

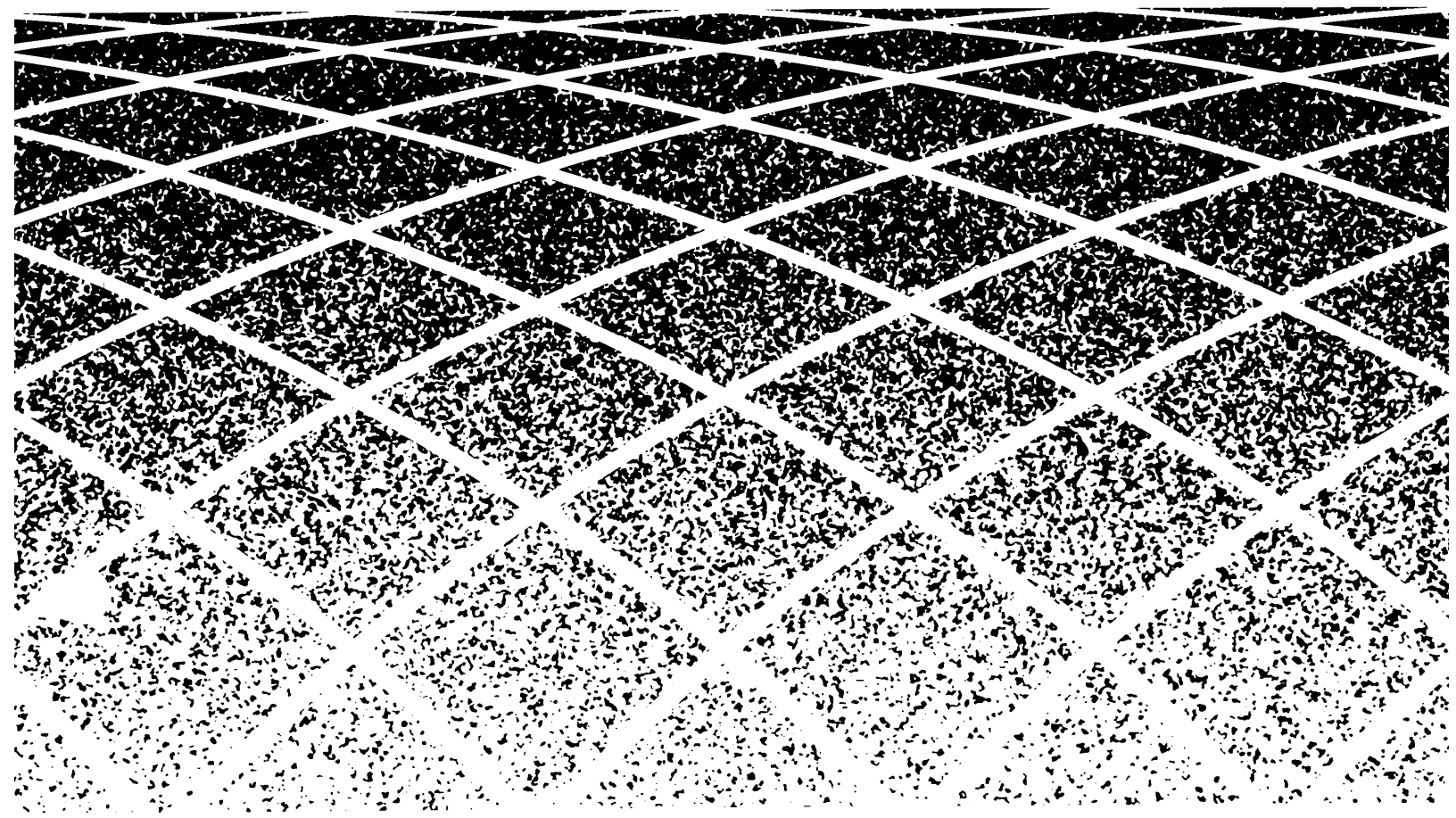


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DEFINITY[®] Communications System

and System 75 and System 85

DS1/DMI/ISDN-PRI Reference



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ABOUT THIS DOCUMENT

PURPOSE

Over the past several years, basic digital signal level 1 (DS1) service has evolved to include new capabilities and thereby support more sophisticated applications. The three prime applications are:

1. Digital multiplexed interface with bit-oriented signaling (DMI-BOS)
2. Digital multiplexed interface with message-oriented signaling (DMI-MOS)
3. Integrated Services Digital Network primary rate interface (ISDN-PRI)

Since these three applications merely build on each proceeding application, and extend basic DS1 service, they are covered in a single document. This document is reissued (as issue 4) to:

1. Include coverage for the 551V ST network channel-terminating equipment (NCTE) (also called the *channel service unit* or *CSU*)
2. Upgrade System 85 R2V4 administration procedures to include:
 - Coverage for issue 7 of the maintenance and administration panel (MAAP) flip charts
 - Additions and corrections to the administration procedures
 - Clarifications on the use of trunk type 120 (ISDN-dynamic) and other trunk types for providing Call-by-Call (CBC) Service Selection
3. Add coverage for DEFINITY® Communications System Generic 2 ISDN-PRI
4. Add coverage for System 75XE DS1/DMI
5. Add coverage for DEFINITY Communications System Generic 1 ISDN-PRI

This document describes System 75 and System 75XE DS1/DMIs as well as Generic 1 and Generic 2 ISDN-PRI. It introduces and defines the concepts and terminology that are unique to DS1/DMI/ISDN-PRI. Also included are descriptions of DS1/DMI/ISDN-PRI applications (for both private and public networks), engineering procedures and considerations, cabling and connection arrangements, and administration requirements, restrictions, and limitations.

INTENDED AUDIENCES

Since this document contains information ranging from the brief tutorial to the detailed requirements, it should prove useful to several groups of readers, including:

- Marketing personnel
- Technical consultants
- Network engineers
- Installation personnel
- System administrators
- Account teams
- Customers

PREREQUISITE SKILLS AND KNOWLEDGE

While there are no prerequisite skills assumed in this document, a basic understanding of telephony and networking is required. The *GLOSSARY* and *ABBREVIATIONS* appendixes of this document are provided to assist you in understanding the terminology used herein. See the *Related Sources* heading later in this preface, *About This Document*, for a list of other documents that discuss similar topics.

HOW THIS DOCUMENT IS ORGANIZED

This document consists of the following chapters:

1. INTRODUCTION — Provides a high-level functional description of the DS1/DMI/ISDN-PRI channels, available framing formats, signaling options, and line coding formats.
2. NETWORK CONNECTIONS AND CONFIGURATIONS — Describes functional connection arrangements to private network facilities (private endpoints) and to public network facilities (public endpoints). Included along with the public network discussions are Switched Access connections and services. This section also describes connection arrangements using digital multiplexer transmission equipment.
3. DS1 — TRANSMISSION AND CABLING — Describes cable distance limitations versus cable size, permitted cable types, the DSX-1 interface specification, the need and function of customer service units, on- and off-premises cable configurations, metallic and nonmetallic cable options, and equalizer and compensation settings.
4. THE DIGITAL LOSS PLAN — Describes transmission loss concepts, the analog and digital loss plans and the differences between them, and the user or installer impact (switch settings and administration values).
5. SYNCHRONIZATION OF DIGITAL FACILITIES — Describes synchronization strategies, objectives, and requirements. This chapter also discusses the availability of synchronization sources and includes the rules for selecting and assigning primary and secondary references and facilities.

-
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6. **PORT TYPES/INSTALLATION COMPATIBILITIES** — Describes the DS1/DMI circuit pack operating modes, slot restrictions, and administration considerations and restrictions. This section also includes a table that lists the available port types and shows their compatibility on a system, release, version, and circuit-pack suffix basis.
 7. **ADMINISTRATION OPTIONS AND REQUIREMENTS** — Covers the following information:
 - Describes those procedures that are required for DS1 services, what the available field encode options are, and the considerations for choosing the options for System 85
 - Describes those procedures that are required for DS1 services, what the available field encode options are, and the considerations for choosing the options for DEFINITY Generic 2
 - Describes the administration screens that are required for DS1 services, any unusual or special field requirements or considerations, and options for System 75 and System 75XE
 - Describes the administration screens that are required for DS1 services, any unusual or special field requirements or considerations, and options for Generic 1
 8. **MAINTENANCE AND ALARMS** — Describes the diagnostic capabilities and alarms provided by DS1/DMI/ISDN-PRI. This part also provides information on methods of alarm analysis and alarm resolution.
- **APPENDIXES**
 - A. **ADMINISTRATION REQUIREMENTS** — Provides screens showing administration field examples for System 75 (R1V2 and R1V3) special-access connections.
 - B. **SAMPLE INSTALLATION AND MAINTENANCE PROBLEMS** — Describes, with examples, some of the more typical field problems, such as translation-based, synchronization-related, and physical-interface connection problems.
 - C. **ADMINISTRATIVE PROCEDURE SUMMARY** — Describes the administrative procedures used on DEFINITY Generic 2 that relate to the ISDN-PRI, including how pertinent administrative fields relate to ISDN-PRI level 3 message contents and general feature operation.
 - D. **TRUNK TYPE AND SIGNALING TYPE COMPATIBILITY TABLES** — Provides tables that define trunk type to signaling type compatibility for System 85 R2V1, R2V2, R2V3, R2V4, and Generic 2.
 - **ABBREVIATIONS**
 - **GLOSSARY**
 - **INDEX**

NOTE: Although this document applies specifically to DS1/DMI and to ISDN-PRI, the Generic 2 Remote Group Interface (RGI) is also a DS1 application. As such, portions of chapter 1, *Introduction*, chapter 3, *DS1 Transmission and Cabling*, chapter 4, *The Digital Loss Plan*, and chapter 8, *Maintenance and Alarms*, may also apply in a general sense to the RGI. Specific information on the RGI is provided in documents on that subject.

HOW TO USE THIS DOCUMENT

How you will use this document will depend on several factors such as the amount of training you have received or your personal preferences for working with something new. You may want to read this document from cover to cover, use it merely as a reference when questions arise, or find that something in between these two extremes will best suit your needs. At the very least, you should make sure that you are familiar with how the document is organized and what it contains. This can be accomplished by reading this preface, *About this Document*, and then carefully scanning the document, taking special note of all headings.

The *Table of Contents* and the *Index* are provided for those times when you have problems finding information about a specific topic.

TRADEMARKS AND SERVICE MARKS

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- MS-DOS is a registered trademark of Microsoft Corporation.

RELATED SOURCES

The following documents may be referenced to obtain additional information on specific subjects.

<i>DP2 Channel Service Unit User's Manual</i>	999-100-189
<i>AT&T DEFINITY 75/85 Communications System Generic 1 Maintenance</i>	555-204-105
<i>AT&T DEFINITY 75/85 Communications System Generic 1 and System 75 and System 75 XE Feature Description</i>	555-200-201
<i>AT&T DEFINITY 75/85 Communications System Generic 2 Administration Procedures</i>	555-104-506
<i>AT&T DEFINITY 75/85 Communications System Generic 2 Maintenance Procedures</i>	555-104-117
<i>AT&T DEFINITY 75/85 Communications System Generic 2 Maintenance Repair Strategies</i>	555-104-118
<i>AT&T Network and Data Services Reference Manual</i>	555-025-201
<i>AT&T System 85 Release 2 Version 4 Administration Procedures</i>	555-103-506
<i>BCM32000 — Description, Installation, and Maintenance — Digital Transmission Systems</i>	365-287-100

<i>Channel Division Multiplexer Installation and Maintenance Manual</i>	365-165-101S
<i>Channel Expansion Multiplexer Installation and Maintenance Manual</i>	365-160-101S
<i>D4-Channel Bank Channel Units — Application Engineering</i>	855-351-105
<i>DEFINITY Communications System Generic 1.1 to 4ESS Via ISDN PRI Access</i>	555-037-234
<i>DEFINITY Communications System Generic 2 Administration Procedures</i>	555-104-506
<i>DEFINITY Communications System Generic 2 Maintenance Repair Strategies</i>	555-104-118
<i>DEFINITY Communications System Generic 2.1 to 4ESS Via ISDN PRI Access</i>	555-037-237
<i>Digital Multiplexed Interface (DMI) Technical Specification Issue 3.2</i>	555-025-204
<i>ESF T1 Channel Service Unit User Manual</i>	999-100-305
<i>ISDN-BRI Reference Manual</i>	555-025-102
<i>Performance Quality Analysis</i>	190-404-120
<i>System 85 R2V4 to 4ESS Via ISDN PRI Access</i>	555-037-232
<i>System 85 R2V4 to DEFINITY Communications System Generic 1.1 via ISDN PRI Access</i>	555-037-233

HOW TO MAKE COMMENTS ABOUT THIS DOCUMENT

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1. INTRODUCTION

Digital signal level 1 (DS1) trunks (trunks that carry 24 multiplexed channels on a single 1.544M-bps stream and use a bit-oriented signaling (BOS) interface) were introduced in 1962 to replace older analog transmission equipment used between toll offices. At the same time, D-type channel banks (channel banks that convert analog data to digital data or vice versa) were also introduced. One D-type channel bank (D4) is used at both the send and receive ends of a DS1 facility. At the send end, a D4-channel bank does analog-to-digital conversions on 24 analog channels (trunks) and multiplexes these channels to the DS1 format. At the receive end, a D4-channel bank does an inverse operation.

Since System 75, System 85, and DEFINITY® Communications System Generic 1 and Generic 2 are digital switches, the analog-to-digital-to-analog conversions used in D4-channel banks are unnecessary. So in place of this DS1/D4 arrangement, digital switches can use a DS1 and a digital multiplexed interface or DMI (an interface that multiplexes voice or data onto 23-bearer channels and either data or signaling onto a twenty-fourth channel). The DS1/DMI arrangement does the same functions as a DS1/D4 arrangement. The signal remains digital and unaltered all the way to the receive end. At the receive end, appropriate loss is added according to the digital loss plan if the signal is converted back to analog. Further discussion on the subject of loss adjustments is contained in chapter 4, *The Digital Loss Plan*.

Some of the reasons for the recent exponential growth in the use of digital transmission facilities on customer premises are:

- Advances in integrated circuit (IC) technology that permit DS1/DMI circuitry to be placed on one circuit pack
- Merging of mature digital carrier capabilities with those of new digital PBX capabilities in the move toward an all-digital network
- Growth of customer-premises switch size to a level comparable to that of a central office (CO)
- Congestion of trunking facilities
- High costs associated with analog copper tip-and-ring facilities
- Acceptance of and movement to the Integrated Services Digital Network (ISDN)

For these and other reasons, DS1/DMIs are revolutionizing private branch exchange (PBX) facility interfaces by reducing their costs, increasing their function, and permitting new applications.

FUNDAMENTALS OF DS1 SIGNALS

The DS1 protocol is the lowest level for multiplexing digital voice and digital data signals. This protocol consists of 24 64K-bps channels (each known as a *DS0 channel* or a *digroup*) plus framing bits. The 24 DS0 channels and framing bits are multiplexed together to form a 1.544M-bps signal.

The bit stream of the DS1 protocol (*1s* and *0s*) is transported over a DS1 line in a special way. The 1s are represented as alternating positive and negative pulses (called an *alternate mark inversion* (AMI) or *bipolar* signal); the 0s are represented as the absence of pulses. Two formats known as a DS1 *line-coding formats* can be used for encoding 1s into the bipolar bit stream. The DS1 channels, signaling, framing, and line-coding formats are all described in this section.

Two applications of DS1 service, known as DMI with bit-oriented signaling (DMI-BOS) and DMI with message-oriented signaling (DMI-MOS), are actually two different types of DMI interfaces. The term *DMI-BOS* is used when a DS1/DMI is optioned to provide BOS and when the interface is used to transport:

- a. Data modes 0, 1, and 2 of 64K-bps digital data between the switch and a BOS-compatible computer (also mode 3 if calls are circuit switched)
- b. Both 64K-bps data and voice between two customer-premises switches
- c. Both 64K-bps data and voice between customer-premises switches and the public network

The term *DMI-MOS* is used when a DS1/DMI is optioned to provide message-oriented signaling and when the interface is used to transport:

- a. 64K-bps digital data (modes 0 through 3) between the switch and a MOS-compatible computer over private network facilities
- b. 64K-bps digital data between two customer-premises switches

Both DMI-BOS and DMI-MOS have the same channel structure, framing formats, and line-coding considerations, as well as metallic-cable considerations. Two significant differences between DMI-BOS and DMI-MOS are:

- a. The way signaling information is encoded into the 24th channel
- b. DMI-MOS bearer channels can transmit link-access procedure on the D-channel (LAPD) data (mode 3)

NOTE: The DMI-BOS and DMI-MOS are two separate, incompatible DS1 interfaces. Communication between the two is permitted by the switch *interworking functions*, which are described later.

A *DMI* uses 24 channels in a *23B + 1D* arrangement. This means that a DMI uses 23 channels to carry either voice or data (called the *bearer* or "*B*" channels) and one channel to carry either data or signaling (called the data or "*D*" channel). The DMI is also the forerunner of the ISDN-PRI. The term *ISDN-PRI*, when used alone, refers exclusively to ISDN-PRI features or capabilities.

Over the past few years, ISDN has emerged as a powerful driving force in the evolution of business communication products and services. The increased demand for products that contain internationally sanctioned (CCITT) standard interfaces exists because of:

- Widespread confusion in the market place about multiple vendor/multiple proprietary interfaces
- Growing customer dissatisfaction with proprietary equipment interfaces

The term *ISDN* refers to the collection of international recommendations that are evolving toward adoption as a CCITT telecommunications standard. These recommendations are based on the following objectives:

1. To provide the user with end-to-end digital connectivity (which in theory will be independent of the network provider)
2. To use the end-to-end digital connections as shared (integrated) facilities, thus permitting the same channel to be used alternately for voice, data, or imagery/video
3. To permit users access to these new services by a limited set of multipurpose customer interfaces (each interface being CCITT approved)

The long-range goal is to provide the full set of ISDN services and features on digital customer-premises switches, digital COs, and to provide these services end-to-end through the public digital network.

The CCITT ISDN recommendations define two (functionally different) types of communication interfaces. They are known as the *ISDN primary rate interface (ISDN-PRI)* and the *ISDN basic rate interface (ISDN-BRI)*. ISDN-PRI recommendations (like DS1) are associated with trunk access, while ISDN-BRI recommendations are associated with line (or user terminal) access.

Initially, the CCITT recommendations were identified by their standardization committee as the "I" series documents (I.412, I.431, I.441, and I.451). Later, another CCITT development committee used the I-series documents to develop another series of documents called the "Q" series (Q.921 or Q.931). Recommendations are designed to be compatible with the Open Systems Interconnection (OSI) 7-layer model. Both ISDN-PRI and ISDN-BRI include recommendations for layers 1, 2, and 3. Recommendations for the PRI are similar in function but not identical to those for the BRI. The BRI and the PRI are compared as follows.

Layer 1	PRI defines functions provided by the physical layer. It requires use of a DS1 and is based on recommendations I.211, I.412, and I.431. These layer 1 functions include the physical connector, the creation of the bit stream by multiplexing the information B-channels and signaling D-channel, the orderly sharing of the D-channel, timing, synchronization, framing, and line coding.
Layer 2	PRI defines the signaling-channel (data-link) protocol. This layer includes the LAPD protocol (the focus of the Q.921 recommendations). The LAPD protocol permits many logical links to be multiplexed into one D-channel. It also provides flow control and error recovery for each logical link.
Layer 3	PRI defines the network-layer protocol, which consists of the Q.931 recommendations. It provides the methods (messages) to establish, maintain, and terminate network connections between communicating ISDN applications. The message set includes over 200 messages, which provide many services/features that are not available without ISDN. Some of these include: • Call establishment messages (alerting, call proceeding, connect, setup) • Call information phase messages (resume, suspend) • Call disestablishment messages (disconnect, release) • Miscellaneous messages

The BRI terminates at a subscriber's residence or office. There, it connects either to an ISDN compatible terminal or to a conventional terminal via a terminal adapter. The BRI channel structure consists of a 2B + 1D format. Each B or bearer channel provides a 64K-bps information channel. Each D-channel provides a 16K-bps signaling channel.

NOTE: Specific descriptions for BRI layers 1, 2, and 3 are not included here. Another document that fully describes ISDN-BRI architecture, specific administration requirements, and service provisioning is being developed. (Refer to *ISDN-BRI Reference Manual* (555-025-102) for more information.)

When connecting customer-premises switches to the public network, consider the features and services supported on each end of the connection. At the time of this publication, the AT&T public network supported the following services:

- Switched digital service
- MEGACOM®
- MEGACOM 800
- Call-by-call (CBC) Service Selection
- Automatic number identification (ANI)

System 85 R2V4 supports ISDN-PRI but not ISDN-BRI. However, System 85 R2V4 uses the line-side digital communications protocol (DCP) to provide end-to-end digital connectivity. The DCP channel structure consists of 2I + 1S channel format. Each I-channel provides a 64K-bps information (voice/data) channel, while the S-channel provides an 8K-bps signaling channel. The DCP is similar to ISDN-BRI, both in structure and in function. The DCP was AT&T's early attempt to offer (what at that time was) the evolving BRI standard. Figure 1-1, *System 85 R2V4 ISDN Configuration*, shows various trunk-side and line-side connections to a System 85 R2V4.

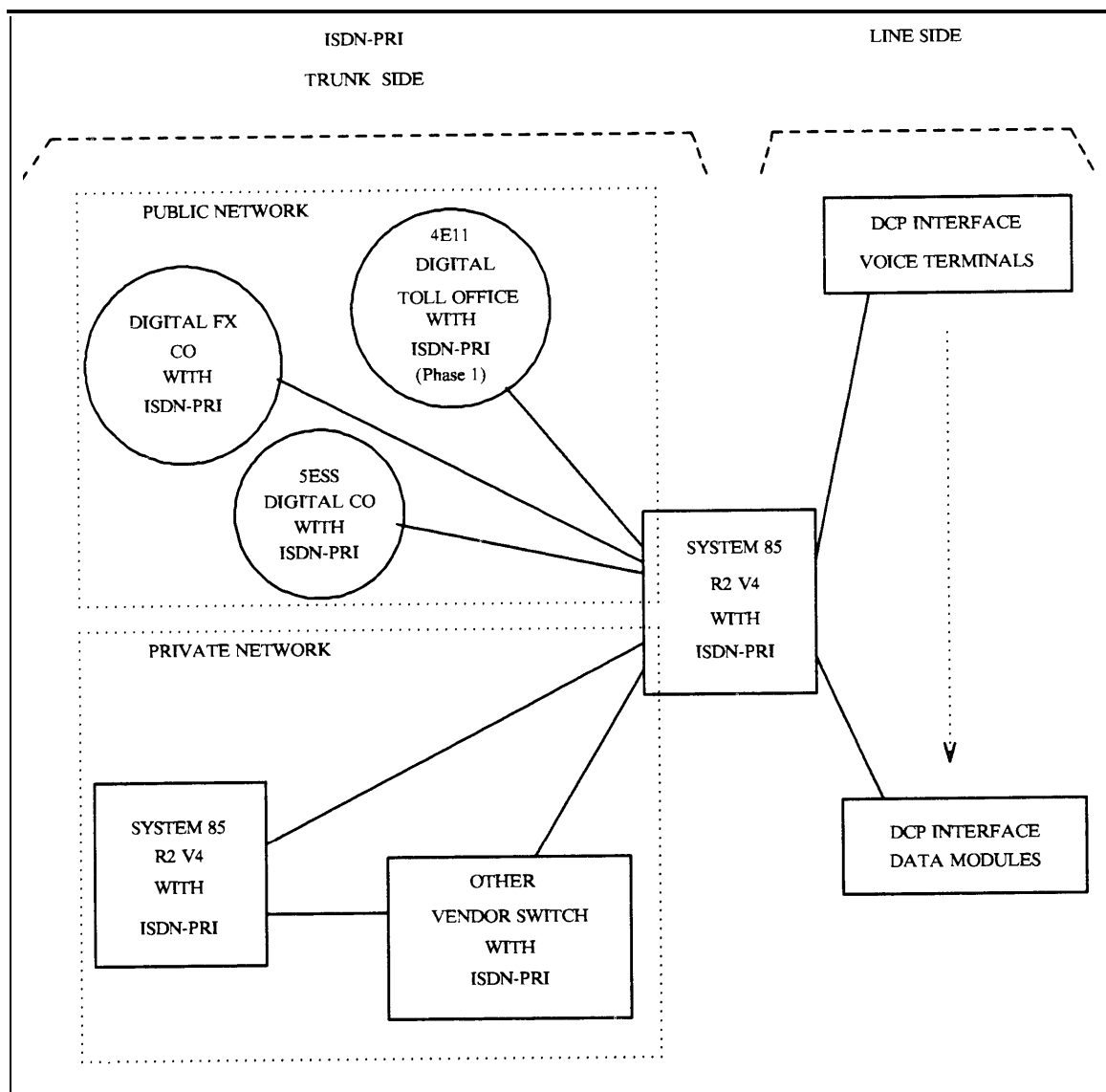


Figure 1-1. System 85 R2V4 ISDN Configuration

Generic 2 provides a signaling method called *nonfacility-associated signaling* (NFAS). NFAS allows a D-channel on one PRI facility (sometimes called a *PRI pipe*) to provide signaling for B-channels on another PRI pipe. With NFAS, if two or more PRI pipes are present, an optional D-channel backup feature is available. One D-channel is administered as the primary D-channel on one DS1 and the secondary D-channel on another DS1. Only one D-channel per primary-secondary pair can be active at a time. If the primary D-channel fails, the signaling function is switched automatically to the secondary (sometimes called the *backup*) D-channel. Without D-channel backup, D-channel failure results in loss of service for all calls passing through a PRI pipe.

Generic 2 offers ISDN-BRI, however, some BRI capabilities are not initially available. Figure 1-2, *Generic 2 ISDN Network Configuration*, shows a Generic 2 switch in a sample network.

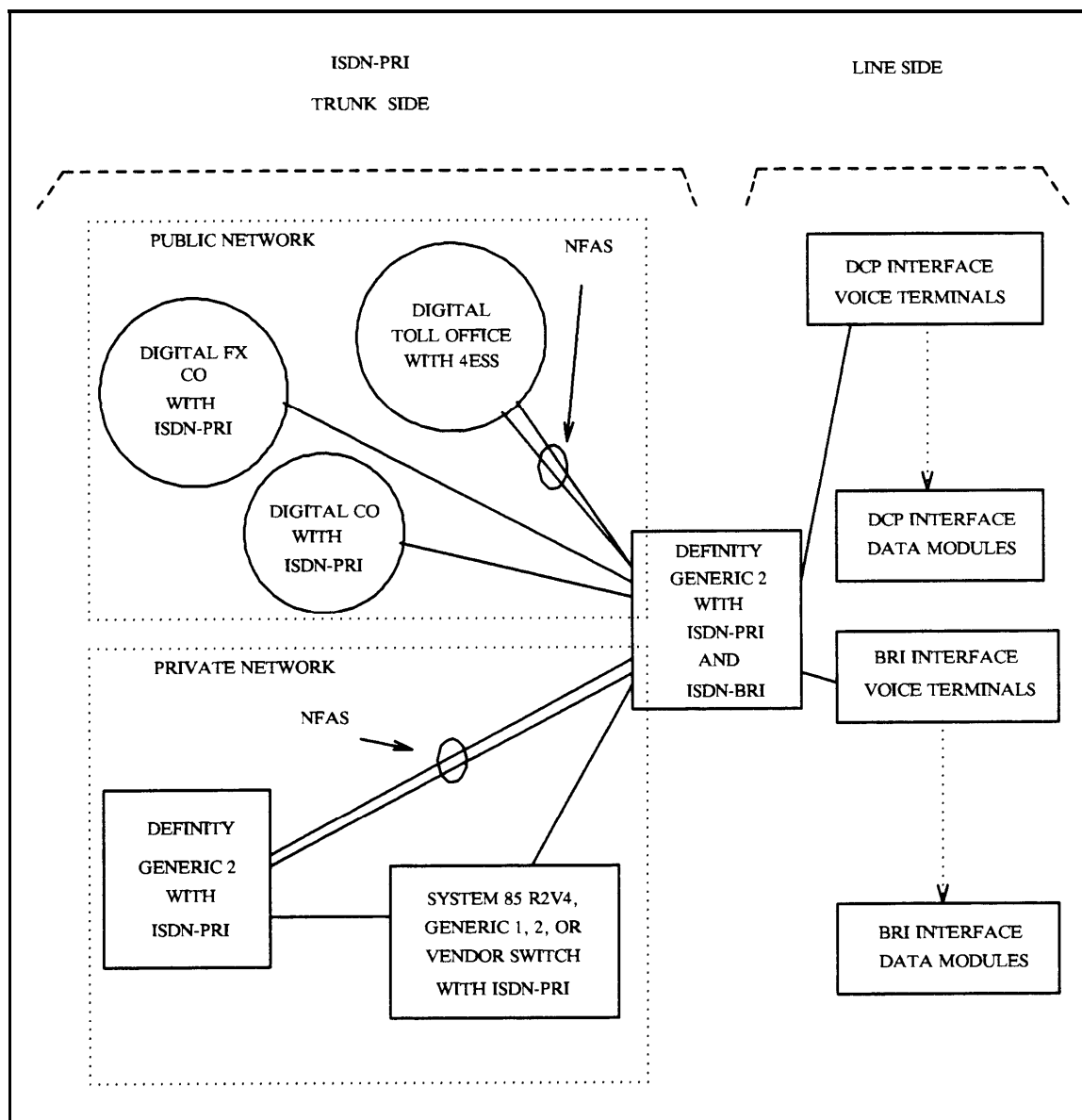


Figure 1-2. Generic 2 ISDN Network Configuration

Generic 1 and Generic 2 provide ISDN-PRI but do not support wideband channels. Additionally, ISDN-BRI is not currently supported in Generic 1. However, end-to-end digital connections are permitted via line-side DCP-interface voice terminals and DCP-interface data modules. Figure 1-3, *Generic 1 ISDN Network Configuration*, shows a Generic 1 in a sample network.

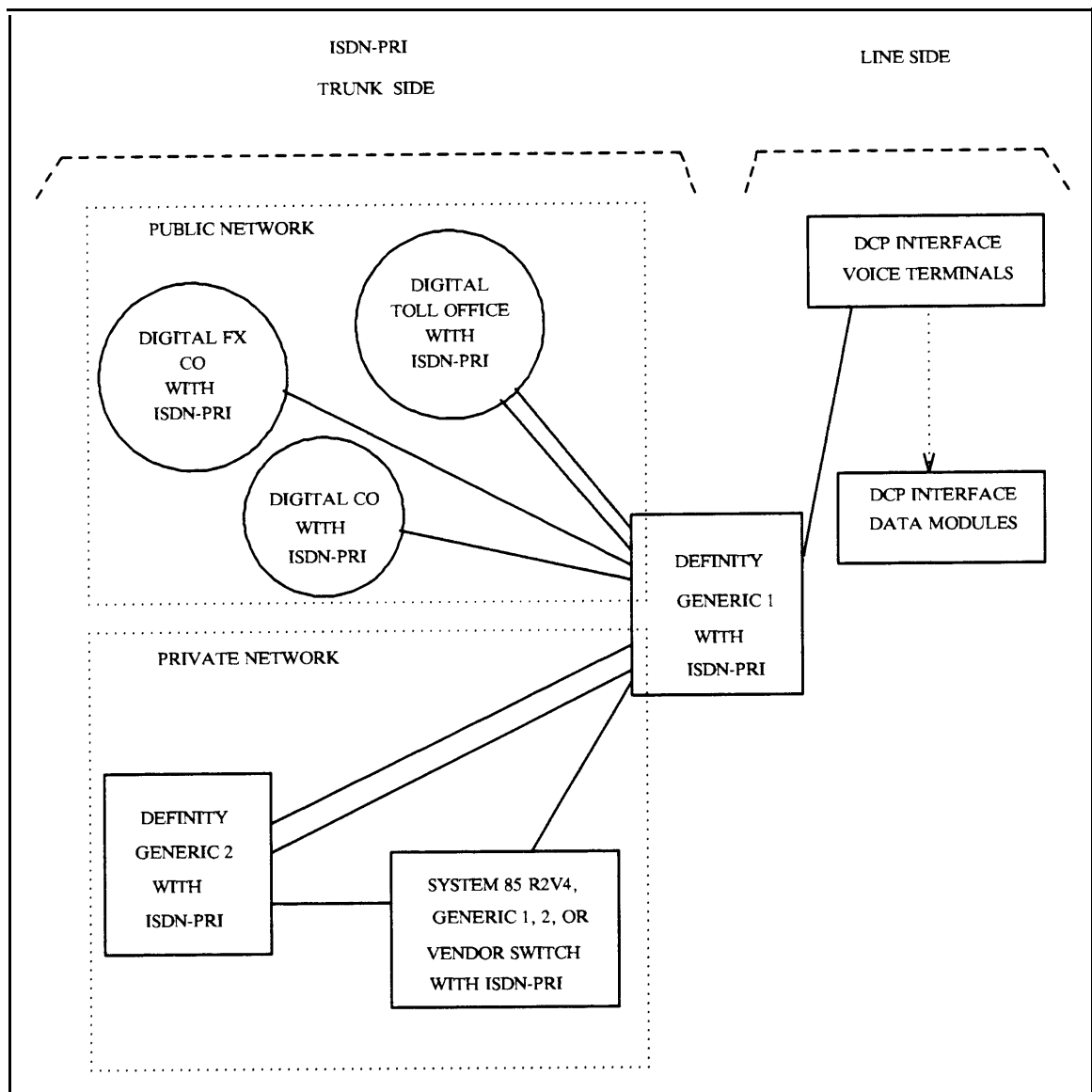


Figure 1-3. Generic 1 ISDN Network Configuration

Channels

Each channel transports 8-bit words (signal samples). Signal samples repeat at an 8K-Hz rate yielding a 64K-bps signal. The channels may be used to transmit any of four different types of signals.

Voice Analog voice data is encoded into 64K-bps pulse-code modulation (PCM) samples using an encoding technique known as the μ -255 law. Details of this encoding technique are not given here. The important point is that each DS1 channel can transport PCM-encoded 64K-bps voice signals.

Voice-grade data Voice grade data is also called *PCM Data* and *voiceband analog data*. Modems receive digital data, convert the data to an analog voiceband signal, and transmit it over analog phone lines. Whenever the modem connects to a digital switch, the modem analog output signal undergoes the same PCM encoding process as voice. Therefore, the modem output is termed *voice-grade data*.

This two-step process of first converting digital data to analog data and then to 64K-bps PCM data is necessary for transmitting data on DS1/DMI facilities that are either administered for robbed-bit signaling (RBS) or routed over a combination of digital and analog sections.

An attribute of voice-grade data is that signaling information can be inserted into the least-significant bit (LSB) of the PCM words without destroying the data. This capability *cannot* be done for those DS1 facilities that transmit digital data (described below).

Voice-grade data calls placed over DS1/DMI facilities, which use RBS, require the use of a modem to permit this two-step conversion. Actually, the modem pool (modem-to-switch) interface does this conversion.

NOTE: Voice-grade data is limited to speeds provided by the modem (typically 19.2K-bps or less). However, DS1 channels accommodate data at rates up through 56K-bps.

Digital data Digital data operates at 64K-bps and 56K-bps rates. Computers and data terminals generate digital data. The computer ports and data terminals interface to data modules. Data modules transmit the digital data (in digital form) to the switch. When this digital data is switched into a DS1/DMI channel without any intervening processes (such as modem pool conversion or embedded signaling information), the channel is said to provide 64K-bps data capability (also known as *mode-1 data*). The important point here is that when a DS1/DMI signal consists of digital data, every bit that goes in at one end must come out the other end unaltered; otherwise, the data would be destroyed.

Data modules support 56K-bps digital data over robbed-bit facilities.

NOTE: Although the digital data channels transmit synchronous 64K-bps data, computer ports and data terminals do not typically generate digital data at this rate. Data modules provide data rate adaptation (modes 0, 1, and 2) and generate nulls or fill characters (as required) for maintaining the 64K-bps data rate.

To properly transmit digital data, the following conditions must be met:

- The data communications protocol must meet the 1s-density requirement (see *Line-Coding Formats* later in this chapter).
- 24th-channel signaling must be administered (except for mode 1 data which can use robbed-bit facilities). (See *24th-Channel Signaling* later in this chapter.)
- The transmission link must consist of an end-to-end digital facility.

Signaling information for the other 23 channels (24th-channel signaling).

B-Channels

For System 85 R2V4 and Generic 1, ISDN-PRI B-channels are identified as channels 1 through 23. For Generic 2, ISDN-PRI B-channels may be identified as channels 1 through 23 when a DS1 facility provides a D-signaling channel or channels 1 through 24 it does not. ISDN-PRI B-channels can only be used for trunk applications. Each B-channel can be used to transmit 64K-bps digitized voice and either restricted digital data or unrestricted digital data.

D-Channels

When a DS1 link contains a D-channel, it is said to use facility associated signaling (FAS). When a DS1 link does not contain a D-channel, it is said to use nonfacility-associated signaling (NFAS). With NFAS, the call-control signaling for the 24 B-channels is associated with a D-channel on another DS1 link. Generic 1 and Generic 2 have NFAS. Earlier products provide FAS only.

ISDN-PRI facilities permit D-channel signaling only over the 24th channel. The full bandwidth (64K-bps) of the D-channel supports the signaling requirements for the associated B-channels. A fundamental difference between the D and B-channels is that each B channel provides a continuous and independent communications link, while the D-channel is used exclusively by the switch to provide call-control signaling and feature services for the associated B-channels.

D-Channel Backup (Generic 2)

Since some network charges are based on the number of D-channels, cost savings are realized by using NFAS and having large groups of B channels. However, the reliability of a large group of B-channels may be decreased because of the dependence on a single D-channel. The D-channel backup capability improves reliability by providing two D-channels. These two channels are called the *primary D-channel (D1)* and the *secondary D-channel (D2)*. Only one D-channel is active at a time, that is, when the primary D channel is active the secondary is idle (and vice versa). If the primary channel fails, the secondary channel switches to the active state.

When NFAS is used with D-channel backup, the two D-channels should be located in different DS1 modules. Which DS1 links contain the primary and secondary channels is based on D-channel loading and the customer's perception of B-channel importance if the B-channel is lost.

Circuit-Switched Versus Packet-Switched Channels

A circuit-switched channel provides the full bandwidth of a channel to the single terminating application on an end-to-end basis. For example, the full 64K-bps B-channel bandwidth is continuously available for both calling and called users.

As a contrast, a single packet-switched channel divides the bandwidth of a channel into multiple logical channels. The logical channels use a channel's bandwidth on an as-required and multiplexed basis. The order in which the logical channels are multiplexed is controlled by a packet switching protocol, such as X.25. A System 85 R2V4, Generic 2, and Generic 1 ISDN-PRI provide only circuit switched B-channels. External hardware may be used for providing packet switched channels and thus provide access to a variety of packet networks.

Framing Formats

A *frame* is a set of 24 8-bit time slots grouped as a single transmission unit. Each DS1 frame has 192 bits (24 x 8), plus 1 bit (called a *framing bit*) that is inserted at the beginning of each frame. Since each frame repeats time slots in the same sequence as previous frames, time slots representing a single conversation or data stream form a channel. DS1 frames repeat the 24-channel sequence in the same order as previous frames at an 8,000 frames per second rate.

There are two methods or formats for providing framing. Either format may be chosen, depending on the equipment and application. The type of framing used at both equipment ends of a DS1 transmission facility must be identical. The framing format does not place any requirement on the type of signaling or line coding to be used.

D4 Framing

The D4 framing format uses a synchronization scheme that relies on a continuously-repeated 12-bit fixed pattern. This 12-bit synchronization pattern is formed by the framing bit from 12 consecutive frames. The receiving port finds the pattern across frames by identifying the beginning and end of each frame. The 12-frame unit which contains the synchronization pattern (one D4 cycle) is called the D4 *superframe*. Figure 1-4, *D4 Framing*, shows the D4 superframe format for a DS1/DMI/ISDN-PRI signal.

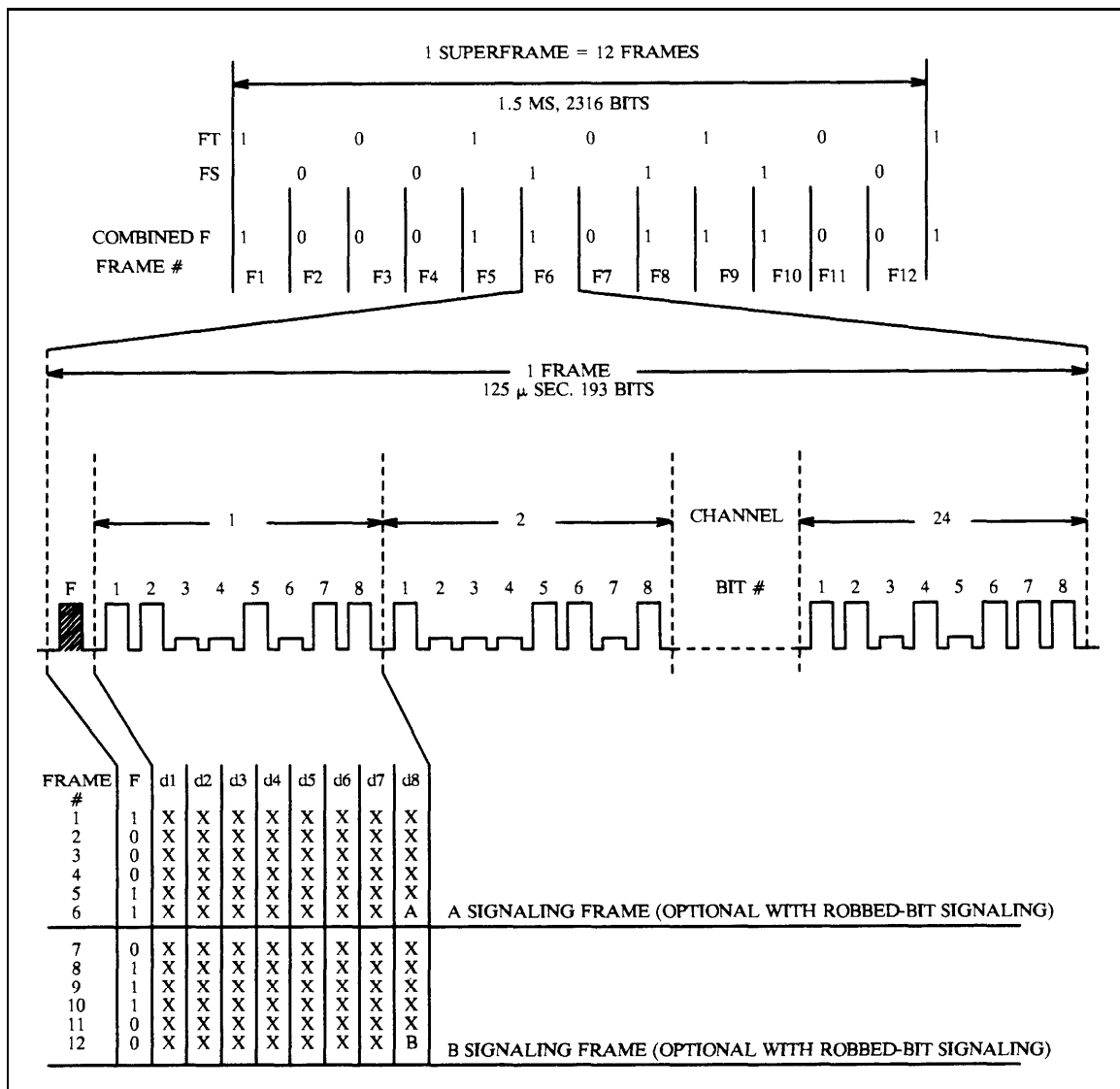


Figure 1-4. D4 Framing

The D4 framing is the format compatible with D4-channel banks. The D4 framing is the only framing format supported by all equipment used with System 75 and System 85 DS1 (such as CEMs and CDMs).

The DS1, while providing an error-detection capability, monitors the receive sequence of framing bits to detect transmission errors. If a transmission error (such as a noise hit) causes a bit in the framing pattern to be in error, a *misframe* is said to have occurred. The DS1 counts misframes and uses the count for processing the facility performance indicators, such as bit error rates, major alarms, and minor alarms.

ESF Framing

Initially, this format was called F_e , pronounced “F sub e,” for *framing extended*. It is now called *extended superframe* (ESF). The ESF framing format was developed after the D4 format. Not all equipment used with a DS1/DMI-BOS interface supports ESF. Specifically, most D4-channel banks (unless they are configured as LIU-3ESF or equivalent) and CDMs do not currently support ESF framing. (See figure 1-5, *DS1 Extended Superframe Format*.)

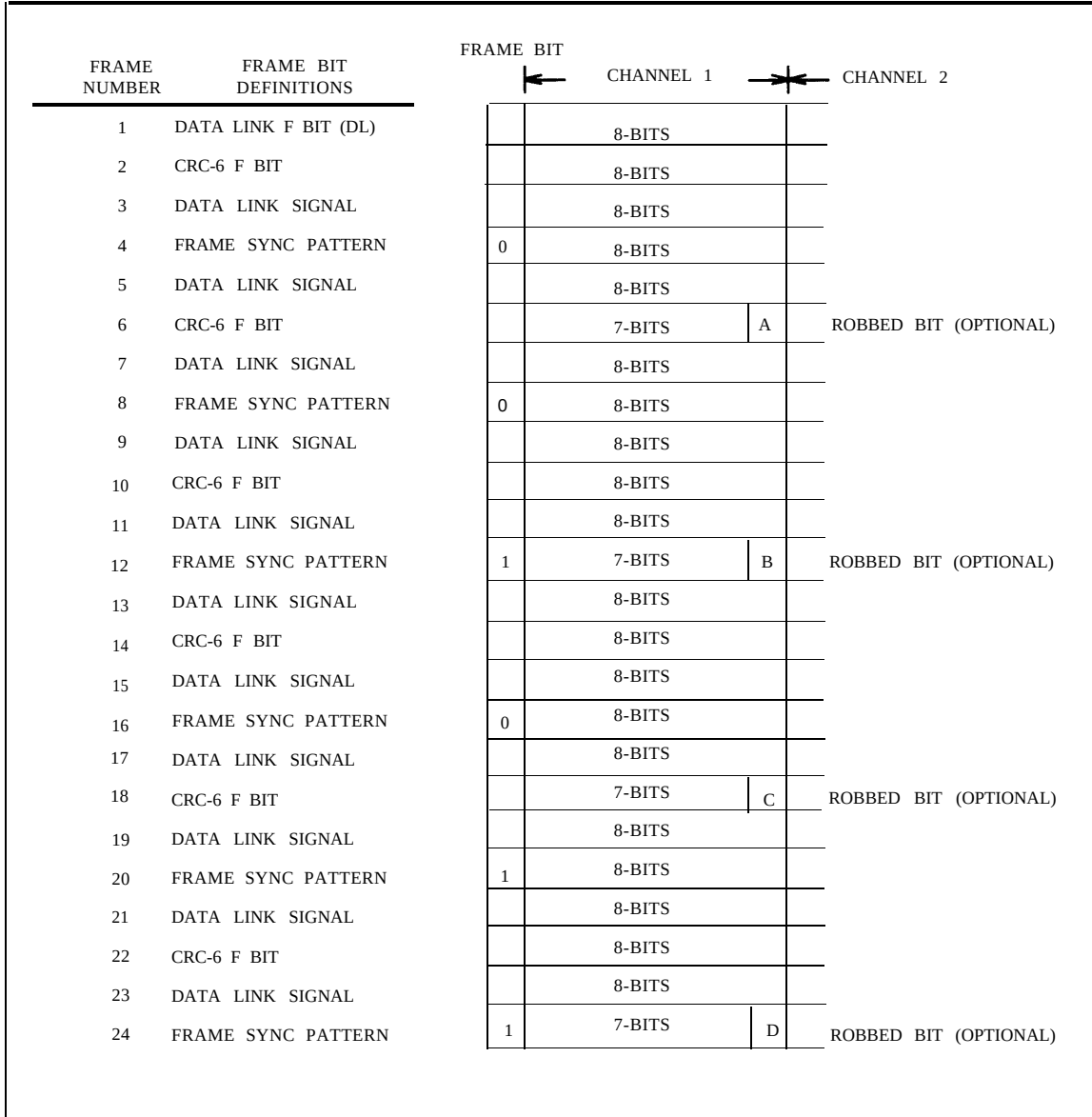


Figure 1-5. DS1 Extended Superframe Format

The ESF format consists of a 24-bit framing pattern. Compared to the 12-bit fixed pattern for D4, only 6 of the 24 bits carry a fixed pattern. The other 18-bits consist of a 6-bit error detection code, called the *cyclic redundancy check (CRC)* sum, and a 12-bit facility data link signal. At the transmit

end, one framing bit is inserted in each succeeding 193rd bit-position of the DS1 signal. The receive end uses the framing pattern to synchronize the end of one 24-channel block and the beginning of the next, to identify the channels that contain embedded signaling information, and to detect errors.

NOTE: This 4K-bps facility data link is designed to maintain and supervise a DS1 facility. However, this link is used by a System 75 and System 85 DS1s only for transmitting yellow alarms.

Each 24-frame entity, spanning one ESF cycle, is called the *ESF superframe*. Figure 1-6, *DS1 Signal, Framing Format, and ESF Superframe (24 Frames)*, shows an ESF superframe.

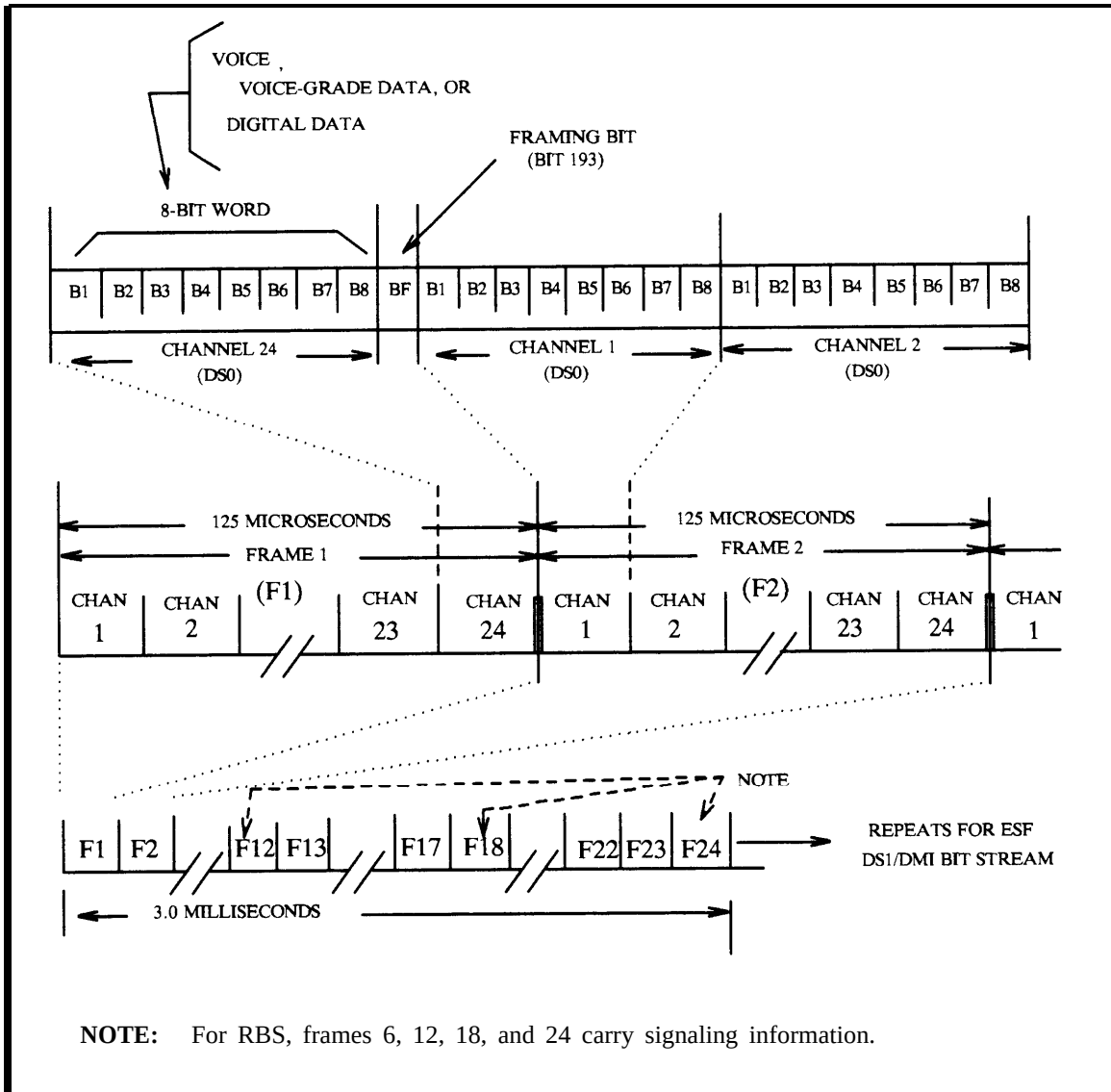


Figure 1-6. DS1 Signal, Framing Format, and ESF Superframe (24 Frames)

The CRC is used at the receive end to detect transmission errors. The CRC is calculated at the transmit end and multiplexed into the DS1 signal. At the receive end, the CRC is recalculated using the data in the received ESF superframe and then compared with the received CRC. If a transmission error (such as one caused by a noise hit) results in the CRC being in error, a *misframe* occurs. The DS1 interface counts misframes and uses the count for processing DS1 facility performance indicators, such as bit error rates, major alarms, and minor alarms.

The ESF reframing algorithm can determine the correct framing pattern embedded in the DS1/DMI/ISDN-PRI signal even if the 8-bit words for the 24 channels carry a bit sequence identical to the framing pattern. Because of this and its superior error detection capabilities, the ESF format should be used (rather than D4 framing) whenever an application permits.

Signaling Types

DS1/DMI provides four distinct and different types of signaling. One type is called *robbed-bit signaling* (RBS). The other three types are variations of 24th-channel signaling called *AT&T proprietary signaling*, *DMI bit-oriented signaling* (DMI-BOS), and *DMI message-oriented signaling* (DMI-MOS). The type of signaling used does not place any requirements on the type of framing or line coding. However, a direct relationship exists between the type of signaling used and the type of signals transmitted over the channels. A facility that uses RBS transmits voice or voice-grade data; a facility that uses 24th-channel signaling transmits voice or digital data.

Robbed-Bit Signaling

Robbed-bit signaling (RBS) replaces (that is, robs) the least significant bit (LSB) of each channel's 8-bit word in every 6th frame. It then replaces this word with the signaling information for that channel. For D4, the 6th and 12th frames carry RBS; for ESF, the 6th, 12th, 18th, and 24th frames carry RBS (refer to figures 1-4 and 1-5, respectively).

Because the signaling information is carried embedded in each channel's 8-bit word, RBS signaling is also called *inband signaling*.

Facilities using RBS cannot be used to transmit 64K-bps data.

24th-Channel Signaling

24th-channel signaling permits DS1 channels to use the full 64K-bps bandwidth on the other 23 channels. This type of signaling provides *clear channels* (clear, except for 1s-density issues). Ones-density issues are those issues associated with the facility being used. (See *Line-Coding Formats* for more information.) 24th (D-channel) signaling places the signaling bits (or LAPD message bytes) for channels 1 through 23 into the 8-bit word of the 24th-channel.

The AT&T proprietary signaling type was the first type of 24th-channel signaling provided by System 75 and System 85 DS1/DMI. It was developed to carry DCP-formatted data (in digital form) between System 75 and/or System 85 switches. AT&T proprietary signaling is described in the initial release of the DMI technical specification.

For AT&T proprietary signaling, a complete set of signaling information is sent every 24 frames. This 24-frame period is not synchronized to the 12-frame superframe format of D4 framing or to the 24-frame superframe format of ESF framing. Each signaling word contains the equivalent of a channel identification number and the signaling state for that channel. The channel identification is necessary since the channel signaling information is not directly related to a particular frame number and does vary as with multilinked facilities.

For DMI-MOS (and ISDN-PRI), each word on the 24th-channel carries a multiword LAPD message within the signaling channel. Messages are transmitted only when signaling is required for one of the other 23 channels along with header and trailer data that identifies the channel for which the signaling is sent. Individual words have no meaning.

The channel identification, its associated signaling, and their relationship to a frame number are related to the concept of superframe synchronization (see the *Superframe Synchronization* section later in this chapter).

Table 1-1, *24th-Channel Signaling Arrangement*, depicts one sample frame number and signaling channel relationship (many other relationship rotations are possible).

TABLE 1-1. 24th-Channel Signaling Arrangement

Signaling Frame No.	D4 Superframe Frame No.	ESF Superframe Frame No.	Signaling Frame No.	D4 Superframe Frame No.	ESF Superframe Frame No.
1	11	7	13	11	19
2	12	8	14	12	20
3	1	9	15	1	21
4	2	10	16	2	22
5	3	11	17	3	23
6	4	12	18	4	24
7	5	13	19	5	1
8	6	14	20	6	2
9	7	15	21	7	3
10	8	16	22	8	4
11	9	17	23	9	5
12	10	18	24	10	6

Some types of public network equipment were incompatible with 24th-channel signaling and, as a result, another type of 24th-channel signaling called *DMI-BOS*, was developed. For DMI-BOS, specific 24th-channel bit locations carry framing and alarm data, and signaling information for the other 23 channels. Unfortunately, DMI-BOS and AT&T proprietary signaling are not compatible. DMI-BOS must be used only for connections to host computers and other vendor's equipment that meets the DMI technical specification for BOS.

For System 85, the ANN11B and ANN11C support only AT&T proprietary signaling. The ANN11D and ANN11E supports both AT&T proprietary signaling and DMI-BOS. The ANN11D and ANN11E defaults to DMI-BOS, but automatically switches to AT&T proprietary signaling whenever the distant end supports only AT&T proprietary signaling.

For System 75, the TN722 provides only AT&T proprietary signaling. However, the TN722B can be administered to provide either AT&T proprietary signaling or DMI-BOS.

The CCITT Q.921 ISDN-PRI recommendations require that MOS-type signaling be used. In DMI-MOS, signaling is done with messages that consist of a series of information elements (IEs). The type of IEs used for a particular signaling message are generally determined by the conditions. (See the *Summary* heading later in this chapter for a description of the different types of IEs.)

For System 85 R2V4 and Generic 1, each ISDN-PRI facility uses the 24th channel as the D (signaling) channel. A Generic 2 switch introduced FAS (administered as $23B + 1D$), and NFAS (administered as $24B$).

Line-Coding Formats

Line coding is the pattern data assumes as it is propagated over a communications channel. Governing line coding is a set parameters that must be defined for all digital transmissions. These transmission parameters specify the voltage level and patterns in which *1s* and *0s* can appear on the line.

The parameters chosen for a given transmission stream must meet the requirements set by the hardware through which the data is transmitted. Most notable among these requirements are two established by the AT&T network. The first of these requirements dictates the voltage levels at which ones and zeros are transmitted. *Alternating mark inversion* line coding was adopted to fulfill this requirement. The second requirement, known as the *ones density requirement* states that in every stream of 15 consecutive digits, a one must appear. Zero code suppression (ZCS) and 8-bit zero substitution (B8ZS) were adopted to meet this requirement. Both ZCS and B8ZS ensure that a one appears in each consecutive octet in every transmission stream. These line coding formats are described next in more detail.

Alternate Mark Inversion

All transmissions generated by DS1s are encoded in the alternating mark inversion (AMI) line coding format. With AMI, a DS1 signal is a continuous stream of “1s” (encoded as +3V and –3V pulses) and “0s” (encoded as 0V pulses). For every 1 in the bit stream, a pulse occurs; for every 0, no pulse occurs. The pulses of successive 1s are of opposite polarity regardless of the number of intervening 0s (lack of pulses). That is, a the polarity of a 1’s pulse alternates plus or minus between successive ones. This type of line coding is called *bipolar* or *alternate mark inversion* (AMI). (See figure 1-7, *Alternate Mark Inversion*.)

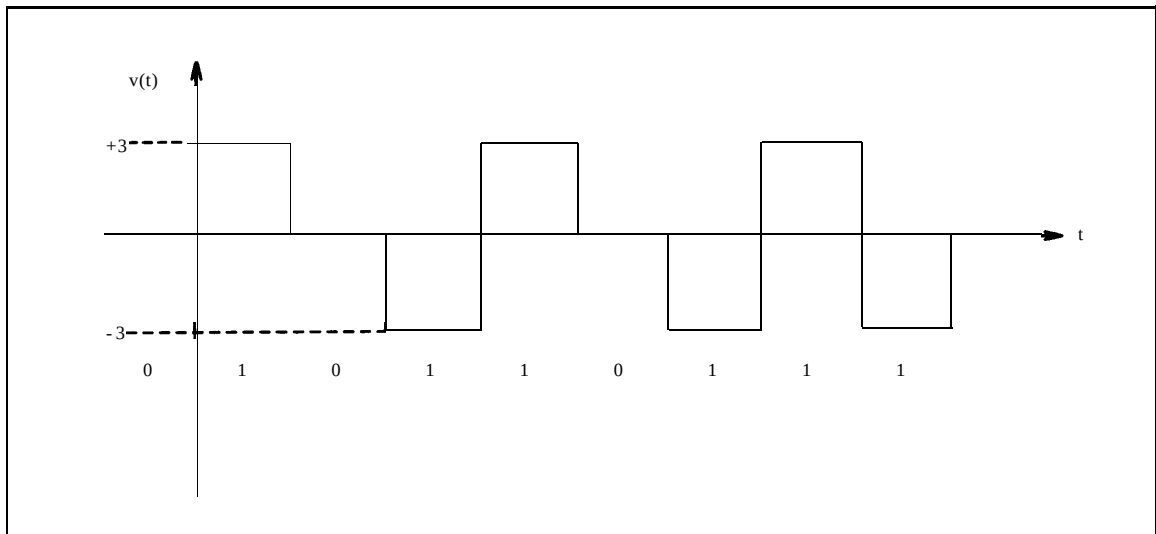


Figure 1-7. Alternate Mark Inversion

1s-Density Requirement

On the receive side, a DS1 uses the received bipolar pulses of the DS1 signal to recover the 1.544M-bps clock signal that transmitted the bit stream. To do this, the bipolar signal must contain enough pulses (1s) to allow the clock recover circuit to remain synchronized with the bipolar signal. This is known as the *1s-density requirement*.

If there are not enough 1s, the clock frequency drifts causing the bits to be received at a different rate than they were transmitted. If this continues, a surplus or deficiency of bits will accumulate at the receiving end. Eventually this surplus or deficiency will equal an entire frame's worth of bits (192). Then, an entire DS1 frame is either repeated or deleted to compensate for the differences in transmitting and receiving clock frequencies. This is called a *slip*. (Slips can also be caused by incorrect switch synchronization as discussed in the *Synchronization of Digital Facilities* chapter.)

The 1s-density requirement specifies that a minimum 1s-density average of 12.5% be maintained and that a maximum of 15 consecutive 0s can occur in the bit stream. If this requirement is not met, it is assumed that an error has occurred and that the network equipment will insert a series of ones into the bit stream to compensate.

Zero Code Suppression and Bipolar with 8 Zero Substitution

To guarantee that data transmitted over a DS1 facility contains enough 1s, a DS1 uses one of two coding options used with AMI line coding. The first option is zero code suppression (ZCS) and the second is bipolar with 8 zero substitution (B8ZS). The option chosen is made through DS1 administration, with ZCS being the default. When ZCS is used, DS1 provides *restricted* channels. When B8ZS is used, DS1 provides *unrestricted* or *clear* channels.

Restricted Channel

A *restricted channel* is a digital transmission facility restricted to transmissions in which an all-0s octet (eight 0s in a single time slot) is never transmitted. In restricted channels, the line equipment's transmitters use ZCS line coding. This format monitors the 24 DS0 channels and prevents eight consecutive 0s (the *all-0s octet*) from being transmitted. On detecting eight 0s, the line-coding format forcibly changes the second LSB to a 1 when it is transmitted because too many 0s causes loss of synchronization. This ensures that the 1s-density requirement is met but the receivers in these facilities have no way of knowing which 1s were 0s when transmitted and the data is destroyed. Therefore, user data transmitted in the DS0 channels with ZCS must be restricted to not generate the all-0s octet (hence the name restricted channels).

ZCS line coding is done in one of two ways:

- For data, a data communications protocol that does not produce the 0s octet is used. The high-level data link control (HDLC) protocol, or those protocols built on HDLC (such as the DCP, PRI, and BRI signaling protocols and DMI modes 2 and 3), do not generate an all-0s octet (when the signal is inverted before transmission) and therefore meets these requirements. Data mode 0 does not generate an all-0s octet if the data terminal equipment (DTE) transmits the HDLC protocol to the data module. (Data mode 0 is used only when a customer provides HDLC.)

For ISDN applications the LAPD protocol is used to make D-channel signaling messages. LAPD is an HDLC-based protocol. The D-channel is inverted before it is transmitted and, therefore, ZCS is never activated.

- For voice, 64K-bps PCM encoding is sent from the voice terminal over one of the I channels (DCP) or B-channels (ISDN-BRI) for call processing. At the DS1 board, when an all-0s octet is encountered on an outgoing call stream, the second least-significant bit of the octet is forcibly changed to a 1 before transmission. When the outgoing call is transmitted from a DS1 board, the board cannot discriminate between originating channel types. Since PCM does not generate an all-0s octet, the ZCS line-coding format does not affect 64K-bps PCM voice.

Unrestricted or Clear Channel

An *unrestricted channel* is a transmission facility that has no restrictions on the number of consecutive 0s so arbitrary insertions of 1s will not occur (as with ZCS line coding). The line equipment's transmitters and receivers in these facilities use *bipolar with 8 zero substitution* (B8ZS) line coding. This format monitors the DS1 bit stream, detects strings of eight consecutive 0s (not restricted to an individual octet), and encodes these 0s (including framing bits) into a unique bipolar pulse sequence (called a *bipolar violation*) that meets the 1s-density requirement. This sequence is detected at the receiver and converted back to eight consecutive 0s. Therefore, digital data can be transmitted on these channels without concern about its content (hence, the name *unrestricted* or *clear* channel) as shown in figure 1-8, *Example of B8ZS Line Coding*. See *AT&T Compatibility Bulletin No. 144: Clear Channel Capability* for the exact algorithms used in B8ZS.

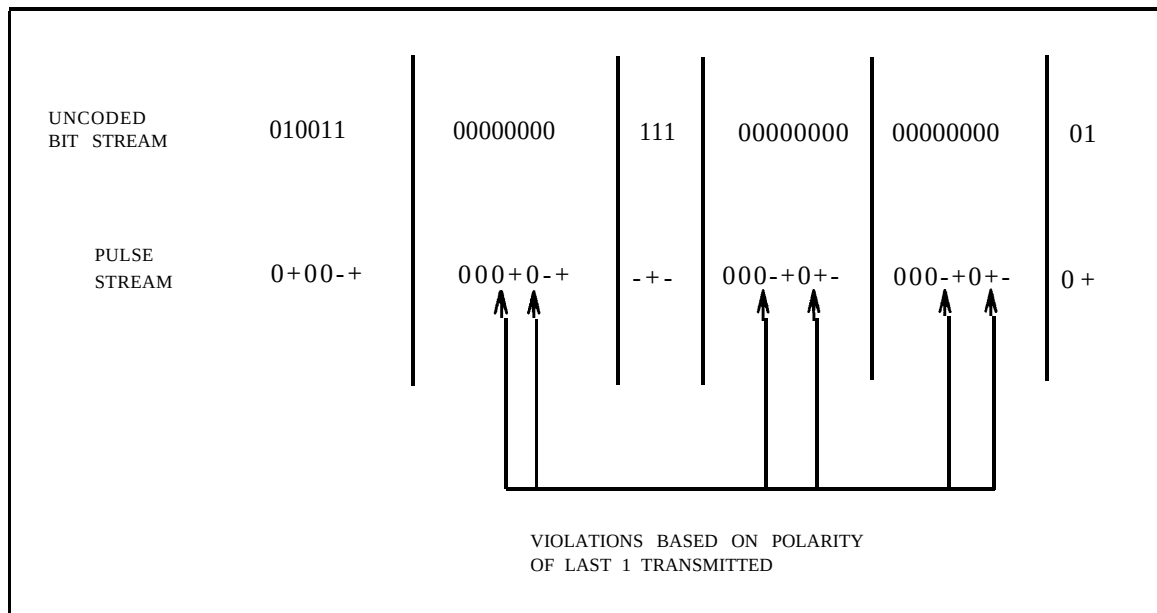


Figure 1-8. Example of B8ZS Line Coding

Applications requiring B8ZS line coding are currently in the minority, but it is expected that in the long term they will be in the majority. The B8ZS provides no substantial advantages for voice and voice-grade data signals over ZCS. However, if the data communications protocol does not already maintain proper 1s-density, then B8ZS is essential for transmitting unrestricted digital data. Even if the AT&T network contains unrestricted facilities, the access facilities through the local exchange may not, which means that you would still be required to use the ZCS option.

Differences Between ZCS and B8ZS

Differences between ZCS and B8ZS include:

1. ZCS requires that user data be presented via a data communications protocol that does not generate the all-0s octet, while B8ZS has no such restrictions
2. ZCS monitors each B-channel (not including the framing bits), while B8ZS monitors the entire DS1 facility (including framing bits)
3. ZCS maintains 1s-density at the expense of altering the data, while B8ZS maintains 1s-density without altering the data
4. When detecting the all-0s octet with ZCS, the transmit side inserts a 1 in the second LSB, which will not be corrected from by the receiving side. When detecting eight consecutive 0s with B8ZS, switch in the special B8ZS code word. The receive end monitors the DS1 bit stream and will switch in eight 0s when detecting B8ZS code words.

Bipolar Violations

As noted earlier, the DS1 bit stream is transmitted as a series of pulses. Successive pulses, regardless of the number of intervening spaces (0s), are of opposite polarity. A bipolar violation is the occurrence of two consecutive identical pulses, that is, when two positive or two negative pulses are received in a row, regardless of the number of intervening 0s.

Usually, bipolar violations are caused by noise hits on the DS1 bit stream. For B8ZS, strings of eight 0s are encoded into special sequences that include bipolar violations. Some network-interface equipment, primarily most network channel-terminating equipment, or NCTE (also called *customer-service units* or CSUs), and network transmission equipment (network high-speed multiplexer), will remove bipolar violations. Therefore, if an application requires B8ZS line coding, then the end-to-end transmission facilities must support B8ZS. Otherwise, the B8ZS encoding will be destroyed. Additional NCTE information is provided in chapter 3, *DS1 Transmission and Cabling*, and chapter 7, *Administration Issues, Options, and Requirements*.

A Generic 2 DS1 interface does not process bipolar violations, because they are removed by most NCTEs.

Communication Protocols and 1s-Density Requirement

As mentioned earlier, there are other methods (communication protocols) used to prevent strings of 0s from occurring in the DS1 bit stream. One such protocol is used with System 75 and System 85 as described next.

System 75 and System 85 digital ports interface to data modules. These data modules encode user data consistent with the DMI specification. The DCP is specifically designed to prevent generation of the all-0s octet when using DMI modes 1-3 and, therefore, either the ZCS or B8ZS line-coding formats may be used. But since the ZCS format has no special equipment requirements, ZCS is the preferred format.

Table 1-2, *Data-Module Capabilities*, summarizes the capabilities of the data modules that can be used on Generic 2 for communications over an ISDN-PRI link. For further details on each data module, refer to *About This Document* for a list of related data module documents. For complete definitions of the four DMI modes (0 through 3), refer to *Digital Multiplexed Interface (DMI) Technical Specification*, Issue 3.2, November 1989 (555-025-204). Ask for the most recent version.

TABLE 1-2. Data-Module Capabilities

Data Module	DMI Mode	User Data Rate	Sync/ Async	Bit Invert	Protocol Packaging	Handshake	Notes
DTDM	2	300 - 19.2K	both	yes	HDLC	mode 2	
MPDM	0	64K	sync	yes	no	mode 2	1, 9
	1	56K	sync	no	DDS	mode 2	
	2	to 19.2K	both	yes	HDLC	yes	
MPDM/M1*	1	56K	sync	no	DDS	no	2, 9
	2	to 19.2K	both	yes	HDLC	no	
3270 A	2	to 19.2K	both	yes	HDLC	mode 3/2 adapt	3
	3	64K	sync	yes	LAPD	mode 3/2 adapt	4
3270 T	3	64K	sync	yes	LAPD	mode 3	
PC/PBX w/ASCII Term Emul	2	to 19.2K	both	yes	HDLC	mode 3/2 adapt	5
	3	64K	sync	yes	LAPD	mode 3/2 adapt	
PC/PBX w/3270 Emulation	3	64K	sync	yes	LAPD	mode 3	
7500 UDM-T	0	64K	sync	no	no	no	6
	1	56K	sync	no	DDS	no	3 7, 8
	2	to 19.2K	both	yes	HDLC	mode 2	
	3	64K	sync	yes	LAPD/X.25	mode 3/2 adapt	

MPDM — modular processor data module

NOTES:

1. A mode-2 handshake works only on 64K-bps facilities (such as robbed-bit). (Use an MPDM/M1* for mode-1 calls made over robbed-bit facilities.) Since an ISDN-PRI link between a System 85 R2V4 and a Generic 1 uses these facilities, this handshaking will work.
2. You must use the MPDM/M1* when the far end data circuit-terminating equipment (DCE) is not another AT&T data module (does not do a mode-2 handshake).
3. "Mode 3/2 adaptive" means that a mode-3 handshake is attempted first. An algorithm is then followed to determine the far-end's mode and either switch to mode 2 or continue in mode 3.
4. Mode-3 data can only be circuit switched in System 85 R2V4 and Generic 1.
5. Mode 2 on the PC/PBX Connection is supported under the ASCII terminal emulation package.
6. It is expected that an option switch will be added to the 7500 to invert or not invert.
7. On outgoing mode-3 calls, the 7500 does not invert bits. On incoming calls, the 7500 checks the low-layer compatibility IE and either inverts or does not invert depending on the contents of the IE.
8. The algorithm for the mode 3/mode 2 handshake is different for DCP data modules and BRI data modules, which could cause DCP/BRI interworking problems.
9. Bit inversion is administrable; "no" is the default value.

Some applications where DCP and DMI formatted data are not used include the following:

- a. When 64K-bps data is transmitted across DS1/DMI/ISDN-PRI facilities (via a dedicated switch connection or DSC) to an endpoint such as a channel bank channel unit.
- b. When a point-to-point data application is done with CDMs to drop and insert DS0 channels. Here, it is up to the user endpoints to ensure that the 1s-density requirement is met.

The method used to provide ACCUNET[®] switched digital service (used by D4-channel banks) also maintains the 1s-density requirement. This method uses only seven of the eight bits for each DS0 channel's 8-bit word to carry user data. The remaining bit (8) is “wired” to a 1. (MPDM/M1* is compatible with ACCUNET switched digital service).

IMPORTANT CONCEPTS

Important concepts discussed in this section include:

- Common-channel signaling
- Alternate voice/data (AVD) trunks
- Bearer capability (BC)
- ISDN call processing
- CBC Service Selection
- Networking restrictions and ISDN-PRI limitations

Common-Channel Signaling

Originally, common-channel signaling (CCS) meant that any of the 24 channels could be used to transmit signaling for the other 23. To offer CCS, both RBS and 24th-channel signaling would have to be disabled to make all 24 channels available to transmit signaling.

