



## **Cisco uBR924 Cable Access Router Hardware Installation Guide**

March 2000

### **Corporate Headquarters**

Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134-1706  
USA  
<http://www.cisco.com>  
Tel: 408 526-4000  
800 553-NETS (6387)  
Fax: 408 526-4100

Text Part Number: OL-0338-01

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Hardware Installation Guide*

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## Preface

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This document is the *Cisco uBR924 Cable Access Router Hardware Installation Guide* and describes installing, powering on, and troubleshooting a Cisco uBR924 cable access router. The document also includes cabling and pinout information.

This section contains:

- Audience
- Purpose
- Organization
- Conventions
- Related Documentation
- Obtaining Documentation
- Obtaining Technical Assistance

## Audience

This guide is intended for coaxial networking transmission installers and technicians who are familiar with the installation, maintenance, and troubleshooting of cable television wiring and equipment. Cable system installers and technicians should be familiar with their cable plant's base operating parameters and subscriber service offerings. Cable system support engineers and administrators should be acquainted with Ethernet and IEEE 802.3 type data communications networks.



**Note**

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This document contains instructions to install or configure the Cisco uBR924 cable access router using procedures that only qualified personnel should perform. This document is not intended for subscribers. See the "Related Documentation" section of this preface for the documentation available for subscribers.

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## Purpose

This guide covers the physical installation of the Cisco uBR924 cable access router. These procedures include site preparation, the physical placement of the router in an appropriate location, the cabling required for the power, Ethernet, voice, and cable connections, and verification of the installation at the router's initial power-on.

These procedures do not require a connection to the router's console port, nor do they require access to the router's command-line interface (CLI). However, CLI access might be required to configure the router and to bring it to full operability. See the *Cisco uBR924 Cable Access Router Software Configuration Guide* for instructions on configuring the router for network operation.

## Organization

This guide is organized into the following chapters and appendixes:

**Table 1**    **Organization**

Chapter	Title	Description
Chapter 1	Product Overview	Describes the Cisco uBR924 cable access router, its operation, and its interaction with the Cable Modem Termination System (CMTS).
Chapter 2	Preparing for Installation	Outlines site preparation requirements to meet before installing a Cisco uBR924 cable access router at a subscriber site. The chapter also discusses safety and agency considerations.
Chapter 3	Installing the Cisco uBR924 Router	Provides instructions to connect the Cisco uBR924 cable access router, perform its initial power-on, and verify its basic functionality.
Chapter 4	Troubleshooting	Contains basic installation troubleshooting information appropriate to field service technicians. (The troubleshooting information in this appendix does not require access to the router's console port or CLI interface.)
Appendix A	Technical Specifications	Contains the physical, environmental, power, data, and voice technical specifications for the router.
Appendix B	Connector and Cable Specifications	Contains the technical description of the interfaces on the Cisco uBR924 cable access router and the most common cables that are used with it.
Appendix C	Regulatory Compliance and Safety Information	Contains international agency compliance, safety, and statutory information for the Cisco uBR924 cable access router. This appendix also contains safety warnings translated into multiple languages.

## Conventions

This document uses the following conventions:



Convention	Meaning	Comments
<b>Boldface</b>	Commands and keywords you enter literally as shown	<b>offset-list</b>
<i>Italics</i>	Variables for which you supply values	<b>command</b> <i>type interface</i> You replace the variable with the type of interface. In contexts that do not allow italics, such as online help, arguments are enclosed in angle brackets (< >).
Square brackets ([ ])	Optional elements	<b>command</b> [abc] abc is optional (not required), but you can choose it.
Vertical bars ( )	Separated alternative elements	<b>command</b> [ abc   def ] You can choose either abc or def, or neither, but not both.
Braces ({ })	Required choices	<b>command</b> { abc   def } You <b>must</b> use either abc <b>or</b> def, but not both.
Braces and vertical bars within square brackets ([ {   } ])	A required choice within an optional element	<b>command</b> [ abc { def   ghi } ] You have three options: <ul style="list-style-type: none"> <li>• Nothing</li> <li>• abc def</li> <li>• abc ghi</li> </ul>
Caret character (^)	Control key	The key combinations ^D and Ctrl-D are equivalent: Both mean hold down the Control key while you press the D key. Keys are indicated in capital letters, but are not case sensitive.
A string	A nonquoted set of characters	For example, when setting an SNMP community string to <i>public</i> , do not use quotation marks around the string; otherwise, the string will include the quotation marks.
System prompts	Denotes interactive sessions, indicates that the user enters commands at the prompt	The system prompt indicates the current command mode. For example, the prompt Router (config) # indicates global configuration mode.
Screen font	Terminal sessions and information the system displays	

Convention	Meaning	Comments
Angle brackets (< >)	Nonprinting characters such as passwords	
Exclamation points (!) at the beginning of a line	A comment line	Comments are sometimes displayed by the Cisco IOS software.

**Caution**

Means *reader be careful*. You are capable of doing something that might result in equipment damage or loss of data.

**Note**

Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this guide.

**Timesaver**

Means *the described action saves time*. You can save time by performing the action described in the paragraph.

**Warning**

**This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. (To see translations of the warnings that appear in this publication, refer to the appendix, "Regulatory Compliance and Safety Information" - Translated Safety Warnings.)**

**Waarschuwing**

**Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. (Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het aanhangsel "Regulatory Compliance and Safety Information" (Vertalingen van veiligheidsvoorschriften) raadplegen.)**

**Varoitus**

**Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. (Tässä julkaisussa esiintyvien varoitusten käännökset löydät liitteestä "Regulatory Compliance and Safety Information" (käännetyt turvallisuutta koskevat varoitukset).)**

<b>Attention</b>	<b>Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures. Avant d'accéder à cet équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures courantes de prévention des accidents. Pour obtenir les traductions des mises en garde figurant dans cette publication, veuillez consulter l'annexe intitulée « Regulatory Compliance and Safety Information » (Traduction des avis de sécurité).</b>
<b>Warnung</b>	<b>Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. (Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Anhang mit dem Titel "Regulatory Compliance and Safety Information" (Übersetzung der Warnhinweise).)</b>
<b>Avvertenza</b>	<b>Questo simbolo di avvertenza indica un pericolo. Si è in una situazione che può causare infortuni. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nell'appendice, "Regulatory Compliance and Safety Information" (Traduzione delle avvertenze di sicurezza).</b>
<b>Advarsel</b>	<b>Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. (Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i vedlegget "Regulatory Compliance and Safety Information" [Oversatte sikkerhetsadvarsler].)</b>
<b>Aviso</b>	<b>Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. (Para ver as traduções dos avisos que constam desta publicação, consulte o apêndice "Regulatory Compliance and Safety Information" - "Traduções dos Avisos de Segurança").</b>
<b>Advertencia</b>	<b>Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. (Para ver traducciones de las advertencias que aparecen en esta publicación, consultar el apéndice titulado "Regulatory Compliance and Safety Information.")</b>
<b>Varning!</b>	<b>Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador. (Se förklaringar av de varningar som förekommer i denna publikation i appendix "Regulatory Compliance and Safety Information" [Översatta säkerhetsvarningar].)</b>

## Related Documentation

Refer to the following Cisco documents for related information. The documents can be found online at Cisco Connection Online (CCO) or on the Documentation CD-ROM. You can also order printed copies of most current documents.

**Note**

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The list that follows is not all-inclusive. New documents and revisions occur frequently.

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## Service Provider Subscriber-Related Publications

- *Cisco uBR924 Cable Access Router Hardware Installation Guide* (this manual)
- *Cisco uBR924 Cable Access Router Software Configuration Guide*
- *Cisco uBR924 Cable Access Router Installation and Startup Quick Start Guide*
- *Bridging and Routing Features for the Cisco uBR924 Cable Access Router*
- *Troubleshooting Tips for the Cisco uBR924 Cable Access Router*

## Subscriber Publications

- *Quick Start, Cisco uBR924 Cable Access Router Subscriber Setup*

**Note**

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Service provider and subscriber publications for other models of Cisco uBR900 series cable access routers are also available on CCO.

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## CMTS Hardware Installation Publications

- *Cisco uBR7200 Series Universal Broadband Router Hardware Installation Guide*
- *Cisco uBR7200 Series Universal Broadband Router Software Configuration Guide*
- *Cisco uBR7200 Series Universal Broadband Router Cable Modem Card Installation and Configuration* publication
- *Cisco uBR7200 Series Universal Broadband Router Port Adapter Installation and Configuration* publication
- *Cisco uBR7200 Series Universal Broadband Router 550-Watt DC-Input Power Supply Replacement Instructions*
- *Cisco uBR7200 Series Universal Broadband Router Subchassis and Midplane Replacement Instructions*
- *Cisco uBR7200 Series Rack-Mount and Cable-Management Kit Installation Instructions*
- *Cisco uBR7200 Series Universal Broadband Router Fan Tray Replacement Instructions*
- *Cisco uBR7200 Series Universal Broadband Router Feature Enhancements* publication

## Cisco IOS Publications

- Cisco IOS Release 12.1 New Feature Sets documentation for feature module descriptions on Cisco IOS 121-based releases
- Cisco IOS Release 12.1 Configuration Guides and Command References for task and command descriptions on Cisco IOS 12.1based releases

**Note**

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Use the Cisco IOS Release *Command Reference Master Index(es)* to obtain document pointers for specific software release feature sets and commands.

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## Configuration Editor and Network Management Publications

- *Cisco Cable Configuration Guide* for information on the Cisco Network Registrar (CNR) product
- *CiscoView: Internetworking Device Monitoring and Management*
- *CiscoView Incremental Installation Quick Reference Guide*
- CiscoWorks documentation for networks that use the Simple Network Management Protocol (SNMP) to monitor Cisco uBR924 cable access routers
- MIB information is available on CCO at <ftp://ftp.cisco.com/pub/mibs>.

## Obtaining Documentation

### World Wide Web

You can access the most current Cisco documentation on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <http://www-europe.cisco.com>.

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- Modem using standard connection rates and the following terminal settings: VT100 emulation; 8 data bits; no parity; and 1 stop bit.
  - From North America, call 408 526-8070
  - From Europe, call 33 1 64 46 40 82

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Hangul (Korean)	korea-tac@cisco.com
Spanish	tac@cisco.com
Thai	thai-tac@cisco.com

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We appreciate and value your comments.







## Product Overview

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This chapter describes the Cisco uBR924 cable access router and its interaction with the Cable Modem Termination System (CMTS)—the cable system headend equipment that provides Internet (TCP/IP) connectivity for subscribers over the cable broadband infrastructure. The chapter provides physical and functional overviews of the Cisco uBR924 cable access router and its supported operating modes.

## Cisco uBR924 Cable Access Router Description

This section provides an overview of the Cisco uBR924 cable access router, its hardware, and its basic operation:

- Introduction
- Initial Power-On and Provisioning
- Data Operations
- Voice Operations

## Introduction

The Cisco uBR924 cable access router functions at its most basic level as a cable modem—a modulator/demodulator that provides high-speed network access on the cable television system to residential and small office/home office (SOHO) subscribers. The router is based on the Data-Over-Cable Service Interface Specifications (DOCSIS), a standard developed with service providers to ensure that any DOCSIS-certified cable modem can interoperate with any bidirectional, DOCSIS-qualified CMTS.



### Note

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Information about DOCSIS requirements and current specifications are available at the CableLabs web site at <http://www.cablelabs.com>.

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In addition to providing DOCSIS connectivity, the Cisco uBR924 router can optionally provide advanced data and routing features, as well as telephone and fax services. The Cisco uBR924 router uses the cable system's existing physical plant to provide Internet and other wide area network (WAN) connectivity over the service provider's Hybrid/Fiber Coax (HFC) cable system.

The router can connect one or more computers to the Internet over the HFC cable system. Depending on the other services purchased from the service provider, subscribers can also send voice and fax traffic over the cable system, or they can use the cable system to link multiple sites into a secure private company network (Intranet). Subscribers can use the Cisco uBR924 router to create high-speed, permanent access to the Internet, without the need for telco-based services such as leased lines.

## Routing and Bridging

When acting as a DOCSIS-compliant cable modem, the Cisco uBR924 router provides DOCSIS bridging for one or more PCs and other customer premises equipment (CPE). The router ships from the factory with a Cisco IOS software image stored in nonvolatile Flash memory that supports DOCSIS-compliant bridging data operations.

Based on the feature licenses your company purchased, other Cisco IOS images can be downloaded from Cisco Connection Online (CCO). These images provide additional functionality such as advanced routing capabilities, advanced security, and Voice over IP (VoIP) support.

For most residential applications that involve basic Internet access or VoIP services, the Cisco uBR924 router is configured as a bridge. For residential and SOHO applications that involve special feature sets such as the firewall features, or that include connection to an existing network at the site, the Cisco uBR924 is configured as a router.



### Note

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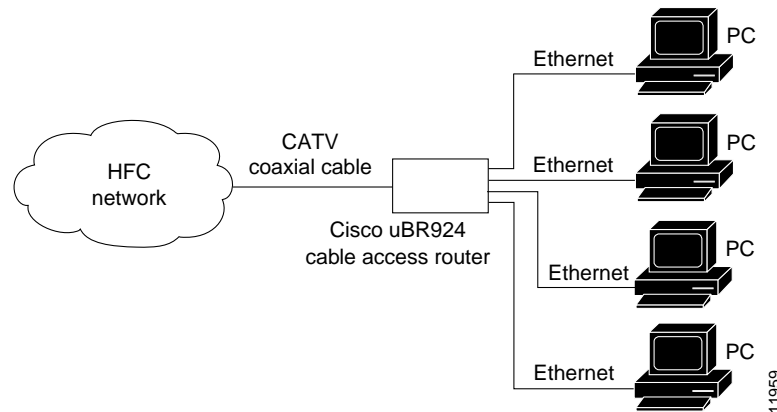
Cisco uBR924 cable access routers use Cisco IOS Release 12.0(4)XI or higher images. All Cisco IOS releases that support the Cisco uBR924 router include at least one image that supports basic DOCSIS connectivity that provides high-speed Internet data access. Most Cisco IOS releases that support the Cisco uBR924 router also include additional images that support VoIP connectivity, as well as advanced feature sets such as data encryption, firewall protection, and additional router features.

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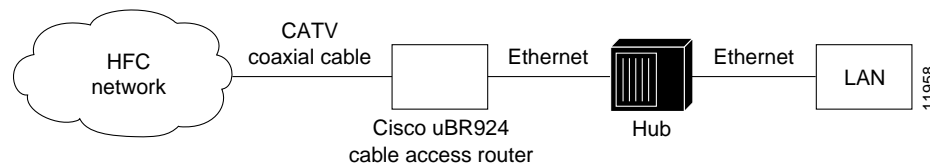
The following paragraphs summarize the router's operation in both bridging and routing modes:

- Bridging—When installed and configured as a bridge, the Ethernet hub ports at the rear of the Cisco uBR924 router can be connected directly to PCs at the subscriber site in one of the following configurations:
  - When using Cisco IOS Release 12.0(4)XI or higher interim builds in bridging mode, a maximum of three PCs can be directly connected to the hub ports—the fourth hub port is unused.
  - When using Cisco IOS Release 12.0(5)T or higher images in bridging mode, four PCs can be directly connected to the hub ports.
  - When using Cisco IOS Release 12.0(5)T or higher images in bridging mode, up to 254 PCs can be connected if one of the four Ethernet hub ports is connected to a standard 10BaseT Ethernet hub, which then connects to additional computers (or hubs) at the site.

Regardless of the configuration, Cisco IOS software treats all four Ethernet hub ports as one Ethernet interface. See Figure 1-1 for a typical configuration.

**Figure 1-1 Cisco uBR924 in a Bridging Configuration**

- **Routing**—When installed and configured as a router, the Cisco uBR924 can be connected directly to four PCs via the Ethernet hub ports at the rear of the router. One of the four Ethernet hub ports can also be connected to a standard 10BaseT Ethernet hub which then connects additional computers or Ethernet devices at the site to a local area network (LAN). (See Figure 1-2.)

**Figure 1-2 Cisco uBR924 in a Routing Configuration**

In routing mode, no maximum limitation exists. The Cisco uBR924 is configured to use the IP address of the headend router as the router's default IP gateway.

**Note**

For better network performance, Cisco recommends a maximum limit of 16 CPE devices in either bridging or routing mode. The service provider can also set a different limit by changing the MAX CPE parameter in the DOCSIS configuration file—the default MAX CPE value is one CPE device. The MAX CPE parameter applies in both routing and bridging modes.

## Upgrading the Software Image

When Cisco IOS images are updated to new releases, the service provider can download them as needed to Cisco uBR924 routers installed in the field (based on the software licenses purchased). See the release notes for the router (listed in “Related Documentation” in the Preface) for a complete list of features and Cisco IOS images that are currently supported.

Service providers can use the router's Media Access Controller (MAC) address to uniquely identify each particular router in the field. The CMTS uses this value to download the proper DOCSIS configuration file to the router before it begins operation.

The DOCSIS configuration file can also contain the name of the software image that the router should be running. If necessary, the CMTS can also download the proper software image to the router and force it to reboot using the new image.

The download of the DOCSIS configuration file usually takes only a few seconds and is done every time the Cisco uBR924 router reboots. The download of the software image can take several minutes to complete, during which time network connectivity is not available. However, the software image must be downloaded only once, until the subscriber needs to be updated with a new or updated image.

The next section, “Initial Power-On and Provisioning,” explains this process. See the *Cisco uBR924 Cable Access Router Software Configuration Guide* for a description on how to download a software image and configuration file to a Cisco uBR924 router installed in the field.

## Initial Power-On and Provisioning

The router ships from the Cisco factory ready to work in a DOCSIS-compliant bridging data-only mode. However, before the router can transmit traffic, the CMTS at the headend must properly provision the router as follows:

- The appropriate service must be purchased from the cable system. If certain features, such as VoIP support or IPSec data encryption, are desired, a license for the appropriate Cisco IOS software image must also be purchased.
- When the router is first brought online, the CMTS at the headend downloads a DOCSIS configuration file to the router. This file—which is a binary file that must be in the format required by the DOCSIS specification—configures the router for the appropriate level of services and sets other parameters as needed.
- At this point the router is completely configured for basic DOCSIS operations, but if additional features beyond those in the default Cisco IOS software image are desired, the DOCSIS configuration file can also specify that the router should download another Cisco IOS image from the CMTS.
- To customize the router’s configuration further, the DOCSIS configuration file can also specify a Cisco IOS configuration file that the CMTS should download to the router. This second configuration file is an ASCII text file that contains the Cisco IOS commands needed to configure the router.



### Note

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The CMTS Cisco uBR924 router downloads the DOCSIS configuration file each time it is powered on, but it downloads the Cisco IOS image (if needed) and Cisco IOS configuration file (if needed) only once when the router is initially brought online. However, a new configuration file or image can be downloaded whenever necessary, such as when the cable service offers new services or subscribers upgrade their services.

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To ensure that subscribers obtain the exact services they have ordered, the Cisco uBR924 router arrives from the Cisco factory with a unique identifier (UID) that consists of a serial number and MAC address. These factory-assigned values are on a label at the bottom of the router; for convenience, these values are also in a barcode label that can be easily scanned for easy entry into the service provider’s provisioning and billing system.

Using the MAC address of the router as the key, the CMTS downloads the DOCSIS configuration file and Cisco IOS image that will provide the services that this particular subscriber has purchased. Service technicians at the headend typically create a number of standard configuration files to match the range of services offered by the provider; these configuration files can be created manually or with tools provided by Cisco Systems for this purpose.

The following sections describe the initial power-on and provisioning sequence in more detail, as well as the requirements that must be met by both the router and the CMTS before provisioning can succeed.

## Initial Power-On Sequence

When connected and first powered on, the Cisco uBR924 cable access router performs the following DOCSIS-mandated procedure for automatic installation and configuration:

1. The router boots the Read Only Memory (ROM) from the ROMMON partition of its Flash memory.
2. The router performs a self-test, initializes processor hardware, and boots the main operating system software—the Cisco IOS release image stored in Flash memory.
3. The router acquires a temporary downstream channel by matching the clock sync signal that is regularly sent out by the CMTS in the downstream frequency range.
4. The router then waits for an Upstream Channel Descriptor (UCD) message from the CMTS and configures itself for the upstream frequency specified in that message.
5. The router waits for the next upstream bandwidth allocation map message (MAP). These messages are regularly sent from the CMTS to find the next available shared request timeslot. The router then uses this timeslot to send a ranging request message to the CMTS, communicating the router's user ID (UID, which includes its unique MAC address), using a temporary service identifier (SID) of 0 (zero) to indicate it has not yet been allocated an upstream channel.
6. In reply to the router's ranging request, the CMTS sends a ranging response containing a temporary SID to be used for the initial router configuration and bandwidth allocation. As needed, the router adjusts its transmit power levels using the power increment value given by the CMTS in its ranging response message.

**Note**

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At this point, the router has established connectivity with the CMTS but is not yet online. The next steps allocate permanent upstream and downstream frequencies, as well the configuration required for IP network connectivity.

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7. After the next MAP message broadcast, the router uses a shared request timeslot to invoke the Dynamic Host Configuration Protocol (DHCP) to establish IP connectivity with the TCP/IP network at the headend.
8. The DHCP server—typically a dedicated server at the headend, but it could also be a CMTS such as a Cisco uBR7200 series universal broadband router—sends a response containing the router's IP address, as well as the IP addresses for the default gateway and time of day (ToD) server. It also sends the IP address for the authorized Trivial File Transfer Protocol (TFTP) server from which the router should download its DOCSIS configuration file. Depending on the particular network configuration, other information could be provided, such as the IP addresses for a syslog server or security server.
9. The router configures itself for the specified IP address and gets the current date and time from the specified ToD server.
10. Using the TFTP protocol, the router downloads the specified DOCSIS configuration file and configures itself for the appropriate parameters. The DOCSIS configuration file defines the router's operating mode such as the provisioned downstream and upstream service assignments, assigned frequencies, data rates, modulation schemes, Class of Service (CoS), type of services to support, and other parameters. Cisco provides tools to help automate the creation of configuration files.

**Caution**

The DOCSIS configuration file must be in the exact format given by the DOCSIS specification. An incorrect DOCSIS configuration file can cause the Cisco uBR924 router to constantly cycle offline. Such errors include: wrong downstream frequency; wrong UCD; wrong downstream Channel ID; invalid CoS; incorrect BPI privacy configurations or shared secret strings.

11. The router sends another registration request to the CMTS containing the CoS parameters given in the DOCSIS configuration file.
12. The CMTS verifies that the router is using the appropriate CoS profile and converts the temporary SID into a data SID with a service class index that points to the applicable CoS profile.

**Note**

Depending on the software image being run and the capabilities of the CMTS, the DOCSIS configuration file can also specify multiple CoS profiles. Each CoS profile is assigned its own SID, either dynamically or statically, depending on the capabilities of the CMTS and software image being used.

13. The router completes its secondary ranging and is then online, passing data between the cable network and the PCs and other customer premises equipment connected to the router.

