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n e t w o r k s

Hardware Installation Guide

For SmartNode 1000 and 2000 Series

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EU Declaration of Conformity

The EU Directives covered by this Declaration

99/5/EC   Guideline of the European Parliament and the Committee for the Harmonization of the Legal Regulations of the Member States concerning radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

The Products covered by this Declaration

The products covered by this declaration are the SmartNode 1000 and 2000 series devices.

The Basis on which Conformity is being Declared

The products identified above comply with the requirements of the above EU directive by meeting the following standards:

- Safety Compliance: EN 60950 (Edition 1997, for SN2400: Edition 2001)
- EMC Compliance: EN 55022 (Edition 1998), EN 55024 (Edition 1998)
        additionally for SN2400 : EN55022 A1 (Edition 2000), EN55024 A1 (Edition 2001)
- ISDN Terminal Equipment Requirements (BRI): ETS TBR3 (Edition 1999)
- ISDN Terminal Equipment Requirements (PRI): ETS TBR4 (Edition 1999)

The CE mark was first applied in 2000.

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ABOUT THIS GUIDE

Objectives

The aim of this Hardware Installation Guide is to provide 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

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 primarily 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.

Organization

The major sections of the guide are organized as follows:

Number	Title	Description
1	SmartNode 1200 Hardware Description	Description of the hardware feature, physical description, front panel, ports, and rear panel of the SmartNode 1200.
2	SmartNode 1400 Hardware Description	Description of the hardware feature, physical description, front panel, ports, and rear panel of the SmartNode 1400.
3	SmartNode 2300 Hardware Description	Description of the hardware feature, physical description, front panel, ports, and rear panel of the SmartNode 2300.
4	SmartNode 2400 Hardware Description	Description of the hardware feature, physical description, front panel, ports, and rear panel of the SmartNode 2400.

5	IC-4BRV Hardware Description	Description of the hardware feature, physical description, front panel, and ports of the IC-4BRV.
6	IC-E1V Hardware Description	Description of the hardware feature, physical description, front panel, and ports of the IC-E1V.
7	IC-4FXS Hardware Description	Description of the hardware feature, physical description, front panel, and ports of the IC-4FXS.
8	Interface Card Installation	Description on how to install interface cards in a SmartNode 2x00.
9	Line Power Module Installation	Description on how to install an optional 48V (or 38V) Line Power Module in a SmartNode 2x00. Moreover a description on how to install and use the optional external 40V S-bus power supply unit.
10	SmartNode Installation	This chapter guides you through the initial site preparation and installation of your SmartNode 1000 and 2000 series.
11	LED Indications	Description of the status information provided by the LEDs on the front and rear panel of your SmartNode.
	Appendix A	Cable specifications and pin outs for each port of your SmartNode
	Appendix B	Internetworking Terms and Acronyms

Document Conventions

Inalp documentation uses the following typographical conventions listed in Table A through Table D in this user guide.

Font	What the Font Represents
boldface	Commands and keywords are in **boldface** font.
boldface italic	Parts of commands, which are related to elements already named by the user, are in *boldface italic* font.
node	The leading IP address or nodename of a SmartNode is substituted with *node* in *boldface italic* font.
italic	Variables for which you supply values are in *italic* font
[ ]	Elements in square brackets ([ ]) are optional.
{a	b	c}	Alternative but required keywords are grouped in braces ({ }) and are separated by vertical bars (	).

Table A: SmartWare Command Line Description

Font	What the Font Represents

SN	The leading **SN** on a command line represents the nodename of the SmartNode
boldface screen	Information you enter is in **boldface screen** font.
screen	Terminal sessions and information the system displays are in screen font.
< >	Nonprinting characters are in angle brackets (< >), e.g. <?> which shows the available commands in any mode or necessary arguments of a command.
#	An hash sign at the beginning of a line indicates a comment line.

Table B: SmartWare Example Description

Font	What the Font Represents
boldface screen	Information you enter on a PC or workstation command line.
screen	Information and items on a PC or workstation screen. Cascading menu items. Command names. File and directory names. Process names. Window and dialog box names.
Keycap	Keyboard keys on a PC or workstation.
[Button]	Buttons on the graphical user interface on a PC or workstation screen

Table C: NMS Workstation Command Line Description

Notice	What the Notice Represents
Note	Contain helpful suggestions or information for important features and instructions.
Warning	Situation that could cause bodily injury or that could result in data loss.
Warning Mains Voltage	Situation that could cause bodily injury and equipment destruction. Be aware of the hazards involved with electrical circuitry.
Caution	Situation that could put equipment or data at risk.
Electrostatic Discharge	Situation that could put equipment at risk. Electrostatic discharge may result in equipment defects or diminished reliability. The defect may not be immediately recognizable.

Table D: Notice Conventions

Inalp Documentation

Title	Part Number
SmartNode Hardware Installation Guide	80-0057
Software Configuration Guide for SmartWare Release 2.10	80-0151
Command Reference Guide for SmartWare Release 2.00	80-0125

Table E: Inalp SmartNode Documentation

How to Read this Guide

Whether you are already familiar with or new to SmartNode hardware, you will find useful information in this user guide. You can either study the chapters sequentially or use the chapter-opening outlines to find the topics that interest you.

The SmartNode hardware represents a complex and multifaceted system. 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 the SmartNode hardware and its installation.

- Chapter 1, "SmartNode SN1200 Hardware Description",
- Chapter 2, "SmartNode SN1400 Hardware Description",
- Chapter 3, "SmartNode SN2300 Hardware Description",
- Chapter 4, "SmartNode SN2400 Hardware Description",
- Chapter 8, "Interface Card Installation" and
- Chapter 10, "SmartNode Installation".

We at Inalp Networks AG, hope you find this guide useful, whether you are a novice or professional working with SmartNodes and SmartWare responsible for convergent telephony and networking solutions.

OBTAINING SERVICE AND SUPPORT

For service and support for an Inalp SmartNode product purchased from a reseller, contact the reseller.

Ordering Documentation

Inalp documentation and additional supporting literature are available on a CD-ROM, which is shipped with your product. To order additional copies of the documentation on CD-ROM contact your local sales representative or call customer service.

Feedback

Your comments and ideas can help us to improve our user documentation. If you have suggestions concerning this manual, send an e-mail containing your comment(s) to:

support@inalp.com

Please include the following document information with your e-mail:

- Title and Revision Number: e.g. "Hardware Installation Guide" Revision 3.03
- Part number: Part numbers are located on the cover page of the document, printed in a frame, e.g. 80-0057
- Chapter title, name and page number: e.g. Chapter 9.5.1, "PM-BRI-ext S-Bus 40V Power Supply", page 41.

Note: Do not use this e-mail address for technical support questions. For information about contacting technical support see the previous Chapter, "Obtaining Service and Support".

Safety Precautions

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

Follow these guidelines to ensure general safety:

- Install the SmartNode in an environment with 5% to 80% relative humidity and a Degree of Pollution 2
- Install the SmartNode in an environment with a temperature range of 0 to +40 deg. Celsius
- Keep tools away from walk areas where you or others could fall over them
- Do not wear lose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves
- Do not perform any action that creates potential hazard to people or makes equipment unsafe.

Safety with Electricity

Warning Mains Voltage: Do not open the case when the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected.

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

Warning: Before opening the chassis, disconnect the telephone network cables to avoid contact with telephone line voltages.

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

Warning: Ultimate disposal of this equipment must be handled according to all applicable national laws and regulations.

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: 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. 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.

Caution: For safety, periodically check the resistance value of the antistatic wrist strap, which should be between 1 and 10 MΩ (Ohm).

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 SN2x00) 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

1 SMARTNODE SN1200 HARDWARE DESCRIPTION

The SmartNode model SN1200 is a compact voice-data access device, which supports two voice channels. The user interfaces consist of one ISDN BRI and one Ethernet 10BaseT. One ISDN BRI and one Ethernet 10BaseT provide network access. It is suitable for home office or small office applications. The ventilated metal case may be placed on a desktop or be wall-mounted. The SN1200 complies with all relevant EU directives.

1.1 Physical Description

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

1.2 Front Panel

The front view of the SN1200 is depicted in Figure 1-1 below.

83-0008-en-1

Figure 1-1: SmartNode SN1200 Front Panel

- Two LEDs (POWER, RUN) indicate the device status.
- Four LEDs (BRI0, BRI1, ETH0, ETH1) indicate the status of the interfaces.
-

See Chapter 11, "Led Indications", for detailed information on LED indications.

1.3 Rear Panel

The rear view of the SmartNode 1200 is depicted in Figure 1-2. Two ' LINK' LEDs indicate the status of the Ethernet connections, and two 'L2' LEDs the status of the BRI interfaces. See Appendix A for connection cable and pin out data.
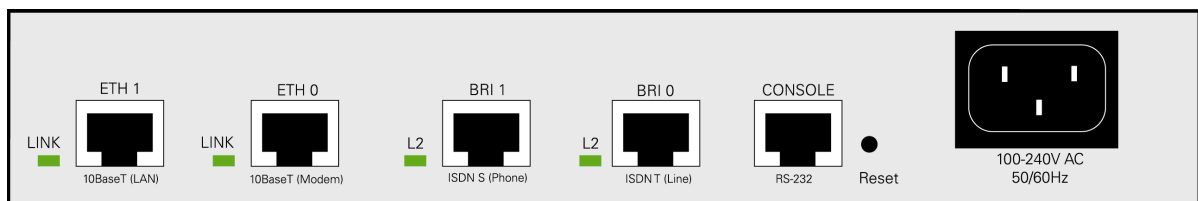
83-0010-en-1

Figure 1-2: SmartNode SN1200 Rear Panel

The ports available are tabulated in Table 1-1 below. Each port is labeled above and below the socket with its interface name and type, as in the Port column of the table.

Port	Description
ETH 0 10BaseT (Modem)	10BaseT Ethernet RJ-45 socket to connect the SmartNode with an Ethernet device. This is 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 wired (1:1) or a crossover 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 10BaseT (LAN)	10BaseT Ethernet RJ-45 socket to connect 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 wired (1:1) to a hub or a crossover 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 to connect 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 A for connection details. **Note:** External S-Bus power supplies must comply with the voltage and current limits set by ISDN standards, i.e. max. 40VDC and 200mA. **Note:** The 'L2' LED indication depends on the connected device.
BRI 1 ISDN S (Phone)	ISDN BRI RJ-45 socket to connect 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 to connect the SmartNode with a serial terminal such as a PC or Workstation with a RS-232 interface, with the following settings: 9600 Baud, no parity, 8 Bit,1 Stop bit, 1 Start bit The console port is only used for service and maintenance purpose. **Warning:** Do not plug in an ISDN connection. The voltage on the S-Bus may permanently damage the console interface.

Table 1-1: SmartNode SN1200 Port Description

In addition two other elements the Reset button and power lines socket are available on the rear panel of a SN1200 as described in Table 1-2 below.

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 SW configuration. • **Restoration:** Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system.

> **Caution:** In this case the existing IP SW 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 - 240VAC   Electricity supply socket for mains power cable.
50/60 Hz

Table 1-2: SmartNode SN1200 Reset Button and Power Line Socket on Rear Panel

2   SMARTNODE SN1400 HARDWARE DESCRIPTION

The SN1400 is a compact voice-data access device, which supports four voice channels. The interfaces consist of two ISDN BRI and two Ethernet 10BaseT. It is suitable for enterprise networking and small office environments. The ventilated metal case can be wall-mounted or placed on a desktop. The SN1400 complies with all relevant EU directives.

2.1   Physical Description

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

2.2   Front Panel

The front view of the SmartNode 1400 is depicted in Figure 2-1 below.

Figure 2-1: SmartNode SN1400 Front View

- Two LEDs ('POWER', 'RUN') indicate the device status.
- Four LEDs ('BRI0', 'BRI1', 'ETH0', 'ETH1') indicate the status of the interfaces.

See Chapter 11, "Led Indications", for detailed information on LED states.

2.3   Rear Panel

The rear view of the SmartNode 1400 is depicted in Figure 2-2. Two 'LINK' LEDs show the Ethernet status and two ' L2' LEDs show the BRI status. See Chapter 11, "Led Indications", for detailed information on LED states. See Appendix A for connection cables and pin out data.
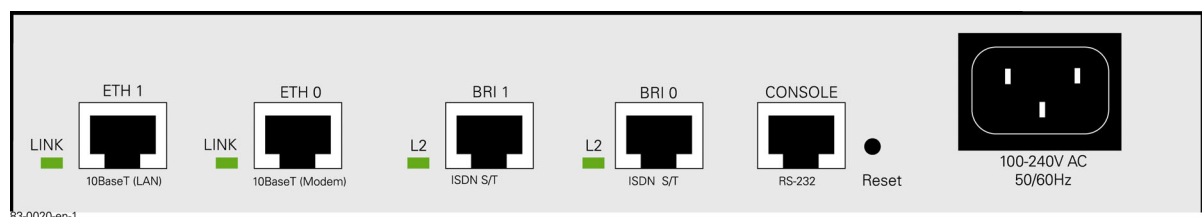
Figure 2-2: SmartNode SN1400 Rear View

The available ports are tabulated in Table 2-1 below. The ports are labeled with the interface type above each socket, as shown in the Port column of the table.