Current AT&T applications use only the 24th-channel as the signaling channel and, therefore, the term CCS has been used more and more as a synonym for 24th-channel signaling. Misuse of the term CCS and its original definition have contributed to some misunderstanding. When comparing System 75 and System 85 DS1/DMI administration procedures, you will find that:

- a. The current definition of CCS is used when administering System 75 and Generic 1, although it is 24th-channel signaling that is actually being administered.
- b. The original definition of CCS cannot be administered for System 85 or Generic 2, however, 24th-channel signaling can be administered. For Generic 2, the equivalent terms, 23B + D or 24th-channel signaling, are used rather than CCS.

Alternate Voice/Data (AVD) Trunks

AVD is an attribute of trunks used with System 85 R2V4 and earlier releases, and System 75 R1V3 and earlier releases, and all Generic 1 switches. For Generic 2, *bearer capability*, which identifies the capabilities previously identified with AVD plus many more, is used instead.

AVD relates a trunk group's translations to the type of signaling required to support the trunk group. From the software perspective (and when applicable), a trunk group is administered for either AVD or voice. Trunk groups administered for AVD may be used for both voice and digital data applications and require a DS1 that is administered for 24th-channel signaling.

Bearer Capability (BC)

System 85 R2V4 introduced the administration attribute known as *bearer capability* (BC). The primary function of BC is to specify the transport mode and the channel requirements (clear/restricted) needed for completing a data call. BC is used for determining compatibility when non-ISDN facilities are connected to ISDN facilities, including originated calls, terminated calls, and tandem connections. BC must be administered for all trunk groups, every extension's class-of-service (COS), and all Automatic Route Selection (ARS) routing-pattern preferences.

System 85 R2V4

For System 85 R2V4, there are the five different BC codes:

- 0 *Voice and voice-grade data* — should be administered for DCP voice extensions, analog lines, analog trunks, and data applications that use modems.

NOTE: Except for 56K-bps, the trunk attribute AVD indicates 24th-channel signaling and whether a modem pool must be inserted to complete the call.

- 1 *Mode-1 data* — with the 56K-bps option — should be administered for 56K-bps synchronous data applications. DCP uses mode-2 handshake unless using MPDM/M1*.

NOTE: The appropriate data module must be installed and optioned for 56K-bps operation. This arrangement can be used to support the special format required to support ACCUNET switched digital service or 56K-bps basic service (if using MPD/M1*).

- 2 *Mode-2 data* — for data modules and EIA data terminations that do not operate as packet-mode data and are optioned for the following data rates: low, 300, 1200, 2400, 4800, 9600, 19.2K-bps. When appropriate, trunk groups that route to DS1/DMI/ISDN-PRI facilities should be administered for mode 2 data. DCP inverts the data and uses mode-2 handshaking.

- 3 *Mode-3 data* — should be administered for trunk groups that are used for packet mode data. DCP inverts the data and uses mode-3/2 handshaking. This is used for patterns associated with ISDN-BRI or PC-PBX.

- 4 *Mode-0 data* — should be administered for digital endpoints that are used to transmit 64K-bps data. These may only be DCP extension, DMI-BOS trunks, and ISDN-PRI facilities. DCP inverts the data and uses Mode 2 handshaking.

Depending on the administered value, an originated call will either require an ISDN channel, have an administered preference that an ISDN channel be used, or have no requirement for what type of facility is used to complete the call. For terminated calls and tandem connections, the BC class (BCC) for both links must be compatible. For example, voice and voice-grade data are equivalent to the no requirement case since the call characteristics for all other types of facilities are satisfactory. In contrast, B-channels transmitting 64K-bps digital data require that the connected channel have the same call characteristics (the same BCC) such as where an ISDN channel is required. This information appears in the traveling class mark (TCM) IE (layer 3) codeset 7 in System 85 R2V4, and in codeset 6 in Generic 2.

Generic 1

For information about how BC is done for Generic 1, refer to the *AT&T DEFINITY 75/85 Communications System Generic 1 and System 75 and System 75 XE Feature Description* (555-200-201).

Generic 2

Generic 2 continues the bearer capability concept with *bearer capability class of service*, (BCCOS). With BCCOS, switch administration software provides a range of codes from 0 through 255. Codes 0 through 8 are predefined as:

- 0 *Voice only* — used for voice application extensions (such as DCP and ISDN-BRI extensions, analog lines, and analog trunks)
- 1 *Mode 2 data* — used for EIA data terminations, and DCP or BRI data modules that do not operate as packet mode data and are optioned for any of the following data rates: low, 300, 1200, 2400, 4800, 9600, or 19.2K-bps
- 2 *Mode 3/2 adaptive data* — used for data applications that can run both mode 3 and mode 2 (such as BRI, PC/PBX, and the 3270 data module). The connection is first established with mode 3; if mode 3 fails, mode 2 is used.
- 3 *Unknown digital* — used for those calls of any mode (0-3) where the signaling message does not specify a mode (such as DS1 trunks using common-channel or 24th-channel signaling)
- 4 *Unknown analog* — used for voice or voice-grade data calls where the signaling message does not specify a type (such as analog trunks and robbed-bit DS1 trunks)
- 5 *Voice-grade data* — used for data applications that use modems
- 6 *Mode-0 data* — used for facilities that transmit 64K-bps data (DCP and BRI extensions, DMI-BOS trunks, and ISDN-PRI facilities).
- 7 *Mode 1 data* — used for 56K-bps synchronous data applications. The appropriate data module must be installed and optioned for 56K-bps operation.

NOTE: This arrangement can be used to support the special format required for ACCUNET switched digital service or 56K-bps basic service. DCP uses a mode-2 handshake unless an MPDM/M1* data module is used.

- 8 *Mode 3 data* — should be administered for those applications requiring packet mode data.

Lines, trunks, and AAR/ARS preferences are assigned the default BC when one is not administered. Generic 2 BCCOS defaults are intended to make a Generic 2 switch operate like a System 85 R2V4 (that is, Generic 2 will insert modem pool members and block calls). Table 1-3, *Bearer Capability Class of Service*, lists the default values for common switch parameters.

TABLE 1-3. BCCOS

Switch Parameter	Default Value
Analog Lines	0
All trunks except Host Access	0
AAR/ARS Preferences	0
Host Access trunks	1
DCP data modules (both lines and trunks)	1
BRI extensions	0

NOTE: Extensions with multiple appearances must have the same BC administered for each appearance.

ISDN Call Processing

ISDN-PRI is a trunk signaling type. ISDN trunk signaling is applied on a per-trunk-group basis and is compatible with most existing switch features. ISDN trunk signaling also supports many new networking features as described next.

Outgoing Calls

For outgoing calls, ISDN trunk groups may be categorized as those that:

1. Require that address digits be collected before trunk seizure (this can be done on non-ISDN trunks)
2. Seize the trunk and do not outpulse any digits (this is called *digit sending*)
3. Seize the trunk, obtain a start dial signal, and then begin digit outpulsing (this is called *cut-through dialing*) to the terminating switch

The ISDN protocol requires that all dialed digits be collected before trunk seizure so cut-through dialing cannot be provided for ISDN calls. Since few applications use digit sending, AAR or ARS software must be used to collect and process dialed digits. If the switch is properly administered and the numbering-plan data blocks are correct, AAR or ARS software processes dialed digits based on data within the routing pattern and routing preference combinations resulting in the selection of a particular service or feature. The routing pattern and routing preference combinations determine which outgoing trunk group is selected and whether ISDN-PRI trunk signaling is used.

Each call routed to an ISDN signaling trunk group generates a series of Q.931 messages over the D-channel. For example, the calling party IE of the ISDN-PRI setup message assembles the dialed digits as ASCII numbers that correspond to the defined numbering-plan format. Also included within the setup message are the BC requirements, B-channel identification, and network-specific facilities (NSF). If the requested facilities are not available, either channel negotiation is begun or, if appropriate, a cause failure code is returned and the call attempt is dropped. Otherwise, the called switch responds with a call proceeding or alerting message.

Incoming Calls

Incoming ISDN calls are generally processed similar to outgoing ISDN calls. Initially, the called switch receives a setup message over the D-channel and processes the contents of the setup message. The call states of the switch, how the particular trunk groups are administered, and decisions taken as a result of processing the setup message will determine exactly how the ISDN call is processed.

Summary

ISDN calls are processed using conventional, well-established, time-proven call-processing techniques. The ISDN layer-3 software maintains status records for the ISDN call states, maintains the call-reference value (CRV) for each B-channel, and starts sending messages. To request services from the conventional call-processing routines, ISDN layer-3 software informs the switch of items such as incoming calls and dialed digits.

The ISDN-PRI level-3 messages are a collection of IEs that are defined in the Q.931 recommendations. Each message has at least one IE. IEs are transmitted and received over the D-channel. IEs contain three headers: protocol discriminator, call reference, and message type. Figure 1-9, *ISDN Message Signaling Format*, shows the message-signaling format.

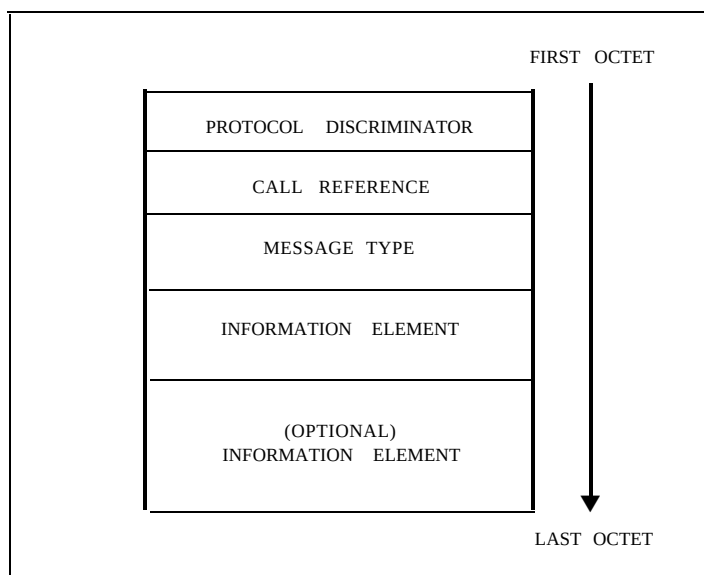


Figure 1-9. ISDN Message Signaling Format

IEs may be one or more octets long, depending on the element type. There are 133 different IE identifiers (called *codepoints*) grouped into eight functional categories (codesets 0 through 7).

How trunk groups are constructed and how ISDN-supported features are administered determines which B-channels may be selected to originate and terminate a particular call. Generally, any B-channel may be used with both originating and terminating calls so a particular channel may support a variety of applications and trunk types. In Generic 2, this capability is called *ISDN dynamic* where channels can support several trunk types on a dynamic, call-by-call basis; in Generic 1, it is called *call-by-call* (CBC). For both Generic 1 and Generic 2, this feature is called *CBC Service Selection*.

Administration software also allows services to be dedicated to specific channels by assigning a channel to a particular trunk type. In this way, the switch always provides enough trunks for a particular type of service. Channels administered for specific services are not available for ISDN-dynamic uses.

With CBC Service Selection, calls requesting various types of services are routed, on a call-by-call basis, over the same ISDN channels. To distinguish between various types of calls, the service type is specified as a part of the message. Also included are BCC and NSF IEs.

The NSF IE identifies the feature or service provided by the network carrier (such as MEGACOM service from AT&T). The called-party IE is used to specify routing digits such as the North American dialing plan and the RNX.

The originating and terminating switches do *channel negotiation* to select a channel that is compatible with both endpoints. Channel negotiation gives some control to the B-channel that is used for the call. If the originating endpoint chooses a B-channel that is unacceptable to the terminating endpoint (for example, planned use of the channel by the terminating endpoint), then the terminating endpoint can request a change in the channel to be used for that call.

Although Q.931 recommendations allow for an asymmetrical design (that is, a user-to-network protocol), most ISDN-PRI procedures on System 85 R2V4, Generic 1, and Generic 2 can be used symmetrically. These communications systems can be administered as either the user side or as the network side. When accessing a 4ESS switch, 5ESS® switch, or vendor-compatible toll-office or CO, the customer-premises switch must have a user-side interface. For ISDN-PRI links between two private network switches, one link must be administered for the user side and the other for the network side.

Differences between the user side and network side are primarily related to resolving occurrences of *glare*. Glare is a condition where both switches try to originate a call on the same channel simultaneously. The network side always gains control of the channel and the user side backs down (terminals are excused from certain protocol functions).

Calls from non-ISDN facilities (analog trunks and/or DMI-BOS trunks) may be connected to ISDN facilities to provide end-to-end tandemed connections. The switch provides the required signal conversions through *interworking routines*. Depending on an extension's COS assignment and other administration options, all conventional switch features and services may be used.

Depending on other administration options, message-associated user-to-user information (MAUUI) or user-to-user information (UUI) may be transmitted from one user endpoint to the other. UUI transfer includes the display of such things as calling number and calling party name.

Equipment manufacturers interpret the ISDN-PRI protocol in different ways. As a result, equipment (and various equipment releases) use different approaches. Currently, one significant difference affects codesets 6 and 7. System 85 R2V4 transfers UUI via codeset 7. System 85 R2V4 transfers network specific information in codeset 7 according to the initial definition of ISDN. Generic 2 transfers network-specific information in codeset 6 leaving codeset 7 available for user-specific information.

NOTE: Codesets 1 through 5 are reserved for future standards expansion.

CBC Service Selection

CBC trunk groups eliminate the need for dedicating specific B-channels to a particular service. CBC Service Selection can dynamically select individual B-channels (from a group of B-channels) and allocate those B-channels to any of the subscribed services. The selected B-channel may function as a specific trunk type (for a specific service) during one call, then later the same B-channel may function as a different trunk type (for a different service) during another call. The primary advantages of CBC Service Selection include:

- More efficient and effective use of ISDN-PRI network access trunks
- More access trunks available for call routing (providing an improvement in the grade of service)
- Reduction (usually) in the number of access trunks needed to provide the required grade of service, because of the increase in efficiency

CBC Service Selection is a public network ISDN feature. The AT&T ISDN network provides CBC Service Selection for AT&T ISDN nodal services (such as MEGACOM service, MEGACOM 800 service, Software Defined Network (SDN), ACCUNET switched digital service). To use CBC Service Selection, the customer-premises switch must manage access to these nodal services. System 85 R2V4, Generic 1, and Generic 2 all provide CBC service selection. Because of architectural differences, these communications systems provide different levels of implementation.

From the customer-premises switch perspective, a CBC trunk group may be designed to support incoming nodal services, outgoing nodal services, or both.

System 85 R2V4/Generic 2 — CBC Implementation

The following describes details of CBC on System 85 R2V4 and Generic 2:

1. With System 85, station identification number/automatic number identification (SID-ANI) can be requested on per trunk group basis but not from the network on a per call basis. Therefore, if the particular trunk group provides CBC service selection, then all calls, regardless of the particular nodal service, must provide SID-ANI.

At service provisioning time, the customer will determine whether to subscribe to this network service. From the AT&T network perspective, this service is available in either of two formats:

- SID-ANI provided on every call
- SID-ANI provided on request, call by call

Regardless of which format is selected, ANI or SID can be ordered exclusively, or the service can be ordered as ANI preferred but will accept SID.

2. Generic 2 does not use the NSF value for processing incoming calls. Instead, switch functions are based on an early interpretation of the ISDN-PRI standard that assumes that the network will not deliver an NSF. Therefore, incoming calls are routed based on the number of digits delivered and the format of those digits. These conditions (the number and format of the digits) may impose restraints on the use and administration of CBC Service Selection.
3. System 85 R2V4 introduced a new trunk type known as ISDN-dynamic. ISDN-dynamic trunk types can only be used with ISDN-PRI facilities. Most other trunk types may be used with ISDN-PRI as well as other facilities. ISDN-dynamic trunk types are useful where more than

one trunk type is needed, only one trunk group is available, and conventional routing digits are inadequate for the current application (for example, when using the same trunk group to provide DID, SDN, and DOD). A single trunk type, other than ISDN-dynamic, cannot provide all services since some calls use CO or tie trunk types.

4. Each AT&T ISDN-PRI nodal service (MEGACOM 800, SDN, ACCUNET switched digital service) may be provisioned to deliver from 0 to 7 digits.

Generic 1 — Implementation

The following describes details of CBC on Generic 1:

1. The SID-ANI number can be received either per trunk group or per call
2. When receiving calls over a CBC trunk group, define the usage-allocation plans. These plans prevent a particular nodal service from monopolizing a trunk group or being deprived of the minimum number of trunks.
3. On Generic 1, the “service type” field on the trunk group form permits entries such as CBC, access, tie, and tandem. When CBC is administered, the call-processing software analyzes the NSF (for incoming calls) for called party number or length. The other entries do not analyze the NSF but permit CBC Service Selection.

Networking Restrictions and ISDN-PRI Limitations

ISDN-PRI has the following limitations:

1. ISDN-PRI facilities cannot be used to connect a main and a satellite (such as a main/satellite trunk). ISDN-PRI trunks provide more feature capabilities than conventional main/satellite trunks. Therefore, it is recommended that AAR be used with ISDN-PRI trunks to provide private network facilities.

Even though main/satellite trunks cannot be used over ISDN-PRI facilities, the main/satellite feature may still exist on a switch that uses ISDN. For example, ISDN-PRI facilities may be used to access the public network using the ARS software while non-ISDN-PRI trunks (such as main/satellite trunks) may be used to connect subtending switches to the main switch. Calls may originate and terminate on the satellite or on the tandem through the main, and route onto the ISDN public network via ISDN-PRI trunks.

2. Centralized Attendant Service (CAS) uses an ISDN-PRI unsupported trunk type. Therefore, CAS is unavailable with ISDN-PRI facilities.
3. Distributed communications system (DCS) network configurations are supported over ISDN-PRI facilities. However, a separate DCIU signaling link is required. This separate signaling link may be a B-channel that is used as a DSC or an analog facility.
4. ISDN-PRI and DCS are two separate networking services. If DCS is used over an ISDN-PRI trunk, in most cases the DCS display appears instead of the ISDN-PRI messages.

With ISDN-PRI, the calling party information is sent to the called party and the called party information is returned to the calling party.

5. Interworking between ISDN-PRI and DCS is a complex issue that is beyond the scope of this document. However, for a combined ISDN-PRI/DCS network, several new ISDN feature and service options are available. These include:
 - Call routing based on BC
 - End-to-end ISDN connectivity routing
 - BC passed on a call-by-call basis
 - User-to-user information transport
 - Locally provided tones
 - Controlled initialization of trunks to in-service at provisioning time
 - Two-way busy out of trunks
 - Digital demand transmission test
6. Generally, DCS networks may overlay on an electronic tandem network (ETN) or main/satellite network. For DCS call routing, ETNs use AAR to complete DCS calls while main/satellite networks use multidigit steering software to complete DCS calls. Therefore, if DCS trunks are provided over ISDN-PRI facilities, then the switch must be configured with AAR. (See item 1 of this list for more information.)
7. DCS software requires that the calling-party number be part of a 4- or 5-digit uniform dial plan. The ISDN-PRI public-network dial plan uses a 10-digit format while the ISDN-PRI private-network dial plan uses a 7-digit format. Proper digit conversion (10- or 7-digit format to the 5- or 4-digit format required for DCS) is provided through the switch administration procedures.
8. When Generic 2 connects to a System 85 R2V4 using ISDN-PRI facilities to provide DCS service, then the originating extension will not receive display updates as the call progresses (for example, to call coverage or is forwarded). The DCS leave word calling feature is only applicable for 4- or 5-digit extension numbers; it will not function with 7- or 10-digit public- or private-network numbers.

Full DCS feature transparency is provided between two or more Generic 2s interconnected with ISDN-PRI facilities. The supported voice terminal features include:

- Abbreviated dialing
 - Alphanumeric display
 - Automatic callback
 - Call coverage
 - Call forwarding — all calls
 - Call waiting — terminating
 - Call waiting — conference
 - Priority calls
 - Distinctive ringing
 - Leave word — calling (no AP)
 - Leave word — call transfer
9. When ISDN-PRI facilities connect an ETN main to an ETN tandem, the main must do additional routing since cut-through operation is not permitted. Dialed digits must first be collected and then the setup message transmitted to the tandem.

Automatic Voice Networks (AUTOVON) and tandem tie-trunk networks (TTTN) and Common-Control Switching Arrangement (CCSA) or Enhanced Private Switched Communications Service (EPSCS) networks that use E&M trunks cannot be served by ISDN-PRI trunks. DS1 facilities that use robbed-bit inband signaling will work. AUTOVON service is not supported for Generic 2 version 1.0 equipped with one or more universal modules.

2. NETWORK CONNECTIONS AND CONFIGURATIONS

This chapter provides a description of common connection arrangements with System 85 R2V4, DEFINITY® Communications System Generic 1 and Generic 2. These connections include private network, public network, and those made through digital signal level 1 (DS1) auxiliary equipment. Also included is a description of the services provided by each connection, any option restrictions, and relevant synchronization issues.

The equipment used for completing the end-to-end connection may include any of the options described in chapter 3, *DS1 Transmission and Cabling*. These options permit distances between endpoints of a few feet to thousands of miles. Detailed information, such as that required to install and administer a connection, is contained in chapter 6, *Port Types/Installation Compatibilities*, and chapter 7, *Administration Options and Requirements*. Common field problems relating to these connections are described in Appendix B, *Sample Installation and Maintenance Problems*. A complete description of synchronization is provided in chapter 5, *Synchronization of Digital Facilities*, and loss adjustments are described in chapter 4, *The Digital Loss Plan*.

NETWORK DIFFICULTIES

Two of the many difficulties that can exist on public and private networks are hyperactivity and glare. Before describing connection arrangements, the methods for dealing with these two difficulties is discussed.

Hyperactivity

When a DS1 facility generates an abnormally high stimulus rate originating from an individual source over a certain amount of time (such as rapid on-hook and off-hook conditions), it is said to be *hyperactive*. The call-processing software can not handle the flood of stimuli, resulting in dial-tone delays. Hyperactivity can be caused by bit errors on the facility, misoptioned equipment, or hardware failures. Severe or long-lasting hyperactivity can overload the communications system with more messages than it can process. Without intervention and corrective action, this could result in degradation or even loss of service on the switch.

On Generic 2, special software handles hyperactivity by executing the following steps:

1. Detecting the presence of possible hyperactivity
2. Identifying a suspected source of hyperactivity
3. Examining the suspected source
4. Arresting the message flow from the suspected port, usually protecting the communications system from excessive stimuli

5. Counting the number of messages and comparing this to other trunks
6. Determining whether a channel is hyperactive
7. Maintenance busying out a virtual trunk group with hyperactive channels or returning cleared channels to normal service

For more information about troubleshooting hyperactivity, refer to *DEFINITY Communications System Generic 2 Maintenance Repair Strategies* (555-104-118).

Normal, though temporarily high, levels of ISDN-PRI D-channel signaling can sometimes create apparent hyperactivity. This happens most often with nonfacility-associated signaling (NFAS) when many B-channels are associated with a particular D-channel. This problem is handled similarly to that described above with the exception that hyperactive D-channels are removed from service (associated B-channels are busied out). Usually, but not always, this problem is transient and disappears before a yellow alarm is sent. If this is a chronic problem in a particular configuration, administration of the NFAS B-channel group can be an effective solution.

Another category of hyperactivity involves digital communications protocol (DCP) equipment. DCP hyperactivity is not directly relevant to DS1, digital multiplexed interface (DMI), or ISDN-PRI, and is not discussed in detail here. DCP hyperactivity and DS1 hyperactivity are handled similarly.

Glare

Glare is the simultaneous seizure of a two-way trunk by two communications systems, resulting in a standoff. Because of ISDN's inherent negotiation capabilities, glare handling on ISDN-PRI trunks is different from that for other trunks. When both sides of the trunk are seized at the same time and setup messages cross on the D-channel, two rules are used to decide which side "wins" (succeeds in making a call on that channel) and which side "loses" (backs off or moves to a different trunk).

The first rule is evaluated using a parameter indicated in the Channel-ID information element (IE), called the *preferred/exclusive* option. This option specifies that either the channel is the only one that can be used for this call, or that the call can be completed over a different channel, specified by the destination switch, if the indicated channel is busy. The full benefits of using the preferred option are only reached if both switches can negotiate. A System 85 or Generic 2, having full negotiation capabilities, always sends a preferred indication, with one exception. In a DCS environment negotiation is impossible, so the exclusive option is used. The 4ESS, in ISDN Phase 2, always uses the preferred option. In terms of glare, if both calls are exclusive, or both calls are preferred, the second rule (described below) is used to decide which call wins. If one call is exclusive and the other preferred, the exclusive call wins the trunk.

The second rule is based on the translation field *Interface Type* in procedure 262, word 1, which is set to either *network* or *user*. This field always has opposite settings on either side of the PRI. When a System 85 R2V4 or Generic 2 is connected to the AT&T public network or a central office (CO), it is translated as *user*. Otherwise, such as when several switches are networked together, the choice of *network* or *user* is optional. When glare occurs and both calls are preferred or both are exclusive, the *network* side wins.

This means that in the exclusive case, the network's call completes, and the user's call must either wait or find another trunk. In the preferred case, the network's call completes, and the user's call is assigned to another trunk in this trunk group that is controlled by the same D-channel.

DS1/DMI PRIVATE-NETWORK CONNECTIONS

Private-network connections include DS1/DMI connections to other customer-premises switches, host computers, and off-premise stations. These types of private network connections are described next.

Generic 1, Generic 2, System 75, or System 85 to Another System

The most frequent application for DS1/DMI with bit-oriented signaling (DMI-BOS) is to provide digital tie trunks that link one switch to another. These tie trunks can be used to transmit voice, voice-grade data, or digital data from one switch to another.

If the two endpoints are colocated, then there are no transmission carrier facilities between the endpoints and any combination of signaling, framing, and line coding may be used. However, both endpoints must be administered for the same options. When carrier facilities connect to DS1/DMI endpoints, the carrier facilities may place limitations on the permitted options. When two or more switches are connected together, they must be synchronized; one switch must be chosen as the timing master, and the others must derive timing from this master. Refer to chapter 5, *Synchronization of Digital Facilities*, for a description of synchronization procedures.

DMI with message-oriented signaling (DMI-MOS) is used exclusively to support connections to a compatible computer. DMI-MOS connections between a System 85 to System 85, System 85 to Generic 1, System 85 to Generic 2, Generic 1 to Generic 1, Generic 1 to Generic 2, or Generic 2 to Generic 2 (that is, switch-to-switch) are supported when they are a part of the link that terminates on a compatible computer.

Host Computer to Another System

Whenever a DS1/DMI connects to a computer, it functions exclusively as a DMI. This application requires a DMI trunk type, 24th-channel signaling (either BOS or MOS, depending on the installation). DMI provides 23 data channels to the computer. Each channel is the functional equivalent of one port that can be used to transmit digital data at rates up through 64K-bps.

Any combination of framing and line coding is acceptable as long as each endpoint uses the same options and as long as any restrictions placed by the network facility (if used) are satisfied. However, when end-to-end transmission facilities will support extended superframe (ESF) framing and bipolar 8 zero substitution (B8ZS) line coding, then it is recommended that either or both be selected. For DMI-MOS applications, the ESF framing option provides additional maintenance capabilities. With System 85 or Generic 2, allowed DMI trunk types are 108 (wink-in/auto-out) and 109 (wink-in/wink-out). With System 75 or Generic 1, the allowed trunk type for DMI-BOS is DMI and the available signaling types (in/out) are *auto/auto*, *auto/immed*, *auto/wink*, *wink/auto*, and *wink/wink*. With System 75 or Generic 1, the allowed service type for ISDN is DMI-MOS. Other trunk types are

administrable but will not work for DMI-to-host-computer applications. Current versions of the AT&T 3B5 and 3B15 computers (DMI) provide E&M trunk signaling and only support the *wink-in/wink-out* trunk type.

Regarding synchronization, the computer must always derive its timing from the DMI signal received from the switch. The computer should never be used as a timing reference by the switch; this would cause each endpoint to get its timing from the other endpoint.

According to the AT&T DMI technical specification, DMI is an open-architecture interface. Therefore, the System 75, System 85, Generic 1, and Generic 2 DS1s/DMIs are compatible with other vendor computer endpoints when used in DMI applications. However, each vendor must pass a certification program to ensure compatibility and compliance.

IBM® IDNX Multiplexer to Another System

The IBM IDNX multiplexer is not a host endpoint, although it connects to a front-end processor or host computer. This is not a DMI-to-host configuration and the DMI trunk type will not work for this application. The only requirement is that 24-channel signaling and the BOS format be used. All other options, including trunk type, are application dependent.

Other Vendor Digital Switch to Another System

When a System 75, System 85, Generic 1, or Generic 2 DS1/DMI connects to another vendor's customer-premises switch (another vendor's DS1/DMI), several items should be verified to determine compatibility:

- The interface electrical characteristics
- Options
- Synchronization capabilities

The following key questions should be answered:

- Does the vendor product provide a DSX-1 interface (see chapter 3, *DS1 Transmission and Cabling*)?
- Does the vendor product support at least one each of the line coding, framing, and signaling options provided by System 75, System 85, Generic 1, and Generic 2?
- Does the vendor implement AT&T ISDN specification?
- Does the vendor support DMI modes?
- For synchronization purposes, what stratum clock does the vendor switch provide?
- Will the vendor switch act as a timing master or slave time to the communications system?
- Does the vendor switch implement the digital loss plan specified by ANSI/EIA/TIA-464-A-1989?

Depending on the answers to these questions, basic compatibility can be determined. However, because System 75, System 85, Generic 1, and Generic 2 DS1/DMI are not generally tested for

compatibility with other vendor products, operation is usually not guaranteed. The only exception to this rule is DMI host applications, where the certification process is assumed to have been executed with the specific computer vendor in question. The certification process also includes verifying that the vendor's host DMI is premises distribution system (PDS) wiring compatible.

Analog Switch to Another System

A D4-channel bank may be used in front of an analog switch (such as a DIMENSION® or other vendor switch) to terminate DS1/DMI-BOS. This connection supports any tie trunk (trunk type) that is common to either System 75, System 85, Generic 1, or Generic 2, and the analog switch (that is, a wink-in/auto-out trunk may be administered if the analog switch supports an auto-in/wink-out trunk type). Trunks that include a digital-to-analog conversion such as these are called *combination tie trunks*.

The D4-channel bank has several requirements and option restrictions when used for this application. First, 4-wire E&M extended range (ER) channel units (or their equivalent) should be used. Only ER units contain variable attenuators that provide a range from 0 to 25.5 dB of loss in each direction and eliminate the need for external attenuators. This wide loss range permits the trunk transmission level to be adjusted to the level that complies with the level specified in chapter 4, *The Digital Loss Plan*. Second, when connected to a D4-channel bank, D4 framing, robbed-bit signaling, and ZCS line coding must be used. Finally, D4-channel banks should be configured with an office interface unit (OIU-2) and, for synchronization purposes, be optioned for loop timing.

OPS to Another System Via a D4-Channel Bank

DS1/DMI-BOS may be used (as an inexpensive means) to support up to 24 analog off-premises stations (OPS). This connection arrangement uses a D4-channel bank that is configured with FXS channel units or their equivalent.

The loss provided by the FXS channel units should normally be correct according to the specifications. If the loss is not acceptable, external pads or FXS with gain transfer (FXS/GT) channel units (or their equivalent) may be used. Refer to chapter 4, *The Digital Loss Plan*, for specific details.

To support ringing at the OPS end, the D4 must be configured with a noninterrupted ringing generator. The ringing signal is interrupted by the communications system end. Also, the D4-channel bank should be configured with an OIU-2 and, for synchronization purposes, be optioned for loop timing.

From a System 75, Generic 1, System 85, or Generic 2 perspective, since a DS1/DMI-BOS connection is to a D4-channel bank, D4 framing, robbed-bit signaling, and ZCS line coding must be used. The OPS ports do not support the message waiting feature. Therefore, the feature should be administered as turned-off for each OPS channel.

In addition to voice, the OPS channels can also be used to transmit voice-grade data.

DS1/DMI PUBLIC-NETWORK CONNECTIONS

Public-network connections may include connections to COs, DACS frames, and toll offices.

4ESS to Another System (Special-Access Connection)

Connections to a 4ESS switch are called *special-access connections*. The physical connection is made directly from customer premises to the 4ESS. Toll calls go directly from a System 75, System 85, Generic 1, or Generic 2 to the AT&T toll network.

The physical connection to a 4ESS toll switch is made (through the digital interface frame, or DIF) to a SM9 circuit pack.

With a 4ESS, several suggestions are applicable for the special-access connection. These suggestions and how they apply are described below.

Framing, Signaling, and Line Coding

A 4ESS provides the option of selecting either D4 or ESF framing, ZCS or B8ZS line coding, and either robbed-bit signaling or ISDN-PRI.

E&M or Reverse-Battery Signaling

A 4ESS has been used traditionally in a class-4 or higher toll office and was not initially designed to support lines. A 4ESS can only provide E&M and reverse-battery signaling. For DS1/DMI-BOS, these signals are identical to E&M signaling. Therefore, all trunks (channels) terminating on a 4ESS should be administered as either E&M or Direct Inward Dialing (DID) trunk type. (Refer to *Special Access Connections to the AT&T Communications Network for New Service Applications* (326-204) for more information.) The following options are applicable for these connections:

- E&M both one-way and two-way operation; either immediate start, wink start, or delay dial
- Reverse-battery — one-way incoming, either immediate start or wink start.

Dial Tone

Second dial tone may be provided by a 4ESS. However, it is recommended that a System 75, System 85, Generic 1, or Generic 2 tone plant be used to provide a second dial tone. With this arrangement, the second dial tone can be provided through use of the Automatic Route Selection (ARS) feature on all DS1/DMI-BOS trunks that terminate on a 4ESS.

Touch-Tone Capability

A 4ESS supports dual-tone multifrequency signaling (DTMF).

Screening Intra-LATA Calls

A 4ESS can be used to block within the local access and transport area (LATA). This is an inefficient use of the customer's trunking arrangements, though. System 75, System 85, Generic 1, and Generic 2 special-access applications should use ARS to screen outgoing calls. By using the ARS feature, only inter-LATA calls are routed to a 4ESS.

Synchronization

A 4ESS is always synchronized to the AT&T reference frequency (formerly the Bell System reference frequency). Therefore, for special-access applications, a System 75, Generic 2, System 85, and Generic 2 normally uses a 4ESS as the master clock source. A particular DS1/DMI-BOS may or may not be selected as the clock reference to the switch, depending on the use and reliability of other interfaces. The rules and considerations for selecting a synchronization source are detailed in chapter 5, *Synchronization of Digital Facilities*.

5ESS to Another System

A 5ESS® is most frequently used by a local exchange company (LEC) or as a large customer-premise switch. A 5ESS provides digital CO services, both to subscribers and customer premises switches (such as System 75 or System 85). With respect to System 75, System 85, Generic 1, and Generic 2 DS1/DMI-BOS connections, a 5ESS supports digital ground start, reverse battery, and E&M trunk types.

Connections between a 5ESS and a DS1/DMI-BOS are supported by a variety of 5ESS digital port boards, and possibly with additional external equipment.

For digital, E&M, and reverse-battery trunk types, a DS1/DMI-BOS connects to an ANN3, ANN3B, or ANN3C digital trunk port. The ANN3, ANN3B, and ANN3C provide D4 or ESF framing, ZCS or B8ZS line coding, and only robbed-bit signaling. When connecting to these types of digital trunk ports, the DS1 channels appear on the trunk side of a 5ESS.

For digital ground-start connections to a 5ESS, a DS1/DMI-BOS connects to an ANN4 port board through a subscriber loop interface module (SLIM). Either D4 or ESF framing, ZCS or B8ZS line coding, and robbed-bit signaling can be used. The ANN4 port board uses the signaling link code (SLC) format, and a SLIM is necessary to convert between the framing format used by DS1/DMI-BOS and the SLC format used by the ANN4. Because of the additional equipment necessary to support ground-start connections, E&M and reverse-battery connections are preferred.

NOTE: To support these ground-start connections, the SLIM must be configured with the WP55 circuit pack. The SLIM contains five rocker switches labeled 1 through 5. Switches 1, 2, and 4 must be set closed. The unit must be power-cycled reset to initialize the unit's circuits.

A 5ESS may or may not be synchronized to the AT&T reference frequency. This issue should be verified. In either case, a 5ESS has a lower stratum (higher accuracy) clock than a System 75, System 85, Generic 1, or Generic 2. A particular DS1/DMI-BOS may or may not be selected as the clock reference to a System 75, System 85, Generic 1, or Generic 2, depending on the use and reliability of all other DS1s.

DACS to Another System

The DACS may be thought of as an “electronic patch panel” for DS1/DMI-BOS. Cross-connections may be made at either the DS1 (1.544M-bps) level or the DS0 (64K-bps) level. A fully equipped DACS can terminate or cross connect 127 independent DS1/DMI-BOS facilities.

The DACS supports both D4 and ESF framing, both ZCS and B8ZS line coding, and depending on the DACS software version, both RBS and DMI-BOS signaling. DACS only supported RBS before release of Generic 8.2.

The DACS digroup card (AMM180B or later version) is required to provide DMI-BOS signaling. The DACS does not provide DMI-MOS or ISDN-PRI.

The primary capability of DACS is to function as a node or hub for DS1/DMI-BOS links. Some of the channels on a DS1 link may be routed to one location, while the other channels are routed to one or more other locations. This separate, recombine, and reroute feature significantly increases the flexibility of DS1/DMI-BOS links. For example, a DS1/DMI using DMI-BOS may use some channels for voice and the other channels for digital data applications. The DACS can route channels used for digital data to one location (for example, a DMI-BOS host computer) and those channels used for voice to another location (for example, the public network).

Each AMM180B circuit pack must be administered compatible with its associated DS1/DMI-BOS. The DACS controller may not only be used to connect one compatible link to another compatible link (such as robbed-bit to robbed-bit and DMI-BOS to DMI-BOS), but it will convert a robbed-bit interface to DMI-BOS and vice-versa.

The DACS provides an additional feature that is known as Customer Controllable Reconfiguration (CCR). This feature enables a customer to reconfigure the electronic cross-connections based on demand or time of day. As an example, this feature allows a customer to use the same DS1/DMI-BOS (between a System 75 or System 85 and a DACS) for voice traffic to one destination during the day and for data traffic to another destination during the night. The reconfiguration is not instantaneous, but occurs within about three to five minutes, from submission of a reconfiguration request.

The DACS contains a stratum-3 clock. In virtually all cases, it can be assumed that the DACS will also be synchronized to the AT&T reference frequency. Therefore, a suitable primary or secondary synchronization reference may optionally be obtained from the DACS.

Analog CO to Another System Via a D4-Channel Bank

DS1/DMI-BOS connections may be made to any analog CO through a D4-channel bank. The channel units used in the channel bank at the CO end will depend on the type of service desired. The switch CO trunks (CO, FX, WATS, and RA trunks) are supported through either FX office (FXO) or special-access office (SAO) channel units. Although DS1/DMI-BOS supports both channel units, administration procedures now permit only FXO channel units to be used. DID trunks are supported through dial-pulse originating (DPO) channel units. Tie trunks (if applicable) are supported in the same way as described in the *Analog Switch to Another System* section. The corresponding DS1/DMI-BOS channels must be administered consistently at the switch end.

Since the D4-channel bank is located at the CO end of a DS1/DMI facility, it is the responsibility of the CO to set the channel unit attenuators to the appropriate loss values. Chapter 4, *The Digital Loss Plan*, includes suggested loss ranges for setting these attenuators.

For synchronization purposes, it should not be assumed that a D4-channel bank (residing in a CO) will obtain its timing from the AT&T reference frequency. If the D4-channel bank is a standalone unit at the CO, it should use the DS1/DMI-BOS received from the System 75 or System 85 as its timing source (loop time). If it is verified that the D4-channel bank is synchronized to the AT&T reference frequency, then the D4-channel may be used as a synchronization reference.

The DS1/DMI-BOS connections may also be made to any digital CO that does not have DS1 trunks with a D4-channel bank.

DS1/DMI TERMINAL-EQUIPMENT CONNECTIONS

This section describes the use of DS1/DMI-BOS-compatible external terminal transmission equipment. The terminal transmission equipment provides additional features and capabilities that make DS1/DMI-BOS facilities more useful and economical.

DMI-MOS/ISDN-PRI connections to in-series terminal transmission equipment are rarely used. The options selected for each piece of equipment must be compatible with those selected for the associated DS1/DMI-BOS.

Since this equipment is external to the switch, an important aspect of its use is how alarms on the equipment are detected. All external equipment providing alarm outputs should be connected to a System 75 or 85 external alarm interface. The various alarms and how they are used are also described.

Since the terminal transmission equipment is in series with a DS1/DMI-BOS facility, the equipment does not have an effect on the use of the facility as a system clock reference. This is determined by the final destination of a DS1/DMI-BOS facility.

CDM

Channel division multiplexer (CDMs) are normally paired together in one of two applications. The first is to emulate a D4-channel bank. The second, more common application uses CDMs to provide a drop and insert function between switching locations.

When emulating a D4-channel bank, CDMs are used at one or both ends of a DS1 facility. Access to the individual channels is provided with channel units, same as with channel banks. Most of the channel units available for the D4 may also be used in the CDM. This allows those DS1/DMI-BOS channels used by the CDM to be used for the same applications as the D4-channel bank.

Channel units are most frequently used to provide dedicated data connections between a group of terminals on one end and a computer on the other end. However, voice and some video applications may also be supported.

When CDMs are used to provide the drop and insert function, they are typically located near where a DS1/DMI-BOS facility leaves the switch and are placed in series with the DS1/DMI signal. The CDMs allow one or more channels to be inserted into a DS1/DMI facility at the transmit end and to be correspondingly dropped from the facility at the receive end. The remaining DS1/DMI channels are passed through the CDMs and to a System 75 or System 85 switch unchanged. This drop and insert capability can be used to provide both point-to-point and multipoint nonswitched private-line data connections over the same DS1/DMI facility that also provides interswitch connectivity.

Multipoint does not mean “shared channel,” but rather that separate channels are dropped or inserted at multiple separate points. For this arrangement (assuming that DMI-MOS or ISDN-PRI is not used), there may be three or more CDMs connected in a series multipoint link.

Because CDMs connect in series with a DS1/DMI-BOS facility, they can work with other equipment, such as channel-expansion multiplexed (CEMs), connected on the same facility. Channels that are dropped or inserted are considered used for dedicated applications (not used by the switch) and should be translated into a dummy trunk group.

With respect to framing, signaling, and line-coding options, ESF framing and B8ZS line coding are not supported by CDMs. The CDM may be connected in series with DS1/DMI-BOS links using either RBS or 24th-channel signaling. However, if those channels that are dropped or inserted require signaling, the associated channel units must use robbed-bit signaling. The CDMs do not now support any format of 24th-channel signaling.

The CDM provides two relay contact closures that are used to indicate major alarm conditions. Since CDMs are located in series with a DS1/DMI facility (assuming that DMI-MOS or ISDN-PRI is not used), alarms could occur on any of the three “segments” of the facility (that is, between the local switch and its associated CDM, between the two CDMs, or between the distant switch and its associated CDM). The relay contact closures indicate the segment of the transmission facility (relative to the CDM) that may contain problems. Both contact closures should be wired to the external alarm interface of the associated switch, so they may be used for fault isolation.

CEM to a BCM32000

The channel-expansion multiplexer (CEM) is also called a *bit-compression multiplexer* (BCM32000). When CEMs are used, they are always used in pairs; one at each end of a DS1/DMI-BOS link connecting two switches. Each CEM provides two DS1/DMI-BOSes to the switch and one DS1 toward the transmission facility. The CEMs may be used to perform two functions:

1. The CEM can compress two DS1/DMI-BOS channels, which contain voice-grade data (4.8K-bps maximum) and/or voice, into one channel. This allows a CEM to compress up to 48 voice or voice-grade data channels onto one DS1/DMI-BOS transmission facility. The compressed channels are uncompressed at the distant or receive-end and used normally.

NOTE: Digital data channels and the 24th signaling channel cannot be compressed. These channels must be transmitted through the CEM as uncompressed channels.

2. The CEM can multiplex both compressed and uncompressed channels onto a single data link.

The assignment of CEM channels must be coordinated with the DS1/DMI-BOS channel assignments on the switch. This is necessary so that only voice and voice-grade data channels are compressed and so that digital data or 24th-signaling channels pass through uncompressed.

The CEM does not place any restriction on a DS1/DMI-BOS between the switch and the CEM. Therefore, this interface may use either D4 or ESF framing, 24th-channel or robbed-bit signaling, and either ZCS or B8ZS line coding. However, the CEM does have other considerations and options. These include:

- The type of signaling used on the compressed DS1/DMI-BOS facility
- The selection of compressed and uncompressed channels
- The use of echo cancelers
- The use of a processor that allows remote administration and maintenance of the CEM

Only the first two options will be discussed here. The other options, along with additional specific information, may be obtained from *CEM: Description, Installation, and Maintenance* (365-287-100).

Two types of mutually exclusive signaling are used with the compressed DS1 facility between the two CEMs. These signaling types are different from the signaling types used by DS1/DMI-BOS. The first type of signaling is *variable bit-robbed (VBR)*. It is similar to RBS in that it is an inband type of signaling. The VBR type is sometimes also called RBS, even though it is a different type from that associated with DS1/DMI-BOS. When VBR signaling is used:

- VBR signaling is the default signaling type supplied with the basic CEM unit
- VBR signaling is the only signaling type that allows a DS1 facility to carry the maximum of 48 compressed voice or voice-grade data channels
- Tandem connections (over several DS1/DMI facilities) can significantly affect signal quality
- All uncompressed channels (that is, digital data channels and the 24th signaling channel) must be provided on the same DS1/DMI

The second signaling format is called *bundling*. It is similar to 24th-channel signaling in that compressed channels are grouped into "bundles" of 12; 11 carry voice or voice-grade data and the 12th (called a *delta channel*) carries signaling for the other 11. The important points associated with bundling signaling are as follows:

1. It is the recommended signaling type for most applications
2. Hardware in addition to that provided with the basic CEM unit must be ordered
3. The maximum number of compressed channels that the CEM can accommodate is reduced to 44
4. It is the only signaling method that allows compressed DS1 channels to be cross-connected through a DACS
5. It is the only signaling type that permits uncompressed channels, from both DS1/DMI-BOSes, to be connected to the CEM. Bundling is required when both DS1/DMI-BOSes operate with 24th-channel signaling.
6. It is required when the CEM is used with a CDM

The method for selecting the channels that are to be compressed and the channels that are to pass through uncompressed depends on the type of signaling used. Both methods are described as follows.

If VBR signaling is used, the assignment of compressed and uncompressed channels on one of the two input DS1/DMI-BOS facilities is done using 12 front-panel switches. The assignment of the other input DS1/DMI-BOS facility is done by default by the CEM. If bundling is used, four templates are used to assign status to each of the four 12 compressed-channel bundles. There are 6 front-panel switches per bundle. These switches select 1 of 64 possible templates per bundle. The templates define the status (compressed or uncompressed) of each channel, the signaling format that is being used, and the channels that have signaling disabled.

Regarding alarms, the CEM provides six relay contact closures. They are used to indicate major alarm conditions. The contacts should be wired individually to the external alarm interface of the switch, or at the minimum should be connected in parallel to one external alarm input of the switch.

ISDN-PRI PRIVATE-NETWORK CONNECTIONS

Private-network connections only include connections to other customer-premises switches.

System 85 R2 to a System 85 R2V4, Generic 1, or Generic 2

These connections are the most frequently used private network configurations. Typically, digital tie trunks are used to connect the switches. However, other trunk types, such as ISDN-dynamic trunk type 120, may be used. These trunks may be used to transmit voice, voice-grade data, and digital data.

If the two switches are colocated, then there are no network facilities between the switches, and any combination of signaling, framing, and line coding may be used. Excluding the user/network option, all other options should be administered identically for both switches.

Whenever carrier facilities are used to connect the ISDN-PRI endpoints, the carrier facilities may place limitations (if there are any) on the permitted options. When two or more switches are connected, they must be synchronized; one switch must be chosen as the timing master, and the other must derive timing from the master. Chapter 5, *Synchronization of Digital Facilities*, describes synchronization procedures.

System 85 or Generic 2 ISDN-PRI to Another Vendor's Digital Switch

When a System 85 or Generic 2 ISDN-PRI connects to another vendor's customer-premises switch (another vendor's ISDN-PRI or equivalent), several items should be verified to ensure compatibility. These include the interface electrical characteristics, options, and synchronization capabilities. The following questions should be answered:

- Does the vendor product provide a DSX-1 interface?
- Does the vendor product support at least one each of the line coding, framing, and signaling options provided by System 85 or Generic 2?
- For synchronization purposes, what stratum clock does the vendor switch provide?
- Will the vendor switch act as a timing master or slave its timing to the System 85 or Generic 2?
- Does the vendor switch implement the digital loss plan specified by EIA/PIN-1429?
- Can the vendor switch be administered for either the user side or the network side as required?

Depending on the answers to these questions, basic compatibility can be determined.

ISDN-PRI PUBLIC-NETWORK CONNECTIONS

Public network connections typically involve connecting a System 75, System 85, Generic 1, or Generic 2 to a 4ESS. Refer to *System 85 R2V4 to 4ESS Via ISDN PRI Access* (555-037-232), *DEFINITY Communications System Generic 1.1 to 4ESS Via ISDN PRI Access* (555-037-234), and *DEFINITY Communications System Generic 2.1 to 4ESS Via ISDN PRI Access* (555-037-235) for more detailed information on these connections.

System 85 R2V4, Generic 1, and Generic 2 to a 4ESS

Connections to a 4ESS are called special-access connections. The physical connection is made from customer premises to a 4ESS. Toll calls go directly from the customer premises switch to the AT&T toll network. Network ISDN features and services are available through a 4ESS. The physical connection to a 4ESS toll switch is made (through the DIF frame) to a SM9 circuit pack.

Framing, Signaling, and Line Coding

A 4ESS does not place any restrictions on the framing, signaling, and line-coding options. Any applicable restrictions are related to the application and particular installation.

Dial Tone

Second dial tone may be provided by a 4ESS. However, it is recommended that the customer-premises switch provide a second dial tone. With this arrangement, the second dial tone can be provided through use of the ARS feature on all ISDN-PRI trunks that terminate on a 4ESS.

Touch-Tone Capability

ISDN-PRI does not support either dial pulse addressing or touch-tone signaling, but provides the equivalent capabilities with ASCII character signaling on the D-channel.

Screening Intra-LATA Calls

A 4ESS can be used to block intra-LATA calls. However, all System 75, System 85, Generic 1, and Generic 2 special-access applications should use the ARS feature to screen outgoing calls. By using the ARS feature, only inter-LATA calls are routed to a 4ESS.

NFAS

Nonfacility-associated signaling is supported by a 4ESS. From a Generic 2 perspective, there are no restrictions with this capability.

Backup D-Channel

The D-channel backup is supported by the 4ESS. From a Generic 2 perspective, there are no restrictions with this capability.

Codeset

Both 4E11 and 4E12 receive and transmit UUI data in codeset 7.

4ESS receives and transmits UUI data in codeset 6. However, it will still tandem codeset-7 information.

User-to-User Information transfer

To pass user-to-user information (UUI) through the ISDN public network, all 4ESS-to-4ESS links must be implemented with CCS7. If as many as one link is implemented with CCS6, then UUI will not be passed.

Network Specific Facility

For outgoing calls from the customer-premises side, the 4E11 and 4E12 will accept a network specific facility (NSF) but do not require that one be present.

For call-by-call trunk groups, the 4ESS will check for a NSF and will reject the call if one is not present.

Synchronization

A 4ESS is always synchronized to the AT&T reference frequency. Therefore, for special-access applications, the System 85 or Generic 2 normally uses a 4ESS as the master-clock source. A particular ISDN-PRI facility may or may not be selected as the clock reference to the switch, depending on the use and reliability of other interfaces. The rules and considerations for selecting a synchronization source are detailed in chapter 5, *Synchronization of Digital Facilities*.

System 85 R2V4, Generic 1, or Generic 2 to a DACS

The DACS does not provide a DMI-MOS or ISDN-PRI and does not support those types of connections. However, D4, ESF, and RBS are supported.

System 85 or Generic 2 ISDN-PRI to a 5ESS

A 5ESS is most frequently used by a LEC. It provides digital CO services, both to subscribers and customer premises switches. For ISDN applications, a 5ESS must be equipped with 5e4.2 or later software.

A System 85 or Generic 2 ISDN-PRI connects to the extended digital subscriber line (EDSL) circuit pack in a 5ESS (only those configured with 5e4.2 Generic implement the network).

A 5ESS may or may not be synchronized to the AT&T reference frequency. A 5ESS has a lower stratum clock (higher accuracy) than a System 85 or Generic 2. Therefore, this issue should be verified for each specific configuration.

3. DS1 TRANSMISSION AND CABLING

Digital signal level 1 (DS1) is the specification for a particular digital signal format. DS1 interfaces should not be confused with T1 digital carriers. T1 is a specific transmission system. T1s are used to transmit digital signals of the DS1/DMI/ISDN-PRI format. This chapter describes the different methods of transmitting DS1 from one point to another.

A digital transmission network consists of the following four major parts:

- Terminals
- Multiplexers
- Cross-connects
- Transmission facilities

Terminals are the endpoints of the network. They generate and terminate digital signals. The DS1/DMI/ISDN-PRI, channel-division multiplexer (CDMs), and channel-expansion multiplexer (CEMs) are examples of terminal transmission equipment.

Digital multiplexers provide interfaces between the different bit rates in the digital network. The DS1 is the lowest level; the DS4 is the highest level. The DS4 contains 4032 64K-bps channels and has a line bit rate of 274.176M-bps. When a System 75 or 85 DS1/DMI/ISDN-PRI signal is routed over facilities provided by a vendor such as AT&T, the signal may be multiplexed on and off higher-rate digital lines on the way to its final destination. Multiplexers may also be used on customer premises and in private networks.

Digital cross-connects are the interconnection points between the cable and the connector for terminals, multiplexers, and transmission facilities. Specifically, the DS1 cross-connect, called *DSX-1*, is used to interconnect DS1s. Several important concepts related to the DSX-1 are as follows:

- Connection to public-network DS1 facilities is made at a DSX-1 cross-connect. This cross-connect point (and usually the equipment used to terminate a DS1 facility) is the point of demarcation where customer-premises responsibility for equipment ends and the network provider's responsibility for equipment begins.
- The signal present at the DSX-1 cross-connect differs from the signal on the DS1 transmission facility in one important respect. The transmission facility carries DC power, which is used to power line repeaters and network channel-terminating equipment (NCTEs). The signal at the DSX-1 cannot carry DC power.
- There exists a maximum cable distance from the DS1 (or DS1 terminal equipment) to the DSX-1 cross-connect point (655 feet for 24-AWG cable). However, a cross-connect point is not always required. An example of when the cross-connect point is not required would be a continuous cable that directly connects two DS1s. For this case, it is recommended that a phantom point midway on the cable be selected as the cross-connect point. With this arrangement, the maximum permitted distance between the two DS1s is twice the value specified to a DSX-1 cross connect.

Digital transmission facilities are used to transmit digital signals from one location to another. Many different digital transmission systems exist of which T1 is one. The type of facility used depends primarily on the distance between the endpoints, but other requirements may also affect facility selection. For example, an application may require nonmetallic facilities as opposed to metallic ones for reasons specific to that application. Examples of some of the DS1 transmission facilities available are T1 Outstate (T1/OS), FT3 Lightwave, and Microwave Digital Radio (DR-18 or DR-23). Details of these transmission systems are not provided here.

Several different interconnection options and considerations exist for a System 75, DEFINITY® Generic 1, System 85, and DEFINITY Generic 2 for DS1/DMI/ISDN-PRI such as cable types, distance limitations, and switch settings that are unique to the particular unit of equipment. These options and considerations are described in the following sections.

METALLIC CABLING OPTIONS

Metallic cable is usually used to connect a DS1 to a DSX-1 cross-connect. Specific cable configurations depend on the application and if intervening transmission terminal equipment is in use.

DSX-1 Distance Limitations

The DSX-1 specification defines a particular pulse shape that guarantees an allowable power spectral density at the DSX-1 cross-connect point. By using the power requirements of this pulse shape and the known dB loss for the permitted cable types, a maximum cable distance (from a DS1 circuit pack to a DSX-1 cross-connect point) may be determined. For either building wiring or shielded cable (the two cable types approved for DS1/DMI/ISDN-PRI interconnections), maximum distance between the DS1/DMI/ISDN-PRI and a DSX-1 cross-connect point is 655 feet. If transmission terminal equipment not providing a DSX-1 is used, this maximum distance may be different. When applicable, refer to the installation manuals for the appropriate terminal equipment.

Network Channel Terminating Equipment (NCTE)

The Network Channel Terminating Equipment (NCTE), also called a *customer service unit* or a *channel service unit* (CSU), is considered customer-premises equipment and is always required when connecting to network-provided metallic transmission facilities. NCTEs may also be required on some customer premises applications. For example, if the on-site distance between the two endpoints is such that office repeaters or line repeaters are required, then NCTEs or their equivalent must be used. NCTEs are generally not required when nonmetallic facilities such as fiber and microwave are used.

Features provided by most NCTEs include:

- Offering bipolar signaling, return-to-zero operation, balanced-to-ground design zero DC component on signal outputs, DSX-1 between the customer's terminal equipment, and a 1.544M-bps digital data rate

- Monitoring of the input DS1 or, when necessary, adding pulses (1s) to ensure that the ones-density requirements are met
- Removing bipolar violations (which implies incompatibility with B8ZS line coding)
- Termination of a DS1 or regeneration of received data using an office repeater
- Provisions for supplying DC power to a DS1 to power line repeaters
- A fault-locating jack to aid in testing repeaters on the DS1
- Jacks for manually looping the NCTE and aiding in maintenance testing
- A DC-triggered remote (toward the far end) loopback relay

Other optional features include inband loopback control and the ability to pass bipolar violations. The most frequently used NCTEs are the 551V and the 551V ST. Other vendor-provided NCTEs may have distance limitations different from those for the 551V and 551V ST.

NOTE: The 551V has a maximum transmit distance (toward a Generic 1 or Generic 2) of 85 feet. Therefore, when this type of NCTE (the 551V) is used, the DS1 should be optioned or administered accordingly. The 551V ST has a maximum transmit distance (toward a Generic 1 or Generic 2) of 655 feet. Exact distance settings are usually determined at installation time and by configuring the NCTE's user-selectable option switches. Switch option selection must be coordinated with the particular switch DS1.

For most types of NCTEs the critical circuitry (such as, network protection and ones-density enforcement) are normally line-powered from the CO using a 60-mA current loop. If power from the CO is not available, then power must be provided locally. The type of power required (120 VAC or -48 VDC) generally depends on installation/engineering specifications and on the NCTE being used; refer to the installation and/or user's manuals for the particular NCTE. The NCTE's noncritical circuits (such as, error monitoring, alarming) are always powered locally.

On-Premises Cabling

When both endpoints are within the same building, cabling between them can be categorized into three distance ranges. The equipment required depends on the range. For these categories, it is assumed that all cabling remains inside and is not exposed to foreign potentials such as lightning, and thus does not need to be appropriately protected. Since all equipment is on customer premises, the customer is responsible for maintaining the equipment. Figure 3-1, *On-Premises Metallic-Cable Configurations*, shows the various possible on-premises metallic cabling configurations.

Direct — Under 1310 Feet

If two DS1s are separated by no more than 1310 feet (or no more than 655 feet to the same DSX-1 cross-connect point), then they may be connected directly without the need of additional equipment. The cross-connect point is generally not required and the connection may consist of a single continuous 1310 foot cable. Figure 3-1-A, *On-Premises Metallic-Cable Configurations*, shows this configuration.

Because ANN11Ds, ANN11Es, TN722Bs, and TN767s contain components that suppress unwanted emissions from a DS1, standard premises distribution system (PDS) cables may be used to interconnect these interfaces. The PDS wiring may only be used when connecting directly between System 75 and System 85 DS1s. Other equipment is not guaranteed to meet FCC emission requirements when used with unshielded cable. Allowable PDS cables include the following cable types or their electrical equivalents:

- All 24-gauge PDS cable
- 26-gauge PDS cable of types ARTM, BKTA, or AFTW

NOTE: A 26-gauge cable has different distance limitations from 24-gauge cable. ANN11Cs do not contain components that suppress unwanted emissions. Therefore, when an ANN11C is used (either at one or both ends of a connection), PDS cables cannot be used. Shielded twisted-pair cable (DCC-5/24-TSA) is required.

Between 1310 and 4310 Feet

When the distance between DS1s exceeds 1310 feet, repeaters are required to regenerate the signal. If the total distance is less than 4310 feet, NCTEs containing office repeaters may be used at each end of a DS1 facility as shown in figure 3-1-B, *On-Premises Metallic-Cable Configurations*. Generally, the repeater module is ordered separately from the NCTE. The repeater module circuit is then installed within the NCTE housing as a part of the installation process.

Office repeaters *only* regenerate signals that are received from the transmission line span. NCTEs must be within 655 feet of their respective DS1 or the distance between the NCTEs should not exceed 3000 feet. Using NCTEs and office repeaters permits a total maximum distance of 4310 feet. NCTEs must be powered by a DS1 line or an external DC power source. Each NCTE connects to its respective DS1, DMI, or ISDN-PRI via a 15-pin D-connector on the rear of the NCTE.

NOTE: PDS cabling should not be used for connecting to or between NCTEs. For equipment cabinet to NCTE connections, use DCC-5/24-TSA cables with appropriate connectors (such as ED1E434-11, group 181, group 370, group 380 or the combination of group 380 and group 506 when connecting to a universal module) and applicable length.

Greater Than 4310 Feet

When distance between DS1s is greater than 4310 feet, line repeaters are required. Line repeaters regenerate the signal for both the receive and transmit directions. NCTEs and their associated DC power supplies (if necessary) are also required for this configuration. NCTEs are used to provide power to the line repeaters over the line.

Line repeaters may be placed up to 3000 feet from the NCTEs, and line repeaters may be spaced up to 6000 feet apart. NCTEs must still be within 655 feet of their respective DS1s. When using two line repeaters, DS1s can be up to 13,310 feet apart. This distance may be extended in increments of 6000 feet by using additional line repeaters. Figure 3-1-C, *On-Premises Metallic-Cable Configurations*, shows this configuration.

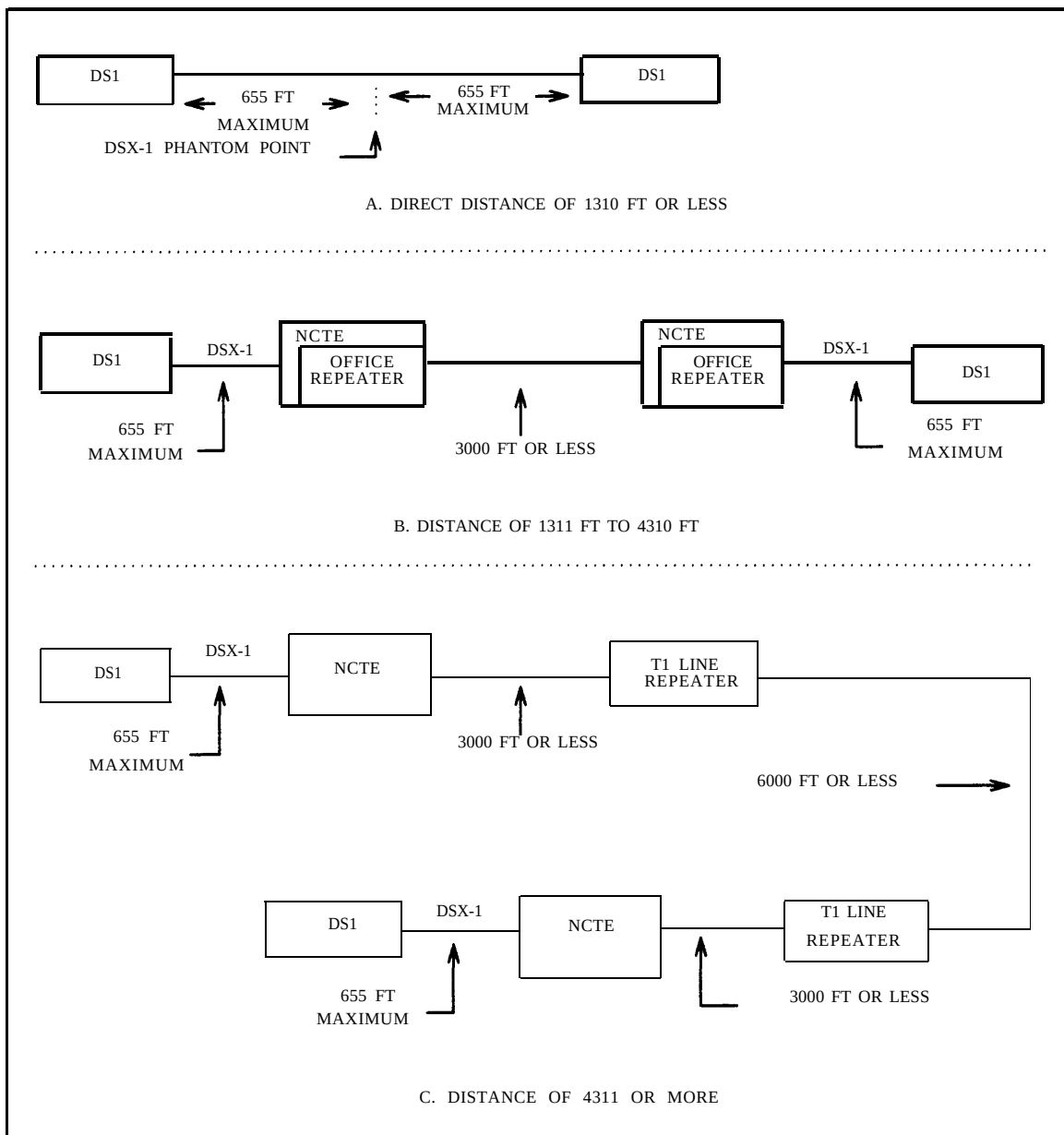


Figure 3-1. On-Premises Metallic-Cable Configurations

Off-Premises Cabling

When DS1s reside in different locations, they are typically connected via a transmission facility (such as a metallic cable configuration) that is leased from the local exchange company (LEC). This facility usually consists of a line and T1 repeater combination. The customer premises equipment interfaces to a DS1 network facility (T1 line) via NCTEs.

The customer is responsible for maintaining NCTEs. When purchasing service from the LEC, the customer must specify the DS1 framing and line-coding requirements.

For off-premises cabling, it is also possible to use any of the connection methods described for “On-Premises Cabling” as long as appropriate lightning and powerline cross-protection is provided.

Echo on voice channels must also be considered when a DS1 facility extends over long distances (that is, long round trip delays are encountered). Round trip delays of about 16-ms equate to about 100 miles through the public switched network or 800 miles in a private network. Each digital switch and each digital multiplexer in a path adds about 3-ms and 2-ms of delay respectively. Therefore, private network routes with several digital switches and digital multiplexer may need to use echo cancelers in path distances of less than 100 miles as shown in figure 3-2, *On-Premises Metallic-Cable Configurations*. For a fee, AT&T Toll Offices can add echo cancelers.

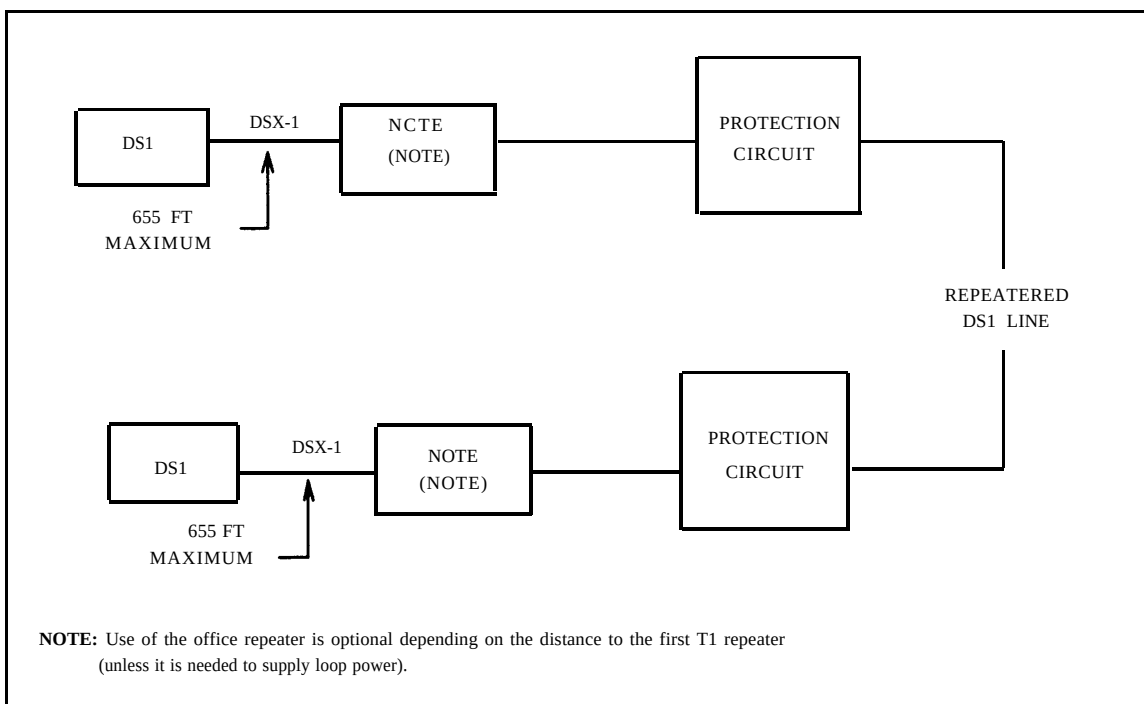


Figure 3-2. Off-Premises Metallic Cable Configuration

NONMETALLIC CABLING OPTIONS

Many alternatives to DS1 metallic transmission facilities exist. Some of these include systems that transmit a DS1 signal on light-guide fiber, microwaves, infrared, and radio waves. All AT&T network distribution systems (NDS) products are compatible. Other systems should be compatible with System 75 and System 85 DS1s as long as the following conditions are met:

- The transmission system connects to a DS1 via a DSX-1 cross-connect
- The transmission system meets any special requirements for the application (for example, the transmission of bipolar violations if B8ZS line coding must be used)

Figure 3-3, *Nonmetallic Cabling Configurations*, shows nonmetallic cabling transmission systems.

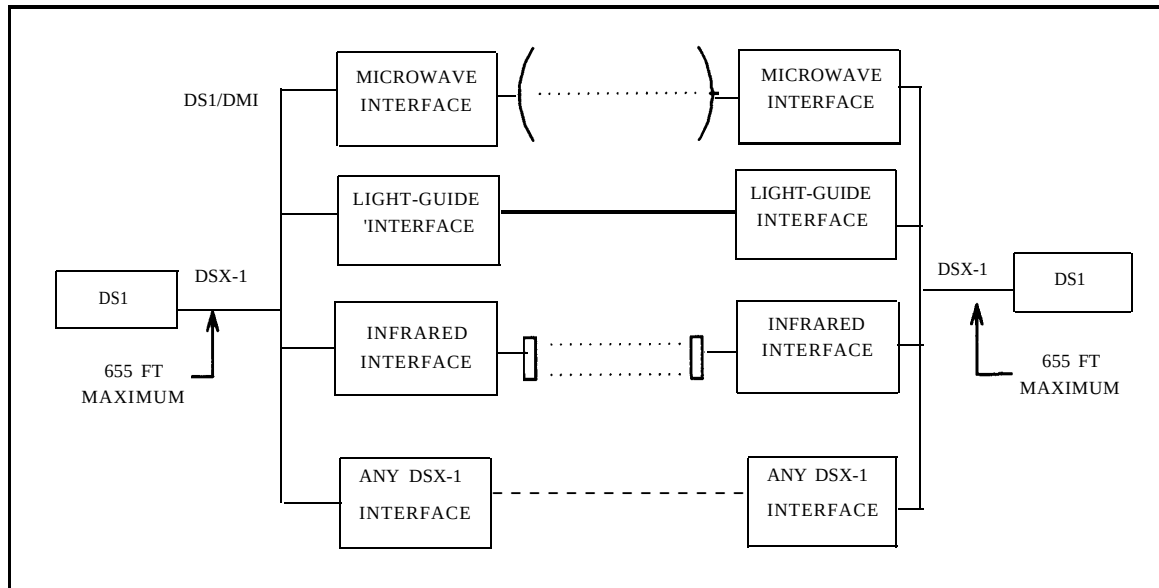


Figure 3-3. Nonmetallic Cabling Configurations

CEM AND CDM CABLING CONFIGURATIONS

Both the CEM and CDM provide a DSX-1 cross-connect to the DS1/DMI-BOS and therefore connect directly to a DS1/DMI-BOS. Any of the previously described metallic or nonmetallic transmission media may be used for completing the connection from a DS1/DMI-BOS to CEMs and CDMs. Figure 3-4, *CEM and CDM Cable Configurations*, shows stand alone and combined CEM and CDM configurations.

Refer to *Service Manual — Installation and Maintenance — Channel Division Multiplexer* (365-165-101) and to *BCM32000 — Description, Installation, and Maintenance — Digital Transmission Systems* (365-287-100) for appropriate distance limitations and switch settings.