**Note**

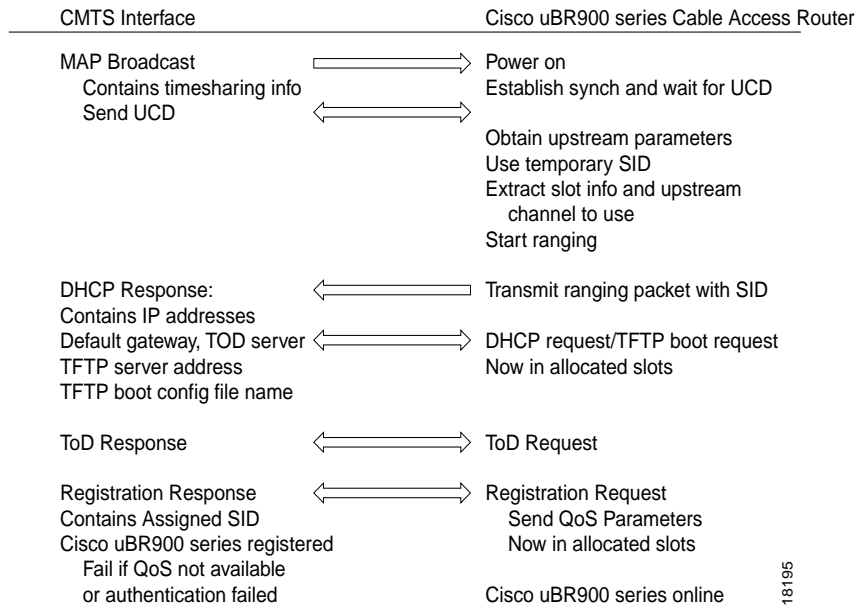
At this point the router is online and operational in the basic DOCSIS bridging mode (“plug and play” mode). The next step is done only if the DOCSIS configuration file specifies that the router must also download a Cisco IOS configuration file and new Cisco IOS image.

14. If the DOCSIS configuration file specifies that the router must download a secondary Cisco IOS image and a Cisco IOS configuration file, the router uses TFTP to download the image and configuration files into its local memory. It then installs the new Cisco IOS image and runs the configuration file.

Alternatively, a system administrator can manually configure the Cisco uBR924 router by giving commands at the router’s CLI interface.

15. If Baseline Privacy Interface (BPI) encryption is configured and enabled on both the router and CMTS, the router and CMTS negotiate the appropriate encryption/decryption parameters. After encryption is enabled, all information sent within Ethernet packets is encrypted to prevent interception or modification by an unauthorized party.

Figure 1-3 illustrates the traffic flow during this process.

**Figure 1-3 Cisco uBR924 Cable Access Router Provisioning Overview**

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**Note**

For more detail on the provisioning process, see the DOCSIS 1.0 Radio Frequency Interface (RFI) specification (SP-RFII01-990731 or later revision).

After the Cisco uBR924 router goes online, it sends traffic between the attached CPE devices and the network (Internet, Intranet, VoIP). The service provider typically uses DHCP to assign IP addresses to the CPE devices. The number of IP addresses each subscriber can obtain depends on the services purchased from the provider.

## Provisioning Prerequisites

The following requirements must be met before a router can be provisioned:

- All required CMTS routing and network interface equipment must be installed, configured, and operational. This includes all headend routers, servers (DHCP, TFTP, and TOD), network management systems, and/or other configuration or billing systems required for your network.
- Based on the quality and capacity of your cable plant, your system administrator or network planner must have defined your network's IP address allocation plan; spectrum management plan outlining the recommended operating parameters to optimize performance; channel plan identifying the channels available to assign to specific Cisco uBR924 routers; and dial plan to match the supported VoIP protocol.
- A CMTS customer service representative must have recorded all needed subscriber information, initiated a work order, and arranged an installation date with the subscriber. For subscriber sites that support multiple telephones or fax devices on a telephone line, all wiring associated with the telephone line extension must be in place. Inside wiring must be in compliance with the country of operation to prevent degradation of service.

- The CMTS system administrator or appropriate personnel must have specified the policy parameters for the Cisco uBR924 router and all computers and other CPE devices to be supported at the subscriber site. See Cisco's Network Registrar (CNR) product documentation for more information.
- The CMTS system administrator or appropriate personnel must have defined and pushed DHCP and DOCSIS configuration files to the appropriate servers so that each router, when initialized, can transmit a DHCP request, receive its IP address, obtain its TFTP and TOD server addresses, and download its DOCSIS configuration file. Cisco IOS images and Cisco IOS configuration files must also be prepared for subscribers who are purchasing services that require new software images and advanced configurations.




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**Note** The CMTS uses the router's unique MAC address for the cable interface to ensure that the router downloads only the file(s) appropriate for the levels of service that have been purchased.

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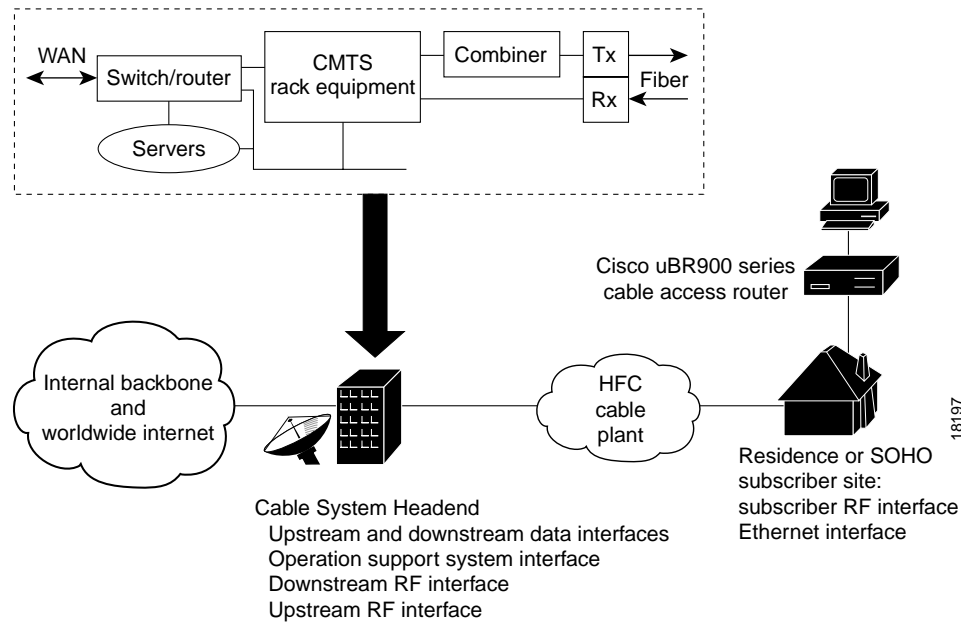
- If DHCP is also being used to provision the IP addresses used by the CPE devices at the subscriber's site, the DHCP server must be able to respond to those requests as well.
- The CMTS system administrator must ensure appropriate databases are updated to activate and support the new subscriber account in the provisioning, billing, and/or network management systems in place for your network after each router is registered with the CMTS.
- The following files should be prepared and available on the TFTP server:
  - DOCSIS configuration file—This is required for every installation. The DOCSIS configuration file specifies the DOCSIS-mandated parameters, such as upstream and downstream frequencies, as well as optional features, such as whether to download a new software image or a Cisco IOS configuration file.
  - Cisco IOS image—If upgrading to a Cisco IOS image different from the factory default, that image must be specified in the router's DOCSIS configuration file and available on a TFTP server, which is accessible either through the serial or the cable interface.
  - Cisco IOS configuration file—Unless the network administrator at the subscriber's site is manually configuring the Cisco uBR924 router through its command-line interface, a Cisco IOS configuration file must be prepared that specifies the routing parameters required to route data between the cable and serial interfaces. This file can specify any other optional features that are desired. It must be made available on a TFTP server, which is accessible either through the serial or the cable interface.

## Data Operations

This section provides an overview of how data is transmitted to and from the Cisco uBR924 router across the cable system's HFC network. Figure 1-4 illustrates a typical broadband data cable system, showing the network path between the Cisco uBR924 router and the CMTS headend equipment (Cisco uBR7200 series universal broadband router or other DOCSIS-compliant CMTS).



Figure 1-4 Cisco Broadband Data Cable System



The Cisco uBR924 router provides the connection between the PC and the cable system, modulating the data transmitted to and from the PC so that it can be carried over the coaxial cable installed by the service provider. To avoid interfering with the cable video signals that are also transmitted over this same coaxial cable, the DOCSIS specification allows only certain frequencies to be used for data transmissions. Separate frequencies are used for the data sent from the CMTS to the cable modem (the downstream direction) and for the data sent from the cable modem to the CMTS (the upstream direction).

The CMTS divides the cable plant into downstream channels and upstream segments or clusters of nodes. Each Cisco uBR924 router on the network is configured to receive data on a particular downstream channel. A downstream channel contains one or more upstream segments; partitioning the upstream plant into smaller segments significantly reduces the number of potential ingress sources and failure points.

## Downstream Transmissions

Because 90% of the data transmitted on the Internet is, on average, sent from the network to the user, the cable system allocates the majority of bandwidth for downstream data (data sent from the CMTS to the router). Downstream transmissions use a 6 MHz data channel in the 88 to 860 MHz range, providing an approximate maximum bandwidth of 27 or 26 Mbps. This bandwidth is shared among all subscribers who have been assigned to this particular downstream channel.

The CMTS receives the downstream data from its Internet or other WAN connections. It addresses the data to the appropriate Cisco uBR924 router and modulates it for transmission on the cable network. When the data arrives at the subscriber's site, the router modulates it for transmission over the Ethernet connection to the appropriate CPE device.

## Upstream Transmissions

The data transmitted in the upstream direction (from the user to the network) is typically much less than that on the downstream direction, so a smaller bandwidth is allocated to it. The upstream transmissions share a 200 kHz-wide to 3.2 MHz-wide channel in the 5 to 42 MHz range, providing a bandwidth of up to 10 Mbps.

Depending on the quality of the physical plant and the CMTS used at the headend, users on a single downstream can be allocated across several upstreams to ensure a responsive network. Service providers can allocate different upstream bandwidths depending on the services purchased by a subscriber. For example, a subscriber purchasing basic home service might be allocated a 128 kbps upstream, while businesses purchasing premium services might be allocated a 384 kbps upstream.

The Cisco uBR924 router receives the upstream data from the CPE devices to which it is connected. It modulates this data for transmission on the coaxial cable system to the CMTS. The CMTS then routes the data to the appropriate destination (local server, Internet, and so forth) through its WAN interfaces.

All DOCSIS cable modems use a request/grant mechanism to obtain bandwidth on the upstream. The CMTS grants the bandwidth according to the requestor's level of service, ensuring that the cable modem is not exceeding the maximum bandwidth for upstream transmissions that has been specified by the subscriber's service agreement.

**Note**

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End-to-end throughput varies based on the design and loading of network components, the mix of traffic, the processing speed and interface of the host server(s), the processing speed and local Ethernet performance of the subscriber's computer, as well as other parameters. Because the network can be configured to support multiple levels of service with different performance requirements, the subscriber's service level agreement also affects throughput. DOCSIS also specifies fundamental performance limitations to ensure that the majority of subscribers experience good performance, rather than permitting a few users to consume the entire capacity.

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## Voice Operations

When using a voice-enabled Cisco IOS image, the Cisco uBR924 cable access router supports Voice over IP (VoIP), which transmits voice and fax calls over a TCP/IP network such as the Internet. Depending on the services purchased from the cable service provider, subscribers can place and receive calls without using the local exchange carrier.

The router supports two simultaneous voice and fax calls from each subscriber site, but multiple telephones and fax devices can be connected to each of the router's two VoIP telephone lines (provided the 5 REN limit for each telephone line is not exceeded). Telephones at each subscriber site must support touch-tone dialing; rotary dialing is not supported, nor are special telephone features such as call waiting, forwarding, and conferencing.

Subscribers can connect standard telephones and fax machines to the Cisco uBR924 router; IP telephones are not required. Depending on the voice network set up by the service provider, subscribers can place calls to numbers that are in the existing telco network; the called party does not have to be using VoIP telephone service.

**Note**

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Fax devices—standard Group III and computer-based Group III machines up to 14,400 baud—are supported in Cisco IOS Release 12.0(5)T and higher voice-enabled images. In general, fax/modem cards are not supported over VoIP links.

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**Caution**

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In certain countries, the provisioning of voice telephony over the Internet or use of these products may be prohibited and/or subject to laws, regulations or licenses, including requirements applicable to the use of the products under telecommunications and other laws and regulations; customer must comply with all such applicable laws in the country where the customer intends to use the product.

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## Features

The Cisco uBR924 cable access router is a compact, easy-to-install device that contains:

- A single F-connector interface to the cable system.
- Four RJ-45 (10BaseT Ethernet) hub ports to connect up to four computers directly to the Ethernet hub ports at the rear of the unit (depending on the Cisco IOS release). Alternatively, one of the four ports can connect to an Ethernet hub which then can connect additional computers or devices at the site. (The actual number of supported CPE devices depends on the Cisco IOS release; see the “Routing and Bridging” section on page 1-2 for details.)
- Two RJ-11 Foreign Exchange Station (FXS) ports to connect telephones and fax devices to the cable system and IP backbone; the router ships from the Cisco factory with the voice ports disabled.

**Note**

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To enable the voice ports, use a Cisco IOS Release 12.0(4)XI or higher image that supports VoIP and configure the router according to your business practices and network configuration. To support fax, use a Cisco IOS Release 12.0(5)T or higher image that supports VoIP and configure the router as appropriate. Also configure the CMTS and related servers. See the *Cisco uBR924 Cable Access Router Software Configuration Guide* for examples of configuration files.

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- One RJ-11 port to connect to a standard, analog telephone line (optional) to provide a backup Plain Old Telephone Service (POTS) connection to the Public Switched Telephone Network (PSTN) should the Cisco uBR924 cable access router lose power.
- One RJ-45 console port (optional) to connect to a laptop PC or console terminal when locally configuring the router; the router ships from the Cisco factory with the console port enabled.

**Note**

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By default, downloading a Cisco IOS configuration file disables the console port and erases all previously saved configurations. This default behavior is recommended as it prohibits configuration access at the remote site.

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Figure 1-5 depicts the front of the Cisco uBR924 cable access router. Figure 1-6 shows the rear of the unit.

Figure 1-5 Cisco uBR924 Cable Access Router Front View

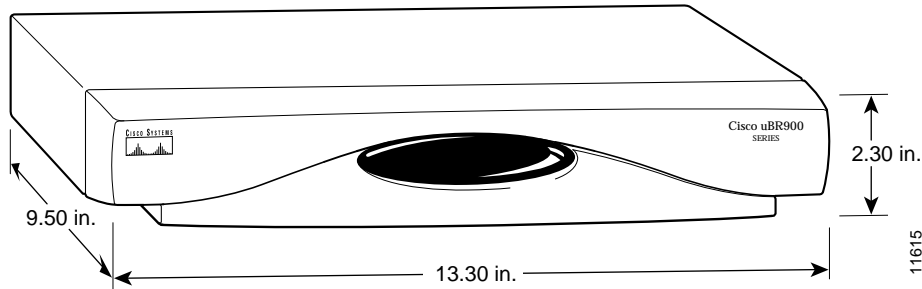
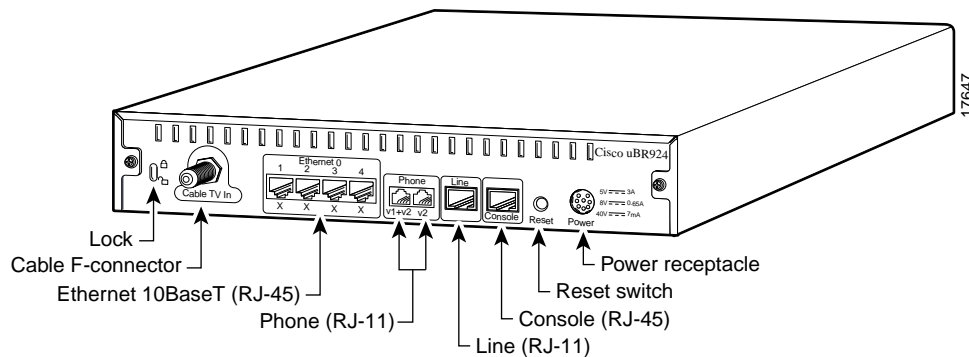


Figure 1-6 Cisco uBR924 Cable Access Router Rear View



The Cisco uBR924 router is designed to work with commercial security products, such as Kensington-compatible lock and cable devices, that attach to the router to prevent theft in small office applications. The router's rear panel contains generic lock and unlock symbols, identified as "Lock" in Figure 1-6.

**Note**

Cisco does not supply these security products.

The following sections describe the router and its features in more detail:

- LED Descriptions
- Data Ports
- Voice Ports
- Backup POTS Connection (RJ-11 Line Connector)
- Power Supply

See Appendix B, "Connector and Cable Specifications," for the pinouts and cabling information for each of these connectors. For information on using the console port, see the *Cisco uBR924 Software Configuration Guide*.

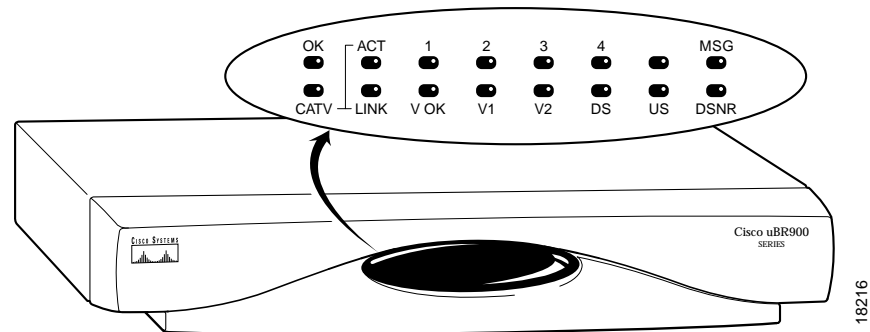
## LED Descriptions

The Cisco uBR924 router contains 15 LEDs on the front panel that provide information about the router's status and network connections. Figure 1-7 illustrates the LEDs on the router's front panel. Table 1-1 lists each LED and its meaning.



**Note** LEDs that are not labeled are not in use.


**Figure 1-7 Cisco uBR924 Cable Access Router Front Panel LEDs**



**Table 1-1 Cisco uBR924 Cable Access Router Front Panel LED Description**

Label	Description	Color	Function
OK	System Status	Green	On = Cisco uBR924 power-on and self-test diagnostics have completed successfully, the system image has been booted, and the system is operational. Blink = After power-on and self-test diagnostics have completed successfully, LED blinks as the system image is booted. Off = No Power. If the OK LED turns off and remains off during the boot process, it indicates the router has failed its self-test diagnostics; in this situation the bottom row of LEDs contain more information about the type of failure (see Table 4-1 on page 4-3).
ACT	Cable Activity	Green	On = Cable Activity Off = No Activity
1–4	Ethernet 1–Ethernet 4	Green	On = Link Up Blink = Activity Off = Link Down
MSG	Message	Green	Reserved for service provider use (typically indicates that messages are waiting in the subscriber's voicemail, but the exact usage depends on the service provider).
V OK	Voice System Status	Green	On = VoIP system is operational Off = VoIP problem; the voice devices may have switched over to the backup POTS line
V1	Voice Port 1	Green	On = Call in progress Off = No call

Table 1-1 Cisco uBR924 Cable Access Router Front Panel LED Description (continued)

Label	Description	Color	Function
V2	Voice Port 2	Green	On = Call in progress Off = No call
LINK	Cable RF Link	Green	On = Cable connection up; RF link up Blink = Cisco uBR924 is searching for a downstream frequency Off = Cable connection down; RF link down
DS <sup>1</sup>	Downstream Signal Lock Status	Green	On = Cisco uBR924 is locked to a downstream frequency (channel). Off = Cisco uBR924 has not yet locked to a downstream frequency (channel) or the router has not yet located a digital signal.
US <sup>1</sup>	Upstream Signal Quality	Green	On = Cisco uBR924 has established upstream communications with the CMTS; cable access router has completed ranging state 2 (as per DOCSIS), has entered provisioning state, and is communicating within 6 dB of desired final power level (generally within 3 dB). Off = Cisco uBR924 has not completed secondary ranging; the CMTS has heard from the cable access router, however, and there is some upstream continuity.
DSNR <sup>1</sup>	Downstream Signal-to-Noise Ratio	Green	On = Receiving quality, downstream signal; SNR is greater than 5 dB above the downstream lock threshold. Off = Receiving low or marginal downstream signal strength or quality.   <b>Note</b> The signal is checked approximately every 25 seconds and the DSNR LED is updated to reflect the current state. If this LED remains off, it could indicate a problem with the cable at the subscriber's site.

1. These are the Cisco factory-default LED settings. Configuration control messages can be sent to the Cisco uBR924 cable access router through Simple Network Management (SNMP) set requests. Using Management Information Base (MIB) objects in the Cisco cable device MIB, the CMTS system administrator can define these LEDs to have other meanings.

## Data Ports

As shown in Figure 1-6, the Cisco uBR924 cable access router contains a coaxial cable F-connector and four Ethernet 10Base T connectors. The cable F-connector must always be connected to the cable system for proper operation. The Ethernet connectors can be connected in one of the following configurations:

- If the router is configured for bridging mode, from one to four CPE devices can be connected directly to the router when using Cisco IOS 12.0(5)T or higher images. (Only three devices can be connected if using Cisco IOS 12.0(4)XI or prior images.)
- If the router is configured for bridging mode, an Ethernet hub can be connected to one of the router's Ethernet ports. The hub can then in turn be connected to up to additional CPE devices (up to three devices are supported in Cisco IOS 12.0(4)XI or prior images, and up to 254 devices are supported in Cisco IOS 12.0(5)T or higher images).
- If the router is configured for routing mode, up to four CPE devices can be directly connected to the router's Ethernet ports.
- If the router is configured for routing mode, an Ethernet hub can be connected to one of the router's Ethernet ports. The hub can then in turn be connected to any number of devices.

**Note**

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For network performance reasons Cisco recommends a maximum limit of 16 CPE devices in either bridging or routing mode. The service provider may also set a different limit by changing the MAX CPE parameter in the DOCSIS configuration file—the default MAX CPE value is one CPE device, which applies in both bridging and routing modes.

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## Voice Ports

As Figure 1-6 shows, the Cisco uBR924 router contains two FXS VoIP ports that are labelled V1+V2 and V2 at the rear of the unit. These ports can be connected directly to analog telephones or fax devices, or to adapters that allow multiple analog telephones or fax devices to be connected to each of the two VoIP telephone lines.

The V1+V2 port on the Cisco uBR924 is a 4-wire port, with the second telco pair wired in parallel with V2. A two-line analog telephone can be connected, therefore, to the V1+V2 port. In this configuration, devices plugged into the V2 port act as extensions to the line 2 telephone.

**Caution**

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Do not connect the V1+V2 and V2 ports to telephone wires that exit the building without appropriate agency-approved protection devices. This is a safety hazard.

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Between 5 and 10 analog telephone devices can be connected to each of the 2 VoIP telephone lines, provided each telephone line does not exceed its Ringer Equivalence Number (REN). In most areas, the sum of the RENs of all devices on any one line should not exceed five. If too many devices are attached, they may not ring properly.

