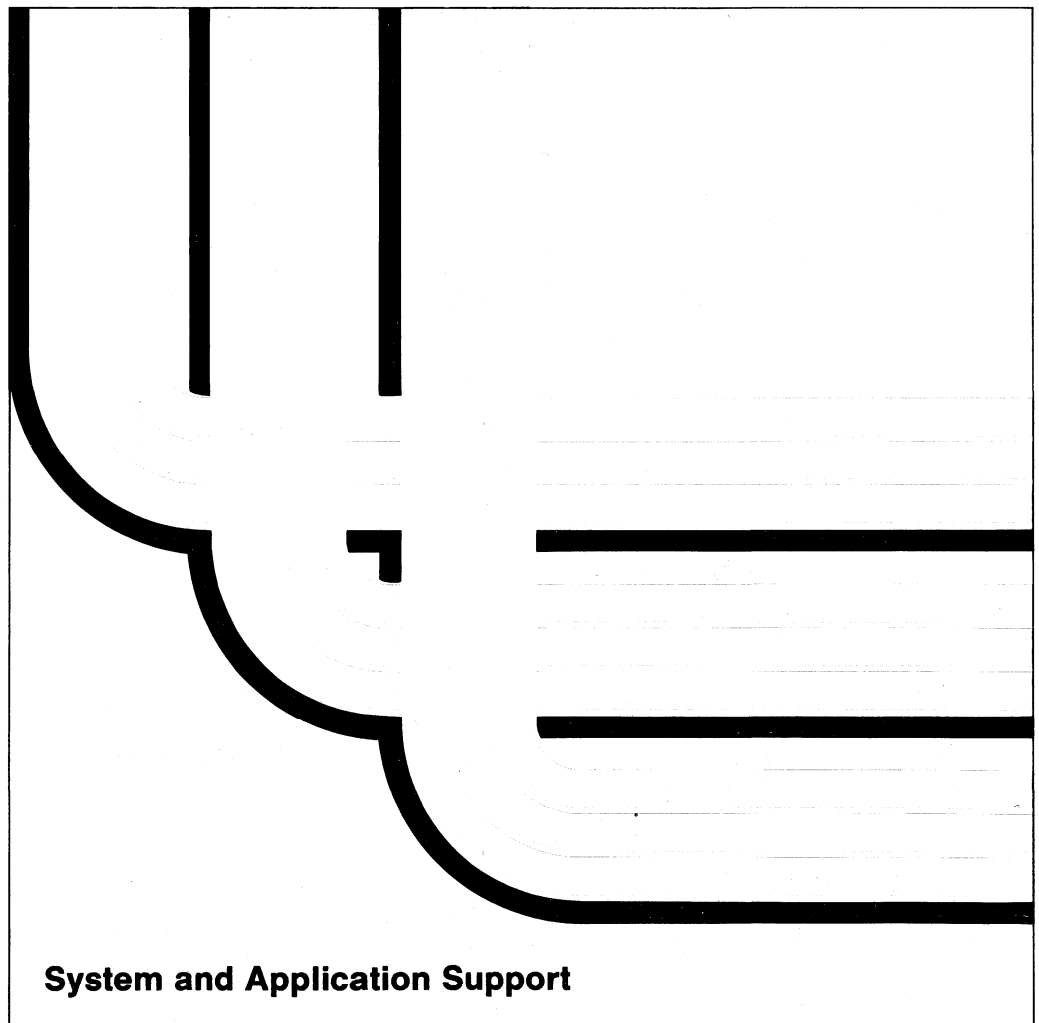


**Communications:
Integrated Services
Digital Network Guide**

Version 2





Application System/400

SC41-0003-02

**Communications:
Integrated Services
Digital Network Guide**

Version 2

Take Note!

Before using this information and the product it supports, be sure to read the general information under "Notices" on page v.

Third Edition (November 1993)

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Refer to the "Summary of Changes" on page ix for a summary of changes made to integrated services digital network support and how it is described in this publication.

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Programming Interface Information

This guide is intended to help the customer use integrated services digital network support. This guide documents General-Use Programming Interface and Associated Guidance Information provided by integrated services digital network support.

General-Use programming interfaces allow the customer to write programs that obtain the services of integrated services digital network support.

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About This Guide

This guide contains concepts about integrated services digital networks (ISDNs) and the specific implementation of ISDNs on AS/400 systems. Also discussed are configuration concepts and examples, differences among various ISDNs, and topics explaining basic requirements for operating ISDNs. Some topics explain the effects of different configurations on network performance.

A programmer or system administrator should use this guide when configuring or using an ISDN with the AS/400 system. This guide includes examples of ISDNs and discusses ISDN performance. Network-specific parameters and differences are also discussed.

You may need to refer to other IBM manuals for more specific information about a particular topic. The *Publications Guide*, GC41-9678, provides information on all the manuals in the AS/400 library.

For a list of related publications, see the "Bibliography" on page H-1.

Who Should Use This Guide

This guide is intended for the programmer responsible for configuring and using an integrated services digital network (ISDN).

You should have a general knowledge of communications concepts. AS/400 communications concepts are discussed in the *System Concepts*, GC41-9802. In addition, specific communications topics are discussed in the online index search. For more information on basic communications, refer to the Discover/Education* Introduction to Data Communications course, which you can order separately.

The *ISDN Guide* is used in conjunction with the *Communications: Operating System/400* Communications Configuration Reference*, SC41-0001.

Summary of Changes

Chapter 1

Chapter 1, "Introduction" has been reorganized, making it easier to use.

European Telecommunications Standards Institute (ETSI) ISDN

Appendix D, "Network Provider Information," discusses the *ETSI value added to the network type (NETTYPE) parameter of the Create Network Interface for ISDN (CRTNWIISDN) command.

Bellcore National ISDN

Appendix D, "Network Provider Information," discusses the *NISDN value added to the network type (NETTYPE) parameter of the CRTNWIISDN command. Also discussed are:

- The addition of the service profile identifier (SPID) parameter to the CRTNWIISDN command, which is required when specifying NETTYPE(*NISDN)
- The requirement that the TEID parameter must be specified as *AUTO when specifying NETTYPE(*NISDN)

X.25 Packet Mode Example

An X.25 packet mode example has been added to Appendix A, "Configuration Examples for ISDN" on page A-1.

New Network Types (*ETSI and *NISDN)

Appendix D, "Network Provider Information" on page D-1 includes network-specific information for European Telecommunications Standard Institute and Bellcore National ISDN.

Chapter 1. Introduction

This guide discusses connecting an AS/400* system to an integrated services digital network (ISDN) using the AS/400 integrated communications adapter. An **ISDN** is a public or private digital communications network that can support voice, data, image, and other services over the same physical interface.

This chapter introduces you to some background information about ISDN, including:

- Why use an ISDN
- ISDN interfaces and channels
- Types of ISDN connections
- Connecting the AS/400 system to an ISDN
- Using the integrated communications adapter and IDLC
- Using the integrated communications adapter and X.25
- ISDN connections using the CallPath* licensed program
- ISDN connections using a terminal adapter and SDLC
- ISDN primary connections using Teleos**
- AS/400 configuration requirements
- ISDN used with SNA or OSI

Why Use ISDN?

ISDN provides benefits not found in more conventional types of communications. These include:

- High speed, low error rate communications
- Switched, high speed communications
- Switched, digital networking
- Advanced networking functions
- Integration of voice and data transmissions
- Integrated support of packet switching (X.31)

In addition, a switched ISDN connection may transmit data at a much higher rate. This high transmission rate may be more cost effective than a less expensive, slower, nonswitched connection.

ISDN Interfaces and Channels

The following interfaces provide ISDN services:

Basic rate interface (BRI)

Provides two 64 000 bps data B-channels and one 16 000 bps signaling D-channel. The **B-channels** (bearer channels) are used for transmitting digital data from one end user to another. The **D-channel** is used for signaling; that is, to communicate information to the network necessary for operations, such as call setup and call ending.

Primary rate interface (PRI)

Provides twenty-three 64 000 bps data B-channels and one 64 000 bps signaling D-channel (Europe allows thirty 64 000 bps B-channels).

The B-channels allow you to have multiple time-multiplexed communications connections sharing the same physical interface. That is, the basic rate interface allows two communications channels over one physical interface. The primary rate

interface allows 23 or 30 communications channels to share the same physical interface.

For an example of how the B-channel and D-channel work together, and how they connect systems using the basic rate interface, see Figure 1-1.

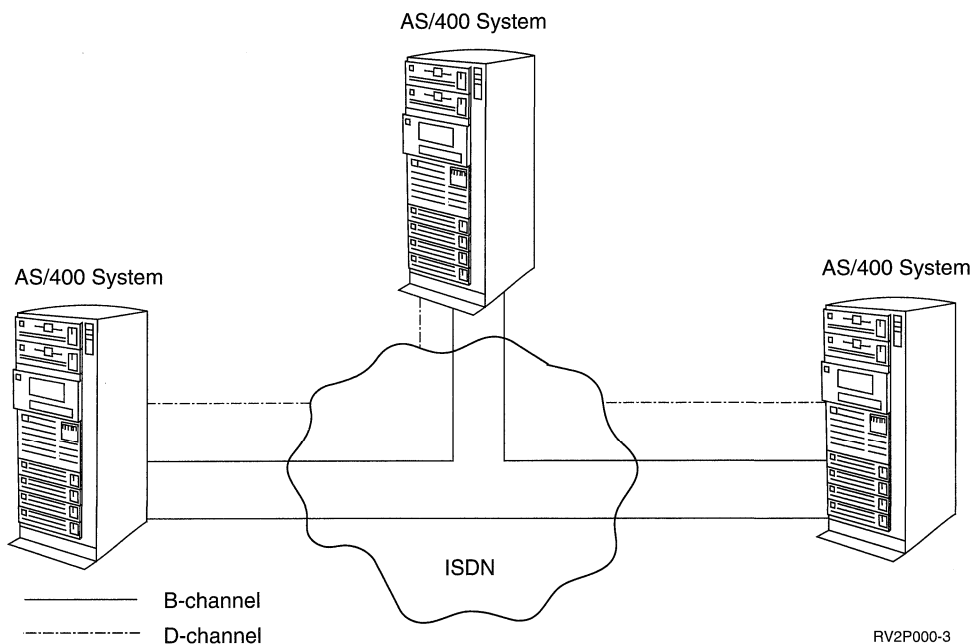


Figure 1-1. Conceptual View of ISDN. The B-channels provide system-to-system communications while the D-channel ends at the network boundary.

Types of ISDN Connections

Connections over an ISDN B-channel can be of two types:

Switched

The connection is established when data is to be transmitted, and is disconnected if it is configured to do so after data has been transmitted. Charging is normally based on the period of time for which the connection remains active.

The D-channel is used for signaling to set up the connection.

Permanent

A connection is always available through the ISDN, and no signaling or call initiation is required. 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.

Note: A **semipermanent connection** refers to one of the following connection types:

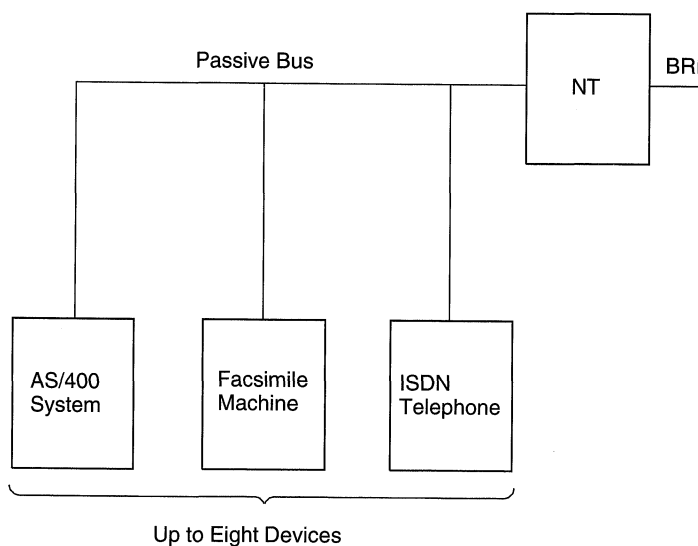
- A special type of switched connection available in Germany. The network subscription specifies the destination, but the user may request session connection or disconnection.
- A permanent connection. CCITT Recommendation X.31 defines semipermanent connections in which the terminal equipment remains connected to the part of the network that handles the X.25

protocol. (The **CCITT recommendations** describe a telecommunications interface.)

Whether a B-channel is switched or permanent is generally determined by the network subscription. On some networks, it is possible to have one switched B-channel and one permanent B-channel on the same BRI.

Passive Bus Configuration

The AS/400 system can be connected on a **passive bus**, which allows up to eight devices to share a basic rate interface. The devices may include computers, facsimile machines, other AS/400 systems, and ISDN telephones. These devices all must contend for available B-channels of the basic rate interface, but only two B-channels can be used at any time. Typically, these devices are connected to the ISDN through **network termination** equipment. This equipment provides the necessary function for the operation of network access protocols. An example of a passive bus connection is shown in Figure 1-2. Refer to Appendix D, "Network Provider Information" for the passive bus capabilities of specific networks.



RV2P008-3

Figure 1-2. An Example Showing an AS/400 System with Other Devices Sharing a Passive Bus

The remainder of this guide discusses connecting an AS/400 system to an ISDN using the integrated communications adapter. The integrated communications adapter for ISDN supports the basic rate interface (BRI)—two B-channels and one D-channel.

Connecting the AS/400 System to an ISDN

The following is an overview of the ways that AS/400 systems can connect to devices over ISDN.

- Basic Rate Network Interfaces
 - Using the integrated communications adapter
 - IDLC
 - X.25
 - CallPath/400 licensed program for third party call control
 - Using the 7820 Terminal Adapter and SDLC when the AS/400 system has no integrated ISDN communications adapter

- Primary Rate Network Interfaces
 - Using Teleos

These methods are described in the following sections.

Using the Integrated Communications Adapter and IDLC

Using the integrated communications adapter and IDLC, the AS/400 system can be connected through an ISDN to other systems.

ISDN Data Link Control

IBM has chosen a new data link control protocol to run over ISDN links using the integrated adapter support. This protocol, called ISDN data link control (IDLC), complies with the data link control protocols defined in CCITT Recommendations Q.921 and Q.922. IDLC defines a set of protocol rules and formats for use on D-channels and B-channels. On the D-channel, IDLC provides a reliable link with the network equipment. On the B-channel, IDLC provides a reliable link with another end user. For a detailed description of the IDLC protocol, refer to the *ISDN Data Link Control Architecture Reference* manual.

Systems requiring SDLC support over ISDN need to attach to the network using the IBM* 7820 Terminal Adapter.

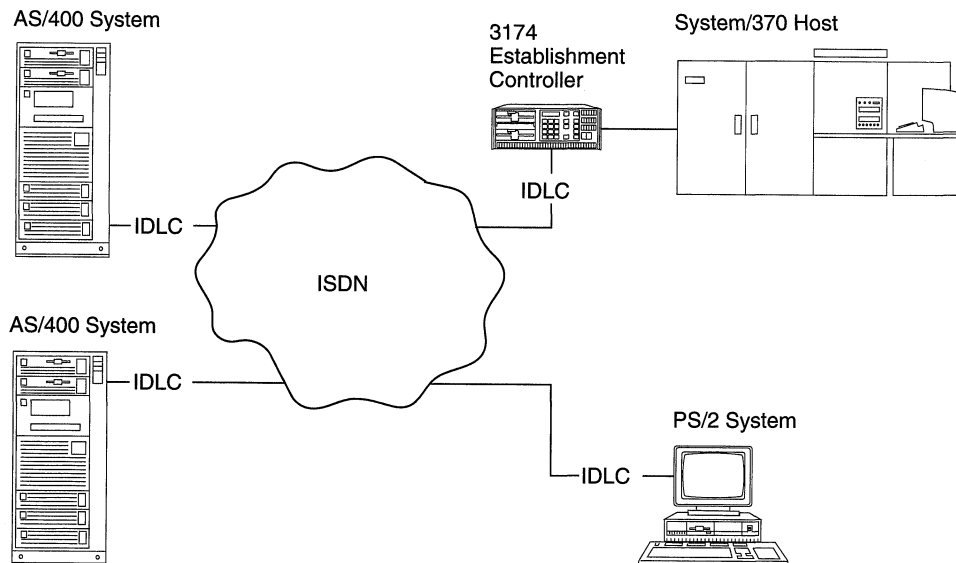
With IDLC, unlike SDLC, either system can transmit data without waiting to be polled. Therefore, IDLC makes better use of the high-speed medium provided by an ISDN.

In AS/400 prompts, messages, and documents, IDLC refers specifically to IDLC on B-channels unless stated otherwise. For information on configuring the IDLC line description, see "Creating a Line Description" on page 2-6.

Connecting to Devices Using IDLC

Using the integrated communications adapter and IDLC, the AS/400 system can connect with the following devices:

- Other AS/400 systems
- Personal System/2* systems using 3270 device emulation
- System/370* host systems connected through a 3174 Establishment Controller
- System/390* host systems connected through a 3174 Establishment Controller
- Other systems that use the IDLC protocol



RV2P003-7

Figure 1-3. AS/400 System Using IDLC in an ISDN

Using the Integrated Communications Adapter and X.25

Using the integrated communications adapter and X.25, the AS/400 system can be connected through an ISDN to other systems.

ISDN Used with X.25 (X.31)

The X.25 protocol may be used on an ISDN in circuit mode or packet mode.

In either mode, the ISDN can be accessed by switched or permanent channels. Some access methods may not be available from some network providers. Permanent ISDN channels, defined by the network subscription, are always ready to be used for X.25 communications. For additional information regarding X.25, X.31, and DTE-to-DTE mode, see the *X.25 Network Guide*. Brief descriptions of the two X.31 modes follow.

Circuit Mode

The two types of circuit mode are as follows:

- X.25 DTE-to-DTE (defined in the ISO 8208 standard). The ISDN B-channel can be used as a high-speed transmission medium between two X.25 DTEs. The X.25 standards define procedures for the *connection of one DTE directly to another without an intervening packet-switching network*. This connectivity, referred to as DTE-to-DTE, requires that one of the DTEs provide a subset of DCE functions. For switched B-channels, the D-channel provides call control to establish a connection between DTEs. The procedure used for the packet transportation is transparent to the ISDN.
- X.31 case A. CCITT Recommendation X.31 case A describes the use of an ISDN B-channel as a high-speed transportation medium. This high-speed transportation medium is between a DTE and data circuit-terminating equipment (DCE) in an X.25 network. The D-channel provides call control for switched B-channels. Once the B-channel connection is established between the DTE and DCE through the ISDN, X.25 communications occurs on the

B-channel. The procedures used for the packet transmission are transparent to the ISDN.

Packet Mode

Recommendation X.31 describes how an X.25 DTE can use ISDN packet services. For switched B-channels, D-channel signaling or the network subscription sets up B-channel connections to a DCE within the ISDN. This DCE, known as a **packet handler**, routes X.25 packets through the ISDN. The D-channel not only sets up B-channel connections but also can support X.25.

Connecting to Devices Using X.25

Using the integrated ISDN adapter with X.25, the AS/400 system can use a basic rate interface B-channel to communicate with a remote device. The following configurations are supported:

- X.25 DTE-to-DTE communication over a B-channel

This method does not require a PSDN or an ISDN packet handler. The following DTE-to-DTE configurations are supported by all ISDNs.

- AS/400 X.25 DTE over an ISDN B-channel to a remote X.25 DTE

Some of the devices that support this configuration are the following:

- AS/400 systems
- Personal System/2 with PC Support/400 and Communications Manager 2.0

Figure 1-4 shows the communication path between an AS/400 system and a X.25 DTE when communicating through an ISDN.

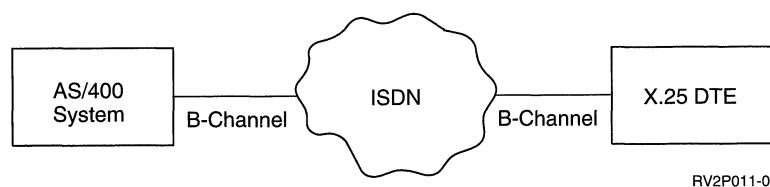


Figure 1-4. X.25 DTE-to-DTE Communications Over ISDN

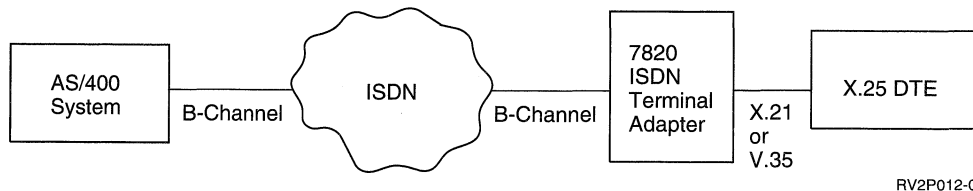
- AS/400 X.25 DTE over ISDN B-channel to remote 7820 Terminal Adapter to remote X.25 DTE

In this configuration, the remote device is unable to accept incoming calls from the AS/400 system. The remote device connects to the 7820 Terminal Adapter using an X.21 or V.35 line.

Some of the devices that support this configuration are the following:

- AS/400 system
- System/38
- 5394
- 5494
- Personal System/2 with PC Support and Communications Manager 2.0
- 3745 Communications controller attached to a S/370 or S/390 host system. (In this case, the S/370 or S/390 host system can accept incoming calls from the AS/400 system.)

Figure 1-5 on page 1-7 shows communications through a 7820 ISDN terminal adapter.



RV2P012-0

Figure 1-5. X.25 DTE-to-DTE ISDN Communication Using a Terminal Adapter

- DTEs using the X.25 packet handling feature of an ISDN (Case B)

In the following network configurations, X.25 communicates over the ISDN B-channel to the packet handler inside an ISDN. The packet handler makes a connection to a B-channel on the other side of the ISDN. Or the packet handler makes a connection through the ISDN to a separate packet-switching data network (PSDN).

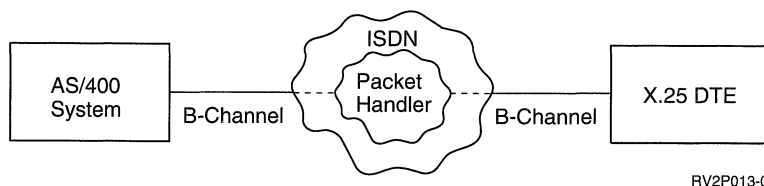
The following X.25 Case B configurations are supported in Japan and in most of North America.

- ISDN with Packet Handler

The AS/400 X.25 DTE communicates over a B-channel to an ISDN with a packet handler. The packet handler communicates through an ISDN B-channel to the remote X.25 DTE.

