



# Connecting Cisco High-Density Extension Modules to the Network

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This guide describes how to connect Cisco high-density extension modules to your network. It contains the following sections:

- [Cisco High-Density Analog and Digital Extension Module for Voice and Fax, page 1](#)
- [Installing Expansion Modules on Cisco High-Density Extension Modules, page 4](#)
- [Connecting Cisco High-Density Extension Modules to the Network, page 6](#)
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## Cisco High-Density Analog and Digital Extension Module for Voice and Fax

The Cisco high-density analog and digital extension module for voice and fax is available as an 8-port analog voice module (EVM-HD-8FXS/DID). Each port can be configured in Foreign Exchange Station (FXS) or Direct Inward Dialing (DID) mode through Cisco IOS software commands.



**Note**

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FXS supports on-premises applications only.

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Cisco high-density extension modules provide an integrated high-density analog and digital voice interface for small or medium branch offices. Together with certain expansion modules (see the [“Expansion Modules for Cisco High-Density Extension Modules” section on page 2](#)), the Cisco high-density extension module provides a maximum of 24 analog voice ports with 8 ports of DID capability.



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**Note**

Cisco high-density extension modules can only be used in certain slots of modular access routers. To determine which slots on your router support high-density extension modules, see the “[Platform and Slot Limitations for Cisco Service Modules and Network Modules](#)” section in [Chapter 1, “Overview of Cisco Network Modules and Service Modules for Cisco Access Routers.”](#)”

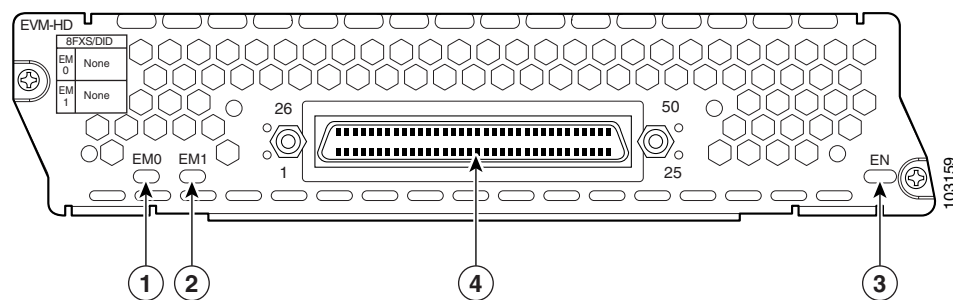
**Caution**

To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, connect the 8-port analog voice/fax expansion module (EM-HDA-8FXS and EM3-HDA-8FXS) and 4-port digital voice/fax expansion module (EM-4BRI-NT/TE) only to intrabuilding or nonexposed wiring or cabling. The intrabuilding cable must be shielded and the shield must be grounded at both ends.

## Cisco High-Density Extension Module LEDs and Interfaces

Figure 1 shows high-density extension module LEDs and interfaces.

**Figure 1** Cisco High-Density Extension Module (EVM-HD-8FXS/DID) LEDs



<b>1</b>	EM0: Green indicates presence of an installed expansion module in slot EM0.	<b>3</b>	EN: Green indicates that the network module has passed self-test and is available to the router.
<b>2</b>	EM1: Green indicates presence of an installed expansion module in slot EM1.	<b>4</b>	RJ-21 connector for use with RJ-21 cable.

## Expansion Modules for Cisco High-Density Extension Modules

The Cisco high-density extension module supports up to two expansion modules (EMs) in the configurations shown in [Table 1](#).

