

High-Density Analog Voice and Fax Service Modules for Cisco 4000 Series ISRs

Product overview

The Cisco® High-Density Analog Voice and Fax Service Modules 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 (ISRs). 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.



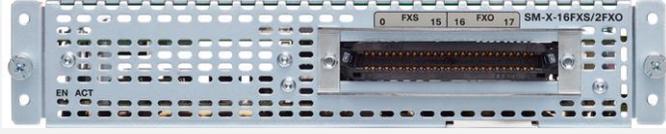
Product details

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 (in North America only).

The FXS port is used to connect analog phones, modems, fax machines, and speaker phones to an enterprise IP voice system, so you can 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. Caller ID is not supported in DID mode.

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 1. Form factors

Model	Picture
SM-X-8FXS/12FXO <ul style="list-style-type: none"> Single-wide service module 	
SM-X-16FXS/2FXO <ul style="list-style-type: none"> Single-wide service module 	
SM-X-24FXS/4FXO <ul style="list-style-type: none"> Single-wide service module 	
SM-X-72FXS <ul style="list-style-type: none"> Double-wide service module 	

Note: These service modules are supported only with the Cisco 4000 Series ISRs.

Features and benefits

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.
- 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)

Refer to Table 2 for the number of FXS-E ports in each module. 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.

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

In addition to the features listed above, the service modules support:

- 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
- 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) 1.0
- Cable detection
- Overload protection

Table 2. 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 phone connectivity

Cisco High-Density Analog Voice and Fax Service Modules are ideal for analog phone deployments ranging from centralized to sparsely concentrated or distributed topologies. The 4000 Series ISRs offer many supplementary analog calling features, depending on the call control and signaling type used. Table 3 lists the supplementary analog calling features available.

Table 3. Supplementary analog features available on 4000 Series ISRs using FXS and FXO service modules

Feature	SCCP features with Cisco Unified Communications Manager	SCCP features with Cisco Unified Communications Manager Express	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
Ad hoc 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	X		
Shared-line support [*]	X		
Shared-line privacy	X		
Precedence and preemption	X		
Call back on busy	X		
DC voltage visual message-waiting indicator (VMWI)	X		

^{*} Simultaneous ringing, hold, and resume across analog and IP phone.

The analog interface on the 4000 Series also supports Feature Access Codes (FACs) for invoking supplementary services.

Fax and modem connectivity

FXS ports on the Cisco High-Density Analog Voice and Fax Service Modules 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 SM-X voice and fax modules 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, and G.729a
- RADIUS and TACACS+ for Telnet and authorization

Platform support and compatibility

Platform compatibility

Cisco High-Density Analog Voice and Fax Service Modules are supported on an SM-X slot within the Cisco 4000 Series ISRs. Single-wide modules will occupy one SM-X slot, while double-wide modules will occupy two adjacent SM-X slots. Table 4 lists platform compatibility for the service modules.

Table 4. 4000 Series ISR platform compatibility

4000 Series platform	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
4321	Not supported	Not supported	Not supported	Not supported
4331	1	1	1	Not supported
4351	2	2	2	1
4431	Not supported	Not supported	Not supported	Not supported
4451	2	2	2	1

Software compatibility

Cisco High-Density Analog Voice and Fax Service Modules are supported on the Cisco 4400 and 4300 Series ISRs and require Cisco IOS® XE Software Release 16.7.1 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.

Table 5 lists the software versions compatible with the FXO and FXS service modules.

Table 5. Software compatibility

Product category	Compatible versions
Cisco IOS XE compatibility (4000 Series ISRs)	16.7.1 and above
Cisco Unified Communications Manager	10.5.2(SU6), 11.5.2(SU4), 12.0.1 and higher
Cisco Unified Communications Manager Express	Version compatible with Cisco IOS XE 16.7.1 and higher
Third-party call control	IP-based trunk: SIP and H.323

Product specifications

Tables 6 and 7 provide the specifications for the FXS and FXO service modules in the 4000 Series ISRs.

Table 6. Service module specifications

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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Up to 1800 ohms (including terminal equipment) 			
On-hook voltage	<ul style="list-style-type: none"> -44V 			
Off-hook loop current	<ul style="list-style-type: none"> 25 mA (maximum) for short-loop-length port 35 mA (maximum) for long-loop-length port 			
Ring tone	<ul style="list-style-type: none"> Configurable for different country requirements 			
Ring voltage	<ul style="list-style-type: none"> 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) 			

Feature	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Ring frequency	<ul style="list-style-type: none"> • 20, 25, 30, and 50 Hz 			
REN loading	<ul style="list-style-type: none"> • 5 RENs per port (short-loop-length port) • 2 RENs per port (long-loop-length port) 			
RJ-11 FXS port terminating impedance option	<ul style="list-style-type: none"> • 600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6 			
Disconnect supervision	<ul style="list-style-type: none"> • Power denial (calling party control and far-end disconnect) 			
Caller ID	<ul style="list-style-type: none"> • On-hook transmission of Frequency-Shift-Keying (FSK) data • Support for DTMF caller ID 			
FXS loop length	<ul style="list-style-type: none"> • 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 			
Cables	<ul style="list-style-type: none"> • Category 3 and Category 5 			
Environment				
Operating temperature	<ul style="list-style-type: none"> • 32° to 104°F (0° to 40°C) 			
Nonoperating temperature	<ul style="list-style-type: none"> • -40° to 158°F (-40° to 70°C) 			
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 7. Regulatory standards compliance: Safety and EMC

Specification	Description
Safety	<ul style="list-style-type: none"> • UL 60950-1 • CAN/CSA C22.2 No. 60950-1 • EN 60950-1 • AS/NZS 60950-1 • IEC 60950-1
Telecom	<ul style="list-style-type: none"> • 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.cisconfax.com/
EMC	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • EN 55024, CISPR 24 • EN50082-1 • EN 61000-6-1 • EN300-386

Specification	Description
NEBS	<ul style="list-style-type: none"> • SR-3085 NEBS Level 3 (USA) • GR-1089-CORE Type 3 • GR-63-CORE • GR-78-CORE

Homologation

The High-Density Analog Voice and Fax Service Modules 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 8. 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 countries ¹	CE countries ¹	CE countries ¹	CE countries ¹
Australia	Australia	Australia	Australia
Japan	Japan	Japan	Japan

¹ 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

Table 9 will help you understand all the components or parts you need to purchase in order to install and use the product. It also provides a direct link to the Cisco Ordering Tool and lists part numbers for customer convenience.

To place an order, visit the [Cisco Ordering Home Page](#). To download software, visit the [Cisco Software Center](#).

Table 9. Ordering information

Product ID	Product description
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

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