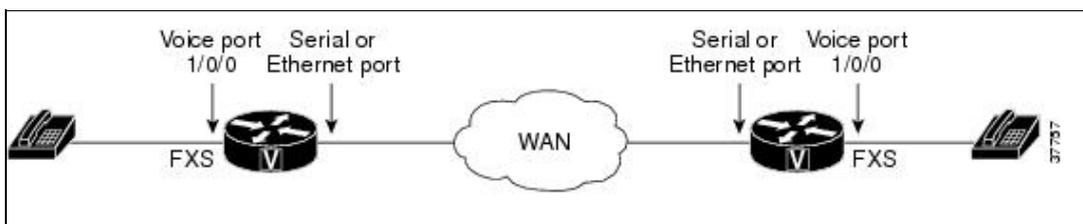An FXS interface connects the router or access server to end-user equipment such as telephones, fax machines, and modems. The FXS interface supplies ring, voltage, and dial tone to the station and includes an RJ-11 connector for basic telephone equipment, keysets, and PBXs. In Figure: FXS Signaling Interfaces, FXS signaling is used for end-user telephony equipment, such as a telephone or fax machine.

Guide Contents
Troubleshooting Cisco IOS Voice Overview
Debug Command Output on Cisco IOS Voice Gateways
Filtering Troubleshooting Output
Cisco VoIP Internal Error Codes
Troubleshooting Cisco IOS Voice Telephony
Troubleshooting Cisco IOS Voice Protocols
Troubleshooting Cisco IOS Telephony Applications
Monitoring the Cisco IOS Voice Network
Cause Codes and Debug Values

Contents

Figure: FXS Signaling Interfaces

FXS Hardware Troubleshooting

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

Troubleshoot FXS hardware by checking the following sections:

- Software Compatibility
- Cabling
- Shutdown Port
- Disabling a Port on a Multiple Port Card

Software Compatibility

To ensure that your FXS card is compatible with your software, check the following:

- For network modules inserted into Cisco 2600 series, Cisco 3600 series, and Cisco 3700 series, check the Overview of Cisco Network Modules for Cisco Access Routers.
- For interface cards inserted into Cisco 1600 series, Cisco 1700 series, Cisco 2600 series, Cisco 3600 series, Cisco 3700 series, and Cisco ICS 7750 platforms, check Voice Interface Cards.

Cabling

Two types of cabling are supported for Cisco FXS interfaces. They are described in the following sections:

- RJ-11 Connectors
- RJ-21 Connectors on the High-Density Analog Telephony Network Module

Note: For FXS connections, use a 2-wire (RJ-11) cable. A 4-wire cable can cause the second port to busy out.

RJ-11 Connectors

The two-port and four-port FXS interface cards support the RJ-11 connector. Illustrations of the connector ports are shown in Figure: Two-Port FXS Card Front Panel and Figure: Four-Port FXS/DID Card Front Panel. Information about LEDs can be found in Voice Interface Cards.

Figure: Two-Port FXS Card Front Panel
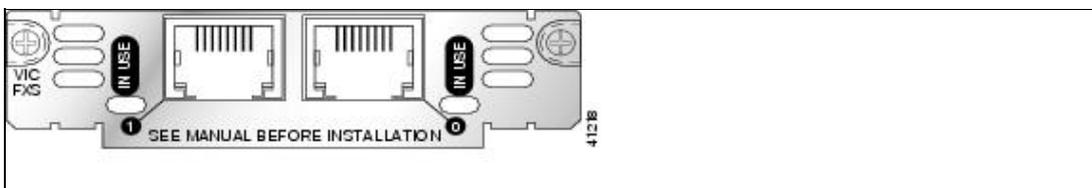
Figure: Four-Port FXS/DID Card Front Panel

For information about the VIC-2FXS interface card, refer to <u>Understanding Foreign Exchange Station (FXS) Voice Interface Cards, document ID 7938</u>.

RJ-21 Connectors on the High-Density Analog Telephony Network Module

The High-Density Analog Telephony network module supports an RJ-21 connector. This network module supports both FXS and FXO traffic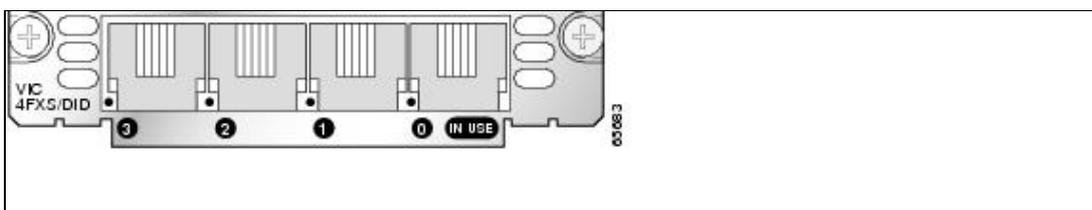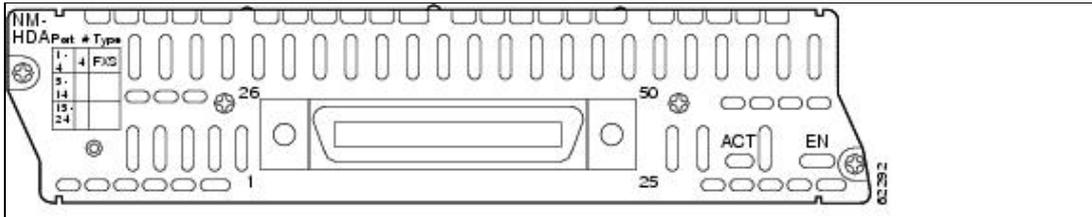. An illustration of the connector port is shown in <u>Figure: High-Density Analog Telephony Network Module</u>. Information about LEDs and pinouts can be found in <u>Connecting High-Density Analog Telephony Network Modules to a Network</u>.

