Cisco 700 Series Router Installation Guide

February 20, 1999

About This Guide

The *Cisco 700 Series Router Installation Guide* provides hardware installation instructions that guide you through the process of establishing connections from your router to LAN, WAN, power, and phone connections. A paper copy of the document is provided with your router. The document is also available on the Cisco Documentation CD-ROM in HTML format (Document Number DOC-782412=). This chapter discusses the audience, organization, related documentation, and conventions of the *Cisco 700 Series Router Installation Guide*.

Audience

This publication is designed for a person with knowledge of network wiring practices and protocols. Although not intended for the novice user, the basic skills necessary to understand this guide can be acquired by reading general information on network communications.

Organization

The major sections of this publication are as follows:

- Chapter 1, "Overview," describes the Cisco 700 series router features and models.

- Chapter 2, "Preparing for Installation," contains safety recommendations, connection preparations, and console and auxiliary port cable connection considerations.

- Chapter 3, "Installing Your Router," contains instructions on how to cable the router.

- Chapter 4, "ISDN and Analog Telephone Devices," contains instructions on how to configure the router for use with an analog telephone device, including how to make data calls over voice lines and how to use call waiting and call holding.

- Chapter 5, "Troubleshooting Cisco 700 Series Routers," contains instructions on troubleshooting any problems that might occur with Cisco 700 series routers. In addition, it lists and describes Integrated Services Digital Network (ISDN) cause values and cause messages that the ISDN switch might send to the router to indicate ISDN call status.

- Chapter 6, "Concepts and Descriptions," contains technical information that is unique to the Cisco 700 series router. Although it is not necessary to understand this information, if you are having trouble with your router, this information might help you find a solution.

- Appendix A, "Specifications," provides the specifications for Cisco 700 series routers, including pinouts for cables used with Cisco 700 series routers, and lists Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) port assignments.

- Appendix B, "Terminal Communications," describes how to connect an ASCII terminal or a PC running terminal emulation software to the configuration port of the router.

- Appendix C, "Provisioning the ISDN BRI Line," describes how to order and correctly configure the ISDN Basic Rate Interface (BRI) line to operate with Cisco 700 series routers.

Related Documentation

The following documentation is also provided with your Cisco 700 series router:

- *Release Notes for Cisco 700 Series Router Software* provides the latest information on the router software. Release notes for previous versions of the software are on the Cisco Documentation CD-ROM and the Cisco Web site.

- *Cisco 760 Quick Reference Guide* and *Cisco 770 Quick Reference Guide* provide hardware installation instructions, forms to assist you in gathering configuration information, and include a Cisco 700 Fast Step CD-ROM.

- *Cisco 700 Series Command Reference* provides descriptions of the software commands, examples of configurations, and discussions on networking topics related to the Cisco 700 series router. The document is available on the Cisco Documentation CD-ROM and the Cisco Web site in HTML format. A paper copy of the document can be ordered from Cisco Systems, Inc. (Document Number DOC-700CR=).

Additional Cisco documentation and literature are available in a CD-ROM package that ships with your Cisco 700 series router. The Documentation CD-ROM, a member of the Cisco Connection family, is updated monthly. Therefore, it may be more up to date than the printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. 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.

Additional Cisco 700 series router configuration information can be found at http://www.cisco.com/warp/public/779/smbiz/service/configs/700_configs.htm and http://www.cisco.com/warp/cpropub/67/sample.html

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Conventions

This section describes the conventions used in this publication to convey instructions and information.

Command descriptions use these conventions:

- Commands and keywords are in **boldface**.

- Variables for which you supply values are in *italic*.

- Elements in square brackets ([ ]) are optional.

- Alternative but required keywords are grouped in braces ({ }) and separated by a vertical bar (|).

Examples use the following conventions:

- Terminal sessions are in screen font.

- Information you enter is in **boldface screen** font.

- Nonprinting characters are shown in angle brackets (< >).

- Information the system displays is in screen font, with default responses in square brackets ([ ]).

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

Timesaver   This symbol means *the described action saves time*. You can save time by performing the action described in the paragraph.

Caution   This symbol means reader be careful. In this situation, you might do something that could result in equipment damage or loss of data.

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. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.

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 laitteen mukana olevasta *Regulatory Compliance and Safety Information* -kirjasesta (määräysten noudattaminen ja tietoa turvallisuudesta).

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. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez le document *Regulatory Compliance and Safety Information* (Conformité aux règlements et consignes de sécurité) qui accompagne cet appareil.

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. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.

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. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare 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 dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.

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. Para ver as traduções dos avisos que constam desta publicação, consulte o documento *Regulatory Compliance and Safety Information* (Informação de Segurança e Disposições Reguladoras) que acompanha este dispositivo.

¡Advertencia! 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 una traducción de las advertencias que aparecen en esta publicación, consultar el documento titulado *Regulatory Compliance and Safety Information* (Información sobre seguridad y conformidad con las disposiciones reglamentarias) que se acompaña con este dispositivo.

Varning! 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 förkommer i denna publikation i dokumentet *Regulatory Compliance and Safety Information* (Efterrättelse av föreskrifter och säkerhetsinformation), vilket medföljer denna anordning.

Overview

Cisco 700 series routers connect Ethernet LANs to other networks over Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI) lines.

Cisco 700 series routers offer multiprotocol routing capability between WAN and LAN ports and can function as transparent bridges.

Product Features

This section describes the major features of Cisco 700 series routers.

CiscoSecure Authentication Agent Support

The CiscoSecure Authentication Agent (available for Windows 95 and Windows NT 4.0) application simplifies the use of token authentication over ISDN. There are two authentication modes: single authentication and double authentication.

The Cisco 700 series router operates in single authentication mode when Token Authentication Support (TAS) is enabled. The CiscoSecure Authentication Agent is available on the Cisco Website.

Fast Step Support

Cisco 700 series router software Release 4.0(1) and higher supports the Cisco 700 Fast Step software. Cisco 700 Fast Step software simplifies the setup, configuration, and monitoring of Cisco 700 series routers.

Cisco 700 Fast Step runs on Microsoft Windows 95, Windows 98, and Windows NT systems. It is provided with your router on the Cisco Fast Step CD-ROM. The application is also available on Cisco Connection Online (CCO).

Always On / Dynamic ISDN (AO/DI)

The Always On/Dynamic ISDN (AO/DI) networking service provides an always-available connection to packet-based services through the WAN. For the user, AO/DI reduces costs by using the D channel to make low-speed data transfers. For service providers, AO/DI removes a significant amount of data traffic from the voice network.

The D channel is an always-available, packet-oriented link between the remote office and the central office. The customer premises equipment (CPE) can use the D channel to pass Multilink Point-to-Point Protocol (PPP) and Transaction Control Protocol and Internet Protocol (TCP/IP) encapsulated in X.25. The D-channel X.25 packets are handled at the central office by the X.25 packet handler, so these packets can be routed without crossing the circuit-switched switch fabric.

When D-channel bandwidth exceeds a defined threshold, the router places one or more ISDN B-channel calls to increase bandwidth. When bandwidth requirements fall below a defined threshold, the B channels are released.

A maximum of four switched virtual circuits (SVCs) can be used for AO/DI. If a D-channel connection is not available, the router uses the first available B channel for a call. After the D channel PPP link is established, it is not torn down. If Bandwidth Allocation Control Protocol (BACP) is configured, Bandwidth on Demand (BOD) is negotiated by using BACP.

Performance of the multilink protocol declines when the bandwidth of the underlying links varies widely; therefore, the router idles the D channel when the B channels are in use. (RFC 1990 describes how packets can be redirected using the multilink procedure.) After the number of links drops to one and that link is idle, the router returns to normal operation.

DHCP Address Lease Time

With Cisco 700 series router software Release 4.2(2), you can specify the lease time for all the addresses. (The previous Cisco 700 series router DHCP server implementation assigned an IP address to the DHCP client with an infinite lease time.)

Enhanced AT Command Support

There are two modes of operation in the Controller PAD (TPAD) implementation that respond to the enhanced point-of-sale system (EPOS), Verbose and Terse. In Verbose mode, the response is in strings, such as "CONNECT," "NO CARRIER," "BUSY," and so forth. In Terse mode the response is in numbers, such as 1 (CONNECT), 3 (DISCONNECT), 7 (BUSY), and so forth. In addition, in software Release 4.3.1, a series of TPAD commands have been implemented to support RIVA functionality.

Permanent Linkup Mode

In areas served by carriers providing flat-rate ISDN service, the lines can be permanently connected between the router and the central office switch. This feature can work on any switch type.

Triggered RIP

Triggered RIP enhances the Routing Information Protocol (RIP) and enables efficient dynamic routing over demand-circuit links such as ISDN. Defined in RFC 2091, Triggered RIP avoids the bandwidth overhead by sending updates for only those routes with changed metrics. Triggered RIP incorporates a reliable delivery mechanism to ensure consistent topology information.

Dial-On-Demand Routing

Dial-on-demand routing (DDR) allows the router to dynamically initiate calls as traffic demands to remote devices across ISDN BRI lines. The router also terminates ISDN connections based on the level of the traffic demanded on the ISDN line and the dynamic routing parameters.

Automatic Configuration From BOOTP

The automatic configuration feature allows the Cisco 700 series router to obtain a configuration file from a remote server using Bootstrap Protocol (BOOTP).

SPID and Switch Automatic Detection

The automatic service profile identifier (SPID) and switch detection simplifies the use of ISDN terminal equipment and makes the equipment easier to use with fewer parameters to enter. With this feature, you only enter the local directory numbers with area code; no SPID number or switch type is required.

The automatic detection feature only applies to ISDN switches for the USA and Canada, usually an AT&T 5ESS Custom, DMS-100, NI-1, or NI-2 switch. The automatic detection mechanism might not work with any other switch, such as a Siemens switch. The automatic detection feature is only implemented in the U. S. image.

Bandwidth Allocation Control Protocol and Bandwidth Allocation Protocol

The Bandwidth Allocation Control Protocol (BACP) and the Bandwidth Allocation Protocol (BAP) define a set of rules to control dynamic bandwidth allocation to coordinate and negotiate the actual allocation and deallocation of the second channel.

NetBIOS Name Spoofing

If spoofing is set, the router keeps a local database of up to 100 Domain Name System (DNS) name entries and has an aging scheme to age out the unused name entries. When a WINS client sends out a NetBIOS Name query, the router can attempt to answer the query in place of the WINS server. If the router cannot answer, the router forwards the query packets to the server, which provides the response to the client.

DHCP Server and Relay Agent

DHCP automates IP addressing and reduces the number of IP addresses a site might require. Cisco 700 series routers can function as a dynamic host configuration protocol (DHCP) server.

Cisco 700 series routers can also function as a DHCP relay agent, but the router cannot act as a DHCP server and a relay agent at the same time. When configured, your router can relay DHCP requests and responses between DHCP clients and a specified DHCP server.

Port Address Translation

Cisco 700 series routers support port address translation (PAT) allowing a designated private IP network to communicate with the outside world. When configured, Cisco 700 series routers translate source addresses from an IP private network to a single, global, unique IP address before forwarding the packets to the outside world.

IP Address Assignment Through IPCP

The router can be assigned an IP address from the remote device using Internet Protocol Control Protocol (IPCP) address negotiation. The implementation is based on RFC 1332, and it supports IPCP options 1 and 3. (It does not support option 2, TCP/IP Header Compression.) IP unnumbered is also supported. IPCP address negotiation is on by default in any profile configured for IP routing. This feature does not support address assignment to remote devices.

Data Compression

Cisco 700 series routers support data compression using the compression algorithm QIC-122 standard, Stacker LZS. Data compression is a software configuration option that optimizes the ISDN line bandwidth. Packets are compressed before being sent to the ISDN line. After they arrive at their destination, the packets are decompressed and sent to the remote LAN.

Fee Pulse Mode

Fee Pulse Mode manages the ISDN connection based on the paid periods of time. If other thresholds indicate a call should be dropped due to low traffic, Fee Pulse Mode maintains the connection until the current paid period has expired. Therefore, you are not paying full price for part of a connection period. This feature is available only for NET3 (same as ETSI) switch types, and you must subscribe to Advice of Charge-During Active Call (AOC-D) supplementary service.

If the feature is enabled and idle time expires, the router checks the remaining time in the current paid period. The router maintains the connection until the end of the paid period, minus the disconnect time required to terminate the PPP and ISDN links.

If the idle time expires too close to the end of the paid period to close the connections before the end of the paid period, the router extends the connection to the end of the next paid period, minus disconnect time.

X.25 Policy Routing

X.25 Policy Routing routes a specific IP packet to the target IP host through an X.25 D channel and provide the parameters needed for a X.25 D channel connection. The router does not require knowledge of POS transaction formats or protocols.

X.25 Over B Channel

Cisco 700 series router software Release 4.1(1) and higher includes a special image that supports the Cardway TPAD services (British Telecom). The connection is made through the Cisco 700 series router serial port.

X.25 Priority Queueing

Priority queueing improves the responsiveness of the D channel link. X.25 is a flow-controlled, nonbroadcast multiaccess (NBMA) protocol. A high-priority packet might not be transmitted first, even when it is eligible. With priority queueing, data can be put into one of the four priority queues: high, medium, normal, and low. Packets with the same priority are sent on a first-in-first-out basis.

Leased Line Authentication Requirement Removed

In software Release 4.0(1) and higher, the authentication sequence is no longer required for leased line connections. (For 64-kbps or 128-kbps leased line connections, previous versions of the software required PAP/CHAP authentication to identify the corresponding profile.)

To eliminate the need for authentication, a user-defined profile named *leasedline* must be present and defined. If this profile is not present upon call connect, the router requires authentication to select the correct profile. If the call cannot be authenticated, the router

defaults to the Standard profile. Within the user-defined profile called leasedline, verify that PPP authentication is set to none. The switch types that support this feature are PERM64 and PERM128.

Security Features

Cisco 700 series routers provide the following security features:

- PPP authentication support, including Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP)

- Password security for local and remote configuration access

- IP filtering based on source and destination addresses, source and destination ports, and packet types

SNMP Support

Cisco 700 series routers support Simple Network Management Protocol (SNMP).

SNMP Community Names

Cisco 700 series routers support the following SNMP community names:

- public

- proxy

- private

- regional

- core

These community names are read-only and cannot be changed. Cisco 700 series routers do not support SNMP **set** commands.

Supported MIBs

Cisco 700 series routers support the following SNMP Management Information Bases (MIBs):

- MIB II
- IEEE 802.1d Bridge MIB

MIB II

Cisco 700 series routers support MIB II standards as follows:

- System
- Interfaces (all objects, except that a connection is considered to be an interface)
- Address translation
- IP
- Transmission Control Protocol (TCP)
- Internet Control Message Protocol (ICMP)
- User Datagram Protocol (UDP)
- SNMP

IEEE 802.1d Bridge MIB

Cisco 700 series routers support IEEE 802.1d MIB standards as follows:

- Base
- Transparent bridging
- Static

Supported RFCs

Cisco 700 series routers support the following Request For Comments (RFC) documents:

- RFC 1058—Routing Information Protocol (RIP)
- RFC 1332—PPP Internet Protocol Control Protocol (IPCP)
- RFC 1334—PPP Authentication Protocols
- RFC 1541—Dynamic Host Configuration Protocol (DHCP)
- RFC 1552—PPP Internetwork Packet Exchange
- RFC 1570—PPP Link Control Protocol (LCP) Extensions
- RFC 1582—Extensions to RIP to Support Demand Circuits
- RFC 1618—PPP Over ISDN
- RFC 1638—PPP Bridging Control Protocol (BCP)
- RFC 1661—Point-to-Point Protocol (PPP)
- RFC 1717—Multilink Protocol (MP) PPP
- RFC 1723—Routing Information Protocol (RIP) Version 2—Carrying Additional Information
- RFC 1974—StacLZS Compression
- RFC 1990—PPP Multilink Control Protocol (MLCP)
- RFC 2091—Triggered Extensions to RIP to Support Demand Circuits

Front Panels

Figure 1-1 shows the front panel of a Cisco 700 series router.

