Cisco VG450 Analog Voice Gateway

The Cisco® VG450 High-Density Analog Voice Gateway enables an IP telephony solution to continue using traditional analog devices while taking advantage of the productivity afforded by IP infrastructure (Figure 1).

The Cisco Unified Communications portfolio of voice and IP communications products and applications enables organizations to communicate more effectively - helping them to streamline business processes, reach the right resource the first time, and improve revenue sales and profitability. The Cisco Unified Communications portfolio is a critical part of the Cisco Business Communications Solution - an integrated solution for organizations of all sizes that also includes network infrastructure, security, and network management products, wireless connectivity, and a lifecycle services approach, along with flexible deployment and outsourced management options, end-user and partner financing packages, and third-party communications applications.

Figure 1. Cisco VG450 High-Density Analog Gateway

The Cisco VG450 High-Density Analog Gateway is a Cisco IOS-XE® Software-based analog phone gateway. It connects analog phones, fax machines, modems, and speakerphones to an enterprise voice system based on Cisco Unified Communications Manager (UCM). The tight integration with the IP-based phone system is advantageous for increased manageability, scalability, and cost-effectiveness. Businesses can also use the Cisco VG450 with Cisco Unified Communications Manager Express to effectively augment an Integrated Services Router (ISR) environment. Either topology environment will support business needs for high concentration of analog voice ports for modem calls, fax calls, and analog supplementary services (Figure 2).

The Cisco VG450 offers Cisco IOS-XE Software manageability on analog phone lines to enable them to be used as extensions to the Cisco Unified Communications Manager or Cisco Unified Communications Manager Express system. The Cisco VG450 is offered in a 19-inch rack-mount chassis form.

Features and benefits

- Cisco IOS-XE Software-based hardware: The hardware includes uniform Cisco Command-Line Interface (CLI) and Simple Network Management Protocol Version 3 (SNMPv3) support for ease of gateway configuration and operation.
- Robust voice quality: Cisco experience in providing toll-quality packet-voice service helps ensure that the Cisco VG450 provides the clear, robust voice quality end users have come to expect from telephony services.
- Investment protection: Customers can continue to use existing analog phones, fax machines, and modems while taking advantage of IP telephony. Basic analog phone connectivity is needed when the infrastructure (wiring) or application does not support or require IP phones. The Cisco VG450 is the ideal platform to support centralized and highly concentrated analog phone line deployments, allowing organizations to deploy IP telephony without having to purchase IP phones for all users and to continue using existing devices. The Cisco VG450 can also be used in a Cisco Unified Communications Manager Express environment and migrated to Cisco Unified Communications Manager deployment with 100-percent investment protection.
- High availability: The Cisco VG450 has four Gigabit Ethernet ports to enable link redundancy configurations toward the LAN. Customers will experience less voice downtime due to WAN link failure.
- Cisco VG450 powered by high-performance multicore processors: In this platform, power redundancy will be available by installing an optional integrated Cisco Redundant Power System (RPS), thereby decreasing network downtime and protecting the network from power-supply failures. DC PSU will be available by 1H2019.
- Reduced barrier to entry: The Cisco VG450 provides a low-cost alternative for low-end analog phones and allows organizations to take advantage of IP telephony with a lower overall IP telephony investment.

