Cisco VG450 Voice Gateway Hardware Installation Guide

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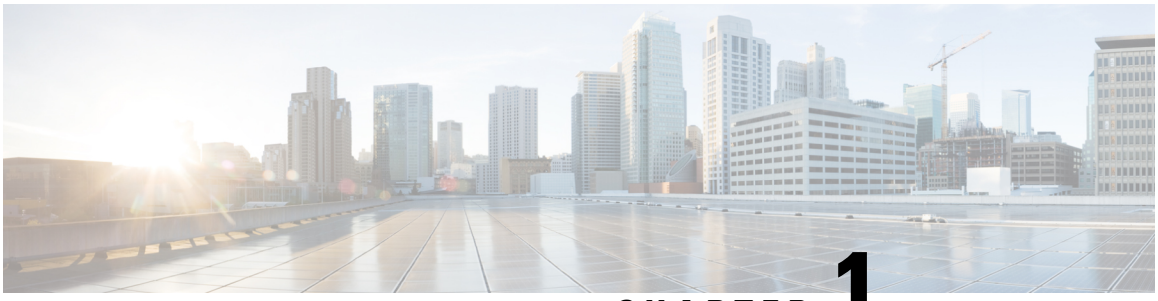


CHAPTER 1

Overview of Cisco VG450 Voice Gateway

Cisco High-Density Analog Voice Gateway provide enterprises, managed services providers, and service providers the ability to directly connect public-switched telephone networks (PSTNs) and existing telephony equipment to Cisco 4000 Series Integrated Services Routers. These fixed-port (FXS and FXO) modules provide Dual-Tone Multifrequency (DTMF) detection, voice compression and decompression, call progress tone generation, Voice Activity Detection (VAD), echo cancellation, and adaptive jitter buffering. Cisco VG450 Voice Gateway is a high-density analog voice gateway. It is an intermediate path that enables TDM to IP transition.

The Cisco VG450 Voice Gateway supports the following interfaces:

- Gigabit Ethernet (GE)
- USB
- Network Interface Module (NIM)
- Single-Wide Service Module (SWSM) interface
- Double-Wide Service Module (DWSM) interface

This chapter contains the following sections:

Features and Benefits of Cisco VG450 Voice Gateway

Cisco VG450 Voice Gateway provides VoIP connectivity to analog devices, such as analog desk phones, analog conference room phones, fax machines and modems. Cisco 450 Voice Gateway provides several improvements from the previous high-density analog and digital extension modules (EVMs), in the following ways:

- **On-board Digital Signal Processor (DSP)—**The FXO and FXS service modules contain an onboard DSP and don't require the router to have a dedicated packet voice DSP module (PVDM) on the motherboard. The DSP on the voice module is necessary for the voice features. It also provides for echo cancellation of up to 128-ms echo-tail length for demanding network conditions.
- **Support for Online Insertion and Removal (OIR)—**The FXS and FXO service modules support Online Insertion and Removal (OIR), reducing the downtime required for new or replacement modules. The

service modules can be inserted into the SM-X slot on the supported Cisco 4000 Series ISRs without powering off the router.

- **FXS-E (extended loops) support—**FXS ports on the new modules support FXS-E with the following details:
  - Higher loop current (35 mA) to accommodate specialty phones
  - Longer loop length for loops with 26 AWG wire, up to 11,000 feet (3400 meters)
  - Higher ringing voltage (65 Vrms, no load)

Note Switching between the modes requires reload of the ISR chassis.

- **FXO failover bypass ports—**A failover bypass port, also called a failover trunk bypass, provides a way to use designated analog phone ports to make phone calls through the PSTN during a power outage.

In addition to these features, Cisco 450 Voice Gateway supports the following features:

- Caller line ID
- G.711, G.729a, and G.726
- G722, iLBC, GSMAMR-NB, and Internet Speech Audio Codec (iSAC)
- Fax detection, pass-through, and relay (T.38)
- Modem pass-through
- DTMF detection
- Echo cancellation
- Voice activity detection
- Comfort noise generation
- Real-Time Control Protocol (RTCP)
- Acoustic shock protection
- Real-Time Transport Protocol (RTP)
- RFC 4733 Digit Relay
- Noise reduction is on the roadmap
- The FXS features include:
- Support for either FXS or DID functionality
- Message-Waiting Indicator (MWI)
- Cable detection: GR909 line test
- The FXO features include:
- Support for both ground-start and loop-start modes
- Support for FXO CAMA signaling type
- Call Detail Record (CDR) information
- Support for interworking with Cisco Unified Communications Manager (Skinny Client Control Protocol [SCCP]), H.323, Session Initiation Protocol (SIP), and Media Gateway Control Protocol (MGCP) 0.1
- Cable detection
- Overload protection

Analog Phone Connectivity

Cisco 450 Voice Gateway are ideal for analog phone deployments ranging from centralized to sparsely concentrated or distributed topologies. Cisco 4000 Series Integrated Services Routers offer many supplementary analog calling features, depending on the call control and signaling type used. All supplementary analog features are supported through the FXS and FXO service modules. The analog interface on Cisco 4000 Series also supports Feature Access Codes (FACs) for invoking supplementary services.

Fax and Modem Connectivity

FXS ports on Cisco 450 Voice Gateway support fax machines and modems. When using fax machines, the gateways support T.38 fax relay and fax pass-through. T.38 fax relay technologies allow transfer of faxes across the network with high reliability using less bandwidth than a voice call. All modems can be connected to the Cisco VG Series Gateways and are transferred over the network using modem pass-through.

Protocols Supported

The voice gateways support the following protocols:

- SCCP
- H.323v4
- MGCP
- SIP
- Real-Time Transport Protocol (RTP)
- Secure Real-Time Transport Protocol (SRTP)
- Trivial File Transfer Protocol (TFTP)
- HTTP server
- Simple Network Management Protocol (SNMP)
- Telnet
- Dynamic Host Configuration Protocol (DHCP)
- DNS
- Cisco Unified Communications Manager or Cisco Unified Communications Manager Express redundancy support using Hot Standby Router Protocol (HSRP)
- Call survivability: MGCP failover to an H.323 connection to the Survivable Remote Site Telephony (SRST) router
- T.38 fax relay and modem pass-through
- Codec support: G.711, G.729. G.729a will be used if the gateway does not support G729 annex b
- RADIUS and TACACS+ for Telnet and authorization

The following table lists the feature specifications for Cisco 450 Voice Gateway.

Table 1: Cisco SM-X Single-Wide Service Module Feature Specifications

Feature	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Tip and Ring Interface for each FXS port				

Feature	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Interface	FXS/FXO (RJ-21)RJ-21 ports 0 to 7: FXSRJ-21 ports 8 to 19: FXO	FXS/FXO (RJ-21)RJ-21 ports 0 to 15: FXSRJ-21 ports 16 and 17: FXO	FXS (RJ-21), FXO (RJ-11)RJ-21 ports 0 to 23: FXSRJ-11 ports 24 to 27: FXO	FXS (RJ-21)
Address signaling format	In-band DTMF Out-of-band pulse (8 to 12 pps)	In-band DTMF Out-of-band pulse (8 to 12 pps)	In-band DTMF Out-of-band pulse (8 to 12 pps)	In-band DTMF Out-of-band pulse (8 to 12 pps)
FXS signaling formats	FXS loop-start, ground-start, and DID signaling	FXS loop-start, ground-start, and DID signaling	FXS loop-start, ground-start, and DID signaling	FXS loop-start, ground-start, and DID signaling

Cisco VG450 Voice Gateway Chassis

The following figures show the front and back panels of the Cisco VG450 Voice Gateway Chassis:

Figure 1: Front Panel of the VG450 Voice Gateway

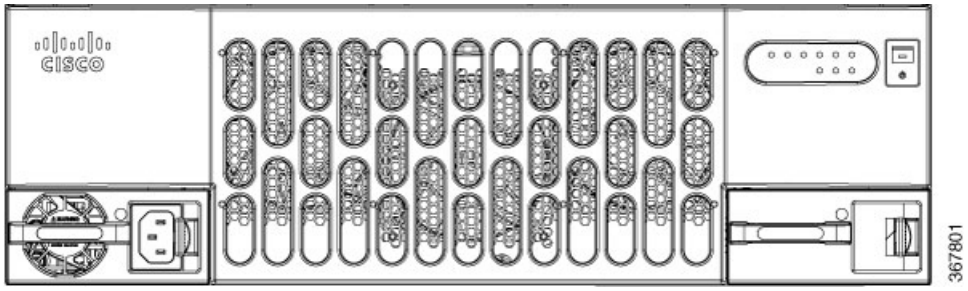
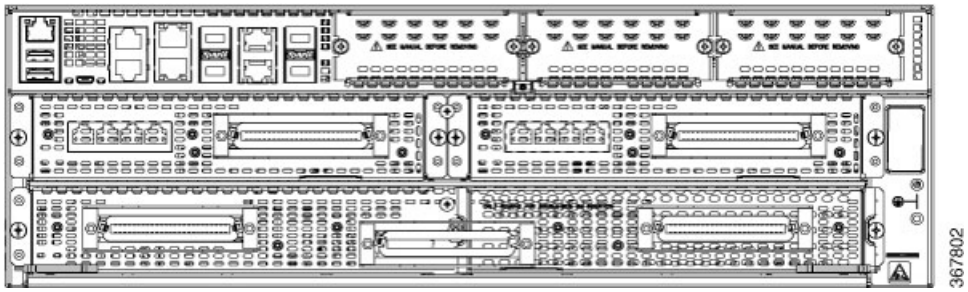


Figure 2: Back Panel of the VG450 Voice Gateway



Slot, Bay, and Ports

The FXO port is used to connect to PBX or key systems, or to provide off-premises connections to the PSTN. It supports battery reversal detection and caller ID. The FXO port is also used to connect to analog Centralized Automatic Message Accounting (CAMA) trunks to provide dedicated E-911 service (only in North America).

The FXS port is used to connect analog phones, modems, fax machines, and speaker phones to an enterprise IP voice system, and to use them as extensions to your Cisco or third-party IP call-control system. Having these devices tightly integrated with the IP-based phone system is advantageous for increased manageability, scalability, and cost-effectiveness. The Direct Inward Dialing (DID) port is used to provide off-premises DID connection from the central office. It serves only incoming calls from the PSTN. The Caller ID feature is not supported in DID mode.

Cisco 450 Voice Gateway supports the following:

- Slot 0/1, 0/2, 0/3:
  - NIM-1MFT-T1/E1
  - NIM-2MFT-T1/E1
  - NIM-4MFT-T1/E1
  - NIM-8MFT-T1/E1
  - NIM-2FXO
  - NIM-4FXO
  - NIM-4EM
  - NIM-2BRI-NT/TE
  - NIM-4BRI-NT/TE
  - NIM-2FXSP
  - NIM-4FXSP
  - NIM-2FXS/4FXOP
- SM Slots 1 and 2:
  - SM-X-8FXS/12FXO
  - SM-X-16FXS/2FXO
  - SM-X-24FXS/4FXO
  - SM-X-72FXS
- SM slot 3:
  - SM-X-72FXS
  - No Skye SM is supported.
  - No DSP Farm is supported
  - No CUBE and CME are supported
  - Old D3 analog FXS and combo FXS/FXO NIMs are not supported.
  - T1/E1: channel-group CLI is not supported
  - CME: telephone service CLI is not supported.

The following table provides information about Cisco 450 Voice Gateway SKU:

Table 2: Cisco 450 Voice Gateway

Interface	Maximum Number of FXS-E Ports	Maximum Number or RENs	LED	Number of Failed-over Ports
SM-X-8-FXS/12FXO	8	16	EN LED (Amber/Green) ACT LED (Green)	8 ports on RJ-21

Interface	Maximum Number of FXS-E Ports	Maximum Number or RENs	LED	Number of Failed-over Ports
SM-X-16-FXS/2FXO	16	16	EN LED (Amber/Green) ACT LED (Green)	2 ports on RJ-21
SM-X-24-FXS/4FXO	16	16	EN LED (Amber/Green) ACT LED (Green)	4 ports on RJ-11
SM-X-72FXS	• 16 for 72FXS mode • 56 for 56FXS-E mode	• 40 • 30	EN LED (Amber/Green) ACT LED (Green)	—

The slot, bay, and port information for Cisco 450 Voice Gateway FXS module is as follows:

Interface	Slot	Bay	Port
SM-X-8-FXS/12FXO	1-2	0	0-7
SM-X-16-FXS/2FXO	1-2	0	0-15
SM-X-24-FXS/4FXO	1-2	0	0-23
SM-X-72FXS	1 and 3	0	17-0 55-0

The slot, bay, and port information for Cisco 450 Voice Gateway FXO module is as follows:

Interface	Slot	Bay	Port
SM-X-8-FXS/12FXO	1-2	0	8-19
SM-X-16-FXS/2FXO	1-2	0	16-17
SM-X-24-FXS/4FXO	1-2	0	24-27

Technical Specifications

Table 3: Cisco VG450 Voice Gateway Technical Specifications

Description	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Physical				
Dimensions (H x W x D)	1.58 x 7.44 x 7.6 inches	1.58 x 7.44 x 7.6 inches	1.58 x 7.44 x 7.6 inches	1.58 x 15.57 x 7.57 inches
Weight	1.90 lb (0.86 kg)	1.98 lb (0.90 kg)	2.12 lb (0.96 kg)	4.94 lb (2.24 kg)
Power				

Description	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
AC power	53.55W	70.32W	79.37W	128.16W
Current	4.46A on 12V	5.86A on 12V	6.61A on 12V	10.68A on 12V
Voltage	12V from backplane	12V from backplane	12V from backplane	12V from backplane
On-hook voltage	-44V	-44V	-44V	-44V
Off-hook loop current	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port
Operating temperature	32 o to 104 o F (0 o to 40 o C)	32 o to 104 o F (0 o to 40 o C)	32 o to 104 o F (0 o to 40 o C)	32 o to 104 o F (0 o to 40 o C)
Nonoperating temperature	-40 o to 158 o F (-40 o to 70 o C)	-40 o to 158 o F (-40 o to 70 o C)	-40 o to 158 o F (-40 o to 70 o C)	-40 o to 158 o F (-40 o to 70 o C)
FXS loop resistance	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port
DID loop resistance	Up to 1400 ohms	Up to 1400 ohms	Up to 1400 ohms	Up to 1400 ohms
Ring frequency	20, 25, 30, and 50 Hz	20, 25, 30, and 50 Hz	20, 25, 30, and 50 Hz	20, 25, 30, and 50 Hz
REN loading	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)
Impedance	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6
FXS loop length	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG
Cables	Category 3 and Category 5	Category 3 and Category 5	Category 3 and Category 5	Category 3 and Category 5

Platform and Software Requirements

Cisco 450 Voice Gateway is supported on Cisco 4461 Integrated Services Router effective with Cisco IOS XE Fuji 16.9.1 or later. The service modules provide gateway services for Cisco Unified Communications using Cisco Unified Communications Manager with SRST or Cisco Unified Communications Manager Express. The following table provides information about the software version that is compatible with FXO and FXS service modules.