Figure 1-1   Front Panel, Cisco 770 Series Router (Cisco 776 Shown)
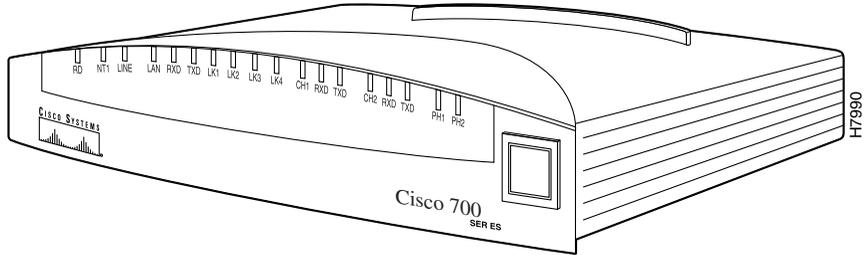
Front-Panel LEDs

The LEDs on the front panel of Cisco 700 series routers display the activity status of the router as connections are made and as packets are sent and received. Figure 1-2 and Figure 1-3 illustrate the LEDs on the front panels of Cisco 700 series routers.

Figure 1-2   Cisco 760 Series LEDs (Cisco 766 Shown)
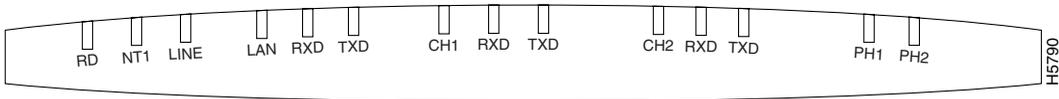
Figure 1-3   Cisco 770 Series LEDs (Cisco 776 Shown)
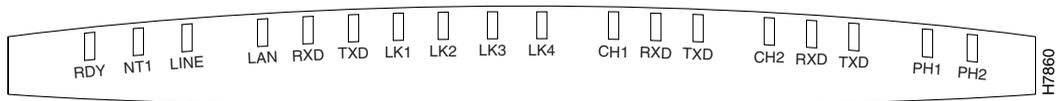
Note Cisco 761, Cisco 765, Cisco 771 and Cisco 775 routers do not have NT1 LEDs. Cisco 761, Cisco 762, Cisco 771 and Cisco 772 routers do not have PH1 and PH2 LEDs.

Table 1-1 lists the LEDs and their functions.

Table 1-1   Front-Panel LED Functions

LED	Function
RD (Cisco 760 series) RDY (Cisco 770 series)	Indicates the router operating status. On when power is supplied to the router, the router passes the self-test, and is operating normally.
NT1 (Cisco 762, Cisco 766, Cisco 772, and Cisco 776 only)	• On when the internal NT1 and the ISDN switch are synchronized. • Blinking (5 blinks per second) indicates that the internal NT1 is attempting to synchronize with the telephone switch. • Blinking (1 blink per second) indicates that the internal NT1 is attempting to synchronize with the ISDN terminal devices.
LINE	On when the NT1 S interface and the ISDN terminal device(s) are synchronized. Also indicates framing between the router and the ISDN switch.
LAN	On when packets have been sent to or received from the Ethernet within the last minute.
RXD	Blinks when packets are received from the LAN.
TXD	Blinks when packets are sent to the LAN.
LK1 (Cisco 770 only)	On when the first LAN link of the unmanaged hub is connected. Blinks (once every 1.5 seconds) when there is a problem with the connection.
LK2 (Cisco 770 only)	On when there is a connection on the second LAN link of the unmanaged hub is connected. Blinks (once every 1.5 seconds) when there is a problem with the connection.
LK3 (Cisco 770 only)	On when there is a connection on the third LAN link of the unmanaged hub is connected. Blinks (once every 1.5 seconds) when there is a problem with the connection.

Table 1-1   Front-Panel LED Functions (continued)

LED	Function
LK4 (Cisco 770 only)	On when there is a connection on the fourth LAN link of the unmanaged hub is connected. Blinks (once every 1.5 seconds) when there is a problem with the connection.
CH1	Blinks when a call is establishing a connection on the first B channel. On when a call is established or the connection has not yet timed out.
CH1 RXD	Blinks when packets are received on the first B channel.
CH1 TXD	Blinks when packets are sent on the first B channel.
CH2	Blinks when a call is establishing a connection on the second B channel. On when a call is established or the connection has not yet timed out.
CH2 RXD	Blinks when packets are received on the second B channel.
CH2 TXD	Blinks when packets are sent on the second B channel.
PH 1 PH 2 (Cisco 765, Cisco 766, Cisco 775, and Cisco 776 only)	• Blinks when the corresponding basic telephone service line is off-hook. • Blinks in the following patterns when entering DTMF commands for the corresponding basic telephone service port on the router: — Blinks twice every second for 2 seconds if the command is entered correctly. — Blinks once every second for 4 seconds if the command is entered incorrectly.

Data Call Button (Cisco 770 Series Routers Only)

The data call button on the front panel of Cisco 770 series routers provides an alternative to establishing or disconnecting data calls through the command interface. The data call button performs in Make or Break mode. If no B channels are connected for data, and at least one B channel is available, the button works in Make mode and attempts to establish a call. When at least one B channel is connected for data, the button works in Break mode, disconnecting the call. Table 1-2 summarizes the operation of the Cisco 770 series data call button.

Table 1-2   Cisco 770 Series Data Call Button Operation Summary

Current Status	Data Call Button Operation
No call up	Make a data call
1 data call only	Disconnect the data call
2 data calls	Disconnect both data calls
1 voice call only	Make a data call
2 voice calls	No action
1 data and 1 voice call	Disconnect the data call

Rear Panels

All Cisco 700 series routers include a DB-9F configuration port. Table 1-3 lists the network interfaces available on each router by model number.

Table 1-3   Cisco 700 Series Router Interfaces by Mode

Model	Interfaces
Cisco 761	1 Ethernet and 1 ISDN BRI S/T
Cisco 762	1 Ethernet, 1 ISDN BRI S/T, and 1 ISDN BRI U
Cisco 765	1 Ethernet, 1 ISDN BRI S/T, and 2 analog telephone
Cisco 766	1 Ethernet, 1 ISDN BRI S/T, 1 ISDN BRI U, and 2 analog telephone
Cisco 771	4-port unmanaged Ethernet hub and 1 ISDN BRI S/T
Cisco 772	4-port unmanaged Ethernet hub, 1 ISDN BRI S/T, and 1 ISDN BRI U
Cisco 775	4-port unmanaged Ethernet hub, 1 ISDN BRI S/T, and 2 analog telephone
Cisco 776	4-port unmanaged Ethernet hub, 1 ISDN BRI S/T, 1 ISDN BRI U, and 2 analog telephone

The rear panels of Cisco 760 series routers are shown in Figure 1-4 through Figure 1-7. Cisco 770 series routers are shown in Figure 1-8 through Figure 1-11.

Figure 1-4   Rear Panel, Cisco 761 Router
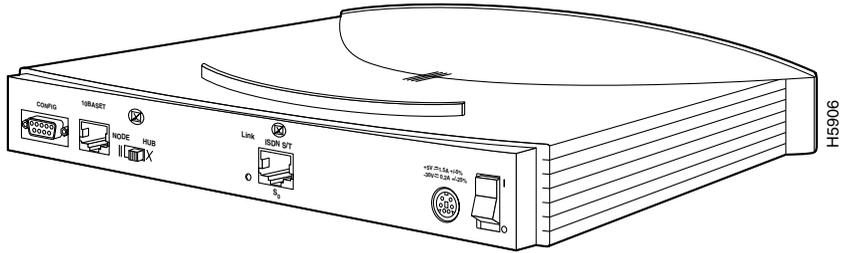
Figure 1-5   Rear Panel, Cisco 762 Router
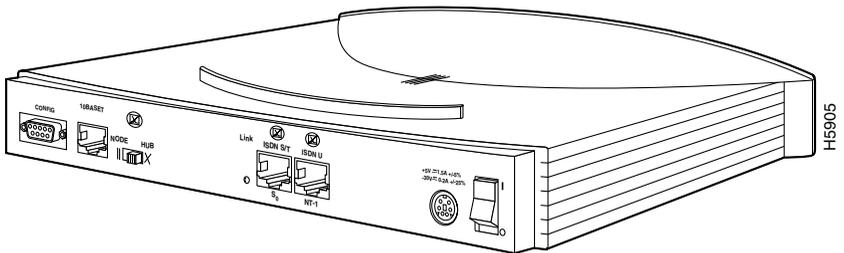
Figure 1-6   Rear Panel, Cisco 765 Router
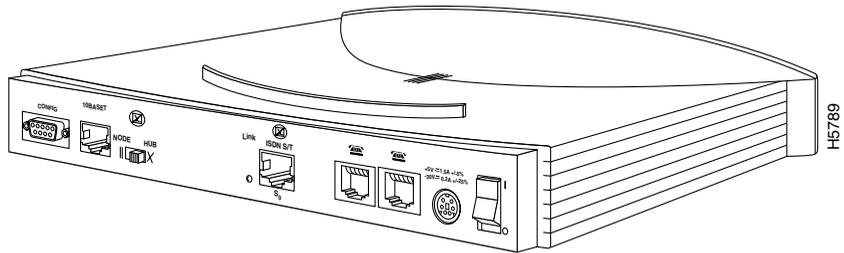
Figure 1-7   Rear Panel, Cisco 766 Router
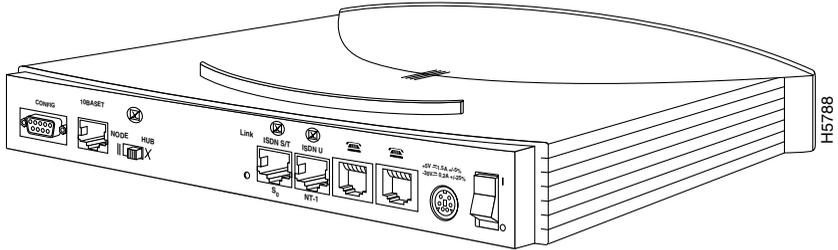
Figure 1-8   Rear Panel, Cisco 771 Router
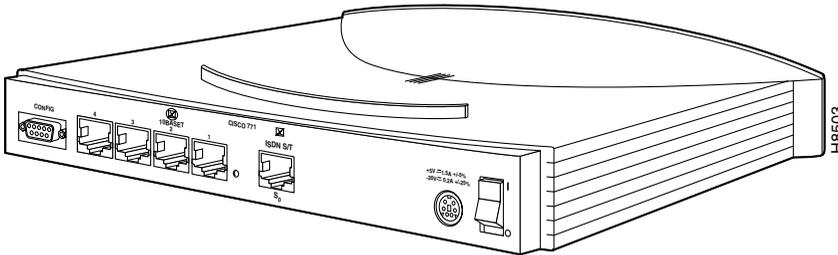
Figure 1-9   Rear Panel, Cisco 772 Router
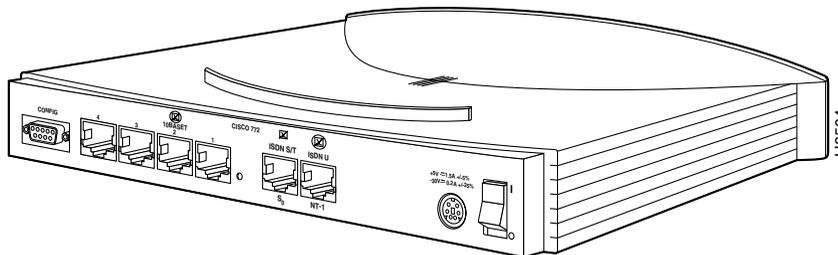
Figure 1-10   Rear Panel, Cisco 775 Router
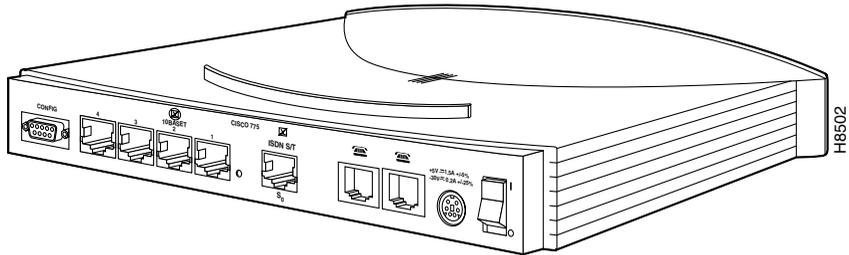
Figure 1-11   Rear Panel, Cisco 776 Router
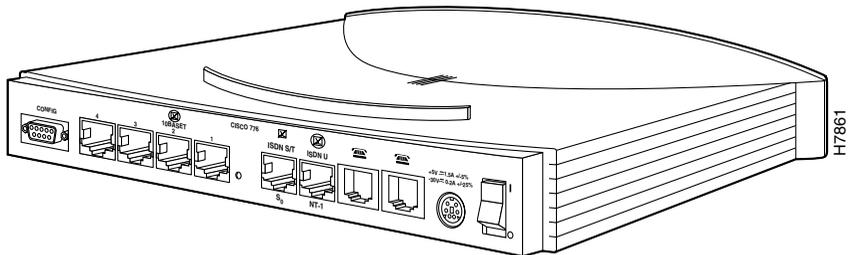
Rear-Panel LINK LED

There is one LED on the rear panel of Cisco 760 series routers, the LINK LED. The LINK LED remains lit when a valid physical connection to another Ethernet device is established. The LINK LED blinks when it is attempting to establish the connection.

Preparing for Installation

This chapter provides information on the following topics:

- Safety

- Preventing Damage to Your Router

- Unpacking Your Router

- Preparing to Install Your Router

- Where To Go From Here

Safety

Observe the caution and warning symbols in this manual. Additional safety information is provided in the *Regulatory, Compliance and Safety Information for* Cisco 700 series router*s*.

Caution   This symbol means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

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.

Before installing the router, read these warnings:

Warning   Read the installation instructions before you connect the system to its power source.

Warning   Before working on any system, turn the power switch to off and unplug the power cord.

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.

Warning   The ISDN connection is regarded as a source of voltage that should be inaccessible to user contact. Do not attempt to tamper with or open any public telephone operator (PTO)-provided equipment or connection hardware. Any hard-wired connection (other than by a nonremovable, connect-one-time-only plug) must be made only by PTO staff or suitably trained engineers.

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.

Warning   Ultimate disposal of this product should be handled according to all national laws and regulations.

Preventing Damage to Your Router

Use the following guidelines when connecting devices to your router:

- Connect the color-coded cables supplied by Cisco to the color-coded ports on the back panel.

- If you must supply additional cables, we strongly recommend ordering the cables from your Cisco 700 series router vendor.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) is a transfer of electrostatic charge between bodies of different electrostatic potentials, such as an operator and a piece of electrical equipment. It occurs when electronic components are improperly handled, and it can damage equipment and impair electrical circuitry. Electrostatic discharge is more likely to occur with the combination of synthetic fibers and dry atmosphere.

Always use the following ESD-prevention procedures when removing and replacing components:

Step 1   Connect the chassis to earth ground with a wire that you provide.

