



FXO, FXS, and E&M Voice Interface Card Support on Cisco 1700 Series Routers

This document describes the support on the Cisco 1751 and Cisco 1760 routers for the following new voice interface cards (VICs):

- VIC2-2FXO, the 2-port Foreign Exchange Office (FXO) VIC, including CAMA functionality
- VIC2-4FXO, the 4-port FXO VIC, including CAMA functionality
- VIC2-2FXS, the 2-port Foreign Exchange Station (FXS) VIC
- VIC2-2E/M, the 2-port recEive and transMit (E&M) VIC

This document contains the following sections:

- [VIC2-2FXS, VIC2-2FXO, and VIC2-4FXO, page 1](#)
- [VIC2-2E/M, page 6](#)
- [Related Documentation, page 6](#)
- [Obtaining Documentation, page 6](#)
- [Obtaining Technical Assistance, page 8](#)

VIC2-2FXS, VIC2-2FXO, and VIC2-4FXO

An FXS interface connects directly to a standard telephone, fax machine, PBX, or similar device, and supplies ring, voltage, and dial tone to the station.

An FXO interface connects local calls to a public switched telephone network (PSTN) central office or to a PBX that does not support E&M signaling. This is the interface a standard telephone provides.

To configure the ports on the 2-port VIC2-2FXS VIC, the 2-port VIC2-2FXO VIC and the 4-port VIC2-4FXO VIC, refer to the [“Configure FXS or FXO Voice Ports”](#) section in the *Cisco 1751 Router Software Configuration Guide*.



Note

On these new VICs (the VIC2-2FXS, VIC2-2FXO, and VIC2-4FXO), the ports are configured separately.



Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Copyright © 2003 Cisco Systems, Inc. All rights reserved.

Restrictions on VIC2-4FXO Usage

When configured for operation in countries that use the TBR21 mode, the use of VIC2-4FXO cards is subject to the following limitations.

- In the Cisco 1751 router, a maximum of one VIC2-4FXO card can be supported.
- In the Cisco 1760 router, a maximum of two VIC2-4FXO cards can be supported.

When not operating in the TBR21 mode, these limitations do not apply.

These restrictions do not apply to VIC2-2FXO cards.

CAMA Functionality on VIC2-2FXO and VIC2-4FXO

The 2-port VIC2-2FXO VIC and the 4-port VIC2-4FXO VIC have the capability to operate in the Centralized Automated Message Accounting (CAMA) mode of operation.

Software Requirements

CAMA functionality on VIC2-2FXO and VIC2-4FXO VICs in Cisco 1751 and Cisco 1760 routers requires Cisco IOS Release 12.3(2)XA or later.

Overview of CAMA

CAMA is a signaling protocol that was originally designed for toll call billing purposes but has been adapted to carry a single telephone number for Enhanced 911 (E911) purposes. E911 is an emergency telephone system capable of automatically displaying the callback number (and in some cases the location) of a person who dials 911 to request emergency help from public safety agencies.

The North American emergency E911 phone system consists of a voice network that is built largely outside of the normal PSTN on which common voice traffic rides. Calls to emergency services are treated specially because they are routed differently from normal traffic within the PSTN. Calls to emergency services are routed on the basis of the calling number, not the called number. The calling number is checked against a database of emergency service providers that cross-references the service providers for the caller's particular location. When this information is determined, the call is then routed to the proper public service answering point (PSAP), which dispatches services to the caller's location.

During setup of a call to E911, before the audio channel is connected, the calling number is transmitted to each switching point, known as a Selective Router (SR), via CAMA. CAMA is used because it carries both the calling and called number using in-band signaling. This allows the telephone system to send a station identification number to the PSAP through the telephone company's E911 equipment. CAMA trunks are used in 80 percent of the E911 network today.

The calling number is needed at the PSAP for two reasons:

- To use the calling number to reference an Automatic Location Identification (ALI) database to find the caller's exact location and any extra information about the caller that may have been stored in the database
- To reconnect to the callback number in case the call is disconnected

[Figure 1](#) shows the topography in existing E911 networks. [Figure 2](#) shows an E911 network using the VIC2-2FXO or VIC2-4FXO card, configured for CAMA, in a Cisco 1751 or Cisco 1760 router.