**Table 1** *Example Hardware Configurations Supported on Cisco High-Density Extension Modules (EVM-HD-8FXS/DID)*

Base Board (FXS or DID)	EM0	EM1	Total Ports					Total Voice Sessions
			FXS or DID	FXS	FXO	BRI		
						Ports	B- channel	
EVM-HD-8FXS/DID	—	—	8	—	—	—	—	8
	EM-HDA-8FXS	—	8	8	—	—	—	16
	EM-HDA-8FXS	EM-HDA-8FXS	8	16	—	—	—	24
	EM-HDA-8FXS	EM-HDA-3FXS/4FXO	8	11	4	—	—	23
	EM-HDA-8FXS	EM-HDA-6FXO	8	8	6	—	—	22
	EM-HDA-8FXS	EM-4BRI-NT/TE	8	8	—	4	8	24
	EM3-HDA-8FXS/DID	EM3-HDA-8FXS/DID	8	8	—	—	—	16
	EM3-HDA-8FXS/DID	EM-HDA-8FXS	8	16	—	—	—	24
	EM3-HDA-8FXS/DID	EM-HDA-3FXS/4FXO	8	11	4	—	—	23
	EM3-HDA-8FXS/DID	EM-HDA-6FXO	8	8	6	—	—	22
	EM3-HDA-8FXS/DID	EM-4BRI-NT/TE	8	8	—	4	8	24
	EM-HDA-3FXS/4FXO	—	8	3	4	—	—	15
	EM-HDA-3FXS/4FXO	EM-HDA-3FXS/4FXO	8	6	8	—	—	22
	EM-HDA-3FXS/4FXO	EM-HDA-6FXO	8	3	10	—	—	21
	EM-HDA-3FXS/4FXO	EM-4BRI-NT/TE	8	3	4	4	8	23
	EM-HDA-6FXO	—	8	—	6	—	—	14
	EM-HDA-6FXO	EM-HDA-6FXO	8	—	12	—	—	20
	EM-HDA-6FXO	EM-4BRI-NT/TE	8	—	6	4	8	22
	EM-4BRI-NT/TE	—	8	—	—	4	8	16
	EM-4BRI-NT/TE	EM-4BRI-NT/TE	8	—	—	8	16	24

The 4-port digital voice/fax expansion module (EM-4BRI-NT/TE) operates as an S/T interface and is capable of NT or TE functionality. In NT mode, the expansion module can supply in-line power for the far end of the connection.

The 7-port analog voice/fax expansion module (EM-HDA-3FXS/4FXO) provides three additional FXS ports and four FXO ports for off-premises analog voice applications.

The 6-port analog voice/fax expansion module (EM-HDA-6FXO) provides six FXO ports for off-premises analog voice applications. The sixth port (port 5) provides a trunk bypass (TBP) or power failover capability.

The 8-port analog voice/fax expansion module (EM-HDA-8FXS and EM3-HDA-8FXS) adds an additional eight FXS ports to the Cisco high-density extension module.

**Tip**

When router power is off, connect an analog phone to the FXO line to make a call. (See the “[Connecting Cisco High-Density Extension Modules to the Network](#)” section on page 6 for more information).

**Note**

If you have specified the use of a private line automatic ringdown (PLAR) off-premises extension (OPX) connection mode for an FXO voice port (with loop resistance less than 8000 Ohm), you must ensure that the soft-offhook option is enabled on the port.

This option allows a stepped offhook resistance during seizure which avoids overloading the circuit during offhook in the event that ringing voltage is present on the circuit at the same time as the trunk seizure. The stepped offhook resistance is initially set to 800 Ohms, then adjusts to 50 Ohms when ringing voltage is not present.

To enable **soft-offhook** command on the port, and to access the **connection** command with **plar opx** syntax, see the [Cisco Command Lookup Tool](#).

## Installing Expansion Modules on Cisco High-Density Extension Modules

Expansion modules can be used to increase the number of ports supported on the high-density extension module.

**Note**

ESD straps should be worn when handling all modules, including during installation of expansion modules. An ESD wrist strap is shipped with the product.

To install expansion modules, follow these steps:

**Step 1** Decide if the expansion board is going in the EM0 slot or EM1 slot.



**Note** The EM0 slot is on the left, and the EM1 slot is on the right as you look at the face plate.

**Step 2** Align the connectors on the underside of the expansion module with the connectors for the slot you plan to use on the network module. (See [Figure 2](#).)

**Step 3** Using gentle pressure, insert the connectors on the underside of the expansion module into the connectors on the network module.

**Tip**

Use the alignment pins on the network module brackets to guide the expansion module during installation.