Figure: High-Density Analog Telephony Network Module

Shutdown Port

If the port is not working, be sure the port is not shut down. Enter the **show voice port** command with the voice port number that you are troubleshooting. The output will tell you:

- If the voice port is up. If it is not, use the **no shutdown** command to make it active.
- What parameter values have been set for the voice port, including default values (which do not appear in the output from **the '***show running-config'* **command**). If these values do not match those of the telephony connection you are making, reconfigure the voice port.

Disabling a Port on a Multiple Port Card

If you shut down a port on a multiple-port card, you can disable all of the ports on that card. If only one port is bad and the others are working, in many cases you can disable the bad port and then use the working ports until a replacement arrives. To disable a bad port, use one of the following methods:

- On a Cisco universal gateway, such as the Cisco AS5350, Cisco AS5400, Cisco AS5800, and Cisco AS5850, busy out the port using the **busyout** command. This setting allows the port to be taken out of service without disrupting the Cisco IOS configuration. See the product documentation for details:
    - <u>Cisco AS5350 product documentation</u>
    - <u>Cisco AS5400 product documentation</u>
    - <u>Cisco AS5800 product documentation</u>
    - <u>Cisco AS5850 product documentation</u>
- On other Cisco gateways, remove the port from the dial peer. Refer to <u>Dial Peer Configuration on Voice Gateway Routers</u> to configure the dial peer.

Ring Voltage Problems

Telephone exchanges and FXSs need to supply DC battery and AC ringing to enable the connected telephone equipment to transmit speech energy and to power the telephone equipment's ringing device. This section discusses what voltages are supplied by various Cisco FXS interfaces and how to overcome some known issues regarding voltage levels.

Figure: Four-Port FXS/DID Card Front Panel

Ringing Voltages

The industry standard for PBX and key systems requires that the ring detection circuit be able to detect a ringing signal as low as 40 Vrms. This voltage takes into account the effects of load and cabling voltage drop on a ringing signal generated from a central office (CO). Conversely, the CO (exchange) must supply ringing with enough power to drive the maximum load over the maximum cable length. In order to meet this requirement, a CO-based unit must present a ringing signal with an amplitude of approximately 85 to 100 Vrms. Cisco voice gateways are intended for use as on premise services (ONS) equipment that is colocated or fairly close to equipment that detects ringing, so it can therefore use a lower ringing voltage and still meet the 40 Vrms 5 Ringer Equivalence Number (REN) requirement.

Idle Battery Voltage

Cisco voice gateways were designed for ONS connections and by default the FXS interface supplies either -24 Vdc or -36 Vdc idle battery, whereas off premise services, such as a CO, would require voltages of -48 V because it might have to interconnect over much greater cable lengths. Certain Cisco FXS interfaces can be configured to supply higher voltages.

Idle Line Voltages

Table: FXS Idle Voltage shows idle line voltages supplied by various Cisco gateway FXS interfaces.

Table: FXS Idle Voltage

FXS Interface	Idle Voltage
VG248	-36V
VIC-2FXS	-26V
VIC-2DID	-24V (low) -48V (high)
ASI 81 and ASI 160	-24V (low) -48V (high)
IAD 24xx-FXS	-24V (low) -48V (high)
1730 IAD	-24V (low) -48V (high)
VIC-4FXS/DID	-48V

Ring Voltage Problems

Voltage problems can cause three types of problems:

- Answering and Call Initiation Problems with Automated Telephony Devices
- Ringing Problems
- FXS Ring Failure in the United Kingdom

Certain automated devices, such as fax machines, answer machines, multiline phones and voice mail systems, look at the line voltage in order to deduce if the line is busy or idle. If another device is off hook, then the line voltage drops, and the automated system does not answer or initiate a call. If the threshold being used is close to -24 V or higher, this can cause the device not to work as expected.

Certain phones might not ring when the default ring voltage and ring frequency are applied from the Cisco FXS interface.

For situations where the line voltage is not high enough, a ring booster can be installed between the interface card and the network.

