Networking
ISDN on AS/400
# Contents

## Part 1. ISDN ............................ 1

### Chapter 1. Print this topic ........... 3

### Chapter 2. Understanding ISDN on the AS/400 ............... 5

What is ISDN? ................................. 5

- Basic telephone concepts ................. 5
- Why use ISDN? ............................. 6
- Types of ISDN connections .................. 6
- Types of ISDN service ...................... 7
- Supported protocols and ISDN hardware ... 10
- Network management ....................... 11
- Configuration objects ..................... 11
- ISDN Connections ......................... 11
- Why calls are accepted or rejected ........ 12
- AS/400 unsupported network issues ....... 16
- IDLC considerations ........................ 16
- Performance issues ....................... 16
- Problem analysis and resolution .......... 19
- Error message and message management ... 20

### Chapter 3. Planning ISDN service ....... 21

Choosing your ISDN connection protocol .... 21

### Chapter 4. Configuring your AS/400 for ISDN ............................ 23

Information you need before configuring ISDN ... 23

- Supported network types .................... 24
- Configuring an ISDN network interface description 29
- Network interface description commands ... 30
- Configuring ISDN connection lists .......... 31
- Details: ISDN connection lists .......... 31
- Calling party identification .............. 31
- Creating an ISDN connection list .......... 32
- Connection list commands ................... 32
- Adding ISDN connection list entries ...... 32
- Configuring a line description for ISDN connections 34
  - Configuring IDLC over ISDN .......... 34
  - Configuring an X.31 (X.25 over ISDN) line description .......... 34
  - Configuring a PPP line description for fax support .......... 35
  - Setting the modem country ID ............ 40
  - Configuring a controller description .......... 41
  - Creating device descriptions ............ 42
  - Configuring fax over ISDN ............... 42

### Chapter 5. Managing AS/400 ISDN support ............... 45

Managing Connections ......................... 45

- Enabling ISDN switched connections .......... 45
- Enabling ISDN permanent connections ....... 46
- Disabling ISDN switched connections ........ 46
- Disabling permanent connections .......... 46
- Changing automatic disconnect timers .......... 46
- Verifying connection status ............... 47
- Commands for ISDN configuration objects .... 48
- Retrieving configuration object status .......... 48
- Deleting configuration objects .......... 48
- Displaying configuration objects .......... 48
- Renaming configuration objects .......... 49
- Managing your connection lists .......... 49
- Controller description commands related to ISDN 49
- Device description commands .......... 49
- Line description commands related to ISDN .......... 49
- NWI description commands ............... 50

### Chapter 6. Performance tuning ISDN ............... 53

Monitoring ISDN ......................... 53

Maximizing ISDN channel performance .......... 53

### Chapter 7. Troubleshooting ISDN ............... 55

Viewing system messages ............... 55

- Cause code descriptions .......... 55
- Common ISDN Problems .......... 57
- Recovering from ISDN errors on the AS/400 ........ 58

© Copyright IBM Corp. 1998, 2000
Part 1. ISDN

You can connect your AS/400 to an Integrated Services Digital Network (ISDN) for faster, more accurate data transmission. An ISDN is a public or private digital communications network that can support data, fax, image, and other services over the same physical interface. Also, you can use other protocols on ISDN, such as IDLC, PPP fax, and X.25.

Existing installations:

If you have an existing ISDN installations, you should read “Existing NWIs” for important information about your configuration objects and what changes you may need to make before varying them on.

ISDN support:

To configure and manage ISDN support on your AS/400, see this information:

- Print this topic
- Understand the ISDN services, and protocols. This information also discusses ISDN network management concerns, and performance and troubleshooting tips.
- Plan your ISDN connections, by learning what you need to know and do before configuring ISDN support.
- Configure ISDN support for PPP, fax, IDLC, or X.31 (X.25 over ISDN).
- Manage your connections and learn what commands are available.
- Tune your communication performance by monitoring the performance of ISDN and maximizing its throughput.
- Troubleshoot your ISDN problems by understanding error messages and finding solutions to common problems.
Chapter 1. Print this topic

You can view or download a PDF version of this document for viewing or printing. You must have Adobe® Acrobat® Reader installed to view PDF files. You can download a copy from Adobe®.

To view or download the PDF version, select ISDN (about 526 KB or 68 pages).

To save a PDF on your workstation for viewing or printing:
1. Open the PDF in your browser (click the link above).
2. In the menu of your browser, click File.
3. Click Save As...
4. Navigate to the directory in which you would like to save the PDF.
5. Click Save.
Chapter 2. Understanding ISDN on the AS/400

To improve your understanding of general ISDN concepts, features, and guidelines for configuring and managing your system’s ISDN support, see this information:

- "What is ISDN?"
- "What protocols and ISDN hardware are supported by your system?"
- "How do I manage my network?" This information discusses connection management and considerations, call acceptance or rejection, and problem or troubleshooting tips.

What is ISDN?

Integrated services digital network (ISDN) makes a digital, rather than an analog, connection to your local telephone service provider. Digital networking increases your speed with less noise and distortion than analog connections. Telephone companies have used ISDN technology since the 1960s for their internal networks. They have almost entirely replaced analog network equipment with digital, with one exception. That exception is their connection to your business or home.

To find out more about the exception and advantages of ISDN, see:

- "Basic telephone concepts"
- "Why use ISDN?" on page 6
- "Types of ISDN connections" on page 6
- "Types of ISDN service" on page 7

Basic telephone concepts

Plain Old Telephone Service (POTS):

Most telephone line connections, from homes and businesses, to the local telephone company’s local central office are analog. This is especially true of residential phone service. The analog connection (which is also called Plain Old Telephone Service [POTS]), carries analog voice signals. This analog connection is not designed to carry computer data, video, or any other types of non-analog or non-voice information. That is why you need a modem to connect your system to the Internet, or to another computer or network. The modem converts your computer’s digital information into an analog signal that can be transmitted over analog phone lines.

The analog "Last-mile" connection:

The connection from your business or home to the telephone company’s local central office is known as the "last-mile" connection. The "last-mile" connection is usually a pair of twisted copper wires. Your telephone is an analog device. The switch, at the telephone company’s central office, converts your telephone’s analog signal to a digital signal. From there on, your phone conversation is transmitted as a digital signal. The remote switch, at the other end of your conversation, converts the digital signal back into an analog signal. That signal is transmitted over the "last mile" to the analog phone at the other end.

The digital "Last-mile" connection:
Analog communications can be very slow, and converting digital signals to analog and back again adds more delay to your communications. ISDN eliminates the analog connection from your computer or network to the local telephone company’s network. It replaces the restrictive analog connection with a digital one, and increases your communication speeds. You can use ISDN on your existing twisted wire connection.

Why use ISDN?

ISDN is fast and flexible.

ISDN eliminates restrictions and problems that are associated with converting digital signals to analog signals, and then transmitting them over an analog connection. You can use ISDN as a high speed connection:

- To the Internet
- To another computer
- To a network

You can send fax (regular telephone service), computer data, and video communications over the same ISDN line. You can connect several different types of devices to your ISDN interface and use them simultaneously. In short, ISDN offers a big improvement in communications when compared to using a modem over an analog telephone line.

Make calls to any number of remote locations, or use it like a ‘leased line.’

You can use ISDN in either the switched mode or the nonswitched mode. In switched mode you make calls whenever, wherever, and as long as you need to. In nonswitched mode you have a ‘permanent’ connection that is always open and available. That connection could be to your Internet Service Provider (ISP) or to a remote local area network (LAN) hundreds of miles away.

ISDN has a low error rate.

Data transmitted over ISDN connections suffers less corruption.

Are there other digital connection options besides ISDN?

Yes. Other digital connection options include asynchronous transfer mode (ATM) and frame relay, which your AS/400 also supports. We do not cover the capabilities of ATM or frame relay here. Your choice of digital connection type depends on what you need to do, whether the service is available in your location, and cost.

Types of ISDN connections

Connections over an ISDN B channel can be switched or permanent:

Switched

The connection begins when you transmit data and ends (if you configure it that way) when you finish transmitting. You are charged for the amount of time the connection remains active.

Permanent

A connection is always available, and requires no signaling or call initiation to establish. The network subscription specifies the destination. A permanent connection is also referred to as nonswitched. Because the connection is always available, you are charged whether data is transmitted or not.
Types of ISDN service

ISDN service on the AS/400 supports basic rate interface (BRI). You should keep in mind that ISDN service may not be available in your location. See Planning for ISDN for more information.

BRI

BRI service consists of two data-bearing channels ('B' channels) and one signalling channel ('D' channel) to initiate connections. The B channels operate at 64 Kbps (maximum); however, in the U.S. it can be at 56 Kbps. The D channel operates at a maximum of 16 Kbps.

FC 2605 input/output adapter

The FC 2605 input/output adapter (IOA) connects your AS/400 to ISDN, and is used for ISDN-to-ISDN connections. The IOA has an S/T interface (4-wire interface). Each FC 2605 IOA provides one BRI connection (2 64 Kbps B channels and 1 16 Kbps D channel). Each B channel connects your system to a remote ISDN device (such as, a PC, workstation, server, router, and so forth). You can use ISDN data link control (IDLC) or X.25 as your protocol.

This IOA works only on SPD buses.

2750 and 2751 IOAs for ISDN BRI connections

The 2750 PCI ISDN BRI U IOA (2-wire interface) and 2751 PCI ISDN BRI S/T IOA (4-wire interface) have 4 BRI ports. Each port supports 2 B channels and one D channel. In addition, each IOA contains an integrated modem for each B channel. The integrated modems support V.90.

These IOAs can provide up to 8 simultaneous ISDN connections, 8 remote non-ISDN connections, or any combination of the two. The figure below shows how you use the IOA’s integrated modem to connect to a remote non-ISDN site over one B channel.

The remote device in the figure above connects to the telephone network through a modem. The IOAs give you modem speeds up to 56 Kbps (V.90 and K56flex).

Note: K56Flex modems can receive data at rates up to 56 Kbps from a K56Flex compatible service provider. 56 Kbps (v.90 compatible) modems can receive data at rate up to 56 Kbps from a V.90 or K56Flex compatible service provider. Both modems can transmit data at rates up to 33.6 Kbps. Public networks currently limit maximum download speeds to about 53 Kbps. Your actual speeds depend on many factors and are often less than the maximum possible.

The figure below shows how the IOA is used for an ISDN-to-ISDN connection over one B channel.
The remote device in the figure above connects to ISDN either directly or indirectly through a terminal adapter.

**Supported protocols:**

The IOAs support the protocols below:
- ISDN data link control (IDLC) on page 10
- Fax (over ISDN)
- PPP over ISDN on page 9 (synchronous and asynchronous)

Currently, these IOAs do not support X.25 or X.31.

**Data over voice:**

The 2750 and 2751 IOAs also support data over voice, where an ISDN voice connection, instead of a data connection, transports data. You use data over voice:
- Where data connections are not available or
- Where it is cheaper to transmit data over a voice connection than data over a data connection

When transmitting data over voice, you may see some performance loss (56 Kbps versus 64 Kbps). If this minimal loss is acceptable, then data over voice is for you. You specify the use of data over voice in the connection list entry for switched connections and in the line description for nonswitched connections.

**Integrated modem:**

The 2750 and 2751 IOAs contain a separate integrated modem for each B channel. The modems support V.90. The integrated modems support:

**Group 3 Fax**

Fax data is transferred over an ISDN voice call at fax speeds (up to 14.4 Kbps). The remote site uses a fax device on an analog telephone line.

**Asynchronous communications**

Asynchronous communications transfer data over an ISDN voice call at these modem speeds:
- Up to 56 Kbps from your system’s digital connection to the remote analog device.
- Up to 33.6 Kbps from the remote analog device to this digital connection.

This remote site is an asynchronous modem on an analog telephone line.

**Synchronous communications**

Synchronous communications transfer data over an ISDN voice call at these modem speeds:
- Up to 56 Kbps from your system’s digital connection to the remote analog device.
• Up to 33.6 Kbps from the remote analog device to this digital connection.

The remote site is a synchronous modem on an analog telephone line.

The 2761 Integrated Analog Modem
The 2761 PCI Integrated Analog Modem contains 8-ports and supports V.90. V.90 requires the remote site to have a digital connection to the network to receive at rates up to 56 Kbps. The modem’s transmitting speed is limited to 33.6 Kbps.

The 2761 IOA also provides connections, by using V.34, for remote sites with an analog connection to the network (PC, workstation, server, router, and so forth).

The figure below shows how the IOA is used for one analog-to-analog connection.

![Diagram of analog-to-analog connection](image)

The remote device in the figure above connects to the telephone network through a modem. The IOA can support up to 8 simultaneous analog connections.

Supported features:
The IOA supports the following:
• Analog-to-analog connections
• Analog-to-digital connections
• PPP (synchronous and asynchronous)
• "Fax over ISDN" over asynchronous communications
• Synchronous data link control (SDLC)

PPP over ISDN
Your AS/400 supports Point to Point Protocol (PPP) on:
• ISDN.
• ISDN by way of the integrated digital modem, synchronously or asynchronously.
• Analog synchronous or asynchronous modems.
• Switched or permanent connections.

