SmartNode 5541 and 4141 Series
VoIP Gateway and eSBC

User Manual

Important
This is a Class A device and is intended for use in a light industrial environment. It is not intended nor approved for use in an industrial or residential environment.

Sales Office: **+1 (301) 975-1000**
Technical Support: **+1 (301) 975-1007**
E-mail: **support@patton.com**
WWW: **www.patton.com**

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Patton Electronics Company, Inc.
7622 Rickenbacker Drive
Gaithersburg, MD 20879 USA
tel: +1 (301) 975-1000
fax: +1 (301) 869-9293
support: +1 (301) 975-1007
web: www.patton.com
e-mail: support@patton.com

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Patton Electronics warrants all SmartNode router components to be free from defects, and will—at our option—repair or replace the product should it fail within one year from the first date of the shipment.

This warranty is limited to defects in workmanship or materials, and does not cover customer damage, abuse or unauthorized modification. If the product fails to perform as warranted, your sole recourse shall be repair or replacement as described above. Under no condition shall **Patton Electronics** be liable for any damages incurred by the use of this product. These damages include, but are not limited to, the following: lost profits, lost savings and incidental or consequential damages arising from the use of or inability to use this product. **Patton Electronics** specifically disclaims all other warranties, expressed or implied, and the installation or use of this product shall be deemed an acceptance of these terms by the user.

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About this guide

This guide describes the SmartNode 5541 and 4141 Series hardware, installation and basic configuration. For detailed software configuration information refer to the *Trinity Command Line Reference Guide* and the available Configuration Notes.

Audience

This guide is intended for the following users:

- Operators
- Installers
- Maintenance technicians

Structure

This guide contains the following chapters and appendices:

- Chapter 1, starting on page 13, provides information about router features and capabilities
- Chapter 2, starting on page 23, contains an overview describing router operation and applications
- Chapter 3, starting on page 26, provides SmartNode device installation procedures
- Chapter 4, starting on page 33, leads you through the steps to set up a new SmartNode device and download a configuration
- Chapter 5, starting on page 40, contains information on contacting Patton technical support for assistance
- Appendix A, starting on page 43, provides compliance info for the SmartNode devices
- Appendix B, starting on page 45, contains specifications for the routers
- Appendix C, starting on page 49, provides cable recommendations
- Appendix D, starting on page 52, describes the router's ports and pin-outs
- Appendix E, starting on page 55, describes how to obtain factory configuration settings for the SmartNode device
- Appendix F, starting on page 57, provides the End User License Agreement

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

Precautions

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

Note Calls attention to important information.

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

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

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

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

Safety when working with electricity

The SmartNode device contains no user serviceable parts, and is not be opened by the user. The equipment shall be returned to Patton Electronics for repairs or repaired by qualified service personnel.

Mains Voltage: In systems without a power switch, line voltages are present in the power supply when the power cord is connected. The mains outlet used to power the SmartNode device shall be within 10 feet (3 meters) of the device, be easily accessible, and protected by a circuit breaker.

For AC powered units, ensure that the power cable used meets all applicable standards for the country in which it is to be installed, and that it is connected to a wall outlet which has earth ground.

For units with an external power adapter, the adapter shall be a listed Limited Power Source.

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 the cables, detach the end away from the SmartNode first.

Before handling the device, disconnect the telephone network cables to avoid contact with telephone line voltages. When detaching the cables, detach the end away from the SmartNode device first.

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

Deutsch

Warnhinweise:

Dieses Gerät ist NICHT für den Anschluss an das Telefonnetz (PSTN) bestimmt und auch NICHT dafür zugelassen. Es ist nur für den Anschluss an Endgeräte beim Kunden vorgesehen.

- Das Gerät entält keine austauschbaren Komponenten und ist vom Benutzer nicht zu öffnen. Bei Systemen ohne Netzschalter und ohne externes Netzteil liegt Netzspannung im Gerät an, wenn das Netzkabel angeschlossen ist.
- Bei Geräten mit externem Netzteil muss das Netzteil die Anforderungen an eine zugelassene Stromquelle mit begrenzter Leistung erfüllen. Die Steckdose, die für die Stromversorgung des Gerätes verwendet wird, sollte höchstens 3 Meter vom Gerät entfernt und leicht zugänglich sein sowie durch einen den örtlichen regulatorischen Anforderungen entsprechenden Schutzschalter abgesichert sein.
- Für mit Wechselstrom betriebene Geräte muss sichergestellt sein, dass das verwendete Netzkabel alle gültigen Normen des Landes erfüllt, in dem es eingesetzt werden soll.
- Für mit Wechselstrom betriebene Geräte, die 3-polige Netzstecker haben (L1, L2 u. GND oder Phase, Neutralleiter u. Schutzleiter), muss die Steckdose geerdet sein.
- Für mit Gleichstrom betriebene Geräte muss sichergestellt sein, dass die Verbindungskabel für Spannung, Strom, erwartete Temperatur, Entflammbarkeit und mechanische Wartbarkeit geeignet sind.
- WAN-, LAN- u. PSTN-Ports (Anschlüsse) können unter gefährlicher Spannung stehen, unabhängig davon, ob das Gerät ein- oder ausgeschaltet ist. PSTN bezieht sich auf Schnittstellen wie Telefon, FXS, FXO, DSL, xDSL, T1, E1, ISDN, Voice, usw. Diese sind als „gefährliche Netzwerkspannungen“ bekannt. Um einen elektrischen Schlag zu vermeiden, muss in der Nähe dieser Anschlüsse mit Vorsicht gearbeitet werden. Werden Kabel von diesen Anschlüssen getrennt, zuerst das Kabel am anderen Ende herausziehen.
- Während eines Gewitters darf nicht am Gerät gearbeitet werden und es dürfen keine Kabel angeschlossen oder vom Netz getrennt werden.

In Übereinstimmung mit den Anforderungen der Richtlinie 2002/96/EG über Elektro- und Elektronik-Altgeräte (WEEE) muss sichergestellt sein, dass Altgeräte von anderem Abfall und Schrott getrennt werden und dem Sammel- und Verwertungssystem für Elektro- und Elektronik-Altgeräte in Ihrem Land zum Recycling zugeführt werden.

General observations

Do not stack multiple SmartNode devices directly on top of one another, and do not place items on top of the device. If you will be installing equipment above the SmartNode device, leave at least 2 inches (5 cm) of clearance between the devices.

Furthermore, leave at least 2 inches (5 cm) to the left, right, front, and rear of the SmartNode device for proper ventilation.

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

- Clean the case with a soft slightly moist anti-static cloth
- Place the unit on a flat surface and ensure free air circulation
- Avoid exposing the unit to direct sunlight and other heat sources
- Protect the unit from moisture, vapors, and aggressive liquids

Typographical conventions used in this document

Procedures described in this manual use the following text conventions:

Table 1. General conventions

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

Chapter 1 General information

Chapter contents

SmartNode devices overview

SmartNode 5541 Enterprise Session Border Controllers (eSBCs) and 4141 VoIP Gateways (see figure 1) combine IP routing, VoIP security and quality of service (QoS) for up to 8 voice and FAX calls over any IP. Leverage low-cost IP services with packet-voice for complete branch office voice and data connectivity or for legacy equipment integration into All-IP environments.

Figure 1. SmartNode 5541 and 4141

The SmartNode 5541 eSBC and 4141 VoIP Gateway are equipped with 2, 4 or 8 FXS interfaces, and provide the following major functions:

- Analog telephony to voice over IP (SIP) conversion for 2, 4 or 8 analog phone ports (FXS)
- Fax T.38 and G711 bypass support
- Modem bypass support
- Optional PacketSmart
- One Ethernet port
- Stateful Firewall
- QoS

In addition, the eSBC supports:

- Second Ethernet port
- USB port
- IP routing including GRE, BGP, VPN[1]
- SIP TLS/SRTP included
- SIP Registrar included

Section "SmartNode 5541 Series eSBC" on page 15 provides more information on the device. Section "SmartNode 4141 Series VoIP Gateway" on page 19 describes the SmartNode 4141 Series.

1. Optional license required at additional charge

SmartNode 5541 Series eSBC

The SmartNode 5541 eSBC Series are compact Enterprise Session Border Controllers that support 2 up to 8 voice calls (FXS–VoIP and versa) depending on the model (see figure 2) and up to 256 SIP-to-SIP calls (non-transcoded). By default there are 4 SIP to SIP calls enabled. Additional calls can be enabled by loading SNSW-1B licenses (additional charge).