Figure 1 Existing E911 Networks

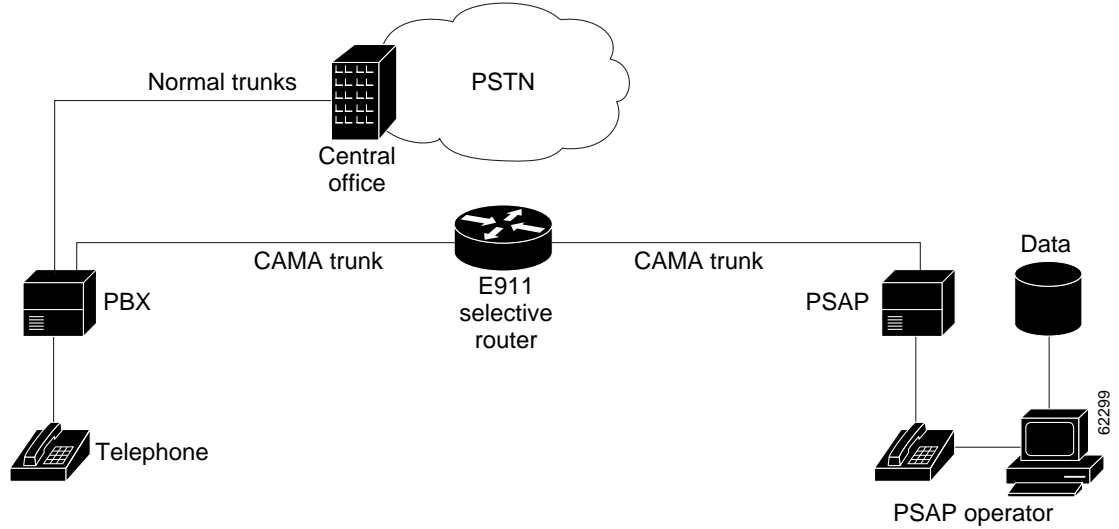
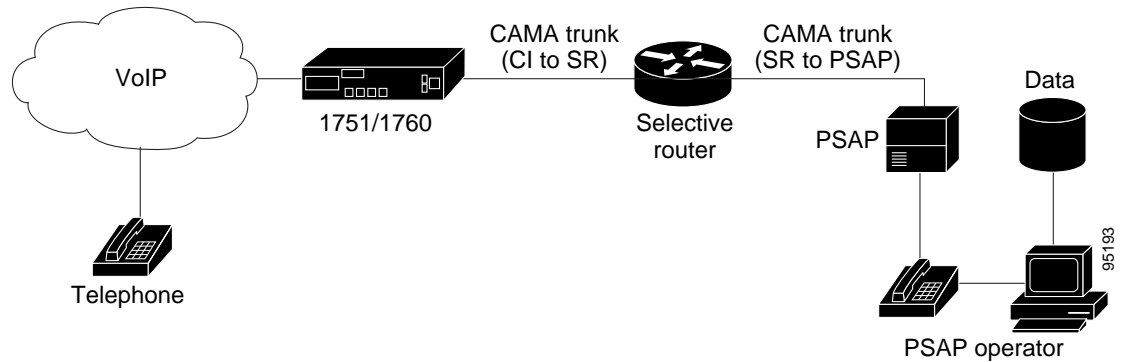


Figure 2 Analog CAMA E911 Networks



Configuring CAMA

To configure a VIC2-2FXO or VIC2-4FXO card to recognize CAMA signaling, perform the following steps in global configuration mode.



Note

When a port on these VICs is not configured for CAMA signaling, the port will function as a normal FXO port, and all existing FXO functionality will be available.

	Command	Purpose
Step 1	Router(config)# voice-port <i>slot/port</i>	Identifies the voice port to be configured.
Step 2	Router(config-voiceport)# signal { cama { KP-0-NPA-NXX-XXXX-ST KP-0-NXX-XXXX-ST KP-2-ST KP-NPD-NXX-XXXX-ST } groundstart loopstart }}	Selects the desired signal and specifies the type of CAMA signaling. The following are the four CAMA signaling options for transmitting the calling number: <ul style="list-style-type: none"> • Type 1 — KP-0-NXX-XXXX-ST • Type 2 — KP-0-NPA-NXX-XXXX-ST • Type 3 — KP-2-ST • Type 4 — KP-NPD-NXX-XXXX-ST The card default, without CAMA enabled, is loopstart.
Step 3	Router(config-voiceport)# shut	Disables the selected port on the voice interface card.
Step 4	Router(config-voiceport)# no shut	Enables CAMA signaling. Note You must perform the shut and no shut commands in steps 3 and 4 to complete the activation of CAMA on the voice ports being configured.