You use the command line to manually start or stop PPP sessions, but you must use Operations Navigator to configure PPP. You should see getting started with PPP for general information about PPP.

Fax over ISDN
Your system supports Group 3 fax over ISDN through the integrated modems to send or receive faxes through a switched connection.

Inbound and outbound fax calls
You create only one connection list, but it contains one entry for outbound fax calls and multiple entries for inbound fax calls. You need only one entry for outbound calls, because the system gets the entry’s remote information an
application like Facsimile Support for AS/400. Even though only one entry exists for outbound calls, that entry can be used to make many simultaneous calls. The maximum number of simultaneous outbound calls is limited by the number of modem ports you have.

**Fax modem initialization commands**
The command initialization string for the integrated modems is created for you and placed in your PPP line description. It is highly recommended that you do not change this string.

**Fax modem initialization commands**
The command initialization string for the integrated modems is created for you and placed in your PPP line description. It is highly recommended that you do not change this string.

**Configuring and managing fax over ISDN**
Fax over ISDN is your first step to providing fax support. To complete your fax configuration, see chapter 2 of *Facsimile Support for AS/400 Installation*, (SC41–0645). To manage and troubleshoot fax, you should see *Facsimile Support for AS/400 Programmer’s Guide and Reference*, (SC41-0656).

**ISDN data link control (IDLC)**
ISDN Data Link Control (IDLC) provides a reliable link, by way of ISDN, on the B channel between your AS/400 and the remote system. Systems Network Architecture (SNA) uses IDLC to communicate with ISDN.

The IDLC protocol is based on the data link control protocols that are defined in CCITT Recommendations Q.921 and Q.922. IDLC provides a reliable link with another end user. For a detailed description of the IDLC protocol, refer to book *ISDN Data Link Control Architecture Reference*, (SC31–6826). IDLC can transmit data without waiting to be polled.

## Supported protocols and ISDN hardware

The many advances in AS/400 communication technology enable a wide range of ISDN services for your users. These services include:
- Multiple port BRI connections on one IOA
- PPP over ISDN
- Fax over ISDN
- IDLC over ISDN
- X.31 (X.25 over ISDN)

Also, your AS/400 supports remote access.

Hardware advances provide these services over multiple dial-in/dial-out connections per IOA. The hardware provides up to 8 connections per IOA. Integrated modems eliminate the need for racks of modems and cabling that would be associated with those modems. The table below shows supported hardware, protocols, and features:

<table>
<thead>
<tr>
<th>IOA*</th>
<th>X.25</th>
<th>ISDN</th>
<th>ISDN data link control (IDLC)**</th>
<th>SDLC</th>
<th>PPP over ISDN</th>
<th>Fax over ISDN</th>
<th>DOV**</th>
<th>Integrated Modem</th>
</tr>
</thead>
<tbody>
<tr>
<td>2605</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2750</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2751</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2761</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- *Input/Output Adapter
- **Data Over Voice
IOAs 2750, 2751, and 2761 form a unified family of adapters that contain integrated modems, and extend and simplify remote access. Basically, remote access involves many geographically dispersed computers or devices that connect to a central server or enterprise network. For more information about the communications and features that each IOA supports, click on the IOA, protocol, or feature in the table above.

Network management

For information that will help you manage your system more efficiently and increase its performance, read the concepts and guidelines below:

- **Configuration objects** is intended for users who did not set up the system but now maintain it.
- **ISDN Connections** is about establishing successful connections.
- **Why calls are accepted or rejected** on page 12 explains how your system accepts or rejects PPP, Fax, IDLC, X.25, and X.31 calls.
- **AS/400 unsupported network issues** on page 14 suggests that you might be able to substitute a supported network type if AS/400 does not support the one you want.
- **IDLC considerations** on page 16 talks about polling for a connection and when to disconnect the controller.
- **Performance issues** on page 16 talks about increasing throughput after a connection is made, increasing the amount of data that is transferred in the channel, and increasing your call acceptance rate.
- **Problem analysis and resolution** on page 13 describes tools that are available to help you identify and solve problems.
- **Error message and message management** on page 20 suggests that you manage your system messages by directing them to a specific message queue.

Configuration objects

Your AS/400 uses configuration objects to describe the characteristics of the local network interface and line, and remote controllers and devices. Another configuration object defines a connection list, which is like a phone book. These objects are also known as descriptions. Thus, in your routine work with the AS/400 you will work with these objects:

- Network interface (NWI) description
- Line description
- Connection list description
- Controller description
- Device description

ISDN Connections

After creating or changing your configuration objects, either you or the system must enable each object before any connection can be established. To enable the object, you or the system varies them on. The configuration instructions for each object tells you how to vary on the object.

Establishing a successful connection includes the proper attachment of each object to the other. For example, if only one connection list contains an entry that matches an incoming call, but your line description does not refer to that list, the call may not be accepted. The configuration instructions will tell you how to attach the objects.
Remember that a switched connection exists only as long as the application uses it. When the application is done with it, the system automatically ends the connection after a period of communications inactivity (you define the length of time).

For permanent connections, either you or the system must vary on the objects, at each end of the connection, that correspond to the connection.

The information below discusses configuration guidelines for the automatic disconnect timers, and a configuration status tool to view how the objects are attached and whether they are connected:

• "ISDN automatic disconnect (switched connections)"
• "Configuration object status"

**ISDN automatic disconnect (switched connections)**
A configuration object’s automatic disconnect feature allows you to disconnect it after a period of communications inactivity. Automatic disconnect disconnects all associated objects, and therefore the ISDN call.

In some cases, you may not want to immediately disconnect a switched ISDN call. For example, when your connection time is less than your provider’s minimum connection time. In this case, you are charged for the longer minimum connection time instead of your actual shorter connection time. It is more economical to keep the connection active for the minimum connection time just in case other data is transmitted within that time frame.

For more information about what parameters to adjust, see Changing disconnect timers.

**Configuration object status**
You can view the status of all the configuration objects by using the Work with Configuration Status (WRKCFGSTS) command. This interactive command shows:
• Status of each configuration object
• Attachments of configuration objects
• Status of jobs
• Connection status

The WRKCFGSTS command shows successful connection status as active (varied on). To ensure that your configuration objects are properly configured, you should review the network interface, line, controller, and device descriptions.

**Why calls are accepted or rejected**
ISDN call acceptance depends on whether the incoming call provides enough information to satisfy your system’s needs or is the right type of call (for example, you only accept asynchronous calls). The information below describes how your system accepts or rejects PPP, Fax, IDLC, X.25, and X.31 calls.

**Note:** You should see "Supported protocols and ISDN hardware" on page 10 for a list of adapters that do not support X.25, or X.31.

• "Circuit Mode call acceptance"
• "Circuit Mode call rejection" on page 13
• "Circuit mode call information" on page 14
• "Packet mode call acceptance" on page 14
• "Packet mode call rejection" on page 15

**Circuit Mode call acceptance**
Connection lists provide the main method your system uses to determine how to accept calls on switched connections for PPP, Fax, IDLC, X.25, and X.31. A
connection list contains entries that identify a system and its associated configuration. The incoming calls contain information that can precisely specify the appropriate line description to accept the call. An incoming call may specify the following information:

- Remote number (calling-party-number information element [IE])
- Local number (called-party-number IE)
- Remote subaddress (calling-party-subaddress IE)
- Local subaddress (called-party-subaddress IE)
- Information transfer type

Not all network types support each of these elements. The network types that support the NSF IEs may use these elements with different contents or formats for unique network type features. It is important to consult with your network provider about these items to ensure proper configuration of connection lists and accurate screening of incoming calls.

The system uses the information that an incoming call contains to search active connection lists for entries that match the incoming call. The system considers a connection list active only if at least one line description referring to the list is varied on. To be considered, a connection list entry must exactly match the items of the incoming call or generally match with the *ANY value. AS/400 then orders the connection lists according to the number of exact matches they contain, so that those having an entry with the most exact matches are first.

The system then searches the line descriptions by referring to the ordered connection lists until it finds an available line description. A line description is considered available when it satisfies all of these conditions:

- Has the desired state of connect-pending and is not currently establishing a call.
- Has an SWTNWILST channel number entry for the NWI that specifies either *CALC or the channel number that the call specifies.
- Lists in its SWTNWILST parameter the network interface description that is receiving the call.

For more information on how to verify call acceptance, see Verifying connections.

**Circuit Mode call rejection**

Several factors can cause your system to reject a call on a switched connection for PPP, Fax, IDLC, and X.25. The table below shows possible rejection scenarios:

<table>
<thead>
<tr>
<th>Rejection Problem</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>An error in the network configuration prevents reaching the desired system.</td>
<td>Specifically, if no active connection list contains a match of each number or element specified by the call, the system finds no appropriate line description to accept the call. This could also occur if a connection list entry matches the calling information, but the connection list is not referred to by the varied on line description. If the varied on line description does not refer to the connection list, the system does not recognize any of the entries in the connection list.</td>
</tr>
<tr>
<td>The information transfer capability differs between network types so that a remote system cannot support the call type of the local system.</td>
<td>The local and remote network interface descriptions uses different connection types (specified in parameter connection type [CNNTYPE]).</td>
</tr>
</tbody>
</table>
### Rejection Problem Possible Cause

| The call is rejected because the ISDN takes too long to contact the remote system and respond to the local system. | In this case, the local system reaches the time-out or retry limit specified by the corresponding parameters. |

To find out why your system rejects a call to or to view rejected calls, see [Verifying connections](#).

### Circuit mode call information

Application programs use the get attributes operation of the intersystem communications function (ICF) to access information that a system receives or sends when making a call using IDLC or X.25. Accessed information includes these types of information:

- Call direction
- Remote number
- Remote number type
- Remote number plan
- Remote subaddress
- Remote subaddress type

Connection lists and their entries contain the same types of information necessary for the local system to process incoming calls. Once information about an incoming call has been retrieved, the application running on the local system can use calling party information and connection list information to process a particular call.

For example, an application might screen the incoming call and compare the information to the information in a file or list that contains security information. When the information matches an entry in this list, the application grants security privileges to that call. Another example is when an identified call is routed to a specific application, based on the identifying information it provides. Screening a call and accessing its information gives an application the ability to process calls selectively.

For more information on writing application programs to access calling party information, see these books:

- [ICF Programming](#)
- [APPC Programming](#)
- [CPI Communications Reference](#) for CPI communications

### Packet mode call acceptance

The notification class (X31NFYCLS) parameter of the network interface description indicates if and when the system receives notification from the ISDN that an X.25 call is waiting to be delivered. When the notification class is either conditional or unconditional, the called system receives X.25 information on the D channel. The value of the X.31 differences parameter (X31DIF) indicates the specific X.25 information that is received with the incoming call. This information may include the calling network address, the called network address, call user data, and other X.25 parameters. The network type and the subscription options should determine how parameter X31DIF is configured.

When the call includes call user data, the system determines the protocol that the call is requesting. If call user data is not requested, the system tries to match the called network address with the network address in a line description. If the called
network address is not received, the call is accepted if there is a configured line that can accept a call on the network interface. The line must be in a state of connect pending, varied on, or active, and it must have an available logical channel.

If the system receives call user data and the requested protocol is SNA, the called system checks SNA calls for the encoded password. It also tries to find a controller with a matching SNA protocol ID. The system checks the SNA controller descriptions to find one that contains a connection number that matches the calling network address of the call. If the system does not receive the calling network address, it does not do this screening.

Once the system has found an appropriate controller description, it screens the line descriptions to which that controller refers for one that matches the incoming call. For the system to perform this screening, the call must supply the called network address. The called system searches for a line description that contains a local network address that matches the called network address of the incoming call. An eligible line description must be in a state of connect pending, varied on, or active, and it must have an available logical channel.

If the protocol ID specifies the asynchronous protocol, the system looks for a line description that contains a switched controller list referring to an eligible controller for the call. If the called network address is supplied with the call, the system tries to match the called network address with the local network address in a line description. If the called network address is not supplied, the system looks for a line in the correct state to accept the call. The system tries to match the received calling network address with the connection number of a controller that it can use to answer the call.

If the protocol of the call is not SNA or asynchronous, or if AS/400 does not find a matching controller description, it searches for an eligible network controller description. The network controller description must be varied on and must have an active application program that will accept the protocol requested in the incoming call.

For more information on how to view connection or call status, see Verifying connections.

Packet mode call rejection
The receiving AS/400 may reject calls for a number of reasons. Generally, the system rejects calls if it cannot match its information with the incoming call’s information, or if it lacks a line and controller description for the called and calling number.