Figure 2. Cisco VG Integration with Cisco Unified Communications Manager

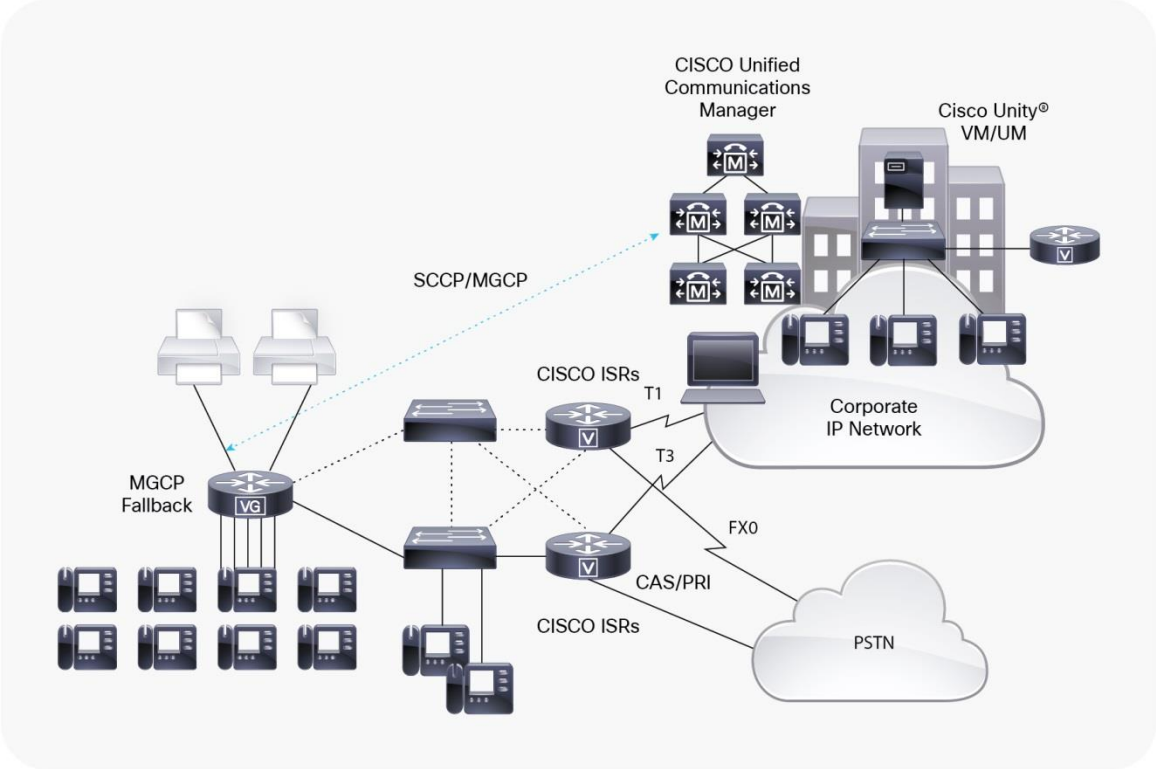
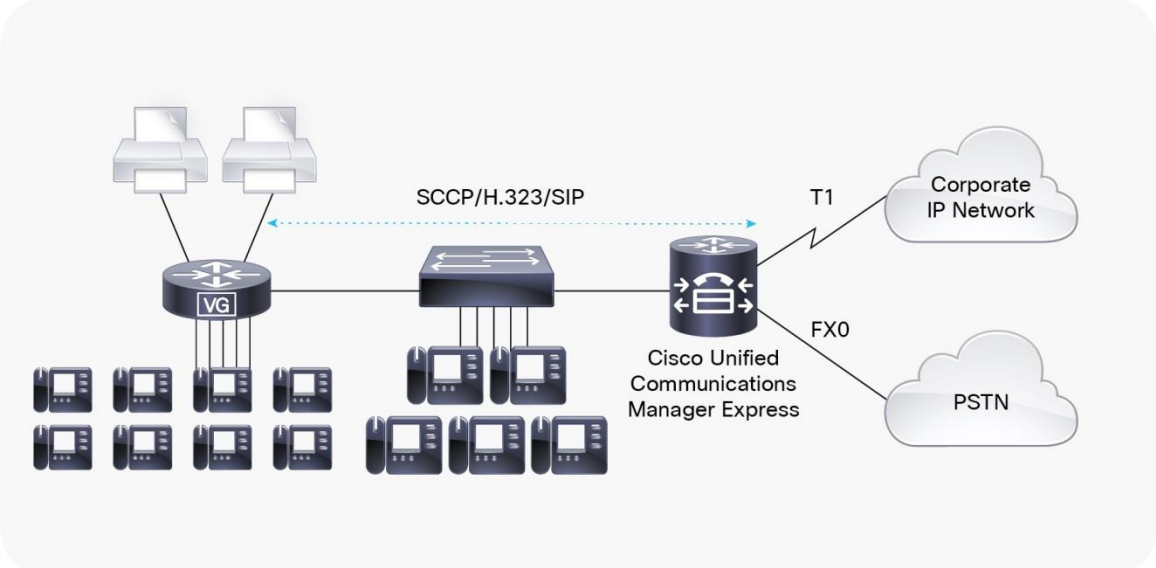


Figure 3. Cisco VG Integration with Cisco Unified Communications Manager Express



Analog phone connectivity

The Cisco VG450 is ideal for analog phone deployments ranging from centralized to sparsely concentrated or distributed topologies. It provides a high level of availability at locations with Media Gateway Control Protocol (MGCP) Fallback, with ease of manageability using Cisco IOS-XE Software monitoring features. It offers many supplementary analog calling features depending on the call control and signaling type used. Refer to Table 1 for the supplementary analog calling features available.

