

## Introduction

The question “What is the difference between FXS and FXO?” is frequently asked by those deploying Patton Voice-over-Internet Protocol (VoIP) SmartNode solutions. Foreign eXchange Subscriber (FXS) and Foreign eXchange Office (FXO) are the names of the two most common interfaces (ports or plugs) found in analog telephony environments.

Analog telephony, also known as Plain Old Telephone Service (POTS), is the service the local phone company typically delivers to your home. Local phone companies deliver POTS from their Central Office (CO) to the subscriber’s premises over a circuit consisting of two copper wires. To increase the distance over which the signal can be transmitted the two wires are twisted together, which also reduces electromagnetic interference. So these two-wire copper cables are commonly known as “twisted pairs”.

## Definitions

**FXS**—**Foreign eXchange Subscriber** interface (the plug on the wall) delivers POTS service from the local phone company’s Central Office (CO) and must be connected to *subscriber* equipment (telephones, modems, and fax machines). In other words an FXS interface *points* to the *subscriber*. An FXS interface provides the following primary services to a subscriber device:

- Dial tone
- Battery current
- Ring voltage

You may also see the FXS acronym rendered as *Foreign eXchange System*.

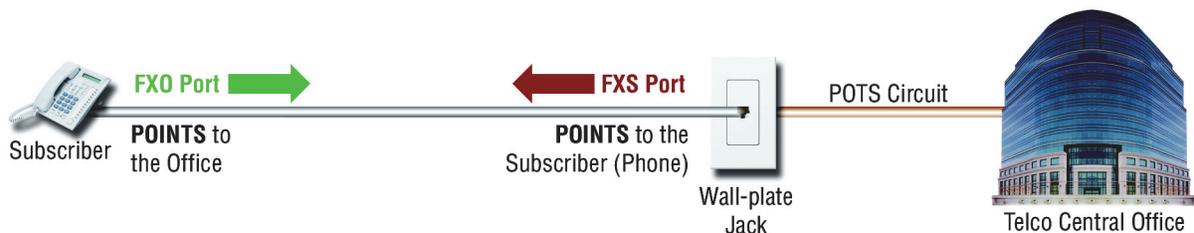


Figure 1. FXS/FXO overview

**FXO**—**Foreign eXchange Office** interface (the plug on the phone) receives POTS service, typically from a Central Office of the Public Switched Telephone Network (PSTN) (see figure 1). In other words an FXO interface points to the Telco office. An FXO interface provides the following primary service to the Telco network device:

- On-hook/off-hook indication (loop closure)

## How it Works

Because of the characteristics described above, a telecommunications line from an FXO port must connect to an FXS port in order for the connection to work. Similarly, a line from an FXS port must connect to an FXO port in order for the connection to work. When the FXO port on your analog telephone is connected to the FXS port in the wall, you receive (FXS) service from the telephone company—and you hear a dial tone when you pick up the phone.

### Common Usage

Within the telephony industry, a device is often referred to by the type of interface it provides (“your phone is an FXO device”), or even spoken of as being the interface (“your wall plug is FXS”). Now, continuing our discussion in common usage....

### What Doesn't Work

If you connect an FXS device to another FXS device, the connection will not work. Likewise, if you connect an FXO device to another FXO it will not work. So, for example, you can *not* plug a standard analog telephone (FXO) directly into a standard analog telephone (FXO) and talk phone-to-phone.

## Networking

The FXS/FXO scenario becomes a more interesting when we introduce additional network elements, such as a Private Branch Exchange (PBX) or a Voice-over-IP gateway or router (see figure 2). For example, you can connect the FXO interface on a phone to the FXS port supplied by a PBX, multiplexer, or Voice-over-IP gateway or router.

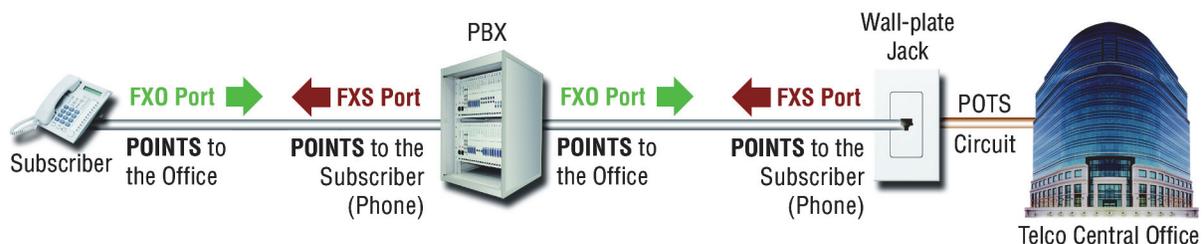


Figure 2. Adding a PBX to the scenario

### PBX Connections

A PBX provides FXS and FXO interfaces.

- **FXS**—When connecting a PBX to analog phones, plug phone cables into FXS ports on the PBX. The FXS ports provide POTS service, including battery current, ring voltage, and dial tone to the phones.
- **FXO**—When you connect a PBX to the Telco Central Office, you plug the (FXS) lines from the phone company into FXO ports on the PBX. The FXO ports on the PBX provide on-hook/off-hook indication (loop closure) to the local Telco network.

## PBX Connections

A PBX provides both FXS and FXO interfaces.