The ability of the system to screen incoming calls depends on how much information it receives with the incoming call. The X31DIF parameter specifies which information the ISDN provides and determines the level of screening that is performed. The call may include this screening information:

- Called network address
- Calling network address
- Call user data

The called system rejects calls when the called network address does not match the network address in any line descriptions of the called system. For asynchronous and SNA protocols, the system rejects the call if no asynchronous or SNA
controller description contains a connection number that matches the calling network address. For the SNA protocol, the system also rejects calls if they include an incorrect password.

When a call comes without the called network address, the calling network address, or the call user data, the system can accept a call that it later must reject. Once the system accepts the call on the D channel, it receives the call over the B channel. Then all the X.25 information comes with the call. Now the system has enough information to reject a non-matching call that it initially accepted.

Even if the supplied information matches the information of the called system, AS/400 can still reject the call for these reasons:
- No logical channel is available.
- No line or controller is in the correct state to accept a call.
- No application program is active and available to accept the protocol of the incoming call.

To find out why your system rejected a call to or to view rejected calls, see Verifying connections.

**AS/400 unsupported network issues**

If your preferred network type does not appear in the list of AS/400 network types, ask your local network provider whether you can substitute one of the supported types. For example, people in many countries know ETSI by another name.

If you cannot find a compatible network type, you must wait until AS/400 supports the network type you want.

**IDLC considerations**

Similar to other data link protocols, IDLC has special considerations for operation. These include polling for a connection and when to disconnect the controller:
- Connection request polling
- Disconnecting switched controllers

**IDLC connection request polling**

For permanent connections, when you are unsure when a remote site will respond to your IDLC request to connect, you can poll the remote site for as long as you want. Parameters Connect retry count (IDLCCNNRTY) and Response timer (IDLCSRPTMR) work together to control how often to poll.

**Disconnecting switched controllers**

The switched disconnect feature allows a switched IDLC controller to be disconnected when it is not in use. When the controller disconnects, the associated switched line description, and therefore the ISDN call, also disconnect. However, there may be circumstances when you may not want a switched ISDN call to be immediately disconnected. For example, when the connection time is very short, and you are charged for a longer time whether it is used or not.

The controller description parameter that affects disconnect time is DSCTMR.

**Performance issues**

You can increase ISDN’s performance by increasing throughput after a connection is made, increasing how much data transfers in the channel, and increasing your call acceptance rate:
**Throughput after connecting**

Parameter settings used for making connections, sometimes do not allow you to have the best throughput after the connection is made. For example, you increase your response wait time because the remote system may be busy. However, this same long wait time causes unnecessarily long delays, which slows down throughput.

To improve performance, you can set up AS/400 to use a larger initial parameter value when attempting to make a connection, and a smaller final value once the connection is made. You define the larger value in the line description and the optional smaller value in the attached controller.

IDLC controller description parameters receive their initial connection values from an attached line description. If you define a value for the controller description parameter, AS/400 uses that value after the connection is made. If you do not define a value, AS/400 keeps the line description value. These controller parameters use (*LIND) as their default value:

- IDLC window size (IDLCWDWSIZ)
- IDLC frame retry (IDLCFRMRTY)
- IDLC response timer (IDLCRSPTMR)
- IDLC connect retry (IDLCCNNRTY)
- Maximum frame size (MAXFRAME)

To adjust these parameters, you should see "Maximizing ISDN channel performance" on page 53.

**Controller description value limit**

**Note:** Having larger values specified in the controller description than in the line description causes an error message to be generated during the connection process.

For example, a higher value for parameter IDLCRSPTMR on the line description causes a longer wait time between retransmissions before establishing a permanent connection. Also, a high value for parameter IDLCCNNRTY on the line description causes greater connection retries until the connection is established. However, once the connection is established, the controller description IDLCRSPTMR parameter’s smaller value determines the time wait between transmissions.

**Controller description value ignored**

The values on the line description may be the only values used. This can happen on connections to a host that is using software prior to VTAM* Version 3, Release 2, and prior to NCP Version 4, Release 3, when the host to initiate the connection). The local system does not have values for the controller description until after the connection is established. In this case, IDLC configuration parameters on the controller description are ignored.

**Channel throughput**

You can maximize channel throughput by choosing the right frame size, window size, and request/response time limit (the maximum time between a request and response, covered in "Maximizing ISDN channel performance" on page 53).
To adjust these parameters, you should see "Maximizing ISDN channel performance" on page 53.

Frame Size

The MAXFRAME parameter in the line and controller descriptions specify the frame size for PPP, IDLC, or X.25. Larger frame sizes and a higher number of frames that can be sent without waiting may provide better performance. However, large frame sizes do not perform well with error-prone lines or networks, or in electrically noisy environments because larger frames require longer transmit time.

Note: Frame sizes above 2064 are not allowed for the 2750 and 2751 IOAs.

IDLC Window Size

The window size refers to the maximum number of IDLC frames that can be sent before an acknowledgment is required. The IDLCWDWSIZ parameter in the line and controller descriptions specifies the window size. The AS/400 support for IDLC allows a maximum window size of 31. In general, a larger window size and a greater number of frames that can be sent without waiting can provide better performance if the frame size is small or if transmission delay is long. Larger window sizes decrease the waiting time for an acknowledgment. However, as with larger frame sizes, a large window size does not perform well with error-prone lines or networks, or in electrically noisy environments.

Call acceptance performance

If your call acceptance times exceed those required by the network, changing your connection lists entries or the number of line descriptions can reduce the time your system processes incoming calls.

Connection list entries

Connection lists can be enhanced in a number of ways to increase call acceptance performance. These are:

• Using the line numbers only once
• Avoid duplicate connection list entries
• Limiting the use of *ANY for remote numbers

Use line numbers only once:

For PPP, fax, IDLC, and X.31 circuit-mode protocols, a line number should appear only once in any connection list for the fastest results. For example, if you have 3 connection lists, line number 1 should appear in only one of the lists. In this case, the system finds only one exact match for a call. As soon as AS/400 finds a match, it stops searching the connection lists for entries with identical information.

Avoid duplicate connection list entries:

Additionally, a connection list used for answering should not contain duplicate entries. Having a unique entry for each remote system reduces search time and avoids having several connection lists qualify as candidates for the same call. You should, if possible, avoid duplicate entries in the same connection list or in different connection lists.

Limit the use of *ANY for remote numbers:

Using *ANY for the Remote number (RMTNBR) parameter in your connection list entries, increases the call’s chances for call acceptance. However, *ANY may also
decrease your system’s performance because it requires more processing. For example, the system-supplied connection list QDCCNNLANY specifies no restrictions on call acceptance. Spending valuable system resources on answering undesirable calls can degrade system performance. To process only calls that are targeted for the interface, you may want to configure an exact local number or local subaddress in the NWI description.

**Number of line descriptions**
For IDLC and X.31, and PPP circuit-mode protocols, your system’s performance decreases as you increase the number of line descriptions that are associated with a connection list. As the number of line descriptions increase, performance slows because the system must check more line descriptions.

**Problem analysis and resolution**
Problem analysis includes identifying the problem, finding the cause of the problem, and eliminating the cause. This section describes the tools to help you identify the problem, find its cause, and find solutions to eliminate the cause. These tools are the system operator message queue, cause codes, and communication traces.

**Note:** For information regarding AS/400 first and second-level error recovery, you should refer to handling communication errors in Communications Management.

- “System messages”
- “Cause codes”
- “ISDN communication traces”

**System messages**
The most general error notification places an entry in the system operator message queue, QSYSOPR. Messages may also appear in other queues as defined by the person who created the PPP or X.25 line description, or the controller description. Parameter MSGQ defines which message queue the message is sent to.

The system displays messages to explain the problem and the appropriate solutions. Messages with an asterisk have additional problem analysis information. To see this information, you press PF14. These messages also display “Cause codes.”

**Cause codes**
Cause codes indicate why network events occur and are usually used with switched lines. Cause codes appear in messages that are sent to QSYSOPR or the configured message queue. For ISDN, the cause code is one field in the cause information element (IE) that the local system may send or receive.

IE fields are:
- Source of generated code
- Coding standard used
- **Cause code**
- Diagnostic codes specific to the network or the terminal equipment (TE)

**ISDN communication traces**
You AS/400 collects trace data for an ISDN on D channels and B channels. To collect D channel data, you perform a trace on your network interface description. To collect B channel data, you perform a trace on your line description.
The data on D channels uses link access procedure D channel (LAPD) format and can help determine call-in and call-out problems. LAPD, recommended by the ITU-T, is a duplex, asynchronous, symmetric procedure used to communicate control instructions, such as setting up and ending a connection, to the control channel (D channel) of ISDN. For more information about interpreting collected data in LAPD or IDLC format, you should refer to ISDN Data Link Control Architecture Reference.

The system provides various tools to gather communications trace data. The tools include the Start System Service Tools (STRSST) command and communications trace commands. The communications trace commands are:

- Start Communications Trace (STRCMNTRC)
- End Communications Trace (ENDCMNTRC)
- Print Communications Trace (PRTCMNTRC)
- Check Communications Trace (CHKCMNTRC)
- Delete Communications Trace (DLTCMNTRC)

Additional information about communications trace is in book Communications Management.

**Error message and message management**

You can manage your system messages by determining to which message queue a message should go. Usually, the system sends messages to the default system message queue (QSYSOPR). However, for controller descriptions and X.25 and PPP line descriptions you determine the message queue through parameter message queue (MSGQ).
Chapter 3. Planning ISDN service

Before you configure your AS/400 for ISDN support, you need to verify:
1. Whether your local telephone company offers ISDN service that AS/400 supports.
2. Whether your local telephone company provides ISDN service to your location.
3. Whether your local telephone company offers the ISDN service you need:
   - Basic rate interface (BRI)
   - Voice service on B channels, if you use PPP to communicate with remote analog modems, the remote site uses data over voice, or you use fax
   - Data service on B channels, for normal ISDN data calls
4. Find out if the AS/400 supports your provider’s network type.
5. Find out if they offer the type of connections that you need (for example, permanent or switched).
6. Choose your protocols.
7. Check to see if you have the proper cards installed. For BRI you need the 2605, 2750, or 2751 input/output adapters (IOAs). For more information about this IOA, see “Supported protocols and ISDN hardware” on page 10.

The next step is to configure your system.

Choosing your ISDN connection protocol

Your choice of ISDN connection protocols depends on the higher layer protocols your application uses. If your applications use Transmission Control Protocol/Internet Protocol (TCP/IP), your connection protocol choices are PPP or X.25. If your applications use Systems Network Architecture (SNA), your connection protocol choices are ISDN data link control (IDLC) or X.25.

Note: You must also verify that your IOA supports your choice of connection protocol.

Unless you have a particular reason for using SNA, PPP is your best choice for these reasons:
- It works for both integrated services digital network (ISDN) and analog interfaces.
- All internet or web applications require it.
- It interoperates with the greatest variety of remote devices.

You use SNA:
- If you need it to interoperate with existing applications.
- If the enterprise network is mandated to be SNA.
- For superior performance and efficiency.
Chapter 4. Configuring your AS/400 for ISDN

Configuring ISDN support for IDLC or X.25:

Configuring an ISDN connection on the AS/400 is not much different than configuring any other type of network connection. You first need to know the ISDN specifications that your telephone service provider uses. Those specifications depend primarily on your location and the terms of your network subscription.

Before you begin to configure your AS/400, obtain the information you need from your network provider or ISDN administrator.

To successfully configure your AS/400 with CL commands, do these steps:
1. Configure a network interface description on your AS/400.
2. Configure a connection list, if you have switched service.
3. Configure a line description.
4. Set the modem country ID.
5. Configure a controller description.
6. If you are using APPN support, AS/400 configures device descriptions automatically. Otherwise, you need to create device descriptions.

Configuring fax or PPP over ISDN:

To configure fax or PPP over ISDN, see this information:
- "Configuring fax over ISDN" on page 43 using switched connections.
- Configuring PPP over ISDN using Operations Navigator (All the necessary configuration objects are created for you).

Note: Before you vary on existing network interface descriptions (NWIs), see changing existing NWI descriptions.

Information you need before configuring ISDN

Before you configure ISDN support on your AS/400, you need information from your service provider:
- Is your service provider’s network type supported by AS/400?
- Find out what information you need to give them and what information you need from them to configure your AS/400. See network type and click on the links in the table to find the information specific to that network type.
- Is basic rate interface (BRI) supported?
- What connection type is supported?:
  - Is the S/T or U interface supported? S/T requires an external network termination (NT)/1 device. In some countries the network provider supplies this. In other countries, the AS/400 customer must supply it.
  - Will a B channel be switched or permanent? Your network subscription determines this. On some networks it is possible to have one switched B channel and one permanent B channel on the same BRI.
  - If you use BRI and want to use a passive bus configuration so devices can share a BRI, you need to know whether your service provider has passive bus capabilities. Passive bus requires a 2605 or 2751 input/output adapter (IOA).
- Local number. This is the number the remote site calls to reach this system on this BRI.
For fax support, you only need the local number. The system gets the remote numbers from your Notes or Facsimile Support for AS/400 database.