Table 1. Analog supplementary features available on Analog voice gateways

	Skinny Client Control Protocol (SCCP) Features with Cisco Unified Communications Manager	SCCP Features with Cisco Unified Communications Manager Express	Session Initiation Protocol (SIP) Features with Cisco Unified Communications Manager
Basic call	X	X	X
Call forward all	X	X	
Call forward busy	X	X	
Call forward cancel	X	X	
Call forward no answer	X	X	
Call hold or resume	X	X	X
Call pickup group	X	X	
Call pickup local	X	X	
Call transfer blind	X	X	
Call transfer consultative	X	X	X
Call waiting	X	X	X
Caller ID	X	X	X
Caller ID on call waiting	X	X	X
Malicious caller ID	X		
Conference call	Up to 3 parties	Up to 3 parties	Up to 3 parties
Impromptu conference call	Up to 3 parties	Up to 3 parties	
Meet-me conference call	X	X	
Directed call park		X	
Directed call pickup		X	
Directed call pickup of ringing extension		X	
Redial	X	X	
Speed dial	X	X	
Call toggle	X	X	X
Music on Hold (MoH)	X		
Shared-line support*	X		
Shared line - privacy	X		
Precedence and preemption	X		
Call back on busy	X		
DC voltage visible message waiting indication (VMWI)	X		

*Simultaneous ringing, hold, and resume across analog and IP phone

The Cisco VG450 supports Feature Access Codes (FAC) in conjunction with Cisco Unified Communications Manager and Cisco Unified Communications Manager Express. Refer to Cisco Unified Communications Manager and Cisco Unified Communications Manager Express documentation for details.

Fax and modem connectivity

The Cisco VG450 supports fax machines and modems. When using fax machines, VG450 supports 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 VG450 and will be transferred over the network using modem pass-through.

Protocols supported

- SCCP
- H.323v4
- MGCP
- SIP
- Real-Time Transport Protocol (RTP)
- Secure Real-Time Transport Protocol (SRTP)
- Trivial File Transfer Protocol (TFTP)
- HTTP server
- SNMP
- Telnet
- Dynamic Host Configuration Protocol (DHCP)
- Domain Name System (DNS)
- Call survivability - MGCP failover to an H.323 connection to the SRST router
- T.38 Fax Relay, and modem pass-through
- Support G.711, and G.729a
- RADIUS and TACACS+ for Telnet and authorization

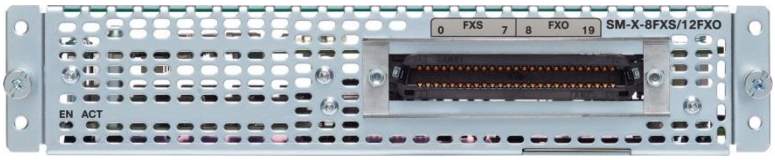
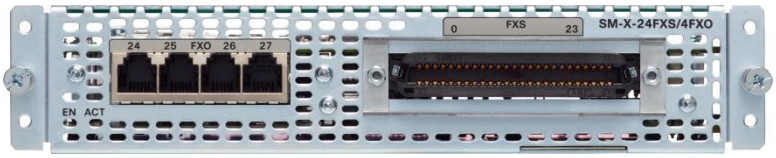
Support for high density analog voice modules on VG450

VG450 leverage new generation of high density analog voice modules to provide modular solution with flexibility to configure FXS and FXO port density.

Figure 4. High density analog voice modules for VG450

Cisco High-Density Analog Voice and Fax Service Modules are available in either a single-wide or double-wide form factor, as depicted in Table 1.

Table 2. Form factors

Model	Picture
SM-X-8FXS/12FXO • Single-wide service module	
SM-X-16FXS/2FXO • Single-wide service module	
SM-X-24FXS/4FXO • Single-wide service module	
SM-X-72FXS • Double-wide service module	

The new generation of Cisco High-Density Analog Voice and Fax Service Modules improves upon the previous high-density analog and digital extension modules (EVMs). These improvements are highlighted below:

- **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.