**Note**

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Only one voice call—telephone or fax—per VoIP line is active at a time. The actual number of voice devices supported depends on the services purchased from the service provider and on the Cisco IOS image that is running on the router.

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Typical length of telephone wire is 3,000 feet (or more) of 26 gauge. The wiring in the average small business usually does not exceed this limit, so the Cisco uBR924 router can support the number of telephones or fax devices typically found in small businesses.

## Backup POTS Connection (RJ-11 Line Connector)

The Cisco uBR924 router provides an RJ-11 cutover port that connects to a standard analog telephone wall jack. In the event of a building power failure or other Cisco uBR924 power problem, this port connects the VoIP ports to the backup PSTN line. If the Cisco uBR924 router loses power while VoIP calls are in progress, the subscriber can re-establish one of the two connections by dialing out over the PSTN.

**Note**

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The backup POTS connection enables only one of the VoIP ports that can be connected to the Cisco uBR924 to function during a power outage. Calls in progress prior to the power outage are disconnected.

If power is re-established while a cutover call is in progress, the connection remains in place until the call is terminated. After the cutover call is terminated, the router automatically reboots.

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## Power Supply

The Cisco uBR924 cable access router uses an external AC-input power supply. Refer to Table A-1 in Appendix A, “Technical Specifications,” for the AC-input power supply power specifications, including input voltage and operating frequency ranges.

The Cisco uBR924 cable access router does not contain a power switch. After the cable system technician installs, connects, powers on, and initializes the unit, it is intended to remain connected to the broadband network when operating normally.

The same power supply supports both domestic (U.S.) and international operation. Different power cords are required, however, depending on the country of operation.

**Warning**

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**The router is designed to work with TN power systems. TN power systems have a protective earth. Read the installation instructions in Chapter 3, “Installing the Cisco uBR924 Router,” before you connect the system to its power source.**

---

**Caution**

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Use only a Cisco-provided power supply and cord. Using any other vendor’s power supply and cord can cause loss of data or permanent damage. Cisco uBR924 and Cisco uBR904 power supplies and cords are identical and interchangeable, provided the power cords are applicable to the country of operation.

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## Preparing for Installation

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This chapter recommends general safety guidelines to follow and identifies requirements to meet before going to a subscriber site to install a Cisco uBR924 cable access router. It also lists the major Federal Communications Commission (FCC), Underwriter Laboratory (UL), and other agency approvals for the router. For additional safety and regulatory information, see Appendix C, “Regulatory Compliance and Safety Information.”



**Warning**

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**Only trained and qualified personnel should be allowed to install or replace this equipment.**

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The chapter includes the following sections:

- Safety
- Site Requirements
- Approvals and Regulations
- Required Tools and Equipment

## Safety

This section describes the general, electrical, and electrostatic discharge guidelines that should be followed when installing the Cisco uBR924 cable access router.

## Warnings and Cautions

Follow these guidelines to ensure general safety:

- Install the Cisco uBR924 cable access router in compliance with national and local electrical codes:
  - In the United States: National Fire Protection Association (NFPA) 70, United States National Electrical Code.
  - In Canada: Canadian Electrical Code, part I, CC22.1.
  - In other countries: International Electro-technical Commission (IEC) 364, part 1 through part 7.

- Ensure the shield of the coaxial cable is connected to the grounding system of the residence or building as close to the point of cable entry as practical. In the United States, the cable system must be in accordance with Article 820-40 of the National Electric Code.
- Keep the router area clear and dust free during and after installation.
- Keep tools and router components away from walk areas.
- Do not wear loose clothing, jewelry (including rings and chains), or other items that could get caught on the cable access router. Fasten your tie or scarf and roll up your sleeves.
- Use the Cisco-provided power supply and power cord to connect the Cisco uBR924 cable access router to its power supply and the power supply to the power outlet. The router ships with a three-wire electrical grounding-type plug which only fits into a grounding-type power outlet. This is a safety feature. Equipment grounding should be in accordance with local and national electrical codes.

**Warning**


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**Failure to properly ground the router—either by circumventing the three-wire grounding-type plug or by using a power outlet that is improperly grounded—can create a potentially hazardous electrical situation.**

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- Operate the Cisco uBR924 cable access router in accordance with its marked electrical ratings and product usage instructions.
- Always unplug the power cable before installing or removing a cable access router.
- Do not work on the system or connect or disconnect cables during periods of lightning activity.

## Electrical

Follow these guidelines when working with electrical equipment:

- Disconnect all power and external cables before installing or removing a cable access router.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Never install equipment that appears damaged.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

In addition, follow these guidelines when working with equipment that is disconnected from a power source, but still connected to cable wiring.

- Never install coaxial wiring during a lightning storm.
- Never install cable jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated cable wires or terminals unless the line has been disconnected at the network interface.
- Use caution when installing or modifying cable lines.

## Electrostatic Discharge

Electrostatic discharge (ESD) damage, which occurs when electronic cards or components are improperly handled, can result in complete or intermittent system failures. The Cisco uBR924 cable access router consists of a printed circuit board that is housed in a metal enclosure. Electromagnetic interference (EMI) shielding and connectors are integral components of the enclosure. Although the enclosure helps protect the boards, use an antistatic strap whenever handling the Cisco uBR924 cable access router. This will minimize the possibility that ESD damage can occur to the internal boards by touching the external connectors.

Following are guidelines for preventing ESD damage:

- If you use an ESD wrist strap or ankle strap, ensure that it makes good skin contact and that the equipment end of the ESD strap is attached to an unfinished surface of the Cisco uBR924 cable access router.
- Always place the router on an antistatic surface or in a static shielding bag. If you are returning the item to the factory, immediately place it in a static shielding bag.

**Caution**

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For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohm (Mohm).

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## Site Requirements

Before going to a subscriber site to install the Cisco uBR924 cable access router, verify that the following have been done:

- Ensure that a coaxial cable connection is run from the cable TV trunk to the subscriber building or residence. For sites that support multiple telephones or fax devices on a VoIP telephone line, ensure all wiring is in place to support the configuration.

**Note**

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Cisco recommends that a dedicated (new) CATV cable drop be run from the grounding block directly to the Cisco uBR924 cable access router. If such a drop is not available, careful qualification of existing cable is often necessary. Cable ground should be connected to the grounding system of the building or residence as close to the point of cable entry as practical. For the United States, refer to the National Electrical Code Section 820-40 guidelines for proper grounding.

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- Verify that each subscriber site is characterized at the headend to support upstream transmission and meets DOCSIS upstream and downstream RF requirements. Observe procedures in the *NCTA Recommended Practises for Measurements on Cable Television Systems*. Also see the “Cabling” section on page 6.
- Some sites specify that high pass filters must be installed on every tap drop that does not carry upstream data, voice, or IPPV services.

**Note**

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Installing a high pass filter between the Cisco uBR924 router and the headend will prevent the router from connecting to the headend—in this situation, the router’s US LED will never light.

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- Ensure that all required headend routing and network interface equipment is installed, configured, and operational. Ensure that DHCP, Cisco IOS images, and configuration files have been created and pushed to appropriate servers such that each Cisco uBR924 router, when initialized, can transmit a DHCP request, receive an IP address, obtain TFTP and TOD server addresses, and download a configuration file (and/or updated software image) in compliance with DOCSIS and the procedures in place for your network.
- Ensure that each subscriber site meets the operating requirements specified in the “Site Requirements” section.
- Ensure that all supported equipment at a subscriber site—PC(s), telephone(s), fax device(s) and/or Ethernet hub—is installed and operational. Ensure telephones at subscriber sites support touch-tone dialing.
- Verify that all PCs at all subscriber locations meet the minimum computing requirements, that TCP/IP and DHCP operating modes are enabled, and that Internet connectivity is set for the Ethernet interface. See the “PC Subsystem” section on page 4-9 for procedures to verify TCP/IP and DHCP PC settings when onsite.

Each service provider will have its own recommendations and requirements for the CPE devices connected to its network. However, at the very minimum a PC should have a 33 MHz 486 processor (a 75 MHz Pentium or greater processor is recommended); 16 MB of RAM; Windows for Workgroups for 486-based PCs and Windows 95 (or higher) for Pentiums; an Internet browser; an installed Ethernet Network Interface Card (NIC), with TCP/IP networking software installed and DHCP enabled.

**Note**


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This recommendation is for Internet access in general and is not specific to the Cisco uBR924. Other operating systems and hardware platforms of comparable capability are also supported.

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- Ensure that you bring sufficient cables to connect all devices at all subscriber locations. For simultaneous TV and computer usage at a subscriber site, obtain cable splitters and directional couplers as appropriate to install when you install the router.
- Ensure the subscriber has ordered the backup POTS line(s) as appropriate from the telephone company and that an RJ-11 modular jack (USOC code) is installed near the location to connect to the router. The phone line should be a regular voice grade line or equivalent. Obtain each customer’s telephone number onsite and verify the voice jack.
- As applicable for testing or reconfiguration based on your network practices, obtain IP addresses and/or telephone numbers pertinent to your network from your system administrator if you are statically configuring the subscriber site and voice dial peer groups. For most networks, IP addresses are supplied automatically. To test VoIP functionality at each site, obtain a special dialing number from your system administrator.

## Environmental

Table 2-1 lists the operating and nonoperating environmental site requirements for operation of the Cisco uBR924 router. The ranges indicate the minimum and maximum values allowed for the router’s operation, but if a measurement approaches the minimum or maximum of a range, it could indicate a potential problem. You can maintain normal operation by anticipating and correcting environmental anomalies before they approach a maximum operating range.

**Table 2-1 Specifications for Operating and Nonoperating Environment**

Specification	Minimum	Maximum
Temperature, ambient operating	32°F (0°C)	104°F (40°C)
Temperature, ambient nonoperating and storage	-13°F (-25°C)	95°F (70°C)
Humidity, ambient (noncondensing) operating	5%	95%
Humidity, ambient (noncondensing) nonoperating and storage	5%	95%
Altitude, operating and nonoperating	Sea level	10,000 ft (3,050 m)
Vibration, operating	10 to 200 Hz, 0.0005 g (1 oct./min.)	N/A
Vibration, nonoperating	10 to 100 Hz, 0.0065 g (1 oct./min.)	N/A

**Caution**

For proper airflow, keep the back, sides, and bottom of the cable access router clear of obstructions and away from the exhaust of other equipment. To prevent unit overheating, never install the Cisco uBR924 router in an enclosed rack or room that is not properly ventilated or air conditioned.

## Power

The Cisco uBR924 router does not contain a power switch. After the cable system technician installs, connects, powers on, and initializes the unit, it is intended to remain connected to the broadband network when operating normally. Before plugging the unit in, verify that the power source is within the values given in Table 2-2.

**Table 2-2 Cisco uBR924 Cable Access Router Power Specifications**

Description	Specification
AC-input voltage	120 to 240 VAC <sup>1</sup> wide input with power factor correction
AC-input current rating	1.2A <sup>2</sup> maximum at 120 VAC and 0.6A maximum at 240 VAC
AC-input cable	18 AWG <sup>3</sup> three-wire cable, with a three-lead receptacle on the power supply end, and a North American (NEMA 5-15P) plug on the power source end; other country-specific cords are available and supplied as ordered.
Power dissipation	12 to 15W
Frequency	50/60 Hz <sup>4</sup>

1. VAC = volts alternating current.
2. A = ampere.
3. AWG = American Wire Gauge.
4. Hz = hertz.

**Note**

The same power supply supports both domestic (U.S.) and international operation. Different power cords are required, however, depending on the country of operation.

**Caution**

---

Use only a Cisco-provided power supply and cord. Using any other vendor's power supply and cord can cause loss of data or permanent damage. Cisco uBR924 and Cisco uBR904 power supplies and cords are identical and interchangeable, provided the power cords are applicable to the country of operation.

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## Cabling

When running the coaxial line from the cable TV trunk connection to the subscriber site, consider the issues of electromagnetic interference (EMI), coaxial cable quality, and distance limitations for signaling, as described in the following sections.

### Interference Considerations

When wires are run for any significant distance in an electromagnetic field, interference can occur between the field and the signals on the wires. This fact has two implications for the construction of plant wiring:

- Bad wiring practice can result in radio interference emanating from the plant wiring.
- Strong EMI, especially when it is caused by lightning or radio transmitters, can destroy the signal drivers and receivers in the Cisco uBR924 router, and can even create an electrical hazard by conducting power surges through lines and into equipment. (Review the safety warnings in the “*Electrical*” section on page 2-2.

**Note**

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Category 5 data wiring and telco wiring is much more susceptible to EMI than high-grade well-shielded coaxial CATV cable.

---

If wires exceed recommended distances, or if wires pass between buildings, give special consideration to the effect of a lightning strike in your vicinity. The electromagnetic pulse caused by lightning or other high-energy phenomena can easily couple enough energy into unsaddled conductors to destroy electronic devices. If you have had problems of this sort in the past, you might want to consult experts in electrical surge suppression and shielding.

### Coaxial Cable Quality

CATV coaxial cable quality can vary dramatically at each installation site. Poor insulation, improperly installed additional outlets, the condition and length of the cable's center conductor, and the quality of the cable can negatively affect the connectivity and performance of the cable access router for digital data transmission. Coaxial cable tolerances for the transmission of two-way digital data are much lower than the tolerances for the transmission of downstream-only video. Coaxial cable used to carry two-way digital data must be of very high quality.

**Note**

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A 5 dB reduction in signal quality for analog downstream video might cause a slight degradation of picture clarity, which might or might not be noticeable to a subscriber.

A 1 dB reduction in signal quality for digital data might completely disrupt service to a Cisco uBR924 router user.

---

Check the cables for general quality level, tears or cuts in the insulation, insulation that is at least 80% braid with foil, a broken or bent center conductor at the conductor ends, the length of the center conductor, and splitters or amplifiers that have been added to extend video connectivity at the installation site.

**Note**

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The center conductor should extend 1/8 inch (3.2 mm) beyond the end of the conductor.

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**Tips**

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Cisco recommends that you replace any cable that is in question and begin the installation with clean, two-way digital data transmission media. If the cable is of high-quality and was recently installed, replacing the connectors with high-quality connectors can also improve performance and eliminate future service calls.

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**Caution**

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If you replace a connector, be careful not to score the center conductor. A scored conductor can reduce or impair performance for channels broadcast between 550 and 860 MHz. If the center conductor is too short, signals between 5 and 42 MHz might be affected.

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## Distance Limitations

The size of your networks and the distances between connections on the CATV network can affect the successful installation of a Cisco uBR924 router, which must be within 100 miles of the CMTS. This distance can also be defined in relation to the speed of light through the transmission network as being less than 2 msec from the CMTS to the Cisco uBR924 router and back again.

**Note**

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Exceeding this distance is a violation of the DOCSIS RFI specification.

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When preparing a site for network connections to the Cisco uBR924 router, consider the following:

- The number of amplifiers from the installation site to the nearest node
- The number of outlets and amplifiers at the installation site
- Cable pinouts if you plan to build your cables

Potential distance limitation problems in the CATV network can be reduced by ensuring the following factors:

- A correct, linear unity gain two-way sweep procedure is in place
- Industry-standard configuration practices are used at the headend
- The downstream frequency is known at the time of installation
- The absolute downstream signal level can be measured where it enters the cable access router

# Approvals and Regulations

The Cisco uBR924 router interfaces with national cable, telco, and network installations, which are subject to government regulation and oversight. Please read the following sections to verify that the installation of the router is within the parameters imposed by the regulatory bodies that are responsible for the subscriber's site. Additional information is available in Appendix C, "Regulatory Compliance and Safety Information."

## FCC Requirements

### Class B Equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna (as appropriate).
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help (as appropriate).

### Rights of the Telephone Company

The FCC has established rules that permit the device to be directly connected to the telephone network. Standardized jacks are used for these connections. This equipment should not be used on party lines or coin phones.

If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until repair has been made. If this is not done, the telephone company may temporarily disconnect service.

The telephone company may make changes in its technical operations and procedures; if such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes. You will be advised of your rights to file a complaint with the FCC.

If the telephone company requests information on what equipment is connected to their lines, inform them of:

- The telephone number to which this unit is connected
- The ringer equivalence number (5 REN per port)
- The USOC jack required (RJ11C)
- The FCC registration number (5B1USA-33873-KX-N)



The ringer equivalence number (REN) and the FCC registration number are indicated on the label. The ringer equivalence number determines the maximum devices that can be connected to your telephone line. In most areas, the sum of the RENs of all devices on any one line should not exceed five. If too many devices are attached, they may not ring properly.

## Country Approvals

As of the date of the publication of this manual, the Cisco uBR924 router is approved to operate in the following countries:

- North America: refer to the text that follows for Canadian requirements
- European Countries—EN55022 requirements
- Australia and New Zealand; AS/NZS 3548 requirements, PTC 210/99/007 requirements
- South America
- Asia: Japan—JATA requirements (approval number is A99-0334JP); Singapore (complies with TAS Standards TS PSTN-1), Hong Kong (approval number is HK99-00/VCS, Class B), Malaysia, Taiwan
- Saudi Arabia; SASO R-200752 requirements

Other companies might have been added to this list since the date of publication. See the release notes for this product for any additions.

## UL/CSA/TUV Approvals

This product is UL-listed, CSA-approved, and TUV-certified for the uses described in this guide.

## Industry Canada Requirements

**NOTICE:** This product is Canadian Industry certified. The Industry Canada Certification Number is 2461 9904 A. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to the certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

**Caution**

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Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

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The Ringer Equivalence Number (REN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total REN of all the devices does not exceed five.

# Required Tools and Equipment

Assemble the tools and equipment needed to install the Cisco uBR924 router at subscriber sites. Table 2-3 lists the recommended items that Cisco does not provide.

**Table 2-3 Recommended Tools, Cabling, and Equipment List**

Checked Off	Item
	Installation toolkit including a flathead screwdriver (small to medium size); Phillips screwdriver (small to medium size); 7/16-inch open-end wrench; ESD-preventive wrist strap
	Signal level meter capable of reading a 64 QAM signal or a spectrum analyzer (HP8594Q or equivalent) as appropriate. An alternative is a clear understanding of the digital-to-analog channel amplitude offset and a calibrated analog signal level meter to measure a nearby adjacent analog carrier.
	Mixed set of attenuators (pads), cable adapters, splitters, High Pass Filters (HPF), directional couplers as appropriate
	Telephone tester (handset) to check the backup POTS telephone line (optional)
	10BaseT Ethernet cable tester
	Portable, hand-held console terminal such as a laptop computer with RS-232 serial port communications software, and a setting of 9600 baud, 8 data bits, no parity, and 1 stop bit (9600 8N1); reserved for technicians in networks supporting remote configuration and troubleshooting.
	Connector assemblies/adapters and wiring items for subscriber sites that support multiple telephones or fax devices on a VoIP telephone line; items and wiring must be in accordance with regulations in the country of operation.
	Applicable cables based on the subscriber site configuration: <ul style="list-style-type: none"> <li>• High-quality, shielded RF coaxial cable (with at least 80% braid) to connect the Cisco uBR924 to the cable system</li> <li>• Category 5 UTP (10BaseT Ethernet) straight-through cables to connect computers directly to the Cisco uBR924</li> <li>• Category 5 UTP (10BaseT Ethernet) crossover cables to connect the Cisco uBR924 to an Ethernet hub (RJ-45 connectors)</li> <li>• All other cables to connect the Ethernet hub to the supported devices</li> <li>• FXS voice cables and appropriate items to connect the Cisco uBR924 to telephone or fax equipment (RJ-11 connectors) per the site's configuration</li> <li>• Backup POTS (optional) line connection (RJ-11 connectors)</li> <li>• Cable to connect the console port to the portable, hand-held console device (RJ-45 connectors)</li> </ul>

The Cisco uBR924 cable access router is available in differing bulk box and single packages:

- Bulk box packages include: five Cisco uBR924 cable access routers, five power supplies, five power cords based on the country of operation, five 10BaseT Ethernet straight-through cables, five subscriber documentation sets, and one service provider documentation set.

- Single packages include: one Cisco uBR924 cable access router, one power supply, one 10BaseT Ethernet straight-through cable, and one service provider and subscriber documentation set. A power cord appropriate to the country of operation can be purchased together or separately from the router.

**Caution**

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Use only the Cisco-provided power supply and cord. Using any other vendor's power supply and cord can cause loss of data or permanent damage. Ensure the power cord is suitable for your country of operation. Cisco uBR904 and Cisco uBR924 power supplies and cords are identical and interchangeable, provided the power cords are applicable to the country of operation.

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**Note**

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A cable console kit and console cable, used to locally reconfigure the router, can be purchased separately.

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The subscriber in-box documentation set includes:

- *Quick Start, Cisco uBR924 Cable Access Router Subscriber Setup* publication

The service provider in-box documentation set includes:

- Warranty card
- Licensing information

The following additional documents are available via CCO:

- *Cisco uBR924 Cable Access Router Hardware Installation Guide*—this document
- *Cisco uBR924 Cable Access Router Software Configuration Guide*
- *Quick Start Guide, Cisco uBR924 Cable Access Router Installation and Startup* publication
- Release notes are available for all Cisco IOS Release images

Based on the number of subscriber sites you are scheduled to install, ensure that you have sufficient Cisco-provided bulk box packages. After you have completed installation, give each subscriber a copy of the *Quick Start, Cisco uBR924 Cable Access Router Subscriber Setup* publication, along with any documentation your company provides.



## Installing the Cisco uBR924 Router

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This chapter contains the following sections that provide instructions on installing the router, initial power-on, and verifying the installation:

- Cisco uBR924 Router Installation Checklist
- Physical Placement
- Verifying Power Requirements
- Connecting to the Cable System
- Connecting the Ethernet Cables
- Connecting to Telephones or Fax Devices
- Connecting the Backup POTS Connection
- Connecting Power
- Connecting to Telephones or Fax Devices
- Router Power-On and Initialization Sequence
- Verifying Installation



### Caution

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Before proceeding with the installation, verify that you have fulfilled all of the requirements listed in Chapter 2, “Preparing for Installation.” Also read and follow the safety guidelines in the “Safety” section on page 2-1, as well as those contained in this chapter.

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## Cisco uBR924 Router Installation Checklist

Table 3-1 presents a checklist, identifying the installation tasks to complete at each subscriber site. Use this table as a guide while installing the router.