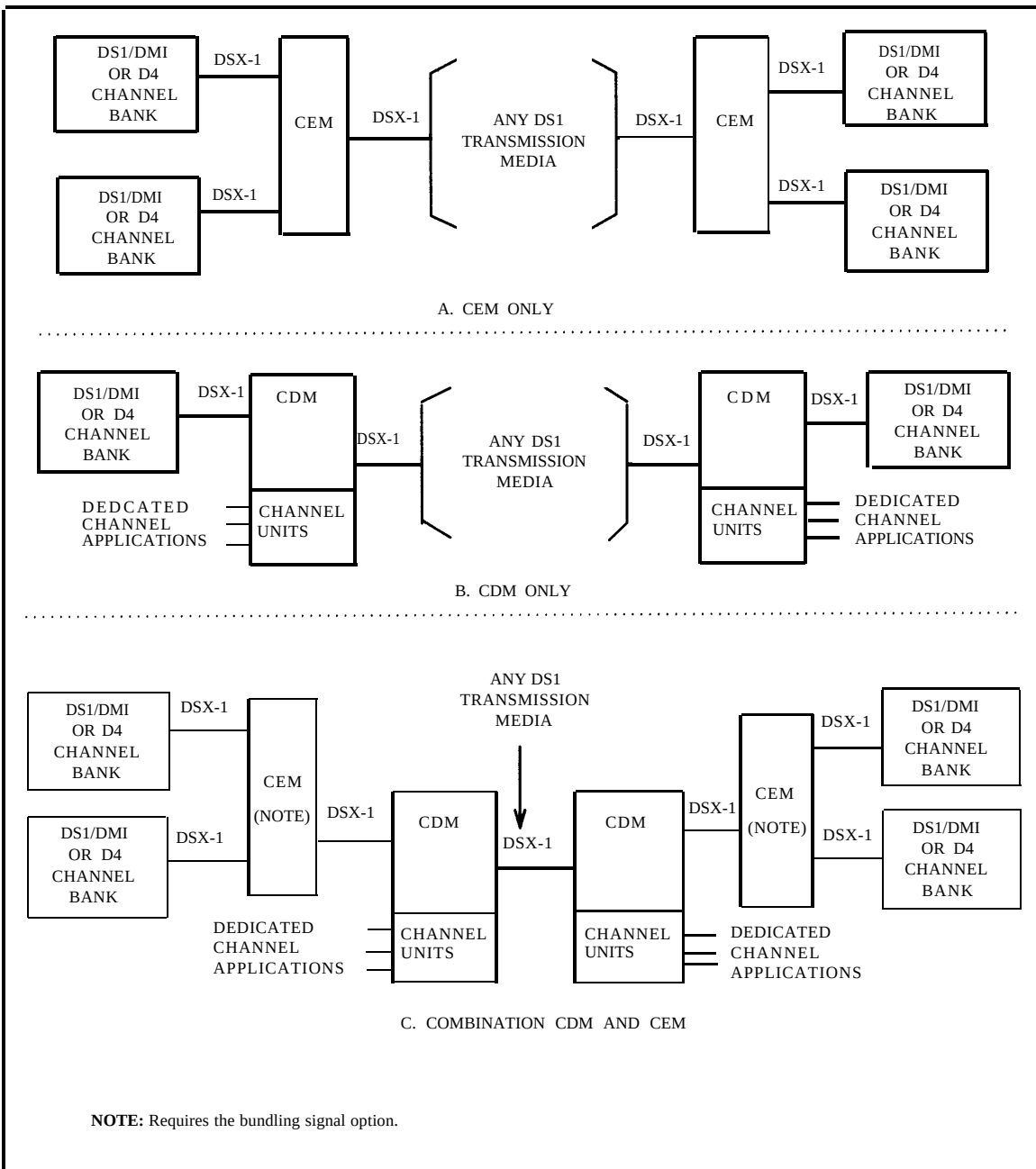


Figure 3-4. CEM and CDM Cable Configurations

LINE EQUALIZER AND COMPENSATION SETTINGS

The Generic 1 and Generic 2 DS1 circuit packs generate a signal that is preequalized. Preequalized means that the bipolar signal is shaped so that when it reaches the cable end it conforms to the DSX-1 power specification.

System 85 Traditional Modules

Traditional modules may be equipped with the ANN11_ and ANN35 circuit packs. Preequalization is provided by properly setting the three equalizer switches, on the circuit packs. The three switches must be set for either half or all of the distance to the far end. The correct equalizer and compensation setting is determined based on the cable configuration. If a DS1 terminates at a NCTE or DSX-1 cross-connect, the total distance to the NCTE or DSX-1 should be used. If a DS1 terminates on another DS1, then half the distance to the other interface should be used. This setting is done in increments of about 133 feet [see table 3-1, *System 85 Traditional Module Equalizer Settings (Metallic Cable)*].

TABLE 3-1. *System 85 Traditional Module Equalizer Settings (Metallic Cable)*

Distance to Midpoint or Endpoint (FT)		ANN11_, ANN35 Switch Settings		
22 AWG ABAM & 24 AWG PDS	26 AWG PDS	1	2	3
0 to 133	0 to 90	ON	ON	OFF
133 to 266	90 to 180	ON	OFF	ON
266 to 399	180 to 270	ON	OFF	OFF
399 to 532	270 to 360	OFF	ON	ON
532 to 665	360 to 450	OFF	ON	OFF
NOTE: The ANN11_ and ANN35 circuit packs only have three switches. Off (1) is away from the switch number; on (0) is toward the switch number.				

Generic 1 and Generic 2 Universal Modules

For TN722_ and TN767 circuit packs, preequalization is provided by properly administering the line compensation field. Compensation adjustments are described in the appropriate Generic 1 and Generic 2 administration manuals.

Pinouts for the cables connecting these circuit packs are given in *System 85 R2V4 to DEFINITY Communications System Generic 1.1 via ISDN PRI Access* (555-037-233), *DEFINITY Communications System Generic 1.1 to 4ESS via ISDN PRI Access* (555-037-234), and *DEFINITY Communications System Generic 2.1 to 4ESS via ISDN PRI Access* (555-037-237).

4. THE DIGITAL LOSS PLAN

Transmission loss is required so that talker echo is minimized. Furthermore, transmission loss must be kept low enough so that speech volume is perceived as adequately loud. Transmission loss is the total of all losses and gains from one end of a connection to the other. Distributed transmission losses as well as any connection loss inserted by the switch are included. Two different loss plans are available. They are known as:

1. Via-net loss (VNL), which has traditionally been used to assign losses for analog circuits terminating on an analog switch
2. Digital loss, which is used to assign losses for digital circuits terminating on a digital switch

The introduction of digital switching systems and digital trunk facilities permit more flexible control of the switch connection loss (insertion loss) and thereby transmission performance. From the network perspective, transmission performance becomes entirely a function of the port-to-port losses (total loss) from all switches in the transmission link.

The digital loss plan is significantly different from the VNL. Since the two loss plans do differ, it cannot be assumed that the port-to-port losses measured in an all-digital network or in a combined digital and analog network are the same as the loss measured between the same ports in an all-analog network.

Generic 1 and Generic 2 provide for implementing the digital loss plan specified by ANSI/EIA/TIA-464-A-1989. There are two versions of the digital loss plan. The early version is called *digital fixed loss plan* and the later version is called *ISL digital low loss plan*. Digital COs, such as AT&T 5ESSs or Northern Telecom DMS 100s, and toll switches, such as AT&T 4ESSs, also implement parts of the digital loss plan.

The digital loss plan requires a 6-dB loss (connection loss) from the switch port at one end to the switch port at the other end for private digital networks. Transmission performance for private networks using this 6-dB loss specification is very good. The public-network and digital COs have a similar 6-dB requirement.

Private-network to public-network connections result in a total connection loss of 12 dB — possibly more depending on the public network switch and factors such as whether a channel bank is used. Transmission performance for this type of connection is generally considered marginal, and if another private-network connection (another 6 dB of loss) is added, then the end-to-end transmission performance becomes unacceptable. These types of connections and their unacceptable transmission performance were the motivation for developing the ISL digital low loss plan.

For both Generic 1 and Generic 2, the administration options of the ISL low loss plan allows you to optimize transmission performance for those private network to public network types of connections at the planning and installation stage. With proper design and application, the ISL digital low loss plan makes possible a significant improvement in transmission performance for call-forwarded calls involving off-network connections.

Some quantity of connection loss is desirable and deliberately engineered into most types of transmission links. The quantity of loss (magnitude and number of dBs) depends on the loss plan that is administered and the particular type of facility involved. Each particular set of port-to-port connection losses is known as a *loss pad group*.

Connection loss serves to eliminate or significantly reduce talker echo on long-distance transmission links. User perception of transmission performance is primarily a function of the network connections most frequently used and the particular loss plan administered for those connections. Once a loss plan is selected and administered, the transmission performance becomes a fixed function of call routing. Regardless of the loss plan that is used, the functional operation of the other switch features will not be affected.

The digital loss plan provides for the flexible assignment of loss-pad groups on a trunk-group basis that is independent of trunk type and also of the port circuit pack type (DS1 or analog). Before the availability of this administration capability, loss-pad-group assignment had been fixed, transparent, and dictated by the trunk type and port circuit pack type being used. For example with fixed loss, a port on a Generic 2 circuit pack administered as trunk type 47 is automatically assigned the ETA digital tie trunk pad group. Conversely, with the low-loss option, a trunk group administered as trunk type 47 or 70 can be assigned one of several loss-pad groups and thus appear on either an analog or digital port.

Therefore, the digital loss plan options that are administered depend on the application and the configuration of the transmission facilities. For example, application may include such items as whether the facility is a DMI-to-host link, and whether the connection is on-premises to on-premises, or on-premises to off-premises. Configuration of the transmission facilities may include:

- Whether the connection is completed via a private network or a combination of private and public networks
- Whether the end-to-end connection is completed via all digital or a combination of analog and digital switching facilities

LOSS-PLAN IMPLEMENTATION AND PROVISIONING

The digital loss plan options vary between DEFINITY® Generic 2 and Generic 1 as described next.

Generic 2

The digital loss plan options are administered by specifying an encode that corresponds to the desired pad group. For line applications, this information is translated in field 8 of procedure 000, word 1. For trunk applications, this information is translated in field 13 of procedure 101, word 1. The permitted encodes and their corresponding loss-plan function for trunks are listed in table 4-1, *Digital Loss Plan Encodes*.

TABLE 4-1. Digital Loss Plan Encodes

Encode	Loss-Plan Function	ANSI/EIA/TIA-464-A-1989 Designator
0	The digital fixed-loss plan pad loss is determined by the trunk type administered in procedure 100, word 1	—
1	ISL tie trunk S/DTT	
2	EIA tie trunk (recommended for ISDN)	D/TT
3	ISL digital CO	D/CO -3/3 loss
4	EIA digital CO	D/CO 0/6 loss
5	digital toll office	D/TO
6	analog toll office	A/TO
7	N12A (AUTOPLEX™ NETWORK Interface V)	—
8	N12B (AUTOPLEX NETWORK Interface Y)	—

Although the digital loss plan provides for the assignment of a loss-pad group independent of port type (analog or digital), there are certain restrictions. Administration does not provide for alternate port appearance on DS1 port circuit packs for the following labeled pad groups: analog tie trunk, analog CO trunk (terminal balanced), analog CO trunk (not balanced).

For System 85 R2, the digital loss plan may be implemented in phases, dependent on the switch version and software issue. The digital fixed-loss plan is implemented in System 85 R2V3 with issue 1.0 software. System 85 R2V3 issue 1.1 software provides for administering the ISL tie-trunk pad group. The complete digital low-loss plan is initially available with R2V4 1.0 generic. It is planned (as a class AC change) to provide the complete plan with System 85 R2V2 issue 1.4 software and System 85 R2V3 issue 1.2 software.

The TSI arithmetic logic unit (ALU) under module processor control actually inserts (digitally) the administered quantity of loss in the connection. The TN380D module processor (or later) is required for providing the full digital low loss plan. Therefore, to implement any portion of the low loss plan, it is essential to have both the appropriate hardware (TN380D) and software issue. A network consisting of some nodes that implement the fixed-loss plan and other nodes that implement the low loss plan are permitted. However, their transmission performance is the same as for an all fixed-loss network.

Generic 1

Generic 1 implements the full digital loss plan (excluding the two AUTOPLEX® pad groups) when configured with either System 75 R1V2 issue 1.4, R1V3 issue 1.1, or R1V4 issue 1.0 software. The appropriate loss value is administered, for the particular trunk group, by entering T# in the NAME field for screens on pages 2 through 5 of the trunk-group member assignments. Noted below are the minor differences in names (terminology) used for Generic 1 and those used for Generic 2. The following list identifies the option values:

Loss plan	pbx-eia — for private-network-only applications that use analog tie trunks or digital tie trunks
	pbx-low — for use with combination tie trunks (private networks tandemed with public networks)
	toll — for use with connections to an analog toll office or digital toll office
Digital conn loss	normal — same as the EIA options used with Generic 2
	low — same as the ISL options used with Generic 2; recommended for combination tie-trunk applications where low speech volume is a problem but echo is not a problem

For both Generic 1 and Generic 2, digital loss plans are engineered by the NEC/REC and administered at installation time. It is then the customer's responsibility to monitor the user's perceptions of the plan and to administer appropriate changes as the user's network configuration is altered.

PORT-TO-PORT LOSS VALUES

The port-to-port loss values shown in table 4-2, *Digital Loss Plan (Port-to-Port Losses)*, can be used to determine the correct loss between two properly terminated ports of a digital switch.

To determine the correct end-to-end loss for a tandem connection (through both an analog and digital switch), simply add up the losses in each leg. Figure 4-1, *End-to-End Loss Configuration Using Combination Tie Trunks*, shows a tandem network consisting of two analog switches and one digital switch, with combination tie trunks connecting the analog switch to the digital switch.

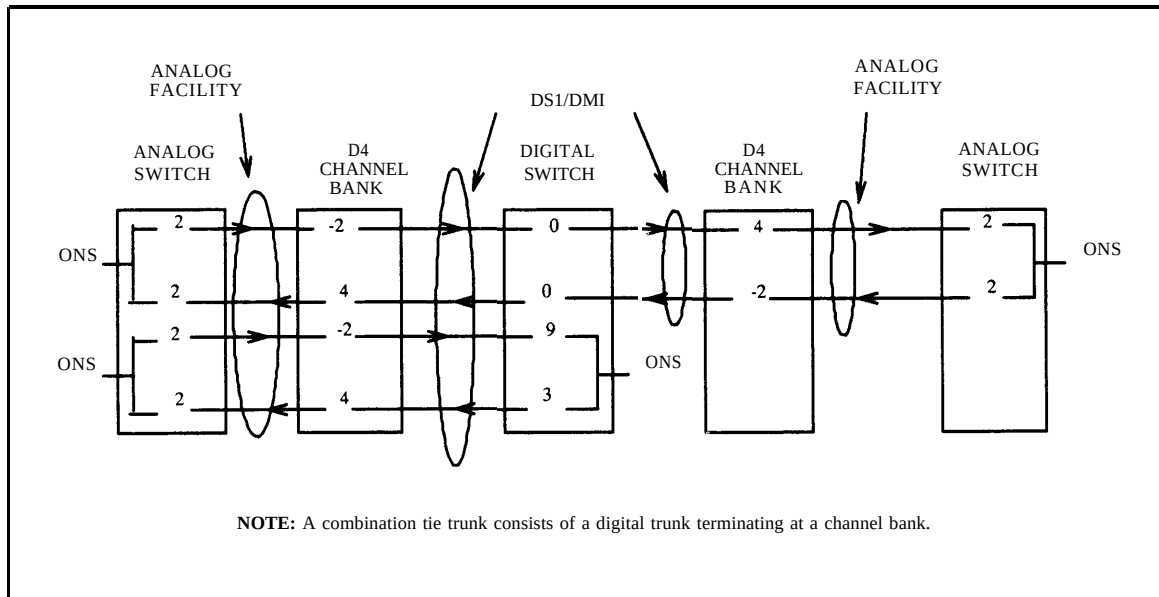
Combination tie trunks are frequently encountered when station-to-station calls are being completed. Depending on the particular facilities involved, some unexpected losses may be encountered. For the network shown in figure 4-1, if a call is made from an on-premises station (ONS) on one of the analog switches tandeming through the digital switch to an ONS on the other analog switch, an end-to-end loss of 6 dB should be measured in each direction. However, if a call is made from an ONS on the digital switch to an ONS on either one of the analog switches, an end-to-end loss of 9 dB should be measured in each direction. This 3-dB difference is a result of analog and digital loss plan differences and should be expected.

Before specific loss information is given, the following important points should be remembered:

- There are *no* adjustable attenuators associated with Generic 1 and Generic 2 ports. Port-to-port losses are composed of distributed losses in the ports and in the internal connection made between the ports. The loss for the internal connection is a function of the port type and the number of ports on the connection. Different port types (such as, digital CO, digital tie trunk, digital off-premises station) use the same DS1/DMI hardware.

TABLE 4-2. Digital Loss Plan (Port-to-Port Losses)

Transmit Direction	Receive Direction (Values in dB Loss)										
	ONS-Line	OPS-Line	ANAL Tie TRK	COMB or DTT	Analog CO Trunk		EIA DCO TRK	ISL DTT	ATO TRK	DTO TRK	ISL DCO
					BAL	N BAL					
On-premises station (ONS)	6	3	3	3	0	0	3	3	6	3	3
Off-premises station (OPS)	3	0	2	0	0	0	0	2	3	0	0
Analog tie trunk (A/TT)	3	2	0	-3	0	2	2	0	0	-3	2
Combination or digital tie trunk (D/TT)	9	6	3	0	3	6	6	6	3	0	3
Analog CO trunk (A/CO)	BAL	0	0	-3	0	0	0	0	2	0	0
	N BAL	0	0	0	0	2	2	2	2	0	2
EIA digital CO trunk (D/CO 0/6 loss)	3	0	2	0	0	2	0	0	3	0	0
ISL digital tie trunk (S/DTT)	3	2	0	0	0	2	0	0	3	0	0
analog toll office trunk (A/TO)	6	3	0	-3	2	2	3	3	0	-3	3
digital toll office trunk (D/TO)	9	6	3	0	6	6	6	6	3	0	6
ISL digital CO trunk (D/CO -3/3 LOSS)	3	0	2	-3	0	2	0	0	3	0	0
NOTE: A terminal balanced trunk is defined as meeting an ERL of ≥ 18 dB and an SRL of ≥ 10 dB, when measured into a quiet termination at the CO.											

**Figure 4-1.** End-to-End Loss Configuration Using Combination Tie Trunks

- Port-to-port losses in Generic 1 and Generic 2 conform to the ANSI digital loss plan standard. Table 4-2, *Digital Loss Plan (Port-to-Port Losses)*, is an excerpt from this standard. If other vendors' switches are used in the same network, port-to-port loss measurements through such a

switch will have value only after verification of this switch's port-to-port loss specification. Conformance with ANSI standards greatly simplifies this process and reduces the likelihood of compatibility problems.

- The loss between switches is 0 dB over digital facilities, 1 dB for combination facilities, and VNL for analog facilities.
- If the losses in a switch network have been verified correct and specific problems associated with the loss plan remain, the appropriate transmission engineering organization should be consulted.

DS1/DMI/ISDN-PRI PORT LOSSES

All DS1/DMI/ISDN-PRI circuit-pack channels, regardless of the type of port for which they are used, are transparent (zero loss) and preserve digital bit integrity. All connection losses are inserted in the switch network in conformance with the digital loss plan and dependent on switch administration options.

TERMINATING A DS1 AT A CHANNEL BANK

The DS1/DMI-BOS channels that leave the switch in digital form and are converted to analog form by a channel bank are called *combination channels*. Three basic types are described below.

Tie Trunk Ports

To obtain the required channel unit losses for combination tie trunks, extended-range E&M channel units (or their equivalent) should be used. The attenuators on this channel unit are set as follows: the transmit (A-to-D) attenuator should be set to $(15.5-L_c)$ dB, where L_c is defined as the loss in the interconnecting cable between the channel bank and the analog switch, and the receive (D-to-A) attenuator should be set to $(12.5-L_c)$ dB, where L_c is as above. Setting the channel unit attenuators to these values will meet the requirement for combination tie trunks. This requirement specifies a net gain of 2 dB in the A to D direction and a net loss of 4 dB in the D to A direction.

CO DID Trunk Ports

Digital ground-start CO, loop-start CO, and Direct Inward Dial (DID) trunks may (optionally) terminate on channel banks located at a CO. If this is the case, it is the CO's responsibility to set the channel unit losses. As a guideline, the net loss should range from 1 to 3 dB. Also, the loss should be the same in both directions.

OPS Ports

Analog off-premises station (OPS) facility requirements specify a loss not to exceed 4 dB in each direction. To provide for transmission stability (eliminate singing and echo) with D4-channel units, at least 1 dB of loss in both directions is required from the 2-wire analog hybrid terminals. Foreign exchange subscriber end channel units (FXSs) provide losses adjustable from 1.0 through 1.8 dB. This capability permits their use with analog facilities having losses as great as 3 dB, giving a net loss of 4 dB. FXS end with gain transfer channel units (FXS/GTs) make available an additional 2-wire gain of 6 dB, permitting their use with analog facilities with losses as great as 9 dB. Attenuator, equalizer, and balance settings should be made with the engineering data listed on the circuit detail record.

Refer to *D4-Channel Bank Channel Units — Application Engineering/Carrier Engineering* (855-351-105) for engineering design information as well as switch settings and application notes on D4-channel units.

5. SYNCHRONIZATION OF DIGITAL FACILITIES

The DS1 transmit and receive buffers (for Generic 1 and Generic 2) operate from a single external or internal clock. Each digital switch can accommodate multiple DS1 or T1 spans that link multiple switches. These may include both ISDN-PRI and DS1 links. Since each switch can transmit at a rate determined by its internal clock, information will be lost if the digital network is not synchronized to a single clock. Furthermore, one switch should be selected as the master and all others should obtain slave-timing from it. Figure 5-1, *Options for Synchronization*, shows various DS1 synchronization applications.

Synchronization issues affect all network nodes. Compatibility details must be addressed, and a network synchronization plan must be developed, deployed, and verified to be installed correctly.

THE NEED FOR SYNCHRONIZATION

The term *synchronization* refers to an arrangement whereby digital facilities operate from a common clock. Whenever digital signals are transmitted over a communications link, the receiving end must be synchronized with the transmitting end to read the digital signals properly. This arrangement is called *link synchronization*.

When digital signals are transmitted over a network of digital communications links, switching nodes, multiplexers, and transmission interfaces, all entities in this network must be synchronized together. This is known as *network synchronization*.

With digital transmission, information is coded into discrete pulses. When these pulses are transmitted over a communications link, there must be at least three different levels of synchronization. For transmitting data, these levels are known as *bit*, *character*, and *message synchronization*. For pulse-code modulation (PCM) voice transmission, the levels are *bit*, *time-slot*, and *frame synchronization*.

Bit synchronization refers to the requirement for the transmitter end and the receive end to operate at the same clock rate so that bits are not lost. Other levels of synchronization refer to the need for the transmitter and receiver to achieve proper phase alignment so that the beginning and the end of a character, message, time slot, or frame can be identified.

For synchronous transmission, data is transmitted at a fixed rate. Each bit occupies a fixed-unit interval. All significant transitions must correspond to multiples of the fixed-unit interval. Message and frame synchronization are achieved by using special characters at the beginning and end of the message, and by knowing the number of bits contained in each frame.

Figure 5-1, *Options for Synchronization*, shows the exchange of digital bit streams between various elements that require some form of synchronization. The role of synchronization is examined in each of the three configurations.

Figure 5-1-A, *Options for Synchronization*, shows one possible connection between a pair of D4-channel banks. Such a connection (using D4-channel banks) can typically be found with a pair of analog switching systems connected by T1-carrier facilities. For this arrangement, the transmitting portion of each channel bank independently determines the clock rates. The receiving portion of each channel bank derives its clock from the incoming digital bit stream. In this arrangement, the channel banks convert the received digital signal directly to analog, and there is no requirement that the two clock frequencies precisely match as the channel bank does not interface to another digital system.

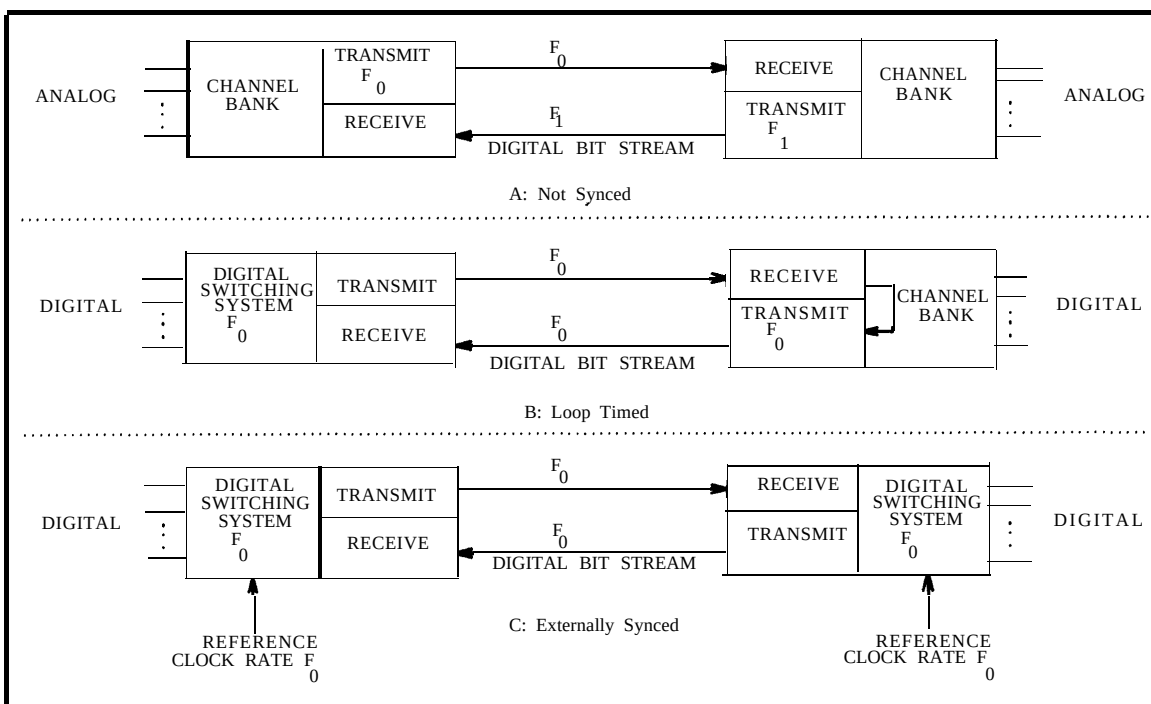


Figure 5-1. Options for Synchronization

Figure 5-1-B, *Options for Synchronization*, shows a different connection between a channel bank and a digital switching system. For this configuration, the digital switch transmits a digital bit stream at the rate (F_0) that is determined by its internal clock. The digital switch must receive the incoming digital bit stream at this same rate (F_0). Otherwise, the switch's receiving buffer may eventually overrun or underrun.

NOTE: Switching is done by placing the signals from individual time slots on one link into the time slots on other links using a process called *time-slot interchange* (TSI). For this process to work properly, bit synchronization must be maintained on all links terminating on the digital switching node, no matter where the links originate.

If the average transmit rate is faster than the average receive rate, the receive buffer will eventually overrun. If the average receive bit-clock rate is faster than the average transmit bit-clock rate, the receive buffer will eventually underrun. It is necessary to prevent overruns (deletions) and underruns (repetitions) by synchronizing the network properly. Improper synchronization results in buffers repeating or deleting bits in 1-frame increments.

NOTE: The deletion or repetition of a single frame is termed a *slip* or a *controlled slip*. For an individual digital bit stream, slips are serious impairments since digital switching systems with improperly synchronized clocks will eventually suffer slips on every received digital bit stream.

Notice in figure 5-1-B, *Options for Synchronization*, that the overrun or underrun problem can be prevented by forcing the channel bank transmitter to operate at the same clock rate as the receive portion of the channel bank. This arrangement is called *channel-bank loop timing*. This becomes more complex when two digital switches terminate a digital transmission facility. Figure 5-1-C, *Options for Synchronization*, shows this configuration.

In figure 5-1-C, *Options for Synchronization*, each switching system transmits at a rate determined by a reference clock. Unless the received digital bit stream arrives at the same clock rate as its internal clock rate, slips will occur. To prevent or minimize slips, it is necessary to force both switching systems to synchronize on a common reference clock rate (F0). Both will then be part of a synchronized network, and will read and write their buffers as they should.

The primary objective of network synchronization is to minimize the slip rate. This is done by synchronizing the clocks associated with the switching nodes so that all transmissions from these nodes have the same average line rate. For short-term intervals, the switching-system receive buffers absorb the difference between the line rate and the average rate. These short term variations are called *jitter*. A long-term difference will result in a slip.

The impact of slips on a customer varies with the services used. For example, voice services are insensitive to slips. Slip rates as high as 20 per second are barely perceptible; therefore, speech is not considered a limiting factor in setting slip-rate standards. However, data services are much more sensitive to slips since each bit of data is a discrete piece of information. For data applications, a slip (at any slip rate) requires retransmission and will adversely affect the throughput and degrade performance of data transmission facilities.

Slips can occur for two basic reasons:

1. Lack of or loss of frequency synchronization among the network nodes (for example, when slips occur at a constant, regular rate)
2. Phase modulation of the transmitted digital bit streams owing to environmental variations of the transmission facilities (such as temperature variations that affect the electrical length of a transmission line)

Therefore, even if all network nodes are synchronized, slips can still occur owing to transmission impairments.

SYNCHRONIZATION HIERARCHY

Within North America, all private digital telecommunications facilities that connect to the public digital network must obtain synchronization by the hierarchical method. This method is based on:

1. Controlling the slip rate to provide satisfactory service to the customer
2. Maximum reliability

3. Minimum costs
4. Ease of administration
5. Ease of maintenance

For the hierarchical method, a node containing a very stable reference frequency is identified as the source or *master reference*. The master reference is transmitted to another node that is synchronized (slaved) to this master reference. A network implementing this method is hierarchical in nature with nodal clocks supplying the synchronization frequency to certain other nodes, which in turn supply the reference to still other nodes. Figure 5-2, *Synchronization Hierarchy*, shows a hierarchical network configuration.

With the hierarchical method, the existing digital transmission facilities are used to distribute the reference frequency. For example, with a T1-carrier, the slave nodes can derive their reference clock from either the 56K-bps data rate or the 8000-frames-per-second rate. Since the clock frequency is derived from the digital bit stream, the traffic-carrying capacity of a carrier system is not diminished (that is, the bandwidth is not used to carry a separate clock signal).

Reliable operation is an important consideration for all parts of a telecommunications network. So, the synchronization network should consist of both *primary* and *secondary* synchronization facilities. In addition, each node must be equipped with an internal clock that (with automatic switching) can bridge short disruptions of the primary and secondary synchronization reference. Therefore, if synchronization is disrupted, the internal clock will assume control. The internal clock will drift at a rate determined by its stability (also called *free run ability* or *accuracy*).

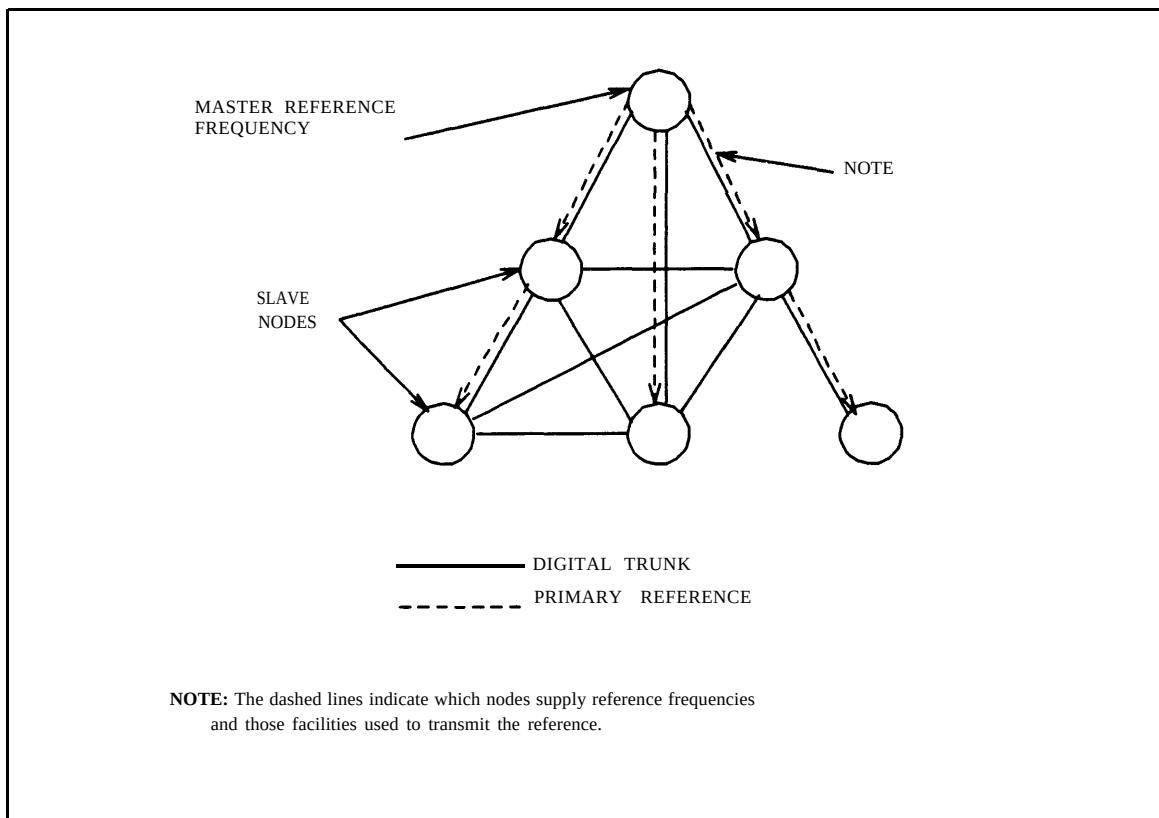


Figure 5-2. Synchronization Hierarchy

Switching nodes in digital networks are divided into synchronization layers called *strata*. There are four strata, 1 to 4, where stratum 1 has the highest accuracy and stratum 4 the lowest. Public digital networks use stratum 1, 2, and 3 synchronization. Historically, private digital networks used stratum-4 clocks all synchronized together. However, to provide higher quality synchronization performance, stratum-3 clocks are currently being used with some customer-premises equipment.

Because of recent changes within the synchronization hierarchy, stratum-4 clocks are now defined as *stratum-4 type I* or *stratum-4 type II*. The specifications for stratum-4 type I define limits that minimize and control phase changes that occur while switching from one synchronization source to another. However, stratum-4 type-II clocks do not comply with this specification and all other stratum-4 specifications remain the same for both type-I and type-II clocks. Beginning in 1990, public-network connections cannot use a stratum-4 type-II clock as a synchronization source (a stratum-4 type-I clock can be used).

Each stratum from 1 to 4 is progressively less stable and less expensive clock. Within AT&T, there is a system of stratum-1 clocks. These clocks use the AT&T standard reference frequency, formerly the Bell System reference frequency. The stratum-1 output is transmitted to various public digital network nodes via either broadband analog facilities or the DATAPHONE® Digital Service (DDS).

The public digital network nodes and services that the AT&T private digital switches and digital terminal products can connect to are as follows:

- DDS
- Digital serving office (DSO), also called a digital toll office, such as a 4ESS
- Digital central office (DCO) such as a 5ESS
- Digital-access and cross-connect system (DACS)

The AT&T private digital network nodes are the following:

- System 75
- System 85
- DEFINITY® Communications System Generic 1
- DEFINITY Communications System Generic 2

The digital terminal products include the following:

- D4- and D5-channel banks
- Channel-division multiplexer (CDM)
- Bit-compression multiplexer (BCM-32000)
- Digital data multiplexer (DDM-1000)

All public and private digital network nodes have internal clocks. Figure 5-3, *Stratum Levels for the Synchronization Hierarchy*, shows the synchronization hierarchy and the node's internal clock stratum level.

Each node is compelled to take its timing from the following:

1. A higher stratum level
2. A node equal to its own stratum level
3. A free-running timing clock (generated internally) that meets or exceeds the requirements for its level

The minimum clock accuracy for each stratum level is as follows:

- Stratum 1 (± 0.00001 ppm, most accurate)
- Stratum 2 (± 0.0017 ppm, more accurate than stratum 3)
- Stratum 3 (± 4.6 ppm, more accurate than stratum 4)
- Stratum 4 (± 32 ppm, least accurate)

NOTE: When a hierarchical public digital network is implemented (and when full network synchronization is obtained), each node clock, regardless of its stratum level, will have an average frequency identical to its master and to the AT&T standard reference frequency.

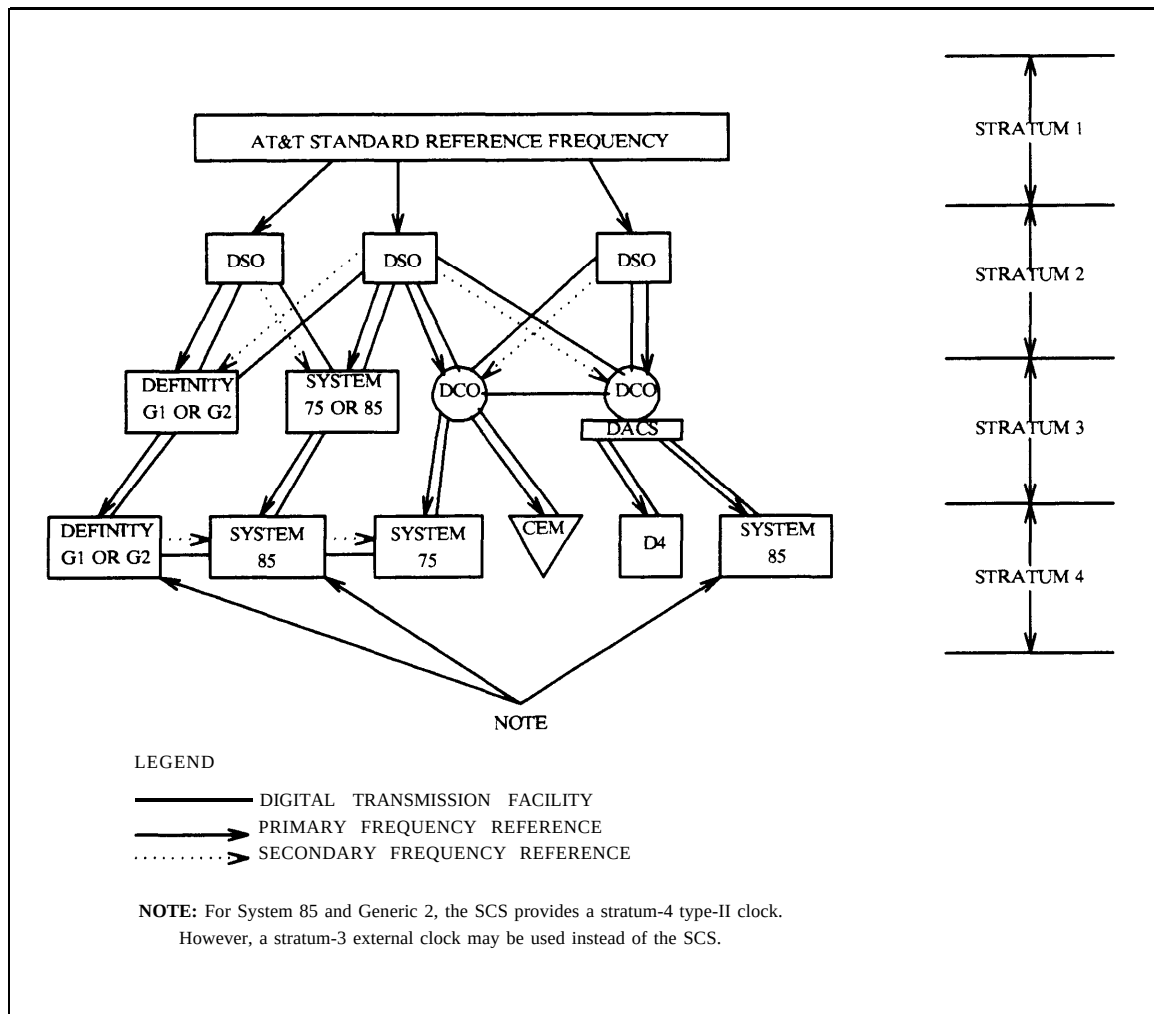


Figure 5-3. Stratum Levels for the Synchronization Hierarchy

System 85 and Generic 2 Synchronization Architecture

Both System 85 and Generic 2 can function as either a timing slave or timing master. As a slave, the switch receives digital data from one or two DSIs. One interface supplies the primary synchronization reference and the other interface supplies the secondary reference. The timing source selected is determined by the system clock synchronizer (SCS) TN463 circuit pack and synchronization software. The SCS synchronizes (phase locks) to either the primary reference, secondary reference, or the internal high-accuracy clock. Figure 5-4, *SCS (Generic 2)*, shows the SCS circuit pack.

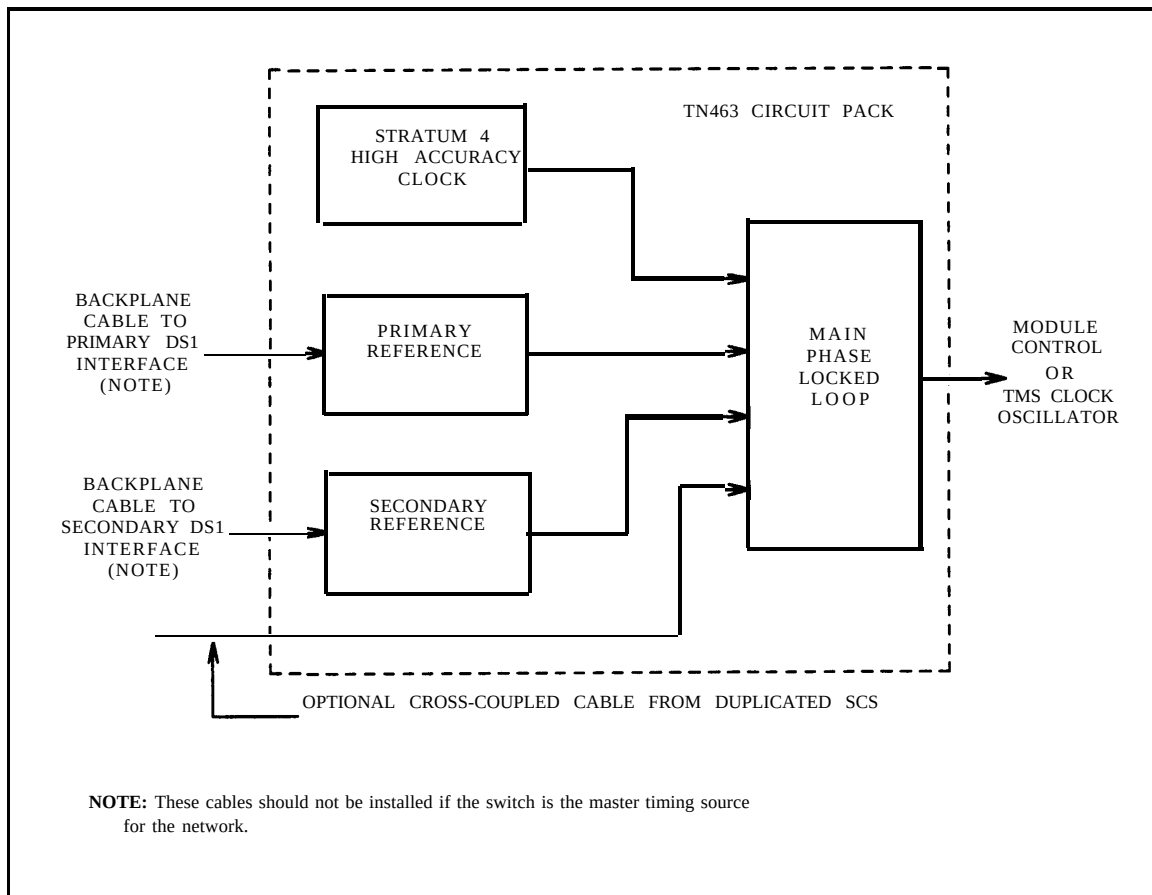


Figure 5-4. SCS (Generic 2)

Typically, the switch will be equipped with several DS1 circuit packs. The DS1 that is selected as the primary or secondary reference is dependent on the internal cable configuration and administration details. Here, each System 85 or Generic 2 that is configured with at least one DS1 requires a SCS, including the master node. Unless synchronized to the network and not the stratum-3 or stratum-4 clock, the master node will not have the primary and secondary synchronization cables.

A System 85 or Generic 2 may consist of either a single-module or multimodule architecture. Typically, the switch architecture is unduplicated, but it may also be duplicated for critical reliability applications. The switch architecture determines the equipment carriers that will contain the SCS circuit packs.

For single-module applications, the SCS is located in the module control carrier. In addition to the SCS, a module clock is also required. The SCS controls the module clock. For multimodule applications, the SCS is located in the time-multiplexed switch (TMS) carrier and controls the TMS clock oscillator.

When the switch architecture is duplicated, the synchronization components and cables will also be duplicated. For duplicated systems, functioning modules are called *online*, while backup modules are called *offline*. The offline SCS phase locks to the cross-coupled clock signal from the online SCS. In

a duplicated synchronization system, the same DS1 facility provides the primary and secondary reference for both duplicated halves. Figure 5-5, *Duplicated Synchronization Architecture and Cross Coupling*, shows a System 85 or Generic 2 with a duplicated architecture and cross-coupled cables.

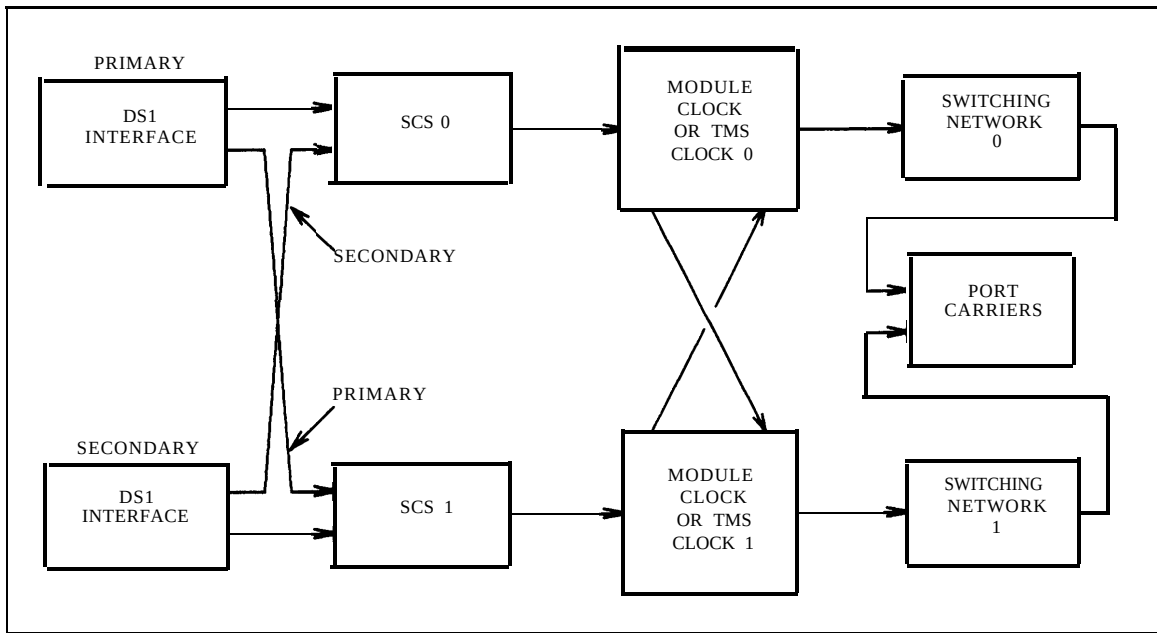


Figure 5-5. Duplicated Synchronization Architecture and Cross Coupling

The TN767 is a DS1 circuit pack for a hybrid module; the ANN11 is a DS1 circuit pack for a traditional module. The standard cable that comes with the TN767 is the H600307. It can be ordered in eight different lengths, up to 650 feet, by ordering one of eight different group numbers (groups 1 - 8). See *System 85 R2V4 to DEFINITY Communications System Generic 1.1 via ISDN PRI Access* (555-037-233), *DEFINITY Communications System Generic 1.1 to 4ESS via ISDN PRI Access* (555-037-234), and *DEFINITY Communications System Generic 2.1 to 4ESS via ISDN PRI Access* (555-037-237), for specific cabling and administrative information.

System 85 and Generic 2 Synchronization Software Operation

The synchronization software consists of a series of tasks that monitor several system status parameters and thus maintain the best synchronization source online. (The online source is the synchronization reference currently in control. This reference can be either the primary or secondary reference, or an on-board local oscillator.) Several levels of control are maintained. One level is controlled by a 1-second software task that uses the system status to keep the best incoming DS1 reference clock online. The other is controlled both by hardware and the 1-second software task to maintain a healthy SCS on line. If a SCS can receive a suitable reference clock from a DS1, then the best combination is chosen.

The principal error conditions used to determine if a switch to a different DS1 clock reference is needed are, in order of importance:

- Loss of signal (LOS) at the (SCS) circuit for more than 200 ms. A switch is made to the high-accuracy clock (HAC) on the SCS by the SCS. A further analysis is then made to determine if the LOS is network related or switch related. A switch to a healthy reference is done if appropriate.
- Blue alarm means that the switch cannot be used as a reference.
- Out-of-lock (OOL) condition means that the HAC is unable to lock onto the incoming clock from the current DS1 reference. A switch to a healthy reference is done if one is available. Otherwise, a switch to the HAC is performed.
- Red alarm means that two out of four (or worse) framing patterns were received.
- Slip rate of selected DS1 facilities (with respect to the primary reference) exceeds a given threshold
- Misframes at the primary reference exceed a given threshold
- Reception of a yellow alarm (or a blue alarm for R2V4, 1.1 and later)
- Health of SCS circuit pack
- Insane condition of the board processor on a DS1 circuit

Table 5-1, *SCS References Switches*, summarizes these conditions:

TABLE 5-1. SCS References Switches

Primary Reference Indicators	Secondary Reference Indicators						
	RED	BLUE	YEL	GOOD	LOS	MISF	BO
RED	HAC	HAC	SEC	SEC	HAC	SEC	HAC
BLUE	HAC	HAC	SEC	SEC	HAC	SEC	HAC
YEL	PRI	PRI	PRI	SEC	PRI	PRI	PRI
GOOD	PRI	PRI	PRI	PRI	PRI	PRI	PRI
LOS	HAC	HAC	SEC	SEC	HAC	SEC	HAC
MISF	PRI	PRI	SEC	SEC	PRI	PRI	PRI
BO	HAC	HAC	SEC	SEC	HAC	SEC	HAC

BLUE Blue alarm
RED Red alarm
YEL Yellow alarm
LOS Loss of signal
HAC System 85's internal high-accuracy clock
BO Maintenance busied out
MISF Misframe
GOOD No alarms

The SCS circuit pack's health is examined when the system clock's health is evaluated. Error conditions of varying severity can exist on the SCS. If the fault is minor and the SCS can still lock on the current DS1 reference, a low-priority request for a soft switch to the offline side is made after an unsuccessful attempt to clear up the error condition on the SCS. If the SCS cannot lock onto the current DS1 reference clock, a high-priority request for a soft switch is made. The offline SCS is also

monitored to make sure that a switch is not attempted to an unhealthy SCS. If the SCS is not duplicated and the HAC is healthy, serious failures cause a switch to the HAC to ensure switch reliability. When the SCS can once more lock onto a DS1 reference, a switch to that reference is performed.

Synchronization occurs at several priority levels; records are kept for perusal at the demand test level with procedure 625. In addition, several yellow LEDs on the SCS can be observed to get a current picture of how the system is configured from a reference clock point of view.

- The LED in position #4 refers to the primary DS1 reference. The LED is OFF if a synchronization signal is present and the SCS is capable of locking. The #4 LED is ON if an error condition exists and the synchronization cable is present.
- The LED in position #5 refers to the secondary DS1 reference. The LED is OFF if a synchronization signal is present and the SCS is capable of locking. The #5 LED is ON if an error condition exists and the synchronization cable is present.
- The following four yellow LEDs indicate the selected timing reference: #14 (HAC), #15 (primary reference), #16 (secondary reference), and #17 (cross-coupling). When the system is first brought up and no references are administered, the HAC LED should be lit for the online SCS and the cross-coupling LED should be lit for the offline SCS. Shortly after the DS1 references are administered, the primary reference LED should turn on and the HAC LED should turn off for the online SCS. The cross-coupling LED is the only one lit for the offline SCS.

The synchronization subsystem described above also functions as a periodic maintenance monitor. Status detected during the synchronization process is passed along to other levels of maintenance software for processing. This processing includes error logging for procedure 600 and alarming.

CHANGES TO THE SCS SOFTWARE MADE AVAILABLE VIA SOFTWARE PATCHES

The following changes (regarding the SCS software) may apply, providing that the appropriate patches have been installed.

System 75 and Generic 1 Synchronization Architecture

System 75 and Generic 1 can function as either a timing slave or timing master. As a slave, the switch receives digital data from one or two DS1s. One interface supplies the primary synchronization reference; the other supplies the secondary reference. The timing source selected is determined by the tone-clock circuit pack and maintenance software. The tone clock synchronizes (phase locks) to either the primary reference, secondary reference, or the internal high-accuracy clock. Figure 5-6, *Tone-Clock Synchronizer (Nonduplicated, Generic 1)*, shows the tone clock circuit.

The DS1 that is used as the primary or secondary reference is totally dependent on administration details. Although there are no restrictions on placing one or both synchronization references in the second cabinet, it is recommended that the references be located in the first cabinet (processor port network) to maximize reliability. The tone clock generates the call-processing system tones and also provides the switch with the stratum-4 clock in the absence of a reliable reference.

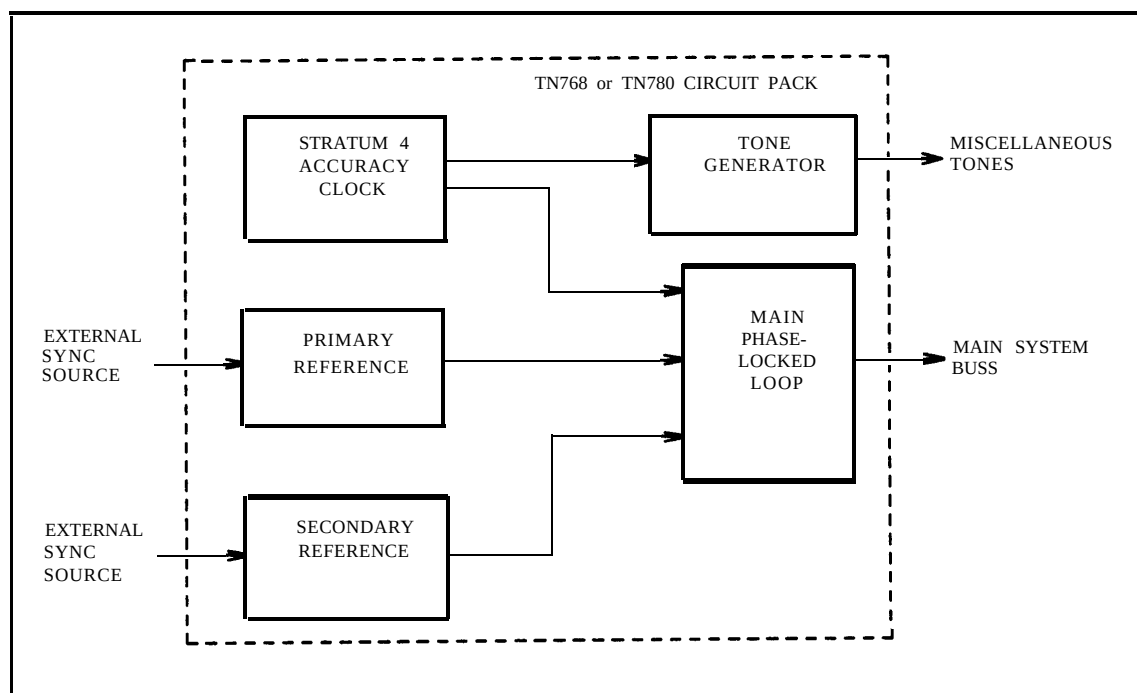


Figure 5-6. Tone-Clock Synchronizer (Nonduplicated, Generic 1)

System 75 and Generic 1 Synchronization Software Operation

System 75 and Generic 1 synchronization software differs slightly from System 85 and Generic 2 because of architectural differences; however, both switches provide the same overall functions. Primarily, these functions include monitoring the synchronization references and keeping the primary or other reference that has the best health online and thus providing high quality digital communications via DS1 facilities.

A subpart of the maintenance software monitors the TN768 or TN780 circuit packs and synchronization references. Depending on the state-of-health of the references, the maintenance software provides automatic switching between the references. Switching from one reference to another can be done by any of the following conditions:

- On-line synchronization reference failure
- Primary reference restoration
- Administration reference changes, either from Initialization and Administration System (INADS) or the local Manager-1 (M-1) terminal
- Craft command from an M-1 terminal

The TN768 and TN780 circuit packs contain edge-mounted LEDs. These LEDs indicate the following status sequences:

- Yellow LED is on 2.7 seconds and off 0.3 seconds — the tone-clock synchronizer is in “active” mode and a DS1 is being used as a synchronization reference.
- Yellow LED is on 0.3 seconds and off 2.7 seconds — the tone-clock synchronizer is in “active” mode and the local oscillator is being used as a synchronization reference.
- Yellow LED is on continuously — the tone-clock synchronizer reset properly but did not receive translations update. It is in “active” mode and is providing synchronization from the local oscillator.
- Yellow LED is off continuously — the tone-clock synchronizer is in standby mode. It is neither generating tones nor supplying a clock reference.
- The tone-clock synchronizer is characterized as being in either “active” mode (participating in the synchronization process) or standby mode (not currently participating in the synchronization process). The best method to determine the functional mode of the tone-clock synchronization circuit pack is to execute the `system status` command. While maintenance is running, both the yellow and green LEDs will flash. The standby mode pattern is: on 0.1 seconds, off 0.2 seconds, on 0.1 seconds, off 0.4 seconds, on 0.4 seconds, off 0.4 seconds, repeatedly. The “active” mode pattern is different.

Criteria for Switching to the Secondary Reference

Each occurrence of an abnormal or error condition results in incrementing the appropriate error counter. Each error counter has its own unique threshold limit. Exceeding an error counter's threshold results in a change in operation (such as switching to a different synchronization reference).

The principal error conditions used to determine if a switch to a different clock synchronization reference is needed are, in order of importance:

1. The master tone-clock synchronizer detects LOS.
2. Craft has done a remote loop-around test for the online DS1.
3. The online reference reports a red alarm.
4. The online reference reports a blue alarm.
5. If as many as 50% of those spans that are administered for slip-enable are experiencing slips (with respect to the primary), then a decision is made to switch to the secondary.
6. The online reference reports that its misframe threshold has been exceeded.
7. The online reference reports that its slip threshold has been exceeded.

For switches that do not have the secondary reference, a switch to the local oscillator will only be made for cases 1, 2, and 3.

Criteria for Switching Back to the Primary Reference

Each time the master tone-clock synchronizer reports a LOS, it increments the excessive reference switch counter. If a total of 50 switches occur within a 1-hour interval then the local oscillator is placed online and automatic reference switching is disabled. Automatic reference switching is only enabled by hourly maintenance or by the `enable synchronization` command.

With automatic reference switching enabled, most Generic 1 error counters are decremented by 1 every 15 minutes and initialized to zero on reaching the threshold value. The following conditions cause an offline reference to be restored to online.

1. The system configuration maintenance detects DS1 circuit pack sanity (for example, a DS1 has been reinitialized, reinserted into the carrier, and/or replaced).
2. The DS1 reference determines that the LOS error no longer exists.
3. The remote loop-around test is completed.
4. The red alarm has been cleared.
5. The blue alarm has been cleared.
6. The slip error counter has cleared.
7. The misframe error counter has cleared.

The External Synchronization Clock

Beginning in 1990, all customer premises switches (except for System 75, R1V4, and Generic 1) that connect to the AT&T public network and transfer timing must use a stratum-4 type-I clock or better (such a clock already exists in System 75, R1V4). For AT&T customer-premises switches (except Generic 1), the method chosen to meet this requirement is the external synchronization clock (Generic 1 uses an internal-clock upgrade). For System 85, the external clock, new cabling, and TN2131 external clock interface circuit pack are used instead of the SCS-tone clock and its associated cabling and administration.

One advantage of the stratum-3 clock is that it offers free running accuracy. Using an external stratum-3 clock, therefore, can avoid many slips when a network is severed.

The external clock may be retrofit into existing System 85s (R2V3 and R2V4). Furthermore, most Generic 2s will use the external clock. The clock is physically mounted external to the switch cabinets.

The external clock requires -48VDC power. This power source may be an existing -48VDC power plant (which is located on customer premises), or one or two cabinet-mounted power supplies. The input voltage tolerance is -45V to -52V with a worst-case current drain of 3A. Each cabinet mounted power supply provides up to 10 minutes of holdover.

In terms of functional application, the external clock connects between the NCTEs and the switch. Cabling for the I/O and alarm connections is via 25-pair cables with 50-pin telephone connectors. The NCTE-to-external clock connection has the same distance limitations as the NCTE-to-DS1 connection (655 feet maximum). For System 85 and Generic 2, the cable run from the external clock to the TN2131 circuit pack cannot exceed 3000 feet. Cable connections to and from the external clock will route via the yellow cross-connect field. Figure 5-7, *Public-Network External Clock*, shows a public-network configuration of the external clock.

The external clock provides two timing reference inputs and may connect to two NCTEs. These timing reference inputs are called *Reference 1* and *Reference 2*. They are functionally equivalent to the primary and secondary references used with the stratum-4 type-I or type-II clock; however, the

references must be from a stratum 3 or stratum 2 source. The same basic considerations that apply to the selection of primary and secondary references also apply to these references.

For System 85 and Generic 2, all functions previously performed by SCS synchronization software are now provided external to the switch — by the external clock. Furthermore, the switch does not know which reference (1 or 2) is online nor can the switch change from one reference to the other.

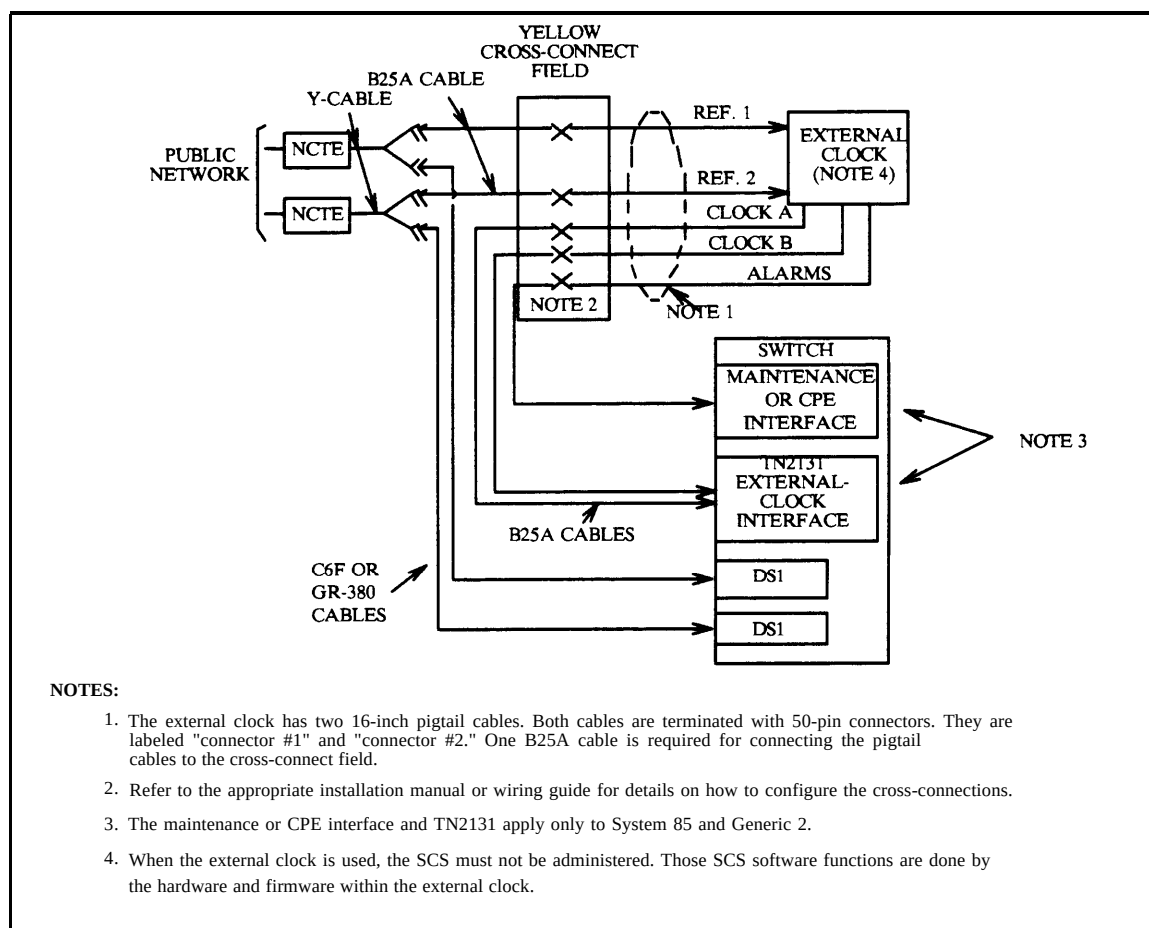


Figure 5-7. Public-Network External Clock

The external clock is designed to provide stratum-1 reliability and exists in a duplex (clock 1 with reference switching and clock 2) version. This version provides *hot standby* capability (the ability to pull out circuit packs with power on) to the alternate clock and may be used with a switch containing a single common control or a duplicate common control. This version may be used with a switch that only contains a single common control. Figure 5-8, *External Clock*, shows a functional diagram of the external clock.

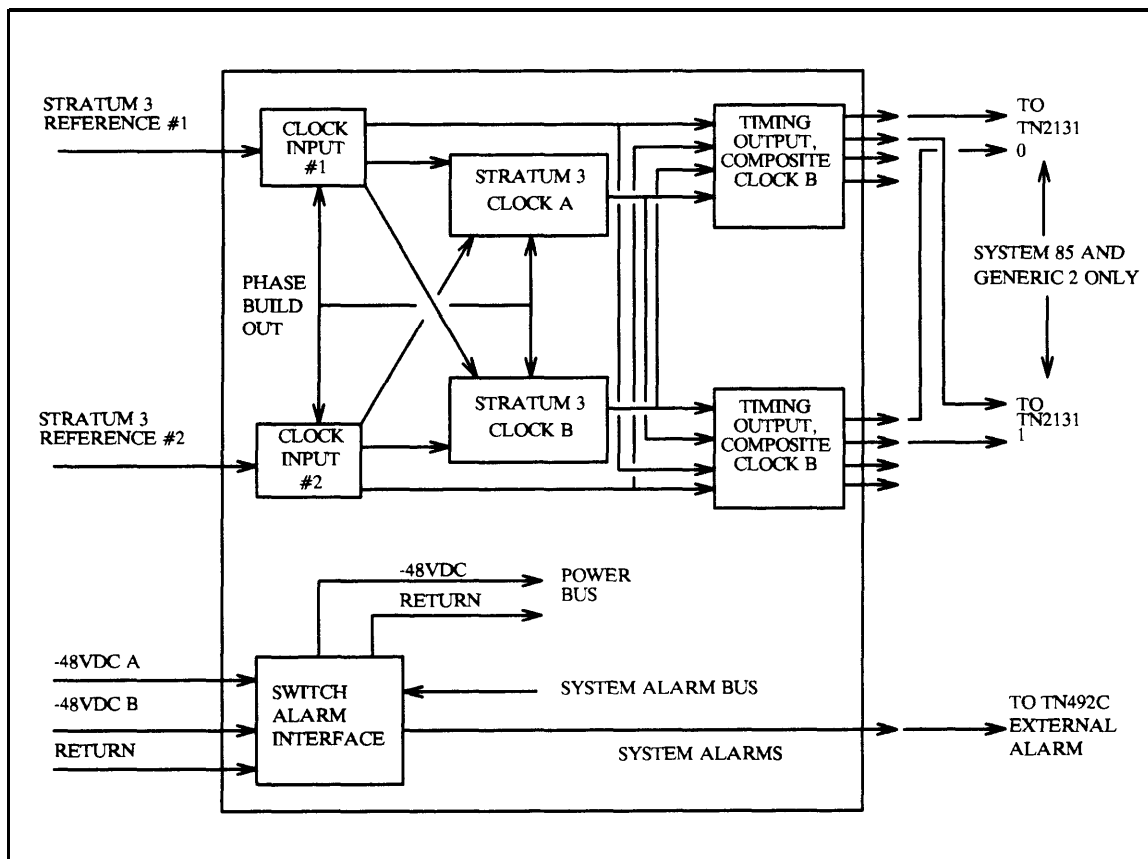


Figure 5-8. External Clock

Private network applications that do not have digital connections to the public network will not provide the *Reference 1* and *Reference 2* inputs or the clock-input #1 and clock-input #2 circuit packs. These types of network applications are not allowed.

For public-network applications, the clock-input circuit pack derives a 1.544M-bps clock signal from the reference. The clock #1 and #2 circuit packs generate a 64K-bps stratum-3 clock signal. The *composite clock output* circuit pack monitors the 64K-bps signals from the references and clocks and, on detecting a failure or other error, automatically changes from the online reference clock to an alternate. Furthermore, an alarm signal alerting you of the problem is generated. Additionally, the composite clock output circuit pack generates a 64K-bps composite clock signal. This signal is a special bipolar (return-to-zero) signal that contains a bipolar violation every eighth bit and is cabled to the switch (for System 85 and Generic 2, the TN2131 circuit pack).

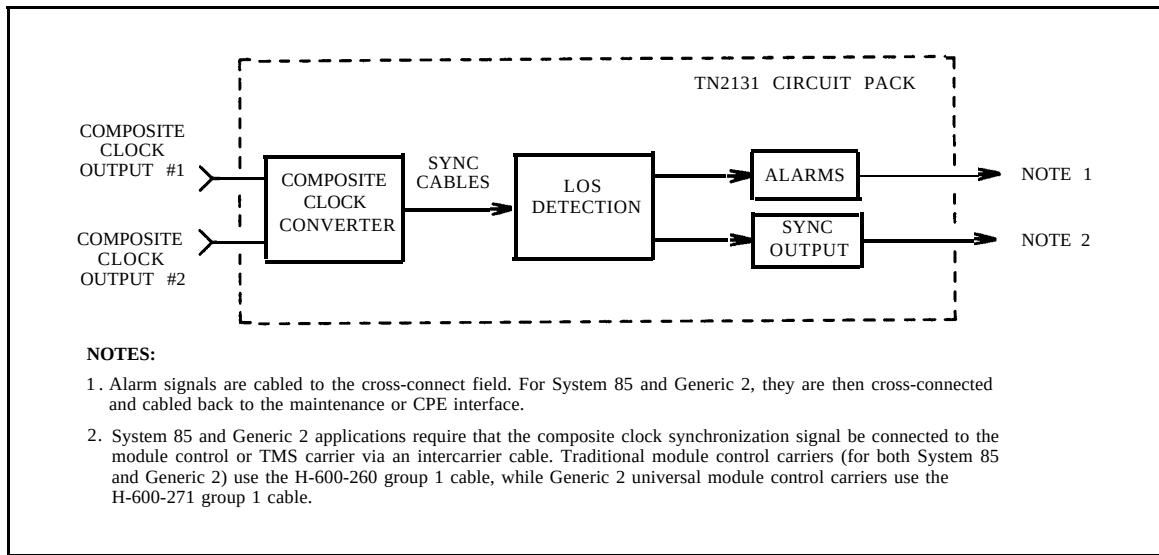


Figure 5-9. External-Clock Interface

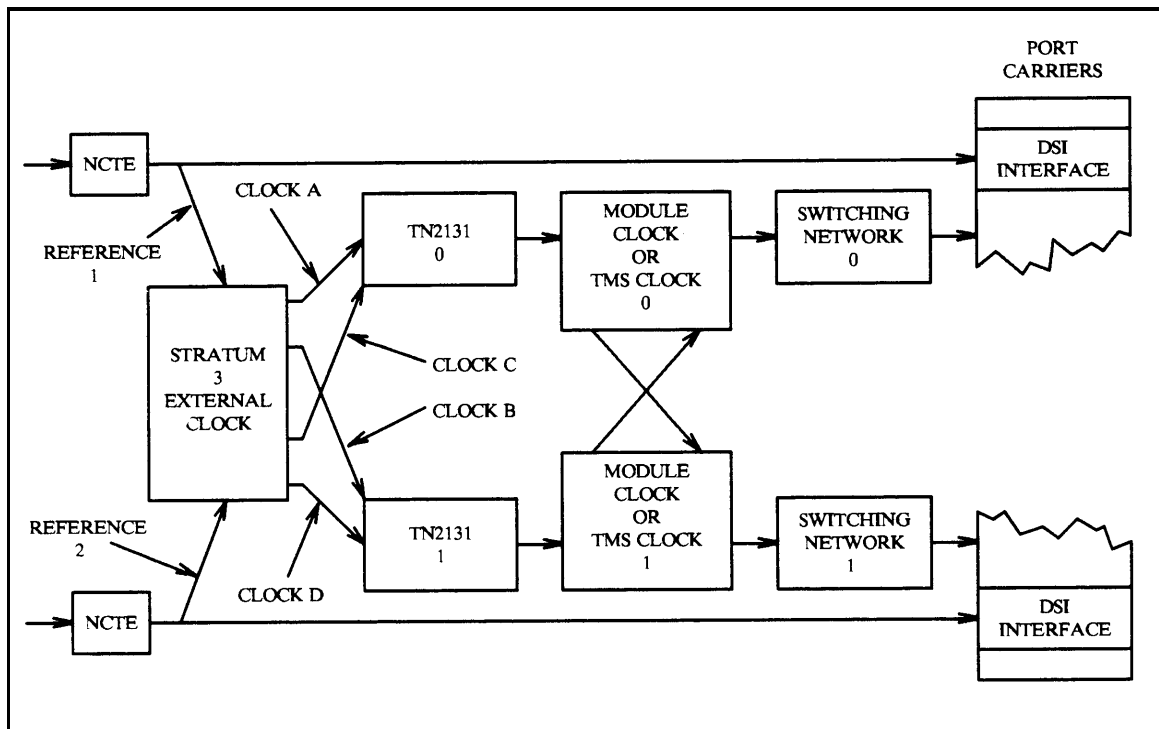


Figure 5-10. External-Clock Duplicated Synchronization

NETWORK SYNCHRONIZATION AND ENGINEERING

The primary goals of network synchronization are:

- To keep each digital network node reliable
- To make sure that each digital termination can meet the network objectives

The procedures to achieve these goals include:

- Ensure that all nodes and facilities are synchronized to a single source of timing; or at the worst, to two or more stratum-2 timing sources
- Select the most reliable digital facilities to serve as synchronization references at each node
- Choose facilities with the greatest availability and least outage. For example, facilities that are located in hostile environments or that have a history of service disruptions should not be used.
- Ensure that no timing loops can be created even under failure conditions, that is, timing from one node can never serve as a source of timing back to that node, even if it is looped through several other nodes

Selecting a Timing Source for the Switch

Before selecting a timing source, you should draw or obtain a copy of the network topology (which indicates each node and the interconnecting digital trunk facilities). The nodes in the private network should be stratified (divided) into two levels known as *externally* referenced and *internally* referenced (sometimes called *unreferenced*). Externally referenced nodes are those within the private network that connect directly to public network timing sources. Internally referenced nodes have digital facilities that do not connect directly to public network timing sources. Figure 5-11, *External and Internal Reference Levels*, shows a typical network topology with externally and internally referenced nodes.