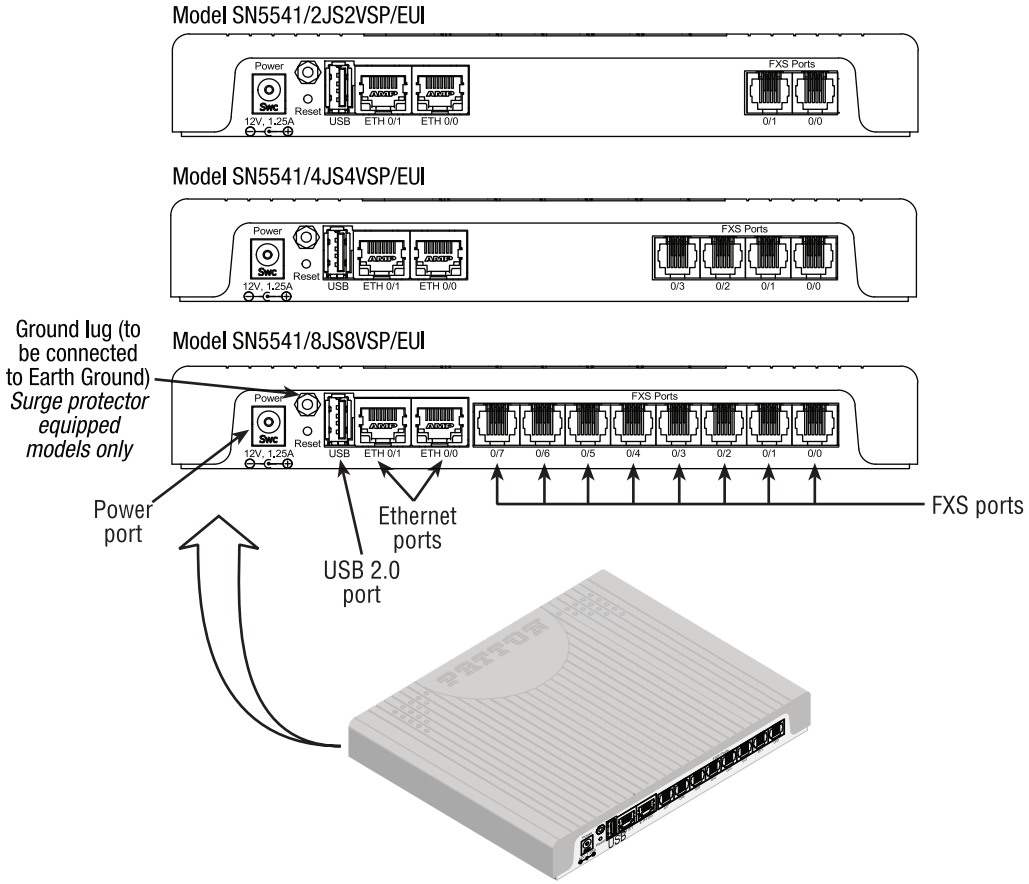

Figure 2. Examples of SN5541 Series rear panels

The following models (each equipped with two 10/100/1000Base-T Ethernet ports) are available:

- SN5541/2JS2V/EUI (2 voice calls)
- SN5541/2JS2VSP/EUI (2 voice calls)[1]
- SN5541/4JS4V/EUI (4 voice calls)
- SN5541/4JS4VSP/EUI (4 voice calls)[1]
- SN5541/8JS8V/EUI (8 voice calls)
- SN5541/8JS8VSP/EUI (8 voice calls)[1]

1. Available upon request.

On the products the following model code conventions apply:

- *JS* stands for FXS ports
- *V* stands for number of voice channels
- *SP* stands for surge protection (K.21 compliant)[1]
- *EUI* stands for external universal input power supply

Note For a complete listing of available models, refer to the SmartNode VoIP page at https://www.patton.com/products/voip-comparison.asp

Port descriptions

The SmartNode 5541 Series rear panel ports are described in table 2.

Table 2. Rear panel ports

Port	Location	Description
10/100/100 Ethernet ETH 0/0 & ETH 0/1	Rear panel	RJ-45 connectors that connect the SmartNode device to an Ethernet device (e.g., a cable or DSL modem, LAN hub or switch).
Analog voice port, FXS	Rear panel	FXS RJ-11(6 position, 4 wire) connectors that connect the device with an analog terminal (a telephone, for example). FXS on-hook voltage is 48V for each FXS port.
Power	Rear panel	The SmartNode device requires 12 VDC, 1.25 A power for operation. Every SmartNode device comes with an external power supply converting from AC to DC power (100–240 VAC, 50/60 Hz).
USB 2.0	Rear panel	USB 2.0 host port used to connect a USB 3G/4G cellular modem. A list of supported USB models can be found here Certified USB Modems

Reset button behavior

For those SmartNode devices that have a *Reset* button on the rear panel, its behavior is as follows:

- To restart the unit with the current startup configuration—Press for less than 1 second and release the *Reset* button. The SmartNode will restart with the current startup configuration.
- To restart the unit with factory default configuration—Press the *Reset* button for 5 seconds until the Power LED starts blinking. The unit will restart with factory default configuration.
- To restart the unit in bootloader mode (to be used only by trained SmartNode technicians)—Start with the unit powered off. Press and hold the *Reset* button while applying power to the unit. Release the *Reset* button when the *Power* LED starts blinking so the unit will enter bootloader mode.

Furthermore the *Reset* button may be used to perform a system software image switch as follows:

1. Hold the *Reset* button during boot. The power LED flashes quickly for 2 seconds, during which time the *Reset* button must remain pressed The power LED will begin a blink pattern (described in table 3 on page 17).

2. Pressing the *Reset* button will change the blink pattern. 10 seconds after the last *Reset* button press, an action will be performed based on the selected pattern

Table 3. Power LED blink patterns

Pattern	Action
1 blink, pause	Boot normally
2 blinks, pause	Switch to backup image, then boot (Boot normally if the device only has a single image)
3 blinks, pause	Erase all configuration and licenses, then boot

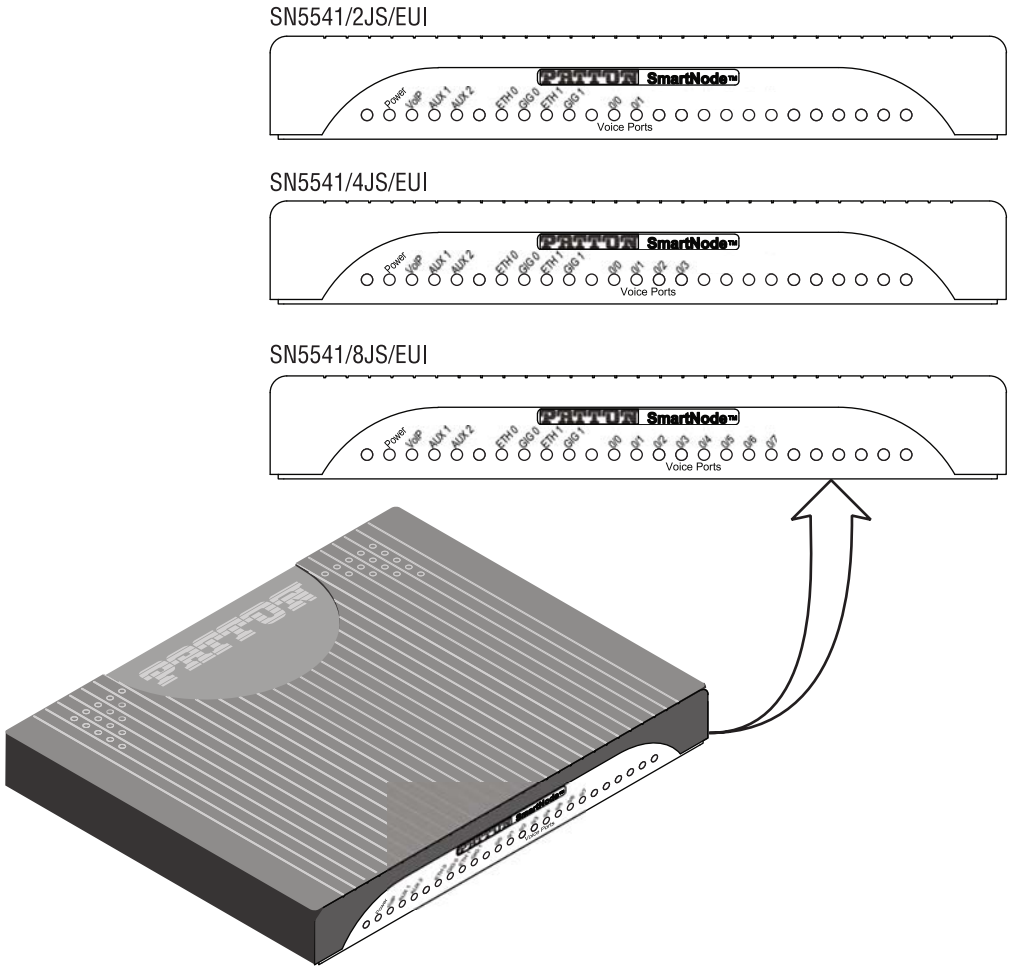

Figure 3. SmartNode SN5541 Series front panels

Front panel LED definitions

Figure 3 shows SmartNode 4141 LEDs; the LED definitions are listed in table 4 on page 18.

Note If an error occurs, all LEDs will flash for *more* than 5 seconds before the device reboots.

Table 4. SmartNode 5541 LED Definitions

LED	Description
Power	When lit, indicates power is applied. Blinks fast during bootloader phase and blinks slow during the boot process . Becomes solid when the system is up and running.
VoIP	• When lit, indicates the SmartNode device is registered to a SIP server, or a SIP device has registered to the SmartNode device. • Off indicates the unit is not configured or registered, or has no active directly routed VoIP connection.
AUX 1 & AUX 2	• Auxiliary LEDs for future use.
Voice Ports 0/0 to 0/7 (number of ports depending on model)	• When lit, indicates FXS port is enabled. Flashes when there are ongoing or ringing calls. • Off when no line or phone is connected or the port is shut down.
ETH 0 & ETH 1	• When lit, indicates the Ethernet connection on the corresponding port has a link indication. • Flashes when data is received or transmitted at the corresponding Ethernet port.
GIG 0 & GIG 1	• When lit, indicates Ethernet is connected to a 1000Mb network. • Off when Ethernet is connected to a 10Mb or 100Mb network or not connected.