- **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)
  - The SM-X-72FXS module supports two FXS-E modes:
- Mode 1 (default): First 16 ports are FXS-E enabled, with the remaining 56 ports as regular FXS.
- Mode 2: First 56 ports are FXS-E enabled, with the remaining 16 ports disabled.

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

Table 2 summarizes the supported FXO failover bypass feature in each service module.

- **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.

Table 3. Feature and port comparison

Part number	Number of FXS ports	Number of FXO ports	FXO failover bypass ports	FXS-E enabled ports
SM-X-8FXS/12FXO	8	12	8	8
SM-X-16FXS/2FXO	16	2	2	16
SM-X-24FXS/4FXO	24	4	4	16
SM-X-72FXS	72	–	–	Mode 1: 16 (FXS-E)/ 56 (FXS) Mode 2: 56 (FXS-E)/16 (disabled)

Analog and digital voice NIM (Network Interface Module) support on VG450

VG450 allows to mix and match the high density analog voice modules (Single wide and double wide module slots) along with FXS/FXO Network Interface Modules (NIM) on the chassis to obtain optimal density for FXS and FXO ports in a single chassis.

Following are valid hardware combination options for high density analog voice modules in service module slot for VG450 bundles.

VG450-144FXS/K9

- Two SM-X-72FXS modules on VG450 for 144FXS Ports (top and bottom DW slots).

VG450-72FXS/K

- One SM-X-72FXS module (bottom DW slot) with at least one single-wide high density analog voice module in top slot (mandatory). Max two single-wide high density analog voice service module in top slot.
- Only double wide high density module (SM-X-72FXS) supported in bottom slot.

VG450/K9

- Chassis only without any modules or NIMs.

Figure 5. Cisco FXO, FXS, and Combo 2FXS/4FXO NIMs Compatible with VG450

Following Analog Voice NIM modules are supported in the NIM slot for VG450

Table 4. Analog Voice NIM module support on VG450

Part Number	Number of Ports	Product Description
NIM-2FXO	2	2-port Network Interface Module - FXO (Universal)
NIM-4FXO	4	4-port Network Interface Module - FXO (Universal)
NIM-2FXSP	2	2-Port Network Interface Module - FXS, FXS-E and DID
NIM-4FXSP	4	4-Port Network Interface Module - FXS, FXS-E and DID
NIM-2FXS/4FXOP	6	2-Port FXS/FXS-E/DID and 4-Port FXO Network Interface Module
NIM-4E/M	4	4-Port E/M Network Interface Module
NIM-2BRI-NT/TE	2	2-Port BRI Network Interface Module
NIM-4BRI-NT/TE	4	4-Port BRI Network Interface Module

Additionally, VG450 support T1E1 Voice Network Interface Modules in NIM slots for VG450.

The T1/E1 modules contain an onboard Cisco Packet Voice Digital Signal Processor Module 4 (PVDM4) slot, which requires a fourth-generation PVDM4 module. A PVDM4 on the T1/E1 module is necessary for the voice features.

The PVDM4 also provides for echo cancellation of up to 128-ms echo-tail length for demanding network conditions.

Figure 6. Cisco T1/E1 NIMs Compatible with VG450

Table 5. Digital Voice NIM module support on VG450

Part Number	Number of Ports	Product Description
NIM-1MFT-T1/E1	1	1 port Multi-flex Trunk Voice/Clear-channel Data T1/E1 Module
NIM-2MFT-T1/E1	2	2 port Multi-flex Trunk Voice/Clear-channel Data T1/E1 Module
NIM-4MFT-T1/E1	4	4 port Multi-flex Trunk Voice/Clear-channel Data T1/E1 Module
NIM-8MFT-T1/E1	8	8 port Multi-flex Trunk Voice/Clear-channel Data T1/E1 Module

- SM-X-NIM-ADPTR is not supported on SM slots for VG450
- There are no PVDM slots on VG450 motherboard.

Software compatibility

VG450 does not natively support CUBE (Cisco unified border element), CUCME (Cisco unified call manager express) or SRST (Survivable remote site telephony). Additionally VG450 does not support DSP farm capability. These functions are only available in ISR4000.