Some of the devices that support this configuration are the following:

- Other AS/400 systems
- Personal System/2 systems using Communications Manager 2.0 and PC Support



RV2P013-0

Figure 1-6. ISDN with a Packet Handler

- ISDN with Packet Handler with D-Channel Data Transfer

The AS/400 X.25 DTE communicates over a B-channel to an ISDN with a packet handler. The packet handler communicates through an ISDN D-channel to the remote device X.25 DTE.

Some of the devices that support this configuration are the following:

- Devices that support D-channel data transfer with X.25



RV2P014-0

Figure 1-7. X.25 Communications on ISDN with Packet Handler using Remote D-Channel Data Transfer

- ISDN with Packet Handler to Terminal Adapter

The AS/400 X.25 DTE communicates over a B-channel to an ISDN with a packet handler. The packet handler communicates over a B-channel to a 7820 Terminal Adapter that is connected through X.21 or V.35 to the remote X.25 DTE.

Some of the devices that support this configuration are the following:

- Other AS/400 systems
- 5394
- 5494
- Personal System/2 systems using Communications Manager 2.0 and PC Support
- System/38

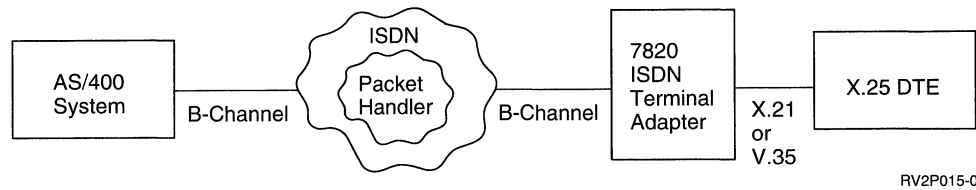


Figure 1-8. X.25 Communications over ISDN with Packet Handler using a Terminal Adapter

- ISDN with Packet Handler, Internetworking to a Packet-Switching Data Network (PSDN)

The AS/400 X.25 DTE is connected over a B-channel to an ISDN with a packet handler. The packet handler communicates with a PSDN. The PSDN connects to a remote X.25 DTE. Note that the remote X.25 DTE does not need to support ISDN communications.

Some of the devices that support this configuration are the following:

- Other AS/400 systems
- 5x94
- Personal System/2 systems with Communications Manager 2.0 and PC Support
- System/36
- System/38
- 37x5
- 3x74
- Other X.25 DTEs

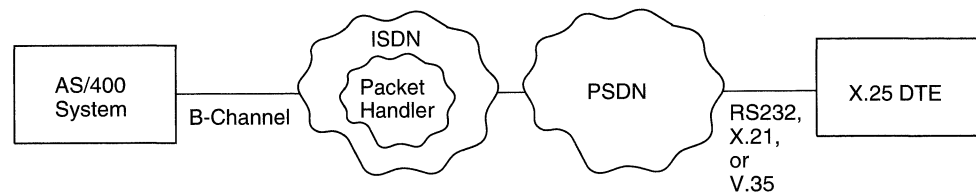


Figure 1-9. X.25 Communications Over ISDN, Internetworking to a PSDN

- France Numeris ISDN and TRANSPAC X.25 Connections (Case A)

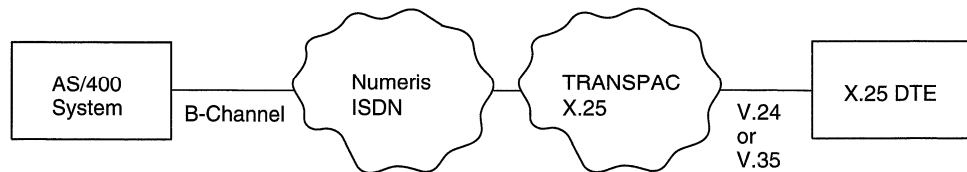
In the following network configurations, the AS/400 X.25 DTE connects over the ISDN B-channel through the French Numeris ISDN to the TRANSPAC X.25 network. The remote X.25 DTE is connected to TRANSPAC X.25 by one of the following methods:

– ISDN to TRANSPAC X.25

In this case, the AS/400 X.25 DTE connects with an ISDN B-channel through the French Numeris ISDN to TRANSPAC X.25. The remote X.25 device connects to TRANSPAC using a V.24 or V.35 line.

Some of the devices that support this are the following:

- Other AS/400 systems
- 5x94
- Personal System/2 systems with Communications Manager 2.0 and PC Support/400
- System/36
- System/38
- 37x5
- 3x74
- Other X.25 DTEs



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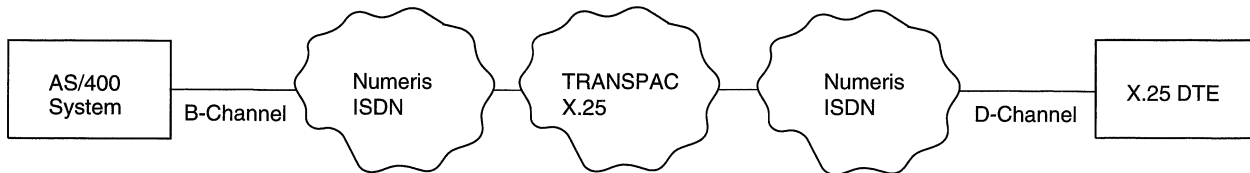
Figure 1-10. ISDN to TRANSPAC X.25

– ISDN to TRANSPAC X.25 to ISDN

In this case, the AS/400 X.25 DTE connects with an ISDN B-channel through the French Numeris ISDN to TRANSPAC X.25. TRANSPAC routes the connection back through Numeris ISDN to the remote device. The remote X.25 DTE connects through Numeris ISDN using the lower speed D-channel.

Some of the devices that support this are the following:

- Personal System/2 systems with Communications Manager 2.0 and PC Support/400



RV2P018-0

Figure 1-11. ISDN to TRANSPAC X.25 to ISDN

– ISDN to TRANSPAC X.25 to ISDN to 7820 Terminal Adapter

In this case, the AS/400 X.25 DTE connects with an ISDN B-channel through the French Numeris ISDN to TRANSPAC X.25. TRANSPAC routes the connection back through Numeris ISDN. Numeris ISDN uses a B-channel to connect to a 7820 ISDN Terminal Adapter. The B-channel is then connected to a unit provided by France Telecom, called the Coffret Numeris. This unit provides device identification to the network. The device identification unit connects to the remote X.25 DTE device using V.24 or V.35.

In this configuration, the remote device must initiate the connection to TRANSPAC. See Appendix D, "Network Provider Information" on page D-1 for other limitations.

Some of the devices that support this configuration are the following:

- AS/400 system
- 3745

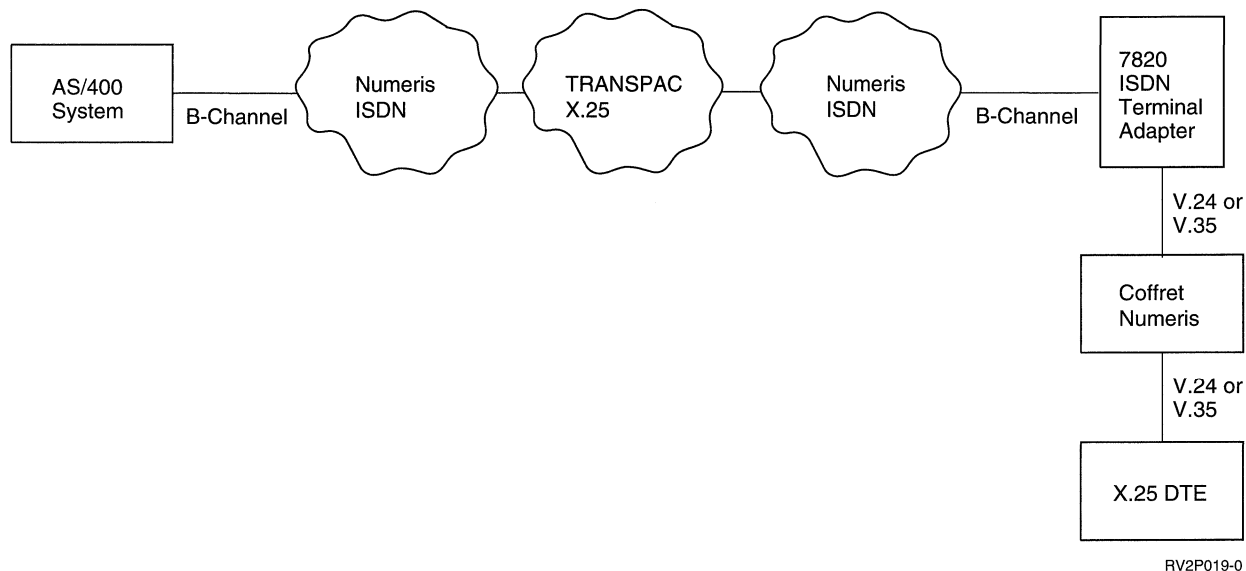


Figure 1-12. ISDN to TRANSPAC X.25 to ISDN to 7820 ISDN Terminal Adapter

ISDN Connections Using CallPath

Using the integrated ISDN adapter with the CallPath/400 application, the AS/400 system performs third-party call control.

Third-party call control allows the CallPath/400 application on the AS/400 system to act as a third party to manage connections, typically between two telephones, using the AT&T** DEFINITY** G3i or G3r (*ATTG3) switch. (In contrast, **first-party call control** occurs when an AS/400 system directly receives or sends a call to another system.) Using a single D-channel, the CallPath/400 application can control many simultaneous connections on the AT&T DEFINITY G3i or G3r switch. Information about a call from the AT&T DEFINITY G3i or G3r switch enables the AS/400 system to send commands back to the switch to control the call according to the CallPath/400 application. For more information regarding CallPath/400 configuration, see the *CallPath/400* Planning and Installation Guide*.

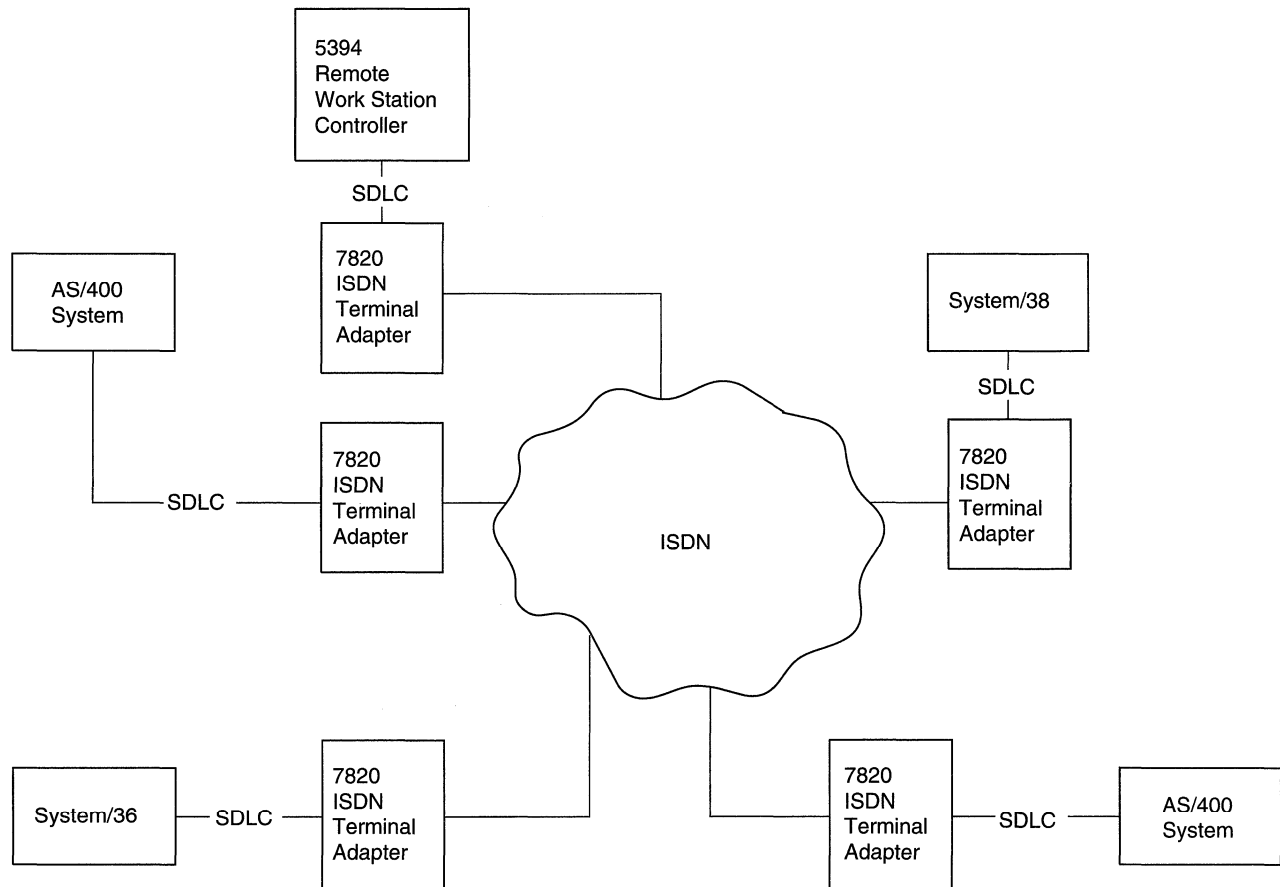
ISDN Connections Using a Terminal Adapter and SDLC

Using a 7820 ISDN terminal adapter and synchronous data link control (SDLC), the adapter converts data from an SNA DTE. This data is not compatible with an ISDN. The data is converted into a form that can be transmitted through an ISDN. Systems without an integrated communications adapter for ISDN, but with SDLC can be attached. These systems include:

- AS/400 system (without integrated ISDN adapter)
- System/36
- System/38
- 5394

- 5494
- Personal System/2 system using Communications Manager 2.0 and PC Support/400
- Other systems that use the SDLC protocol

An example of an AS/400 system using SDLC and a 7820 terminal adapter to connect to an ISDN is shown in Figure 1-13. For more information on connectivity using the 7820 terminal adapter, see the *7820 ISDN Terminal Adapter Description and Planning Guide*.



RV2P006-3

Figure 1-13. AS/400 System Using SDLC and a 7820 ISDN Terminal Adapter

ISDN Primary Connections Using Teleos

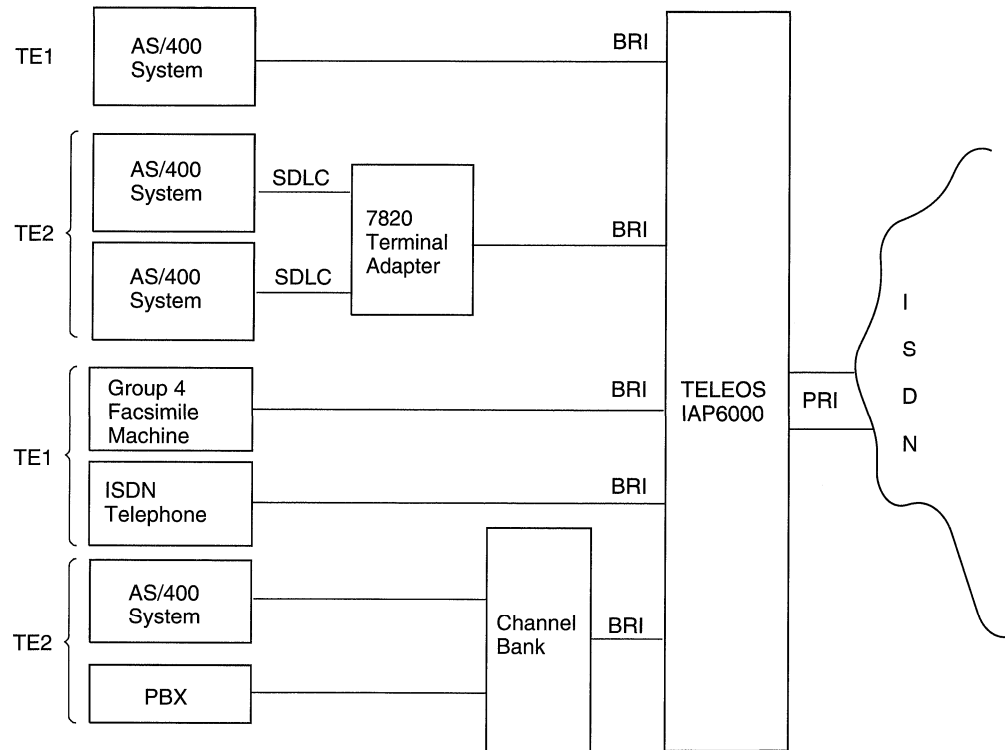
Using the Teleos communications, Incorporated, Teleos IAP6000** ISDN Access Provider, a Teleos IAP6000 can do the following:

- Connect up to 32 local area networks through an ISDN.
- Connect basic rate interface devices to a primary rate interface.

- Connect devices with an integrated communications adapter for ISDN (**TE1**)¹ and devices without an integrated communications adapter for ISDN (**TE2**)² to the same Teleos IAP6000.

An example of using a Teleos IAP6000 in an ISDN is shown in Figure 1-14.

For more information on connectivity using the Teleos IAP6000, contact a Teleos marketing representative.



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Figure 1-14. Using a Teleos IAP6000 to Connect TE1 Devices and TE2 Devices to an ISDN. A **channel bank** is a converter between TE2 devices (including computers and PBXs) and a T1 interface to the network.

Note: Similar devices may be available in countries other than the United States. For more information regarding similar devices, contact IBM support personnel or your network provider.

AS/400 Configuration Requirements

Attaching the AS/400 system to an ISDN using the integrated communications adapter may require two additional objects to be configured. These objects are in addition to the line description, controller description, and device description. However, if the two B-channels are nonswitched, or if one is used only for X.25 (X.31) packet mode, no connection list is required. The two objects are:

¹ Terminal equipment 1 (TE1) is data terminal equipment (DTE) with an integrated communications adapter for ISDN.

² Terminal equipment 2 (TE2) is data terminal equipment (DTE) without an ISDN interface. To communicate with other equipment through an ISDN, this equipment must have the protocol changed to one that is recognized by the network. For example, a 7820 ISDN terminal adapter may be used.

Network interface description

The network interface description represents the physical interface to the ISDN.

Connection list

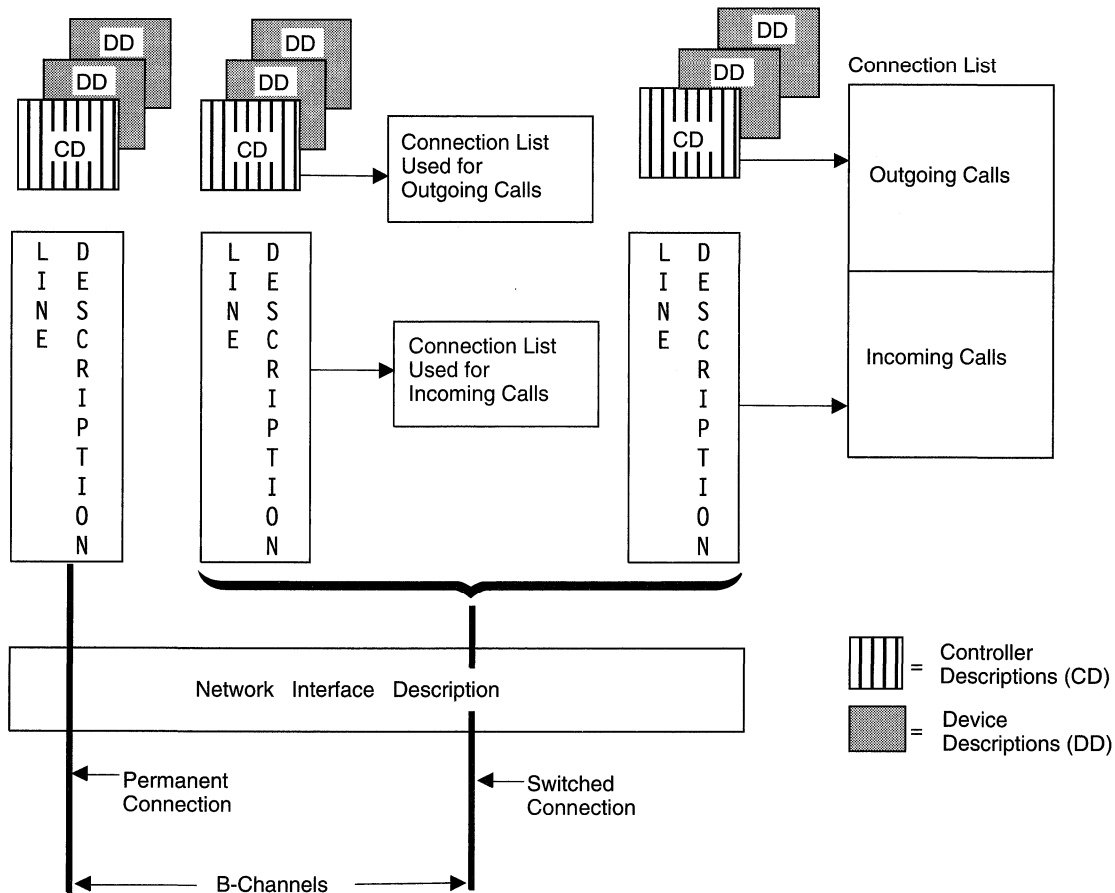
The connection list is a list of information to be used for call validation and setup for switched connections.

Network Interface Description

The network interface description is configured to describe the physical interface from the AS/400 system to the ISDN. It has a physical resource name associated with it.

The network interface description allows up to two B-channels for communications. If either of the channels is to be switched, the D-channel provides signaling to set up the path for the B-channel through the network. Switched channels indicate temporary connections through the ISDN. Line descriptions represent the logical connections (B-channels) in a physical interface.

Refer to Figure 1-15 to see how the network interface description relates to the other communications objects on the system. The line description on the left has a permanent connection through the network to a specified destination. The two line descriptions on the right are for switched lines. They share a network interface description that has a B-channel whose path may be switched to different destinations in the network.



RV2P002-5

Figure 1-15. Relationship of ISDN Configuration Objects

When configuring the network interface description, you must specify the type of ISDN to which your system will connect. The AS/400 system is designed to work with the following network types and the indicated network software:

- AT&T 5ESS** (Versions 5E4.2, 5E5, 5E6)
- AT&T DEFINITY (Versions G3i and G3r)
- Northern Telecom (DMS100 switch, Versions BCS-29 and BCS-31)
- France Post Telegraph Telephone (PTT) (France Telecom (Numeris VN2))
- German PTT (Deutsche Bundespost (1TR6))
- Japan (Nippon Telegraph & Telephone (NTT) INS-NET64)
- Teleos IAP6000
- United Kingdom (British Telecom BTNR191)
- European Telecommunications Standard Institute (ETSI)
- Bellcore National ISDN (North America)

Note: It is possible that the AS/400 system may not connect to all the above networks. The ability to connect an AS/400 system to some of the above networks depends on successful completion of type approval, also known as homologation testing. (**Type approval**, as required by the network provider, is testing to approve connection of data communications equipment to a specified network.)