Port	Description
ETH 0 10BaseT (Modem)	10BaseT Ethernet RJ-45 socket to connect the SmartNode with an Ethernet device This is 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 wired (1:1) or with a crossover 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 10BaseT (LAN)	10BaseT Ethernet RJ-45 socket to connect 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 wired (1:1) to a hub or with a crossover 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 to connect the SmartNode with an ISDN device over a S/T bus, e.g. a PBX or a NT. The interface may be used as fallback if connected to a 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 SmartWare 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 A for details. **Note:** External S-Bus power supplies must comply with the voltage and current limits set by ISDN standards, i.e. max. 40VDC and 200mA maximum. **Note:** The 'L2' LED indications depend on the connected device.
BRI 1 ISDN S/T	ISDN BRI RJ-45 socket to connect the SmartNode with an ISDN device over a 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 indications depend on the connected device.
Console (RS-232)	RS-232 RJ-45 connector to connect the SmartNode with a serial terminal such as a PC or workstation with an RS-232 interface, with the following settings: 9600 Baud, no parity, 8 Bit, 1 Stop bit, 1 Start bit The console port is only used for service and maintenance purpose. **Warning:** Do not plug in an ISDN connector. The voltage on the S-Bus may permanently damage the console interface.

Table 2-1: SmartNode SN1400 Port Description

In addition two other elements the Reset button and power lines socket are available on the rear panel of a SN1400 as described in Table 2-2 below.

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 SW configuration. • **Restoration:** Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system.

> **Caution:** In this case the existing IP SW 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 - 240VAC 50/60 Hz	Electricity supply socket for mains power cable.

Table 2-2: SmartNode SN1200 Reset Button and Power Line Socket on Rear Panel

3 SMARTNODE SN2300 HARDWARE DESCRIPTION

The SN2300 is a powerful multi-service access device. The 19in aluminum chassis can be rack-mounted, and provides three expansion slots for interface cards. The SN2300 complies with all relevant EU directives.

3.1 Physical Description

- 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 38V) Line Power Module PM-48V-int (or PM-38V-int)
- Power supply AC 100 - 240 V, 50/60 Hz , max. 1.0 A

3.2 Front Panel

The front view of the SmartNode 2300 is depicted in Figure 3-1 below.

Figure 3-1: SmartNode SN2300 Front View

- Three front LEDs ('PWR','RUN', and 'ACT') indicate the status of the device.

See Chapter 11, "Led Indications", for detailed information on the LED states.

3.3 Rear Panel

The rear view of the device is depicted in Figure 3-2. There are three expansion slots for optional interface cards, and four board-mounted sockets. Three LEDs 'Status', 'LINK', '100Mb/s') indicate the status of the on-board interfaces. See Appendix A for cabling connections and pin out data.
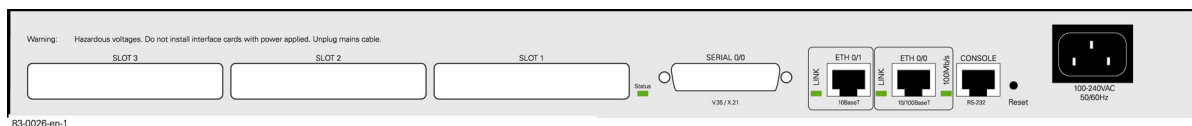
Figure 3-2: SmartNode SN2300 Rear View

3.4 Expansion Slots

Three slots, labeled SLOT 1 - SLOT 3, accept different PMC interface cards to integrate voice and data over IP networks. The interface cards and their ports are described individually later in this Guide.

3.5 On-Board Ports

Three motherboard-mounted network interfaces are available for use, independently of those, which are available with interface cards mounted in SLOT 1 - SLOT 3. The motherboard-mounted ports are tabulated in below. The Port column of the table shows the port's label and the interface type.

Port	Description
SERIAL 0/0 (V.35 / X.21)	DB25 socket providing a V.35 and X.21 interface for Leased Lines up to 2Mbit/s. A LED to the left of the connector indicates its status.
ETH 0/1 (10BaseT)	10BaseT Ethernet RJ-45 socket to connect 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 wire (1:1) to a hub, or a crossover cable to a host port. The 'LINK' LED to the left of the connector is lit when the port is connected correctly to an active Ethernet device.
ETH 0/0 (10 / 100BaseT)	10 / 100BaseT Ethernet RJ-45 socket. The interface has similar functionality to ETH 0/1 except for the option of 100BaseT capability. The '100Mb/s' LED is lit when the port is connected correctly to an active 100BaseT Ethernet device.
Console (RS-232)	RS-232 RJ-45 connector to connect the SmartNode with a serial terminal such as a PC or workstation with a RS-232 interface, with the following settings: 9600 Baud, no parity, 8 Bit, 1 Stop bit, 1 Start bit The console port is only used for service and maintenance purpose. **Caution:** Do NOT plug in an ISDN connector. The voltage on the S-Bus may permanently damage the console interface.

Table 3-1: SmartNode SN2300 Port Description

In addition two other elements the Reset button and power lines socket are available on the rear panel of a SN2300 as described in Table 3-2 below.

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 SW configuration. **Restoration:** Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system. **Caution:** In this case the existing IP SW 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 - 240VAC 50/60 Hz	Electricity supply socket for mains power cable.

Table 3-2: SmartNode SN2300 Reset Button and Power Line Socket on Rear Panel

3.6   *Rack Mounting*

If you want to mount the SN2300 in a 19'' rack, see Chapter 10.18, "Rack-Mounting for SmartNode 2000 Series", on page 56 of this document for detail.

4   SMARTNODE SN2400 HARDWARE DESCRIPTION

The SN2400 is a powerful multi-service access device. The 19in aluminum chassis can be rack-mounted, and provides four expansion slots for interface cards. The SN2400 complies with all relevant EU directives.

4.1   Physical Description

- 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 38V) Line Power Module PM-48V-int (or PM-38V-int)
- Power supply AC 100 - 240 V, 50/60 Hz, max. 1.0A or DC 48V, max. 2A

4.2   Front Panel

The front view of the SmartNode 2400 is depicted in Figure 4-1 below.
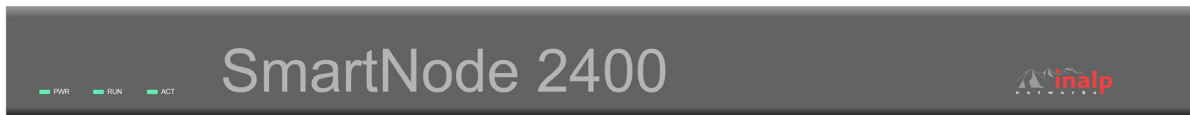
Figure 4-1: SmartNode SN2400 Front View

- Three front LEDs ('PWR','RUN', and 'ACT') indicate the status of the device.

See Chapter 11, "Led Indications", for detailed information on the LED states.

4.3   Rear Panel

The rear view of the device is depicted in Figure. There are four expansion slots for optional interface cards, and four board-mounted sockets. Two LEDs ('Link', '100Mb/s') for each of the Ethernet interfaces indicate their status. See Appendix A for cabling connections and pin out data.
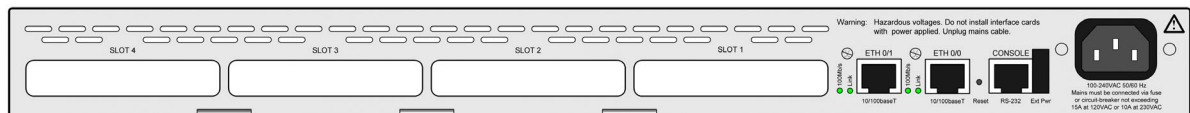
Figure 4-2: SmartNode SN2400 Rear View

4.4   Expansion Slots

Four slots, labeled SLOT 1 - SLOT 4, accept different PMC interface cards to integrate voice and data over IP networks. The interface cards and their ports are described individually later in this Guide.

4.5   On-Board Ports

Two motherboard-mounted network interfaces are available for use, independently of those, which are available with interface cards mounted in SLOT 1 - SLOT 4. The motherboard-mounted ports are tabulated in below. The Port column of the table shows the port's label and the interface type.

Port	Description
ETH 0/0 (10 / 100BaseT)	10/100BaseT Ethernet RJ-45 socket to connect the SmartNode to 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 wire (1:1) to a hub, or a crossover cable to a host port.
	The 'Link' LED to the left of the connector is lit when the port is connected correctly to an active Ethernet device. The '100Mb/s' LED, also to the left of the connector, is lit when the port is connected correctly to an active 100BaseT Ethernet device.
ETH 0/1 (10 / 100BaseT)	same as ETH 0/0
Console (RS-232)	RS-232 RJ-45 connector to connect the SmartNode with a serial terminal such as a PC or workstation with a RS-232 interface, with the following settings:
	9600 Baud, no parity, 8 Bit, 1 Stop bit, 1 Start bit
	The console port is only used for service and maintenance purpose.
	Caution: Do NOT plug in an ISDN connector. The voltage on the S-Bus may permanently damage the console interface.

Table 4-1: SmartNode SN2400 Port Description

In addition two other elements the Reset button and power lines socket are available on the rear panel of a SN2400 as described in Table 3-2 below.

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 SW configuration.
	• **Restoration:** Pressing and holding the reset button for 5 seconds will restore the factory configuration and automatically reboot the system.
	Caution: In this case the existing IP SW 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 - 240VAC 50/60 Hz	Electricity supply socket for AC mains power cable. **Warning:** The mains supply **must** be secured with an external fuse or circuit-breaker, with a maximum tripping current of 16A.
Ext. Pwr	Electricity supply socket for DC mains power cable.
48 VDC +/- 20%	The external power supply connected to this socket must comply with the EN/IEC 60950 standard. It must be a current source with power limitation according to EN/IEC 60950. Its primary circuit must be isolated from the secondary twice or in an enhanced manner.

Table 4-2: SmartNode SN2400 Reset Button and Power Line Sockets on Rear Panel

4.6   Rack Mounting

If you want to mount the SN2400 in a 19'' rack, see Chapter 10.18, "Rack-Mounting for SmartNode 2000 Series", on page 56 of this document for detail.

5   IC-4BRV HARDWARE DESCRIPTION

The IC-4BRV interface card is designed for the SmartNode 2000 series of devices. It meets IEEE P1386.1 standards and provides 4 BRI ISDN ports.

5.1   Physical Specification

- 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
- Optional internal Line Power Module PM-48V-int (or PM-38V-int): up to 2.5W per BRI port

5.2   Front Panel

The front view of the 'IC-4BRV' interface card is depicted in Figure 5-1. The individual sockets are labeled on the bezel.
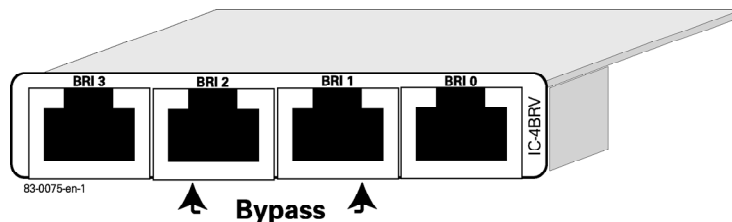
Figure 5-1: IC-4BRV Front View

5.3   Ports

The card provides the four BRI ports whose details are tabulated in Table 5-1 below. Each one is terminated internally at 100 Ohm. See Appendix A for pin out data.

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

Table 5-1: IC-4BRV Port Description

5.4   Description

The IC-4BRV interface card provides four ISDN Basic Rate Interface ports, together allowing up to 8 ISDN B-channels to work in parallel.

5.5   Operating Modes

The four ports can be used in three different modes, which are tabulated in Table 5-2 below.

- 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 5-2 below.

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

Table 5-2: BRI Port Configurations

5.6   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 2 must be connected to the ISDN network if the bypass is active.
- BRI 1 must be connected with a telephone terminal or PBX 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. See the Software Configuration Guide document. Figure 5-2 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.

83-0126-en-1
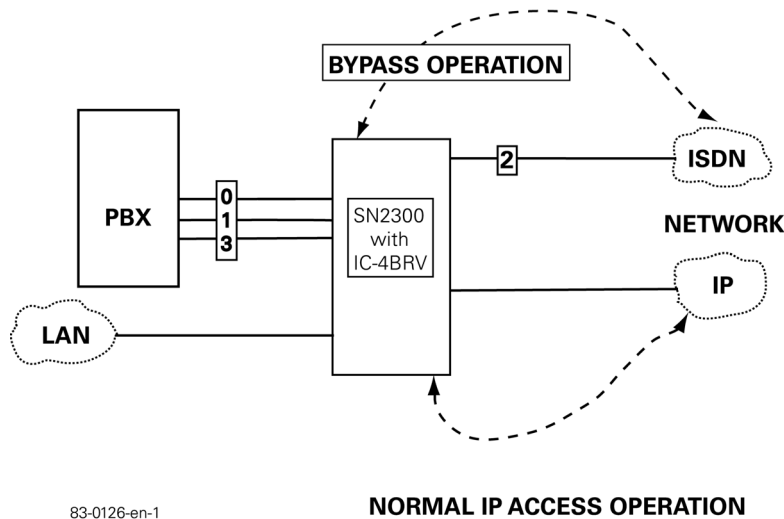
Figure 5-2: Bypass (Fallback) Mode

5.7   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 5-3.