SmartNode 4141 Series VoIP Gateway

The SmartNode 4141 Series are compact VoIP Gateways that support 2 to 8 VoIP calls (see figure 4).

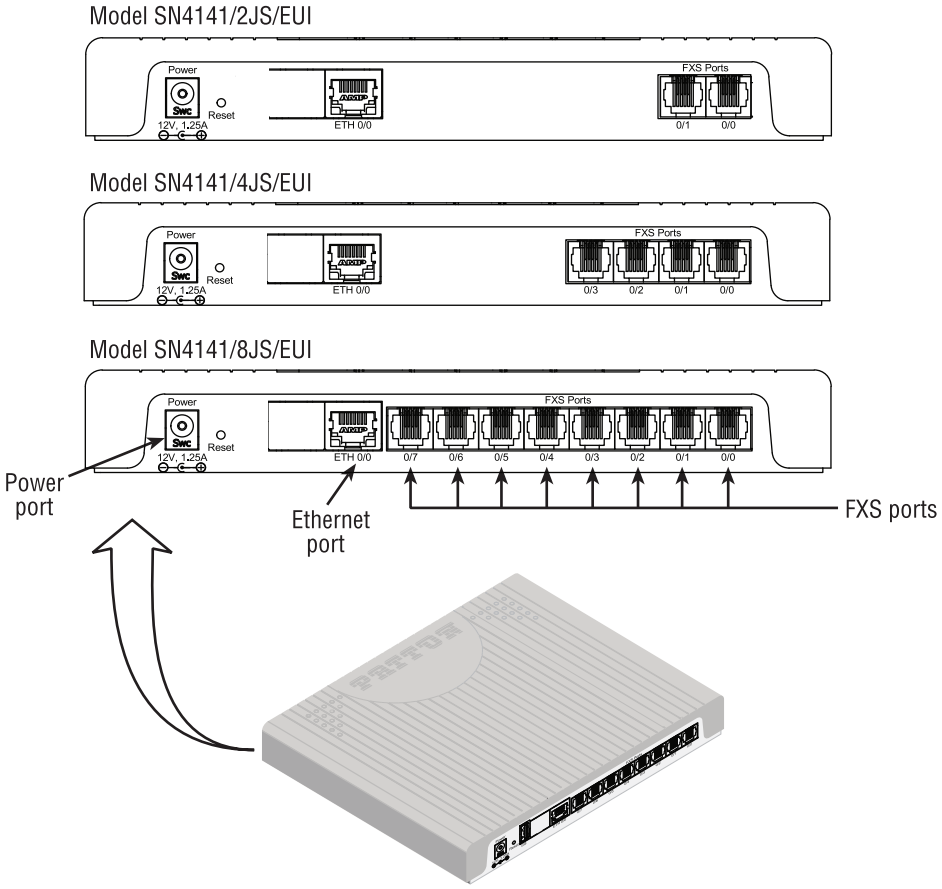

Figure 4. Examples of SN4141 Series rear panels

The following models (each equipped with one 10/100/1000Base-T Ethernet port) are available:

- SN4141/2JS/EUI (2 voice calls)
- SN4141/4JS/EUI (4 voice calls)
- SN4141/8JS/EUI (8 voice calls)

On the products the following model code conventions apply:

- *JS* stands for FXS ports
- *EUI* stands for external universal input power supply

> **Note** For a complete listing of available models, refer to the SmartNode VoIP page at https://www.patton.com/products/voip-comparison.asp.

Port descriptions

The SmartNode 4141 Series rear panel ports are described in table 5.

Table 5. Rear panel ports

Port	Location	Description
10/100 Ethernet ETH 0/0	Rear panel	RJ-45 connector that connects the SmartNode device to an Ethernet device (a cable or DSL modem, LAN hub or switch, for example).
Analog voice port, FXS	Rear panel	FXS RJ-11(6 position, 4 wire) connectors that connect the SmartNode device with an analog terminal (a telephone, for example) FXO port. EuroPOTS support (ETSI EG201 188). FXS on-hook voltage is 48V for each FXS port.
Power	Rear panel	The SmartNode device requires 12 VDC, 1.25 A power for operation. Every SmartNode device comes with an external power supply converting from AC to DC power (100–240 VAC, 50/60 Hz).

Reset button behavior

For those SmartNode devices that have a *Reset* button on the rear panel, its behavior is as follows:

- To restart the unit with the current startup configuration—Press for less than 1 second and release the *Reset* button. The SmartNode will restart with the current startup configuration.
- To restart the unit with factory default configuration—Press the *Reset* button for 5 seconds until the Power LED starts blinking. The unit will restart with factory default configuration.
- To restart the unit in bootloader mode (to be used only by trained SmartNode technicians)—Start with the unit powered off. Press and hold the *Reset* button while applying power to the unit. Release the *Reset* button when the *Power* LED starts blinking so the unit will enter bootloader mode.

Furthermore the *Reset* button may be used to perform a system software image switch as follows:

1. Hold the *Reset* button during boot. The power LED flashes quickly for 2 seconds, during which time the *Reset* button must remain pressed The power LED will begin a blink pattern (described in table 3).
2. Pressing the *Reset* button will change the blink pattern. 10 seconds after the last *Reset* button press, an action will be performed based on the selected pattern.

Table 6. Power LED blink patterns

Pattern	Action
1 blink, pause	Boot normally
2 blinks, pause	Switch to backup image, then boot (Boot normally if the device only has a single image)
3 blinks, pause	Erase all configuration and licenses, then boot

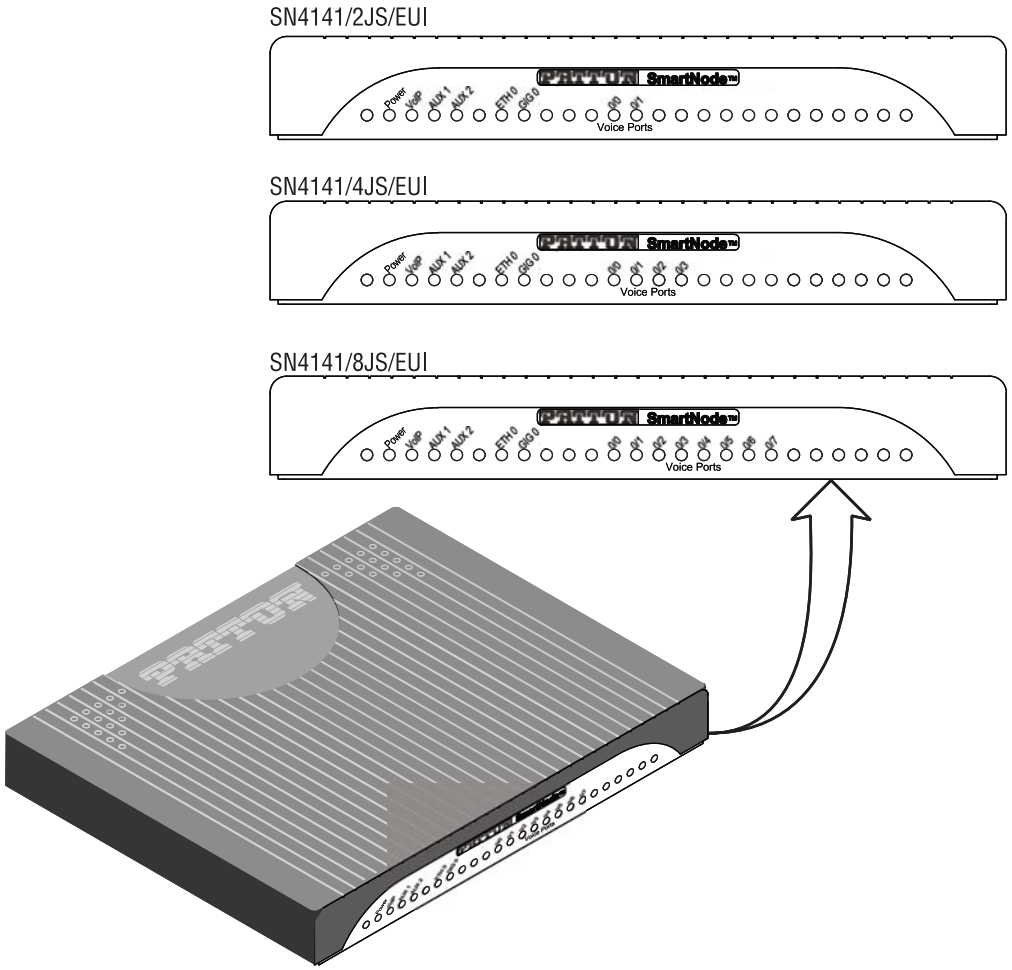

Figure 5. SmartNode 4141 Series front panels

Front panel LED definitions

Figure 5 shows SmartNode 4141 LEDs; the LED definitions are listed in table 7 on page 22.

Note If an error occurs, all LEDs will flash for *more* than 5 seconds before the device reboots.