1. Connect standard analog telephones (FXO) to the PBX's FXS ports (see figure 3).

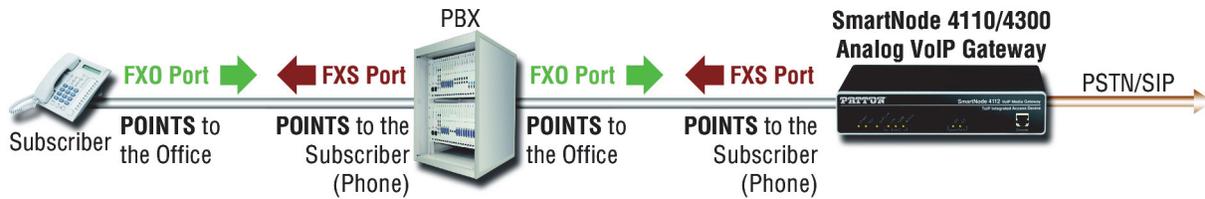


Figure 3. Connecting Subscribers (Phones) to PBX

2. Connect the FXO ports on your PBX to the SmartNode's FXS ports (see figure 4).

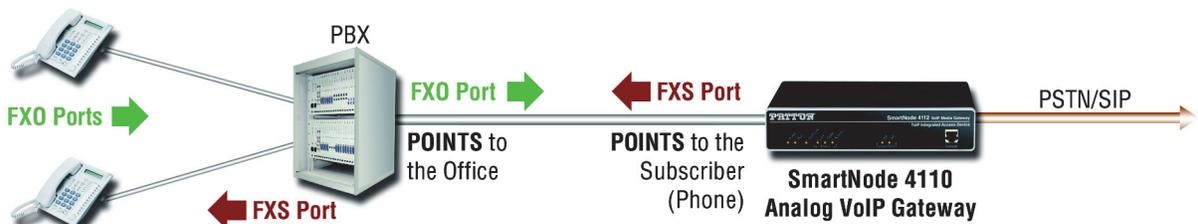


Figure 4. Connecting PBX to SmartNode

## FXS/FXO Call Procedures

### FXS

**Call Initiation**—An FXS device initiates a call by presenting ring voltage over the line to the attached FXO device. (FXS devices cannot pass dialed digits.)

**Call Reception**—An FXS device receives a call by:

1. Detecting the line has been seized (the attached telephone—FXO device—has gone off hook)
2. Receiving Dual-Tone Multi-Frequency (DTMF) digits indicating how the call should be routed.

**Line Power**—FXS devices supply approximately 50 volts DC power to the line. During an emergency, FXO devices can use FXS line voltage for power in order to remain operable in the event of a local electrical power failure.

### FXO

**Call Initiation**—An FXO device initiates a call by:

1. Going off-hook to seize the telephone line.
2. Dialing the Dual-Tone Multi-Frequency (DTMF) digits, which identify the destination to be called.

**Call Reception**—An FXO device receives a call by:

1. Detecting the ring voltage supplied by the FXS device (SmartNode, PBX, etc.).
2. Going off-hook to answer the call.

## FXS/FXO Call Clearing

Under normal circumstances an FXS device does not initiate call clearing. Instead, FXS devices rely on the two parties at each end of the call to recognize the call has ended (by saying goodbye or hearing the line go quiet); then the FXO device at each end clears its segment of the call.

## SmartNode Connectivity Options

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In the meantime, using SmartNodes you can:

- Connect the SmartNode to the PSTN via the T1/E1/PRI or BRI ports.
- Connect to the Telco indirectly through a PBX by connecting the FXS ports on the SmartNode to the FXO ports on the PBX.
- Implement toll bypass without a PBX by connecting the SmartNode to the Public Switched Telephone Network (PSTN) using the SmartNode's T1/E1/PRI, or ISDN BRI S/T ports.
- Enable a PBX for VoIP by connecting the SmartNode to the PBX's T1, E1, ISDN BRI, or FXO ports

## For More Information

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For more information about VoIP and Patton's IP telephony solutions visit <http://www.patton.com/voip> or contact [sales@patton.com](mailto:sales@patton.com).

## Contacting Patton Technical Services for Free Support

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Patton Electronics offers a wide array of free technical services. If you have questions about any of our other products we recommend you begin your search for answers by using our [technical knowledge base](#). Here, we have gathered together many of the more commonly asked questions and compiled them into a searchable database to help you quickly solve your problems.

**Note** If you are looking for help in configuring your SmartNode device, check out the customized configuration templates at Patton's [WEB Wizard](#) portal first.

## Global Technical Support—Contact Info and Hours of Operation

| Region         | North America                     | Western Europe                                    | Central & Eastern Europe        | Middle East North Africa        |
|----------------|-----------------------------------|---|---------------------------------|---------------------------------|
| Location       | Maryland, USA                     | Bern, Switzerland                                 | Budapest, Hungary               | Beirut, Lebanon                 |
| Time Zone      | EST/EDT<br>UTC/GMT - 4/5 hours    | CET/CEDT<br>UTC/GMT + 1/2 hours                   | CET/CEDT<br>UTC/GMT + 1/2 hours | EET/EEDT<br>UTC/GMT + 2/3 hours |
| Business Hours | Monday-Friday<br>8:00am to 5:00pm | Monday-Friday<br>09:00 to 12:00<br>13:30 to 17:30 | Monday-Friday<br>8:30 to 17:00  | Monday-Friday<br>8:00am to 5pm  |
| Email          | support@patton.com                | support@patton.com                                | support@patton.com              | support@patton.com              |
| Phone          | + 1 301 975 1007                  | +41 31 985 25 55                                  | +36 439 3835                    | +96 1 359 1277                  |
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