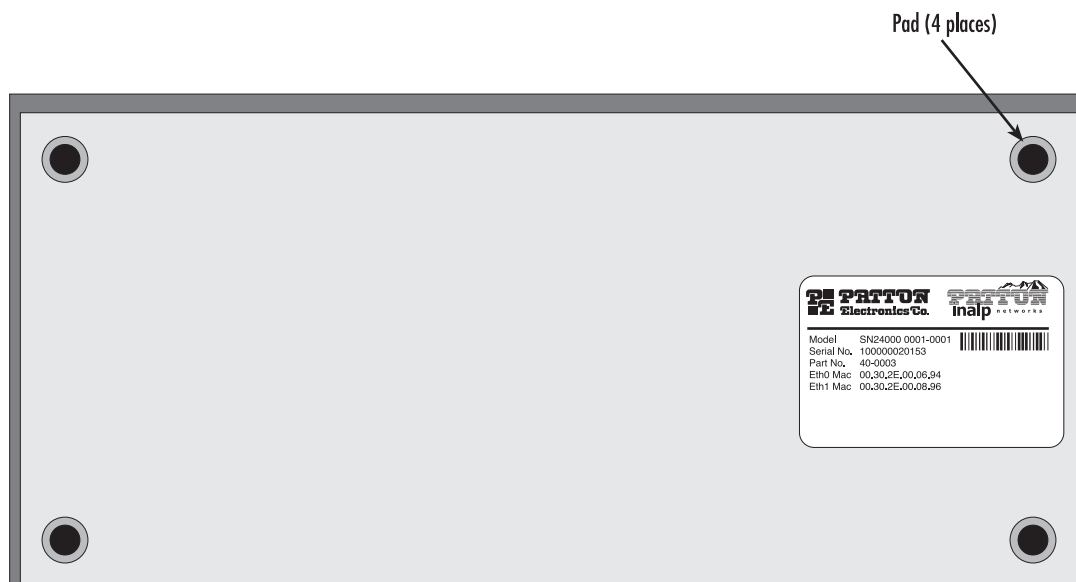
Figure 69. Pad locations

2. Repeat step 1 to install pads on the remaining three corners on the bottom of the SmartNode 2400.

3. Place the unit on a desktop, shelf or other flat, hard, and secure surface.

    Note   Allow sufficient space at the rear of the chassis for cable connections. In addition you should consider the need to access the chassis for future upgrades, maintenance and troubleshooting. Multiple SmartNodes can be stacked one atop the other.

Rack-mounted installation

For rack-mounting, screw holes are provided at standard mounting positions for industry-standard 19-inch equipment racks.

    Note   The SmartNode 2400 requires AC power 100–40V, 50/60Hz. Its power dissipation is 10W. It should be installed in an open rack wherever possible. If cabinet installation is unavoidable then ensure that the cabinet has adequate ventilation.

Install the rack-mount brackets before you install the SmartNode 2400 in the rack. When installing multiple SmartNode 2400s in one rack, we recommend that you leave one height unit (2.54 cm/1 inch) of clear space between two devices. Two rack mounting brackets and eight screws for attaching the brackets to the chassis are provided. The screws for installing the chassis in a rack are not included.

Do the following to mount a SmartNode 2400 in a 19-inch rack:

1. Locate the two angled mounting brackets included in the installation kit pack. The bracket (see figure 70) is designed so you can have the 1.5 cm flange facing to the front or to the rear. There are four holes for countersunk screws on the long side of the bracket.
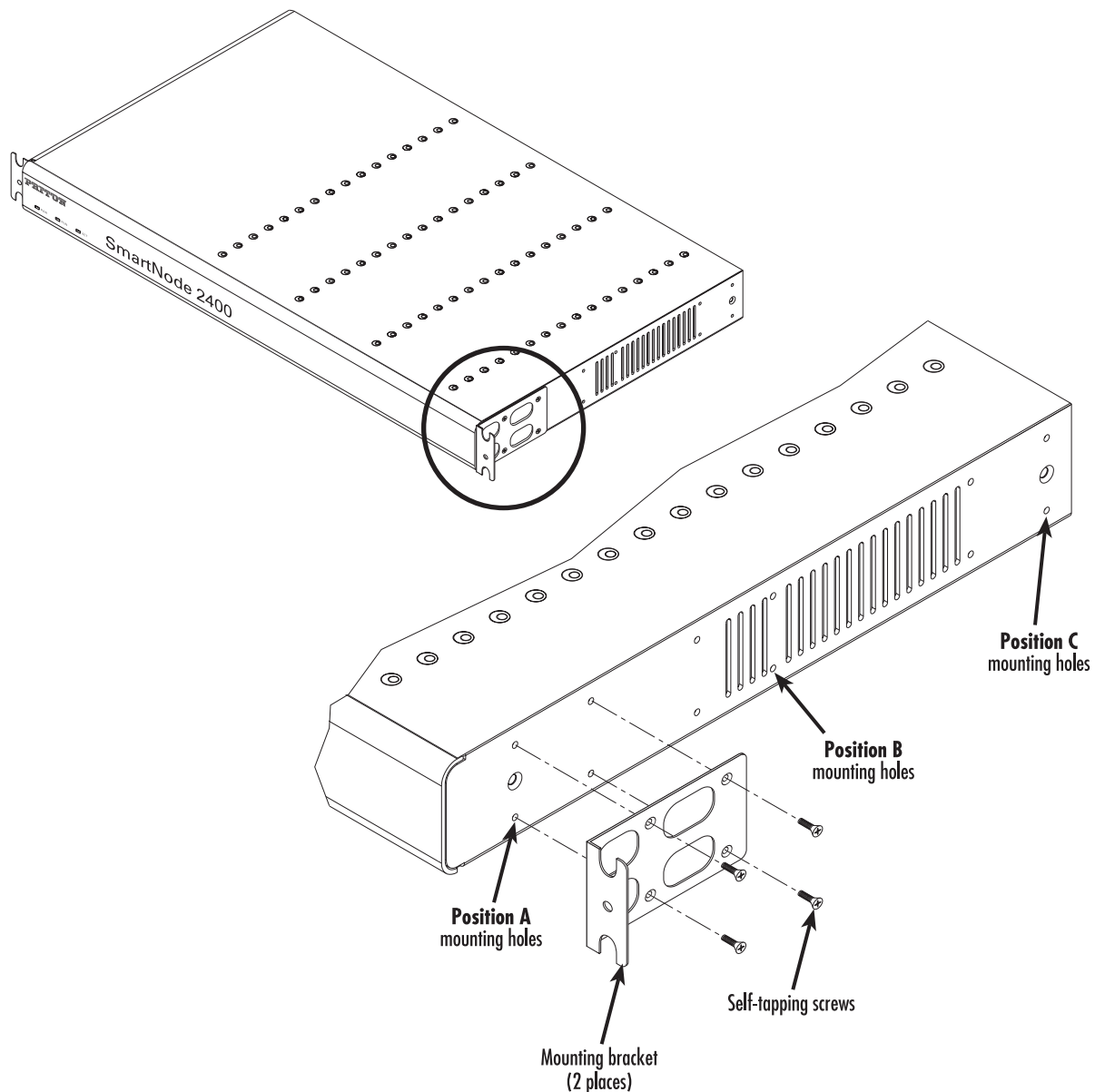
Figure 70. SmartNode 2400 rack mounting bracket location holes

2. Attach a bracket to each side of the SmartNode 2400 with the four self-tapping screws provided. There are three mounting positions for the brackets (positions A, B, and C as shown in figure 70 on page 113), so choose the one that best suits your requirements.

3. Install the unit into the rack using the user-provided rack mounting hardware.
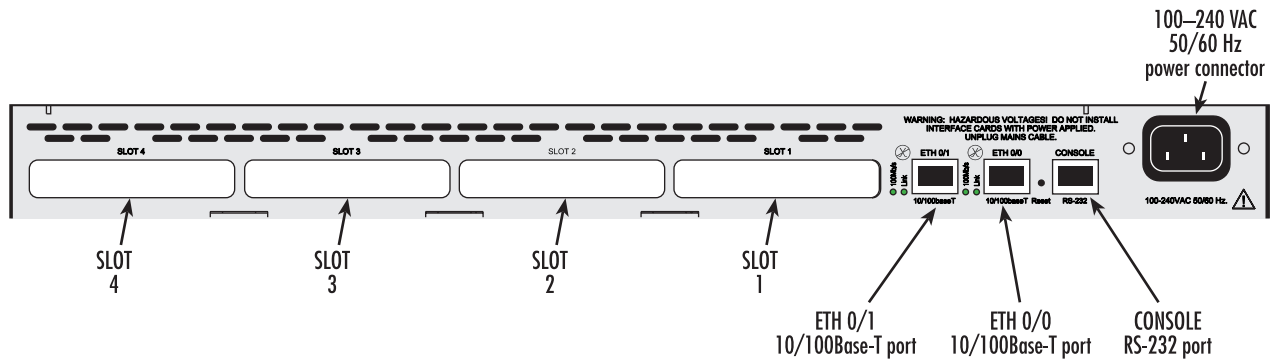
Figure 71. SmartNode 2400 connectors

Connecting cables

Installing SmartNode 2400 cables takes place in the following order:

⚠ WARNING	**Do not work on the system or connect or disconnect cables during periods of lightning activity.**

⚠ CAUTION	**The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

1. Installing the 10Base-T or 100Base-T Ethernet cables into ports *ETH 0/1* and *ETH 0/0* (see figure 71) (see "Installing the Ethernet cables" on page 115).

2. Installing the interface card cables (see "Installing the interface card cables" on page 116).

3. Installing the power cord (see "Installing the power cord" on page 123).

Installing the Ethernet cables

> ⚠️ **CAUTION**
>
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

Ethernet devices (10Base-T and 100Base-T) are connected to the SmartNode's Ethernet ports (see table 36 for port pin-out listing) via a cable terminated with RJ-45 plugs. Use a cross-over cable to connect to a host (see figure 72), or a straight-through cable to connect to a hub (see figure 73 on page 116).

Table 36. Ethernet 10Base-T (RJ-45) port pin-outs

Pin	Signal
1	TX+
2	TX-
3	RX+
6	RX-

Note   Pins not listed are not used.
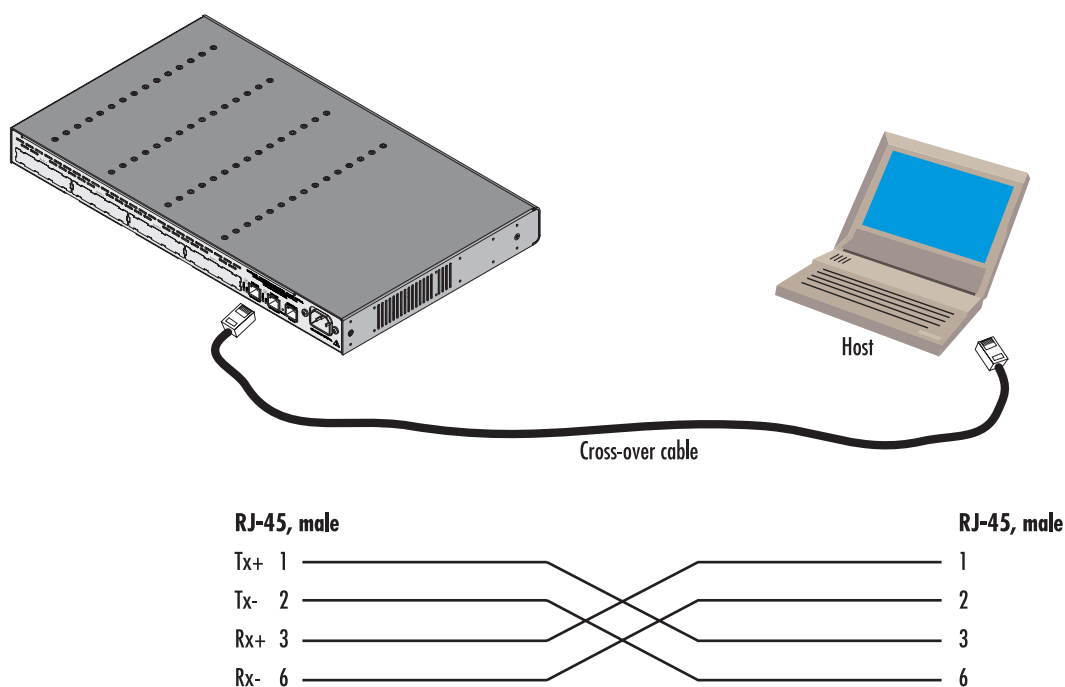
Figure 72. Connecting to a host
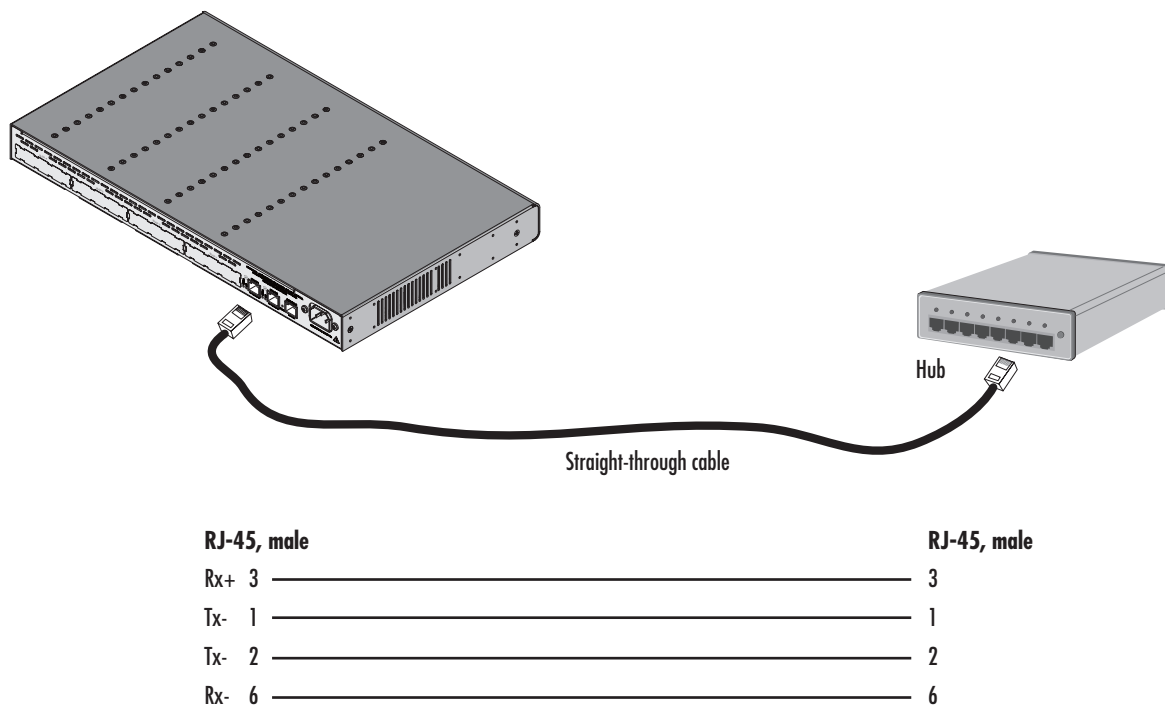
Figure 73. Connecting to a hub