Step 2   Wear an ESD-preventive wrist strap that you provide, ensuring that it makes good skin contact.

Connect the clip to an unpainted surface of the chassis frame to safely channel unwanted ESD voltages to ground. To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis. Always follow the guidelines in the preceding section, "Safety."

Step 3   Do not touch any exposed contact pins or connector shells of interface ports that do not have a cable attached.

If cables are connected at one end only, do not touch the exposed pins at the unconnected end of the cable.

Note   This device is intended for use in residential and commercial environments only.

> ⚠️ **Caution** Periodically check the resistance value of the antistatic strap, which should be between 1 and 10 megaohms (Mohms).

Unpacking Your Router

The contents of your Cisco 700 series router package is as follows:

- One Cisco 700 series router.

- One yellow Ethernet cable.

- One red ISDN U cable (Cisco 772 and Cisco 776 routers only).

- One orange ISDN S/T cable (Cisco 771 and Cisco 775 routers only).

- One RJ-45-to-RJ-11 adapter.

- One blue configuration cable.

- One black power supply.

- One black power supply cord.

- One *Cisco 700 Series Router Installation Guide*.

- One Documentation CD-ROM set. (The *Cisco 700 Series Command Reference* is on Disk 2 of the CD-ROM set.)

- One *Cisco 700 Quick Reference Guide*.

- One Cisco Fast Step CD-ROM. (The CD-ROM is inside the back cover of the *Cisco 700 Quick Reference Guide*.)

These items are shown in the *Cisco 700 Quick Reference Guide*. If any item is missing or damaged, contact your customer service representative.

Preparing to Install Your Router

Before you begin installing your router, perform the following steps:

Step 1 Order an ISDN BRI line from your telephone service provider.

Step 2 If you have a Cisco 761, Cisco 765, Cisco 771, or Cisco 775 router, do the following:

(a) If you are outside North America, ask your telephone service provider if you must provide an external Network Termination 1 (NT1) and the ISDN U cable that connects the NT1 to the ISDN wall jack. Ask for NT1 vendors if necessary.

(b) If you are inside North America, ask your telephone service provider for external NT1 vendors. Provide the ISDN U cable that connects the NT1 to the ISDN wall jack.

Step 3 Be aware of the standard Ethernet and ISDN cable distance limitations.

Step 4 Gather the Ethernet devices to be connected to the router: hub, server, workstation, or PC.

Step 5 If you have a Cisco 761, Cisco 765, Cisco 771, or Cisco 775 router and plan to connect a digital telephone, you must provide an NT1 with two S/T interfaces and one U interface, a telephone cable to connect the telephone (usually this cable is provided with the device), and an ISDN U cable that connects the NT1 to the ISDN wall jack.

Step 6 If you have a Cisco 765, Cisco 766, Cisco 775, or Cisco 776 router and plan to connect an analog telephone, fax, or modem, gather these devices. You must also provide the telephone cable to connect each device (usually this cable is provided with the device).

Step 7 If you plan to configure the software using a terminal or PC connected to the router, provide the terminal or PC.

Where To Go From Here

To install the router, continue to Chapter 3, "Installing Your Router."

Installing Your Router

This chapter describes the tasks necessary to connect your PC or hub through the router to an ISDN line and connect a PC or ASCII terminal to the router for configuration purposes.

Before you begin, it is important to know if the device you are connecting to a hub or a node. Basically, a hub is a device that connects three or more nodes. Nodes are everything else, such as network interface cards (NICs) installed in PCs. For additional information on hubs and nodes, see the "HUB/NODE Switch" section in Chapter 6, "Concepts and Descriptions."

To install your Cisco 700 series router, you must perform the following tasks:

- Connect the Ethernet devices to the router.

- Connect the ISDN line to the router.

- Connect the router to a power source.

- Verify the router installation.

Note   The *Cisco 700 Quick Reference Guide* has diagrams showing common installations.

Connecting Ethernet Devices

The Ethernet ports are marked in yellow on the back panel.

Caution   Do not connect the yellow Ethernet ports on your router to any other port or device, except another Ethernet port. Connecting the cable to the wrong port can damage your router.

To connect Ethernet devices to the router, complete the following steps:

Step 1   If you are connecting to a node, or if you are connecting a Cisco 761, Cisco 762, Cisco 765, Cisco 771, Cisco 772, or Cisco 775 router to a hub, connect the yellow Ethernet cable to the yellow port labeled ETHERNET on the rear panel.

If you are connecting a Cisco 766 or Cisco 776 router to a hub, connect an Ethernet crossover cable (not supplied) to any open Ethernet port.

Step 2   Connect the other end of the cable to the Ethernet connector on the LAN device, such as the Ethernet port of the NIC on the back of your computer. (See Figure 3-1.)

Step 3   Set the HUB/NODE switch if you are connecting a Cisco 700 series router other than a Cisco 766 or Cisco 776 router.

(a)   If your router is connected to another device, such as a NIC in a PC, set the switch in HUB position.

(b)   If your router is connected to an Ethernet hub, set the switch in NODE position. (Cisco 766 or Cisco 776 routers do not have a HUB/NODE switch.)

Figure 3-1   Connecting the Ethernet Cable

Connect yellow cable
to yellow Ethernet port

Connect other end of cable
to server, PC, or workstation
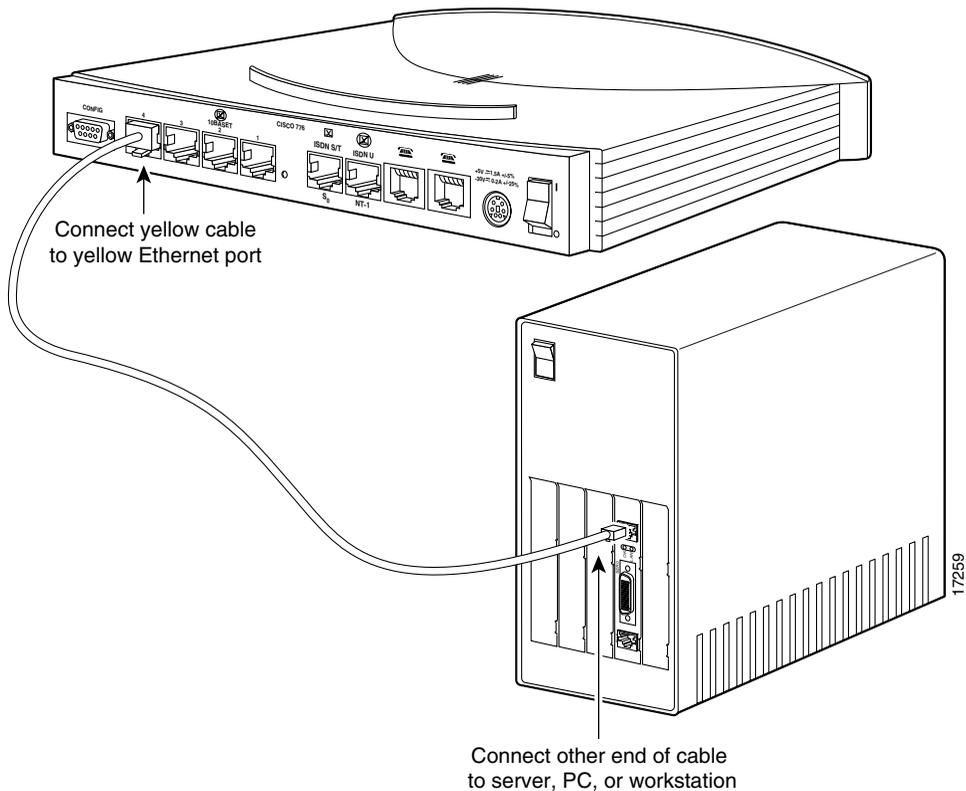
Connecting the ISDN Line

The procedure to connect an ISDN line depends on the router and in some cases your location. The following sections describe each.

Provisioning the NT1

Outside of North America, you might need to provide an external network terminator type 1 (NT1) and the ISDN U cable that connects the NT1 to the ISDN wall jack. Contact your telephone service provider and ask for the following information:

- Is an external NT1 and an ISDN U cable required?

- Does the telephone service provider provide the NT1 or must you supply it?

- If you must supply the NT1, can the telephone service provider provide a list of NT1 vendors?

Inside North America, if you have a 761, 765, 771, or 775, you must provide an external NT1 and the ISDN U cable that connects the NT1 to the ISDN wall jack. Contact your telephone service provider for a list of NT1 vendors. If you have a 762, 766, 772, or 776, you can use the internal NT1 in the router.

Note Detailed information on provisioning your line can be found in Appendix C, "Provisioning the ISDN BRI Line." In addition, the *Cisco 700 Quick Reference Guide* contains a form to guide you in gathering the provisioning information.

Warning Network hazardous voltages are present in the ISDN cable. If you detach the ISDN cable, detach the end away from the router first to avoid possible electric shock. Network hazardous voltages also are present on the system card in the area of the ISDN port (RJ-45 connector), regardless of when power is turned to standby.

Warning Do not work on the system or connect or disconnect cables during periods of lightening activity.

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

Connecting the ISDN Line to the S/T Port

The S/T port connects to some telephone service provider networks using an external NT1. The need for an external NT1 is determined by your telephone service provider network.

Note   If you are interested in the technical aspects of S/T ports, additional information can be found in the "ISDN Ports" section of Chapter 6, "Concepts and Descriptions."

Caution   Always connect the orange cable to the orange S/T port on the router. Do not connect the cable to a yellow Ethernet port. This will damage your router.

To connect an ISDN line to the S/T port of a router when your telephone service provider said that an NT1 is not required, complete the following steps:

Step 1   Connect the orange S/T cable to the orange port labeled S/T on the rear panel of your router.

Step 2   Connect the other end of the orange S/T cable to the ISDN wall socket. (See Figure 3-2.)

Figure 3-2   Connecting to the ISDN S/T Port When an NT1 Is Not Required

Connect orange cable
to orange ISDN S/T port

Connect orange cable
to ISDN wall jack
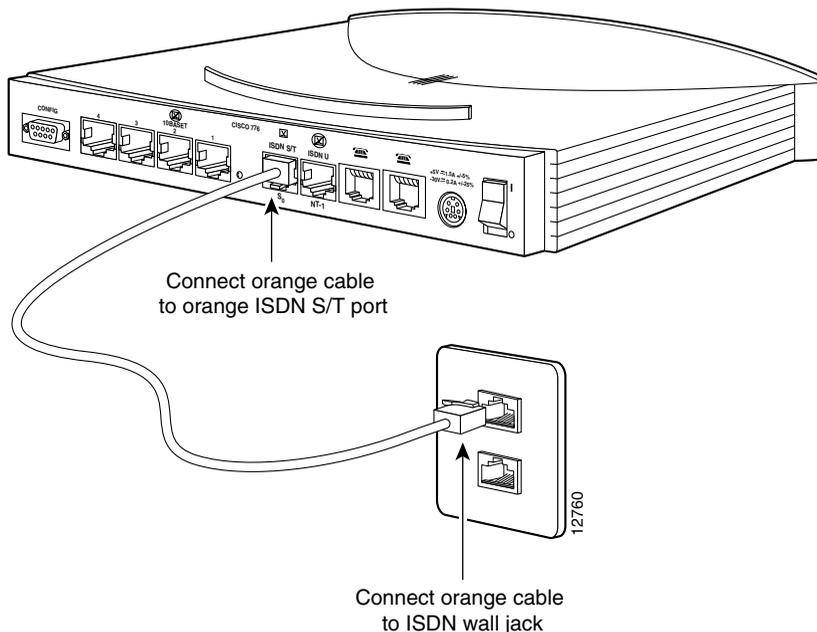
NT1 Required

To connect an ISDN line to the S/T port of a Cisco 761, Cisco 762, Cisco 765, Cisco 771, Cisco 772, or Cisco 775 router when your telephone service provider said that an NT1 is required, complete the following steps:

Step 1   Connect the orange ISDN S/T cable to the orange port labeled ISDN S/T on the rear panel of your router.

Step 2   Connect the other end of the orange ISDN S/T cable to the NT1.

Step 3   Connect the ISDN cable provided with the NT1 to the NT1.

Step 4   Connect the other end of the ISDN cable to the ISDN wall jack.
(See Figure 3-3.)

Figure 3-3   Connecting to the ISDN S/T Port When an NT1 Is Required

Connect NT1
power cord to
electrical outlet

Connect orange cable
to orange ISDN S/T port

Connect orange
cable to NT1

Connect ISDN U
cable to NT1

Connect cable to
ISDN wall jack

17258
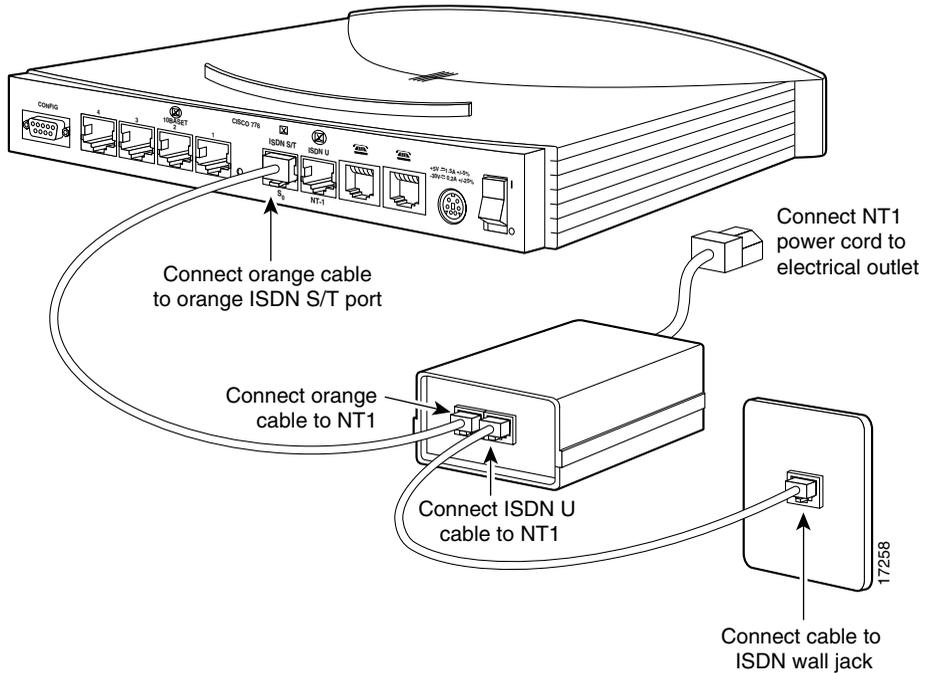
Connecting the ISDN Line to the U Port

The U port connects to the telephone service provider network using the internal NT1.
Figure 3-4 shows the ISDN U port connection.

Caution   Always connect the red cable to the red U port on the router. Do not
connect the cable to a yellow Ethernet port. This will damage your router.

To connect an ISDN line to the U port on a router, complete the following steps.

Step 1   Connect the red ISDN U cable to the red port labeled ISDN U on the rear panel of your router.

Step 2   Connect the other end of the red ISDN U cable to the ISDN wall socket. (See Figure 3-4.)