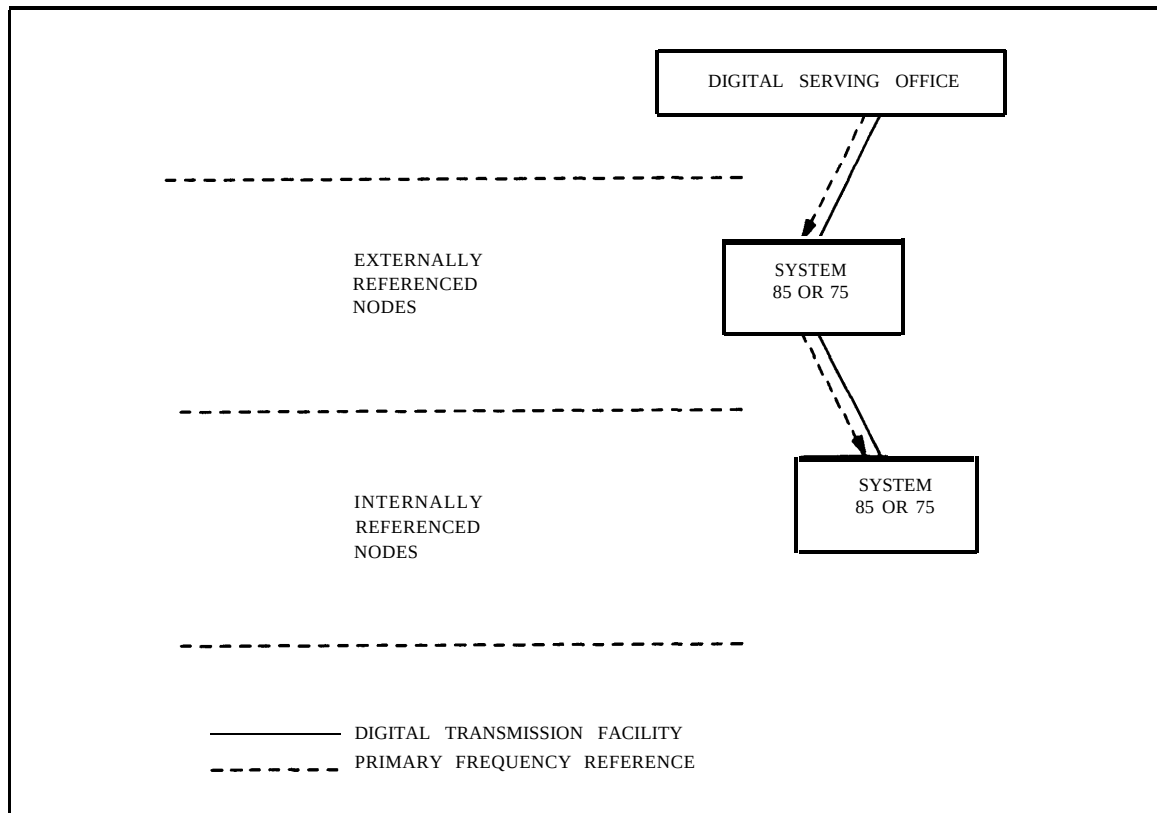


Figure 5-11. External and Internal Reference Levels

For externally referenced nodes, the operating company personnel will specify what the source of timing is on those links. If the network does not receive timing from the public network at any of its nodes, the master-slave relationships in the network will then be determined by those persons responsible for engineering the synchronization of the network.

This internal and external referencing concept permits constraints in synchronization network layout to be expressed in terms of network layout rules. The rules constitute a procedure to select the nodes used as primary and secondary references. Two sets of reference selection rules are available: one set for internally referenced networks and the other for externally referenced networks.

Internal Reference Selection Rules

The seven rules used to select internal synchronization references are described next.

RULE 1:

Select the node with the lowest stratum clock as the network reference clock master and have the rest of the nodes derive slave timing from it.

If there one or more clocks in the network at the lowest stratum level, the following steps can be taken to determine the clock that should become the network reference clock source.

Step 1: If there is only one digital switch in the network, that switch is to be the network reference clock master.

Step 2: If there is more than one digital switch in the network, rules 2 through 7 should be used to determine the switch that should be the network reference clock (master).

Step 3: If there are no digital switches in the network, choose a digital terminal product as the network reference clock master and have the other nodes derive timing from it. Listed in order of preference, use a CEM, a D4-channel bank, or a CDM as the network reference clock master.

The CDMs can only be used to provide timing when they are used to emulate a D4-channel bank.

EXAMPLE FOR RULE 1

Figure 5-12, *Nonpublic Network without Digital Services*, is used to explain the application of rule 1.

To determine the synchronization plan for figure 5-12, *Nonpublic Network without Digital Switches*, the following tasks were performed. First, according to rule 1, an attempt was made to find a node with the lowest stratum clock. The attempt failed because all the nodes in the illustration provide stratum-4 timing. Therefore, the steps under rule 1 must be used. Steps 1 and 2 are not applicable because there is no digital switch in the network.

Under Step 3, it was determined, according to the ranking, that a CEM should be the network source clock. Next, rules 2 through 7 were used to determine which of the two CEMs should be the network source clock. For rules 2 through 6, both CEMs were equally qualified. Therefore, an arbitrary decision was made to choose the CEM on the left.

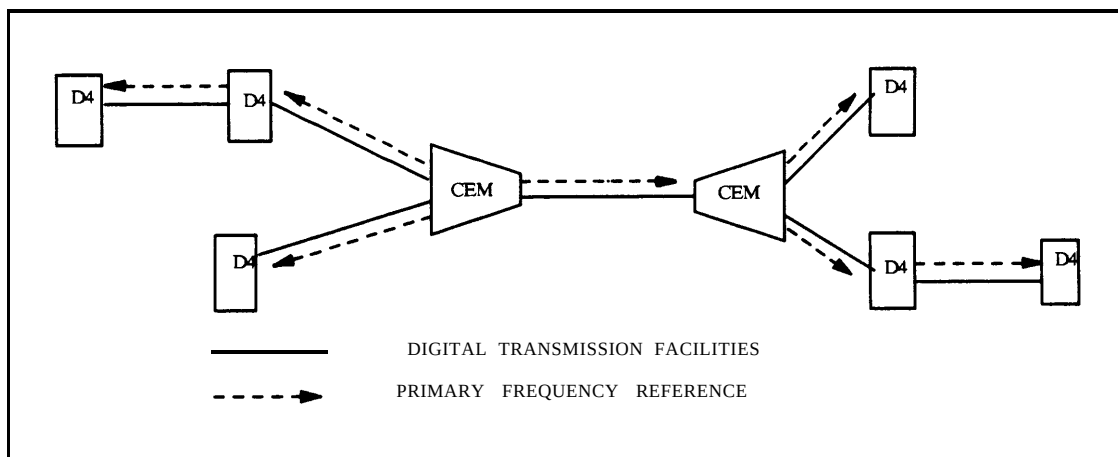


Figure 5-12. Nonpublic Network without Digital Switches

The digital terminal products do not automatically switch to their internal high-accuracy clock on synchronization reference failure.

RULE 2:

A node may use a facility as a backup only if the node at the other end is not using that same facility as a backup.

EXAMPLE FOR RULE 2

Figure 5-13, *Proper Use of Backup Facilities*, illustrates an application of rule 2 and proper use of a backup facility between nodes A and C.

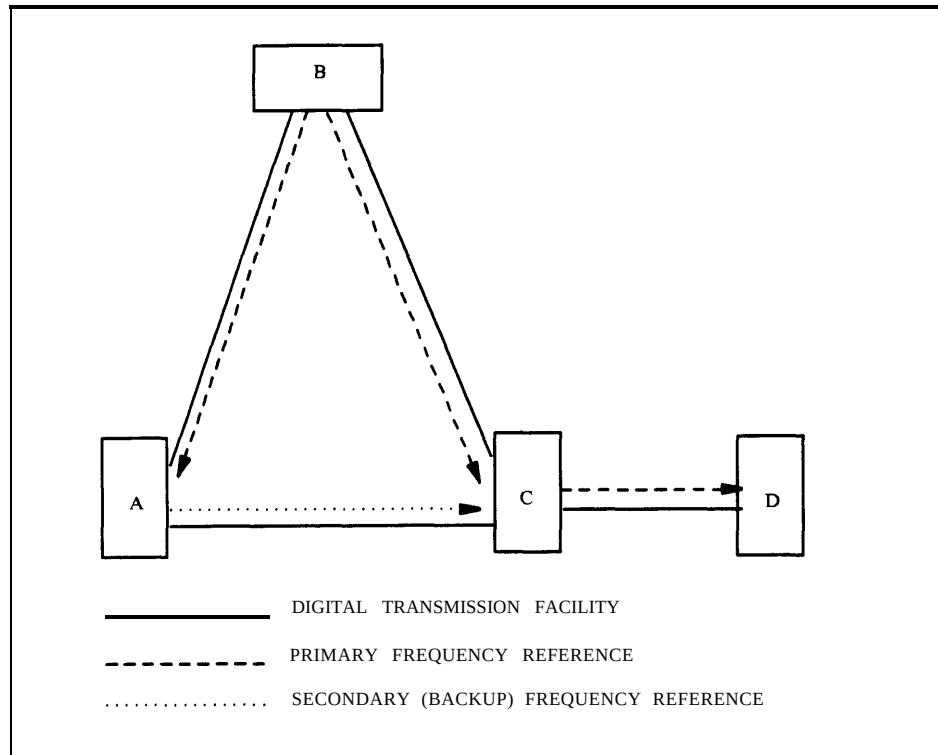


Figure 5-13. Proper Use of Backup Facilities

Figure 5-14, *Improper Use of Backup Facilities*, shows the same network arrangement but with improper use of the backup facility between nodes A and C. This improper arrangement would form a timing loop if node B should fail (nodes A and C would switch to their backup, which is each other).

RULE 3:

The transmission facilities associated with those nodes meeting Rules 1 and 2 and having the greatest availability must be selected for primary and secondary synchronization facilities.

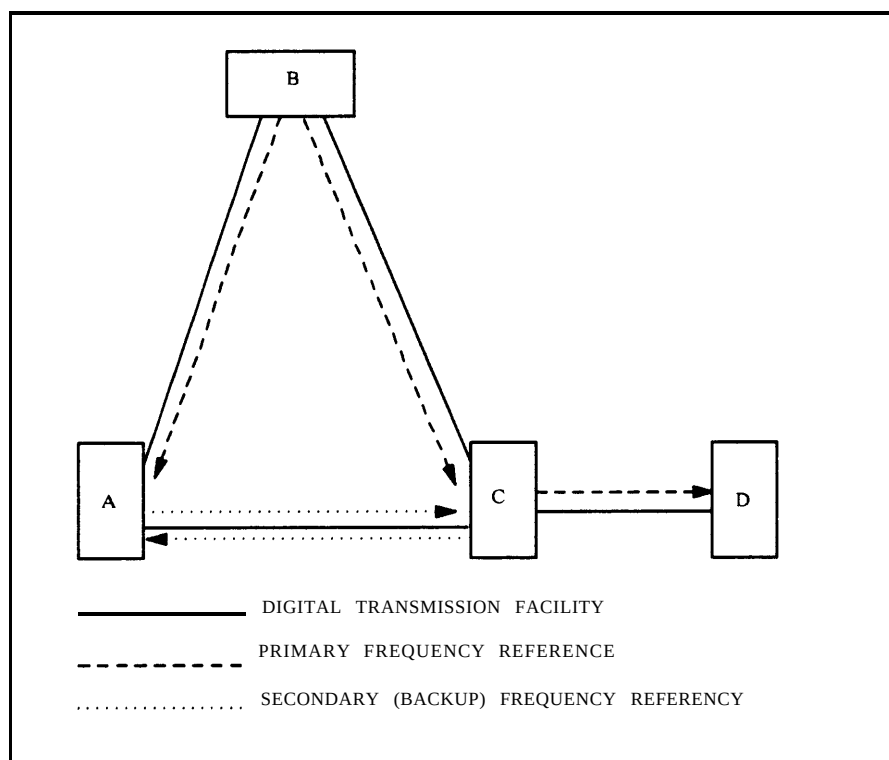


Figure 5-14. Improper Use of Backup Facilities

Availability is defined as the ratio of the mean time between failures (the average time between successive system failures abbreviated *MTBFs*) to the sum of the *MTBFs* and the mean time to repair (the total maintenance time divided by the total number of failures during the same amount of time abbreviated *MTTR*). Low availability (poor transmission performance) is used as a criterion to reject a facility as a reference candidate or to reassign one already chosen.

Characteristics that primarily determine the availability of a transmission facility are rank-ordered as follows:

1. History record
2. Activity
3. Facility length
4. System rate (that is, whether the facility supports T1 or fiber)
5. Protection switching
6. Physical type (that is, whether the facility is physically installed as an underground, buried, or aerial paired cable, a coaxial cable, or a radio link). (Satellite facilities should not be used to supply synchronization.)
7. Number and type of regenerative repeaters
8. Number of digital terminal products and other intermediate office equipment, if any

Facility rank ordering is generally based on limited technical and operational information. It is recommended that facility selections be based on local field experience where available.

In figure 5-14, *Improper Use of Backup Facilities*, only node C has both a primary and a secondary frequency reference. Node C derives its primary source from node B and its secondary timing source from node D. This configuration is optimal because if either node B, D, or the interconnecting facilities should fail, node C would still receive timing traceable to node A from the other node.

RULE 4:

Where possible, the routes for all primary and secondary synchronization facilities should be diverse.

EXAMPLE FOR RULE 4

Figure 5-15, *Optimal Diverse Routing*, explains the optimal configuration when rule 4 is used. Figure 5-16, *Less Than Optimal Diverse Routing*, shows a less than optimal application of rule 4.

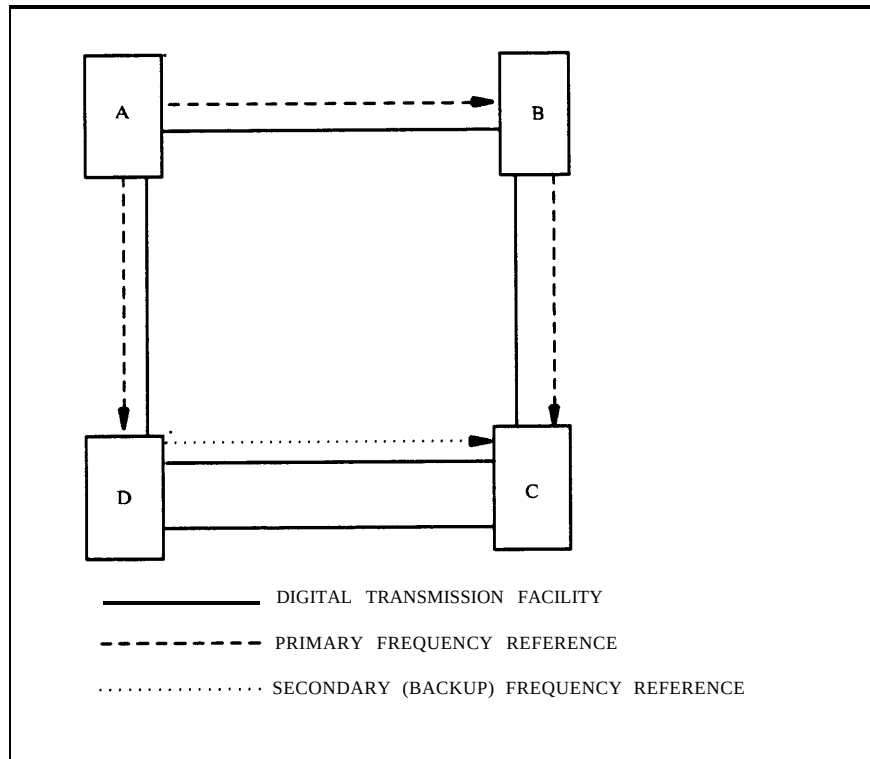


Figure 5-15. Optimal Diverse Routing

Figure 5-16, *Less Than Optimal Diverse Routing*, shows node C deriving both primary and secondary timing from node D, via the two separate T1 facilities. If node D should fail, node C would no longer receive timing that is traceable to node A. Here, node C would lose synchronization and begin to introduce slips into the network.

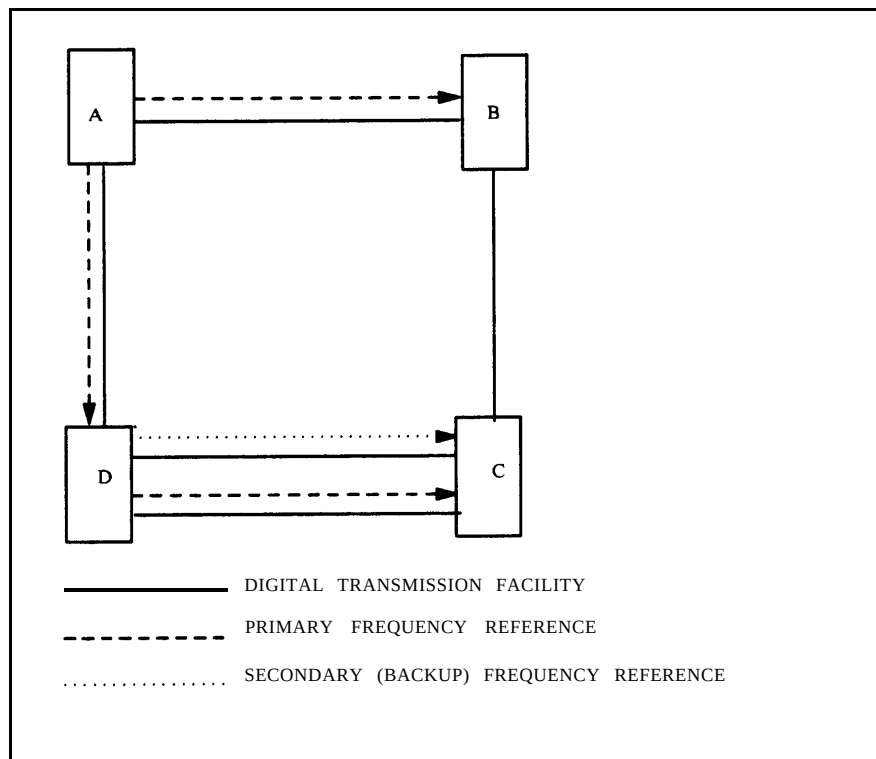


Figure 5-16. Less Than Optimal Diverse Routing

RULE 5:

Obtaining both primary and secondary synchronization facilities from within the same transmission cable should be minimized.

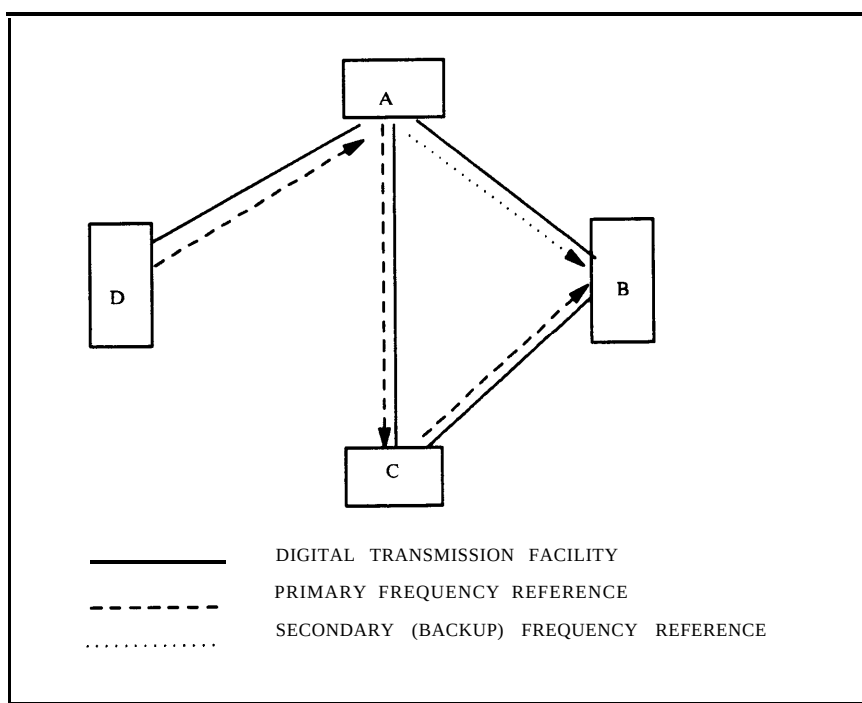
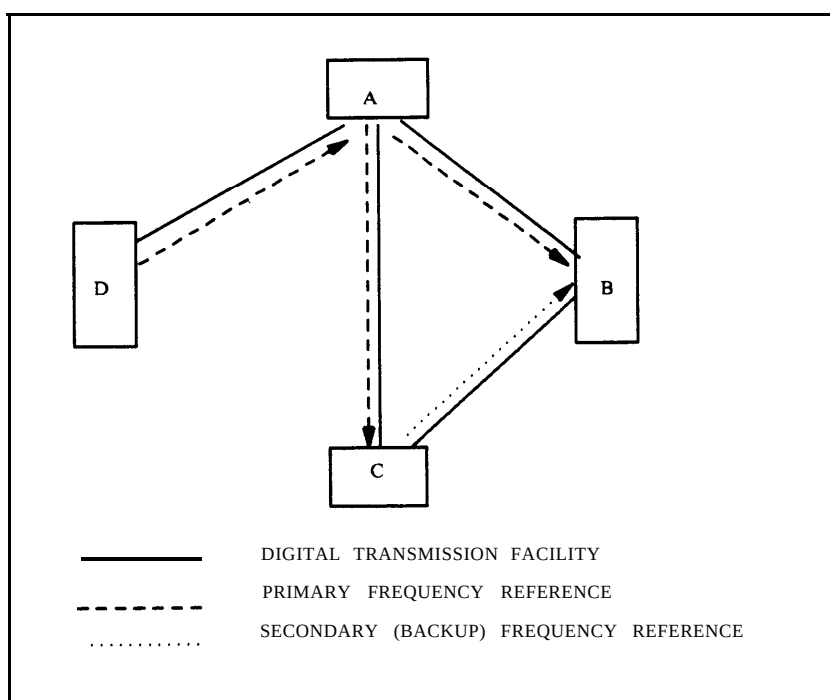
RULE 6:

The total number of cascade node connections from the referenced node should be minimized.

EXAMPLE FOR RULE 6

Figure 5-17, *Excessive Cascading*, shows excessive cascading in that node B derives timing from a source three transmission facilities away.

Figure 5-18, *Minimized Cascading*, shows less cascading in that node B derives timing from a source two transmission facilities away. Excessive cascading is undesirable because of intermediate link vulnerability. For example, an intermediate link failure in node C of figure 5-17, *Excessive Cascading*, would cause node B to lose timing. Such a failure increases the number of slips between nodes A and B. However, the same failure in Node C of figure 5-18, *Minimized Cascading*, does not affect node B's synchronization.

**Figure 5-17.** Excessive Cascading**Figure 5-18.** Minimized Cascading

RULE 7:

The number of nodes receiving synchronization reference from any given node should be minimized.

EXAMPLE FOR RULE 7

Figure 5-19, *Excessive Synchronization from One Node*, shows an excess of synchronization from one node. If transmission facility linking nodes A-B fails, then nodes B, D, E, and F will lose their synchronization. However, if this same facility fails in figure 5-20, *Minimized Synchronization from One Node*, only nodes B, D, and E will lose synchronization. Node F remains synchronized to the network.

With few exceptions, it is not possible to engineer a synchronization network that will satisfy all seven rules. In general, rules 1 through 3 apply in all cases. For rules 4 through 7, use those rules that apply to your specific network and try to minimize outages based on the cases presented in the examples for each of these rules.

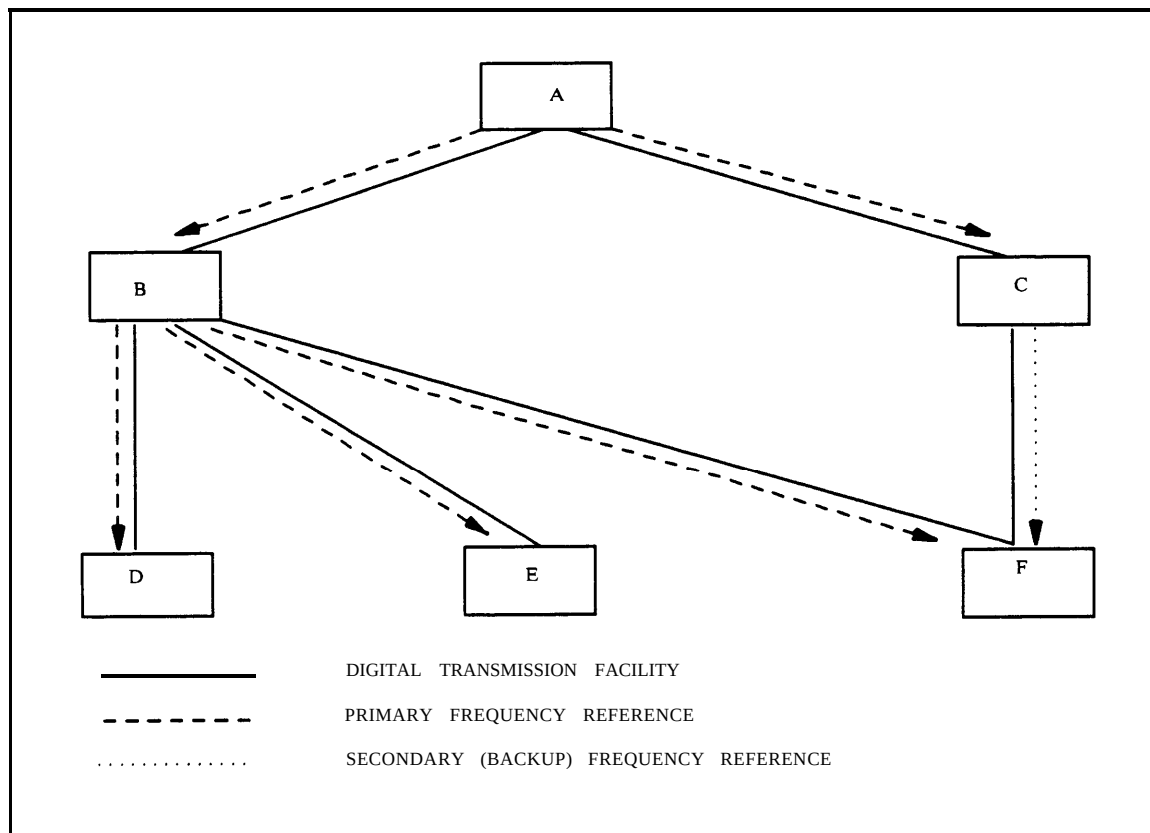


Figure 5-19. Excessive Synchronization from One Node

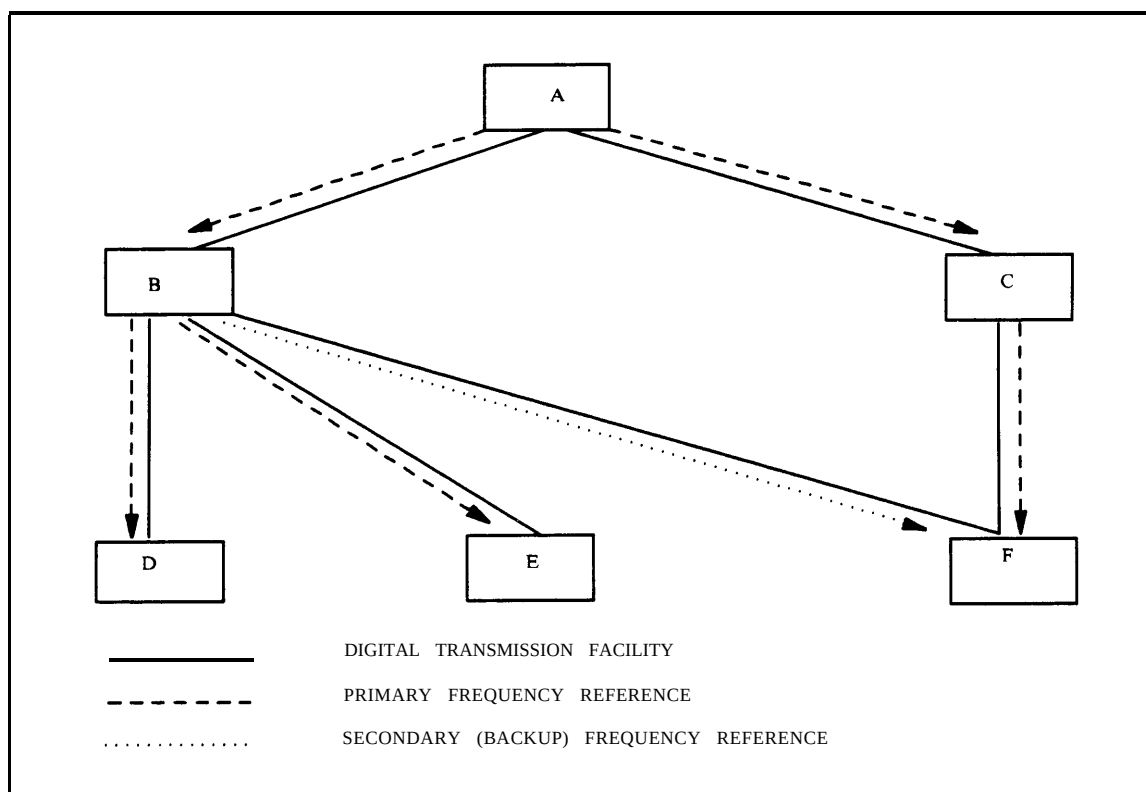


Figure 5-20. Minimized Synchronization from One Node

External-Reference Selection Rules

There are seven rules for selecting external synchronization references. These rules are described next.

RULE 1:

Nodes within the externally referenced sublevel may not use as a reference source a facility from a node within the internally referenced sublevel (refer to figure 5-11, External and Internal Reference Levels, for an explanation of these terms).

RULES 2 THROUGH 7:

Rules 2 through 7 are the same for both internal- (that is, SCS and HAC) and external-reference selections.

AVAILABILITY OF SYNCHRONIZATION SOURCES

- Misconception 1** The local exchange company (LEC) can always provide the synchronization source.
- Fact 1** The LECs are not always subscribers to the AT&T reference frequency. Many end offices still use analog switches and D4-channel banks. In the past, these channel banks have not had to be synchronized and probably have not been equipped with an office interface unit (OIU-2); therefore, they do not provide a lower- (3, 2, or 1) stratum reference.
- Even if the CO provides a lower stratum reference, a T1 facility must be terminated in equipment that is clocked by the lower stratum reference to access this lower reference.
- Misconception 2** AT&T communications can provide the synchronization source.
- Fact 2** AT&T communications is bound by FCC tariffs that currently do not require the use of framing bits in the customer's incoming T1 bit stream. Until framing bits are required, you should not arbitrarily assume that the carrier's T1 facilities provide a synchronization source.
- Misconception 3** Synchronization is not necessary for DS1 networks that only transmit voice.
- Fact 3** The issue here is the use of a digital switch instead of channel banks. With channel banks, the transmit and receive functions are separate and could have different clock frequencies without slipping. With channel banks, it makes no difference whether you transmit voice or voice-grade data. However, a Generic 1 and Generic 2 DS1 does not have separate transmit and receive equipment and therefore must use a single reference frequency to prevent overrunning or underrunning the buffers.
- Misconception 4** The OIU-2 is not required in a D4-channel bank since both Generic 1 and Generic 2 are D4 compatible.
- Fact 4** Both Generic 1 and Generic 2 are (when operating in D4 mode) compatible with D4-formatted DS1 or T1 facilities. However, a DS1 was not designed to be functionally the equivalent of a channel unit. D4-channel banks, as described in Fact 3 above, use line-powered oscillators to provide their clocking. Given the normal drift in an AC line, the transmit frequency of a D4-channel bank can vary significantly. The OIU adds a stratum-4 clock to the common equipment of a D4, allowing the transmit and receive sections to be commonly synchronized to:
- The incoming line (loop timed)
 - Free-running (stratum 4 accuracy)
 - An external reference (a link to the output of a lower stratum reference), which applies to both DS1 span; you can select either DS1 span as the reference for both

CONCLUSIONS ON SYNCHRONIZATION

Make no assumptions regarding synchronization. Reverify items such as the availability of a synchronization source, the clock stratum, and compatibility of every T1 span. The best guarantee is written confirmation that the local exchange carrier, AT&T Communications, or other vendor will either synchronize to a System 75, System 85, Generic 1, Generic 2, or provide an appropriate synchronization reference.

Develop a diagram showing the network synchronization plan. Make multiple copies of this diagram and keep a copy at each switch site. This diagram is essential for installing, administering, and *tuning up* a DS1 network. Such a diagram can also be used by maintenance personnel to troubleshoot network problems associated with synchronization.

USE OF GENERIC 2 AS A SYSTEM CLOCK REFERENCE

To provide increased reliability, it is recommended that (for all cases) the primary and secondary system clock references be placed in different modules. Tips on how best to use DS1 as a clock reference are provided next.

ISDN-PRI Trunk Facilities (ANN35 or TN767 with TN755)

ISDN-PRI trunks may terminate on a 4ESS toll office, 5ESS digital CO, System 85 R2V4, Generic 1, Generic 2, or compatible vendor's switch. Depending on other considerations, any of these terminating connections may be selected as a synchronization reference, either primary or secondary.

Line-Only Mode DS1/DMI-BOS (ANN11_ or TN767)

When using a line-only mode interface for synchronization purposes, the following facts should be known:

- Since the D4-channel bank (or equivalent) at the far end will be timed to the signal received from a DS1, no slips should occur on a line-only mode DS1 facility. Because of this, slip counts from line-only mode DS1s should not be used in the process of determining the health of a clock reference (that is, they would tend to make the reference appear to be in better condition than it may be).
- Line-only mode DS1s should not be used as system clock references unless it is known for certain that the incoming DS1 is locked to the AT&T reference frequency. Normally a DS1 facility terminating directly on the far end D4-channel bank will not be locked to the AT&T reference frequency.

Line+Trunk Mode DS1/DMI-BOS (ANN35 or TN767 with TN555)

Regarding the use of a line+trunk mode DS1/DMI-BOS for synchronization, the following point should be noted. Since it would be expected that a line+trunk mode DS1 would terminate at a class-5 or higher CO or at another switch, the line+trunk interface should be suitable for use as a primary or secondary clock reference (or to be the timing master for another switch).

The slip count provided by the interface should also be used in the process of choosing a healthy clock reference. However, when the interface terminates on a D4-channel bank (or equivalent) that is not locked to the AT&T reference frequency for its timing, then the interface should not be used for synchronization.

DMI-MOS (ANN35 or TN767 with TN755)

System 85 DS1/DMI-MOS (ANN35) will only terminate at a compatible computer. The computer must always obtain its timing from the switch. The switch should never select the DMI-MOS link as a timing reference.

Although those circuit packs that support connections to remote modules operate at the DS1's rate, they are not the same as the DS1/DMI/ISDN-PRI. Remote module connections cannot be used as a clock synchronization reference.

USE OF GENERIC 1 AS A SYSTEM CLOCK REFERENCE

To provide increased reliability, it is recommended that (for all cases) the primary and secondary system clock references be placed in different modules. Tips on how best to use DS1s as a clock reference are provided next.

Trunk-Mode ISDN-PRI (TN767)

ISDN-PRI trunks may terminate on a 4ESS toll office, 5ESS digital CO, System 85 R2V4, Generic 1, Generic 2, or compatible vendor's switch. Depending on other considerations, any of these terminating connections may be selected as a synchronization reference, either primary or secondary.

Trunk-Mode Interface (ISDN-PRI + Robbed Bit) (TN767)

Since it is expected that a trunk mode DS1 would terminate at a class-5 or higher CO or at another switch, the trunk interface should be suitable for use as a primary or secondary clock reference (or to be the timing master for another switch).

The slip count provided by the interface should also be used in the process of choosing a healthy clock reference. However, when the interface terminates on a D4-channel bank (or equivalent) that is not locked to the AT&T reference frequency for its timing, then the interface should not be used for synchronization.

Line-Only Mode DS1/DMI-BOS (TN767)

When using a line-only mode interface for synchronization purposes, the following facts should be known:

- Since the D4-channel bank (or equivalent) at the far end will be timed to the signal received from a DS1/DMI, no slips should occur on a line-only mode DS1/DMI facility. Because of this, slip counts from line-only mode DS1/DMI should not be used in the process of determining the health of a clock reference (that is, they would tend to make the reference appear to be in better condition than it may be).
- Line-only mode DS1/DMI should not be used as system clock references unless it is known for certain that the incoming DS1/DMI signal is locked to the AT&T reference frequency. Normally, a DS1/DMI facility terminating directly on the far end D4-channel bank will not be locked to the AT&T reference frequency.

Trunk-Mode DS1/DMI-MOS (TN767)

For Generic 1, DS1/DMI-MOS (TN767) will only terminate at a compatible computer. The computer must always obtain its timing from the switch. The switch should never select the DMI-MOS link as a timing reference.

6. PORT TYPES/INSTALLATION COMPATIBILITIES

This chapter describes the operating modes, installation compatibilities, and port types supported by DS1s. Because of differences between Generic 1 and Generic 2 software and hardware, appropriate distinctions are identified and separate sections provided.

To date, DS1s have been well accepted. For both Generic 1 and Generic 2, DS1s were initially available for providing digital tie trunks. Later versions of DS1s and later releases and versions of the switch software provide additional capabilities. These later version circuit packs are always backward compatible with previous types.

However, new capabilities that depend on software may only be available on the earlier releases when the required software is provided, whether the software is a patch or later issue of the tape. Not all new capabilities are backward compatible to earlier releases and versions. Table 6-1, *Supported Digital Facilities*, lists the available capabilities and the hardware and software dependencies.

Engineering problems are minimized by having a good understanding of:

- DS1/DMI, and ISDN-PRI capabilities
- Hardware and software compatibility requirements
- Services that the particular application requires
- All carrier facilities that will be used to complete the end-to-end transmission facility (both local exchange company (LEC) and toll network carrier)
- The labeled network diagram

Installation problems are minimized by proceeding from a labeled network diagram. Each DS1 or all intermediate transmission equipment, such as channel-expansion multiplexers (CEMs), channel-division multiplexers (CDMs), network channel-terminating equipment (NCTE), network carrier multiplexers, channel banks, or channel units, should be verified for compatibility. Verification includes a review of the administration options and, where appropriate, the option-switch settings.

Each end of the channel must be fully compatible. For example, if at one end channel 1 is used as a tie trunk, then channel 1 at the distant end must also be used as a tie trunk. Or, if a group of channels (for example, 1-16) are administered for call-by-call (CBC) use at one end, then the same group of channels must also be used for call by call. If, at one switch, extended super framing (ESF), 24th-channel signaling, and the zero code suppression (ZCS) line-code format are optioned, then the distant end and all intermediate facilities must be administered or optioned likewise.

CAUTION: The 551V channel service units will only function with the ZCS line-code format. They will not pass B8ZS bipolar violations. If the B8ZS line-code format is used for copper carrier facilities, then the 551V ST (or equivalent) NCTE should be installed and optioned accordingly.

The CDMs are T1 multiplexers that provide an economical means to independently access any of the 24 channels from a DS1 or T1 facility. This access means is called *per-channel drop and insert capability*. One line-interface unit, the CDM DS1, connects to the compatible equipment (such as, a

Generic 1, Generic 2, CEM, or D4-channel bank). The other line-interface unit connects to the NCTE and T1 facility.

Dedicated data applications, both point-to-point and multipoint, can be connected to the CDM and inserted in selected channels. At the receive end, particular channels may be dropped from a DS1 or T1 facility by another CDM, or routed through a dedicated switch connection (DSC) as required.

TABLE 6-1. Supported Digital Facilities

DS1/DMI/ISDN-PRI Circuit-Pack Suffix Compatibility Matrix									
Signaling Type	System 85 R2 and G2						System 75 R1 and G1		
	Switch Version	TN380_	ANN11_ (Note 1)	ANN35_	TN555 (G2 Only)	TN767 (G2 Only)	Switch Version	TN722_	TN767
E&M Signaling	V1-V4,G2	B, C, D (Note 2)	B, C, D, E (Notes 2&3)	N/A	N/A	all	V2,V3,G1	all	all
Ground Start (CO, FX, WATS, RA, Plus DID)	V3,V4,G2	C, D	C, D, E	N/A	N/A	all	G1	N/A	all (Note 4)
Loop Start (CO, FX, WATS, RA)	V3,V4,G2	C, D	C, D, E	N/A	N/A	all	G1	N/A	all (Note 4)
OPS Line (Note 5)	V3,V4,G2	C, D	C, D, E	N/A	N/A	all	G1	N/A	all
DMI-BOS (Note 3)	V3,V4,G2	C, D	D, E	N/A	N/A	all	V2,V3,G1	B	all
DSC (analog data)	V3,V4,G2 (Note 6)	C, D	C, D, E	all	N/A	all	N/A	N/A	N/A
DMI-MOS and ISDN (Note 7)	V4,G2	D	N/A	all	N/A (Note 8)	all	G1	N/A	all
Proprietary	V1-V4,G2	B,C,D (Note 2)	C,D,E	N/A	N/A	all	V2,V3,G1	all	all

NOTES:

1. The ANN11E and ANN11C have similar functions with one exception: the ANN11E supports the DMI-BOS 24th-channel-signaling format and the ANN11C does not. The DMI-BOS format was added in addition to the proprietary 24th-channel and robbed-bit formats supported by ANN11C. The applications of these formats are summarized below in a feature comparison. The ANN11C and ANN11E are compatible with respect to all other options not listed in this table (including robbed-bit (RB) signaling, D4/ESF framing, and ZCS/B8ZS line coding).

SIG. TYPE ANN11 REQ	APPLICATIONS SUPPORTED
Robbed Bit C or E	Voice-grade tie, DID, & CO trunks, OPS lines, connections to D4-channel banks, DSCs, ACCUNET® switched digital
Proprietary C or E 24th Chan.	AVD-tie trunks between System 85s and between System 85 and System 75
DMI-BOS E 24th Chan.	Proprietary 24th-channel format applications plus connections to any endpoint conforming to the "AT&T Digital Multiplexed Interface Technical Specification". Examples include 3B5 hosts, HP3000 hosts, and IBM® IDNX multiplexers. These endpoints are called "DMI-BOS endpoints" in these notes. Other vendor equipment is certified by AT&T for this connectivity. Certified equipment requires an ANN11E at the System 85 end.

Application issues about the ANN11C and ANN11E are summarized below.

- a. It is not necessary to administer a DMI trunk type (108 or 109) or set the “Application Type” in procedure 260 to “DMI-BOS” to use DMI-BOS signaling. To get DMI-BOS, use an ANN11E and administer 24th-channel signaling on the ANN11E by setting field 8 in procedure 260 to 0. This causes ANN11E firmware to use the DMI-BOS signaling format for all trunk types administered on that ANN11E. The only exception is where an ANN11E is connected to an ANN11C that is also administered for 24th-channel signaling (see item c below).
 - b. ANN11E provides both DMI-BOS and proprietary 24th-channel signaling types. However, these two signaling types are not selectable via ANN11E administration. When administered for 24th-channel signaling, the ANN11E defaults to DMI-BOS. However, an ANN11E may still be connected to an ANN11C. The ANN11E will automatically determine when the ANN11C (or any other endpoint) is using proprietary signaling and switch to proprietary 24th-channel signaling to maintain compatibility.
 - c. DMI trunk types 108 and 109 are intended for connections to DMI host computer endpoints and for ACCUNET switched digital service. The primary difference of trunk types 108 and 109 is that they inhibit the use of “Data Answer tone” on the trunk. Examples of applications requiring this are a DMI-BOS trunk to a host (which uses DMI-BOS 24th channel signaling) or an ANN11 used for ACCUNET switched digital service access (which requires robbed-bit signaling). Again, trunk types 108 and 109 are not the only trunk types that can provide DMI-BOS signaling. This matters for “non host” DMI-BOS endpoints, such as the IBM IDNX multiplexer. This multiplexer requires DMI-BOS 24th-channel signaling but is not a host. Therefore, the ANN11E that terminates on an IDNX should be administered as any appropriate trunk type other than 108 or 109. Note that, at present, DMIs are only certified for switch-to-host connectivity and not for switch-to-switch connectivity, which appears to be the application of the IDNX multiplexer. This is now the only application of DMI that requires trunk types other than 108 or 109.
 - d. ANN11C may be used in any R2 switch supporting DS1 trunks. However, there is one caveat that applies to switches supporting DMI host trunk types 108 & 109 (System 85 R2V3 and later). If the ANN11C is administered for 24th-channel signaling, it will use the proprietary type. This means that it will work as long as it is connected to a System 75 or System 85 but will not work if connected to another vendor’s DMI-BOS endpoint using trunk type 108 or 109.
 - e. Setting the “Application Type” field of procedure 260 to “DMI-BOS” prevents the associated ANN11 board from being used as a clock reference by a system clock synchronizer. This is only useful when the ANN11 connects to a host. Here, the host loop times to the switch and cannot be used as a clock reference.
 - f. An ANN11D is equivalent to an ANN11E. The E suffix came from adding a fiber interface to the ANN11D. However, the fiber connectivity was not pursued. ANN11Ds were produced in limited numbers for System 85 R2V4.
 - g. The DMI-BOS signaling supported by ANN11E from System 85 R2V3 and later should not be confused with DMI-MOS supported by ANN35 (Primary Rate Interface) from System 85 R2V4 and later.
2. The TN380B (module processor) and ANN11B (DS1) are manufacture discontinued (MD) and are not available for R2V3 or later versions. For duplicated modules, both modules must always be equipped with the same type of module processor; both modules must be equipped with the TN380C or TN380D circuit packs. (TN380D supersedes TN380C and earlier in ISCN 249DR.)
The TN580 has all functions of the TN380D.
 3. The DMI-BOS is available with the ANN11D, ANN11E, and TN722B circuit packs. The ANN11D is only used on some R2V4 CIs. The ANN11E supersedes the ANN11C as the production model. For System 85 and Generic 2, DMI-MOS is available with the ANN35 circuit pack (traditional modules) and with the TN767 or TN755 circuit pack (universal modules).
 4. For Generic 1, DS1, CO, & foreign exchange (FX) with TN767.
 5. The OPS line option is initially available with the TN380C, TN380D, ANN11C, ANN11D, and ANN11E circuit packs. Therefore, the R2V3 software (or later version) is required for administration purposes (procedure 000).
 6. System 85 R2V3 for analog DSC endpoints; System 85 R2V4 for added digital endpoints.
 7. The dynamic trunk group includes CO trunk types (17, 27, and 30), tie trunk types (41, 42, 43, 46, and 47), as well as DMI trunk types (108 and 109).
 8. This requires an accompanying TN555 circuit pack to terminate the D-channel.

Six different types of channel units may be used to provide drop or insert channels. The 4-wire E&M tie trunk is compatible with DS1 tie trunks and may be used for the dedicated switch connection. The All-Rate OCU Dataport — RS-232C (2.4, 4.8, 9.6K-bps) or V.35 (56K-bps) is compatible with an identical channel unit when configured in a D4-channel bank. All other CDM channel units must terminate at a distant CDM on the same channel with an identical channel unit. The emphasis here is what is on one end must be compatible with what is on the other end, channel per channel.

The D4-channel bank is versatile. It may be used as customer-premises equipment to support both circuit-switched (such as with a switch) and dedicated-line applications. The D4-channel banks can also be used at an analog end office (class 5) or configured to provide both voice and data interfaces to a digital toll office (4ESS).

Although the D4-channel bank is compatible with other devices using D4 standards, its most frequent application (from this document's perspective) is as the interface between a DIMENSION® and DS1 or T1 facilities. The physical connections from the D4 to the switch are identical to connections used in any 4-wire analog tie trunk connection. The 4-wire E&M-ER tie trunk should be used because these units include variable attenuators in the range between 0 and 25.5 dB. Therefore, external attenuator pads are not required. Since both analog and digital tie trunks are involved in the end-to-end link, the end-to-end transmission facilities (called a *combination tie trunk*).

GENERIC 1 DS1/DMI-BOS

The operating mode and supported port types for Generic 1 DS1/DMI-BOS are described next.

Operating Mode

Except for the spare slot adjacent to the pack, there are no special slot or option strap considerations for Generic 1 DS1/DMI, as with Generic 2. The TN722, TN722B, and TN767 plug into any normal port slot in the system.

Supported Port Types

The TN722 and TN722B only emulate tie-trunk signaling. That is, they provide 2-state signaling (on-hook/off-hook signaling). Two categories of trunk types perform 2-state signaling: tie trunks and DMI trunks.

The TN767 circuit pack provides CO in addition to tie and DMI trunk types. That is, it provides 4-state signaling (on-hook/off-hook signaling as well as ringing and no-ringing indication, and reverse battery).

NOTE: No restrictions are placed on the type of framing, signaling, or line-coding options used with any of the port types. However, take care to assure that the interface options are compatible with the distant endpoint (D4-channel banks are not now compatible with 24th-channel signaling; most D4-channel banks do not support ESF framing).

Tie Trunk

Generic 1 DS1/DMI tie trunks appear to the switch software as a TN760B analog tie trunk. Therefore, things that can be administered for a digital tie trunk can also be administered for an analog tie trunk (except for alternate voice/data (AVD) common-type trunks).

A tie trunk port presents an interface of a channel unit requiring tie trunk signaling to a far end D4-channel bank. Since six types of tie-trunk channel units use the same digital signaling format, there may not be a one-to-one relationship between a DS1/DMI tie-trunk port and the channel unit on which it terminates at a channel bank. The six types of channel units are type I, II, and III 4-wire E&M, and type I, II, and III 2-wire E&M. While these channel units have the same digital

interface, they differ in their analog voice interfaces (2- or 4-wire) and in the type of E&M (analog) signaling to which DS1/DMI signaling states are converted (type I, II, or III).

A Generic 1 analog tie trunk is a 4-wire type I E&M trunk. Thus, a DS1/DMI tie-trunk port can be considered to be the same, and a 4-wire type I channel unit (or its equivalent) could be used to interface to a DS1/DMI tie-trunk port at the far end.

It appears that any of the other five types of E&M channel units could be used as well, although this capability has not been tested.

DMI Trunks

The DMI trunks are used to provide 64K-bps data connectivity to a host computer or to provide both voice and 64K-bps data connectivity to private or public networks that support DMI-BOS signaling. These trunks must be optioned for the DMI-BOS 24th-channel signaling format. The DMI specification requires one of the four following trunk types: wink-in/wink-out, wink-in/auto-out, auto-in/wink-out, and auto-in/auto-out though Generic 1 does not restrict other trunk types from being administered. These trunk types are administered the same way as other trunk types.

GENERIC 1 ISDN-PRI

All operating modes and supported trunk types of Generic 1 DS1/DMI-BOS are supported for Generic 1 ISDN-PRI. In addition, ISDN-PRI is available with a TN767. Refer to chapter 7, *Administration Options and Requirements*, for specific administration information.

SYSTEM 85 DS1, TRADITIONAL MODULES (ANN11)

The operating mode and supported port types for System 85 DS1 (ANN11) in traditional modules are described next.

Operating Modes

The two operating modes and grouping rules are described next.

Line-Only Mode

The line-only mode of a DS1 allows up to 24 analog stations (and optional modems) to be remoted through a DS1 facility. A D4-channel bank or its equivalent is required at the off-premises end.

NOTE: Each DS1/MFAT carrier may contain a maximum of four DS1 circuit packs that function in line-only mode. These circuit packs may only be located in physical carrier slots 0, 5, 13, and 18. For a DS1 to function in line-only mode (rather than line+trunk mode), those slots containing the DS1 circuit packs must be configured with an option strap. This strap connects

backplane pins 208 and 224. For J58888N1 List 2 Modification C or later, the carrier is manufactured with the strap always installed on slots 0 and 13. The strap may be field installed on slots 5 and 18, as required.

In line-only mode, a DS1 provides the functional equivalent of three analog OPS circuit packs, each containing eight ports. The line-only DS1 thus requires three carrier slots: one for the actual circuit pack and two more as virtual slots. The term *virtual* is used to represent slots whose backplane signals are used by the line-only mode DS1, but not physically occupied by the interface. Virtual slots result from a physical limitation in the number of time slots that are available in each carrier slot.

Only 8 time slots per carrier slot are available to OPS circuit packs. Since a DS1 uses 24 time slots, it must use the time slots associated with the occupied carrier slot, plus those from 2 additional slots. The two virtual slots associated with the real line-only mode DS1 always occupy the two earner slots immediately to the right of the real DS1.

WARNING: These two virtual slots must be left vacant. Otherwise, circuit packs inserted in these slots may be damaged along with the DS1.

A fully equipped carrier contains four line-only DS1s and has four other slots available for analog-type circuit packs. These other slots are physical slot numbers 3, 8, 16, and 21. Therefore, a single carrier can provide up to 96 digital OPS ports. Figure 6-1, *Physical and Virtual Carrier Slot Relationships, Line-Only Mode*, shows the carrier slots, physical versus virtual slot locations, and their relationship to OPS port numbers.

Line+Trunk Mode

The line+trunk mode of a DS1 provides the capability of mixing both lines and trunks on the same DS1 facility.

The DS1 works (by default) in line+trunk mode, unless the backplane strap is configured. Here, a DS1 provides the functional equivalent of six analog circuit packs, each providing four ports. The line+trunk DS1 thus requires six slots: one for the actual circuit pack and five as virtual slots. Virtual slots mean the same thing for line+trunk mode as they do for the line-only interface with one variation: virtual slots provide four ports for the line+trunk mode versus eight ports for the line-only mode.

System 85 hardware allows a maximum of four trunk circuits per slot. Therefore, line+trunk mode only uses four backplane time slots from each of the six carrier slots. Thus, a maximum of four OPS ports may be administered for any one of the virtual (or actual) slots.

A maximum of two line+trunk circuit packs may be configured in each carrier. They may only be placed in slots 5 and 18. Therefore, with line+trunk mode, the carrier will support a maximum of 48 digital trunks or 48 OPS ports. Virtual slots are the leftmost three slots of the left quarter and the two slots immediately to the right of the real DS1 in the right quarter of the half carrier in which the DS1 is contained. These virtual board locations must be left vacant or damage to a port board and the DS1 could result.

A carrier equipped with two line+trunk DS1s will have four slots available for other port boards in physical slots 3, 8, 16, and 21. Figure 6-2, *Physical and Virtual Carrier Slot Relationships, Line+Trunk Mode*, shows the carrier slots, physical versus virtual slot locations, and their relationship to line+trunk-mode use.

Because line+trunk mode requires six carrier slots while line-only mode requires only three, mode selection is not made a software configurable option.

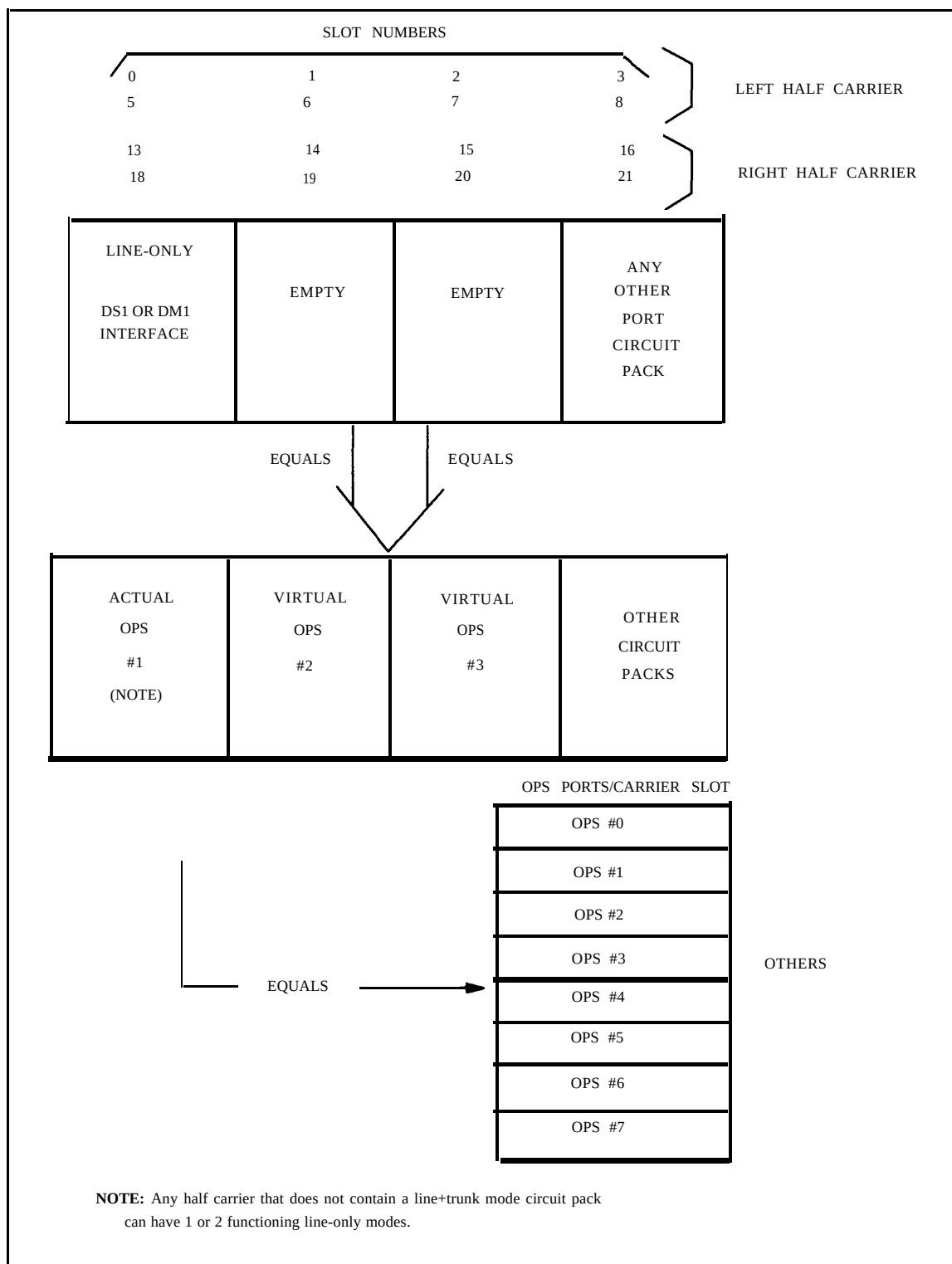
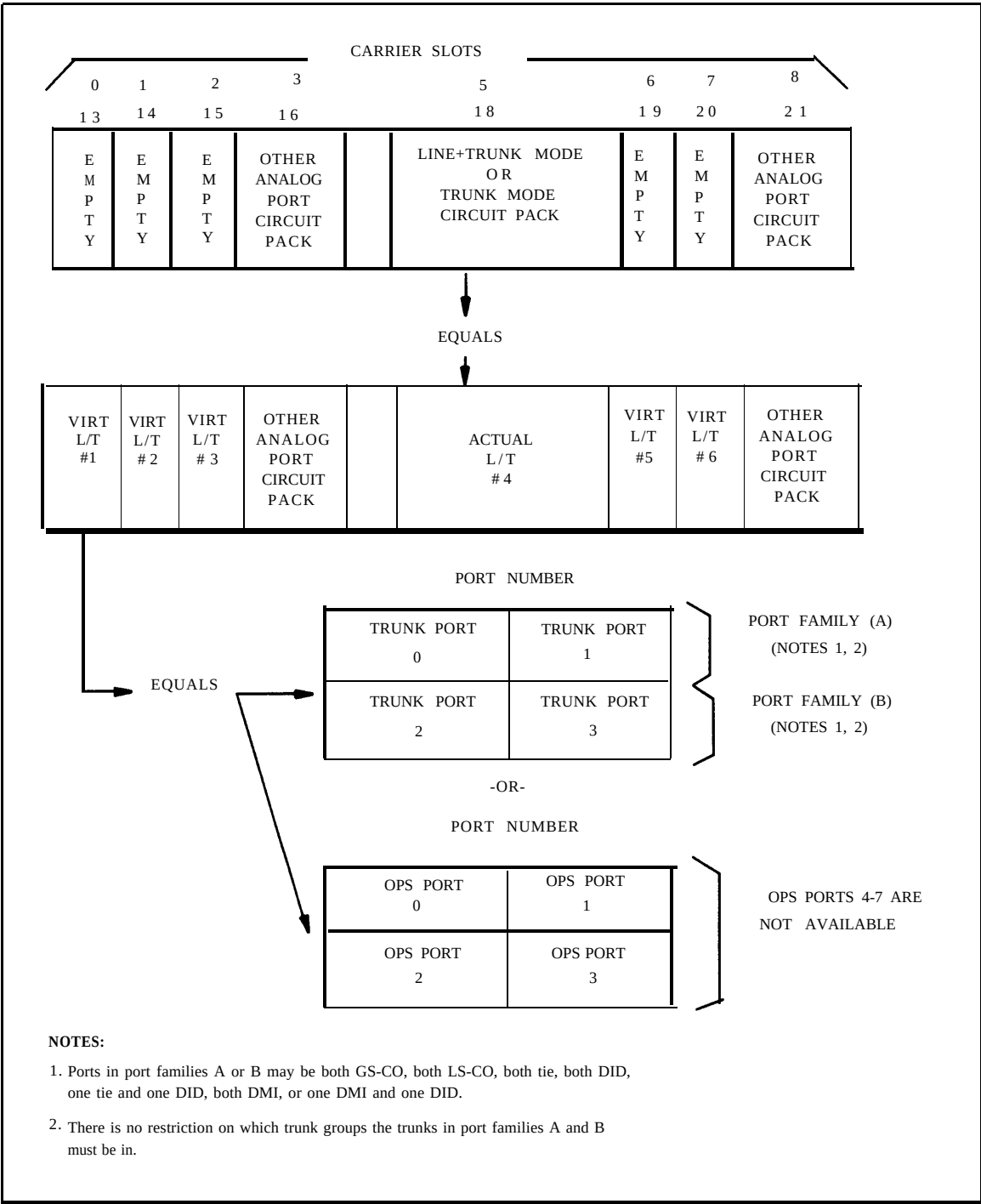


Figure 6-1. Physical and Virtual Carrier Slot Relationships, Line-Only Mode



Line+Trunk Mode Port Grouping Rules

Administration permits assignment of DS1 trunk types in consecutive groups of two. These consecutive groups of two ports are called a *port family*. The real DS1/DMI and each virtual line+trunk mode slot contain two port families (four ports). The first port family, family A, is composed of ports 0 and 1. The second port family, family B, is composed of ports 2 and 3. From a digital facility point-of-view, tie and DID trunks are the same because the bits representing on-hook and off-hook states are the same for tie and DID trunks. Therefore, port families that are optioned as tie or DID trunks may be further broken down into subfamilies of one. In other words, a tie or DID family may be used to provide two ties, two DIDs, or one tie and one DID.

To illustrate the flexibility in line+trunk mode port assignment, the above port grouping rules could be applied to administer a virtual 4-port slot for two CO trunks, a tie trunk, and a DID trunk.

There is only one restriction in line+trunk mode port administration. The OPS ports cannot be mixed on the same 4-port slot with trunk ports. All four ports on a line+trunk slot must be either lines or a mixture of trunks. No restrictions are made on the trunk groups in which the DS1/DMI trunks must be placed. The DS1/DMI trunks do not all need to be in the same trunk group, unless there are other reasons for them to be in the same trunk group.

Supported Port Types

This subpart presents an overview of the port types supported by DS1/DMI-BOS. Included is a brief description of how DS1 ports appear to a far end D4-channel bank (in terms of working into an equivalent channel unit at the switch end). The type of D4-channel bank channel unit required to terminate each port type at the far end is specified.

NOTE: No restrictions are placed on the framing, signaling, or line coding options used with any of the port types. Take care to assure that the interface options are compatible with the DS1/DMI endpoint (for example, D4-channel banks are not now compatible with 24th-channel signaling or ESF framing).

Three categories of port types — trunks, lines, and ports — support dedicated switched connections (DSCs) for System 85 R2V3 or later. Ports in the last category are called *transparent* ports. They are generally not used for connections to the endpoints described in this document but are included here for completeness.

Tie Trunk

Switch software treats digital tie trunks the same as a SN233 analog tie trunk. Therefore, things that can be administered for an analog tie trunk may also be administered for a digital tie trunk.

The DS1/DMI tie trunk port presents an interface of a channel unit requiring tie trunk signaling to a far end D4-channel bank. Six types of tie-trunk channel units use the same signaling format. Thus, there may not be a one-to-one relationship between a DS1/DMI tie-trunk port and the channel unit on which it terminates at a channel bank. The six types of channel units are type-I, II, and III 4-wire E&M and type-I, II, and III 2-wire E&M. These channel units have the same digital (DS1)

interface. They differ in their analog voice interfaces (2- or 4-wire) and in what type of E&M (analog) signaling to which the DS1/DMI signaling states are converted (type-I, II, or III).

A System 85 analog tie trunk is a 4-wire type-I E&M trunk. Thus, a DS1/DMI tie-trunk port can be considered to be the same, and a 4-wire type-I channel unit (or its equivalent) could be used to interface to a DS1/DMI tie trunk port at the far end.

It appears that any of the other five types of E&M channel units could be used as well, although this capability has not been tested.

DMI-BOS Trunks

DMI-BOS trunks are used to provide 64K-bps data connectivity to a host computer or to provide both voice and 64K-bps data connectivity to private or public networks that support DMI-BOS signaling. These trunks must be optioned for the 24th-channel signaling format.

DID Trunk

The digital DID trunks appear to switch software the same as an SN232 analog DID trunk. Therefore, things that can be administered for an analog DID trunk can also be administered for a digital DID trunk.

The DID trunks are supported by dial-pulse D4-channel bank channel units. The digital DID trunks function as a dial-pulse terminating (DPT) channel unit. They should terminate on a dial-pulse originating (DPO) channel unit (or its equivalent) at the far end.

Ground-Start CO Trunk

The digital ground-start CO trunks appear to switch software the same as a SN230B analog ground-start CO trunk. Therefore, things that can be administered for an analog Ground-Start trunk can also be administered on its digital counterpart.

Ground-start CO trunks are supported by either FX or special-access D4-channel units. Each of these units provides the same function, but they use different digital signaling bit states to represent CO trunk call states (the special-access units have some bits inverted relative to the FX units). Special-access channel units are used primarily in Canada. This use of special-access channel units should not be confused with the 4ESS special-access connection capability.

For Generic 2, the type of channel units DS1/DMI ground-start ports will work with is controlled by administration, but is now restricted to the FX format. A DS1 ground-start CO trunk port will act as a FX subscriber end (FXS) channel unit operating in the ground-start signaling mode. The trunk port should terminate on a FX office (FXO) end channel unit (or its equivalent), which also operates in the ground-start signaling mode.

When the special-access option is administered, the DS1 ground-start CO trunk port will act as a special-access subscriber (SAS) end channel unit operating in the ground-start signaling mode. The trunk port should terminate on a special-access office (SAO) end channel unit (or its equivalent), which also operates in the Ground-Start signaling mode.

Loop-Start CO Trunk

Generic 2 does not provide an analog equivalent of a DS1 loop-start CO trunk. It is only available as a digital trunk. Use of the loop-start CO trunk is not recommended because of inherent glare and disconnect supervision problems associated with this trunk type.

The DS1/DMI loop-start CO trunk appears to the switch software the same as a ground-start CO trunk. However, to the far end, a DS1/DMI loop-start CO trunk port appears as a loop-start CO trunk. This trunk is provided with present switch software capabilities and conversions performed by the DS1/DMI microprocessor.

The DS1/DMI supports loop-start CO trunks using either FX or special-access D4-channel bank units. The loop-start CO trunk port will act as a FX station (FXS) end channel unit operating in the loop-start mode. The trunk port should terminate at a FXO end channel unit (or its equivalent) operating in the loop-start mode.

When the special-access option is provided by administration software (Generic 2), then the loop-start CO trunk port acts as a SAS end channel unit operating in the loop-start mode. The trunk port should terminate at a SAS end channel unit (or its equivalent) operating in the loop-start mode. This configuration works fine in private networks. However, avoid this configuration when connecting to the public network.

Of-Premises Stations

Generic 2 administration software allows DS1/DMI channels to be administered as off-premises stations, for both the line-only mode and line+trunk mode. A DS1/DMI OPS port appears to switch software the same as a SN221, SN222, SN228, or SN229 analog port would appear, but with one exception: digital OPS ports do not support the Message Waiting feature. The reason is that no D4-channel bank units provide Message Waiting. Therefore, Message Waiting should be turned off when digital OPS ports are administered. The D4-channel bank may support OPS with either the FX or special-access channel units. However, for this port type the office-end channel unit is considered a Generic 2.

By default, OPS ports function the same as FXO end channel units operating in loop-start mode. The ports should terminate at a FXS end channel unit that is configured to operate in loop-start mode.

When Generic 2 administration software allows the special-access channel unit option, then the OPS port will act as a SAO end channel unit operating in the loop-start mode. The port should terminate at a SAS end channel unit operating in the loop-start mode at the D4-channel bank (far end).

The channel units used to support DS1/DMI OPS ports should be connected to a noninterrupted ringing supply in the D4-channel bank. Ringing for these ports is interrupted by the switch.

Transparent Ports

All System 85 or Generic 2 DS1/DMI ports have a transparent signaling mode. There does not exist an equivalent signaling method for analog ports. The transparent signaling mode permits direct access to a DS1/DMI channel's signaling bits. This function is necessary for DSCs, where DS1/DMI

channel signaling bits must be passed directly between two DS1/DMI ports without any switch processing software interaction. Any DS1/DMI port, regardless of its operating mode, may be switched into its corresponding transparent mode through administration. Additional details about DS1/DMI port types can be found in the DSC feature reference.

SYSTEM 85 DS1 OR DMI-MOS, TRADITIONAL MODULES (ANN35)

The operating mode and supported port types for System 85 DS1 or DMI-MOS (ANN35) in traditional modules are described next.

Operating Mode

DMI-MOS only works in trunk mode and it does not support line mode capabilities. The backplane strap, which may optionally be used for DMI-BOS, must not be configured. Here, DMI-MOS provides the functional equivalent of six analog circuit packs, each providing four ports, but using message-oriented-signaling. Therefore, the DMI-MOS requires six slots: one for the actual circuit pack and five as virtual slots. Each virtual slot provides four ports.

System 85 hardware allows a maximum of four trunk circuits per slot. Therefore, this mode only uses four backplane time-slots from each of six carrier slots (24 time-slots producing 24 DMI-MOS channels).

A maximum of two DMI-MOS trunk-mode circuit packs may be configured in each DS1 or MFAT carrier. They may only be placed in slots 5 and 18. Virtual slots are the leftmost three slots of the left quarter and the two slots immediately to the right of the real DMI-MOS in the right quarter of the half carrier in which the interface is contained.

CAUTION: These virtual slots must be left vacant or damage to a port board and the DMI could result.

With R2V4 and later versions, a DS1 or MFAT carrier may be configured with both DMI-MOS and DMI-BOS circuit packs. Recall that the DMI-BOS circuit pack may be used to provide either line+trunk mode or line-only mode. When the two are mixed within the same carrier, the appropriate restrictions apply to each; refer to *Operating Modes* under the heading *Generic 2 DS1/DMI-BOS*.

A carrier equipped with two trunk mode DMI-MOSs will have four slots available for other port boards in physical slots 3, 8, 16, and 21. Figure 6-2, *Physical and Virtual Carrier Slot Relationships, Line+Trunk Mode*, shows the carrier slots, physical versus virtual slot locations, and their relationship to trunk mode and/or line+trunk Mode use.

Port Grouping Rules

There are no port grouping restrictions for DMI-MOS trunks.

Supported Port Types

The DMI-MOS trunks are used to provide high-speed (up to 64K-bps) data connectivity to a host computer. The DMI-MOS trunks are restricted to two types:

- Wink-in/wink-out
- Wink-in/auto-out

The ANN35 supports several other trunk types when used for ISDN applications; refer to table 6-1, *Supported Digital Facilities*.

7. ADMINISTRATION OPTIONS AND REQUIREMENTS

Administering DS1/DMI/ISDN-PRI services involves configuring the software translations to know what the equipment-carrier configuration and circuit pack types are and what services are to be done.

For System 85 R1 through R2V3, switch administration may be done from the system-management terminal (SMT), maintenance and administration panel (MAAP), or Remote Maintenance, Administration, and Traffic System (RMATS)-II. A System 85 R2V4 includes an additional administration terminal known as the visual maintenance and administration panel (VMAAP). These administration terminals use flipchart *procedures*.

Generic 2 is significantly different and may only be administered via a MS-DOS® based computer running the Manager II applications software. The Manager II applications software provides three modes of operation. The modes are referred to as:

- Basic mode
- Enhanced mode
- Task mode

The enhanced mode consists of fill-in-the-blank screen-display procedures that contain many of the same fields as the flipchart procedures. However, with enhanced mode, each screen-based procedure provides a user-friendly interface with optional pop-up help instructions. Therefore, with Manager II, Generic 2 is administered similarly to System 75, System 75XE, and Generic 1.

Because Generic 2 administration is significantly different from previous System 85 releases and versions, this administration section contains a separate heading that includes descriptions on how to administer DS1/DMI/ISDN-PRI services for Generic 2.

For System 85, administering DS1/DMI-BOS/DMI-MOS simply consists of translating procedures 250, 260, and 116. Being familiar with administering these procedures is a good starting point for understanding the options and requirements of ISDN-PRI. Administering ISDN-PRI uses procedures 250, 260, 116, plus several additional procedures.

Some applications (such as off-premises station or *OPS*) may also require that other additional procedures be administered.

Generic 1 may be administered from a Manager I terminal or by the Initialization and Administration System (INADS). Generally, the administration procedures consist of executing the proper administration and maintenance commands (from the command line feature set) and translating, in the required order, the following screen-based forms:

- DS1 circuit pack
- Sync-plan
- DMI-BOS (when required)
- Trunk group (as required)
- Trunk member assignments (as required)

SYSTEM 85 (R2V1 THROUGH R2V4)

This part describes administration options and requirements for System 85 R2V1 through R2V4.

Procedure 275 Word 4: ISDN Service — Enable/Disable

Procedure 275 is used to translate the system class-of-service (COS) assignments as well as several other miscellaneous services and features. Word 4 provides the capability for enabling and disabling the ISDN service. Figure 7-1, *Procedure 275 Word 4: System COS and Miscellaneous Service Assignments (System 85 R2V4)*, depicts procedure 275, word 4.

ENHANCED MODE - PROCEDURE: 275, WORD: 4	
SYSTEM COS - MISCELLANEOUS	
1. Code Calling Access Digits:	13. CMS Status:
3. Trunk-to-Trunk Transfer:	14. ISDN Status:
ATTENDANT RELEASE LOOP OPERATION	ADMINISTRABLE ALARMS
4. Status:	15. Even Port Peripherals:
5. Timed Recall Timer:	16. Trunk Software:
	17. Auxiliary Software:
6. Default Recent Disconnect Interval:	DISPLAY ONLY
MAXIMUM PREEMPTION LEVEL	18. Local Switch Number:
7. All Incoming:	
OUTGOING	
8. Terminal:	
9. Attendant:	
10. AUTOVON Interface Switch:	
11. ACD Abandon Call Search:	
Connected to CC0 ON-LINE ☐ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-1. Procedure 275 Word 4: System COS and Miscellaneous Service Assignments (System 85 R2V4)

Field 14 V4 Only

For System 85 R2V4, field 14 must always be translated. Field encodes and their descriptions are:

- (Dash) required when ISDN is not provided. Current policy is to always ship ISDN-PRI software with the switch. However, the administration software still provides the option to show that this software is not provided.
- 0 Must be translated when ISDN is provided but not active disabled.
- 1 Must be translated to enable ISDN service.