Installing the interface card cables

> ⚠ **CAUTION** **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The following interface cards are available for use with the SmartNode 2400:

- **IC-4FXS**—Gateway interface card for 4 analog FXS ports (see section "Installing the IC-4FXS interface card cables")

- **IC-4BRV-8V**—8-channel gateway interface card for ISDN BRI (see section "Installing the IC-4BRV-8V interface card cables" on page 118)

- **IC-E1V**—30-channel E1 gateway interface card for ISDN PRI (see section "Installing the IC-E1V interface card cables" on page 120)

- **IC-T1V**—23-channel T1 gateway interface card for ISDN PRI (see section "Installing the IC-T1V interface card cables" on page 121)

Determine which cards are installed in your SmartNode 2400, then go to the appropriate section to install the device.

Installing the IC-4FXS interface card cables

> ⚠️ **CAUTION** **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The IC-4FXS supports up to four analog connections (see table 37 for port pin-out listing) via cables terminated with RJ-12 plugs (see figure 74 on page 117).

Table 37. RJ-12 socket

Pin	Signal
3	Ring (-)
4	Tip (+)

Note   The IC-4FXS is actually equipped with RJ-11 sockets. An RJ-11 socket is similar to an RJ-12 socket but pins 1 and 6 are omitted.

Note   Pins not listed are not used.

Telephone

RJ-12, male
Ring (-) 3
Tip (+)   4

RJ-12, male
3   Ring (-)
4   Tip (+)
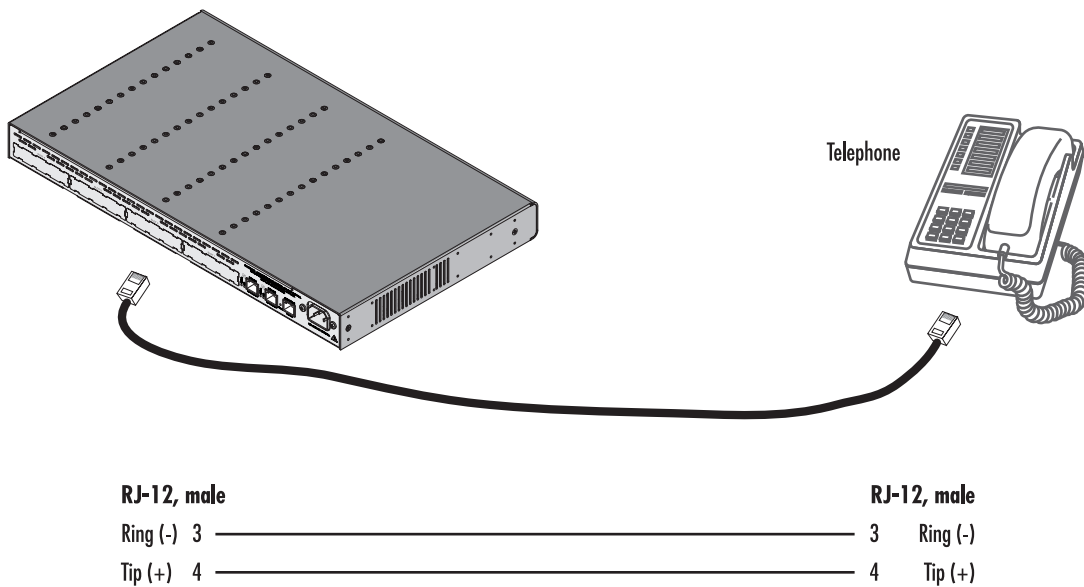
Figure 74. Analog FXS connection

Installing the IC-4BRV-8V interface card cables

> ⚠ **CAUTION**
>
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

A straight-through S-Bus cable terminated with RJ-45 plugs is used to connect an ISDN NT or TE to the interface card ports (see table 38 for port pin-out listing). If you are connecting a BRI to an ISDN telephone, see figure 75; or see figure 76 on page 119 if you are connecting a BRI to an NT. For BRI ports with configurable pin-outs ensure that the appropriate mode (NET or USR) is configured.

Table 38. BRI (RJ-45) port pin-outs

Pin	Signal (USR)	Signal (NET)
3	TX+	RX+
4	RX+	TX+
5	RX-	TX-
6	TX-	RX-

Note   Pins not listed are not used.

> ⚠ **WARNING**
>
> **Hazardous network voltages are present in the BRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the BRI port, regardless of when power is turned OFF.**

> ⚠ **CAUTION**
>
> To prevent damage to the system, make certain you connect the BRI cable to the BRI port only and not to any other RJ-45 socket.

ISDN phone

S-Bus cable

RJ-45, male   **RJ-45, male**
Rx+ 3 ——————————————————————————— 3
Tx-   4 ——————————————————————————— 4
Tx-   5 ——————————————————————————— 5
Rx-   6 ——————————————————————————— 6

Figure 75. Connecting a BRI to an ISDN telephone

NT

S-Bus cable

RJ-45, male   **RJ-45, male**
Rx+ 3 ——————————————————————————— 3
Tx-   4 ——————————————————————————— 4
Tx-   5 ——————————————————————————— 5
Rx-   6 ——————————————————————————— 6
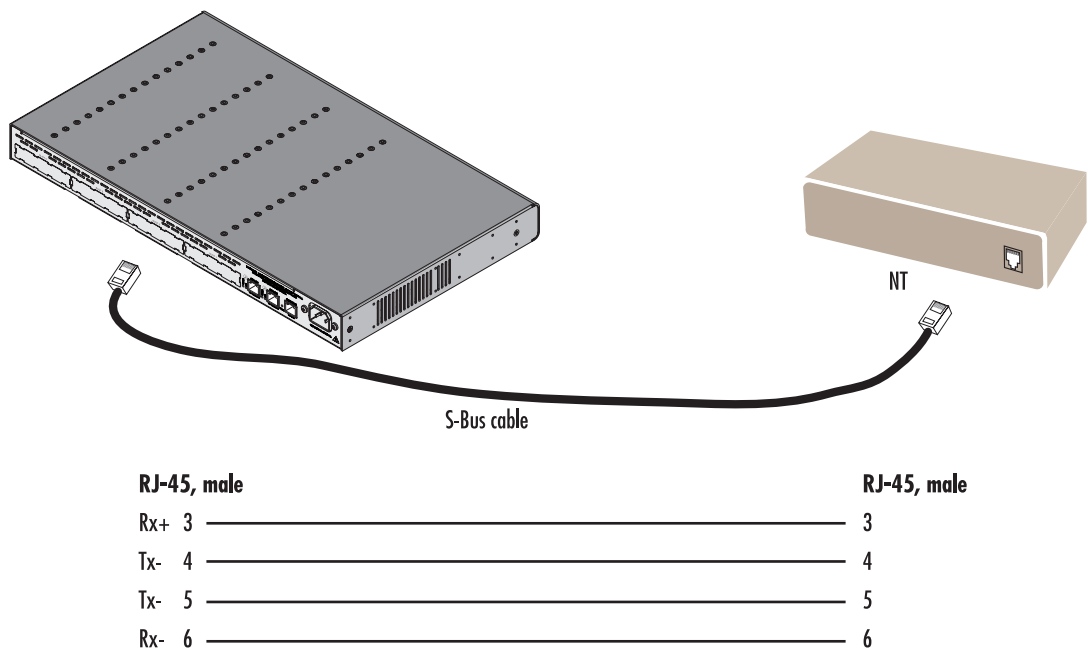
Figure 76. Connecting a BRI to an NT

Installing the IC-E1V interface card cables

> **⚠ CAUTION**
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The PRI is usually connected to a PBX or telco switch (local exchange (LE)). Type and pin-outs of these devices vary depending on the manufacturer. In most cases, a straight-through RJ-45 to RJ-45 can be used to connect the PRI (see table 39 for IC-E1V card port pin-out listing) with a PBX (an NT). A cross-over cable is required to connect to a LE, as illustrated in figure 77 on page 121.

Table 39. RJ-48C socket

Pin	USR
1	TX Ring
2	TX Tip
3	TX Shield
4	RX Ring
5	RX Tip
6	RX Shield

Note   Pins not listed are not used.

> **⚠ WARNING**
> **Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of when power is turned OFF.**

> **⚠ CAUTION**
> To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ-45 socket.
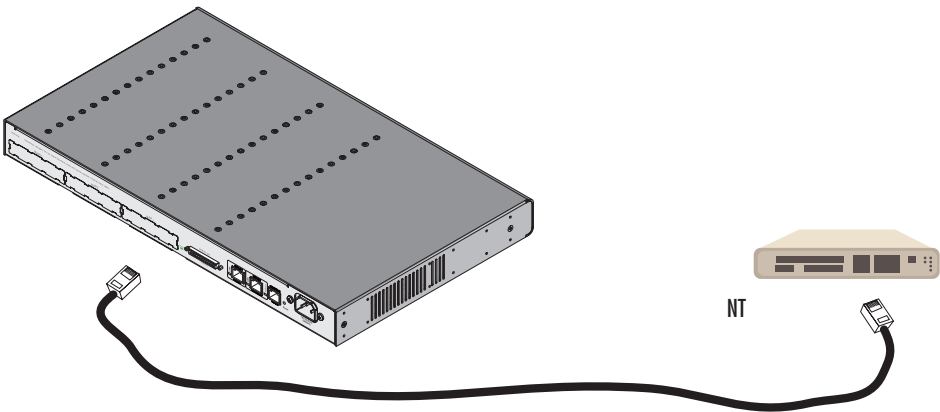
Figure 77. Connecting an E1 PRI port to an NT
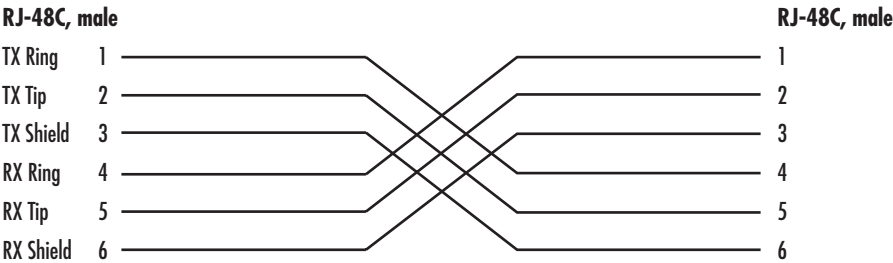
Figure 78. E1 crossover cable

Installing the IC-T1V interface card cables

> ⚠ **CAUTION** **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The PRI is usually connected to a PBX or telco switch—local exchange (LE). The type and pin outs of these devices vary depending on the manufacturer. In most cases, a straight-through RJ-45 to RJ-45 can be used to connect the PRI (see table 40 for IC-T1V card port pin-out listing) with a PBX (an NT) (see figure 79). A cross-over cable is required to connect to an LE, as illustrated in figure 80.
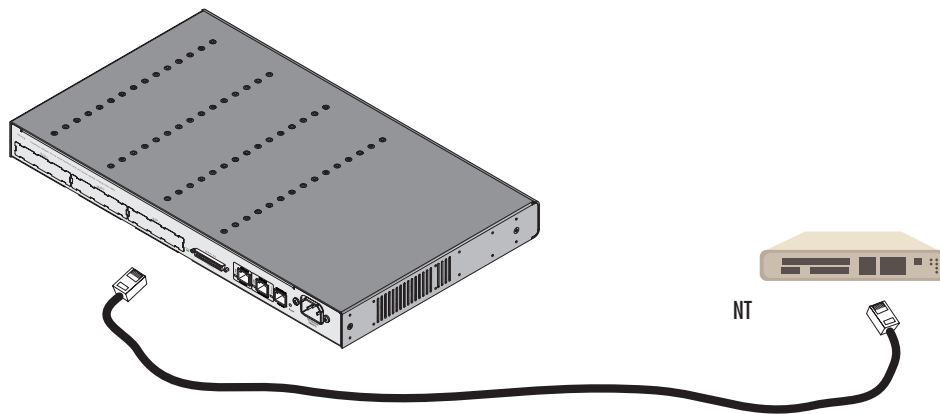
Figure 79. Connecting an T1 PRI port to an NT

RJ-48C, male   **RJ-48C, male**

TX Ring   1   1
TX Tip   2   2
TX Shield   3   3
RX Ring   4   4
RX Tip   5   5
RX Shield   6   6
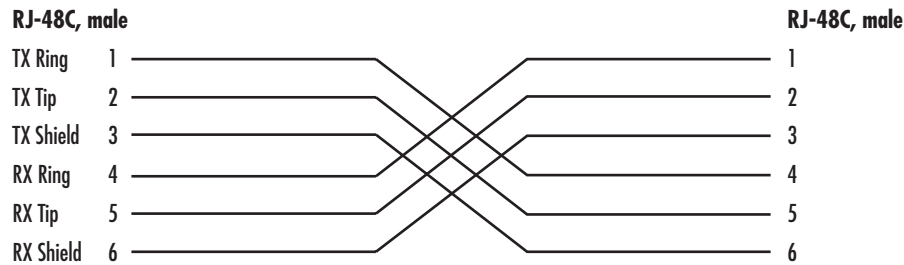
Figure 80. T1 crossover cable

Table 40. RJ-48C socket

Pin	USR
1	TX Ring
2	TX Tip
3	TX Shield
4	RX Ring
5	RX Tip
6	RX Shield

Note   Pins not listed are not used.