Figure 3-4   Connecting to the ISDN U Port

Connect red cable to red ISDN U port

Connect red cable to ISDN wall jack

RJ-45-to-RJ-11 adapter cable

If your wall jack has an RJ-11 connector, attach RJ-45-to-RJ-11 adapter cable to red cable, and then connect RJ-11 connector to ISDN wall jack
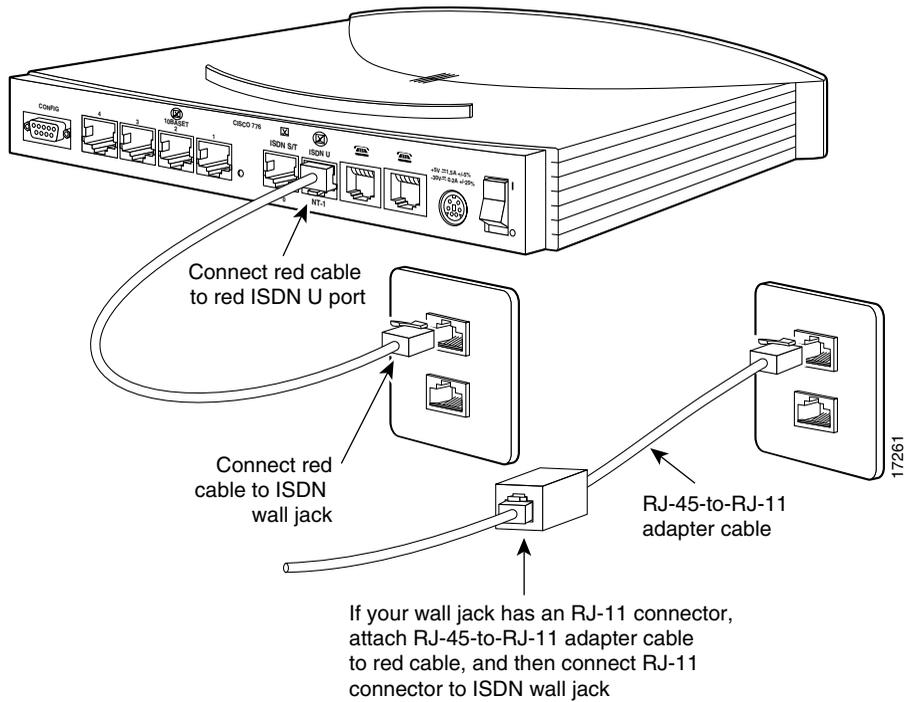
Connecting the Power Supply

⚠️ **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, 16A international) is used on the phase conductors (all current-carrying conductors).

⚠️ **Warning** This equipment is intended to be grounded. Ensure that the host is connected to earth ground during normal use.

To connect the power supply, complete the following steps:

Step 1   Connect the round end of the power supply cable to the black circular power connector on the rear panel of your router.

Step 2   Connect the black power supply cord to the black power supply.

Step 3   Connect the power supply cord to an electrical outlet. (See Figure 3-5.)

Figure 3-5   **Connecting Power Supply (Cisco 765 shown)**
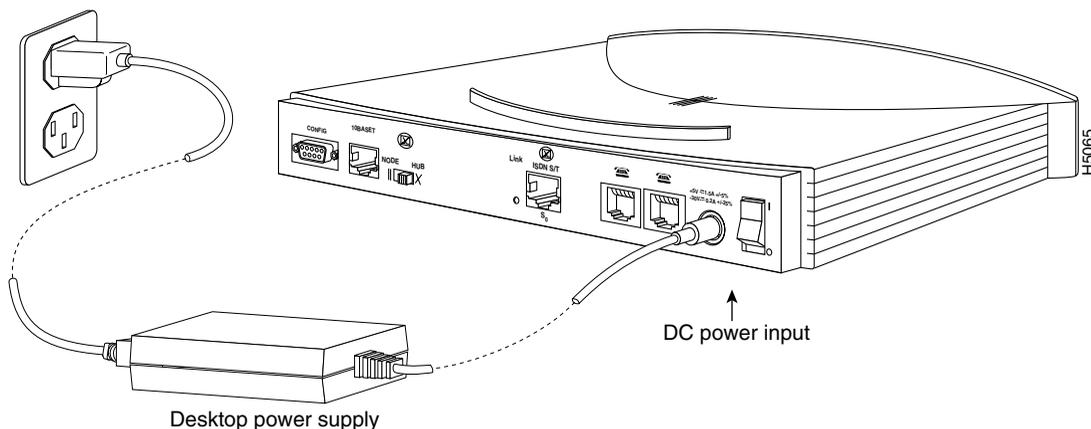
Verifying Installation

When the router is powered on, it is automatically booted, and the router attempts to establish links to the LAN and the WAN.

Compare the LED states with known activity. For example, all LEDs should blink at least once during the boot process, which takes a few minutes. Once the router is booted, you can verify your connections by using the LEDs.

The LAN, CH1, and CH2 LEDs each have companion RDX and TDX LEDs. The RDX and TDX LEDs indicate traffic on the respective channels. Using an application such as a Web browser, verify that the router is receiving data from the WAN. When you access a Web page on the network, the router indicates the transfer of data by turning on the LAN LED and blinking the companion RDX and TDX LEDs. The CH1 LED also turns on and the companion RDX and TDX LEDs blink. The CH2 LED might turn on, depending on the amount of traffic. If the LEDs do not behave as expected, check the physical connections.

Brief descriptions of the LED states as they relate to the physical connections are provided in Table 3-1. All the LEDs are listed, but each router model has a different subset of LEDs.

If your connections are correct and the LEDs are not in the correct state, it might be because the router or PC is not yet configured. If your router is configured and the states are not correct, see Chapter 5, "Troubleshooting Cisco 700 Series Routers."

Table 3-1   Verifying the Connections

LED	Connection	Normal Pattern
RDY	Power	On when the router is powered on.
		Off when the router is powered off.
NT1	ISDN U port	On when connected. Blinks when not connected.
LINE	ISDN U or S/T port	On when connected. Off when not connected.
LAN	Ethernet	On for 1 minute after boot.
		Off if there is no traffic on the LAN for 1 minute.

Table 3-1   Verifying the Connections (continued)

LED	Connection	Normal Pattern
RDX	Ethernet	Off when there is no traffic on the network.
		On when there is traffic is received from the network.
TDX	Ethernet	Off when there is no traffic on the network.
		On when there is traffic is transmitted to the network.
LINK, LK1, LK2, LK3, LK4	Ethernet	On when a connection from the Ethernet port to an Ethernet device is established.
		Blinks while attempting to establish a connection.
		Off when there is no connection.
CH1, CH2	ISDN U or S/T port	On when the router has an active voice or data connection to the WAN or the channel has not yet timed out after the connection was closed.
		Off when there is no active connection to the WAN and the channel has timed out.
PH1 and PH2[1]	Analog telephone, fax, or modem	On when telephone, fax, or modem is in use.
		Off when not in use.

1   You can also pick up the handset and listen for a dial tone.

Where To Go From Here

You have completed the basic hardware installation. You can add digital or analog telephone devices if desired. For additional information, see Chapter 4, "ISDN and Analog Telephone Devices."

If your router has been preconfigured by your vendor or a service provider, you should be able to turn on your PC, enter the configuration parameters for the PC (your service provider or network administrator provides these instructions), and connect to the Internet or your corporate network. Once the connection is established, the installation is complete.

If your router is not preconfigured, gather the information listed in *Cisco 700 Quick Reference Guide*. This information is commonly available from your ISDN service provider (telephone company) and the network administrator of the central site network or your Internet service provider.

Cisco strongly recommends that you use the Cisco 700 Fast Step Setup application unless you have been instructed to do otherwise. Cisco 700 Fast Step applications are located on the CD-ROM inside the *Cisco 700 Quick Reference Guide*.

If you are an experienced user and want to use the command-line interface (CLI) to configure the software or have been instructed to do so, refer to the *Cisco 700 Series Command Reference* for a list of the commands and some configuration examples.

ISDN and Analog Telephone Devices

This chapter describes how to connect an ISDN or analog telephone to a Cisco 700 series router and how to configure the router to support that telephone. An ISDN telephone can be connected to the ISDN S/T port of any Cisco 700 series router. An analog telephone can be connected to a Cisco 765, Cisco 766, Cisco 775, or Cisco 776 router basic telephone service port (also known as "plain old telephone service" or "POTS" port).

Note During a voice call, if the remote party hangs up the receiver and your receiver remains off-hook, you will hear a fast busy tone after 30 seconds.

Connecting an ISDN (Digital) Telephone

You can connect an ISDN telephone to any Cisco 700 series router with an S/T port. The ISDN telephone communicates over the same ISDN line the router uses to send and receive data. ISDN telephones are available in two basic models, self-powered (described in the section "Connecting a Self-Powered Digital Telephone") and with an independent power supply (described in the section "Connecting a Digital Telephone with an External Power Supply").

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 (indicated by a clicking sound) by an incoming call.

> ⚠️ **Caution**   Do not connect the router telephone ports to the telephone wall jack. These ports are not meant for direct connection to a public network. This connection can damage your router.

Connecting a Self-Powered Digital Telephone

You can connect an ISDN telephone to the Cisco 761, Cisco 765, Cisco 771, or Cisco 775 only through an external NT1 connector. If you are connecting an ISDN telephone directly to the Cisco 762, Cisco 766, Cisco 772, or Cisco 776, connect the ISDN telephone cable (provided with the ISDN telephone) to the RJ-45 port labeled ISDN S/T on the rear panel of the router. Cable the ISDN wall jack to the port labeled ISDN U. (See Figure 4-1.)

Refer to the instructions provided by the manufacturer of the telephone.

Figure 4-1   ISDN Telephone to Router Connection (Cisco 766 Shown)
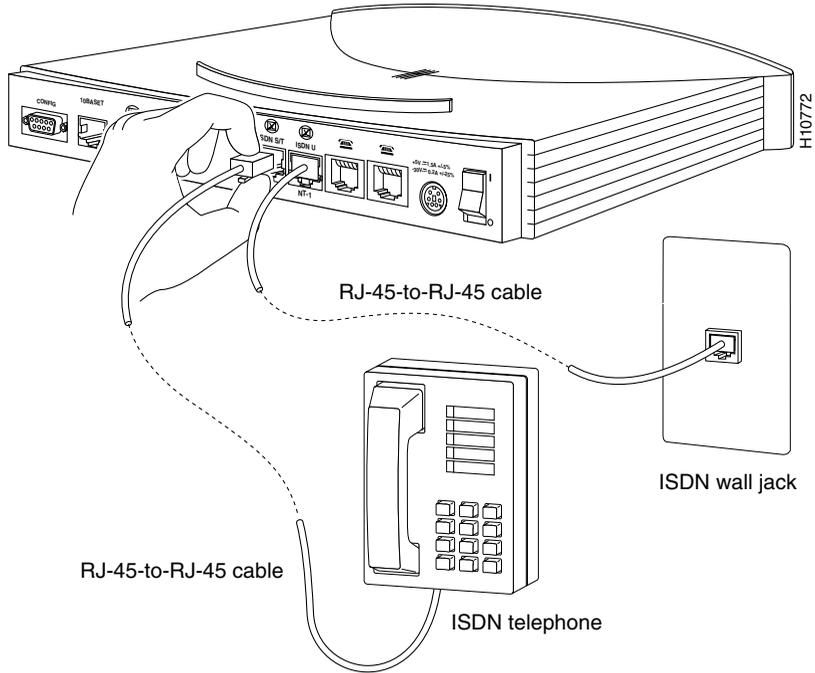
Connecting a Digital Telephone with an External Power Supply

This section describes how to connect an ISDN telephone that requires an external power supply to the router. Depending upon the ISDN telephone model and power supply model you use, the procedure to connect the ISDN telephone and power supply might differ slightly. This example procedure describes how to connect an AT&T ISDN telephone (model ISDN 8510T) and an AT&T external power supply (model MSP-1). Also refer to the instructions provided by the manufacturer of the telephone.

You must provide the following equipment:

- NT1 with two S/T interfaces and one U interface.

- Telephone cable to connect digital telephone. (This cable is usually provided with the telephone.)

- ISDN U cable that connects the NT1 to the ISDN wall jack.

Take the following steps to connect the ISDN telephone and external power supply. This procedure assumes you have connected the ISDN U port to the ISDN wall jack (see Figure 4-1).

Step 1   Connect an RJ-45-to-RJ-45 cable (included) from the ISDN S/T port (on the rear panel of the router) to the port labeled LINE on the ISDN telephone power supply. (See Figure 4-2.)

Step 2   Connect the ISDN telephone RJ-45 cable to the port labeled PHONE on the ISDN telephone power supply. (See Figure 4-2.)

Step 3   Connect the telephone power supply to the power outlet.

You can now use the ISDN telephone on the same ISDN line as the router.

Figure 4-2   Router to ISDN Power Supply Connection (Cisco 766 Shown)

From ISDN S/T port

Power supply for ISDN telephone

RJ-45-to-RJ-45 cable
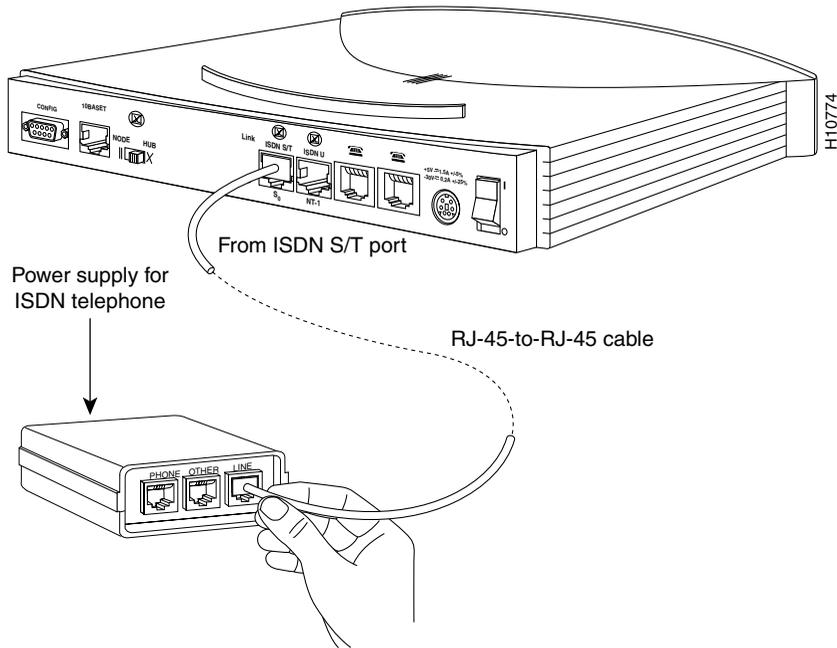
Connecting an Analog Telephone Device

If you are using a Cisco 765, Cisco 766, Cisco 775, or Cisco 776, you can connect one or two analog devices, such as a telephone, fax machine, or modem, directly to the router. The analog device is connected to basic telephone services through the same ISDN line the router uses.

Also, if you are outside of North America, you might need to provide an adapter cable for the type of connector that your device uses (the telephone uses an RJ-11 connector.)

To connect the analog device to the router, connect the telephone cable (provided with the analog device) to the RJ-11 port (labeled with a telephone icon) on the rear panel of the router, as shown in Figure 4-3.