The CAMA signaling options are as follows:

- **KP-0-NXX-XXXX-ST**—7-digit Automatic Number Identification (ANI) transmission. The Numbering Plan Area (NPA) or area code is implied by the trunk group and is not transmitted.
- **KP-0-NPA-NXX-XXXX-ST**—10-digit transmission. The E.164 number is fully transmitted.
- **KP-2-ST**—Default transmission when the CAMA trunk cannot obtain a corresponding Numbering Plan Digit (NPD) in the look-up table, or when the calling number is fewer than 10 digits. (NPA digits are not available.)
- **KP-NPD-NXX-XXXX-ST**—8-digit ANI transmission, in which the NPD is a single multifrequency (MF) digit that is expanded into the NPA. The NPD table is preprogrammed by configuring ANI mapping in the sending and receiving equipment (on each end of the MF trunk); for example: 0= 408, 1=510, 2=650, 3=415. See [Configuring ANI Mapping](#), below.

NPD values range from 0 through 3. Examples of telephone numbers in this signaling option are:

- 05550123 = (408) 555-0123
- 25550199 = (650) 555-0199



Note If the NPD value does not match a value in the NPD table, the CAMA signaling option defaults to **KP-2-ST**.

Configuring ANI Mapping

To configure a VIC2-2FXO or VIC2-4FXO card for 8-digit ANI transmission, perform the following steps in global configuration mode.

	Command	Purpose
Step 1	Router(config)# voice-port <i>slot/port</i>	Identifies the voice port that you want to configure and enters voice-port configuration mode.
Step 2	Router(config-voiceport)# ani mapping <i>NPD-value NPA-number</i>	Builds the table that translates the Numbering Plan Area (NPA), or area code, into a single MF digit. The number of Numbering Plan Digits (NPDs) programmed is determined by local policy and by the number of NPAs or area codes that the PSAP serves. The NPD value range is 0-3. The NPA number range is 100-999. Note Repeat Step 4 until all NPAs (area codes) are configured or until the NPD range maximum is reached.

Configuration and Verification

The following example shows the configuration of the VIC2-2FXO card for 8-digit transmission. In this example, ANI mapping is shown for the following area codes (NPAs): 0=408, 1=510, 2=650, 3=415.

```
voice-port 0/0
  ani mapping 0 408
  ani mapping 1 510
  ani mapping 2 650
  ani mapping 3 415
  signal cama KP-NPD-NXX-XXXX-ST
  shut
  no shut
```

Configuration may be verified by use of the **show run** command, or the **show voice port** command, or the **show voice port summary** command.

```
router # show run
...
!
voice-port 0/0
  ani mapping 0 408
  ani mapping 1 510
  ani mapping 2 650
  ani mapping 3 415
  signal cama KP-NPD-NXX-XXXX-ST
!
...
end
```

The following example shows the result of a **show voice port summary** command on a router with a VIC2-2FXO card in slot 0. Port 0 is configured for CAMA, and port 1 is configured for normal FXO operation.

```
router# show voice port summary
-----
PORT      CH    SIG-TYPE  ADMIN OPER STATUS  STATUS  EC
-----  --  -----  -----  -----  -----  -----  --
0/0       --   fxo-cama  up    up    idle   on-hook  y
0/1       --   fxo-ls   up    up    idle   on-hook  y
```

VIC2-2E/M

An E&M interface connects remote calls from an IP network to PBX trunk lines (tie lines) for local distribution.

To configure the ports on the 2-port VIC2-2E/M VIC, refer to the “[Configure E&M Voice Ports section](#)” in the *Cisco 1751 Router Software Configuration Guide*.



Note

On all E&M VICs, including the VIC2-2E/M VIC, the ports cannot be configured separately.

Related Documentation

For information on installing FXO, FXS, and E&M VICs in Cisco 1700 series routers, refer to the following:

- [Cisco Interface Cards Hardware Installation Guide](#)

For additional information about installing and configuring the Cisco 1751 and Cisco 1760 routers, go to the Cisco 1700 series routers website

http://www.cisco.com/univercd/cc/td/doc/product/access/acs_mod/1700/index.htm

and refer to the following documentation:

- [Cisco 1751 Router Hardware Installation Guide](#)
- [Cisco 1751 Router Software Configuration Guide](#)
- [Cisco 1760 Modular Access Router Hardware Installation Guide](#)
- [Quick Start Guide for Installing Your Cisco 1760 Modular Access Router](#)

Obtaining Documentation

Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation on the World Wide Web at this URL:

<http://www.cisco.com/univercd/home/home.htm>

You can access the Cisco website at this URL:

<http://www.cisco.com>

International Cisco web sites can be accessed from this URL:

http://www.cisco.com/public/countries_languages.shtml

Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which may have shipped with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual subscription.