Table 7. SmartNode 4141 LED Definitions

LED	Description
Power	When lit, indicates power is applied. Blinks fast during bootloader phase and blinks slow during the boot process. Becomes solid when the system is up and running.
VoIP	• When lit, indicates the SmartNode device is registered to a SIP server, or a SIP device has registered to the SmartNode device. • Off indicates the unit is not configured or registered, or has no active directly routed VoIP connection.
AUX 1 & AUX 2	Auxiliary LEDs for future use.
Voice Ports 0/0 to 0/7 (number of ports depending on model)	• When lit, indicates FXS port is enabled. Flashes when there are ongoing or ringing calls. • Off when no line or phone is connected or the port is shutdown.
ETH 0	• When lit, indicates the Ethernet connection has a link indication. • Flashes when data is received or transmitted at the Ethernet port.
GIG 0	• When lit, indicates Ethernet is connected to a 1000Mb network. • Off when Ethernet is connected to a 10Mb or 100Mb network or not connected.

Chapter 2 Applications overview

Chapter contents

Introduction

Patton's SmartNode eSBCs and VoIP Gateways deliver the features you need for advanced multi-service voice and data network applications. They combine high quality voice-over-IP with powerful quality of service routing, assessment and monitoring functions to build professional, secure and reliable VoIP and data networks. This chapter describes typical applications for which this SmartNode is uniquely suited.

Note Detailed configuration information for SmartNode applications can be found online at:

- www.patton.com/session-border-controller/
- www.patton.com/voip-gateway/

Application for SmartNode 5541 eSBC

The SmartNode 5541 eSBC, equipped with 2 Ethernet ports, acts as an Enterprise Session Border Controller securing the LAN from the WAN and it connects up to 8 Analog devices integrating them in to an All-IP environment (see figure 6).

The major functions of the SN5541 eSBC are:

- Network topology hiding
- Fraud prevention
- Service demarcation
- Network quality assessment and monitoring (optional PacketSmart[1])
- QoS (quality of service with downstream and upstream QoS)
- Number normalization and mapping
- Fallback and survivability call routing
- Fax, modem, PoS integration and VoIP conversion
- Solves interoperability issues between softswitches and IP PBXs
- 4G–LTE USB cellular modem WAN uplink[1]

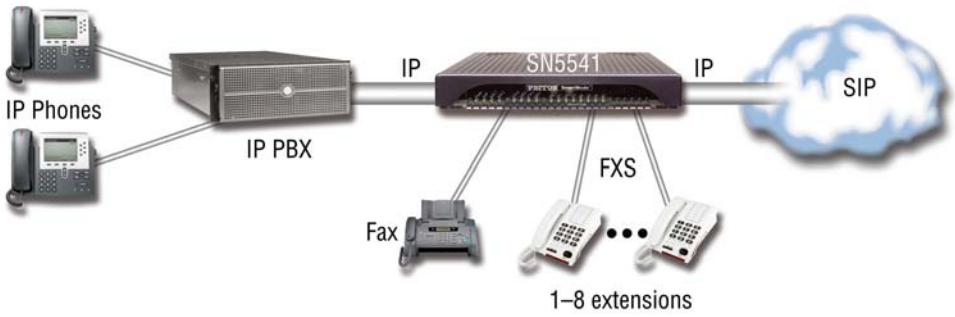

Figure 6. SN5541 application

1. Licensed feature at additional charge

Application for SmartNode 4141 VoIP Gateway

The SmartNode 4141 VoIP Gateway, equipped with 1 Ethernet port, acts as a VoIP Gateway connecting POTS equipment which cannot easily be replaced by an IP-ready device (such as alarm systems, fax machines, modems, PoS terminals, etc.) into an All-IP environment (see figure 7).

The major functions of the SmartNode 4141 VoIP Gateway are:

- Network quality assessment and monitoring (optional PacketSmart[1])
- QoS (packet tagging)
- Number normalization and mapping
- Fallback and survivability call routing to alternate SIP provider/IP-PBX
- Fax, modem, PoS integration and VoIP conversion
- Legacy telephone to VoIP conversion

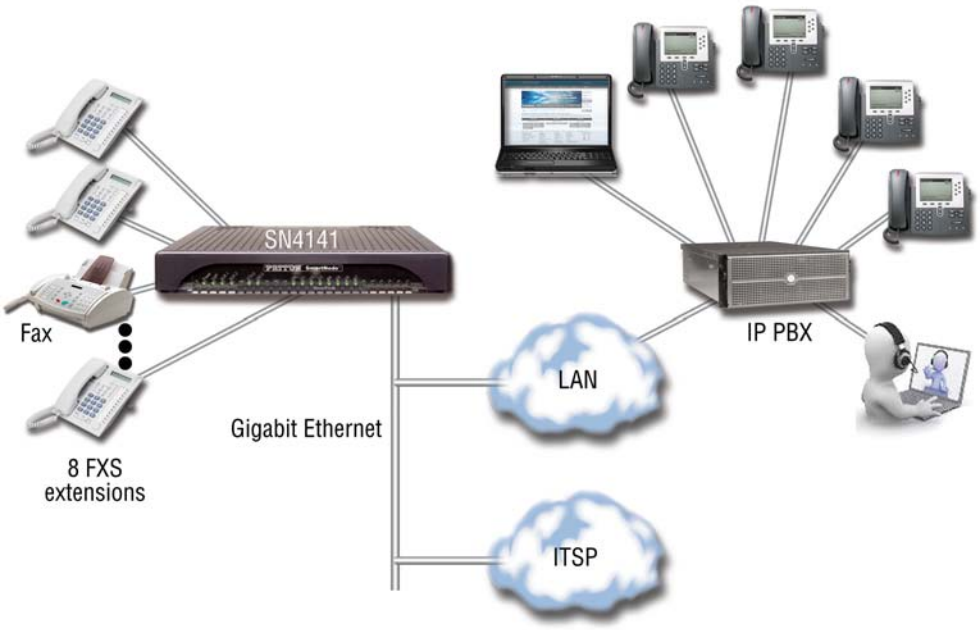

Figure 7. SN4141 application

1. Licensed feature at additional charge. See the following link for Certified USB modems: https://www.patton.com/products/trinity_usb_modems.asp

Chapter 3 SmartNode Installation

Chapter contents

Planning the Installation

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

- **Create a network diagram** (see section "Network information" on page 27)
- **Gather IP related information** (see section "IP related information" on page 27 for more information)
- **Install the hardware and software needed to configure the SmartNode device**. (See section "Software tools" on page 28)
- **Verify power source reliability** (see section "Power source" on page 28).

When you finish preparing for SmartNode device installation, go to section "Installing the SmartNode device" on page 28 to install the device.

Site log

Patton recommends that you maintain a site log to record all actions relevant to the system, if you do not already keep such a log. Site log entries should include information such as listed in table 8.

Table 8. Sample site log entries

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

Network information

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

Network Diagram

Draw a network overview diagram that displays all neighboring IP nodes, connected elements and telephony components.

IP related information

Before you can set up the basic IP connectivity for your SmartNode device you should have the following information:

- IP addresses used for Ethernet LAN and WAN ports
- Subnet mask used for Ethernet LAN and WAN ports

- IP addresses and/or URL of SIP servers or Internet telephony services (if used)
- Login and password for PPPoE Access
- Login and Password for SIP based telephony services
- IP addresses of central TFTP server used for configuration upload and download (optional)

Software tools

You will need a PC (or equivalent) with Windows Telnet or a program such as Tera Term Pro or Putty to configure the software on your SmartNode device. Also you may use your web browser to configure the unit. The WebWizard in this case reduces time to get your unit up and running. See more details on www.patton.com/wizard.

Power source

If you suspect that your AC power is not reliable, for example if room lights flicker often or there is machinery with large motors nearby, have a qualified professional test the power. Patton recommends that you include an uninterruptible power supply (UPS) in the installation to ensure that VoIP service is not impaired if the power fails.

Installing the SmartNode device

SmartNode device installation consists of the following:

- Placing the device at the desired installation location (see section "Placing the SmartNode device" on page 28)
- Installing the grounding wire (if your SmartNode device came equipped with a surge protector), and installing interface and power cables (see section "Connecting cables" on page 29)

When you finish installing the SmartNode device, go to Chapter 4, "Initial Configuration" on page 33.

Placing the SmartNode device

Place the SmartNode device on a desktop or similar sturdy, flat surface. Allow sufficient space at the rear of the chassis for cable connections. Additionally, you should consider the need to access the unit for future upgrades and maintenance.

To prevent overheating and damaging the unit, proper ventilation is required when placing the device. The device should be installed in a dry environment with sufficient space to allow air circulation for cooling.

Do not stack multiple SmartNode devices directly on top of one another, and do not place items on top of the device. If you will be installing equipment above the SmartNode device, leave at least 2 inches (5 cm) of clearance between the devices.

Furthermore, leave at least 2 inches (5 cm) to the left, right, front, and rear of the SmartNode device for proper ventilation.

Connecting cables

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

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

Connect the cables in the following order:

1. If your SmartNode device is equipped with a surge protector go to section "Installing a grounding wire on the SmartNode device's ground lug") to install the ground wire. Otherwise, go to step 2.

   Note SmartNode devices that include surge protection have **/SP** in their model code. All SmartNode /SP models provide a secondary protection against over-voltage and over-current conditions (surges) including lightning strikes and power cross.

2. Installing the RJ-11 voice port (FXS) cable or cables (see section "Installing an interface cable on the SmartNode device's FXS interface ports")

   Note SmartNode devices that include surge protection have **/SP** in their model code. All SmartNode /SP models provide a secondary protection against over-voltage and over-current conditions (surges) including lightning strikes and power cross.

   For phone lines that go across buildings (TNV-3), a SmartNode /SP device (which includes K.21-compliant surge protection) is required.

   For SmartNode models without surge protection, only TNV-2 circuits are allowed to be connected inside buildings.