Table 4: Compatible Software Versions with the FXO and FXS Service Modules

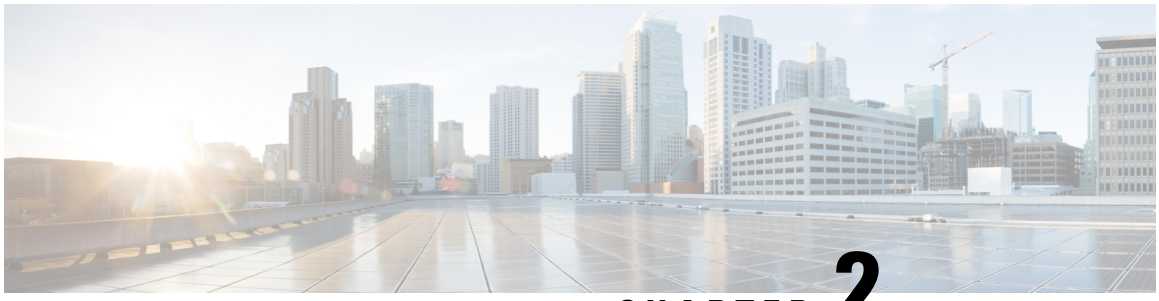
Product Category	Software Version
Cisco IOS XE Software	Cisco IOS XE Fuji 16.9.1
Cisco Unified Communications Manager	10.5.2(SU8), 11.5.1(SU6) and 12.5
Cisco Unified Communications Manager Express	Any version that is compatible with Cisco IOS XE Fuji 16.7.1
Third-party Call Control	IP-based trunk; SIP and H.323

Configuration Methods

After the Cisco VG450 Voice Gateway is operational, use the procedures described in the *Cisco Voice 450 Gateway Software Configuration Guide* to configure specific services and functions, or to make changes to an existing configuration.

You can configure the Cisco VG450 Voice Gateway by one of the following methods:

- System configuration dialog
- Configuration mode: Cisco IOS software CLI
- Setup command facility: Remote configuration through a LAN
- SNMP-based application: CiscoView or HP OpenView
- HTTP-based configuration server: Provides access to the CLI from a web browser



CHAPTER 2

Planning Your Installation

This chapter provides preinstallation information, such as recommendations and requirements that must be met before installing your Cisco VG450 Voice Gateway. See the following sections to prepare for installation:

Location and Mounting Requirements

The mounting possibilities for your Cisco VG450 Voice Gateway are:

- Rack-mount
- Bench-top

The mounting location must provide the following:

Temperature Control and Ventilation

The installation location (room, closet, or cabinet) for the Cisco VG450 Voice Gateway should always be well ventilated and provide adequate air circulation to ensure proper cooling. The room temperature should be maintained between 32 to 122°F (0 to 50°C).

Note The Cisco VG450 Voice Gateway chassis is designed for back and sides-to-front airflow.

Enclosed Racks

Caution Enclosed racks must have adequate ventilation. An enclosed rack should never be overcrowded and should have louvers and a fan.

If the Cisco VG450 Voice Gateway is installed in an enclosed rack with a ventilation fan at the top, make sure that heated air drawn upward from other equipment does not prevent adequate cooling.

If the chassis is installed using slide rails, check for blocked ventilation ports when it is in position in the rack or cabinet. Make sure that the ventilation ports of the Cisco VG450 Voice Gateway are not blocked.

Tip Baffles can help isolate exhaust air from intake air. Baffles also help draw cooling air through the cabinet. The best location for the baffles depends on the airflow patterns in the rack. You can test the airflow by experimenting with different equipment arrangements.

Bench-Mounted

If the unit is placed on a bench-top, do not stack other equipment or paper on the chassis. Provide plenty of space for air circulation (front to back). Inadequate ventilation can result in overheating and damage.

Rack requirements

The following information can help you plan your equipment rack configuration:

- Allow clearance around the rack for maintenance.
- Enclosed racks must have adequate ventilation. Ensure that the rack is not congested, because the hardware generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air. Heat generated by equipment at the bottom of the rack can be drawn upward into the intake ports of the equipment above it.
- When mounting a chassis in an open rack, ensure that the rack frame does not block the intake or exhaust ports. If the chassis is installed on slides, check the position of the chassis when it is seated in the rack.

If the Cisco VG400 Voice Gateway is installed in an enclosed rack with a ventilation fan at the top, make sure that heated air drawn upward from other equipment does not prevent adequate cooling.

Note Enclosed racks must have adequate ventilation. An enclosed rack should never be overcrowded and should have louvers and a fan

If the chassis is installed using slide rails, check for blocked ventilation ports when it is in position in the rack or cabinet. Make sure that the ventilation ports of the Cisco VG450 Voice Gateway are not blocked.

Baffles can help isolate exhaust air from intake air. Baffles also help draw cooling air through the cabinet. The best location for the baffles depends on the airflow patterns in the rack. You can test the airflow by experimenting with different equipment arrangements.

Access to Chassis

Allow space at the rear of the chassis for cable connections. Also consider the need to access the chassis for future upgrades, maintenance, and troubleshooting.

Chassis grounding is provided through the power cable, which uses a standard grounding plug. However, the chassis also requires a reliable earth ground using the earth ground lug and hardware provided. For more information, see the *Chassis Grounding* section.

Power Source

A Cisco VG450 Voice Gateway with AC power supply autoselects either 100–127 volt or 200–240 volt operation. AC versions include a 6-foot (1.8-meter) electrical power cord. (A label near the power cord indicates the correct voltage, frequency, current draw, and power dissipation.)

Power Suppy Considerations

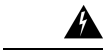
Cisco VG450 Voice Gateway requires significantly more power because of its high-density ports and OPX 'Lite' requirements.

This require a larger 48V battery backup that may need to be custom built.

To handle power failure conditions, an uninterrupted power supply (UPS) is needed. UPS is widely available in all markets, including emerging markets (due to prevalence of UPS for personal computers). Thus, a separate UPS for Cisco VG450 Voice Gateway is a viable option when the ISR/UPS is not co-located with it.

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

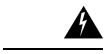
Warning Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088



Warning Read the installation instructions before you connect the system to its power source. Statement 1004

Warning This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than:120 VAC, 15A U.S. (240 VAC, 10A international) Statement 1005

Warning The device is designed for connection to TN and IT power systems. Statement 1007



Warning This unit is intended for installation in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means by security. Statement 1017

Network Cabling Considerations

The cable types that are used are dependent on the Cisco VG450 Voice Gateway that you are using. For more information, see the "Cable Specifications and Information" section on page A-1 .

The following are the cable types that are used in the Cisco VG450 Voice Gateway:

- GE cables (RJ-45 to RJ-45 straight-through cables)
- Analog voice cables (RJ-21)

Distance Limitations for Interface Cables

When planning your installation, consider distance limitations and potential electromagnetic interference (EMI) as defined by the Electronic Industries Association (EIA). Distance limitation information is included for the following VG ports:

- Gigabit Ethernet Maximum Distance: The maximum segment distance for Gigabit Ethernet is 330 feet (100 meters) (specified in IEEE 802.3).
- FXS Analog Voice Port Maximum Distance: The maximum distance is established by a total allowable loop resistance, including the phone or terminal equipment, of 600 ohms.
- FXS-E (Extended loop) Analog Voice Port Maximum Distance: The maximum distance is established by a total allowable loop resistance, including the phone or terminal equipment, of 1400 ohms.

Note Typically, a 26 AWG wire is equal to 81.6 ohm/Kft and 24 AWG wire is equal to 51.3 ohm/Kft.