Figure 4-3   Analog Telephone to Router Connection (Cisco 766 Shown)
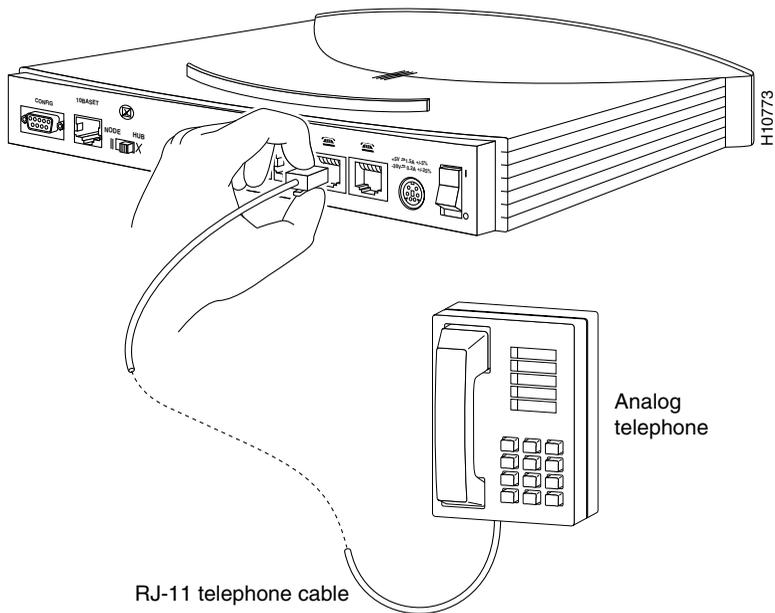
Supplementary Services

This section describes how to configure the Cisco 765, Cisco 766, Cisco 775, and Cisco 776 routers for supported supplementary services. These are the only models that support the following supplementary services:

- Call Waiting

- Call Hold and Retrieve

- Call Transfer

- Three-Way Call Conferencing

Cisco 700 series routers do not support Open Service Intervals or Battery Reversal.

Note To use DTMF commands from the telephone keypad, the **set local access** command must be set to **on**.

Note In this section, the term *on-hook* means to hang up the telephone.

Call Waiting

Call waiting sounds a tone if you are already on a call and there is a second incoming call. Your BRI line must be provisioned for the additional call offerings (ACOs) call hold and call retrieve to use call waiting. (For more information on ACOs, refer to the appendix "Provisioning the ISDN BRI Line.") One analog telephone interface can support two calls; therefore, only one call at a time can be waiting.

To retrieve the new call, perform a flash or short on-hook (quickly press the telephone receiver button once) to place the call in progress on hold and answer the new call. If your analog telephone offers the option, you can press the **Flash** key instead of the telephone receiver button to put the call on hold and answer the new call.

You can toggle between calls on the same analog telephone interface by performing the short on-hook or by using the **Flash** key.

If you terminate one call and return the receiver to the hook, the waiting call remains active. The telephone rings, and when you pick up the receiver, you are connected to the waiting call.

The **set callwaiting** command enables call waiting for the analog port specified. Following is an example of the **set callwaiting** command that turns on the call waiting feature on the phone1 port:

```
766> set callwaiting interface phone1 on
```

Disabling Call Waiting

Depending upon the devices connected to the analog telephone ports, it might be necessary to disable call waiting, for example, if the tone generated by the call waiting service interrupts data transfer when using an analog fax machine connected to the router. (Consult the instructions provided by the manufacturer of the device to determine if this is necessary.)

The **set callwaiting** command disables call waiting for the analog port specified. Following is an example of the **set callwaiting** command that turns off the call waiting feature on the phone1 port:

```
766> set callwaiting interface phone1 off
```

Disabling Call Waiting on a Per-Call Basis

When making an outgoing voice call over one of the analog telephone ports, you might want to disable the call waiting feature on a per-call basis. To disable call waiting, use the dual tone multifrequency (DTMF) command, dialed on the keypad of the telephone, as shown in the following example:

```
**99#
```

When the voice call is completed, call waiting is restored.

Call Hold and Retrieve

Call hold and retrieve is the ability to place a caller on hold, make a second call, and return to the first call. (Some countries that use the NET3 switch do not support ISDN provisioning for call hold and call retrieve.)

To place a call on hold:

Step 1   Perform a short on-hook (quickly press the telephone receiver button once) to get a dial tone.

If your analog telephone device offers the option, you can press the **Flash** key instead of the short on-hook to put the call on hold.

Step 2   Dial the hold access number, ****95#**.

Step 3   Dial the second call.

To retrieve the call placed on hold, perform the short on-hook or press the **Flash** key again.

If you have a call on hold and you hang up, the telephone rings, indicating a call is on hold. Picking up the telephone receiver connects you to the caller on hold.

Call Transfer

Call transfer is the ability to transfer an active call to another number. (Some countries that use the NET3 switch do not support ISDN provisioning for call transfer.)

Take the following steps to transfer an active incoming call to another telephone number:

Step 1   Perform a short on-hook (quickly press the telephone receiver button once) to get a dial tone.

If your analog telephone device offers the option, you can press the **Flash** key instead of the short on-hook to put the call on hold.

You can also return to the original call by performing another short on-hook.

Step 2   Dial the number to which the call is to be transferred.

Step 3   Hang up the receiver. The call is transferred.

If the transfer fails, the caller remains on hold, and the telephone rings to alert you to the call on hold.

Three-Way Call Conferencing

Three-way call conferencing adds another party to an active call. (Some countries that use the NET3 switch do not support ISDN provisioning for three-way call conferencing.) Up to three people can be connected using three-way conferencing. (It is a known limitation that no more than two Cisco 700 series routers can be connected.)

Take the following steps to add a third party to an active call:

Step 1   Perform a short on-hook (quickly press the telephone receiver button once) to get a dial tone.

If your analog telephone device offers the option, you can press the **Flash** key instead of the short on-hook to put the call on hold.

Step 2   Dial the second call.

Step 3   When the second call is answered, perform a short on-hook to connect the original caller.

Country-Specific Dialing Instructions

Integrated Network Service (INS) ISDN lines are used in Japan. NET3 lines are used throughout Europe and parts of Asia. 1TR6 ISDN lines are used throughout Europe. This section describes analog telephone dialing instructions specific to these countries.

Dialing with INS ISDN Lines for Japan

To make an analog telephone call over INS ISDN lines in Japan from a telephone connected to Cisco 700 series routers, take the following steps:

Step 1   Enter each individual number (called a dialing digit) of the telephone number on the telephone keypad.

You must enter each successive dialing digit within 6 seconds of entering the previous digit. If you wait longer than 6 seconds, an incomplete set of dialing digits is sent to the switch.

Step 2   Send the entire set of dialing digits to the switch in one of the following ways:

- Press the **pound** (#) key on the telephone keypad.

- Wait 6 seconds without entering any more dialing digits on the telephone keypad. After 6 seconds, the set of dialing digits is automatically sent to the switch.

Disabling the Pound Key's End-of-Dial Function

If the **pound** (#) key is one of the dialing digits in a telephone number, you can disable the end-of-call function on a per-call basis. This command applies only to INS router software.

To disable the end-of-call function, use the following DTMF command:

    **98#

After entering the ****98#** command, wait for the dial tone and enter the desired dialing digits, including the **pound** (#) key. The call is sent 6 seconds after the last dialing digit is entered. When the call is terminated, the end-of-call function is restored for the next call.

Internal Tones for NET3 and 1TR6 ISDN Lines for Europe

Depending on the ISDN service provider, certain internal tones, such as dial, ring back, and busy tones, might not be provided by the telephone switch (the device on the other end of the ISDN line). If this is the case with the ISDN line you are using, you can configure Cisco 700 series routers to provide just the dial tone or all tones. This command applies only to NET3 router software and to 1TR6 router software.

The **set internaltones** command provides just the dial tone or all internal tones. By default, the router provides all internal tones.

The following is an example of a **set internaltones** command that enables the dial tone only:

    766> set internaltones dialtone

Call Forwarding in Sweden and Finland

Call Forwarding supplementary service has been added to software Release 4.0(2) and higher for Sweden and Finland (NET3). The Call Forwarding types supported are as follows:

Call Forwarding Unconditional (CFU)—Enables the network to redirect all incoming calls to another party, regardless of the status of the user.

Call Forwarding No Reply (CFNR)—Enables the network to redirect calls to another party when the call is not established within a predefined period of time.

Call Forwarding Busy (CFB)—Enables the network to redirect to another party calls that meet a busy condition.

In all types of Call Forwarding, the user's ability to originate calls is unaffected by the Call Forwarding supplementary service.

The feature numbers for Call Forwarding are provided here for convenience, but they could be different in your area, depending upon the local telephone service provider.

To activate Call Forwarding:

Step 1   Take the phone off hook.

Step 2   Dial *feature number* phone number to be forwarded to #.

Step 3   Hang up. You might hear a confirmation signal from the network before you hang up.

To deactivate Call Forwarding:

Step 1   Take the phone off hook.

Step 2   Dial #feature number#.

   If the wrong feature number is entered, you might hear a signal indicating the wrong feature number was entered or the activation or deactivation failed.

Call Forwarding Unconditional

Activation: ***21***forwarded-to number#

Deactivation: **#21#**

Call Forwarding No Reply

Activation: ***61***forwarded-to number#

Deactivation: **#61#**

Call Forwarding Busy

Activation: ***67****forwarded-to number#*

Deactivation: **#67#**

The switch type NET3 supports these features where the country group must be set for Sweden and Finland.

There is no equivalent command-line command to activate or deactivate Call Forwarding. The phone number to which calls are redirected is not displayed.

All types of Call Forwarding supplementary services must be provisioned on the ISDN line for the service to be available.

Where To Go From Here

If your router has been preconfigured, there is nothing more to do except power on the router.

If you are using the Cisco 700 Fast Step Setup application to configure your router, it includes steps to configure the digital and analog devices attached to your router. Cisco 700 Fast Step applications are on the CD-ROM inside the *Cisco 700 Quick Reference Guide*.

If you are an experienced user and want to use the command-line interface (CLI) to configure the digital and analog devices or have been instructed to do so, refer to the *Cisco 700 Series Command Reference* for a list of the commands and some configuration examples. The *Cisco 700 Series Command Reference* is on the Documentation CD.

Troubleshooting Cisco 700 Series Routers

This chapter helps you find solutions to problems you might be having with your router. Begin by attempting to isolate the problem to a specific source.

Power-On Self-Test

When the router is powered on, it performs a series of self-tests. After these tests are completed, the LEDs indicate operating status. Any operational problem is represented by a combination of lit and unlit LEDs. Cisco 760 series routers have 12 to 14 (depending on the model) LEDs on the front panel. Cisco 770 series routers have 15 to 18 LEDs on the front panel.

Note   The function of each LED is described in the "Front-Panel LEDs" section of Chapter 1, "Overview."

LED Diagnostics

The front-panel LEDs can be used for diagnostic purposes. Table 5-1 lists the combinations of lit and unlit LEDs and their significance.

To verify your Ethernet connection, check that one of the following LEDs is on:

Table 5-1   LED Error Messages

RDY	NT1	LINE	CH1	CH2	Test Result
On	Blinks several times a second	Off	Off	Off	Internal NT1 is unable to synchronize with the ISDN switch.

Table 5-1   LED Error Messages (continued)

RDY	NT1	LINE	CH1	CH2	Test Result
On	Blinks once a second	Off	Off	Off	Internal NT1 is synchronized with the ISDN switch, but is unable to synchronize with the ISDN terminal devices.
Off	Off	On	Off	Off	Waiting for software.
On	Off	On	On	On	Processor inactive.
Off	Off	Off	Off	Off	Processor self-test error.
Off	Off	Off	Off	On	EPROM[1] checksum error.
Off	Off	Off	On	Off	RAM error.
Off	Off	Off	On	On	Flash memory error.
Off	Off	On	Off	On	HDLC[2] packet chip error.
Off	Off	On	On	Off	Configuration port error.
Off	Off	On	On	On	ISDN interface chip error.

1   EPROM = erasable programmable read-only memory.
2   HDLC = High-Level Data Link Control.

TWAIT Timer

During initialization (power-up or reboot), with the switch type set to NI1, the following message displays:

```
host> Please wait for TWAIT timer to expire in __ seconds
host> Make a call to bypass this timer
```

The timer value varies from 1 second to 5 minutes. Upon expiration of the time, the router requests a terminal endpoint identifier (TEI) and initiates SPID initialization as usual. If needed, either a voice or data call can be initiated instead of waiting for the timer to expire. This stops the timer immediately and allows initialization to continue.

Note that the call will be successful unless the ISDN line has not been given enough time to *rest* before power-up or reboot.

Communicating with the WAN

This section describes the problems and solutions commonly found in Cisco 700 series router configurations.

Terminal Identifier or SPID Problems

Either of the following messages received on your terminal might indicate a SPID configuration problem:

```
Channel Not Available

Facility Not Subscribed
```

Check for the following conditions:

- The wrong ISDN switch type was set. Change the switch type by using the **set switch** command or the Cisco 700 Fast Step Setup application.

- The ISDN line was incorrectly configured by the ISDN service provider. Confirm the line configuration with the ISDN service provider.

- The SPIDs were not entered or were entered incorrectly. Enter or change the SPIDs by using the **set spid** command or the Cisco 700 Fast Step Setup application.

Outgoing Calls Cannot be Initiated

If outgoing calls are unsuccessful, check for the following conditions:

- A telephone number was not correctly configured. Enter or change the number with the **set number** command or the Cisco 700 Fast Step Setup application.

- The ISDN B channel is under operator control and does not respond to the router. Contact your ISDN service provider.

- The SPIDs were not entered or were entered incorrectly. Enter or change the SPIDs by using the **set spid** command or the Cisco 700 Fast Step Setup application.

Outgoing Calls are Rejected

If an outgoing call is initially successful and then rejected, check for the following conditions:

- A telephone number was incorrectly configured with the **set number** command.

- To resolve error messages such as "Incompatible Destination," use the **set number** command to enter a 1 at the beginning of the number, even if the number called is in the same area code. (Some networks require the 1 to connect a data call at 64 kbps.)

- The number called is busy. Try the call again.

- The ISDN line was incorrectly configured by the ISDN service provider. Confirm the line configuration with the ISDN service provider.

- If using authentication, the client password or secret might not match the remote router's host password or secret.

Incoming Calls Not Received

If the router places outbound calls without any problems, but cannot receive incoming calls, check the following:

- Verify the directory numbers are set correctly. Enter or change the number with the **set directory number** command or the Cisco 700 Fast Step Setup application.

- ISDN line provisioning is correct. Confirm the line configuration with the ISDN service provider.

- PPP host secret and password match the client secret and password. Confirm the passwords with the ISDN service provider.

- A profile with a name matching the client host name exists. Rename or delete the profile.

Router Calls Itself

ISDN supports two separate logical data channels on the same physical line. If these two numbers are the same, the router might attempt to call itself when on-demand dialing is enabled or if the user issues the **call** command.

If the router calls itself, check that the number configured with the **set number** command is not the same as the number configured with the **set directory number** command.

Communicating with the LAN

If you have problems communicating with a 10BaseT Ethernet LAN device (such as your PC), do the following:

- Verify the LINK LED on the back panel of all models except Cisco 766 or Cisco 776 routers or at least one of the link (LK1, LK2, LK3, or LK4) LEDs on Cisco 766 or Cisco 776 routers is on, indicating the router is communicating with the LAN device. If the LED is blinking, it is attempting to establish a connection. Check the Ethernet cables or the device attached to the other end of the cable, such as the network interface card (NIC) in your PC.

- Verify the LAN LED on the front panel is lit, indicating the router is communicating with the LAN device. If the LED is blinking, it is attempting to establish a connection. Check the Ethernet cables or the device attached to the other end of the cable, such as the NIC in your PC.

- Check the HUB/NODE switch located on the back panel of all models except Cisco 766 or Cisco 776 routers. This switch eliminates the need for an Ethernet crossover cable when connecting to a hub. If it is in the wrong position, it will not cause any damage to the equipment; however, the signals will not be sent to the correct location. If you are connecting directly to a PC, the switch should be in the HUB position. If you are connecting to a hub, the switch should be in the NODE position.