83-0125-en-2
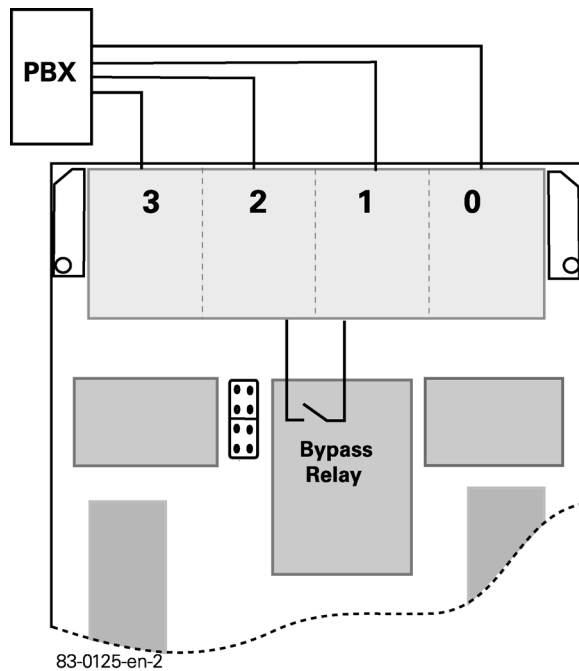
Figure 5-3: All Four Ports Connected to PBX

- Three ports (0, 1, 3) are connected to the PBX and one port (2) to the ISDN network (local breakout) as shown in Figure 5-4. The local breakout port can be used to route calls from and to the ISDN network. This is the fallback situation described in the paragraph 'Hardware Bypass' above. When power fails or the bypass is manually activated Ports 1 and 2 are interconnected through the bypass relay so providing a lifeline to the ISDN network.

83-0125-en-3
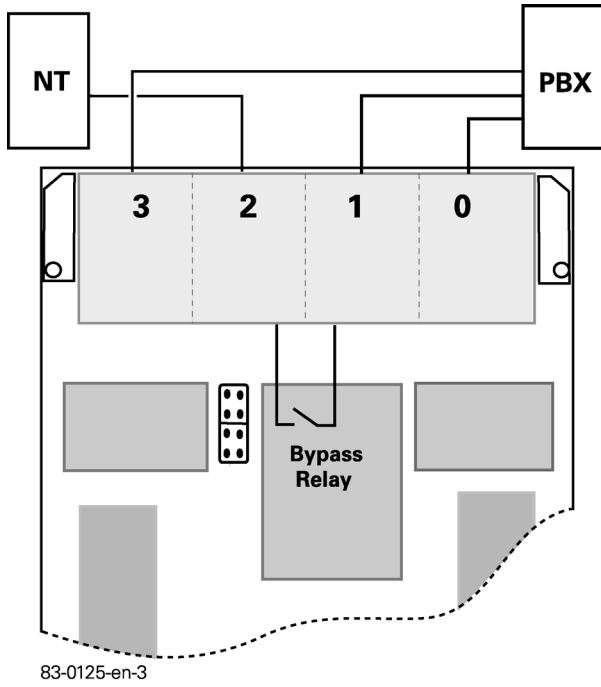
Figure 5-4: Three Ports are connected to the PBX and one Port to the ISDN Network

- Two ports (0, 1) are connected to the PBX and two ports (2, 3) to the ISDN network. 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.

83-0125-en-4
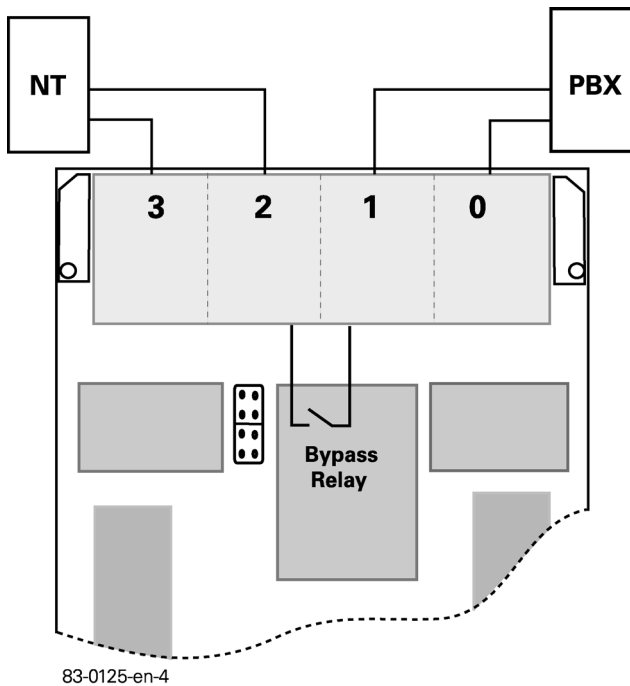
Figure 5-5: Two Ports are connected to the PBX and two Ports to the ISDN Network

5.8   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-38V-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-38V-int). This is described in Chapter 9.3, "Mounting the Internal 48V (or 38V) Line Power Module", on page 40 of this document.
- Configure the IC-4BRV card's jumper settings. This procedure is described in the following paragraphs.

5.9   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.

Warning: 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 SN2x00.

5.9.1   Possible Jumper Settings for IC-4BRV and PM-48V-int (or PM-38V-int) fitted in SmartNode SN2x00

- No jumpers are set: this setting is used with Ports 2 & 3 configured in 'USR' mode & connected to NTs as shown in Figure 5-6.
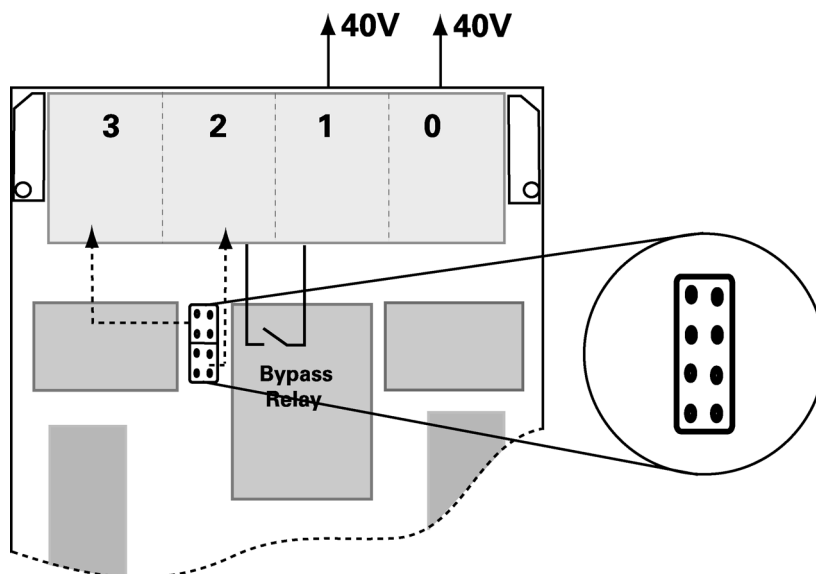
Figure 5-6: No Jumpers Set

- Upper four jumper pins bridged: this setting is used with Port 2 configured as Fallback and connected to a NT as shown in Figure 5-7.
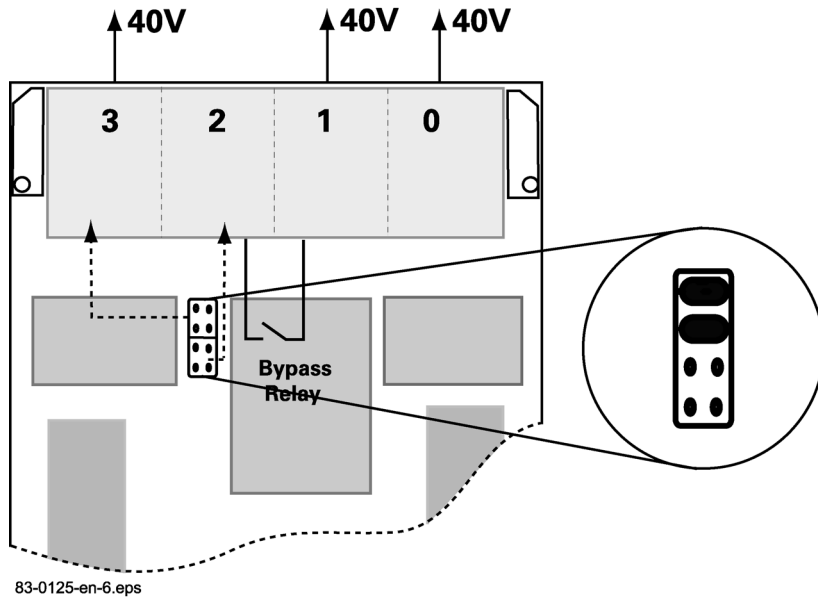
Figure 5-7: Upper Four Jumper Pins Bridged

- 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 .
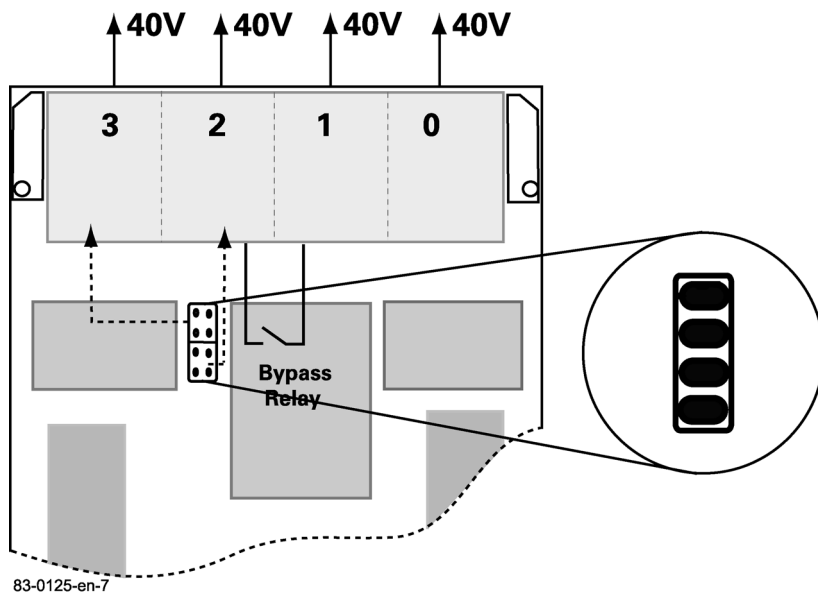
Figure 5-8: All Eight Jumper Pins Bridged

6   IC-E1V HARDWARE DESCRIPTION

The IC-E1V interface card is produced for the SmartNode 2000 series of devices. It is a standard PMC card designed to IEEE P1386.1 standard and provides one PRI E1 connection. It is only for use in the SN2000-series.

6.1   Physical Specification

- 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

6.2   Front Panel

The front view of the 'IC-E1V' interface card is depicted in Figure 6-1. The front LED ' LINK' indicates the status of the interface. See Chapter 11 for detailed information on the LED states.
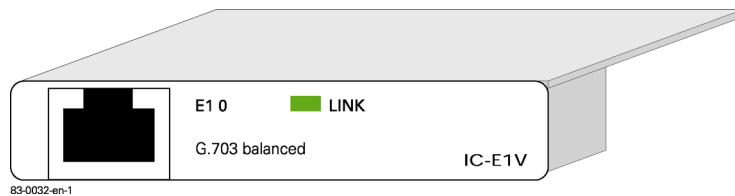
Figure 6-1: IC-E1V Front View

6.3   Interface

The card provides one PRI port, described in Table 6-1 below. The connector is terminated at 120 Ohm.

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

Table 6-1: IC-E1V Port Description

6.4   Description

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

6.5   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 exposed in Table 6-2. For cabling, see Appendix A.

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

Table 6-2: Interface Modes

When changing the interface mode from 'NET' to 'USR' and vice versa 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 and Command Reference Guide. The next time that the interface mode is changed the clock source changes back automatically to the default again.

7   IC-4FXS HARDWARE DESCRIPTION

The IC-4FXS interface card is designed for the SmartNode 2000 series of devices. It meets IEEE P1386.1 standards and provides 4 FXS (Foreign Exchange Station) ports to which analog phone sets can be connected.

7.1   Physical Specification

- 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-38V-int) to generate ringing and loop voltages

7.2   Front Panel

The front view of the 'IC-4FXS' interface card is depicted in Figure 7-1. The individual sockets are labeled on the bezel.

Figure 7-1: IC-4FXS Front View

7.3   Ports

The card provides the four FXS ports whose details are tabulated in Table 5-1 below. Protector circuits protect the ports from high voltage surges. See Appendix A for pin out data.

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).

Table 7-1: IC-4FXS Port Description

7.4   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 functionality:
• provide –48 VDC to the connected terminal
• provide ring voltage to the connected terminal (normally 96 VAC at 25 Hz)
• provide on hook transmission
• provide caller identification (CLIP)
• provide 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 9.2). This Line Power Module provides the loop voltage (-48VDC) and the input to the ring voltage generator.

8   INTERFACE CARD INSTALLATION

This chapter describes how to install interface cards on a SmartNode 2000 series device.