Interference Considerations

When you run cables for any significant distance in an electromagnetic field, interference can occur between the electromagnetic field and the signals on the cables. This has two implications for the installation of terminal plant cabling:

- Unshielded plant cabling can emit radio interference.
- Strong electromagnetic interference (EMI), especially as caused by lightning or radio transmitters, can destroy the EIA/TIA-232 drivers and receivers in the Cisco VG450 Voice Gateway.

If you use twisted-pair cables with a good distribution of grounding conductors in your plant cabling, emitted radio interference is unlikely.

If you have cables exceeding recommended distances, or if you have cables that pass between buildings, give special consideration to the effect of lightning strikes or ground loops. If your site has these characteristics, consult experts in lightning suppression and shielding. The electromagnetic pulse caused by lightning or other high-energy phenomena can easily couple enough energy into unshielded conductors to destroy electronic devices.

Most data centers cannot resolve such infrequent, but potentially catastrophic problems without pulse meters and other special equipment. Take precautions to avoid these problems by providing a properly grounded and shielded environment and by installing electrical surge suppression.

If you remove any module, you must either install a module in its place or install a cover plate over the opening. All module openings must be either occupied or covered to prevent electromagnetic interference.

For advice on the prevention of electromagnetic interference, consult experts in radio-frequency interference (RFI).

Required tools and equipment for installation

Warning Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

You need the following tools and equipment to install and upgrade the Voice Gateway and its components:

- Standard flat-blade screwdriver as required for attaching the brackets, as per your mounting.
- Phillips screwdriver for attaching the brackets to the Voice Gateway.
- Mounting brackets and screws for the 24-inch rack, if required.
- Four telco machine screws, for installing the chassis in a rack (use the screw size required by the rack).
- Screws and anchors for wall-mounting (if applicable):
  - Eight wood screws or other fasteners, for installing the chassis on a wall.
  - An additional starter screw can be used to facilitate wall-mounting.
- An ESD-preventive wrist strap
- In addition, you might also need the following external equipment:
  - A Console terminal or PC with terminal emulation software
  - A PC running terminal emulation software for administrative access
  - Modem for remote access.
  - Analog voice RJ-11 cables
  - Ethernet switch
- A modem for remote configuration.

Site Log

We recommend that you maintain a Site Log to record all actions relevant to the system. Site Log entries might include the following:

- Installation—Print 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. Update the Site Log to reflect the following:
  - Configuration changes
  - Maintenance schedules, requirements, and procedures performed
  - Comments, notes, and problems
  - Changes and updates to Cisco IOS software

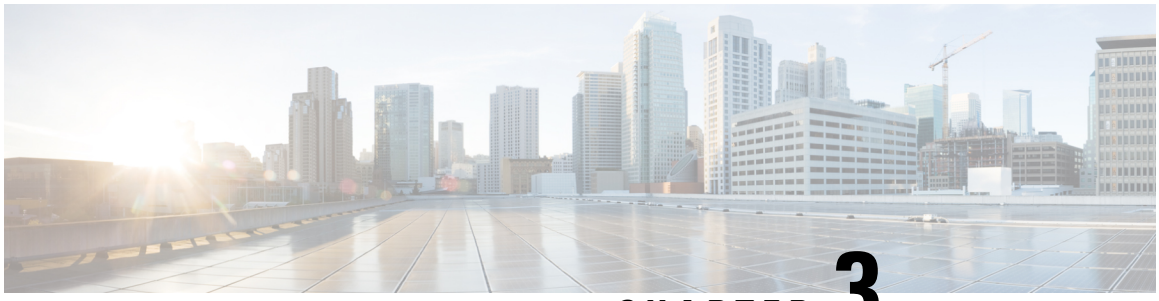
Installation Checklist

The folllowing Installation Checklist lists the tasks for installing a Cisco VG450 Voice Gateway. Print a copy of this checklist and mark the entries as you complete each task. For each Cisco VG450 Voice Gateway, include a copy of the checklist in your Site Log. (Installation Checklist image)

Installation Checklist for site _____

Cisco VG name/serial number _____

Task	Verified by	Date
Background information placed in Site Log		
Environmental specifications verified		
Site power voltages verified		
Installation site prepower check completed		
Required tools available		
Additional equipment available		
Cisco VG received		
Quick start guide received		
Regulatory compliance and safety information received		
Information packet, warranty card, and Cisco.com card received		
Software version verified		
Rack, or desktop mounting of chassis completed		
Initial electrical connections established		
ASCII terminal attached to console port		
Modem attached to console port (for remote configuration)		
Signal distance limits verified		
Startup sequence steps completed		
Initial operation verified		



CHAPTER 3

Installing the Cisco VG450 Voice Gateway

Tip While you do this installation, record your progress and site information. See the suggested format in the *Installation Checklist*.

Warning Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

Warning Read the installation instructions before connecting the system to the power source. Statement 1004

This chapter contains the procedures for installing your Cisco VG450 Voice Gateway and consists of the following sections:

Safety Recommendations

The following information is included to alert you to safety recommendations and best practices when working with this equipment.

Maintaining Safety with Electricity

Follow these guidelines when working on equipment powered by electricity.

Warning High leakage current—earth connection essential before connecting to system power supply. Statement 342

Warning When installing the product, please use the provided or designated connection cables/power cables/AC adaptors/batteries. Using any other cables/adaptors could cause a malfunction or a fire. Electrical Appliance and Material Safety Law prohibits the use of UL-certified cables (that have the "UL" or "CSA" shown on the cord), not regulated with the subject law by showing "PSE" on the cord, for any other electrical devices than products designated by CISCO. Statement 371

Warning This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that the protective device is rated not greater than 15A minimum, 60VDC, 35A minimum, 60VDC, 45A minimum, 60VDC, or 50A minimum, 60VDC for the Circuit Breaker. Statement 1005

Warning This equipment has been designed for connection to TN and IT power systems. Statement 1007

Warning Class 1 laser product. Statement 1008

Warning Avoid using or servicing any equipment that has outdoor connections during an electrical storm. There may be a risk of electric shock from lightning. Statement 1088

Warning This equipment must be grounded. Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available. Statement 1024

Warning This unit might have more than one power supply connection. All connections must be removed to de-energize the unit. Statement 1028

Warning Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place. Statement 1029

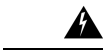
Warning To prevent personal injury or damage to the chassis, never attempt to lift or tilt the chassis using the handles on modules (such as power supplies, fans, or cards); these types of handles are not designed to support the weight of the unit. Statement 1032

Warning Do not use this product near water; for example, near a bathtub, wash bowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool. Statement 1035

Warning Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations. Statement 1036

Warning Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface. Statement 1037

Warning Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning. Statement 1038

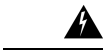


Warning To report a gas leak, do not use a telephone in the vicinity of the leak. Statement 1039

Warning Before opening the unit, disconnect the telephone-network cables to avoid contact with telephone-network voltages. Statement 1041

Warning This equipment contains a ring signal generator (ringer), which is a source of hazardous voltage. Do not touch the RJ-11 (phone) port wires (conductors), the conductors of a cable connected to the RJ-11 port, or the associated circuit-board when the ringer is active. The ringer is activated by an incoming call. Statement 1042

Warning Installation of the equipment must comply with local and national electrical codes. Statement 1074



Warning Pluggable optical modules comply with IEC 60825-1 Ed. 3 and 21 CFR 1040.10 and 1040.11 with or without exception for conformance with IEC 60825-1 Ed. 3 as described in Laser Notice No. 56, dated May 8, 2019.

General Safety Practices

Follow these guidelines to ensure personal safety and to protect the equipment:

- 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 and others could fall over them.
- Do not wear loose clothing that could get caught in the chassis.
- Wear safety glasses if you are working under any conditions that might be hazardous to your eyes.