Procedure 276 Word 1: Other Feature Groups

Procedure 276, word 1, may be displayed to verify which of the optional networking features (such as AAR or DCS) are enabled for the switch. Figure 7-2, *Procedure 276 Word 1: Feature Group COS (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 276, WORD: 1

FEATURE GROUP CLASS OF SERVICE

1. Standard Network:

2. Multipremise:

3. DCS:

4. AUTOVON:

5. Call Vectoring:

6. Tenant Services:

7. System 85 SE:

9. Look-Ahead Interflow:

10. Integrated Telemarketing Gateway:

DISPLAY ONLY

11. Use Procedure:

Connected to CC0 ON-LINE ♥

MAJOR

MINOR

RUN TAPE

BUSY OUT

IN USE

WAIT

enter command:

F3 DATA

F5 HELP

F6 FIELD

F7 INPUT

F8 CMDS

Figure 7-2. Procedure 276 Word 1: Feature Group COS (System 85 R2V4)

Procedure 250 Word 1: DS1 — Carrier Designation

Primarily, procedure 250 is used to assign the equipment carriers to a module and cabinet. Additionally, it is also used to assign the type of carrier, the carrier port electrical number, and whether the carrier is equipped with a synchronization clock (SC). Figure 7-3, *Procedure 250 Word 1: System Configuration, Carriers (System 85 R2V4)*, depicts procedure 250, word 1.

ENHANCED MODE - PROCEDURE: 250, WORD: 1			
CARRIERS			
CARRIER	LOCATION	LOCAL RMI	LOCATION
1. Module:	--	12. Module:	--
2. Cabinet:	--	13. Cabinet:	--
3. Carrier:	--	14. Carrier:	--
4. Carrier Type:	--	15. Slot:	--
MODULE CONTROL			
5. I/O:	--		
6. PDS:	--		
7. Duplicated:	--		
8. TMS:	--		
9. Port Electrical Carrier:	--		
10. TMS Electrical Carrier:	--		
11. SC Equipped:	--		
Connected to CC0 ON-LINE ♥			
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT			
enter command: --			
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS			

Figure 7-3. Procedure 250 Word 1: System Configuration, Carriers (System 85 R2V4)

DS1 circuit packs may only be installed within DS1 port carriers. Each System 85 that is equipped with one or more DS1s will also contain a TN463 SC. For single-module systems, the SC is located in the module control carrier along with the TN460 module clock. For multimodule systems, the SC is located in the TMS carrier.

Fields 1-3 V1-V4

Identifies a module number (0-30), cabinet number (0-7), and physical carrier position (0-3).

Field 4 V1-V4

Translates a particular type of carrier (such as DS1/MFAT, module control, or TMS) to the equipment location identified by fields 1-3. For DS1/DMI/ISDN-PRI applications the pertinent encodes are:

- 4 TMS 0 control
- 5 TMS 0 growth
- 6 Module control 0
- 7 Module control 1
- 8 TMS 1 control
- 9 TMS 1 growth
- 11 DS1/MFAT port carrier

Select a particular encode based on the intended purpose for translating this procedure, either to assign the SC or to assign a DS1/MFAT carrier.

Fields 5-10 V1-V4

DS1/DMI/ISDN-PRI does not place any additional requirements on translating these fields.

Field 11 V1-V4

Field encodes and their descriptions are:

- 0 When the carrier (which is identified by fields 1-10) is not equipped with an SC. When an external synchronization clock is used, do not administer the SC. The SC software functions are replaced by the hardware/firmware contained within the external clock.
- 1 When the carrier (module control or TMS) is equipped with an SC. The network synchronization plan should be available, and is required, to determine how to properly synchronize the switch.

Fields 12-15 V1-V4

Not applicable for DS1/DMI/ISDN-PRI applications. Therefore, a dash (–) is appropriate.

Procedure 260 Word 1: DS1/DMI/ISDN-PRI Physical Interface

System 85 R2V3 DS1 administration software (procedure 260) contains all the same fields, options, and considerations as R2V1 and V2. Procedure 260 also provides a new field (14) for defining new application types for DS1 facilities. The R2V3 systems require the ANN11C, ANN11D, or ANN11E vintage circuit pack to provide the OPS line option. The ANN11D or ANN11E is required to provide the DMI-BOS option.

System 85 R2V1 and V2 only provide trunks. However, R2V3 and V4 provide trunks, analog OPS lines, and DMI-BOS trunks. System 85 R2V4 (and later versions) provides DMI-MOS trunks; refer to table 7-1, *DS1 Administration — Channel Versus Line Assignments*.

Depending on the application type (encode) translated, there may be additional administration, slot, and port grouping restrictions.

Service or Facility Options

Procedure 260 is used to administer the DS1/DMI/ISDN-PRI Interfaces (ANN11B, ANN11C, ANN11D, ANN11E, or ANN35). Figure 7-4, *Procedure 260 Word 1: System Configuration, Circuit Pack Assignments (System 85 R2V4)*, shows procedure 260, word 1.

ENHANCED MODE - PROCEDURE: 260, WORD: 1	
DS1/ISDN AND RG CIRCUIT PACK ASSIGNMENTS	
EQUIPMENT LOCATION	SC
1. Module:	12. Equipment Type:
2. Cabinet:	13. SC Reference:
3. Carrier:	
4. Slot:	14. Application:
	15. Bit Inversion:
SIGNALING	16. Link Type:
6. Framing:	17. SA/FX:
7. PCS/CCS:	
8. 24C/RBS:	DISPLAY ONLY:
9. ZCS/B8ZCS:	18. SC Information:
10. Slip Enable:	
11. External Loop:	
Connected to CC0 ON-LINE ☐ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-4. Procedure 260 Word 1: System Configuration, Circuit Pack Assignments (System 85 R2V4)

Fields 1-4 V1-V4

Assigns the circuit pack to an equipment location. These assignments include the module number (0 through 30), cabinet number (0 through 7), DS1/MFAT carrier number (0 through 3), and slot number (5 or 18) for line plus trunk operation; or slot numbers (0, 5, 13, or 18) for line-only operation.

System 85 R2V4 permits only trunk mode operation (that is, only slot numbers 5 or 18 can be assigned).

Field 5 V1-V2

For DS1, 0 is the only choice.

V3-V4

This field is reserved for further use and contains a dash (-).

Field 6 V1-V4

Used for assigning the framing format. The choices are D4 and ESF (previously referred to as F.).

The choice of framing format is totally dependent on the equipment connected to the interface (such as D4-channel bank, channel-division multiplexer or *CDM*, channel-expansion multiplexer or CEM, host computer, and other switches). Normally the format is not dependent on facilities used, but older digital radio equipment may still be in place that only supports D4. The extended superframe (ESF) format consists of a better framing algorithm and therefore provides more reliable error detection than D4. ESF is preferred to T1 spans from System 75-to-System 75, System 75-to-Generic 1, System 75-to-Generic 2, System 75-to-System 85, System 85-to-System 85, System 85-to-Generic 1, and System 85-to-Generic 2. The D4 format should be selected for T1-spans connecting D4-channel banks and CDMs since they do not typically support ESF.

Field 7 V1-V4

Selects per-channel signaling or common-channel signaling. This option deals with the way signaling bits are constructed for each DS0 channel. The default option is per-channel signaling (0).

Field 8**V1-V4**

Offers the choice of 24th-channel or robbed-bit signaling (RBS). The choice of signaling method used is dependent on the application. The DS1/DMI-BOS applications may be translated for either option. However, ISDN-PRI applications always require that 24th-channel signaling be selected.

With RBS, information is transmitted in the least-significant bit (LSB) position of each channel every six frames. This effectively limits the channel's use to voice and voiceband analog data applications. Digital data ports connected to Digital Communications Protocol (DCP) data modules must use the modem pooling capability to transmit data over DS1/T1 RBS facilities. Analog data ports must be configured with analog modems.

24th-channel signaling multiplexes all signaling information for channels 1 through 23 into the 24th channel. This makes available the full 64K-bps bandwidth (of channels 1 through 23) for voice and/or digital data transmission called *alternate voice/data* (AVD).

AVD allows pure 64K-bps digital data to be transmitted over those digital trunk facilities that use 24th-channel signaling. Although AVD trunks are designed for digital data transmission, they may also be used for voice transmission. However, because of a modem-pooling limitation, AVD trunks cannot easily be used for analog voice-grade data transmission.

24th-channel signaling is required for those trunk groups that are translated AVD (from procedure 101, field 17).

Either the AT&T proprietary format or the DMI-BOS format may be used with another System 85 or System 75. The DMI-BOS format is required to provide 24th-channel signaling capability with other vendors' digital switches. 24th-channel signaling (both methods) is not compatible with D4-channel banks. The AT&T proprietary format is provided by the ANN11C version-8 (or later) circuit pack. All previous versions will eventually be replaced via a class-A change. The DMI-BOS format is provided by the ANN11D or ANN11E circuit pack. When 24th-channel signaling is optioned, the ANN11D or ANN11E circuit pack automatically interrogates the far-end and provides the required format. For System 75, the proprietary format is administered by translating a *n* in the *DMI-BOS* field. To select the DMI-BOS format, simply administer a *y* for the *DMI-BOS* field.

V3-V4

A mode 1 data call requires a Line+Trunk-mode circuit pack with RBS option.

Field 9

V1-V4

Determines which line-coding format will be used to forcibly ensure that the data meets T1-carrier ones-density requirement. The two choices are:

- Zero code suppression (ZCS)
- Bipolar 8 zero code suppression (B8ZS)

For a 56K-bps call over a robbed-bit facility, use the ACCUNET switched digital service.

The ZCS line-coding format scans each byte for the all-zeroes octet and on detecting this bit sequence, substitutes a one for the zero in bit position two. The ZCS format is the most common and it is used widely. The ZCS format can be used (without any consideration of the communications protocol) to transmit seven-bit characters/data at rates up through 56K-bps via modems and multiplexers that do bit stuffing. If the data communications protocol is based on the high-level data link control (HDLC) protocol and data is transmitted as inverted HDLC, then the ZCS option can be used for data rates up through 64K-bps.

System 85 and System 75 data modules use the DCP protocol. The DCP protocol is based on the DMI specification (which uses HDLC as a building platform) and therefore meet these conditions.

The DS1/T1 facilities that use RBS and are optioned for ZCS maintain the ones-density requirement by converting any all-zeroes octet to a string of seven zeros and a one. This does not significantly affect voice and voice-band data since it is in analog (pulse-code modulation of *PCM*) form. For DS1/T1 facilities that use 24th-channel signaling and are optioned for ZCS, the data communications protocol/communications equipment used must prevent the all-zeroes octet from occurring; otherwise, the ZCS method will forcibly alter the data (causing errors) to guarantee proper ones-density.

The B8ZS line coding format substitutes a unique code (bipolar violation code) for any eight consecutive zeros. This bipolar violation code is detected at the receiving end and converted back to the original string of eight zeros. The B8ZS encoding method permits data transmission at rates up through 64K-bps without consideration of the *clear channel transmission* protocol.

Several different types of network digital facilities may be linked together to complete the end-to-end connection. Typically, they will be multiplex-derived facilities. Usually, the multiplexer will contain a bipolar violation monitor and removal circuit that corrects all bipolar violations (alters B8ZS data) and also produces an all 1s if a loss of input signal occurs. This bipolar violation monitor and removal feature is currently an inherent part of the MX3, M13, MX2, and M1C multiplexers, as well as most vendors multiplexers.

Field 10

V1-V4

This options enables (1) or disables (0) switching between the primary, secondary, or internal high-accuracy clock. The decision to switch from one source to the other is normally based on an internal slip count calculation (software record). However, hardware events (such as primary link failures) may take precedence over any software controls.

Slips are caused by differences in clock frequencies. A slip results in the deletion or repetition of a single frame. Slips are not caused by noise on the line.

DS1/T1 spans that are used to provide the primary and secondary synchronization reference should be administered for slip enable (1). Since the switch software does this automatically, this task is not mandatory but is a good procedure to follow. Typically, other DS1/T1 spans that are used for data applications and deemed important should also be administered for slip enable. This excludes all T1-spans connecting channel banks, unless the channel bank is externally timed. Normally, DS1/T1 spans that are used exclusively for voice and not assigned as the primary or secondary synchronization source should be administered for slip disable (0). The goal is to keep that reference on-line, which minimizes slips for all those DS1/DMI Interfaces for which slips cannot be tolerated.

The digital switch always maintains a slip-count record for each DS1. Slip counts are calculated on a 24-hour continuous interval. As a historical record, the slip counts for each DS1 are maintained for the last 24 consecutive intervals. The slip count is used to determine if a DS1 span is experiencing errors and, if so, the severity of the errors (type alarm).

If the primary facility uses 24th-channel signaling and if the secondary facility uses RBS, then the primary will always be on-line unless a hardware event forces a switch to the secondary. A software algorithm is used to select the facility (primary or secondary) that is on-line for the cases where:

- a. Both primary and secondary facilities use the same type of signaling (either 24th-channel or RBS)
- b. The primary uses robbed-bit, and the secondary uses 24th-channel signaling

The slip count can be viewed in procedure 625 test 1.

Criteria for Switching to the Secondary Facility

If 50% of the spans administered for slip enable are experiencing slips (with respect to the primary), then a decision is made to switch to the secondary. When a System 85 switches to its secondary, a software bit is set making the primary appear as though it exceeded its maximum slip limit. The primary is not reevaluated for one hour.

Criteria for Switching Back to the Primary Facility

At the end of the one-hour interval, the slip count is analyzed. If the primary slip count is less than 2, then a switch back to the primary is made. If the primary has a

slip count of 44 or less and if the secondary and 50% of those DS1s that are enabled for slip enable have reached their maximum slip count of 88, then a switch back to the primary is made.

Field 11 V1-V4

Offers the options external loop not available (0) or external loop available (1). The external loop available option should only be selected when demand diagnostic maintenance is done and then only after a DS1 has been busied out. If DS1 is a primary or secondary reference, the reference should be switched off line. This option is used with procedure 620, test 2, to extend the range of the test to include the network channel-terminating equipment (NCTE) and the connecting facility.

The external loop available option should only be used for the duration of the test.

Field 12 V1-V4

Specifies whether (1) or not (0) the associated T1-span is used as an incoming synchronization source to the switch.

The network synchronization diagram should show those transmission facilities that are used for synchronization. Each switch permits a maximum of two interfaces (one primary and one secondary) to be translated (1) in field 12. However, there is no requirement to have both.

Field 13 V1-V4

Selects whether a DS1 facility (translated in field 12) is to be used as the primary or secondary synchronization source to the switch. Field encodes and their descriptions are:

- 0 The facility is not used as a synchronization source
- 1 The facility is the primary synchronization source
- 2 The facility is the secondary synchronization source

NOTE: The primary must be administered before the secondary. The secondary must be removed before the primary.

Only slots translated (1) and (2) must be configured with synchronization cables. These cables connect the backplane of the translated ANN11_/ANN35 to the backplane of the TN463. The cables are identified as group 334 for intercabinet and group 361 for intracabinet applications.

CAUTION: A loop-timing problem can be created if the synchronization sources are not administered correctly. The loop-timing problem exists as the result of an error where both switch endpoints (for the same T1-span) are administered as the primary. This causes the clock frequency to vary widely and result in bringing down the switch. Loop-timing problems can be avoided by following a correctly engineered network synchronization diagram.

Field 14

V3-V4

Field encodes and their descriptions are:

- 0 Selects the DS1/DMI-BOS channels used for both trunks and lines; the latter is frequently referred to as OPS. Each DS1/MFAT carrier will support a maximum of two DS1s (slots 5 and 18).

The ACCUNET switched digital service can be provided by setting up a trunk group with encode 109. However, a DS1 must be optioned for RBS (procedure 260, field 8). The only other administration requirement is that the trunk groups translation (field 3 of procedure 100, word 2) be enabled for 56K-bps encode one. In a private network, this can be used to pass 56K-bps calls over robbed-bit facilities.

The trunk group used to provide ACCUNET switched digital service may contain as few as 1 or as many as 24 members. Therefore, the same DS1 may also be used to provide CO, foreign exchange (FX), Wide Area Telecommunications Service (WATS), Direct Inward Dialing (DID), and Remote Access trunks.

- 1 Selects the interface is used to provide DMI-BOS trunks. The DMI-BOS trunk groups are defined by using procedure 100, word 1 (encode 108 and/or 109).

The DMI-BOS application uses the switch's DS1 to provide a high-speed multiplexed data interface for connecting to compatible computers. The computers may be located on the same customer premises as the switch or many miles away. The DS1/T1-carrier facilities are used between the switch and the remote computers.

The DMI-BOS application provides 23 data channels plus 1 signaling channel. Each data channel can be considered a 64K-bps channel. However, permissible data rates are dependent on the trunk group translations selected in procedure 100, word 2.

24th-channel signaling is the only required service/facility option. All others (framing format and line-coding format) are DMI application independent. However, the distant computer and all intermediate T1 transmission equipment must be compatible.

CAUTION: A loop-timing problem can be created if the synchronization sources are not administered correctly. The loop-timing problem exists as the result of an error where both switch endpoints (for the same T1-span) are administered as the primary. This causes the clock frequency to vary widely and result in bringing down the switch. Loop-timing problems can be avoided by following a correctly engineered network synchronization diagram.

NOTE: Neither DMI-BOS nor DMI-MOS may be used to provide synchronization to the switch.

- 2 Selects the DS1/DMI-BOS facility that provides 24 lines, called OPS.

DS1/OPS Related Translations

When a DS1 facility is used exclusively for lines, it must be administered for RBS.

Also, the facility cannot be used as a synchronization reference.

When a DS1 is administered for lines (OPS), it provides 24 channels that terminate in a remote D4-channel bank, CDM, or their equivalent.

Each analog line circuit pack provides eight circuits. Therefore, one DS1/OPS functionally replaces three analog circuit packs. Each DS1 or multifunction analog terminal (MFAT) carrier will support a maximum of four DS1s (OPS applications). These may be located in slots 0, 5, 13, and 18.

The DS1 channels are assigned to slot and circuit locations according to the order in which the module processor scans the equipment carrier. Table 7-1, *DS1 Administration — Channel Versus Line Assignments*, lists the equipment location versus DS1 channel assignments for DS1/OPS.

Analog equipment location assignments are administered by procedure 000, word 1, with field 8 translated a 2. The DS1/OPS channels are translated to equipment locations (individual extensions) with procedure 000, word 1, with field 8 translated 9, rather than with procedure 116 that was used for trunks.

5 Selects the DS1 used to provide 64K-bps data with DMI-MOS or ISDN-PRI trunk facilities. When encode 5 is administered, procedure 262 is automatically translated with standard default options. These default options should (later) be checked for consistency with the distant end; refer to procedure 262.

TABLE 7-1. DS1 Administration — Channel Versus Line Assignments

DS1 Channel	Slot/Circuit	DS1 Channel	Slot/Circuit
1	0/0, 5/0, 13/0, or 18/0	13	0/4, 5/4, 13/4, or 18/4
2	1/0, 6/0, 14/0, or 19/0	14	1/4, 6/4, 14/4, or 19/4
3	2/0, 7/0, 15/0, or 20/0	15	2/4, 7/4, 15/4, or 20/4
4	0/1, 5/1, 13/1, or 18/1	16	0/5, 5/5, 13/5, or 18/5
5	1/1, 6/1, 14/1, or 19/1	17	1/5, 6/5, 14/5, or 19/5
6	2/1, 7/1, 15/1, or 20/1	18	2/5, 7/5, 15/5, or 20/5
7	0/2, 5/2, 13/2, or 18/2	19	0/6, 5/6, 13/6, or 18/6
8	1/2, 6/2, 14/2, or 19/2	20	1/6, 6/6, 14/6, or 19/6
9	2/2, 7/2, 15/2, or 20/2	21	2/6, 7/6, 15/6, or 20/6
10	0/3, 5/3, 13/3, or 18/3	22	0/7, 5/7, 13/7, or 18/7
11	1/3, 6/3, 14/3, or 19/3	23	1/7, 6/7, 14/7, or 19/7
12	2/3, 7/3, 15/3, or 20/3	24	2/7, 7/7, 15/7, or 20/7

Field 15 *V4 Only*

Some applications require that the contents of the D-channel be inverted to guarantee that the minimum ones-density be maintained. This field shows whether the signaling channel is inverted. Field encodes and their descriptions are:

- (Dash) means ZCS chosen in procedure 260. This is the default when ZCS is chosen (this automatically inverts the D-channel).

The dash is appropriate for all applications of the ANN11_ circuit pack. RBS does not use the 24th-channel to transmit signaling information. 24th-channel signaling via BOS uses A and B bits for signaling, and the channel structure is such that the ones-density is never violated.

- 0 Selects inverted signaling information (contents of the 24th-channel). Either 0 or 1 must be administered for MOS. Recall that B8ZS is recommended for MOS-based applications. However, not all transmission facilities will permit B8ZS on an end-to-end basis. Administration must be coordinated with the network facilities/distant-end to ensure compatibility.

NOTE: This field must be a dash (–) when ZCS line coding is selected with ISDN.

- 1 Selects uninverted signaling information (contents of the 24th-channel). The 1 option (no inversion) is recommended for use when B8ZS is administered.

Field 16 *V4 Only*

The DS1/DMI-BOS applications should be administered with a (–) .

The DMI-MOS/ISDN-PRI applications should be optioned (0) for use when connecting to metallic copper cable. Connections to fiber cable are not currently supported. Therefore, option one is not applicable.

Field 17 *V4 Only*

This field is added to bring a System 85 R2V4 into compliance with EIA specification PIN-1429. This EIA specification relates to BOS; MOS is defined by a CCITT specification. Field encodes and their descriptions are:

- (Dash) means not applicable. The dash is appropriate for all applications of the ANN35 circuit pack (both DMI-MOS and ISDN-PRI).
- 0 Appropriate for all applications of DS1/DMI-BOS except when connecting to a switch that uses the Canadian style of signaling.
- 1 Selected when connecting to a DS1/DMI-BOS that uses the Canadian style signaling as specified in PN-1429.

Procedure 262 Word 1: ISDN Board Parameters

Procedure 262 is used in System 85 R2V4 and Generic 2 to administer DMI-MOS (ANN35) for other service/facility options (DMI-MOS/ISDN-PRI only). Figure 7-5, *Procedure 262 Word 1: ISDN Board Parameters*, depicts procedure 262, word 1.

ENHANCED MODE - PROCEDURE: 262, WORD: 1	
ISDN BOARD PARAMETERS	
EQUIPMENT LOCATION	
1. Module:	--
2. Cabinet:	--
3. Carrier:	--
4. Slot:	--
PRI PARAMETERS	
5. Interface Type:	--
6. Facility Test Code:	--
7. Terminal Endpoint Identifier:	---
PRI LAYER 2 PARAMETERS	
8. Timer T203:	---
9. Timer T200:	---
10. Counter N200:	--
11. Counter K:	--
Connected to CC0 ON-LINE ♥	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: █	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-5. Procedure 262 Word 1: ISDN Board Parameters

Fields 1-4 *V4 Only*

Assigns the circuit pack to an equipment location. These include the module number (0 through 30), cabinet number (0 through 7), DS1/MFAT carrier number (0 through 3), and slot number (5 or 18).

NOTE: Entries for these four fields are the default values from translating a 5 in field 14 of procedure 260. These entries should always be correct.

Field 5 *V4 Only*

Assigns the interface type or side. The default option is (0) for user side. Alternately, a (1) should be administered for network side. The configuration of the network should be analyzed to determine if the (0) option is appropriate.

For MOS-type facilities (such as DMI-MOS and ISDN-PRI), each link must be segmented into user and network sides. Each System 85 R2V4 MOS-based transmission facility connecting to the public network will always be the user side (0), while the network side (for example, a 5ESS or 4ESS) is administered (1). For private network DMI-MOS and ISDN-PRI connections, additional care must be exercised in defining user and network sides. Specifically, only one end must be administered user side (0), while the alternate must be defined as the network side (1). If the private network node is a tandem switch, then that node may function as both user side and network side depending on the particular facility.

NOTE: For System 85 R2V4 DMI-MOS to host computers equipped with MOS, the computer should always be assigned as the network side.

Field 6 *V4 Only*

Administers the facility test code. For most installations it is desirable to enable or establish permission, thus allowing selected maintenance software to test the DMI-MOS/ISDN-PRI transmission facility on a demand basis.

Procedure 648 contains several tests that may be done on a demand basis (by executing procedure 648) when facility test code 1, 2, or 3 is administered).

The DMI-MOS/ISDN-PRI communication protocol consists of three layers or levels. Level 1 is the physical layer. Level 2 is the data link layer. Level 3 is the network layer, also called the *link access procedure on the D-channel* (LAPD).

Field encodes and their descriptions are:

0 Disables or prohibits maintenance testing from being done on the specified (module, cabinet, carrier, and slot) transmission facility.

1 Selects level-2 testing via procedure 648.

NOTE: This encode should be translated for all DMI-MOS to host computer links.

2 Selects level-3 (network layer) testing. Level 3 does loopback testing and requires the use of a separate special test line (SN261C Analog Digital Facility Test Circuit).

3 Permits both level-2 and level-3 tests to be done.

NOTE: This encode should be translated for all ISDN-PRI connections that terminate on a 4ESS.

Field 7 *V4 Only*

This field will accept encodes within the range of 0 through 126. However, all point-to-point (nonswitched) links, such as an System 85 R2V4 DMI-MOS link to a host computer, must be administered with encode 0. Encodes 1 through 126 are not used at this time.

Field 8 *V4 Only*

The field will accept encodes ranging from 0 through 255, corresponding to 1-second intervals for an elapsed time of up to 4 minutes and 15 seconds. The default value for this T203 timer is 30, meaning 30 seconds.

This timer monitors the facility data link and specifies the maximum time allowed without frames being exchanged on a data link layer connection.

Field 9 *V4 Only*

The field will accept encodes ranging from 0 through 255, which corresponds to 0.1 second per increment for a maximum range of up to 25.5 seconds. The default value for this T200 timer is 10, meaning 1 second. This timer monitors multiple-frame operations on the data link layer.

Field 10 *V4 Only*

This field defines a value for the N200 counter. The value determines the maximum number of frame retransmissions. The permitted range is from 1 through 10, with 3 being the default value.

Field 11 *V4 Only*

This field defines a value for the K counter. The value determines the maximum number of outstanding or unacknowledged information I frames. The range of permitted values is from (1 through 10), with 7 being the default value.

NOTE: Administration values for these procedure 262 timers and counters must be coordinated with the other terminating end.

Procedure 354 Word 3: NPA-NXX Digits Assignment

This word and procedure are used to administer the ISDN numbering plan area (NPA). Depending on the switch configuration, there may be more than one ISDN numbering plan. Contents of these fields make up a part of the calling number identification. This is used to transmit information such as the station identification number (SID) and the connected number. The SID is transmitted in the calling number IE, which is a part of the setup message. Figure 7-6, *Procedure 354 Word 3: NPA-NXX Assignment (System 85 R2V4)*, depicts procedure 354, word 3.

NOTE: This word need not be translated unless the application requires that SID or the connected number be transmitted to the network.

ENHANCED MODE - PROCEDURE: 354, WORD: 3	
NPA-NXX ASSIGNMENT	
1. NPA-NXX Designator:	
2. NPA:	
3. NXX:	
4. Thousand's Digit:	
Connected to CC0 ON-LINE MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-6. Procedure 354 Word 3: NPA – NXX Assignment (System 85 R2V4)

- | | |
|----------------|--|
| Field 1 | This field should be translated for both private-and public-network connections. The NPA-NXX designator is a 2-digit field and must be within the range of 1 through 99. |
| Field 2 | This 3-digit field should contain the numbering plan area (NPA), which is also called the <i>area code</i> . Assignment is therefore dependent on the particular location and application. |
| Field 3 | This 3-digit field should specify the NXX, which is also called the <i>local exchange company</i> (LEC). Permitted values must be those numbers within the range of 200 through 999 and should be the office code of the local exchange. |
| Field 4 | This 1-digit field specifies the thousands digit. When not used, it should contain (–). When used, digits 0 through 9 may be assigned. Use this field only with three-digit dial plans. Do not use it with four- or five-digit dial plans. |

Procedure 000 Word 4: NPA-NXX Index Designator

Depending on how the switch is used, procedure 000, word 4, may or may not be translated. Specifically, field 4 of word 4 is used for partitioning, ISDN, or both, and *must be* translated when:

- a. The switch transmits SID or connected number to the network
- b. The switch provides unique extension number partitions

Field 4 of procedure 000, word 4, need not be translated when the switch does not transmit SID or connected number to the network (public or private).

If the switch contains more than one office code, multiple NPA/NNX designators may be needed.

Figure 7-7, *Procedure 000 Word 4: NPA–NXX Partition Assignment (System 85 R2V4)*, depicts procedure 000, word 4.

ENHANCED MODE - PROCEDURE: 000, WORD: 4	
EXTENSION	NPA-NXX/PARTITION ASSIGNMENT
1. First Extension:	----
2. Last Extension:	-----
3. Extension Partition:	----
4. NPA-NXX Designator:	--
DISPLAY ONLY	
5. Invalid Extension:	-----
Connected to CC0 ON-LINE♥	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: -	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-7. Procedure 000 Word 4: NPA – NXX/Partition Assignment (System 85 R2V4)

- Field 1** Assigns a single extension number or the first extension number for a block of numbers. The single number or block of numbers will be unique in terms that they relate to a single extension partition identification.
- Field 2** Assigns the last extension number for a block of numbers.
- Field 3** Assigns the extension partition identification for the tenant services feature.
- Field 4** Associates an NPA-NXX Designator with a range of extensions.

Procedure 210 Word 2: LDN, NPA, and NNX Attendant Partition Assignments

This procedure is used to configure the attendant consoles into functional groups known as *attendant partitions*. Also, listed directory number (LDN) and NPA-NXX assignments are completed, thus relating these assignments to a particular attendant console or attendant partition. Figure 7-8, *Procedure 210 Word 2: Attendant Partition Assignments (System 85 R2V4)*, depicts procedure 210, word 2.

ENHANCED MODE - PROCEDURE: 210, WORD: 2	
CONSOLE ASSIGNMENTS - ATTENDANT PARTITIONS	
1. Console Number:	
2. Attendant Partition:	
3. Control:	
4. LDN:	
5. NPA-NNX Designator:	
Connected to CC0 ON-LINE ♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-8. Procedure 210 Word 2: Attendant Partition Assignments (System 85 R2V4)

Field 1 Translates a console number. Permitted encodes are any 2-digit number within the range of 1 through 40.

NOTE: The console must have previously been assigned in procedure 210, word 1.

Field 2 Assigns the attendant partition number. Permitted encodes are any unused number within the range of 0 through 40.

Field 3 Assigns the one console in the attendant partition that will be the controlling console. All other members of this group must have control denied. Field encodes and their descriptions are:

0 For all but the controlling console

1 Only for the controlling console.

Field 4 Assigns or associate the LDN with a particular console or console partition. This number depends on the switch or private network numbering plan.

Field 5 Assigns or associate the NPA-NNX designator with the console. The encode must have been previously defined in procedure 354, word 3.

Procedure 010 Word 4: Line Side (B-Channel) BC and ISDN Routing Options

Figure 7-9, *Procedure 010 Word 4: Terminal COS Restrictions (System 85 R2V4)*, depicts procedure 010, word 4.

ENHANCED MODE - PROCEDURE: 010, WORD: 4	
EXTENSION CLASS OF SERVICE - RESTRICTIONS	
1.	Class of Service: --
2.	Maximum Precedence Level: --
3.	Bearer Capability: --
4.	ISDN Routing: --
Connected to CC0 ON-LINE♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: ■	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-9. Procedure 010 Word 4: Terminal COS Restrictions (System 85 R2V4)

- Field 1** When ISDN is administered, each COS assignment must have an associated BC and ISDN routing assignment. That is to say that whenever ISDN is enabled, all COS assignments must also be translated for this procedure. COS assignments must be within the 2-digit range of 1 through 63.
- Field 2** This field's encodes are only useful for AUTOVON applications. Dash (–) is appropriate for ISDN applications.

Field 3 This field is used to populate the BC code IE. All endpoints (such as analog lines and DCP voice terminals) must show their information transfer requirements in terms of a BC code. The BC code is the mechanism by which specialized routing is provided for various categories of calls.

NOTE: Once the BC code is assigned, it is fixed and does not change with different calls.

Field encodes and their descriptions are:

- 0 Voice and Voice-grade data
- 1 Mode 1 data (56K-bps)
- 2 Mode 2 data (subrate up to 19.2K-bps)
- 3 Mode 3 data (also called packet mode)
- 4 Mode 0 data (64K-bps digital data).

Field 4 This field is used to populate part of the TCM IE and shows an ISDN-PRI Routing option. Field encodes and their descriptions are:

- 0 For when any type of trunking facility is OK. This option should be used when there are no specific requirements for ISDN-PRI trunks. Generally, this will include all voice and voice-grade data applications (BC code = 0) except those where user-to-user information transfer is desired.
- 1 When ISDN-PRI trunking facilities are required. Generally, these applications include those COS groups established for Mode 1 data (BC code = 1), Mode 3 data (BC code = 3), and Mode 0 data (BC code = 4).

Mode 0 data, depending on its origin, may require a restricted channel. Recall that a restricted channel is only provided by those ISDN-PRI facilities that use the B8ZS line-coding format.
- 2 When any trunking facility will work but when ISDN-PRI trunk facilities are preferred. This may include voice and voice-grade data (BC code = 0) and Mode 2 data (BC code = 2).

Procedure 100 Word 1: Trunk Group Type, Signaling, and Dial Access (ID) Code

Translating word 1 is the first step in establishing trunk groups. Those trunk groups established for ISDN applications may be of the same design as those for non-ISDN applications, except for the type of signaling used. Or, they may (optionally) be designed to take maximum advantage of the ISDN capabilities. Figure 7-10, *Procedure 100 Word 1: Trunk Group Translations (System 85 R2V4)*, shows procedure 100, word 1.

ENHANCED MODE - PROCEDURE: 100, WORD: 1	
TRUNK GROUP TRANSLATION	
1. Trunk Group:	
DIAL ACCESS CODE/TRUNK ID CODE	
2. Digit 1:	
3. Digit 2:	
4. Digit 3:	
5. Digit 4:	
6. Trunk Type:	
7. Dial Access Restriction:	
8. Personal CO Line Appearance:	
DISPLAY ONLY	
9. Signaling Type:	
Connected to CC0 ON-LINE ☐ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-10. Procedure 100 Word 1: Trunk Group Translations (System 85 R2V4)

- Field 1** Assigns a trunk group number. Permitted entries are any unused number from 18 through 999.
- Field 2** Assigns the first digit of the trunk access code. Permitted entries are 0 through 9 for digits 0 through 9 and with 11 and 12 for the symbols * and #, respectively.
- Field 3** Assigns the second digit of the trunk access code. Permitted entries are 0 through 9.
- Field 4** Assigns the third digit of the trunk access code. Permitted entries are 0 through 9.
- Field 5** Assigns the fourth digit of the trunk access code. Permitted entries are 0 through 9.
- Field 6** Defines the trunk type of a specific trunk group. The ISDN-PRI facility may be used to support several different trunk types. These may include both conventional and the ISDN-dynamic trunk types. An important point to remember is that the service application (such as MEGACOM, MEGACOM 800, or SDN) and incoming digits are the primary determining factors controlling which trunk type is selected.

To date, trunk type 41, 42, or 43 have been the trunk types used most frequently to support all ISDN applications, including CBC.

Incoming ISDN dynamic trunk type 120 calls (to a System 85) may or may not specify an NSF. Generally, incoming calls from the public network will specify an NSF while calls from the private network will not specify an NSF. For example, if the NSF is delivered and it shows an SDN call, then the System 85 defaults to trunk type 46. For all other incoming NSF values, the switch will default to trunk type 30. For those incoming calls which do not deliver an NSF the switch will either use those interface endpoint trunks that are translated in procedure 116 or use a default that is dependent on the type call. For example, trunk type 41 is the default for switch-to-switch connections, trunk type 30 is the default for public network-to-switch connections, and trunk type 108 is the default for host-to-switch calls.

Table 7-2, *Trunks Supporting Signaling Type 20*, shows permitted field entries that support signaling type 20.

TABLE 7-2. Trunks Supporting Signaling Type 20

Trunk Description	Trunk Type
CO	16, *17 (Note 1), 18, 19, 20
Data	100—107
DID	*30, *31
DMI (Note 2)	*108, *109
FX	21—25
ISDN	120 (Note 3)
M/S TIE	70—78
Special	2, 5, 6, 50—58, 62, 65—67, 90—93
TIE	32—40, *41, *42, *43, 44, 45, *46, *47
WATS	26, *27, 28

NOTES:

1. Trunk types preceded with an asterisk (*) may be selected by trunk type 120 on an as needed Call-By-Call (CBC) Service Selection basis.
2. Trunk types not included in these categories may not be translated for ISDN-PRI service. Most conventional trunk types specify, as a part of their name, an in/out signaling sequence. Actually, these signaling sequences are disabled and type 20 signaling is used exclusively over ISDN facilities.
3. Beginning with the 1.0 software load of Generic 2 and the 1.2 software load of System 85 R2V4 digits may be inferred when using the ISDN-dynamic trunk type. The default of 30 infers DID (if necessary). A default of 46 infers AAR/ARS. (See Appendix C, **Administrative Procedure Summary**, for a complete explanation of this field.)

For ISDN trunk groups as well as other types of trunk groups, the entered type defines feature operation for the trunk group. For example, if a trunk group is assigned the type of 19, incoming calls over this trunk group are routed to the attendant console. On DID trunk type groups, the switch expects station number digits on all incoming trunks; on tie trunk type groups the switch can handle either station number digits or network numbers.

For an ISDN trunk group, a dynamic trunk type (120) can be assigned to the group. This trunk type allows the group to process calls with a different trunk type on a call by call basis. For example, one incoming call over the group may expect station number digits (as does a MEGACOM call), while the next call over the group may expect a network number (as does an SDN call).

This trunk type allows flexibility in processing calls as opposed to a fixed static trunk type. Both an AAR/ARS prefix digit (procedure 103) and a DID additional digit (procedure 101) can be administered for ISDN dynamic trunk groups. (This cannot be done for any other type of trunk group.) The dynamic trunk type may be used for CBC service although any of the conventional trunk types could also be used if incoming digits have been provisioned consistently. For example, trunk type 41 could be used as a CBC trunk group to support MEGACOM, MEGACOM 800, and SDN if the incoming digits (for both MEGACOM 800 and SDN) reflect extension numbers or seven digit RNX-XXXX numbers. Customers can choose between 0 and 7 incoming digits to a switch.

Field 7 Assigns the dial access code restriction. Field encodes and their descriptions are:

- 0 Allows access to the trunk group via a dial access code.
- 1 Restricts and only allows access to the trunk group for trunk testing and for providing unattended console service.

Field 8 Assigns the trunk group as a MFT CO line appearance. For the ISDN application, encode (0) is applied.

Field 9 Displays default signaling and verify that the type of trunk signaling is correct. The ISDN feature uses message-oriented signaling. Therefore, encode 20 should be used. If the trunk signaling is not as desired — then it may be changed with field 2 of word 3.

Procedure 100 Word 2: Trunk Group Data Translations

This word is used to administer data characteristics for each trunk group. The ISDN feature does not place any new or additional requirements or restriction on the use of this procedure. Selecting the appropriate translations requires the same basic considerations as previously. Therefore, a description for this procedure's fields is not provided. Figure 7-11, *Procedure 100 Word 2: Trunk Group Data Characteristics (System 85 R2V4)*, depicts procedure 100, word 2.

ENHANCED MODE - PROCEDURE: 100, WORD: 3																															
TRUNK GROUPS - MODEM POOLING AND BCCOS																															
1. Trunk Group: --- <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left; width: 10%;">DATA</th> <th style="text-align: left; width: 10%;">RATE</th> <th style="width: 80%;"></th> </tr> <tr><td>2.</td><td>64K:</td><td> - </td></tr> <tr><td>3.</td><td>56K:</td><td> - </td></tr> <tr><td>4.</td><td>19.2K:</td><td> - </td></tr> <tr><td>5.</td><td>9.6K:</td><td> - </td></tr> <tr><td>6.</td><td>4.8K:</td><td> - </td></tr> <tr><td>7.</td><td>2.4K:</td><td> - </td></tr> <tr><td>8.</td><td>1.2K:</td><td> - </td></tr> <tr><td>9.</td><td>300:</td><td> - </td></tr> <tr><td>10.</td><td>LOW:</td><td> - </td></tr> </table> 11. SYNCHRONOUS: - 12. DUPLEX: -	DATA	RATE		2.	64K:	-	3.	56K:	-	4.	19.2K:	-	5.	9.6K:	-	6.	4.8K:	-	7.	2.4K:	-	8.	1.2K:	-	9.	300:	-	10.	LOW:	-	MODEM POOLING 13. Originate Mode: - 14. Answer Mode: - 15. Modem Type: - 16. Clock: - 17. First Choice: - 18. Test Type: -- 19. Host Access Clock: -
DATA	RATE																														
2.	64K:	-																													
3.	56K:	-																													
4.	19.2K:	-																													
5.	9.6K:	-																													
6.	4.8K:	-																													
7.	2.4K:	-																													
8.	1.2K:	-																													
9.	300:	-																													
10.	LOW:	-																													
Connected to CC0 ON-LINE ♥ <table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 2px 10px;">MAJOR</td> <td style="border: 1px solid black; padding: 2px 10px;">MINOR</td> <td style="border: 1px solid black; padding: 2px 10px;">RUN TAPE</td> <td style="border: 1px solid black; padding: 2px 10px;">BUSY OUT</td> <td style="border: 1px solid black; padding: 2px 10px;">IN USE</td> <td style="border: 1px solid black; padding: 2px 10px;">WAIT</td> </tr> </table>		MAJOR	MINOR	RUN TAPE	BUSY OUT	IN USE	WAIT																								
MAJOR	MINOR	RUN TAPE	BUSY OUT	IN USE	WAIT																										
enter command: - <table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 2px 10px;"></td> <td style="border: 1px solid black; padding: 2px 10px;"></td> <td style="border: 1px solid black; padding: 2px 10px;">F3 DATA</td> <td style="border: 1px solid black; padding: 2px 10px;"></td> <td style="border: 1px solid black; padding: 2px 10px;">F5 HELP</td> <td style="border: 1px solid black; padding: 2px 10px;">F6 FIELD</td> <td style="border: 1px solid black; padding: 2px 10px;">F7 INPUT</td> <td style="border: 1px solid black; padding: 2px 10px;">F8 CMDS</td> </tr> </table>				F3 DATA		F5 HELP	F6 FIELD	F7 INPUT	F8 CMDS																						
		F3 DATA		F5 HELP	F6 FIELD	F7 INPUT	F8 CMDS																								

Figure 7-11. Procedure 100 Word 2: Trunk Group Data Characteristics (System 85 R2V4)

Procedure 100 Word 3: ISDN Trunk Group Signaling Options

With System 85 R2V4, the two attributes (trunk type and signaling type) are separated and translated as individual parameters. Figure 7-12, *Procedure 100 Word 3: Trunk Group/Trunk Type — Signaling Type Translations (System 85 R2V4)*, depicts the procedure for translating the signaling type and associating that attribute to a particular trunk group or trunk type.

ENHANCED MODE - PROCEDURE: 100, WORD: 3

TRUNK GROUPS - SIGNALING AND OTHER PARAMETERS

1. Trunk Group: ---

2. Signaling Type: ---

3. Glare: -

4. Retry: -

5. Outgoing Maintenance Busy Out Seizure: -

6. Incoming Permanent Seizure: -

7. Failure Threshold: --

8. Optional ISDN Information Inhibited: -

DISPLAY ONLY

9. Trunk Type: ---

Connected to CC0 ON-LINE

MAJOR

MINOR

RUN TAPE

BUSY OUT

IN USE

WAIT

enter command: -

F3 DATA

F5 HELP

F6 FIELD

F7 INPUT

F8 CMDS

Figure 7-12. Procedure 100 Word 3: Trunk Group/Trunk Type — Signaling Type Translations (System 85 R2V4)

- Field 1

Specifies a trunk group. Permitted entries include any not already used number within the range of 18 to 999.
- Field 2

Administers or changes the signaling type for the trunk group.
- Field 3

For all ISDN trunking applications except DCS, glare is resolved by the ISDN protocol. Glare is discussed in more detail in the chapter entitled "Network Connections and Configurations" in this document. Specifically, ISDN negotiates the losing call to a different channel if the original channel is preferred. Exclusive calls (such as DCS) are not negotiated and the user hears the reorder tone. In either case, the network has priority over the user when both calls are preferred or exclusive. This capability is administered in procedure 262, word 1, and field 5. Therefore, this field 3 entry may be any of the available encodes (0, 1, or 2) since this field is ignored for ISDN applications.

Field 4 Retry permits multiple attempts to seize a busy trunk from the specified trunk group.

This field is primarily applicable for those trunk groups routed over analog facilities and use one of the following trunk types: 41, 42, 43, 46, or 47. Depending on the particular configuration, RETRY may or may not be applicable for ISDN applications. Field encodes and their descriptions are:

- 0 When multiple retry is not desired RETRY NOT ACTIVE. The ISDN-PRI protocol contains retry capability. When signaling type 20 is selected, 0 encode is required.
- 1 Recommended for ISDN applications where the 40-series of trunk types is used. Encode 1 enables a double retry and thus provides slightly improved call completion, particularly for large trunk groups that span across more than one transmission facility.

Field 5 Not applicable for ISDN applications. Therefore, the required option must be 0 for not active.

Field 6 Not applicable for ISDN applications. Therefore, the required option must be 0 for not active.

Field 7 Not applicable for ISDN applications. Therefore, the required option must be 0 for no failure threshold. See field 17 of procedure 107, word 5, for related information.

NOTE: This field is only applicable for analog trunk facilities. It permits the user to establish a trunk failure threshold that, when exceeded, will generate an alarm. The threshold limit will affect service availability and, on an indirect basis, the customer's maintenance costs.

Field 8 Selects whether the optional ISDN information is transmitted and access to other ISDN network features is desired.

The optional ISDN IEs include the following:

- Calling number display
- *Connected party number
- *User-to-user information
- *Called party name
- *Calling party name
- *Data mode 3 parameters
- *Traveling class marks

NOTE: Those items identified with an asterisk (*) can only be passed through the ISDN public network, on an end-to-end basis, whenever all interoffice signaling links use CCITT signaling system number 7 (SS7).

Field encodes and their descriptions are:

- (Dash) only applicable whenever ISDN is not available

0 Recommended for all ISDN configurations, both public and private network arrangements.

1 When the optional ISDN IEs are not to be transmitted.

Field 9 Used as a display-only field. The field displays the trunk type that was administered in procedure 100, word 1.

Procedure 101 Word 1: ISDN Trunk Group, SMDR, Digital Loss Plan, and AVD Assignments

Procedure 101, word 1, is used primarily to start SMDR, as well as translate the digital loss plan and AVD options. Figure 7-13, *Procedure 101 Word 1: Additional Trunk Group Translations (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 101, WORD: 1	
TRUNK	GROUP CHARACTERISTICS
1. Trunk Group:	---
2. Balance:	☐
3. Battery Reversal:	☐
4. Incoming Prefix Digit:	☐
5. DCS:	☐
6. Touch-Tone In:	☐
7. Touch-Tone Out:	☐
8. SMDR Active:	☐
9. AIOD Billing Number:	----
15. APLT Features Allowed:	☐
16. Disconnect Supervision:	☐
17. AVD:	☐
TIMED RECALL	
10. Time:	--
11. Level:	☐
12. SMDR Variable Timer:	--
13. Pad Group:	☐
14. Tie Toll:	☐
Connected to CC0 ON-LINE ☒ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-13. Procedure 101 Word 1: Additional Trunk Group Translations (System 85 R2V4)

- Field 1** Displays the trunk group number, such as previously translated in procedure 100.
- Field 2** Selects whether the trunk group uses balanced transmission facilities. Field encodes and their descriptions are:
- 0 Not provided — the required option for ISDN-PRI.
 - 1 Provided — not applicable for ISDN-PRI.
- Field 3** Translates the battery reversal option. Field encodes and their descriptions are:
- 0 Not provided — the required option for ISDN-PRI
 - 1 Provided — not applicable for ISDN-PRI
- Field 4** Depending on how each type of DID service is provisioned it may or may not be necessary for the switch to infer (generate) a digit to complete the call. Field encodes and their descriptions are:
- Dash (–) is applicable for all ISDN-PRI applications except DID (trunk types 30, 31, and 120).
 - Any single digit number (0 through 9). Which number is determined by the trunk group and its application.
- NOTE:** When using System 85 R2V4 1.1 software, digits cannot be inferred for ISDN-dynamic trunk types.
- Field 5** Assigns whether the trunk group is (1) or is not (0) used for DCS applications.

- Fields 6-7** Selects in/out touch-tone availability. Field encodes and their descriptions are:
- 0 When only rotary pulses are received via the trunk group
 - 1 When either rotary pulses or touch-tone can be accepted
- NOTE:** The ISDN-PRI applications use the D-channel to transmit and receive dialed digits. Dialed digits are transmitted as ASCII characters. Therefore, for ISDN applications, this field is ignored; either option may be translated.
- Field 8** Assigns the trunk group to SMDR record keeping. Field encodes and their descriptions are:
- 0 Trunk group usage not applicable for SMDR recording
 - 1 Trunk group usage will be recorded by SMDR
 - 2 Trunk group usage will be recorded, account code is required
- Fields 9-11** Not used for ISDN applications.
- Field 12** This field is only applicable when SMDR is being used, and then only to change the default SMDR timer value. Field encodes represent intervals in 1-second increments. The range is 1 through 99 with dash (–) being the default timer value of 6 seconds.
- Field 13** Administers the optional transmission loss assignments. The encode translated depends on the network configuration and service application. Field encodes and their corresponding loss plan are listed as follows:
- 0 The Digital Fixed Loss Plan
 - 1 ISL Tie Trunk
 - 2 EIA Tie Trunk
- NOTE:** This is the recommended option for Special Access Connections to a 4ESS.
- 3 ISL Digital Central Office
 - 4 EIA Digital Central Office
 - 5 Digital Toll Office
 - 6 Analog Toll Office
 - 7 AUTOPLEX NETWORK Interface V
 - 8 AUTOPLEX NETWORK Interface Y
- Refer to chapter 4, *The Digital Loss Plan*, for a description of the digital loss plan and to table 4-2, *Digital Loss Plan (Port-to-Port Losses)*, in this same chapter for a list of port-to-port loss values.
- Field 14** Assigns whether a trunk is toll restricted (1) or unrestricted (0).
- NOTE:** This field is ignored by the ISDN software. Either encode is satisfactory.

-
- Field 15** The APLT type services are not applicable in the ISDN-PRI environment. Therefore, for trunk groups using ISDN-PRI facilities, this field is ignored. Refer to Appendix C, *Administrative Procedure Summary*, for more information about the dynamic 120 trunk types.
- Field encodes and their descriptions are:
- 0 When APLT services are not available for analog or DS1/DMI-BOS facilities
 - 1 When APLT services are available for analog or DS1/DMI-BOS facilities.
- Field 16** Assigns whether disconnect supervision is (1) or is not (0) provided.
- NOTE:** The ISDN-PRI protocol provides disconnect supervision. Therefore, this field is ignored by ISDN software.
- Field 17** *V4 Only*
- Assigns whether the trunk group may be used to support modem pool calls. Field encodes and their descriptions are:
- 0 When AVD is not provided (that is, insert a modem). This includes voice and digital data. This option is required for all trunk groups that support modem pool calls including voice and digital data.
 - 1 When the AVD option is provided (that is, do not insert a modem).

Procedure 103 Word 1: Trunk Group Digit Collection and Trunk-Side BC

This procedure is used to translate the trunk group network parameters. Figure 7-14, *Procedure 103 Word 1: Network Trunk Group Translations (System 85 R2V4)*, depicts procedure 103, word 1.

ENHANCED MODE - PROCEDURE: 103, WORD: 1	
NETWORK TRUNK GROUP TRANSLATION	
1. Trunk Group:	--
2. Facility Restriction Level:	--
3. Network Trunk:	--
4. Main/Tandem:	--
5. Incoming Tie to AAR/ARS or APLT:	--
6. Authorization Code Required:	--
7. Bridge-On Allowed:	--
8. Trunk Reservation Limit:	--
9. AAR/ARS Prefix:	--
10. Data Protection (Permanent):	--
11. Remote Access Echo Suppressor:	--
12. AAR Conditional Routing:	--
13. Second TCM:	--
14. Digit Collection:	--
15. Bearer Capability:	--
Connected to CC0 ON-LINE ☒ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: --	
-- -- F3 DATA -- F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-14. Procedure 103 Word 1: Network Trunk Group Translations (System 85 R2V4)

- Field 1** Displays the trunk group number previously administered in procedures 100 and 101.
- Fields 2-13** DS1 or ISDN-PRI do not place any new or additional considerations on translating these fields. The encodes that are translated are generally dependent on each trunk group, its application, and the associated trunk groups. Refer to Appendix C, *Administrative Procedure Summary*, for more information about the dynamic 120 trunk types. For more information see *Dynamic Trunk Type in Procedure 100 Word 1*.
- Field 14** Specifies how the dialed digits are outpulsed. Field encodes and their descriptions are:
- 0 When digit outpulsing may overlap digit reception
 - 1 When all digits must be received before outpulsing may start. All ISDN applications, regardless of the trunk type, require that a (1) be translated in this field. Digit outpulsing does not begin until all digits are received. Then digits are outpulsed as ASCII characters — per the ISDN recommendations.

Field 15 *V4 Only*

Used for non-ISDN trunk groups that interwork to ISDN trunk groups. Therefore, field 15 only applies to non-ISDN trunk groups. Generally, trunk groups can use both analog and ISDN-PRI (digital) transmission facilities. Any restrictions and compatibility requirements are conveyed as information known as the BC code. This field is used to populate the BC IE. Field encodes and their descriptions are:

- 0 Voice and Voice-grade data
- 1 Mode 1 data (56K-bps)
- 2 Mode 2 data (subrate up to 19.2K-bps)
- 3 Mode 3 data (also called packet mode)
- 4 Mode 0 data (64K-bps digital data)

Procedure 116 Word 1: DS1/DMI/ISDN-PRI Trunk Assignments

Each analog trunk circuit pack provides four circuits that are administered by using procedure 150. Conversely, each DS1 provides 24 circuits (channels) that are administered by using procedure 116. Figure 7-15, *Procedure 116 Word 1: DSI Trunk Assignments to Equipment/Circuit Location (System 85 R2V4)*, depicts procedure 116, word 1. Each DS1/MFAT carrier will support a maximum of two DS1s, each occupying one slot and located in slots 5 and 18. When a DS1/DMI/ISDN interface (trunk applications) is located in slot 5, it functionally uses the six slots 0, 1, 2, 5, 6, and 7. When the interface is located in slot 18, it functionally uses the six slots 13, 14, 15, 18, 19, and 20.

ENHANCED MODE - PROCEDURE: 116, WORD: 1	
DS1 AND ISDN TRUNK ASSIGNMENTS	
EQUIPMENT LOCATION	
1. Module:	
2. Cabinet:	
3. Carrier:	
4. Slot:	
5. Circuit:	
6. Trunk Group:	
7. Night Terminal:	
8. Disable Signaling:	
9. AIOD Equipment Number:	
10. Interface Endpoint:	
Connected to CC0 ON-LINE ☐	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-15. Procedure 116 Word 1: DS1 Trunk Assignments to Equipment/Circuit Location (System 85 R2V4)

The DS1 channels are assigned to slot and circuit locations according to the order in which the module processor scans the equipment carrier. The first circuit scanned is circuit 0 of slot 05 (or 18); the second is circuit 0 of slot 06 (or 19); the third is circuit 0 of slot 7 (or 20); and the fourth is circuit 1 of slot 05 (or 18). Continue in this way to channel 12 that will be located at circuit 3 of slot 07 (or 20); remaining 12 channels are assigned beginning with circuit 0 of slot 0 (or 13). Continue in this way through channels 23 or 24, depending on whether robbed-bit or 24th-channel signaling is translated; refer to table 7-3, *DS1/ISDN-PRI Administration — Channel Versus Trunk Assignments*.

TABLE 7-3. DS1/ISDN-PRI Administration — Channel Versus Trunk Assignments

DS1 Channel	Slot/Circuit	DS1 Channel	Slot/Circuit
1	*/0	13	*+1/0
2	*/1	14	*+1/1
3	*/2	15	*+1/2
4	*/3	16	*+1/3
5	*/4	17	*+1/4
6	*/5	18	*+1/5
7	*/6	19	*+1/6
8	*/7	20	*+1/7
9	*/8	21	*+1/8
10	*/9	22	*+1/9
11	*/10	23	*+1/10
12	*/11	24	*+1/11

LEGEND:

* Any slot for the TN767 except slot number one in the universal port carrier.

*+1 The slot next to the TN767 or TN555.

NOTE: Channel 24 is the D-channel.

NOTE: When the equipment carrier is configured with two DS1s, physical slots 3, 8, 16, and 21 are available for other applications. If only one DS1 is configured, then six additional slots are available for other applications.

To minimize confusion and eliminate the need for maintaining elaborate trunk to channel cross-reference tables, trunk group member assignments should match the DS1 channel assignments (for example, trunk group member 1 should be on channel 1). When using procedure 116, word 1, refer to Table 7-2, *Trunks Supporting Signaling Type 20*, to determine which slot and circuit to translate for channel 1. Repeat this procedure by sequentially selecting DS1 channels (2, 3, and so on) and translating the appropriate slot and circuits as required.

Fields 1-5 These fields are used to translate the equipment location, including slot and circuit (channel) location, and to associate the equipment location (channel) with the particular trunk group translated in field 6.

Field 6 Translates the trunk group. Permitted encodes must be numbers with the range of 18 through 999.

Field 7 Translates a particular number that functions as the night service number. The number of digits depend on the particular application and its numbering plan.

- Field 8** Disables a channel's signaling. Field encodes and their descriptions are:
- (Dash) used when ISDN is enabled.
 - 0 Used when signaling is enabled. This is the default option (not used with ISDN).
 - 1 Used when signaling is disabled. Use this with dedicated switched connection to disable signaling for a tie trunk. The signaling bit then can be used as a data bit, allowing the full 64K-bps to be used for data.
- Field 9** Not applicable for ISDN-PRI.
- Field 10** For outgoing AAR and TVS test calls, this field determines the encoding of the called party IE as assigned in procedure 107, word 1, and procedure 108, word 1. If the B-channel is in an ISDN dynamic trunk group, this field also determines how an incoming call over the trunk is processed (see the *Procedure 100 Word 1* section earlier in this chapter).
- See Appendix C, *Administrative Procedure Summary*, for a discussion of the called party IE and the *Procedure 107 Word 1* and *Procedure 108 Word 1* sections in this chapter for more information. Field encodes and their descriptions are:
- 0 For another customer premises switch
 - 1 For a private network connection to a host computer
 - 2 For public network connections

Procedure 012 Word 1: Name Database

The name database is used by those features (such as DCS, ISDN-PRI) which provide display type information to voice terminals. Some examples of the more common display information include; calling party name, vector directory number, and trunk group name. For ISDN-PRI applications, the name database information is used to populate the display IE in the call setup and connect messages. Figure 7-16, *Procedure 012 Word 1: Name Database Establish Key (System 85 R2V4)*, depicts the first of three related procedures.

ENHANCED MODE - PROCEDURE: 012, WORD: 1	
NAME DATABASE - NAME TO BE DISPLAYED	
1. Extension, VDN, or Trunk Group:	-----
2. Type:	-
3. Display Start:	--
4. Outgoing Trunk Display:	-
5. Copy Mode:	-
6. Extension, VDN, or Trunk Group to Copy or Share:	-----
DISPLAY ONLY	
7. Characters In Name	--
8. Shared Primary Extensions or Trunk Groups	--
9. Associated Extension Name Assigned	-
Connected to CC0 ON-LINE♥	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: -	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-16. Procedure 012 Word 1: Name Database Establish Key (System 85 R2V4)

- Field 1** Assigns either an extension number, vector directory number, or trunk group. Field encodes and their descriptions are:
- 000 through 99999, for extension and directory numbers
- NOTE:** Whether the number is three, four, or five digits depends on the numbering plan.
- 18 through 999, for trunk group numbers
- Field 2** Assigns whether the encode for field 1 is a trunk group or extension/vector directory number. Field encodes and their descriptions are:
- 0 For trunk groups
 - 1 For extension numbers and vector directory numbers
- Field 3** This field is only applicable for the identified extension's display module. It controls the number of blank spaces that are inserted before the first displayed character of the name, dialed number, or trunk group name. Permitted encodes are numbers 1 through 30.

Field 4 The main function of this field is to provide some administration control over what is displayed on the voice terminals digital display. Field encodes and their descriptions are:

- (Dash) for all incoming only trunk groups.
- 0 Used when the user (extension) does not want the outgoing trunk group name displayed but does desire the dialed number to remain on the display.
- 1 Used when the user desires to display the name of the outgoing trunk group (such as ISDN/SDN, MEGACOM, or CBC).

NOTE: For a tandem interworking call, the name of the incoming trunk group is transmitted in the display IE of the ISDN-PRI outgoing trunk group.

Field 5 The method that defines the name. Field encodes and their descriptions are:

- 0 Used for adding a new name or changing an existing name; requires that the name change be made with word 2.
- 1 Used for copying the name from the extension or trunk group that is displayed in field 6

Field 6 This field is used with field 5 to copy an existing name to the extension or trunk group identified in field 1. Field encodes and their descriptions are:

- 000 through 99999, for extension and directory numbers

NOTE: Whether the number is three, four, or five digits depends on the numbering plan.

- 18 through 999, for trunk group numbers

Procedure 012 Word 2: Name Database

This word is used to translate a name (up to a maximum of 30 characters). Figure 7-17, *Procedure 012 Word 2: Name Database Entry (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 012, WORD: 2																															
NAME DATABASE - ENTRY																															
1. Segment: CHARATER ENCODES <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 15%;">2. Character 1:</td><td style="width: 10%;"> </td><td style="width: 10%;"> </td></tr> <tr><td>3. Character 2:</td><td> </td><td> </td></tr> <tr><td>4. Character 3:</td><td> </td><td> </td></tr> <tr><td>5. Character 4:</td><td> </td><td> </td></tr> <tr><td>6. Character 5:</td><td> </td><td> </td></tr> <tr><td>7. Character 6:</td><td> </td><td> </td></tr> <tr><td>8. Character 7:</td><td> </td><td> </td></tr> <tr><td>9. Character 8:</td><td> </td><td> </td></tr> <tr><td>10. Character 9:</td><td> </td><td> </td></tr> <tr><td>11. Character 10:</td><td> </td><td> </td></tr> </table>		2. Character 1:			3. Character 2:			4. Character 3:			5. Character 4:			6. Character 5:			7. Character 6:			8. Character 7:			9. Character 8:			10. Character 9:			11. Character 10:		
2. Character 1:																															
3. Character 2:																															
4. Character 3:																															
5. Character 4:																															
6. Character 5:																															
7. Character 6:																															
8. Character 7:																															
9. Character 8:																															
10. Character 9:																															
11. Character 10:																															
Connected to CC0 ON-LINE MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT																															
enter command:																															
 F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS																															

Figure 7-17. Procedure 012 Word 2: Name Database Entry (System 85 R2V4)

Field 1 Identifies one-of-three 10-character fields. Field encodes and their descriptions are:

- 1 Used for characters 1 through 10
- 2 Used for characters 11 through 20
- 3 Used for characters 21 through 30

There exists 94 different encodes (00-12, 14, 15, 17-96) which correspond to numbers 0 through 9, lower case letters, upper case letters, and special characters. The Manager II help screen or the document *AT&T System 85 Release 2 Version 4 Administration Procedures* (555-103-506) may be used for determining the desired encodes.

Fields 2-11 Each field should be translated with the encode that corresponds to the desired character.

Procedure 012 Word 3: Name Database

Since the name database has the potential to use a large amount of memory it is generally desirable to run the compact operation whenever all names have been added. Figure 7-18, *Procedure 012 Word 3: Name Database* (System 85 R2V4), depicts this procedure.

ENHANCED MODE - PROCEDURE: 012, WORD: 3	
NAME DATABASE COMPACTION	
1. Compact: ☐ DISPLAY ONLY 2. Names That Can Yet Be Assigned: 3. Words Available: 4. Words to Be Gained by Compacting:	
Connected to CC0 ON-LINE ☐ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-18. Procedure 012 Word 3: Name Database (System 85 R2V4)

Field 1 Assigns whether (1) or not (–) to compact the name database.

Fields 2-4 Are display only and serve to show status of the database.

Procedure 309 Word 1: ARS Assignments and IXC/ISDN Network Identifier

This procedure is used for translating/controlling the Automatic Route Selection feature. Figure 7-19, *Procedure 309 Word 1: ARS (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 309, WORD: 1	
ARS - ROUTE TABLES	
1.	ARS Plan:
2.	Pattern Number:
3.	Preference Number:
4.	Trunk Group:
5.	Facility Restriction Level:
6.	Warning Tone:
7.	Distant Area Code (NPA):
8.	Send 1 For Toll:
9.	Toll Table Index:
10.	Number of Digits Deleted:
11.	Digit Collect (DC) Signal Ignore:
12.	IXC ISDN Network Identifier:

Connected to CC0 ON-LINE ☐ MAJOR ☐ MINOR ☐ RUN TAPE ☐ BUSY OUT ☐ IN USE ☐ WAIT

enter command:

F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-19. Procedure 309 Word 1: ARS (System 85 R2V4)

Fields 1-11 The ISDN-PRI does not place any new or additional considerations on translating these fields. The codes/digits translated are generally dependent on each ARS plan and other switch/network considerations.

Field 12 Specifies either the number (designation) of the interexchange carrier (IXC) or the ISDN Network Service Identifier for the trunk group. The IXC/ISDN network identifier enables the switch to provide equal access capability by populating either the NSF IE or the Transit Network Selection IE. If sending an NSF IE and a particular IXC vendor number is specified in this field, that entry is included in the NSF IE. If no IXC vendor number is specified, an is created automatically in the Transit Network Selection IE. Permitted field entries may be any number within the range of 0 through 999.

When the trunk group is routed over private network ISDN-PRI transmission facilities, then no IXC/ISDN network is used and the 0 option must be translated.

Each network provider (of ISDN service) will have a different IXC identifier number, When connecting to AT&T ISDN network facilities, the required number is 288.

Procedure 309 Word 5: ARS and ISDN Trunk — Network Characteristics

This procedure is required for translating ISDN trunk groups into the ARS plan. Figure 7-20, *Procedure 309 Word 5: ARS and Transit Network Identifiers (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 309, WORD: 5 ARS - ISDN AND BEARER CAPABILITY COS	
1. ARS Plan:	
2. Pattern Number:	
3. Preference Number:	
4. ISDN Dynamic Trunk Type:	
5. Network Service Value:	
BEARER CAPABILITY	
6. Voice or Voice Grade:	
7. Mode 1 Data:	
8. Mode 2 Data:	
9. Mode 3 Data:	
10. Mode 0 Data:	
Connected to CC0 ON-LINE ♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-20. Procedure 309 Word 5: ARS and Transit Network Identified (System 85 R2V4)

Fields 1-3 The ISDN-PRI does not place any new or additional consideration on translating these fields. The codes/digits translated are generally dependent on each ARS plan and other switch or network considerations.

Field 4 Translates ISDN trunk type 120 only. Recall that for ISDN applications the trunk type may be translated as fixed (that is, one specific type) or dynamic (which may include those from the fixed category). Generally, the trunk type selected will depend on the network service or feature value, which is translated in field 5. Table 7-4, *Network Service/Feature Options*, shows the relationships.

TABLE 7-4. Network Service/Feature Options

Network Service (or) Network Feature	Network Value	ISDN Trunk Type
OUTWATS Banded (Note 1)	33-288	(Note 2)
Operator Handled	324	47
Pre-Subscribed Common Carrier Operator	325	47
SDN	352	47
MEGACOM 800 Service (inc. International)	(Note 4)	n/a
MEGACOM Service	354	47
INWATS	355	47
WATS Maximal Subscribed Band	356	47
ACCUNET switched digital service	357 (4E13)	47

NOTES:

1. OUTWATS bands 0 through 255 are assigned sequential numeric values ranging from 33 through 288 (for example, band 0 is network service value 33).
2. Trunk types 26 and 27 (DMI data) may be translated depending on local requirements.
3. The trunk group administered to this preference must be assigned as trunk type 120 (dynamic trunk type) in procedure 100, word 1.
4. Connection made with procedure 309, word 5. Not available in System 85 R2V4.

Field 5 Specifies the network service that is requested. Refer to Table 7-4, *Network Service/Feature Options*, for the appropriate encode.

Fields 6 through 10 are translated to enable or disable one or more BC codes for the ARS plan — pattern number — preference number.

Field 6 Enables (1) or disables (0) support for voice or voice-grade data BC code.

Field 7 Enables (1) or disables (0) support for data mode 1 BC code.

Field 8 Enables (1) or disables (0) support for data mode 2 BC code.

Field 9 Enables (1) or disables (0) support for data mode 3 BC code.

Field 10 Enables (1) or disables (0) support for data mode 0 BC code.

Procedure 321 Word 1: AAR Assignments and IXC/ISDN Network Identifier

This procedure is used for translating/controlling the AAR feature. Figure 7-21, *Procedure 321 Word 1: AAR (System 85 R2V4)*, depicts the procedure.

ENHANCED MODE - PROCEDURE: 321, WORD: 1	
AAR - ROUTE TABLES	
1.	Pattern Number:
2.	Preference Number:
3.	Trunk Group:
4.	Facility Restriction Level:
5.	Warning Tone:
6.	Off Net:
7.	Number of Digits Deleted:
8.	Digit Collect (DC) Signal Ignore:
9.	0xxx Allowed:
10.	IXC ISDN Network Identifier:
Connected to CC0 ON-LINE ♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-21. Procedure 321 Word 1: AAR (System 85 R2V4)

Fields 1-9 The ISDN-PRI does not place any new or additional considerations on translating these fields. The codes or digits translated are generally dependent on each AAR plan and other switch or network considerations.

See table 7-5, *Administrative Summary*, in procedure 321, word 5, for the relationship between administering field 4 in this word and field 4 in word 5.

Field 10 Specifies either the number (designation) of the interexchange carrier (IXC) or the ISDN Network Service Identifier for the trunk group. The IXC/ISDN network identifier enables the switch to provide equal access capability by populating either the NSF IE or the Transit Network Selection IE. If sending an NSF IE and a particular IXC vendor number is specified in this field, that entry is included in the NSF IE. If no IXC vendor number is specified, an is created automatically in the Transit Network Selection IE. Permitted field entries may be any number within the range of 0 through 999.

When the trunk group is routed over private network ISDN-PRI transmission facilities, then no IXC/ISDN network is used and the 0 option must be translated.

Each network provider (of ISDN service) will have a different IXC identifier number. When connecting to AT&T ISDN network facilities, the required number is 288.

Procedure 321 Word 5: AAR and ISDN Trunk — Network Characteristics

This procedure is used to translate ISDN trunk groups in the AAR plan. Figure 7-22, *Procedure 321 Word 5: AAR and Transit Network Identifiers (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 321, WORD: 5	
AAR - ISDN AND BEARER CAPABILITY	
1.	Pattern Number:
2.	Preference Number:
3.	ISDN Dynamic Trunk Type:
4.	Network Service Value:
BEARER CAPABILITY	
5.	Voice or Voice Grade:
6.	Mode 1 Data:
7.	Mode 2 Data:
8.	Mode 3 Data:
9.	Mode 0 Data:
Connected to CC0 ON-LINE♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-22. Procedure 321 Word 5: AAR and Transit Network Identifiers (System 85 R2V4)

- Field 1** Specifies the AAR pattern number. Permitted encodes are 1 through 640.
- Field 2** Specifies the AAR preference number. Permitted encodes are sequential numbers within the range of 1 through 16.
- Field 3** Translates the ISDN trunk type. Recall that for ISDN applications the trunk type may be translated as fixed (that is, one specific type) or dynamic (which may include those from the fixed category). Generally, the trunk type selected will depend on the network service or feature value, which is translated in field 4. Table 7-3, *Network Service/Feature Options*, shows the relationships.
- Field 4** Specifies the network service requested. Refer to Table 7-3, *Network Service/Feature Options*, for the appropriate encode.
- Fields 5-9** Enables one or more BC codes for the AAR plan — pattern number — preference number.

Table 7-5, *Administration Summary*, summarizes administration of NSF in word 5, field 4, and IXC in word 1, field 10:

TABLE 7-5. Administration Summary

Procedure 321		
Word 5 Field 4 (NSF)	Word 1 Field 10 (IXC)	IE Results
208	208	NSF
dash	208	TNS
208	dash	NSF
dash	dash	nothing

- Field 5** Enables (1) or disables (0) support for the voice or voice-grade data BC code.
- Field 6** Enables (1) or disables (0) support for the data mode 1 BC code.
- Field 7** Enables (1) or disables (0) support for the data mode 2 BC code.
- Field 8** Enables (1) or disables (0) support for the data mode 3 BC code.
- Field 9** Enables (1) or disables (0) support for the data mode 0 BC code.

Procedure 107 Word 1: ISDN Trunk Verification by Terminal, Attendant, and ATMS

This procedure must be translated to support trunk verification by voice terminal and trunk verification by attendant over ISDN-PRI facilities. Figure 7-23, *Procedure 107 Word 1: ATMS Terminating Test Line Assignment (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 107, WORD: 1	
ATMS - TERMINATING TEST LINE ASSIGNMENT	
1. Trunk Group: ---	
2. Test Line Type: --	
TTL TELEPHONE DIGITS	
3. Digit 1: -	11. Digit 9: -
4. Digit 2: -	12. Digit 10: -
5. Digit 3: -	13. Digit 11: -
6. Digit 4: -	14. Digit 12: -
7. Digit 5: -	15. Digit 13: -
8. Digit 6: -	16. Digit 14: -
9. Digit 7: -	17. Digit 15: -
10. Digit 8: -	18. Digit 16: -
DISPLAY ONLY	
19. Trunk Type: ---	
Connected to CC0 ON-LINE ♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: -	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-23. Procedure 107 Word 1: ATMS Termination Test Line Assignment (System 85 R2V4)

- Field 1** Identifies those ISDN-PRI trunk groups accessed by the trunk verification features. Permitted encodes are previously defined trunk group numbers from 18 to 999.
- Field 2** Dash (-), is appropriate for voice terminal and attendant console applications. If a transmission test line is used, its type should be specified.
- Fields 3-18** Assigns digits for the terminating test line. Procedure 107, words 2-7, need only be translated whenever ATMS is used.

Procedure 108 Word 1: ISDN Trunk Group Terminating Test Line Number (Digits)

This procedure is used for ISDN-PRI testing purposes with procedure 648 test 3. This procedure translates the line number that identifies the loop around termination for the particular B-channel. This test line number must be assigned for both private and public network configurations. Whether more than one terminating test line number is needed depends on the number of ISDN-PRI links and whether they terminate on more than one switch. Figure 7-24, *Procedure 108 Word 1: ISDN Terminating Test Line Assignments (System 85 R2V4)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 108, WORD: 1	
ISDN TERMINATING TEST LINE ASSIGNMENT	
1. Trunk Group:	
TERMINATING TEST LINE TELEPHONE DIGITS	
2. Digit 1:	10. Digit 9:
3. Digit 2:	11. Digit 10:
4. Digit 3:	12. Digit 11:
5. Digit 4:	13. Digit 12:
6. Digit 5:	14. Digit 13:
7. Digit 6:	15. Digit 14:
8. Digit 7:	16. Digit 15:
9. Digit 8:	17. Digit 16:
DISPLAY ONLY	
18. Trunk Type:	
Connected to CC0 ON-LINE ☒ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA	F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-24. Procedure 108 Word 1: ISDN Terminating Test Line Assignments (System 85 R2V4)

Field 1 Translates the termination for each trunk group that identifies the ISDN loop around terminating test line. The terminating test line is required for B-channel maintenance testing.