Table 6. Software compatibility

Product category	Compatible versions
Cisco IOS XE compatibility (4000 Series ISRs)	16.9.2 IOS-XE or later
Cisco Unified Communications Manager	10.5.2 (SU8), 11.5.1SU6 or higher, 12.0.1SU2 or higher
Cisco Unified Communications Manager Express	All version of CUCME compatible with IOS-XE 16.12.1 or higher
Third-party call control	IP-based trunk: SIP and H.323

High density analog voice service module technical specifications

Table 7. Technical specifications for the FXS and FXO service modules for VG450

Feature	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Tip and ring interfaces for each FXS port (SLIC)				
Interface	FXS/FXO (RJ-21) RJ-21 ports 0 to 7: FXS RJ-21 ports 8 to 19: FXO	FXS/FXO (RJ-21) RJ-21 ports 0 to 15: FXS RJ-21 ports 16 and 17: FXO	FXS (RJ-21), FXO (RJ-11) RJ-21 ports 0 to 23: FXS RJ-11 ports 24 to 27: FXO	FXS (RJ-21)
Address signaling formats	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 2 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
FXS loop resistance	• Up to 600 ohms (including phone or terminal equipment) for short-loop-length port • Up to 1400 ohms (including phone and terminal equipment) for long-loop-length port			
DID loop resistance	• Up to 1800 ohms (including terminal equipment)			
On-hook voltage	• -44V			
Off-hook loop current	• 25 mA (maximum) for short-loop-length port • 35 mA (maximum) for long-loop-length port			
Ring tone	• Configurable for different country requirements			
Ring voltage	• 54 Vrms into 5 ringer equivalence numbers (RENs) at zero-loop-length port (balanced) (short-loop-length port) • 65 Vrms into 2 RENs at zero-loop-length port (balanced) (long-loop-length port)			
Ring frequency	• 20, 25, 30, and 50 Hz			
REN loading	• 5 RENs per port (short-loop-length port) • 2 RENs per port (long-loop-length port) • For each SM-X-72FXS, Max 40 total REN load in Mode 1 and X total REN load in Mode 2			
RJ-11 FXS port terminating impedance option	• 600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6			
Disconnect supervision	• Power denial (calling party control and far-end disconnect)			
Caller ID	• On-hook transmission of frequency-shift-keying (FSK) data • Support for DTMF caller ID			

Feature	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
FXS loop length	• Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWG • Long-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG			
Ring Waveform	• Sine wave if no DC offset			
VMWI	• FXS ports on HWIC slot supports FSK VMWI only • FXS ports on SM-X-FXS modules support both FSK and DC voltage VMWI. Default to FSK. (DC voltage VMWI is only supported with STCAPP protocol)			
Cables	• Category 3 and Category 5			
Environment				
Operating temperature	• 32º to 104ºF (0º to 40ºC)			
Non-operating temperature	• -40º to 158ºF (-40º to 70ºC)			
Voltage	12V from backplane	12V from backplane	12V from backplane	12V from backplane
Current	4.46A on 12V	5.86A on 12V	6.61A on 12V	10.68A on 12V
Power	53.55W	70.32W	79.37W	128.16W
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)
Dimensions (H x W x D)	1.58 x 7.44 x 7.6 in 4.02 x 18.90 x 19.30 cm	1.58 x 7.44 x 7.6 in 4.02 x 18.90 x 19.30 cm	1.58 x 7.44 x 7.6 in 4.02 x 18.90 x 19.30 cm	1.58 x 15.57 x 7.57 in 4.02 x 39.55 x 198.23 cm

Table 8. Regulatory standards compliance: Safety and EMC

Specification	Description
Safety	• UL 60950-1 • CAN/CSA C22.2 No. 60950-1 • EN 60950-1 • AS/NZS 60950-1 • IEC 60950-1
Telecom	• TIA/EIA/IS-968 • CS-03 • TBR21 (FXO) • ES 201 970 (FXS) • S002, S003 • Homologation requirements vary by country and interface type. For specific country information, refer to the online approvals data base at: https://www.ciscofax.com/.
EMC	• 47 CFR, Part 15 • CES-003 Issue 4 • EN55022 Class A/B • CISPR22 Class A/B • AS/NZS 3548 Class A • VCCI V-3 • CNS 13438 • EN 300-386
Immunity	• EN 55024, CISPR 24 • EN50082-1 • EN 61000-6-1 • EN300-386

VG450 technical specifications

Table 9 gives the Cisco VG450 technical specifications.