Safety Tips

Use these tips as safety guidelines when installing or working around this equipment:

- Locate the emergency Power-off switch for the room in which you are working. Then, if an electrical accident occurs, you can act quickly to turn off the power.
- Disconnect all power before installing or removing a chassis.
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.
- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, and missing safety grounds.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself.
  - Turn off power to the system.
  - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. ESD occurs when electronic components are improperly handled; it can result in complete or intermittent failures.

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

- Ensure that the chassis is electrically connected to earth ground.
- Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact.
- Connect the clip to the ESD-strap connection jack (to the left of the power switch on the rear of the chassis) or to an unpainted chassis frame surface.

⚠

Caution For safety, periodically check the resistance value of the antistatic strap, which should be between 1 and 10 megohm (Mohm).

Unpacking and Inspection

Do not unpack the Cisco VG450 until you are ready to install it. If the installation site is not ready, keep the chassis in its shipping container to prevent accidental damage.

The Cisco VG450, cables, printed publications, and any optional equipment you ordered might be shipped in more than one container. When you unpack each shipping container, check the packing list to ensure that you received all the following items:

- Cisco VG450 Voice Gateway
- Power cord, 6-foot (1.8-meter)
- RJ-45-to-DB-25 adapter cable (labeled Console)
- RJ-45-to-DB-9 adapter cable (labeled Auxiliary)
- Rack-mounting brackets for 19-inch rack (one pair) with screws for attaching to chassis
- Grounding lug and fasteners

Inspect all items for shipping damage. If anything appears damaged, or if you encounter problems when installing or configuring your system, contact a customer service representative.

Install the Cisco VG450 Voice Gateway

Caution To prevent damage to the chassis, never attempt to lift or tilt the chassis by holding it by the plastic panel on the front. Always hold the chassis by the sides of the metal body.

You can install the Cisco VG450 Voice Gateway in one of the following ways:

Setting the Chassis on a Desktop

You can place the router on a desktop, bench top, or shelf.

Note Do not set the chassis in an area where the high acoustic noise can be an issue.

Caution Do not place anything on top of the router that weighs more than 10 pounds (4.5 kg), and do not stack the gateway hardware on a desktop. Excessive distributed weight of more than 10 pounds, or pound point load of 10 pounds on top could damage the chassis.

Warning To prevent airflow restriction, allow clearance around the ventilation openings to be at least 1 inch (2.54cms). Statement 1076.

After you install the voice gateway, you must connect the chassis to a reliable earth ground. For the chassis ground connection procedures, see the Chassis Grounding section.

Mount Cisco VG450 Voice Gateway Chassis in Rack

Warning To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:

- This unit should be mounted at the bottom of the rack if it is the only unit in the rack.
- When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack. Statement 1006.

You can install the Cisco VG450 Voice Gateway in 19-inch (48.26-cm) EIA and 23-inch (58.42-cm) Southwestern Bell Corporation (SBC) racks. You can also mount the voice gateway in a 600-mm ETSI rack. Use the standard brackets shipped with the hardware for mounting the chassis in a 19-inch EIA rack; you can order optional larger brackets for mounting the chassis in a 23-inch SBC rack.

You can mount the voice gateway in the following ways:

- Center-front mounting: Brackets attached in the center front of the chassis with only the front panel facing forward.
- Center-back mounting: Brackets attached in the center back of the chassis with only the back panel facing forward.
- Front mounting: Brackets attached at the front of the chassis with the front panel facing forward.
- Back mounting: Brackets attached at the back of the chassis with the back panel facing forward.

1. Attach the mounting brackets to the chassis as shown in the following images, using the screws provided.

Caution Do not over-torque the screws. The recommended torque is 15 to 18 inch-lb (1.7 to 2.0 N-m).

2. Attach the second bracket to the opposite side of the chassis. Use a number-2 Phillips screwdriver to install the number-8 bracket screws.

Caution Your chassis installation must allow unrestricted airflow for chassis cooling.

Figure 3: Bracket Installation for Front Mounting

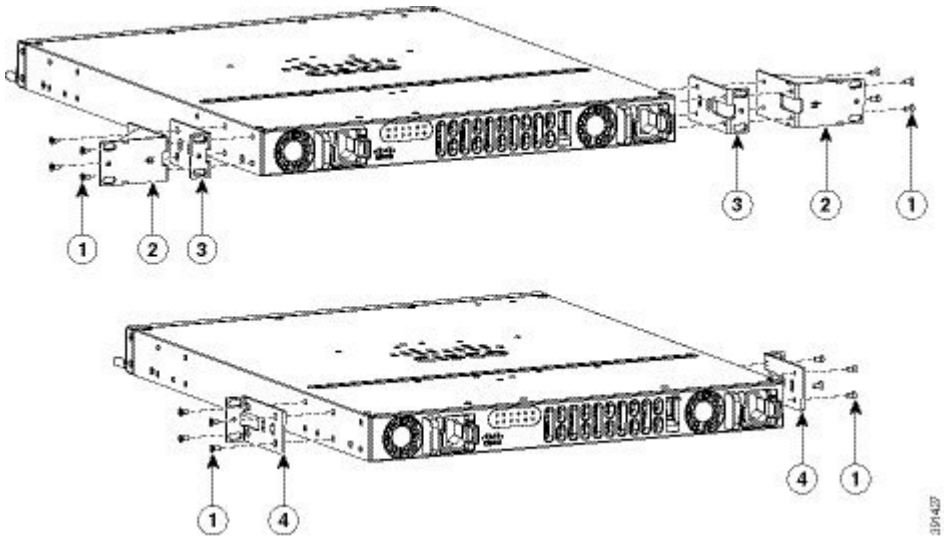
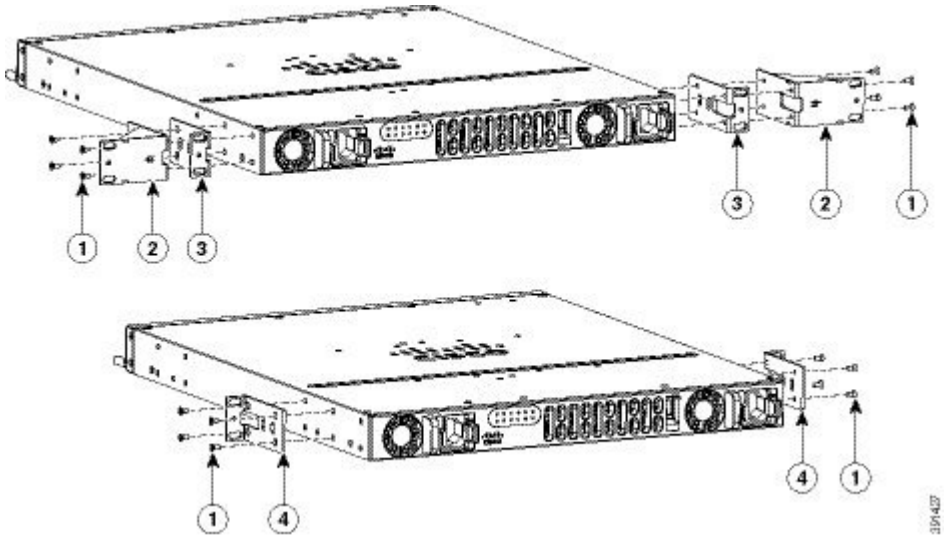