**Supported network types**

A network type is your service provider’s implementation of ISDN as identified by the AS/400. Your system supports the network types that are listed in the table below. For information specific to a network type, click on links in the table below to find out:

- What kinds of information to give to your provider.
- What kinds of information to get from the provider to configure your AS/400.

The table also shows the current network types and network types they replace. The AS/400 IOAs work with these network types:

<table>
<thead>
<tr>
<th>Network type</th>
<th>AS/400 NETTYPE parameter values</th>
<th>Replaces previous network types</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T Generic Interface</td>
<td>*ATT</td>
<td>• *ATT5E42 (AT&amp;T 5ESS version 5E4.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• *ATT5E5 (AT&amp;T 5ESS version 5E5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• *ATT5E6 (AT&amp;T 5ESS version 5E6)</td>
</tr>
<tr>
<td>German Post Telephone and Telegraph Administration</td>
<td>*DBP1TR6</td>
<td></td>
</tr>
<tr>
<td>Administration (PTT) (Deutsche Bundespost (1TR6). For use with the &quot;FC 2605 input/output adapter&quot; on page 7 only. For other German network types, use *ETSI.</td>
<td>*ETSI</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• *BTNR191 (British Telecom ISDN2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• *FTVN2 (France Telecom Numeris VN2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• *SWISSNET2 (Swiss PTT)</td>
</tr>
<tr>
<td>European Telecommunications Standard Institute</td>
<td>*JAPAN</td>
<td></td>
</tr>
<tr>
<td>(also known as EuroISDN standard)</td>
<td></td>
<td>• INSNET64 (Nippon Telephone &amp; Telegraph INS-NET64)</td>
</tr>
<tr>
<td>Japan (Nippon Telegraph &amp; Telephone (NTT))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nortel Generic (formerly Northern Telecom)</td>
<td>*NORTEL</td>
<td></td>
</tr>
<tr>
<td>National ISDN (or North American Interface)</td>
<td>*NISDN</td>
<td></td>
</tr>
<tr>
<td>Use this if you specified a default network type in the network attributes.</td>
<td>*NETATR</td>
<td></td>
</tr>
</tbody>
</table>

In North America, you need the additional information below from your provider:

- If the phone company says that you are connected to an AT&T switch, then ask if the switch is running National ISDN or AT&T Generic.
- If you have a basic rate interface and your network type is AT&T Generic, Nortel Generic, or National ISDN (also called North American Interface), you should know what the SPIDs (service profile identifiers) are.

If your network type is not supported, see "AS/400 unsupported network issues" on page 16.
ETSI (Europe)
Use this information to connect your AS/400 to the European Telecommunications Standards Institute (ETSI) network type.

AS/400 information that you need to share with your service provider:
• AS/400 supports circuit-switched data on B channels.
• AS/400 supports packet-mode data on B channels (if you are using the 2605 IOA).
• AS/400 supports only basic rate service.
• More than one device can share a basic rate interface (BRI) through a passive bus.
• AS/400 can initiate and receive both voice (at 56 Kbps) and data (at 64 or 56 Kbps) calls.

Distinguishing devices or functions:
Check with your network provider to find out which subscription options are available.
• For BRI, these subscription options might include:
  – One local number associated with both B channels. This is the normal default for a BRI line. Additional numbers might have an additional charge.
  – Multiple subscriber number. The subscribed BRI is assigned a set of different local numbers. Each separate device or function that is addressed has its own unique local number.
  – Direct dial-in. The subscribed BRI is assigned multiple extensions that callers can address by appending the extension digits after the number.
  – Subaddressing. This option allows you to assign unique subaddresses to each device or function that must be separately accessed on the BRI. Subaddressing increases the number of individually addressable entries on a BRI without additional subscribed local numbers.

Configuration considerations:
When you create your network interface description, use *ETSI as the network type.

If you configure connection lists, use these values:
• For outgoing calls, specify the remote number that your service provider gives you.
• For incoming calls, specify *ANY or a specific remote number.
• For the remote subaddress, specify *ANY of a specific remote subaddress value.
• For the local number, specify *ANY or a subscribed local number.
• For the local subaddress, specify *ANY or a specific subaddress value.
• If the reactivation timer has a value of 123, AS/400 does not detect power. Use this mode of operation to attach to private branch exchanges (PBX) or other devices that do not provide Power Source 1. Do not use it on a public network.

Nortel Generic (formerly Northern Telecom)
Use this information to connect your AS/400 to the Nortel Generic network type.
If your network provides National ISDN, you should use the *NISDN network type parameter value. For Nortel Generic, you must subscribe to all these options from your ISDN provider:
• AS/400 supports circuit-switched data on B channels.
• AS/400 supports packet-mode data on B channels (if you are using the 2605 IOA).
• One nonautomatic (fixed, static) terminal end-point identifier (TEI) assignment for each circuit-switched B channel.
• A fixed B channel that is allocated for each circuit-switched device.

Hardware considerations:

Two hardware situations are possible with this network type:
• One AS/400 ISDN adapter connects to the BRI. An adapter can use up to one specific circuit-switched B channel. The remaining B channel can either be subscribed as a permanent channel for X.25 (X.31 packet mode) or used exclusively by another device that shares the same BRI.
• Two AS/400 ISDN adapter cables share the same BRI. This enables one AS/400 to use two circuit-switched B channels.

Distinguishing devices or functions:

You will need the SPID information from your provider.

Each circuit-switched device that is connected to a BRI has a unique number for each B channel that it uses.

Configuration considerations:

When you create your network interface description:
• Use *NORTEL for the Network type parameter.
• For the Channel entries parameter, use:
  – If the subscribed local number uses B channel 1, specify *NONSWT as the connection type for channel 2.
  – If the subscribed local number uses B channel 2, specify *NONSWT as the connection type for channel 1.
  – If a subscribed local number does not apply, specify *NONSWT as the connection type for both channels.
• Use a specific value for the Terminal end-point identifier (TEID) parameter unless you use only X.25 (X.31) packet mode.

You do not need a connection list if you use only permanent B channels or only X.25 (X.31) packet mode.

JAPAN
Use this information to connect your AS/400 to the Nippon Telephone and Telegraph (NTT) network type.

AS/400 information that you need to share with your service provider:
• AS/400 supports circuit-switched data on B channels.
• AS/400 supports packet-mode data on B channels (if you are using the 2605 IOA).
• AS/400 supports only basic rate service (BRI) service.
• More than one device can share a basic rate interface through a passive bus.
• AS/400 can initiate and receive both voice (at 56 Kbps) and data (at 64 or 56 Kbps) calls.

Distinguishing devices or functions:

All circuit-switched devices that share a BRI, and functions that must be addressed individually in a device, have unique addresses.

Configuration considerations:

Use these values when you configure your network interface description:
• The value for the network type parameter is *JAPAN.
• For channel entries use *SWT2B unless one of these applies:
  – If the subscribed local number exclusively uses B channel 1, channel 2 should use channel connection type *NONSWT.
  – If the subscribed local number exclusively uses B channel 2, channel 1 should use channel connection type *NONSWT.
  – If a subscribed local number does not apply, channels 1 and 2 should both use channel connection type *NONSWT.

**AT&T (North America)**

If you are in North America and connected to an AT&T switch, you should ask the phone company if the switch is running National ISDN or AT&T Generic. Use the information that is on this page if your service provider uses AT&T Generic.

**AS/400 information that you need to share with your service provider:**

• AS/400 supports only basic rate service (BRI) service.
• AS/400 supports circuit-switched data on B channels.
• AS/400 supports packet-mode data on B channels (if you are using the 2605 IOA).
• The terminal type for AS/400 is E.
• AS/400 can initiate and receive both voice (at 56 Kbps) and data (at 64 or 56 Kbps) calls.
• For BRI service, you must specify either:
  – Point-to-point operation. Only one device can connect to the BRI.
  – Multipoint operation (does not apply to 5E4.2). More than one device can share a BRI. AS/400 operates as a non-endpoint terminal that initializes connections. If your ISDN provider limits each device to use one B channel and you want your AS/400 to use both B channels, subscribe to the point-to-point option instead.

**Distinguishing devices or functions:**

You will need the SPID information from your provider.

For multipoint operation, each device that is connected to a BRI has a unique number.

**Configuration considerations:**

When you create your network interface description:

• Use *ATT for the Network type parameter.
• For the Channel entries parameter, use *SWT2B unless one of these conditions applies:
  – If the subscribed local number exclusively uses B channel 1, specify *NONSWT as the connection type for channel 2.
  – If the subscribed local number exclusively uses B channel 2, specify *NONSWT as the connection type for channel 1.
  – If a subscribed local number does not apply, specify *NONSWT as the connection type for both channels.

**National ISDN (also called North American Interface)**

If you are in North America and connected to an AT&T switch, ask the phone company if the switch runs National ISDN or AT&T Generic. Use the information on this page if your service provider responds with National ISDN.

**AS/400 information that you need to share with your service provider:**
• AS/400 supports only basic rate service (BRI) service.
• AS/400 supports circuit-switched on B channels.
• AS/400 supports packet-mode data on B channels (if you are using the 2605 IOA).
• The terminal type for AS/400 is E.
• AS/400 can initiate and receive both voice (at 56 Kbps) and data (at 64 or 56 Kbps) calls.
• More than one device can share a BRI through a passive bus. However, network providers usually limit the number of possible B-channel accesses to the BRI to 2. They also do not allow more devices to contend for the B channels. This limitation means that a BRI that supports both B channels can have either:
  – A single device that can access both B channels.
  – Two devices, each with access to only a single B channel.
• Check with your service provider for the exact restrictions regarding the number of devices that may share the same passive bus.

Distinguishing devices or functions:

You will need the SPID information from your provider.

Ask whether your network service provider provides Automated service profile identifier detection (SPID) capability. If so, you get a SPID value when you subscribe. You can use this value when you configure your network interface description to identify individual devices on a BRI line.

Normal operation of National ISDN uses a separate SPID and local number for each separate physical device that is attached to the BRI. Additionally, some versions of National ISDN require a separate SPID and directory number for each B channel access to the BRI. These separate entries are required even when a single device accesses both B channels.

You can also choose not to use SPID parameters at all. The network provider calls this choice "using a default terminal service profile." You should not choose this option if your application needs multiline hunt group capabilities that the network provides. Ask your service provider which modes of operation your network supports.

Depending on availability, subscription options might include:
• Additional addressing of different devices on a passive bus.
• Additional addressing of different functions within a single device. These subscription options can include:
  – One local number that is associated with both B channels. This can be either:
    - A single device that accesses both B channels and uses a single SPID.
    - Multiple devices that use the default terminal service profile (no SPID).
  
    When all devices on a passive bus use different call types, the ISDN protocol automatically distinguishes between different devices. For example, when devices use both telephone and circuit-switched data, no further subscription options are necessary to uniquely address those specific devices.
  – Two local numbers (and two SPIDs) that are associated with the BRI.
• Multiple subscriber number (MSN), which gives you a set of different local numbers to the subscribed BRI. These numbers are different from the multiple numbers that are in use because of multiple SPIDs on the BRI. Each separate device or function that needs to be addressed is then assigned its own unique local number.
• Direct dial-in. The subscribed BRI is assigned multiple extensions that callers can address by appending the extension digits after the number.
• Subaddressing. You can use this option to individually access more devices or functions on a BRI without additional subscribed local numbers.
• Calling line identification presentation (or caller ID) causes the network to deliver the number of the caller, with some exceptions. The sender can block calling line identification on either a call-by-call or subscription basis.

Configuration considerations:

When you configure the network interface description for this network type, use *NISDN for the Default network type (DFTNETTYPE) parameter.

Configuring an ISDN network interface description

Once you have the information you need from your service provider, you are ready to set up the physical interface from your AS/400 to the ISDN. The first step is to configure a network interface description that "describes" the interface to your AS/400. Take these steps:

1. You need the resource name of the ISDN port to associate with this NWI description. To find out resource names, you use the Work with Hardware Resources (WRKHDWRSC) command:
   a. On the AS/400 command line, type WRKHDWRSC TYPE(*CMN) and press Enter.
   b. Locate an ISDN port by looking for the phrase "ISDN basic port" in the text column.
   c. Once found, move your cursor to the port’s Option column, press 5, and then press Enter.
   d. Press 1 and press Enter.
2. Type in a name for your ISDN NWI description and press Enter to create a network interface description.
   Notice that parameter Resource name contains the name of the selected resource.
3. For parameter Network type, specify the correct network type or use the default *NETATR if you have used the Change Network Attributes (CHGNETA) command to specify a default ISDN network type. You can use the Display Network Attributes (DSPNETA) command to see what the current settings are.
4. Press F9 to display all parameters.
5. Use the Channel entries field to establish the characteristics for specific channels in your network interface.
   With BRI service, if you want one switched connection and one permanent one, you can create two B-channel entries and one D-channel entry.
   Channel number field specifies the channel number. Possible values for this field are:
   *SWTALL
   Use this value if all your B channels are switched.