Table 3-1 Installation Checklist



Checked Off	Task	For More Information, See...
	Ensure the selected location to install the router is free of dust and meets all requirements.	“Environmental” section on page 2-4
	Install the Cisco uBR924 router: <ul style="list-style-type: none"> <li>• Close to the cable drop connection.</li> <li>• On a stable, flat surface or desktop close to the devices to be connected such that your cables reach all devices, but in a location where the bottom, sides, and rear of the router are clear of obstructions and away from the exhaust of other equipment.</li> <li>• Close to the power source—depending on the country in which the router operates, the power source must be a grounded 100 to 240 VAC outlet.</li> <li>• Near to a standard, analog telephone line if the router connects to a backup POTS connection.</li> </ul>	“Physical Placement” section on page 3-4
	Check the power at the subscriber site before and after installation to ensure that you are receiving clean power. Ensure proper grounding.	“Verifying Power Requirements” section on page 3-4
	Verify that each PC to be connected to the router has an Ethernet NIC and that TCP/IP networking with DHCP support is enabled. Ensure that all other PC prerequisites are met.	
	Connect the router’s F-connector to the cable TV coaxial drop cable. (If the subscriber also subscribes to cable TV services, install a cable splitter/directional coupler and high-pass filter as appropriate.)	“Connecting to the Cable System” section on page 3-5
	Connect the Cisco uBR924 router to CPE devices at the site: <ul style="list-style-type: none"> <li>• To directly connect PCs to the Cisco uBR924 router, connect up to four of the unit’s Ethernet hub ports directly to the 10BaseT Ethernet (RJ-45) ports of the PCs. Use 10BaseT Ethernet straight-through cables.</li> <li>• To connect additional PCs/devices at the site or to connect to an existing network at the site, connect one of the unit’s Ethernet hub ports directly to the 10BaseT Ethernet port of an Ethernet hub. Use a 10BaseT Ethernet crossover cable. Then connect each computer/device to the hub, again using 10BaseT Ethernet crossover cables.</li> </ul>  <p><b>Note</b> If your hub has an uplink port, you might be able to use straight-through cables to connect the hub to the PC.</p>	“Connecting the Ethernet Cables” section on page 3-6

Table 3-1 Installation Checklist (continued)

Checked Off	Task	For More Information, See...
	<p>Connect the router's Phone V1+V2 and V2 connectors (RJ-11 to RJ-11) to telephones or fax devices directly, or to adapter(s) that allow multiple telephones or fax devices to be connected to the two VoIP telephone line(s). At subscriber sites supporting multiple voice devices on a single VoIP telephone line, ensure you have all certified connector assemblies/adapters and wiring items needed to support the configuration.</p> <p> <b>Note</b> Cisco does not provide these items. Since the V1+V2 connector is a 4-wire port, with the second telco pair wired in parallel with V2, a two-line telephone can be plugged into the V1+V2 connector using a single cable if the cable has four wires. If this is done, the V2 port is not used.</p>	"Connecting to Telephones or Fax Devices" section on page 3-7
	Attach the 7-pin end of the power supply cord into the router's Power connector and connect the other end to the power supply. Plug the router's power supply into the wall outlet. Watch the router power on and initialize.	"Connecting Power" section on page 3-10
	If applicable, connect the router's Line (RJ-11 to RJ-11) connector to a standard, analog POTS telephone line. Verify the telephone circuit/connection is working.	"Connecting the Backup POTS Connection" section on page 3-9
	Power on all other devices at the subscriber site: PCs, Ethernet hub and all other equipment as applicable.	"Router Power-On and Initialization Sequence" section on page 3-12
	<p>Ensure the data channel frequency has a sufficient RF signal level to meet your cable plant specifications and verify the RF input levels relative to a nearby analog video level:</p> <ul style="list-style-type: none"> <li>• Check the RF signal with an RF power meter at the Type F coax connector to verify the DOCSIS system signal.</li> <li>• Verify the nearby analog video signal is within the correct range—0 to +15 dBmV for most CATV systems.</li> </ul>	
	<p>Test the installation:</p> <ul style="list-style-type: none"> <li>• Establish an Internet connection and request data from a PC connected to the router.</li> <li>• Make a VoIP telephone call.</li> <li>• Send a VoIP fax.</li> <li>• To test the backup POTS connection, disconnect the three prong end of the power cord from the power outlet to power off the Cisco uBR924 (follow safety instructions in the "Connecting Power" section on page 3-10) and verify that a call can be established over the PSTN. Hang up that call, wait until the Cisco uBR924 reboots, and reverify that a VoIP telephone call can be made.</li> </ul>	"Verifying Installation" section on page 3-13

## Physical Placement

Place the cable access router on a stable, flat surface such as a desktop, close to the cable TV drop connection and all devices to be connected at the subscriber site. The bottom, sides, and rear of the router must remain unobstructed to ensure adequate airflow and to prevent the unit from overheating. The rubber feet on the bottom of the router provide enough clearance when the unit is placed on a flat, hard surface. Cisco recommends at least 3 inches of clearance at the rear of the router.



### Caution

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Do not place the router on an uneven or soft surface.

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Install the router in compliance with all national and local electrical codes such as:

- US NFPA 70
- Canadian Electrical Code, part I, CC22.1
- IEC 364, part 1 through part 7

## Verifying Power Requirements

The cable access router uses one external AC-input power supply. The OK (power) LED on the front of the unit indicates that the power supply is supplying power to the unit when it is connected and operational.

The AC-input power supply uses a power factor corrector that allows the Cisco uBR924 cable access router to operate in any country where the input voltage is between 100 and 240 VAC, and 50 or 60 Hz. Different power cords are available to suit the country of operation.

Refer to Table A-1 on page A-1 for AC-input power supply specifications, including input voltage and operating frequency ranges. Cisco recommends that you follow these precautions:

- Check the power at the subscriber site before and after installation to ensure that you are receiving clean power. Install a power conditioner if necessary.



### Warning

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**The plug-socket combination must be accessible at all times because it serves as the main disconnecting device.**

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- If plugging the router into an Uninterruptible Power Supply (UPS), verify that the total power and current requirements used by all devices plugged into the UPS are within the maximum limits of the UPS.
- Install proper grounding to avoid damage from lightning and power surges. If using a North American (NEMA 5-15P) plug, you must plug the unit into a three-lead receptacle to ensure proper grounding.



### Warning

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**Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.**

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- Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A International) is used on the phase conductors (all current-carrying conductors providing power to the device).



- Do not work on the system or connect or disconnect any cables (Ethernet, cable, or power) during periods of lightning activity—the possibility of serious physical injury exists if lightning should strike and travel through those cables. In addition, the equipment could be damaged by the higher levels of static electricity present in the atmosphere.

**Note**

Adhere to the safety guidelines presented in the “Safety” section on page 2-1 before following procedures in the remainder of this chapter. Be sure all equipment to be connected to the cable access router is powered off.

**Caution**

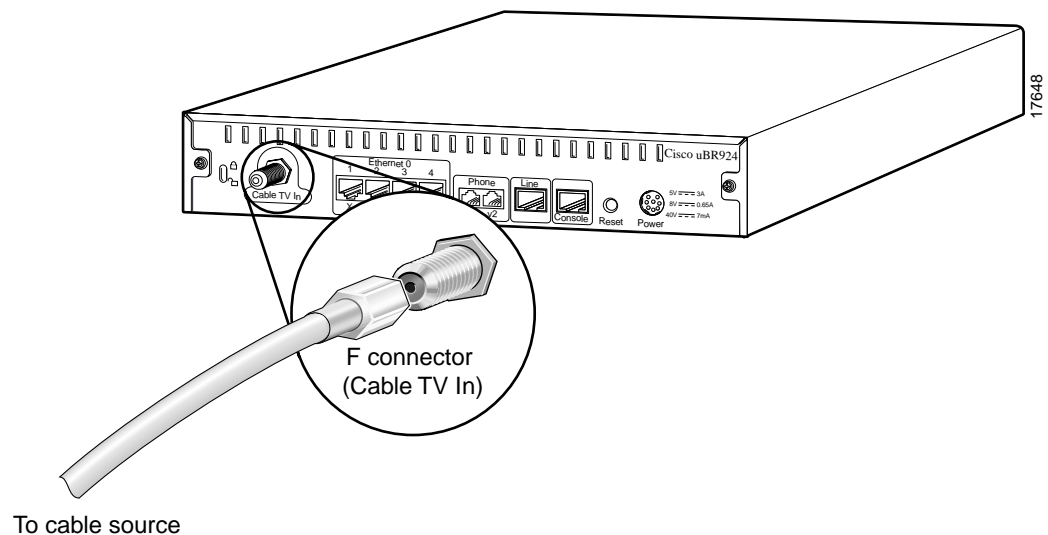
Do not connect the router to power at this point because the router will begin its initial power-on sequence and attempt to connect to the network. The unit should be powered on only after all other connections have been made, as described later in this chapter.

## Connecting to the Cable System

To connect the Cisco uBR924 router to the cable system:

- Step 1** Verify that the router is not connected to power.
- Step 2** Locate the RF coaxial cable coming from the CATV wall outlet.
- Step 3** Install a cable splitter/directional coupler if needed to separate signals for TV and computer usage. If necessary, also install a high-pass filter to prevent interference between the TV and computer signals.
- Step 4** Connect the RF coaxial cable to the router’s F-connector. Hand-tighten the connector, making sure it is finger tight; then give it a 1/6 turn with a wrench. (See Figure 3-1.)

**Figure 3-1** Connecting the CATV Coaxial Cable to the Cisco uBR924 Router



**Caution**

Do not overtighten the connector because this can break off the connector. Using a torque wrench is not recommended because of the danger of tightening the connector more than the recommended 1/6 turn after it is finger tight.

**Step 5**

Make sure all other coaxial cable connectors—all intermediate splitters, couplers, or ground blocks—are securely tightened from the distribution tap to the Cisco uBR924 router, following instructions in step 4.

**Note**

Loose connectors inside the building or residence can cause intermittent router operation.

**Caution**

To ensure compliance with FCC limits, connection to the cable system must be made with a high-quality, shielded cable. If the quality or general condition of the coaxial cable at the subscriber site is in question, Cisco recommends that you replace the coaxial cable. For more information on the effects of substandard cabling on the cable access router installation, see the “Cabling” section on page 2-6.

## Connecting the Ethernet Cables

To connect the Cisco uBR924 router to computers and other CPE devices at the site:

**Step 1**

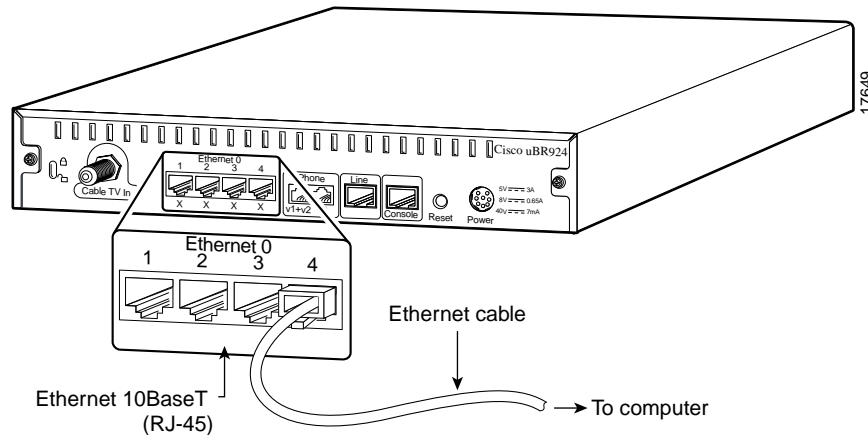
Locate all needed 10BaseT RJ-45 Ethernet cables:

- Use straight-through Ethernet cables to directly connect up to four PCs to the Cisco uBR924 cable access router’s four Ethernet hub ports.
- Use a crossover Ethernet cable to connect the Cisco uBR924 cable access router to an Ethernet hub if more than four PCs or other LAN devices are to be connected at the site (supported only when running Cisco IOS Release 12.0(5)T or higher images). Connect all devices to the hub using straight-through Ethernet cables. (If your hub has an uplink port, you might be able to use a straight-through cable to connect the hub directly to the computer.)

**Step 2**

Connect one end of the Ethernet cable to one of the router’s Ethernet ports (labeled 1X, 2X, 3X, or 4X) at the rear of the unit. (See Figure 3-2.)

Figure 3-2 Connecting the Ethernet Cable to the Cisco uBR924 Cable Access Router

**Note**

Do not connect the Ethernet cables into the RJ-45 console connector.

- Step 3** Press the cable end firmly into the router's Ethernet receptacle and connect the other end to the computer or hub as applicable.
- Step 4** Repeat steps 2 and 3 for each Ethernet connection from the Cisco uBR924 cable access router.

**Warning**

To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to the telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits and WAN ports contain TNV circuits. RJ-45 connectors are used for both LAN and WAN ports—use caution when connecting cables to ensure that the proper ports are being connected.

Hazardous network voltages are presented in WAN ports regardless of whether power to the unit is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the unit first.

## Connecting to Telephones or Fax Devices

If you have purchased voice services from your service provider and are using a Cisco IOS image with voice support, use the following procedure to connect the Cisco uBR924 router to telephone or fax devices at the site:

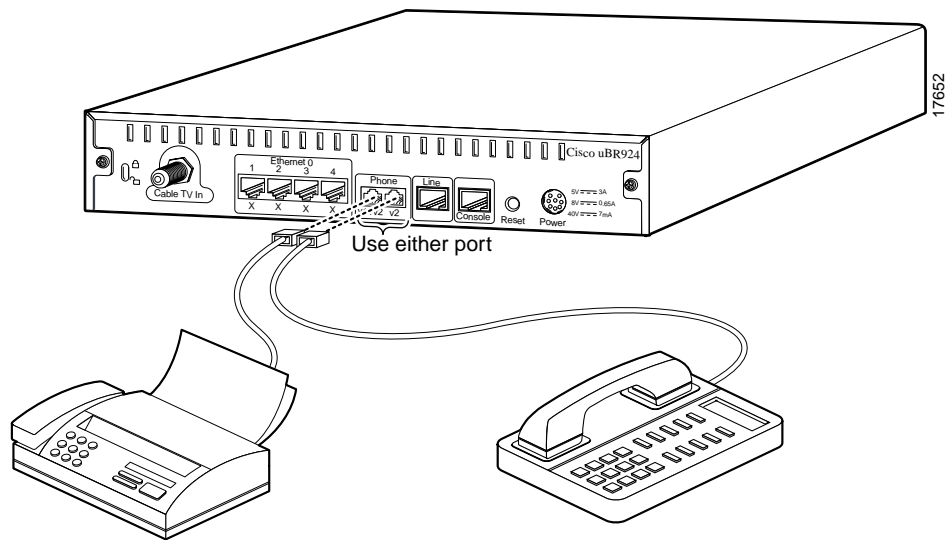
- Step 1** Use one RJ-11 to RJ-11 cable for each analog telephone or fax device that is directly connected to the Cisco uBR924 router. If multiple analog telephones or fax devices are to be connected to a VoIP telephone line, ensure the wiring is in place to support the configuration and assemble all needed items to support the site's configuration.



**Note** Refer to the “Required Tools and Equipment” section on page 2-11. Cisco does not provide these items.

- Step 2** Connect one end of the cable to one of the Phone ports (labeled V1+V2 and V2) at the rear of the router. Press the cable firmly into the receptacle. (See Figure 3-3.)

**Figure 3-3 Telephone Cable and RJ-11 Connector**



The V1+V2 connector supports either a single-line analog telephone or a two-line analog telephone that uses four wires. If using a two-line telephone, line 2 of the telephone behaves as if a single-line telephone is plugged into the second voice port. In this configuration, devices plugged into the V2 port act as extensions to the line 2 telephone.



**Note** Use only telephones with a pushbutton dial set. Fax/modem cards and software on a PC can be used but only in fax mode; the data mode of the fax/modem card cannot be used with the VoIP network. Contact your network management, provisioning, or operations team to determine if modems are supported across your VoIP network. When combining telephones and fax devices on a VoIP line, only one voice call—telephone or fax—can be active on that line at a time.

- Step 3** Connect the other end of each RJ-11 cable directly to the telephone or fax device as shown in Figure 3-3. For multiple telephones or fax devices, connect the other end to an adapter and ensure all telephones and fax devices are connected correctly on that VoIP telephone line.



**Caution** If you are connecting multiple telephones or fax devices to a telephone line, be sure the sum of the RENs of all devices on any one line does not exceed five. If too many devices are attached, they may not ring properly.

**Warning**

---

**Equipment must be installed using an acceptable method of connection. Install adapters and/or connector assembly parts to support multiple voice devices per VoIP telephone line in compliance with regulations in your country. Incorrect connection of this or connected equipment to a general purpose outlet could result in a hazardous situation.**

---

**Step 4**

Repeat steps 2 and 3 to connect the device(s) to the second telephone line according to the configuration to support at the site.

---

**Warning**

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**This equipment contains a ring signal generator (ringer), which is a source of hazardous voltage. Do not touch the RJ-11 (phone) port wires (conductors), the conductors of a cable connected to the RJ-11 port, or the associated circuit board when the ringer is active. The ringer is activated by an incoming call.**

---

## Connecting the Backup POTS Connection

To connect the Cisco uBR924 router to the backup, standard analog telephone line, follow the instructions below.

**Warning**

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**To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord. For Australia and New Zealand operation, this equipment is to be installed and maintained by service personnel only as defined by AS/NZS 3260 Clause 1.2.14.3 Service Personnel.**

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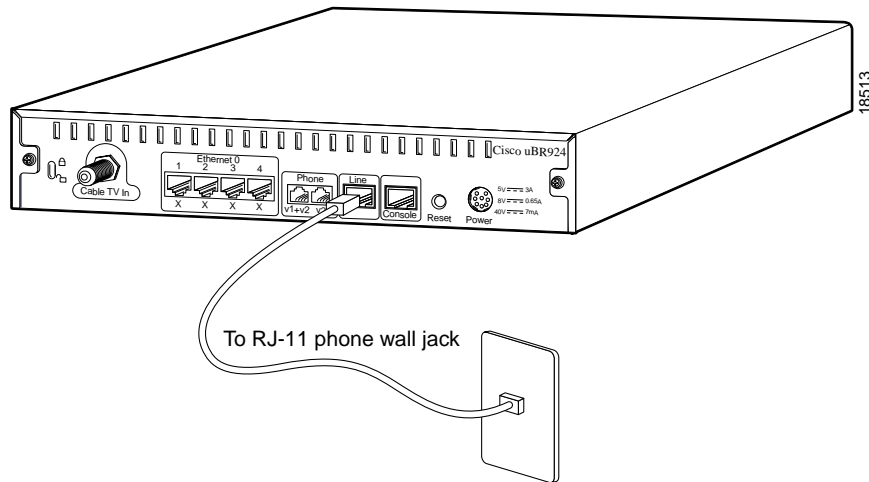
**Step 1**

Obtain an RJ-11 to RJ-11 cable (minimum 26 AWG).

**Step 2**

Connect one end of the cable to the backup POTS line port (labeled Line) at the rear of the router. Press the cable firmly into the receptacle. When properly connected, the RJ-11 connector locks into the receptacle and can only be removed by pressing the plastic tab on the connector while pulling the cable back from the receptacle. (See Figure 3-4.)

Figure 3-4 Backup Telephone Line Connector



**Step 3** Connect the other end of the cable to the telephone wall jack.



#### Warning

**This equipment contains a ring signal generator (ringer), which is a source of hazardous voltage. Do not touch the RJ-11 (phone) port wires (conductors), the conductors of a cable connected to the RJ-11 port, or the associated circuit board when the ringer is active. The ringer is activated by an incoming call.**

When the Cisco uBR924 router has a backup connection to the PSTN and the router loses power while VoIP calls are in progress, the subscriber can establish a voice connection by dialing out over the public switched telephone network (PSTN).

The backup POTS connection enables only one of the two VoIP lines connected to the Cisco uBR924 router to function during a power outage. Calls in progress prior to the power outage are disconnected. If power is re-established while a cutover call is in progress, that connection remains in place until the call is terminated. When the call is terminated, the router automatically reboots.



#### Note

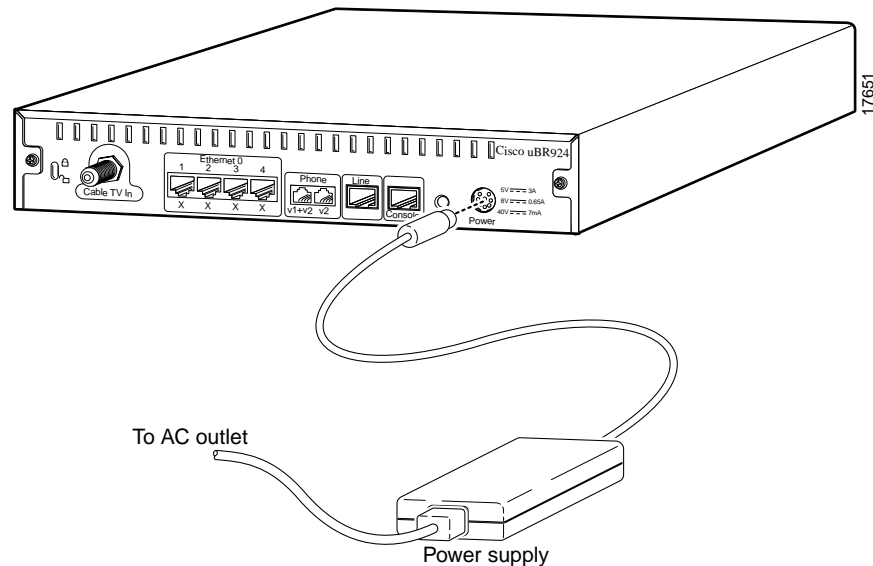
Calls using the backup POTS connection are made over the PSTN, not the VoIP network. Any special features of the VoIP network are not available until power is restored and network connections are re-established.

## Connecting Power

To connect AC-input power to the Cisco uBR924 router:

- Step 1** Locate the power receptacle at the rear of the cable access router. (Refer to “Verifying Power Requirements” section on page 3-4 to verify that this power source is adequate for the router.)
- Step 2** Plug the 7-pin end of the AC power supply cord into the power connector at the rear of the router. (See Figure 3-5.)

Figure 3-5 Connecting the Power Cord



- Step 3** Connect the AC power supply cord to the power supply.
- Step 4** Plug the 3-prong end of the power cord into a standard electrical power outlet at the site. Power is immediately supplied to the router. The router is meant to be left on at all times, and therefore, has no power switch.

**Warning**

**This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A International) is used on the phase conductors (all current-carrying conductors). The plug-socket combination must be accessible at all times because it serves as the main disconnecting device.**

- Step 5** Turn ON power for all other equipment, and wait for the devices to complete their startup processes.

**Caution**

To turn off the router when it is operational, disconnect the 3-prong end of the power cord from the power outlet. To prevent electrical shock, do not disconnect the AC power supply cord from the power supply while the router is operating.

**Warning**

**Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.**

# Router Power-On and Initialization Sequence

When the Cisco uBR924 router is connected and powered on, it executes automatic self-diagnostic and installation procedures. The following procedure describes what you should see during this process.


**Note**

For the router to complete its power-on sequence, a number of tasks must be completed at the CMTS. Refer to the “Initial Power-On and Provisioning” section on page 1-4 for an overview of the router’s initialization and provisioning processes.

While the Cisco uBR924 cable access router initializes:

- 
- Step 1** Watch the LEDs on the front of the router. When the cable access router first powers on, all LEDs (except for the four Ethernet LEDs and the ACT LED) briefly light and then turn off. As self-test is executed, various LEDs light to reveal diagnostic progress and turn off when self-test is complete.
- Step 2** The OK LED then blinks as the router completes self-test and boots a Cisco IOS image. When this is finished, the OK LED lights again.


**Note**

The six LEDs in the lower right of the front panel display—V OK, V1, V2, DS, US, DSNR—display the power-on self-test progress and status. Should the self-test fail, these six LEDs display error codes. Because self-test failed, the OK LED remains off. Refer to the “Initialization and Self-Test Problems” section on page 4-2 for a description of self-test LED error patterns.