Check with your IBM branch office and your network provider to make sure that your AS/400 system can connect to the ISDN in your country.

In addition, network type *CCITT88 is the IBM interpretation of the CCITT recommendation. However, if you use any of the previously discussed networks, do not use network type *CCITT88 unless directed to in Appendix D, "Network Provider Information." For information on configuring the network interface description, see "Creating a Network Interface Description" on page 2-2.

Connection List

The ISDN connection list provides information on when to accept incoming calls and what information to send with an outgoing call. This information is like a list of telephone numbers and is used only for switched connections. A default connection list (QDCCNNLANY) is provided with the system and is configured for answering any incoming ISDN calls. If your system is only used to accept all incoming calls, you are not required to create and configure a connection list. However, if your system places outgoing calls or screens incoming calls, you must do one of the following:

- Create and configure a connection list.
- Change the default connection list (QDCCNNLANY) by adding entries with remote numbers.

Figure 1-15 on page 1-13 shows some possible connection list configurations. You may use one connection list for both answering and dialing, or you may use separate connection lists, one for answering and one for dialing. Information in the ISDN connection list specifies the following:

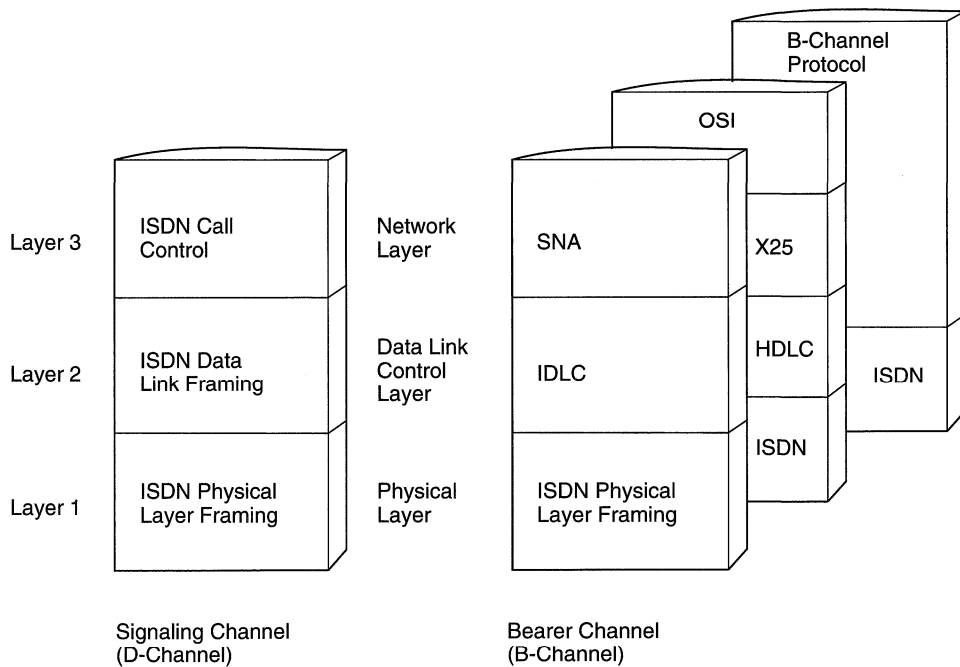
- The amount of information contained in the incoming or outgoing call setup messages
- Network differences
- Connection authorization (security)
- Matching attributes of the local and remote systems
- Switched services for multiple locations

Note: The connection list is not used for X.25 packet mode (X.31) calls or for permanent connections.

For information on configuring the connection list, see “Creating a Connection List” on page 2-5.

ISDN Used with System Network Architecture or Open Systems Interconnection

The recommended standards for communication with an ISDN are defined by the International Telegraph and Telephone Consultative Committee (CCITT). For a comparison between the CCITT recommendation for ISDN used with Systems Network Architecture (SNA) and ISDN used with Open Systems Interconnection (OSI), see Figure 1-16.



RV2P009-2

Figure 1-16. Examples of ISDN Used with SNA or OSI

The CCITT recommendations for ISDN define layers 1 through 3 for the D-channel and layer 1 (physical layer) for the B-channel. Layers 2 and higher on the B-channel may vary with the application. Examples include SNA with ISDN data link control (IDLC), and OSI with X.25. **IDLC** is a peer-to-peer, duplex, data link protocol, which can be used between two systems to exchange information over an ISDN B-channel. IDLC complies with CCITT recommendation Q.922.

Chapter 2. Configuring for ISDN

This chapter contains an overview of the commands necessary to configure ISDN support on the AS/400 system. In addition to the line, controller, and device descriptions configured for most communications, ISDN also uses a network interface description and a connection list. Details on all commands are provided in the *OS/400* Communications Configuration Reference*.

Before configuring ISDN support on an AS/400 system, you should obtain the following information from your network provider:

- Network type.
- Connection type, whether a B-channel is switched or permanent, is generally determined by the network subscription. On some networks, it is possible to have one switched B-channel and one permanent B-channel on the same BRI. An example of this is shown in Figure 1-15 on page 1-13.
- Local number and remote numbers of systems to call.
- Some network types require additional information from your network provider. Refer to Appendix D, "Network Provider Information," for this information.

The following is a suggested order for creating the ISDN configuration objects:

1. Specify a default network type and default connection list using the Change Network Attributes (CHGNETA) command.
2. Create a network interface description using the Create Network Interface Description (CRTNWIISDN) command.
3. Create a connection list description using the Create Connection List (CRTCNL) command, and add connection list entries using the Add Connection List Entry (ADDCNNLE) command. **Connection list entries** identify connection or call information which your AS/400 system uses to make outgoing calls and to accept incoming calls. Connection list entries must be entered into the connection list.

Note: Depending on how you want your system to accept incoming calls, you may not need to configure a connection list. A default connection list (QDCCNNLANY) is provided with the system. If, however, your system is to make outgoing calls or screen incoming calls, you are required to configure a connection list and add connection list entries.

4. Create an IDLC line description using the CRTLINIDLC command, or create an X.25 line description using the CRTLINX25 command.
5. Create a controller description using the CRTCTLAPPC, CRTCLRWS, and CRTCTLHOST commands. For X.25 lines, you may also use the CRTCTLASC, CRTCLFNC, and CRTCLRTL commands.
6. Create device descriptions using the CRTDEVASC, CRTDEVRTL, CRTDEVFNC, CRTDEVAPPC, CRTDEVHOST, and CRTDEVDSP commands. If you are using Advanced Peer-to-Peer Networking* (APPN*) support, device descriptions are automatically created.

This chapter also discusses commands necessary for verifying ISDN connections and using ISDN. These commands include:

- Vary Configuration (VRYCFG)

- Retrieve Configuration Status (RTVCFGSTS)
- Work with Configuration Status (WRKCFGSTS)
- Retrieve Configuration Source (RTVCFGSRC)
- Restore Configuration (RSTCFG)
- Work with Hardware Resources (WRKHDWRSC)

Changing Network Attributes

Network attributes are local system values that determine how the AS/400 system participates in the network. The AS/400 system is shipped with IBM-supplied values for the network attributes. You may need to change some of these attributes depending on the local AS/400 system's participation in the network.

It is especially important to change the default network type. The initial value after AS/400 system installation is blank, and the default value for the network type parameter on the CRTNWIISDN command is *NETATR. If the network attribute value is not changed, the command will fail, telling the user that the default network type attribute is blank.

Change Network Attributes (CHGNETA) Command

The network attributes are changed using the Change Network Attributes (CHGNETA) command. The default for all the parameters of the CHGNETA command is *SAME, which means that the current value is unchanged.

This section describes the parameters that have unique meaning to ISDN:

Default network type (DFTNETTYPE)
 Default connection list for ISDN (DFTCNLST)

Default network type (DFTNETTYPE)

Specifies the type of ISDN to which this system will attach. For information about supported ISDN types, refer to Appendix D, "Network Provider Information."

Note: Check with your IBM branch office and your network provider to ensure that your AS/400 system can connect to the ISDN in your country.

Default connection list for ISDN (DFTCNLST)

Specifies the default connection list used by IDLC or X.25 line descriptions having *NETATR specified in the CNLSTIN parameter.

QDCCNLANY: The IBM-supplied value that is shipped with the system. Using this connection list, this system accepts all incoming ISDN data calls.

connection-list-name: Specify a connection list.

Creating a Network Interface Description

The network interface description is a system object that represents the AS/400 physical interface to the ISDN. Each network interface description has a physical resource name associated with it (for example, LIN011).

For ISDN, the network interface description allows up to two B-channels for communication. Certain ISDNs may only allow the use of one B-channel. If either of the channels on the interface are to be switched (that is, have temporary connections through the ISDN), the D-channel provides signaling to the network to set

up the path for the B-channel through the network. The B-channel handles user data.

The higher level protocol using the individual B-channels of a particular network interface description is represented by the line descriptions. Figure 1-15 on page 1-13 shows how the network interface description relates to the other communications objects on the system.

Network Interface Description Commands

To create a network interface description, use the Create Network Interface Description (CRTNWIISDN) command. The following are required parameters for the CRTNWIISDN command:

Network interface description name (NWID) parameter

Specify the name of the network interface description.

Resource name (RSRCNAME) parameter

Specify the resource name of the communications interface. The resource name consists of the input/output adapter (IOA) resource name and the port number on the IOA. For example, if the resource name of the IOA is LIN01 and the port on the IOA is 1, then the resource name would be LIN011.

Use the Work with Hardware Resources command (WRKHDWRSC TYPE(*CMN)) to help determine the resource names.

The following parameters must be considered when configuring a network interface description with a network type of *NISDN:

Service profile identifier (SPID) parameter

Specify the service profile identifier number and the service profile identifier value. The service profile identifier number indicates whether this is the first or second service profile. The network provider must supply this value at the time of subscription. This parameter is only valid for network type *NISDN.

For example, the service profile identifier number can be either 1 or 2. The service profile identifier value must be a minimum of 9 characters and a maximum of 20 characters.

Terminal endpoint identifier (TEID) parameter

Specify the terminal endpoint identifier. The terminal endpoint identifier must be *AUTO when NETTYPE(*NISDN) is configured.

All other parameters are optional and have default values.

For the CRTNWIISDN command, the channel entry (CHLENTY) parameter's default value specifies two switched B-channels, and the network type (NETTYPE) parameter's default value specifies that the network type be retrieved from the related network attributes field.

When using third-party call control, additional parameters must be specified using the CRTNWIISDN command. These parameters are described in Appendix D, "Network Provider Information."

Additional Network Interface Description Commands: Other network interface description commands are:

- 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 (CHGNWIISDN).
- Display Network Interface Description (DSPNWID).
- Delete Network Interface Description (DLTNWID).

In addition to the commands listed above, the following commands also support network interface descriptions:

- Work with Configuration Status (WRKCFGSTS)
- Retrieve Configuration Status (RTVCFGSTS)
- Retrieve Configuration Source (RTVCFGSRC)
- Vary Configuration (VRYCFG)
- Restore Configuration (RSTCFG)

ISDN Connection Lists

The ISDN connection list provides information that allows the system to determine when to accept incoming calls and what information to send with an outgoing call. IDLC line descriptions and X.25 circuit-mode line descriptions refer to connection lists to determine if the system should answer a particular call. For IDLC, controller descriptions refer to an entry in a connection list for information to use on an outgoing call. For X.25 circuit mode, the connection list entries are referred to by the line descriptions.

The following are important steps in using the connection list:

1. Know the ISDN number of the remote user you want to call.
2. Create the connection list (using the CRTCNL command).
3. Add information about the caller, such as the remote number (using the ADDCNLE command).
4. For outgoing calls, refer to the connection list from the controller description. For incoming calls, refer to the connection list and the connection list entries from the line description. Additionally, one connection list may be used for both incoming and outgoing calls.

Configuration advantages of the connection list objects are:

- The same connection list can be used for both answering and dialing, which minimizes required configuration.
- The ISDN connection list can be referred to from the line description and controller description, which reduces changes required to these objects.
- Each ISDN connection list can be referred to by several line descriptions and controller descriptions which minimizes required configuration.

Specifically, the ISDN connection list object helps handle incoming and outgoing calls from the ISDN, including:

- The amount of information contained in outgoing call setup messages. The setup message may contain:
 - A number for both the local and remote system.
 - A local and remote **subaddress**, which are extensions of an ISDN number (telephone number), used to identify individual users within a group of users who are identified by a single number.

- A number of additional **information elements (IEs)** that are used for functions, including describing transit networks crossed. An information element is a unique field that is encoded in messages sent over the D-channel between the AS/400 system and the ISDN. Refer to Appendix D, “Network Provider Information” for connection list considerations for specific networks.
- Network differences

Not all networks support exchanging all the information provided by the CCITT recommendation for ISDN, so information varies from network to network. In addition, some networks specify additional charges for some special types of information provided about a call (for example, calling party identification).

Calling party identification is information that the ISDN provides about the incoming call. This information includes a calling party number information element (IE) and calling party subaddress IE. You may prefer not to subscribe to information for which there are special charges.

For more information about network differences, see “Network Differences” on page 4-2.

IBM-Supplied Connection List

Depending on how you want your system to accept incoming calls, you may not need to configure a connection list. A default connection list (QDCCNNLANY) is provided with the system. QDCCNNLANY allows your system to accept all incoming calls for data. Voice, video, and other nondata calls will not be accepted. If, however, your system is to make outgoing calls or screen incoming calls, you are required to configure a connection list or change QDCCNNLANY. (The IBM-supplied connection list is created during an IPL if a default connection list is not found.)

Creating a Connection List

To create a connection list, use the Create Connection List (CRTCNL) command. The following is the required parameter for the CRTCNL command:

Connection list name

Specify the name of the connection list.

All other parameters are optional and have default values.

Additional Connection List Commands: Other connection list commands are:

- Work with Connection List (WRKCNL), 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; rename and work with connection list entries in a connection list; or retrieve a configuration source program.
- Change Connection List (CHGCNL).
- Display Connection List (DSCNL).
- Delete Connection List (DLTCNL).
- Retrieve Configuration Source (RTVCFGSRC), which copies a connection list and all its entries.
- Restore Configuration (RSTCFG).

Adding Connection List Entries

Once an ISDN connection list has been created (by you, or by the system if you use the default connection list and your system is to make outgoing calls), you must add one or more entries to the list. These entries identify information (for example, remote numbers) which this system can use to make outgoing calls and accept incoming calls.

To add entries to a connection list, use the Add Connection List Entries (ADDCNNLE) command. The following are the required parameters for the ADDCNNLE command:

Connection list entry

Specify the name of the entry to be placed in the connection list. Each entry in the connection list must have a unique name.

Connection list

Specify the name of the connection list with which this entry is associated.

Remote number

Specifies the number assigned to the remote system. For incoming calls, the value specified on this parameter determines which, if any, remote number value in the Calling Party Remote Number Information Element (IE) is accepted by the system. For outgoing calls, the value specified on this parameter determines how the system assigns the Called Party Remote Number IE. The possible values are:

***ANY:** Incoming calls from any remote number are accepted by the system. Outgoing calls attempting to use this value will fail because the local system requires a specific remote number for dial-out operations.

remote number: Specify up to 40 characters enclosed in apostrophes for the remote number. Only calls from the specified remote number are accepted for this entry. Outgoing calls are made using the specified remote number. Extra characters, such as parentheses, can be used if they are specified on the remove character (RMVCHR) parameter of the Create Connection List (CRTCNL) or Change Connection List (CHGCNLE) commands.

All other parameters are optional and have default values.

Additional Connection List Entry Commands: Other connection list entry commands are:

- Work with 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.
- Change Connection List Entry (CHGCNNLE).
- Rename Connection List Entry (RNNCNNLE).
- Remove Connection List Entry (RMVCNNLE).

Creating a Line Description

With an ISDN, you can use either the IDLC protocol for data transfer or the X.25 protocol to transfer X.25 packets. Use the Create Line Description (IDLC) (CRTLINIDLC) command to create a line that uses the IDLC protocol, and use the Create Line Description (X.25) (CRTLINX25) command to create an X.25 line

description. These commands and their associated parameters are discussed in the following sections.

Common Parameters for IDLC and X.25

You should be familiar with the following parameters for both IDLC and X.25 line descriptions.

Parameters for Both Switched and Permanent Connections

Specify the following for both permanent and switched connections:

Line description name (LIND) parameter

Specifies the name of the line description. This is a required parameter.

Network interface connection type (CNN) parameter

Specifies whether this line description is permanently attached to the network interface description identified by the Network Interface (NWI) parameter or whether one of the network interface descriptions specified in the switched network interface list (SWTNWILST) parameter is used by this line when a switched connection is established.

***SWT:** Indicates that a switched connection can be established over any of the network interface descriptions listed in the switched network interface list (SWTNWILST) parameter.

***NONSWT:** Indicates that the line is permanently attached to the channel specified by the NWI and NWICHLNBR parameters in the network interface description.

Switched Connection Parameters

The following parameters apply to switched connections.

Switched NWI list (SWTNWILST) parameter

Specifies, for ISDN switched connections, a list of network interface descriptions to which this line can be connected. A maximum of 64 network interface descriptions can be specified. This parameter consists of three elements:

network interface description:

Specifies the name of the switched network interface to which the line attaches. The network interface description must exist and at least one B-channel connection type must be *SWT. The network interface description does not need to be varied off before creating the line description.

NWI channel type:

Specifies the ISDN channel type to which this line can attach. Currently, only the B-channel type is supported. This parameter defaults to *B.

NWI channel number:

Specifies the switched channel number, as identified by the network interface description channel entry (CHLENTY) parameter, to which the line can attach. This parameter defaults to *CALC, meaning that an available channel is selected.

Incoming connection list (CNLSTIN) parameter

For IDLC and X.25 circuit-mode connections, this parameter specifies the name of the connection list used to retrieve call information for identifying authorized incoming calls.

Permanent Connection Parameters

The following parameters apply to permanent connections.

Attached nonswitched network interface (NWI) parameter

Specifies for a nonswitched connection, the network interface description that contains the channel to which this line attaches. The network interface description must exist on the system and the channel connection type must be *NONSWT, but the network interface description does not need to be varied off before creating the line description. The specific channel of the network interface description to which this line attaches, as specified by the network interface channel number (NWICHLNBR) parameter, cannot already be attached to another line description.

Information transfer type (INFTRFTYPE) parameter

For nonswitched connections, specifying the information transfer type with this parameter determines the layer 1 protocol used for the call. The information transfer type used may affect the operating speed of the B-channel. This parameter does not apply to lines using X.31 packet mode.

Network interface channel type (NWICHLTYPE) parameter

For permanent connections, this parameter specifies the type of ISDN channel or channels that this line description represents. Currently, only the B-channel type is supported.

***B:** This line uses one ISDN B-channel from the network interface description.

Network interface channel number (NWICHLNBR) parameter

Specifies the nonswitched channel number, as identified in the network interface description channel entry (CHLENTY) parameter, to which this line is attached. Only one line description can be attached to each channel.

IDLC Line Description

You describe the data-bearing B-channel connection and the IDLC protocol to be used between the local AS/400 system and the remote system by using the Create Line Description (IDLC) (CRTLINIDLC) command. The data link control identifier cannot be configured for the AS/400 system. The system uses the default defined in the *ISDN Data Link Control Architecture Reference* manual. The 10-bit value of the default data link control identifier is 32.

IDLC line descriptions are configured as switched (*SWT) or permanent (*NONSWT), depending on the channel type used.

A line description configured as switched can connect to different switched B-channels of the same network interface description or other network interface descriptions. Unlike other line descriptions (for example, SDLC), a resource name is not allowed for an IDLC line description. An IDLC line description must attach to a network interface description (for a permanent connection) or refer to at least one network interface description (for a switched connection) before it can be used. The network interface description includes the resource name.

The attached nonswitched controller (CTL) parameter, described below, is unique to IDLC line descriptions.

Attached nonswitched controller (CTL) parameter

Specifies for permanent connections, the name of the one controller that is attached to this line. The controller description must already exist if this param-

eter is specified. However, this parameter is automatically updated if a controller description is created after creating this line description and if the line is specified in the nonswitched line parameter.

For considerations for using IDLC line descriptions, see "IDLC Considerations" on page 3-6.

X.25 Line Description

To use ISDN channels to transmit X.25 packets, in either packet mode or circuit mode, create a line description using the Create Line Description (X.25) (CRTLINX25) command.

Specify the following parameters with the CRTLINX25 command.

Resource name (RSRCNAME) parameter

This parameter specifies the resource name that identifies the hardware that the description represents. Specify the value *NWID, which means the line uses the resource name specified in the NWID.

Physical interface (INTERFACE) parameter

When creating an X.25 line to be used on an ISDN, this parameter must be *X31.

Packet mode (PKTMODE) parameter

This parameter specifies whether to access the X.25 network using packet mode or circuit mode. The value *NO specifies circuit mode, and the value *YES specifies packet mode.

The following parameters are valid for circuit mode (PKTMODE has the value of *NO).

Outgoing connection list (CNLSTOUT) parameter

For ISDN circuit-mode switched connections, this parameter specifies the name of a connection list that contains ISDN-assigned numbers for a dial out operation to the ISDN.

Outgoing connection list entry (CNLSTOUTE) parameter

For ISDN circuit-mode switched connections, this parameter specifies the entry name from the connection list used to make a call to the ISDN. The connection list must be specified on the CNLSTOUT parameter.

Additional line description commands follow:

- Change Line Description (IDLC) (CHGLINIDLC)
- Change Line Description (X.25) (CHGLINX25)
- Display Line Description (DSPLIND)
- Work with Line Description (WRKLIND)
- Retrieve Configuration Source (RTVCFGSRC)
- Retrieve Configuration Status (RTVCFGSTS)
- Vary Configuration (VRYCFG)
- Restore Configuration (RSTCFG)
- Work with Configuration Status (WRKCFGSTS)

Creating a Controller Description

The controller descriptions describe communications characteristics of the remote systems. Certain parameters on the Create Controller Description Advanced Program-to-Program Communications (APPC) (CRTCTLAPPC), Create Controller Description (Host) (CRTCTLHOST), or Create Controller Description Remote Work Station (CRTCLRWS) commands determine how the local system treats the remote system. In addition, if the X.25 protocol is used, the following create controller commands are also supported:

- Create Controller Description (Asynchronous) (CRTCTLASC)
- Create Controller Description (Finance) (CRTCLFNC)
- Create Controller Description (Network) (CRTCLNET)
- Create Controller Description (Retail) (CRTCLRRTL)

This section describes the parameters that have unique meaning to ISDN. The ISDN-related parameter for the CRTCTLAPPC command, CRTCTLHOST command, and the CRTCLRWS command is:

Link type (LINKTYPE) parameter

This specifies the type of data link connection. It is a required parameter and has no default. Use *IDLC for ISDN data link connections and *X25 for X.25 connections.