3. Connect the 10/100/1000Base-T Ethernet LAN and WAN (see section "Connecting the 10/100/1000Base-T Ethernet LAN and WAN cables" on page 31)
4. Connect the power mains cable (see section"Connecting the power supply" on page 31)

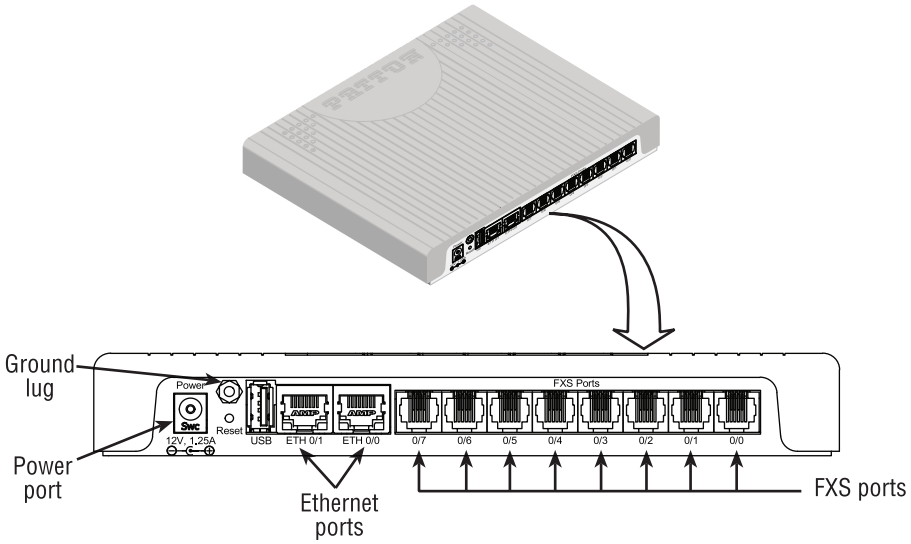

Figure 8. Rear view showing location of Ethernet and FXS connectors (SmartNode 5541 shown)

Installing a grounding wire on the SmartNode device's ground lug

1. Route the grounding wire from a building ground connection to the SmartNode device.

According to UL60950/IEC62368, a connection to earth ground—using the ground lug at the rear of the units (see figure 8)—is required to protect against power cross.

2. Connect the grounding wire to the ground lug of the SmartNode device (see figure 8).
3. Verify that the resistance of the ground path is less than 0.5 ohms.

Installing an interface cable on the SmartNode device's FXS interface ports

The SmartNode comes with at least two FXS analog ports (see figure 8 on page 30) located on the back of the device. The FXS interfaces are connected to analog devices via cables (see figure 9) terminated with RJ-11 connectors (see table 9 for pin-out information).

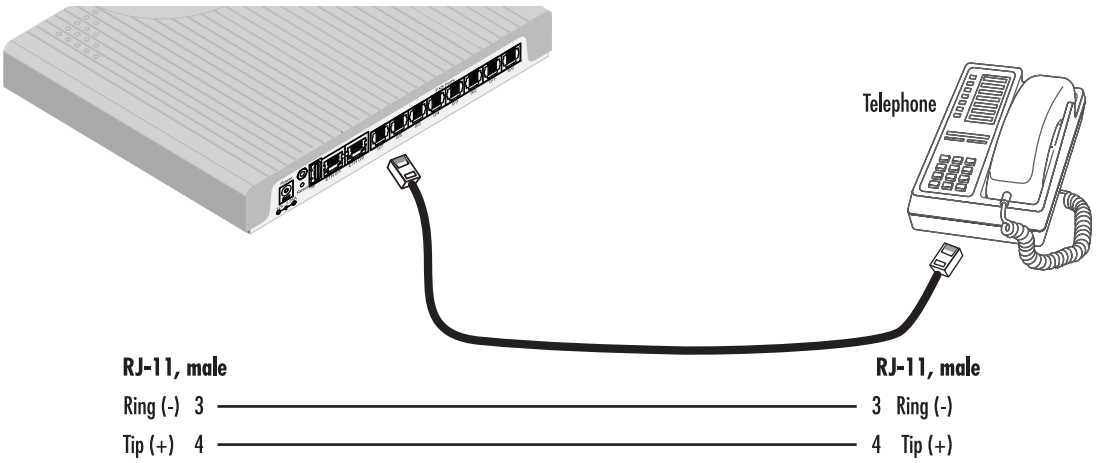

Figure 9. Analog FXS connection

Table 9. RJ-11 socket

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

Connecting the 10/100/1000Base-T Ethernet LAN and WAN cables

The SmartNode device has automatic MDX (auto-cross-over) detection and configuration on the Ethernet ports. Any of the two ports can be connected to a host or hub/switch with a straight-through wired cable.

1. Connect to the subscriber port of the broadband access modem (DSL, cable, WLL) to ETH 0/0.
2. Connect port ETH 0/1 to your LAN.

For details on the Ethernet port pinout and cables, refer to Appendix C, "Cabling" on page 49 and Appendix D, "Port pin-outs" on page 52.

Connecting the power supply

Do the following to connect the main power to the SmartNode device:

1. Verify that the AC power supply included with your device is compatible with local standards. If it is not, refer to Chapter 5, "Contacting Patton for Assistance" on page 40 to find out how to replace it with a compatible power supply.

> **Note** The SmartNode does not have a power switch; it powers on when the device is plugged in.

2. The power connection is made via the barrel jack on the rear panel of the SmartNode. No configuration is necessary for the power supply.

   Connect the female end (barrel plug) to the barrel jack on the rear of the SmartNode (see figure 2 on page 15 for an SN5541 or figure 4 on page 19 for an SN4141) and the power supply male connectors to an appropriate power outlet.

3. Verify that the green *Power* LED is lit (see figure 10). It blinks fast during bootloader phase and blinks slow during boot process of Trinity Software. It becomes solid when the system is up and running.

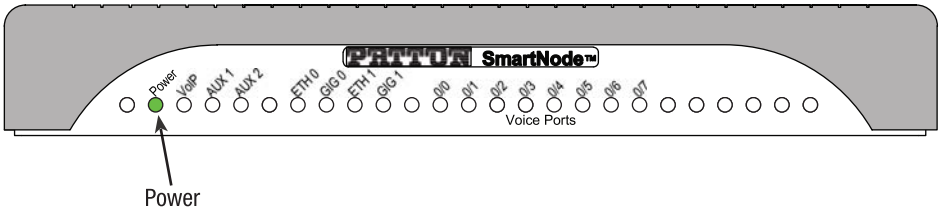

Figure 10. Power LED

Congratulations, you have finished installing the SmartNode device! Now go to Chapter 4, "Initial Configuration" on page 33.

Chapter 4 Initial Configuration

Chapter contents

Introduction

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

> **Note** If you haven't already installed the SmartNode device, refer to Chapter 3, "SmartNode Installation" on page 26.

If you are installing an SN5541, see section "Connecting the SN5541 to your laptop PC". Otherwise, to install an SN4141, see section "Connecting the SN4141 to a laptop PC" on page 36.

Connecting the SN5541 to your laptop PC

First, the SmartNode device must be connected to the main power supply with the power cable. Wait until the Power LED stops blinking and stays lit constantly. Now the SmartNode device is ready.

> **Note** The SmartNode device is equipped with Auto-MDX Ethernet ports, so you can use straight-through cables for host or hub/switch connections (see figure 11).

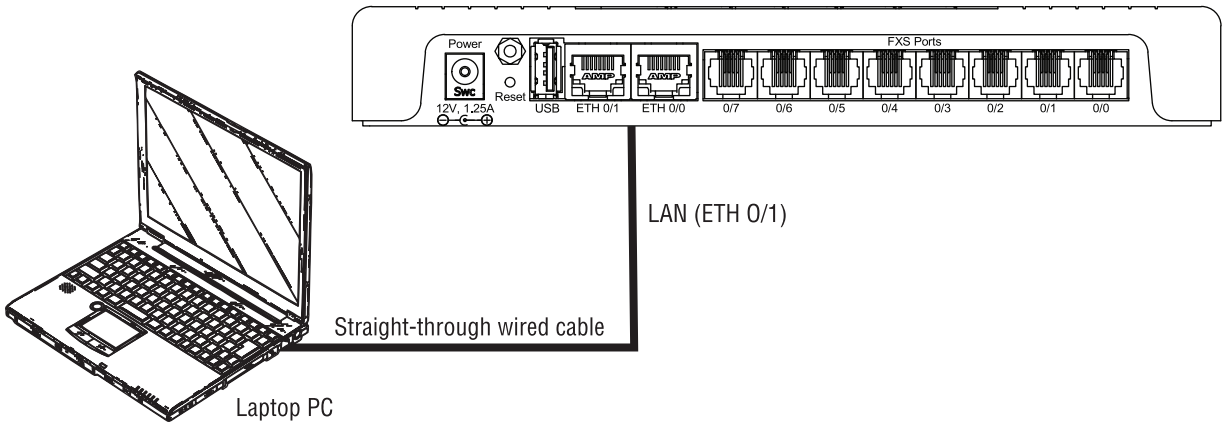

Figure 11. Connecting the SmartNode device to your laptop PC

The SmartNode device comes with a built-in DHCP server to simplify configuration. Therefore, to automatically configure the PC for IP connectivity to the SmartNode device, the laptop PC must be configured for DHCP. The SmartNode will provide the PC with an IP address. You can check the connection to the SmartNode by executing the ping command from the PC command window as follows:

```
ping 192.168.1.1
```

Configure the desired IP address

Factory-default IP Settings

The factory default configuration for the Ethernet interface IP addresses and network masks are listed in table 10. Both Ethernet interfaces are activated upon power-up. LAN interface *ETH 0/1 (LAN)* provides a default

DHCP server, the WAN interface uses DHCP client to automatically assign the IP address and network mask.