WARNING   **Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of when power is turned OFF.**

CAUTION   To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ-45 socket.

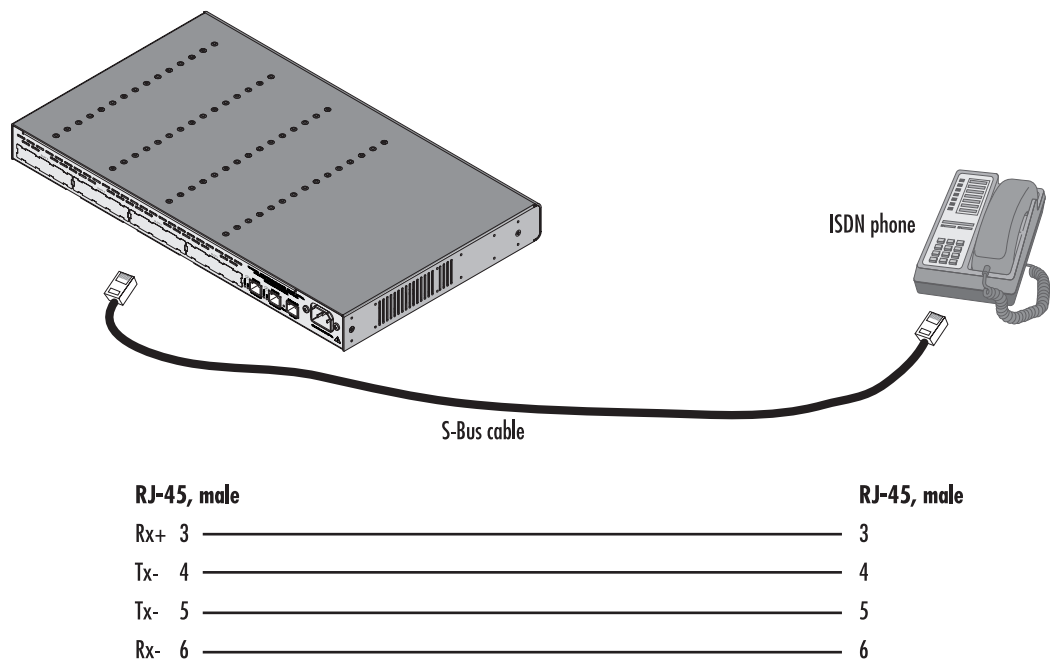### *Installing the power cord*

Do the following:

1. Insert the barrel type connector end of the AC power cord into the 100–240 VAC power connector (see figure 71).

> ⚠
> **CAUTION**
>
> The SmartNode 2400 power supply automatically adjusts to accept an input voltage from 100 to 240 VAC (50/60 Hz).
>
> Verify that the proper voltage is present before plugging the power cord into the receptacle. Failure to do so could result in equipment damage.

Note   *Do not connect the other end of the power cord to the power outlet at this time.*

2. Verify that the AC power cord included with your router is compatible with local standards. If it is not, refer to chapter 12, "Contacting Patton for assistance" on page 155 to find out how to replace it with a compatible power cord.

3. Connect the male end of the power cord to an appropriate power outlet.

4. Verify that the green *PWR* LED is lit (see figure 81).

5. Unplug the power cord from the router to power down the unit.

Figure 81. SmartNode 2400 front panel LEDs

Congratulations, you have finished installing the SmartNode 2400! Now go to chapter 10, "Getting Started with the SmartNode Device" on page 139.

Chapter 8 Line power module installation

Chapter contents

Introduction

This chapter tells you how to install an optional internal 48V (or 40V) line power module in a SmartNode 2000 series device. It also describes the installation of the optional external S-Bus 40V power supply units.

Safety Recommendation

Follow these guidelines to ensure general safety:

- Keep the chassis area clear and dust-free during and after installation.

- Put the removed chassis cover in a safe place.

- Keep tools away from walk areas where you or others could fall over them.

- Do not wear loose clothing that could get caught in the electronic device or chassis.

- Do not perform any action that creates a potential hazard to people or that makes equipment unsafe.

- Before opening the chassis, disconnect all cables to avoid contact with hazardous voltages.

WARNING	**Mains Voltage: Do not open the case when the power cord is connected. Hazardous voltages exist in mains-connected cables. Do not touch power supply when the power cord is connected. Line voltages are present within the power supply when the power cord is connected.**
WARNING	**Hazardous network voltages are present in WAN and telephone networks ports regardless of whether power to the device is OFF or ON. Use caution when working near these ports to avoid electric shock. When detaching cables, detach the end away from the SmartNode first.**
CAUTION	Electrostatic Discharge: Always follow electrostatic discharge (ESD) prevention procedures when removing and replacing interface cards. Ensure that the SmartNode chassis is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to earth ground to channel unwanted ESD voltages to ground safely. If no ESD wrist strap is available, ground yourself by touching the metal part of the chassis. If you place an electronic component down on your bench, lay it on its shielded plastic bag.

Internal PM-48V-INT or PM-40V-INT line power module installation

Refer to the following and select the appropriate procedure based on whether you are installing a line power module into a SmartNode 2300 or SmartNode 2400:

- Installing the PM-48V-INT 48V power supply module into the SmartNode 2300 (see section "SmartNode 2300 line power module installation" on page 128)

- Installing the PM-40V-INT 40V power supply module into the SmartNode 2400 (see section "SmartNode 2400 line power module installation" on page 130)

SmartNode 2300 line power module installation

The 48V line power module is mounted inside the SmartNode 2300, next to the existing 12V power supply. You should not move the 12V power supply module from its installed location (see figure 82 for 12V power supply location).

Note   The 12V and the 48V line power modules are very similar in appearance. The 48V module is labeled *ZWS30-48* on the large electrolytic capacitor (see figure 82).

⚠ **CAUTION**

Connecting the 48V line power supply to the 12V socket instead of the 48V socket may result in permanent damage to the main board.

Figure 82. Internal 48V line power module and 12V power supply module locations in SmartNode 2300

If you look at the exposed SN2300 chassis, you will see the motherboard and the 12V power module that is already installed (see figure 82). (The figure shows the general arrangement of the chassis-mounted components only, with little or no component details. The IC-4BRV-8V card is omitted for clarity). To the left of the existing 12V power module are two screw holes tapped into dimples, and two smaller holes. These four holes are for mounting the 48V line power module (see figure 83).

Figure 83. Fixing points: internal 48V (or 40V) line power module

Follow the steps below to mount a 48V internal line power module.

1. Remove the 48V line power module from its packing. Verify that the side of the largest electrolytic capacitor has the label ZWS30-48.

2. Position the plastic insulating foil over the four mounting holes in the SmartNode 2300 chassis.

3. Insert the plastic mounting studs into the line power module, one into each of the two corner holes that are on the opposite side to the finned heat sinks (see figure 82 on page 128). Insert them from below.

4. Position the line power module so that the studs pass through the holes in the plastic foil and engage in the two chassis holes that are nearest to the front (LED) side of the SmartNode. Press down gently to secure.

5. From above, insert the screws into the module, one into each of the two holes at the corners of the heat-sink side. Screw them home so that the screws pass through the foil and secure the module onto the SmartNode chassis dimples. See the lower picture in figure 83 on page 129.

6. First insert the white 4-lead 48V supply cable in the line power module's socket. Then connect it to the 48V socket on the motherboard. The plug is polarized so you cannot insert the sockets the wrong way round. See figure 83 on page 129.

7. Take the mains lead and insert the plug into the motherboard socket. This is adjacent to the 230V external power socket. Insert the other end in the line power module's socket. All plugs are polarized so that they cannot be inserted the wrong way round. Clip the cable to the side of the chassis.

Go to section "Completing the installation" on page 131.

SmartNode 2400 line power module installation

The 40V line power module is mounted inside the SmartNode 2400, next to the existing 12V power supply. You should not move the 12V power supply module from its installed location (see figure 84 for 12V power supply location).

Do not install a 48V line power module into the SmartNode 2400!

CAUTION
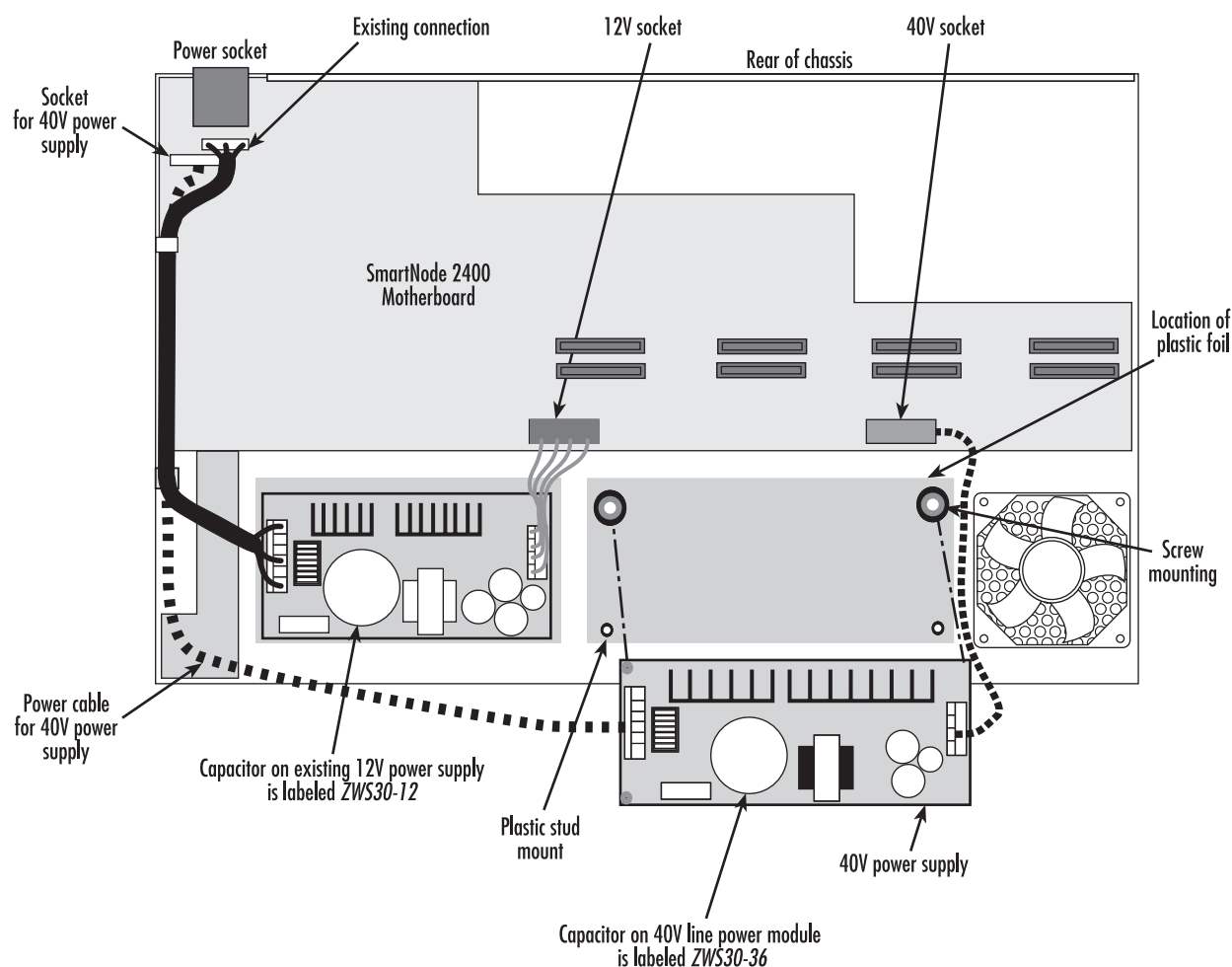
Figure 84. Internal 40V line power module and 12V power supply module locations in SmartNode 2400

Note   The 12V and the 40V line power modules are very similar in appearance. The 40V module is labeled *ZWS30-36* on the large electrolytic capacitor (see figure 84).