- Step 3** During the router’s initialization and download, the green OK and ACT LEDs both blink. After completing the download procedure (which could take up to 10 minutes if downloading a new Cisco IOS image as well as a configuration file), the green OK LED remains on.
- Step 4** Check that the DS, US, LINK, and DSNR LEDs remain on to indicate the router is operational and receiving a healthy signal:
- The DS LED reveals the router is locked to a downstream channel.
  - The US LED reveals the router has established connectivity with the CMTS and is operating within 6 dB of desired power level (generally within 3 dB).
  - The LINK LED reveals the cable interface is operational.
  - The DSNR LED reveals the router is receiving a quality downstream signal with a low signal-to-noise ration and that is 5 dB above the downstream lock threshold.
- Step 5** Check the remaining LEDs for proper operation:
- The ACT LED blinks to indicate activity on the cable interface.
  - The Ethernet 1, 2, 3, 4 LEDs blink to indicate activity from the PCs and other customer premises devices connected to the corresponding Ethernet ports.
  - The V OK LED indicates the VoIP system is operational. The V1 and V2 LEDs light when the voice ports are active. (These LEDs light only if the router has loaded a Cisco IOS image with voice support.)
- Step 6** If all LEDs appear normal, proceed to the “Verifying Installation” section on page 3-13 to test the router and its connection to each part of the network. If any problems occur, proceed to Chapter 4, “Troubleshooting,” to troubleshoot and solve the problem.



- Step 7** After verifying operations, acquaint the subscriber with the router recommended ambient temperature requirement of 23° to 113°F (-5° to 45°C). Remind the subscriber to keep the area around the router as free from dust as is practical and review general safety standards.
- Step 8** Give the subscriber the Cisco-provided subscriber publications, along with any literature your company provides, including instructions on how to contact your customer service department.
- 

## Verifying Installation

Use the following procedures to verify the router's installation and operation; see Chapter 4, "Troubleshooting," if any problems occur.

- Internet Connection
- VoIP Telephone Connection
- VoIP Fax Connection
- Backup POTS Connection

## Internet Connection

Use the following procedure to verify Internet connectivity between the PCs connected to the router's Ethernet ports and the internet access provided by the CMTS:

- 
- Step 1** From a PC connected to the Cisco uBR924 router, start the Internet browser program installed on the PC.
- Step 2** Enter a URL of your choice in your web browser. If a URL is not known, use <http://www.cisco.com> to connect to Cisco's CCO web site.
- Step 3** Watch the appropriate Ethernet LED on the front of the router blink as data is transmitted on the link. If the selected web page comes up in the Internet browser screen, the network connection is successfully established and this particular Ethernet port is operational.
- Step 4** Repeat steps 1 through 3 for each PC connected to the Cisco uBR924 router.
- Step 5** Disconnect the cable system input by unscrewing the cable F-connector at the back of the router.
- Step 6** Using an in-line attenuator, add 3 to 6 dB of attenuation between the router and the CATV cable input.



**Note** The addition of 3 to 6 dB of attenuation simulates the variation found in a cable network over time and in relation to temperature. If you install a router at a time of year when the temperature is cooler, this step might not be necessary.

If you install a cable access router at a time of year when the temperature is warmer, this step might assist you in determining how the cable access router will function over time. If the router does not function properly with the addition of attenuation, you should replace and reconfigure the coaxial cables at the subscriber site.

---

- Step 7** Reconnect the cable system to the router and recheck the network connection at one of the PCs. Reload the previous web page or another URL to verify that you can still access the Internet.

- Step 8** Disconnect the cable system again by unscrewing the cable connector at the back of the router.
- Step 9** Remove the in-line attenuator from the back of the router.
- Step 10** Reconnect the cable system to the router and recheck the network connection at the PC as in step 7.
- 

## VoIP Telephone Connection

If the router has loaded a Cisco IOS image with voice support, use the following procedure to test the VoIP network by making a telephone call over the HFC and IP backbone network:

- Step 1** Pick up a telephone connected to one of the router's VoIP (V1+V2 or V2) rear ports. This signals an off-hook condition. In response, the router's voice software issues a dial tone and waits for a telephone number to be dialed.

If you do not hear a dial tone, the router's voice ports may be not enabled. Refer to the "VoIP Subsystem" section on page 4-11.

- Step 2** Dial a number. The QoS reservations specified by the configuration file are sent to achieve the desired QoS over the cable system and IP network. The router turns on the codecs and protocols required to transmit packetized voice and the call proceeds.

The V1 or V2 front-panel LED (depending on the port the telephone is using) lights to denote a call is in progress and remains on until the call is disconnected.

Any call-progress indications and other signals that can be carried in-band (for example, remote phone ringing) are cut through the voice path as soon as an end-to-end audio channel is up. You either hear the far end telephone ringing until the caller picks up or you hear a busy signal if the far end telephone is already in use.

- Step 3** When either end hangs up, the call is torn down. The session ends, with each end going idle, waiting for another off-hook condition.
- 

## VoIP Fax Connection

If the router has loaded a Cisco IOS image with voice support, use the following procedure to test the VoIP network by sending a fax over the HFC and IP backbone network:

- Step 1** Place a document in the fax machine's document feeder, according to instructions for the fax device.
- Step 2** Enter a destination number to receive the fax and press Dial or Start on most fax machines. The QoS reservations specified by the configuration file are sent to achieve the desired QoS over the cable system and IP network. The router turns on the CODECs and protocols required to transmit fax data and the fax proceeds.

The V1 or V2 LED (depending on the port the fax machine is using) lights to denote a fax is in progress and remains on until the fax call is disconnected.

Any call-progress indications and other signals that can be carried in-band (for example, remote phone ringing) are cut through the voice path as soon as an end-to-end audio channel is up. You either hear the far end ringing (depending on the fax machine setup) until the remote fax answers or you hear a busy signal if the remote fax is already in use.

- Step 3** Listen for the fax tone on the other end and verify that the fax is transmitted. When either end hangs up, the call is torn down. The session ends, with each end going idle, waiting for another off-hook condition.
- Step 4** Verify that the fax was correctly received at the destination.
- 

## Backup POTS Connection

To verify the backup POTS line to the PSTN is operational:

- 
- Step 1** Simulate a power failure in the Cisco uBR924 router by disconnecting the 3-prong end of the power cord from the power outlet—be certain to follow all safety instructions in the “Connecting Power” section on page 3-10.
- Step 2** Pick up one of the telephones connected to the VoIP ports and dial out over the backup POTS line. Wait for a connection to be established.
- Step 3** When a cutover call is in place, connect the 3-prong end of the power cord to the power outlet. Power is immediately supplied to the router.
- Step 4** Verify that the cutover call remains connected.
- Step 5** Disconnect the call. The router automatically reboots.
- Step 6** After the router has come back online, test one of the VoIP ports (see “VoIP Telephone Connection” section on page 3-14) to verify that VoIP connectivity has been re-established.
-





## Troubleshooting

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This chapter provides basic installation troubleshooting information. The chapter includes the following sections:

- Troubleshooting Overview
- Initialization and Self-Test Problems
- Troubleshooting Subsystems
- Using the Reset Switch
- Further Contacts



**Note**

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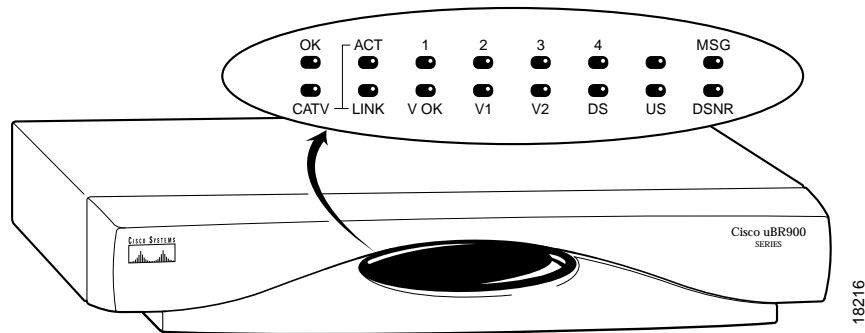
This chapter provides only hardware troubleshooting information that does not require access to the router's command-line interface (CLI) or knowledge of CLI commands. For more advanced troubleshooting, refer to the Cisco IOS online document *Troubleshooting Tips for the Cisco uBR924 Cable Access Router*.

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## Troubleshooting Overview

Installation problems with Cisco uBR924 routers are commonly due to the cable system and its topography. LEDs on the front panel of the Cisco uBR924 router reveal operational status and help you determine problem areas. See Figure 4-1 for the layout of the LEDs on the router's front panel; see Table 1-1 on page 1-13 for a description of these LEDs.

Figure 4-1 Cisco uBR924 Cable Access Router Front Panel LEDs



## Initialization and Self-Test Problems

When the Cisco uBR924 router first powers on, the following occurs:

1. The router runs its self-test and diagnostic procedures. All LEDs (except for the four Ethernet LEDs and the ACT LED) briefly light and then turn off when self-test and diagnostic procedures are successful. The procedures ensure Cisco uBR924 components are functioning. To complete all self-test and diagnostic procedures, the Cisco uBR924 processor must be able to:
  - Perform a system reset trap.
  - Fetch and execute instructions from the ROM Monitor area of the bootflash chip.
  - Write several internal registers and reset the control program without crashing.
  - Correctly configure the port A and port D registers.
  - Perform conditional branches.
  - Ensure all software-controlled LEDs are functional.
2. The next step of the self-test is to initialize the memory controller and its Dynamic Random Access Memory (DRAM). If a failure exists, the OK LED turns off and the following LEDs on the bottom row turn on to indicate the specific problem that occurred.
  - The router first attempts to initialize the memory controller. If this fails, the DS and DSNR LEDs light and remain on to indicate a problem with the memory controller. Otherwise, the console port is initialized and the banner is output to the console port.
  - Next, the router performs a self-test on the low registers of the DRAM. If a problem exists, the V2, the DS, and the DSNR LEDs light and remain on to indicate a processor cache failure.
  - If the cache memory passed the self-test, the next portion of DRAM is tested. If this self-test fails, the V-OK, V2, DS, and DSNR LEDs light and remain on to indicate a memory or controller problem.
  - The router then attempts to clear the BSS area of the DRAM; if this fails, the V2, DS, and US LEDs light and remain on to indicate a memory or controller problem.
  - Finally, the router attempts to clear the rest of DRAM. If this fails, the DS LED lights and remains on, while all other LEDs remain off to indicate a possible memory or controller problem.

Table 4-1 summarizes the self-test failure codes displayed by the LEDs; these patterns appear only when the OK LED turns OFF and remains OFF during boot.

**Table 4-1 LED Self-Test Failure Codes**

DS	US	DSNR	V OK	V1	V2	Error Description
ON		ON				Initialization of the memory controller failed.
ON		ON			ON	The self-test of the low registers of the DRAM failed. This indicates a processor cache failure.
ON		ON	ON		ON	A memory or controller problem was detected during the DRAM initialization.
ON	ON				ON	A memory or controller problem was detected while clearing the BSS area of the DRAM.
ON						A memory or controller problem was detected while clearing the remaining DRAM.

If the main initialization routine successfully completes, all LEDs turn off.

3. If all self-tests passed, the router boots the Cisco IOS image stored in its NVRAM memory. The OK (power) LED blinks during the boot process and remains on if the router was able to successfully load and start up the image. If the LED *does not* start to blink, proceed to the “Power Subsystem” troubleshooting section.
4. The router starts normal operations after it starts up the Cisco IOS image. At this point, the US, DSNR and LINK LEDs remain on to indicate the router is operational and receiving a healthy signal:
  - The DS LED indicates the router is locked to a downstream channel.
  - The US LED indicates the router has established connectivity with the CMTS and is operating within 6 dB of desired power level (generally within 3 dB).
  - The LINK LED indicates the cable interface is operational.
  - The DSNR LED reveals the router is receiving a quality downstream signal with a low signal-to-noise ratio (SNR) and that is 5 dB above the downstream lock threshold.
  - The ACT LED blinks to indicate activity on the cable interface.
  - The Ethernet 1, 2, 3, 4 LEDs blink to indicate activity from the PCs and other customer premises devices connected to the corresponding Ethernet ports.
  - The V OK LED indicates the VoIP system is operational. The V1 and V2 LEDs light when the voice ports are active. (These LEDs light only if the router has loaded a Cisco IOS image with voice support).



**Note**

Because the signal-to-noise ratio and lock threshold can drift, they are regularly checked and the DSNR LED is updated. While this might cause the DSNR LED to occasionally blink briefly, under normal conditions the DSNR LED should remain on.

5. When the router and computer have booted successfully, you should be able to access an Internet web site, which will confirm that the router is configured correctly. If you cannot access a web site, proceed to the “PC Subsystem” section on page 4-9.

6. The voice port LEDs (V1 and V2) on the cable access router light when a subscriber establishes a VoIP connection. If you do not have dial tone on the Cisco uBR924 voice ports and cannot establish a VoIP connection, proceed to the troubleshooting “VoIP Subsystem” section on page 4-11.

## Troubleshooting Subsystems

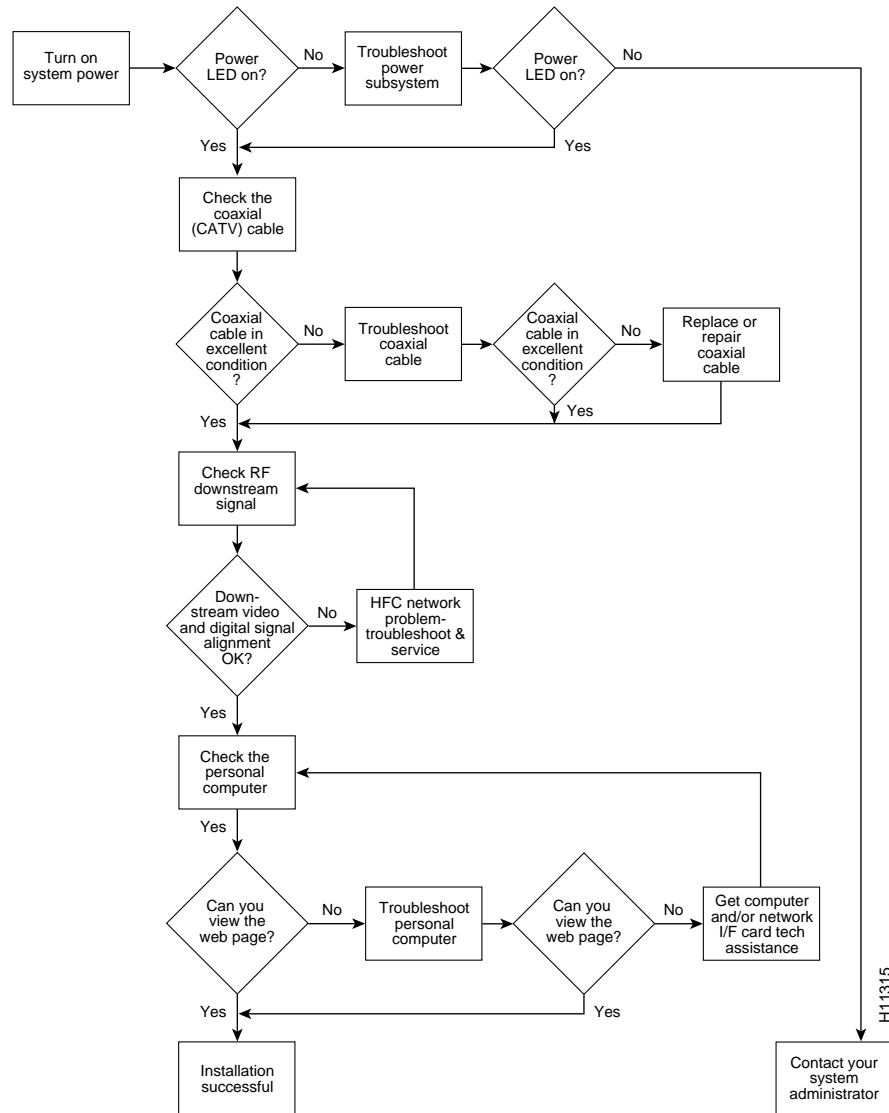
The key to troubleshooting is to isolate a problem to a specific subsystem:

- Power subsystem
- Coaxial cable subsystem
- RF and digital signal subsystem
- PC subsystem
- VoIP subsystem

Figure 4-2 on the next page provides a general troubleshooting flowchart. Table 4-2 and Table 4-3 help you correlate LED behavior with possible problems, and suggested courses of actions.



Figure 4-2 Basic Troubleshooting Strategy for Startup Problems



H11315

**Table 4-2 General Troubleshooting Tips**

<b>LED</b>	<b>Status</b>	<b>Possible Problem</b>	<b>Suggested Action</b>
OK	System status LED is off.	Power cord not properly seated.  Power outlet not operating.  Power supply has failed.  The router failed its self-test.	Check power connections.  Check the outlet.  Contact field service dispatch to replace the power supply.  See Table 4-1 or contact field service dispatch to replace the unit.
1, 2, 3, or 4	Ethernet LEDs are off when data is transmitted to/from the device.	PC/device not powered on.  Bad Ethernet connection.  Incorrect cable between the router, the hub if applicable and the PC.  Faulty Ethernet card.	Verify the PC/device is powered on.  Reseat the Ethernet cable at both ends. Make sure TCP/IP and DHCP are enabled.  Replace the cable, reviewing the hub user guide or Ethernet user guide.  Notify the subscriber to replace the Ethernet card.
LINK	Cable RF LED is off.          Cable RF LED is blinking.	Router searching for a signal; RF levels wrong.       Cable is out.    Router is locked to a signal and connecting to the headend per DOCSIS.	Check for a DOCSIS system signal and verify the nearby analog video signal is within the correct range—0 to +15 dBmV for most CATV systems.       Check if the cable TV is working if the subscriber also subscribes to broadcast TV services.    Wait until the router completes initialization. The router can pause on a digital video signal during installation, but will timeout and then locate the DOCSIS system signal.
DS	Downstream LED is off.	RF coaxial cable is not properly connected to the router.	Reconnect the cable.

**Table 4-2 General Troubleshooting Tips (continued)**

LED	Status	Possible Problem	Suggested Action
US	Upstream LED is off.	Upstream signal is not reaching the headend; router is unable to communicate with the remote end. Systematic RF noise problem or other outage.	Verify continuity back to the headend using the standard procedures for your system. Temporarily locate the router closer to the ground block, the tap, or another tap closer to the headend—ensuring correct RF input level at all times.
DSNR	Downstream signal-to-noise LED is off.	Systematic RF noise problem or other outage.	Verify correct RF input to the router. Temporarily locate the router closer to the ground block, the tap, or another tap closer to the headend—ensuring correct RF input level at all times.  Do not install the router unless your system management expressly states this is the procedure to follow. This is an early indication of low quality cable signals and indicates a high likelihood of intermittent router operation.

## Power Subsystem

To help isolate a problem with the Cisco uBR924 router power subsystem, look at the OK LED. Does the LED remain on when self-test is completed and a software image booted?

- If yes, the power source is good and the power supply is functional.
- If no, make sure the power cable is connected at the back of the router and that the power supply is properly connected to power at the wall outlet.
  - If the OK LED remains off but other LEDs are ON, check for possible diagnostic codes.
  - If the OK LED remains off and all other LEDs are also OFF, check the power source or power supply. Connect the power cord to another power source, if available. If the LED goes on, the problem is the first power source.
  - If the OK LED fails to blink after you connect the power cord to a new power source, the power supply is probably faulty.



### Note

If you are unable to resolve the problem or you determine that either a power supply or cable access router connector is faulty, contact your field office for instructions.

## Coaxial Cable Subsystem

For proper operation the Cisco uBR924 router must be able to establish a connection with the service provider's CMTS. There are many conditions inherent to coaxial cable that can inhibit this connection:

- 
- Step 1** Verify the cable connection from the router to the HFC plant and headend by checking the video reception. You should test the same coaxial cable that the router is connected to—if necessary, disconnect the router from the coaxial cable and connect a cable-ready TV in its place.
- If the TV does not receive any cable channels, contact the service provider to re-establish service to the site. If the TV does receive cable channels, it indicates that the basic infrastructure between the site and the HFC plant and headend is working; however, because data connections are much more sensitive to signal interference than cable TV service, it is still possible that a problem exists that prevents reception of the data signals.
- Step 2** If you are using a splitter or couple to share the coaxial cable between a TV and the router, remove the splitter/coupler, TV, and any other devices connected to the cable (such as video or DVD players) so that the router connects directly to the coaxial cable coming out of the CATV wall outlet. Make sure the router is the only device on this segment of cable.
- If the router functions in this configuration, inspect the splitter and any other devices that were installed on this cable segment. If necessary, upgrade them and their interconnecting cables with ones that have higher-quality connectors—see “Coaxial Connector and Cable Specifications” in Appendix B, “Connector and Cable Specifications” for the recommended cable and connector quality. A high-pass filter might be necessary between the modem and TV to prevent signal interference. If this does not help, you might need to install a separate cable for TV reception.
- Step 3** Disconnect the coaxial cable from the back of the router and inspect the cable and its connector. Is the center conductor on the coaxial cable end straight and of the correct length to ensure a good connection?
- If the center conductor is not straight or appears to be too long or too short, cut the coaxial cable behind the connector end, and strip the insulation back. Make sure that the newly exposed center conductor is straight. Before replacing the new cable connector end, check the general condition of the cable. Make sure the new conductor end is securely crimped to the cable.




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**Note** The center connector should extend 1/8 inch (3.2 mm) beyond the end of the connector.

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- Step 4** Is the coaxial cable running to the router in excellent condition?
- The coaxial cable between the router and the cable tap must be very high quality. The cable insulation must be at least 80% braid with foil. If the existing cable appears to be of lesser quality or in poor condition, replace the cable from the ground block or tap to the cable end.
- Step 5** Is the coaxial cable connection to the back of the cable access router secure?
- Check that the coaxial cable end is securely screwed onto the F-connector at the back of the cable access router. Hand-tighten the connector, making sure it is finger tight; then give it a 1/6 turn.




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**Note** If you are unable to resolve the problem, contact your internal service organization for instructions and assistance.

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## RF and Digital Subsystem

The use of RF and digital signals on the same cable can lead to interference if the HFC network is not correctly configured.

- 
- Step 1** Is the downstream video signal being received at the ground block or at the tap?
- Connect a premium services cable converter to the ground block or at the tap and contact field service dispatch. Ask the CMTS system administrator to check if they can locate the box on the network by sending an impulse, or on-demand, video signal to the converter.
- If field service can locate the converter at the ground block or at the tap, repeat the test with the cable access router connected to the cable end near the computer.
- If field service cannot locate the converter at the cable end, but can locate the converter at the ground block or tap, replace the cable from the ground block or tap to the cable end.
- Step 2** Check the adjacent video channel. The digital data signal should be approximately in the range of -2 to +15 dBmV on a nearby analog channel. Confirm this value using a portable field strength meter, or power meter, to measure the adjacent analog video signal.
- 

## PC Subsystem

To isolate a problem with a PC that is connected to the Cisco uBR924 router:

- 
- Step 1** Can you access a web page using the web browser installed on the computer?
- If you cannot access a web page, verify that the computer network protocol is configured for TCP/IP and that DHCP services are enabled using the following Windows 95 options:
- Turn on your PC and enter your network username and password.
  - Choose **Start:Settings:Control Panel** to display the Control Panel.
  - Double-click the **Network** icon. The Network window appears with the Configuration tab in the foreground. If the Configuration tab is not in the foreground, click this tab.
  - Scroll the network components list box until the Ethernet adapter TCP/IP option displays for your network adapter and double-click the selection. The TCP/IP Properties window appears with the IP Address tab in the foreground. If the IP Address tab is not in the foreground, click this tab.