8.1   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 interface card down on your bench, lay it on its shielded plastic bag.

8.2   Installing Interface Cards

To install interface cards follow the steps described in below. Figure 8-1 depicts an example of a card installation in SLOT 2 of a SmartNode SN2x00.

Step	Description
Step 1	Remove all cables, including mains power cord, Ethernet and telephone network interface cables.
Step 2	Put on an ESD wrist wrap to prevent electrostatic discharge.
Step 3	Use a Phillips screwdriver to remove the cover of the SmartNode. There are a total of nine screws on an SN2300: three on each side, two on the top at the rear (connector-side) and one underneath at the front (LED) side. SN2400 has only six screws, two on each side, one on the top at the rear (connector-side) and one underneath at the front (LED) side.
Step 4	Use a Phillips screwdriver to remove the blank filler panel from the expansion slot in which the interface card is to be installed. There are screws on the bottom of the SmartNode; see Figure 2. Save the blank panel for future use.

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

Step 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.

Step 7   Fix the interface card by replacing the 2 screws into the holes on the bottom of the SmartNode, using the Phillips screwdriver: See Figure 1 and 'Card Locating Screws' on the next page.

Step 8   Replace the cover and secure it to the side panels of the SmartNode chassis by the 9 screws that you removed in Step 3.

Step 9   Reinstall the cables, connect the installed interface card.
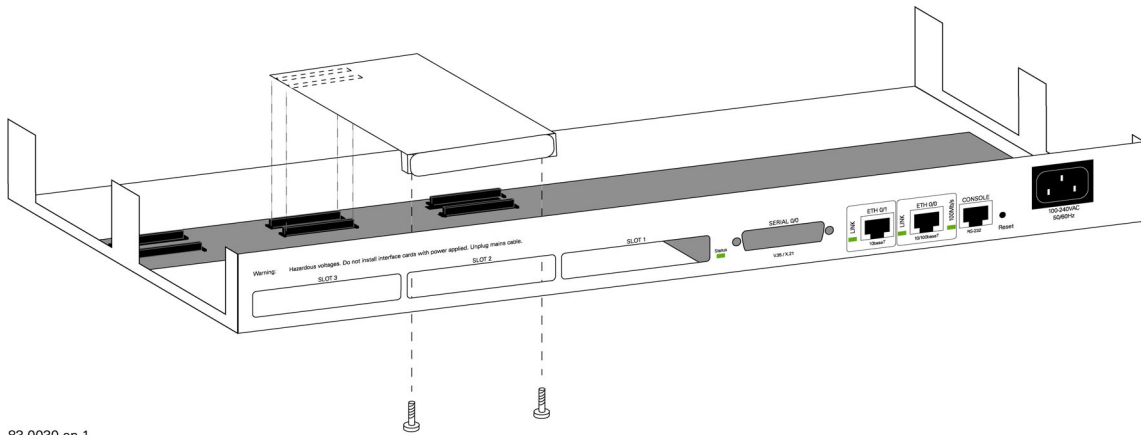
83-0030-en-1

Figure 8-1: Example Card Installation in SLOT 2

8.3   *Card Locating Screws*

Figure 8-2 shows part of the under side of the SN2300 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 interface card and can be seen in the IC-4BRV chapter.
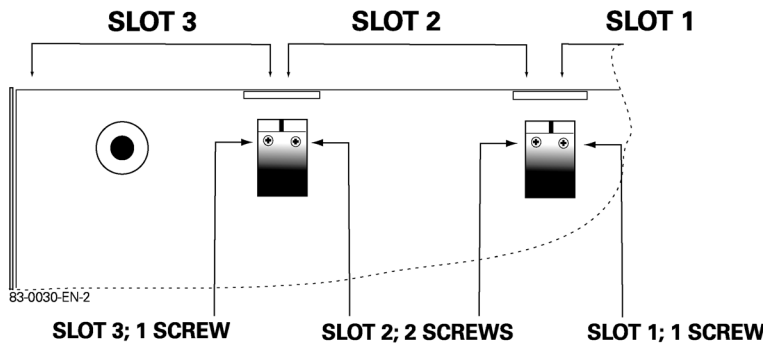
Figure 8-2: SN2300 Expansion Slots: Securing Screws for Interface Cards

9   LINE POWER MODULE INSTALLATION

This chapter tells you how to install an optional internal 48V (or 38V) Line Power Module in a SmartNode 2000 series device. It also describes the installation of the optional external S-Bus 40V power supply units.

9.1   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.

9.2   Internal PM-48V-int (or PM-38V-int) Line Power Module

9.2.1   Physical Specification
- Input 230VAC
- Output 48V (or 38V) DC 30W

9.2.2   Module Installation

The 48V Line Power Module is mounted inside the SN2300, closely adjacent to the existing 12V power supply. You should not move the 12V power supply module from its existing location. See Figure 9-1 below.
The SN2400 requires a 38V Line Power Module. The 38V Line Power Module for the SN2400 is mounted at the same location and in the same way as the 48V Line Power Module for the SN2300.

Warning: Do not install a 48V Line Power Module into the SN2400!

POWER SOCKET   REAR OF ALU - CHASSIS

EXISTING CONNECTION

MOTHER BOARD

POWER CABLE
For 48V Power
Supply

LOCATION OF PLASTIC
FOIL

48 V SOCKET   12 V SOCKET

SCREW MOUNTING

PLASTIC STUD MOUNT

EXISTING 12 v POWER SUPPLY

83-0123-en-1

48 V 4-STRAND CABLE

48 V POWER SUPPLY
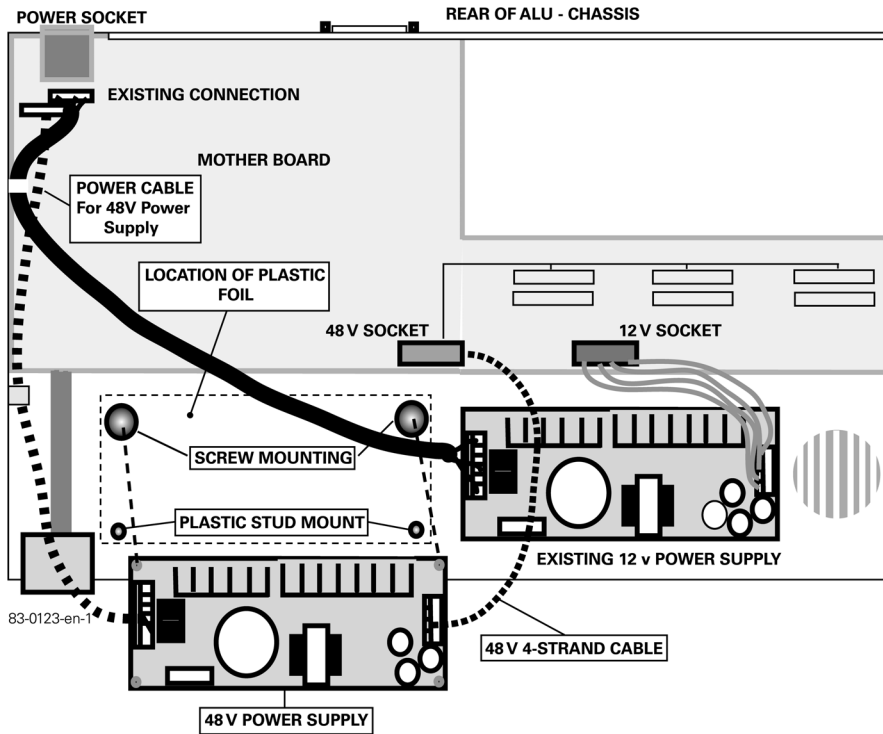
Figure 9-1: Internal 48V (or 38V) Line Power Module Location

Warning: the 12V and the 48V (or 38V) Line Power Modules are closely similar in appearance. The 48V (or 38V) module is labeled ZWS30-48 (or ZWS30-38) on the large electrolytic capacitor.

Warning: Connecting the 48V (or 38V) power supply to the 12V socket instead of the 48V/38V socket may result in permanent damage to the main board.

If you look at the exposed SN2x00 chassis, you will see the motherboard and the 12V power module that is already installed: see Figure 1. (The figures show the general arrangement of the chassis-mounted components only, with little or no component details. The IC-4BRV 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 (or 38V) Line Power Module: see Figure 9-1 and Figure 9-2.

83-0124-en-1
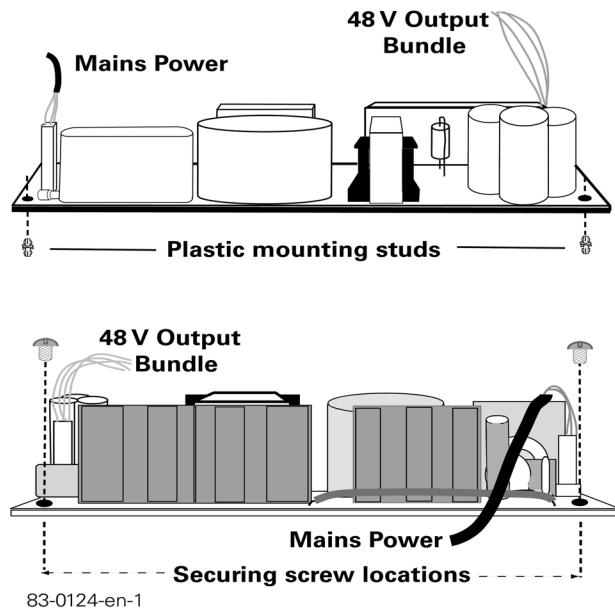
Figure 9-2: Fixing Points: Internal 48V (or 38V) Line Power Module

9.3   Mounting the Internal 48V (or 38V) Line Power Module

Follow the steps described in Table 9-1 below to mount a 48V (or 38V) internal Line Power Module.

Step	Description
Step 1	Remove the 48V (or 38V) Line Power Module from its packing. Check that the side of the largest electrolytic capacitor has the label ZWS30-48 (or ZWS30-38).
Step 2	Locate the plastic insulating foil over the four mounting holes in the SN2x00 chassis.
Step 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. Insert them from below. See the upper picture in Figure 9-2 above.
Step 4	Locate 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.
Step 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 9-2.
Step 6	First insert the white 4-lead 48V (or 38V) supply cable in the Line Power Module's socket. Then connect it to the 48V/38V socket on the motherboard. You can not insert the sockets the wrong way round. See Figure 9-2.
Step 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.

Table 9-1: Steps to Mount an Internal Line Power Module

9.4 Completing the Installation

Once you have installed the 48V (or 38V) Line Power Module and set the jumper pins you can conclude the final steps as described in Table 9-2.

Step	Description
Step 1	Install the IC-4BRV and/or IC-4FXS card in its expansion slot: see Chapter 8, "Interface Card Installation", of this document.
Step 2	Close the case and insert the mains power supply lead.
Step 3	Insert the network cables and observe the LED indications: see Chapter 11, "Led Indications". Test the correct functioning of the connections.

Table 9-2: Final Steps to Mount an Internal Line Power Module

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 below. Jumper settings are described in Chapter 5.9, "Line Power Jumper Settings".

9.5 External S-Bus Power Supply

Many ISDN telephone handsets require that 40VDC 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.

The SmartNode 1000 series does not supply S-Bus line power on the BRI ports. 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 trough to the other BRI port.

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

9.5.1 PM-BRI-ext S-Bus 40V Power Supply

Item: Phantom Power Supply; PM-BRI-ext

Part Number: 50-0003

Voltage Specifications: Input 230VAC, Output 40VDC

Caution: 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 Inalp Networks AG, 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.

9.5.2 Installation Options

SmartNode	Description
SmartNode 1200	In the absence of an NT the PM-BRI-ext may be connected directly to the BRI 0 port on the SmartNode. The terminals are connected to the BRI 1 port. See Figure 9-3.
SmartNode 1400	The PM-BRI-ext is connected to the S-Bus via an S-Bus Multi-socket. See Figure 9-4. This method can also be used on the SmartNode 1200.

9.5.3   SmartNode 1200

Warning: 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.