As part of the installation and ISDN-PRI services provisioning process, the terminating test line number assignment must be coordinated with the terminating switch.

Fields 2-17 Assigns digits for the terminating test line.

GENERIC 2

Depending on whether the switch provides private network ISDN service or public network ISDN services, whether the switch functions as an endpoint or as a tandem node, will determine whether other features should be administered before ISDN-PRI. Primarily, these other features include tandem tie trunk access, trunk-to-trunk calling, and miscellaneous trunk restrictions. When applicable, these features are administered with procedures 275, word 1, 110, 111, 102, and 010, word 3.

Procedure 275 Word 4: ISDN Service — Enable/Disable

Screen-based procedure 275 is used to translate the system COS assignments as well as several other miscellaneous services and features. Word 4 provides the capability for enabling and disabling the ISDN service. Figure 7-25, *Procedure 275 Word 4: System COS and Miscellaneous Service Assignments (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 275, WORD: 4	
SYSTEM COS - MISCELLANEOUS	
1. Traditional Code Calling Access Digits: ☐	
3. Trunk-to-Trunk Transfer: ☐	
ATTENDANT RELEASE LOOP OPERATION	
4. Status: ☐	
5. Timed Recall Timer: ☐	
6. Default Recent Disconnect Interval: ☐	14. ISDN Status: ☐
MAXIMUM PREEMPTION LEVEL	
7. All Incoming: ☐	ADMINISTRABLE ALARMS
OUTGOING	15. Even Port Peripherals: ☐
8. Terminal: ☐	16. Trunk Software: ☐
9. Attendant: ☐	17. Auxiliary Software: ☐
	DISPLAY ONLY
10. AUTOVON Interface Switch: ☐	18. Local Switch Number: ☐
11. ACD Abandon Call Search: ☐	
12. MLL Status: ☐	
13. CMS Status: ☐	
Connected to CC0 ON-LINE ▼ ☐ MAJOR ☐ MINOR ☐ RUN TAPE ☐ BUSY OUT ☐ IN USE ☐ WAIT	
enter command:	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-25. Procedure 275 Word 4: System COS and Miscellaneous Service Assignments (Generic 2)

Field 14 For Generic 2, field 14 must always be translated. Field encodes and their descriptions are:

- (Dash) required when ISDN is not provided. Current policy is to always ship ISDN-PRI software with the switch. However, the administration software still provides the option to assign this software as unprovided.
- 0 Must be translated when ISDN is provided but not active DISABLED.
- 1 Must be translated to ENABLE ISDN service.

Procedure 276 Word 1: Other Feature Groups

Use this procedure to turn on optional networking features such as AAR, DCS, SNC, and Look-Ahead Interflow or to see which of these features are turned on. Figure 7-26, *Procedure 276 Word 1: Feature Group COS (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 276, WORD: 1		
	FEATURE GROUP CLASS OF SERVICE	
1. Standard Network:	-	
2. Multipremise:	-	
3. DCS:	-	
4. AUTOVON:	-	
5. Call Vectoring:	-	
6. Tenant Services:	-	
7. System 85 SE:	-	
8. SNC:	-	
9. Look-Ahead Interflow:	-	
DISPLAY ONLY		
10. Use Procedure:	<input 3"="" style="padding: 10px 0 0 0;" type="text" value="---</input></td> <td></td> </tr> <tr> <td colspan="/> Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: -		
		F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-26. Procedure 276 Word 1: Feature Group COS (Generic 2)

Procedure 250 Word 1: SC/DS1 — Carrier Designation

This procedure is used to assign the equipment carriers to a module and cabinet. Additionally, it is used to assign the type of carrier, the carrier port electrical number, and whether the carrier is equipped with an SC. Figure 7-27, *Procedure 250 Word 1: System Configuration — Carriers (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 250, WORD: 1	
CARRIERS	
CARRIER LOCATION 1. Module: -- 2. Cabinet: -- 3. Carrier: -- 4. Carrier Type: --	LOCAL RMI LOCATION 12. Module: -- 13. Cabinet: -- 14. Carrier: -- 15. Slot: --
MODULE CONTROL 5. I/O: -- 6. PDS: -- 7. Duplicated: -- 8. TMS: --	
9. Port Electrical Carrier: -- 10. TMS Electrical Carrier: -- 11. SC Equipped: --	
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-27. Procedure 250 Word 1: System Configuration — Carriers (Generic 2)

DS1 circuit packs may only be installed within DS1 port carriers. Each Generic 2 that is equipped with one or more DS1s will also contain either a TN463 synchronization clock (SC) or a TN2131C. For single-module systems, the SC is located in the module control carrier along with the TN460 module clock. For multimodule systems, the SC is located in the TMS carrier.

Fields 1-3 Identifies a module number, cabinet number, and physical carrier position. The appropriate encodes are determined based on whether the module is traditional or universal and the physical equipment location, refer to table 7-6, *Equipment Parameters and Permitted Translation Encodes*.

Field 4 Translates a particular type of carrier (such as DS1/MFAT, module control, or TMS) to the equipment location identified by fields 1-3. For DS1/DMI/ISDN-PRI applications, field encodes and their descriptions are:

- 2 Universal Module Control 0
- 3 Universal Module Control 1
- 4 TMS 0 Control
- 5 TMS 0 Growth
- 6 Traditional Module Control 0
- 7 Traditional Module Control 1
- 8 TMS 1 Control
- 9 TMS 1 Growth
- 10 Universal port
- 11 DS1 port carrier

Depending on whether the purpose for translating this procedure is to assign the SC or to assign a DS1 port carrier will determine which encode to select.

Fields 5-10 DS1/DMI/ISDN-PRI does not place any additional requirements on translating these fields.

Field 11 Field encodes and their descriptions are:

- 0 Translated for external synchronization, when the carrier (which is identified by fields 1-10) is not equipped with an SC.
- 1 When the carrier (module control or TMS) is equipped with an SC.

NOTE: The network synchronization diagram should be available, and is required, to determine how to properly synchronized the switch.

Fields 12-15 Not applicable for DS1/DMI/ISDN-PRI applications. Therefore, a dash (–) is appropriate.

Procedure 260 Word 1: DS1/DMI/ISDN-PRI Physical Interface

Procedure 260 is required to administer each DS1. For traditional modules, the ANN11_ circuit pack provides DS1/DMI-BOS services while the ANN35 provides DMI-MOS/ISDN-PRI services. For universal modules, the TN767 circuit pack provides DS1/DMT services while the TN767/TN555 pair provides ISDN-PRI services. Figure 7-28, *Procedure 260 Word 1: Additional DMI-MOS/ISDN-PRI Circuit Pack Assignments (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 260, WORD: 1	
DS1/ISDN AND RG CIRCUIT PACK ASSIGNMENTS	
EQUIPMENT LOCATION	SC
1. Module:	12. Equipment Type:
2. Cabinet:	13. SC Reference:
3. Carrier:	
4. Slot:	14. Application:
	15. Bit Inversion:
SIGNALING	16. Link Type:
6. Framing:	17. SA/FX:
7. 23B+D/24B:	18. Loop Length:
8. 24C/RBS:	19. E Bit:
9. ZCS/B8ZS:	
10. Slip Enable:	
11. External Loop:	
DISPLAY ONLY	
20. SC Information:	
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-28. Procedure 260 Word 1: Additional DMI-MOS/ISDN-PRI Circuit Pack Assignments (Generic 2)

Fields 1-4 Assigns the circuit pack to an equipment location. Table 7-6, *Equipment Parameters and Permitted Translation Encodes*, depicts the permitted ranges for these encodes.

TABLE 7-6. Equipment Parameters and Permitted Translation Encodes

Equipment Parameter	Traditional Module	Universal Module
Module Number	0-30	0-30
Cabinet Number	0-7	0
DS1 Carrier ID	0-3	c-e
Slot Numbers (Note 1)		
ISDN-PRI Trunks	5 and 18 (Note 2)	1-19 (Note 3)
Line+Trunk Mode	5 and 18 (Note 2)	1-19 (Note 4)
OPS Line-Only Mode	0,5,13, and 18	1-19 (Note 5)

NOTES:

1. The circuit pack application type (Field 14) will to a large degree determine which slots may be used.
2. When a DS1/MFAT carrier is configured with two DS1s, physical slots 3, 8, 16, and 21 are available for other applications. If only one DS1 is configured, then six additional slots are available for other applications.
3. When the slot is used for ISDN-PRI trunk applications the adjacent right slot must be configured with the TN555 circuit pack, except in nonfacility associated signaling (NFAS) arrangements that have no D-channel on this DS1 link.
4. When used for a mixture of lines and trunks (two slots are required) the adjacent right slot must remain vacant.
5. When used for OPS line applications, there is no requirement to leave a vacant slot to the right. Actually, all 19 slots (1 through 19 consecutively) may be used to provide OPS. However, it is still recommended that the slot to the right remain vacant to accommodate future changes.

Field 6 Used for assigning the framing format. The choices are D4 and ESF (previously referred to as F_e).

The choice of framing format is totally dependent on the equipment connected to the interface (such as D4-channel bank, CDM, BCM32000, host computer, and other switches). Normally the format is not dependent on facilities used, but there could be some older digital radio equipment that only supports D4. The ESF format consists of a better framing algorithm and therefore provides more reliable error detection than D4. The ESF is the preferred selection for System 75-to-System 75, System 75-to-Generic 1 or -Generic 2, System 75-to-System 85, System 85-to-System 85, System 85-to-Generic 1 or -Generic 2 T1-spans. The D4 format should be selected for T1-spans connecting D4-channel banks and CDMs since they do not typically support ESF.

- Field 7** This field is functionally equivalent to the Per-Channel Signaling and common channel signaling options used with System 85 R2V4. However, the terms have been changed to facility associated signaling (FAS) and NFAS.
- This field is used to specify the method used to constructed signaling bits for each DS0 B-channel. The option (23B + 1D) is also referred to as FAS. This is the default option (field encode 0) . It is required for all DS1/DMI links. It is also required for all ISDN-PRI links that transmit B-channel signaling information with that particular DS1 link.
- The option (24B) is also referred to as NFAS. It is required for those ISDN-PRI links that have their B-channel signaling information transmitted over a different ISDN-PRI link. Field encode 1 enables this option.
- For each ISDN-PRI facility using NFAS (field 7 translated with a 1), that facility must be translated as part of a D-channel group in procedure 116, word 1. Each D-channel group number must be associated with a particular ISDN-PRI facility that transmits the signaling for all links within the group. The (23B + 1D) ISDN-PRI equipment location that provides this capability is called the *primary D-channel*. Reliability may be increased by administering an alternate (23B + 1D) ISDN-PRI equipment location as the backup D-channel (as administered with procedure 262, word 2).
- Field 8** Offers the choice of 24th-channel or RBS. The choice of signaling method used is dependent on the application. The DS1/DMI-BOS applications may be translated for either option. However, non-NFAS ISDN-PRI applications always require that 24th-channel signaling be selected. With NFAS, it is possible that no D-channel exists for this DS1 link.
- 24th-channel signaling multiplexes all signaling information for channels 1 through 23 into the 24th channel. This makes available the full 64K-bps bandwidth (of channels 1 through 23) for voice and/or digital data transmission.

Field 9

Assigns the line coding format that will be used to forcibly ensure that the data meets T1-carrier ones-density requirement. Field encodes and their descriptions are:

- Zero Code Suppression (ZCS)
- Bipolar 8 Zero Code Suppression (B8ZS).

The ZCS line-coding format (restricted) scans each byte for the all-zeroes octet and, on detecting this bit sequence, substitutes a one for the zero in bit position 2. The ZCS format is the most common and is used widely. The ZCS format can be used (without any consideration of the communications protocol) to transmit 7-bit characters/data at rates up through 56K-bps via modems and multiplexers that do bit-stuffing. If the data communications protocol is based on the HDLC protocol and data is transmitted as inverted-HDLC, then the ZCS option can be used for data rates up through 64K-bps. The data modules (both DCP and BRI) use the DCP protocol and BRI protocol respectively. Both DCP and BRI are based on the null based DMI specification, and therefore meet these requirements.

Those DS1/T1 facilities that use RBS and are optioned for ZCS maintain the ones-density requirement by converting all-zero octets in the transmit PCM stream of each channel to a string of seven zeros and a one. This does not significantly affect voice and voiceband data since it is in analog (PCM) form. For DS1/T1 facilities that use 24th-channel signaling and are optioned for ZCS, the data communications protocol/communications equipment used must prevent the all-zeroes octet from occurring; otherwise, the ZCS method will forcibly alter the data (causing errors) to guarantee proper ones-density.

The B8ZS line-coding format (unrestricted) substitutes a unique code (bipolar violation code) for any eight consecutive zeros. This bipolar violation code is detected at the receiving end and converted back to the original string of eight zeros. The B8ZS encoding method permits data transmission at rates up through 64K-bps without consideration of the protocol clear channel transmission.

CAUTION: Several different types of network digital facilities may be linked together to complete the end-to-end connection. Typically, these will be multiplex-derived facilities. Usually, the multiplexers will contain a bipolar violation monitor and removal circuit that corrects all bipolar violations (alters B8ZS type data) and also produces an all ones if a loss of input signal occurs. This bipolar violation monitor and removal feature is currently an inherent part of the MX3, M13, MX2, and M1C multiplexers, as well as most vendor's multiplexers.

Field 10

Offers the options slip enable (1) or disable (0). This option enables/disables collection of slip data to support excessive slip rate based on switching between the primary, secondary, or internal high-accuracy clock. The decision to switch from one source to the other is normally based on an internal slip count calculation (software record). However, hardware events (such as primary link failures) may take precedence over any software controls.

Slips are caused by differences in clock frequencies. A slip results in the deletion or repetition of a single frame. Slips are not caused by noise on the line.

Those DS1/T1 spans that are used to provide the primary and secondary synchronization reference should be administered for slip enable (1). Since the switch software does this automatically, this task is not mandatory but is a good procedure to follow. Typically, those other DS1/T1 spans that are used for data applications and that are deemed important should also be administered for slip enable. This excludes all T1-spans connecting channel banks, unless the channel bank is externally timed. Normally, those DS1/T1 spans that are used exclusively for voice and that are not assigned as the primary or secondary synchronization source should be administered for slip disable (0). The goal is to keep that reference on-line, which minimizes slips for all those DS1s for which slips can't be tolerated.

The digital switch always maintains a slip count record for each DS1. Slip counts are calculated on a 24-hour continuous interval. As a historical record, the slip counts for each DS1 are maintained for the last 24 consecutive intervals. The slip count is used to determine if a DS1-span is experiencing errors and, if so, the severity of the errors (type alarm).

If the primary facility uses 24th-channel signaling and if the secondary facility uses RBS, then the primary will always be on-line unless a hardware event forces a switch to the secondary. A software algorithm is used to select the facility (primary or secondary) that is on-line for the cases where:

- a. Both primary and secondary facilities use the same type of signaling (either 24th-channel or RBS)
- b. The primary uses robbed-bit and the secondary uses 24th-channel signaling

Criteria for Switching to the Secondary

If as many as 50% of those spans that are administered for slip enable are experiencing slips (with respect to the primary), then a decision is made to switch to the secondary. On switching to the secondary, a software bit is set making the primary appear as though it has exceeded its maximum slip limit. At this point, the primary is not evaluated again for 1 hour.

Criteria for Switching Back to the Primary

At the end of the 1-hour interval, the slip count is analyzed. If the primary slip count is less than 2, then a switch back to the primary is made. Also, if the primary has a slip count of 44 or less and if the secondary and 50% of those DS1s that are enabled for slip enable have reached their maximum slip count of 88, then a switch back to the primary is made.

Field 11 Offers the options external loop not available (0) or external loop available (1) .

The external loop available option should only be selected when demand diagnostic maintenance is done and then only after the interface has been busied out. This option is used with procedure 620, Test 2 to extend the range of the test to include the network channel-terminating equipment (NCTE) and the connecting facility (any external equipment to the point of the DS1 loop around). The test requires that either the colocated or the distant NCTE be physically optioned for loopback mode.

The external loop available option should only be used for the duration of the test.

Field 12 Specifies whether (1) or not (0) the associated T1-span is used as an incoming synchronization source to the switch. The network synchronization diagram should show those transmission facilities that are used for synchronization. Each switch permits a maximum of two interfaces (one primary and one secondary) to be translated (1) in field 12. However, there is no requirement to have both.

For the case where Generic 2 is the master timing server, neither primary or secondary is administered.

Each Generic 2 that is equipped with a DS1 will also contain a TN463 synchronization clock (SC). For single-module systems, the SC is located in the module control carrier along with the TN460 module clock. For multimodule systems, the SC is located in the TMS carrier. The SC should have previously been assigned in procedure 250.

Field 13

Assigns whether a DS1 facility (translated in field 12) is to be used as the primary or secondary synchronization source to the switch. Field encodes and their descriptions are:

- 0 Assigns that the facility is not used as a synchronization source
- 1 Assigns that the facility is the primary synchronization source
- 2 Assigns that the facility is the secondary synchronization source

NOTE: The primary must be administered before the secondary. The secondary must be removed before the primary.

Traditional modules may be configured with the ANN11 and/or ANN35 circuit packs. Only the slot translated 1 (primary) and/or the slot translated 2 (secondary) must be configured with synchronization cables. These cables connect the backplane of the translated DS1 to the backplane of the TN463. The cables are identified as group 334 for intercabinet and group 361 for intracabinet applications. When traditional modules are translated, field 20 will display the number (code 99) which shows that the switch could not read information from the DS1 circuit pack.

Universal modules may be configured with the TN767 circuit pack. The intercabinet cable (group 503) is required to connect to the TN463 SC, which will always be located in the TMS cabinet. For universal modules, whenever this field is translated, field 20 displays a number which corresponds to:

- a. Whether the circuit pack is used as a synchronization source
- b. If a synchronization source then which type
- c. Which cable connector (cable 0 or cable 1) contains the circuit pack synchronization leads

CAUTION: A loop-timing problem can be created if the synchronization sources is not administered correctly. The loop-timing problem exists as the result of an error where both switch endpoints (for the same T1-span) are administered as the primary. This causes the clock frequency to vary widely and result in bringing down the switch. Loop-timing problems can be avoided by following a correctly engineered network synchronization diagram.

NOTE: Depending on the application type (encode) translated, there may be additional administration, slot, and port grouping restrictions.

Field 14 Field encodes and their descriptions are:

- 0 Assigns that the DS1/DMI-BOS channels can be used for both trunks and lines (MIXED); the latter is frequently referred to as off-premises stations (OPS).
- 1 Assigns that the interface is used to provide DMI-BOS trunks. The DMI-BOS trunk groups are defined using procedure 100, word 1 (encode 108 and/or 109).

The DMI-BOS application uses the switch's DS1 to provide a high-speed multiplexed data interface for connecting to compatible computers. The computers may be located on the same customer premises as the switch or many miles away. The DS1/T1-carrier facilities are used between the switch and remote computers.

The DMI-BOS application provides 23 data channels plus 1 signaling channel. Each data channel can be considered a 64K-bps clear-channel. However, the permissible data rates are dependent on the trunk group translations that are selected in procedure 100, word 2.

24th-channel signaling is the only required service/facility option. All others (framing format and line coding format) are DMI application independent. However, the distant computer and all intermediate T1 transmission equipment must be compatible; refer to the caution regarding B8ZS line format and data communication protocols.

The ACCUNET switched digital service can be provided by setting up a trunk group with encode 109. However, a DS1 must be optioned for RBS (procedure 260 field 8). The only other administration requirement is that the trunk groups translation (field 3 of procedure 100, word 2) be enabled for 56K-bps encode one.

The trunk group used to provide ACCUNET switched digital service may contain as few as 1 or as many as 24 members. Therefore, the same DS1 may also be used to provide CO, FX, WATS, DID, and Remote Access trunks.

- 2 Assigns that the DS1 provides 24 lines. These are generally called off-premises stations (OPS).

When a DS1 facility is used exclusively for lines, it must be administered for RBS. Also, the facility cannot be used as a synchronization reference.

When a DS1 is administered for lines (OPS), it provides 24 channels that terminate in a remote D4-channel bank, CDM, or their equivalent.

Analog equipment location assignments are administered by procedure 000, word 1, with field 8 translated a 2. The DS1/OPS channels are translated to equipment locations (individual extensions) with procedure 000, word 1, with field 8 translated (9), rather than with procedure 116 that was used for trunks.

- 5 Assigns that the DS1 is used to provide DMI-MOS or ISDN-PRI trunk facilities.

NOTE: When encode 5 is administered, procedure 262 is automatically translated with standard default options. These default options should be checked (later) for consistency with the distant end; refer to procedure 262, word 1.

Field 15 Some applications require that the contents of the signaling channel or the ISDN-PRI D-channel be inverted to guarantee that the minimum ones density be maintained. This field shows whether the signaling channel is inverted or not. Field encodes and their descriptions are:

- (Dash) not applicable or ZCS line coding is translated in field 9. The dash is appropriate for all applications of the ANN11 circuit pack. RBS does not use the 24th-channel to transmit signaling information. 24th-channel signaling via the BOS interface uses A and B bits for signaling and the channel structure is such that the ones-density is never violated.

- 0 Assigns that the signaling information, contents of the ISDN-PRI D-channel, is inverted.

Either 0 or 1 must be administered for ISDN-PRI. Recall that B8ZS is recommended for ISDN-PRI applications. However, not all transmission facilities will permit B8ZS on an end-to-end basis. Administration must be coordinated with the network facilities/distant end to ensure compatibility.

NOTE: This field must be a dash (–) when ZCS line coding is selected with ISDN.

- 1 Assigns that the signaling information, contents of the ISDN-PRI D-channel, is not inverted. The 1 option (No Inversion) is strongly recommended for use when B8ZS is administered.

Field 16 The DS1/DMI-BOS applications should be administered with a dash (–).

The DMI-MOS/ISDN-PRI applications may be optioned (0) indicating metallic copper cable facilities. The (1) option is used to show nonmetallic fiber cable.

NOTE: Terminating fiber cable directly on the DS1/MFAT carrier or universal module port carrier is not currently supported. Therefore, the (1) option is not applicable.

Field 17 This field is added to bring System 85 R2V4 into compliance with EIA specification PIN-1429. This EIA specification relates to bit-oriented-signaling (BOS); message-oriented-signaling (MOS) is defined by a CCITT specification.

Field encodes and their descriptions are:

- (Dash) not applicable

NOTE: The dash is appropriate for all applications of the ANN35 and TN767 circuit packs (both DMI-MOS and ISDN-PRI).

- 0 Appropriate for all applications of DS1/DMI-BOS except when connecting to a switch that uses the Canadian style of signaling.

- 1 Used when connecting to a DS1/DMI-BOS that uses the Canadian style signaling as specified in PN-1429.

Field 18

Loop length refers to the total cable distance between the switch and the NCTE, CDM, BCM32000, DSX-1 cross-connect, and T1 office repeater. Traditional modules may contain the ANN11 and/or ANN35 circuit packs. Both circuit packs contain DIP switches for setting the compensation value, refer to table 3-1, *System 85 Traditional Module Equalizer Settings (Metallic Cable)*. Therefore, software administration is not applicable and the (–) should be administered for traditional modules.

Universal modules may contain the TN767 circuit pack. Line compensation value be administered in software. Table 7-7, *TN767 Compensation Values*, identifies the appropriate administration encode for distance intervals of 133 feet up to a maximum distance of 655 feet.

TABLE 7-7. TN767 Compensation Values

Distance to Midpoint or Endpoint (FT)		Compensation
22 AWG ABAM & 24 AWG PDS	26 AWG PDS	Value
0 to 133	0 to 90	0
133 to 266	90 to 180	1
266 to 399	180 to 270	2
399 to 532	270 to 360	3
532 to 665	360 to 450	4
NOTE: Compensation values assume 22-gauge ABAM or 24-gauge PDS cables. Two switches (colocated) can be up to 1310 feet apart with maximum compensation on both systems. If 26-gauge PDS cables are used, distances are reduced as assigned.		

The T1 office repeaters or T1 line repeaters can be used when the on-premises distance limitation is exceeded. A T1 office repeater is required at each end of the connection to provide an interconnection range of up to 3000 feet. Each repeater only provides regeneration for the receive direction. The T1 line repeaters can be used to accommodate distances up to 6000 feet between switches. The T1 line repeaters can be used in tandem to accommodate greater distances.

Field 19

Field encodes and their descriptions are:

- (Dash) required option for all traditional modules. It is also required for all ISDN-PRI links provided with universal modules.
- 0 Preferred for DS1 service provided with universal modules (shows that a DS1 provides standard DMI-BOS).
- 1 Assigns that the DS1 provides the AT&T proprietary method of signaling on the 24th channel. This option is required when connection to System 75 that still has the TN722 circuit packs.

NOTE: When connecting to a TN722B or ANN11 circuit pack, the recommended option is (0).

Field 20 This display-only field serves to show which cables contain which synchronization cables.

Procedure 262 Word 1: Additional DMI-MOS/ISDN-PRI Facility Options

Procedure 262 is used to administer the ANN35 and TN767 circuit packs. Figure 7-29, *Procedure 262 Word 1: Additional DMI-MOS/ISDN-PRI Facility Options (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 262, WORD: 1	
ISDN BOARD PARAMETERS	
EQUIPMENT LOCATION	13. PRI Interface Identifier: --
1. Module: --	
2. Cabinet: --	
3. Carrier: --	
4. Slot: --	
5. Circuit: --	
PRI PARAMETERS	
6. Interface Type: -	
7. Facility Test Code: --	
8. Terminal Endpoint Identifier: ---	
PRI AND BRI LAYER 2 PARAMETERS	
9. Timer T203: <input text"="" type="text" value="--"/>	
12. Counter K: -	
Connect to CC0 ON-LINE ▼	MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT
enter command:	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-29. Procedure 262 Word 1: Additional DMI-MOS/ISDN-PRI Facility Options (Generic 2)

Fields 1-4 Assigns the circuit pack to an equipment location. These include the module number, cabinet number, Port carrier number, and slot number.

NOTE: Entries for these four fields are the default values from translating a five in field 14 of procedure 260. These entries should always be correct.

Field 5 *BRI Only*

For ISDN-PRI and DMI-MOS applications, the dash (–) is appropriate.

Field 6 Assigns the interface type or side. The default option is (0) for user side. Alternately, a (1) should be administered for network side. The configuration of the network should be analyzed to determine whether the (0) option is appropriate.

For MOS facilities (such as DMI-MOS and ISDN-PRI), each link must be segmented into user and network sides. At the Generic 2, each MOS-based facility connected to the public network is administered as the user side (0), while the network side (such as a 4ESS) is administered (1). For private network DMI-MOS and ISDN-PRI connections, additional care must be exercised in defining user and network sides. Specifically, only one end must be administered user side (0), while the alternate must be defined as the network side (1). If the private network node is a tandem switch, then that node may function as both user side and network side depending on the particular facility.

NOTE: Whenever a Generic 2 connects to a host computer via MOS, the computer should always be assigned as the network side.

Field 7 This field is used for administering one of four facility test codes. For most installations it is desirable to enable or establish permission, thus allowing selected maintenance software to test the DMI-MOS/ISDN-PRI transmission facility on a demand basis.

Procedure 648 contains several tests that may be done on a demand basis (by executing procedure 648) whenever facility test codes 1, 2, or 3 are administered.

The DMI-MOS/ISDN-PRI communication protocol consists of three layers or levels. Level 1 is the physical layer. Level 2 is the data link layer. Level 3 is the network layer, also referred to as the link access procedure on the D channel (LAPD).

Field encodes and their descriptions are:

- 0 Disables or prohibits maintenance testing from being done on the specified (module, cabinet, carrier, and slot) transmission facility.
- 1 Assigns that a level-2 test may be executed via procedure 648.
Encode 1 should be translated for all DMI-MOS to host computer links.
- 2 Assigns that only the level-3 network layer may be tested. Level 3 does loopback testing and requires the use of a separate special test line (SN261C).
- 3 Permits both level-2 and level-3 tests to be done.
Encode (3) should be translated for all ISDN-PRI connections that terminate on a 4ESS.

Field 8 This field accepts encodes from 0 to 126. However, all point-to-point (nonswitched) links, such as an System 85 R2V4 or Generic 2 DMI-MOS link to a host computer, must be administered with encode 0 (the default value).

-
- Field 9** The field accepts encodes from 0 through 255, which correspond to 1 second intervals for a maximum elapsed time of 4 minutes and 15 seconds. The default value for this T203 timer is 30 (30 seconds). This timer functions to monitor the facility data link and specifies the maximum time allowed without frames being exchanged on a data link layer connection.
- Field 10** The field accepts encodes from 0 through 255, which correspond to 0.1 seconds per increment for a maximum range of 25.5 seconds. The default value for this T200 timer is 10 (1 second). This timer functions to monitor multiple frame operation on the data link layer.
- Field 11** This field defines a value for the N200 counter. The value determines the maximum number of frame retransmissions. Permitted are 1 to 10, with 3 being the default value.
- Field 12** This field defines a value for the K counter. The value determines the maximum number of outstanding or unacknowledged information I frames. Permitted values are 1 to 10, with 7 being the default value.

NOTE: Administration values for these procedure 262 timers and counters must be coordinated with the other terminating end.

- Field 13** *NFAS-PRI Only*
- Use to specify NFAS arrangements. This information must match exactly and the encode must come from the premise switch (as described in *Technical Publication 41459*). Field encodes and their descriptions are:
- Dash (-), the only value for non-NFAS arrangements
 - Any number within the range of (0 through 31) for NFAS arrangements.

Procedure 262 Word 2: ISDN-PRI D-Channel Backup

This procedure is currently only applicable for certain ISDN-PRI connections. Specifically, those B-channel groups that use NFAS. Each of these groups is identified by a unique number known as the D-Channel group number. For NFAS, fields 2 through 5 define the D-channel for a signaling group. Figure 7-30, *Procedure 262 Word 2: ISDN-PRI D-Channel Backup (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 262, WORD: 2			
ISDN NFAS/D-CHANNEL BACKUP			
1. D-Channel Group Number:			
PRIMARY	D-CHANNEL	EQUIPMENT	LOCATION
2. Module:			
3. Cabinet:			
4. Carrier:			
5. Slot:			
BACKUP	D-CHANNEL	EQUIPMENT	LOCATION
6. Module:			
7. Cabinet:			
8. Carrier:			
9. Slot:			
DISPLAY ONLY			
10. Number of Trunks Assigned to This D-Channel Group:			
Connected to CC0 ON-LINE♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT			
enter command:			
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS			

Figure 7-30. Procedure 262 Word 2: ISDN-PRI D-Channel Backup (Generic 2)

Field 1 Identifies a particular D-Channel group number. The range of encodes is 1 through 255.

NOTE: ISDN trunks are assigned to a specific equipment location in procedure 116. Procedure 116 is also used to assign ISDN-PRI circuits to the D-Channel group numbers.

Fields 2-5 Assigns a particular circuit pack as providing the PRIMARY D-Channel for the identified D-Channel Group Number. Table 7-8, *Codeset Differences*, depicts the permitted equipment ranges.

NOTE: The ISDN-PRI facility (slot) that is translated as the primary must have also been translated for (23B + 1D) signaling, procedure 260, field 7, must use encode (0).

Fields 6-9 Assigns a particular circuit pack as providing the BACKUP D-Channel (which is optional) for the identified D-Channel Group Number. Table 7-8, *Codeset Differences*, depicts the permitted equipment ranges.

A prime objective for the design of each D-channel group is to have members from two or more modules. By accommodating this objective, it is highly recommended that the Backup D-Channel equipment location be a different module from that selected as the Primary D-Channel. The ISDN-PRI facility (slot) that is translated as the backup must be translated for (23B + 1D) signaling, procedure 260, field 7, must have encode (0).

Procedure 262 Word 3: ISDN-PRI Codeset Map Assignments

Depending on the terminating switch it may be necessary to administer a Codeset Map Assignment and convert from one codeset or codepoint to a different codeset or codepoint. This administration assignment is required for ISDN-PRI links originating on a Generic 2 and terminating on a System 85 R2V4. Figure 7-31, *Procedure 262 Word 3: ISDN-PRI Codeset Map Assignments (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 262, WORD: 3	
ISDN LINK PARAMETERS	
EQUIPMENT LOCATION	
1. Module:	--
2. Cabinet:	-
3. Carrier:	-
4. Slot:	--
5. Circuit:	--
6. Codeset Map Number:	--
7. Hyperactivity Management:	-
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: 	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-31. Procedure 262 Word 3: ISDN-PRI Codeset Map Assignments (Generic 2)

- Fields 1-4** Assigns a particular equipment location/circuit pack to be given a codeset map number. Table 7-8, *Codeset Differences*, depicts the permitted equipment ranges.
- Field 5** Assigns whether the circuit pack is BRI or PRI. dash (–) is appropriate for ISDN-PRI.
- Field 6** Assigns a codeset map number. The permitted range is (0 through 15). Number selection is arbitrary, however; a suggestion is start with 0 and select higher numbers as needed.

When Codeset map numbers are translated they are assigned on a D-Channel Group number basis. All ISDN-PRI circuits within a D-Channel Group must be administered with the same Codeset Map Number.

Field 7

Assigns whether hyperactivity management will be enabled for the ISDN-PRI link. Hyperactivity is defined as erratic behavior by the D-signaling channel. Typically, a hyperactive link will generate an excessive amount of meaningless traffic. Excessive D-channel traffic may overload the module processor and degrade system performance.

Field encodes and their descriptions are:

- (Dash) not applicable. This would be administered for all ISDN-BRI links.
- 0 Disables hyperactivity management for the particular ISDN-PRI link (this is the recommended option for SNC links).
- 1 Enables hyperactivity management (recommended for all ISDN-PRI links except SNC links). This software (hyperactivity management) functions to monitor link performance, detect when certain error thresholds have been exceeded, busyout the link on exceeding the threshold, and record the failure reason as FAULT CODE 337 in the maintenance log.

Procedure 280 Word 1: ISDN-PRI Receive/Transmit Codeset Mapping

This procedure is used to translate Codeset Mapping parameters. Figure 7-32, *Procedure 280 Word 1: ISDN-PRI Receive/Transmit Codeset Mapping (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 280, WORD: 1	
ISDN CODESET MAPPING	
1. Codeset Map Number:	--
2. Incoming/Outgoing:	-
MAPPED FROM CODESET/INFORMATION ELEMENT	
3. Codeset:	-
4. IE Opcode:	<input 2"="" style="padding: 5px;" type="text" value="---</input></td> </tr> <tr> <td colspan="/> MAPPED TO CODESET/INFORMATION ELEMENT
5. Codeset:	-
6. IE Opcode:	<input 2"="" style="padding: 5px;" type="text" value="---</input></td> </tr> <tr> <td colspan="/> DISPLAY ONLY
7. Available Map Number Mappings:	<input 2"="" style="padding: 5px;" type="text" value="---</input></td> </tr> <tr> <td colspan="/> Connected to CC0 ON-LINE ▾ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT
enter command: - F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-32. Procedure 280 Word 1: ISDN-PRI Receive/Transmit Codeset Mapping (Generic 2)

Field 1 Assigns a codset map number (such as defined in procedure 262, word 3). Field encodes and their descriptions are:

- Dash (-), which disables codeset mapping.
- Any number between 0 and 15 that is previously defined with procedure 262, word 3.

Field 2 Specifies whether codeset mapping is for incoming messages or outgoing messages. Field encodes and their descriptions are:

- 0 Assigns mapping for incoming messages.
- 1 Assigns mapping for outgoing messages.

From a Generic 2 perspective, incoming means mapped from Codeset 6 to Codeset 7. While outgoing means Codeset 6 is mapped to Codeset 7. Two-way trunk groups will normally have a Codeset Map translated for both incoming and outgoing.

Field 3 Specifies a mapped from codeset number. Permitted encodes are 0 to 7. These numbers correspond to the respective codesets on a number-per-number basis.

NOTE: Currently, codeset 1 through codeset 5 are reserved for future use. Thus, only encodes 6 and 7 are applicable for the codeset fields.

If field 2 is translated (0) for incoming then encode (7) is appropriate for field 3.

If field 2 is translated (1) for outgoing then encode (6) is appropriate for field 3.

Field 4 Identifies the IE code to be mapped from. Field encodes and their descriptions are:

- (Dash) is available but not recommended. If a dash were translated, all IEs would be mapped from one codeset to the other codeset on a one-to-one basis. Because some codeset 7 IEs are different from their numerical equivalent in codeset 6, it is generally NOT desirable to map on a one-to-one basis.

Table 7-8, *Codeset Differences*, identifies current IE differences between codeset 6 and codeset 7.

TABLE 7-8. Codeset Differences

IE Name	Codeset 6	Codeset 7
Traveling Class Mark	8	8
Logical Link Identification	26	4
Display	40	40
Packet Layer Parameters	62	2
Link Layer Parameters	64	1

number Any number within the range of (0 through 127).

Field 5 Specifies a mapped-to codeset number. Permitted encodes are numbers within the range (0 through 7) These numbers correspond to the respective codesets on a number-per-number basis.

If field 2 is translated one for incoming, then encode seven is appropriate for field 5.

Field 6 Identifies the IE code to be mapped to. Permitted encodes are the same as field 4.

Field 7 Each code set map number may contain up to a maximum of 255 incoming and 255 outgoing mappings. This display-only field shows the number of mappings that remain (the number of unassigned mappings).

Procedure 354 Word 3: NPA-NXX Digits Assignment

This word and procedure are used to administer the ISDN numbering plan. Depending on the switch configuration, there may be more than one ISDN numbering plan. Contents of these fields make up a part of the calling number identification. This is used to transmit information such as the Station Identification Number (SID) and the connected number. The SID is transmitted in the calling number IE, which is a part of the setup message. Figure 7-33, *Procedure 354 Word 3: NPA-NXX Digits Assignment (Generic 2)*, depicts this procedure.

NOTE: This word need not be translated unless the application requires that SID or the connected number be transmitted to the network.

ENHANCED MODE - PROCEDURE: 354, WORD: 3	
NPA-NXX ASSIGNMENT	
1. NPA-NXX Designator: 2. NPA: 3. NXX: 4. Thousand's Digit:	
Connected to CC0 ON-LINE ☐ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-33. Procedure 354 Word 3: NPA-NXX Digits Assignment (Generic 2)

- Field 1** This field should be translated for both private and public network connections. The NPA-NXX designator is a 2-digit field and within the range of 1 through 99.
- Field 2** This 3-digit field should contain the Numbering Plan Area (NPA), which is also referred to as the area code. Assignment is therefore dependent on the particular location and application.
- Field 3** This 3-digit field should specify the NXX, which is also referred to as the local exchange code. Permitted values must be those numbers within the range 200 through 999 and must be the office code of the local exchange.
- Field 4** This 1-digit field specifies the thousands digit. When not used, it should contain (-). When used, digits 0 through 9 may be assigned. Use this field only with three-digit dial plans. Do not use it with four- or five-digit dial plans.

Procedure 000 Word 4: NPA-NXX Index Designator

Depending on how the switch is used, procedure 000, word 4, may or may not be translated. Specifically, word 4, field 4, is used for partitioning, ISDN, or both, and must be translated when:

- a. The switch transmits SID or connected number to the network
- b. The switch provides unique extension number partitions

Field 4 of procedure 000, word 4, need not be translated when: the switch does not transmit SID or connected number to the network (public or private).

If the switch contains more than one office code, multiple NPA/NNX designators may be needed. Figure 7-34, *Procedure 000 Word 4: NPA-NXX Index Designator*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 000, WORD: 4

EXTENSION NPA-NXX/PARTITION ASSIGNMENT

1. First Extension:

2. Last Extension:

3. Extension Partition:

4. NPA-NXX Designator:

DISPLAY ONLY

5. Invalid Extension:

Connected to CC0 ON-LINE ▾

MAJOR

MINOR

RUN TAPE

BUSY OUT

IN USE

WAIT

enter command: -

F3 DATA

F5 HELP

F6 FIELD

F7 INPUT

F8 CMDS

Figure 7-34. Procedure 000 Word 4: NPA-NXX Index Designator

- Field 1**

Assigns a single extension number or the first extension number for a block of numbers. The single number or block of numbers will be unique in terms that they relate to a single extension partition identification.
- Field 2**

Assigns the last extension number for a block of numbers.

- Field 3** Assigns the extension partition identification for the tenant services feature. This number associates the single or block of extension numbers to a particular ISDN facility (NPA-NXX Designator).
- Field 4** Associates an NPA-NXX Designator with the previously defined extension.

Procedure 210 Word 2: LDN, NPA, and NNX Attendant Partition Assignments

This procedure is used to configure the attendant consoles into functional groups known as attendant partitions. Also, LDN and NPA-NXX assignments are completed, thus relating these assignments to a particular attendant console or attendant partition. Figure 7-35, *Procedure 210 Word 2: LDN, NPA, and NNX Attendant Partition Assignments*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 210, WORD: 2	
CONSOLE ASSIGNMENTS - ATTENDANT PARTITIONS	
1. Console Number:	--
2. Attendant Partition:	--
3. Control:	-
4. LDN:	-----
5. NPA-NXX Designator:	--
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: 	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-35. Procedure 210 Word 2: LDN, NPA, and NNX Attendant Partition Assignments

- Field 1** Translates a console number. Permitted encodes are any 2-digit number within the range of 1 through 40.
- NOTE:** This console must be previously assigned in procedure 210, word 1.
- Field 2** Assigns the attendant partition number. Permitted encodes are any unused number within the range of 0-40.

- Field 3** Assigns the one console in the attendant partition that will be the controlling console. All other members of this group must have control denied. Field encodes and their descriptions are:
- 0 For all but the controlling console
 - 1 Only for the controlling console
- Field 4** Assigns or associate the LDN with a particular console or console partition. The number is dependent on the switch or private network numbering plan.
- Field 5** Assigns or associate the NPA-NNX designator with the console or console partition. The encode must be the same as that defined in procedure 354, word 3.

Procedure 014 Word 1: BCCOS Routing Options

This procedure is required to administer the attributes of each BCCOS assignment. A Generic 2 permits up to a maximum of 256 different numeric assignments. The switch software is supplied with numbers (0 through 8) already defined. Each number (0 through 8) has different default parameters. Therefore, each number is unique and may be applied to a different type of routing configuration. It is currently believed that these numbers may be applied to meet the needs of most routing configurations.

If it is determined that the existing BCCOS numbers do not meet the needs of a particular routing configuration, then new numbers may be defined. New numbers should begin with 255 and continue in descending order.

Differences Between System 85 R2V4 and Generic 2

- 1 . With System 85 R2V4, BC and ISDN routing are administered in procedure 010, word 4; but, with Generic 2 these are moved to procedure 014, word 1.
- 2 . With System 85 R2V4, the switch assumes that all user data/information will be presented for transmission in a form referred to as Restricted. Restricted means that the data/information is encoded so that the all-zeroes octet will not occur. The DCP data modules encode user data into the form Restricted.

With Generic 2, the switch administration software (procedure 014 word 1, field 3) assigns whether user data/information is presented to the switch as Restricted or Unrestricted. Unrestricted means that the data may contain the all-zeroes octet.
- 3 . With System 85 R2V4, the AVD bit shows when a modem pool is required. With Generic 2, the BCCOS with AAR and ARS shows whether a modem pool is required.

Figure 7-36, *Procedure 014 Word 1: BCCOS Routing Options*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 014, WORD: 1	
BEARER CAPABILITY CLASS OF SERVICE - CALL OPTIONS	
1. Bearer Capability COS:---	DEFAULT CAPABILITIES
2. Transport Mode:-	14. Transport Mode:-
3. Information Type:-	15. Information Type:-
	16. Bearer Capability:--
CALL TYPES AND ACTION TAKEN	
4. Voice:-	
5. Voice Grade Data:-	
6. Mode 0:-	
7. Mode 1:-	
8. Mode 2:-	
9. Mode 3:-	
10. Unknown Digital:-	
11. Unknown Analog:-	
12. Mode 3/2:-	
13. X.25:-	
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: -	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-36. Procedure 014 Word 1: BCCOS Routing Options

Field 1 Translates new (additional) BCCOS numbers. Field encodes and their descriptions are:

- Dash (-) is used when the BCCOS does not support new numbers
- Numbers between (0 and 255)

Field 2 Assigns the transport mode. Field encodes and their descriptions are:

- 0 Circuit switch the call
- 1 Packet switch the call
- 2 Both circuit and packet

Field 3 Specifies whether the endpoint is unrestricted (1) or restricted (0) with respect to incoming calls.

It is the AAR/ARS software that routes calls. This software will block calls from an unrestricted type to a restricted type. As a contrast, the software will route calls from a restricted type to an unrestricted type. Furthermore, the software will route calls from restricted to restricted, depending on other attributes of the two BCCOS encodes.

Fields 4-13 The translation parameters administered for fields 4 through 13 determine what actions the switch will take for the BCCOS specified in field 1. Regarding Generic 2, it is important to remember that the administration (of the BCCOS) determines when a modem pool member is added and not the particular trunk type. By administering the BCCOS on an AAR/ARS preference basis allows a single trunk group to support both circuit switched and modem pooled calls. Field encodes and their descriptions are:

- 0 Circuit switch the call
- 1 Insert a mode 2 modem pool
- 2 Block the call

Fields 14 through 16 are the default capabilities assumed by the switch for an originating facility (on this switch) that does not have a BCCOS IE (non-ISDN). The switch assumes these default capabilities are acceptable to the originating facility when it tries to connect the originating facility to the terminating facility. These default capabilities are not the predefined BCCOSs that default through administration.

Field 14 Assigns a packet switched (1) or a circuit switched (0) call transport mode

Field 15 Assigns a clear (1) or a restricted (0) channel type. This relates to calls outgoing from an endpoint, except for DMI modes 0 or 3.

Field 16 Used for an outgoing call BC IE (except for BRI modes). Field encodes and their descriptions are:

- 0 Voice
- 1 Mode 1
- 2 Mode 2
- 3 Mode 3
- 4 Mode 0
- 5 Voice grade data
- 6 Unknown digital
- 7 Unknown analog
- 8 Mode 3/2
- 9 X.25

Procedure 014 Word 2: BCCOS Data Options

This procedure is used to define the data capabilities for the modem pools. The data rates selected are dependent on local requirements and the particular type of analog modem used. Figure 7-37, *Procedure 014 Word 2: BCCOS Data Options*, depicts this procedure.

ENHANCE MODE - PROCEDURE: 014, WORD: 2	
BEARER CAPABILITY CLASS OF SERVICE - DATA OPTIONS	
1. Bearer Capability COS: --	
DATA RATE	
2. 64000 bps:	-
3. 56000 bps:	-
4. 19200 bps:	-
5. 9600 bps:	-
6. 4800 bps:	-
7. 2400 bps:	-
8. 1200 bps:	-
9. 300 bps:	-
10. Low Speed:	-
11. Synchronous:	-
12. Duplex:	-
13. Clock:	-
14. Default Data Rate:	-
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-37. Procedure 014 Word 2: BCCOS Data Options

- Field 1** Translates BCCOS modem pool support. Field encodes and their descriptions are:
- Dash (-) is used when the BCCOS does not support modem pools
 - Numbers between (0 and 255)
- Fields 2-10** These fields select the data rates (64000, 56000, 19200, 9600, 4800, 2400, 1200, 300, or low speed) supported by this modem pool. Field encodes and their descriptions are:
- 0 Not supported
 - 1 Supported
- Field 11** Defines if synchronization is (1) or is not (0) supported.
- Field 12** Defines if half (1) or full (0) duplex operation is supported.
- Field 13** Defines if an external (1) or an internal (0) clock source is used.
- Field 14** Whenever a modem pool supports more than one data rate it is generally desirable to assign one data rate as a default or first choice. Field encodes and their descriptions are numbers (1 through 9; which correspond to Low, 300,...64000-bps respectively).

Procedure 010 Word 4: Line Side (B-Channel) BC and ISDN Routing Options

Figure 7-38, *Procedure 010 Word 4: Line Side (B-Channel) BC and ISDN Routing Options*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 010, WORD: 4	
EXTENSION CLASS OF SERVICE - RESTRICTIONS	
1.	Class of Service:--
2.	Maximum Precedence Level:--
3.	ISDN Routing:--
Connected to CC0 ON-LINE ♥ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: ■	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-38. Procedure 010 Word 4: Terminal COS Restrictions (Generic 2)

- Field 1

When ISDN is administered, each COS assignment must have an associated BC and ISDN routing assignment. That is to say that whenever ISDN is enabled, all COS assignments must also be translated for procedure 010, word 4. COS assignments must be within the 2-digit range of 1 through 63.
- Field 2

This field's encodes are only useful for AUTOVON applications. Dash (-) is appropriate for ISDN applications.

Field 3 All endpoints (such as analog lines and DCP voice terminals) must show their information transfer requirements in terms of a BC code. The BC code is the mechanism by which specialized routing is provided for various categories of calls.

NOTE: Once the BC code is assigned, it is fixed and does not change with different calls.

Field encodes and their descriptions are:

- 0 Voice and Voice-grade data
- 1 Mode 1 data (56K-bps)
- 2 Mode 2 data (subrate up to 19.2K-bps)
- 3 Mode 3 data (also called packet mode)
- 4 Mode 0 data (64K-bps digital data)

Field 4 This field shows the ISDN-PRI routing option. Field encodes and their descriptions are:

- 0 Any type of trunking facility is OK. The 0 option should be used when there are no specific requirements for ISDN-PRI trunks. Generally, this will include all voice and voice-grade data applications (BC code = 0) except those where user-to-user information transfer is desired.
- 1 ISDN-PRI trunking facilities are required. Generally, these applications include those COS groups established for Mode 1 data (BC code = 1), Mode 3 data (BC code = 3), and Mode 0 data (BC code = 4).

NOTE: Mode 0 data, depending on its origin, may require a restricted channel. Recall that an unrestricted channel is only provided by those ISDN-PRI facilities that use the B8ZS line-coding format.

- 2 Any trunking facility will work but ISDN-PRI trunk facilities are preferred. This may include voice and voice-grade data (BC code = 0) and Mode 2 data (BC code = 2).

Procedure 100 Word 1: Trunk Group Type Signaling and Dial Access (ID) Code

Translating Word 1 is the first step in establishing trunk groups. Those trunk groups established for ISDN applications may be of the same design as those for non-ISDN applications, except for the type of signaling used. Or, they may (optionally) be designed to take maximum advantage of the ISDN capabilities. Figure 7-39, *Procedure 100 Word 1: Trunk Group Type Signaling and Dial access (ID) Code*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 100, WORD: 1	
TRUNK GROUP TRANSLATION	
1. Trunk Group: ---	
DIAL ACCESS CODE/TRUNK ID CODE	
2. Digit 1: --	
3. Digit 2: -	
4. Digit 3: -	
5. Digit 4: -	
6. Trunk Type: ---	
7. Dial Access Restriction:	-
8. Personal CO Line Appearance:	-
9. Public Network Access/Egress:	-
DISPLAY ONLY	
10. Signaling Type: ---	
Connected to CC0 ON-LINE ▼	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-39. Procedure 100 Word 1: Trunk Group Type Signaling and Dial Access (ID) Code (Generic 2)

- Field 1** Assigns a trunk group number. Permitted entries include any not already used number within the range of 18 through 999.
- Field 2** Assigns the first digit of the trunk access code. Permitted entries 0 through 9 for digits 0 through 9 and with 11 and 12 for the symbols * and #, respectively.
- Field 3** Assigns the second digit of the trunk address code. Permitted entries include digits 0 through 9.
- Field 4** Assigns the third digit of the trunk address code. Permitted entries include digits 0 through 9.
- Field 5** Assigns the fourth digit of the trunk access code. Permitted entries include digits 0 through 9.

Field 6 Defines the trunk type of a specific trunk group. The ISDN-PRI facilities may be used to support several different trunk types. These may include both conventional trunk types as well as the ISDN-dynamic trunk type. An important point to remember is that the particular service application and the incoming digits are the primary determining factors that control which trunk type is selected. Most service applications may be supported (over ISDN facilities) by either a conventional trunk type or ISDN-dynamic.

Table 7-9, *Trunks Supporting Signaling Type 20*, shows some permitted field entries that support signaling type 20.

NOTE: Trunk types not included in the categories listed in table 7-9 may not be translated for ISDN-PRI service. Most conventional trunk types specify, as a part of their name, an in/out signaling sequence. Actually, these signaling sequences are disabled and type 20 signaling is used exclusively over ISDN facilities.

TABLE 7-9. Trunks Supporting Signaling Type 20

Trunk Description	Trunk Type
2-way CCSA/APLT	12—15
CO	16, *17 (Note), 18—20
Data	100—107
DID	*30, *31
DMI	*108, *109
FX	21—25
ISDN	120
M/S TIE	70—78
Special	2, 5, 6, 50—58, 62, 65—47, 90—93
TIE	32—40, *41, *42, *43, 44, 45, *46, *47
WATS	26, *27, 28

NOTE: Trunk types preceded with an asterisk (*) may be selected by trunk type 120 on an as needed CBC Service Selection basis.

For ISDN trunk groups as well as other types of trunk groups, the entered type defines feature operation for the trunk group. For example, if a trunk group is assigned the type of 19, incoming calls over this trunk group are routed to the attendant console. On DID trunk type groups, the switch expects station number digits on all incoming trunks; on tie trunk type groups the switch can handle either station number digits or network numbers.

For an ISDN trunk group, a dynamic trunk type (120) can be assigned to the group. This trunk type allows the group to process calls with a different trunk type on a call by call (CBC) basis. For example, one incoming call over the group may expect station number digits (for example, a MEGACOM call), while the next call over the group may expect a network number (for example, an SDN call).

This trunk type allows flexibility in processing calls as opposed to a fixed static trunk type. Both an AAR/ARS prefix digit (procedure 103) and a DID additional digit (procedure 101) can be administered for ISDN dynamic trunk groups. (This cannot be done for any other type of trunk group.) The dynamic trunk type may be used for CBC service although any of the conventional trunk types could also be used if incoming digits have been provisioned consistently. For example, trunk type 41 could be used as a CBC trunk group to support MEGACOM, MEGACOM 800, and SDN if the incoming digits (for both MEGACOM 800 and SDN) reflect extension numbers or seven digit RNX-XXXX numbers. Customers can choose between 0 and 7 incoming digits to a switch.

Field 7 Assigns the dial access code restriction. Field encodes and their descriptions are:

- 0 Allows access to the trunk group via a dial access code.
- 1 Restricts and only allows access to the trunk group for trunk testing and for providing unattended console service.

Field 8 Assigns the trunk group as a Multifunction Terminal CO line appearance. For the ISDN application, encode (0) is applied.

Field 9 Assigns the type of network access for the trunk group. Encodes are:

- 0 Allows access to the public network
- 1 Allows access to private network facilities

Field 10 Displays and verify that the type of trunk signaling is correct. ISDN uses message-oriented signaling. Therefore, encode 20 should be displayed.

Procedure 100 Word 2: Trunk Group Data Translations

This word is used to administer data characteristics for each trunk group. The ISDN feature does not place any new or additional requirements or restriction on the use of this flipchart. Selecting the appropriate translations requires the same basic considerations as previously. Therefore, a description for these fields is not provided. Figure 7-40, *Procedure 100 Word 2: Trunk Group Data Translations*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 100, WORD: 2	
TRUNK GROUP - MODEM POOLING AND BCC	
1. Trunk Group:	
2. Bearer Capability Class of Service:	
MODEM POOLING	
3. Originate Mode:	
4. Answer Mode:	
5. Modem Type:	
6. First Choice:	
7. Test Type:	
Connected to CC0 ON-LINE ▼	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA	F5 HELP
F6 FIELD	F7 INPUT
F8 CMDS	

Figure 7-40. Procedure 100 Word 2: Trunk Group Data Translations (Generic 2)

- Field 1** Specifies a particular trunk group. The field encode will be the same as previously translated in procedure 100, word 1.
- Field 2** Assigns a BCCOS to the trunk group. The permitted range of encodes is (0 through 255). Field encodes and their descriptions are:
- 0 Voice
 - 1 Mode 2 Data
 - 2 Voice
 - 3 Unknown Digital
 - 4 Unknown Analog
 - 5 Voice Grade Data
 - 6 Mode 0 data
 - 7 Model data
 - 8 Mode 3 data
 - 9 X.25 Packet Switched on B-channel

Procedure 100 Word 3: ISDN Trunk Group Signaling Options

The trunk type and signaling type attributes are translated as individual parameters. Figure 7-41, *Procedure 100 Word 3: ISDN Trunk Group Signaling Options*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 100, WORD: 3	
TRUNK GROUPS - SIGNALING AND OTHER PARAMETERS	
1. Trunk Group:	---
2. Signaling Type:	---
3. Glare:	-
4. Retry:	-
5. Outgoing Maintenance Busy Out Seizure:	-
6. Incoming Permanent Seizure:	-
7. Failure Threshold:	--
8. Optional ISDN Information Inhibited:	-
DISPLAY ONLY	
9. Trunk Type:	---
Connected to CC0 ON-LINE 	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: 	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-41. Procedure 100 Word 3: ISDN Trunk Group Signaling Options (Generic 2)

- Field 1** Specifies a trunk group. Permitted entries include any not already used number within the range of 18 to 999.
- Field 2** Specifies the signaling type for the trunk group.
- Field 3** For all ISDN trunking applications except DCS, glare is resolved by the ISDN protocol. Glare is discussed in more detail in the chapter entitled *Network Connections and Configurations* in this document. Specifically, ISDN negotiates the losing call to a different channel if the original channel is preferred. Exclusive calls (such as DCS) are not negotiated and the user hears the reorder tone. In either case, the network has priority over the user when both calls are preferred or exclusive. This capability is administered in procedure 262, word 1, and field 5. Therefore, this field 3 entry may be any of the available encodes (0, 1, or 2) since this field is ignored for ISDN applications.

Field 4	Retry permits multiple attempts to seize a busy trunk from the specified trunk group. This field is primarily applicable for those trunk groups routed over analog facilities and uses trunk types 41, 42, 43, 46, or 47. Depending on the particular configuration, retry may or may not be applicable for ISDN applications. Field encodes and their descriptions are: 0 Multiple retry is not desired, that is retry not active NOTE: The ISDN-PRI protocol contains an automatic retry capability. Whenever trunk type 120 is selected, the zero (0) encode is required. ¹ Recommended for ISDN applications where the 40-series of trunk types is used. This encode enables a double try single retry and thus provides slightly improved call completion, particularly for large trunk groups that span across more than one transmission facility.
Field 5	Not applicable for ISDN applications (encode must be 0 for not active).
Field 6	Not applicable for ISDN applications (encode must be 0 for not active).
Field 7	Not applicable for ISDN applications (encode must be 0 for no failure threshold). NOTE: This field is only applicable for analog trunk facilities. It permits the user to establish a trunk failure threshold that, when exceeded, will generate an alarm. The threshold limit will affect service availability and, on an indirect basis, the customer's maintenance costs.

Field 8 Permits user control of whether the optional ISDN information is transmitted and whether access to other ISDN network features is desired.

The optional ISDN IEs include the following:

- Calling number display
- *Connected party number
- *User-to-user information
- *Called party name
- *Calling party name
- *Data mode 3 parameters
- *Traveling class marks

NOTE: Items preceded with an asterisk (*) are only transmitted on an end-to-end basis whenever all public network links are provided with CCITT interoffice communication.

Field encodes and their descriptions are:

- (Dash) only applicable whenever ISDN is not available
- 0 Recommended for all ISDN configurations, both public and private network arrangements.
- 1 Whenever the optional ISDN IEs are not to be transmitted.

Field 9 Used as a display-only field. This field displays the trunk type that was administered in procedure 100, word 1.

Procedure 101 Word 1: ISDN Trunk Group, CDR, and Digital Loss Plan

Procedure 101, word 1, is used (primarily) to turn on CDR, as well as translate the digital loss plan. Figure 7-42, *Procedure 101 Word 1: ISDN Trunk Group, CDR, and Digital Loss Plan*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 101, WORD: 1	
TRUNK GROUP CHARACTERISTICS	
1. Trunk Group:	---
2. Balance:	-
3. Battery Reversal:	-
4. Incoming Prefix Digit:	-
5. DCS:	-
6. Touch-Tone In:	-
7. Touch-Tone Out:	-
8. CDR Active:	-
9. AIOD Billing Number:	----
TIMED RECALL	
10. Time:	--
11. Level:	-
12. CDR Variable Timer:	--
13. Pad Group:	-
14. Tie Toll:	-
15. APLT Features Allowed:	-
16. Disconnect Supervision:	-
Connected to CC0 ON-LINE ▼	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-42. Procedure 101 Word 1: ISDN Trunk Group, CDR, and Digital Loss Plan (Generic 2)

- Field 1** Displays the trunk group number, such as previously translated in procedure 100.
- Field 2** Assigns whether the trunk group has (1) or does not have (0) balanced transmission facilities. Encode 1 is required for ISDN-PRI.
- Field 3** Assigns whether the trunk group has (1) or does not have (0) the battery reversal option. Encode 0 is required for ISDN-PRI.
- Field 4** Assigns the number of prefix digits. Field encodes and their descriptions are:
- Dash (-) is always applicable for ISDN-PRI applications except for DID trunks (trunk types 30 and 31).
 - Any single digit number (0 through 9). Which number is determined by the trunk group and its application.
- Field 5** Assigns whether the trunk group is (1) or is not (0) used for DCS applications.
- Fields 6-7** This field is ignored for ISDN applications and either encode (0 or 1) may be translated.

Field 8 Assigns or not assign the trunk group to SMDR record keeping. Field encodes and their descriptions are:

- 0 Trunk group usage not applicable for SMDR recording
- 1 Trunk group usage will be recorded by SMDR
- 2 Trunk group usage will be recorded, account code is required

Fields 9-11 Not used for ISDN applications.

Field 12 This field is only applicable when SMDR is being used, and then only to change the default SMDR timer value. Field encodes represent intervals in 1-second increments. The range is 1 through 99 with dash (–) being the default timer value of 6 seconds.

Field 13 Administer the optional transmission loss assignments. The encode translated depends on the network configuration and service application. Field encodes and their corresponding loss plan are listed as follows:

- 0 The Digital FIXED Loss Plan
- 1 ISL Tie Trunk
- 2 EIA Tie Trunk
- NOTE:** This is the recommended option for Speedial Access Connections to a 4ESS.
- 3 ISL Digital Central Office
- 4 EIA Digital Central Office
- 5 Digital Toll Office
- 6 Analog Toll Office
- 7 AUTOPLEX NETWORK Interface V
- 8 AUTOPLEX NETWORK Interface Y

Refer to chapter 4, *The Digital Loss Plan*, for a description of the digital loss plan and to table 4-2, *Digital Loss Plan (Port-to-Port Losses)*, in this same chapter for a list of port-to-port loss values.

Fields 14-16 These fields are ignored by ISDN software. Either encode (0 or 1) is satisfactory.

Procedure 103 Word 1: Network Trunk Group Translations

This procedure is used to translate the trunk group network parameters. Figure 7-43, *Procedure 103 Word 1: Network Trunk Group Translations*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 103, WORD: 1	
NETWORK TRUNK GROUP TRANSLATION	
1.	Trunk Group: <input 100px;"="" style="width: 100px;" type="text" value="-" width:=""/>
3.	Network Trunk: -
4.	Main/Tandem: -
5.	Incoming Tie to AAR/ARS or APLT: -
6.	Authorization Code Required: -
7.	Bridge-On Allowed: -
8.	Trunk Reservation Limit: --
9.	AAR/ARS Prefix: -
10.	Data Protection (Permanent): -
11.	Remote Access Echo Suppressor: -
12.	AAR Conditional Routing: -
13.	Second TCM: -
14.	Digit Collection: -
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-43. Procedure 103 Word 1: Network Trunk Group Translations (Generic 2)

- Field 1** Displays the trunk group number, such as previously administered in procedure 100 and 101.
- Fields 2-13** The ISDN-PRI does not place any new or additional considerations on translating these fields. The encodes that are translated are generally dependent on each trunk group, its application, and the associated trunk groups.
- Field 14** Specifies how the dialed digits are outpulsed. Field encodes and their descriptions are:
- 0 Digit outpulsing may overlap digit reception.
 - 1 All digits must be received before outpulsing may start All ISDN applications, regardless of the trunk type, require that a (1) be translated in this field. Digit outpulsing does not begin until all digits are received. Then digits are outpulsed as ASCII characters — per the ISDN recommendations.

Procedure 116 Word 1: DS1/DMI/ISDN-PRI Trunk Assignments

For more information, see the chapter in this book entitled *Port Types and Installation Compatibilities*. Each analog trunk circuit pack provides four circuits that are administered by using procedure 150. Conversely, each DS1 provides 24 circuits (channels) that are administered by using procedure 116.

For traditional modules, each DS1/MFAT carrier will support a maximum of two DS1s, each occupying one slot and located in slots 5 and 18. When a DS1/DMI/ISDN interface (trunk applications) is located in slot 5, it functionally uses the six slots 0, 1, 2, 5, 6, and 7. When the interface is located in slot 18, it functionally uses the six slots 13, 14, 15, 18, 19, and 20. Figure 7-44, *Procedure 116 Word 1: DS1/DMI/ISDN-PRI Trunk Assignments*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 116, WORD: 1	
DS1 AND ISDN TRUNK ASSIGNMENTS	
EQUIPMENT	LOCATION
1. Module:	--
2. Cabinet:	-
3. Carrier:	-
4. Slot:	--
5. Circuit:	--
6. Trunk Group:	---
7. Night Terminal:	-----
8. Disable Signaling:	-
9. AIOD Equipment Number:	-----
10. Interface Endpoint:	-
11. D-Channel Group Number:	---
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: -	
 F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-44. Procedure 116 Word 1: DS1/DMI/ISDN-PRI Trunk Assignments (Generic 2)

The DS1 channels are assigned to slot and circuit locations according to the order in which the module processor scans the equipment carrier as shown in table 7-10, *DS1/ISDN-PRI Administration — Channel Versus Trunk Assignments*.

When the traditional module DS1/MFAT carrier is configured with two DS1s, physical slots 3, 8, 16, and 21 are available for other applications. If only one DS1 is configured, then six additional slots are available for other applications.

TABLE 7-10. DS1/ISDN-PRI Administration — Channel Versus Trunk Assignments

DS1 Channel	Slot/Circuit	DS1 Channel	Slot/Circuit
1	5/0 or 18/0	13	0/0 or 13/0
2	6/0 or 19/0	14	1/0 or 14/0
3	7/0 or 20/0	15	2/0 or 15/0
4	5/1 or 18/1	16	0/1 or 13/1
5	6/1 or 19/1	17	1/1 or 14/1
6	7/1 or 20/1	18	2/1 or 15/1
7	5/2 or 18/2	19	0/2 or 13/2
8	6/2 or 19/2	20	1/2 or 14/2
9	7/2 or 20/2	21	2/2 or 15/2
10	5/3 or 18/3	22	0/3 or 13/3
11	6/3 or 19/3	23	1/3 or 14/3
12	7/3 or 20/3	24	2/3 or 15/3

When the traditional module DS1-MFAT carrier is configured with two DS1s, physical slots 3, 8, 16, and 21 are available for other applications. If only one DS1 is configured, then six additional slots are available for other applications.

To minimize confusion and eliminate the need for maintaining elaborate trunk to channel cross-reference tables, trunk group member assignments should match the DS1 channel assignments; for example, trunk group member 1 on channel 1. For example, using procedure 116, word 1, refer to table 7-10, *DS1/ISDN-PRI Administration — Channel Versus Trunk Assignments*, to determine which slot and circuit to translate for channel 1. Repeat this procedure by sequentially selecting DS1 channels (2, 3, and so on) and translating the appropriate slot and circuits as required.

Fields 1-5 These fields are used to translate the equipment location, including slot and circuit (channel) location, and to associate the equipment location (channel) with the particular trunk group translated in field 6.

Field 6 Translates the trunk group. Permitted encodes must be numbers with the range of 18 through 999.

Field 7 Translates a particular number that functions as the night service number. The digits depend on the particular application and its numbering plan.

Field 8 Disables a channel's signaling. This disable function is required for establishing a dedicated switched connection. Field encodes and their descriptions are:

0 Signaling is enabled (default value).

1 Signaling is disabled. This option is only translated for the channels that is used as a dedicated switched connection.

Field 9 Not applicable for ISDN-PRI.

Field 10 Assigns the function of the terminating endpoint. Field encodes and their descriptions are:

- 0 Another customer premises switch
- 1 A private network connection to a host computer
- 2 Public network connections

Field 11 Translates the D-channel group number. These numbers should be coordinated with field 1 of procedure 262, word 2. Field encodes and their descriptions are:

- Dash (-), for non-NFAS arrangements.
- Numbers within the range 1 through 255 for all NFAS arrangements.

Procedure 012 Word 1: Name Database

The name database is used by those features (such as DCS, ISDN-PRI) which provide display type information to voice terminals. Some examples of the more common display information include; calling party name, vector directory number, and trunk group name. For ISDN-PRI applications, the name database information is used to populate the display IE. Figure 7-45, *Procedure 012 Word 1: Name Database*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 012, WORD: 1	
NAME DATABASE - NAME TO BE DISPLAYED	
1. Extension, VDN, or Trunk Group:	
2. Type:	
3. Display Start:	
4. Outgoing Trunk Display:	
5. Copy Mode:	
6. Extension, VDN, or Trunk Group to Copy or Share:	
DISPLAY ONLY	
7. Characters In Name:	
8. Shared Primary Extensions or Trunk Groups:	
9. Associated Extension Name Assigned:	
Connected to CC0 ON-LINE ▼	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-45. Procedure 012 Word 1: Name Database (Generic 2)

Field 1	Assigns either an extension number, vector directory number, or trunk group. Field encodes and their descriptions are: • 000 through 99999, for extension and directory numbers. Whether the number is three, four, or five digits depends on the numbering plan. • 18 through 999, for trunk group numbers.
Field 2	Specifies whether the encode for field 1 is a trunk group or extension/vector directory number. Field encodes and their descriptions are: 0 Trunk groups 1 Extension numbers and vector directory numbers
Field 3	This field is only applicable for the identified extension's display module. It controls the number of blank spaces that are inserted before the first displayed character of the name, dialed number, or trunk group name. Permitted encodes are numbers from 1 to 30.
Field 4	The main function of this field is to provide some administration control over what is displayed on the voice terminals digital display. Field encodes and their descriptions are: – (Dash) all incoming only trunk groups 0 The user (extension) does not want the outgoing trunk group name displayed but does desire the dialed number to remain on the display 1 The user desires to display the name of the outgoing trunk group (for example, ISDN/SDN, MEGACOM, CBC) NOTE: For a tandem interworking call the name of the incoming trunk group is transmitted in the display IE of the ISDN-PRI outgoing trunk group.
Field 5	Assigns the method used to define the name. Field encodes and their descriptions are: 0 Add a new name or change an existing name; requires that the name change be made with word 2 1 Copy the name from the extension or trunk group displayed in field 6
Field 6	This field is used with field 5 to copy an existing name to the extension or trunk group identified in field 1. Field encodes and their descriptions are: • 000 through 99999, for extension and directory numbers. Whether the number is three, four, or five digits depends on the numbering plan. • 18 through 999, for trunk group numbers.

Procedure 012 Word 2: Name Database

This word is used to translate a name (up to a maximum of 30 characters). Figure 7-46, *Procedure 012 Word 2: Name Database*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 012, WORD: 2																					
NAME DATABASE - ENTRY																					
1. Segment: CHARACTER ENCODES <table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 15%;">2. Character 1:</td><td style="width: 15%;"> </td></tr> <tr><td>3. Character 2:</td><td> </td></tr> <tr><td>4. Character 3:</td><td> </td></tr> <tr><td>5. Character 4:</td><td> </td></tr> <tr><td>6. Character 5:</td><td> </td></tr> <tr><td>7. Character 6:</td><td> </td></tr> <tr><td>8. Character 7:</td><td> </td></tr> <tr><td>9. Character 8:</td><td> </td></tr> <tr><td>10. Character 9:</td><td> </td></tr> <tr><td>11. Character 10:</td><td> </td></tr> </table>		2. Character 1:		3. Character 2:		4. Character 3:		5. Character 4:		6. Character 5:		7. Character 6:		8. Character 7:		9. Character 8:		10. Character 9:		11. Character 10:	
2. Character 1:																					
3. Character 2:																					
4. Character 3:																					
5. Character 4:																					
6. Character 5:																					
7. Character 6:																					
8. Character 7:																					
9. Character 8:																					
10. Character 9:																					
11. Character 10:																					
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT																					
enter command: F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS																					

Figure 7-46. Procedure 012 Word 2: Name Database (Generic 2)

Field 1 Identifies one-of-three 10 character fields. Field encodes and their descriptions are:

- 1 Characters 1 through 10
- 2 Characters 11 through 20
- 3 Characters 21 through 30

There exists 94 different encodes (00-12, 14, 15, 17-96) which correspond to numbers 0 through 9, lower case letters, upper case letters, and special characters. The Manager II help screen or the document *DEFINITY Communications System Generic 2 Administration Procedures* (555-104-506) may be used for determining the desired encodes.

Fields 2-11 Each field should be translated with the encode that corresponds to the desired character.

Procedure 012 Word 3: Name Database

Since the name database has the potential to use a large amount of memory it is generally desirable to run the compact operation whenever all names have been added. Figure 7-47, *Procedure 012 Word 3: Name Database*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 012, WORD: 3

NAME DATABASE COMPACTION

1. Compact: ☐

DISPLAY ONLY

2. Names That Can Yet Be Assigned:

3. Words Available:

4. Words to Be Gained by Compacting:

Connected to CC0 ON-LINE

enter command:

Figure 7-47. Procedure 012 Word 3: Name Database (Generic 2)

- Field 1** Assigns whether the name database is (1) or is not (0) to be compacted.
- Fields 2-4** Are display only and serve to show status of the database.

Procedure 279 Word 1: Network Facilities Coding

Each interexchange carrier (which provides public network ISDN service) must have a unique identifier number. Furthermore, each carrier may provide multiple ISDN services and ISDN features that must be individually identified via a NSF coding value. Translation of this procedure is required before you use procedure 309 or procedure 321, word 5, NSV fields. Figure 7-48, *Procedure 279 Word 1: Network Facilities Coding*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 279, WORD: 1	
NETWORK-SPECIFIC FACILITY	
1. ISDN Network Service Value:	---
ISDN NETWORK DEFINITION	
2. Parameterized - Binary:	-
3. Feature - Service:	-
4. Facility Coding Value:	--
PARAMETERS	
5. Parameter 1:	--
6. Parameter 2:	--
7. Parameter 3:	--
8. Parameter 4:	--
9. Parameter 5:	--
10. Parameter 6:	--
11. Parameter 7:	--
Connected to CC0 ON-LINE ▼	
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: 	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-48. Procedure 279 Word 1: Network Facilities Coding (Generic 2)

Field 1 Translates Network Service. Field encodes and their descriptions are:

- Dash (-), whenever a carrier identifier number is not applicable.
- Numbers (1 through 511).