**Note** If there is no TCP/IP entry for the installed network adapter, the computer is not configured for IP. Refer to the subscriber's computer and network interface card user guides on how to configure these settings.

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- Make sure that the button next to **Obtain an IP address automatically** is selected. If this button is not selected, the computer is not configured for DHCP. Select the **Obtain an IP address automatically** radio button now and save the configuration settings.
  - Close all networking windows and close the Control Panel.
  - Follow the onscreen instructions and reboot your PC.
- Step 2** Is the network interface card operational?

Verify that the network card is installed properly and that necessary software drivers have been installed and are running on the computer. Consult the user guide or other documentation that accompanied the network card. Contact technical support for the network card manufacturer as necessary.

- Step 3** Is the computer preconfigured to work with special software such as America Online? Some computers come with dialup adapters preconfigured to work with special software. To ensure the setup is correct, follow the procedures below.

#### Setting the Internet Properties

- a. Turn on your PC and enter your network username and password.
- b. Choose **Start:Settings:Control Panel** to display the Control Panel.
- c. Double-click the **Internet** icon. The Internet Properties window appears with the General tab in the foreground.
- d. Click the **Connection** tab. The Internet Properties Connection tab displays. The Connect to the Internet: as needed check box is checked and the name of the dialup adapter appears in the Dial-Up Networking connection list box.
- e. Click the **Connect to the Internet: as needed** check box to deselect the option.



#### Note

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The check box must not be checked. If the checkbox is checked, the computer attempts to open a dialup adapter connection each time a network application is started.

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- f. Click **OK**.
- g. From the Control Panel, double-click the **System** icon. The System Properties window displays with the General tab in the foreground.
- h. Click the **Device Manager** tab.
- i. Click the **Network adapter** selection. Make sure the display does not contain either a red “X” or a yellow exclamation point.
- j. Click **OK**.

#### Setting Network Components

- a. Turn on your PC and enter your network user name and password.
- b. Choose **Start:Settings:Control Panel** to display the Control Panel.
- c. Double-click the **Network** icon. The Network window appears with the Configuration tab in the foreground.
- d. Scroll the list box until the particular dialup adapter selection appears. If the computer has America Online installed, two network components will be displayed: **AOL Dialup Adapter** and **TCP/IP:AOL Dialup Adapter**.



#### Note

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The computer might have more than one dialup adapter. Be sure to select the right dialup adapter.

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- e. If the subscriber does not intend to use America Online, remove both these components from the Network components list box:
  - Click **AOL Dialup Adapter** to highlight it. Click **Remove**.
  - Click **TCP/IP:AOL Dialup Adapter** to highlight it. Click **Remove**.

- f. If the subscriber intends to use America Online, double-click the TCP/IP component associated with the dialup adapter. The TCP/IP Properties window appears with the IP Address tab in the foreground.
- g. Click the **Obtain an IP address automatically** button. The IP address for the dialup connection will only be assigned when the connection is made. By default, the computer will be assigned an IP address by the Cisco uBR924 router via DHCP.



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**Note** When set up correctly, the Cisco uBR924 router is the default Internet connection device. The subscriber might select the dialup adapter as an alternative connection path.

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- h. Click **OK**. A dialog box appears, informing you for the change to become effective, the computer must be rebooted.
  - i. Click **Yes** to reboot the computer.
- 

## VoIP Subsystem

If you do not have dial tone when picking up a telephone or fax device connected to the Cisco uBR924 router's voice ports, ensure the router is using a Cisco IOS image that supports voice. For more information on Cisco IOS images, refer to the release notes that accompanied the router; also refer to the *Cisco uBR924 Cable Access Router Software Configuration Guide*.

Table 4-3 gives some general VoIP troubleshooting tips.

Table 4-3 VoIP Troubleshooting Tips

LED	Status	Possible Problem	Suggested Action
V OK	Voice status LED is off for a router configured for voice.	VoIP system configuration problem.	<p>Contact your provisioning or billing administrator or customer service department. If your provisioning or billing system is designed to support automatic feature upgrades, and the router's UID (cable MAC address) is already in the billing system and configured for use with voice, ask to have the router refreshed with the correct voice configuration.</p> <p> <b>Note</b> This procedure can take several minutes.</p>
V1 or V2	Voice port LED is off when a call on the port is initiated for a router configured for voice.	<p>Bad telephone or fax machine connection.</p> <p>Bad cable.</p> <p>Equipment configuration problem.</p>	<p>Reseat the RJ-11 to RJ-11 cable at both ends for both the telephone and fax machine.</p> <p>Use a different cable.</p> <p>For a telephone, make sure a push-button dial set is used.</p> <p>For fax, make sure the fax machine is on. If fax software is used, make sure the data mode is not used. Ensure a Cisco IOS Release 12.0(5)T image is used.</p> <p>If a two-line telephone is connected to the router, make sure it is connected to the V1+V2 rear connector. If a single line telephone is plugged into V2 at the same time a two-line telephone is plugged into V1+V2, the single-line telephone and line 2 of the two-line telephone act as if they are attached in parallel to V2.</p> <p>Make sure the sum of the RENs of all devices on any one telephone line does not exceed five for subscriber sites that support multiple voice devices per telephone line.</p>

## Using the Reset Switch

The Cisco uBR924 router contains a reset switch with three different actions:

- A quick press (less than 10 seconds) initiates a hardware reset, similar to a power cycle or software reload.
- Pressing the reset switch from between 10 and 30 seconds causes the router to clear its saved RF parameters and do a hardware reload. This reload is similar to plugging in the router for the first time.
- Pressing the reset switch for longer than 30 seconds causes the router to erase its system image and download a new system image over the cable interface should the CMTS system administrator have set certain options in the configuration file, in conjunction with field service personnel. The router then reboots with this new image.



See Table 4-4 for additional elaboration.

**Table 4-4** *Reset Descriptions*

Type of Reset	Press Reset Switch...	What Happens...
Warm	Less than 10 seconds	The router reboots, using the downstream frequencies saved in the configuration file.
Cold	10 to 29 seconds	The router reboots the image in Flash memory, ignoring the downstream frequencies saved in the configuration file. The router initiates a downstream frequency search which may take a few minutes. The new frequencies are saved in the configuration file and are used at the next warm reset.
Cold	More than 30 seconds	The router downloads a new image from the CMTS and reboots, storing this image in Flash memory, assuming coordination between the CMTS system administrator and field personnel.



**Note**

The reset switch on the back panel of the Cisco uBR924 cable access router is recessed to prevent accidental resets of the router. To depress the switch, use a blunt object, such as a pen or pencil point; do not use a sharp object, such as a knife or awl, because this could permanently damage the switch and the router's circuitry.

## Further Contacts

If you experience trouble with the startup that is not resolved with the procedures and tips in this chapter, contact field service dispatch for further assistance and instructions. Also see the documentation available in the Broadband Cable section on CCO and the Documentation CD-ROM.



**Note**

Cisco recommends that a CMTS systems engineer or network administrator be available, or on-call, to assist field service technicians or installers in troubleshooting a Cisco uBR924 cable access router.

If you are a network administrator or systems engineer with a Cisco product covered under warranty or a maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or [tac@cisco.com](mailto:tac@cisco.com).





## Technical Specifications

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This appendix contains the following technical specifications for the Cisco uBR924 cable access router:

- Physical, Power, and Environmental Specifications
- Data Specifications
- Voice Specifications

### Physical, Power, and Environmental Specifications

Table A-1 lists the Cisco uBR924 cable access router physical specifications and power requirements.

**Table A-1 Cisco uBR924 Cable Access Router Physical Specifications**

Description	Specification
Dimensions (H x W x D)	2.30 x 13 x 9.30 in. (5.842 x 33.02 x 24.77 cm)
Weight	3 lb (1.36 kg) 1 lb (0.45 kg) for the AC-input external power supply
AC-input voltage	120 to 240 VAC <sup>1</sup> wide input with power factor correction
AC-input current rating	1.2A <sup>2</sup> maximum at 120 VAC and 0.6A maximum at 240 VAC
AC-input cable	18 AWG <sup>3</sup> three-wire cable, with a three-lead receptacle on the power supply end, and a North American (NEMA 5-15P) plug on the power source end; other country-specific cords are available and supplied as ordered.
Power dissipation	12 to 15W
Frequency	50/60 Hz <sup>4</sup>
Temperature	32° to 104°F (0 to 40°C) operating; -13° to 158°F (-25° to 70°C) nonoperating
Humidity	5 to 95% noncondensing
Noise level	38 dBa <sup>5</sup> maximum at desktop, 43 dBa maximum in an office

**Table A-1 Cisco uBR924 Cable Access Router Physical Specifications (continued)**

Description	Specification
Software requirement	Cisco uBR924 cable access router software—Cisco IOS Release 12.0(4)XI or higher
Agency approvals	Safety: UL 1950, CSA 22.2 No. 950, EN60950, IEC60950, AS/NZS3260, TS001 EMI: FCC Class A, FCC Class B, CSA Class A, EN60555-2, EN55022 Class B, VCC1 Class 2, AS/NZS 3548 Class A Immunity: IEC-1000-4-2, IEC-1000-4-3, IEC-1000-4-4, IEC-1000-4-5, IEC-1000-4-6, IEC-1000-4-11, IEC-1000-3-2, IEC 60950, AS3260, TS001  See also Appendix C, “Regulatory Compliance and Safety Information.”

1. VAC = volts alternating current.
2. A = ampere.
3. AWG = American Wire Gauge.
4. Hz = hertz.
5. dBa = adjusted decibels.

# Data Specifications

Table A-2 lists the specifications for the Cisco uBR924 cable access router's data ports.

**Table A-2 Cisco uBR924 Cable Access Router Data Specifications**





Description	Downstream Values	Upstream Values
Frequency Range	88 to 860 MHz	5 to 42 MHz
Modulation	64 QAM 256 QAM	QPSK 16 QAM
Data Rate	30 Mbps/64 QAM (27 Mbit/sec after FEC overhead)  42.8 Mbps/256 QAM (36 Mbit/sec after FEC overhead)	QPSK—320 Kbit/sec to 5 Mbit/sec  16 QAM—640 Kbit/sec to 10 Mbit/sec
Bandwidth	6 MHz	200K, 400K, 800K, 1.6M, 3.2 MHz
FEC	RS (122, 128) Trellis	
Signal-to-Noise Ratio (SNR)	<p>64 QAM: &gt;23.5 dB @ BER &lt;10<sup>-8</sup></p> <p>256 QAM*: &gt;30 dB @ BER &lt;10<sup>-8</sup> (For input level between +15 and -8 dBmV, SNR must be greater than 30 dB. For input level between -8 and -15 dBmV, SNR must be greater than 33 dB.)</p> <p> <b>Note</b> These performance numbers are in laboratory-controlled conditions, against statistically pure noise sources (AWGN). Since such conditions do not exist in practise, a 6 or more dB SNR margin is required for reliable operation. Check with your local system guidelines.</p>	<p>QPSK: &gt;15 dB @ BER &lt;10<sup>-8</sup> (QPSK will work at 98% successful ping rate for SNR &gt;13 dB. An SNR of 15 dB will be needed to get almost optimal packets per minute transition.)</p> <p>16 QAM: &gt;22 dB @ BER &lt;10<sup>-8</sup> (For 16 QAM, an SNR &gt;22 dB makes the grade for 98% ping efficiency. To get good packet rate, you need SNR &gt;25 dB)</p> <p> <b>Note</b> These measurements were done for 0 and -10 dBmV input to the CMTS, 1280 ksym/sec and 64 bytes packet size with a Cisco uBR904 and laboratory-controlled conditions.</p>

Table A-2 Cisco uBR924 Cable Access Router Data Specifications (continued)

Description	Downstream Values	Upstream Values
One Channel	Receive level of digital signal -15 to +15 dBmV  <b>Note</b> Most field measurements are of nearby or adjacent analog signal which is normally +6 to +10 dB (system specific) above the digital signal level	QPSK— +8 to +58 dBmV  16 QAM— +8 to +55 dBmV
Security	DES decryption: DOCSIS Baseline Privacy (BPI), 40-bit, 56-bit, and 168-bit DES encryption, as controlled by the headend and configuration files.  <b>Note</b> Cisco IOS images must contain encryption software at both the CMTS and the Cisco uBR924 router. Both routers must be enabled and properly configured to support encryption.	DES encryption

# Voice Specifications

Table A-3 lists the specifications for the voice ports on the Cisco uBR924 cable access router.

**Table A-3 Cisco uBR924 Cable Access Router Voice Specifications**

Metric	Value
Loss (between DCS and BTI gateway)	Nominal: 4 dB $\pm$ .5 dB (off hook) Nominal: 9 dB $\pm$ .5 dB (on hook)
Attenuation distortion: DCS $\leftrightarrow$ BTI (200Hz-3.5kHz) BTI $\leftrightarrow$ DCS (304 Hz-3004Hz) DCS $\rightarrow$ BTI (204 Hz-3004 Hz)	Nominal: +1 dB/-3 dB $\pm$ 0.5 dB $\pm$ 0.5 dB0
Idle channel noise	$\leq$ 18 dBmC (noise shall not exceed)
Signal to C-notched noise	$\geq$ 35 dB
Inter-modulation distortion: R2 R3	$\geq$ 52 dB $\geq$ 52 dB
Single frequency interference: 0 to 12 kHz 0 to 4 kHz	$\leq$ -28 dBmO $\leq$ -40 dBmO
Frequency shift (offset)	$\leq$ $\pm$ 0.2 Hz (max) $\leq$ $\pm$ 0.1 Hz (99.5%)
Amplitude tracking (input Level, dBmO): -37 to 0 (on-hook) -37 to +3 (off hook) -50 to -37 (off-hook) -55 to -50 (off-hook)	Max Dev.                      Ave. Dev. $\leq$ $\pm$ .5 dB $\leq$ $\pm$ .5 dB $\leq$ $\pm$ .25 dB $\leq$ $\pm$ 1.0dB $\leq$ $\pm$ .5 dB $\leq$ $\pm$ 3.0 dB $\leq$ $\pm$ 1.5 dB
Crosstalk	$\leq$ -65 dBmO
Amplitude jitter 20-300 Hz 4-300 Hz	$\leq$ 2.5% Peak $\leq$ 2.9% Peak
Phase jitter 20 to 300 Hz 4 to 300 Hz	$\leq$ 1.5 P-P $\leq$ 1.8 P-P
Envelope delay distortion: 1704 Hz to 604 Hz 1704 Hz to 2804 Hz 1704 Hz to 204 Hz 1704 Hz to 3404 Hz	$\leq$ 350 usec $\leq$ 195 usec $\leq$ 580 usec $\leq$ 400 usec

Table A-3 Cisco uBR924 Cable Access Router Voice Specifications (continued)

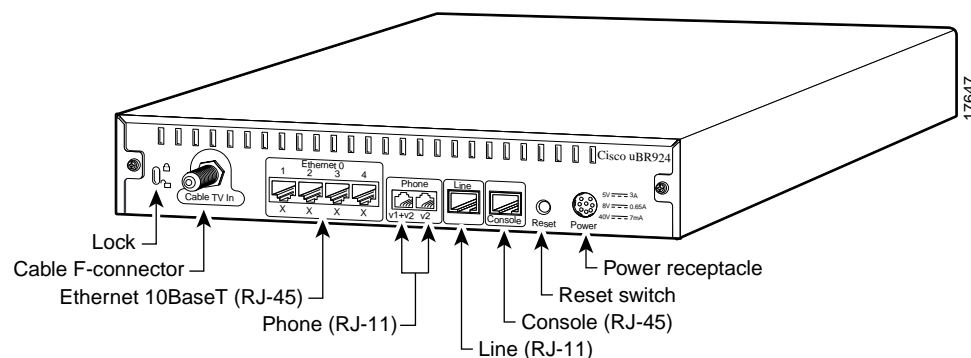
Metric	Value
Hybrid balance:	
Echo Return Loss (ERL)	> 26 dB (standard test line) > 14 dB (station off hook)
SRL	> 21 dB (standard test line) > 11 dB (station off hook)
Clipping: Speech segments <5 ms Speech segments > 5ms	< 0.5% 0.0%
Impulse noise: ( $\geq 6$ dB below receive signal)	0 in 93% of all 15 min intervals $\leq 1$ count in all 30 min intervals
Phase hits ( $\geq 10$ deg)	0 in 99.75% of all 15 min intervals $\leq 1$ count in all 30 min intervals
Gain hits ( $\geq \pm 3$ dB)	0 in 99.9% of all 15 min intervals $\leq 1$ count in all 30 min intervals
Dropouts ( $\geq 12$ )	0 in 99.9% of all 15 min intervals $\leq 1$ count in all 60 min intervals
Ringer voltage and frequency	52 VRMS (max, short loop, balanced ringing) at a default of 20 Hz—the frequency can be changed using the <b>voice-port ring frequency</b> configuration command.
Port terminating impedance	600 ohms (default)—this can be changed using the <b>voice-port impedance</b> configuration command.



## Connector and Cable Specifications

This appendix describes the pinouts and cabling requirements for the interfaces and cables used on the Cisco uBR924 router. All connectors for these interfaces are on the rear-panel, as shown in Figure B-1.

**Figure B-1 Cisco uBR924 Cable Access Router Connectors**



This appendix describes the following connectors and cabling requirements:

- Coaxial Connector and Cable Specifications
- Ethernet Connector and Cabling
- Voice Port Connectors
- Console Port Connector and Cables

Refer to the following sections for more information.

## Coaxial Connector and Cable Specifications

The Cisco uBR924 router connects to the HFC cable system with a type-F, right-angle, PCB-mount connector manufactured by Amp (model number 531-40047). The body is die cast out of zinc, with a tin-lead plating. The round, center contact is made of phosphor bronze, with a tin-lead plating. The insulator is polypropylene and will accept a coaxial cable center conductor with a diameter ranging from 0.022 inch (0.056 mm) to 0.042 inch (1.07 mm).

The coaxial cable used to connect the Cisco uBR7200 series universal broadband routers at the headend should be very high-quality cable because imperfections that do not visibly affect video transmissions can significantly affect digital data transmissions. In particular, poor insulation, improperly installed

additional outlets, the condition and length of the cable's center conductor, and the quality of the cable can negatively affect the connectivity and performance of the cable access router for digital data transmission.

For example, a 5 dB reduction in signal quality for analog downstream video might cause a slight degradation of picture clarity, which might or might not be noticeable to a subscriber. However, a reduction of only 1 dB in signal quality for digital data might completely disrupt service to a Cisco uBR924 router user.

Cisco recommends that you use a headend-grade coaxial cable or a quad-shield coaxial cable with a minimum of 60% + 40% braid and double foil insulation to connect the cable modem cards to the HFC network. The center conductor must be straight and extend 1/8 inch (3.2 mm) beyond the end of the connector, and the connector should be securely crimped to the cable. The following cables are recommended:

- RG-59—0.034 inch (0.86 mm) center conductor diameter
- RG-59/U—0.0226 inch (0.57 mm) center conductor diameter
- RG-6—0.041 inch (1.05 mm) center conductor diameter

**Note**

All three of the coaxial cables listed can be used to connect a Cisco cable modem card to the HFC network; however, the consistent use of RG-59 cable is preferred. If you connect an RG-59 cable to a cable modem card that was previously connected using RG-6 cable, the difference in the center connector diameter might cause intermittent connectivity loss.

If you use different types of coaxial cable, the following problems can appear:

- Co-channel interference—If signals at the same frequency are carried on long, parallel runs of coaxial cable, interference can occur between the signals. Higher quality cable helps to prevent this with better shielding. Co-channel interference is seen as hum or patterns in analog video channels and intermittent data loss in digital channels.
- Damage to Cisco uBR7200 series cable modem card connectors—The modem card connectors are designed for RG-59 or RG-6 cable and connectors. Larger cables can damage the connectors.
- High signal return loss—High quality cable and correct connectors help to ensure an optimal return loss of 16 dB or higher.

**Note**

Refer to the *Cisco uBR924 Cable Access Router Software Configuration Guide* for additional configuration and site requirement information related to the setup of the analog RF signal and digital data.

## Ethernet Connector and Cabling

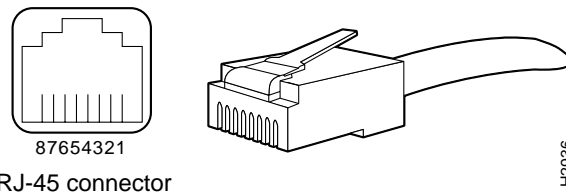
The Cisco uBR924 router provides four RJ-45 connectors that provide the following Ethernet 10BaseT connectivity:

- When the router is configured for either routing or bridging mode, up to four computers or other customer premises equipment, such as IP-capable printers, can be connected directly to the router, one device per connector. Use straight-through cables for these connections.

- When the router is configured for routing mode, one of the four connectors can be connected to an Ethernet hub, which in turn connects additional computers and other Ethernet devices to the local area network. Typically, a crossover cable connects the router's port to the 10BaseT Ethernet port on the hub. (However, you may be able to use a straight-through cable if the hub has an uplink port; see the hub's documentation for further details.)

Figure B-2 shows the RJ-45 connector and plug used for the Cisco uBR924 router's Ethernet ports. Table B-1 lists the pinouts and signals for the RJ-45 connector.

**Figure B-2 RJ-45 Connector and Plug**



**Warning**

**To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.**

**Table B-1 RJ-45 Receptacle Pinouts**

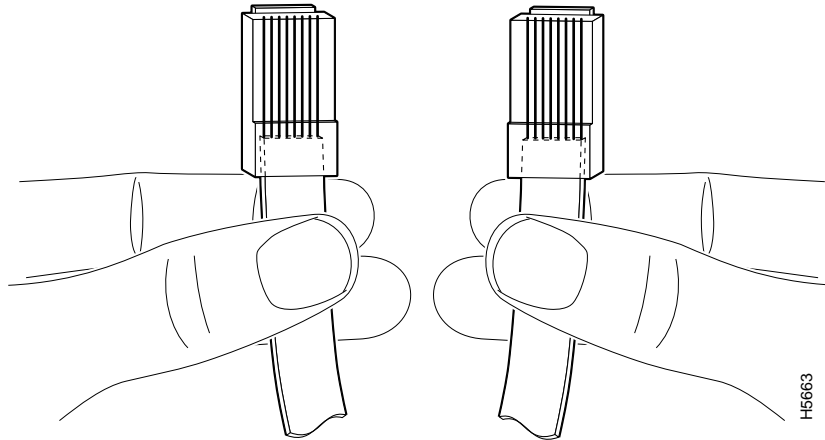
Pin	Description
1	Receive Data + (RxD+)
2	RxD-
3	Transmit Data + (TxD+)
6	TxD-



**Note**

Referring to the RJ-45 pinout in Table B-1, proper common-mode line terminations should be used for the unused cable pairs 4/5 and 7/8. Common-mode termination reduces electromagnetic interference (EMI).