IDLC Controller Description Parameters

The following parameters are used to create an IDLC controller.

Outgoing connection list (CNNLSTOUT) parameter

This parameter is for switched controllers only. This is the name of a connection list object that contains at least one entry for a remote system.

Connection list entry (CNNLSTOUTE) parameter

This parameter is for switched controllers only. This specifies the entry name from the connection list from which the local system obtains the remote number information when calling a remote system. The connection list must have been identified by the CNNLSTOUT parameter.

IDLC window size (IDLCWDWSIZ) parameter

Specifies the maximum number of information frames that can be outstanding before an acknowledgement is required.

***LIND:** The default window size is taken from the line description.

default-window-size: Specify a value from 1 to 31.

IDLC frame retry (IDLCFRMRTY) parameter

Specifies maximum number of frame transmit attempts before reporting an error.

***LIND:** The default maximum number of retries is taken from the line description.

frame retry: Specify a value from 0 to 100.

IDLC response timer (IDLCRSPTMR) parameter

Specifies the time, in tenths of seconds, to wait before retransmitting a frame when an acknowledgement has not been received.

***LIND:** The default response timer is taken from the line description.

response timer: Specify a value from 10 to 100.

IDLC connect retry (IDLCCNNRTY) parameter

This is the number of times to retry a transmission at connection time.

***LIND:** The connection retry value is taken from the line description.

***NOMAX:** Try until successful. This is only valid for permanent connections.

connect retry: Specify a value from 1 to 100.

Additional controller description commands that support controller descriptions attached to IDLC line descriptions follow:

- Change Controller Description (APPC) (CHGCTLAPPC)
- Change Controller Description (HOST) (CHGCTLHOST)
- Change Controller Description (Remote WS) (CHGCTLRWS)
- Display Controller Description (DSPCTLD)
- Work with Configuration Status (WRKCFGSTS)
- Retrieve Configuration Status (RTVCFGSTS)
- Retrieve Configuration Source (RTVCFGSRC)
- Restore Configuration (RSTCFG)
- Vary Configuration (VRYCFG)
- Work with Controller Description (WRKCTLD)

Creating a Device Description for ISDN

The commands to create device descriptions include CRTDEVAPPC, CRTDEVHOST, and CRTDEVDSP. There are no parameters that have a unique meaning for ISDN. If you are using APPN support, device descriptions are created automatically.

Chapter 3. Using ISDN

This chapter contains information you will need to use ISDN, once your system has been configured. These topics include:

- Starting and ending ISDN (switched and permanent connections)
- Verifying ISDN connections
- Accepting and rejecting calls
- Calling party identification
- IDLC considerations
- Recovering from errors

Starting ISDN

Starting ISDN involves two systems establishing a connection through an ISDN so that they can communicate with each other. Depending on the type of connection, the procedure may involve specifying the desired called (or remote) system. The following sections describe the process for different connection types.

Switched Connection

A switched connection in an ISDN does not have a predetermined link to a remote system. Although the link from each system to the ISDN is permanent, line descriptions and controller descriptions accessing a connection list determine the system with which a switched connection should be made. When a system attempts to call another system, the ISDN performs the switching and contacts the remote system to setup a B-channel connection.

To enable a switched connection, use the VRYCFG command to vary on the network interface and switched line descriptions individually. (If a line is ready for switched connectivity and has at least one NWI over which it could receive or make calls, the line has a connect pending state. Otherwise, the line remains at vary on pending.) Vary on the switched controller descriptions using the VRYCFG command with the range (*NET) parameter. This results in any attached device descriptions also being varied on. Once the configuration objects have been varied on, the system is ready for switched connections. However, a switched connection is only established if an application requires it. The connection becomes active when an application sends data or a command across the network

Permanent Connection

This section applies only to network subscriptions that include permanent connections (connections that are always available and require no signaling or call initiation). A permanent connection is the simplest one to start because it has a permanent B-channel connection with the remote system. You only need to use the VRYCFG command with the range (*NET) parameter to vary on the network interface description—this varies on all nonswitched line, controller, and device descriptions associated with the network interface description. A permanent connection is ready for use by applications when both the local and remote systems have varied on the network interface, line, and controller descriptions corresponding to the permanent B-channel connection between them. The connection becomes active when an application sends data or a command across the network between the local and remote systems.

Ending ISDN

Permanent and switched connections remain active while application data is being sent and received on the connection and the hardware is in working order. Both types of connections can end according to user preferences and needs. Most permanent connections remain active, while switched connections generally end when no user application requires their use. The following sections describe how to end both types of connections.

Switched Connection

To end an ISDN switched connection, all application programs must have ended. If the switched disconnect (SWTDSC) parameter of the controller description is *YES and no applications need the connection, the connection ends following the expiration of the switched disconnect timer (SWTDSCCTMR) parameter. For X.25, the SWTDSC and SWTDSCCTMR parameters determine if the line is disconnected when no virtual circuits are active. For more information on switched disconnect parameters, see "Disconnect Parameters for a Switched IDLC Controller" on page 3-8.

Another way to end an ISDN switched connection is to vary off the corresponding configuration objects.

Permanent Connection

Users generally keep permanent connections active all the time. However, if the user chooses to end an ISDN permanent connection by varying off all the associated objects, all application programs must have completed or have been ended. If you also use the NWI for a switched connection, you may not want to vary it off.

Verifying ISDN Connections

Verify the ISDN connections by looking at the status of the network interface description (*NWI). Two commands allow you to retrieve this information. The Work with Configuration Status (WRKCFGSTS) command and Retrieve Configuration Status (RTVCFGSTS) command are described in the following sections.

Work with Configuration Status (WRKCFGSTS) Command

The interactive WRKCFGSTS command presents a graphic representation of your system's configuration, which allows you to display and view the communications configuration and the status of the network interface description (*NWI). This command allows you to verify the attachments of the communications descriptions and the status of jobs or communications descriptions for the network interface, lines, controllers, or devices. The command displays successful connections by showing a status of active or varied on. You should also view the network interface description, the line, controller, and device descriptions to ensure that the actual configuration matches the desired configuration.

Retrieve Configuration Status (RTVCFGSTS) Command

The RTVCFGSTS command can be used to retrieve status information from a Control Language (CL) program. The RTVCFGSTS command only retrieves status for one object, and it does not show connections. This command is useful in a programming environment for programs requiring the status of an object.

ISDN Call Processing

ISDN calls may involve IDLC, X.25 circuit mode, and X.25 (X.31) packet mode. Processing of X.25 packet-mode calls uses different communications objects and data than processing of IDLC and X.25 circuit-mode calls. The following sections describe the algorithms used for the different types of ISDN calls.

IDLC and X.25 Circuit Mode

The use of connection lists is described in the following sections.

Call Acceptance

Connection lists described earlier provide the main method the system uses to determine how to accept calls on switched connections. A connection list contains entries that identify a system and its associated configuration. 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)
- Network specific facilities (NSF) IEs

In Germany, the NSF IEs determine the connection type required by the call. The connection type (CNNTYPE) parameter may be semipermanent (*SEMIPERM) or switched (*CIRCUIT) accordingly.

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 your network provider about these items to ensure proper configuration of connection lists and accurate screening of incoming calls.

The system uses the information contained in incoming calls to search active connection lists for entries that match the incoming call. The system considers a connection list to be active only if at least one line description referring to the list has been varied on. A connection list entry must exactly match the items of the incoming call or generally match with the *ANY value to be considered. After searching, the system orders the connection lists according to the number of exact matches contained in the lists, so that those having an entry with the most exact matches are first.

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

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

Call acceptance may be verified in two ways. First, looking at the status indicates an accepted call if the connection to the remote system shows a status of active. You may also use the Display Message (DSPMSG) command to look at the system operator message queue, QSYSOPR. The queue contains messages that occur during an attempted call, including messages indicating successful call attempts.

Call Rejection

Several factors may cause rejection of calls on a switched connection. An error in the network configuration may not allow the desired system to be reached. 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 line description that has been varied on. 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.

If remote and local network interface descriptions have different connection types specified in the connection type (CNNTYPE) parameter, the remote and local systems will not establish communications. The particular information transfer capability might differ between network types so that a remote system does not support the call type of the local system.

A call is also rejected if 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.

Calling Party Information

Applications written in high-level languages use the get attributes operation of the intersystem communications function (ICF) to access information that a system receives or sends when making a call. Accessed information includes the following types of information:

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

Connection lists, as described in "ISDN Connection Lists" on page 2-4, 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.

An example application might screen the incoming call and compare the information to information in a file or list containing security information. When the information matches an entry in this list, that call is granted security privileges by the applica-

tion. 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 the *ICF Programmer's Guide* for using ICF, and the *APPC Programmer's Guide* and the *SAA* CPI Communications Reference* for using CPI Communications.

X.31 Packet Mode

X.31 packet-mode calls are screened with X.25 information from the call to find lines, controllers, and applications for acceptable calls. The X.31 differences (X31DIF) parameter of the network interface is used to determine which X.25 call information is available for call screening.

Call Acceptance

The notification class (X31NFYCLS) parameter of the network interface, which is based on the network subscription, indicates if and when the system receives notification from the ISDN that there is an X.25 call 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 indicates the specific X.25 information 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 the X.31 difference parameter is configured.

When the call includes call user data, the system determines the protocol requested by the call. 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 call user data is received and the requested protocol is SNA, the called system 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 matching the calling network address of the call. If the calling network address is not received, this screening is not done. SNA calls are also checked for the encoded password if call user data is received.

Once the system has found an appropriate controller description, it screens the line descriptions referred to by that controller 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 containing 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 for the call, 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 may be used to answer the call.

If the protocol of the call is not SNA or asynchronous, or if a matching controller description is not found, the system 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.

Call Rejection

Calls may be rejected by the receiving system for a number of reasons. Generally, if no matching information is found for the information supplied with the incoming call, or if a line description and controller description for the called and calling number are not available, the system cannot accept the call.

The ability of the system to screen incoming calls depends on how much information is received with the incoming call. The X31DIF parameter specifies which information is provided by the ISDN and determines the level of screening performed. Screening information that may be received in the call includes the called network address, the calling network address, and the call user data.

The called system rejects calls when the called network address does not match the network address in any of the 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. Additionally for the SNA protocol, calls can be rejected if an incorrect password is included with the call.

When the called network address, the calling network address, or the call user data is not supplied, the system can accept a call that it later must reject. Once accepted on the D-channel, the call is received over the B-channel. When the call is received on the B-channel, all the X.25 information is received with the call. Then the system has enough information to reject a nonmatching call that it initially accepted.

Even if the supplied information matches the information of the called system, the call can be rejected for other reasons. The system cannot accept the call if no logical channel is available, if no line or controller is in the correct state to accept a call, or if no application program is active that can accept the protocol of the incoming call.

IDLC Considerations

Similar to other data link protocols, IDLC has special considerations for operation. These include:

- IDLC parameters used to establish the logical connection
- Delayed contact for permanent connection
- Frame size related to performance
- Disconnect parameters for a switched IDLC controller

IDLC Parameters Used to Establish the Logical Connection

The following parameters are used to establish a logical connection to a remote system:

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

Values for all of these parameters are provided on the line description because the corresponding value on the controller description may not be known until after the connection is established. The default value for the controller descriptions is the value from the line description (*LIND). However, if you specify a unique value on the controller description, the system will use that value once the logical connection is established. The values specified on the controller description must not be greater than the values specified on the line description.

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

It is possible the values on the line description are the only values used. This can happen on connections to a host using software prior to VTAM* Version 3, Release 2, and prior to NCP Version 4, Release 3, when the host initiates 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 not used. You may need to change the default values on the line description.

Delayed Contact for Permanent Connections

Delayed contact means the local system keeps trying to connect to the remote system because it is not known when the remote system will be ready to establish the connection. This is controlled by polling parameters on the local system.

You will want to consider how many times the local system polls for a connection to the remote system and how long the local system waits before sending another transmission to the remote system. In the IDLC line description, these considerations relate to the IDLC connection retry (IDLCCNNRTY) parameter and the IDLC response timer (IDLCRSPTMR) parameter, respectively.

Following is a description of these parameters and how they are used before the connection is established.

IDLC response timer (IDLCRSPTMR) parameter

Specifies the time in tenths of seconds to wait before retransmitting a frame when an acknowledgement is not received. For permanent connections, a small value specifies that retransmissions are sent frequently.

***CNN:** The system determines this value based on the connection type.

response-timer: Specify a value from 10 to 100.

IDLC connection retry (IDLCCNNRTY) parameter

Specifies the number of times to retry a transmission at connection time.

***CNN:** The system determines the IDLC connection retry value based on the type of connection.

***NOMAX:** For permanent connections, try until successful.

connect-retry: Specify a value from 1 to 100.

For example, with an IDLCRSPTMR value of 10 and an IDLCCNNRTY value of *NOMAX, the local system will attempt a connection every second until it is successful.

Frame Size Considerations for IDLC Performance

The AS/400 support for IDLC can use a range of frame sizes from 265 to 8196 bytes. The default size is 2048. The frame size is specified with the maximum frame size (MAXFRAME) parameter in the line and controller descriptions. Usually, the larger the frame size used, the better the performance. If, however, the communications environment is electrically noisy, a smaller frame size will produce better performance.

The values specified for IDLC response timers (IDLCRSPTMR parameters) on controller descriptions should be greater than or equal to the value of the associated line description MAXFRAME parameter divided by 205.

Disconnect Parameters for a Switched IDLC Controller

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

For example, if data is transmitted for one minute, but the minimum connection time for which the carrier charges is three minutes, it would be more economical to keep the connection active if other data needs to be transmitted before the three minute limit is exceeded. The following parameters in the controller description control the switched disconnect of a controller.

Switched disconnect (SWTDSC) parameter

For switched IDLC controller (CNN(*SWT)), specifies whether the switched IDLC controller and the associated ISDN call are to be disconnected when no application requires them, and the disconnection timer specified on the DSCTMR parameter has expired.

***YES:** Controller and call will be disconnected when not required.

***NO:** Controller and call will remain connected.

switched-IDLC-controller: Accept the default or change the value to *NO. You can change this parameter when the line is varied off using the CHGCTLAPPC, CHGCTLHOST, or CHGCTLRWS command.

Disconnect timer (DSCTMR) parameter

This parameter specifies the timer used for disconnecting a switched IDLC controller and associated ISDN call from a remote system. The timer starts when the connect is established. CNN(*SWT) and SWTDSC(*YES) must both be specified to use this parameter.

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minimum-connection-timer: Specify a value from 0 to 65535 in 1-second intervals. You can change this parameter when the controller is varied off using the CHGCTLAPPC, CHGCTLHOST, or CHGCTLRWS command.

Error Recovery

The most general error notification places an entry in the system operator message queue, QSYSOPR. The system displays messages to explain the problem and the appropriate solutions to you.

A second form of notification is through cause codes. The network generates specific reasons for the error based on the particular network type.

The system attempts to prevent failures for certain types of errors. This means the system is tolerant of certain types of network failures and does not completely drop a line because of the errors.

One of these failures may result from a temporary condition. The AS/400 system does not complete a particular call successfully, but it also does not drop the network connection. If the original problem is temporary and resolves itself by the next call, the call attempt completes successfully. For information regarding AS/400 first- and second-level error recovery, refer to handling communication errors in the *Communications Management Guide*.

Communications Line Trace for ISDN

The AS/400 system collects trace data for an ISDN on both D-channels and B-channels. The data on D-channels is in link access procedure D-channel (LAPD) format and can be used to help determine call-in and call-out problems. Third-party call control messages are also traced. **LAPD**, recommended by the CCITT, 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.

The communication trace option in the service system tools (SST) has a field in the trace start screen. The field, TYPE, allows you to specify 1 to collect data for a line description or 2 to collect data for a network interface description. This option also has a Configuration Object field. You may enter the name of a specific line description or network interface description for which trace data is collected.

You can also begin the trace using the Start Communications Trace (STRCMNTRC) command. For more information about the communications trace, see the *Communications Management Guide*.

For information on how to interpret the collected data in LAPD or IDLC format, refer to the *ISDN Data Link Control Architecture Reference* manual.

Chapter 4. Managing Networks

This chapter discusses considerations you should be aware of when planning and using your system in an ISDN. These topics may not be required for every system. Rather, these topics may be useful for advanced functions. They include:

- Network management (threshold parameters)
- Network differences
- Network timing
- Problem analysis

Network Management

You may use threshold parameters to customize the level of information provided to you on network errors. The performance monitoring feature lets you see statistics about your system's performance and how network errors affect your system's performance.

Thresholds

The threshold feature allows users to specify the sensitivity to errors before receiving a message that errors have occurred. The following five values may be specified:

- *OFF** Turns off threshold feature
- *MIN** Provides minimum sensitivity to errors
- *MED** Provides medium sensitivity to errors
- *MAX** Provides maximum sensitivity to errors
- *SELECT** Provides ability to set individual threshold values

The maximum sensitivity feature generates a message as soon as one error has occurred. This feature may be turned off using the *OFF value.

You may specify the *SELECT value to set each threshold value individually. When *SELECT is specified, you may specify one of the four values or you may specify a number from a wide range. A specified number represents the maximum number of errors that can occur in a 15-minute interval before an error message is sent to the system operator message queue, QSYSOPR. In this way, the user may choose not only the degree of sensitivity but also areas of sensitivity. This feature tracks the number of errors that occur over time. Refer to the *OS/400* Communications Configuration Reference* manual for more detail and a complete list of threshold values and meanings.

Maintenance Channel

In addition to the B- and D-channels, some network termination equipment in North America provides a low speed maintenance channel. This maintenance channel includes a subchannel called the S1 channel. If your NT supports the S1 channel, you can specify the Activate Channel S1 (*ACTCHLS1) value for the Procedural Differences (PRCDIF) parameter on the Create Network Interface Description for the ISDN (CRTNWIISDN) command.

Specifying this value enables:

- Power outages signaled by the NT to be reported in a message to the system operator message queue, QSYSOPR.
- Network connection problems, signaled by the NT causing the problems, to be reported in a message to the system operator message, QSYSOPR.
- Some of the thresholds associated with the network interface description to report events signaled by the NT.

Network Differences

If you use switched connections, you may need to understand how various networks are different from the CCITT recommendation. (Network differences do not apply if you only use permanent connections.) For more detail regarding network differences, refer to the *OS/400* Communications Configuration Reference* manual. Network difference information will be useful:

- When your network provider changes your network

When your network provider upgrades your network, you will receive notification from them. Since the network provider supports communications equipment from many vendors, the provider may not tell you specifically how to upgrade your AS/400 configuration. This section discusses which network interface parameters you may need to change.

- When you operate in a network that is not one of the networks for which AS/400-type approval has been performed

If your network has a type approval requirement, you cannot use ISDN on the AS/400 system until the necessary type approval is obtained for your network.

- For network timing

After you have configured your network and it is operating correctly, you may decide to change the timing parameters within the network interface description. This will vary depending on which network you use.

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.

You may be required to adjust parameters in the network interface description and the connection list description for ISDN. In general, any parameter where *NETTYPE may be specified may have network differences. The *NETTYPE default values have been chosen as the best values for specific network types. Depending on your communications configuration, you may achieve better results by using different values. The following list shows the network-type keywords that represent the network types.

- *CCITT88 (CCITT standard, 1988)
- *DBP1TR6 (Deutsche Bundespost 1TR6)
- *INSNET64 (Nippon Telephone & Telegraph INS-NET64)
- *BTNR191 (British Telecom ISDN2)
- *FTVN2 (France Telecom Numeris VN2)
- *ATT5E42 (AT&T 5ESS, Version 5E4.2)

- *ATT5E5 (AT&T 5ESS, Version 5E5)
- *ATT5E6 (AT&T 5ESS, Version 5E6)
- *ATTG3 (AT&T DEFINITY, Versions G3i and G3r)
- *NT100B29 (Northern Telecom DMS100 switch, Versions BCS-29 and BCS-31)
- *ETSI (European Telecommunications Standards Institute)
- *NISDN (National ISDN-1, National ISDN-2)

The following sections explain types of network differences and specifies which parameters may have network differences. The types of network differences are:

- Procedural differences
- Interface timers
- Other network interface differences
- Connection list differences

Network parameters have been set to the default values determined by type approval and are based on the value of the Network Type (NETTYPE) parameter or the Default Network Type (DFTNETTYPE) parameter of the system network attributes. For the network types having different default values for the following parameters, see Appendix D, "Network Provider Information."

Procedural Differences

Procedural differences occur when the system performs an internal procedure differently, based on which network type is specified. In general, the system provides the default value *NONE for the network difference parameter SETUPDIF. An entry of *NONE indicates that the network follows the CCITT recommendation for the network operations associated with the parameter. Based on the network type, the system may provide a different default value.

Interface Timers

Timing parameters are related to a timer or a retry counter and specify a numeric value, based on the network type that is specified. The activation timer (ACTTMR) parameter and the reactivation timer (REACTTMR) parameter are network-dependent parameters supported by the AS/400 system. In general, the system provides a default value of 16, the time in tenths of seconds. However, different network types may have different default values.

Other Network Interface Differences

Some network difference parameters relate neither to procedural differences nor to performance tuning. These parameters include the local number type (LCLNBRTYPE) parameter, the local number plan (LCLNBRPLAN) parameter, and the local subaddress type (LCLSUBTYPE) parameter. In general, the system provides a default value of *UNKNOWN for these parameters. However, LCLSUBTYPE defaults to *USER, and X31NFYCLS usually defaults to *NONE. Different network types may have different default values.

Connection List Differences

Connection list differences relate to parameters on the connection list commands. They can be used to customize how call setup messages are sent to the network. In general, the system provides a default value of *UNKNOWN for the following parameters:

- Remote number type (RMTNBRTYPE)
- Remote number plan (RMTNBRPLAN)
- Local number plan (LCLNBRPLAN)

- Local number type (LCLNBRTYPE)
- Transit network plan (TRSNETPLAN)

In addition, the system generally provides the default value *USER for the following parameters:

- Remote subaddress type (RMTSUBTYPE)
- Local subaddress type (LCLSUBTYPE)
- Transit network type (TRSNETTYPE)

The default values of these parameters depends on the network type. The parameters are specified by the ADDCNNLE and CHGCNNLE commands.