Note For a description of the HUB/NODE switch function, see "HUB/NODE Switch" section in Chapter 6, "Concepts and Descriptions."

Inband Timeout Violation

The Inband Timeout Violation error message indicates the router cannot communicate with the remote device after an ISDN connection had been established. This might be caused by the speed of the connection. Under some conditions, the router attempts to connect at 56 kbps, and the remote device attempts to connect at 64 kbps. The data becomes unusable. Set the speed to 64 kbps, and attempt the connection again.

ISDN BRI Cause Values

This section describes ISDN BRI standard cause values that might be received from the ISDN switch when using Cisco 700 series routers. These values are sent from the ISDN switch to the router to indicate ISDN call status.

Although ISDN service providers generally define cause messages with decimal values, Cisco 700 series routers display the hexadecimal (or *hex*) translation of the decimal value.

Table 5-2 lists the ISDN BRI cause values, the hexadecimal translation, the cause message, and a short definition of the cause message. Cause values are standardized; however, each ISDN service provider uses its own version of the cause message wording. Therefore, the cause messages shown in Table 5-2 might not match the messages exactly as they appear on the terminal.

Table 5-2   ISDN BRI Cause Values and Cause Messages

Cause Value[1]	Hex Value[2]	Cause Message	Definition
1	0001	Unassigned number	The ISDN number was sent to the switch in the correct format; however, the number is not assigned to any destination equipment.
2	0002	No route to specified transit network	The ISDN exchange is asked to route the call through an unrecognized intermediate network.
3	0003	No route to destination	The call was routed through an intermediate network that does not serve the destination address.

Table 5-2   ISDN BRI Cause Values and Cause Messages (continued)

Cause Value[1]	Hex Value[2]	Cause Message	Definition
6	0006	Channel unacceptable	The service quality of the specified channel is insufficient to accept the connection.
7	0007	Call awarded and delivered	The user is assigned an incoming call that is connected to a channel with an established call.
16	0010	Normal call clearing	Normal call clearing has occurred.
17	0011	User busy	The called system acknowledges the connection request, but is unable to accept the call because all B channels are in use.
18	0012	No user responding	The connection cannot be completed because the destination does not respond to the call.
19	0013	No answer from user (user alerted)	The destination responds to the connection request, but fails to complete the connection within the prescribed time. The problem is at the remote end of the connection.
21	0015	Call rejected	The destination is capable of accepting the call, but rejected the call for an unknown reason.
22	0016	Number changed	The ISDN number used to set up the call is not assigned to any system. (If an alternate address is assigned to the called equipment, it might be returned in the diagnostic field of this message.)
26	001A	Non-selected user clearing	The destination is capable of accepting the call, but rejected the call because it was not assigned to the user.
27	001B	Destination out of order	The destination cannot be reached because the interface is not functioning correctly, and a signaling message cannot be delivered. This might be a temporary condition, but could last for an extended period of time. For example, the remote equipment might be turned off.

Table 5-2   ISDN BRI Cause Values and Cause Messages (continued)

Cause Value[1]	Hex Value[2]	Cause Message	Definition
28	001C	Invalid number format	The connection could be established because the destination address was presented in an unrecognizable format or because the destination address was incomplete.
29	001D	Facility rejected	The facility requested by the user cannot be provided by the network.
30	001E	Response to STATUS ENQUIRY	The status message was generated in direct response to the receipt of a status inquiry message.
31	001F	Normal, unspecified	Reports the occurrence of a normal event when no standard cause applies. No action required.
34	0022	No circuit/channel available	The connection cannot be established because no appropriate channel is available to take the call.
38	0026	Network out of order	The destination cannot be reached because the network is not functioning correctly, and the condition might last for an extended period of time. An immediate reconnect attempt will probably be unsuccessful.
41	0029	Temporary failure	An error occurred because the network is not functioning correctly. The problem will be resolved shortly.
42	002A	Switching equipment congestion	The destination cannot be reached because the network switching equipment is temporarily overloaded.
43	002B	Access information discarded	The network cannot provide the requested access information.
44	002C	Requested circuit/channel not available	The remote equipment cannot provide the requested channel for an unknown reason. This might be a temporary problem.
47	002F	Resource unavailable, unspecified	The requested channel or service is unavailable for an unknown reason. This might be a temporary problem.

Table 5-2   ISDN BRI Cause Values and Cause Messages (continued)

Cause Value[1]	Hex Value[2]	Cause Message	Definition
49	0031	Quality of service unavailable	The requested quality of service (as defined by CCITT[3] recommendation X.213) cannot be provided by the network. This might be a subscription problem.
50	0032	Requested facility not subscribed	The remote equipment supports the requested supplementary service, but only by subscription.
57	0039	Bearer capability not authorized	The user requested a bearer capability (BC) that the network provides, but that the user is not authorized to use. This might be a subscription problem.
58	003A	Bearer capability not presently available	The network normally provides the requested BC, but not at the present time. This might be due to a temporary network problem or to a subscription problem.
63	003F	Service or option not available, unspecified	The network or remote equipment was unable to provide the requested service option for an unspecified reason. This might be a subscription problem.
65	0041	Bearer capability not implemented	The network cannot provide the bearer capability (BC) requested by the user.
66	0042	Channel type not implemented	The network or the destination equipment does not support the requested channel type.
69	0045	Requested facility not implemented	The remote equipment does not support the requested supplementary service.
70	0046	Only restricted digital information bearer is available	The network is unable to provide unrestricted digital information BC.
79	004F	Service or option not available, unspecified	The network or remote equipment is unable to provide the requested service option for an unspecified reason. This might be a subscription problem.

Table 5-2   ISDN BRI Cause Values and Cause Messages (continued)

Cause Value[1]	Hex Value[2]	Cause Message	Definition
81	0051	Invalid call reference value	The remote equipment received a call with a call reference that is not currently in use on the user-network interface.
82	0052	Identified channel does not exist	The receiving equipment is requested to use a channel that is not activated on the interface for calls.
83	0053	A suspended call exists but this call identity does not	The network received a call resume request. The call resume request contained a Call Identify information element that indicates that the call identity is being used for a suspended call.
84	0054	Call identity in use	The network received a call resume request. The call resume request contained a Call Identify information element that indicates that it is in use for a suspended call.
85	0055	No call suspended	The network received a call resume request when there was not a suspended call pending. This might be a transient error that will be resolved by successive call retries.
86	0056	Call having requested call identity has been cleared	The network received a call resume request. The call resume request contained a Call Identity information element, which once indicated a suspended call. However, the suspended call was cleared either by timeout or by the remote user.
88	0058	Incompatible destination	Indicates that an attempt was made to connect to non-ISDN equipment, for example, to an analog line.
91	005B	Invalid transit network specified	The ISDN exchange was asked to route the call through an unrecognized intermediate network.
95	005F	Invalid message, unspecified	An invalid message was received, and no standard cause applies. This is usually due to a D-channel error. If this error occurs systematically, report it to your ISDN service provider.

Table 5-2   ISDN BRI Cause Values and Cause Messages (continued)

Cause Value[1]	Hex Value[2]	Cause Message	Definition
96	0060	Mandatory information element is missing	The receiving equipment received a message that did not include one of the mandatory information elements. This is usually due to a D-channel error. If this error occurs systematically, report it to your ISDN service provider.
97	0061	Message type non-existent or not implemented	The receiving equipment received an unrecognized message, either because the message type was invalid or because the message type was valid but not supported. Cause 97 is due to either a problem with the remote configuration or a problem with the local D channel.
98	0062	Message incompatible with call state or message type non-existent	The remote equipment received an invalid message, and no standard cause applies. Cause 98 is due to a D-channel error. If this error occurs systematically, report it to your ISDN service provider.
99	0063	Information element nonexistent or not implemented	The remote equipment received a message that includes information elements, which were not recognized. This is usually due to a D-channel error. If this error occurs systematically, report it to your ISDN service provider.
100	0064	Invalid information element contents	The remote equipment received a message that includes invalid information in the information element. This is usually due to a D-channel error.
101	0065	Message not compatible with call state	The remote equipment received an unexpected message that does not correspond to the current state of the connection. This is usually due to a D-channel error.
102	0066	Recovery on timer expiry	An error-handling (recovery) procedure was initiated by a timer expiration. This is usually a temporary problem.
111	006F	Protocol error, unspecified	An unspecified D-channel error when no other standard cause applies.

Table 5-2   ISDN BRI Cause Values and Cause Messages (continued)

Cause Value[1]	Hex Value[2]	Cause Message	Definition
127	007F	Interworking, unspecified	An event occurred, but the network does not provide causes for the action that it takes. The precise problem is unknown.
UNKNOWN	–	Unknown or local error	An event occurred, but the network does not provide causes for the action that it takes. The precise problem is unknown.

1   Cause value is shown in decimal format.
2   Hex value = hexadecimal translation of the decimal cause value.
3   CCITT = Consultative Committee for International Telegraph and Telephone.

Concepts and Descriptions

This chapter provides technical explanations of many of the features of the Cisco 700 series router. Although this information is not required to successfully install the router, it might be of interest and assist with troubleshooting efforts.

Definition of Terms and Acronyms

This section defines some networking terms you will encounter when gathering required information and using Cisco 700 series router manuals to configure the router.

Access code

A number that must be dialed preceding the telephone number to dial outside of a specific telephone system, such as a Centrex system.

AT commands

ATtention commands (used for modem communications)

BT

British Telecom

Challenge Handshake Authentication Protocol (CHAP)

A form of PPP authentication that requires an exchange of user names and secrets (encrypted passwords) between two devices. This security feature is supported on lines using PPP encapsulation. CHAP passwords are called *secrets* because they are sent encrypted. Both devices must support PPP.

Directory numbers

The equivalent of telephone numbers. This is the number the router dials to connect to a remote router. ISDN BRI lines are generally assigned two local directory numbers, one for each B channel.

EPOS

Electronic Point of Sale

IE

Information Element of a Q.931 message

Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI)

A digital communication medium that operates over existing analog telephone lines. The BRI provides two 64-kbps B channels (for voice and data) and one 16-kbps D channel (for customer and call information). This channel combination is sometimes denoted as 2B+D.

Internet Protocol (IP) address

A network address that uniquely identifies a device on an IP network. This type of address consists of 4 bytes, represented as decimal values, separated by periods, as in 123.45.67.89.

Media Access Control (MAC) address

Also known as a hardware address. This address is assigned by the device manufacturer, for example, 1234.5678.9000.

Point-to-Point Protocol (PPP)

A direct connection between two nodes; a connection without any intervening nodes or switches. In an internetwork, the term refers to a direct connection between two networks.

Password Authentication Protocol (PAP)

A form of PPP authentication that requires an exchange of user names and clear-text passwords between two devices. PAP passwords are sent unencrypted. Both devices must support PPP.

PAT

Port Address Translation

PSTN

Public Switched Telephone Network

RIP

Routing Information Protocol

Service Profile Identifiers (SPIDs)

Numbers assigned by the ISDN service provider that identify the ISDN B channels. They are assigned only in North America. The SPID format is generally the ISDN telephone number with several numbers added to it. Depending on the switch type supporting your ISDN BRI line, your ISDN line might be assigned none, one, or two SPIDs.

TCP

Transmission Control Protocol

TPAD

Terminal Packet Assembler and Disassembler

ISDN Ports

Cisco 700 series routers provide one basic rate interface (BRI). The ISDN BRI service provided by your telephone service provider offers two bearer channels (B channels) and one data channel (D channel). The B channel operates at 64 kbps and carries user data. The D channel operates at 16 kbps and carries control and signaling information, although it can support user data transmission under certain circumstances.

Outside North America, telephone service providers typically provide an S/T interface. The S/T interfaces are four-wire (two pairs of two wires) interfaces that supports full-duplex data transfer over two pairs of wires.

Inside North America, telephone service providers typically provide a U interface. The U interface is a two-wire (single pair) interface that supports full-duplex data transfer over a single pair of wires.

NT1 and the ISDN Ports

Commonly, telephone carriers use a four-wire network within their system. The wiring in your home or business is a two-wire local loop. A Network Termination 1 (NT1) device connects the telephone carrier four-wire network to a two-wire local loop.

Inside North America, it is common to find an NT1 built into a network device. Outside North America, the telephone carrier or the user must provide an external NT1. To use the internal NT1, the telephone carrier line is connected to an ISDN U port. If an external NT1 is required, the telephone carrier line is connected the ISDN U port on the NT1, and the router's ISDN S/T port is connected to the ISDN S/T port on the NT1.

HUB/NODE Switch

The Ethernet ports on hubs are wired differently than the Ethernet ports on nodes. This allows the devices to communicate with a straight-through Ethernet cable. Basically, transmitted data must be sent from the transmit pin on one device to the receive pin on the other device, and vice versa. Nodes connected to hubs handle this crossover internally. If the signal does not cross over, the transmitted data is sent from the transmit pin on the sending device to the transmit pin on the receiving device, and communications fails.

To connect two nodes or two hubs, the signal must be crossed externally. Usually this is accomplished using an Ethernet crossover cable. The pins of a crossover cable have been rewired so the transmit pins are connected to the receive pins, as shown in Figure 6-1.

Figure 6-1
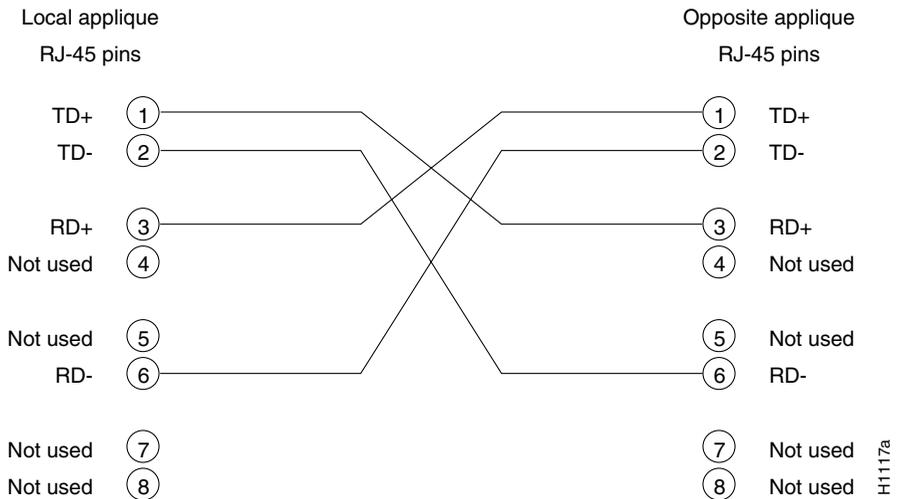
Your Cisco 761,Cisco 762, Cisco 765, Cisco 771, Cisco 772, or Cisco 775 router can be either a hub or a node. The HUB/NODE switch eliminates the need for a crossover cable. When the switch is in NODE position, the router is seen as a node and connects to a hub with a straight Ethernet cable. When the switch is in HUB position, the router can connect to a network interface card (NIC) installed in a PC.

Cisco 766 and Cisco 776 routers have an unmanaged 4-port Ethernet hub. If you are connecting a Cisco 766 or Cisco 776 router to another Ethernet hub, you must use a crossover cable.

For additional information on standard cabling specifications, use the following paths:

On CCO use
http://www.cisco.com/univercd/cc/td/doc/product/access/acs_mod/cismc/mchim/22048.htm.

On the Documentation CD-ROM use
http://127.0.0.1:8080/cc/td/doc/product/access/acs_mod/cismc/mchim/22048.htm.