To identify the RJ-45 cable type, hold the two ends of the cable next to each other so you can see the colored wires inside the ends, as shown in Figure B-3.

**Figure B-3 RJ-45 Cable Identification**

Examine the sequence of colored wires to determine the type of RJ-45 cable:

- Straight-through—The colored wires are in the same sequence at both ends of the cable.
- Crossover—The first (far left) colored wire at one end of the cable is the third colored wire at the other end of the cable.

**Note**

Both the standard straight-through and crossover Ethernet cables should be Category 5 UTP (RJ-45) cables. Cisco does not supply Category 5 UTP cables; these cables are available commercially.

## Voice Port Connectors

This section contains pinout and connection information for the three voice ports on the Cisco uBR924 router. The V1+V2 and V2 voice connectors are part of a dual-connector package. These are symmetrical 6-pin connectors that use standard voice RJ-11 connectors and straight-through cables.

**Note**

To enable the voice ports, use a Cisco IOS Release 12.0(5)T or higher interim image that supports VoIP and configure the router appropriately. See the *Cisco uBR924 Software Configuration Guide* for more details.

Table B-2 lists the signals used on the voice ports.

Table B-2 Voice Port Signals

Connector	Pin	Signal	Description
V1+V2	1	NC	Not connected.
	2	RING [+2]	RING connection for second pair of 4-wire voice port v1+v2. This is connected in parallel with voice port v2 RING.
	3	RING	RING connection for first pair of 4-wire voice port v1+v2. This is the voice port v1 RING connection.
	4	TIP	TIP connection for first pair of 4-wire voice v1+v2. This is the voice port v1 TIP connection.
	5	TIP [+2]	TIP connection for second pair of 4-wire voice port 1[+2]. This is connected in parallel with voice port v2 TIP.
	6	NC	Not connected.
V2	7	NC	Not connected.
	8	NC	Not connected.
	9	RING	RING connection for voice port v2. Pin 9 on the dual connector maps to pin 3 on a standard 6-pin RJ-11.
	10	TIP	TIP connection for voice port v2. Pin 9 on the dual connector maps to pin 3 on a standard 6-pin RJ-11.
	11	NC	Not connected.
	12	NC	Not connected.
	13, 14	GND	Ground pins are connected to board ground.
Line (Telco crossover port)	1	NC	Not connected.
	2	NC	Not connected.
	3	RING	Standard 2-wire RING connection for RJ-11 connector.
	4	TIP	Standard 2-wire TIP connection for RJ-11 connector.
	5	NC	Not connected.
	6	NC	Not connected.

## Console Port Connector and Cables

The Cisco uBR924 router provides an RJ-45 serial connector for asynchronous serial console access. The console port is a DCE device, so connecting it to another DTE device, such as the serial port on a laptop PC, requires a straight-through DCE-to-DTE cable.

Table B-3 lists the pinouts for the console port and for the cabling required when connecting to a DTE device that uses an RJ-45, DB-25, or DB-9 connector.

**Table B-3 Console Port Signaling and Cabling**

Console Port (DCE)		Terminal Port (DTE)			
Signal	RJ-45 Pinout	RJ-45 Pinout	DB-25 Pinout	DB-9 Pinout	Signal
RTS	1 <sup>1</sup>	8	5	8	CTS
DTR	2	7	6	6	DSR
TxD	3	6	3	2	RxD
GND	4	5	7	5	GND
GND	5	4	7	5	GND
RxD	6	3	2	3	TxD
DSR	7	2	20	4	DTR
CTS	8 <sup>1</sup>	1	4	7	RTS

1. The console port does not support hardware flow control, so it does not support nor use the RTS and CTS signals. To accommodate other devices that use these signals, pin 1 on the console port (RTS) is connected internally to pin 8 (CTS), so that devices that assert the RTS signal automatically receive the CTS signal in reply.

The console port is hardwired for 9600 baud, 8 data bits, no parity, 1 stop bit (9600 8N1) and does not support either hardware or software flow control. If the console port is connected to a laptop computer or other PC when the Cisco uBR924 is first powered-on, the initial system banner should be displayed on the computer's console screen. If you do not see the system banner, verify that the laptop's serial port is set correctly and that it is properly connected to the console port.

**Note**

By default downloading a Cisco IOS configuration file disables the console port and erases all previously saved configurations. The Cisco uBR924 cable access router ships from the factory with the console port enabled, and it remains enabled from the time of initial power-on until it begins to download a Cisco IOS configuration file.



## Regulatory Compliance and Safety Information

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This publication provides international agency compliance, safety, and statutory information for the Cisco uBR924 cable access router. This publication is intended for service providers and subscribers. The publication presents general safety guidelines to follow and includes translations of safety warnings in the service provider documentation set: *Cisco uBR924 Cable Access Router Hardware Installation Guide* and the *Cisco uBR924 Cable Access Router Installation and Startup Quick Start Guide*.

The following sections are included in this publication:

- If You Need More Information, page C-1
- Agency Approvals for the Cisco uBR924, page C-2
- Safety Information, page C-3
- Regulatory Statements, page C-3
- Translated Safety Warnings, page C-5

### If You Need More Information

The Cisco IOS software running on the Cisco uBR924 contains extensive features and functionality. Feature sets and operating modes differ based on the Cisco IOS release, the cable plant's base operating parameters, and the services to be offered to subscribers. Documentation requirements vary for service providers and subscribers.

### Service Providers

For service providers, the following documentation resources are available to obtain information on configuring and maintaining the Cisco uBR924 router:

- Cisco Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more current than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription.

- Cisco Connection Online (CCO)  
You can also access Cisco documentation on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <http://www-europe.cisco.com>. If you are reading Cisco product documentation on the World Wide Web, you can submit comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco. We appreciate your comments.
- For hardware installation and configuration information on the Cisco uBR924, see the *Cisco uBR924 Cable Access Router Hardware Installation Guide*, *Cisco uBR924 Cable Access Router Software Configuration Guide*, and the *Cisco uBR924 Cable Access Router Installation and Startup Quick Start Guide*.
- For Cisco IOS software configuration information, refer to the feature modules and modular configuration and command reference publications in the Cisco IOS software configuration documentation set.
- To obtain general information about documentation, see CCO or the customer documentation CD-ROM, or call customer service at 800 553-6387 or 408 526-7208. Customer service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding Cisco-observed company holidays). You can also send e-mail to [cs-rep@cisco.com](mailto:cs-rep@cisco.com). You can also refer to the *Cisco Information Packet* that shipped with your router.

## Subscribers (End Users)

For subscribers, the following documents are available:

- *Cisco uBR924 Cable Access Router Subscriber Setup Quick Start* card which describes how to connect the Cisco uBR924 to the service provider's network; this document ships with each Cisco uBR924 cable access router.

If you are a subscriber, review these documents, along with any other document your service provider gives you.

To obtain support, contact your service provider. Before contacting your service provider, note the MAC address and the UID found on a label at the bottom of your Cisco uBR924 cable access router.

## Agency Approvals for the Cisco uBR924

The Cisco uBR924 has the following agency approvals as of the date of this publication:

- Safety: UL 1950, CSA 22.2 No.950, EN60950, IEC 60950, AS/NZS3260, TS001, PTC 210/99/007, SASO R-200752
- EMI: FCC Class B, CSA Class A, EN60555-2, EN55022 Class B, VCCI Class B, AS/NZS 3548 Class A, CISPR 22, PTC 210/99/007, SASO R-200752, BCIQ 3882A337
- Immunity: IEC-1000-4-2, IEC-1000-4-3, IEC-1000-4-4, IEC-1000-4-5, IEC-1000-4-6, IEC-1000-4-11, IEC 1000-3-2, IEC 60950, AS3260, TS001

Countries the Cisco uBR924 is approved to operate in, as of this date, include:

- North America; refer to the following section and page: Industry Canada Requirements, page C-4, for Canadian regulatory requirements.
- European Countries; EN55022 requirements
- Australia and New Zealand; AS/NZS 3548 requirements, PTC 210/99/007 requirements



- South America
- Asia: Japan—JATA requirements (approval number is A99-0334JP); Singapore (complies with TAS Standards TS PSTN-1), Hong Kong (approval number is HK99-00/VCS, Class B), Malaysia, Taiwan
- Saudi Arabia; SASO R-200752 requirements

## Safety Information

Following are safety instructions that you must follow when installing a Cisco uBR924. Failure to install the unit in accordance with these instructions will invalidate the agency approvals for the Cisco uBR924 router.

### General Safety

- Do not work on the system or connect and disconnect cables during a lightning storm.
- Safety requirements are not fulfilled unless the equipment is connected to a wall socket outlet with protective earth ground.
- Do not use this unit near liquids.
- Do not place this unit on an unstable surface.

### Subscriber Safety

- Do not remove covers. No operator serviceable parts are inside. Refer servicing to qualified personnel.
- Do not attempt to service or configure the Cisco uBR924 router yourself. Only authorized personnel should service or configure the unit. If the unit requires service, contact your service provider.
- Do not insert any objects into the unit.

**Note**

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In the event of equipment malfunction, contact your service provider. It is the responsibility of end-users requiring service to report the need for service to their service provider.

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## Regulatory Statements

### FCC Requirements

1. The Federal Communications Commission (FCC) has established Rules which permit this device to be directly connected to the telephone network. Standardized jacks are used for these connections. This equipment should not be used on party lines or coin phones.

2. If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until repair has been made. If this is not done, the telephone company may temporarily disconnect service.
3. The telephone company may make changes in its technical operations and procedures; if such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes. You will be advised of your right to file a complaint with the FCC.
4. If the telephone company requests information on what equipment is connected to their lines, inform them of:
  - a. The telephone number to which this unit is connected.
  - b. The ringer equivalence number. [5 REN per port]
  - c. The USOC jack required. [RJ11C]
  - d. The FCC Registration Number. [5B1USA-33873-KX-N]

Items (b) and (d) are indicated on the label. The Ringer Equivalence Number (REN) is used to determine how many devices can be connected to your telephone line. In most areas, the sum of the RENs of all devices on any one line should not exceed five (5.0). If too many devices are attached, they may not ring properly.

## Industry Canada Requirements

### Equipment Attachment Limitations

**NOTICE:** This product is Canadian Industry certified. The Industry Canada Certification Number is 2461 9904 A. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to the certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.



#### Caution

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Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

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The Ringer Equivalence Number (REN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total REN of all the devices does not exceed 5.

The Ringer Equivalence Number of this unit is 5.

## Translated Safety Warnings

This section repeats in multiple languages the warnings found in the documentation related to the Cisco uBR924 router:

### Warning Definition



#### Warning

This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

#### Waarschuwing

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

#### Varoitus

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.

#### Attention

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.

#### Warnung

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.

#### Avvertenza

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.

#### Advarsel

Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

#### Aviso

Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.

<b>¡Advertencia!</b>	<b>Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.</b>
<b>Varning!</b>	<b>Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.</b>

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## Lightning Activity Warning



<b>Warning</b>	<b>Do not work on the system or connect or disconnect cables during periods of lightning activity.</b>
<b>Waarschuwing</b>	<b>Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.</b>
<b>Varoitus</b>	<b>Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.</b>
<b>Attention</b>	<b>Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.</b>
<b>Warnung</b>	<b>Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.</b>
<b>Avvertenza</b>	<b>Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.</b>
<b>Advarsel</b>	<b>Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.</b>
<b>Aviso</b>	<b>Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).</b>
<b>¡Advertencia!</b>	<b>No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.</b>
<b>Varning!</b>	<b>Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.</b>

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## Installation Warning




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<b>Warning</b>	<b>Read the installation instructions before you connect the system to its power source.</b>
<b>Waarschuwing</b>	<b>Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.</b>
<b>Varoitus</b>	<b>Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.</b>
<b>Attention</b>	<b>Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.</b>
<b>Warnung</b>	<b>Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.</b>
<b>Avvertenza</b>	<b>Consultare le istruzioni di installazione prima di collegare il sistema all'alimentatore.</b>
<b>Advarsel</b>	<b>Les installasjonsinstruksjonene før systemet kobles til strømkilden.</b>
<b>Aviso</b>	<b>Leia as instruções de instalação antes de ligar o sistema à sua fonte de energia.</b>
<b>¡Advertencia!</b>	<b>Ver las instrucciones de instalación antes de conectar el sistema a la red de alimentación.</b>
<b>Varning!</b>	<b>Läs installationsanvisningarna innan du kopplar systemet till dess strömförsörjningsenhet.</b>

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## TN Power Warning




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<b>Warning</b>	<b>The device is designed to work with TN power systems.</b>
<b>Waarschuwing</b>	<b>Het apparaat is ontworpen om te functioneren met TN energiesystemen.</b>
<b>Varoitus</b>	<b>Koje on suunniteltu toimimaan TN-sähkövoimajärjestelmien yhteydessä.</b>
<b>Attention</b>	<b>Ce dispositif a été conçu pour fonctionner avec des systèmes d'alimentation TN.</b>
<b>Warnung</b>	<b>Das Gerät ist für die Verwendung mit TN-Stromsystemen ausgelegt.</b>
<b>Avvertenza</b>	<b>Il dispositivo è stato progettato per l'uso con sistemi di alimentazione TN.</b>
<b>Advarsel</b>	<b>Utstyret er utfomet til bruk med TN-strømsystemer.</b>

<b>Aviso</b>	<b>O dispositivo foi criado para operar com sistemas de corrente TN.</b>
<b>¡Advertencia!</b>	<b>El equipo está diseñado para trabajar con sistemas de alimentación tipo TN.</b>
<b>Varning!</b>	<b>Enheten är konstruerad för användning tillsammans med elkraftssystem av TN-typ.</b>

## SELV Circuit Warning



### Warning

To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.

### Waarschuwing

Om elektrische schokken te vermijden, mogen veiligheidscircuits met extra lage spanning (genaamd SELV = Safety Extra-Low Voltage) niet met telefoonnetwerkspanning (TNV) circuits verbonden worden. LAN (Lokaal netwerk) poorten bevatten SELV circuits en WAN (Regionaal netwerk) poorten bevatten TNV circuits. Sommige LAN en WAN poorten gebruiken allebei RJ-45 connectors. Ga voorzichtig te werk wanneer u kabels verbindt.

### Varoitus

Jotta välttyt sähköiskulta, älä kytke pienjännitteisiä SELV-suojapiirejä puhelinverkkojännitettä (TNV) käyttöviin virtapiireihin. LAN-portit sisältävät SELV-piirejä ja WAN-portit puhelinverkkojännitettä käytäviä piirejä. Osa sekä LAN-että WAN-porteista käyttää RJ-45-liittimiä. Ole varovainen kytkiessäsi kaapeleita.

### Attention

Pour éviter une électrocution, ne raccordez pas les circuits de sécurité basse tension (Safety Extra-Low Voltage ou SELV) à des circuits de tension de réseau téléphonique (Telephone Network Voltage ou TNV). Les ports du réseau local (LAN) contiennent des circuits SELV et les ports du réseau longue distance (WAN) sont munis de circuits TNV. Certains ports LAN et WAN utilisent des connecteurs RJ-45. Raccordez les câbles en prenant toutes les précautions nécessaires.

### Warnung

Zur Vermeidung von Elektroschock die Sicherheits-Kleinspannungs-Stromkreise (SELV-Kreise) nicht an Fernsprechnetzspannungs-Stromkreise (TNV-Kreise) anschließen. LAN-Ports enthalten SELV-Kreise, und WAN-Ports enthalten TNV-Kreise. Einige LAN- und WAN-Ports verwenden auch RJ-45-Steckverbinder. Vorsicht beim Anschließen von Kabeln.

### Avvertenza

Per evitare scosse elettriche, non collegare circuiti di sicurezza a tensione molto bassa (SELV) ai circuiti a tensione di rete telefonica (TNV). Le porte LAN contengono circuiti SELV e le porte WAN contengono circuiti TNV. Alcune porte LAN e WAN fanno uso di connettori RJ-45. Fare attenzione quando si collegano cavi.

### Advarsel

Unngå å koble lavspenningskretser (SELV) til kretser for telenettspenning (TNV), slik at du unngår elektrisk støt. LAN-utganger inneholder SELV-kretser og WAN-utganger inneholder TNV-kretser. Det finnes både LAN-utganger og WAN-utganger som bruker RJ-45-kontakter. Vær forsiktig når du kobler kabler.

- Aviso** Para evitar choques eléctricos, não conecte os circuitos de segurança de baixa tensão (SELV) aos circuitos de tensão de rede telefónica (TNV). As portas LAN contêm circuitos SELV e as portas WAN contêm circuitos TNV. Algumas portas LAN e WAN usam conectores RJ-45. Tenha o devido cuidado ao conectar os cabos.
- ¡Advertencia!** Para evitar la sacudida eléctrica, no conectar circuitos de seguridad de voltaje muy bajo (safety extra-low voltage = SELV) con circuitos de voltaje de red telefónica (telephone network voltage = TNV). Los puertos de redes de área local (local area network = LAN) contienen circuitos SELV, y los puertos de redes de área extendida (wide area network = WAN) contienen circuitos TNV. En algunos casos, tanto los puertos LAN como los WAN usan conectores RJ-45. Proceda con precaución al conectar los cables.
- Warning!** För att undvika elektriska stötar, koppla inte säkerhetskretsar med extra låg spänning (SELV-kretsar) till kretsar med telefonnätspänning (TNV-kretsar). LAN-portar innehåller SELV-kretsar och WAN-portar innehåller TNV-kretsar. Vissa LAN- och WAN-portar är försedda med RJ-45-kontakter. Iaktta försiktighet vid anslutning av kablar.
- 

## Warning Statement for Norway and Sweden



- Advarsel** Apparatet skal kobles til en jordet stikkontakt.
- Varning!** Apparaten skall anslutas till jordat nätuttag.

## Product Disposal Warning



- Warning** Ultimate disposal of this product should be handled according to all national laws and regulations.
- Waarschuwing** Het uiteindelijke wegruimen van dit product dient te geschieden in overeenstemming met alle nationale wetten en reglementen.
- Varoitus** Tämä tuote on hävitettävä kansallisten lakien ja määräysten mukaisesti.
- Attention** La mise au rebut ou le recyclage de ce produit sont généralement soumis à des lois et/ou directives de respect de l'environnement. Renseignez-vous auprès de l'organisme compétent.
- Warnung** Die Entsorgung dieses Produkts sollte gemäß allen Bestimmungen und Gesetzen des Landes erfolgen.

<b>Avvertenza</b>	<b>Lo smaltimento di questo prodotto deve essere eseguito secondo le leggi e regolazioni locali.</b>
<b>Advarsel</b>	<b>Endelig kassering av dette produktet skal være i henhold til alle relevante nasjonale lover og bestemmelser.</b>
<b>Aviso</b>	<b>Deitar fora este produto em conformidade com todas as leis e regulamentos nacionais.</b>
<b>¡Advertencia!</b>	<b>Al deshacerse por completo de este producto debe seguir todas las leyes y reglamentos nacionales.</b>
<b>Varning!</b>	<b>Vid deponering hanteras produkten enligt gällande lagar och bestämmelser.</b>

## No On/Off Switch Warning



<b>Warning</b>	<b>Unplug the power cord before you work on a system that does not have an on/off switch.</b>
<b>Waarschuwing</b>	<b>Voordat u aan een systeem werkt dat geen aan/uit schakelaar heeft, dient u de stekker van het netsnoer uit het stopcontact te halen.</b>
<b>Varoitus</b>	<b>Ennen kuin teet mitään sellaiselle järjestelmälle, jossa ei ole kaksiasentokytkintä, kytke irti virtajohto.</b>
<b>Attention</b>	<b>Avant de travailler sur un système non équipé d'un commutateur marche-arrêt, débrancher le cordon d'alimentation.</b>
<b>Warnung</b>	<b>Bevor Sie an einem System ohne Ein/Aus-Schalter arbeiten, ziehen Sie das Netzkabel heraus.</b>
<b>Avvertenza</b>	<b>Prima di lavorare su un sistema che non è dotato di un interruttore on/off, scollegare il cavo di alimentazione.</b>
<b>Advarsel</b>	<b>Før det skal utføres arbeid på et system som ikke har en av/på-bryter, skal strømledningen trekkes ut.</b>
<b>Aviso</b>	<b>Antes de começar a trabalhar num sistema que não possui um interruptor ON/OFF, desligue o cabo de alimentação.</b>
<b>¡Advertencia!</b>	<b>Antes de trabajar sobre cualquier sistema que carezca de interruptor de Encendido/Apagado (ON/OFF), desenchufar el cable de alimentación.</b>
<b>Varning!</b>	<b>Dra ur nätsladden innan du utför arbete på ett system utan strömbrytare.</b>



## Jewelry Removal Warning



### Warning

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

### Waarschuwing

Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.

### Varoitus

Ennen kuin työskentelet voimavirtajohtoihin kytkettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänapoihin.

### Attention

Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.

### Warnung

Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzen sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

### Avvertenza

Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

### Advarsel

Fjern alle smykker (inkludert ringer, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgjenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelte fast til polene.

### Aviso

Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

- ¡Advertencia!** Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (incluidos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.
- Varning!** Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontakterna.

## Ground Conductor Warning



### Warning

Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

### Waarschuwing

De aardingsleiding mag nooit buiten werking gesteld worden en de apparatuur mag nooit bediend worden zonder dat er een op de juiste wijze geïnstalleerde aardingsleiding aanwezig is. Neem contact op met de bevoegde instantie voor elektrische inspecties of met een electricien als u er niet zeker van bent dat er voor passende aarding gezorgd is.

### Varoitus

Älä koskaan ohita maajohdinta tai käytä laitteita ilman oikein asennettua maajohdinta. Ota yhteyttä asianmukaiseen sähkötarkastusviranomaiseen tai sähköasentajaan, jos olet epävarma maadoituksen sopivuudesta.

### Attention

Ne jamais rendre inopérant le conducteur de masse ni utiliser l'équipement sans un conducteur de masse adéquatement installé. En cas de doute sur la mise à la masse appropriée disponible, s'adresser à l'organisme responsable de la sécurité électrique ou à un électricien.

### Warnung

Auf keinen Fall den Erdungsleiter unwirksam machen oder das Gerät ohne einen sachgerecht installierten Erdungsleiter verwenden. Wenn Sie sich nicht sicher sind, ob eine sachgerechte Erdung vorhanden ist, wenden Sie sich an den zuständigen elektrischen Fachmann oder einen Elektriker.

### Avvertenza

Non escludere mai il conduttore di protezione né usare l'apparecchiatura in assenza di un conduttore di protezione installato in modo corretto. Se non si sa con certezza che è disponibile un collegamento di messa a terra adeguato, esaminare le Norme CEI pertinenti o rivolgersi a un elettricista qualificato.

### Advarsel

Omgå aldri jordingslederen og bruk aldri utstyret uten riktig montert jordingsleder. Ta kontakt med det riktige organet for elektrisk inspeksjon eller en elektriker hvis du er usikker på om det finnes velegnet jording.