83-0153
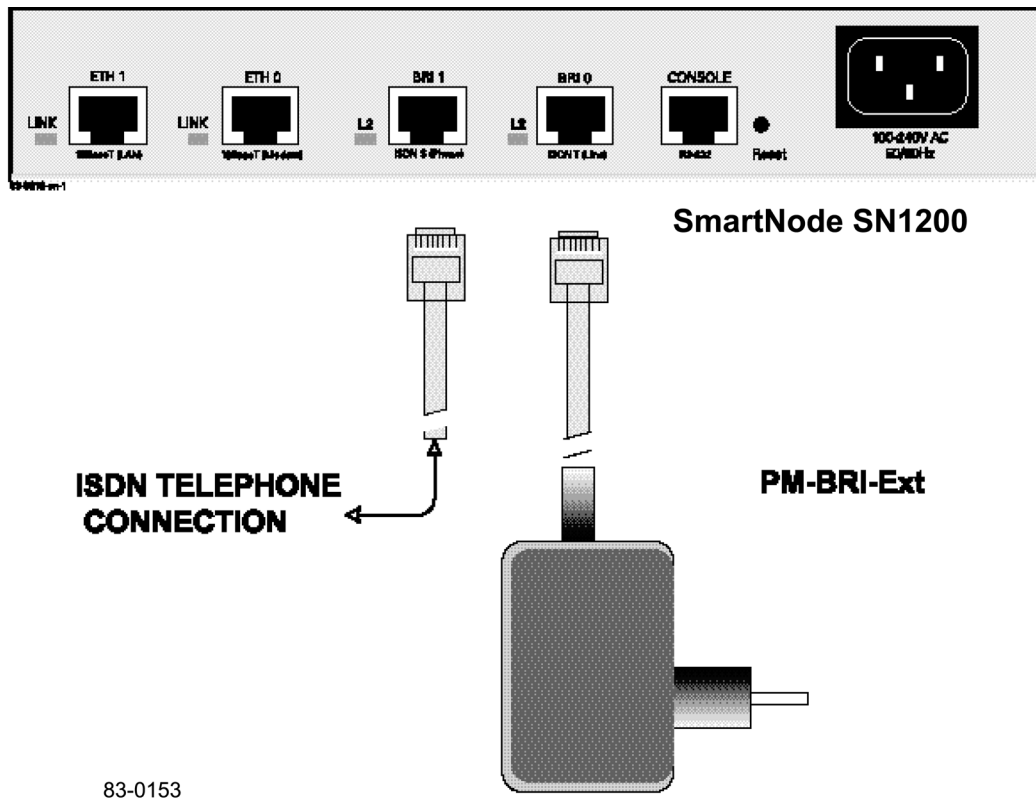
Figure 9-3: SN1200 External 40V Power Supply

9.6   SmartNode 1400

Connect the PM-BRI-ext directly on one S-Bus on port BRI 0 or BRI. Use a commercially available S-Bus 3-way multi-socket connector. The line power is fed through to the other BRI port. See Figure 9-4 for an example.
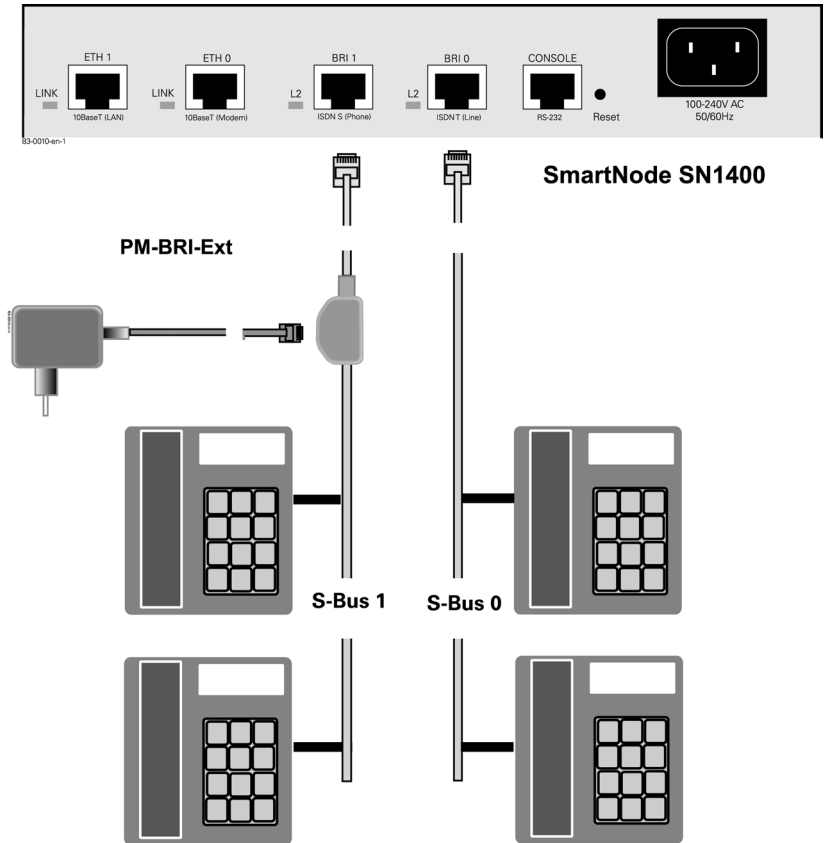
Figure 9-4: SN1400 External 40V Power Supply

Warning: Do not connect more than one phantom power supply on the BRI ports. Since line power is connected between BRI port 0 and 1, the power supplies may be damaged even if they are on separate ports.

Note: The BRI Port that has no external PSU connected is supplied with power internally through the SmartNode, from the BRI port that has the external PSU connected.

Warning: For this installation option do not use any other phantom power supply than the PM-BRI-ext supplied by Inalp Networks AG. 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.

Note: The appearance of the three-way multi-connector may differ from the one depicted, depending on the vendor that you have chosen.

10   SMARTNODE INSTALLATION

10.1   Introduction

This chapter will guide you through the initial site preparation and installation of your SmartNode 1000 and 2000 series. The chapter covers a variety of SmartNode models that are similar in functionality but which differ in the number of interfaces that are supported. Some of the information provided may not therefore apply to your particular SmartNode model.

The chapter includes the following sections:

- Target audience
- Overview
- Warnings
- SmartNode 1000 and 2000 Series Deployment
- Installation Checklist
- Planning Your Installation
- Interface Card Configuration
- Installing Line Power Module / S-Bus Power Supply
- Installing Interface Cards
- Installing SmartNode 1000 and 2000 Series
- Connecting Cables
- Performing Initial Configuration
- Where to Go Next

This Chapter is not meant to provide comprehensive configuration instructions. For detailed software configuration information refer to the companion documents Software Configuration Guide and Command Reference Guide.

10.2   Audience

The information is intended for the person installing the SmartNode. You should be familiar with electronic circuitry and wiring practices and have experience as an electronic or electromechanical technician.

Warning: Only trained and qualified personnel should be allowed to install or replace this equipment. Before you start to work on a chassis, to open a chassis or to work near power supplies, unplug the power cord of your SmartNode.

10.3   Overview

The SmartNode 1000 and 2000 series aggregate multiple channels of data and voice user-side traffic for transport over a singlewide area network (WAN) uplink. With one or more ISDN BRI or PRI interfaces the SmartNode 1000 (see Figure 10-1) and 2000 (see Figure 10-2) series can be connected to an ISDN PBX or to 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.

Voice is transported as Voice over Internet Protocol (VoIP) using the H.323 standards for sending and receiving audio and data or Inalp Networks' 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. For a detailed description of the built-in interfaces for the SmartNode 1000 and 2000 series refer to Chapters 1 through 3 of this manual.

Depending of the deployment scenario, optional interface cards are available for the expansion slots of SmartNode 2000 series. For a detailed description of the available interface cards for the SmartNode 2000 series refer to Chapters 4 and 5 of this manual.

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

10.4   System Model of the SmartNode 1000 and 2000 Series

The system model of Inalp SmartNodes is depicted in Figure 10-1 and Figure 10-2. The devices have three main components:

- ISDN switching, with two ISDN Base Rate Interfaces.
- 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 Inalp 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.
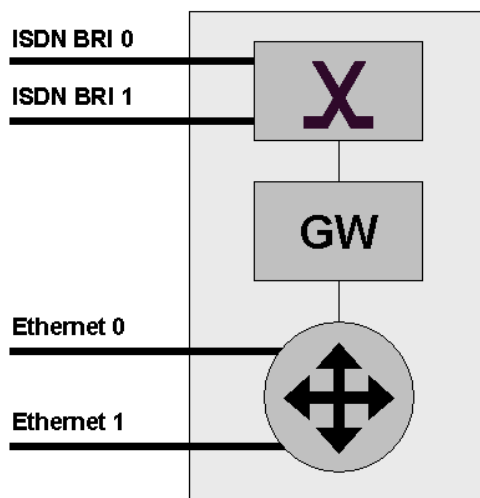
Figure 10-1: System Model, SmartNode 1000 Series
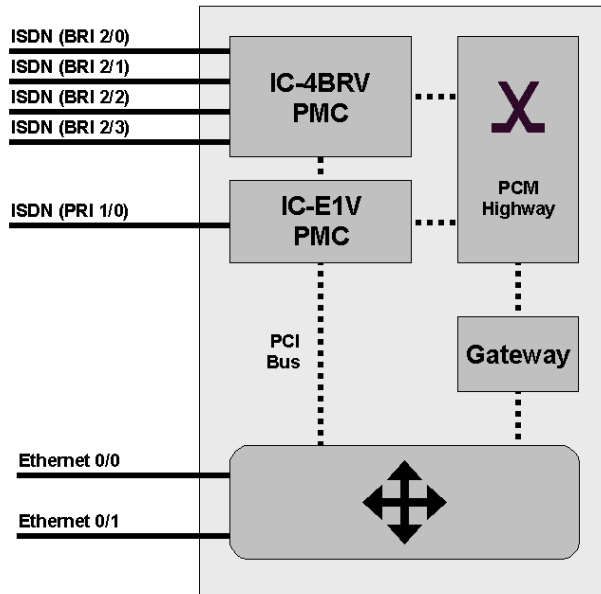
Figure 10-2: System Model, SmartNode 2000 Series

10.5   Voice Routing

Via its Gateway an Inalp 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.

10.6   SmartNode Deployment

10.6.1 Customer Premises Gateway; Multi-Service Providers

Figure 10-3 through Figure 10-5 show typical deployment scenarios for the SmartNode 1000 and 2000 series used as customer premises gateway supplied by a multi-service provider.

10.6.2 Small Office or Home Office (SOHO)

Figure 10-3 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.
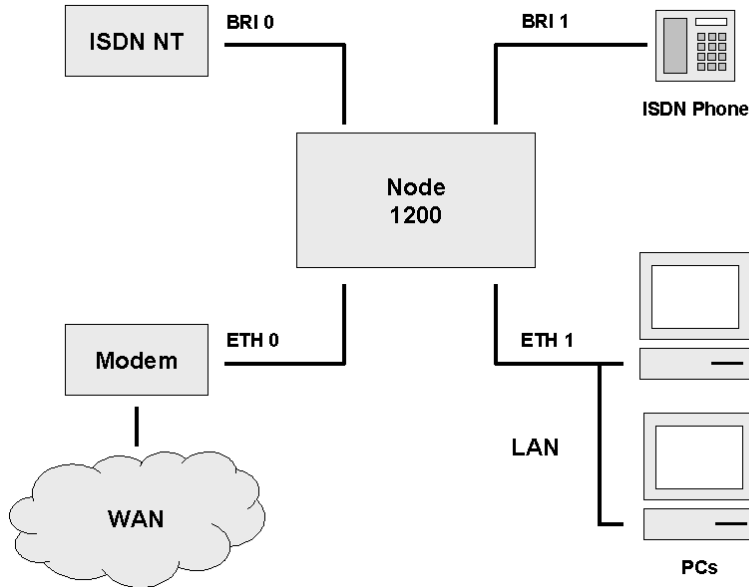
Figure 10-3: SmartNode 1200 with ISDN Phone and ISDN Fallback in a SOHO Environment

10.6.3 Small and Medium Enterprise (SME)

The SmartNode 1400 in Figure 10-4 is set up as a voice gateway and IP router in a 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.
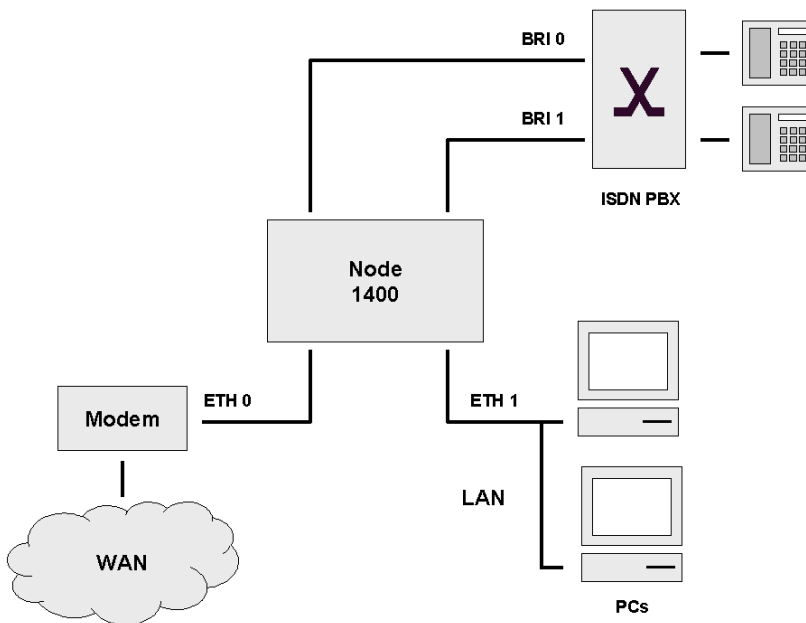
Figure 10-4: SmartNode 1400 attached to PBX via both ISDN BRIs in an SME Environment

Figure 10-5 depicts a SmartNode 2000 series used as a voice gateway and IP router in a 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.
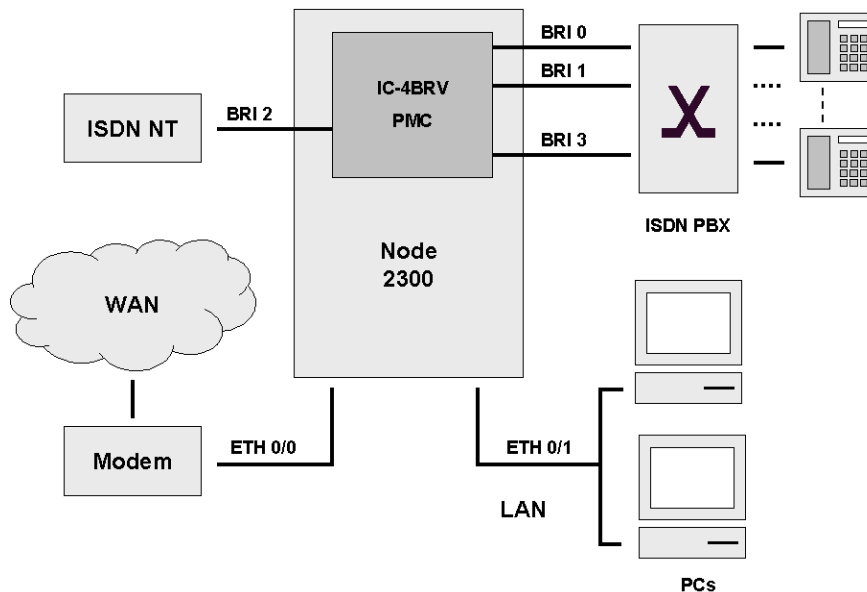
Figure 10-5: SmartNode 2000 Series Device connected to a PBX via three BRI Ports with Fallback to PSTN with one BRI in an SME Environment

10.7 Multi-Service Gateway/Router for Private Enterprise Networks

10.7.1 Company Branch Office

In Figure 10-6 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.