Performance Tuning

For ISDN, performance tuning includes:

- Maximizing channel throughput
- Accepting calls fast enough so the network does not time-out

Maximizing Channel Throughput

To maximize channel throughput for performance, the frame size, window size, and RU maximum length parameters may be used. Refer to the *OS/400* Communications Configuration Reference* manual for additional performance information.

Frame Size

The MAXFRAME parameter in the line and controller descriptions specify the frame size. The AS/400 support for IDLC allows a range of frame sizes of up to 8196 bytes. For X.25, the maximum frame size is 4096 bytes. 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 of the longer time required to retransmit large frames.

Window Size

The window size refers to the maximum number of IDLC frames that can be sent before an acknowledgement 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 acknowledgement. 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.

Request/Response Unit Maximum Length

The maximum length of an SNA request/response unit (RU) can be specified by the MAXLENRU parameter in a mode description (APPC) or in host device descriptions. If the value *CALC is specified for MAXLENRU, the system automatically selects an SNA RU size that is compatible with the chosen frame size.

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 involved with the protocol 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.

Performance Related to Accepting Calls

If call acceptance times exceed those required by the network, configuration considerations and changes can reduce system processing time for incoming calls. Look at the following aspects of your connection lists to increase performance.

Unique Connection List Entries

For IDLC and X.31 circuit-mode protocols, a unique line number entry should appear in only one connection list for the fastest results. In this case, the system finds only one exact match for a call. As soon as the match is found, the system no longer needs to search the connection lists for entries with identical information. 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 as candidates for the same call. Avoid duplicate entries in the same connection list or in different connection lists.

Lines Referring to a Connection List

For IDLC and X.31 circuit-mode protocols, the number of line descriptions associated with a connection list may increase or decrease system performance. As the number of line descriptions increase, performance slows because the system must check more line descriptions for ones that may accept the call.

Similarly, other parts of a connection list entry may have the value of *ANY so that the number and type of calls accepted increases while the system performance decreases. The extreme example of this exists when the system-supplied connection list QDCCNNLANY specifies no restrictions on call acceptance. Performance may be degraded because system resources are used to answer any calls of any type, while also answering the desired calls. You may want to configure an exact local number or local subaddress in the NWI description so that your system only processes calls targeted for the interface.

Problem Analysis

Problem analysis includes isolating the cause of a problem and eliminating the cause. This function is performed by the user and may be aided by system-generated information. For example, isolating the cause of line transmission errors (a power cord next to a communications line) and eliminating the cause (moving the power cord or the communications line).

System Operator Message Queue QSYSOPR

When problems occur with ISDN communications, the first resource to look at is the system operator message queue, QSYSOPR. The system puts messages in this queue that indicate the cause of the problem and suggests steps for recovering from the problem. You should read and follow these messages.

Problem Analysis and Resolution

For some messages, more information may be available for problem analysis. Messages in the system operator message queue, QSYSOPR, that have an asterisk next to them have additional problem analysis information. Press PF14 to see this problem analysis information.

Cause Codes

Cause codes indicate the reasons why events have occurred in the network and are usually used with switched lines. For ISDN, the cause code is one field in the cause information element which may be sent or received by the local system. This IE has the following fields:

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

Appendix B, "Cause Code Descriptions," describes the specific cause codes.

The cause code portion of the cause information element is displayed in applicable messages in QSYSOPR.

Common Problems

When you have followed the configuration guidelines for the ISDN you are using, your AS/400 system should operate properly with the ISDN. If you have problems, consider the following:

1. If you have NWI problems, such as not being able to connect to the ISDN, ensure that *NETTYPE is set to the proper network type. See previous sections and tables in this chapter that refer to network differences.
2. Another common problem relates to the system rejecting an incoming ISDN call. This may occur for the following reasons:
 - No matching connection list entry exists for the call.
 - No line description has been varied on that refers to the appropriate connection list in its Connection List (CNNLSTIN) parameter on the local system.
 - The Connect Type (CNNTYPE) parameter of the line description has not been configured as *BOTH or *ANS.

Problem analysis (if available) is helpful for connection list problems.

3. If a switched connection ends unexpectedly, refer to cause code identified in the associated messages in the system operator message queue, QSYSOPR.
4. IDLC connection failures with remote systems allowing the data link control identifier to be configured may indicate a wrong value for the data link control identifier. The AS/400 system uses the default defined in the *ISDN Data Link Control Architecture Reference* manual. Ensure that the data link control identifier value of the remote system 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.
5. When switched lines are used with IDLC, a problem can occur if the system cannot find a switched controller. Because the system uses information

received from the remote system (for example, the exchange identifier from the XID command), incorrect configuration on either system can result in a failed connection attempt. The following controller parameters for IDLC affect which controller is selected, based on the information received:

- Remote Control Point Name (RMTCPNAME) and Remote Network ID (RMTNETID)

This 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.

For permanent connections, the system verifies that these values have been received if the values have been configured in the controller description.

6. For IDLC, a controller description for a permanent connection can stay at a vary on pending state, resulting in no connection. If this happens, ensure that the remote system is ready for the permanent connection. This means that the network interface and associated line and controller descriptions must be varied on.

Appendix A. Configuration Examples for ISDN

This appendix shows example configurations for permanent and switched ISDN data link control (IDLC) connections, X.25 circuit-mode, and packet-mode connections. The examples for permanent and switched connections can also be found in the QUSRTOOL library loaded on your AS/400 system. The configurations provided here are merely hypothetical. It is assumed that a network provider has provided a permanent connection for the configurations.

Permanent IDLC Connection

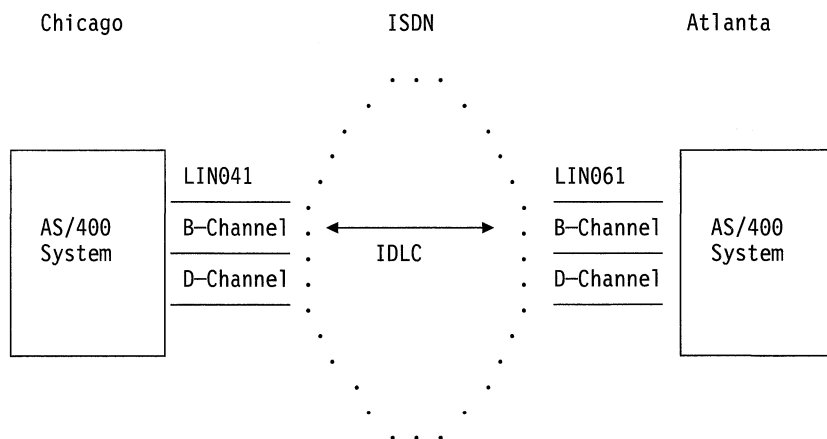


Figure A-1. Example of ISDN Basic Rate Interface Configuration. This example shows two AS/400 systems connected to an ISDN through resource LIN041 (Chicago) and resource LIN061 (Atlanta). The basic rate interface uses one of the B-channels for the permanent connection from Chicago through the ISDN to Atlanta.

The following commands show the minimum parameters necessary to create the above configuration. All other parameters are IBM default values, and you should consider whether altering them will benefit network startup, error recovery, performance, or ease of use.

The following commands create the Chicago AS/400 system configuration objects necessary to communicate through the ISDN:

```
CRTNWIISDN NWID(CHICNET) RSRNAME(LIN041) CHLENTY((1 *NONSWT))
           TEXT('Chicago Network Interface')

CRTLINIDLC LIND(ATLANTA) CNN(*NONSWT) NWI(CHICNET) NWICHLNBR(1)
           TEXT('Line to ISDN for Chicago')

CRTCTLAPPC CTLD(ATLANTA) LINKTYPE(*IDLC) SWITCHED(*NO) LINE(ATLANTA)
           RMTCPNAME(ATLSYS01) TEXT('Controller to Atlanta')

CRTDEVAPPC DEVD(ATLANTA) RMTLOCNAME(ATLSYS01) CTL(ATLANTA)
           TEXT('Device Description to Atlanta')
```

The following commands create the Atlanta AS/400 configuration objects necessary to communicate through the ISDN:

```
CRTNWIISDN NWID(ATLANET) RSRCTYPE(LIN061) CHLENTY((2 *NONSWT))
          TEXT('Atlanta Network Interface')

CRTLINIDL LIND(CHICAGO) CNN(*NONSWT) NWI(ATLANET) NWICHLNBR(2)
          TEXT('Line for Atlanta to ISDN')

CRTCTLAPPC CTLD(CHICAGO) LINKTYPE(*IDL) SWITCHED(*NO) LINE(CHICAGO)
          RMTCPNAME(CHISYS01) TEXT('Controller to Chicago')

CRTDEVAPPC DEVD(CHICAGO) RMTLOCNAME(CHISYS01) CTL(CHICAGO)
          TEXT('Device to Chicago')
```

Network Attributes Considerations

For the CRTNWIISDN command, the NETTYPE parameter is not specified and will default to *NETATR. This value is obtained from the system network attribute parameter, DFTNETTYPE. The DFTNETTYPE parameter is determined by the attached ISDN. This parameter can be viewed with the DSPNETA command, or altered with the CHGNETA command.

For the CRTCTLAPPC command, the value for the RMTCPNAME parameter is taken from the remote system network attribute parameter, LCLCPNAME. This is only valid for AS/400-to-AS/400 communications. To communicate with other systems, refer to the appropriate communications manuals for that system. You may need to compare parameters between your AS/400 system and the other system.

For the CRTDEVAPPC command, the value for the RMTLOCNAME parameter is taken from the remote system network attribute parameter, LCLLOCNAME. The CRTDEVAPPC command is only valid for AS/400-to-AS/400 communications. To communicate with other systems, refer to the appropriate communications manuals for that system. You may need to compare parameters between your AS/400 system and the other system.

Note: Since the default value for this configuration is APPN(*YES), you do not need to manually create the device description. The AS/400 system automatically creates the necessary device description when a job starts on one system that requires resources on another system. For example, the STRPASTHR command causes device descriptions to be created by other systems.

Explanation of Parameters by Command

The following list contains the commands and associated parameters used in this example.

CRTNWIISDN

Creates the network interface description needed to interface with the ISDN.

NWID: The name you give to your network interface description. Here we used the names CHICNET and ATLANET. We could use the remaining available channel on each system to connect with locations either switched or non-switched anywhere the ISDN provides service.

RSRCNAME: The physical hardware the ISDN cable will be connected to. You may view your local hardware configuration with the command DSPLCLHDW or WRKHDWRSC *CMN.

CHLENTY: Either a 1 or 2 for Basic Rate Interface. *SWT for switched connection or *NONSWT for nonswitched (permanent) connection. The appropriate channel and connection information should be provided by the ISDN supplier.

CRTLINIDLC

Creates the IDLC line description to attach to the NWID.

LIND: The name you give to your line description. This name, as with all description names, should have some meaning to your network or particular environment.

CNN: *SWT for switched connections or *NONSWT for nonswitched connections.

NWI: The name of the NWID to which you decide to attach this line description.

NWICHLNBR: The channel on which you decide to use this line. For BRI, this would be either 1 or 2.

Note: NWICHLNBR and CNN should match one of the Channel Entries (CHLENTY parameter) from the NWID to which you are attaching this LIND.

CRTCTLAPPC

Creates an APPC controller description.

CTLD: The name you give to your controller.

LINKTYPE: Must be *IDLC.

SWITCHED: *NO for nonswitched, or *YES for switched. Must agree with CNN parameter on attached LIND.

LINE: The name of the line description (LIND) to which this controller is attached.

RMTCPNAME: Name of the remote control point. See "Network Attributes Considerations" on page A-2.

CRTDEVAPPC

Creates the APPC device description for communications with the remote system.

DEVVD: The name you give to this device description.

RMTLOCNAME: The local name of the system with which you are trying to communicate. See "Network Attributes Considerations" on page A-2.

CTL: The name of the controller to which this description will be attached.

Switched IDLC Connection

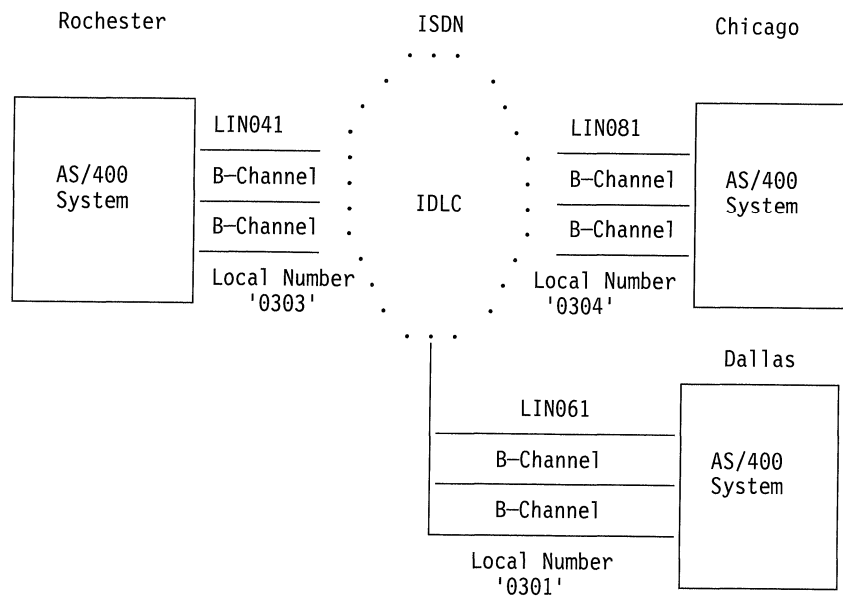


Figure A-2. Example ISDN Switched Connection. This example shows three AS/400 systems connected to an ISDN. Each system has two B-channels configured to the ISDN. The D-channel is not shown in this diagram.

The following commands show the minimum parameters necessary to create the above configuration. All other parameters are defaults, and the user should consider if their alteration will benefit network startup, error recovery, performance, or ease of use of the AS/400 system. The following commands create the Rochester AS/400 configuration objects necessary to communicate through the ISDN.

```

CRTNWIISDN NWID(RCHNET) RSRNAME(LIN041) TEXT('Network Interface
for Rochester AS/400 system')

CRTCNNL CNNL(ISDNLIST) TEXT('Connection List of Rochester AS/400 system')

ADDCNNLE CNNL(ISDNLIST) ENTRY(ANY) RMTNBR(*ANY) TEXT('Accept calls
from any remote system')

ADDCNNLE CNNL(ISDNLIST) ENTRY(DALLAS) RMTNBR(0301) TEXT('To call out
to Dallas AS/400 system')

ADDCNNLE CNNL(ISDNLIST) ENTRY(CHICAGO) RMTNBR(0304) TEXT('To call out
to Chicago AS/400 system')

CRTLINIDLC LIND(RCHLIN1) SWTNWILST((RCHNET)) CNNLSTIN(ISDNLIST)
TEXT('Line Description for a B-channel')

CRTLINIDLC LIND(RCHLIN2) SWTNWILST((RCHNET)) CNNLSTIN(ISDNLIST)
TEXT('Line Description for a B-channel')

CRTCTLAPPC CTLD(DALLAS) LINKTYPE(*IDLC) SWITCHED(*YES)
SWTLINLST(RCHLIN1 RCHLIN2) RMTCPCNAME(DALLAS)
CNLSTOUT(ISDNLIST) CNLSTOUTE(DALLAS)
TEXT('Controller to Dallas AS/400 system')

CRTCTLAPPC CTLD(CHICAGO) LINKTYPE(*IDLC) SWITCHED(*YES)
SWTLINLST(RCHLIN1 RCHLIN2) RMTCPCNAME(CHICAGO)
CNLSTOUT(ISDNLIST) CNLSTOUTE(CHICAGO)
TEXT('Controller to Chicago AS/400 system')

```

The following commands create the Chicago AS/400 configuration objects necessary to communicate through the ISDN.

```

CRTNWIISDN NWID(CHINET) RSRNAME(LIN081) TEXT('Network Interface
for Chicago AS/400 system')

CRTCNNL CNNL(ISDNLIST) TEXT('Connection List of Chicago AS/400 system')

ADDCNNLE CNNL(ISDNLIST) ENTRY(ANY) RMTNBR(*ANY) TEXT('Accept calls
from any remote system')

ADDCNNLE CNNL(ISDNLIST) ENTRY(DALLAS) RMTNBR(0301) TEXT('To call out
to Dallas AS/400 system')

ADDCNNLE CNNL(ISDNLIST) ENTRY(ROCHESTER) RMTNBR(0303) TEXT('To call
out to Rochester AS/400 system')

CRTLINIDLC LIND(CHILIN1) SWTNWILST((CHINET)) CNNLSTIN(ISDNLIST)
TEXT('Line Description for a B-channel')

CRTLINIDLC LIND(CHILIN2) SWTNWILST((CHINET)) CNNLSTIN(ISDNLIST)
TEXT('Line Description for a B-channel')

CRTCTLAPPC CTLD(DALLAS) LINKTYPE(*IDLC) SWITCHED(*YES)
SWTLINLST(CHILIN1 CHILIN2) RMTCPCNAME(DALLAS)
CNLSTOUT(ISDNLIST) CNLSTOUTE(DALLAS)
TEXT('Controller to Dallas AS/400 system')

CRTCTLAPPC CTLD(ROCHESTER) LINKTYPE(*IDLC) SWITCHED(*YES)
SWTLINLST(CHILIN1 CHILIN2) RMTCPCNAME(ROCHESTR)
CNLSTOUT(ISDNLIST) CNLSTOUTE(ROCHESTER)
TEXT('Controller to Rochester AS/400 system')

```

The following commands create the Dallas AS/400 configuration objects necessary to communicate through the ISDN.

```

CRTNWIISDN NWID(DALNET) RSRNAME(LIN061) TEXT('Network Interface
for Dallas AS/400 system')

CRTCNNL CNL(ISDNLIST) TEXT('Connection List of Dallas AS/400 system')

ADDCNNLE CNL(ISDNLIST) ENTRY(ANY) RMTNBR(*ANY) TEXT('Accept calls
from any remote system')

ADDCNNLE CNL(ISDNLIST) ENTRY(CHICAGO) RMTNBR(0304) TEXT('To call out
to Chicago AS/400 system')

ADDCNNLE CNL(ISDNLIST) ENTRY(ROCHESTER) RMTNBR(0303) TEXT('To call
out to Rochester AS/400 system')

CRTLINIDLC LIND(DALLIN1) SWTNWILST((DALNET)) CNLSTIN(ISDNLIST)
TEXT('Line Description for a B-channel')

CRTLINIDLC LIND(DALLIN2) SWTNWILST((DALNET)) CNLSTIN(ISDNLIST)
TEXT('Line Description for a B-channel')

CRTCTLAPPC CTLD(CHICAGO) LINKTYPE(*IDLC) SWITCHED(*YES)
SWTLINLST(DALLIN1 DALLIN2) RMTCPNAME(CHICAGO)
CNLSTOUT(ISDNLIST) CNLSTOUTE(CHICAGO)
TEXT('Controller to Chicago AS/400 system')

CRTCTLAPPC CTLD(ROCHESTER) LINKTYPE(*IDLC) SWITCHED(*YES)
SWTLINLST(DALLIN1 DALLIN2) RMTCPNAME(ROCHESTR)
CNLSTOUT(ISDNLIST) CNLSTOUTE(ROCHESTER)
TEXT('Controller to Rochester AS/400 system')

```

Considerations for the Network Interface

For the CRTNWIISDN command, the NETTYPE parameter is not specified, and the default is *NETATR. This value is obtained from the system network attribute parameter, DFTNETTYPE. The DFTNETTYPE parameter is determined by the attached ISDN. This parameter can be viewed with the DSPNETA command, or altered with the CHGNETA command.

Considerations for Line Descriptions

In the CRTLINIDLC command, you specify the name of the connection list in which there are entries of valid connection numbers to accept calls.

You may want to add an entry that allows any remote number to call in to your local system. This is because some networks may change numbers, and you cannot be sure of the format of the number on the local system.

These entries are created by the CRTCNNL and ADDCNNLE commands.

To use two B-channels simultaneously, you can create and vary on more than one line description to a network interface (NWI). This sample switched connection is configured to show two B-channels being used on one NWI. The configuration must match the subscription to the network supplier.

The samples in this appendix do not define one line with a B-channel and the other with the other B-channel. This allows the lines to connect to either B-channel.

Considerations for Controller Descriptions

For the CRTCTLAPPC command, the value for the RMTCPNAME parameter is taken from the remote system network attribute parameter, LCLCPNAME. This is only valid for AS/400-to-AS/400 communications. If you want to communicate with other types of systems, you need to refer to the appropriate communications manuals for that system, and you may need to compare parameters.

Considerations for Device Descriptions

Since this configuration contains a default value of APPN(*YES), manually creating the device descriptions is unnecessary. The AS/400 system automatically creates the necessary device description when a job starts on one system that requires resources on another system. For example, the STRPASTHR command causes device descriptions to be created by the systems.

Considerations for Connection List

For the remote numbers needed to call out to remote systems, you should contact the network supplier to get the exact format. The samples show rather simple numbers like '0301', but numbers used and the complexity of the number vary with the suppliers of the ISDN.

Explanation of Parameters by Command

The following list contains the commands and associated parameters used in this example.

CRTNWIISDN

Creates the network interface description needed to connect to the ISDN.

NWID: The name you give to the network interface description.

RSRCNAME: The physical hardware to which the ISDN cable will be connected. You may view your local hardware configuration with the command DSPLCLHDW or WRKHDWRSC *CMN.

CRTCNNL

Creates the connections list that contains the remote numbers of the remote systems.

CNNL: The name of the connection list.

ADDCNNLE

Adds the remote numbers and system names to the connection list defined above.

CNNL: The name of the connection list to which this entry is to be added.

ENTRY: The name of the remote system.

RMTNBR: The ISDN-assigned remote number of the system.

CRTLINIDLC

Creates the IDLC line description to attach to the NWID.

LIND: The name you want to give to your line description. This name, as with all description names, should have some meaning for your network or particular environment.

SWTNWILST: A list of network interface descriptions that can be connected to this line.

CNNLSTIN: The connection list to use for incoming calls. The Switched Connection List (SWTCNN) parameter must have the value of *ANS or *BOTH.

CRTCTLAPPC

Creates an APPC controller description.

CTLD: The name you give to your controller.

LINKTYPE: Must be *IDLC for V2R1.

SWITCHED: *NO for nonswitched, or *YES for switched. Must agree with CNN parameter on attached LIND.

SWTLINLST: A list of line descriptions that this controller may use.

RMTCPCNAME: Name of the remote control point. See "Network Attributes Considerations" earlier in this section.

CNNLSTOUT: The name of the connection list to use when making an outgoing call. The connection list contains the ISDN assigned numbers with which to make the connection.