Connecting the 40V line power supply to the 12V socket instead of the 40V socket may result in permanent damage to the main board.
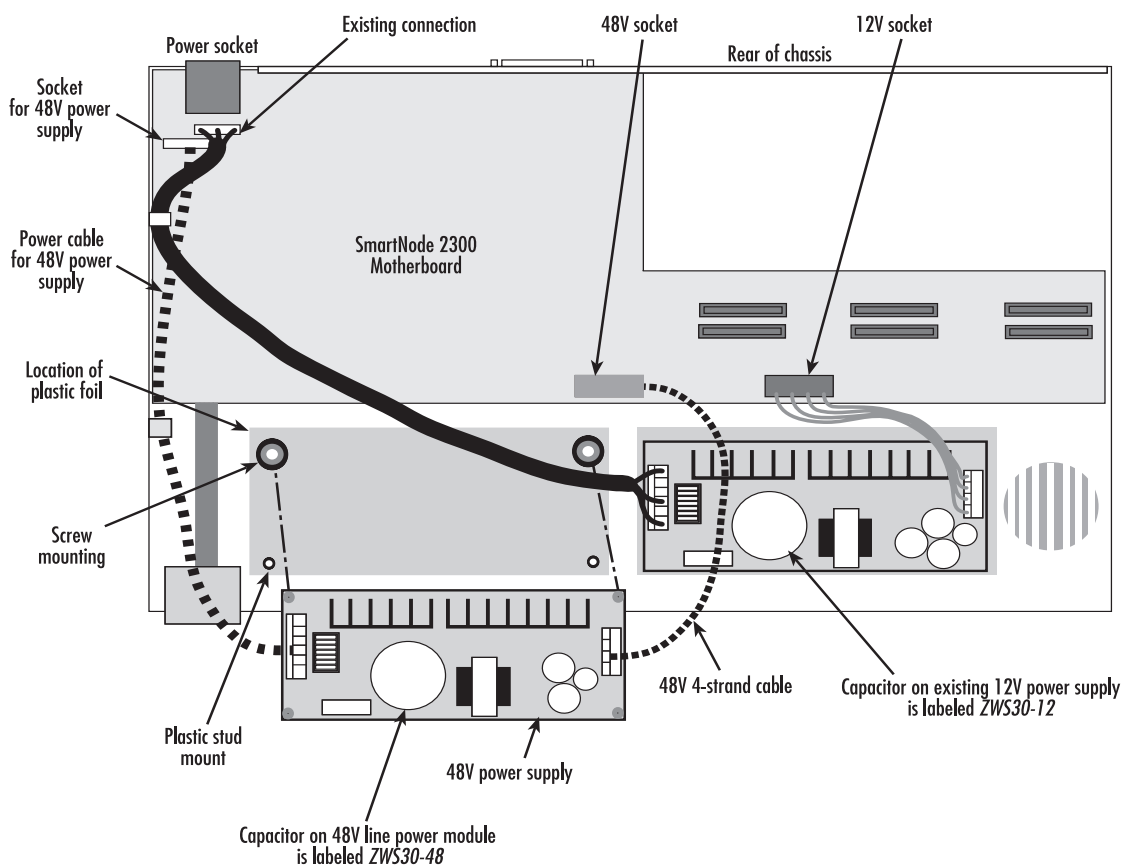
CAUTION

If you look at the exposed SN2400 chassis, you will see the motherboard and the 12V power module that is already installed (see figure 84). (The figure shows the general arrangement of the chassis-mounted components only, with little or no component details.). To the right of the existing 12V power module are two screw holes tapped into dimples, and two smaller holes. These four holes are for mounting the 40V line power module (see figure 83 on page 129).
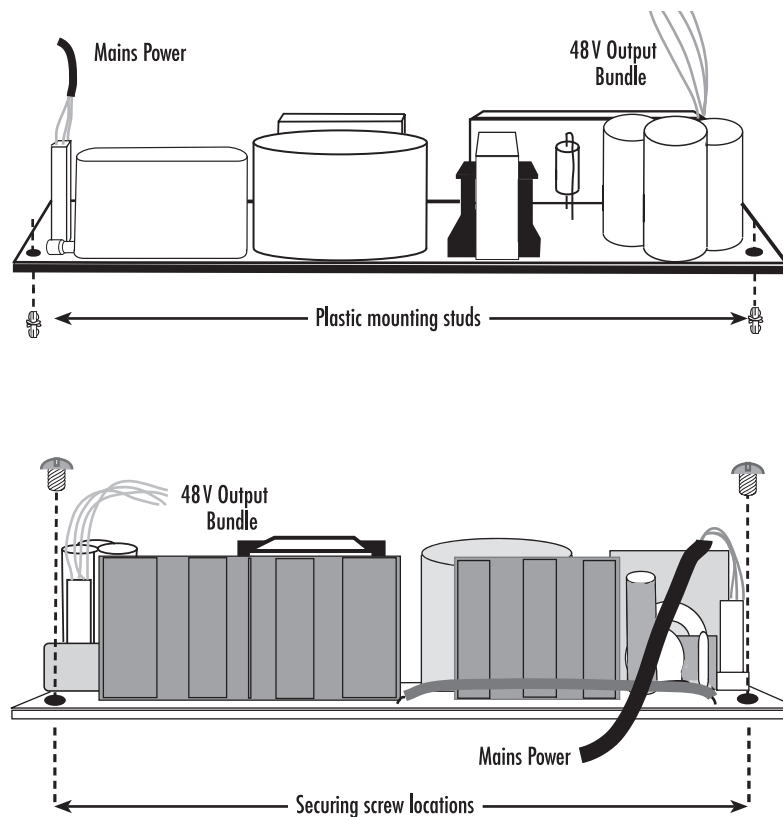
Follow the steps below to mount a 40V internal line power module.

1. Remove the 40V line power module from its packing. Verify that the side of the largest electrolytic capacitor has the label *ZWS30-36*.

2. Position the plastic insulating foil over the four mounting holes in the SmartNode 2400 chassis.

3. Insert the plastic mounting studs into the line power module, one into each of the two corner holes that are on the opposite side to the finned heat sinks (see figure 84 on page 130). Insert them from below.

4. Position the line power module so that the studs pass through the holes in the plastic foil and engage in the two chassis holes that are nearest to the front (LED) side of the SmartNode. Press down gently to secure.

5. From above, insert the screws into the module, one into each of the two holes at the corners of the heat-sink side. Screw them home so that the screws pass through the foil and secure the module onto the Smart-Node chassis dimples. See the lower picture in figure 83 on page 129.

6. First insert the white 4-lead 40V supply cable in the line power module's socket. Then connect it to the 40V socket on the motherboard. The plug is polarized so you cannot insert the sockets the wrong way round. See figure 83 on page 129.

7. Take the mains lead and insert the plug into the motherboard socket. This is adjacent to the 230V external power socket. Insert the other end in the line power module's socket. All plugs are polarized so that they cannot be inserted the wrong way round. Clip the cable to the side of the chassis.

Go to section "Completing the installation".

Completing the installation

Once you have installed the 48V (or 40V) line power module and set the jumper pins, do the following:

1. Install the interface card in its expansion slot (see chapter 9, "Interface card installation" on page 133).

2. Close the case and insert the mains power supply lead.

3. Insert the network cables and observe the LED indications (see chapter 11, "Monitoring Status" on page 151). Test the correct functioning of the connections.

The maximum total power consumption of all ISDN devices connected to internally powered S0 ports is limited to 30W. If your connected devices need more power switch off the internal power connection for some ports by removing the corresponding jumpers, and use the external Phantom power supply (PM-BRI-EXT) unit on these ports .The external Phantom power supply and its connection is described in section "External S-Bus power supply". Jumper settings are described in section "S-Bus line power" on page 41.

External S-Bus power supply

Many ISDN telephone handsets require that 40 VDC power be supplied via the S-Bus connection. In other words, they have no separate or built-in power supply. In general point-to-multipoint ISDN BRI NTs supply line power to the S-Bus. Point-to-point NTs connected to a PBX in general do not supply line power.

If line power is not available from the NT, but required for connected terminals, the PM-BRI-EXT S-Bus Phantom power supply can be used.

Table 41. PM-BRI-EXT S-Bus 40V power supply

Item:	Phantom Power Supply; PM-BRI-EXT
Voltage Specifications:	Input 230VAC, Output 40VDC

WARNING
The PM-BRI-EXT power supply unit is equipped with a transformer that is specially designed for S-Bus line power. The use of a general purpose DC power transformer may cause equipment damage.

CAUTION
If you use a Phantom power supply other than that supplied by Patton Electronics Co., you must ensure that it conforms to ITU I.430 Section 9.7.3.2.2. which specifies that the maximum current delivered shall not exceed 200mA.

Chapter 9   Interface card installation

Chapter contents

Introduction

This chapter describes how to install interface cards in a SmartNode 2000 Series device.

Safety Recommendation

Follow these guidelines to ensure general safety:

- Keep the chassis area clear and dust-free during and after installation.

- Put the removed chassis cover in a safe place.

- Keep tools away from walk areas where you or others could fall over them.

- Do not wear loose clothing that could get caught in the electronic device or chassis.

- Do not perform any action that creates a potential hazard to people or that makes equipment unsafe.

- Before opening the chassis, disconnect all cables to avoid contact with hazardous voltages.

⚠ **WARNING**   **Mains Voltage: Do not open the case when the power cord is connected. Hazardous voltages exist in mains-connected cables. Do not touch power supply when the power cord is connected. Line voltages are present within the power supply when the power cord is connected.**

⚠ **WARNING**   **Hazardous network voltages are present in WAN and telephone networks ports regardless of whether power to the device is OFF or ON. Use caution when working near these ports to avoid electric shock. When detaching cables, detach the end away from the SmartNode first.**

⚠ **CAUTION**   Electrostatic Discharge: Always follow electrostatic discharge (ESD) prevention procedures when removing and replacing interface cards. Ensure that the SmartNode chassis is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to earth ground to channel unwanted ESD voltages to ground safely. If no ESD wrist strap is available, ground yourself by touching the metal part of the chassis.

If you place an electronic component down on your bench, lay it on its shielded plastic bag.

Installing interface cards

Figure 85 depicts an example of a card installation in *SLOT 2* of a SmartNode 2000 Series device.
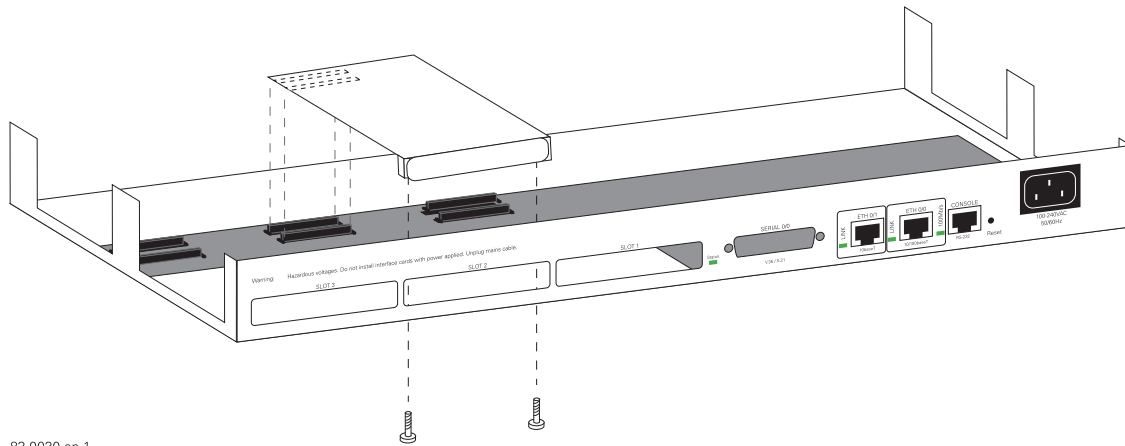
Figure 85. Example card installation in SLOT 2

To install interface cards, do the following:

1. Remove all cables, including mains power cord, Ethernet and telephone network interface cables.

2. Put on an ESD wrist wrap to prevent electrostatic discharge.

3. Use a Phillips screwdriver to remove the cover of the SmartNode. There are a total of nine screws on a SmartNode 2300: three on each side, two on the top at the rear (connector-side) and one underneath at the front (LED) side. The SmartNode 2400 has six screws, two on each side, one on the top at the rear (connector-side) and one underneath at the front (LED) side.

4. Use a Phillips screwdriver to remove the blank filler panel from the expansion slot in which the interface card is to be installed. Save the blank panel for future use.

5. Move the front panel of the interface card into the expansion slot opening of the SmartNode until it fits correctly.

6. Press the interface card gently down until you feel its connector mate securely with the socket on the motherboard. Take great care to ensure that the card fits correctly in the connector and is pressed fully home.

7. Secure the interface card by replacing the 2 screws into the holes on the bottom of the SmartNode, using the Phillips screwdriver (ee section "Card locating screws" on page 137).

8. Replace the cover and secure it to the side panels of the SmartNode chassis by the screws that you removed in step 3.

9. Install the cables you removed in step 1, then connect the installed interface card cables.

Card locating screws

Figure 86 shows part of the under side of the SmartNode 2300 with the arrangement of securing screws for two of the three interface cards. The two outer expansion slots (*SLOT 1*, *SLOT 3*) have each a single securing screw towards the inner sides. *SLOT 2* has two securing screws. (SLOT 1 is similar to SLOT 3 and so is not shown). You can see the location of an extension card's screw holes in the metal blocks on either side of the group of four sockets in the jumper pin setting diagrams, which depict the underside of the IC-4BRV-8V interface card and can be seen in the section "IC-4BRV-8V 8-channel gateway interface card for ISDN BRI" on page 43.
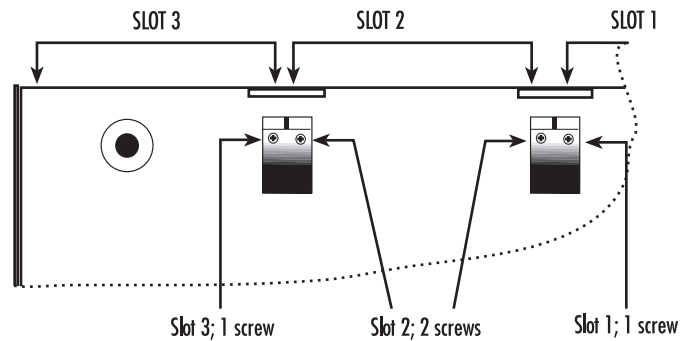
Figure 86. SmartNode 2300 expansion slots: securing screws for interface cards

Chapter 10 Getting Started with the SmartNode Device

Chapter contents

Introduction

This chapter leads you through the basic steps to set up a new SmartNode and to download a configuration.