Table 9. Cisco VG450 technical Specifications

Category	
System	VG450
Processor	High-performance multicore processors
Memory DRAM (default) /(max)	8GB / 32GB – DDR4 SDRAM
Compact Flash (default) / (max)	8GB / 32GB
External USB 2.0 slots (type A)	2
Ethernet	Up to four 10/100/1000 Ethernet LAN ports All four 10/100/1000 Ethernet LAN ports can support Small Form-Factor Pluggable (SFP)-based connectivity in lieu of RJ-45 ports, enabling fiber connectivity
Console/auxiliary (max)	A new, innovative, mini-B USB console port supports management connectivity when traditional serial ports are not available Traditional console and auxiliary ports are also available
Power	
AC Input Voltage	100 to 240 VAC auto ranging
AC Input Current (max)	7.1 to 3.0Amp
AC input Frequency	47 to 63 Hz
AC input surge current	60 A peak and less than 5 Arms per half cycle
Maximum power with AC power supply (watts)	1000W (no PoE)
Power Dissipation	230Watts (maximum consumption)
Redundant Power Supply	Optional integrated Redundant Power Supply (RPS). DC RPS is on roadmap
Physical	
Width	17.25 inches (438.15 mm)
Height	5.22 x (132.6 mm)
Depth	18.8 inches (477.65 mm)
Weight (max)	40.4 lbs. (18.3 Kg)
Mounting	3 RU, 19 in. EIA/23 in
Environment	
Operating Temperature	32 to 104ºF (0 to 40ºC)
Non-operating Temperature	-40 to 158ºF (-40 to 70ºC)
Operating Humidity	5 to 85%
Noise Level (max)	Sound Pressure: 54.3 dB typical, 68.9 dB maximum – Sound Power: 66.3 dB typical, 81.0 dB maximum
On-Premise or Off-Premise	On premise only, restricted access area, permanent ground required, to be installed and serviced only by trained professionals

Homologation

High-Density Analog Voice and Fax Service Modules in VG450 are approved for the countries listed in Table 8 for off-premises (FXO) and on-premises (FXS) connections. Approval for other countries is in progress. Refer to the Cisco Telecom Approvals Website for approval progress for other countries: https://tools.cisco.com/cse/prdapp/jsp/externalsearch.do?action=externalsearch&page=EXTERNAL_SEARCH.

Table 10. Telecom approvals

SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
United States	United States	United States	United States
Canada	Canada	Canada	Canada
CE countries1	Canada	Canada	Canada
Australia	Australia	Australia	Australia
Japan	Japan	Japan	Japan

The CE mark is recognized in the following countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Gibraltar, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxemburg, Malta, Monaco, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, and United Kingdom.

Ordering information

To order this product, use the information provided in Table 11.

Table 11. Ordering information

Product Number	Product Description
VG450/K9	Cisco VG450 High Density Voice over IP Analog Gateway
VG450-144FXS/K9	Cisco VG450 144 FXS Bundle. Leveraging two SM-X-72FXS
VG450-72FXS/K9	Cisco VG450 72 FXS with option to use two single wide analog voice and fax service module
SM-X-8FXS/12FXO	Single-Wide High Density Analog Voice Service Module with 8 FXS and 12 FXO
SM-X-16FXS/2FXO	Single-Wide High Density Analog Voice Service Module with 16 FXS and 2 FXO
SM-X-24FXS/4FXO	Single-Wide High Density Analog Voice Service Module with 24 FXS and 4 FXO
SM-X-72FXS	Double-Wide High Density Analog Voice Service Module with 72 FXS

Services and support

Using the Cisco Lifecycle Services approach, Cisco and our partners offer a broad portfolio of end-to-end services. These services are based on proven methodologies for deploying, operating, and optimizing IP Communications solutions. Initial planning and design services, for example, can help you meet aggressive deployment schedules and minimize network disruption during implementation. Operate services reduce the risk of communications downtime with expert technical support. Optimize services enhance solution performance for operational excellence. Cisco and our partners offer a system-level service and support approach that can help you create and maintain a resilient, converged network that meets your business needs.

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Flexible payment solutions to help you achieve your objectives

Cisco Capital makes it easier to get the right technology to achieve your objectives, enable business transformation and help you stay competitive. We can help you reduce the total cost of ownership, conserve capital, and accelerate growth. In more than 100 countries, our flexible payment solutions can help you acquire hardware, software, services and complementary third-party equipment in easy, predictable payments. Learn more.

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