Figure 4: Bracket Installation for Back Mounting



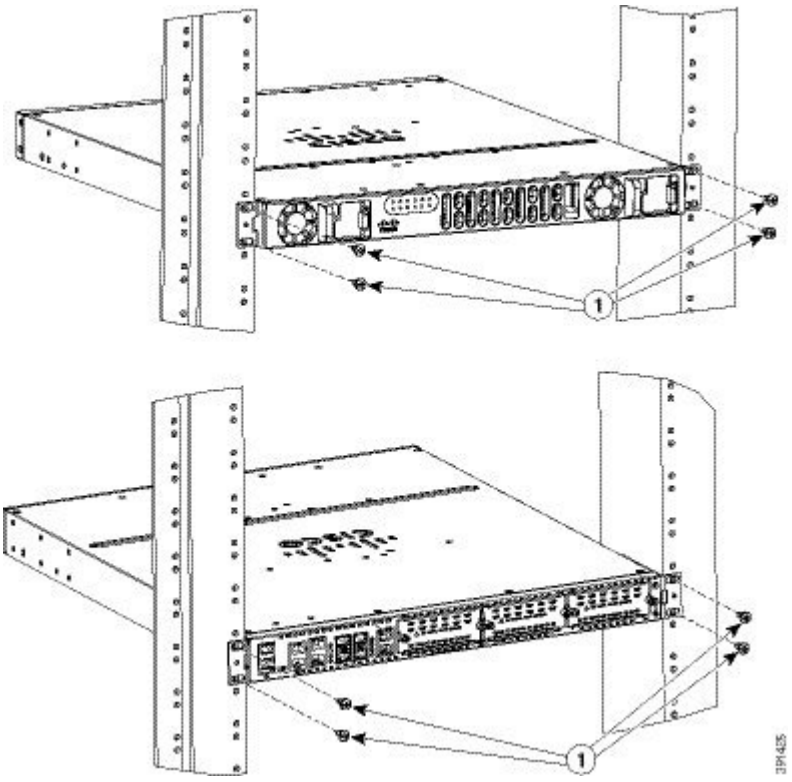
1	Screws	4	23-inch SBC brackets
3	19-inch EIA brackets	4	19-inch EIA brackets

3. Use the screws provided with the rack to install the chassis in the rack. For both the 19-inch EIA brackets and the 23-inch SBC brackets, start the lower pair of screws first, and rest the brackets on the lower screws while you insert the upper pair of screws.

Tip The screw slots in the brackets are spaced to line up with every second pair of screw holes in the rack. When the correct screw holes are used, the small, threaded holes in the brackets line up with unused screw holes in the rack. If the small holes do not line up with the rack holes, you must raise or lower the brackets to the next rack hole.

The following image shows a typical installation with back mounting

Figure 5: Bracket Installation for Back Mounting



1	Mounting Screws (4)

After you install the voice gateway, you must connect the chassis to a reliable earth ground. For the chassis ground connection procedures, see the *Chassis Grounding* section.

Chassis Grounding

Warning To reduce the risk of electric shock, the chassis of this equipment needs to be connected to permanent earth ground during normal use. Statement 445

Use a size 10 AWG (4 mm2) or larger copper wire and an appropriate user-supplied ring terminal with an inner diameter of 1/4 in. (5–7 mm).

To install the ground connection for your router, perform the following steps:

SUMMARY STEPS

1. Strip one end of the ground wire to the length required for the ring terminal.
2. Crimp the ground wire to the ring terminal, using a crimp tool of the appropriate size.
3. Attach the ground lug or ring terminal to the chassis as shown in the following image. Use one of the screws provided. Tighten the screws to a torque of 8 to 10 in-lb (0.9 to 1.1 N-m).
4. Connect the other end of the ground wire to a known reliable earth ground point at your site.

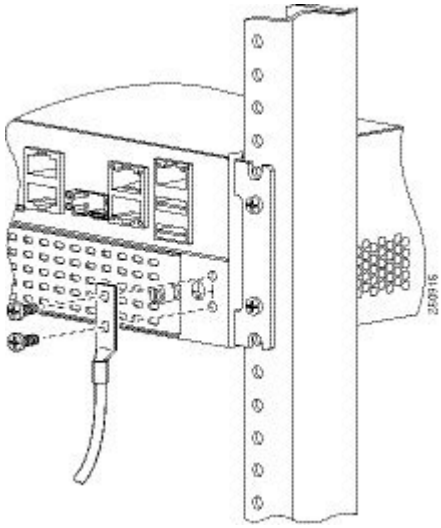
DETAILED STEPS

Step 1 Strip one end of the ground wire to the length required for the ring terminal.

Step 2 Crimp the ground wire to the ring terminal, using a crimp tool of the appropriate size.

Step 3 Attach the ground lug or ring terminal to the chassis as shown in the following image. Use one of the screws provided. Tighten the screws to a torque of 8 to 10 in-lb (0.9 to 1.1 N-m).

Figure 6: Chassis Ground Connection on the Router



Step 4 Connect the other end of the ground wire to a known reliable earth ground point at your site.

Power-On Procedure

Perform this procedure to power on your Cisco VG450 Voice Gateway, and verify that it goes through its initialization and self-test. When this is finished, the Cisco VG450 Voice Gateway is ready to configure.

Warning This unit might have more than one power supply connection. All connections must be removed to de-energize the unit. Statement 1028

Warning Installation of the equipment must comply with local and national electrical codes. Statement 1074

To power on the Cisco VG450 Voice Gateway, perform the following:

Step 1 Power on your terminal or PC, and configure it for 9600 bps, 8 data bits, 1 stop bit, and no parity.

Step 2 Move the Cisco VG450 Voice Gateway power switch to the ON position.

The green LED next to the auxiliary port come on and the fan starts to operate. If this does not happen, see the *Troubleshooting* section in this guide.

The following message is displayed at the end of the boot-up messages:

Example:

```
--- System Configuration Dialog ---
Would you like to enter the initial configuration dialog? [yes/no]:
```

Step 3 Enter **no** to proceed with manual configuration using the CLI:

Example:

```
Would you like to enter the initial configuration dialog? [yes/no]: no
Would you like to terminate autoinstall? [yes]
```

Step 4 Press Return to terminate autoinstall and continue with manual configuration.

Several messages are displayed, ending with a line similar to the following:

Example:

```
...
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled <date
> <time
> by <person
>
```

Step 5 Press Return to bring up the Router> prompt:

Example:

```
...
flashfs[4]: Initialization complete.
Router>
```

Step 6 Enter privileged EXEC mode:

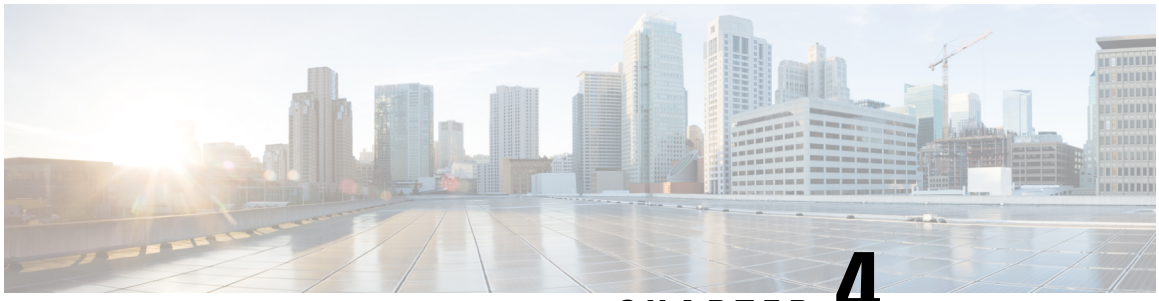
Example:

```
Router> enable

Router#
```

Step 7 Continue with the *Troubleshooting* section.

Note If the rommon 1> prompt appears, your system has booted in ROM monitor mode. For information on the ROM monitor, refer to the router rebooting and ROM monitor information in the *Cisco IOS Configuration Fundamentals Configuration Guide* for your Cisco IOS software release.



CHAPTER 4

Troubleshooting the VG450 Voice Gateway Installation Issues

This section describes possible mechanical problems and corrective actions.