Patton SmartNodes can be used for a wide variety of IP-based network applications. To support and ease the configuration of the SmartNodes configuration, templates for the most important applications are available on the Patton server at www.patton.com/voip.

The main steps for setting up a new SmartNode (as of release 2.00 or 2.10) are shown in figure 87.

1   **Configure IP address**
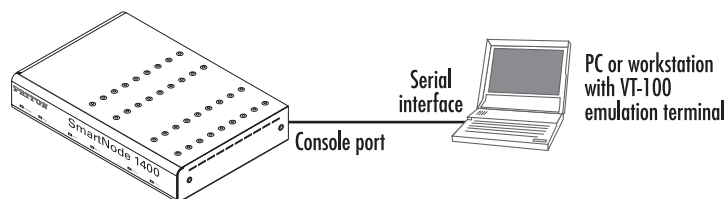
2   **Connect the SmartNode to the network**
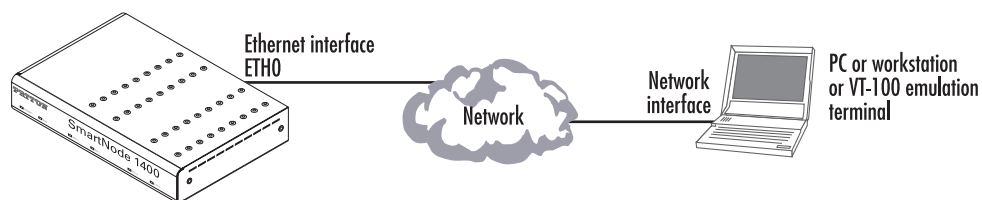
3   **Load configuration**
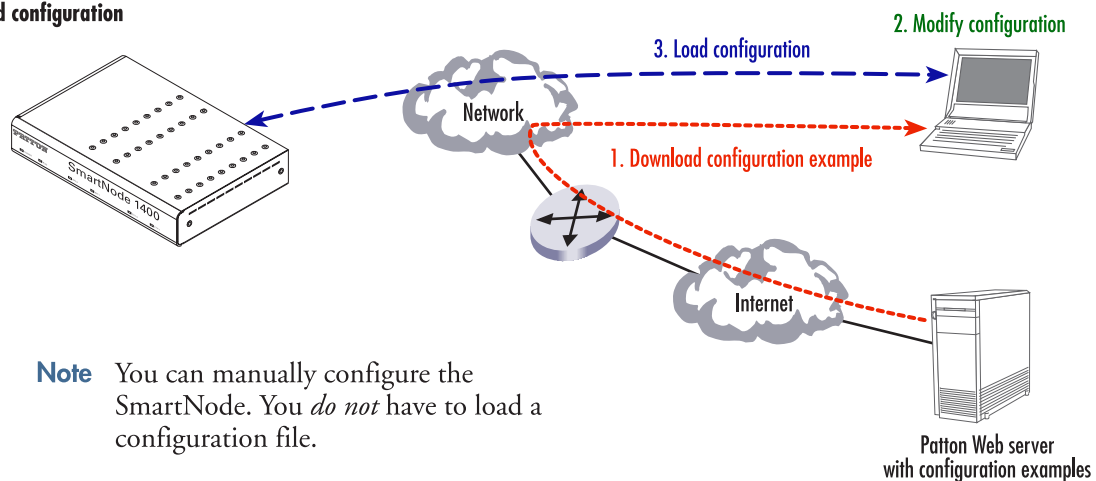
Note   You can manually configure the SmartNode. You *do not* have to load a configuration file.

Figure 87. Steps for setting up a new SmartNode

1. Configure IP address

Power connection and default configuration

First the SmartNode must be connected to the mains power supply with the power cable. Wait until the *Run* LED stops blinking and lights constantly. Now the SmartNode is ready.

The factory default configuration for the Ethernet interface IP addresses and network masks are listed in table 42.

Table 42. Factory default IP address and network mask configuration

	IP Address	Network Mask
Interface Ethernet 0 (ETH0)	172.16.40.1	255.255.0.0
Interface Ethernet 1 (ETH1)	192.168.1.1	255.255.255.0

Both Ethernet interfaces are activated upon power-up.

If these addresses match with those of your network, go to section "2. Connect the SmartNode to the network" on page 144. Otherwise, refer to the following sections to change the addresses and network masks.

Connect with the serial interface

> ⚠️ **CAUTION**
> The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability

The *Console* port is wired as an EIA-561, RS-232 port. Use the included Model 16F-561 adapter and cable (see figure 88) between the SmartNode's *Console* port and a PC or workstation's RS-232 serial interface. Activate the terminal emulation program on the PC or workstation that supports the serial interface (e.g. HyperTerm).

RJ-45, male   **Sub-D, 9 pol, female**

```
TxD  6 ─────────────╲    ╱──────────────────── 2
TxD  3 ──────────────╲  ╱───────────────────── 3
GND  4 ───────────────╳╳──────────────────────
GND  5 ──────────────                          5
```
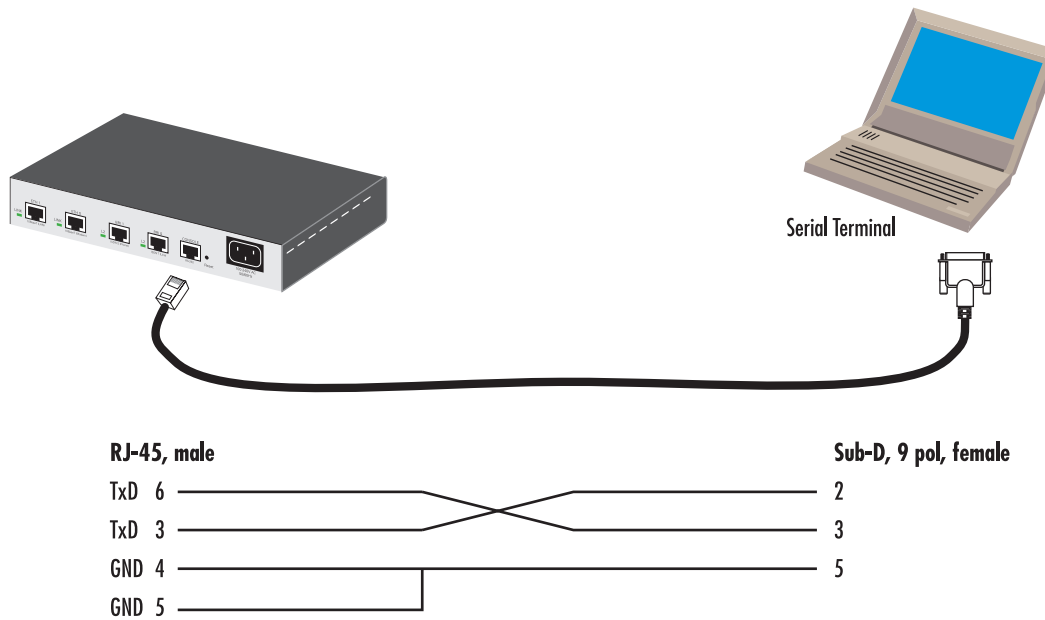
Figure 88. Connecting to the terminal

Terminal emulation program settings:

- 9600 bps
- no parity
- 8 bit
- 1 stop bit
- 1 start bit
- No flow control

Login

Accessing your SmartNode via the local console port (or via a Telnet session) causes the login screen to display. Type the factory default login: *administrator* and leave the password empty. Press the *Enter* key after the password prompt.

```
login:administrator
password: <Enter>
172.16.40.1>
```

After you have successfully logged in you are in the operator execution mode, indicated by > as command line prompt. With the commands *enable* and *configure* you enter the configuration mode.

```
172.16.40.1>enable
172.16.40.1#configure
172.16.40.1(cfg)#
```

Changing the IP address

Select the context IP mode to configure an IP interface.

```
172.16.40.1(cfg)#context ip router
172.16.40.1(ctx-ip)[router]#
```

Now you can set your IP address and network mask for the interface *eth0*. Within this example a class C network (172.16.1.0/24) is assumed. The IP address in this example is set to *172.16.1.99* (you should set this to an unused IP address on your network).

```
172.16.40.1(ctx-ip)[router]#interface eth0
172.16.40.1(if-ip)[eth0]#ipaddress 172.16.1.99 255.255.255.0
2002-10-29T00:09:40 : LOGINFO    : Link down on interface eth0.
2002-10-29T00:09:40 : LOGINFO    : Link up on interface eth0.
172.16.1.99(if-ip)[eth0]#
```

Copy this modified configuration to your new start-up configuration. Upon the next start-up the system will initialize itself using the modified configuration.

```
172.16.1.99(if-ip)[eth0]#copy running-config startup-config
172.16.1.99(if-ip)[eth0]#
```

The SmartNode can now be connected with your network.

2. Connect the SmartNode to the network

Depending whether you connect the SmartNode to a host directly or via a hub or switch either straight-through wired or cross-over cables must be used (see figure 89).

Note   The SmartNode 4520 Series is equipped with Auto-MDX Ethernet ports. Use straight-through or cross-over cables for host or hub/switch connections. The SmartNode 4110 will require the proper cable as it does not have the MDX feature.

CAUTION   The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability
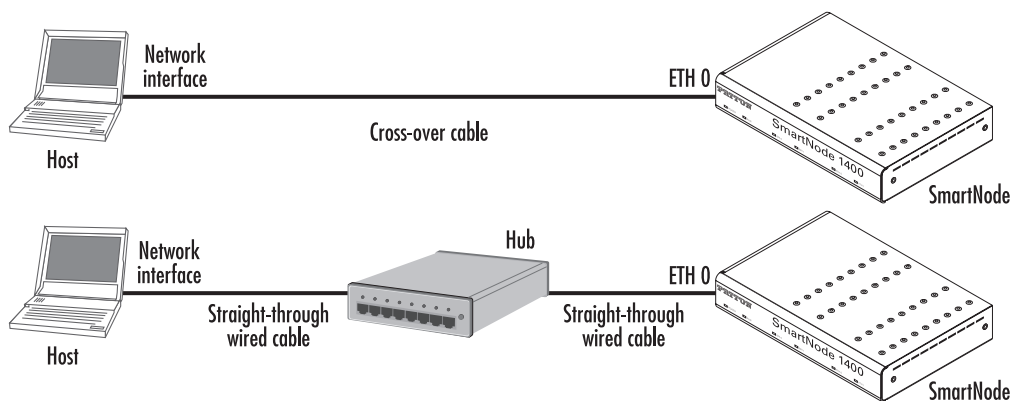
Figure 89. Connecting the SmartNode to the network

You can check the connection with the ping command to another host on the local LAN.

```
      172.16.1.99(if-ip)[eth0]#ping <IP Address of the host>
```
Respectively from the host: *ping 172.16.1.99*

> **Note**   To ping outside your local LAN, you will need to configure the default gateway.

3. Load configuration

Download a configuration note to your PC from the support page of the Patton-Inalp web server (http://www.inalp.ch/en/support/confignotes/), which matches your application. Adapt the configuration as described in the configuration note to your network (do not forget to modify the IP address) and copy the modified configuration to a TFTP server. The SmartNode can now load its configuration from this server.

In this example we assume the TFTP server on the host with the IP address 172.16.1.11 and the configuration named *SN.cfg* in the root directory of the TFTP server.

```
      172.16.1.99(if-ip)[eth0]#copy tftp://172.16.1.11/SN.cfg startup-config

      Download...100%

      172.16.1.99(if-ip)[eth0]#
```

After the SmartNode has been rebooted the new start up configuration will be activated.

```
      172.16.1.99(if-ip)[eth0]#reload

      Running configuration has been changed.

      Do you want to copy the 'running-config' to the 'startup-config'?

      Press 'yes' to store, 'no' to drop changes : no

      Press 'yes' to restart, 'no' to cancel : yes

      The system is going down
```

Bootloader

The bootloader ensures that basic operations, network access, and downloads are possible in case of interrupted or corrupted application image downloads.

Start Bootloader and login

To start the Bootloader explicitly, power on the SmartNode *while* pressing the reset button. All front LEDs will light up. Keep pressing the reset button until the BRI/Ethernet LEDs on SmartNode 1x00 and the ACT LED on SmartNode 2x00 are off. When the bootloader starts, the BRI LEDs on SmartNode 1x00 and the ACT LED on SmartNode 2x00 are blinking. Open a Telnet connection to the SmartNode via either one of Ethernet interfaces and the Login display shown in figure 90 will appear. Use the credentials *admin/patton* to login.

> **Note**   The Bootloader does ***not*** support the console interface. The Ethernet inter-
> faces preserve the IP addresses, IP masks, and default gateway that they had
> before starting the bootloader.
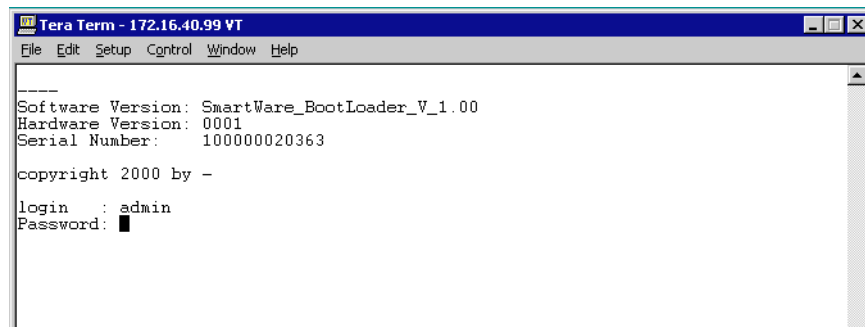
Figure 90. Login display

Main shell and domains

After login, you access the Main Shell (see figure 91). You can select from three available domains:

• Route Table Manager (RTM)

• Download Agent

• Diagnostic

The **Route Table Manager** (RTM) manages static routes and also provides a view of all routes.