Channel number value
   Specify the channel number (1 or 2) if you are not using *SWTALL. Use the + (more) field, following the channel fields, to specify values for the other channel.

Channel connection field specifies the connection for a channel. You do not need to specify a value here if Channel number is *SWTALL. Possible values for this field are:
*SWT
Use this value for switched connections.

*NONSWT
Use this value for nonswitched (permanent) connections.

**Line description field**

Line description name
Use this field to specify an existing line description. If you have not configured the line description yet, leave this field empty. Your system fills in this field when you specify the name of this NWI description while creating the line description. Valid line descriptions include names of ISDN data link control (IDLC), Point to Point Protocol (PPP), and X.25 line descriptions.

6. Use parameter Protocol entries to specify your protocol (PPP, ISDN data link control (IDLC) on page 10, or X.25) and information specific to that protocol.

7. If you use this NWI description with BRI and your network type is *ATT, *NISDN, or *NORTEL, you must specify Service profile identifiers (which you get from your service provider). This parameter does not apply to other network types.

   a. To display parameter Service profile identifiers, press F9 (all parameters) and follow the rules below for each SPID:

   b. **SPID number 1**
      - If field SPID value has a value other than *NONE, you must specify a value for the Local number field.

   c. **SPID number 2**
      - Field SPID value must be *NONE, if the SPID value field of SPID number 1 has a value of *NONE.
      - If field SPID value has a value other than *NONE, then you must specify a second number for the Local number field.

   All other parameters are optional and have default values. If you are configuring this NWI for fax support, return to "Configuring fax over ISDN" on page 42. If the NWI description is for a switched connection and you want AS/400 to place outgoing calls or screen incoming calls, you need to configure a connection list next. Otherwise, the next step is to create a line description. You can also see a list of other commands that are available to work with network interface descriptions.

**Network interface description commands**

Additional commands that you can use to work with network interface descriptions include:

- Work with Network Interface Description (WRKNWID), which shows you a list of all network interface descriptions on the system. From the list you can create, change, copy, delete, display, print, rename, or work with the status of network connections or retrieve a configuration source program.
- Change Network Interface Description for ISDN (CHGNWIIISDN).
- Display Network Interface Description (DSPNWID).
- Delete Network Interface Description (DLTNWID).

Additional commands that support network interface descriptions include:

- Work with Configuration Status (WRKCFGSTS).
- Retrieve Configuration Status (RTVCFGSTS).
- Retrieve Configuration Source (RTVCFGSRC).
- Vary Configuration (VRYCFG).
Configuring ISDN connection lists

Information you supply in the connection list tells your AS/400 when to accept incoming calls and what information to send with an outgoing call. This information is like a telephone book. AS/400 uses it only for switched connections.

Your system comes with a default connection list (QDCCNLANY), which directs it to answer all incoming ISDN calls. If this is all you want your AS/400 to do with ISDN calls, you do not need to create and configure a connection list. However, for your system to place outgoing calls or screen incoming calls, you can do one or more of the tasks below:

- Create a connection list and add entries to it.
- Change the default connection list (QDCCNLANY) by adding entries with remote numbers.

You can use one connection list for both answering and dialing, or create different connection lists. To assign a connection list for incoming calls, you must specify the connection list in the line description.

To assign a connection list for outgoing calls, you must specify it and one of its entries in the line description or controller description. The connection list entry contains the phone number to dial and the information transfer type to use for the call.

For more detailed information about connection lists, see Connection lists. You can also see a list of other commands that work with connection lists and their entries.

Details: ISDN connection lists

Connection lists and connection list entries help your system handle incoming and outgoing calls from the ISDN by providing information to include in outgoing call setup messages:

- A number for both the local and remote system.
- Local and remote subaddresses, which are extensions of an ISDN number (telephone number). Your system uses these to identify individual users within a group of users that have a single telephone number.
- A number of additional information elements (IEs) that are used for such functions as describing transit networks crossed. An information element is a unique field that is encoded in messages sent over the D channel between AS/400 and the ISDN.
- Information to collect about incoming calls.
- Network differences.

Not all networks support exchanging all the information provided by the ITU-T recommendations for ISDN, so information varies from network to network. In addition, some networks charge extra for providing special information about a call (for example, calling party identification). You may prefer not to subscribe to information for which there are special charges.

Calling party identification

Calling party identification is information that the ISDN provides about the incoming call.
Creating an ISDN connection list

If you have a switched connection and want your system to make outgoing calls or screen incoming calls, you need to either create a connection list or change the IBM-supplied default connection list (QDCCNNLANY) by adding entries. To create a connection list, you need *LIBCRTAUTH authority.

To create a connection list, use the Create Connection List (CRTCNNL) command:
1. On the AS/400 command line, type CRTCNNL, and press F4.
2. Fill in the name for your connection list, and press Enter.
3. In parameter Text ‘description’, type in any text you want to describe it.
4. Choose the correct Network type.
   To use this connection list with a particular NWI, their network types must be the same.
5. If you are configuring this connection list for fax support, return to “Configuring fax over ISDN” on page 43. Otherwise, continue to the next step.
6. You can make telephone numbers in this list more readable by adding extra characters (for example, parentheses or hyphens). Your system will use these characters unless you tell it to ignore them. What characters your AS/400 ignores by default, depend on your network connection type. To see what characters your AS/400 ignores, press F9 (all parameters). You can add to this list if you want.
7. Press Enter to create the connection list and exit the command.

Your next step is to add entries into the connection list you created.

Connection list commands

Additional commands that you can use to work with connections lists include:
- Create connection list (CRTCNNL).
- Work with Connection Lists (WRKCNNL), which shows you a list of all connection lists on the system. From the list you can create, change, copy, delete, display, or print connection lists. You can also rename and work with the entries in a connection list or retrieve a configuration source program.
- Change Connection List (CHGCNNL).
- Display Connection List (DSPCNNL).
- Delete Connection List (DLTCNNL).
- Retrieve Configuration Source (RTVCFGSRC), which copies a connection list and all its entries.
- Restore Configuration (RSTCFG).

You can also use these commands to work with connection list entries:
- Work with Change Connection List Entries (WRKCNNLE), which shows you a list of all the entries in a specified connection list. From the list you can add, change, copy, remove, display details, or rename entries.
- Add Connection List Entry (ADDCNNLE).
- Change Connection List Entry (CHGCNNLE).
- Rename Connection List Entry (RNMCNNLE).
- Remove Connection List Entry (RMVCNNLE).

Adding ISDN connection list entries

To use a connection list that you have created or to change the default connection list (QDCCNNLANY) to allow your system to make outgoing calls, you must add one or more entries to the list. These entries identify information that this system can use to make outgoing calls and accept incoming calls.

You should see call acceptance performance for guidelines on configuring connection list entries.
To add entries to a connection list, use the Add Connection List Entries (ADDCNNLE) command.

To do this, take these steps:
1. On the AS/400 command line, type ADDCNNLE, and press F4.
2. For parameter Connection list, specify the name of the connection list to associate this entry with (either one you created or the default list [QDCCNNLANY]).
3. For parameter Entry, specify a name for the new entry.
   Each entry in the connection list must have a unique name.
4. Press F9 to display all parameters.
5. If your ISDN provider assigned a remote number for the remote system, specify it in the Remote number field.
   Your system uses this number to screen incoming calls and route outgoing calls. Enclose the number, which can be up to 32 characters, in apostrophes. (You can use extra characters, such as parentheses, to improve readability. You may need to direct your AS/400 to ignore them, if you did not do this when you created the connection list (step 6 on page 32). You can change the connection list after you have added the entries.
   If you leave the default *ANY, your system accepts calls from any remote number. Outgoing calls that attempt to use the default value fail because your system needs a specific remote number to initiate a call.
6. If this is a switched entry and you plan to use it with the integrated modem, configure the integrated modem.
   All other parameters are optional and have default values.
8. Press Enter to save your description and exit the command.
9. If you are configuring entries for fax support, return to “Configuring fax over ISDN” on page 42.

Next you need to create a line description.

Ignoring characters in remote telephone-numbers
AS/400 ignores certain extra characters within numbers in your connection list; which ones depend on your network type. To see which characters it ignores for your network and add characters if your want, use the Change connection list command (CHGCNNL):
1. On the AS/400 command line, type CHGCNNL CNNL(connection_list) and press F4.
   where connection_list is the name of your connection list.
2. Press F9 to display the Characters to remove field (RMVCHR parameter). This parameter contains the list of characters that the AS/400 ignores, by default, for the network type.
3. Specify up to 10 characters to ignore and press Enter.
4. Your AS/400 ignores these extra characters when it uses numbers from this connection list.

Configuring the ISDN integrated modem
The integrated modem on the 2750 and 2751 input/output adapters (IOA), can only be used with a switched connection that is used for a fax over PPP line. The steps shown on this page associate the integrated modem with a connection list entry. Therefore, the information here assumes that you are in the process of adding an entry into a connection list.
1. Press F9 to display all parameters.
2. Locate parameter Information transfer type and specify the type of information to transfer through the modem. Select one of the values below:
Select *FAXMODEM for fax support.

To see more information about these values, press F1.

3. IBM provides a default command string for the integrated modem. To specify your own, you can locate the Modem init command string field and type in your commands.

You should click your web navigator’s back button to continue with the next step.

---

**Configuring a line description for ISDN connections**

After configuring a network interface description and, if appropriate, a connection list, you need to "describe" a particular communication line to your AS/400. You do this by creating a line description. Your method for doing this depends on which protocol you use:

- For Systems Network Architecture (SNA) over IDLC, create an IDLC line description.
- For X.31 (X.25 over ISDN), create an X.25 line description if you are using the 2605 IOA.
- For fax over an ISDN connection, create a PPP line description.

You can also see a list of other commands that are available to work with line descriptions.

**Configuring IDLC over ISDN**

You need to "describe" the data-bearing B channel connection and the IDLC protocol to be used between your local AS/400 and the remote system. You do this by creating a line description with the Create Line Description for IDLC (CRTLINIDLC) command. Take these steps:

1. On the AS/400 command line, type CRTLINIDLC and press F4.
2. Use the Line description field to provide a name and press Enter.
3. For the NWI connection type parameter, the default value *SWT indicates that a switched connection can be established over any of the network interface descriptions that you will list in the Switched NWI list field. If you have a permanent connection, change the value for the NWI connection type.
4. For switched connections, use the Switched NWI list field to list up to 64 network interface descriptions to which this line can be connected. (Your AS/400 places the name of this line description into the network interface description's field Line description field, of the channel entries parameter, if it is empty.)
5. Press F9 to display all parameters.
6. To use data over voice (DOV) with non-switched lines, type *DOV into the Information transfer type field.
7. Press Enter twice to save your description and exit the command.

When you have configured your line description, you are ready to configure a controller description.

**Configuring an X.31 (X.25 over ISDN) line description**

You can use X.31 if you are using IOA 2605. After configuring a network interface description and, if appropriate, a connection list, you need to create a line
description to use ISDN channels to transmit X.25 packets, in either packet mode or circuit mode. You do this by using the Create line description (X.25) command (CRTLINX25):

2. Use parameter Line description to provide a name.
3. The Resource name identifies the hardware that the description represents. Specify *NWID to use the resource name that the network interface (NWI) description provides.
4. Use parameter Logical channel if you want to add, remove, or change entries in the logical channel table. Specify *PROMPT if you want to see the current logical channel entries. You can use this option to add, remove, or alter any entry except those with attached permanent virtual circuit controllers.
5. Specify the Local network address for your AS/400.
6. Use parameter Connection initiation to specify whether the local system or remote system initiates the connection. Specify *WAIT if you want the local system to wait for a disconnection from data circuit-terminating equipment before initiating a connection. Specify *CALLER if you want the connection to be initiated by manually dialing from either the local or remote system.
7. For the Physical interface parameter, use *X31.
8. Use parameter Connection type to specify a switched or nonswitched line.
9. For a switched line you need to specify the name of the connection list to be used for outgoing calls. If you want, you can also specify a particular entry name from that connection list.
10. To use data over voice (DOV) with nonswitched lines, type *DOV into parameter Information transfer type.
11. Attach connection list to line.

When you have configured your line description, you are ready to configure a controller description.

**Configuring a PPP line description for fax support**

After configuring a network interface description, creating a connection list, and then adding entries, you create a PPP line description to use with fax. Your system uses the line description to place the line into asynchronous mode. The PPP protocol is not used with fax.

The steps below are valid only if you are using the PPP line description with fax services:

1. On the AS/400 command line, type CRTLINPPP and press F4.
2. In the Line description field, type a name for your PPP line description.
4. Press F9 to display all parameters.
5. Do one of these steps:
   - Specify the name of your connection list in the Outgoing connection list field (the CNNLSTOUT parameter). In the Connection list entry field, specify the outgoing name.
   - Specify the name of your connection list in the Incoming connection list field. (This sets the value for the CNNLSTIN parameter.)

**AT commands**

AT commands tell your modem to perform various functions. Your system supports a subset of the industry standard and assumes that you are very familiar with them.