Answering and Call Initiation Problems with Automated Telephony Devices

In voice port configuration mode, configure the **idle-voltage** command on the voice port of the FXS to increase idle battery voltage from -24 V to -48 V. The **idle-voltage low** setting designates -24 V and the **idle-voltage high** setting designates -48 V.

> **Note**: This option is not available on VG248, VIC-2FXS, VIC2-2FXS, VIC3-2FXS/DID, VIC3-2FXS-E/DID, VIC-4FXD/DID, VIC3-4FXD/DID and WS-x6624 FXS interfaces.

Ringing Problems

Phone manufacturers sometimes use frequency filters known as antitinkle circuits to prevent ringer devices from sounding while the user is dialing. Sometimes it is necessary to adjust the frequency of the ring to suit the connected device.

Configure the ring frequency for Cisco modular access routers by issuing the following command:

```
Router(config-voiceport)# ring frequency ?
 25 ring frequency 25 Hertz
 50 ring frequency 50 Hertz
```

Configure the ring frequency for the Cisco IAD2400 platform by issuing the following command:

```
Router(config-voiceport)# ring frequency ?
 20 ring frequency 20 Hertz
 30 ring frequency 30 Hertz
```

To prevent ringer devices from sounding, you can also provide a voltage threshold so that the lower voltages, which can be produced during dialing, are ignored. Increasing the voltage can overcome this.

Configure the DC offset voltage on Cisco IAD2400 series routers by issuing the following command:

```
Router(config-voiceport)# ring dc-offset ?
 10-volts Ring DC offset 10 volts
 20-volts Ring DC offset 20 volts
 24-volts Ring DC offset 24 volts
```

> **Note**: This command sequence can be used only for Cisco IAD2400 series routers. The 24-V ring DC offset setting is available for Cisco IOS 12.2(11)T and later releases.

FXS Ring Failure in the United Kingdom

A telephone approved for the United Kingdom might fail to ring when connected to a Cisco FXS port. The failure results from a physical interoperability issue and is independent of Cisco hardware or software. British Telecom did not implement RJ-11 type connectors when it adopted plug-and-socket connection methodology. RJ-11 connectors allow parallel connectivity for the transmission path and the ringer circuit. They were not used because older telephones needed to have their ringer circuits connected in series due to a requirement for high current.

Outside the United Kingdom, ringer circuitry is self-contained in each phone. The U.K. implementation puts the capacitor, which provides the AC ring path, and the antitinkle feature (prevents the bell or ringer from sounding when pulse dialing is used) externally in the first socket, connected to the local loop.

In the United Kingdom, certain British Approval Board for Telecommunications (BABT) telephones fail to ring when they are connected to FXS ports on Cisco voice-enabled routers and switches. Outgoing calls can be made and voice communication in both directions can be established. However, incoming calls do not ring

the telephone. These telephones functioned correctly before they were connected to the FXS ports.

Because a proprietary connection system is implemented, you must use an adapter to connect the telephone to an FXS port. The adapter must be a *master* that contains the capacitor, or the telephone fails to ring.

For a schematic and more information, refer to Understanding Why Telephones in the United Kingdom Connected to Cisco FXS Interfaces May Fail to Ring, document ID 25800.

Unbreakable Dial Tone

A common problem encountered in a VoIP network is being unable to break dial tone. The router seizes a line on the local PBX but when digits are dialed, the dial tone stays. The calling party is unable to pass the dual-tone multifrequency (DTMF) tones or digits to the terminating device, resulting in callers being unable to dial the desired extension or interact with a device that needs DTMF tones such as a voice mail or an interactive voice response (IVR) application. This problem can result from a number of sources, for example:

- DTMF tones are not passed.
- DTMF tones are not understood.
- DTMF tones are too distorted to be understood.
- Other signaling and cabling issues occur.

Make sure the dial type is set as DTMF on both the router and the PBX. The FXS port does not pass on the digits; therefore, this setting is not available on an FXS port. However, this setting can be changed on FXO and E&M ports:

```
Router(config-voiceport)# dial-type ?
  dtmf   touch-tone dialer
  mf     mf-tone dialer
  pulse  pulse dialer
```

For more information, refer to Inability To Break Dialtone in a Voice over IP Network, document ID 22376.

No LED When Phone Off the Hook

Verify if you have an analog or digital card. If you have an analog card like the VIC-2FXS or the VIC2-4FXS, you might have one of the following problems:

- The port is in a shutdown state.
- The port is in a park state.
- The port is bad.

If you have a digital card like the NM-2V, you might have bad DSPs.

Use the following procedure if there is no LED when your phone is off hook:

1. Check the cable to make sure that it is RJ-11 with two pins for the FXS port.
2. Test the LED using a different phone.
3. Check your Cisco IOS version to make sure that the feature set is either IP Plus or Enterprise Plus.
4. If Steps 1 to 3 do not work, replace the voice interface card (VIC).