The **Download Agent** allows you to set and read different TFTP server settings:

• IP address (**ssip**, **gsip**)

• Retry count (**strc**, **gtrc**)

• Continue flag (**stcf**, **gtcf**)

• Download file lifetime (**sdfl**, **gdfl**)

Diagnostic offers three actions:

• Ping an IP address

• Test various sectors of the flash memory

• Delete the contents of the embedded file system

The available command set is shown in table 43.

Table 43. Main shell command set

Command	Function
?	Displays the main menu with available commands, domains and active sessions.
help	Displays a list of the commands available in the current domain.
boot	Restarts the system.
div d s	Diverts the output of domain d to another session s, i.e. to Telnet interfaces.
sd d	Switches to another domain. You can display the available domains in the main menu by entering "?". The "d = 0" command invokes the Route Table Manager; "d = 1" invokes the Download Agent; "d = 2" invokes the Diagnostics.

Table 43. Main shell command set

Command	Function
quit/quit s	Terminates the current session/the session at Telnet interfaces.

```
Tera Term - 172.16.40.99 VT
File  Edit  Setup  Control  Window  Help

-------------------------------------------------------------------------------
TARGET MAIN SHELL
-------------------------------------------------------------------------------

Available commands:
  help       : display domain specific commands
  boot       : restart
  div    d t : divert output of domain d to session s
  sd     d   : switch to domain d
  quit   s   : terminate session s
  quit       : terminate current session

Active sessions:
  TELNET 0

Available domains :
  0 : RTM                (output on TELNET 0)
  1 : DownloadAgent      (output on TELNET 0)
  2 : Diagnostic         (output on TELNET 0)

[0] >>
```

Figure 91. Main shell

Route Table Manager (RTM)

The Route Table Manager (RTM) manages static routes and also provides a view of all routes.

To access the Route Table Manager, type **sd 0**.

Type **help** to display a list of commands that are available in the RTM domain (see figure 92).

```
Tera Term - 172.16.40.99 VT
File  Edit  Setup  Control  Window  Help

-------------------------------------------------------------------------------
HELP FOR ROUTE TABLE MANAGER
-------------------------------------------------------------------------------

Available Commands:
    help       : display this text

    add        : add a new static route
      add [destination] mask[mask] gw[gateway] metric[metric] [port[port]]

    delete     : delete a static route
      delete [destination] mask[mask] gw[gateway] [port[port]]

    clear      : un-mount all static routes on router
    update     : re-mount all static routes on router
    print      : display all routes currently active
RTM[0] >>
```

Figure 92. Route Table Manager display

To add a new static route, use the command **add**.

For example:

```
add 1.2.3.4 mask 255.255.0.0 gw 1.2.3.10 metric 0
```
You can delete a route by using the command **delete**.

For example:

```
delete 1.2.3.4 mask 255.255.0.0 gw 1.2.3.10
```
To deactivate/activate all static routes, use the commands **clear** followed by **update**.

You can display a list of all routes currently active by typing **print**.

Download Agent

The Download Agent allows you to set and read different TFTP server settings:

- IP address (**ssip**, **gsip**)

- Retry count (**strc**, **gtrc**)

- Continue flag (**stcf**, **gtcf**)

- Download file lifetime (**sdfl**, **gdfl**)

To access the Download Agent, type **sd 1**.

Type **help** to display a list of commands that are available in the Download Agent domain (see figure 93).

Figure 93. Download Agent display

You can use the command **download** to download an application image or a configuration file from the TFTP server, for example:

```
download /SmartWare/Sn1xxx/Vx/R2.10/BUILD21215 b
```
where */SmartWare/...* is the path to the directory where the application image (Build) is stored, relative to the configured TFTP root, and 'b' is the batch file that tells the Download Agent which files to download.

Diagnostic

Diagnostic offers three actions:

• Ping an IP address

• Test various sectors of the flash memory

• Delete the contents of the embedded file system

To access the Diagnostic domain, type **sd 2**.

Type **help** to display a list of the available commands in the Diagnostic domain (see figure 94).
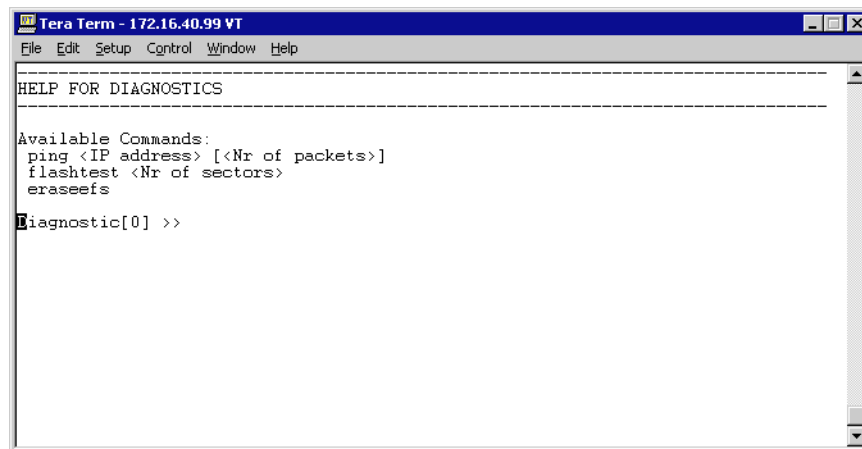
Figure 94. Diagnostic Display

The command **ping** allows you to verify the IP connectivity within a network.

You can test the various sectors of the SmartNode flash memory with the command **flashtest**.

Use the command **eraseefs** to delete the contents of the EFS.

Additional information

For detailed information about configuring and operating guidance, set up procedures, and troubleshooting, refer to the *Software Configuration Guide* on the enclosed CD-ROM. On the CD you will also find a freeware TFTP server, which is also available from the http://solarwinds.net/ web site.

Chapter 11 **Monitoring Status**

Chapter contents

Status LEDs

The LEDs on the SmartNode provide information about the status of the device and its interfaces. They are located on both the front and the rear of the device. Indication is conveyed by [on / off] and [steady / blinking] states, not by color change. Depending on the type of SmartNode that you have installed, some LEDs may not be available.

There are five possible states for a SmartNode:

• Normal boot process (Normal Boot). The SmartNode starts the normal application, that is the configuration stored in the flash memory.

• Normal operating behavior (Normal Run). The SmartNode is running the normal application that is the configuration stored in the flash memory.

• Boot loader started (Boot Loader). The boot loader started instead of the normal application. Refer to the Software Configuration Guide for more details of the boot loader.

• Default download in progress (Default Download). A configuration file is downloaded for the first time to the flash memory, i.e. the configuration file default-config in the storing location nvram: does not exist yet. It means that a configuration file is being downloaded.

• Error state (Error State)

If neither the normal application nor the boot loader are running, the device may have a more serious problem. The error state is indicated by the LEDs as described in table 44.

Table 44. SmartNode LED Indications

LED	Normal Boot	Normal Run	Boot Loader	Default Download	Error State
PWR (Power)	On	On	On	On	On
RUN	On–Off[a]	On	Off	Off	Blinking[b]
ACT	On–Off[a]	Blinking[c]	Blinking[b]	On	Off
BRI x	On–Off[a]	On[d]	Blinking[b]	On	Off
ETH x[e]	On–Off[a]	Blinking[f]	Off	Blinking[e]	Off
LINK	Off	On[g]	Off	On[f]	Off
L2	Off	On[f]	Off	Off	Off
100Mbs	Off	On[h]	Off	Off	Off
STATUS	Not Used	Not Used	Not Used	Not Used	Not Used

    a. 1 sec ON, then OFF
    b. 500ms ON, 500ms OFF
    c. Blinks according to CPU load
    d. ON if one or more B-Channels are active on the BRI interface
    e. BRI 1 and BRI 2 blink when interconnected (fallback) on interface card IC-4BRV-8V
    f. Blinks according to IP activity
    g. ON if correctly connected to an active ISDN device
    h. ON if connected to a 100Mbs Ethernet device, OFF otherwise

Chapter 12 Contacting Patton for assistance

Chapter contents

Introduction

This chapter contains the following information:

- "Contact information"—describes how to contact PATTON technical support for assistance.

- "Warranty Service and Returned Merchandise Authorizations (RMAs)"—contains information about the RAS warranty and obtaining a return merchandise authorization (RMA).

Contact information

Patton Electronics offers a wide array of free technical services. If you have questions about any of our other products we recommend you begin your search for answers by using our technical knowledge base. Here, we have gathered together many of the more commonly asked questions and compiled them into a searchable database to help you quickly solve your problems.

Patton support headquarters in the USA

- Online support: available at **www.patton.com**

- E-mail support: e-mail sent to **support@patton.com** will be answered within 1 business day

- Telephone support: standard telephone support is available five days a week—from **8:00 am** to **5:00 pm EST** (**1300** to **2200 UTC/GMT**)—by calling **+1 (301) 975-1007**

- Fax: **+1 (253) 663-5693**

Alternate Patton support for Europe, Middle East, and Africa (EMEA)

- Online support: available at **www.patton-inalp.com**

- E-mail support: e-mail sent to **support@patton-inalp.com** will be answered within 1 business day

- Telephone support: standard telephone support is available five days a week—from **8:00 am** to **5:00 pm CET** (**0900** to **1800 UTC/GMT**)—by calling **+41 (0)31 985 25 55**

- Fax: **+41 (0)31 985 25 26**

Warranty Service and Returned Merchandise Authorizations (RMAs)

Patton Electronics is an ISO-9001 certified manufacturer and our products are carefully tested before shipment. All of our products are backed by a comprehensive warranty program.

Note   If you purchased your equipment from a Patton Electronics reseller, ask your reseller how you should proceed with warranty service. It is often more convenient for you to work with your local reseller to obtain a replacement. Patton services our products no matter how you acquired them.

Warranty coverage

Our products are under warranty to be free from defects, and we will, at our option, repair or replace the product should it fail within one year from the first date of shipment. Our warranty is limited to defects in workmanship or materials, and does not cover customer damage, lightning or power surge damage, abuse, or unauthorized modification.

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Out-of-warranty service

Patton services what we sell, no matter how you acquired it, including malfunctioning products that are no longer under warranty. Our products have a flat fee for repairs. Units damaged by lightning or other catastrophes may require replacement.

Returns for credit

Customer satisfaction is important to us, therefore any product may be returned with authorization within 30 days from the shipment date for a full credit of the purchase price. If you have ordered the wrong equipment or you are dissatisfied in any way, please contact us to request an RMA number to accept your return. Patton is not responsible for equipment returned without a Return Authorization.

Return for credit policy

• Less than 30 days: No Charge. Your credit will be issued upon receipt and inspection of the equipment.

• 30 to 60 days: We will add a 20% restocking charge (crediting your account with 80% of the purchase price).

• Over 60 days: Products will be accepted for repairs only.

RMA numbers

RMA numbers are required for all product returns. You can obtain an RMA by doing one of the following:

• Completing a request on the RMA Request page in the *Support* section at **www.patton.com**

• By calling **+1 (301) 975-1000** and speaking to a Technical Support Engineer

• By sending an e-mail to **returns@patton.com**

All returned units must have the RMA number clearly visible on the outside of the shipping container. Please use the original packing material that the device came in or pack the unit securely to avoid damage during shipping.

Shipping instructions

The RMA number should be clearly visible on the address label. Our shipping address is as follows:

Patton Electronics Company
RMA#: xxxx
7622 Rickenbacker Dr.
Gaithersburg, MD 20879-4773 USA

Patton will ship the equipment back to you in the same manner you ship it to us. Patton will pay the return shipping costs.

Appendix A **Specifications**

Chapter contents

Physical description

SN1200
- Chassis dimensions: 8.7W x 1.6H x 6.3D in. (220W x 40H x 160D mm)
- Weight: 600 g
- CPU Motorola MPC850 @ 50MHz
- Memory 16 Mb SDRAM
- Flash memory 4 Mb
- 2-channel DSP
- Power dissipation 4 W
- Power supply AC 100–240 VAC, 50/60 Hz, 70 mA

SN1400
- Chassis W / H / D: 220 / 40 / 160 mm
- Weight: 600 g
- CPU Motorola MPC850 @ 50MHz
- Memory 16 Mb SDRAM
- Flash 4 Mb
- 4-channel DSP
- Power dissipation 4 W
- Power supply AC 100–240 VAC, 50/60 Hz, 70 mA

SN2300
- Chassis W/H/D 440 / 42 / 265 mm
- Weight 1650g
- CPU Motorola MPC860 @ 50 MHz
- Memory 16 MB SDRAM
- Flash 4 MB
- Power dissipation 30 W, fully loaded interface card (IC) slots, without internal 48V (or 40V) Line Power Module PM-48V-INT (or PM-40V-INT)
- Power supply AC 100 - 240 V, 50/60 Hz , max. 400 mA

SN2400
- Chassis W/H/D 440 / 42 / 265 mm
- Weight 1650g
- CPU Motorola MPC750 @ 333 MHz

- Memory 32 MB SDRAM, up to 128MB SO-DIMM

- Flash 8 MB

- Power dissipation 30 W, fully loaded interface card (IC) slots, without internal 48V (or 40V) Line Power Module PM-48V-INT (or PM-40V-INT)

- Power supply AC 100 - 240 V, 50/60 Hz, max. 1.0A or DC 48V, max. 2A

IC-4BRV-8V

- Dimensions: 0.53H x 5.9W x 2.9D in. (13.5H x 149W x 74D mm)

- Weight: 3.5 oz (100 g)

- PMC card with 32-bit PCI bus

- CPU Motorola MPC850 at 50 MHz

- Memory 8 Mb SDRAM

- Power dissipation less than 3W

- Optional internal Line Power Module PM-48V-INT (or PM-40V-INT): up to 2.5W per BRI port

IC-E1V

- Size W / H / D:149 / 13.5 / 74 mm

- Weight: 80 g

- PMC card with 32bit PCI bus

- CPU Motorola MPC850 @ 50 MHz

- Memory 8MB SDRAM

- Power dissipation 2,5W

IC-4FXS

- W / H / D: 149 / 13.5 / 74 mm

- Weight: 100 g

- PMC card with 32bit PCI bus

- CPU Motorola MPC850 @ 50 MHz

- Memory 8MB SDRAM

- Power dissipation < 3W

- Requires internal Line Power Module PM-48V-INT (or PM-40V-INT) to generate ringing and loop voltages

Line power module

- Input: 230VAC

- Output: 48V (or 40V) DC 30W

T1/E1 daughter card
Hardware Interface (software selectable):
- E1 – RJ48C

- T1 – RJ48C

Indication LEDs
- Link – Indicates securing the T1/E1 signal.