Table 10. Factory Default IP Address and Network Mask Configuration

	IP Address	Network Mask
WAN Interface Ethernet 0 (ETH 0/0)	DHCP	DHCP
LAN Interface Ethernet 1 (ETH 0/1)	192.168.1.1	255.255.255.0
DHCP Address Range	192.168.1.10–192.168.1.99	255.255.255.0

If these addresses match with those of your network, go to section "Connecting the SmartNode device to the network" on page 36. Otherwise, refer to the following sections to change the addresses and network masks.

Login

To access the SmartNode, start the Telnet application. Type either the host name
smartnode.local
or the default IP address into the address field of the Telnet application:
192.168.1.1
Accessing your SmartNode via a Telnet session displays the login screen. Type the factory default login: *admin* and leave the password empty. Press the Enter key after the password prompt.

```
login:admin
password: <Enter>
192.168.1.1>
```

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

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

Changing the WAN IP address

Select the context IP mode to configure an IP interface.

```
192.168.1.1 (cfg) #context ip ROUTER
192.168.1.1 (ctx-ip) [ROUTER} #
```

Now you can set your IP address and network mask for the interface *ETH 0/0 (WAN)*. Within this example a network 172.16.1.0/24 address is assumed. The IP address in this example is set to *172.16.1.99* (you should set the IP address given to you by your network provider).

```
192.168.1.1(ctx-ip)[Router]#interface WAN
192.168.1.1(if-ip)[WAN]#no ipaddress DHCP
192.168.1.1(if-ip)[WAN]#ipaddress WAN 172.16.1.99/24
2002-10-28T00:09:40 : LOGINFO : Link down on interface WAN.
2002-10-29T00:09:40 : LOGINFO: Link up on interface WAN.
172.16.1.99(if-ip)[WAN]#
```

Copy this modified configuration to you new start-up configuration. This will store your changes in non-volatile memory. Upon the next start-up the system will initialize itself using the modified configuration.

Note The modified configuration is applied immediately. It is not necessary to reboot the device when changing any configuration parameter.

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

The SmartNode can now be connected to your network.

Connecting the SmartNode device to the network

In general, the SmartNode will connect to the network via the *WAN (ETH 0/0)* port. This enables the SmartNode to offer routing services to the PC hosts on *LAN (ETH 0/1)* port. The SmartNode device is equipped with Auto-MDX Ethernet ports, so you can use straight through or crossover cables for host or hub/switch connections. (see figure 12).

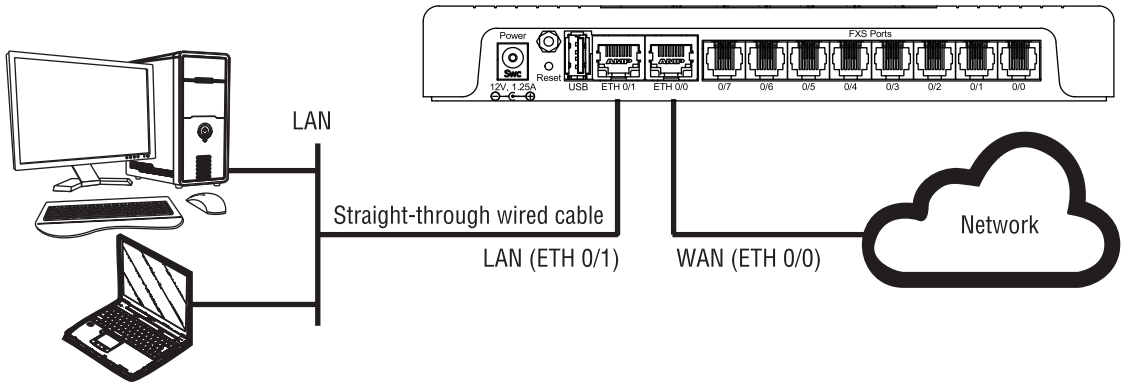

Figure 12. Connecting the SmartNode to the network

You can check the connection with the ping command from the SmartNode to another host on the network.

```
172.16.1.99(if-ip)[WAN]#ping <IP Address of the host>
```

Note If the WAN address is not set to DHCP, to ping a device outside your local LAN you must first configure the default gateway. (For information on configuring the default gateway, refer to section “Set IP addresses” in the Trinity Software Configuration Guide.)

Note Connecting both Ethernet ports to the same switch will only work if the switch has separate ARP tables for each connection.

Go to section “Loading the Configuration (optional)” on page 39.

Connecting the SN4141 to a laptop PC

First, the SmartNode device must be connected to the main power supply with the power cable. Wait until the *Power* LED stops blinking and stays lit constantly. Now the SmartNode device is ready.

Note The SmartNode device has a fixed IP and a DHCP client setup to simplify configuration. The Ethernet port is equipped with Auto-MDX so you can use a straight-through cable for host or hub/switch connection.

There are two options for configuring the SmartNode device:

1. The SmartNode device is connected to a laptop PC (see figure 13) that is configured with a fixed IP in the same range as the SmartNode device's IP address (for instance: PC's IP address; 192.168.1.10; mask: 255.255.255.0).

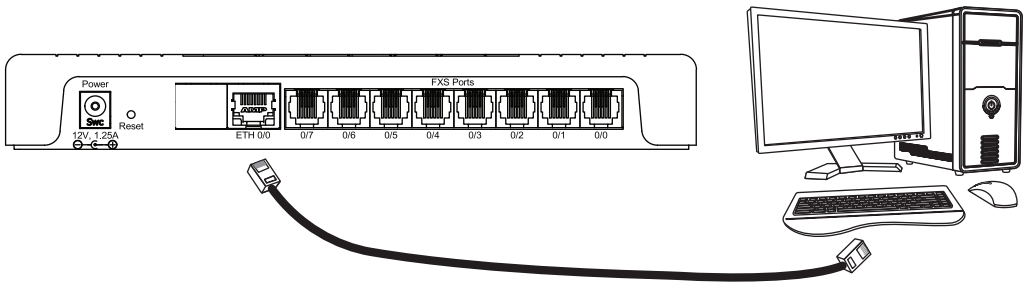

Figure 13. Connecting the SmartNode to a laptop PC

2. The SmartNode device is connected to a local area network (LAN) that has a DHCP server running which assigns an IP address to the SmartNode device (see figure 14). Using the SN Discovery tool, the SmartNode device's IP can be determined.

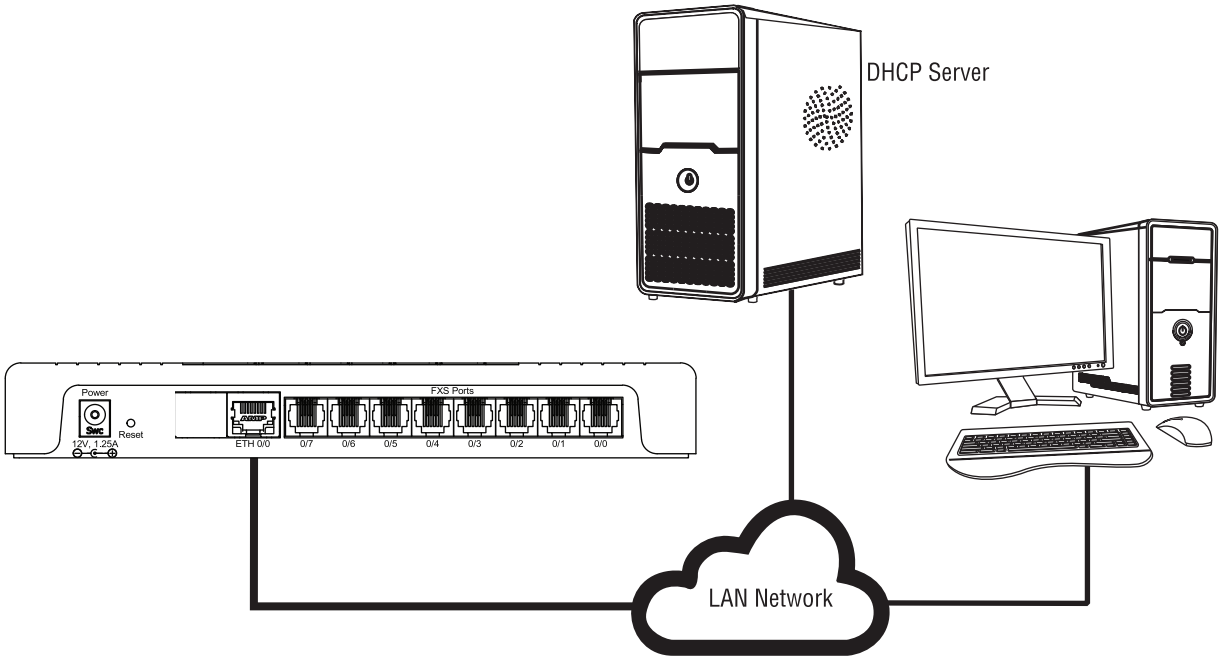

Figure 14. Connecting SmartNode device and PC to a LAN with DHCP server.