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.
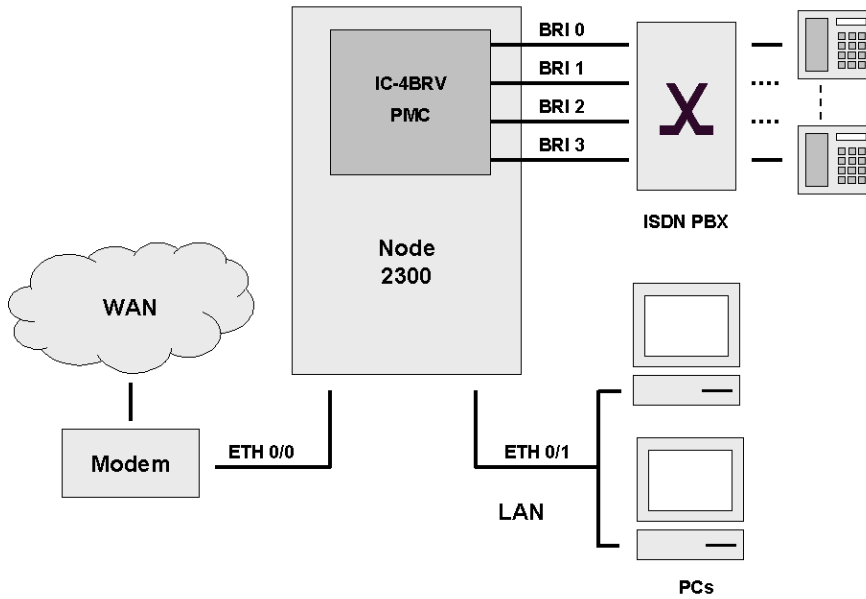
Figure 10-6: SmartNode 2000-Series Device connected to a PBX via Four BRI Ports

10.7.2 Company Headquarters

In Figure 10-7 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.

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.
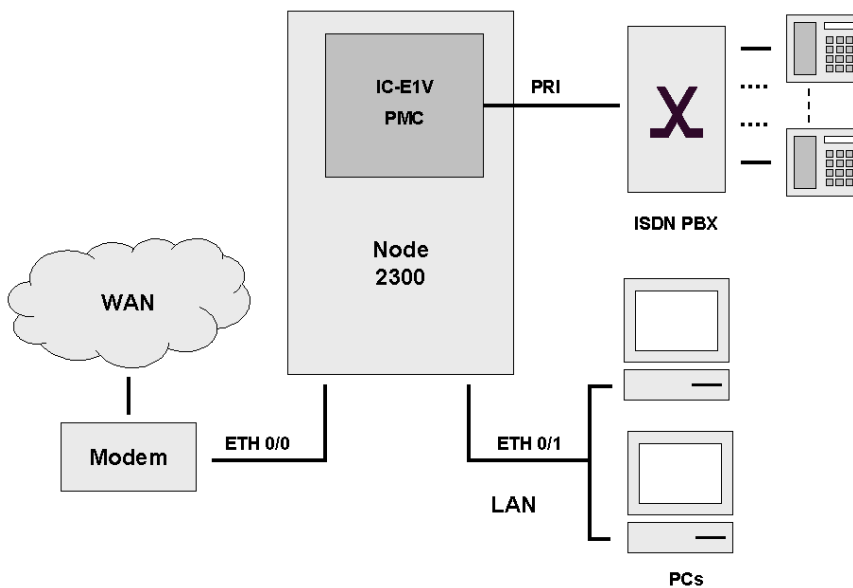
Figure 10-7: SmartNode 2000 Series Device connected to a PBX via one PRI (with IC-E1V Card) into an IP Network

10.7.3 IP Access to the WAN

In Figure 10-3 through Figure 10-7 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.

10.8   ISDN Gateway; LAN based PBX or Call Center Applications

10.8.1 LAN based Telephony Gateways (GW)

The SmartNode 1400 GW depicted in Figure 10-8 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 (see Figure 1) 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 vice versa. Note that hosts on the local LAN need to be connected to Ethernet port ETH 0 using a hub.
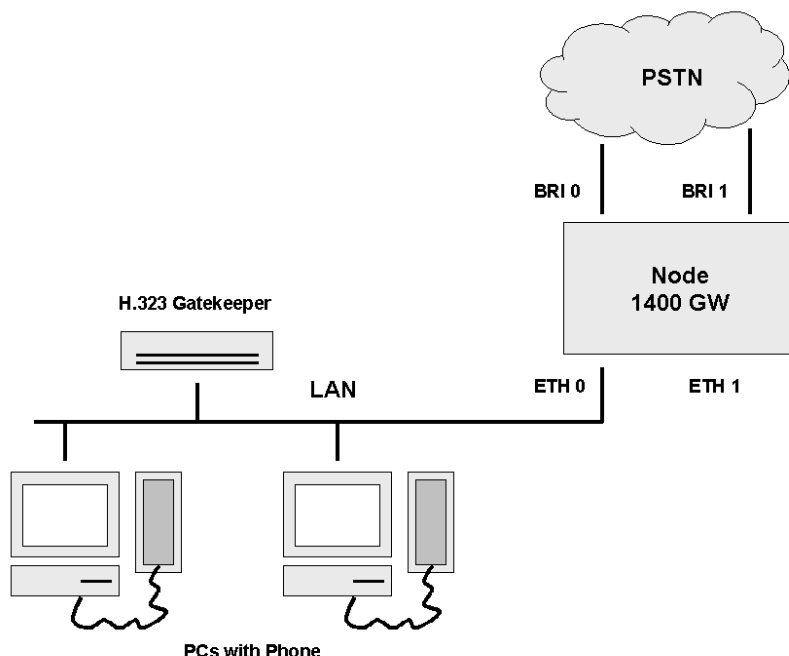
Figure 10-8: SmartNode 1400 GW used as LAN Voice Gateway with H.323 Software Clients on PCs and H.323 Gatekeeper

10.9   Planning Your Installation

Before you start the actual installation, it is strongly recommended that you gather all the information needed to install and setup the device. See Table 1 below 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.

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.

10.10 Installation Checklist

The Installation Checklist in Table 10-1 overleaf 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.

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		
[1]		

Table 10-1: Installation Checklist

10.11 Site Log

Inalp recommends you to 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 10-2.

---

[1] Blank row for your special requirements.

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

Table 10-2: Site Log Entries

10.12 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.

10.12.1 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 log.

10.12.2 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 up- and download

10.12.3 ISDN Related Information

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

- 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

10.12.4 Synchronous Serial Interface

The SmartNode 2300 supports both the V.35 and X.21 standard for synchronous serial interfaces, with speeds up to 2 MBit/s. 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 that a SmartNode 2300 is functioning 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.

10.12.5 Software Tools

Install a serial communication and Telnet application on your PC or workstation. You will use this link to configure the software on your SmartNode 1000 or 2000 series.

10.13 Power Source

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

10.13.1 Location and Mounting Requirements

There are three mounting possibilities for your SmartNode 1000 or 2000 series:

- Placed on a desktop
- Rack-mounted (SmartNode 2000 series only)
- Wall-mounted (SmartNode 1000 series only)

Choose the mounting method that is appropriate for your location and which offers best access to the cables.

10.13.2 Access to Chassis

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.

10.13.3 Interface Card Configuration

Before using an IC-4BRV interface card in your SmartNode 2000 series the interface card has to be configured according to the application scenario. Refer to Chapter 5 for a more detailed description of this procedure.

10.14 S-Bus Installation

10.14.1 General Notes on S-Bus Installation

When installing an ISDN S-bus and its 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 that 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 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 200 meters, but in practice 150 meters is the usual maximum.

10.14.2 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 150 meters. Note that SmartNode BRI interfaces are internally terminated at 100 Ohms.

10.14.3 SmartNode BRI Port Configured in NET mode

The SmartNode acts as NT1. The general S-Bus conditions apply, the maximum recommended bus length is 150 meters. Note that SmartNode BRI interfaces are internally terminated at 100 Ohms.

10.15 Installing an S-Bus Power Supply

If your SmartNode 2000 series needs to be equipped with an optional Line Power Module refer to Chapter 9 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 Chapter 5.

10.15.1 Installing Interface Cards

Follow the detailed installation description in Chapter 7 to install an optional interface card into your SmartNode 2000 series.

10.16 Site Installation of SmartNode 1000 or 2000 Series

During installation and wiring the SmartNode must be disconnected from the mains power supply. See the applicable instructions in the following sections.

10.17 Desktop Installation

The SmartNode can be placed on a desktop, shelf or other flat, hard and secure surface. Before placing the SmartNode attach one of the rubber pads included on an adhesive strip in each corner on the bottom of the SmartNode.

SmartNodes should be placed in a dry environment with sufficient space to allow air circulation for cooling. Leave at least 5 cm to the left, right, front and rear of the equipment. Multiple SmartNodes can be stacked on top of each other.

10.18 Rack-Mounting for SmartNode 2000 Series

The SN2x00 requires AC power 100 - 240V, 50/60Hz. Its power dissipation is 10W. The SN2400 alternatively offers a 48V (or 38V) DC power input.
It should be installed in an open rack wherever possible. If cabinet installation is unavoidable then ensure that the cabinet has adequate ventilation. SN2400 comes with a fan mounted in the right front corner in order to improve air circulation within the device.

Note: To prevent overheating we recommend that the SN2x00 is not installed in a closed rack or in a room that is not properly ventilated or air-conditioned.

Warning: Review the safety guidelines that are given in this document. Provide proper grounding to avoid damage from lightning or power surges. The SN2x00 is grounded via the mains and there is a ground connection between the mains connector, the chassis and the rack mounting brackets.

Install the rack mount brackets before you install the SN2x00 in the rack. When installing multiple SN2x00s in one rack you are recommended to leave one height unit (2.54 cm/1 inch) 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.