RJ-48C Jack		Signal Name
	1	(TX) Transmit (Ring)
	2	(TX) Transmit (Tip)
	3	Shield
	4	(RX) Receive (Ring)
	5	(RX) Receive (Tip)
	6	Shield
	7	No connection
	8	No connection

Figure 95. RJ48C pinout

E1 0   LINK

G.703 balanced   IC-E1V
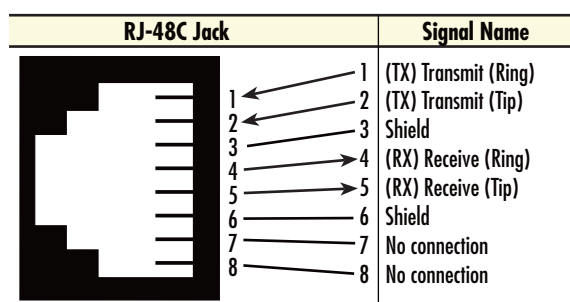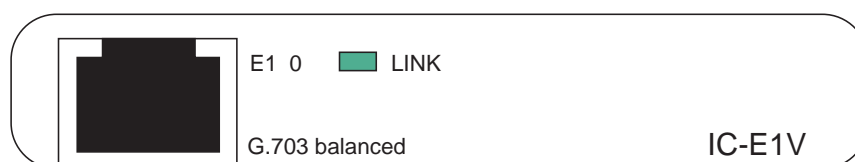
Figure 96. T1/E1 card showing LED and RJ48C

Identification of the SmartNode devices via SNMP

All SmartNode devices have assigned sysObjectID (.iso.org.dod.internet.mgmt.mib-2.system.sysObjectID) numbers (see table 45).

Table 45. SmartNode Models and their Unique sysObjectID

SmartNode Model	SysObjectID
SN1200	.iso.org.dod.internet.private.enterprises.patton.products.sn1200 1.3.6.1.4.1.1768.2.4.1
SN1400	.iso.org.dod.internet.private.enterprises.patton.products.sn1400 1.3.6.1.4.1.1768.2.4.2
SN2300	.iso.org.dod.internet.private.enterprises.patton.products.sn2300 1.3.6.1.4.1.1768.2.4.3
SN2400	.iso.org.dod.internet.private.enterprises.patton.products.sn2400 1.3.6.1.4.1.1768.2.4.4

According to table 45, an SNMP get request to *.iso.org.dod.internet.mgmt.mib-2.system.sysObjectID* of a Smart-Node 1200 device reads out a numeric OID of *1.3.6.1.4.1. 1768.2.4.1*, which represents a SmartNode 1200

device. The mapping of the sysObjectID to each of the SmartNode model is realized with the SmartNode product identification MIB.

The SNMP agent running in SmartWare is SNMP version 1 (SNMPv1) compliant. SNMP version 2 (SNMPv2) and SNMP version 3 (SNMPv3) are not currently supported.

IMPORTANT

Appendix B **Cabling**

Chapter contents

Introduction

This section provides information on the cables used to connect the SmartNode and the interface cards to the existing network infrastructure and to third party products.

Serial console

⚠ **CAUTION**   **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

The SmartNode can be connected to a serial terminal over its serial console port, as depicted in figure 97.

Serial Terminal

RJ-45, male   **Sub-D, 9 pol, female**

TxD 6 —————————————   ————————————— 2
TxD 3 —————————————   ————————————— 3
GND 4 ———————————————————————————————— 5
GND 5 ——————————————————————
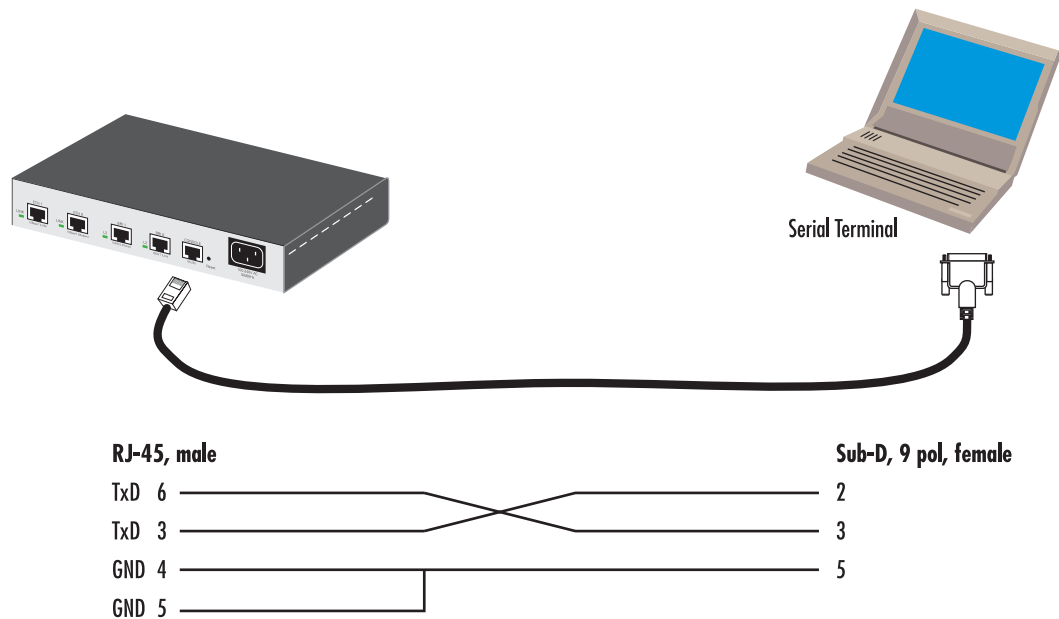
Figure 97. Connecting a serial terminal

Ethernet 10Base-T and 100Base-T

> ⚠️ **CAUTION**
>
> **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

Ethernet devices (10Base-T/100Base-T) are connected to the SmartNode o to an interface card over a cable with RJ-45 plugs. Use a cross-over cable to a host, or a straight cable to a hub. See figure 98 (host) and figure 99 (hub) for the different connections.

Host

Cross-over cable

RJ-45, male		RJ-45, male
Tx+ 1		1
Tx- 2		2
Rx+ 3		3
Rx- 6		6
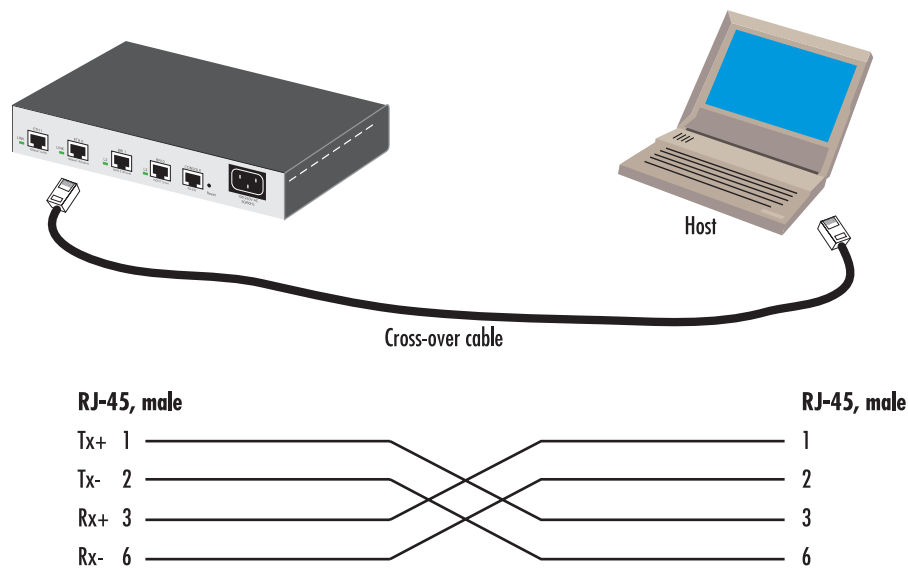
Figure 98. Connecting a host

Straight-through cable

RJ-45, male   **RJ-45, male**

Rx+ 3 ———————————————————————— 3
Tx-   4 ———————————————————————— 4
Tx-   5 ———————————————————————— 5
Rx-   6 ———————————————————————— 6
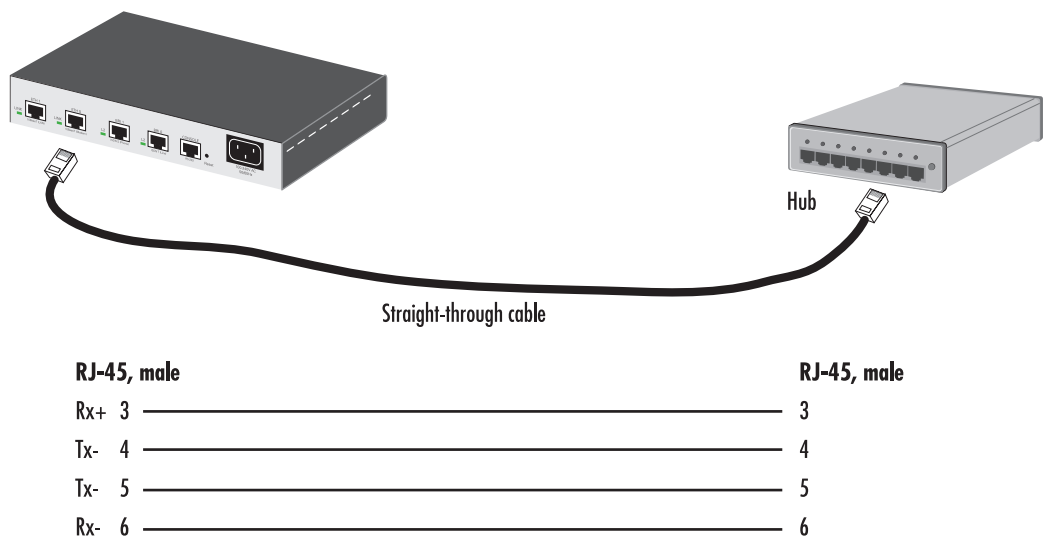
Figure 99. Connecting a hub

V.35 and X.21

Figure 100 on page 170 shows the cables that are required to connect the serial port of a SmartNode to a standard X.21 or V.35 network termination unit (NTU).

Note   Some NTUs have non-standard or mirrored connections and require special cables. Consult the NTU maker's product documentation.

The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability

CAUTION

X.21

DB-25, male

TXDa	12	2	TXDa
TXDb	11	9	
RXDa	9	4	
RXDb	10	11	
SETa	22	6	
SETb	21	13	
INDa	23	5	
INDb	16	12	
CNTa	14	3	
CNTb	13	10	
RTSa	8		
CTSb	25		
SIGNAL GROUND	7	8	
DTR	6		
DCD	4		

SmartNode 2300 / **Modem NTU**

V.35

DB-25, male

TXDa	12	P	
TXDb	11	S	
RXDa	9	R	
RXDb	10	T	
RXCa	22	V	
RXCb	21	X	
TXCa	23	Y	
TXCb	16	a	
RTS	8	C	
DTR	6	H	
DCD	4	F	
CTS	25	D	
SIGNAL GROUND	7	B	
FRAME GROUND	1	A	

SmartNode 2300 / **Modem NTU**

Figure 100. V.35 and X.21 modem connection

BRI

A straight-through S-Bus cable with RJ-45 plugs is used to connect an ISDN NT or TE to the SmartNode or interface card. See figure 101 (telephone connection) and figure 102 on page 172 (NT connection) for the appropriate information. For BRI ports with configurable pin outs ensure that the appropriate mode (NET or USR) is configured.

WARNING **Hazardous network voltages are present in the BRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the BRI port, regardless of when power is turned OFF.**

WARNING To prevent damage to the system, make certain you connect the BRI cable to the BRI port only and not to any other RJ-45 socket.