You can check the connection to the SmartNode by executing the ping command from the PC command window as follows:

```
ping 192.168.1.1
```

Configure the Desired IP Address

Factory-default IP Settings

The factory default configuration for the Ethernet interface is listed in table 10. The interface bound to *ETH 0/0 (WAN)* has a DHCP client running and a fixed IP address.

Table 11. Factory Default IP Address and Network Mask Configuration

WAN Interface Ethernet 0 (ETH 0/0)	IP Address	Network Mask
Fixed IP	192.168.1.1	255.255.255.0
DHCP client	DHCP	DHCP

If these addresses match with those of your network, go to section "Loading the Configuration (optional)" on page 39. Otherwise, refer to the following sections to change the addresses and network masks.

Login

To access the SmartNode, start the Telnet application. Type either the default IP address into the address field of the Telnet application:
192.168.1.1
Or use the *SN Discovery Tool* to find out the IP address previously assigned by the DHCP server.

Accessing your SmartNode device via a Telnet session displays the login screen. Type the factory default login: *admin* and leave the password empty. Press the Enter key after the password prompt.

```
login:admin
password: <Enter>
192.168.1.1>
```

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

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

Changing the WAN IP address

Select the context IP mode to configure an IP interface.

```
192.168.1.1 (cfg) #context ip ROUTER
192.168.1.1 (ctx-ip) [ROUTER} #
```

Now you can set your IP address and network mask for the interface *ETH 0/0 (WAN)*. Within this example a network 172.16.1.0/24 address is assumed. The IP address in this example is set to *172.16.1.99* (you should set the IP address given to you by your network provider).

```
192.168.1.1(ctx-ip)[Router]#interface WAN
 192.168.1.1(if-ip)[WAN]#no ipaddress
192.168.1.1(if-ip)[WAN]#ipaddress WAN 172.16.1.99/24
2002-10-28T00:09:40 : LOGINFO : Link down on interface WAN.
2002-10-29T00:09:40 : LOGINFO: Link up on interface WAN.
172.16.1.99(if-ip)[WAN]#
```

Copy this modified configuration to you new start-up configuration. This will store your changes in non-volatile memory. Upon the next start-up the system will initialize itself using the modified configuration.

Note The modified configuration is applied immediately. It is not necessary to reboot the device when changing any configuration parameter.

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

The SmartNode device can now be connected to your network.

Loading the Configuration (optional)

The WebWizard Community provides a collection of Wizards that help to reduce the setup time of a Patton device.

Simply download the appropriate Wizard to your device, execute it locally, and you are ready to do phone calls after the SmartNode has rebooted.

Optionally, you may execute the Wizard that matches your application online, and import the generated .cfg config into the SmartNode device.

In addition to that the Knowledgebase provides configuration file templates that may fit your application.

Note If your application is unique and not covered by any of Patton's configuration templates, you can manually configure the SmartNode instead of loading a configuration file template. In that case, refer to the *Trinity Command Line Reference Guide* for information on configuring the SmartNode device.

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

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

After the SmartNode device has been rebooted the new startup configuration will be activated.

```
172.16.1.99(if-ip)[WAN]#reload
Press 'yes' to restart, 'no' to cancel :yes
The system is going down NOW
```

Additional Information

For detailed information about configuring and operating guidance, set-up procedures, and troubleshooting, refer to the *Trinity Command Line Reference Guide* available online at www.patton.com/manuals.

Chapter 5 Contacting Patton for Assistance

Chapter contents

Introduction

This chapter contains the following information:

- "Contact information"—describes how to contact Patton technical support for assistance.
- "Warranty Service and Returned Merchandise Authorizations (RMAs)"—contains information about the warranty and obtaining a return merchandise authorization (RMA).

Contact information

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

Contacting Patton Technical Services for Free Support

REGION	North America	Western Europe	Central & Eastern Europe	Middle East North Africa
Location	**Maryland, USA**	**Bern, Switzerland**	**Budapest, Hungary**	**Beirut, Lebanon**
Time Zone	EST/EDT UTC/GMT - 4/5 hours	CET/CEDT UTC/GMT + 1/2 hours	CET/CEDT UTC/GMT + 1/2 hours	EET/EEDT UTC/GMT + 2/3 hours
Business Hours	Monday-Friday 8:00am to 5:00pm	Monday-Friday 09:00 to 12:00 13:30 to 17:30	Monday-Friday 8:30 to 17:00	Monday-Friday 8:00am to 5pm
Email	support@patton.com	support@patton.com	support@patton.com	support@patton.com
Phone	+ 1 301 975 1007	+41 31 985 25 55	+36 439 3835	+96 1 359 1277
Fax	+1 301 869 9293	+41 31 985 2526		

Warranty Service and Returned Merchandise Authorizations (RMAs)

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

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

Warranty coverage

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

Out-of-warranty service

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

Returns for credit

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

Return for credit policy

- Less than 30 days: No Charge. Your credit will be issued upon receipt and inspection of the equipment.
- 30 to 60 days: We will add a 20% restocking charge (crediting your account with 80% of the purchase price).
- Over 60 days: Products will be accepted for repairs only.

RMA numbers

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

- Completing a request on the RMA Request page in the *Support* section at **www.patton.com**
- By calling **+1 (301) 975-1007** and speaking to a Technical Support Engineer
- By sending an e-mail to **returns@patton.com**

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

Shipping instructions

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

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

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

Appendix A Compliance Information

Chapter contents

Compliance

EMC

- FCC Part 15, Class A
- EN55022, Class A
- EN55024

Safety

- UL60950-1/CSA C22.2 No. 60950-1
- IEC/EN 60950-1, 2nd edition
- AS/NZS 60950-1

Radio and TV interference

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

CE Declaration of Conformity

Patton Electronics, Inc declares that this device is in compliance with the essential requirements and other provisions of Council Directive 1999/5/EC on the approximation of the laws of the member states relating to Radio and Telecommunication Terminal Equipment and the mutual recognition of their conformity.

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

The signed Declaration of Conformity can be downloaded at www.patton.com/certifications.

Authorized European Representative

D R M Green
European Compliance Services Ltd
Greyfriars Court
Paradise Square
Oxford, OX1 1BE, UK

Appendix B Specifications

Chapter contents

Note For a complete listing of available models, refer to the SmartNode VoIP page at https://www.patton.com/products/voip-comparison.asp.

DSP

One 8-channel DSP. 2V and 4V models are restricted by software to not allow more than 2/4 calls. Upgradeable by license to max. 8 calls, which can also be used for SIP to SIP call transcoding.

Voice Connectivity

2, 4 or 8 FXS ports, RJ-11/12

2-wire Loopstart

EuroPOTS (ETSI EG201188)

Programmable AC impedance, feeding, ring and onhook voltage

Caller-ID FSK and ITU V.23/Bell 202 generation

Long Reach FXS—10 km @ 3REN load

Surge and over-voltage protection—K.21 compliant (/SP models only)

Data Connectivity

Two 10/100/1000Base-TX Ethernet ports (SN5540)

One 10/100/1000Base-TX Ethernet port (SN4140)

All ports full duplex, auto-sensing, auto-MDX

USB 2.0 host port for 3G/4G Cellular Model data links

Voice Processing (signalling dependent)

2, 4, or 8 full-duplex channels with voice CODECS (upgradeable to max. 8):

- G.711 A-Law/-Law (64 kbps)
- G.722 (64 kbps)
- G.726 (ADPCM 16,24,32,40 kbps)
- G.723.1 (5.3 or 6.3 kbps)
- G.729ab (8kbps)

G.168 echo cancellation (128ms)

Four or eight simultaneous low-bandwidth voice or T.38 fax calls

DTMF detection and generation

Carrier tone detection and generation

Silence suppression and comfort noise

Adaptive and configurable dejitter buffer

Configurable tones (dial, ringing, busy, etc.)

Configurable transmit packet length

RTP/RTCP (RFC 1889)

SRTP (RFC 3711)

Fax and modem support

Automatic fax and modem detection

Codec fallback for modem-bypass

T.38 Fax-Relay (Gr. 3 Fax, 9.6 k, 14.4 K)

G.711 Fax-Bypass

Super G3 fax

Voice Signalling

SIPv2 and SIPv2 over TLS (licensed feature on SN4141 Series)

SIP call transfer, redirect

Overlap or en-bloc dialing

DTMF in-band, out-of-band

Configurable progress tones

Voice Routing—session router

Local switching (hairpinning)

Least cost routing

Interface huntgroups

Call-Distribution groups

Number blocking

Call Routing Criteria:

- Interface
- Calling/called party number
- Time of day, day of week, date
- Wildcard and regular expression matching

Regular expression number manipulation functions:

- Replace numbers
- Add/remove digits
- Pattern matching and replacement

IP Services

IPv4 router; IPv6 basic functionalities

Routing functionalities are included on SN5551 and optional on SN4151

- BGP
- GRE
- OpenVPN (License at additional charge)

Programmable static routes and policy-routing

ICMP redirect (RFC 792); Packet fragmentation

DiffServe/ToS set or queue per header bits

Packet Policing discards excess traffic

DHCP client and server

DNS client and relay-server, DynDNS

Management

Web-based GUI; Trinity WEB Wizard

Industry standard CLI with remote Telnet and SSH access, fully documented

HTTP web management and firmware loading

TFTP configuration & firmware loading

HTTPS configuration & firmware provisioning

SNMP v1 agent (MIB II and private MIB)

Built-in diagnostic tools (trace, debug)

Secure Auto-provisioning

System

Dual Core CPU Broadcom BCM53012 operating at 1GHz

Memory:

- 256 Mbytes DRAM
- 128 Mbytes Flash

Physical

Dimensions: 7.3W x 1.6H x 6.1D in. (18.5H x 4.1W x 15.5D cm)

Weight: <15.9 oz. (<450g)

Power Consumption: <10W

Operating Temperature: 32-104°F (0-40°C)

Operating humidity: up to 90%, non condensing

Appendix C **Cabling**

Chapter contents

Introduction

This section provides information on the cables used to connect the SmartNode device to the existing network infrastructure and to third party products.