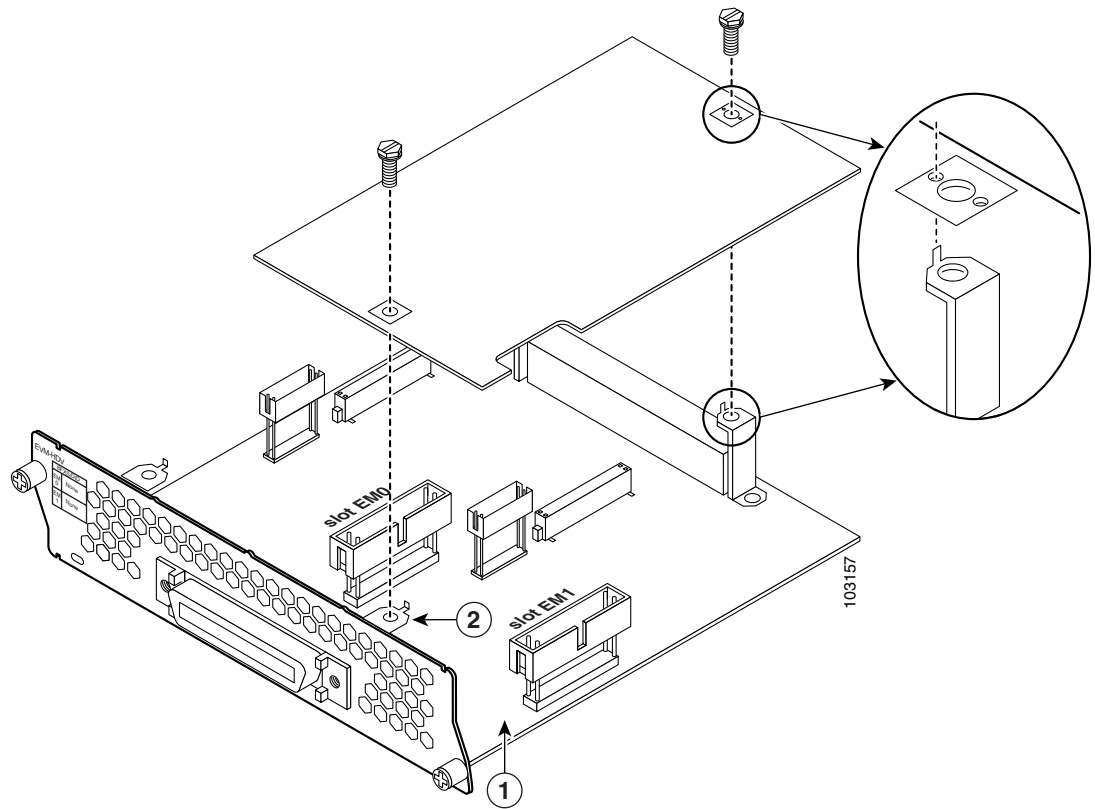
**Note** Press firmly on the expansion module until the board seats to ensure proper network connections.



**Caution** For each expansion module, two mounting screws must be installed with 6-8 lbs-in (67.8 N-cm) of torque. Failure to properly secure the expansion module to the base module with two screws compromises product reliability. **In the case of FXO ports, failure to properly tighten both mounting screws causes FXO ground-start outgoing call operation to fail.**

**Step 4** Insert two screws from the hardware kit through the screw guides on the expansion module into the threaded holes on the network module brackets.

**Figure 2** *Installing an Expansion Module on Extension Module Slot EM1*



<b>1</b> Expansion module connector on the network module (for slot EM1).	<b>2</b> Screw bracket on the network module faceplate (for slot EM1).
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**Step 5** Using a small flat-blade screwdriver, tighten the screws to secure the expansion module to the network module.



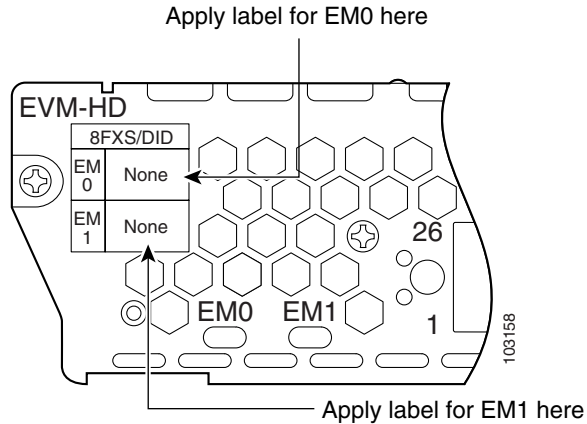
**Warning** Failure to secure the expansion module to the base module with two screws defeats the earth ground, causing a potential safety hazard. Statement 347

**Tip**

To maintain proper seating of the network module, tighten the rear screw first.

**Step 6** Apply the appropriate label on the front of the network module faceplate. (See [Figure 3](#).)

**Figure 3** Label Locations for Expansion Modules on Cisco High-Density Expansion Modules



**Step 7** Install the network module into the router. (See the “[Installing Cisco Network Modules and Service Modules in Cisco Access Routers](#)” section on page 5.)