Warning Only trained and qualified personnel should be allowed to install, replace, or service this equipment. Statement 1030

Warning No user-serviceable parts inside. Do not open. Statement 1073

If there appears to be a malfunction, first check all cables and connections. If these are in order, see the following table for specific troubles and solutions.

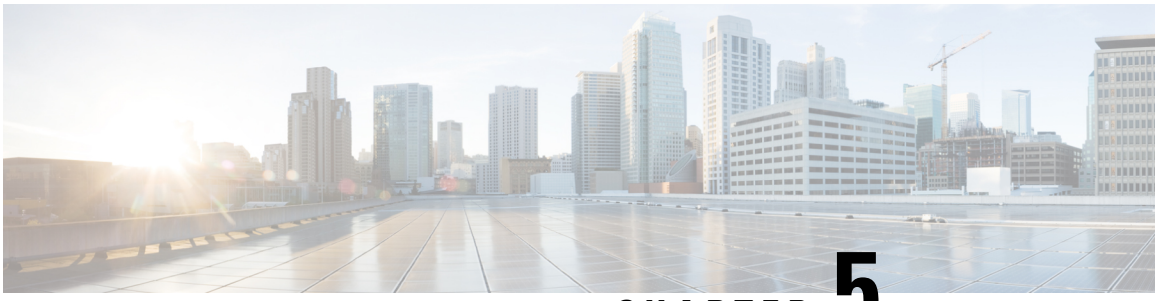
If you face issues with the Voice Gateway configuration, refer to the *Cisco VG450 Voice Gateway Software Configuration Guide*.

Table 5: Troubleshooting the Cisco VG450 Voice Gateway

Symptom	Possible Cause	Corrective Action
Power LED and fan are off	Power source switched off	Switch power source on
	Faulty power cable	Check/replace power cable
	Faulty power source	Check/correct input power
	Faulty internal power supply	Contact Cisco[1] or your Cisco reseller
Power LED on; fan off	Faulty Cisco VG450	Contact Cisco 1 Technical Service Center or your Cisco reseller
Power LED off; fan on	Faulty Cisco VG450	Contact Cisco 1 or your Cisco reseller
No initialization response from Cisco VG450	Faulty modem console terminal	Check/replace modem/terminal
	Faulty cabling to terminal	Check/replace cable
	Faulty Cisco VG450	Contact Cisco 1 or your Cisco reseller

Symptom	Possible Cause	Corrective Action
Unit shuts off after operating for some time	Overheating	Check ventilation
	Faulty Cisco VG450	Contact Cisco 1 or your Cisco reseller
Console screen display freezes	Console fault	Reset/replace console
	Software error	Repeat power-on procedure
	Faulty Cisco VG450	Contact Cisco 1 or your Cisco reseller

[1] See the “Obtaining Technical Assistance” section.



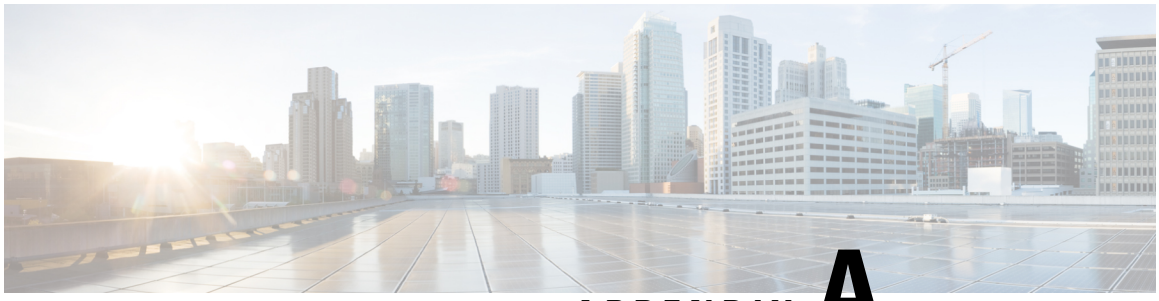
CHAPTER 5

Configuration Methods

After the Cisco VG450 Voice Gateway is operational, use the procedures described in the *Cisco Voice 450 Gateway Software Configuration Guide* to configure specific services and functions, or to make changes to an existing configuration.

You can configure the Cisco VG450 Voice Gateway by one of the following methods:

- System configuration dialog
- Configuration mode: Cisco IOS software CLI
- Setup command facility: Remote configuration through a LAN
- SNMP-based application: CiscoView or HP OpenView
- HTTP-based configuration server: Provides access to the CLI from a web browser



APPENDIX A

Cable Specifications and Information

This appendix provides the connector and pinout information you need for making or purchasing cables used with Cisco VG450 Voice Gateway. To order cables from Cisco, see the *Obtaining Technical Assistance* section. This appendix contains the following sections:

Console and Auxiliary Port Cables and Pinouts

Your Cisco VG450 Voice Gateway comes with the cable and adapters you need to connect a PC, an ASCII terminal, or a modem to your Cisco VG450 Voice Gateway. The cable kit includes:

- RJ-45-to-RJ-45 rollover cable
- RJ-45-to-DB-9 adapter cable for console connection
- RJ-45-to-DB-25 adapter cable for modem connection

The following illustrations and tables provide cable pinout information:

- Console port to a PC—See *Table A - 1* and *Table A - 4*.
- Console port to an ASCII terminal—See *Table A - 2* and *Table A - 4*.
- Auxiliary port to a modem—See *Table A - 3* and *Table A - 4*.

The console port is configured as data communications equipment (DCE); the auxiliary port is configured as data terminal equipment (DTE). Both are asynchronous serial ports and use RJ-45 connectors.

Console Port to PC

Figure A-1 shows the RJ-45-to-RJ-45 rollover cable assembly and the RJ-45-to-DB-9 female DTE adapter (labeled TERMINAL); Table A-1 lists the pinouts.

Figure 7: Figure A-1 Console Port to PC - Cable and Adapter

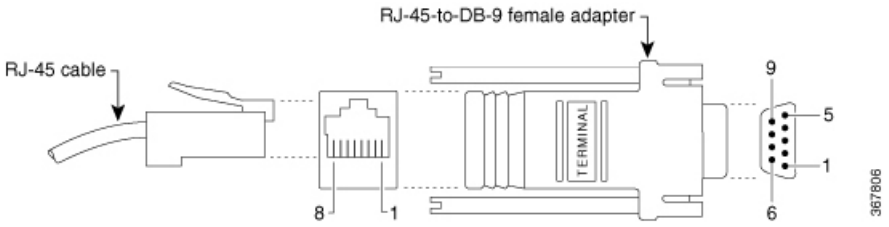


Table 6: Console Port to PC—Cable Pinouts (RJ-45 to DB-9)

Console Port (DCE, RJ-45)	RJ-45-to-RJ-45 Rollover Cable	RJ-45-to-DB-9 Adapter "TERMINAL"	PC Port (DTE, DB-9)		
Signal	RJ-45 Pin	RJ-45 Pin	RJ-45 Pin	DB-9 Pin	Signal
RTS	1[2]	8	8	8	CTS
DTR	2	7	7	6	DSR
TxD	3	6	6	2	RxD
GND	4	5	5	5	GND
GND	5	4	4	5	GND
RxD	6	3	3	3	TxD
DSR	7	2	2	4	DTR
CTS	81	1	1	7	RTS

[2] Pin 1 is connected to pin 8 inside the Cisco VG450 Voice Gateway.

Console Port to ASCII Terminal

Figure A-2 shows the RJ-45-to-RJ-45 rollover cable assembly and the RJ-45-to-DB-25 female DTE adapter (labeled TERMINAL); *Table A-2* lists the pinouts.