Ethernet

Ethernet devices (10/100/1000 Base-T) are connected to the SmartNode over a cable with RJ-45 plugs. All Ethernet ports on the SmartNode device are Auto-MDX. Use any straight or crossover cable to a host, hubs, switches, PCs or other devices.

CAUTION

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

Note Connecting both Ethernet ports to the same switch will only work if the switch has a separate ARP table for each connection.

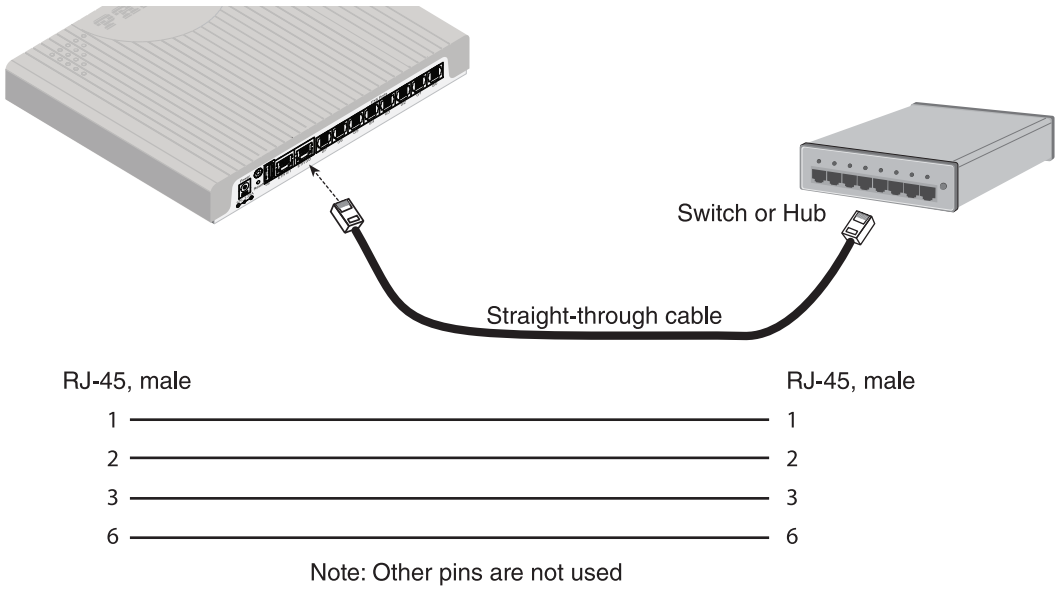

Figure 15. Typical Ethernet straight-through cable diagram for 10/100Base-T

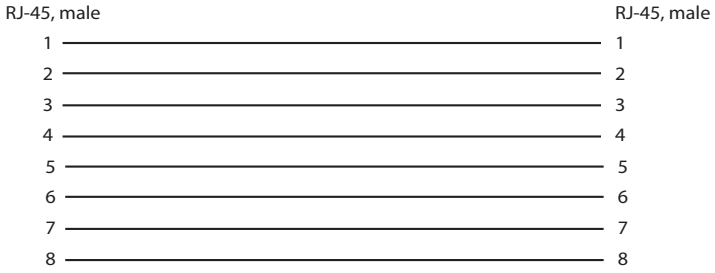

Figure 16. Typical Ethernet straight-through cable diagram for 1000Base-T

Analog FXS

CAUTION

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

Applicable to SmartNode devices equipped with FXS ports. The FXS ports are connected to analog terminals (phones, fax machines, answering machines, etc.) via cables terminated with RJ-11 connectors (see section "FXS port" on page 53 for details on port pinouts).

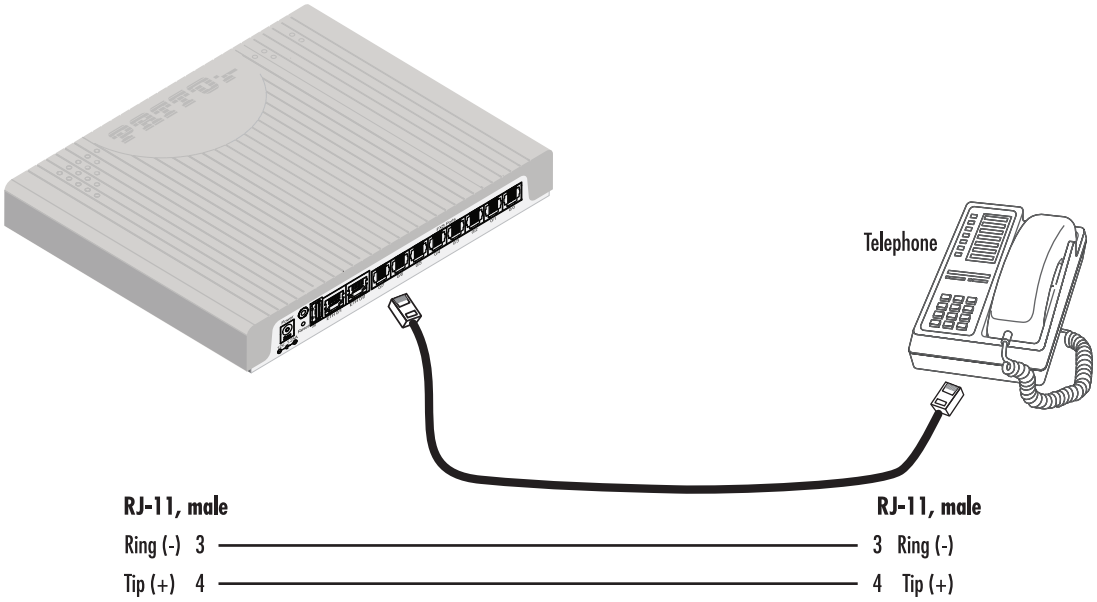

Figure 17. Connecting an FXS device

Appendix D **Port pin-outs**

Chapter contents

Introduction

This section provides pin-out information for the ports of the SmartNode.

Ethernet

Table 12. 10/100 Base-T RJ-45 socket

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

Note Pins not listed are not used.

Table 13. 1000Base-T RJ-45 Socket

Pin	Signal
1	TRD0+
2	TRD0-
3	TRD1+
4	TRD1-
5	TRD2+
6	TRD2-
7	TRD3+
8	TRD3-

FXS port

The FXS ports use an RJ-11 connector with 6 positions. The middle two positions 3 and 4 are used according to table 14 and figure 18 on page 54.

Table 14. RJ-11 socket

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

Note Pins not listed are not used.

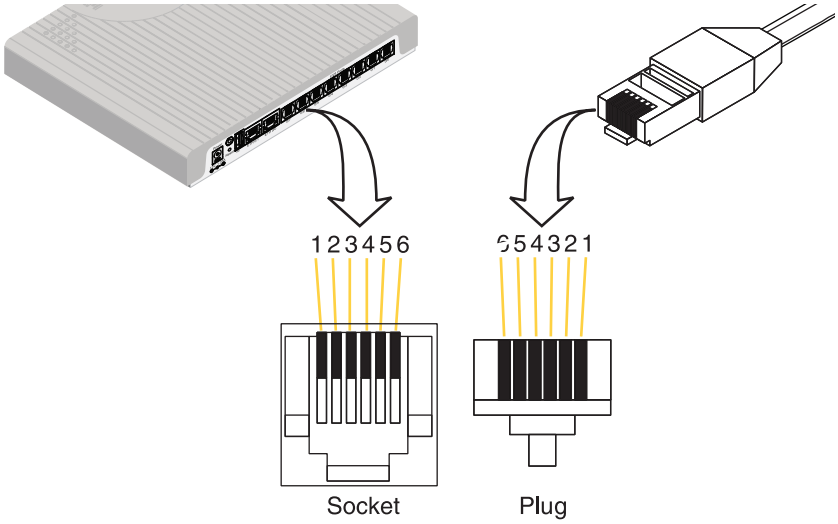

Figure 18. RJ-11 pinout diagram

Appendix E SmartNode Device Factory Configuration

Chapter contents

Introduction

Factory configuration settings for the SmartNode device can be obtained with the following command through the CLI;

```
login: admin
password: <Enter>
192.168.1.1>show config:shipping-config
```

See Chapter 4, "Initial Configuration" on page 33 for more details about IP address settings for initial configuration.

Appendix F End User License Agreement

Chapter contents

End User License Agreement

By operating this package, operating the Designated Equipment or downloading the Programs electronically, the End User agrees to the following conditions:

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A) Effective Date shall mean the earliest date of purchase or download of a product containing the Patton Electronics Company Program(s) or the Program(s) themselves.

B) Program(s) shall mean all software, software documentation, source code, object code, or executable code.

C) End User shall mean the person or organization which has valid title to the Designated Equipment.

D) Designated Equipment shall mean the hardware on which the Program(s) have been designed and provided to operate by Patton Electronics Company.

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