For most ISDN public network connections it is expected that the CBC Service Selection capability will be implemented. With this capability the ISDN B-channels must (on a per-call basis) support multiple ISDN features and services. The public network CO originates an incoming call by transmitting a call-setup message to the switch. The call-setup message contains a NSF IE that identifies the ISDN feature/service. At the switch, fields 2 through 11 are used to define the various ISDN public network features and services. Table 7-11, *Network Services/Network Features*, lists the currently available AT&T ISDN network services and features and their further defining attributes.

TABLE 7-11. Network Services/Network Features

NAME	Network Service Value	Parameterized (0) or Binary (1)	Feature (0) or Service (1)	Facility Coding Value
Out-WATS band	33-288	0	1	1
SID preferred	320	1	0	1
ANI preferred	320	1	0	1
SID only	322	1	0	3
ANI only	323	1	0	4
Operator handled	324	1	0	5
Pre-subscribed CC operator	325	1	0	6
SDN	352	1	1	1
MEGACOM 800 service	353	1	1	2
MEGACOM	353	1	1	3
In-WATS	353	1	1	4
WATS maximal subscribed band	353	1	1	5
ACCUNET switched digital services	353	1	1	6
Long distance service	353	1	1	7
Caller data	8	0	0	8

Field 2 Assigns whether the service/feature is binary (1) or parametrized (0). As an option, fields 5-11 may contain additional defining parameters (refer to table 7-11, *Network Services/Network Features*). However, even though a service/feature may be defined as parametrized, it is generally not required that fields 5 through 11 be translated.

For a binary service/feature, fields 5-11 cannot be translated.

Field 3 Assigns whether the facility coding value represents a *feature* or a *service*, refer to table 7-11, *Network Services/Network Features*. Field encodes and their descriptions are:

- 0 Feature
- 1 Service

Field 4 Assigns the facility coding value (refer to table 7-11, *Network Services/Network Features*). Field encodes and their descriptions are:

- Dash (-), not applicable
- Numbers (0 through 31)

Fields 5-11 There are no default values.

Procedure 309 Word 1: ARS Route Tables

This procedure is used for translating/controlling the Automatic Route Selection feature. Figure 7-49, *Procedure 309 Word 1: ARS Route Tables*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 309, WORD: 1	
ARS - ROUTE TABLES	
1.	ARS Plan:
2.	Pattern Number:
3.	Preference Number:
4.	Trunk Group:
5.	Facility Restriction Level:
6.	Warning Tone:
7.	Distant Area Code (NPA):
8.	Send 1 For Toll:
9.	Toll Table Index:
10.	Number of Digits Deleted:
11.	Digit Collect (DC) Signal Ignore:
12.	ICX ISDN Network Identifier:
Connectd to CC0 On-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
	F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-49. Procedure 309 Word 1: ARS Route Tables (Generic 2)

Fields 1-11 The ISDN-PRI does not place any new or additional considerations on translating these fields. The codes/digits translated are generally dependent on each ARS plan and other switch and network considerations. Field 11 is not applicable to ISDN.

Field 12 Specifies the number (designation) of the interexchange carrier (IXC)/ISDN Network Identifier for this trunk group. Permitted field entries may be any number within the range of 0 through 999.

NOTE: The IXC/ISDN network identifier enables the switch to provide equal access capability.

When the trunk group is routed over private network ISDN-PRI transmission facilities, then no IXC/ISDN network is used and the zero (0) option must be translated.

Each network provider (of ISDN service) will have a different IXC identifier number. When connecting to AT&T ISDN network facilities, the required number is 288.

Procedure 309 Word 5: ARS-ISDN BCCOS

This procedure is required for translating ISDN trunk groups into the ARS plan. Figure 7-50, *Procedure 309 Word 5: ARS-ISDN BCCOS*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 309, WORD: 5	
ARS - ISDN AND BEARER CAPABILITY COS	
1. ARS Plan:	
2. Pattern Number:	
3. Preference Number:	
4. ISDN Dynamic Trunk Type:	
5. ISDN Network Service Value:	
6. Bearer Capability COS:	
Connected to CC0 ON-LINE ▼ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: 	
	 F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-50. Procedure 309 Word 5: ARS-ISDN BCCOS (Generic 2)

- Fields 1-3** The ISDN-PRI does not place any new or additional considerations on translating these fields. The codes and digits translated are generally dependent on each ARS plan and other switch and network considerations.
- Field 4** Translates the ISDN trunk type. The network SERVICE application, and any associated application requirements, will determine the appropriate trunk type. Furthermore, trunk type selection should be coordinated with previous assignments from procedure 100, word 1. Table 7-11, *Network Services/Network Features*, lists the current AT&T network services/network features and (for most applications) the recommended trunk type.
- Field 5** Specifies the network service that is requested. Refer to table 7-11, *Network Services/Network Features*, for the appropriate encode.
- Field 6** Assigns a BCCOS to the preference. Permitted numbers include any previously defined BCCOS from procedure 014, word 1.

Procedure 321 Word 1: AAR Tables (Generic 2)

This procedure is used for translating/controlling the Automatic Alternate Routing feature. Figure 7-51, *Procedure 321 Word 1: Automatic Alternate Routing Route Tables (Generic 2)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 321, WORD: 1		
AAR - ROUTE TABLES		
1.	Pattern Number:	---
2.	Preference Number:	--
3.	Trunk Group:	---
4.	Facility Restriction Level:	-
5.	Warning Tone:	-
6.	Off Net:	-
7.	Number of Digits Deleted:	-
8.	Digit Collect (DC) Signal Ignored:	-
9.	0xxx Allowed:	-
10.	IXC ISDN Network Identifier:	---
Connected to CC0 ON-LINE ▾ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT		
enter command: F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS		

Figure 7-51. Procedure 321 Word 1: AAR Route Tables (Generic 2)

- Fields 1-9** The ISDN-PRI does not place any new or additional considerations or translating these fields. The codes and digits translated depend on each AAR plan and other switch and network considerations.
- Field 10** Specifies either the number (designation) of the interexchange carrier (IXC) or the ISDN Network Service Identifier for this trunk group. The IXC/ISDN network identifier enables the switch to provide equal access capability by populating either the NSF IE or the Transit Network Selection IE. If sending an NSF IE and a particular IXC vendor number is specified in this field, that entry is included in the NSF IE. If no IXC vendor number is specified, an is created automatically in the Transit Network Selection IE. Permitted field entries may be any number within the range of 0 through 999.

When a trunk group is routed over a private network ISDN-PRI transmission facility (an IXC/ISDN network is not used), encode 0 must be translated.

Each network provider (of ISDN service) will have a different IXC identifier number. When connecting to AT&T ISDN network facilities, encode 288 must be translated. Numbers in the range 1 through 15 represent IXCs; numbers in the range 16 through 999 are network IDs.

Procedure 321 Word 5: AAR-ISDN and Other Feature Parameters

This procedure is required for translating ISDN trunk groups into the AAR plan. Figure 7-52, *Procedure 321 Word 5: AAR-ISDN and Other Feature Parameters*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 321, WORD: 5	
AAR - ISDN AND BEARER CAPABILITY COS	
1. Pattern Number:	
2. Preference Number:	
3. ISDN Dynamic Trunk Type:	
4. ISDN Network Service Value:	
5. Bearer Capability COS:	
Connected to CC0 ON-LINE MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command:	
F3 DATA	F5 HELP F6 FIELD F7 INPUT F8 CMDS

Figure 7-52. Procedure 321 Word 5: AAR-ISDN and Other Feature Parameters (Generic 2)

- Field 1** Specifies the AAR pattern number. Permitted encodes are numbers within the range of 1 through 640.
- Field 2** Specifies the AAR preference number. Permitted encodes are sequential numbers within the range of 1 through 16.
- Field 3** Translates ISDN trunk type 120 only. Recall that for ISDN applications the trunk type may be translated as fixed (for example, one specific type) or dynamic (which may include those from the fixed category). Generally, the trunk type selected will depend on the network service/feature value, which is translated in field 4.
Translates the ISDN trunk type. The network SERVICE application, and any associated application requirements, will determine the appropriate trunk type. Furthermore, trunk type selection should be coordinated with previous assignments from procedure 100, word 1.
- Field 4** Specifies the network service requested. Refer to table 7-11, *Network Services/Network Features*, for the appropriate encode.

Field 5 Assigns a BCCOS to the preference. Permitted numbers include any previously defined BCCOS from procedure 014, word 1. However, BCCOS = 4 is the recommended option.

Procedure 107 Word 1: ISDN Trunk Verification by Terminal, Attendant, and ATMS

This procedure must be translated to support the trunk verification by voice terminal and trunk verification by attendant features over ISDN-PRI facilities. Figure 7-53, *Procedure 107 Word 1: ISDN Trunk Verification by Terminal, Attendant, and ATMS*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 107, WORD: 1		
ATMS - TERMINATING TEST LINE ASSIGNMENT		
1. Trunk Group:	---	
2. Test Line Type:	--	
TTL	TELEPHONE	DIGITS
3. Digit 1:		-
4. Digit 2:		-
5. Digit 3:		-
6. Digit 4:		-
7. Digit 5:		-
8. Digit 6:		-
9. Digit 7:		-
10. Digit 8:		-
11. Digit 9:		-
12. Digit 10:		-
13. Digit 11:		-
14. Digit 12:		-
15. Digit 13:		-
16. Digit 14:		-
17. Digit 15:		-
18. Digit 16:		-
DISPLAY ONLY		
19. Trunk Type:	---	
Connected to CC0 ON-LINE ♥		
MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT		
enter command: -		
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS		

Figure 7-53. Procedure 107 Word 1: ATMS TTL Assignment (System 85 R2V4)

Field 1 Identifies those ISDN-PRI trunk groups to be accessed by the trunk verification features. Permitted encodes are previously defined trunk group numbers within the range of 18 through 999.

Field 2 Dash (-), is appropriate for voice terminal and attendant console applications.

If a transmission test line is used, its type should be specified.

Fields 3-18 Assigns digits for the terminating test line.

NOTE: Procedure 107, words 2-7, need only be translated whenever ATMS is used.

Procedure 108 Word 1: ISDN Trunk Group TTL Number (Digits)

This procedure is used to assign the line number that identifies the particular B-channel used for ISDN-PRI testing purposes. This test line number must be assigned for both private and public network configurations. Whether more than one terminating test line number is needed depends on the number of ISDN-PRI links and whether they terminate on more than one switch. Figure 7-54, *Procedure 108 Word 1: ISDN Trunk Group TTL Number (Digits)*, depicts this procedure.

ENHANCED MODE - PROCEDURE: 108, WORD: 1	
ISDN TERMINATING TEST LINE ASSIGNMENT	
1. Trunk Group: ---	
TERMINATING TEST LINE TELEPHONE DIGITS	
2. Digit 1: -	10. Digit 9: -
3. Digit 2: -	11. Digit 10: -
4. Digit 3: -	12. Digit 11: -
5. Digit 4: -	13. Digit 12: -
6. Digit 5: -	14. Digit 13: -
7. Digit 6: -	15. Digit 14: -
8. Digit 7: -	16. Digit 15: -
9. Digit 8: -	17. Digit 16: -
DISPLAY ONLY	
18. Trunk Type: ---	
Connected to CC0 ON-LINE ☐ MAJOR MINOR RUN TAPE BUSY OUT IN USE WAIT	
enter command: -	
F3 DATA F5 HELP F6 FIELD F7 INPUT F8 CMDS	

Figure 7-54. Procedure 108 Word 1: ISDN Trunk Group TTL Assignment (Generic 2)

Field 1 Translates the trunk group that identifies the ISDN terminating test line. The terminating test line is required for B-channel maintenance testing.

NOTE: As part of the installation and ISDN-PRI services provisioning, the terminating test line number assignment must be coordinated with the terminating switch.

Fields 2-17 Assigns digits for the terminating test line.

NOTE: If B-channel signaling control is used on the D-channel of another facility, you must use NFAS (see procedures 260, word 1; 262, word 1; 262, word 2; and 262, word 3).

SYSTEM 75 (R1V2 AND R1V3)

System 75 has the same facility considerations (framing, signaling, line coding format, etc.) as System 85 or Generic 2 and many similar equipment considerations (both require an additional clock circuit pack for synchronization). The main differences are in terms of administration methods (screens for System 75 versus procedures for System 85), and for some fields a difference in terminology. The primary equipment differences are:

- No synchronization cables are required.
- Line compensation is translated in software rather than set by DIP switches.

All screens shown have their fields depicting default or recommended options.

Service/Facility Options

The DS1 CIRCUIT PACK screen is used to define characteristics of a DS1 facility.

NOTE: This screen requires that the circuit pack (TN722/TN722B) have been previously assigned to an equipment location (carrier and slot) by the CIRCUIT PACK ADMINISTRATION screen.

Figure 7-55, *DS1 Circuit Pack Screen*, depicts this procedure.

DS1 CIRCUIT PACK		Page 1 of 1
Location: ---	Name: _____	
Line Compensation: 1	Zero Code Suppression: zcs	
Framing Mode: esf	Signaling Mode: common-chan	
DMI-BOS? y		
MAINTENANCE PARAMETERS		
Slip Detection? n	Remote Loop-Around Test? n	

Figure 7-55. DS1 Circuit Pack Screen

Location	A display-only field specifying the carrier and slot of a DS1.
Name	The name as shown on the network diagram.
Line Compensation	Refers to the distance between the switch and the NCTE, CDM, CEM, DSX-1 cross-connect, T1 office repeater, or other equipment. The compensation setting is for the total distance between the switch and the endpoint.

TABLE 7-12. Line Compensation Settings

Compensation Value	Distance (Feet)
1	000 to 133
2	133 to 266
3	266 to 399
4	399 to 533
5	533 to 655

NOTE: Compensation values assume 22-gauge ABAM or 24-gauge PDS cables. Two colocated switches can be up to 1310 feet apart with compensation on both systems set to the maximum values. If 26-gauge PDS cables are used, distances are reduced as shown in table 3-1, *System 85 Traditional Module Equalizer Settings (Metallic Cable)*.

The T1 office repeaters or T1 line repeaters can be used when the on-premises distance limitation is exceeded. A T1 office repeater is required at each end of the connection to provide an interconnection range of up to 3000 feet. Each repeater only provides regeneration for the receive direction. The T1 line repeaters can be used to accommodate distances up to 6000 feet between switches. The T1 line repeaters can be used in tandem to accommodate greater distances.

Zero Code Suppression	Assigns the line coding format (ZCS or B8ZS) that will be used to forcibly ensure that the data meets T1-carrier ones-density requirements. The same considerations regarding the choice of data rates, communications protocol, and facility requirements that were discussed under System 85 procedure 260, field 9, apply here.
Framing Mode	The choices are D4 or ESF (previously referred to as F ₀). The network diagram should show the choice for the particular DS1/T1-span. The other end and all intermediate equipment should be optioned accordingly.

Signaling Mode

The default option is common-channel. This option is the same as 24th-channel or AVD for System 85. The alternate choice is robbed-bit. The choice of signaling mode used is dependent on the application.

Common-channel signaling multiplexes all signaling information for channels 1-23 into the 24th-channel. This makes available the full 64K-bps bandwidth (of channels 1-23) for voice and/or digital data transmission. This capability is sometimes referred to as Alternate Voice Data (AVD).

The term AVD is a software attribute for a trunk. AVD allows pure 64K-bps digital data to be transmitted over those DS1 trunks that use 24th-channel signaling. Although AVD trunks are designed for digital data transmission they may also be used for voice and voice-grade data transmission. However, a pooled modem is required to transmit voice-grade data over AVD trunks.

CAUTION: Due to a change in the evolving DS1/DMI protocol specification, two methods for providing 24th-channel signaling exist. The two methods are not compatible with each other. The earlier method is known as the AT&T proprietary format (conventional T1 test equipment cannot analyze it). This latter version is known as the DMI-BOS format (T1 test equipment can analyze this format).

Either the AT&T proprietary format or the DMI-BOS format, depending on the circuit pack configuration, may be used with another System 75 or System 85. The DMI-BOS format is required to provide 24th-channel signaling capability with other vendors' digital switches. Common-channel signaling (both methods) are not compatible with channel banks and multiplexers.

CAUTION: The TN722 circuit pack provides the AT&T proprietary format; the circuit pack does not provide DMI-BOS. The TN722B circuit pack may be administered to provide either the proprietary format or DMI-BOS format.

DMI-BOS

Assigns the DS1's format. Field encodes and their descriptions are:

- n AT&T proprietary. This option assumes that common-channel signaling is selected; otherwise, RBS is used.
- y DMI. This option is equivalent to a 1 in field 14 of procedure 260.

Maintenance Options or Parameters

Slip Detection This option enables (y) or disables (n) switching between the primary, secondary, and internal high-accuracy clock. The decision to switch from one source to the other is based on an internal slip count calculation.

NOTE: Those DS1/T1 facilities that are used to provide the primary and secondary synchronization reference should be administered for slip detection y. Typically, those other DS1/T1 spans that are used for data applications and deemed important should also be administered for slip detection. All T1-spans connecting channel banks are excluded, unless the channel bank is externally timed. Normally, DS1/T1 spans that are used exclusively for voice and which are not assigned as the primary or secondary synchronization source should be administered for slip detection n. Refer to the network synchronization diagram to determine which option to choose.

The digital switch maintains a slip count record for each DS1. The slip count is used to determine if the T1-span is experiencing errors and, if so, the severity of the errors (type alarm). Option y enables switching between the primary, secondary, or internal high-accuracy clock. If as many as 50% of those spans that are administered for slip detection are experiencing slips (with respect to the primary), then a decision is made to switch to the secondary.

Option y is equivalent to a 1 in field 10 of procedure 260,

Remote Loop Around Option y is only used during some phases of DS1/DMI diagnostic testing. The normal or operational choice is n. Option n is equivalent to a 0 in field 11 of procedure 260.

Network Synchronization Options

The SYNCHRONIZATION PLAN screen is used to specify which of the two DS1/T1-spans (that were previously administered with slip detection y) is the primary reference source and which is the secondary reference source. Figure 7-56, *Synchronization Plan Screen*, depicts this procedure.

SYNCHRONIZATION PLAN
Page 1 of 1

SYNCHRONIZATION SOURCE (DS1 circuit pack location)

Primary: ____ Secondary: ____

DS1 CIRCUIT PACKS

Location	Name	Slip	Location	Name	Slip
---	-----	-	---	-----	-
---	-----	-	---	-----	-
---	-----	-	---	-----	-
---	-----	-	---	-----	-

Figure 7-56. Synchronization Plan Screen

Primary The 3-character location of the circuit pack that is the primary synchronization reference.

NOTE: The primary will be one of those DS1 circuit packs that has previously been administered with slip detection y. The *Location*, *Name*, and *Slip* (actually slip detection) fields list the DS1 circuit packs administered on the DS1 CIRCUIT PACK screen. The primary and secondary source must be selected from this list.

Secondary The 3-character location of the circuit pack that is the secondary synchronization reference.

There is no requirement that a secondary source be provided. However, it is a good practice.

The Command Line Feature set provides four executable commands for controlling and monitoring synchronization. They are:

- Disable
- Enable
- Status
- Set

Trunk Group/Trunk Group Members

For System 75 R1V2 and R1V3, there are three applications for a DS1 (tie and DMI); refer to table 7-6, *Equipment Parameters and Permitted Translation Encodes*.

The DS1 tie trunks are defined by using Page 1 of the TRUNK GROUP screen; this is the same as for analog tie trunk groups. Trunk members are added to the GROUP MEMBER ASSIGNMENTS screen (pages 2 through 5). This series of screens administers many of the same parameters as procedures 100 and 101 do for System 85. Figure 7-57, *Trunk Group Screen*, depicts this procedure.

TRUNK GROUP		Page 1 of 11
Group Number: ____	Group Type: tie	SMDR Reports? y
Group Name: OUTSIDE CALL	COR: 1	TAC: 114
Direction: two-way	Outgoing Display? n	Data Restriction? n
MIS Measured? n		
Dial Access? y	Busy Threshold: 99	Night Service: ____
Queue Length: 0	Internal Alert? n	Incoming Destination? _
Comm Type: voice	Auth Code? n	
TRUNK PARAMETERS		
Trunk Type (in/out): _____	Incoming Rotary Timeout(sec): 5_	
Outgoing Dial Type: tone____	Incoming Dial Type: tone__	
Digit Treatment: _____	DTT to DC0 Loss: normal	Digits: ____
Connected to Toll? n	SST Loss: normal	
Incoming Dial Tone? y		
Bit Rate: 1200	Synchronization: async	Duplex: full
Answer Supervision Timeout? 10		

Figure 7-57. Trunk Group Screen, Page 1

Most fields require no unusual entries for DS1 tie trunk applications. Only those that may require special attention are mentioned.

Comm Type The default is *voice* with *avd* and *data* being the alternate selections.

NOTE: Trunk groups that are administered *avd* require that the DS1 also be administered for common-channel signaling (24th). Furthermore, if *avd* is translated; then *Bit Rate*, *Synchronization*, and *Duplex* fields are displayed. These three fields enable the trunk group to function with a modem pool. A *Data Originate code* is required to start a modem pool call. The *avd* option is equivalent to translating System 85 procedure 101, field 17, with a 1.

Trunk Type (in/out) Establishes the physical type of incoming and outgoing trunks. For tie trunk applications, field encodes and their descriptions are:

- Auto
- Immed-start
- Wink-start
- Delay-dial

Figure 7-58, *Trunk Group Screen, Page 2*, depicts this procedure.

GROUP MEMBER ASSIGNMENTS						Page 2 of 5
Port	Name	Mode	Type	Answer	Delay	
1:	-----	-----	-----	-----	-----	
2:	-----	-----	-----	-----	-----	
3:	-----	-----	-----	-----	-----	
4:	-----	-----	-----	-----	-----	
5:	-----	-----	-----	-----	-----	
6:	-----	-----	-----	-----	-----	
7:	-----	-----	-----	-----	-----	
8:	-----	-----	-----	-----	-----	
9:	-----	-----	-----	-----	-----	
10:	-----	-----	-----	-----	-----	
11:	-----	-----	-----	-----	-----	
12:	-----	-----	-----	-----	-----	
13:	-----	-----	-----	-----	-----	
14:	-----	-----	-----	-----	-----	
15:	-----	-----	-----	-----	-----	

Figure 7-58. Trunk Group Screen, Page 2

Port This field associates each trunk group member to a particular carrier (A-E), slot (01-20), and circuit (01-24).

NOTE: System 75 does not have the same DS1 circuit pack slot restrictions as System 85. However, trunk group member assignments should match the DS1 channel assignments (for example, trunk group member 1 on channel 1) and maintain this procedure as long as possible.

Name This field does not apply to PRI.

Mode For DS1 tie trunk applications, the default and only permitted entry is **e&m**.

Type For DS1/DMI applications, the default is **T1 stan** (T1 standard). Normally, this field is not administered. The default value is appropriate.

Answer Delay Allowable entries (in milliseconds) range from 20 to 5100 in intervals of 20. This field should only be translated if delay-dial were optioned.

The DS1/DMI trunks are defined by using the TRUNK GROUP screen. This screen is somewhat equivalent to System 85 procedure 260, field 14, encode 1. Figure 7-59, *Trunk Group Screen, Page 1 (DMI)*, depicts this procedure.

TRUNK GROUP		Page 1 of 5
Group Number: __	Group Type: dmi	SMDR Reports? y
Group Name: OUTSIDE CALL	COR: 1	TAC: __
Direction: two-way	Outgoing Display? n	
Dial Access? y	Busy Threshold: 60	Night Service: __
Queue Length: 0		Incoming Destination: __
TRUNK PARAMETERS		
Trunk Type(in/out): _____	Incoming Rotary Timeout(sec): 5	
Outgoing Dial Type: tone	Incoming Dial Type: tone	
	Disconnect Timing(msec): 500	
Digit Treatment: _____	Digits: _____	
ACA Assignment? n	Long Holding Time(hours): 1	
Short Holding Time(secs.): 10	Short Holding Threshold: 15	
Bit Rate: 1200	Synchronization: async	Duplex: full
Incoming Dial Tone? y	Maintenances Test? y	
Answer Supervision Timeout: __	Supress # Outpulsing? y	

Figure 7-59. Trunk Group Screen, Page 1 (DMI)

This screen is similar to the one for administering tie trunks. The primary difference is related to data capabilities (Bit Rate, Synchronization, and Duplex). (Bit rate and data rate mean the same for System 75 applications.)

GENERIC 1

Generic 1 has the same DS1 facility considerations (such as framing, signaling, line coding format) as System 75. It also requires the additional clock circuit pack for synchronization. The main significant difference between a System 75 and Generic 1 is support of the TN767 circuit pack for both DS1/DMI and ISDN-PRI.

Depending on whether a Generic 1 provides private network ISDN service or public network ISDN services, whether the switch functions as an endpoint or as a tandem node, will determine whether other features or screens should be administered with ISDN-PRI. Primarily, these other features and screens include:

1. AAR/ARS
2. Ten- to seven-digit conversion
3. DCS/uniform dialing plan
4. Call-by-Call Service Selection
5. SID prefix assignments
6. Routing patterns

The `SYSTEM-PARAMETERS CUSTOMER-OPTIONS` screen displays these and other optional features. New switches should come with the appropriate optional features already enabled. Switch upgrades (depending on the specifics) may require that the CSSO alter the `SYSTEM-PARAMETERS CUSTOMER-OPTIONS` screen.

Service/Facility Options

The `DS1 CIRCUIT PACK` screen is used to define characteristics of the DS1 facility. This screen requires that the circuit pack (TN722_/TN767) have been previously assigned to an equipment location (carrier and dot) by the `CIRCUIT PACK ADMINISTRATION` screen. For ISDN-PRI applications, the screen has minor differences. Therefore, two screens are depicted. The first is for DS1/DMI-BOS and the second is for ISDN-PRI.

Screens are shown with default or recommended field options. Figures 7-60, *DS1 Circuit Pack Screen, Common-Channel Signaling*, and 7-61, *DS1 Circuit Pack Screen, ISDN-PRI Signaling*, depict this procedure.

DS1 CIRCUIT PACK		Page 1 of 1
Location: ---	Name: _____	
Line Compensation: 1	Zero Code Suppression: zcs	
Framing Mode: es f	Signaling Mode: common-chan	
DMI-BOS? y		
MAINTENANCE PARAMETERS		
Slip Detection? n	Remote Loop-Around Test? n	

Figure 7-60. DS1 Circuit Pack Screen, Common-Channel Signaling

DS1 CIRCUIT PACK		Page 1 of 1
Location: ---	Name: _____	
Line Compensation: 1	Zero Code Suppression: zcs	
Framing Mode: es f	Signaling Mode: isdn-pri	
	Connect: pbx	
	Interface: user	
MAINTENANCE PARAMETERS		
Slip Detection? n	Remote Loop-Around Test? n	

Figure 7-61. DS1 Circuit Pack Screen, ISDN-PRI Signaling

Location	A display-only field specifying the carrier and slot of the DS1 Interface.
Name	The name as assigned on the network diagram.
Line Compensation	Refers to the distance between the switch and the network channel-terminating equipment (NCTE), CDM, CEM, DSX-1 cross-connect, T1 office repeater, or other equipment. The compensation setting is for the total distance between the switch and the endpoint. Table 7-13, <i>Line Compensation Values</i> , summarizes compensation.

TABLE 7-13. Line Compensation Values

Compensation Value	Distance (Feet)
1	000 to 133
2	133 to 266
3	266 to 399
4	399 to 533
5	533 to 655

NOTE: Compensation values assume 22-gauge ABAM or 24-gauge PDS cables. Two colocated switches can be up to 1310 feet apart with compensation on both systems set to the maximum values. If 26-gauge PDS cables are used, distances are reduced as shown in table 3-1, *System 85 Traditional Module Equalizer Settings (Metallic Cable)*.

The T1 office repeaters or T1 line repeaters can be used when the on-premises distance limitation is exceeded. A T1 office repeater is required at each end of the connection to provide an interconnection range of up to 3000 feet. Each repeater only provides regeneration for the receive direction. The T1 line repeaters can be used to accommodate distances up to 6000 feet between switches. The T1 line repeaters can be used in tandem to accommodate greater distances.

Zero Code Suppression	Specifies the line coding format (ZCS or B8ZS) that will be used to forcibly ensure that the data meets T1-carrier ones-density requirements. The choice of data rates, communications protocol, and facility requirements discussed under System 85 procedure 260, field 9, also apply here.
Framing Mode	The choices are D4 or ESF (previously referred to as F _o). The network diagram should show the choice for the particular DS1/T1-span. The other end and all intermediate equipment should be optioned accordingly.

Signaling Mode

The default option is common-channel. This option is the same as 24th-channel or AVD for System 85. The alternate choices are ISDN-PRI and robbed-bit.

If ISDN-PRI is optioned, then the *DMI-BOS* field disappears and the *Connect* field appears. The choice of signaling mode used is dependent on the application.

Common-channel signaling multiplexes all signaling information for channels 1-23 into the 24th-channel. This makes the full 64K-bps bandwidth of channels 1-23 available for voice and/or digital data transmission. This capability is sometimes referred to as Alternate Voice Data (AVD).

The term **AVD** is a software attribute for a trunk. It (AVD) allows pure 64K-bps digital data to be transmitted over those DS1 trunks that use 24th-channel signaling. Although AVD trunks are designed for digital data transmission they may also be used for voice and voice-grade data transmission. However, a pooled modem is required to transmit voice-grade data over AVD trunks.

CAUTION: Due to a change in the evolving DS1/DMI protocol specification, two methods for providing 24th-channel signaling exist. The two methods are not compatible with each other. The earlier method is known as the AT&T proprietary format (conventional T1 test equipment cannot analyze it). This latter version is known as the DMI-BOS format (T1 test equipment can analyze this format).

Either the AT&T proprietary format or the DMI-BOS format, depending on the circuit pack configuration, may be used with another System 75 or System 85. The DMI-BOS format is required to provide 24th-channel signaling capability with other vendors' digital switches. Common-channel signaling (both methods) are not compatible with channel banks and multiplexers.

CAUTION: The TN722 circuit pack provides the AT&T proprietary format; the circuit pack does not provide DMI-BOS. The TN722B/TN767 circuit pack may be administered to provide either the proprietary format or DMI-BOS format.

DMI-BOS

Assigns the DS1 format. Field encodes and their descriptions are:

- n AT&T proprietary. This option assumes that common-channel signaling is selected; otherwise, RBS is used.
- y DMI. This option is equivalent to a 1 in field 14 of procedure 260.

Connect

This field is not available unless the *Signaling Mode* field is translated *isdn-pri*. Field encodes and their descriptions are:

- **network** (default option) — implies that the Generic 1 will function as user side and the switch connects to the ISDN-PRI public network facilities.
- **pbx** — implies that a Generic 1 will connect to ISDN-PRI private network facilities.
- **host** — implies that a Generic 1 will function as network side and the switch connects to a host computer (which is always user side).

Interface This field is not available unless the *Connect* field is translated *pbx*. Field encodes and their descriptions are:

- *user* (default option)
- *network*

NOTE: For ISDN-PRI private network connections, additional care must be exercised in defining user and network sides. Specifically, only one end must be administered user side, while the alternate must be defined as network side. If the private network node is a tandem switch, then that node may function as both user side and network side depending on the particular facility.

Maintenance Options or Parameters

Slip Detection This option enables (y) or disables (n) switching between the primary, secondary, and internal high-accuracy clock. The decision to switch from one source to the other is based on an internal slip count calculation.

NOTE: Those DS1/T1 facilities that are used to provide the primary and secondary synchronization reference should be administered for slip detection y. Typically, those other DS1/T1 spans that are used for data applications and deemed important should also be administered for slip detection. All T1-spans connecting channel banks are excluded, unless the channel bank is externally timed. Normally, those DS1/T1 spans used exclusively for voice and not assigned as the primary or secondary synchronization source should be administered for slip detection of n. Refer to the network synchronization diagram to determine which option to choose.

The digital switch maintains a slip count record for each DS1 Interface. The slip count is used to determine if the T1-span is experiencing errors and, if so, the severity of the errors (type alarm). Option y enables switching between the primary, secondary, or internal high-accuracy clock.

NOTE: If as many as 50% of those spans that are administered for slip detection are experiencing slips (with respect to the primary), then a decision is made to switch to the secondary.

Option y is equivalent to a 1 in field 10 of procedure 260.

Remote Loop Around Option y is only used during some phases of DS1/DMI diagnostic testing. The normal or operational choice is n. Option n is equivalent to a 0 in field 11 of procedure 260.

Network Synchronization Options — DS1 and ISDN-PRI Applications

The SYNCHRONIZATION PLAN screen is used to specify which of the two DS1/T1-spans (that were previously administered with slip detection y) is the primary reference source and which is the secondary reference source. Figure 7-62, *Synchronization Plan Screen*, depicts this procedure.

SYNCHRONIZATION PLAN						Page 1 of 1
SYNCHRONIZATION SOURCE (DS1 circuit pack location)						
Primary: ___			Secondary: ___			
DS1 CIRCUIT PACKS						
Location	Name	Slip	Location	Name	Slip	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	
---	-----	-	---	-----	-	

Figure 7-62. Synchronization Plan Screen

Primary The 3-character location of the circuit pack that is the primary synchronization reference.

NOTE: The primary will be the DS1 circuit pack administered with slip detection *y*. The *location*, *name*, and *slip* (that is, slip detection) fields list the DS1 circuit packs that have been administered on the DS1 CIRCUIT PACK screen. The primary and secondary source must be selected from this list.

Secondary The 3-character location of the circuit pack that is the secondary synchronization reference. There is no requirement that a secondary source be provided. However, it is a good practice.

The Command Line Feature set provides four executable commands for controlling and monitoring synchronization. They are:

- Disable
- Enable
- Status
- Set

Trunk Group/Trunk Group Members — DS1 Trunk Applications

For DS1/DMI applications the TN722_ circuit pack emulates three categories of trunk types, while the TN767 circuit pack emulates three additional trunk types; refer to table 6-1, *Supported Digital Facilities*.

DS1/DMI trunking applications are defined by using page 1 and page 2 of the TRUNK GROUP screen; this is the same as for analog trunk groups. Trunk members are added to the GROUP MEMBER ASSIGNMENTS screen (pages 3 through 9). This series of screens administers many of the same parameters as procedures 100 and 101 do for Generic 2. Figure 7-63, *Trunk Group Screen, Page 1 (Tie)*, depicts this procedure.

TRUNK GROUP		Page 1 of 9
Group Number: __	Group Type: tie	SMDR Reports? y
Group Name: OUTSIDE CALL	COR: 1	
TAC: ____		
Direction: two-way	Outgoing Display? n	
Dial Access? y	Busy Threshold: 99	Night Service: ____
Queue Length: 0		Incoming Destination: _
Comm Type: avd	Auth Code? n	BCC: 0
TRUNK PARAMETERS		
Trunk Type (in/out): _____	Incoming Rotary Timeout(sec): 5	
Outgoing Dial Type: tone	Incoming Dial Type: tone	
	Disconnect Timing(msec): 500	
Digit Treatment: _____	Digits: _____	
Connected to Toll? n	STT Loss: normal	DTT to DCO Loss: normal
Incoming Dial Tone? y		
Bit Rate: 1200	Synchronization: async	
Duplex: full	Answer Supervision Timeout? 10	

Figure 7-63. Trunk Group Screen, Page 1 (Tie)

Most fields require no unusual entries for DS1 service applications. Only those fields that may require special attention are mentioned.

Comm Type The default is *voice* with *avd* and *data* being the alternate selections.

NOTE: Trunk groups that are administered *avd* require that the DS1 Interface also be administered for common-channel signaling (24th). Furthermore, if *avd* is translated; then the *baud rate*, *synchronization*, and *duplex* fields are displayed. These three fields enable the trunk group to function with a modem pool. A "Data Originate code" is required to start a modem pool call.

BCC	This field is only displayed when ISDN-PRI is enabled on the <code>SYSTEM PARAMETERS CUSTOMER-OPTIONS</code> screen and when the <i>Communications Type</i> field is administered <i>avd</i> or <i>data</i> .
Trunk Type (in/out)	Establishes the physical type of incoming and outgoing trunks. For tie trunk applications, field encodes and their descriptions are: • Auto • Immed-start • Wink-start • Delay-dial With System 75, the digital loss plan is administered by entering a code with the <i>Group Name</i> field. With Generic 1, the digital loss plan is administered with the following three fields.
Connect to Toll	The default is <code>n</code> . Enter <code>y</code> if the trunk group terminates on a Digital Toll Office.
STT Loss	This field is only displayed condition that the <i>Connected to Toll</i> field is translated <code>n</code> . Allowable entries are the default <i>normal</i> or option <i>low</i> . Refer to chapter 4, <i>The Digital Loss Plan</i> , for a description of the digital loss plan and for application information.
DTT to DCO Loss	Allowable entries are the default <i>normal</i> or option <i>low</i> . Refer to chapter 4, <i>The Digital Loss Plan</i> , for a description of the digital loss plan and for application information.

Figures 7-64, *Trunk Group Screen, Page 2 (Tie)*, and 7-65, *Trunk Group Screen, Page 3 (Tie)*, depict this procedure.

TRUNK GROUP		Page 2 of 9
ACA Assignment?	n	Long Holding Time(hours): 1
Short Holding Time(secs.):	10	Short Holding Threshold: 15
MIS Measured?	n	
Internal Alert?	n	
Used for DCS?	n	PBX ID: 1
Maintenance Tests?	y	Data Restriction? n
Suppress # Outpulsing?	n	

Figure 7-64. Trunk Group Screen, Page 2 (Tie)

GROUP MEMBER ASSIGNMENTS		Page 3 of 9
Port	Name	Night Mode Type Ans Delay
1:	_____	_____
2:	_____	_____
3:	_____	_____
4:	_____	_____
5:	_____	_____
6:	_____	_____
7:	_____	_____
8:	_____	_____
9:	_____	_____
10:	_____	_____
11:	_____	_____
12:	_____	_____
13:	_____	_____
14:	_____	_____
15:	_____	_____

Figure 7-65. Trunk Group Screen, Page 3 (Tie)

Port	This field associates each trunk group member to a particular network (1 or 2), carrier (A-E), slot (01-20), and circuit (01 -24). To keep things simple, try to match trunk group member and DS1 channel assignments (for example, trunk group member 1 on channel 1
Name	Typically, this entry is a 7-digit telephone number. However, another candidate would be the 10-digit trunk circuit identification number, which is available from the circuit provider.
Night	This is a new capability with Generic 1 and System 75, R1V3. It permits an individual trunk member to override the night service option that is administered on page 1 of the TRUNK GROUP screen. Allowable entries are an extension, the attendant, or to leave blank if the <i>Trunk Type</i> field does not begin with auto/...
Mode	For DS1 tie trunk applications, the default and only permitted entry is e&m .
Type	For DS1/DMI applications, the default is T1 stan (T1 standard). Normally, this field is not administered. The default value is appropriate.
Ans Delay	Allowable entries (in milliseconds) range from 20 to 5100 in intervals of 20. This should only be translated if delay-dial were optioned.

Processor Interface Data Module — ISDN-PRI Applications

Each ISDN-PRI circuit pack maintains the 24th channel as the D-signaling channel. For the switch processor to communicate with the D-signaling channel an administration link must be established between the processor and the D-channel. The procedure for establishing this link involves administering the following three screens:

- PROCESSOR INTERFACE DATA MODULE
- PROCESSOR CHANNEL ASSIGNMENTS
- INTERFACE LINKS

Figure 7-66, *Data Module Screen*, depicts this procedure.

DATA MODULE		Page 1 of 1
Data Extension:	_____	
Type:	procr-infc	
Physical Channel:	_____	
Name:	_____	COS: 1
COR:	1	
Maintenance Extension:	_____	
ABBREVIATED DIALING		
List1:	_____	
HOT LINE DESTINATION		
Abbreviated Dialing Dial Code (from above list): __		
ASSIGNED MEMBERS (Stations with a data extension button for this data module)		
Ext	Name	Ext Name
1:		3:
2:		4:

Figure 7-66. Data Module Screen

- Data Extension** A unique extension number that identifies the data module. Actually, this is a phantom data module and frequently this extension number is identified as a phantom number. The extension number can be any reserved number within the Dial Plan Record. (See also the *Physical Channel* field description below.)
- Type** Enter `procr-infc` for ISDN-PRI applications.
- Physical Channel** A two digit number which corresponds to the physical channel of the processor interface circuit packs (TN765s). If there is one TN765, these numbers range form 01 to 04; if there are two TN765s, these numbers range form 01 to 08.
- Name** Completing this field is optional. If you choose to complete this field, enter a unique link application, such as ISDN-PRI(1) or ISDN-PRI(2).

The ISDN-PRI application does not place any additional restraints or special considerations on the remaining fields.

Processor Channel Assignments — ISDN-PRI Applications

This screen associates a processor channel to an interface link number. (Processor Interface Data Module), which was previously defined. Additionally, 1 of the 64 interface channels is identified and linked, via administration, to identified processor channel. Figure 7-67, *Processor Channel Assignment Screen*, depicts this procedure.

PROCESSOR CHANNEL ASSIGNMENT							Page 1 of 4
Proc Chan	Appl.	Interface Link	Chan	Priority	Remote Proc Chan	Machine-ID	
1:	-----	-	--	-----	--	--	
2:	-----	-	--	-----	--	--	
3:	-----	-	--	-----	--	--	
4:	-----	-	--	-----	--	--	
5:	-----	-	--	-----	--	--	
6:	-----	-	--	-----	--	--	
7:	-----	-	--	-----	--	--	
8:	-----	-	--	-----	--	--	
9:	-----	-	--	-----	--	--	
10:	-----	-	--	-----	--	--	
11:	-----	-	--	-----	--	--	
12:	-----	-	--	-----	--	--	
13:	-----	-	--	-----	--	--	
14:	-----	-	--	-----	--	--	
15:	-----	-	--	-----	--	--	
16:	-----	-	--	-----	--	--	

Figure 7-67. Processor Channel Assignment Screen

Proc Chan	This is a display only field. You can select any of the following processor channels (5-7, 9, 11-58, 60-64); conditional that the identified channel is not already used.
Appl	This field should be administered <code>isdn</code> for ISDN-PRI applications.
Interface Link	Permitted encodes are 1 through 8. The number selected should match the number previously administered on the PROCESSOR INTERFACE DATA MODULE screen.
Interface Chan	Not used in Generic 1.
Priority	Servicing the D-channel is a high priority issue. Therefore, <code>h</code> , (for high) should be administered for all ISDN-PRI applications.

For ISDN-PRI applications the other fields should remain blank.

Interface Links — ISDN-PRI Applications

This screen identifies the interface link and enables the link. Figure 7-68, *Interface Links Screen*, depicts this procedure.

INTERFACE LINKS								Page 1 of 1
Link	Enable	Est Conn	PI Ext	Prot	Destination Digits	Brd	DTE/DCE	Identification
1:	y	y	-----	ISDN	-----	-----	- - -	-----
2:	n	-	-----	-----	-----	-----	- - -	-----
3:	n	-	-----	-----	-----	-----	- - -	-----
4:	n	-	-----	-----	-----	-----	- - -	-----
5:	n	-	-----	-----	-----	-----	- - -	-----
6:	n	-	-----	-----	-----	-----	- - -	-----
7:	n	-	-----	-----	-----	-----	- - -	-----
8:	n	-	-----	-----	-----	-----	- - -	-----
9:	n	-	-----	-----	-----	-----	- - -	-----
10:	n	-	-----	-----	-----	-----	- - -	-----
11:	n	-	-----	-----	-----	-----	- - -	-----
12:	n	-	-----	-----	-----	-----	- - -	-----
13:	n	-	-----	-----	-----	-----	- - -	-----
14:	n	-	-----	-----	-----	-----	- - -	-----
15:	n	-	-----	-----	-----	-----	- - -	-----

Figure 7-68. Interface Links Screen

- Link** This is a display only field. The interface link identified and enabled should be the same number as previously translated in the *Physical Channel* field of the DATA MODULE screen.
- Enable** Enter y to enable the link.
- Est Conn** Enter y for all ISDN-PRI applications.
- PI Ext** This is a display only field. It should display the phantom Data Extension that was previously administered with the DATA MODULE screen.
- Prot** Enter ISDN for all ISDN-PRI applications,
- Destination Digits** Field disappears when PROT=ISDN
- Destination Brd** Enter the ISDN-PRI 4-character circuit pack address. The first digit (1 or 2) identifies the port, the second character (A-E) identifies the carrier, the third and fourth digits (01-20 or 01-18) identify the circuit pack slot number.
- DTE/DCE** Field disappears when PROT=ISDN
- Identification** Optional, but typically should include the identifying name of the destination switch.

Trunking Considerations — ISDN-PRI Applications

It is necessary to determine those types of ISDN-PRI network services desired before attempting to build the ISDN-PRI trunk groups. Some of the more significant considerations should include the following:

NOTE: An ISDN-PRI trunk group is created by translating the *Group Type* field as *isdn-pri*.

1. Will the switch provide ISDN-PRI private network access or ISDN-PRI public network access?
2. If private network access, you can translate the *Service Type* field as *tie*. Depending on the particular application other service types may also be applicable (such as *tandem*), in particular if you want traveling class marks (TCMs).
3. If public network access, then the identity of the interexchange carrier (IXC) or local exchange carrier (LEC) must be known. Furthermore, the particular carrier's ISDN network Services/Features (that are to be used) must be known and defined in software translations.

NOTE: The NETWORK-FACILITIES screen lists (by name and facility coding definition) each of the currently available AT&T ISDN network Services/Features. These are frequently called the *Predefined Services/Features*. If public network access is to an LEC or to an IXC other than AT&T (or if it is not defined), then that carrier's ISDN Services/Features should be defined in the lower half of the screen.

4. If public network access, then translate the *Service Type* field as required (such as *cbc*).
5. If the *Service Type* field is translated *cbc*, then (as an option):
 - a. From 1-to-3 *USAGE ALLOCATION PLANS* may be defined.
 - b. A time-of-day day-of-week *ASSIGNMENT SCHEDULE* (consisting of up to six transition times per day) may be defined for each usage allocation plan. Alternately, a usage allocation plan may be defined as *fixed* meaning that the selected allocation plan is always in effect.
6. For all Service Types, each incoming type of Service/Feature (such as MEGACOM 800 and SDN) may receive service-specific incoming call handling treatment. Included is the administration ability to request SID-ANI on a per call basis, to do digit deletion/digit insertion on a per call basis, or to effect night-service routing based on attributes of the incoming call.

NOTE: The determination of whether the switch will request SID/ANI (on a CBC basis) depends on the station called and certain administration data for that station.

Advantages of CBC Trunking

In a non-CBC Service Selection environment, specific DS1 channels must be preassigned and provisioned for each desired service. To determine the proper number of trunks per service application requires extensive traffic engineering studies. With such a study, trunk groups can be designed to accommodate a customer's peak traffic for given service applications. Furthermore, the time when one service application encounters peak traffic may not coincide with when another service application encounters peak traffic. As an alternative, if multiple network services are

accommodated with a single trunk group, and that trunk group is provided with allocation and scheduling controls, then significant trunking efficiencies are realized by distributing the traffic over the total number of available trunks.

CBC Usage Allocation Plans control the trunk groups so that dedicating a trunk group to an ISDN application is not needed. However, the administration ability to establish dedicated (or static) trunk groups still exists. By implementing usage allocation plans, the customer can optimize the CBC trunk group without involving any of the IXC/LEC network services personnel. The flexibility to control the CBC trunk is built into Generic 1; changes are transparent to the network provider.

Network Facilities — ISDN-PRI Applications

This screen is, from the user perspective, display only. However, the Customer Support Service Organization (CSSO) may administer (add) new services or features as required. In terms of comparison, this screen is somewhat equivalent to procedure 279, word 1. Figure 7-69, *Network-Facilities Screen*, depicts this procedure.

NETWORK-FACILITIES					
Predefined Services/Features					
Name	Facility Type	Coding	Name	Facility Type	Coding
outwats-bnd	0	00001	mega800	1	00010
operator	0	00101	megacom	1	00011
sub-operator	0	00110	inwats	1	00100
sdn	1	00001	wats-max-bnd	1	00101
accunet	1	00110	lds	1	00111
Additional Services/Features					
Name	Facility Type	Coding	Name	Facility Type	Coding
_____	-	_____	_____	-	_____
_____	-	_____	_____	-	_____
_____	-	_____	_____	-	_____
_____	-	_____	_____	-	_____

Figure 7-69. Network-Facilities Screen

Name	Up to 15 alphanumeric characters that uniquely identify (by name) the <i>Service</i> or <i>Feature</i> .
Facility Type	The ISDN-PRI specification requires that each network capability be identified as either a <i>feature</i> (0), or <i>service</i> (1).

**Facility
Coding**

The ISDN-PRI specification further requires that each service or feature be identified as a:

- Parameterized Service
- Parameterized Feature
- Binary Service
- Binary Feature

The facility coding values, listed on the NETWORK-FACILITIES screen, provide this identification.

Trunk Group — ISDN-PRI Trunk Applications

ISDN-PRI trunk groups are defined by using the first page of the TRUNK GROUP screen. Since ISDN-PRI uses Message Oriented Signaling, the format of this screen is somewhat different from the assigned basic DS1 service.

Page 2 administers certain features that are unique to ISDN-PRI trunk groups. Screen pages 3 and 4 are only displayed if the *Service Type* field on page 1 is administered CBC. Screen pages 5 through 11 are used as required to assign group members.

Figure 7-70, *Trunk Group Screen, Page 1 (ISDN-PRI)*, depicts this procedure.

TRUNK GROUP		Page 1 of 11
Group Number: __	Group Type: isdn-pri	SMDR Reports? y
Group Name: OUTSIDE CALL	COR: 1	TAC: ____
Direction: two-way	Outgoing Display? n	
Dial Access: y	Busy Threshold: 99	Night Service: ____
Queue Length: 0		
Service Type: cbc	Auth Code? n	
Usage Alloc? y	Far End Test No: _____	
TRUNK PARAMETERS		
Send Display/TCM in codeset 6/7: 6		
Max Message Size to Send: 260		
Connected to Toll? n	STT Loss: normal	DTT to DCO Loss: normal
Bit Rate: 1200	Synchronization: async	Duplex: full

Figure 7-70. Trunk Group Screen, Page 1 (ISDN-PRI)

Only the new ISDN-PRI service application fields or those fields that require special or additional considerations are mentioned here.

Group Type	For ISDN-PRI service applications this field should be translated <i>isdn-pri</i> . NOTE: The <code>SYSTEM-PARAMETERS CUSTOMER-OPTION</code> screen must have ISDN-PRI service enabled before this trunk group type can be translated.
Dial Access	Normally, this field is defined as <i>y</i> . However, for some public network connections (such as service type <i>CBC</i> , <i>MEGACOM</i> , etc.), this field is defined as <i>n</i> .
Night Service	If administered, then the extension number translated will receive all incoming calls (for the particular trunk group) when the switch is placed in night service mode. NOTE: Page 2 of the <code>TRUNK GROUP</code> screen permits an override entry for each particular type of ISDN network service. Also, trunk member night service is allowed.
Service Type	Assigns the service application for the ISDN-PRI trunk group. Since <i>CBC</i> permits reduced costs (depending on tariff and application), an improved grade-of-service, and customer premis control of networking, the option <i>cbc</i> should be considered for public network applications. Other options include any of the predefined or additional Services/Features listed in the <i>Name</i> field of the <code>NETWORK-FACILITES</code> screen. Also, the options <i>access</i> , <i>tie</i> , and <i>tandem</i> are permitted.
Usage Alloc	Field encodes and their descriptions are: <i>y</i> Enable usage allocation for those services provided by the trunk group. Used to maximize customer control of the allocation of <i>CBC</i> trunk group members to services (such as preventing a service from monopolizing the member of a group). NOTE: This option permits up to three usage allocation plans to be defined for the identified trunk group. The term usage allocation is the ability to set both a minimum and maximum number of trunk members that an ISDN Service/Feature may use at a given time. Each usage allocation plan can set limits for up to 10 services/features. <i>n</i> Disable usage allocation for the trunk group (default). This option places restrictions on either the Services/Features that can be carried on the trunk group or the number of calls that any one Service/Feature can have at any given time.
Far End Test No	This is the number associated with the far-end's test equipment and is reserved exclusively for maintenance testing. The test number should be assigned for both private and public networks. There is one test number per trunk group. As a part of the installation and ISDN-PRI service provisioning process, the test number must be coordinated with the terminating switch. NOTE: This field is equivalent to translating procedure 108, word 1, for Generic 2.

Send Display/TCM in Codeset 6/7 This field maps the display information (codepoint 8) and the TCM information (codepoint 40) to codeset 6 or codeset 7, depending on whether a 6 or a 7 is translated. The distant switch will determine which should be translated. Specifically, if the distant switch is a 4ESS with 4e11 or 4e12 software, or a System 85 R2V4, then this field should be translated with a 7. If the distant switch is a 4ESS with 4e13, Generic 1, or Generic 2, then the field should be translated with a six.

NOTE: For tandem node configurations, Generic 1 rebuilds the message in conformance to the outgoing trunk group. If any codeset/codepoint conversions are required, then the two endpoints must coordinate the conversions. Generic 1 can receive in either codeset (this is a send option).

Max Message Size to Send This field determines the maximum number of bytes that may be transmitted before an acknowledge reply is required. Permitted entries are 128, 244, 256, and 260 (default). This field must be administered to be the maximum size messages that the far end is able to receive and process. If the distant switch is another Generic 1, then any entry will work. Currently, System 85 R2V4, Generic 2, all releases of 4ESS, and 5ESS only support 128.

The fields on page 2 of the TRUNK GROUP screen comprise an incoming call handling table. The table consists of up to 12 rows of seven columns per row. The first three columns constitute a key that together select which row or unique treatment should apply for an incoming call on the group. The remaining four columns specify the treatment to be provided for a call that matches the key.

The first column or field in the key is the *Service/Feature* field. If an incoming call is for a service listed in a row in the incoming call handling table, then that row may specify the treatment for the call, depending on the other two columns of the key. The *Called Len* field is used to continue the row determination. If the number of digits received with the incoming call match the number of digits in the *Called Len* field for calls to the matched service, then this row may apply. If no other row also contains a matching service and called length, then this row does apply. If another row does exist with the same service and number length, then the *Called Number* field will be used to continue the row determination. If the leading digits received with the incoming call match the digits specified in the *Called Number* field, then this row applies to the call. Therefore, with this table, a unique treatment can be given to any incoming call, even if these calls are to the same service or have the same length of digits. The remaining four fields specify the unique treatment for the call once the row has been determined. Together, the *Del* and *Insert* fields can be used to manipulate the incoming number that will be used to route the call. The *Per Call SID/ANI* field can be used to request SID/ANI only for specific calls incoming on the group. The *Night Serv* field is used to have calls of different types routed to different night destinations when night service is in effect.

The biggest application of this table is when a Generic 1 is connected to the public network with several different services, such as MEGACOM® 800 service and ACCUNET® Switched Digital Services, but it also has applications when used in a private network.

NOTE: Administering this table is optional.

Figure 7-71, *Trunk Features Screen, Page 2 (ISDN-PRI)*, depicts this procedure.

Send Name This field determines whether the calling (originating) party's administered name is sent to the network for outgoing calls and whether the connected (answering) party's name is sent to the network for incoming calls. Field encodes and their descriptions are:

- y Enable this capability. You can enable this field; however, there may be cases where it is desirable to disable this option (for example, security, privacy, and personal preference).
- n Disable this capability (default).

NOTE: Administering the *Send Name* field is equivalent to administering procedure 012, words 1 and 2, with the exception that Generic 1 cannot be administered to transmit the trunk group name.

Typically, those trunk groups that are administered for cbc service type will receive a variety of incoming call types. These incoming calls may originate from a variety of sources (for example, public network, private network, or host computer).

The incoming call handling software processes incoming calls based on:

- The number of digits received
- The type of digits
- Whether the call has an identifying NSF (for example, MEGACOM 800, SDN, or ACCUNET)

Service/Feature Permitted entries include any of the predefined or additional Services/Features listed on the NETWORK FACILITIES screen and supported by this trunk group. Also, the special identifier, other, may be translated (as a catch-all entry) for all Services/Features not explicitly specified.

The *Service/Feature* field is the first item searched. Following a match in the *Service/Feature* field, then the associated entry for the *Called Len* field is searched, and if a match is found then the *Called Number* field is searched. Failure to match the associated *Called Len* or *Called Number* will cause the search to continue to the next *Service/Feature* entry. (For a list of predefined Service/Features that can be received, see the *Service Type* field description.)

Called Len Specifies the expected number of digits to be contained in the called-party number IE. Field encodes and their descriptions are:

- A number within the range (0 to 16) — the number of digits received must match the number that is administered in this field.

If the IXC is AT&T and if the ISDN network service is MEGACOM 800, SDN, or a switched digital service, then a 4ESS may deliver from 0 to 7 digits. Therefore, if the service is correctly provisioned, then the proper number (and required number) of digits will be delivered to the switch.

- No entry, leave the field blank. This will suffice for the case where the number of digits received is not significant.

**Called
Number**

Generally, this field only specifies some of the leading digits that are contained in the called-party number IE. The digits received must match, on a digit-per-digit basis, what is administered in this field. Field encodes and their descriptions are:

- A series of numbers, which may consist of from 1 to 16 digits, corresponding to the required leading digits.

NOTE: If this field is administered then the associated *Called Len* field must also be administered.

- No entry, leave the field blank. This will suffice for the case where the digits received are not significant.

Del

The digit *Del* and digit *Insert* fields (together) provide the ability to do digit manipulation/digit replacement on incoming calls. It is the manipulated number that is used to route the call.

The *Del* field specifies the number of leading digits to be deleted from the Called Party Number IE. Once the specified number of digits have been deleted, the digits specified in the *Insert* field are prepended to the front of the Called Party Number. Field encodes and their descriptions are:

- A series of numbers, which may consists of from 1 to 16 digits, corresponding to the leading digits that are to be deleted. This administration option may be used to solve many of the problems relating to cross dial plan mapping.

Application Example #1

If the called-party number IE contains a 4 digit number (that uniquely identifies an extension or hunt group) but does not align with the required address because the switch has a 5 digit dial plan. Then, the appropriate leading digit may be inserted so that the call will route correctly.

Application Example #2

If the called-party number IE contains the digits [8123] or [8567] but it is desired to route these calls to hunt groups with extensions [44123] and [44567] respectively. Then, the screen would have an entry for each number, and the *Del* fields would contain a one and the *Insert* fields would contain the digits 44.

NOTE: The number of digits deleted cannot be greater than the number specified in the *Called Len* field.

- No entry, leave the field blank. When no digits are to be deleted.
- The word all. This option may be used to route particular types of calls to a specific extension number. This specific extension number would be administered in the *Insert* field.

Insert	The digits inserted before the Called Party Number IE. This specifies the digits prepended to the front of the remaining digits after any (optional) digit deletion has been performed. The resultant number formed from digit deletion/insertion is used to route the call, providing that night service is not in effect. Field encodes and their descriptions are: • A series of numbers, which may consists of from 1 to 16 digits. • No entry, leave the field blank. This will suffice for the case where no digits are to be inserted.
Per Call SID/ANI	Specifies if and how to request SID or ANI for this particular type of Service/Feature. Field encodes and their descriptions are: • No entry, leave the field blank (default). Specifies that the switch will not request either SID or ANI for any of these types of calls after call delivery. Use <code>no entry</code> when the network is provisioned to always send SID/ANI with call setup. • ANI-only • ANI-pref — but will accept SID • SID-only • SID-pref — but will accept ANI • None — same as blank
Night Serv	Permits the administration of a particular night service extension for each row in the table. This entry will override the night service administered for the whole trunk group (on page 1 of the <code>TRUNK GROUP</code> screen). Field encodes and their descriptions are: • An extension number • The attendant • No entry, leave the field blank (default). This will not override night service for the whole trunk group.

The `TRUNK FEATURES` screen (Page 2 of 11) may have more than one entry for the same Service/Feature. Frequently, multiple entries (per Service/Feature) are used to provide multiple call routes for that Service/Feature. The route selected will be dependent on the received digits and specific administration details of the digit manipulation fields. If an incoming call matches more than one entry, then the most restrictive entry is selected. (This is why it is not CBC specific.)

The following case examples show this point and should clarify how the incoming call handling software functions in this scenario.

Case 1

- *Service/Feature* field is specified (for example, `mega800`).
- *Called Len* field is specified with a requirement of N digits (for example, `N = 5`).

- *Called Number* field is specified with M leading digits, where M is a number of digits less than N (for example, the three digits 855).

NOTE: The screen that follows these case examples depicts a line entry (Service/Feature, Called Len, Called Number,...) for each case. The first (top) entry is for case 1, the second entry from the top is for case 2,...the last entry shown is for case 7.

Case 2

- *Service/Feature* field is specified (for example, **mega800**) .
- *Called Len* field is specified with a requirement of N digits (for example, N = 5) .
- *Called Number* field is specified with M leading digits, where M is a number of digits less than N (for example, the single digit 8).

Application for Case 1 being selected — most restrictive

Assume the switch receives a MEGACOM 800 call that has a called-party number IE with 85542. Based on the *Service/Feature* and *Called Len* fields alone, this call will match both case 1 and case 2. However, on analyzing the called-party number, the incoming call handling software will select Case 1 since it is the more restrictive match. Each incoming call is searched against every screen entry to identify the appropriate match.

Application for Case 2 being selected

Assume the switch receives a MEGACOM 800 call that has a called-party number IE with the digits 84000. Based on the *Service/Feature* and *Called Len* fields alone, this call will match both Case 1 and case 2. However, on analyzing the called-party number, it is determined that the leading digits (84000) do not match the digits for Case 1 but do match for Case 2.

Case 3

- *Service/Feature* field is specified (for example, **mega800**) .
- *Called Len* field is specified (for example, 4).
- *Called Number* field is not specified (that is, left blank).

Application for Case 3 being selected

A MEGACOM 800 call is received that has a called-party number IE with the digits 8654. Based on the *Service/Feature* field alone, this call matches Cases 1-3. However, on analyzing the Called Party Number IE, there are only 4 leading digits (8654). Cases 1 and 2 are eliminated since they require a Called Len of 5 digits (Case 3 requires 4 digits). Furthermore, the Case 3 *Called Number* field is blank, which matches any number regardless of digit format. The incoming call handling software selects Case 3 since it matches and is more restrictive than Cases 4-7.

Case 4

- *Service/Feature* field is specified (for example, **mega800**) .
- *Called Len* field is not specified (that is, left blank).
- *Called Number* field is not specified (that is, left blank).

Application for Case 4 being selected

Assume the switch receives a MEGACOM 800 call that has a called-party number IE with the digits 75442. Based on the *Service/Feature* field alone, this call will match Case 1, 2, 3, and 4. However, on analyzing the Called Party Number IE, it is determined that there are the following 5 leading digits (75442). Case 3 does not match because it requires 4 digits. Case 1 and 2 both require 5 digits, but specify an 8 as the leading digit and therefore do not match. For Case 4, the *Called Len* and *Called Number* fields are blank, which matches any number regardless of the number of digits or digit format.

Case 5

- *Service/Feature* field is specified as other.
- *Called Len* field is specified with a requirement of N digits (for example, N = 5).
- *Called Number* field is specified with M leading digits, where M is a number of digits less than N (for example, the three digits 855).

Case 6

- *Service/Feature* field is specified as other.
- *Called Len* field is specified with a requirement of N digits (for example, N = 5).
- *Called Number* field is specified with M leading digits, where M is a number of digits less than N (for example, the single digit 8).

Case 7

- *Service/Feature* field is specified (for example, **other**)
- *Called Len* field is specified (for example, **N**)
- *Called Number* field is not specified (that is, left blank)

Case 8

- *Service/Feature* field is specified (for example, **other**)

- *Called Len* field is not specified (that is, left blank).
- *Called Number* field is not specified (that is, left blank).

NOTE: Case 8 is the least restrictive (nonrestrictive) and will match all calls not handled by any other case.

Applications for Cases 5-8

Cases 5-8 are similar to Cases 1 through 4 respectively. The only difference is that the *Service/Feature* field is changed to other. The remaining fields repeat the same conditions on a case-by-case basis. Therefore, cases 5-8 may serve to receive other incoming Services/Features (for example, SDN or any of the Switched Digital Services).

Example Screen Entries for Cases 1-8

Figure 7-72, *Trunk Group Screen, Page 2 (ISDN-PRI) for Cases 1-8*, depicts this example.

TRUNK FEATURES				Page 2 of 11		
ACA Assignment? n		Long Holding Time (hours): 1				
Short Holding Time (secs.): 10		Short Holding Threshold: 15				
MIS Measured? n		Internal Alert? n				
Used For DCS? n		PBX ID: 1		Data Restriction? n		
Maintenance Tests? y		Send SID? n				
					Send Name? n	
Service/ Feature	Called Len	Called Number	Del	Insert	Per Call SID/ANI	Night Serv
mega800	5	855	---	_____	_____	_____
mega800	5	8	---	_____	_____	_____
mega800	4	_____	---	_____	_____	_____
mega800	---	_____	---	_____	_____	_____
other	N	M	---	_____	_____	_____
other	N	M	---	_____	_____	_____
other	N	blank	---	_____	_____	_____
other	bla	blank	---	_____	_____	_____
_____	---	_____	---	_____	_____	_____
_____	---	_____	---	_____	_____	_____
_____	---	_____	---	_____	_____	_____
_____	---	_____	---	_____	_____	_____

Figure 7-72. Trunk Group Screen, Page 2 (ISDN-PRI) for Cases 1-8

Trunk Group Usage Allocation — ISDN-PRI Applications

If the trunk group *Service Type* field is administered cbc, then up to 10 Service/Feature specific digit treatments can be administered for each usage allocation plan, refer to the CBC TRUNK GROUP USAGE ALLOCATION screen (Page 3 of 11).

NOTE: Although each usage allocation plan may contain up to 10 entries, a given Service/Feature may only be listed once per plan.

Many other scenarios may be developed for applying a plan. Various reasons may be used. Figure 7-73, *Trunk Group Screen, Page 3 (ISDN-PRI)*, depicts this procedure.

[illegible]

Figure 7-73. Trunk Group Screen, Page 3 (ISDN-PRI)

Usage Allocation Plan Before administering the Usage Allocation Plans it is first necessary to define a strategy for each plan. For example; plan 1 could specify those actions to be taken during a normal business day, plan 2 could specify those actions to be taken during non working hours of the business day (during lunch and when phones are not attended), while plan 3 could specify those actions to be taken during the weekend. An alternate example could just use plans 1 and 2 on a scheduled basis, but have plan 3 defined and available for fixed allocation. Obviously, many other strategies could be defined.

Service/Feature Permitted entries include any of the predefined or additional *Service/Features* listed on the NETWORK FACILITIES screen that this trunk group supports. Also, the special identifier other may be translated (as a catch-all entry) for all Services/Features not explicitly specified.

Min# Chan This field reserves a specified number of trunk group members that are to always be available to the associated Service/Feature. Permitted numbers are any number within the range of 0 to 99.

NOTE: For each allocation plan, the sum of the Min# Chan columns must be less than the total number of members for the trunk group. To maximize the utility of CBC Service Selection, the sum of the Min# Chan column must be much less than the total number of members for the trunk group. The difference between this sum and the total numbers of members determines the overflow pool.

Max# Chan This field established the maximum number of trunk members that can be used by the associated Service/Feature application at any one time (for example, MEGACOM 800).

An Example Application for Usage Allocation Plans

A given ISDN-PRI trunk group has the *Service Type* field translated cbc and has 23 trunk members. And if:

1. At any given time, no more than 15 members (that is, Max# Chan = 15) will be used for the particular Service/Feature.
2. At least 5 members (that is, Min# Chan = 5) will always be reserved for this service application.

Then, these Min Chan and Max Chan administration assignments insure the following:

1. At least 8 trunk members will be available for other types of calls. Other types of calls may be a combination of both incoming and outgoing.
2. Regardless of the maximum bound assigned to other services, there will always be at least 5 members that can carry calls for the associated Service/Feature (for example, MEGACOM 800).

NOTE: This type of allocation plan has the characteristic of insuring that no single service will dominate the trunk group, while still allowing for periodic fluctuations in demand. If a particular Service/Feature attempts a call that would result in exceeding the specified threshold, then that call is rejected.

Usage Allocation Plan Assignment Schedule — ISDN-PRI Applications

The CBC USAGE ALLOCATION PLAN ASSIGNMENT SCHEDULE screen permits the customer to administer a usage allocation plan and to vary the plan by both time of day and day of week. Figure 7-74, *Trunk Group Screen, Page 4 (ISDN-PRI)*, depicts this procedure.

CBC TRUNK GROUP USAGE ALLOCATION PLAN ASSIGNMENT SCHEDULE												Page 4 of 11	
Usage Method:													
Fixed? y Allocation Plan Number: 1													
Scheduled? n													
Usage Allocation Plan Activation Schedule:													
	Act	Plan	Act	Plan	Act	Plan	Act	Plan	Act	Plan	Act	Plan	
	Time	#	Time	#	Time	#	Time	#	Time	#	Time	#	
Sun	---	---	---	---	---	---	---	---	---	---	---	---	
Mon	---	---	---	---	---	---	---	---	---	---	---	---	
Tue	---	---	---	---	---	---	---	---	---	---	---	---	
Wed	---	---	---	---	---	---	---	---	---	---	---	---	
Thu	---	---	---	---	---	---	---	---	---	---	---	---	
Fri	---	---	---	---	---	---	---	---	---	---	---	---	
Sat	---	---	---	---	---	---	---	---	---	---	---	---	

Figure 7-74. Trunk Group Screen, Page 4 (ISDN-PRI)

Fixed This method allows the customer to specify a single usage allocation plan to be used for all time. Field encodes and their descriptions are:

y Enable this method. The plan that is administered in the *Allocation Plan Number* field will be enabled.

n Disable this method. Consequently, the scheduled method must be enabled for this CBC application.

Allocation Plan Number Specifies the plan number (1, 2, or 3) that is to be enabled when fixed usage is selected.

Scheduled This method allows the customer to specify that scheduled usage allocation is desired. Field encodes and their descriptions are:

y Enable this method.

NOTE: The time of day (account time or plan number) day of week entries must have been administered before this field is enabled. The customer can override or suspend the specified usage allocation schedule by changing or enabling the fixed method.

n Disable this option.

Act Time Specifies the time that the associated usage allocation plan will become effective. Time must be specified in 24-hr format. Permitted entries are 00:00 through 23:59.

NOTE: Each day of the week must have at least one entry, but may have as many as six transition times. A transition time is defined as the time when another plan becomes effective. A new or different plan will not effect existing calls, but will effect new call attempts.

Plan # Specifies the plan number effective from the activation time to the activation time of the next *Act Time*. Field encodes and their descriptions are:

- 1 Plan number 1
- 2 Plan number 2
- 3 Plan number 3

Trunk Group Member Assignments — ISDN-PRI Trunk Applications

Adding members to an ISDN-PRI trunk group is similar to adding members to a DS1 trunk group. The prime difference is that with ISDN-PRI the **TRUNK GROUP** screen does not have the right three fields (*Mode*, *Type*, and *Ans Delay*). Figure 7-75, *Trunk Group Screen, Page 5 (ISDN-PRI)*, depicts this procedure.

GROUP MEMBER ASSIGNMENTS			Page 5 of 11
Port	Name	Night	
1:	_____	_____	
2:	_____	_____	
3:	_____	_____	
4:	_____	_____	
5:	_____	_____	
6:	_____	_____	
7:	_____	_____	
8:	_____	_____	
9:	_____	_____	
10:	_____	_____	
11:	_____	_____	
12:	_____	_____	
13:	_____	_____	
14:	_____	_____	
15:	_____	_____	
16:	_____	_____	

Figure 7-75. Trunk Group Screen, Page 5 (ISDN-PRI)

- Port** This field associates each trunk group member to a particular network (1 or 2), carrier (A-E), slot (01-20), and circuit (01-24). To keep things simple, try to match trunk group member assignments with B-channel assignments (for example, trunk group member 1 on channel 1).
- Name** Typically, this entry is a 7-digit telephone number. However, another candidate would be the 10-digit trunk circuit identification number (available from the circuit provider).
- Night** This is a new capability with Generic 1. It permits an individual trunk member to override the night service option that is administered on page 1 of the TRUNK GROUP screen. Allowable entries are an extension, the attendant, or to leave blank.

SID Prefix Table — ISDN-PRI Applications

If the *Trunk Group* field *Send SID* is enabled (page 2 of the TRUNK FEATURES screen), then the screen **SID PREFIX TABLE** must be administered. Figure 7-76, *SID Prefix Table Screen*, depicts this procedure.

SID PREFIX TABLE						Page 1 of 5		
Ext Len	Ext Code	SID Prefix	Ext Len	Ext Code	SID Prefix	Ext Len	Ext Code	SID Prefix
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----
-	-----	-----	-	-----	-----	-	-----	-----

Figure 7-76. SID Prefix Table Screen

Permitted entries are single digit numbers less than or equal to the number administered in the *Page Length* field of the DIAL PLAN RECORD screen. For example, if the *Page Length* field is translated five (meaning a five digit numbering plan), then this field may contain the number 1, 2, 3, 4, or 5. If the *Page Length* field is translated four (meaning a four digit numbering plan), then this field may contain the number 1, 2, 3, or 4.

NOTE: For most applications it is expected that this field will be translated with the same number as the *Page Length* field.

Ext Code Specifies a single explicit extension number, or a range of extension numbers. Permitted entries are any valid extension number, or range of extension numbers that are defined on the DIAL PLAN RECORD screen.

For example, assume that the Ext Len is five and that the Ext Code is administered with the digits 65. Then, the range of extension numbers is 65000 through 65999.

SID Prefix The number that is prefixed to the extension number to form a 10-digit Station Identification. The SID prefix can be a 5, 6, 7, 8, 9, or 10-digit number, or blank. A typical 6-digit SID prefix would be the switch 3-digit NPA and the 3-digit NNX (that is, NPANNX). If the number of digits in the SID prefix plus the extension length exceed ten, then excess leading digits from the extension number are deleted when forming the 10-digit SID number. If the SID prefix is a 10-digit number, then the extension number is not used.

An Example Application that uses SID

Assume that the switch has a 5-digit dial plan. For illustration purposes, assume that a company has its billing department (extensions 31000 through 31999) and sales department (extensions 41000 through 41999) located on the same switch. Furthermore, assume that the billing department does not want their individual extension numbers displayed on the far-end but rather wants the company's LDN (for example, 201-235-3000) displayed. On the other hand, the sales department does want their individual calling party's number displayed rather than the company's LDN. Figure 7-77, *SID Prefix Table Screen, Sample Application*, depicts the appropriate translations to achieve these objectives.

NOTE: If the *SID Prefix* field is blank, then neither the calling party name or calling party extension number is displayed.

SID PREFIX TABLE						Page 1 of 5		
Ext Len	Ext Code	SID Prefix	Ext Len	Ext Code	SID Prefix	Ext Len	Ext Code	SID Prefix
5	31	2012353000	-	----	-----	-	----	-----
5	41	20123	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----
-	----	-----	-	----	-----	-	----	-----

Figure 7-77. SID Prefix Table Screen, Sample Application

Routing Patterns — ISDN-PRI Applications

NOTE: The ROUTING PATTERN screen only relates to outgoing calls; page 2 of the TRUNK GROUP screen only relates to incoming calls.