## Connecting Cisco High-Density Extension Modules to the Network

The Cisco high-density extension module is connected to a distribution frame or patch panel with an RJ-21 cable. (See [Figure 4](#).) RJ-21 cables are not provided with the network module.

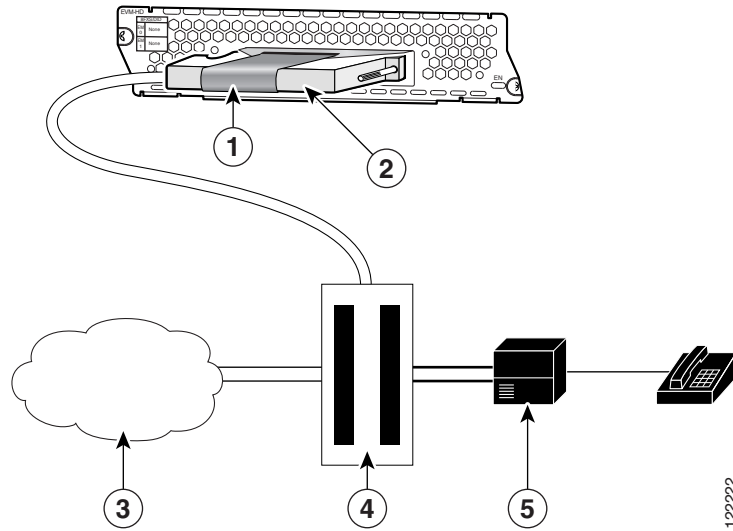
**Warning**

**Do not work on the system or connect or disconnect cables during periods of lightning activity.**  
Statement 1001

**Caution**

To comply with the Telcordia GR-1089 NEBS standard for electromagnetic compatibility and safety, connect the 8-port analog voice/fax expansion module (EM-HDA-8FXS and EM3-HDA-8FXS) and 4-port digital voice/fax expansion module (EM-4BRI-NT/TE) only to intrabuilding or nonexposed wiring or cabling. The intrabuilding cable must be shielded and the shield must be grounded at both ends.

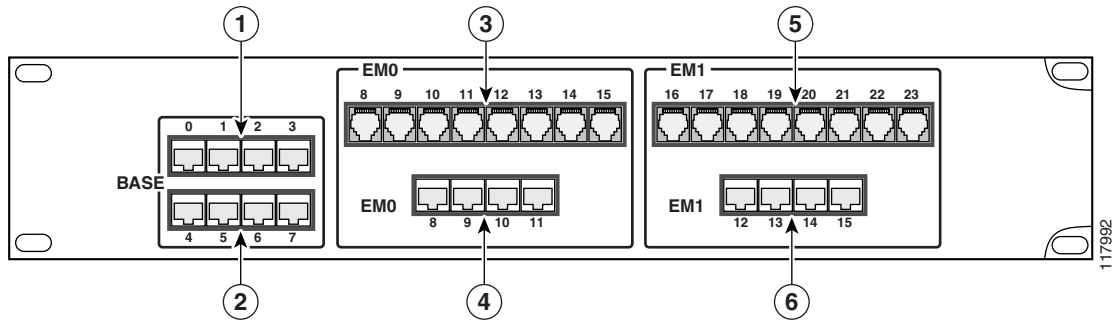
**Figure 4** Connecting Cisco High-Density Extension Modules (EVM-HD-8FXS/DID) to a Main Distribution Frame or Patch Panel



1	Strap to secure connector	4	Main distribution frame
2	RJ-21 connector	5	PBX
3	Public switched telephone network		

Distribution panels are generally available from multiple cable and network adapter vendors. Customers may, at their sole discretion, consider using a patch panel from Black Box Corporation (JPM2194A—see [Figure 5](#)). *(Mention of products or services other than Cisco products or services is for information purposes only and constitutes neither an endorsement nor a recommendation.)* The Black Box patch panel accommodates RJ-11 and RJ-45 combinations possible on Cisco high-density expansion modules, and offers flexibility for expansion module upgrades (either analog or digital). For ordering information, see the Cisco High-Density Extension Module data sheet.