<b>Aviso</b>	<b>Nunca anule o condutor à terra nem opere o equipamento sem ter um condutor à terra adequadamente instalado. Em caso de dúvida em relação ao sistema de ligação à terra, contacte os serviços locais de inspeção eléctrica ou um electricista qualificado.</b>
<b>Advertencia</b>	<b>No inhabilitar nunca el conductor de tierra ni hacer funcionar el equipo si no existe un conductor de tierra instalado correctamente. Póngase en contacto con una autoridad apropiada de inspección eléctrica o con un electricista competente si no está seguro de que hay una conexión a tierra adecuada.</b>
<b>Varning!</b>	<b>Koppla aldrig från jordledningen och använd aldrig utrustningen utan en på lämpligt sätt installerad jordledning. Om det föreligger osäkerhet huruvida lämplig jordning finns skall elektrisk besiktningsauktoritet eller elektriker kontaktas.</b>

## Router Grounding Warning



### Warning

Failure to properly ground the router, either by circumventing the three-wire grounding-type plug or by using a power outlet that is improperly grounded, can create a potentially hazardous electrical situation.

### Waarschuwing

Als u niet zorgt voor correcte aarding bij de aansluitingen van de router, hetzij door geen geaarde stekker te gebruiken, hetzij door het ontbreken van een geaard stopcontact, kan dit leiden tot een potentieel gevaarlijke situatie.

### Varoitus

Jos reititin maadoitetaan huonosti, joko kiertämällä kolmijohtoinen maadoituspistoke tai käyttämällä huonosti maadoitettua pistorasiaa, voi aiheutua sähköiskun vaara.

### Attention

Une mauvaise mise à la terre du routeur, due à la connexion de la prise terre à trois fiches à une prise ordinaire ou à l'utilisation d'une prise mal reliée à la terre, présente un risque d'accident électrique.

### Warnung

Unsachgemäße Erdung des Routers, entweder durch Umgehen des dreiadrigen Schutzkontaktsteckers oder durch Verwenden einer unsachgemäß geerdeten Steckdose, stellt eine potentielle Gefahrenquelle dar.

### Avvertenza

Il mancato o improprio collegamento a terra del router, escludendo il connettore di messa a terra a tre fili o utilizzando una presa di corrente priva di messa a terra adeguata, può creare una situazione di rischio elettrico.

### Advarsel

Hvis du ikke jorder ruterens skikkelig, enten ved å avskjære den treledede joringspluggen eller ved å bruke en strømuttak som ikke er skikkelig jordet, kan det oppstå en farlig elektrisk situasjon.

### Aviso

O não cumprimento da correcta ligação a terra do router, evitando a tomada terra trifilar ou ligando incorrectamente à terra a saída de corrente, pode ter como resultado uma situação eléctrica potencialmente perigosa.

- ¡Advertencia!** Si el enrutador no tiene toma de tierra, ya sea por no conectar los tres cables del enchufe o por usar una toma de corriente con toma de tierra defectuosa, se corre riesgo de electrocución.
- Varning!** Underlåtenhet att korrekt ansluta skyddsjord till routern, antingen genom att förbikoppla det jordade kontaktdonet eller genom att använda ett strömottag som inte är jordat på rätt sätt, kan skapa en potentiellt farlig elektrisk situation.
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## Disconnecting Telephone-Network Cables



### Warning

Before opening the unit, disconnect the telephone-network cables to avoid contact with telephone-network voltages.

### Waarschuwing

Voordat u de eenheid opent, dient u de verbinding met het telefoonnetwerk te verbreken door de kabels te ontkoppelen om zo contact met telefoonnetwerk-spanning te vermijden.

### Varoitus

Vältä joutumista kosketuksiin puhelinverkkojännitteiden kanssa irrottamalla puhelinverkoston kaapelit ennen yksikön aukaisemista.

### Attention

Pour éviter tout risque de choc électrique (tensions présentes dans l'unité), débranchez les câbles du réseau téléphonique AVANT d'ouvrir l'unité.

### Warnung

Bevor Sie das Gerät öffnen, ziehen Sie die Telefonnetzkabel aus der Verbindung, um Kontakt mit Telefonnetzspannungen zu vermeiden.

### Avvertenza

Prima di aprire l'unità, scollegare i cavi della rete telefonica per evitare di entrare in contatto con la tensione di rete.

### Advarsel

Før enheten åpnes, skal kablene for telenettet kobles fra for å unngå å komme i kontakt med spenningen i telenettet.

### Aviso

Antes de abrir a unidade, desligue os cabos da rede telefónica para evitar contacto com a tensão da respectiva rede.

### ¡Advertencia!

Antes de abrir la unidad, desconectar el cableado dirigido a la red telefónica para evitar contacto con voltajes de la propia red.

### Varning!

Koppla loss ledningarna till telefonnätet innan du öppnar enheten så att kontakten med telefonnätsspänningen bryts.

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## Circuit Breaker (15A) Warning

**Warning**

This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors).

**Waarschuwing**

Dit produkt is afhankelijk van de installatie van het gebouw voor kortsluit-(overstroom)beveiliging. Controleer of er een zekering of stroomverbreker van niet meer dan 120 Volt wisselstroom, 15 A voor de V.S. (240 Volt wisselstroom, 10 A internationaal) gebruikt wordt op de fasegeleiders (alle geleiders die stroom voeren).

**Varoitus**

Tämä tuote on riippuvainen rakennukseen asennetusta oikosulkusuojauksesta (ylivirtasuojauksesta). Varmista, että vaihevirtajohtimissa (kaikissa virroitetuissa johtimissa) käytetään Yhdysvalloissa alle 120 voltin, 15 ampeerin ja monissa muissa maissa 240 voltin, 10 ampeerin sulaketta tai suojakytkintä.

**Attention**

Pour ce qui est de la protection contre les courts-circuits (surtension), ce produit dépend de l'installation électrique du local. Vérifier qu'un fusible ou qu'un disjoncteur de 120 V alt., 15 A U.S. maximum (240 V alt., 10 A international) est utilisé sur les conducteurs de phase (conducteurs de charge).

**Warnung**

Dieses Produkt ist darauf angewiesen, daß im Gebäude ein Kurzschluß- bzw. Überstromschutz installiert ist. Stellen Sie sicher, daß eine Sicherung oder ein Unterbrecher von nicht mehr als 240 V Wechselstrom, 10 A (bzw. in den USA 120 V Wechselstrom, 15 A) an den Phasenleitern (allen stromführenden Leitern) verwendet wird.

**Avvertenza**

Questo prodotto dipende dall'installazione dell'edificio per quanto riguarda la protezione contro cortocircuiti (sovracorrente). Verificare che un fusibile o interruttore automatico, non superiore a 120 VCA, 15 A U.S. (240 VCA, 10 A internazionale) sia stato usato nei fili di fase (tutti i conduttori portatori di corrente).

**Advarsel**

Dette produktet er avhengig av bygningens installasjoner av kortslutningsbeskyttelse (overstrøm). Kontroller at det brukes en sikring eller strømbryter som ikke er større enn 120 VAC, 15 A (USA) (240 VAC, 10 A internasjonalt) på faselederne (alle strømførende ledere).

**Aviso**

Este produto depende das instalações existentes para protecção contra curto-circuito (sobrecarga). Assegure-se de que um fusível ou disjuntor não superior a 240 VAC, 10A é utilizado nos condutores de fase (todos os condutores de transporte de corrente).

- ¡Advertencia!** Este equipo utiliza el sistema de protección contra cortocircuitos (o sobrecorrientes) del propio edificio. Asegurarse de que se utiliza un fusible o interruptor automático de no más de 240 voltios en corriente alterna (VAC), 10 amperios del estándar internacional (120 VAC, 15 amperios del estándar USA) en los hilos de fase (todos aquéllos portadores de corriente).
- Varning!** Denna produkt är beroende av i byggnaden installerat kortslutningsskydd (överströmsskydd). Kontrollera att säkring eller överspänningsskydd används på fasledarna (samtliga strömförande ledare) för internationellt bruk max. 240 V växelström, 10 A (i USA max. 120 V växelström, 15 A).

## Main Disconnecting Device



### Warning

The plug-socket combination must be accessible at all times because it serves as the main disconnecting device.

### Waarschuwing

De combinatie van de stekker en het elektrisch contactpunt moet te allen tijde toegankelijk zijn omdat deze het hoofdmecanisme vormt voor verbreking van de aansluiting.

### Varoitus

Pistoke/liitinkohta toimii pääkatkaisumekanismina. Pääsy siihen on pidettävä aina esteettömänä.

### Attention

La combinaison de prise de courant doit être accessible à tout moment parce qu'elle fait office de système principal de déconnexion.

### Warnung

Der Netzkabelanschluß am Gerät muß jederzeit zugänglich sein, weil er als primäre Ausschaltvorrichtung dient.

### Avvertenza

Il gruppo spina-presa deve essere sempre accessibile, poiché viene utilizzato come dispositivo di scollegamento principale.

### Advarsel

Kombinasjonen støpsel/uttak må alltid være tilgjengelig ettersom den fungerer som hovedfrakoplingsenhet.

### Aviso

A combinação ficha-tomada deverá ser sempre acessível, porque funciona como interruptor principal.

### ¡Advertencia!

El conjunto de clavija y toma ha de encontrarse siempre accesible ya que hace las veces de dispositivo de desconexión principal.

### Varning!

Man måste alltid kunna komma åt stickproppen i uttaget, eftersom denna koppling utgör den huvudsakliga fråkopplingsanordningen.

## Hazardous Voltages in WAN Ports



### Warning

Hazardous network voltages are present in WAN ports regardless of whether power to the router is OFF or ON. To avoid electric shock, use caution when working near WAN ports. When detaching cables, detach the end away from the router first.

### Waarschuwing

Er is gevaarlijke netwerkspanning aanwezig in WAN poorten ongeacht of de stroom naar de router INGESCHAKELD of UITGESCHAKELD is. Om elektrische schokken te vermijden, dient u voorzichtig te werk te gaan wanneer u in de nabijheid van WAN poorten werkt. Wanneer u kabels losmaakt, dient u eerst het uiteinde dat zich het verst van de router vandaan bevindt, te verwijderen.

### Varoitus

WAN-porteissa on vaarallisia verkkojännitteitä riippumatta siitä, onko reitittimen virta kytketty vai ei. Välttääksesi sähköiskulta ole varovainen työskennellessäsi WAN-porttien lähetyvillä. Kun irrotat kaapeleita, irrota reitittimestä kauempana sijaitseva pää ensiksi.

### Attention

Les ports de réseau longue distance (WAN) gèrent des tensions de réseau dangereuses, que le routeur soit sous tension ou pas. Pour éviter tout risque d'électrocution, prenez toutes les précautions nécessaires avant de travailler à proximité des ports WAN. Pour déconnecter les câbles, commencez par débrancher l'extrémité la plus éloignée du routeur.

### Warnung

In WAN-Ports sind gefährliche Netzspannungen vorhanden, auch wenn der Strom zum Router abgeschaltet wurde. Zur Vermeidung von Elektroschock Vorsicht bei der Arbeit in der Nähe von WAN-Ports. Beim Abtrennen von Kabeln zuerst das vom Router entfernte Ende lösen.

### Avvertenza

Nelle porte WAN sono presenti tensioni di rete pericolose, sia che il router sia acceso o meno (ON od OFF). Per evitare scosse elettriche, fare attenzione quando si lavora in prossimità di porte WAN. Quando si scollegano cavi, staccare per primo il connettore collegato al router.

### Advarsel

Det er livsfarlig nettverksspenning i WAN-utganger, uavhengig av om strømmen til fordelingsenheter er slått av (OFF) eller på (ON). Vær forsiktig når du jobber nær WAN-utganger slik at du unngår elektrisk støt. Hvis du skal løsne kabler, må du først løsne den enden som er lengst borte fra fordelingsenheter.

### Aviso

Existem sempre tensões de rede perigosas nas portas WAN, independentemente da corrente para o dispositivo repartidor de mensagens estar ligada (ON) ou desligada (OFF). Para evitar choques eléctricos, tenha o devido cuidado ao trabalhar perto das portas WAN. Ao desconectar os cabos, separe primeiro a extremidade que se encontra ligada ao dispositivo repartidor de mensagens.

- ¡Advertencia!** Hay tensiones de red peligrosas en los puertos de redes de área extendida (WAN), tanto con la alimentación al router conectada como desconectada. Para evitar la sacudida eléctrica, proceda con precaución cuando trabaje en las proximidades de puertos WAN. Para desconectar los cables, desconecte primero el extremo que va al router.
- Varning!** Farlig nätverksspänning föreligger i WAN-portarna oavsett om strömförsörjningen till distributören är bruten eller ej. För att undvika elektriska stötar ska du vara försiktig vid arbete i närheten av dessa portar. När du kopplar bort en kabel ska du först koppla bort den ände som inte är ansluten till distributören.

## Incorrect Connection Warning



### Warning

Incorrect connection of this or connected equipment to a general purpose outlet could result in a hazardous situation.

### Waarschuwing

Incorrecte aansluiting van deze of aangesloten apparatuur op een stopcontact voor algemene doeleinden kan een gevaarlijke situatie tot gevolg hebben.

### Varoitus

Tämän laitteen tai siihen liitettyjen laitteiden virheellinen kytkentä yleispistorasiaan voi aiheuttaa vaaratilanteen.

### Attention

Un branchement incorrect de cet équipement ou de l'équipement branché à une prise d'usage général peut créer une situation dangereuse.

### Warnung

Inkorrektes Anschließen von diesem oder damit verbundenen Geräten an einer Allzwecksteckdose kann eine Gefahrensituation verursachen.

### Avvertenza

Un collegamento errato di questo apparecchio, o dell'apparecchiatura a esso collegato, a una presa di uso generale può causare una situazione pericolosa.

### Advarsel

Feil kobling av dette utstyret eller tilhørende utstyr til et vanlig uttak kan føre til farlige situasjoner.

### Aviso

Uma conexão incorrecta a uma ficha de alimentação eléctrica normal, deste ou de qualquer equipamento a este conectado, poderá resultar numa situação potencialmente perigosa.

### Advertencia

La conexión incorrecta de este equipo, o del equipo conectado, a una toma o receptáculo de tipo general podría resultar en una situación peligrosa.

### Varning!

Felaktig koppling av denna eller ansluten utrustning till ett universaluttak kan orsaka riskfylld situation.



## Service Personnel Warning


**Warning**

This equipment is to be installed and maintained by service personnel only as defined by AS/NZS 3260 Clause 1.2.14.3 Service Personnel.

**Waarschuwing**

Deze apparatuur mag slechts geïnstalleerd en onderhouden worden door servicepersoneel conform de definitie van AS/NZS 3260 Clausule 1.2.14.3 Service Personnel.

**Varoitus**

Tämän laitteen saa asentaa tai huoltaa ainoastaan Australiassa ja Uudessa Seelannissa sovellettavan AS/NZS 3260 -standardin kohdan 1.2.14.3 Service Personnel määrittelemä huoltohenkilöstö.

**Attention**

Cet équipement ne doit être installé et entretenu que par du personnel d'entretien comme défini par la réglementation AS/NZS 3260 Clause 1.2.14.3 Service Personnel.

**Warnung**

Dieses Gerät darf nur von Wartungspersonal gemäß AS/NZS-Definition 3260, Paragraph 1.2.14.3, "Service Personnel", installiert und gewartet werden.

**Avvertenza**

Questo apparecchio deve essere installato e mantenuto in efficienza esclusivamente da personale tecnico che soddisfi i requisiti specificati nella sezione 1.2.14.3 sul 'Service Personnel' contenuta nelle norme AS/NZS 3260.

**Advarsel**

Installasjon og vedlikehold av dette utstyret skal kun foretas av vedlikeholdspersonell som definert i AS/NZS 3260, klausul 1.2.14.3 Service Personnel.

**Aviso**

Este equipamento deverá ser instalado e reparado apenas por pessoal de manutenção qualificado, conforme estipulado em AS/NZS 3260 Cláusula 1.2.14.3 Service Personnel.

**Advertencia**

Este equipo se debe instalar y mantener solamente por personal de servicio, según definido por AS/NZS 3260 Cláusula 1.2.14.3 Service Personnel.

**Varning!**

Installation och underhåll av denna utrustning får endast utföras av servicepersonal enligt definition i AS/NZS 3260 klausul 1.2.14.3 Service Personnel.

## Telecommunications Lines Warning


**Warning**

The telecommunications lines must be disconnected 1) before unplugging the main power connector and/or 2) while the housing is open.

**Waarschuwing**

De telecommunicatielijnen moeten verbroken worden 1) voordat de hoofvoedingsconnector uitgeschakeld wordt en/of 2) terwijl de behuizing nog open is.

<b>Varoitus</b>	<b>Tietoliikennelinjat on kytkettävä irti 1) ennen kuin päävirtaliitin irrotetaan pistorasiasta ja/tai 2) kun suojus on auki.</b>
<b>Attention</b>	<b>Les lignes de télécommunications doivent être déconnectées 1) avant de débrancher le connecteur d'alimentation principal et/ou 2) lorsque le boîtier est ouvert.</b>
<b>Warnung</b>	<b>Die Fernmeldeleitungen müssen getrennt werden, 1) bevor der Netzstecker abgezogen wird und/oder 2) während das Gehäuse geöffnet ist.</b>
<b>Avvertenza</b>	<b>Le linee di telecomunicazione vanno scollegate sia prima di scollegare la spina dell'alimentazione di rete sia prima di aprire l'involucro (non ricollegarle finché non si chiude l'involucro).</b>
<b>Advarsel</b>	<b>Telekommunikasjonsledningene må være frakoblet 1) før hovedstrømskoblingen kobles ut og/eller 2) når huset er åpent.</b>
<b>Aviso</b>	<b>As linhas de telecomunicações têm de ser desligadas: 1) antes de desligar o conector de corrente principal; e/ou 2) enquanto a cobertura estiver aberta.</b>
<b>Advertencia</b>	<b>Las líneas de telecomunicaciones deben desconectarse 1) antes de desenchufar el conector principal de energía y 2) mientras la caja esté abierta.</b>
<b>Varning!</b>	<b>Telekommunikationslinjerna måste vara urkopplade 1) innan huvudströmskontakten tas ur och/eller 2) medan kåpan är öppen.</b>

## No. 26 AWG Warning



### Warning

To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

### Waarschuwing

Om brandgevaar te reduceren, dient slechts telecommunicatielijnsnoer nr. 26 AWG of groter gebruikt te worden.

### Varoitus

Tulipalovaaran vähentämiseksi käytä ainoastaan nro 26 AWG- tai paksumpaa tietoliikennejohdinta.

### Attention

Pour réduire le risque d'incendie, n'utiliser que des cordons de lignes de télécommunications de type AWG n° 26 ou plus larges.

### Warnung

Zur Reduzierung der Feuergefahr eine Fernmeldeleitungsschnur der Größe 26 AWG oder größer verwenden.

### Avvertenza

Per ridurre il rischio di incendio, usare solo un cavo per linea di telecomunicazioni di sezione 0,12 mm<sup>2</sup> (26 AWG) o maggiore.

### Advarsel

Bruk kun AWG nr. 26 eller telekommunikasjonsledninger med større dimensjon for å redusere faren for brann.

<b>Aviso</b>	<b>Para reduzir o risco de incêndio, utilize apenas terminais de fio de telecomunicações N°. 26 AWG ou superiores.</b>
<b>Advertencia</b>	<b>Para reducir el riesgo de incendios, usar sólo líneas de telecomunicaciones de calibre No. 26 AWG o más gruesas.</b>
<b>Warning!</b>	<b>För att minska brandrisken skall endast Nr. 26 AWG eller större telekommunikationsledning användas.</b>

## Ring Signal Generator Warning



### Warning

This equipment contains a ring signal generator (ringer), which is a source of hazardous voltage. Do not touch the RJ-11 (phone) port wires (conductors), the conductors of a cable connected to the RJ-11 port, or the associated circuit-board when the ringer is active. The ringer is activated by an incoming call.

### Waarschuwing

Deze apparatuur brengt een belsignaal voort wat op spanningsgevaar duidt. Wanneer de bel rinkelt, mogen de RJ-11-draden (telefoon), d.w.z. de geleiders van een aan de RJ-11-poort verbonden kabel, en de bijbehorende circuitplaat, niet aangeraakt worden. De bel wordt geactiveerd door een binnenkomend analogoog gesprek.

### Varoitus

Tämä laite on varustettu soittovirran generaattorilla (puhelinkello), jossa on vaarallinen jännite. Älä koske RJ-11 (puhelimen liittymän) liitäntäjohtoihin (johtimet), RJ-11-liittymään yhdistetyn kaapelin johtimiin tai piirilevyyn puhelinkellon ollessa päälle kytkettynä. Saapuva analogisoitto aktivoi puhelinkellon.

### Attention

Cet appareil contient un générateur de sonneries, source de tensions dangereuses. Lorsque la sonnerie est active, ne touchez en aucun cas les fils de port (conducteurs) du connecteur RJ11 (téléphone), les âmes du câble connecté au port RJ11 ou les cartes imprimées correspondantes. La sonnerie est activée par un appel entrant.

### Warnung

Dieses Gerät enthält einen Rufsignalgeber (Rufumsetzer), der unter gefährlicher Spannung steht. Die RJ-11 (Telefon-) Anschlußdrähte (Leiter), die Leiter eines im RJ-11-Anschluß eingesteckten Kabels bzw. die dazugehörige Leiterplatte auf keinen Fall berühren, wenn der Rufumsetzer aktiviert ist. Der Rufumsetzer wird aktiviert, wenn ein Analoganruf eingeht.

### Avvertenza

Questa apparecchiatura contiene un generatore di segnali di chiamata (suoneria) che origina un voltaggio pericoloso. Quando la suoneria è attivata, non toccare l' RJ-11 (telefono), i fili della porta (conduttori), i conduttori di un cavo collegato alla porta RJ-11 o l' associata scheda a circuiti stampati. La suoneria è attivata da un segnale di chiamata analogica in arrivo.

### Advarsel

Dette utstyret inneholder en ringesignalgenerator (ringeklokke) med farlig spenning. Berør ikke RJ-11-utgangens (telefonutgangens) ledninger (lederne), lederne til den kablen som er koplet til RJ-11-utgangen, eller tilhørende kretskort når ringeklokken er aktivert. Ringeklokken aktiveres av innkommende analoge anrop.

**Aviso** Este equipamento contém um gerador de sinal de campainha que constitui uma fonte de tensão perigosa. Não toque nos fios de porta (condutores) RJ-11 (telefone), nos condutores do cabo conectado à porta RJ-11 ou na placa de circuito associada quando a campainha estiver activa. A campainha é activada pela entrada de uma chamada analógica.

**¡Advertencia!** Este equipo contiene un generador de señal de llamada (timbre), el cual es una fuente de tensión peligrosa. No toque los alambres de la puerta (conductores) RJ-11 (teléfono), ni los conductores de un cable conectado a la puerta RJ-11, ni la placa del circuito relacionado cuando el timbre está activo. El timbre es activado por medio de una llamada de entrada analógica.

**Varning!** Denna utrustning innehåller en tongenerator (ringklocka) med farlig spänning. Vidrör inte RJ-11-portens (telefonportens) ledningar (ledarna), ledarna hos kabel som är ansluten till porten RJ-11 eller tillhörande kretskort när ringklockan är aktiverad. Ringklockan aktiveras av inkommande analoga anrop.

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