CNNLSTOUTE: The entry in the above connection list to use when making the outgoing call.

Circuit Mode X.25 DTE-to-DTE

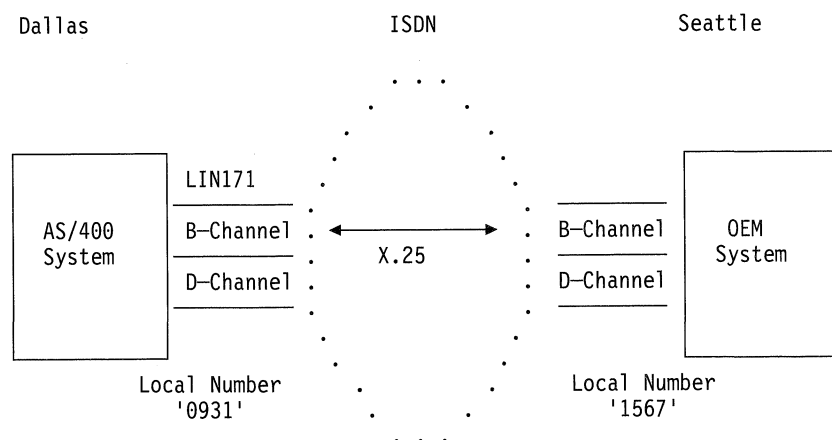


Figure A-3. Example of an ISDN Circuit Mode X.25 DTE-to-DTE Configuration. This example shows an AS/400 system connected to an ISDN basic rate interface through resource LIN171. The AS/400 system uses one of the switched B-channels for a DTE-to-DTE circuit mode connection to an original equipment manufacturer (OEM) system. The TCP/IP protocol is being used on a switched virtual circuit between the two systems.

In this example, the AS/400 system in Dallas is configured as a DCE to allow the DTE-to-DTE connection. This allows the two systems to be connected without any X.25 network. A switched ISDN B-Channel is used to provide the connection between the systems. The OEM system in Seattle must either have an integrated ISDN adapter or be attached using a terminal adapter, such as the 7820. The OEM system must support CCITT recommendation X.25 and the TCP/IP protocol. The system in Dallas uses the AS/400 TCP/IP Connectivity Utility. The following commands show the minimum parameters necessary to create the AS/400 configuration in this example. All other parameters are defaults, and the user should consider if their alteration will benefit network startup, error recovery, performance, or ease of use of the AS/400 system.

The following commands create the ISDN and X.25 configuration objects necessary on the AS/400 system in Dallas to communicate through the ISDN to the OEM system in Seattle:

```

CRTNWISDN NWID(DALLIN171) RSRNAME(LIN171) NETTYPE(*ATT5E6)
      TEXT('ISDN basic rate network interface (0931)')
      LCLNBR('0931')

CRTCNNL CNNL(OEMLIST) NETTYPE(*ATT5E6)
      TEXT('Connection list for OEM system in Seattle')

ADDCNNLE CNNL(OEMLIST) ENTRY(OEMSEATTLE) RMTNBR(1567)
      TEXT('To call out to OEM system in Seattle')

CRTLINX25 LIND(OEMSEATTLE) RSRNAME(*NWID)
      LGLCHLE((001 *SVCBOTH) (002 *SVCBOTH) (003 *SVCBOTH))
      NETADR(61200320) CNNINIT(*LOCAL) INTERFACE(*X31)
      CNN(*SWTPP) SWTNWILST((DALLIN171))
      LINESPEED(*CALC) MAXPKTSIZE(1024) CNLSTOUT(OEMLIST)
      CNLSTOUTE(OEMSEATTLE)
      TEXT('X.25 Line on ISDN BRI to OEM in Seattle')
      X25DCE(*YES)
  
```

For further information on configuring TCP/IP on the AS/400 system, see the *TCP/IP Guide*. The OEM system requires equivalent configurations to run circuit mode X.25 and the TCP/IP protocol.

The following sections describe considerations, parameters, and parameter values that are unique to the type of connection configured in this example.

Network Interface Considerations

In this example, the network type is explicitly defined by the value of the network type (NETTYPE) parameter. The default network type, *NETTYPE, can also be specified with the Change Network Attributes (CHGNETA) command. By specifying the specific network type, the system does not need to determine the network type from the network attributes.

For incoming calls, this example uses the default connection list QDCCNNLANY. This is shipped with the system and is configured to accept any incoming calls.

Device and Controller Considerations

The TCP/IP protocol connects the remote system. The protocol automatically creates the network device description (NETDEV) and the network controller description (NETCTL).

Line Considerations

The Create Line Description (X25) (CRTLINX25) command creates a line that allows X.25 to be used over an ISDN. In this example, the logical channel entry (LGLCHLE) parameter specifies three logical channels defined as switched virtual circuits.

To use an X.25 line description, the AS/400 system must be configured as a DCE by specifying *YES for the X25DCE parameter. This allows the AS/400 system to connect to the remote system using X.25 circuit mode without an X.25 network present. Also, the INTERFACE parameter has a value of *X31 to specify X.25 over an ISDN.

Because the switched network interface list (SWTNWILST) parameter contains a specific entry, this line can only connect to the single network interface description that was specified.

The resource name (RSRCNAME) parameter contains the value *NWID, which indicates that the system gets the resource name from the network interface description.

Circuit Switched Mode X.25 DTE-to-DTE Connection

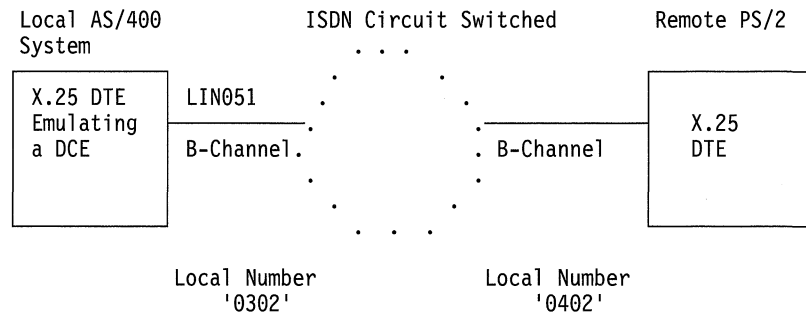


Figure A-4. Example of an ISDN X.25 Circuit Mode Configuration. Example of an ISDN Circuit Mode X.25 DTE-to-DTE Configuration. This example shows an AS/400 system connected to an ISDN basic rate interface through resource LIN051. The AS/400 system uses one of the switched B-channels for a DTE-to-DTE circuit mode connection to a PS/2 system. This configuration allows the PS/2 user to run 5250 emulation stand-alone or PC Support/400.

In this example, the AS/400 system is configured as a DCE to allow the DTE-to-DTE connection. This configuration allows the AS/400 system to connect to the PS/2* system without any X.25 network. A switched ISDN B-channel provides the connection between the systems. The PS/2 system must have an ISDN adapter and OS/2 Communications Manager Version 1.0 installed.

The following commands create the ISDN and X.25 configuration objects that you need on the AS/400 system to communicate through the ISDN network to the remote PS/2 system.

```

|                                     /*****
|                                     /* CREATE CONNECTION LIST AND CONNECTION LIST ENTRY */
|                                     /* FOR SWITCHED LINE USE */
|                                     *****/
|
| CHGNETA DFTNETTYPE(*ATT5E5)
|
| CRTCNNL CNNL(ISDNATT5) NETTYPE(*ATT5E5) TEXT('Connection list +
|         for outgoing calls')
| ADDCNNLE CNNL(ISDNATT5) ENTRY(ENTRY31) RMTNBR('0402') TEXT('Number +
|         used to make outgoing call') LCLNBR(0302)
|
| ADDCNNLE CNNL(ISDNATT5) ENTRY(ANY) RMTNBR(*ANY) +
|         TEXT('ACCEPT ANY INCOMING CALL ')
|                                     /*****
|                                     /* CREATE NETWORK INTERFACES */
|                                     *****/
|
| CRTNWIISDN NWID(ISATT5) RSRNAME(LIN051) ONLINE(*NO) +
|         NETTYPE(*ATT5E5) CHLENTY((1 *SWT) (2 *SWT)) +
|         PCLENTY(*X25MAX) THRESHOLD(*MED) TEXT('Network +
|         Interface on resource ISATT5') LCLNBR(0302) +
|         LCLNBRTYPE(*UNKNOWN) LCLNBRPLAN(*UNKNOWN) +
|         SETUPDIF(*NONE) ACTTMR(300) REACTTMR(10) CMNRCYLMT(2)
|
|                                     /*****
|                                     /* SWITCHED APPC CONFIGS */
|                                     *****/
|
| CRTLINX25 LIND(ISATT52) RSRNAME(*NWID) LGLCHLE((001 *SVCBOTH) (002 +
|         *SVCBOTH)) NETADR(0302) CNNINIT(*LOCAL) +
|         INTERFACE(*X31) CNN(*SWTPP) SWTNWILST((ISATT5)) +
|         EXCHID(05600051) CNNLSTOUT(ISDNATT5) +
|         CNNLSTOUTE(ENTRY31) X25DCE(*YES)
|
| CRTCTLAPPC CTLD(ISATT52) LINKTYPE(*X25) SWITCHED(*YES) APPN(*YES) +
|         SWTLINLST(ISATT52) RMTCPNAME(X25PC) EXCHID(05D00001) +
|         CNNNBR(0402) ROLE(*NEG) NETLVL(1980) TEXT('Switched +
|         APPC controller on line ISATT51') CMNRCYLMT(2)

```

Network Interface Considerations

In the previous example, the network type is explicitly defined by the value of the network type (NETTYPE) parameter. The default network type, *NETTYPE, can also be specified with the Change Network Attributes (CHGNETA) command. When you specify the network type, the system does not need to determine the network type from the network attributes.

For incoming calls, this example uses the default connection list QDCCNNLANY. This list is shipped with the system and is configured to accept any incoming call.

Line Considerations

The Create Line Description (X25) (CRTLINX25) command creates a line that allows X.25 to be used over an ISDN. In the example above, the logical channel entry (LGLCHLE) parameter specifies two logical channels defined as switched virtual circuits.

Either the AS/400 system or the remote DTE must be configured to emulate the DCE. You can specify *YES for the X25DCE parameter to configure the AS/400 system as a DCE. This allows the AS/400 system to connect to the remote system using X.25 circuit mode without an X.25 network present. You also have to specify a value of *31 for the INTERFACE parameter to use X.25 over an ISDN.

Because the switched network interface list (SWTNWILST) parameter contains a specific entry, this line can only connect to the single network interface description that was specified.

The resource name (RSRCNAME) parameter contains the value *NWID, which indicates that the system gets the resource name from the network interface description.

Controller and Device Considerations

When the APPN controller parameter is set to *YES, the system automatically creates the device description.

OS/2 Communications Manager

The installation and configuration of OS/2 Communications Manager Version 1.0 is done with menus. Currently, there are nine required and two optional profiles to be configured. The two optional profiles are SNA Connections and SNA features. Although these profiles are defined as optional, they are required to make an outgoing call from the PS/2.

Figure A-5. OS/2 Communications Manager Configuration Considerations

| Profile | Consideration |
|--|---|
| X.25 Links | Network type should be specified as 9. |
| SNA Connections | Select the <i>To peer node</i> option. |
| ISDN Connection Manager | After specifying a name for your outgoing call directory, you must select what information elements are included in the SETUP message transmitted to the network. Select the following: <ul style="list-style-type: none"> • Bearer capability¹ • Channel ID • Called party number • Low layer compatibility |
| 5250 Emulation | Set mode to QPCSUPP |
| <p>Note:</p> <p>¹ Specify the AS/400 line description information transfer type (INFTRFTYPE parameter) as follows:</p> <ul style="list-style-type: none"> • If the OS/2 Communications Manager bearer capability is 64 Kbps, specify INFTRFTYPE(*UNRESTRICTED) for the AS/400 system • If the OS/2 bearer capability is 56 Kbps, specify INFTRFTYPE(*V110) | |

Packet Mode X.25 Configuration

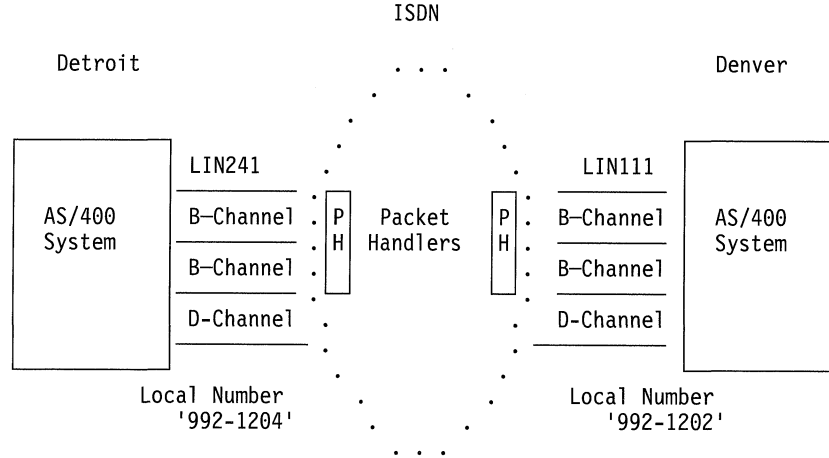


Figure A-6. Example of an ISDN X.25 Packet Mode Configuration. This example shows two AS/400 systems, one in Detroit and one in Denver, connected to an ISDN using a basic rate interface. Each system is configured to use both switched B-channels for packet mode X.25 communications. Each B-channel is configured to support up to 10 virtual circuit connections to other X.25 data terminal equipment (DTEs), meaning a total of 20 simultaneous virtual circuit connections is possible on each basic rate interface.

This configuration example shows the configuration of an APPN connection between two AS/400 systems over the ISDN using packet mode services. The controller description configurations required for connections to other packet mode DTEs are not shown here.

The following commands show the minimum parameters necessary to create the above configuration. All other parameters are defaults, and the user should consider whether altering them benefits network startup, error recovery, performance, or ease of use.

The following commands create the Detroit AS/400 configuration objects necessary to communicate using packet mode X.25 through the ISDN.

```

| CRTNWIISDN NWID(DETROIT) RSRNAME(LIN241) PCLENTY((*X25 *LOAD *MAX)) +
| TEXT('ISDN basic rate interface') X31NFYCLS(*UNCONDITIONAL) +
| X31DIF(*NOCALLINGNETADR)
|
| CRTLINX25 LIND(DETROIT1) RSRNAME(*NWID) LGLCHLE((001 *SVCBOTH) +
| (002 *SVCBOTH) (003 *SVCBOTH) (004 *SVCBOTH) (005 *SVCBOTH)
| (006 *SVCBOTH) (007 *SVCBOTH) (008 *SVCBOTH) +
| (009 *SVCBOTH) (00A *SVCBOTH)) NETADR(9921204) +
| CNNINIT(*LOCAL) INTERFACE(*X31) CNN(*SWTPP) +
| SWTNWILST((DETROIT *B *CALC)) PKTMODE(*YES) +
| MAXPKTSIZE(1024) TEXT('Packet mode line description 1')
|
| CRTLINX25 LIND(DETROIT2) RSRNAME(*NWID) LGLCHLE((001 *SVCBOTH) +
| (002 *SVCBOTH) (003 *SVCBOTH) (004 *SVCBOTH) (005 *SVCBOTH)
| (006 *SVCBOTH) (007 *SVCBOTH) (008 *SVCBOTH) +
| (009 *SVCBOTH) (00A *SVCBOTH)) NETADR(9921204) +
| CNNINIT(*LOCAL) INTERFACE(*X31) CNN(*SWTPP) +
| SWTNWILST((DETROIT *B *CALC)) PKTMODE(*YES) +
| MAXPKTSIZE(1024) TEXT('Packet mode line description 2')
|
| CRTCLAPP CTLD(DENVER) LINKTYPE(*X25) SWITCHED(*YES) +
| SWTLINLST(DETROIT1 DETROIT2) RMTCPNAME(DENVER) +
| CNNBR('9921202') ANSNBR(*ANY) NETLVL(1984) +
| CNPND('D001') TEXT('X.25 APPC controller for Denver') +
| DFTPRTSIZE(256 *TRANSMIT)

```

The following commands create the Denver AS/400 configuration objects necessary to communicate using packet mode X.25 through the ISDN.

```

| CRTNWIISDN NWID(DENVER) RSRNAME(LIN111) PCLENTY((*X25 *LOAD 2)) +
| TEXT('ISDN basic rate interface') X31NFYCLS(*UNCONDITIONAL) +
| X31DIF(*NOCALLINGNETADR)
|
| CRTLINX25 LIND(DENVER1) RSRNAME(*NWID) LGLCHLE((001 *SVCBOTH) +
| (002 *SVCBOTH) (003 *SVCBOTH) (004 *SVCBOTH) (005 *SVCBOTH)
| (006 *SVCBOTH) (007 *SVCBOTH) (008 *SVCBOTH) +
| (009 *SVCBOTH) (00A *SVCBOTH)) NETADR(9921202) +
| CNNINIT(*LOCAL) INTERFACE(*X31) CNN(*SWTPP) +
| SWTNWILST((DENVER *B *CALC)) PKTMODE(*YES) +
| MAXPKTSIZE(1024) TEXT('Packet mode line description 1')
|
| CRTLINX25 LIND(DENVER2) RSRNAME(*NWID) LGLCHLE((001 *SVCBOTH) +
| (002 *SVCBOTH) (003 *SVCBOTH) (004 *SVCBOTH) (005 *SVCBOTH)
| (006 *SVCBOTH) (007 *SVCBOTH) (008 *SVCBOTH) +
| (009 *SVCBOTH) (00A *SVCBOTH)) NETADR(9921202) +
| CNNINIT(*LOCAL) INTERFACE(*X31) CNN(*SWTPP) +
| SWTNWILST((DENVER *B *CALC)) PKTMODE(*YES) +
| MAXPKTSIZE(1024) TEXT('Packet mode line description 2')
|
| CRTCLAPP CTLD(DETROIT) LINKTYPE(*X25) SWITCHED(*YES) +
| SWTLINLST(DENVER1 DENVER2) + RMTCPNAME(DETROIT) +
| CNNBR('9921204') ANSNBR(*ANY) NETLVL(1984) +
| CNPND('D001') TEXT('X.25 APPC controller for Detroit') +
| DFTPRTSIZE(256 *TRANSMIT)

```

Considerations for the Network Interface

In this example, the protocol entries (PCLENTY) parameter is set to *LOAD. This value causes the system to load the X.25 Licensed Internal Code into the communications I/O processor. The Licensed Internal Code is loaded when the network interface description is varied on. If you specify *LOAD, the AS/400 system answers the first ISDN packet mode call more quickly.

If you specify X31NFYCLS(*UNCONDITIONAL), the ISDN network uses the unconditional notification class, which means notification of all incoming X.25 calls is given on the D-channel. In this example, the ISDN network does not pass the calling network address in the D-channel notification of the X.25 call. If you specify X31DIF(*NOCALLINGNETADR), the system does not check the calling network

address against the connection number (C>NNNBR) parameter in controller descriptions specified as LINKTYPE(*X25). The network does not pass the calling network address; therefore, X31DIF(*NOCALLINGNETADR) must be configured.

Considerations for Line Descriptions

In this example, a connection list name is not specified on the CRTLINX25 command. It is assumed that the AS/400 system always calls the ISDN network to establish the switched B-channel connections to the packet handler of the ISDN.

Note that specifying PKTMODE(*YES) indicates that this X.25 line is used for packet mode communications, as opposed to the circuit mode configuration shown in "Circuit Mode X.25 DTE-to-DTE" on page A-9.

To use two B-channels simultaneously, you can create and vary on more than one line description to a network interface (NWI). This sample switched connection is configured to show two B-channels being used on one NWI for X.25 communications. However, the configuration must match the subscription options of the network supplier.

The examples in this appendix do not define one line with a B-channel and the other with the other B-channel. If you configure lines without specifying which B-channel should be connected, the lines can connect to either B-channel. The channel number is specified as *CALC on the SWTNWILST parameter.

Considerations for Controller Descriptions

In the previous CL command example, either of the two line descriptions may be used for the connection to the remote system. The system chooses a line description to use for the connection based on the SWTLINLST and switched line selection (SWTLINSLCT) parameters in the controller description. There are no ISDN-specific parameters in controller descriptions for X.25.

Considerations for Device Descriptions

In the previous CL command example, the controller configuration specifies the default value of APPN(*YES). This value allows the AS/400 system to automatically create the necessary device description when a job starts on one system that requires resources on another system. For example, if you start the display station pass-through function (using the STRPASTHR command), the device descriptions are created by the systems.

Explanation of Parameters by Command

The following list contains the commands and associated parameters used in the previous CL command example.

CRTNWIISDN

Creates the network interface description needed to connect to the ISDN.

NWID: The name you give to the network interface description.

RSRCNAME: The physical hardware to which the ISDN cable is connected. You may view your local hardware configuration with the Display Local Hardware (DSPLCLHDW) command or the Work with Hardware Resources (WRKHDWRSC *CMN) command.

| **PCLENTRY:** The list of protocols to be used on the network interface and
| characteristics of the protocols on the interface.

| **X31NFYCLS:** The X.31 notification class of this network interface. The value
| given must match the network subscription.

| **X31DIFS:** The X.31 differences for the network you are using. These differ-
| ences are specific to your network type.

| **CRTLINX25**

| Creates the X.25 line description to attach to the NWID.

| **LIND:** The name you want to give to your line description. This name, as with
| all description names, should have some meaning for your network or particular
| environment.

| **RSRCNAME:** The physical hardware to which the X.25 line is connected. For
| ISDN connections, the resource name must be *NWID. This value indicates
| that the physical hardware is determined by the network interface that is used
| for the connection on this line.

| **INTERFACE:** INTERFACE(*X31) indicates that the physical interface for this
| line is over an ISDN network.

| **SWTNWILST:** A list of network interface descriptions that can be connected to
| this line.

| **PKTMODE:** Whether the connection is packet mode or circuit mode.

| **CNN:** Whether the line connection is switched (on-demand) or semi-
| permanent.

| **CRTCTLAPPC**

| Creates an APPC controller description.

| **CTLD:** The name you give to your controller.

| **LINKTYPE:** Must be *X25 for packet mode connections.

| **SWITCHED:** For SVC controllers, this parameter must be *YES. Only
| switched controller descriptions are allowed on switched B-channels.

| **SWTLINLST:** A list of line descriptions that this controller may use.

Appendix B. Cause Code Descriptions

This appendix contains CCITT standard cause codes, in decimal, and descriptions of each. In general, a cause code indicates current activity on the ISDN or reports an error that has occurred on the ISDN.