**Figure 5** Black Box Patch Panel (JPM2194A) for Use with Cisco High-Density Expansion Modules



<p><b>1</b> RJ-11 receptacles for FXS/DID ports on the EVM-HD-8FXS/DID baseboard.</p>	<p><b>4</b> RJ-45 receptacles for BRI ports on the EM-4BRI-NT/TE when installed in slot EM0.</p>
<p><b>2</b> RJ-11 receptacles for FXS/DID ports on the EVM-HD-8FXS/DID baseboard.</p>	<p><b>5</b> RJ-11 receptacles for FXS or FXO ports on an FXS or FXO expansion module when installed in slot EM1.</p> <p><b>Note</b> Applies to EM-HDA-8FXS, EM3-HDA-8FXS, EM-HDA-6FXO, or EM-HDA-3FXS/4FXO expansion modules only.</p>
<p><b>3</b> RJ-11 receptacles for FXS or FXO ports on an FXS or FXO expansion module when installed in slot EM0.</p> <p><b>Note</b> Applies to EM-HDA-8FXS, EM3-HDA-8FXS, EM-HDA-6FXO, or EM-HDA-3FXS/4FXO expansion modules only.</p>	<p><b>6</b> RJ-45 receptacles for BRI ports on the EM-4BRI-NT/TE when installed in slot EM1.</p>

Table 2 provides pin definitions for the RJ-11 and RJ-45 receptacle types:

**Table 2** Pinouts for RJ-11 and RJ-45 Receptacle Types

Receptacle Type	Pin Definitions
RJ-11	Pin 3 = Ring Pin 4 = Tip
RJ-45	Pin 3 = ISDN BRI-S/T Bus Transmit+ Pin 4 = ISDN BRI-S/T Bus Receive+ Pin 5 = ISDN BRI-S/T Bus Receive- Pin 6 = ISDN BRI-S/T Bus Transmit-

## Establishing Emergency or Power-Fail Connections

During power failures or when router power is off, emergency voice connections can be made through power-fail ports on the EM-HDA-6FXO expansion module. The expansion module must be properly installed on the Cisco high-density extension module. (See the “[Installing Expansion Modules on Cisco High-Density Extension Modules](#)” section on page 4.)

To provide an emergency connection, connect an analog phone using the port information listed in [Table 3](#).



### Note

There will not be a dial tone on port 15 or port 23 until the router is powered down.

**Table 3** *Establishing Emergency Connections through Cisco High-Density Extension Modules*

Expansion Module Slot	Analog Phone Port	PSTN Port
EM0	Port 15 Tip/Ring	Port 13 Tip/Ring
EM1	Port 23 Tip/Ring	Port 21 Tip/Ring



### Caution

Analog phones connected to the power-fail ports should not be connected in parallel to a normal FXS port on Cisco high-density extension modules. The protection circuit on the FXS port can interfere with phone operation when router power is off.

## Cisco High-Density Extension Module Cable Pinouts

[Figure 6](#) shows the RJ-21 connector wiring for the cable used for the high-density extension module, and [Table 4](#) lists cable pinouts. Port usage depends on the type of installed expansion module.