To mount a SN2x00 in a 19'' rack, you will need two angled mounting brackets. A bracket is shown in Figure 10-9. It is symmetrically 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.
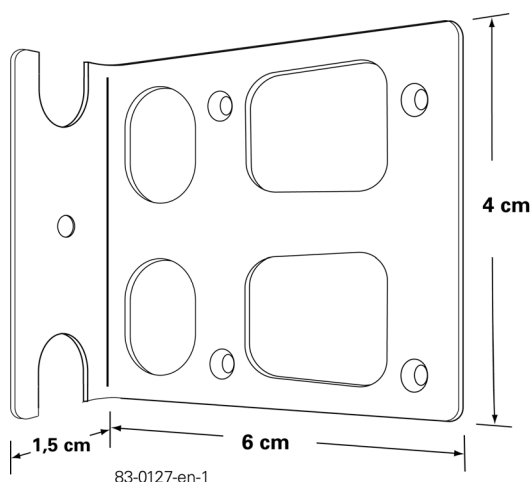
Figure 10-9: SmartNode 2000 Series Rack Mounting Bracket

One bracket is attached to each side of the SN2x00 with the four self-tapping screws provided. There are three mounting positions for the brackets, so choose the one that best suits your requirements. In Figure 10-10 you can see the four mounting holes (shown as black disks) and the three available positions. The flange can face to either the front or rear, as mentioned above.
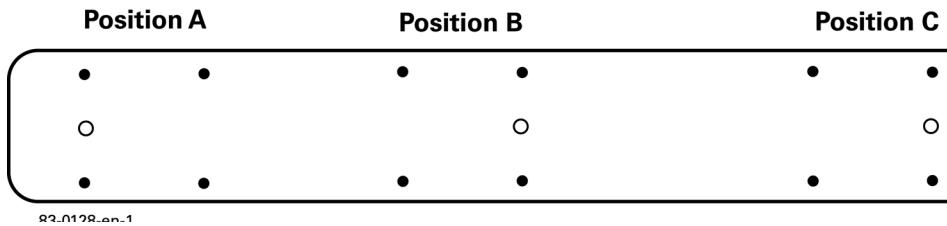
Figure 10-10: SmartNode 2000 Series Rack Mounting Bracket Location Holes

10.19 Wall-Mounting for SmartNode 1000 Series

As shown in Figure 10-11 a SmartNode 1000 Series may also be wall-mounted by suspending it from the two recesses on the underside that are situated nearest to the LED side of the SmartNode.
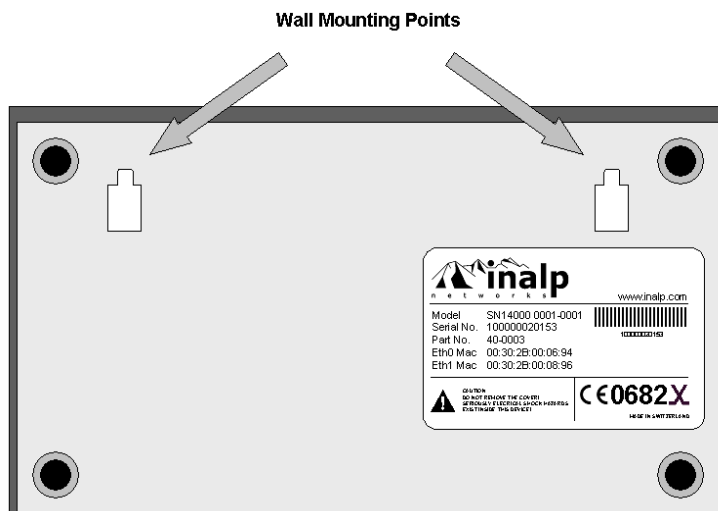
Figure 10-11: SmartNode 1000 Series Wall Hanging Points

10.20 Connecting Cables

Warning: Do not work on the SmartNode, or connect or disconnect cables during periods of lightning activity. Refer to the safety advice section in this document for more information.

10.20.1 Cables and Connections for SmartNodes

Cabling information and pin-out data are provided in Appendix A to this document.

10.21 Perform Initial Configuration

A summary of the procedures for the initial software installation of a SmartNode is provided in the Quick Start Guide that is provided with each type of SmartNode. These procedures are described in more detail in the SmartWare Software Configuration Guide.

The procedures for configuring the voice and data features are described in the companion document SmartWare Software Configuration Guide. Check that the document version is the one that matches your Software release and build number.

10.22 Where to Go Next

Additional documentation is available on the documentation CD-ROM or you can access the most current Inalp documentation on the World Wide Web at:

http://www.inalp.com

For detailed configuration information specific to the SmartNode 1000 or 2000 series refer to either the SmartWare *Software Configuration Guide* or the SmartWare *Command Reference Guide* as appropriate.

For additional specialized configuration procedures for advanced voice and data features, refer to the SmartWare *Configuration Notes* that are applicable for your Software Release.

11 LED INDICATIONS

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.

The indications provided by LED states are described in the table. The terms in (brackets) in the following list refer to the headings in the table overleaf.

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 11-1 below.

LED	Normal Boot	Normal Run	Boot Loader	Default Download	Error State
PWR/POWER	ON	ON	ON	ON	ON
RUN	ON-OFF[1]	ON	OFF	OFF	BLINKING[2]
ACT	ON-OFF[1]	BLINKING[3]	BLINKING[2]	ON	OFF
BRI x	ON-OFF[1]	ON[4]	BLINKING[2]	ON	OFF
ETH x[8]	ON-OFF[1]	BLINKING[5]	OFF	BLINKING[5]	OFF
LINK	OFF	ON[6]	OFF	ON[6]	OFF
L2	OFF	ON[6]	OFF	OFF	OFF
100Mbs	OFF	ON[7]	OFF	OFF	OFF
STATUS	not used	not used	not used	not used	not used

Table 11-1: SmartNode LED Indications

The superscript keys in Table 11-1 are explained in Table 11-2 on the next page.

Superscript	Meaning
1	1 sec ON, then OFF
2	500ms ON, 500ms OFF
3	Blinks according to CPU load
4	ON if one or more B-Channels are active on the BRI interface
5	Blinks according to IP activity
6	ON if correctly connected to an active ISDN device
7	ON if connected to a 100Mbs Ethernet device, OFF otherwise
8	BRI 1 and BRI 2 blink when interconnected (fallback) on interface card IC-4BRV

Table 11-2: Key to Superscript Numbers

APPENDIX A

This Appendix provides cable specifications and pin out data for the ports of the SmartNode family and the interface cards.

It consists of the following main sections:

- Connector types
- Port pin outs
- Cabling

Connector Types

RJ-45 / RJ-48 Connector
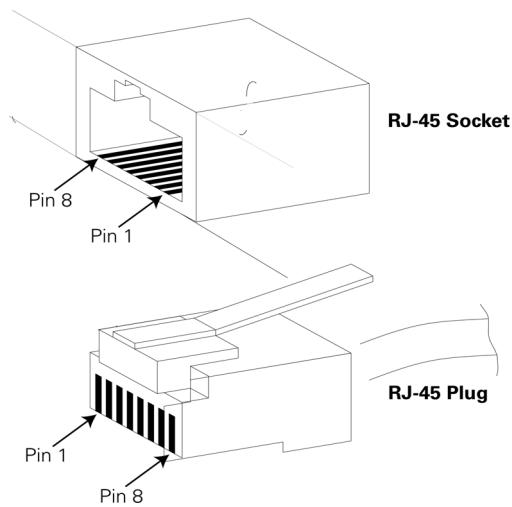
Figure 1: RJ-45 and RJ-48 Connector

RJ-12 Connector
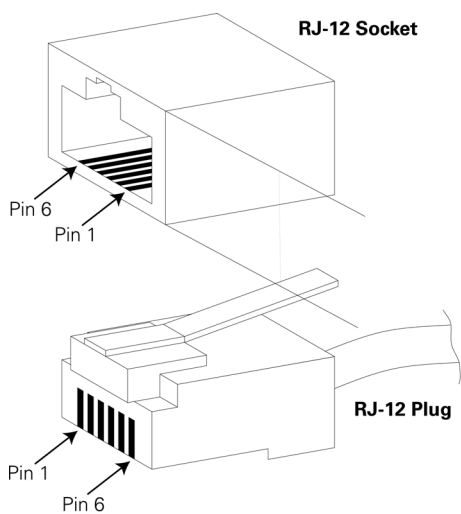
Figure 2: RJ-12 Connector

Port Pin Outs

This section provides pin out information for the ports of the SmartNode and its interface cards.

Console Port

Pin	Signal
3	TxD
4	GND
5	GND
6	RxD

Table 3: RJ-45 Socket

Note: Pins not listed are not used.

Ethernet 10BaseT and 100BaseT Port

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

Table 4: RJ-45 Socket

Note: Pins not listed are not used.

BRI Port

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

Table 5: RJ-45 Socket

Note: Pins not listed are not used.

FXS Port

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

Table 6: RJ-12 Socket

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.
Pins not listed are not used.

PRI Port

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

Table 7: RJ-45 Socket

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.

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

Table 8: Serial Port V.35 Signals

Note: Pins not listed are not used.

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

Table 9: Serial Port X.21 Signals

Note: Pins not listed are not used.

Cabling

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

The SmartNode can be connected to a serial terminal over its serial console port, as depicted in Figure 3.
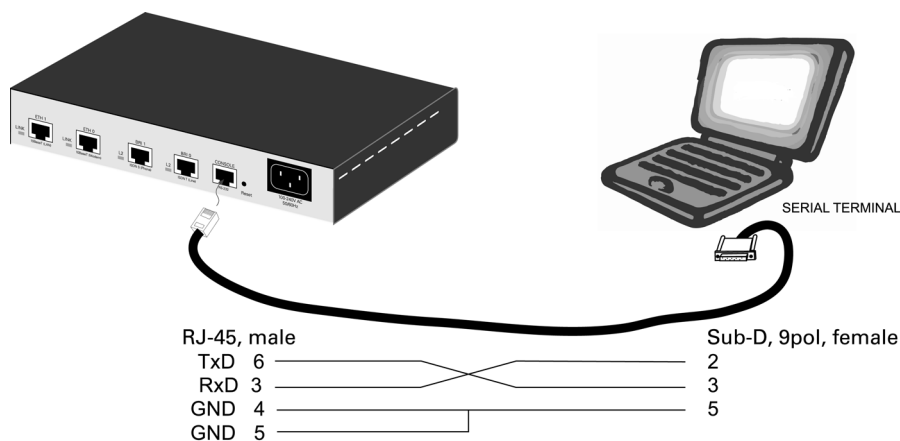
Figure 3: Connecting a Serial Terminal

Ethernet 10BaseT and 100BaseT

Ethernet devices (10BaseT / 100BaseT) are connected to the SmartNode o to an interface card over a cable with RJ-45 plugs. Use a crossover cable to a host, or a straight cable to a hub. See Figure 4 (host) and Figure 5 (hub) for the different connections.

Figure 4: Connecting a Host

Figure 5: Connecting a Hub

V.35 and X.21

Figure 6 on the following page 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).
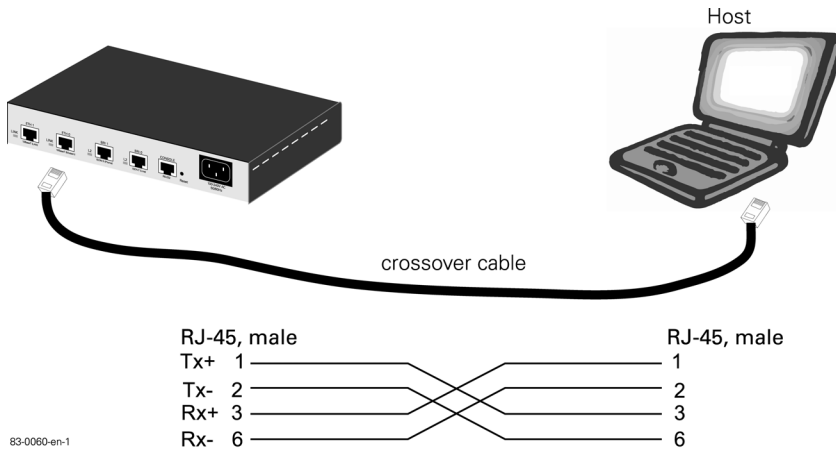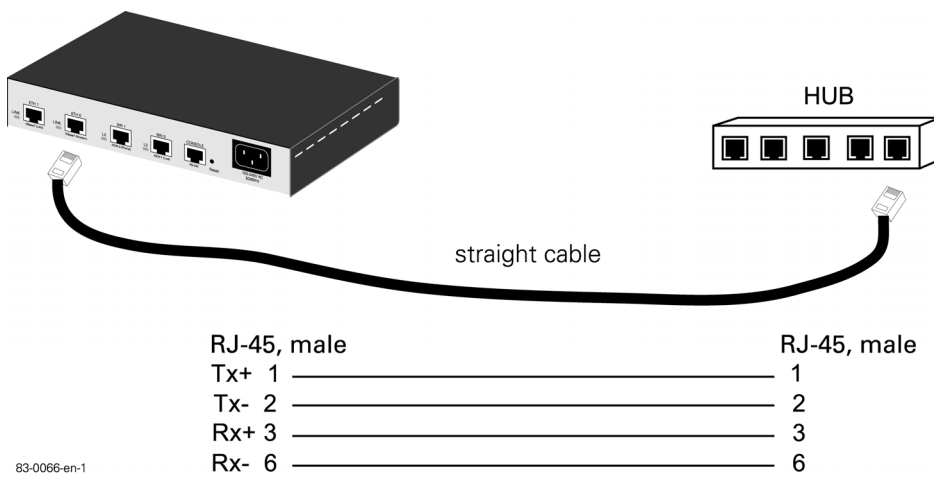
Note: Some NTUs have non-standard or mirrored connections and require special cables. Consult the NTU maker's product documentation.
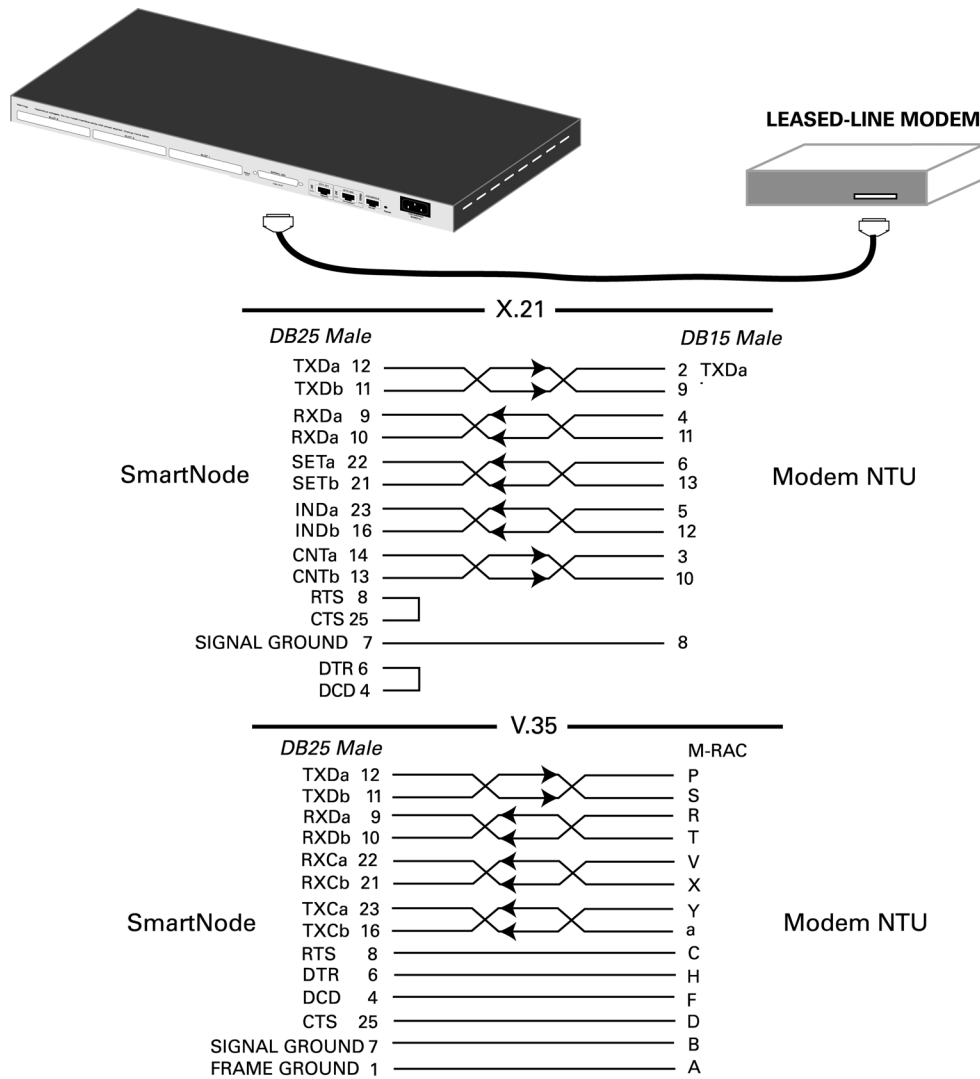
Figure 6: V.35 and X.21 Modem Connection