Incoming cause codes are not translated from the network-specific value to the CCITT value used by the AS/400 system. However, the cause codes are checked to see if they indicate normal and acceptable calling conditions. All other values are logged into the system error log.

Figure B-1 (Page 1 of 2). Cause Code Descriptions

| Cause Code | Cause Description |
|-------------------|--|
| 1 | Unallocated (unassigned number) |
| 2 | No route to specified transit network |
| 3 | No route to destination |
| 6 | Channel unacceptable |
| 7 | Call awarded and being delivered in an established channel |
| 16 | Normal call clearing |
| 17 | User busy |
| 18 | No user responding |
| 19 | No answer from user (user alerted) |
| 21 | Call rejected |
| 22 | Number changed |
| 26 | Nonselected user clearing |
| 27 | Destination out of order |
| 28 | Incorrect number format |
| 29 | Facility rejected |
| 30 | Response to Status Enquiry |
| 31 | Normal, unspecified |
| 34 | No circuit/channel available |
| 38 | Network out of order |
| 41 | Temporary failure |
| 42 | Switching equipment congestion |
| 43 | Access information discarded |
| 44 | Requested circuit/channel not available |
| 47 | Resources unavailable, unspecified |
| 49 | Quality of service unavailable |
| 50 | Requested facility not subscribed |
| 57 | Bearer capability not authorized |
| 58 | Bearer capability not presently available |
| 63 | Service or option not available, unspecified |

Figure B-1 (Page 2 of 2). Cause Code Descriptions

| Cause Code | Cause Description |
|-------------------|---|
| 65 | Bearer capability not implemented |
| 66 | Channel type not implemented |
| 69 | Requested facility not implemented |
| 70 | Only restricted digital information bearer capability is available |
| 79 | Service or option not implemented, unspecified |
| 81 | Call reference value not valid |
| 82 | Identified channel does not exist |
| 83 | A suspended call exists, but this call identity does not |
| 84 | Call identity in use |
| 85 | No call suspended |
| 86 | Call having the requested call identity has been cleared |
| 88 | Incompatible destination |
| 91 | Transit network selection not valid |
| 95 | Message not valid, unspecified |
| 96 | Mandatory information element is missing |
| 97 | Message type nonexistent or not implemented |
| 98 | Message not compatible with call state or message type nonexistent or not implemented |
| 99 | Information element nonexistent or not implemented |
| 100 | Information element contents not valid |
| 101 | Message not compatible with call state |
| 102 | Recovery on timer expiry |
| 111 | Protocol error, unspecified |
| 127 | Interworking, unspecified |

Appendix C. ISDN Q.931 and Q.932 Protocol Messages

The messages in this appendix are sent by TEs across the D-channel. The messages determine the behavior of connections within the ISDN. The ISDN uses the information elements embedded within the messages to route calls between systems. For more information regarding the format and sequence of Q.931 messages, see the *ISDN Circuit-Switching Signaling Control Architecture Reference*.

Message Descriptions

The following message types are used by an AS/400 system and an ISDN:

| | |
|----------------------------|---|
| Alerting | This message is sent by the called user to the network or by the network to the calling user to indicate that called user alerting has been initiated. |
| Call Proceeding | This message is sent by the called user to the network or by the network to the calling user to indicate that the requested call establishment has been initiated and no more call establishment information will be accepted. |
| Connect | This message is sent by the called user to the network or by the network to the calling user to indicate call acceptance by the called user. |
| Connect Acknowledge | This message is sent by the network to the called user to indicate that the user has been awarded the call. |
| Disconnect | This message is sent by the user to request that the network clear an end-to-end connection or is sent by the network to indicate that the end-to-end connection is cleared. |
| Facility | Defined by CCITT Recommendation Q.932 and used for third-party call control, this message is sent by the user or the network to request or acknowledge a supplementary service. In this case, the supplementary service is the CallPath/400 application. |
| Notify | This message is sent by the network to indicate information about a call such as being a user-suspended call. |
| Progress | This message is sent by the network to indicate the progress of a call. |
| Register | Defined by CCITT Recommendation Q.932 and used by third-party call control, this message is sent by the user or the network to allocate a call reference associated with transactions other than calls. |
| Release | This message is sent by the user or the network to indicate that the equipment sending the message has disconnected the channel and intends to release the channel and the call reference. The receiving equipment should release the channel and prepare to release the call reference after sending the release-complete message. |

For X.31 packet mode, this message with cause code number 7 indicates that the equipment sending the message will only release the call reference.

Note: The purpose of the call reference is to identify the call at the local user network interface to which the particular message applies. The call reference is included in all ISDN messages.

Release Complete

This message is sent by the user or the network to indicate that the equipment sending the message has released the channel and call reference. The channel is available for reuse and the receiving equipment releases the call reference.

For third-party call control and some X.31 packet mode calls, this message indicates that the equipment sending the message has released just the call reference.

Note: The purpose of the call reference is to identify the call at the local user network interface to which the particular message applies. The call reference is included in all ISDN messages.

Restart

This message is sent by the network to clear all B-channel calls.

Setup

This message is sent by the calling user to the network and by the network to the called user to initiate a call.

Setup Acknowledge

This message is sent by the network to the calling user or by the called user to the network to indicate that a call has been initiated but additional information may be required.

Status

This message is sent by the user or the network in response to a Status Enquiry message or at any time during a call to report certain error conditions.

Status Enquiry

This message is sent by the network to solicit a status message containing the status of the current call.

Message Information Elements

Each of the messages in this appendix may contain one or more Information Elements (IEs) as described below.

Bearer Capability

The Bearer Capability IE is used to exchange information transfer attributes between the user and the network.

Called Party Number

The Called Party Number IE identifies the called party of a call to the network or the called user.

Calling Party Number

The Calling Party Number IE identifies the origin of a call from either the network or the calling user. This information element contains the calling party number, type of number, and numbering plan identification.

| | |
|------------------------------------|---|
| Calling Party Subaddress | The Calling Party Subaddress IE identifies the subaddress associated with the origin of a call (from either the network or the calling user). This information element contains the calling party subaddress and type of subaddress. |
| Called Party Subaddress | The Called Party Subaddress IE identifies the subaddress of the called party of a call from either the network or the calling user. This information element contains the called party subaddress and type of subaddress. |
| Cause | The Cause IE describes the reason for generating certain messages, provides diagnostic information in the event of procedural errors, and indicates the location of the cause originator. This information element may be repeated in a message. |
| High-Layer Compatibility | The High-Layer Compatibility IE provides a means for the remote user to check for compatibility with the local user. This information is transported transparently by an ISDN between a call originator (a calling user) and the addressed entity (a remote user or high-layer function network node addressed by the call originator). |
| Low-Layer Compatibility | The Low-Layer Compatibility IE provides a means for an addressed user (a remote user) to check for compatibility with a local user. This information element is transferred transparently by an ISDN between the call originator (the calling user) and the addressed entity. |
| Network-Specific Facilities | The Network-Specific Facilities IE indicates which network facilities are being called. This information element may be repeated up to four times in a message. |
| Service Indicator | Used in place of Bearer Capability in Germany. |
| Terminal Capability | The Terminal Capability IE is used in France by the user to identify its characteristics to the network and to the remote user. |
| Transit Network Selection | The Transit Network Selection IE identifies one requested transit network. This information element may be repeated in a message to select a sequence of transit networks, through which a call must pass. |

Appendix D. Network Provider Information

This appendix includes network and parameter information supported or required by several ISDN providers. The information is for configuring your AS/400 system for a specific ISDN.

Nippon Telephone and Telegraph INS-NET 64

This section provides the information needed to connect an AS/400 system to the Nippon Telephone and Telegraph (NTT) INS-NET 64 network type.

Subscription and Hardware Considerations

The AS/400 system supports circuit-switched and packet-mode data on the B-channels.

A basic rate interface may be shared by more than one device through a passive bus.

Distinguishing Devices or Functions on a Basic Rate Interface

Each circuit-switched device sharing a basic rate interface (BRI), or function that must be addressed individually in a device, has a unique subaddress.

Network Interface Description Considerations

The following parameter values should be used when configuring the network interface descriptions for this network type.

| Parameter | Parameter Values |
|--|---|
| Default network type (DFTNETTYPE) | *INSNET64 |
| Channel entries (CHLENTY) | *SWT2B unless one of the following applies: <ul style="list-style-type: none">• If the subscribed local number exclusively uses B-channel 1, channel number 2 should use channel-connection type *NONSWT.• If the subscribed local number exclusively uses B-channel 2, channel number 1 should use channel-connection type *NONSWT.• If a subscribed local number does not apply, channel numbers 1 and 2 should both use channel-connection type *NONSWT. |
| X.31 notification class (X31NFYCLS) | Applies only if X.31 packet mode is subscribed. The system supplies a default value of *UNCONDITIONAL. |
| • At least one X.25 switched virtual circuit (SVC) is subscribed | *UNCONDITIONAL |
| • Only X.25 permanent virtual circuits (PVCs) are subscribed | *NONE |
| Terminal end-point identifier (TEID) | |

| Parameter | Parameter Values |
|---------------------------------|---|
| • Nonswitched B-channel used | Specific TEID value. If a point-to-point interface is subscribed, the TEID must be 0. |
| • Only switched B-channels used | *AUTO or specific TEID value |

Note: Parameters LCLNBR and LCLSUBADR do not apply if only X.25 (X.31) packet mode is used. Packet mode is configured using the packet mode (PKTMODE) parameter in the X.25 line description.

The system uses a value of *WAIT for the reactivation timer (REACTTMR) parameter.

Connection List Considerations

The following parameter values should be used when configuring the connection lists for this network type.

| Parameter | Parameter Values |
|-------------------------------|---|
| Remote number (RMTNBR) | |
| • For outgoing calls | Specific remote number |
| • For incoming calls | *ANY or a specific remote number |
| Remote subaddress (RMTSUBADR) | *ANY or a specific remote subaddress value ¹ |
| Local number (LCLNBR) | *ANY or a subscribed local number |
| Local subaddress (LCLSUBADR) | *ANY or a specific subaddress value ¹ |

Note:

¹ If the subaddress type is the value *USER, it is recommended that subaddresses are an even number of characters in length. Each pair of characters represents one byte. If the subaddress type is the value *NSAP, the subaddress must start with two characters that represent a byte known as the authority and format identifier. This byte specifies the format of the characters that follow. For example, with an authority and format identifier byte of 50, the characters that follow should be a hexadecimal representation of International Alphabet 5 (IA5) characters.

Note: No connection lists are needed if only X.25 (X.31) packet mode is used.

Network Provider Power Considerations

The AS/400 ISDN BRI adapter does not use power from the ISDN jack. However, the adapter detects the presence of power at the ISDN jack. This allows the AS/400 system to quickly detect if the ISDN cable has been disconnected from the ISDN jack. Power must be present at the ISDN jack to use the AS/400 ISDN BRI adapter unless only nonswitched B-channels and X.25 permanent virtual connections (PVCs) are used.

Northern Telecom DMS100 (BCS29 or BCS31)

This section provides the information needed to convert an AS/400 system to the Northern Telecom DMS100 (BCS29 or BCS31) network types. If your network is providing Bellcore National ISDN, it is recommended that the AS/400 use the National ISDN (*NISDN) network type parameter value.

Subscription Considerations

You must subscribe to all of the following options from your ISDN provider:

- Circuit-switched or packet-mode data on the B-channels
- One nonautomatic (fixed, static) TEI assignment for each circuit-switched B-channel
- A fixed B-channel allocated for each circuit-switched device

Hardware Considerations

Two hardware situations are possible with this network type:

- One AS/400 ISDN adapter is connected to the BRI. An adapter can use up to one specific circuit-switched B-channel. The remaining B-channels can either be subscribed as a permanent channel for X.25 (X.31 packet mode) or used exclusively by another device sharing the same BRI.
- Two AS/400 ISDN adapter cables share the same BRI. This enables one AS/400 system to use two circuit-switched B-channels.

Note: The ISDN adapter supports one circuit-switched B-channel and one D-channel on BRI's served by a Northern Telecom DMS100 switch. This is instead of the usual two circuit-switched B-channels and one D-channel. This restriction does not apply if the Northern Telecom DMS100 is providing National ISDN and the AS/400 system is using the National ISDN (*NISDN) network type parameter value.

Distinguishing Devices or Functions on a BRI

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

Network Interface Description Considerations

The following parameter values should be used when configuring the network interface descriptions for this network type. For two AS/400 adapters connected to the same BRI, two network interface descriptions must be configured with differing values for the CHLENTY and TEID parameters.

| Parameter | Parameter Values |
|-----------------------------------|------------------|
| Default network type (DFTNETTYPE) | *NT100B29 |

| Parameter | Parameter Values |
|--------------------------------------|---|
| Channel entries (CHLENTY) | One of the following: <ul style="list-style-type: none"> If the subscribed local number uses B-channel 1, channel number 2 should use channel-connection type *NONSWT. If the subscribed local number uses B-channel 2, channel number 1 should use channel-connection type *NONSWT. If a subscribed local number does not apply, channel numbers 1 and 2 should both use channel-connection type *NONSWT. |
| Terminal end-point identifier (TEID) | Specific TEID value |
| Procedural differences (PRCDIF) | *ACTCHLS1 is allowed if your network termination supports maintenance channel S1. |

Note: Parameters LCLNBR, LCLSUBADR, and TEID do not apply if only X.25 (X.31) packet mode is used. Packet mode is configured using the packet mode (PKTMODE) parameter in the X.25 line description.

Connection List Considerations

The following parameter values should be used when configuring the connection lists for this network type.

| Parameter | Parameter Values |
|--|--|
| Remote number (RMTNBR) | <ul style="list-style-type: none"> For outgoing calls: Specific remote number. For incoming calls: *ANY or a specific remote number. Some ISDN providers do not provide the remote number. Other ISDN providers may provide the remote number depending on subscription options. |
| Remote subaddress (RMTSUBADR) | *ANY or a specific remote subaddress value (a specific value does not apply to BCS29). The same considerations apply as for a remote number. ¹ |
| Local number (LCLNBR) | *ANY or a subscribed local number value. Some ISDN providers do not send the user-supplied local number with outgoing calls. |
| Local subaddress (LCLSUBADR) | *ANY or a specific local subaddress value (a specific value does not apply to BCS29). The same considerations apply as for a local number. ¹ |
| Information transfer type (INFTRFTYPE) | <ul style="list-style-type: none"> For outgoing calls: *UNRESTRICTED or *V110. *V110 is required if any part of the connection is not 64 000 bps unrestricted. |

| Parameter | Parameter Values |
|----------------------|---|
| • For incoming calls | Does not apply. The system adapts to the incoming call information transfer type. |

Note:

¹ If the subaddress type is changed to the value *NSAP, the subaddress must be preceded by two characters that represent a byte known as the authority and format identifier. This byte specifies the format of the characters that follow. For example, with an authority and format identifier byte of 50, the characters that follow should be a hexadecimal representation of International Alphabet 5 (IA5) characters.

Note: No connection lists are needed if only permanent B-channels are used or if only X.25 (X.31) packet mode is used.

Network Provider Power Considerations

The AS/400 ISDN basic rate interface adapter does not use power from the ISDN jack or detect power from the ISDN jack.

American Telephone and Telegraph 5ESS (5E4.2, 5E5, or 5E6)

This section provides the information needed to connect an AS/400 system to the American Telephone and Telegraph 5ESS (5E4.2, 5E5, or 5E6) network types. If your network is providing National ISDN, it is recommended that the AS/400 system use the National ISDN (*NISDN) network type parameter value.

Subscription and Hardware Considerations

You must supply the following information to your ISDN provider:

- The AS/400 system supports circuit-switched and packet-mode data on the B-channels.
- The terminal type for the AS/400 system is E.
- One of the following must be specified:
 - Point-to-point operation. Only one device may be connected to the basic rate interface (BRI).
 - Multipoint operation (does not apply to 5E4.2). A BRI may be shared by more than one device. An AS/400 system operates as a nonend-point initializing terminal. If your ISDN provider limits each device to the use of one specific B-channel and you want your AS/400 system to use both B-channels, you should subscribe to the point-to-point option instead.

Distinguishing Devices or Functions on a BRI

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

Network Interface Description Considerations

The following parameter values should be used when configuring the network interface descriptions for this network type.

| Parameter | Parameter Values |
|-----------------------------------|--------------------------------|
| Default network type (DFTNETTYPE) | *ATT5E42, *ATT5E5, or *ATT5E6. |

| Parameter | Parameter Values |
|---------------------------------|--|
| Channel entries (CHLENTY) | <p>*SWT2B unless one of the following applies:</p> <ul style="list-style-type: none"> • If the subscribed local number exclusively uses B-channel 1, channel number 2 should use channel-connection type *NONSWT. • If the subscribed local number exclusively uses B-channel 2, channel number 1 should use channel-connection type *NONSWT. • If a subscribed local number does not apply, channel numbers 1 and 2 should both use channel-connection type *NONSWT. |
| Procedural differences (PRCDIF) | *ACTCHLS1 is allowed if your network termination supports maintenance channel S1. |

The system supplies a default value of *LCLDIRNBR for the local number type (LCLNBRTYPE) parameter and a default value of *ISDN for the local numbering plan (LCLNBRPLAN) parameter.

Note: Parameters LCLNBR and LCLSUBADR do not apply if only X.25 (X.31) packet mode is used. Packet mode is configured using the packet mode (PKTMODE) parameter in the X.25 line description. If you use packet mode, the connection initiation (CNNINIT) parameter in the X.25 line description should have the value *LOCAL.

Connection List Considerations

The following parameter values should be used when configuring the connection lists for this network type.

| Parameter | Parameter Values |
|--|--|
| Remote number (RMTNBR) | |
| <ul style="list-style-type: none"> • For outgoing calls | Specific remote number. |
| <ul style="list-style-type: none"> • For incoming calls | *ANY or a specific remote number. Some ISDN providers do not provide the remote number. Other ISDN providers may provide the remote number depending on subscription options. |
| Remote subaddress (RMTSUBADR) | *ANY. The network does not support specific values. |
| Local number (LCLNBR) | *ANY or subscribed local number value. Some ISDN providers do not send the user-supplied number with outgoing calls. Other ISDN providers may send the user-supplied number depending on subscription options. |
| Local subaddress (LCLSUBADR) | *ANY. The network does not support specific values. |
| Information transfer type (INFTRFTYPE) | |

| Parameter | Parameter Values |
|--|---|
| <ul style="list-style-type: none"> For outgoing calls | *UNRESTRICTED or *V110. *V110 is required if any part of the connection is not 64 000 bps unrestricted. |
| <ul style="list-style-type: none"> For incoming calls | Does not apply. The system adapts to the incoming call information transfer type. |

Note: No connection lists are needed if only X.25 (X.31) packet mode is used.

The system supplies a default value of *LCLDIRNBR for the remote number type (RMTNBRTYPE) and local number type (LCLNBRTYPE) parameters. The system supplies a default value of *ISDN for the remote numbering plan (RMTNBRPLAN) and local numbering plan (LCLNBRPLAN) parameters.

Network Provider Power Considerations

The AS/400 ISDN BRI adapter does not use power from the ISDN jack or detect power from the ISDN jack.

American Telephone and Telegraph DEFINITY (G3i and G3r)

This section provides the information necessary to connect an AS/400 system to the American Telephone and Telegraph DEFINITY (G3i and G3r) network type.

Network Interface Description Considerations

For third-party call control, use the Create Network Interface Description (CRTNWIISDN) command to specify the necessary values for the following parameters.

| Parameter | Parameter Values |
|---------------------------|------------------|
| Network type (NETTYPE) | *ATTG3 |
| Call control (CALLCTL) | *THIRD |
| Channel entries (CHLENTY) | *D |

With these values, the AS/400 system automatically configures a network line description, a network controller description, and a network device description, if necessary, when the CallPath/400 application begins. These network object descriptions allow the D-channel to send and receive application messages.

France Telecom Numeris (VN2)

This section provides the information necessary to connect an AS/400 system to the France Telecom Numeris (VN2) network type.

Subscription and Hardware Considerations

The AS/400 system supports circuit-switched data on the B-channels. A basic rate interface (BRI) may be shared by more than one device through a passive bus.

Distinguishing Devices or Functions on a BRI

Each device sharing a BRI (or function that must be addressed individually in a device) has one or both of the following:

- Unique extension (last four digits of the subscribed number)
- Unique subaddress for a given extension

Network Interface Description Considerations

The following parameter value should be used when configuring the network interface descriptions for this network type.

| Parameter | Parameter Value |
|-----------------------------------|-----------------|
| Default network type (DFTNETTYPE) | *FTVN2. |

The system uses a value of *WAIT for the reactivation timer (REACTTMR) parameter.

Connection List Considerations

The following parameter values should be used when configuring the connection lists for this network type.

| Parameter | Parameter Values |
|-------------------------------|--|
| Remote number (RMTNBR) | |
| • For outgoing calls | Specific and complete remote number. |
| • For incoming calls | *ANY or a specific and complete remote number. |
| Remote subaddress (RMTSUBADR) | *ANY or a specific remote subaddress. ¹ |
| Local number (LCLNBR) | |
| • For outgoing calls | *ANY or a complete subscribed local number. |
| • For incoming calls | *ANY or the last four digits of the subscribed local number. |
| Local subaddress (LCLSUBADR) | *ANY or a specific subaddress value. ¹ |

Note:

¹ If the subaddress type is changed to the value *NSAP, the subaddress must be preceded by two characters that represent a byte known as the authority and format identifier. This byte specifies the format of the characters that follow. For example, with an authority and format identifier byte of 50, the characters that follow should be a hexadecimal Representation of International Alphabet 5 (IA5) characters.

Using ISDN to Access Transpac X.25

Two types of calls are possible:

- Calls from the AS/400 system to Transpac (EBS). The called data terminal equipment (DTE) must accept charges for the X.25 call.
- Calls from Transpac to the AS/400 system (SBS). The X25DCE parameter in the X.25 line description must use the value *YES. Parameters for local and remote subaddresses in the ISDN network interface description and connection list do not apply. The value *ANY is recommended.

Network Provider Power Considerations

The AS/400 ISDN BRI adapter does not use power from the ISDN jack. However, the adapter can detect the presence of power at the ISDN jack. This allows the AS/400 system to quickly detect if the ISDN cable has disconnected from the ISDN cable from the ISDN jack.

The AS/400 system supports two modes of operation. You can determine the active mode by using the Display Network Interface Description (DSPNWID) command and noting the value of the terminal end-point identifier (TEID) parameter.

- Power is detected and required if the TEID parameter has the value *AUTO.
- Power is not detected if the TEID parameter does not have the value *AUTO.

Deutsche Bundespost (1TR6)

This section provides the information necessary to connect an AS/400 system to the Deutsche Bundespost (1TR6) network type.