Registered Cisco.com users can order the Documentation CD-ROM (product number DOC-CONDOCCD=) through the online Subscription Store:

<http://www.cisco.com/go/subscription>

Ordering Documentation

You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpk/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Networking Products Marketplace:
<http://www.cisco.com/en/US/partner/ordering/index.shtml>
- Registered Cisco.com users can order the Documentation CD-ROM (Customer Order Number DOC-CONDOCCD=) through the online Subscription Store:
<http://www.cisco.com/go/subscription>
- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, U.S.A.) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

Documentation Feedback

You can submit comments electronically on Cisco.com. On the Cisco Documentation home page, click **Feedback** at the top of the page.

You can e-mail your comments to bug-doc@cisco.com.

You can submit your comments by mail by using the response card behind the front cover of your document or by writing to the following address:

Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com, which includes the Cisco Technical Assistance Center (TAC) Website, as a starting point for all technical assistance. Customers and partners can obtain online documentation, troubleshooting tips, and sample configurations from the Cisco TAC website. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC website, including TAC tools and utilities.

Cisco.com

Cisco.com offers a suite of interactive, networked services that let you access Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

Cisco.com provides a broad range of features and services to help you with these tasks:

- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

To obtain customized information and service, you can self-register on Cisco.com at this URL:

<http://www.cisco.com>

Technical Assistance Center

The Cisco TAC is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two levels of support are available: the Cisco TAC website and the Cisco TAC Escalation Center. The avenue of support that you choose depends on the priority of the problem and the conditions stated in service contracts, when applicable.

We categorize Cisco TAC inquiries according to urgency:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

Cisco TAC Website

You can use the Cisco TAC website to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC website, go to this URL:

<http://www.cisco.com/tac>

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC website. Some services on the Cisco TAC website require a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

<http://tools.cisco.com/RPF/register/register.do>

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC website, you can open a case online at this URL:

<http://www.cisco.com/en/US/support/index.html>

If you have Internet access, we recommend that you open P3 and P4 cases through the Cisco TAC website so that you can describe the situation in your own words and attach any necessary files.

Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

<http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: *Internetworking Terms and Acronyms Dictionary*, *Internetworking Technology Handbook*, *Internetworking Troubleshooting Guide*, and the *Internetworking Design Guide*. For current Cisco Press titles and other information, go to Cisco Press online at this URL:
<http://www.ciscopress.com>
- *Packet* magazine is the Cisco monthly periodical that provides industry professionals with the latest information about the field of networking. You can access *Packet* magazine at this URL:
http://www.cisco.com/en/US/about/ac123/ac114/about_cisco_packet_magazine.html
- *iQ Magazine* is the Cisco monthly periodical that provides business leaders and decision makers with the latest information about the networking industry. You can access *iQ Magazine* at this URL:
http://business.cisco.com/prod/tree.taf%3fasset_id=44699&public_view=true&kbns=1.html
- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in the design, development, and operation of public and private internets and intranets. You can access the *Internet Protocol Journal* at this URL:
http://www.cisco.com/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training, with current offerings in network training listed at this URL:

http://www.cisco.com/en/US/learning/le31/learning_recommended_training_list.html

This document is to be used in conjunction with the documents listed in the “[Related Documentation](#)” section.

CCSP, CCVP, the Cisco Square Bridge logo, Follow Me Browsing, and StackWise are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn, and iQuick Study are service marks of Cisco Systems, Inc.; and Access Registrar, Aironet, ASIST, BPX, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Empowering the Internet Generation, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, FormShare, GigaDrive, GigaStack, HomeLink, Internet Quotient, IOS, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, LightStream, Linksys, MeetingPlace, MGX, the Networkers logo, Networking Academy, Network Registrar, *Packet*, PIX, Post-Routing, Pre-Routing, ProConnect, RateMUX, ScriptShare, SlideCast, SMARTnet, StrataView Plus, TeleRouter, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0502R)

Copyright © 2003 Cisco Systems, Inc. All rights reserved.