Specifications

This chapter provides the specifications for your router and companion equipment.

Router Specifications

The specifications for Cisco 700 series routers are listed in Table A-1.

Table A-1   Hardware Specifications

Description	Design Specification
Height x Width x Depth	1.6 x 8.3 x 9.6 in. (4.1 x 21.1 x 24.4 cm)
Weight	Cisco 761 and Cisco 771: 1.4 lb. (0.6 kg) Cisco 762 and Cisco 772: 1.5 lb. (0.7 kg) Cisco 765 and Cisco 775: 1.6 lb. (0.7 kg) Cisco 766 and Cisco 776: 1.7 lb. (0.8 kg)
Power supply	External
Voltage	100 or 250 VAC
Frequency	50 to 60 Hz
Processor	25-MHz 80386
Memory	1.5 MB of primary memory 1.0 MB of Flash memory 16 KB of NVRAM
Operating temperature	32 to 120° F (0 to 50° C)
Storage temperature	–30 to 160° F (–35 to 70° C)
Operating humidity	20 to 95%, noncondensing

> **Warning** Ultimate disposal of this product should be handled according to all national laws and regulations.

Port Pinouts

The router ports are industry standard, unless otherwise noted in this section. Figure 1-3 in Chapter 1, "Overview," lists the ports by model.

Ethernet Port

Table A-2 compares the pinouts of the Ethernet port depending on the position of the HUB/NODE switch.

Table A-2   **Ethernet Connector Pinouts (RJ-45)**

Pin	Function (HUB/NODE switch in HUB Position)	Function (HUB/NODE Switch in NODE Position or the Unmanaged Hub on Cisco 766 and 776 routers)
1	TX+	RX+
2	TX–	RX–
3	RX+	TX+
4	Unused	Unused
5	Unused	Unused
6	RX–	TX–
7	Unused	Unused
8	Unused	Unused

Serial Configuration Port

Table A-3 shows the pinouts for the configuration port.

Table A-3   Configuration Port Pinouts (DB-9)

Pin	Function
1	Carrier Detect (CD)
2	Received Data (RXD)
3	Transmitted Data (TXD)
4	Data Terminal Ready (DTR)
5	Signal Ground
6	Data Set Ready (DSR) input
7	Not used
8	Not used
9	Not used

The console port is configured as a data communications equipment (DCE) device. The default parameters for the console port are as follows:

- Bits per second = 9600
- Data bits = 8
- Parity = None
- Stop bits = 1

Power Connector

Table A-4 shows the pinouts for the router power connector, and, Figure A-1 shows the location of the power connector pins.

Table A-4   **Power Supply Cable (Mini DIN Plug)**

Pin	Voltage	Current	Tolerance
1	Ground	–[1]	–
2	+5 VDC	1.5A	+/– 5%
3	Ground	–	–
4	+5 VDC	1.5A	+/– 5%
5	Not used	–	–
6	+30 VDC	0.2A	+/– 25%
7	Not used	–	–

1   A dash indicates that the information does not apply to the pin.

Figure A-1   **Power Supply Comnnector**
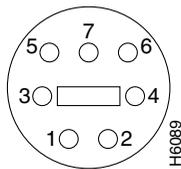
Common Port Assignments

Table A-4 lists currently assigned TCP port numbers. To the extent possible, UDP uses the same numbers.

Table A-5   Currently Assigned TCP and UDP Port Numbers

Port	Keyword	Description
0	–	Reserved
1–4	–	Unassigned
5	RJE	Remote Job Entry
7	ECHO	Echo
9	DISCARD	Discard
11	USERS	Active users
13	DAYTIME	Daytime
15	NETSTAT	Who is up or NETSTAT
17	QUOTE	Quote of the Day
19	CHARGEN	Character Generator
20	FTP-DATA	File Transfer Protocol (data)
21	FTP	File Transfer Protocol
23	TELNET	Terminal connection
25	SMTP	Simple Mail Transport Protocol
37	TIME	Time
39	RLP	Resource Location Protocol
42	NAMESERVER	Host Name Server
43	NICNAME	Who is
49	LOGIN	Login Host Protocol
53	DOMAIN	Domain Name Service
67	BOOTPS	Bootstrap Protocol Server
68	BOOTPC	Bootstrap Protocol Client
69	TFTP	Trivial File Transfer Protocol
75	–	Any private dial-out service
77	–	Any private RJE service
79	FINGER	Finger

Table A-5   Currently Assigned TCP and UDP Port Numbers (continued)

Port	Keyword	Description
95	SUPDUP	SUPDUP Protocol
101	HOSTNAME	NIC Host Name Server
102	ISO-TSAP	ISO-TSAP[1]
103	X400	X400
104	X400-SND	X400-SND
111	SUNRPC	SUN Remote Procedure Call
113	AUTH	Authentication Service
117	UUCP-PATH	UUCP[2] Path Service
119	NNTP	Usenet Network News Transfer Protocol
123	NTP	Network Time Protocol
126	SNMP	Simple Network Management Protocol
137	NETBIOS-NS	NETBIOS Name Service
138	NETBIOS-DGM	NETBIOS Datagram Service
139	NETBIOS-SSN	NETBIOS Session Service
161	SNMP	Simple Network Management Protocol Q/R
162	SNMP-TRAP	Simple Network Management Protocol Traps
512	rexec	UNIX rexec (Control)
513	TCP—rlogin UDP—rwho	TCP—UNIX rlogin UDP—UNIX Broadcast Name Service
514	TCP—rsh UDP—syslog	TCP—UNIX rsh and rep UDP—UNIX System Log
515	Printer	UNIX line printer remote spooling
520	RIP	Routing Information Protocol
525	Timed	Time Server

1   TSAP=Transport Service Access Point
2   UUCP=UNIX-to-UNIX Copy Protocol

Terminal Communications

This appendix describes the processes for establishing a terminal connection, loading the Cisco 700 IOS software (also known as the software image), and loading and saving the current configuration.

Establishing a Terminal Connection

By connecting an ASCII terminal or PC running terminal emulation software, you can configure the router through a serial connection. This might not be necessary for the following reasons:

- You are configuring the router through the LAN by using Cisco 700 Fast Step Setup or Telnet.

- The router is preconfigured by a vendor or network administrator to be "plug-and-play."

- The router will be configured using Trivial File Transfer Protocol (TFTP) and can "discover" its configuration.

The example in this section shows how to connect to the router serial communications port from your ASCII terminal or PC by using Hyperterminal. (Hyperterminal is an accessory software application included with the Windows operating system.)

Take the following steps to connect your router to a console through the configuration port:

Step 1   Connect the blue DB-9-to-DB-9 serial cable from your terminal to the rear-panel port labeled CONFIG. (See Figure B-1.)

If your terminal or PC console has a DB-25 connector, use the included DB-25-to-DB-9 adapter. If you are connecting the router to a Macintosh computer, you need a straight-through RS-422-to-DB-9 or RS-422-to-DB-25 cable.

Figure B-1   Console Cable Connection (Cisco 766 Shown)
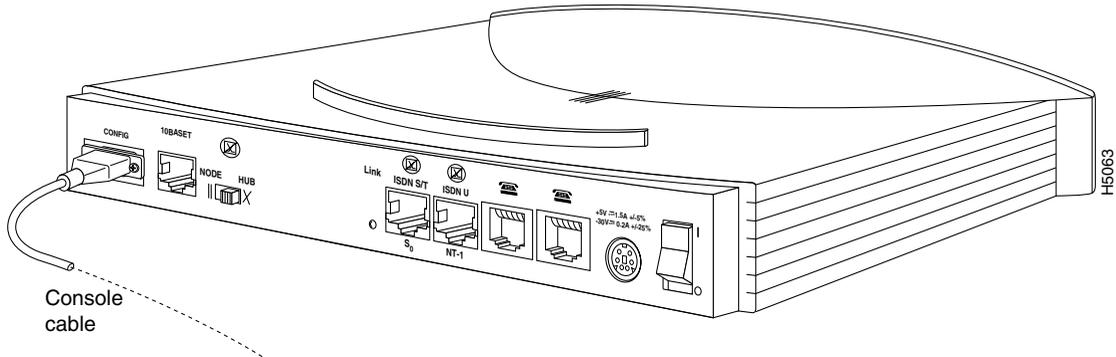
Console
cable

Step 2   Connect the other end of the console cable to the ASCII terminal or PC.

> **Note**   The router is a data communications equipment (DCE) device. A
> crossover cable is not required.

Step 3   Start HyperTerminal. Click **Start**>**Accessories**>**HyperTerminal**. The
Connection Description window displays.

Step 4   Enter a name in the **Name** field of the Connection Description window. When
you click **OK**, the Phone Number window displays.

Step 5   Select the COM port from the **Connect using** list to which the router is
connected. For example, if the router is connected to the COM2 port of your PC,
select **Direct to COM2**. When you click **OK**, the Port Settings window displays.

Step 6   Set the port as follows:

- Bits per second = 9600
- Data bits = 8
- Parity = None
- Stop bits = 1
- Flow control = None

> **Note** The configuration port does not support hardware flow control.

Step 7 Power on the router.

Step 8 Click **OK** to connect. You can test the connection by pressing **Enter**. A command-line interface prompt appears.

It is assumed that this is a new connection. Once it is created, you can save the Connection Description by selecting **File>Save As**.

Troubleshooting the Terminal Connection

Although the balance of the Hyperterminal settings should default to the correct values, if you have problems, select **File>Properties**, and check the following.

Table B-1   Hyperterminal Default Settings

Setting	Location	Value
Use FIFO buffers	**Configure>Advanced**	Windows should detect the presence of the 16550 UART chip and set this correctly by default. If there is any doubt about the presence of the chip, deselect the check box.
Receive Buffer	**Configure>Advanced**	Low
Transmit Buffer	**Configure>Advanced**	Low
Function, arrow, and control keys act as	Settings	**Terminal Keys**
Emulation	Settings	**Auto Detect**
Backscroll buffer lines	**Settings**	**500**
Send line ends with line feed	**Settings>ASCII Setup**	Deselected
Echo typed characters locally	**Settings>ASCII Setup**	Deselected
Line delay	**Settings>ASCII Setup**	**0**

Table B-1   Hyperterminal Default Settings (continued)

Setting	Location	Value
Character Delay	**Settings>ASCII Setup**	**0**
Append line feeds to incoming line ends	**Settings>ASCII Setup**	Deselected
Force incoming data to 7-bit ASCII	**Settings>ASCII Setup**	Deselected
Wrap lines that exceed terminal width	**Settings>ASCII Setup**	Selected

In addition, check for COM port conflicts. If you suspect a hardware conflict, select **Start>Help**, and search for **ports>Hardware Conflict Troubleshooter**. From the Hardware Conflict Troubleshooter help window, you can launch the Hardware Conflict Troubleshooter.

TPAD Support

The serial port can be configured as a TPAD port. Communications with the router through the serial port for configuration purposes are not possible when TPAD is enabled. You can continue to enter configuration commands by using Telnet.

The following example sets the serial port as a TPAD port:

```
Host> set serialport tpad
```

To switch from TPAD mode to configuration mode, do one of the following:

- From the terminal connected to the serial port, enter ^A three times, followed by a **Return** to restore the prompt.

- From a Telnet session, enter the **set serial config** command.

The current state of the serial port can be displayed by using the **show configuration** command in a Telnet session.

For complete information on TPAD, see the *Cisco 700 Series Command Reference*.

Downloading Software

The default image for Cisco 761, Cisco 765, Cisco 771, and Cisco 775 routers is NET3, IR. The default image for all other Cisco 700 series routers is US. Usually the software loaded in your router at the factory is the most up-to-date version available. You might want to update the image if

- The default image is not the correct image for your area.

- A new version of the image has been released.

- Another version of the image contains features you desire.

The following example loads the operating system software in the router through a serial connection from the terminal to the configuration port.

Table B-2 shows the approximate software load times.

Table B-2   Approximate Software Load Time

Load Rate (Baud)	Approximate Time (Minutes)
2400	48
9600	12
19200	6
38400	3
57600	2
115200	1

To load new software, follow these steps:

Step 1   Connect to the router as described in the "Establishing a Terminal Connection" section.

Step 2   Enter the **swl** (software load) command:

```
Host> swl
```

You are prompted to verify that you intend to download the software image.

Step 3   Enter **y** to continue:

```
Are you sure? y
```

You are prompted to select the baud rate.

```
BOOT version 2.0(1) 04-16-96 12:03:06
Copyright (c) 1993-1996. All rights reserved.

Ready to upload new firmware into flash. Select baud rate:

    1 -     300 baud
    2 -    1200 baud
    3 -    2400 baud
    4 -    4800 baud
    5 -    9600 baud
    6 -   19200 baud
    7 -   38400 baud
    8 -   57600 baud
    9 -  115200 baud
```

Step 4   Enter 5.

Note   Hyperterminal does not allow you to change baud rate on-the-fly; however, if you are using another terminal emulation software, you might be able to do so to increase the speed of the download.

To change the baud rate, enter the number that corresponds to the desired baud rate. *Do not* press the **Return** key. Set the baud rate on the terminal to match the selected baud rate. Set the protocol to ASCII on the terminal. Press **Return**.

Download the file containing the new software to the router by following the prompts on your terminal.

Step 5   Select **Transfer>Send text file**. The system loads the file on the router. (The LINE LED blinks throughout the loading process.)

When the download is complete, the LINE LED turns off, and the RDY LED turns on.

Troubleshooting Software Downloads

If the download was not successful, use Table B-3, which shows symptoms and possible solutions.

Table B-3   Software Download Command Troubleshooting

Symptom	Probable Cause and Solution
Download takes significantly longer than the approximate time listed in Table B-2.	The terminal emulation program interline and intercharacter delays are not set to zero. If the load was successful, no further action is necessary. If the load was terminated prematurely, reset the interline and intercharacter delays to zero, and reload the software.
The terminal displays unrecognizable text after the download is completed.	The terminal has not been reset to 9600 baud. Reset the terminal any time after loading the new software. After changing the terminal baud rate, press **Return** to display the prompt (>).
Two or more LEDs are blinking.	Incorrect configuration of the PC COM port or a defective console cable. Press **Esc** and try to load the software again.

A combination of blinking LEDs indicates a software download problem. An error code is also displayed on the terminal.

Table B-4 lists the combination of blinking LEDs that indicate an error, along with the error code and a description of the error.

Table B-4   LED Error Messages—Software Download

Blinking LED	Error Code	Description of Error
Line CH 2	E-1	A framing, parity, or overflow error occurred during software download, usually because of an incorrect data rate or configuration port setting. Check the data rate and configuration port settings.
CH 1	E-2	A colon was not at the beginning of a line in the new software image file. Either the software image file is corrupted or some characters were entered before the download started. Start the software load process again. If the same error occurs, replace the software image file.

Table B-4   LED Error Messages—Software Download (continued)

Blinking LED	Error Code	Description of Error
Line CH 1	E-3	One line in the software image file has a bad checksum, usually because of a temporary line error. Start the software download process again.
Line CH 1 CH 2	E-5	The software image file has a bad or missing checksum. Start the software load process again. If the same error occurs, replace the software image file.

Saving a Configuration

We advise that you store a copy of your router configuration in a safe place. If your configuration is corrupted, it can be restored using the download process described in the "Loading a Configuration" section.

The following example appends the configuration to a file by using HyperTerminal for Windows, a common terminal emulation software program.

Note   Hyperterminal does not create new files. The file must exist before you upload the data.

To save a configuration, complete the following steps:

Step 1   Connect to the router as described in the "Establishing a Terminal Connection" section.