Figure 8: Console Port to ASCII Terminal—Cable and Adapter

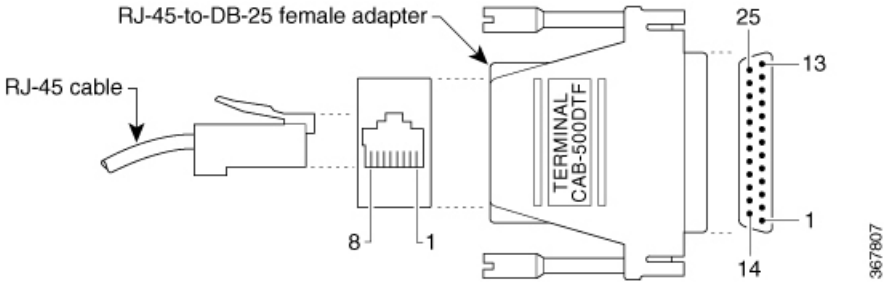


Table 7: Console Port to ASCII Terminal—Cable Pinouts (RJ-45 to DB-25)

Console Port (DCE, RJ-45)	RJ-45-to-RJ-45 Rollover Cable	RJ-45-to-DB-25 Adapter "TERMINAL"	Terminal Port (DTE, DB-25)		
Signal	RJ-45 Pin	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	Signal
RTS	1[3]	8	8	5	CTS
DTR	2	7	7	6	DSR
TxD	3	6	6	3	RxD
GND	4	5	5	7	GND
GND	5	4	4	7	GND
RxD	6	3	3	2	TxD
DSR	7	2	2	20	DTR
CTS	81	1	1	4	RTS

[3] Pin 1 is connected to pin 8 inside the Cisco VG450 Voice Gateway.

Auxiliary Port to Modem

Figure A-3 shows the RJ-45-to-RJ-45 rollover cable assembly and the RJ-45-to-DB-25 male DCE adapter (labeled MODEM); *Table A-3* lists the pinouts.

Figure 9: Auxiliary Port to Modem—Cable and Adapter

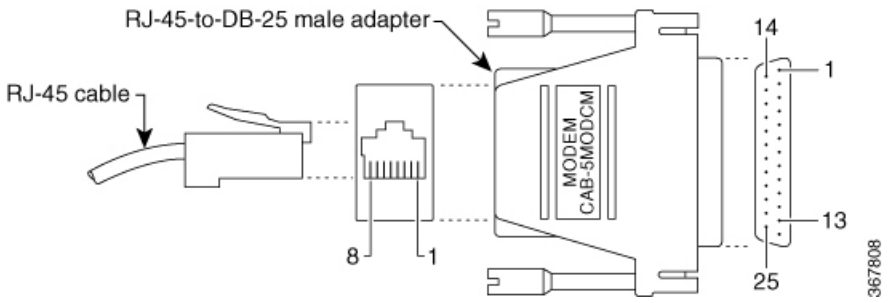


Table 8: Auxiliary Port to Modem—Cable Pinouts (RJ-45 to DB-25)

Auxiliary Port (DTE, RJ-45)	RJ-45-to-RJ-45 Rollover Cable	RJ-45-to-DB-25 Adapter "MODEM"	Modem Port (DCE, DB-25)		
Signal	RJ-45 Pin	RJ-45 Pin	RJ-45 Pin	DB-25 Pin	Signal

Auxiliary Port (DTE, RJ-45)	RJ-45-to-RJ-45 Rollover Cable	RJ-45-to-DB-25 Adapter "MODEM"	Modem Port (DCE, DB-25)		
RTS	1	8	8	4	RTS
DTR	2	7	7	20	DTR
TxD	3	6	6	2	TxD
GND	4	5	5	7	GND
GND	5	4	4	7	GND
RxD	6	3	3	3	RxD
DSR	7	2	2	8	DCD
CTS	8	1	1	5	CTS

Alternative Connections to Terminal and Modem

Your Cisco VG450 Voice Gateway ships with an RJ-45-to-RJ-45 rollover cable and two adapters for connection to a PC, a terminal, or a modem. If you want to use an RJ-45 straight-through cable or other adapters, see *Table A-4* for usable cable and adapter combinations.

Table 9: Alternative Terminal and Modem Connections

Cisco VG450 Port Connection	RJ-45 Cable Type	Adapter
Console port to PC	Straight-through	DCE, DB-9 female
Auxiliary port to modem	Rollover[4]	DCE[5], DB-25, male
	Straight-through	DTE2, DB-25, male

[4] An octal cable or RJ-45 breakout cable is equivalent to a rollover cable.
[5] Modify the DB-25 adapter by removing the wire in pin 6 and placing it in the pin 8 position.

Gigabit Ethernet Port Pinouts (RJ-45)

Figure A-4 shows the RJ-45 connector wiring for the Gigabit Ethernet cable; *Table A-5* lists the pinouts.

Note Pinout shown is for category 3, 4, or 5 10/100BASE-T connection to an Gigabit Ethernet switch.

Figure 10: RJ-45 Connector Wiring

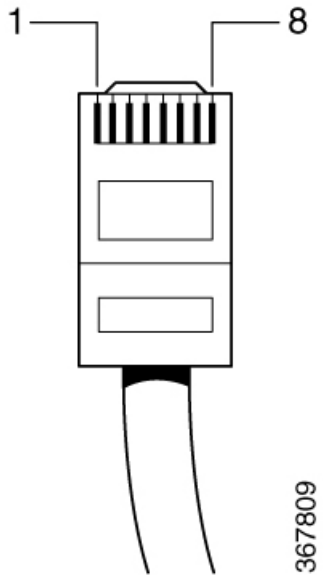


Table 10: Gigabit Ethernet Port Pinouts (RJ-45)

Pin[6]	Signal
1	TX+
2	TX–
3	RX+
4	–
5	–
6	RX–
7	–
8	–

[6] Any pin not referenced is not connected.

Analog Voice Multiport Pinouts (RJ-21X/CA21A)

Figure A-5 shows the RJ-21 connector wiring for the cable used for the multiport analog voice interface.

Figure 11: RJ-21 Connector Wiring

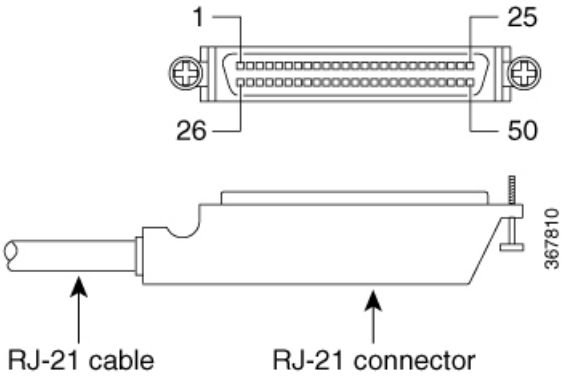


Table A-6 lists the pinouts for the RJ-21 connector.

Table 11: RJ-21 Connector Pinouts

Port Number	Connector Pin Number	Signal	Port Number	Connector Pin Number	Signal
1	126	RingTip	13	1338	RingTip
2	227	RingTip	14	1439	RingTip
3	328	RingTip	15	1540	RingTip
4	429	RingTip	16	1641	RingTip
5	530	RingTip	17	1742	RingTip
6	631	RingTip	18	1843	RingTip
7	732	RingTip	19	1944	RingTip
8	833	RingTip	20	2045	RingTip
9	934	RingTip	21	2146	RingTip
10	1035	RingTip	22	2247	RingTip
11	1136	RingTip	23	2348	RingTip
12	1237	RingTip	24	2449	RingTip
—	—	—	—	25, 50, 51, 52	GND