AS/400 supports these AT commands:

- "Basic AT commands" on page 34
- "AT & commands" on page 34
Basic AT commands
Your system supports these basic AT commands:

Bn (line modulation options)
Configures the modem for CCITT or Bell modulation with line speeds of 300 or 1200 bps.
Range: \( n = 0 \) or \( 1 \)
Default: 1

P (set pulse dialing)
Instructs the modem to use pulse dialing by default.

Sn (select S register)
Selects a specific S register and establishes it as the last-accessed S register.
Range: \( n = 0 \) to \( 99 \)

T (enable tone dialing)
Instructs the modem to use tone dialing by default.

Yn (long space disconnect)
Enables or disables long space disconnect.
Range: \( n = 0 \) or \( 1 \)
Default: 0

AT & commands
Your system supports these AT & (ampersand) commands:

&Fn (load factory settings)
Loads the configuration programmed at the factory.
Range: \( n = 0 \) or \( 1 \)
Default: 0

&Gn (guard tone operation)
Determines which guard tone, if any, to transmit.
Range: \( n = 0 \) to \( 2 \)
Default: 0

&Kn (set flow control)
Defines how the data terminal equipment (DTE) and Distributed Computing Environment (DCE) will handle flow control.
Range: \( n = 0, 3, 4, 5 \) or \( 6 \)
Default: 3

&Pn (dial pulse ratio)
Determines the make or break ratio that is used during pulse dialing.
Range \( n = 0 \) to \( 3 \)
Default: 0

&Qn (communications mode option)
Selects the connection modes that are permitted.
Range: \( n = 0 \) to \( 6 \)
Default: 5
AT % commands
Your system supports these AT % (percent) commands:

%Cn (data compression)
Enables or disables data compression negotiation.
Range:
n = 0 or 1
Default: 1

%En (enable/disable line quality monitor and auto-retrain fallback/ fall forward)
Determines whether the modem will automatically monitor the line quality and request a retrain or fall back when line quality is insufficient, or fall forward when line quality is sufficient.
Range n = 0 to 2
Default: 0

AT \ commands
Your system supports these AT \ (backslash) commands:

\An (block size for MNP)
An MNP error-corrected link will use the maximum block size specified by the parameter.
Range: n = 0 to 3
Default: 1

\Nn (modem protocol options)
Selects the error correction mode for subsequent connections.
Range:
n = 0 to 5
Default: 3

AT + command
Your system supports these AT + (plus) commands:

+MS (select modulation)
Selects the modulation. Optional parameters can be used to enable/disable automode and set lower and upper limits for connection rates.

Command format:
+MS=<mode> [,[,<automode>][,[<minimum_rate>][,[<maximum_rate>]]]]

Ranges and defaults:
mode: 0, 1, 2, 3, 9, 10, 11, 56, 64, 69 (default: 56)
automode: 0, 1 (default: 1)
minimum_rate: 300 - 33600 (default: 300)
maximum_rate: 300 - 56000 (default: 56000)

AT commands for S registers
All bit-mapped registers are read-only. You should use the appropriate AT command that controls the relevant S-register bits to change the value.

The read-only memory (ROM) contains the factory default values and are loaded into the active configuration at power-up. All of the factory default values may be loaded at any time by entering the &F command.

Your system supports these S-register commands:

S0 (automatic answer ring count)
Sets the number rings required before the modem automatically answers a call. Setting this register to zero disables autoanswer mode.
S9 (carrier validation time)
Sets the time, in tenths of a second, that the carrier must be present before the modem considers it valid and turns on received line signal detector (RLSD).

Range: 1 to 255
Default: 6
Units: 0.1 seconds

S10 (lost carrier delay)
Sets the length of time, in tenths of a second, that the modem waits before hanging up after a loss of carrier.

Range: 1 to 255
Default: 14
Units: 0.1 seconds

S11 (DTMF duration)
Sets the length, in milliseconds, of DTMF tones.

Range: 50 to 255
Default: 95
Units: 1 millisecond

S12 (guard time)
Defines the maximum period, in 20 millisecond intervals, allowed between consecutive asynchronous escape characters (+) for the escape sequence to be considered valid.

Range: 0 to 255
Default: 50
Units: 0.02 seconds

S29 (flash dial modifier time)
The length of time, in 10-millisecond units, that the modem stays on-hook when running a ! (flash) dial modifier. This may be limited by country restrictions.

Range: 0 to 255, 10-millisecond intervals
Default: 0

S30 (inactivity timer value)
The period of communications inactivity before the modem disconnects. In error-correcting mode, that is transmitted or received resets the timer. In other modes, any data transmitted resets the timer. The timer is Inoperative in synchronous mode.

Range: 0 to 255, Default: 0, Units: 10-second intervals

S33 (XOFF character)
Defines the value of the XOFF character.

Range: 0 to 255
Default: 19 (13h)

S36 (LAPM failure control)
Action to take when LAPM failure occurs. Fallback options are initiated immediately at connection when $S48 = 128$. If you enter an invalid number, $S36$ accepts it into the register, but behaves as if you entered the default value. Bits 2, 1, 0 combine to indicate:
- 000 = Modem disconnects.
- 001 = Modem stays online, and Direct mode connection is established.
• 010 = Reserved.
• 011 = Modem stays online, and Normal mode connection is established.
• 100 = MNP connection is attempted; failure results in disconnection.
• 101 = MNP connection is attempted; failure results in Direct mode connection.
• 110 = Reserved.
• 111 = MNP connection is attempted; failure results in Normal mode connection.

Bits 7-3: Reserved

Default: 7 (00000111b)

**S38 (delay before forced hang up)**

Specifies how long to wait after receiving the H command (or ON to OFF transition of DTR if the modem is set to follow the signal) before going on-hook. This command applies only to connections with error correction. You can use it to ensure that all data in the modem’s buffer is sent before disconnection.

Range:
- 0 - 254: the number of seconds before disconnecting
- 255: no disconnect

**S46 (data compression control)**

Range: 136 or 138
Default: 138 (disabled)
136: Execute error correction protocol with no compression.
138: Execute error correction protocol with compression.

**S48 (V.42 negotiation action)**

The V.42 negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, you can bypass this process.

Range:
- 0, 7 or 128. Invalid numbers treated as if 128 were entered.
Default: 7
- 0: Disable negotiation; bypass the detection and negotiation phases; proceed with LAPM.
- 7: Enable negotiation.
- 128: Disable negotiation; bypass detection and negotiation phases; proceed at once with the fallback action that is specified in S36. You can use this to force MNP.

**S91 (public-switched telephone network [PSTN] transmit attenuation level)**

Sets the level, in dBm, of attenuation of the transmitted signal in PSTN mode.

Default: 10
Range: 0 - 15

**S92 (fax transmit attenuation level)**

Sets the level, in dBm, of attenuation of the transmitted signal in FAX mode.

Default: 10
Range: 0 - 15

**Starting or stopping PPP sessions**

You do all PPP configuration and management through Operations Navigator. However, you can manually start or stop your PPP profiles only through the command line. Before you can use these commands, you need the name of your PPP profile.

**Starting PPP:**
After configuring PPP, you can manually start PPP. To do this, enter STRTCPPTP CFGPRF (your_PPP_profile) RESTART (+NO).

Ending PPP:

To disable your PPP connection or end a session, enter ENDTCPPTP CFGPRF (PPP_profile_name) OPRMODE (operating_mode), where operating_mode specifies what kind of profiles to work with:
- *ANY (any PPP profile whose name matches PPP_profile_name)
- *ANS (any PPP profile in answer mode)
- *DIAL (any PPP profile in dial mode)

**Diagnosing PPP problems**

There are a couple of commands to help you diagnosis your PPP problems: CFGTCPPTP and STRTCPPTP. The CFGTCPPTP command allows you to gather important status information.

**Using STRTCPPTP:**

The STRTCPPTP command allows you to print out errors or any messages that occur on the communication path between you and the remote site. These messages also appear in the system message queue (QSYSOPR). To enable this feature:

On the AS/400 command line, enter STRTCPPTP CFGPRF (PPP_profile) OUTPUT (print_output), where:
- PPP_profile is the name of your PPP profile.
- print_output is:
  - *ERROR (print only error messages).
  - *PRINT (print out all messages that occur on specified PPP profile).
  - *NONE (do not print the messages).

**Note:** You can use the SNDIQMSG parameter to hold the connection until you are ready to send data over the connection.

For more information, see [Troubleshooting ISDN](#).

---

### Setting the modem country ID

If you have NWI or PPP line descriptions associated with IOAs 2750, 2751, or 2761, you must set the modem country ID prior to varying on the descriptions. Otherwise the descriptions will fail to vary on.

**To set the modem country ID:**

1. On the command line type CHGNETA and press F4.
2. Locate parameter Modem country ID (MDMCNTRYID).
3. Place your cursor on the field and press F4.
4. Locate the two character country ID, type it into the field, and press Enter.
   Do not precede the ID with an asterisk.
5. Press Enter to save your changes and exit the command.

---

40 AS/400e: Networking ISDN on AS/400
Configuring a controller description

After you have configured your line description, you are ready to configure a controller description to "describe" communications characteristics of the remote system. Certain parameters on the commands determine how the local system treats the remote system. The command you use depends on what kind of controller you want to create.

- For advanced program-to-program communications, type `CRTCTLAPPC` on an AS/400 command line.
- To make the remote system a host system, type `CRTCTLHOST` on an AS/400 command line.
- TCP/IP over PPP automatically configures a controller description for you. If you do not have Advanced Peer-to-Peer Networking (APPN) enabled, you can create a network controller by typing `CRTCTLNET` on an AS/400 command line.
- For a remote workstation, type `CRTCTLRWS` on an AS/400 command line.

The ISDN-related parameter for the `CRTCTLAPPC` command, `CRTCTLHOST` command, and the `CRTCTLRWS` command is the `Link type` parameter. It is a required parameter and has no default. Use `*IDLC` for ISDN data link connections and `*X.25` for X.25 connections.

If you are using the X.25 protocol, you can also use these commands:

- Create controller description (asynchronous) `CRTCTLASC`.
- Create controller description (finance) `CRTCTLFNC`.
- Create controller description (network) `CRTCTLNET`.
- Create controller description (retail) `CRTCTRLRTL`.

To create an IDLC controller, use these parameters on the commands:

**Outgoing connection list (CNNLSTOUT) parameter**
Use this parameter to supply your connection list name for outgoing calls. You need it only for switched controllers.

**Connection list entry (CNNLSTOUTE) parameter**
When you specify a connection list, you can use this parameter to specify which entry name from the connection list provides the number for calling a remote system. This parameter is also for switched controllers only.

**IDLC window size (IDLCWDSIZ) parameter**
Specifies the maximum number of information frames that can be outstanding before an acknowledgment is required. The default `*LIND` takes the window size from the line description. You can specify a value from 1 to 31.

**IDLC frame retry (IDLCFRMRTY) parameter**
Specifies maximum number of frame transmit attempts before reporting an error. If you use the default `*LIND`, AS/400 retrieves the value from the line description. You can specify a value from 0 to 100.

**IDLC response timer (IDLCRSTPMR) parameter**
Specifies the time, in tenths of seconds, to wait before retransmitting a frame when an acknowledgment has not been received. The default `*LIND` takes the response timer from the line description. You can specify a value from 10 to 100.

**IDLC connect retry (IDLCCNNRTY) parameter**
Specifies the number of times to retry a transmission at connection time. If you use the default `*LIND`, AS/400 retrieves the value from the line description. You can specify a value from 1 to 100. If you have a permanent connection, you can specify `*NOMAX`, which means try until successful.
You might want to see a list of other commands that are available to work with the controller descriptions that you created.

APPN support automatically does the final configuration step, creating device descriptions for you. If you are not using APPN support, you need to create device descriptions to finish configuring your AS/400 for ISDN.

Creating device descriptions

APPN support automatically does the final configuration step, creating device descriptions for you. If you are not using APPN support, you need to create device descriptions to finish configuring your AS/400 for ISDN. Which command you use depends on the type of controller description. The commands to create device descriptions include:

- Create Device Description (APPC). To use this command, type `CRTDEVAPPC` on the AS/400 command line.
- Create Device Description (SNA Host). To use this command, type `CRTDEVHOST` on the AS/400 command line.
- Create Device Description (Display) To use this command, type `CRTDEVDSP` on the AS/400 command line.
- Create Device Description (Network). To use this command for PPP or X.25, type `CRTDEVNET` on the AS/400 command line.
- Create Device Description (Async). To use this command for X.25, type `CRTDEVASC` on the AS/400 command line.

These commands have no parameters with a unique meaning for ISDN.

Configuring fax over ISDN

Configuring fax over ISDN is part of your providing Facsimile Support for AS/400. To configure fax over ISDN, you set up configuration objects for ISDN and set fax-specific parameters within these objects. You do not have to create all the objects or specify all fax-related values here. AS/400 creates these objects and sets these values for you later when you use the Create fax description (CRTFAXD) command.