Step 2   Enter the **upload** command at the command-line prompt, but *do not* press **Return** after you enter the command:

```
Host> Upload
```

Step 3   Select **Transfer>Capture Text**.

Step 4   Select the file and directory in which you want to save the file.

Step 5   Click **OK**.

Step 6 Press **Return** to execute the command. The configuration is saved to the file specified in Step 3.

Step 7 Select **Transfer>Capture Text>Stop** when the configuration has finished uploading.

Loading a Configuration

A configuration can be downloaded to the router through the terminal. The following example loads a configuration using Hyperterminal:

Step 1 Connect to the router as described in the "Establishing a Terminal Connection" section.

Step 2 Select **Text Transfer>Send Text File**. The Send Text dialog box appears.

> **Note** If you are using terminal emulation software other than Hyperterminal, it might be necessary to set **Flow Control** to **Line-at-a-Time**, and set **Delay Between Lines** to **0.5** to **1** second. Refer to the "Troubleshooting the Terminal Connection" section for additional information.

Step 3 Select the file containing the configuration.

Step 4 Click **OK.**

Step 5 Select **Transfer>Send Text File**.

Step 6 Select the file to be loaded.

Step 7 Click **OK**. The parameters are transferred to your router.

Step 8 If errors occur during the transfer, enter the **set default** command to reset the configuration, and repeat the procedure for loading the configuration beginning with Step 2.

> **Note** If you are using terminal emulation software other than Hyperterminal, it might be necessary to increase the delay between lines.

Provisioning the ISDN BRI Line

If your router has not been preconfigured, usually you can configure your router by filling out the forms provided in the *Cisco 700 Quick Reference Guide* and following the instructions in the Cisco Fast Step Setup application. The Cisco Fast Step Setup application takes advantage of the Cisco 700 series router's ability to detect the switch type and SPID information. However, there might be cases where you need detailed information to complete the configuration.

This appendix provides detailed information to help you order and configure the Integrated Service Digital Network (ISDN) Basic Rate Interface (BRI) line to operate with your Cisco 700 series router.

Both the ISDN line configuration and the router configuration are dependent on the switch type used. Switches that comply with the NI1 standard provide the best performance with Cisco 700 series routers.

Data and Voice

The Cisco 765, Cisco 766, Cisco 775, and Cisco 776 routers support data and voice applications. The voice applications on these four router models are implemented with ISDN BRI and through the analog telephone port on the router.

Note When ordering an ISDN line to support multiple voice calls, provision the line for call appearances 1 and 2.

Note Some ISDN service providers might charge a lower rate for an ISDN line that supports only data applications. If you do not require voice capability on your ISDN line, provision the line for data application support only.

Table C-1 describes the data and voice application features.

Table C-1   **ISDN BRI Data and Voice Applications**

Feature	Description
Subaddressing	Provides locally addressed terminals within a specific ISDN access area.
Speech/3.1-kHz audio-bearer capability	Enables use of terminal equipment that supports voice applications. Examples of this type of equipment are ISDN telephones and terminal adapters.
Multiple subscriber numbers (MSN)	Enables the use of multiple directory numbers on the same ISDN line. Each piece of terminal equipment on the same ISDN line can then be assigned its own directory number.
Call hold and retrieve	Enables a call in progress to be put on hold and then retrieved.
Call waiting	During a voice call, enables the call waiting tone to be generated when a second voice call is received.
Call bumping	When two data calls are in progress and ACO is provisioned on the ISDN line, the router can be configured to either ignore a voice call or disconnect a data call to accept the voice call. (Also referred to as voice priority.)
Call transfer	Transfers an active call to another telephone number.
3-way call conferencing	Adds a third party to an existing call.

> **Note** There might be an additional charge for configuring the line to support some of these features. Check with your service provider.

North America Switch Types

The following section describes the switch types commonly found inside North America that are compatible with Cisco 700 series routers.

National ISDN-1

National ISDN-1 (NI1) switches comply with established National ISDN standards. This type of line is supported by AT&T, Lucent, Northern Telecom, and other manufacturers' switches.

> **Note** Switches that comply with the NI1 standard provide the best performance with Cisco 700 series voice-priority feature. If possible, order this type of ISDN line from your service provider.

Lucent 5ESS Custom

Lucent 5ESS switches can run in custom mode, in addition to NI1 mode.

Custom mode allows the switch to be configured to operate in either a point-to-point or a multipoint configuration. Point-to-point configuration supports one piece of terminal equipment on the ISDN line and does not require Service Profile Identifiers (SPIDs). Multipoint configuration supports multiple pieces of terminal equipment on the same ISDN line and requires SPIDs.

Northern Telecom DMS-100 Custom

Northern Telecom DMS-100 switches support a custom mode used with older terminal equipment.

International ISDN Switch Types

Cisco 700 series routers support most international switch types. International ISDN lines generally use one of the following switch types:

- EURO-ISDN (also known as NET3)

- 1TR6

- TPH

- Nippon Telegraph and Telephone (NTT)

Note International ISDN lines are not assigned SPIDs.

EURO-ISDN Switch Type

The EURO-ISDN switch type, also known as NET3, is used in Europe and parts of Asia, including the United Kingdom, France, Germany, Singapore, and Taiwan.

Enter the **show version** command to verify that the software loaded on your Cisco 700 series router is *ISDN Stack Revision NET3 2.10*. If the correct software is not loaded on your router, contact your customer service representative.

1TR6 ISDN Switch Type

The 1TR6 switch type is used in Germany. Enter the **show version** command to verify that the software loaded on your router is *ISDN Stack Revision 1TR6 2.10*. If the correct software is not loaded on your router, contact your customer service representative.

Multiple Subscriber Numbers with 1TR6

The 1TR6 lines can be configured for multiple subscriber numbers, usually referred to as "extended addressing" in Germany. The line is usually assigned a group of eight sequential directory numbers that can be used for the different pieces of terminal equipment used on the ISDN line. These numbers are also used for allocation to the analog telephone port and for call routing.

International Data and Voice Application Terminology

The data and voice applications described in the section "Data and Voice" earlier in this appendix might be referred to by different names, depending on the service provider and your location. The terms can differ even within a country. Some international service providers might use codes instead of names to refer to the data and voice applications. Table C-2 lists the names and codes that might be used outside North America to refer to data and voice applications.

Table C-2   ISDN BRI Data and Voice Applications—Terms Used Outside North America

North AmericaName	Other Names	Code
Call hold and retrieve	Call hold	CH HOLD
Call waiting	Anklopfen[1]	CW
Multiple subscriber numbers	Extended addressing Selection directe a l'arrive[2]	SDA MSN

1   Germany only.
2   France only.

National ISDN Capability Packages

A capability package is a set of standardized features that simplifies the process of configuring an ISDN line. The capability package ordering codes described in this section apply to NI1.

Note   The Cisco 765, Cisco 766, Cisco 775, and the Cisco 776 require two SPIDs for the analog telephone ports to operate correctly.

Capability Package S

Package S provides alternate voice and circuit-switched data with no additional features. When a minimum feature set is needed, Package S is the preferred NI1 capability package for Cisco 765, Cisco 766, Cisco 775, and Cisco 776 routers.

Capability Package EZ-1 or U

Package EZ-1 (also referred to as Capability Package U) provides alternate voice and circuit-switched data with all the features and capabilities of the router enabled. Package EZ-1 is the preferred NI1 capability package for the Cisco 765, Cisco 766, Cisco 775, and Cisco 776 routers. The features include flexible calling (conference calling, call transfer, call hold and retrieve), ACO (call waiting), and Call Forward Busy (CFB).

Note The 5ESS Custom does not support multiple directory numbers per SPID.

If you have any problems with your NI1 provisioning, contact Cisco ISDN Support Services (United States only). To access this service or to obtain more information, call (800) 553-NETS (6387) and select the Customer Service option, or visit the Cisco ISDN Web site at www.cisco.com/isdn.

When provisioning multiple directory numbers for a NI1, additional provisioning information that activates the distinctive ringing feature is available from Cisco ISDN Support Services; however, the flexible calling features (three-way conference calling call transfer, hold, and retrieve) are not available.

In North America, call forwarding is available with NI1 Capability Package EZ-1. The feature is known as call forwarding variable (CFV). It forwards incoming calls to another number. You can turn the feature on or off using the access codes provided by your ISDN service provider.

Switch Provisioning Summaries

The following section contains provisioning summaries to use when you order an ISDN line other than NI1. Each summary is a list of codes used by the ISDN service ISDN line, photocopy the appropriate summary for your switch type, and attach it to your order form. This will help ensure that your ISDN line is ordered correctly.

We recommend using the switch provisions listed in the following section to support voice priority on one B channel.

Table C-3 lists the definitions of terms used when indicating line provisioning.

Table C-3   ISDN Line Provisioning Terms

Term	Definition
CSD	Circuit-switched data—Number of B channels that can be simultaneously connected for circuit-switched data calls.
CSD CHL	Circuit-switched data channel—B channel(s) used for data calls.
CSD LIMIT	Circuit-switched data limit—Number of data calls that can be made simultaneously.
CSV	Circuit-switched voice—Number of B channels that can be simultaneously connected for voice calls.
CSV ACO	Circuit-switched voice additional call offering—Indicates an additional call when the B channel is being used.
CSV CHL	Circuit-switched voice channel—B channel(s) that will be used for voice calls.
CSV LIMIT	Circuit-switched voice limit—Number of voice calls that can be made simultaneously.
CSV NBLIMIT	Circuit-switched voice notification busy limit—Number of additional voice calls allowed.
EKTS	Key system option—Whether or not a key system is being used. (A key system is a system in which multiple telephone numbers are shared across terminals.)
MAXB CHL	Maximum B channels—Number of B channels that can be used simultaneously.
MTERM	Maximum terminals—Number of terminals active on the ISDN line.
TERMTYP	Terminal type—Terminal type used on the ISDN line. Valid types for NI1 switches are Type A and Type C.

Lucent 5ESS Custom Provisioning Summary

Table C-4 lists the provisioning summary for Lucent 5ESS Custom switches.

Table C-4   Lucent 5ESS Custom Provisioning Summary

Line Provision	Configuration
2B1Q line code[1]	–[2]
2B&D line	–
B1	Circuit-switched data or voice/data[3]
B2	Circuit-switched data or voice/data[4]
D	Signaling only
MTERM	1
MAXB CHNL	2
ACT USR	Y
CSD	2
CSD CHL	ANY
TERMTYP	TYPE A
DISPLAY	Y
CA PREF	1
Call transfer	Y
3-way call conferencing	Y

1   Order this line provision when connecting the router to the U interface.
2   A blank cell indicates that the configuration option is not applicable to the line provision.
3   If you do not require voice capability on your line, provision B1 for data only.
4   If you do not require voice capability on your line, provision B2 for data only.

Note   Incoming voice priority is not available with Lucent 5ESS Custom switches.

Northern Telecom DMS-100 Custom Provisioning Summary

Table C-5 lists the provisioning summary for Northern Telecom DMS-100 switches.

Table C-5   Northern Telecom DMS-100 Custom Provisioning Summary (ACOU Supported)

Line Provision	Configuration
2B1Q line code[1]	–[2]
2B&D line	–
Version to Functional Signaling	–
Issue 2 (NI1)	–
Call transfer	Yes
3-way call conferencing	Yes
TEI	DYNAMIC
CS	Yes
EKTS	No
Set Option	Key 1-ACOU 1, Key 2-AFC

1   Order this line provision when connecting the router to the U interface.
2   A blank cell indicates that the configuration option is not applicable to the line provision.

Some BRI service providers do not support additional call offering U (ACOU). Use the provisioning summary listed in Table C-6 if your service provider does not support ACOU.

Table C-6   Northern Telecom DMS-100 Provisioning Summary (ACOU Not Supported)

Line Provision	Configuration
2B1Q line code[1]	–[2]
2B&D line	–
Version to Functional Signaling	–

Table C-6   Northern Telecom DMS-100 Provisioning Summary (ACOU Not Supported) (continued)

Line Provision	Configuration
Issue 2 (NI1)	–
TEI	DYNAMIC
CACH	No
CS	Yes
Call transfer	Yes
3-way call conferencing	Yes
EKTS	Yes
Set Option	2 call appearances

1   If connecting at U interface.
2   A blank cell indicates that the configuration option is not applicable to the line provision.

Router Configuration Requirements

This section is a list of configuration requirements for Cisco 700 series routers when using specific switch types. After your ISDN line is ordered and installed, if your router does not automatically detect the switch type, you can use the configuration information in this section to configure your Cisco 700 series router.

Configuration Requirements for NI1

Table C-7 lists the router configuration requirements when using Cisco 700 series routers with an Lucent 5ESS NI1 switch in a multipoint configuration.

Note   The NI1 switch does not support a point-to-point configuration.

Table C-7   NI1 Configuration

Parameter	Configuration	Software Command
Router software	U.S. version	—[1]
Switch type	NI1	**set switch**
SPIDs	At least one required[2]	**set spid**
Directory number	At least one required	**set directory number**

1   This parameter is not set with a software command.
2   The Cisco 765, Cisco 766, Cisco 775, and Cisco 776 require two SPIDs so that the basic telephone service ports (POTS) operate correctly.

Configuration Requirements for Lucent 5ESS Custom Switch

This section describes the router configuration requirements when using Cisco 700 series routers with an Lucent 5ESS Custom switch.

Point-to-Point Configuration

Table C-8 lists the router configuration requirements when using an Lucent 5ESS Custom switch in a point-to-point configuration.

Table C-8   Lucent 5ESS Custom Point-to-Point Configuration

Parameter	Configuration	Software Command
Router software	U.S. version	—[1]
Switch type	5ESS	**set switch**
SPIDs	None required	—[2]
Directory number	Optional	**set directory number**

1   This parameter is not set with a software command.
2   This parameter is not set when SPIDs are not used because it might cause unpredictable results.

Multipoint Configuration

Table C-9 lists the router configuration requirements when using an Lucent 5ESS Custom switch in a multipoint configuration.

Table C-9   **Lucent 5ESS Custom Multipoint Configuration**

Parameter	Configuration	Software Command
Router software	U.S. version	Note[1]
Switch type	5ESS	**set switch**
SPIDs	At least one required[2]	**set spid**
Directory number	Optional (recommended)	**set directory number**

1   This parameter is not set with a software command.
2   The Cisco 765, Cisco 766, Cisco 775, and Cisco 776 require two SPIDs so that the basic telephone service ports (POTS) operate correctly.

Configuration Requirements for Northern Telecom DMS-100 Switch

This section describes the router configuration requirements when using Cisco 700 series routers with a Northern Telecom DMS-100 switch.

Configuration for Router Only on ISDN Line

Table C-10 lists the router configuration requirements when using the router only on a Northern Telecom DMS-100 ISDN line.

Table C-10   Northern Telecom DMS-100—Router Only

Parameter	Configuration	Software Command
Router software	U.S. version	Note[1]
Switch type	DMS	**set switch**
SPIDs	Two required	**set spid**
Directory number	Two required	**set directory number**

1   This parameter is not set with a software command.

Configuration for Router and One Additional Device on ISDN Line

Table C-11 lists the router configuration requirements for using a Northern Telecom DMS-100 switch when using the router and one additional device on the ISDN line.

Note   In this configuration, the router can use only one B channel.

Table C-11   Northern Telecom DMS-100—Router and One Additional Device

Parameter	Configuration	Software Command
Router software	U.S. version	Note[1]
Switch type	DMS	**set switch**
SPIDs	One required	**set spid**
Directory number	One required	**set directory number**

1   This parameter is not set with a software command.

C

S

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