CAUTION **The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**
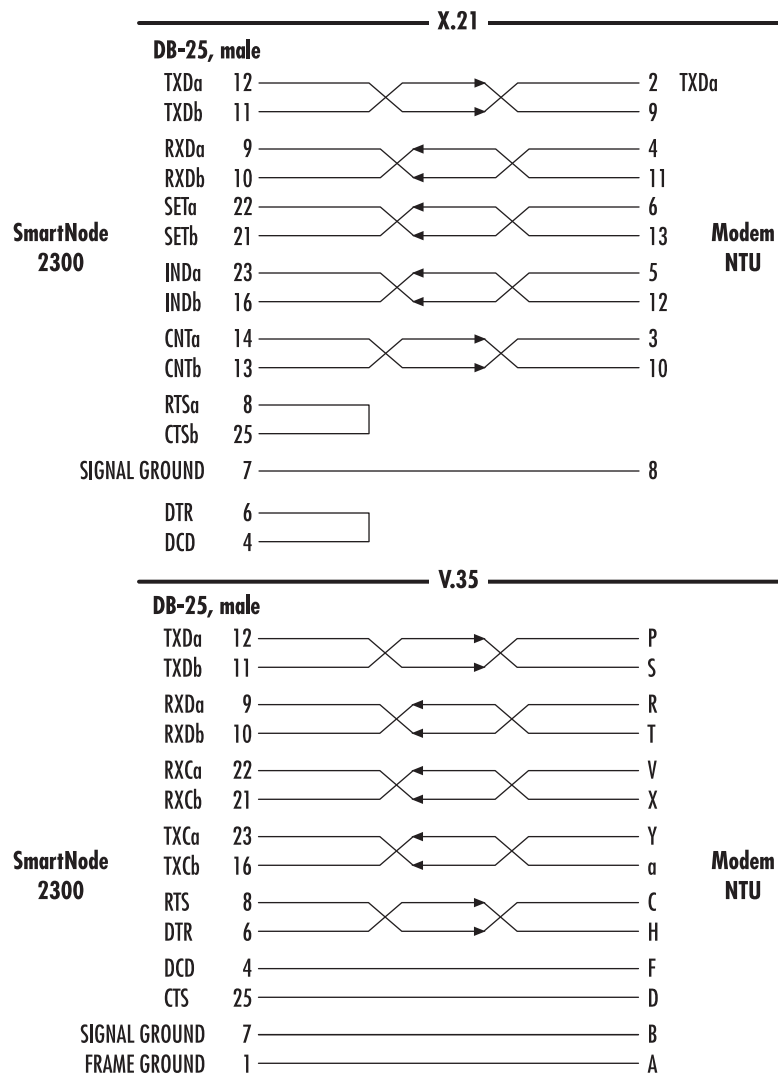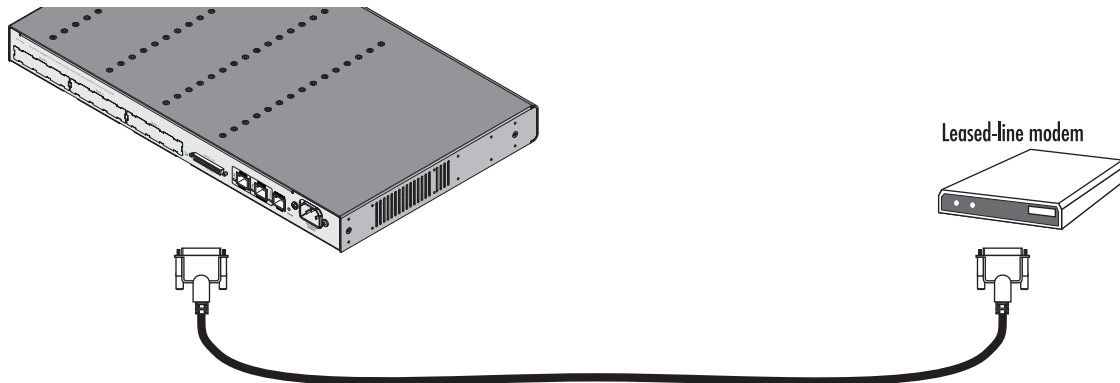
ISDN phone

S-Bus cable

RJ-45, male				**RJ-45, male**
Rx+	3	————————————————		3
Tx-	4	————————————————		4
Tx-	5	————————————————		5
Rx-	6	————————————————		6

Figure 101. Connecting a BRI to an ISDN telephone

RJ-45, male   **RJ-45, male**

Rx+ 3 ——————————————————————————— 3
Tx- 4 ——————————————————————————— 4
Tx- 5 ——————————————————————————— 5
Rx- 6 ——————————————————————————— 6

Figure 102. Connecting a BRI to an NT

E1 PRI

The E1 PRI is usually connected to a PBX or telco witch—local exchange (LE). Type and pin outs of these devices vary depending on the manufacturer. In most cases, a straight-through RJ-45 to RJ-45 can be used to connect the PRI with a PBX (an NT) (see figure 103). A cross-over cable is required to connect to an LE, as illustrated in figure 104.

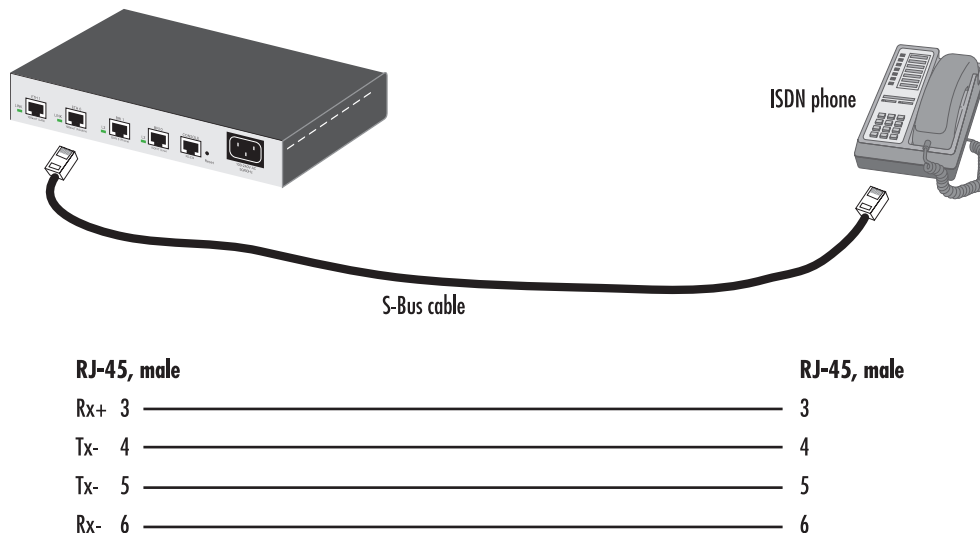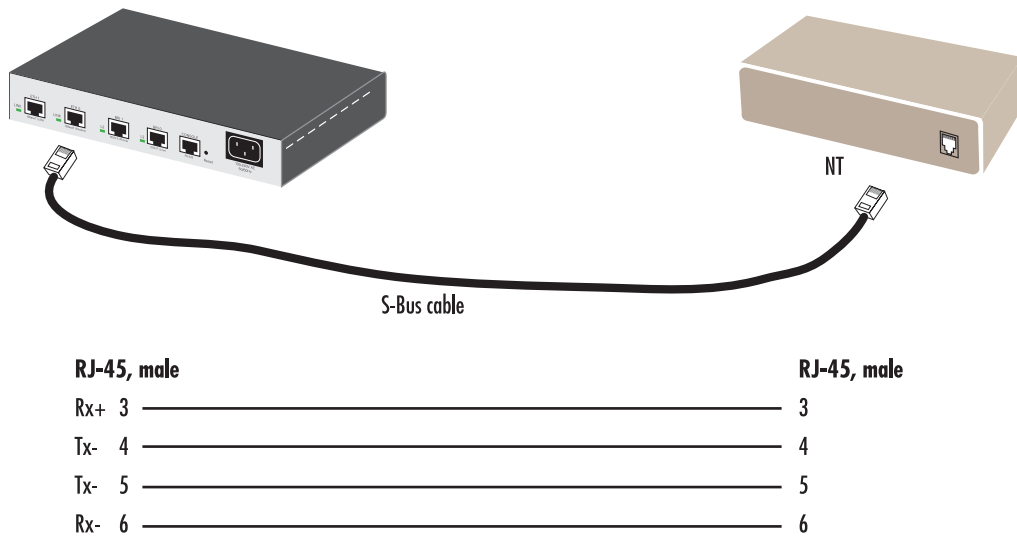|	
⚠ WARNING	**Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of when power is turned OFF.**
⚠ WARNING	To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ-45 socket.
⚠ CAUTION	**The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

Figure 103. Connecting an E1 PRI port to an NT

RJ-48C, male   RJ-48C, male

TX Ring	1		1
TX Tip	2		2
TX Shield	3		3
RX Ring	4		4
RX Tip	5		5
RX Shield	6		6

Figure 104. E1 crossover cable

T1 PRI

The T1 PRI is usually connected to a PBX or telco switch—local exchange (LE). Type and pin outs of these devices vary depending on the manufacturer. In most cases, a straight-through RJ-45 to RJ-45 can be used to connect the PRI with a PBX (an NT) (see figure 105). A cross-over cable is required to connect to an LE, as illustrated in figure 106.

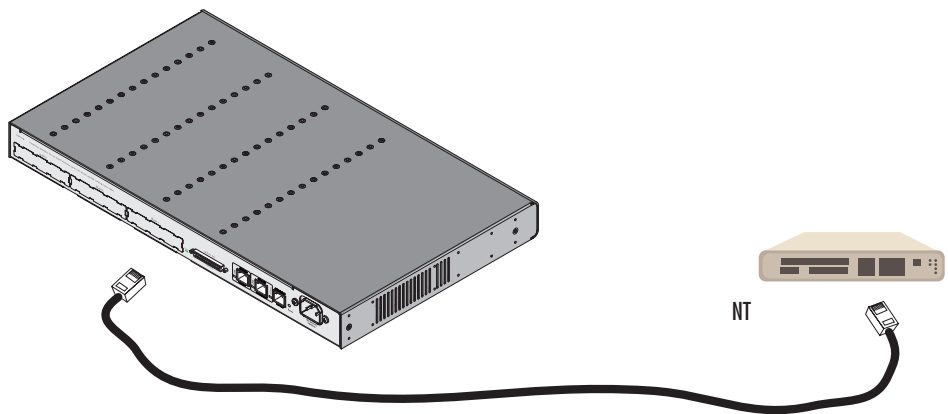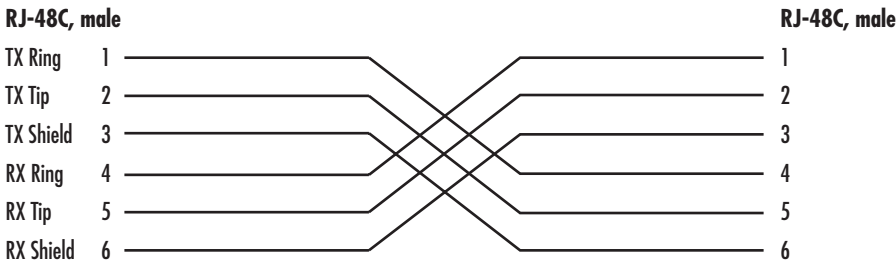|	
WARNING	**Hazardous network voltages are present in the PRI cables. If you detach the cable, detach the end away from the SmartNode or interface card first to avoid possible electric shock. Network hazardous voltages may be present on the device in the area of the PRI port, regardless of when power is turned OFF.**
WARNING	To prevent damage to the system, make certain you connect the PRI cable to the PRI port only and not to any other RJ-45 socket.
CAUTION	**The Interconnecting cables shall be acceptable for external use and shall be rated for the proper application with respect to voltage, current, anticipated temperature, flammability, and mechanical serviceability**

Figure 105. Connecting an T1 PRI port to an NT

RJ-48C, male   **RJ-48C, male**

TX Ring	1		1
TX Tip	2		2
TX Shield	3		3
RX Ring	4		4
RX Tip	5		5
RX Shield	6		6
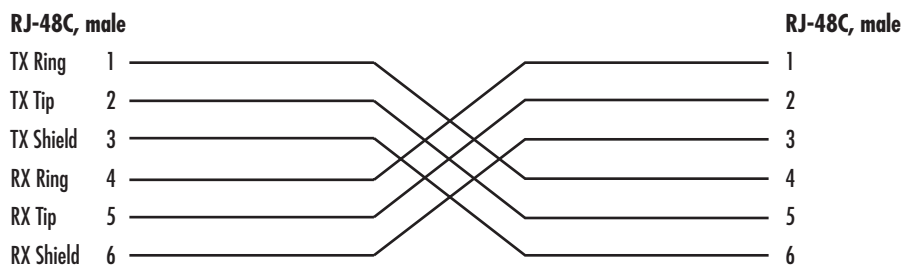
Figure 106. T1 crossover cable

Appendix C **Port pin-outs**

Chapter contents

Introduction

This section provides pin out information for the ports of the SmartNode and its interface cards.

Console port

Table 46. RJ-45 socket

Pin	Signal
3	TxD
4	GND
5	GND
6	RxD

Note   Pins not listed are not used.

Ethernet 10Base-T and 100Base-T port

Table 47. RJ-45 socket

Pin	Signal
1	TX+
2	TX-
3	RX+
6	RX-

Note   Pins not listed are not used.

BRI port

Table 48. RJ-45 socket

Pin	Signal (USR)	Signal (NET)
3	TX+	RX+
4	RX+	TX+
5	RX-	TX-
6	TX-	RX-

Note   Pins not listed are not used.

FXS port

Table 49. RJ-12 socket

Pin	Signal
3	Ring (-)
4	Tip (+)

Note   The IC-4FXS is actually equipped with RJ-11 sockets. An RJ-11 socket is similar to an RJ-12 socket but pins 1 and 6 are omitted.

Note   Pins not listed are not used.

PRI port

Table 50. RJ-48C socket

Pin	USR
1	TX Ring
2	TX Tip
3	TX Shield
4	RX Ring
5	RX Tip
6	RX Shield

Note   Pins not listed are not used.

Serial port

The serial port is configurable to work in either V.35 or in X.21 mode. A standard D-subminiature female socket with 25 positions is used.

Table 51. Serial port V.35 signals

Pin	Signal V.35
1	Frame Ground
4	DCD
6	DTR
7	Signal Ground
8	RTS
9	RXDa
10	RXDb
11	TXDb
12	TXDa
16	TXCb
21	RXCb
22	RXCa
23	TXCa
25	CTS

Note   Pins not listed are not used.

Table 52. Serial port X.21 signals

Pin	Signal X.21
7	Signal Ground
9	RXDa
10	RXDb
11	TXDb
12	TXDa
13	CNTb
14	CNTa
16	INDb
21	SETb
22	SETa
23	INDa

Note   Pins not listed are not used.