After configuring fax over ISDN, you must complete other steps before using Facsimile Support for AS/400 (see the bottom of this page).

**Before you begin, you need this information from your service provider or ISDN administrator:**

- Network provider information

**To configure fax over ISDN:**

1. Set the modem country ID
2. Create an NWI for a switched PPP connections, and ensure that the parameters below are properly defined:
   - Set channel entries for switched connections (for the appropriate channel). See step 5 on page 29 of "Configuring an ISDN network interface description" on page 29.
3. Create an ISDN connection list
   - For information about connection lists, you should see connection list.
4. Add entries to the connection list. You need separate entries for inbound and outbound calls.
You should know the name of the PPP line description that will use the entry before adding the entry. Your connection list should have only one entry for outbound fax calls.

Use these values for other fax-related parameters:
- In the Information transfer type field (INFTRFTYPE parameter), specify *FAXMODEM.
- In the Modem init command string field (MDMINZCMD parameter), specify *LIND.
- In the Local number field, specify a value for the inbound connection list entry. (*ANY is a legal value.)
- Specify *LIND in the Modem init command string field.

5. Create a PPP line description for inbound fax calls.
6. Create a PPP line description for outbound fax calls.

Although you use a PPP line description for Facsimile Support for AS/400, the PPP protocol is not used with fax. The system uses the line description to place the line in asynchronous mode.

To complete your fax configuration, see chapter 2 of *Facsimile Support for AS/400 Installation Guide*, (SC41-0654).
Chapter 5. Managing AS/400 ISDN support

After configuring your network interface (NWI), controller, line, and device descriptions, you are now ready to enable your configuration objects and maintain the ISDN service. To do these tasks, see:

- “Managing Connections”
- “Verifying connection status” on page 47
- “Commands for ISDN configuration objects” on page 48

For general management information about PPP or fax, see:

- Getting started with PPP

Managing Connections

To enable or disable connections, or change automatic disconnect timers, see this information:

- “Enabling ISDN switched connections”
- “Disabling ISDN switched connections” on page 46
- “Command for ISDN configuration objects” on page 48
- “Disabling permanent connections” on page 46
- “Changing automatic disconnect timers” on page 46

Enabling ISDN switched connections

If you have set your configuration objects to vary on after IPL, then you do not need to enable the connections. You should use the instructions here if your objects are not varied on.

The steps assume that you have created descriptions for the NWIs, lines, controllers, and devices, plus the necessary connection lists. Also, they assume that you have made the necessary attachments (referring one object to another). If you have not done these things, see “Chapter 4. Configuring your AS/400 for ISDN” on page 23.

Before performing the steps below, make sure that you have the names of the objects you want to vary on. To enable switched connections you should enter the following on the command line:

1. VRYCFG CFGOBJ(your_nwi_object) CFGTYPE (*NWI) STATUS (*ON)
2. VRYCFG CFGOBJ(your_switched_line_description) CFGTYPE (*LIN) STATUS (*ON)
3. VRYCFG CFGOBJ(your_switched_controller_description) CFGTYPE (*CTL) STATUS (*ON) RANGE (*NET)

Note: If you vary on a switched controller with RANGE set to (*NET), the system will vary on the attached device description for you.

The system is now ready to make switched connections. A switched connection is established only if an application requires it and becomes active when an application sends data or a command across the network.
Enabling ISDN permanent connections

If you have set your configuration objects to vary on after IPL, then you do not need to enable the connections. You should use the instructions here if your objects are not varied on.

The instructions here assume that you have created descriptions for the NWIs, lines, controllers, and devices and that you have made the necessary attachments (referring one object to another). If you have not done these things, see "Chapter 4: Configuring your AS/400 for ISDN" on page 23.

Before performing the steps below, make sure that you have the names of the objects you want to vary on. To enable permanent connections, type VRYCFG CFGOBJ (your_nwi_object) CFGTYPE (*NWI) STATUS (*ON) RANGE (*NET) on the command line, and press Enter.

This command enables all nonswitched line, controller, and devices associated with the NWI.

Disabling ISDN switched connections

To disable switched connections, type VRYCFG CFGOBJ (your_configuration_object) CFGTYPE (*NWI) STATUS (*OFF) on the command line, and press Enter.

Disabling permanent connections

Varying off configuration objects disables your permanent connection. You can vary off the objects one at a time or all at once. Varying off at least one of the configuration object disables the permanent connection. The steps below show you how to vary off individual objects:

1. To vary off your switched line description, type VRYCFG CFGOBJ(description_name) CFGTYPE (*LIN) STATUS (*OFF), and press Enter.
2. To vary off your switched controller description, type VRYCFG CFGOBJ(description_name) CFGTYPE (*CTL) STATUS (*OFF) RANGE (*NET), and press Enter.

Note: Varying off a switched controller with RANGE set to (*NET) automatically varies off the associated device description.

Changing automatic disconnect timers

To change your automatic disconnect timers, follow the instructions below for the appropriate protocol. For more information about the disconnect timers, see "ISDN automatic disconnect (switched connections)" on page 12.

X.25:

To change the automatic disconnect timers for X.25, do these steps:

1. Type CHGLINX25 on the command line, and press Enter.
2. Press F9 to show all parameters.
3. Locate the Switched disconnect field and specify *YES (disconnect when the timer expires) or *NO (do not disconnect when the timer expires).
4. Locate the Disconnect timers field and specify values for these fields:
   - Minimum connect timer (the timer starts after the connection is established).
   - Disconnection delay timer (the period of time to wait after the last communications before disconnecting).
The system disconnects when the minimum disconnect timer and disconnection delay timer expire.

**Switched ISDN data link control (IDLC):**

In your switched IDLC controller description, do this to change parameters:
1. Run the appropriate command (CHGCTLAPPC, CHGCTLHOST, or CHGCTRLWS) to change your controller description.
2. Press F9 to show all parameters.
3. Press F11 to display the keywords.
4. Set parameter to SWTDISC to *YES (disconnect when the timer expires) or *NO (do not disconnect when the timer expires).
5. Locate parameter Disconnect timers and specify values for fields:
   - Minimum connect timer (the timer starts after the connection is established).
   - Disconnection delay timer (the period of time to wait, after the last communications, before disconnecting).

   The system disconnects when the minimum disconnect timer and disconnection delay timers expire.

**Note:** When the controller is varied off, you can change the disconnection timer value with the DSCTMR parameter of the appropriate command: CHGCTLAPPC, CHGCTLHOST, or CHGCTRLWS.

**PPP:**

If you used Operations Navigator to configure PPP, you should use it to change the disconnect timer. Otherwise, to change your PPP disconnect timer:
1. Run the Change Line (PPP) (CHGLINPPP) command.
2. Press F9 to show all parameters.
3. Press F11 to display the keywords.
4. Specify one of these values for the inactive timer (INACTTMR) parameter:
   - *SAME.
   - *NOMAX (do not disconnect).
   - Number of seconds to wait before disconnecting (15 to 65,535 seconds).

   **Note:** This is the number of seconds to wait between transfers of TCP/IP data. The transfer of TCP/IP data resets the timer. Transferring other types of data (such as LCP and asynchronous data) does not reset the inactivity timer.

---

**Verifying connection status**

You can use the commands below to view successful or unsuccessful connection attempts. To view the connection status of all your configuration objects, type WRKCFSSTS CFGTYPE (*NWI), and press Enter:

**Note:** Switched lines that do not have a connection do not appear in the display.

Objects that are successfully connected show a status of varied on or active. If any objects do not show this status, the connection is broken.

Also, the hierarchy displayed shows how the objects are attached to each other. Use this display to verify that the association matches what you expected.
To view messages concerning your connections, type the command `DSPMSG MSGQ(queue_name)` (where queue_name is QSYSOPR or the configured message queue), and press Enter.

**Note:** For X.25 or PPP connections, the messages may be in another queue (see parameter Message queue of your line description).

### Commands for ISDN configuration objects

You can use CL commands to manage your configuration objects and their entries.

**Note:** Your AS/400 provides a command line with a lot of help information. To view commands according to tasks, you press F4 without typing anything on the command line; then select 2. For more details about the parameters for a specific command, type the command on AS/400 and press F1 for each parameter.

You can use these commands:

- “Retrieving configuration object status”
- “Deleting configuration objects”
- “Displaying configuration objects”
- “Renaming configuration objects” on page 49
- “Managing your connection lists” on page 49
- “Controller description commands related to ISDN” on page 43
- “Device description commands” on page 49
- “Line description commands related to ISDN” on page 49
- “NWI description commands” on page 50

### Retrieving configuration object status

You can view information about your configuration objects directly from the command line by using the Work with Configuration Status (WRKCFGSTS) command. You can also use the Retrieve Configuration Status (RTVCFGSTS) and Retrieve Network Attributes (RTVNETA) APIs within an interactive or batch command language, or in REXX programs.

To view the status of all configuration objects and their associations (indicated by hierarchy), type the `WRKCFGSTS CFGTYPE(*NWI)` command, and press Enter.

### Deleting configuration objects

The commands to delete a configuration object are:

- Delete Connection List (DLTCNNL)
- Delete Controller Description (DLTCTLD)
- Delete Device Description (DLTDEVD)
- Delete Line Description (DLTLIND)
- Delete Network Interface Description (DLTNWID)

### Displaying configuration objects

Use these commands to display configuration objects:

- Display Connection List (DSPCNNL)
- Display Device Description (DSPDEVD)
- Display Line Description (DSPLINL)
- Display Controller Description (DSPCTLD)
- Display Network Interface Description (DSPNWI)
- Display Network Attributes (DSPNETA)
Renaming configuration objects

To rename a configuration object, use the Rename object (RNMOBJ) command (you can shorten it to REN or RNM).

Managing your connection lists

You can use these commands to work with your connection lists and the entries on those connection lists:

- **Connection list commands**
  - Work with Connection Lists (WRKCNNL)
  - Change Connection List (CHGCNNL)
  - Delete Connection List (DLTCNNL)
  - Display Connection List (DSPCNNL)

- **Connection list entry commands**
  - Add Connection List Entry (ADDCNNLE)
  - Change Connection List Entry (CHGCNNLE)
  - Rename Connection List Entry (RNMCNNLE)
  - Work with Connection List Entries (WRKCNNLE)

To create new connection lists, see "Configuring ISDN connection lists" on page 31.

Controller description commands related to ISDN

Additional commands that you can use to work with controller descriptions include:

- Work with Controller Descriptions (WRKCTLD), which shows you a list of all controller descriptions on the system. From the list you can change, copy, delete, display, print, rename or work with the status of line descriptions, retrieve a configuration source program, or print device addresses.
- Change Controller Description (APPC) (CHGCTLAPPC).
- Change Controller Description (HOST) (CHGCTLHOST).
- Change Controller Description (Remote work station) (CHGCTLRWS).
- Change Controller Description (asynchronous) (CHGCTLASC).
- Change Controller Description (Network) (CHGCTLNET).
- Display Controller Description (DSPCTLD).
- Delete Controller Description (DLTCTLD).
- Retrieve Configuration Source (RTVCFGSRC).
- Retrieve Configuration Status (RTVCFGSTS).
- Vary Configuration (VRYCFG).
- Restore Configuration (RSTCFG).
- Work with Configuration Status (WRKCFGSTS).

Device description commands

The device descriptions commands are:

- Work with Device Descriptions (WRKDEVD)
- Display Device Description (DSPDEV) (display device description)
- Change Device Description (Asynchronous) (CHGDEVASC)
- Change Device Description (SNA host) (CHGDEVHOST)
- Change Device Description (Network) (CHGDEVNET)
- Change Device Description (APPC) (CHGDEVAPPC)
- Change Device Description (Display) (CHGDEVDSP)
- Delete Device Description (DLTDEV)

Line description commands related to ISDN

Additional commands that you can use to work with line descriptions include:
• Work with Line Descriptions (WRKLIND), which shows you a list of all line descriptions on the system. From the list you can change, copy, delete, display, print, rename or work with the status of line descriptions or retrieve a configuration source program.
• Change IDLC Line Description (CHGLINIDLC).
• Change X.25 Line Description (CHGLINX25).
• Change PPP Line Description (CHGLINPPP). You should use this only for descriptions used with fax.
• Change Line Description (Asynchronous) (CHGLINASC).
• Change Line Description (FAX) (CHGLINEAX).
• Change Line Description (Network) (CHGLINNET).
• Change Line Description (SDLC) (CHGLINSDLC).
• Display Line Description (DSPLINT).
• Retrieve Configuration Source (RTVCFGSRC), which copies a connection list and all its entries.
• Restore Configuration Status (RTVCFGSTS).
• Vary Configuration (VRYCFG).
• Restore Configuration (RSTCFG).
• Work with Configuration Status (WRKCFGSTS).
• Delete Line Description (DLTLIND).