BRI

A straight S-Bus cable with RJ-45 plugs is used to connect an ISDN NT or TE to the SmartNode or interface card. See Figure 7 (telephone connection) and Figure 8 (NT connection) for the appropriate information. For BRI ports with configurable pin outs ensure that the appropriate mode (NET or USR) is configured.

Warning: Network hazardous 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.

S-Bus Cable

RJ-45 Male   *RJ-45 Male*
Rx+ 3 ─────────────────────────── 3
Tx+ 4 ─────────────────────────── 4
Tx- 5 ─────────────────────────── 5
Rx- 6 ─────────────────────────── 6
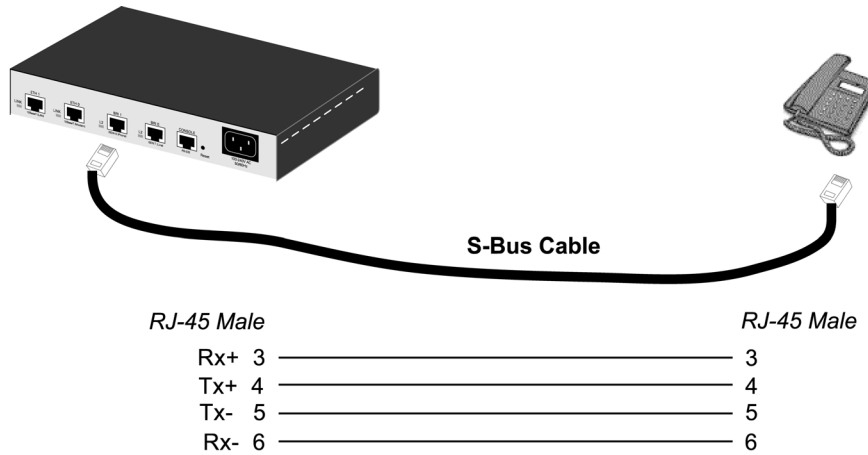
Figure 7: Connecting a BRI to an ISDN Telephone

NT

S-Bus Cable

RJ-45 Male   *RJ-45 Male*
Tx+ 3 ─────────────────────────── 3
Rx+ 4 ─────────────────────────── 4
Rx- 5 ─────────────────────────── 5
Tx- 6 ─────────────────────────── 6
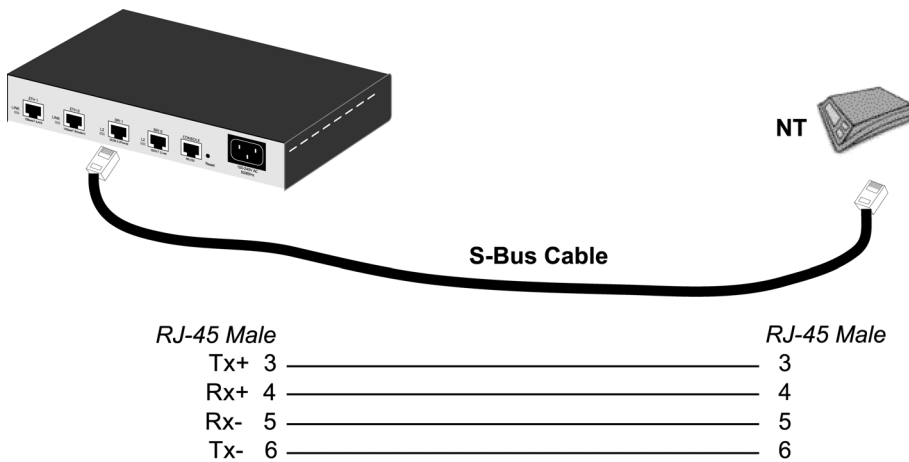
83-0067-en-1

Figure 8: Connecting a BRI to an NT

PRI

The PRI is usually connected to a PBX or switch (LE). Type and pin outs of these devices vary depending on the manufacturer. In most cases, a straight RJ-45 to RJ-45 can be used to connect the PRI with a PBX. A crossover cable is required to connect to a NT1, as illustrated in Figure 9.

Warning: Network hazardous 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 only to the PRI Port and not to any other RJ-45 Socket.
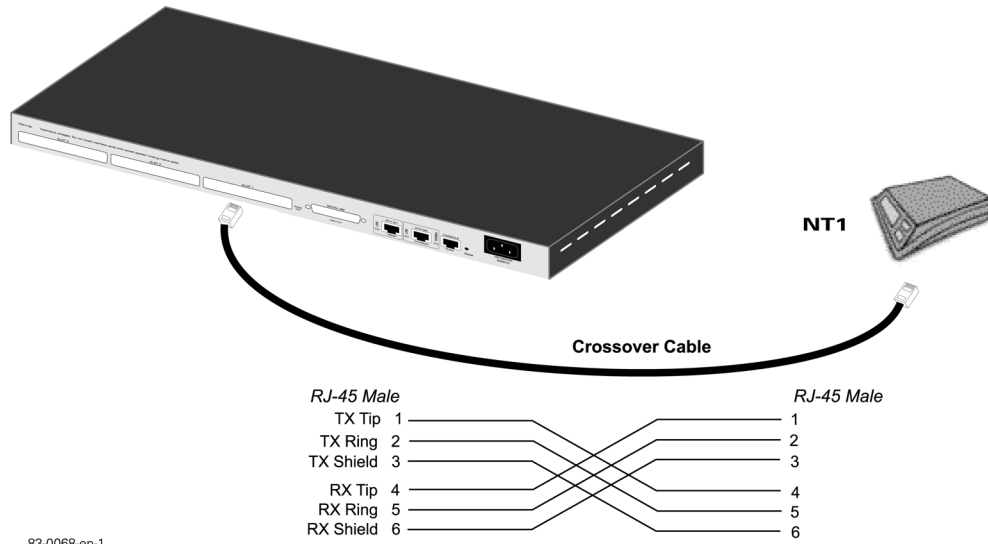
Figure 9: Connecting a PRI Port to an NT1

APPENDIX B

Internetworking Terms and Acronyms

Abbreviation	Meaning
Numeric	
10BaseT	Ethernet Physical Medium
A	
AAL	ATM Adaptive Layer
ABR	Available Bit Rate
AC	Alternating Current
AOC	Advice of Charge
ATM	Asynchronous Transfer Mode
audio 3.1	ISDN Audio Service up to 3.1 kHz
audio 7.2	ISDN Audio Service up to 7.2 kHz
B	
BRA	Basic Rate Access
BRI	Basic Rate Interface
C	
CAC	Carrier Access Code
CBR	Constant Bit Rate
CFP	Call Forwarding Procedure
CD ROM	Compact Disc Read Only Memory
CDR	Call Detail Record
CLEC	Competitive Local Exchange Carriers
CLI	Command Line Interface
CLIP	Calling Line Identification Presentation
CO	Central Office
CPE	Customer Premises Equipment
CPU	Central Processor Unit
CRC32	32 bit Cyclic Redundancy Check
D	
DC	Direct Current
DDI	Direct Dialing In number
DHCP	Dynamic Host Configuration Protocol

Abbreviation	Meaning
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer
DSP	Digital Signal Processor
DTMF	Dual Tone Multi-frequency
E	
E1	Transmission Standard at 2.048 Mb/s
E-DSS1	ETSI Euro ISDN Standard
EFS	Embedded File System
ET	Exchange Termination
ETH	Ethernet
F	
FAQ	Frequently Asked Questions
FCC	Federal Communication Commission
FR	Frame Relay
FXO	Foreign Exchange Office
FXS	Foreign Exchange Station (also called 'Subscriber')
G	
G.711	ITU-T Voice encoding standard
G.723	ITU-T Voice compression standard
GUI	Graphic User Interface
GW	Gateway
H	
H.323	ITU-T Voice over IP Standard
HFC	Hybrid Fiber Coax
HTTP	HyperText Transport Protocol
HW	HardWare
I	
ICMP	Internet Control Message Protocol
IAD	Integrated Access Device
ILEC	Incumbent Local Exchange Carriers
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISDN NT	ISDN Network Termination
ISDN S	ISDN S(ubscriber Line) Interface

Abbreviation	Meaning
ISDN T	ISDN T(runk Line) Interface
ISDN TE	ISDN Network Terminal Mode
ISoIP	ISDN over Internet Protocol
ITC	Information Transfer Bearer Capability
L	
L2TP	Layer Two Tunneling Protocol
LAN	Local Area Network
LCR	Least Cost Routing
LDAP	Lightweight Directory Access Protocol
LED	Light Emitting Diode
LE	Local Exchange
LT	Line Termination
M	
MGCP	Media Gateway Control Protocol
MIB II	Management Information Base II
Modem	Modulator – Demodulator
MSN	Multiple Subscriber Number
N	
NAPT	Network Address Port Translation
NAT	Network Address Translation
NIC	Network Interface Card
NMS	Network Management System
NT	Network Termination
NT1	Network Termination 1
NT2	Network Termination 2
NT2ab	Network Termination with 2a/b Connections
NTU	Network Termination Unit
O	
OEM	Original Equipment Manufacturer
OSF	Open Software Foundation
OSPF	Open Shortest Path First
P	
PBR	Policy Based Routing (principles)
PBX	Private Branch Exchange

Abbreviation	Meaning
PC	Personal Computer
PMC	Production Technology Management Committee
POP	Point of Presence
POTS	Plain Old Telephony Service
PRA	Primary Rate Access
PRI	Primary Rate Interface
PSTN	Public Switched Telephone Network
pt-mpt	point-to-multi point
pt-pt	point-to-point
PVC	Permanent Virtual Circuit
pwd	Password
PWR	Power
Q	
QoS	Quality of Service
R	
RIPv1	Routing Information Protocol Version 1
RIPv2	Routing Information Protocol Version 2
RJ-45	Western Connector Type
RTM	Route Table Manager
RTP	Real-time Protocol
S	
S1	SN-connection for Trunk Line
S2	SN-connection for Subscriber Line
SAR	Segmentation and Reassembly
S-Bus	Subscriber Line (Connection) Bus
SCN	Switched Circuit Network
SDSL	Symmetric Digital Subscriber Line
SGCP	Simple Gateway Control Protocol
SME	Small and Medium Enterprises
SmW	SmartWare
SN	SmartNode
SNMP	Simple Network Management Protocol
SOHO	Small Office Home Office
SONET	Synchronous Optical Network

Abbreviation	Meaning
SS7	Signaling System No. 7
STM	SDH Transmission at 155 Mb/s
SVC	Switched Virtual Circuit
SW	SoftWare
T	
TCP/IP	Transport Control Protocol / Internet Protocol
TE	Terminal Equipment
TFTP	Trivial File Transfer Protocol
U	
UBR	Unspecified Bit Rate
UD 64	Unrestricted Data 64 kb/s
UDP	User Datagram Protocol
V	
VBR	Variable Bit Rate
VCI	Virtual Channel Identifier
VoIP	Voice over Internet Protocol
VPI	Virtual Path Identifier
W	
WAN	Wide Area Network