**Figure 6** *Close-Up of the RJ-21 Connector Pinout for Cisco High-Density Extension Modules (EVM-HD-8FXS/DID)*

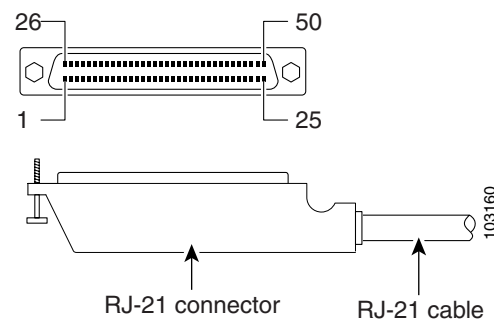


Table 4 RJ-21 Connections for the Cisco High-Density Extension Module

RJ-21 Pin	Hardware Component	Base Card Ports	Expansion Module Ports			
		8FXS/DID	EM-HDA-8FXS/EM 3-HDA-8FXS	EM-HDA-3FXS/4FXO	EM-HDA-6FXO	EM-4BRI-NT/TE
26	Base card (EVM-HD-8FXS)	Port 0 Tip	—	—	—	—
1		Port 0 Ring				
27		Port 1 Tip				
2		Port 1 Ring				
28		Port 2 Tip				
3		Port 2 Ring				
29		Port 3 Tip				
4		Port 3 Ring				
30		Port 4 Tip				
5		Port 4 Ring				
31		Port 5 Tip				
6		Port 5 Ring				
32		Port 6 Tip				
7		Port 6 Ring				
33		Port 7 Tip				
8		Port 7 Ring				
34	EM0	—	Port 8 Tip	FXS Port 8 Tip	Port 8 Tip	Port x/0 SX-
9			Port 8 Ring	FXS Port 8 Ring	Port 8 Ring	Port x/0 SX+
35			Port 9 Tip	FXS Port 9 Tip	Port 9 Tip	Port x/0 SR-
10			Port 9 Ring	FXS Port 9 Ring	Port 9 Ring	Port x/0 SR+
36			Port 10 Tip	FXS Port 10 Tip	Port 10 Tip	Port x/1 SX-
11			Port 10 Ring	FXS Port 10 Ring	Port 10 Ring	Port x/1 SX+
37			Port 11 Tip	Unused	Port 11 Tip	Port x/1 SR-
12			Port 11 Ring	Unused	Port 11 Ring	Port x/1 SR+
38			Port 12 Tip	FXO Port 12 Tip	Port 12 Tip	Port x/2 SX-
13			Port 12 Ring	FXO Port 12 Ring	Port 12 Ring	Port x/2 SX+
39			Port 13 Tip	FXO Port 13 Tip	Port 13 Tip	Port x/2 SR-
14			Port 13 Ring	FXO Port 13 Ring	Port 13 Ring	Port x/2 SR+
40			Port 14 Tip	FXO Port 14 Tip	Unused	Port x/3 SX-
15			Port 14 Ring	FXO Port 14 Ring	Unused	Port x/3 SX+
41			Port 15 Tip	FXO Port 15 Tip	PFP <sup>1</sup> Tip	Port x/3 SR-
16			Port 15 Ring	FXO Port 15 Ring	PFP Ring	Port x/3 SR+

**Table 4** RJ-21 Connections for the Cisco High-Density Extension Module (continued)

RJ-21 Pin	Hardware Component	Base Card Ports	Expansion Module Ports			
		8FXS/DID	EM-HDA-8FXS/EM 3-HDA-8FXS	EM-HDA-3FXS/4F XO	EM-HDA-6FXO	EM-4BRI-NT/TE
42	EM1	—	Port 16 Tip	FXS Port 16 Tip	Port 16 Tip	Port x/4 SX–
17			Port 16 Ring	FXS Port 16 Ring	Port 16 Ring	Port x/4 SX+
43			Port 17 Tip	FXS Port 17 Tip	Port 17 Tip	Port x/4 SR–
18			Port 17 Ring	FXS Port 17 Ring	Port 17 Ring	Port x/4 SR+
44			Port 18 Tip	FXS Port 18 Tip	Port 18 Tip	Port x/5 SX–
19			Port 18 Ring	FXS Port 18 Ring	Port 18 Ring	Port x/5 SX+
45			Port 19 Tip	Unused	Port 19 Tip	Port x/5 SR–
20			Port 19 Ring	Unused	Port 19 Ring	Port x/5 SR+
46			Port 20 Tip	FXO Port 20 Tip	Port 20 Tip	Port x/6 SX–
21			Port 20 Ring	FXO Port 20 Ring	Port 20 Ring	Port x/6 SX+
47			Port 21 Tip	FXO Port 21 Tip	Port 21 Tip	Port x/6 SR–
22			Port 21 Ring	FXO Port 21 Ring	Port 21 Ring	Port x/6 SR+
48			Port 22 Tip	FXO Port 22 Tip	Unused	Port x/7 SX–
23			Port 22 Ring	FXO Port 22 Ring	Unused	Port x/7 SX+
49			Port 23 Tip	FXO Port 23 Tip	PFP Tip	Port x/7 SR–
24			Port 23 Ring	FXO Port 23 Ring	PFP Ring	Port x/7 SR+
50			Unused	Unused	Unused	Unused
25			Unused	Unused	Unused	Unused

1. During power failures or when router power is off, emergency voice connections can be made through power-fail ports (PFP) on the EM-HDA-6FXO expansion module.

**Note**

If there is only one EM-4BRI-NT/TE and it is installed in EM1, number the ports x/0 through x/3.

## Related Documents

For additional information, see the following documents and resources.

Related Topic	Document Title
Regulatory compliance and safety information	<i>Cisco Network Modules and Interface Cards Regulatory Compliance and Safety Information</i> <a href="http://www.cisco.com/en/US/docs/routers/access/interfaces/rcsi/IOHrcsi.html">http://www.cisco.com/en/US/docs/routers/access/interfaces/rcsi/IOHrcsi.html</a>
Cisco IOS software website and reference documentation	<i>Cisco IOS Software</i> <a href="http://www.cisco.com/web/psa/products/index.html?c=268438303">http://www.cisco.com/web/psa/products/index.html?c=268438303</a>

# Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>

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