NWI description commands

You can use these ISDN-specific commands to work with your network interface descriptions (NWIs):
• Work with Network Interface Description (WRKNWID)
• Change Network Interface Description for ISDN (CHGNWIISDN) (change ISDN NWI description)
• Display Network Interface Description (DSPNWID)
• Delete Network Interface Description (DLTNWID)

Existing NWIs

Existing installations should be aware of two issues:
• Mapping of old network types
• Changing network types

Mapping:

To ease migration to your new operating system, the system maps your old network types to the new network types. You see this mapping occurs when you vary on or display the objects. For example, when you display an object that uses the old network type, the system displays the new network type in the network type field instead of the old type.

The system maps network types for your NWI descriptions and connection lists. To see what the new network type is replacing, see the table in "Supported network types" on page 24. If the system re-maps one of the network types below, you must provide SPID information in your NWI description if it does not have it:
• *ATT5E42
• *ATT5E5
• *ATT5E6
• *NISDN
• *NT100B29

See the steps in "Configuring an ISDN network interface description" on page 29 for instructions on adding SPID information.

Changing network types:
If you are changing network type, you must delete and re-create NWI descriptions and connection lists that you created for the 2605 input/output adapter (IOA) before you can use them on the 2750 or 2751 IOAs. Take these steps:

1. Record non-default information from your existing NWI description:
   a. Typing CHGNWIISDN or CHGCNNL on the command line and pressing Enter.
   b. Type the name of your object, and press Enter.
   c. Record the name of the description.
   d. Record your non-default and attachment information if any.

2. Delete the object by typing DLTNWID object_name or DLTCNLL object_name where object_name is the name of the object to delete.

3. Re-create your object and enter your non-default and attachment information into it. You must also replace the old network types with the current network types (see the table in “Supported network types” on page 24 for replacement values).

To re-create your NWI description, see “Configuring an ISDN network interface description” on page 29. To re-create your connection list, see “Creating an ISDN connection list” on page 32.
Chapter 6. Performance tuning ISDN

Performance tuning requires you to know how well your system is performing and what you can do to change it to make it better. Section Monitoring ISDN shows you how to find out the present performance of your system. Section Maximizing ISDN channel performance shows what commands you can use to maximize your channel throughput. For additional information about performance tuning, see “Performance issues” on page 16.

Monitoring ISDN

To collect performance data, you can use the Start performance monitor (STRPFRMON) command and performance application program interfaces (APIs).

STRPFRMON command:

The STRPFRMON command collects performance data into many files, two of which contain data that interests you:
- QAPMIDLC contains ISDN performance data.
- QAPMLAPD contains LAPD performance data.

For more information about STRPFRMON and performance file data formats, see Work Management, SC41-5306-03, Appendix A.

Performance collector APIs:

Two performance collector APIs gather a subset of the data that the STRPFRMON command retrieves:
- List Performance Data (QPMLPFRD) collects performance data.
- Work with Collector (QPMWKCOL) collects "work with" command types of performance data.

Collection Services GUI:

You can also collect performance data through Performance collection function of the Operations Navigator interface. For more information about this, see the Operations Navigator help menu.

Maximizing ISDN channel performance

You may be able to maximize your channel throughput by changing your frame size, window size, or maximum time between a response and request. For more information about channel throughput, see “Performance issues” on page 16. You can change those parameters by using one of these change commands for your line or controller description:
- Change commands
  - CHGLINPPP
  - CHGLINFAX
  - CHGLINIDLC
  - CHGLINSDLRC
  - CHGLINX25
  - CHGCTLFNC
  - CHGCTLHOST
- CHGCTRLTL
- CHGCTLAPPC
- CHGCTRLWS

- **Frame size parameters (MAXFRAME (PPP, X.25, and IDLC)):**

  **Note:** The maximum frame size on the 2751 and 2750 input/output adapters (IOA) is 2064 bytes. Exceeding this value causes an IOP activation failure with a message that warns of a MAXFRAME configuration problem.

- **Window size parameters (IDLCDWDSIZ (IDLC))**
- **Request/response maximum time:**
  - IDLCRSPTMR (IDLC)
    
    For the response timer parameter (IDLCRSPTMR) on controller descriptions, specify values that are greater than or equal to the value of the MAXFRAME parameter on the associated line description, divided by 205.

  - **MAXLENRU (SNA)**
    
    You can specify the maximum length of an SNA request unit (RU) by using the MAXLENRU parameter in a mode description (APPC) or in host device descriptions. To have the system automatically select an SNA RU size that is compatible with the chosen frame size, you can specify *CALC for MAXLENRU.

    For a value other than *CALC, choose an RU size that is slightly less than the frame size or that is a multiple of the frame size. It should be slightly less because of the additional overhead that is involved with the protocol that is used. For example, SNA adds 9 bytes to the RU being transmitted. To maximize performance for SNA, choose an RU size so that the original RU size plus 9 equals the frame size or a multiple of frame sizes.

    To improve performance, do not choose an RU size that is slightly greater than a multiple of the frame size. This could cause partially empty RUs to be sent, wasting bandwidth.

  **Note:** For the response timer parameter (IDLCRSPTMR) on controller descriptions, specify values that are greater than or equal to the value of the MAXFRAME parameter on the associated line description, divided by 205.
Chapter 7. Troubleshooting ISDN

To view and find ISDN errors, see this information:
- Viewing system messages
- Cause code descriptions
- Common ISDN Problems on page 57
- Recovering from ISDN errors

For PPP troubleshooting, you should see Diagnosing PPP problems on page 40.

For more information about problem analysis and tools, see:
- Problem analysis (and tools)
- Verifying connection status on page 47
- Why calls are accepted or rejected on page 12
- Troubleshooting on the AS/400

Note: You are encouraged to use the default parameters for a specified network type. If you change parameters from the default values, unpredictable results may occur.

Viewing system messages

To view messages or errors in a message queue, enter DSPMSG MSGQ(queue_name), where queue_name is QSYSOPR or the message queue that your line description specifies.

Cause code descriptions

This section contains descriptions of Telecommunication Standardization Sector (ITU-T) standard cause codes. In general, a cause code indicates current ISDN activity or reports an ISDN-specific error. Network-specific cause codes are not translated to the ITU-T value that AS/400 uses. However, the system does check the cause codes for normal and acceptable calling conditions. All other values are logged into the system error log (QSYSOPR or the configured message queue).

<table>
<thead>
<tr>
<th>Cause Code (decimal)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unallocated (unassigned number)</td>
</tr>
<tr>
<td>2</td>
<td>No route to specified transit network</td>
</tr>
<tr>
<td>3</td>
<td>No route to destination</td>
</tr>
<tr>
<td>6</td>
<td>Channel unacceptable</td>
</tr>
<tr>
<td>7</td>
<td>Call awarded and being delivered in an established channel</td>
</tr>
<tr>
<td>16</td>
<td>Normal call clearing</td>
</tr>
<tr>
<td>17</td>
<td>User busy</td>
</tr>
<tr>
<td>18</td>
<td>No user responding</td>
</tr>
<tr>
<td>19</td>
<td>No answer from user (user alerted)</td>
</tr>
<tr>
<td>21</td>
<td>Call rejected</td>
</tr>
<tr>
<td>22</td>
<td>Number changed</td>
</tr>
<tr>
<td>26</td>
<td>Non-selected user clearing</td>
</tr>
<tr>
<td>27</td>
<td>Destination out of order</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>28</td>
<td>Incorrect number format</td>
</tr>
<tr>
<td>29</td>
<td>Facility rejected</td>
</tr>
<tr>
<td>30</td>
<td>Response to Status Enquiry</td>
</tr>
<tr>
<td>31</td>
<td>Normal, unspecified</td>
</tr>
<tr>
<td>34</td>
<td>No circuit/channel available</td>
</tr>
<tr>
<td>38</td>
<td>Network out of order</td>
</tr>
<tr>
<td>41</td>
<td>Temporary failure</td>
</tr>
<tr>
<td>41</td>
<td>Switching equipment congestion</td>
</tr>
<tr>
<td>43</td>
<td>Access information discarded</td>
</tr>
<tr>
<td>44</td>
<td>Requested circuit/channel not available</td>
</tr>
<tr>
<td>47</td>
<td>Resources unavailable, unspecified</td>
</tr>
<tr>
<td>49</td>
<td>Quality of service unavailable</td>
</tr>
<tr>
<td>50</td>
<td>Requested facility not subscribed</td>
</tr>
<tr>
<td>57</td>
<td>Bearer capability not authorized</td>
</tr>
<tr>
<td>58</td>
<td>Bearer capability not presently available</td>
</tr>
<tr>
<td>63</td>
<td>Service or option not available, unspecified</td>
</tr>
<tr>
<td>65</td>
<td>Bearer capability not implemented</td>
</tr>
<tr>
<td>66</td>
<td>Channel type not implemented</td>
</tr>
<tr>
<td>69</td>
<td>Requested facility not implemented</td>
</tr>
<tr>
<td>70</td>
<td>Only restricted digital information bearer capability is available</td>
</tr>
<tr>
<td>79</td>
<td>Service or option not implemented, unspecified</td>
</tr>
<tr>
<td>81</td>
<td>Call reference value not valid</td>
</tr>
<tr>
<td>82</td>
<td>Identified channel does not exist</td>
</tr>
<tr>
<td>83</td>
<td>A suspended call exists, but this call identity does not</td>
</tr>
<tr>
<td>84</td>
<td>Call identity in use</td>
</tr>
<tr>
<td>85</td>
<td>No call suspended</td>
</tr>
<tr>
<td>86</td>
<td>Call having the requested call identity has been cleared</td>
</tr>
<tr>
<td>88</td>
<td>Incompatible destination</td>
</tr>
<tr>
<td>91</td>
<td>Transit network selection not valid</td>
</tr>
<tr>
<td>95</td>
<td>Message not valid, unspecified</td>
</tr>
<tr>
<td>96</td>
<td>Mandatory information element is missing</td>
</tr>
<tr>
<td>97</td>
<td>Message type nonexistent or not implemented</td>
</tr>
<tr>
<td>98</td>
<td>Message not compatible with call state or message type nonexistent or not implemented</td>
</tr>
<tr>
<td>99</td>
<td>Information element nonexistent or not implemented</td>
</tr>
<tr>
<td>100</td>
<td>Information element contents not valid</td>
</tr>
<tr>
<td>101</td>
<td>Message not compatible with call state</td>
</tr>
<tr>
<td>102</td>
<td>Recovery on timer expiry</td>
</tr>
<tr>
<td>111</td>
<td>Protocol error, unspecified</td>
</tr>
<tr>
<td>127</td>
<td>Interworking, unspecified</td>
</tr>
</tbody>
</table>
## Common ISDN Problems

Your following the ISDN configuration guidelines should ensure that your AS/400 system operates properly with ISDN. If a problem does occur, usually it is because a connection-related parameter is incorrectly set. The following table shows some common connection problems and possible solutions.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution or reason for problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inability to connect to ISDN</td>
<td>The inability to connect to ISDN can be caused by an incorrectly configured NWI. For NWI problems, ensure that the network type (NETTYPE) parameter has the correct value.</td>
</tr>
</tbody>
</table>
| Your system rejects incoming ISDN calls. | • No matching connection list entry exists for the call.  
• The line description that is associated with a connection list is not varied on. Check the local connection list parameter (CNNLSTIN).  
• No line description, that is varied on, refers to a connection list that can answer the call. Line description parameter incoming connection list (CNNLSTIN) defines the connection list to use to answer the incoming calls.  
• Line description parameter Connection type (CNNTYPE) is not set to either *BOTH or *ANS |
| Switched connection ends unexpectedly | Refer to the cause code in related messages. See the messages in the system operator message queue (QSYSOPR), or the message queue defined by the controller or line description message queue (MSGQ) parameter. |
| ISDN data link control (IDLC) fails to connect | If the remote system allows the data link control identifier (DLCI) to be configured, the remote system may have a DLCI value that is not compatible with the AS/400. Ensure that the remote system’s data link control identifier value is 32 (10-bit format) or 256 (13-bit format). The use of the data link control identifier is based on CCITT Recommendation Q.922. |
| Cannot connect because a switched controller was not found for an IDLC line | AS/400 uses information received from the remote system (for example, the exchange identifier from the XID command) to select a switched controller to attach to the IDLC line. Incorrect configuration on either the local or remote system can cause the connection to fail. The following IDLC-related controller parameter affect which controller is selected:  
• Remote Control Point Name (RMTCPNAME)  
  Applies to both host and advanced program-to-program communications (APPC) controllers.  
• Remote Network ID (RMTNETID)  
  Applies to both host and APPC controllers.  
• Exchange Identifier (EXCHID)  
  This applies to APPC and remote work station controllers.  
• System Services Control Point Identifier (SSCPID)  
  This applies only to host controllers. |
| IDLC permanent connection cannot connect to remote site | If your controller description remains at vary on pending, ensure that the remote system is ready for the permanent connection (the NWI description and associated line and controller descriptions are varied on). |
Recovering from ISDN errors on the AS/400

You may find solutions to a problem in the system message. For more information about finding the solutions, see [System messages](#).