Subscription and Hardware Considerations

The AS/400 system supports circuit-switched data on the B-channels. In some cases, an adapter must be put in the ISDN jack before connecting the AS/400 ISDN cable. A basic rate interface (BRI) may be shared by more than one device through a passive bus.

Distinguishing Devices or Functions on a BRI

Each device sharing a basic rate interface or function that must be addressed individually in a device, must be assigned a unique one-digit number, known as an EAZ digit.

Network Interface Description Considerations

The following parameter value should be used when configuring the network interface descriptions for this network type.

| Parameter | Parameter Value |
|-----------------------------------|-----------------|
| Default network type (DFTNETTYPE) | *DBP1TR6 |

The system uses a value of *NOLLCIE for the setup differences (SETUPDIF) parameter, *WAIT for the reactivation timer (REACTTMR) parameter, and a default value *ISDN for the local number plan (LCLNBRPLAN) parameter.

Connection List Considerations

The following parameter values should be used when configuring the connection lists for this network type.

| Parameter | Parameter Values |
|------------------------|--|
| Remote number (RMTNBR) | <ul style="list-style-type: none">• For outgoing calls A specific remote number. This is the complete number with the EAZ digit as the last digit. |

| Parameter | Parameter Values |
|--|---|
| <ul style="list-style-type: none"> For incoming calls | *ANY or a specific remote number. If the remote system did not specify an EAZ digit, the network adds an EAZ digit of 0. |
| Remote subaddress (RMTSUBADR) | *ANY. The network does not support specific values. |
| Local number (LCLNBR) | *ANY or a specific local number value, which is the EAZ digit only. |
| Local subaddress (LCLSUBADR) | *ANY. The network does not support specific values. |
| Connection type (CNN) | *CIRCUIT or *SEMIPERM. If your ISDN subscription includes a semipermanent connection to the specified remote number, you can use the *SEMIPERM value. |
| Network specific (NETSPFINF) | This parameter has four value fields. Specific values are in some fields. |
| <ul style="list-style-type: none"> CNN parameter set to *CIRCUIT | (<value> <value> <value> <value>), where <value> is *ANY, *NONE or a specific value. |
| <ul style="list-style-type: none"> CNN parameter set to *SEMIPERM | (*ANY *ANY <value> <value>), where <value> is *ANY, *NONE or a specific value. On outgoing calls, the system internally uses the first two value fields to request a semipermanent connection. On incoming calls, the system internally uses the first two value fields to screen for a semipermanent connection. |

Note: Your network subscription should provide information on specific parameter values, if required.

The system supplies a default value of *ISDN for the remote numbering plan (RMTNBRPLAN) and local numbering plan (LCLNBRPLAN) parameters.

Network Provider Power Considerations

The AS/400 ISDN BRI adapter does not use power from the ISDN jack. However, the adapter can detect the presence of power at the ISDN jack. This allows the AS/400 system to quickly detect if the ISDN cable has been disconnected from the ISDN jack.

The AS/400 system supports two modes of operation. You can determine the active mode by using the Display Network Interface Description (DSPNWID) command and by noting the value of the terminal end-point identifier (TEID) parameter.

- Power is detected if the TEID parameter has the value *AUTO. In this mode, power must be detected at the ISDN jack in order for the ISDN adapter to continue.
- Power is not detected if the TEID parameter does not have the value *AUTO.

Deutsche Bundespost (1TR8, Permanent Interface S0FV)

This section provides the information necessary to connect an AS/400 system to the Deutsche Bundespost (1TR8) permanent interface S0FV.

Hardware Considerations

In some cases, an adapter must be put in the ISDN jack before connecting the AS/400 ISDN cable.

Network Interface Description Considerations

The following parameter values should be used when configuring the network interface descriptions for this network type.

| Parameter | Parameter Values |
|-----------------------------------|---|
| Default network type (DFTNETTYPE) | *DBP1TR6 |
| Channel entries (CHLENTY) | Channel numbers 1 and 2 should use channel-connection type *NONSWT. |

Network Provider Power Considerations

The AS/400 ISDN BRI adapter does not use power from the ISDN jack or detect power from the ISDN jack.

British Telecom ISDN 2 (BTNR-191)

This section provides the information needed to connect an AS/400 system to British Telecom ISDN 2 (BTNR-191) network type.

Subscription and Hardware Considerations

The AS/400 system supports circuit-switched data on the B-channels. A basic rate interface (BRI) may be shared by more than one device through a passive bus.

Distinguishing Devices or Functions on a BRI

Subscription options from your ISDN provider can affect how incoming calls are directed to different devices or functions on a BRI. These options may include the following:

- One local number associated with both B-channels. This is normally the default for a BRI line. When all devices on a passive bus use different call types, the ISDN protocol automatically distinguishes between devices. For example, the two call types might be telephone and circuit switched data. For these cases, no further subscription options should be necessary to uniquely address specific devices.
- Two local numbers, each uniquely associated with a particular B-channel. The two numbers could correspond to two devices sharing a BRI, where each device can use only one B-channel.
- Direct Dial In. The subscribed BRI is assigned multiple “extensions” which callers may address by appending the extension digits after the number.
- Multiple Subscriber Number. The subscribed BRI is assigned a block of ten local numbers which differ in the last digit.

- Subaddressing. This option may be used in conjunction with any of the above. Subaddressing increases the number of individually addressable entities on a BRI without additional subscribed numbers.
- Calling Line Identification Presentation (CLIP). CLIP causes the network to deliver the caller's number, with some exceptions. One exception is when the sender is subscribed to Calling Line Identification Restriction (CLIR).

Network Interface Description Considerations

The following parameter values should be used when configuring the network interface descriptions for this network type.

| Parameter | Parameter Values |
|-----------------------------------|--|
| Default network type (DFTNETTYPE) | *BTNR191. |
| Channel entries (CHLENTY) | *SWT2B unless one of the following applies: <ul style="list-style-type: none"> • If the subscribed local number exclusively uses B-channel 1, channel number 2 should use channel-connection type *NONSWT. • If the subscribed local number exclusively uses B-channel 2, channel number 1 should use channel-connection type *NONSWT. |

The system uses a value of *WAIT for the reactivation timer (REACTTMR) parameter.

Connection List Considerations

The following parameter values should be used when configuring the connection lists for this network type.

| Parameter | Parameter Values |
|---|--|
| Remote number (RMTNBR) | |
| <ul style="list-style-type: none"> • For outgoing calls | Specific remote number. You may append Direct Dial In digits if the remote device uses Direct Dial In. |
| <ul style="list-style-type: none"> • For incoming calls <ul style="list-style-type: none"> – CLIP subscribed locally | *ANY or specific remote number. You may append Direct Dial In digits if the remote device uses Direct Dial In. |
| <ul style="list-style-type: none"> – CLIP subscribed locally | *ANY. The network does not provide a remote number. |
| Remote subaddress (RMTSUBADR) | |
| <ul style="list-style-type: none"> • For outgoing calls | *ANY or specific value. ^{1,2} |
| <ul style="list-style-type: none"> • For incoming calls | *ANY. The network does not provide a remote subaddress. |
| Local number (LCLNBR) | |

| Parameter | Parameter Values |
|---|--|
| <ul style="list-style-type: none"> For outgoing calls | *ANY recommended except in special cases, such as when the Direct Dial In or Multiple Subscriber Number is subscribed locally and identification by specific Direct Dial In or Multiple Subscriber Number digits is desired. |
| <ul style="list-style-type: none"> For incoming calls | |
| <ul style="list-style-type: none"> – Direct Dial In or Multiple Subscriber Number subscribed locally | *ANY or subscribed value. Up to 6 digits for Direct Dial In, single digit for Multiple Subscriber Number. |
| <ul style="list-style-type: none"> – Direct Dial In or Multiple Subscriber Number not subscribed locally | *ANY. The network does not provide a local number. |
| Local subaddress (LCLSUBADR) | |
| <ul style="list-style-type: none"> For outgoing calls | *ANY. The network does not provide a local subaddress. |
| <ul style="list-style-type: none"> For incoming calls | *ANY or specific value. ^{1,2} |

Note:

¹ If the subaddress type is the value *USER, it is recommended that subaddresses are an even number of characters in length. Each pair of characters represents one byte. If the subaddress type is the value *NSAP, the subaddress must start with two characters that represent a byte known as the authority and format identifier. This byte specifies the format of the characters that follow. For example, with an authority and format identifier byte of 50, the characters that follow should be a hexadecimal representation of International Alphabet 5 (IA5) characters.

² Subaddresses that are more than 8 characters (4 bytes) in length are not recommended. The high order bit of each byte must be zero.

Network Provider Power Considerations

The AS/400 ISDN BRI adapter does not use power from the ISDN jack. However, the adapter can detect the presence of power at the ISDN jack. This allows the AS/400 system to quickly detect if the ISDN has been disconnected from the ISDN jack.

The AS/400 system supports two modes of operation. You can determine the active mode by using the Display Network Interface Description (DSPNWID) command and noting the value of the terminal end-point identifier (TEID) parameter.

- Power is detected and required if the TEID parameter has the value *AUTO.
- Power is not detected if the TEID parameter does not have the value *AUTO.

Teleos IAP6000

This section provides the information needed to connect an AS/400 system with a Teleos IAP6000 network type.

Network Interface Description Considerations

The following parameter value should be used when configuring the network interface descriptions.

| Parameter | Parameter Value |
|-----------------------------------|---|
| Default network type (DFTNETTYPE) | *ATT5E42 is recommended. The Teleos IAP emulates an AT&T 5ESS (5E4.2) network switch. |

Connection List Considerations

The following parameter values should be used when configuring the connection lists.

| Parameter | Parameter Values |
|------------------------------------|---------------------------|
| Remote number (RMTNBR) | |
| • For outgoing calls | Specific value. |
| • For incoming calls | *ANY or a specific value. |
| Remote numbering plan (RMTNBRPLAN) | *UNKNOWN. |
| Remote subaddress (RMTSUBADR) | *ANY. |
| Local number (LCLNBR) | *ANY or a specific value. |
| Local numbering plan (LCLNBRPLAN) | *UNKNOWN. |
| Local subaddress (LCLSUBADR) | *ANY. |

European Telecommunications Standards Institute (ETSI)

This section provides the information necessary to connect an AS/400 system to the ETSI network type.

Subscription and Hardware Considerations

The AS/400 system supports circuit-switched and packet-mode data on the B-channels.

A basic rate interface may be shared by more than one device through a passive bus.

Distinguishing Devices or Functions on a Basic Rate Interface

Use subscription options available from your network provider to address of different devices on a passive bus or different functions within a single device. These subscription options may include:

- One local number associated with both B-channels. This is normally the default for a BRI line. If different devices on a passive bus are using different call types, the ISDN protocol automatically distinguishes between devices. An example of this is when both telephone and switched data are used. In this case, no further subscription options are necessary to uniquely address specific devices.
- Multiple subscriber number. The subscribed BRI is assigned a set of different local numbers. 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 may address by appending the extension digits after the number.
- Subaddressing. This option allows the user to assign unique subaddresses to each device or function, which must be separately accessed on the BRI. Subaddressing increases the number of individually addressable entities on a BRI without additional subscribed local numbers.
- Calling line identification presentation. Calling line identification presentation causes the network to deliver the number of the caller, with some exceptions. Exceptions include the sender blocking calling line identification presentation either on a call-by-call basis or on a subscription basis.

Check with your network provider to find out which of these options is available. Some of these options may be combined to form more flexible addressing schemes.

Network Interface Description Considerations

Use the following parameter values when configuring the network interface descriptions for this network type.

| Parameter | Parameter Values |
|-----------------------------------|------------------|
| Default network type (DFTNETTYPE) | *ETSI |

For the SwissNet2 ISDN network, the TEID value of zero must not be used.

Connection List Considerations

Use the following parameter values when configuring the connection lists for this network type.

| Parameter | Parameter Values |
|--|--|
| Remote number (RMTNBR) | |
| <ul style="list-style-type: none"> • For outgoing calls • For incoming calls | Specific remote number *ANY or a specific remote number |
| Remote subaddress (RMTSUBADR) | *ANY or a specific remote subaddress value |
| Local number (LCLNBR) | *ANY or a subscribed local number |
| Local subaddress (LCLSUBADR) | *ANY or a specific subaddress value |

Note:

If the subaddress type is the value *USER, it is recommended that subaddresses are an even number of characters in length. Each pair of characters represents one byte. If the subaddress type is the value *NSAP, the subaddress must start with two characters that represent a byte known as the authority and format identifier. This byte specifies the format of the characters that follow. For example, with an authority and format identifier byte of 50, the characters that follow should be a hexadecimal representation of International Alphabet 5 (IA5) characters.

Note: No connection lists are needed if you use only X.25 (X.31) packet mode.

Network Provider Power Considerations

The AS/400 ISDN BRI adapter does not use power from the ISDN jack. However, the adapter can detect the presence of power at the ISDN jack. This allows the AS/400 system to quickly detect if the ISDN cable has been disconnected from the ISDN jack.

The AS/400 system supports two modes of operation. You can determine the active mode by using the Display Network Interface Description (DSPNWID) command. Then note the value of the terminal end-point identifier (TEID) parameter.

- Power is detected if the TEID parameter has the value *AUTO. In this mode, power must be detected at the ISDN jack in order for the ISDN adapter to continue.

Bellcore National ISDN

This section provides the information needed to connect an AS/400 system to the NISDN network type.

Subscription and Hardware Considerations

The AS/400 system supports circuit-switched and packet-mode data on the B-channels.

A basic rate interface may be shared by more than one device 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 means that a BRI supporting both B-channels may have the following attached to it:

- A single device, which may access both B-channels
- Two devices, each of which may access only a single B-channel

Check with your network provider for the exact restrictions regarding the number of devices that may share the same passive bus.

Note: When the AS/400 system and the network are running National ISDN, the restriction limiting the AS/400 system to use a single B-channel on a BRI when attached to a Northern Telecom DMS100 switch does not apply.

Distinguishing Devices or Functions on a Basic Rate Interface

For Bellcore National ISDN, you can distinguish individual devices on a BRI line by using the service profile identifier (SPID) parameter. Obtain the SPID parameter from your network provider at line subscription time. Normal operation of Bellcore National ISDN uses a separate SPID and local number for each separate physical device attached to the BRI. Additionally, some versions of Bellcore National ISDN require a separate SPID and directory number for each B-channel access to the BRI. These separate entries are required even when both B-channels are being accessed by a single physical device. There is also an option to not use SPID parameters at all. To the network provider, this is known as using a default terminal service profile. The default terminal service profile should not be used if your application needs the use of multi-line hunt group capabilities provided by the network. It is necessary to find out from your network provider which of these modes of operation is supported by your network.

Use subscription options available from your network provider to do:

- Additional addressing of different devices on a passive bus.
- Additional addressing of different functions within a single device. These subscription options may include the following:
 - One local number associated with both B-channels. This is the case for the following:
 - A single device accessing both B-channels and using a single SPID
 - Multiple devices on a BRI, which all use the default terminal service profile (no SPID).

When all devices on a passive bus are using different call types, the ISDN protocol automatically distinguishes between devices. For example, when both telephone and circuit-switched data is used, no further subscription options are necessary to uniquely address specific devices.

 - Two local numbers (and two SPIDs) associated with the BRI. Some network implementations of Bellcore National ISDN use these as defaults.
- Multiple subscriber number (MSN). The subscribed BRI is assigned a set of different local numbers. These numbers are different from the multiple numbers 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 may address by appending the extension digits after the number.
- Subaddressing. This option allows users to assign unique subaddresses to each device or function that they must separately access on the BRI. Subaddressing increases the number of addressable entities you can access individually on a BRI without additional subscribed local numbers.
- Calling line identification presentation. Calling line identification presentation causes the network to deliver the number of the caller, with some exceptions. Exceptions include the sender blocking calling line identification presentation either on a call-by-call basis or on a subscription basis.

Check with your network provider to find out which of these options is available. Some of these options may be combined to form more flexible addressing schemes.

Network Interface Description Considerations

Use the following parameter values when configuring the network interface descriptions for this network type.

| Parameter | Parameter Values |
|--|---|
| Default network type (DFTNETTYPE) | *NISDN |
| Service Profile Identifiers (SPID) | |
| <ul style="list-style-type: none">• Using a single SPID for both B-channels This is the preferred mode of operation for the AS/400 system. This mode may not be available on some network implementations of Bellcore National ISDN. | SPID number 1 is configured to be the subscribed value. SPID number 2 is configured to have a value of *NONE. |

| Parameter | Parameter Values |
|--|---|
| <ul style="list-style-type: none"> Using separate SPIDs (and local numbers) for each B-channel. <p>For this configuration of Bellcore National ISDN, each BRI is assigned two separate telephone numbers and each number is allowed one call at a time. Because of this, there is a greater chance of call contention. assigned to a single BRI (each telephone number is only allowed to make a single call at once). Applications that use the BRI for only incoming or outgoing calls do not encounter this problem.</p> <p>To eliminate this problem for applications that use one local number for outgoing calls and the other for incoming calls, the AS/400 system attempts to place outgoing calls on SPID number 1, if it is available.</p> <p>If your application does multiple incoming and outgoing calls over a single BRI, you may subscribe to a multi-line hunt group from your network provider. This reduces the chances of call contention.</p> | Both SPID number 1 and SPID number 2 are configured to be the subscribed values. |
| <ul style="list-style-type: none"> Using the default terminal service profile (no SPIDs). | SPID number 1 is configured to have a value of *ANY and SPID number 2 is configured to have a value of *NONE. |

Connection List Considerations

Use the following parameter values when you configure the connection lists for this network type.

| Parameter | Parameter Values |
|--|---|
| Remote number (RMTNBR) | Specific remote number |
| <ul style="list-style-type: none"> For outgoing calls For incoming calls | *ANY or a specific remote number. Some ISDN providers do not provide the remote number. Other ISDN providers may provide the remote number, depending on subscription options. |
| Remote subaddress (RMTSUBADR) | *ANY or a specific remote subaddress value |
| Local number (LCLNBR) | *ANY or a subscribed local number value. Some ISDN providers do not send the user-supplied number with outgoing calls. Other ISDN providers may send the user-supplied number, depending on subscription options. When configuring Bellcore National ISDN using two separately configured SPID values, use a value of *ANY for the LCLNBR parameter in the connection list. |
| <ul style="list-style-type: none"> For outgoing calls For incoming calls | *ANY or a subscribed local number value |
| Local subaddress (LCLSUBADR) | *ANY or a specific subaddress value |

| Parameter | Parameter Values |
|---|---|
| Information transfer type (INFTRFTYPE) | *UNRESTRICTED or *V110. *V110 is required if any part of the connection is not 64 000 unrestricted. |
| <ul style="list-style-type: none"> • For outgoing calls • For incoming calls | Does not apply. The system adapts to the transfer type of the incoming call information. |
| Note: | |
| ¹ If the subaddress type is *USER, make the subaddresses an even number of characters in length. Each pair of characters represents 1 byte. If the subaddress type is *NSAP, start the subaddress with 2 characters that represent a byte known as the authority and format identifier. This byte specifies the format of the characters that follow. For example, with an authority and format identifier byte of 50, the characters that follow should be a hexadecimal representation of International Alphabet 5 (IA5) characters. | |

Note: No connection lists are needed if only X.25 (X.31) packet mode is used.

Network Provider Power Considerations

The ISDN basic rate interface adapter on the AS/400 system does not use power from the ISDN jack or detect power from the ISDN jack.

Bibliography

This section contains a list of IBM publications that contain information about topics described or referred to in this guide. Refer to the *Publications Guide*, GC41-9678, if you want a list of all manuals in the AS/400 library, and a description of the information contained in those manuals. The manuals in this section are listed with their full title and order number, but when referred to in text, a shortened version of the title is used.

AS/400 Communications Manuals

The following AS/400 communications manuals contain information you may need when you use the AS/400 ISDN support.

- *CallPath/400* Planning and Installation Guide*, SC41-9601, provides information processing managers with an overview of the CallPath/400 program, a description of required system components, and general information about installation planning.
Short Title: *CallPath/400* Planning and Installation Guide*
- *Communications: Advanced Program-to-Program Communications Programmer's Guide*, SC41-8189, provides information about the APPC support provided by the AS/400 system. It is a guide for developing application programs that use APPC and for defining the communications environment for APPC communications.
Short Title: *APPC Programmer's Guide*
- *Communications: Intersystem Communications Function Programmer's Guide*, SC41-9590, provides information needed to write application programs that use AS/400 communications and the OS/400* intersystem communications function (ICF). This guide also contains information on data description specifications (DDS) keywords, system-supplied formats, return codes, file transfer support, and program examples.
Short Title: *ICF Programmer's Guide*
- *Communications: Management Guide*, SC41-0024, supplies programmers with information needed to develop, maintain, and support communications on the AS/400 system. Included is information about error recovery.
Short Title: *Communications Management Guide*

- *Communications: Operating System/400* Communications Configuration Reference*, SC41-0001, contains general configuration information, including detailed descriptions of network interface, line, controller, device, mode, and class-of-service descriptions, configuration lists and connection lists.
Short Title: *OS/400* Communications Configuration Reference*

- *Communications: X.25 Network Guide*, SC41-0005, provides information about the X.25 network interface and the X.31 ISDN access to an X.25 network. It provides configuration examples and includes X.25 network concepts.
Short Title: *X.25 Network Guide*

- *Publications Guide*, GC41-9678, identifies and describes all of the information in the AS/400 library. It also provides information needed to verify that the appropriate manuals were shipped with the product and helps to determine what additional manuals to order. This manual also provides guidance on how, when, and where to use the on-line and printed information.
Short Title: *Publications Guide*

- *System Concepts*, GC41-9802, provides a general understanding of the concepts related to the overall design and use of the AS/400 system and its operating system. This manual includes general information about AS/400 features such as user interface, object management, work management, system management, data management, database, communications, environments, OfficeVision/400*, PC Support, and architecture.
Short Title: *System Concepts*

Other Publications

- *IBM AS/400 ISDN Access brochure*, G325-6013.
- *Integrated Services Digital Networks Circuit-Switching Signaling Control Architecture Reference*, SC31-6827-1.
- *Integrated Services Digital Networks Data Link Control Architecture Reference*, SC31-6826.
- *Systems Application Architecture* Common Programming Interface Communications Reference*, SC26-4399.
- *Transmission Control Protocol/Internet Protocol Guide*, SC41-9875.
- *7820 ISDN Terminal Adapter Description and Planning Guide*, GA33-0130.

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Customer Satisfaction Feedback

Application System/400
 Communications:
 Integrated Services
 Digital Network Guide
 Version 2
 Publication No. SC41-0003-02

Overall, how would you rate this manual?

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