A routing pattern is a set of trunk groups that carry calls to a particular switch. Each routing pattern is identified by a unique number known as the pattern number. A maximum of 254 different patterns may be administered. Each pattern may contain up to six different trunk groups (six alternate trunk routes). Once a routing pattern is accessed the call processing software will, depending on trunk group compatibility (both FRL and BCC) and trunk member availability, select the trunk groups in decreasing order of preference (that is, 1, 2,...6).

NOTE: Both ISDN-PRI private networks and ISDN-PRI public networks require that one or more ROUTE-PATTERN screens be administered. For private networks, the RNX tables must be translated. Each RNX table serves as a pointer to one or more pattern numbers. For public networks, the appropriate *HNPA*, *FNPA*, and/or *RHNPA* tables must be translated. These tables serve as a pointer to one or more different pattern numbers.

Figure 7-78, *Routing Patterns Screen*, depicts this procedure.

ROUTING PATTERNS										Page 1 of 1																																																																																								
Pattern Number: ____																																																																																																		
Pattern Assignments (Enter Up To 6)																																																																																																		
	Grp. No.	FRL	NPA	Prefix Mark	Toll List	No. Del Digits	Inserted Digits	IXC																																																																																										
1.	----	-	----	-	-	-	-----	----																																																																																										
2.	----	-	----	-	-	-	-----	----																																																																																										
3.	----	-	----	-	-	-	-----	----																																																																																										
4.	----	-	----	-	-	-	-----	----																																																																																										
5.	----	-	----	-	-	-	-----	----																																																																																										
6.	----	-	----	-	-	-	-----	----																																																																																										
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Figure 7-78. Routing Patterns Screen

Pattern Number Permitted entries are numbers within the range 1 through 254. The appropriate number must come from the *RNX/HNPA/FNPA/RHNPA* tables.

Grp No. Permitted entries are numbers within the range 1 through 99. The appropriate number must come from the previously administered TRUNK GROUP screen.

NOTE: There is no restriction on using the same trunk group number in more than one routing pattern.

FRL Permitted entries are numbers within the range 0 through 7 (where 0 is least restrictive and 7 is most restrictive).

NOTE: ISDN-PRI does not alter the usage of FRLs. However, to access an ISDN-PRI trunk group, the calling extension must be compatible, both in terms of FRL and BCC.

NPA Permitted entries are the NPA (area code) for the terminating switch.

NOTE: This field is not used for AAR or tie trunk applications, although it may still be translated.

Prefix Mark This field is only used for public network (ARS) applications.

The Prefix Mark relates to the *ARS Prefix 1 Required?* field on the DIAL PLAN RECORD screen. If the *ARS Prefix 1 Required?* field is translated y, then (for certain type of calls) it may be necessary to transmit the one along with the dialed digits. The *Prefix Mark* field permits four different entries (numbers) for administering this capability. Field encodes and their descriptions are:

0 Specifies that the prefix digit one is not inserted.

NOTE: This entry is appropriate when there are no Interchangeable CO Codes within the NPA. If the destination number is seven digits or less (for example, NNX-XXXX or a service code N11) then the digits are sent as dialed. Furthermore, for these type calls, if the prefix digit one is dialed it is not deleted. For 10-digit (NPA-NNX-XXXX) calls, if the prefix one is dialed it is deleted.

1 Specifies that the prefix digit one is sent if and only if the call is a 10-digit calls. For this entry, there may be Interchangeable CO Codes within the NPA.

2 Specifies that the prefix digit one is sent for all 7- and 10-digit toll calls. The associated toll list assigns which office codes are toll calls. For this entry, there may not be Interchangeable CO Codes within the NPA. With this entry, if the customer were to dial a one before a nontoll 7-digit call, the call would route as a toll call.

3 Specifies that the prefix digit one is sent for all toll calls, regardless of the number of digits. For this entry, there may be Interchangeable CO Codes within the NPA.

Toll List This field is only used for public network (ARS) applications.

This field relates a specific ARS toll table to Prefix Marks two and three. Permitted entries are numbers 1 through 32.

No. Del Digits Determines the number of digits deleted from the beginning of the digit string that is being prepared for sending. Permitted entries are numbers within the range of 0 through 11.

NOTE: The insertion or deletion of the NPA is done with the Prefix Mark and the NPA is not included in the number of digits deleted or inserted.

Inserted Digits Specifies the digits to be inserted at the beginning of the digit string that is being prepared for sending.

IXC For ISDN-PRI private networks, enter a blank. For ISDN-PRI public networks the interexchange carrier's three digit identification should be translated. If this field is left blank for public network connections, then the presubscribed common carrier is assumed.

BCC Values Each routing pattern preference (1 through 6) has an associated *BCC Value* field. Therefore, when a preference is translated, the associated BCC must also be translated. A trunk group preference must be valid for one or more BCC values. Permitted entries are y to enable the value and n to disable the value.

A route can only be selected when there is compatibility (a match) with the BCC of the call originating extension or facility and a BCC value specified in the routing pattern.

Service/Feature This field is not used by the AAR software, but is required by the ARS software if the trunk group specified is CBC. Permitted entries include any of the predefined or additional Services/Features listed in the *name* field of the NETWORK-FACILITIES screen.

NOTE: If the IXC is AT&T and the public network connection is to a 4ESS digital switch that is configured with either 4e11 or 4e12 generic software, then the *Service/Feature* field must be completed for all entries except ACCUNET switched digital service. For ACCUNET, this field should be left blank; however, the *BCC* field must be administered n y n n n. If a 4ESS is configured with 4e13 generic software, then the *Service/Feature* field must be completed for every entry — including ACCUNET.

Band Permitted entries are numbers 0 through 255 (which corresponds to outgoing-WATS bands 0 through 255).

NOTE: This field is only displayed when the *Service/Feature* field is translated outwats-bnd.

Hunt Group — ISDN-PRI Applications

This main reason for using this screen (within an ISDN-PRI environment) is to support any of the call management/call distribution systems. Figure 7-79, *Hunt Group Screen*, depicts this procedure.

HUNT GROUP		Page 1 of 6
Group Number: __	Group Extension: ____	Group Type: used
Group Name: _____	Coverage Path: ____	COR: 1
Security Code: ____	Message Center: none	ACD? n
Queue? n	Night Service Destination: ____	
ISDN Caller Disp: _____		

Figure 7-79. Hunt Group Screen

Only the new ISDN-PRI service application fields or those fields that require special or additional considerations are mentioned here.

- ISDN Caller Disp** Specifies whether the hunt group name or the member name will be sent to the originating extension. Field encodes and their descriptions are:
- **grp-name** — specifies that the hunt group name will be displayed on the originating extension display.
 - **mbr-name** — specifies that the hunt group member name will be sent to the originating extension.

Terminating Extension Group — ISDN-PRI Applications

If the extension is part of a Terminating-Extension Group (TEG) then the voice terminal can be assigned a TEG button and associated status lamp. Furthermore, if the voice terminal has a digital display, then (depending on administration details) either the TEG group name or TEG member name can be displayed. Figure 7-80, *Terminating Extension Group Screen*, depicts this procedure.

TERMINATING		EXTENSION		GROUP		Page 1 of 1	
Group Number: ____				Group Extension: ____			
Group Name: _____				Coverage Path: ____			
Security Code: _____				COR: 1_			
ISDN Caller Display: _____							
GROUP		MEMBER		ASSIGNMENTS			
		Ext		Name			
		1: ____				3: ____	
		2: ____				4: ____	

Figure 7-80. Terminating Extension Group Screen

**ISDN Caller
Display**

Specifies whether the hunt group name or the member name will be sent to the originating extension. Field encodes and their descriptions are:

- **grp-name** — specifies that the TEG group name will be sent to the originating extension.
- **mbr-name** — specifies that the TEG member name will be sent to the originating extension.

8. MAINTENANCE AND ALARMS

This chapter describes general maintenance items. For solutions to other problems not covered in this chapter or for additional information about a specific problem, refer to *DEFINITY® Communications System Generic 2 and System 85 Maintenance Procedures* (555-104-117) and *DEFINITY Communications System Generic 2 and System 85 Repair Strategy* (555-104-118).

GENERIC 1 AND GENERIC 2 ISDN-PRI MAINTENANCE PHILOSOPHY

The ISDN-PRI consists of the physical level (layer 1), data-link level (layer 2), and the D-channel signaling protocol (layer 3). The maintenance philosophy is based on the functional distinction between these three layers.

Generally, maintenance problems are resolved starting from layer 1 and working to the higher layers, as required. When an ISDN-PRI facility is functioning, maintenance relies on in-service performance monitoring and nondisruptive testing to localize any detected error. Depending on the type of error and its level of significance, the detected error is either recorded as a performance anomaly or resolved to an alarm. These in-service monitoring and testing procedures are used and exhausted before service disrupting methods are used.

When the customer experiences a trouble, the assigned customer interface should do all available diagnostic tests involving AT&T-supplied customer-premises equipment. The customer interface should record the results of these tests, determine the source of the trouble, and, if appropriate, send a trouble referral to the appropriate maintenance organization.

NOTE: The account team service manager should ensure that the customer understands that *AT&T accepts responsibility only for AT&T supplied products and services* and that all non-AT&T supplied products and services are the responsibility of the customer.

GENERIC 2 MAINTENANCE CAPABILITIES AND CONCERNS

The DS1s, DMIs, or ISDN-PRIs have diagnostic and maintenance procedures that are different from those procedures used for analog port circuit packs. Except for System 75 and Generic 1, analog port circuit packs are dumb; that is, any maintenance testing done on a circuit pack is either automatically directed by the switch processor or manually by the service technician from a maintenance terminal. And for this case, when the switch processor detects a failure on a port, a fault code is logged against that port. The service technician does not have to look up the fault code and determine its meaning; all the service technician does is test the port to see if the failure still exists. If the test fails, the port is made maintenance busy and the circuit pack is replaced out of hours or whenever appropriate.

Unlike other analog port circuit packs, DS1/DMIs and ISDN-PRIs are considered smart and contain an onboard microprocessor. Among other things, the microprocessor is programmed to do special

maintenance activities. Digital circuit packs are able to detect and report errors occurring on both the circuit pack itself and on the digital transmission facility. The circuit packs are also able to restore service automatically when and if any detected faults should clear.

For ISDN-PRI, layer-3 protocol defines a set of maintenance related service messages. The service messages may be transmitted from the near end ISDN-PRI to the far end ISDN-PRI and vice versa. Service messages change the service state of the near end and far end ISDN-PRI. The four primary service messages are as follows:

- In Service — Places into service one or more B-channels that have previously been busied-out.
- Out of Service (either near end or far end) — Removes from service or busies-out one or more B-channels.
- Maintenance — Specifies that one end of the facility intends to send test calls toward the opposite end of the interface. This effectively blocks the origination of calls.
- Service Acknowledge — Specifies that the current function (such as in service, maintenance, or out of service) for which the facility or channel was previously used is being changed.

For DS1/DMI, and ISDN-PRIs, the switch software logs two types of fault codes. They are known as:

- *Facility fault codes* — those that show something about an event that occurred on the digital facility and the action (if any) taken to restore the facility.
- *Interface fault codes* — those that say something about the circuit pack itself.

Generic 2 Maintenance Procedures

For DS1/DMI, and ISDN-PRIs, procedure 600 should be the starting point for all maintenance activities. This procedure displays logged alarms in unit type (such as unit type = 63, 68, 75, or 76), the corresponding circuit pack location, any alarm status, and optionally another procedure for further reference. The next step depends on the identified unit type and which procedure was referenced. For example:

- a . Unit type 63 (external equipment) may be investigated with procedure 618. This would permit the determination of whether the alarms are associated with a DS1, with ISDN-PRI external equipment, or external stratum-3 alarms.
- b . Unit type 68 shows a problem with a particular DS1 circuit pack. *If the identified circuit pack is currently in service, then the service technician should check the circuit pack's current health and status by executing test 1 of procedure 625.* If the health code is 4 or higher, the service technician should attempt a test call (over the facility) to determine whether the facility can support service. If the call completes and is of acceptable quality, then additional maintenance should be deferred until after hours. Procedure 625 allows status monitoring of DS1/DMI facilities, clearing of misframe counters in test 1 on a per-board basis, and clearing of slip counters in test 2 on a systemwide basis.

If the facility is out of service, then procedure 620 should be used to isolate the faulty hardware.

NOTE: Procedure 620 should not be used to check the status of the circuit pack as it is a destructive test (service affecting to all 24 channels on the circuit pack) and should only be used when the facility is unavailable or out of hours.

When procedure 620 is used the following points should be understood:

- *Procedure 620* consists of five separate tests, identified as tests 1 through 5.
- Tests 1, 2, and 3 may be done without affecting service. Tests 4 and 5 affect service.
- Test 1 checks all DS1s or DMIs for the presence of any transmission facility faults; if found, they are stored away until the identified interface has been checked.

NOTE: The alarmed circuit should be checked for hyperactivity before investigating other possible alarms and before doing demand tests (such as test 2, 3, and so on).

- Tests 2, 3, and 4 display facility faults when no other failures are found on the board. To localize facility faults it is frequently helpful to use a strategically placed external loop-around cable.
- The second part of test 4 and all of test 5 display all faults found.
- Tests 4 and 5 will light the red LED on the circuit pack when facility errors cause procedure 620 to fail. Depending on the type of errors, other LEDs may be in their alarm state. However, the circuit pack should not necessarily be replaced, because pulling the circuit pack may cause other facility errors to be introduced.
- Excessive circuit pack removals/insertions reduce the life of the carrier.

For ISDN-PRI related errors, there are two unit types. One unit type (75) points toward ISDN-PRI level-1 faults. The other unit type (76) points toward ISDN-PRI level-2 and level-3 faults.

- c. Unit type 75 shows a problem with a particular ISDN-PRI circuit pack. *If the identified circuit pack is currently in service, then the service technician should check the circuit pack's current health and status by executing test 1 of procedure 625.* If the health code is four or higher, the service technician should attempt a test call (over the facility) to determine whether the facility can support service. If the call completes and is of acceptable quality, then additional maintenance should be deferred until after hours.

However, *if the facility is out of service, then procedure 620 should be used to isolate the faulty hardware.*

NOTE: Procedure 620 should not be used to check the status of the circuit pack as it is a destructive test (service affecting to all 24 channels on the circuit pack) and should only be used when the facility is unavailable or out-of-hours.

Procedure 620 consists of five separate tests numbered 1 through 5. The following summarizes the information displayed for these five tests:

- Tests 1, 2, and 3 may be done without affecting service. Tests 4 and 5 affect service.
- Test 1 checks all ISDN-PRIs for the presence of any transmission facility faults; if found, they are stored away until the identified interface has been checked.

NOTE: The alarmed circuit should be checked for hyperactivity before investigating other possible alarms and before doing demand tests (such as test 2 or 3).

- Tests 2, 3, and 4 display facility faults when no other failures are found on the board. To localize facility faults it is frequently helpful to use a strategically placed external loop-around cable.
- The second part of test 4 and all of test 5 display all faults found.

- Tests 4 and 5 will light the red LED on the circuit pack when facility errors cause procedure 620 to fail. Depending on the type of errors, other LEDs may be in their alarm state. However, the circuit pack should not necessarily be replaced, because pulling the circuit pack may cause other facility errors to be introduced.
- Excessive circuit pack removals and insertions reduce the life of the carrier.

Contrary to the maintenance procedures used for the DS1/DMI, procedure 625 is not the main tool for analyzing ISDN-PRI errors. However, procedure 625 is still useful for analyzing problems relating to synchronization. The primary tool for isolating level-1 errors is via procedure 620. Procedure 648 is the primary tool for analyzing level-2 faults (tests 1 and 2) and level-3 faults (test 3).

- Unit type 76 shows a problem with a one or more of the D-channels on a particular ISDN-facility. (For system 85 R2V4, unit type 76 shows the first B-channel associated with a D-channel.) Procedure 648 (ISDN facility testing) is used to provide end-to-end verification of the transmission path and to display failure history of the ISDN level-2 faults. It consists of three separate tests.

NOTE: Procedure 648, test 3, requires that the D-channel be up and functioning.

- Test 1 is the default test for R2V4 and Generic 2. It is used to examine error information (failure history) logged against ISDN-PRI facilities. The failing facility is identified by physical equipment location. Its alarm status is also displayed. A failing circuit index is provided to present the total number of failing circuits when the first failing circuit is displayed. Test one is also used to resolve any (individual) or all ISDN-PRI alarmed circuit failures.
- Test 2 is an active “once-through” test and provides an ISDN level-2 test. Its primary function is to send a test frame to the far end via the D-channel for that interface associated with the selected trunk and to then verify the response. A particular circuit or a range of circuits can be checked. The status of each failed circuit and the associated trunk group, trunk number, and physical equipment location can be displayed.
- Test 3 does a level-3 loopback. A test call is made from a Generic 2 analog/digital-facility test circuit (ADFTC) or maintenance test controller panel (MTCP) to a terminating test line (TTL) on the far end. The test call originates on the B-channel to be tested. When the connection is made, a framed digital pattern is sent from the ADFTC/MTCP (originating end) to the far end where it is looped back to the ADFTC/MTCP for bit- and block-error rate analysis. The status (fault code as well as bit- and block-error rate calculations) of each failed circuit and the associated trunk group, trunk number, and physical equipment location can be displayed after testing.

Depending on whether procedure 260 is translated for ZCS or B8ZS, procedure 648 will test the channels (as appropriate) for unrestricted or restricted data.

Procedure 648 test 2 (for R2V4) and test 3 (for R2V4 and Generic 2) displays the current status of any or all B-channels in field 9. These states are:

- 0 Idle
- 1 In use
- 2 In use for far-end test call

- 3 Demand maintenance busy (busy-out from a procedure)
- 4 Auto maintenance busy (busy-out from call processing)
- 5 Far-end maintenance busy
- 6 Trunk in transitory state (T-limbo)

Additional trunk status is available in field 10; for example, if test status = 5, then protocol negotiation is taking place.

Summary of Generic 2 Maintenance Capabilities

A Generic 2 DS1 monitors several status parameters, detects abnormal operations, and depending on their severity generates an appropriate alarm. Furthermore, there are offline diagnostic procedures that may be started either locally or remotely by maintenance personnel. These procedures permit both local and network loopback testing as well as viewing of the monitored status parameters. Some of the status parameters include:

- Interface state-of-health
- Excessive slips
- Excessive misframes
- Loss of frame alignment far end or hyperactivity
- Loss of frame alignment near end (red alarm)
- Loss of signal
- Loss of multiframe alignment near end
- Loss of multiframe alignment far end
- Far-end in loop-around (blue alarm)
- Minor alarm (bit error rate between 10^{-6} and 10^{-3})
- Major alarm (bit error rate greater than 10^{-3})

The error detection capabilities for DS1 facilities are comprehensive. Usually, the transmission network (such as repeaters or multiplexers) will not have as many error detection capabilities as a Generic 2. Therefore, the switch usually detects errors caused by the network facilities, while the facilities do not alarm. Typical problems could be a multiplexer or channel bank that is out of alignment.

NOTE: The DS1 may be optioned for B8ZS line coding format, which generates bipolar violations. Most current generation T1 test sets detect bipolar violations as errors. Therefore, these test-sets cannot be used on facilities that are optioned for B8ZS.

GENERIC 1 MAINTENANCE CAPABILITIES AND CONCERNS

Generic 1 provides the same functional maintenance capabilities (such as error detection, error logging, error testing, and alarm reporting) as Generic 2. However, because of hardware and software differences and because Generic 1 uses the Manager rather than the Manager terminal, there are several user-perceived differences.

For example, Generic 1 maintenance uses the concept known as maintenance objects (MOs). Each type of circuit pack defines one or more MOs. Whenever an error is detected an entry is made in the error log for the particular MO. Furthermore, an alarm level (major, minor, or warning), whether the error was resolved as being on the circuit pack or off the circuit pack (such as a particular trunking facility), and the circuit pack name are all listed in the error log.

NOTE: Generic 1 MOs are similar to Generic 2 fault codes.

Generic 1 Maintenance Procedures

The hardware alarm report may be displayed at the Manager terminal by entering the `display alarms` command. The suggested order for doing maintenance is to clear the alarmed troubles first and then the non-alarmed troubles (that is, major alarms first, minor alarms second, and warnings last). When multiple alarms (of the same level) are on, they should be cleared in the order specified in chapter 8 of the *Generic 1 Maintenance Manual*.

For both DS1/DMI, and ISDN-PRIs, the DS1-BD MO should be investigated first as a means of resolving alarms associated with a DS1 circuit pack. This MO contains a series of tests, both nondestructive and destructive, which may be used to verify the alarms. Specifically, these tests are:

Test 138	<i>Loss of Signal Alarm Inquiry</i> — verifies the synchronization status of a DS1 link
Test 139	<i>Blue Alarm Inquiry</i> — verifies that the distant end is out of service
Test 140	<i>Red Alarm Inquiry</i> — checks the framing status of the link [for example, either out of frame, loss of frame alignment (LFA) alarm, or no red alarm detected]
Test 141	<i>Yellow Alarm Inquiry</i> — checks for a remote end out of frame or far end LFA
Test 142	<i>Major Alarm Inquiry</i>
Test 143	<i>Minor Alarm Inquiry</i>
Test 144	<i>Slip Alarm Inquiry</i>
Test 145	<i>Misframe Alarm Inquiry</i>
Test 146	<i>Translation Update</i> — a destructive test that sends new or updated translations to a DS1
Test 160	<i>Remote-Loop Around</i> — used as part of the process to isolate transmission facility failures

For ISDN-PRI facilities, the ISDN-TRK MO should be investigated to verify the service states of the B-channels. The ISDN-LNK MO may be used to verify correct operation of the D-signaling channel.

Summary of Generic 1 Maintenance Capabilities

Since Generic 1 implements the same DS1, DMI, and ISDN-PRI protocols as Generic 2, both switches provide the same maintenance capabilities. Since Generic 1 DS1s provide comprehensive detection capabilities, the switch usually detects errors caused by network facilities even though an alarm will not trip.

ALARMS

Unlike analog port circuit packs, a DS1 has two categories of alarm signals: circuit-pack-level and facility. Service may be interrupted by either of these alarms. Circuit-pack-level alarms show problems with the circuit pack. Facility alarms show incorrect administration of the interface, cabling between the two switch interfaces, failures in the facility equipment, and performance of the transmission facility. (For facility problems, AT&T maintenance responsibility ends at the network interface.)

Circuit Pack Alarms

There are several types of circuit pack alarms that may arise. These are briefly described next.

Yellow LED

On power-up or initialization, the microprocessor executes a thorough set of tests on the circuit-pack hardware. Failure of any of these initialization tests is shown by a flashing yellow LED. The yellow LED flashes following initialization because of power-up or software requests but does not flash if any failures are detected while the interface is online. Following successful initialization, the yellow LED not flash until the circuit pack is administered and until the D-channel is communicating with the far end. As long as the D-channel is up and communication is established, the LED stays on to show a busy state.

Interface Health

The health alarm is controlled by the microprocessor. If any background tests fail (which the processor runs during normal online operation), the health alarm is set. An example would be a failure of the tests run on the circuits that generate a DS1's signal. If hardware problems exist, then either the circuit pack will fail power-up initialization tests or the health alarm will be raised again within several seconds of power-up initialization. If the health alarm remains off following initialization, a transient problem may be assumed to have caused the health bit to be set.

NOTE: The circuit pack may fail the initialization tests for reasons other than bad hardware. Known cases are port data interface or port data store problems and synchronization subsystem problems. An example of the latter would be an online clock reference that has been externally looped to itself. These problems are evidenced by all DS1s in a module or in the system failing to initialize properly.

Facility Alarms

There are several types of facility alarms that may arise. These are briefly described next.

Excessive Slips

Data received from a DS1 facility is stored (clocked) into buffers on the circuit pack using a clock signal derived from the received signal. Data is read from the same buffers using a clock derived from the master clock. If at any time these two clocks are not phase-locked, data will be stored into the buffers at a rate different from the rate read from the buffers. This results in underflow or overflow of the buffers, called *slips*.

Slips result in the repetition or deletion of one 8-bit word for every channel. The slip rate is monitored by the circuit pack. The slip rate is used to determine if that DS1 being used as the system clock reference is functioning properly. Slips cause pops in voice and voice-grade data signals and can cause errors in digital data signals.

An example for a type of problem that will cause slips is having both switches (at each end of a DS1 facility) administered as timing masters instead of one being a master and the other using the received DS1's signal from the master as a timing reference.

Excessive Misframe and CRC Errors

Misframes and cyclic redundancy check (CRC) errors may be produced by marginal or faulty line repeaters, NCTE, noise on the transmission line, or by the circuitry that generates the framing pattern or CRC at the transmit end.

Bit errors, in a DS1's signal, are detected via misframes when D4 framing is used and via CRC errors when ESF is used.

The microprocessor keeps count of the number of misframe or CRC errors and uses the count to process the minor and major alarms. The misframe or CRC count is used in choosing clock references for the switch. Also, an unterminated transmission line could generate noise that looks like an DS1's signal. The absence of a framing pattern or continuous CRC errors is used to show that it is not a DS1.

LFA Alarm

The receive DS1's signal should contain either the D4 or ESF framing pattern. Which framing pattern is determined by administration details. The ANN35 has two green LEDs that function to show local and remote framing status. Normally, both green LEDs will be on when the near end and far end are framing properly.

When the (top) green LED is off, the near end interface cannot frame up on the DS1's signal. This event is known as the LFA alarm. The LFA alarm is also known as the *red alarm*, because a red LED lights on the D4-channel bank when this alarm is on.

One frequent cause of this alarm is an incorrect setting of the framing option at one end of the transmission facility (for example, the near end set for the D4 and the far end set for ESF, or vice-versa). This scenario will cause the LFA at both ends of the transmission link. Another possible cause is an intermittent or broken cable, or a rain-attenuated signal (with microwave transmission facilities).

The LFA alarm is on for about 10 seconds after detecting a continuous loss of framing and will clear about 15 seconds after restoring the in-frame condition. When the LFA alarm is on, the remote-framing status cannot be ascertained. Therefore, the near end interface transmits the remote frame alarm to the far end interface. Both green LEDs will be off.

Remote Frame Alarm

The remote frame alarm (RFA), when received at the near end, shows that the far end is unable to frame up on the signal sent by the near end (the end receiving this alarm). The far end interface will be in an LFA state.

When the (bottom) green LED is off, the far-end interface cannot frame up on the DS1's signal. This event is known as an RFA. A RFA is also known as the *yellow alarm* because a yellow LED lights on the D4-channel bank when this alarm is on.

This alarm shows that something is wrong with the part of the transmission facility that transmits the DS1's signal from the near end to the far end. This alarm may be caused by a broken conductor in the transmission cable wiring. Figure 8-1, *Facilities Generating the RFA*, shows this scenario.

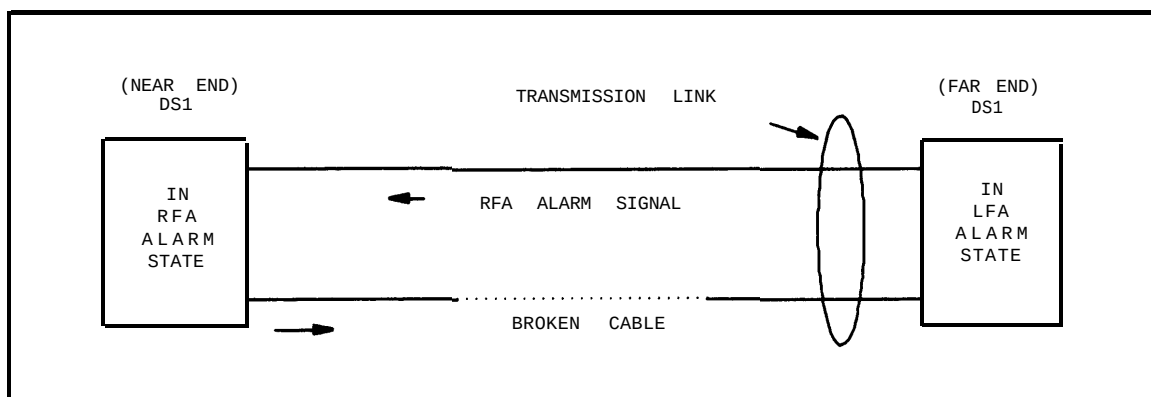


Figure 8-1. Facilities Generating the RFA

Loss of Signal Alarm

The loss of signal (LOS) alarm shows that there is no bipolar signal present at the ISDN-PRI receiver input. This alarm will occur in parallel with the LFA alarm.

A LOS alarm is usually caused by cable-related problems such as a broken pair inside a cable, an intermittent cable at a cross-connect point, or a cable connector not completely seated.

Blue Alarm

The blue alarm shows that maintenance activities are in progress and that the out-of-service condition exists for that DS1 facility. This alarm is recognized as a continuous stream of 1s with no provisions for framing. Depending on the particular NCTE being used, this alarm condition may be treated differently. This condition may result in the NCTE automatically looping the signal back to the switch. If the looped facility is providing synchronization, then the synchronization subsystem must detect that the facility is looped and deal with that condition. Otherwise, synchronization problems will abound.

Beginning with System 85 R2V4, Generic 1.1, and System 75 R1V5 software, if a blue alarm is received from the primary synchronization reference facility, the synchronization software will automatically switch to the secondary reference.

Major and Minor Alarms

The major and minor alarms are relative error performance indicators for a DS1 transmission facility. They are calculated based on the number of misframes or CRC errors that occurred over a set interval. The framing mode that is selected determines whether it is misframes or CRC errors that are counted, and the length of the interval.

Another important performance indicator that is frequently used for determining how well the transmission facility is functioning is known as the *errored second* (ES) count. An ES is simply one second that contained one or more bit errors in the DS1's signal. Although the ISDN-PRI does not provide an ES count directly, table 8-1, *MINOR/MAJOR Alarm to Errored Seconds Conversions*, can be used to convert between major and minor alarms and the equivalent number of ESs that were necessary to cause the alarm.

TABLE 8-1. Minor/Major Alarm to Errored Seconds Conversions

Framing Mode	Alarm Type	Conversion
D4	Minor	$10 \geq \text{ES} \geq 2460$ in 41 minutes
	Major	$\text{ES} > 2$ per second for 15 seconds
ESF	Minor	>1.3 errors per second for 10 minutes
	Major	>320 errors per second for 10 seconds

A. ADMINISTRATION REQUIREMENTS

The following screens detail System 75 (R1V2 and R1V3) special-access administration requirements for implementing a Software Defined Network (SDN), MEGACOM® service, MEGACOM 800 service, and MEGACOM 800 dialed-number identification service (DNIS) connections to a 4ESS configured with 4e9 generic software. All screens are shown with their required or suggested field entries.

NOTE: For System 75, ACCUNET® switched digital service is available only as a special development charge.

DS1 CIRCUIT PACK		Page 1 of 1
Location: (slot location)	Name: (anything)	
Line Compensation: ?	Zero Code Suppression: ZCS	
Framing Mode: D4	Signaling Mode: Robbed-Bit	
DMI-BOS? y		
MAINTENANCE PARAMETERS		
Slip Detection? y	Remote Loop-Around Test? n	

Figure A-1. DS1 Circuit Pack Screen

Line Compensation Relates to the distance between the switch and the network channel-terminating equipment (NCTE), channel-division multiplexer (CDM), channel-expansion multiplexer (CEM), or a digital signal level 1 (DS1) cross connect field (called a *DSX-1*). Refer to System 75 R1V2 under ADMINISTRATION ISSUES for details on selecting the appropriate value.

NOTE: If the switch is equipped with a TN722B and if this connection is to a 4ESS configured with 4e11 generic software, then digital multiplexed interface with bit-oriented signaling (DMI-BOS), extended superframe (ESF) framing, and bipolar with 8-zero substitution (B8ZS) line coding may be selected as options.

Special access connections are always via digital 4-wire ear and mouth (E&M) tie trunks. At the 4ESS, and for MEGACOM service applications, this trunk type is called *PBX* (1-way outgoing trunks). At the 4ESS, these PBX trunk types are translated for DTMFWK type signaling.

TRUNK GROUP		Page 1 of 5
Group Number: (number assigned)	Group Type: tie	SMDR Reports? y
Group Name: MEGACOM	COR: 1	TAC: 189
Direction: 1-way out	Outgoing Display? y	Data Restriction? n
Dial Access? y	Busy Threshold: 60	Night Service: ____
Queue Length: 0	Internal Alert? n	Incoming Destination: ____
Comm Type: voice		
TRUNK PARAMETERS		
Trunk Type(in/out): wink/wink	Incoming Rotary Timeout(sec): 5	
Outgoing Dial Type: tone	Incoming Dial Type: tone	
Digit Treatment: ____	Disconnect Timing(msec): 500	Digits: ____
Used for DCS? n	PBX ID: 1	
ACA Assignment? n	Long Holding Time(hours): 1	
Short Holding Time(secs.): 10	Short Holding Threshold: 15	
Baud Rate: ____	Synchronization: ____	Duplex: ____
Incoming Dial Tone? _	Maintenance Test? y	
Answer Supervision Timeout: ____	Suppress # Outpulsing? n	

Figure A-2. Trunk Group Screen, Page 1 (MEGACOM)

NOTE: If this connection is to a 4ESS configured with 4e9 software, then rotary must be used rather than touch-tone (tone). The general assumption is that a 4ESS will be configured with 4e10 or later software.

At the 4ESS, and for MEGACOM 800 service applications, this trunk type is called *PBX* (1-way incoming trunks). At the 4ESS, these PBX trunk types are translated for DTMFWK type signaling. The *Digits* and *Digits Treatment* fields may or may not be translated depending on the local numbering plan and other addressing requirement or restrictions for a 4ESS toll office.

TRUNK GROUP		Page 1 of 5
Group Number: (number assigned)	Group Type: tie	SMDR Reports? y
Group Name: MEGACOM 800	COR: 1	TAC: 189
Direction: 1 -way in	Outgoing Display? y	Data Restriction? n
Dial Access? y	Busy Threshold: 60	Night Service: ____
Queue Length: 0	Internal Alert? n	Incoming Destination: ____
Comm Type: voice		
TRUNK PARAMETERS		
Trunk Type(in/out): wink/auto	Incoming Rotary Timeout(sec.): 5	
Outgoing Dial Type: ____	Incoming Dial Type: tone	
	Disconnect Timing(msec): 500	
Digit Treatment: ____	Digits: ____	
Used for DCS? n	PBX ID: 1	
ACA Assignment? n	Long Holding Time(hours): 1	
Short Holding Time(secs.): 10	Short Holding Threshold: 15	
Baud Rate: ____	Synchronization: ____	Duplex: ____
Incoming Dial Tone? _	Maintenance Test? y	
Answer Supervision Timeout: ____	Suppress # Outpulsing? n	

Figure A-3. Trunk Group Screen, Page 1 (MEGACOM 800)

At the 4ESS, and for MEGACOM 800 DNIS service applications, this trunk type is called *PBX* (1-way incoming trunks). At the 4ESS, these PBX trunk types are translated for DTMFWK type signaling. The *Digits* and *Digits Treatment* fields may or may not be translated depending on the local numbering plan and other addressing requirements or restrictions for a 4ESS toll office. Generally, the *Incoming Destination* field will be administered with either a 4- or 7-digit number, or no number at all. Exact details depend on how the service is engineered from the toll office and numbering plan limitations of the customer premises switch.

TRUNK GROUP		Page 1 of 5
Group Number: (number assigned)	Group Type: tie	SMDR Reports? y
Group Name: MEGACOM 800 DNIS	COR: 1	TAC: 189
Direction: 1-way in	Outgoing Display? y	Data Restriction? n
Dial Access? y	Busy Threshold: 60	Night Service: ____
Queue Length: 0	Internal Alert? n	Incoming Destination: ____
Comm Type: voice		
TRUNK PARAMETERS		
Trunk Type(in/out): wink/auto	Incoming Rotary Timeout(sec): 5	
Outgoing Dial Type: ____	Incoming Dial Type: tone	
	Disconnect Timing(msec): 500	Digits: ____
Digit Treatment: ____	PBX ID: 1	
Used for DCS? n	ACA Assignment? n	Long Holding Time(hours): 1
Short Holding time(secs.): 10		Short Holding Threshol: 15
Baud Rate: ____	Synchronization: ____	Duplex: ____
Incoming Dial Tone? -		Maintenance Test? y
Answer Supervision Timeout: ____		Suppress # Outpulsing? n

Figure A-4. Trunk Group Screen, Page 1 (MEGACOM 800 DNIS)

At the 4ESS, and for SDN service applications, this trunk type is called *PBX* (typically 2-way trunks). However, both 1-way incoming and 1-way outgoing trunk groups may be translated. At the 4ESS, these PBX trunk types are translated for DTMFWK type signaling. The *Digits* and *Digits Treatment* fields may or may not be translated depending on the local numbering plan and other addressing requirements or restrictions for a 4ESS toll office.

TRUNK GROUP

Page 1 of 5

Group Number: (number assigned)Group Type: tieSMDR Reports? y
Group Name: SDN COR: 1TAC: 189
Direction: two-wayOutgoing Display? yData Restriction? n
Dial Access? yBusy Threshold: 60Night Service: ____
Queue Length: 0Internal Alert? nIncoming Destination: ____
Comm Type: voice

TRUNK PARAMETERS

Trunk Type(in/out): wink/winkIncoming Rotary Timeout(sec): 5
Outgoing Dial Type: toneIncoming Dial Type: tone
Disconnect Timing(msec): 500
Digits: ____
Digit Treatment: ____
Used for DCS? nPBX ID: 1
ACA Assignment? nLong Holding Time(hours): 1
Short Holding Time(secs.): 10Short Holding Threshold: 15
Baud Rate: ____Synchronization: ____Duplex: ____
Incoming Dial Tone? _Maintenance Test? y
Answer Supervision Timeout: ____Suppress # Outpulsing? n

Figure A-5. Trunk Group Screen, Page 1 (SDN)

SYNCHRONIZATION PLAN

Page 1 of 1

SYNCHRONIZATION SOURCE (DS1 circuit pack location)
Primary: ____Secondary: ____
DS1 CIRCUIT PACKS

Location	Name	Slip	Location	Name	Slip
---	-----	-	---	-----	-
---	-----	-	---	-----	-
---	-----	-	---	-----	-
---	-----	-	---	-----	-
---	-----	-	---	-----	-
---	-----	-	---	-----	-

Figure A-6. Synchronization Plan Screen

Primary	System 75 must obtain synchronization timing from a 4ESS. Typically, the carrier slot location for the DS1 connecting to a 4ESS is used as the primary source. The switch must also be equipped with a TN741.
Secondary	If multiple DS1s are present in a System 75 and are connected to this or other 4ESSs, then it may be desirable to enter their slot locations as a secondary synchronization source. Refer to chapter 5, <i>Synchronization of Digital Network Facilities</i> , for details.
Location	Circuit pack slot location (as required)
Name	Enter the facility name (if applicable)
Slip	Generally, DS1 facilities are very stable. Therefore, in most applications, a y should be entered.

B. SAMPLE INSTALLATION AND MAINTENANCE PROBLEMS

Based on field experience, most problems can be categorized into three general areas:

- Translations-based problems
- Synchronization-related problems
- Physical interfacing connection problems

This appendix is organized so that there are additional subject subheadings within each category. The organization is as follows:

Translations-based problems

Facility formats

Trunks and trunk groups

Channel-division multiplexers (CDMs)

Channel-expansion multiplexers (CEMs)

D4-channel banks

Synchronization-related problems

Loss of or no synchronization

Leavenworth loop (timing loop)

D4 synchronization problems

Digital central office (CO) synchronization problems

DACS

Physical interfacing connection problems and recommended solutions

TRANSLATIONS-BASED PROBLEMS

Although these translation problems are primarily related to System 85, the concepts and diagnostic procedures are also applicable to System 75.

The administration of digital signal level 1 (DS1) and digital multiplexed interface (DMI) trunks and trunk groups is similar to that for analog trunks. The same rules for determining trunk type and trunk signaling apply. The differences are that a digital port circuit pack (ANN11_) and the transmission facility characteristics must be translated using procedure 260. Also, procedure 116, rather than procedure 150, is used for assigning the trunk group members to the port locations. These two new procedures and the additional consideration they require make a DS1/DMI a radical departure from analog trunks in terms of:

- Versatility
- Complexity of installation
- Administration
- Operation
- Type of alarms

When a DS1/DMI facility fails to operate (because of a line failure), the first choice in diagnosing the problem is to check the translations. Mistakes in translating procedure 260 are identified by comparing the translations and equipment options from one DS1/DMI and all intermediate equipment to the other DS1.

NOTE: Procedure 260 has one field entry that affects the fault codes displayed in procedure 620. External loop-around is used only during fault isolation in procedure 620 test 2. Normal operation requires this field to be off or 0. Leaving this field set to a 1 results in a fault code of 364 being logged against a DS1 circuit pack continuously.

The following are examples of DS1/DMI facility specifications. First, figure B-1, *Incorrect Translations (Procedure 260)*, shows incorrect translations. Figure B-2, *Correct Translations (Procedure 260)*, shows correct translations. Later examples will show options that will work but cause irrelevant fault codes to be logged in maintenance. Each application requires appropriate option selections based on characteristics of the equipment used and the desired requirements.

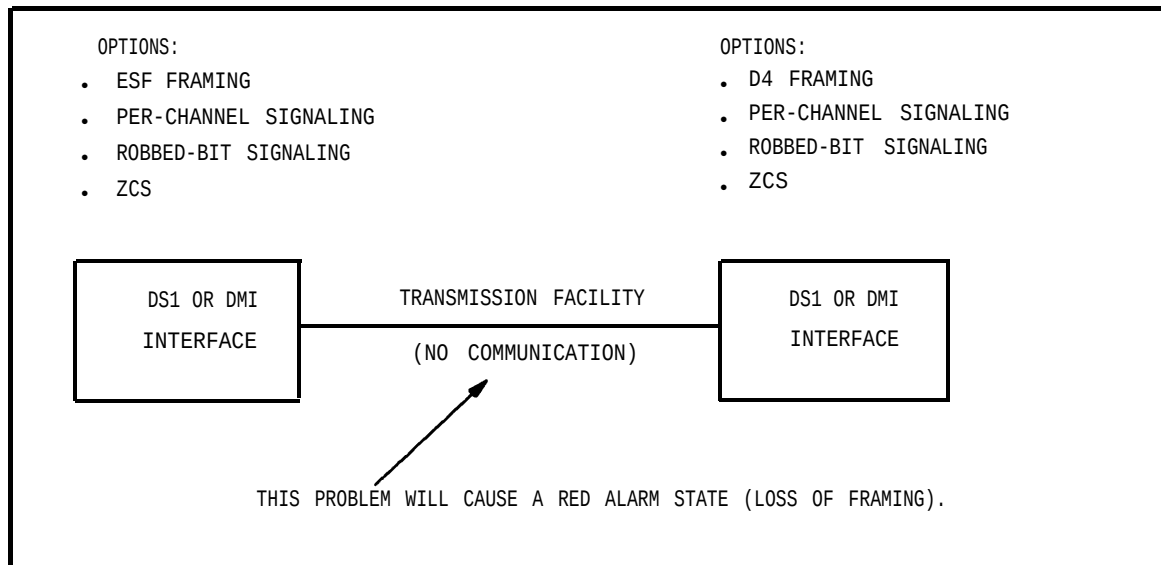


Figure B-1. Incorrect Translations (Procedure 260)

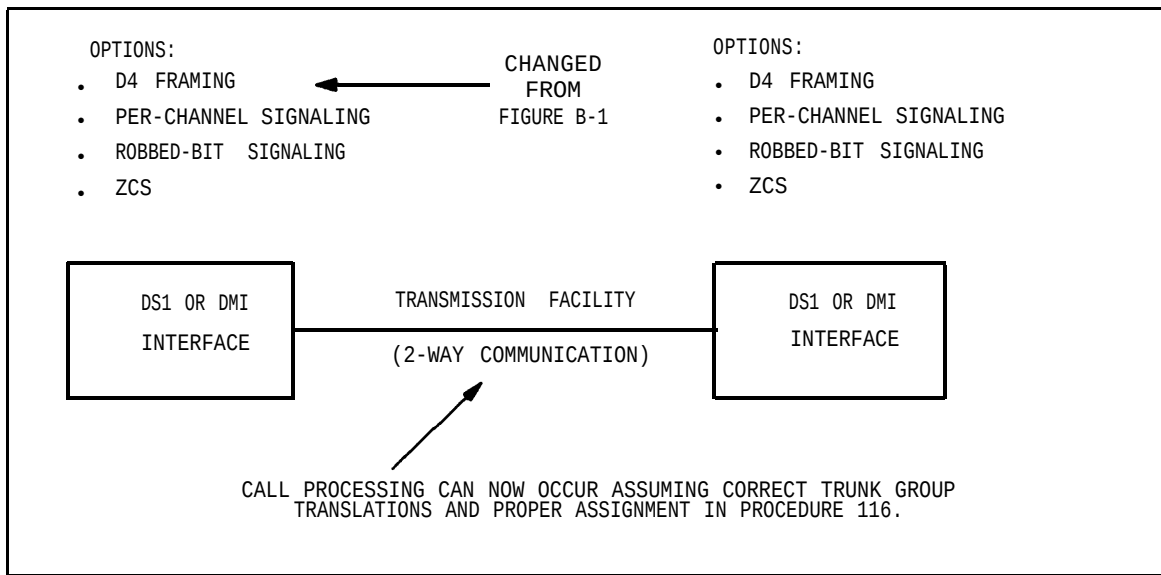


Figure B-2. Correct Translations (Procedure 260)

TRUNKS AND TRUNK GROUPS

Mistakes in translating procedure 116 are not readily evident. The first indication that a problem exists may not occur until the customer complains of call completion failures.

Table 7-1, *DS1 Administration — Channel Versus Line Assignments*, and table 7-2, *Trunks Supporting Signaling Type 20*, list the DS1 channel number assignments versus slot and circuits for System 85. Each end of a DS1 facility must match the assignment of trunks (or off-premises station (OPS) lines) at the other end. For example, if channels 1 through 12 are to be trunk type 75 and channels 13 through 24 are to be trunk type 36, then the assignments must be the same at each end. If location A implements the type 75 trunk starting at slot/circuit location 0/0 and location B incorrectly implements the type 75 trunk starting at slot/circuit location 5/0, then a DS1 facility will come up and appear to operate. However, because of the translations mismatch and trunk signaling incompatibilities, the facility will never support a call between the two locations.

Figure B-3, *Incorrect Assignment of Trunks*, shows this type of scenario showing an incorrect match of translations. Figure B-4, *Correct Assignment of Trunks*, shows a correct translations match.

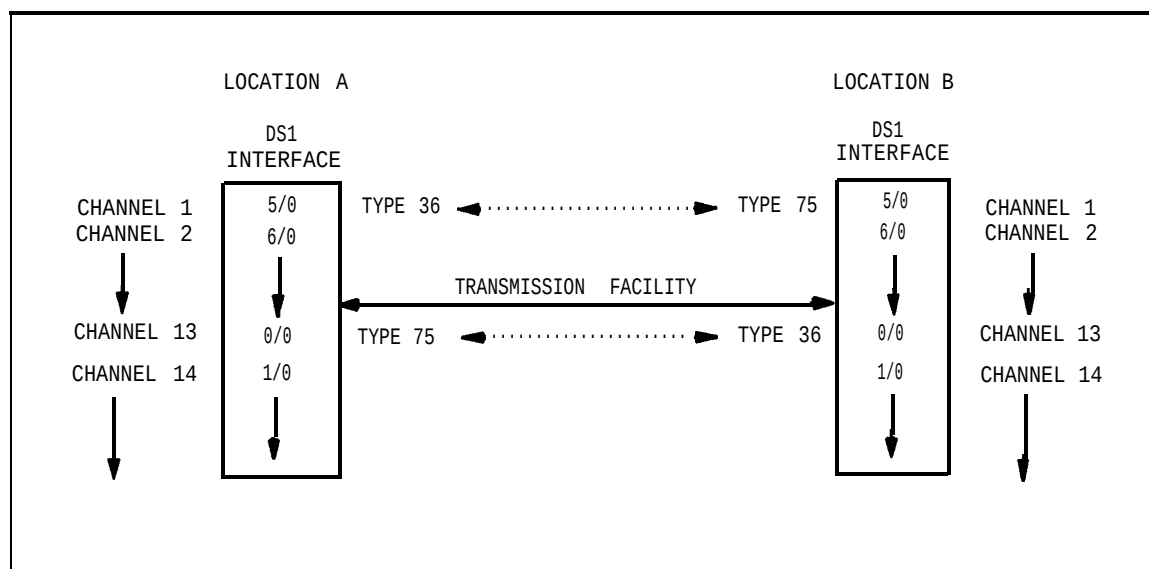


Figure B-3. Incorrect Assignment of Trunks

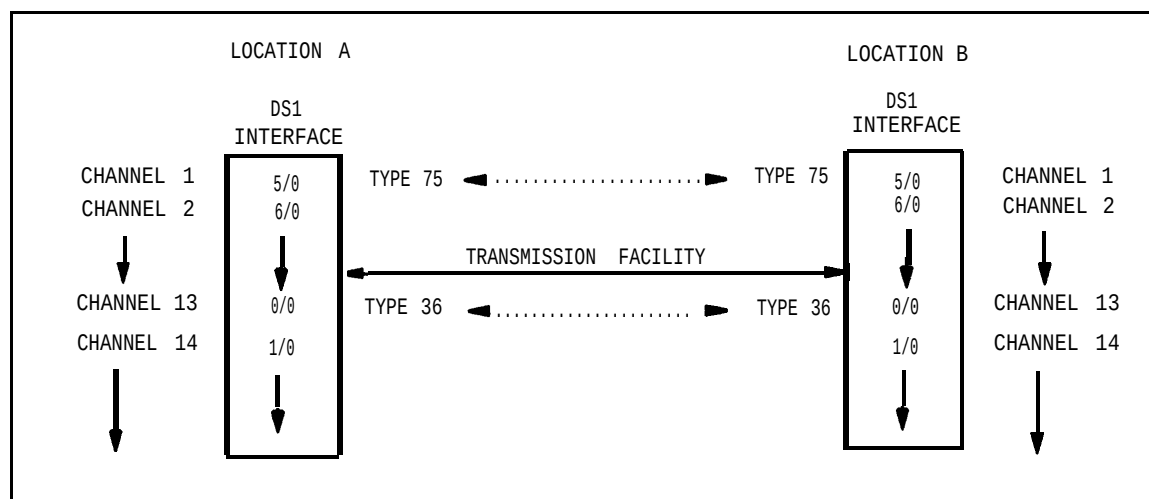


Figure B-4. Correct Assignment of Trunks

Figure B-1, *Incorrect Translations (Procedure 260)*, is an extreme case for this type of problem. A more likely scenario for the problem would be for the trunk assignments to be off by one or two channels, causing from two to four trunks to fail.

When using CEMs (such as the BCM32000) and CDMs in a DS1/DMI network of System 85s and System 75s, you must strictly adhere to the rules for administering procedure 260 and procedure 116.

NOTE: Due to the increased complexity of engineering networks using CEMs and CDMs, all installations using these transmission products are currently engineered by the Regional Engineering Centers (REC) or National Engineering Center (NEC). It is the responsibility of

the REC or NEC to ensure compatibility between these devices and the associated communications systems.

CDMs

The CDM is used to drop or insert one or more DS1/DMI channels from the transmission facility. These channels may be used for external data or voice applications, depending on the channel units that are used in the CDM. Channel 1, for example, can be selected for drop or insert by the CDM. Channels 2 through 24 would then be left for use by the switch endpoints. Figure B-5, *System 75 or System 85 with CDMs*, shows a CDM configuration.

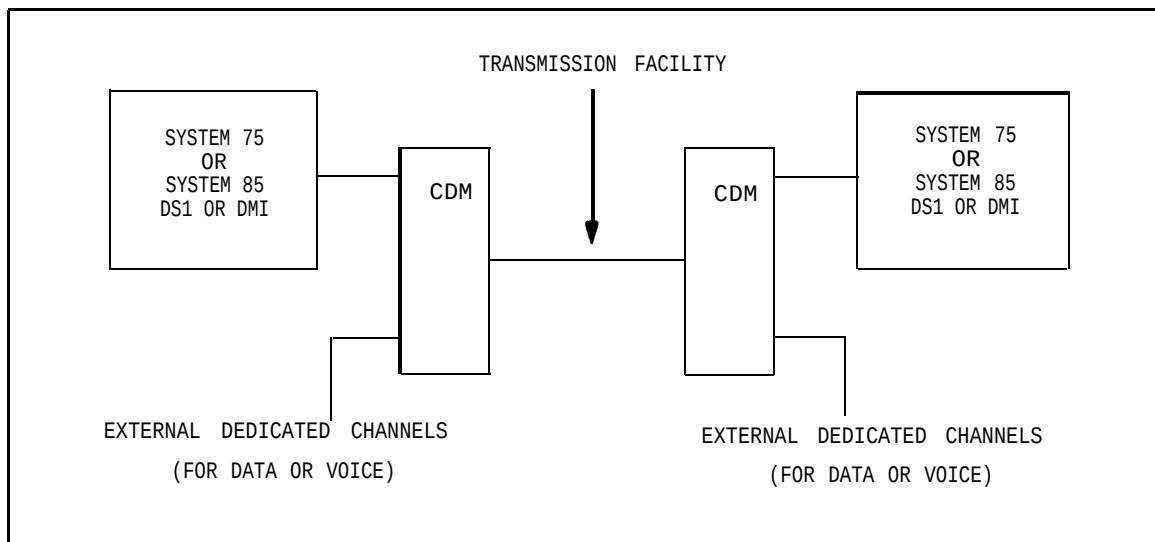


Figure B-5. System 75 or System 85 with CDMs

The effects of translations to the endpoint switches is in accommodating the channels used by the CDM. The recommended method is to translate those channels, which are drop/inserted, into an unused (dummy) trunk group.

CEMs

The CEM takes the output of two DS1/DMIs and compresses them for transmission on one facility. Compression of two DS1 facilities can be as simple as translating 48 voice-grade trunks with robbed-bit signaling or as complex as the mixing of compressed voice-grade trunks with uncompressed alternate voice/data (AVD) trunks and using bundling signaling between the CEMs. Figure B-6, *Translation Effects on the CEM*, shows a simple CEM configuration using two DS1 facilities from each switch. The DS1/DMIs on each switch must be translated the same, and compatible options must be administered for the CEMs (for example, the CEMs must match one another).

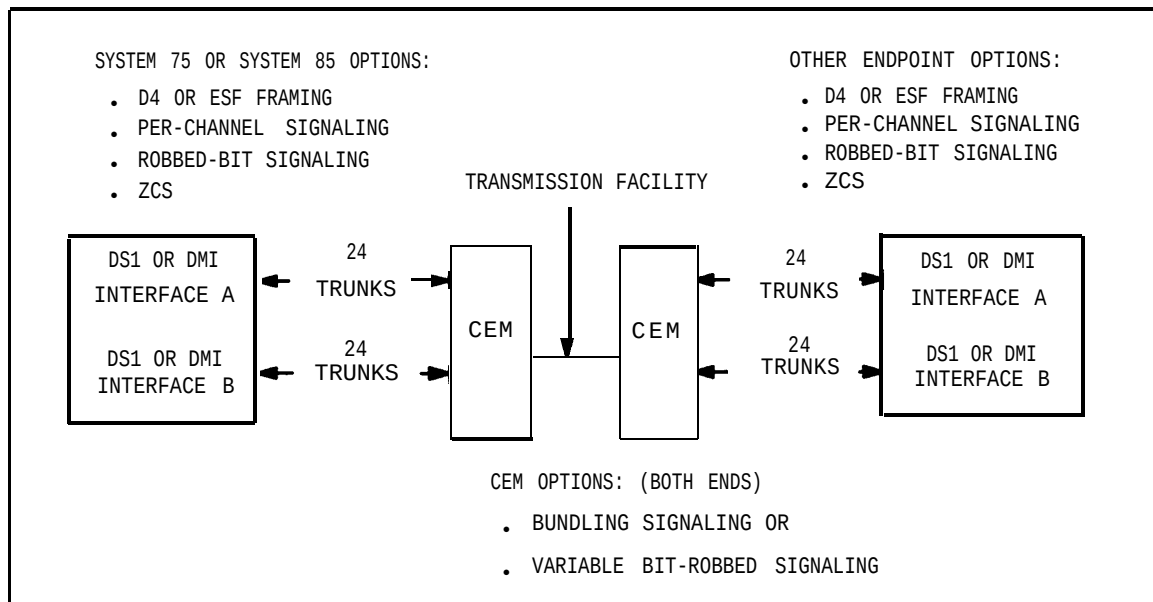


Figure B-6. Translation Effects on the CEM

Robbed-bit signaling (for a DS1) can be used either with variable bit-robbed signaling, or with bundling-mode signaling on both CEMs. For CEMs, the recommended or preferred signaling option is bundling.

A complex installation would involve a mixture of compressed and uncompressed channels. The CEM must be optioned for bundling-mode signaling to transmit digital data (AVD-type trunk groups). The switch translations must match one another to ensure an exact channel-to-channel correspondence. Voice-grade trunks (which are compressible) should be assigned to one DS1/DMI, while digital data trunks should be assigned to the other DS1/DMI. Figure B-7, *Arrangement for a Complex CEM Installation*, shows a complex CEM arrangement.

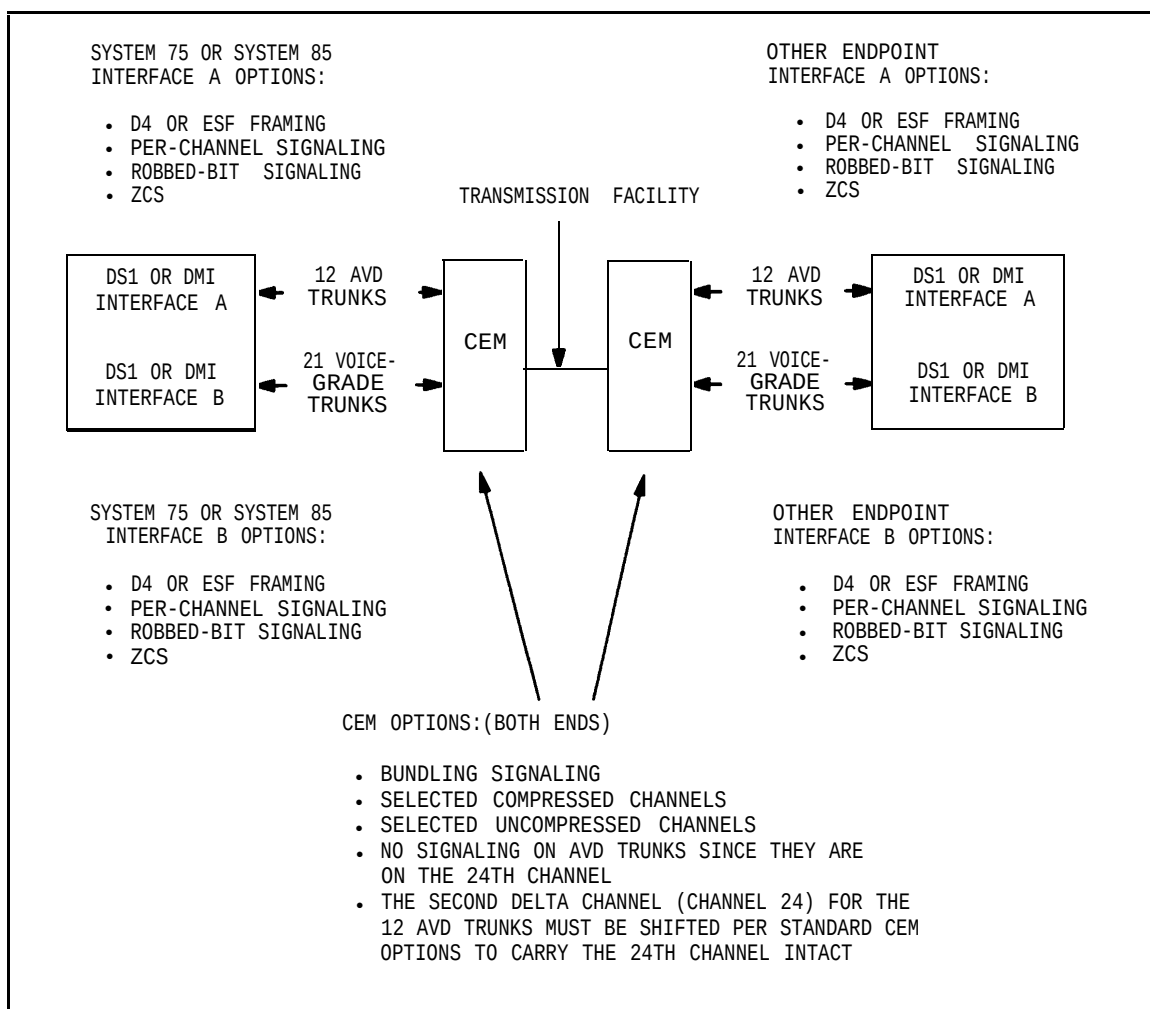


Figure B-7. Arrangement for a Complex CEM Installation

NOTE: Although it is possible to mix compressed and uncompressed channels with the variable bit-robbled signaling option installed in the CEM, this arrangement is not recommended because the compressed channels are restricted to analog data. Bundling signaling is always the recommended option.

D4-Channel Banks

The D4-channel banks used with System 75 and System 85 networks require simple translations. However, there are pitfalls. The D4-channel banks use individual plug-in circuit packs for each channel (trunk interface). System 75 or System 85 DS1/DMI connected to a D4-channel bank must be compatible with those installed plug-in channel units. It is recommended that unused channels (in a System 75 or System 85) be placed in an unused (dummy) trunk group. Figure B-8, *System 75/System 85 to a D4-Channel Bank*, shows a System 75/System 85 connection to a D4-channel bank.

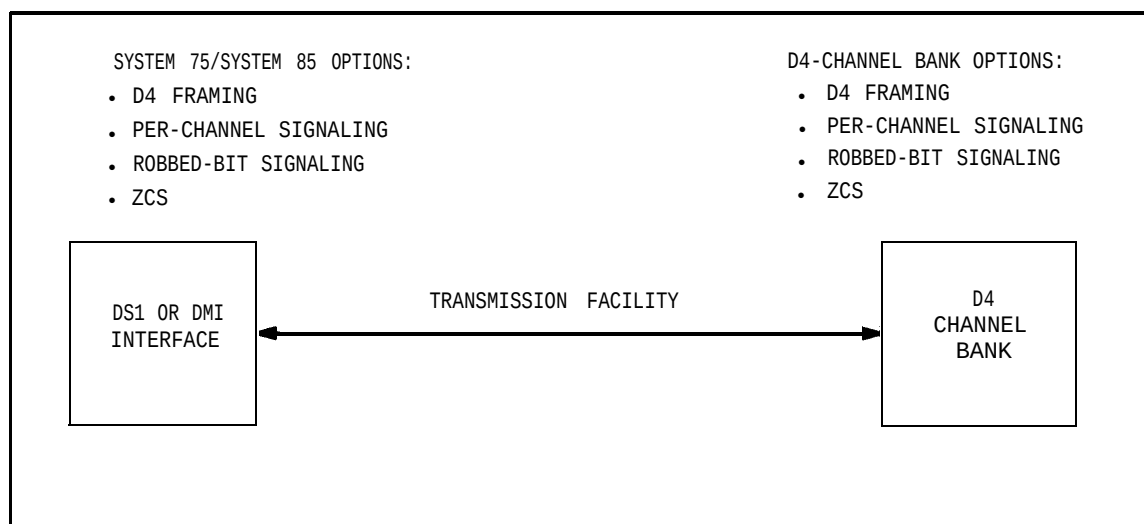


Figure B-8. System 75/System 85 to a D4-Channel Bank

Channels 1 through 24 may be used for almost any combination of trunks. Trunk compatibility is ensured by translating each channel to match the channel unit installed in the D4.

All trunks are translated in pairs, and the D4 must be equipped accordingly.

It is not advisable to use the spare slots in a channel bank for the storage of unused channel units.

SYNCHRONIZATION-RELATED PROBLEMS

Digital networking with customer-premises digital switches has placed new requirements for planning and evacuation on the network designer and installer. Each digital switch must now be synchronized to every other digital switch, digital CO (when applicable), and other DS1 transmission equipment. The NEC or REC should be involved in planning the network and at the same time come up with a network synchronization plan.

Synchronization is coordinated timing. A System 75 or System 85 digital switch and other DS1 transmission products all contain an internal timing source. The timing (clock) source conforms to standards of accuracy that place the clock in a category of accuracy (timing hierarchy). The lower the number of the stratum clock, the higher the accuracy. Therefore, a system with a stratum-4 clock would take its timing from a stratum 3 or a stratum 4, a stratum 3 from a stratum 2 or a stratum 3, and a stratum 2 from a stratum 1 or a stratum 2.

System 75, System 85, CEM, CDM, and D4-channel banks all have internal clocks of stratum-4 accuracy. The most basic rule of synchronization is that timing for all networked products is derived from the lowest-numbered clock connected (via DS1 facilities) to the device. Synchronization is not usually a problem when connecting (via DS1 facilities) to a digital CO. Synchronization problems occur most often in private networks; that is, those networks that do not have any DS1 connections to equipment outside the private network.

Loss of or No Synchronization

Without synchronization, a digital interface runs on its own internal clock. If both ends of a DS1/DMI facility (both DS1s) run on their internal clock, timing differences (slips) occur. Digital transmission, either analog data (modem) or digital data, is disrupted at very low slip rates. Voice transmission can be disrupted at high slip rates, such as when a stratum-4 clock and a stratum-2 clock are connected without the stratum-4 clock being slaved to the stratum 2. Figure B-9, *Internal Timing (No Synchronization)*, shows this arrangement.



Figure B-9. Internal Timing (No Synchronization)

Neither primary or secondary synchronization references are assigned in either switch.

Leavenworth Loop

The Leavenworth loop is a synchronization loop in which two devices on a DS1 transmission facility (typically the two DS1s) are administered to obtain timing from one another. For both System 75 and System 85, this condition renders the transmission facility unusable, and, for System 85, can result in loss of dial tone and apparent time-multiplexed switch (TMS) failures. Figure B-10, *Leavenworth Loop on the Primary Reference*, shows the Leavenworth loop (timing loop) problem.

In this example there is no master reference. Each switch has been administered to take its synchronization from the other. The timing loop is removed by making a device the source of timing for the other.

The Leavenworth loop problem could also occur with three or more switch locations and on a secondary reference facility. For this scenario, either a customer premises switch or a local or network CO is used as the primary reference (master). Switch locations A and B both reference each other for their secondary synchronization source. The failure of any one DS1 facility would not be catastrophic; but the loss of the switch at location C would mean that the primary for both A and B has failed. Both A and B would switch to their secondary reference. Since the secondary reference is incorrectly administered and would create a Leavenworth loop, both locations A and B would fail. Figure B-11, *Leavenworth Loop on the Secondary Reference*, shows this scenario.

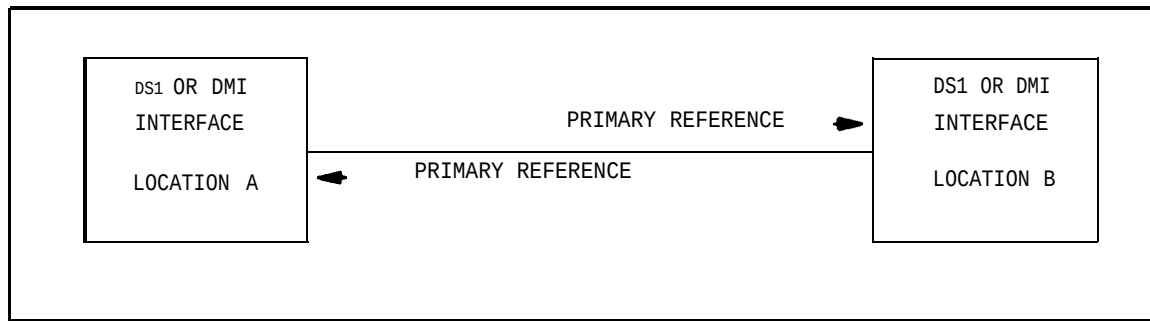


Figure B-10. Leavenworth Loop on the Primary Reference

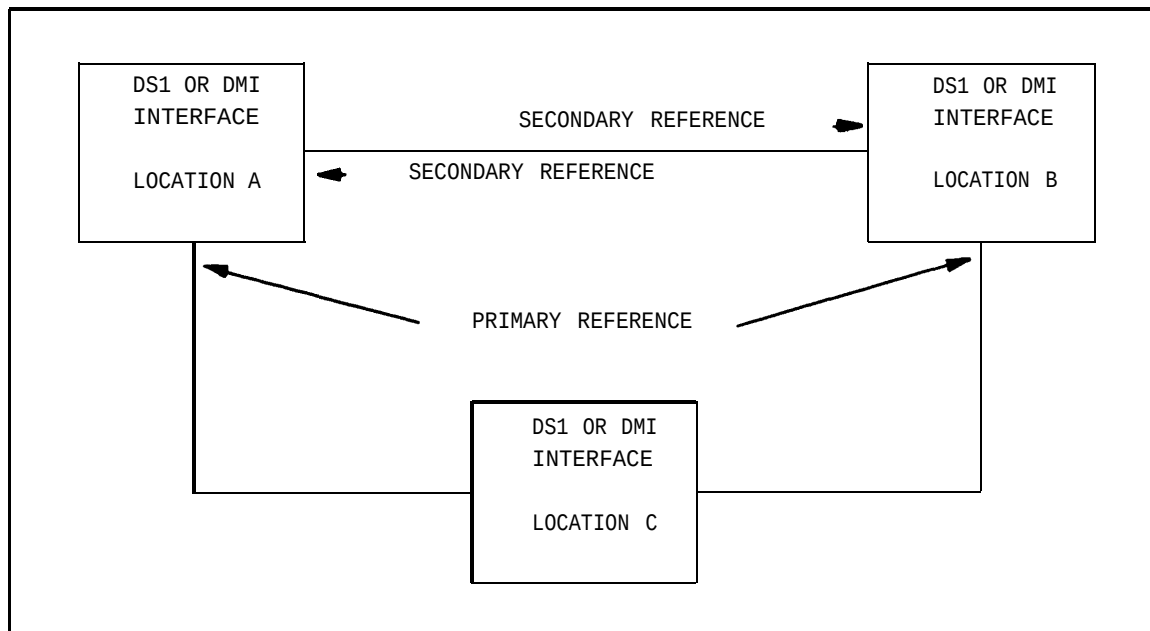


Figure B-11. Leavenworth Loop on the Secondary Reference

Make no assumptions when synchronizing digital networks; don't take any aspect of synchronization for granted and avoid Leavenworth loops. It is better to suffer the problems from high slip rates than to risk losing all services provided by the switch.

It is necessary that the network synchronization diagram be maintained and be available at all switch locations.

D4 Synchronization Problems

The D4-channel banks are used in a variety of applications. Primarily, these include interfacing an analog switch or analog CO to a digital switch. The D4-channel bank is capable of internal stratum-4 timing, or loop timing via the office interface unit (OIU-1/OIU-2) circuit pack located in the

common equipment shelf of the D4. External timing may only be optioned from the OIU-2. Loop timing should be selected (digital switch as the master reference) in every instance but one: when a lower stratum clock is available to time the D4-channel bank externally. Figures B-12, *No Synchronization Reference Assigned at Location A*, and B-13, *No, Primary, or Secondary Sync Reference Assigned at Location A*, show these arrangements.

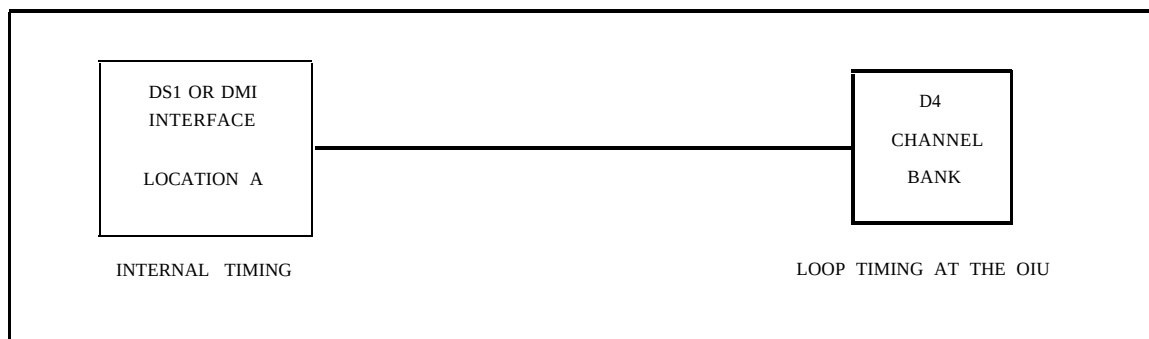


Figure B-12. No Synchronization Reference Assigned at Location A

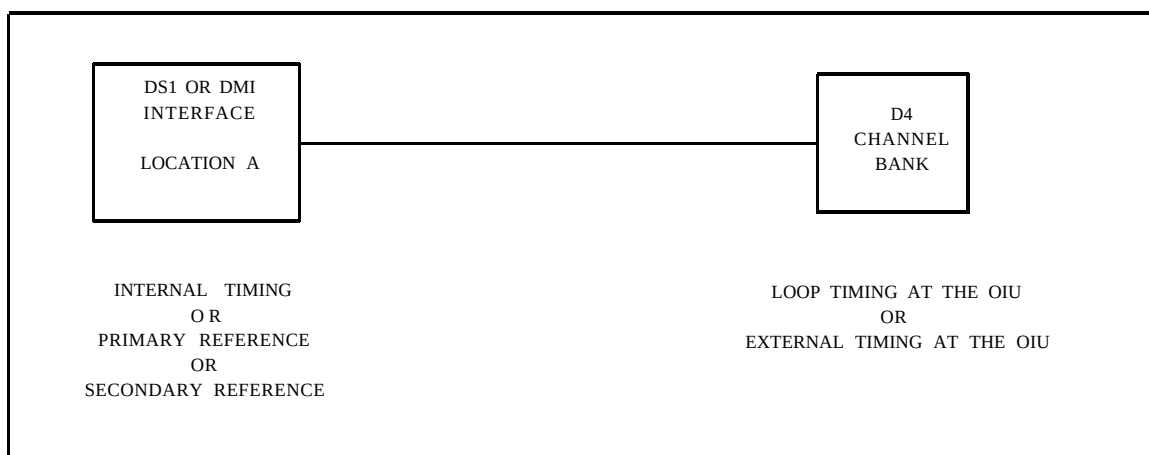


Figure B-13. No, Primary, or Secondary Sync Reference Assigned at Location A

Synchronization remains an issue when interfacing with COs. An analog CO (such as a 1A ESS) does not have an internal clock compatible with DS1, nor does it have a direct DS1. Normally, the CO is interfaced to a DS1/DMI via a D4-channel bank. The local exchange company (LEC) may or may not have a DS1 reference available for connection to customer facilities. The options are expanded, but the issues are the same as when the D4 is located on customer premises; it is either timed from the customer premises switch A or it is externally timed.

Digital CO Synchronization Problems

Synchronization of DS1 links into a digital CO presents far fewer problems. When a DS1/DMI facility is connected directly into a digital interface circuit pack in the CO, then the only questions are:

1. Is the CO reference (stratum clock) a stratum 3 or better?
2. Is that reference compatible with any other reference available to the System 75 or System 85?

Figure B-14. *Compatible Synchronization References*, shows this arrangement.

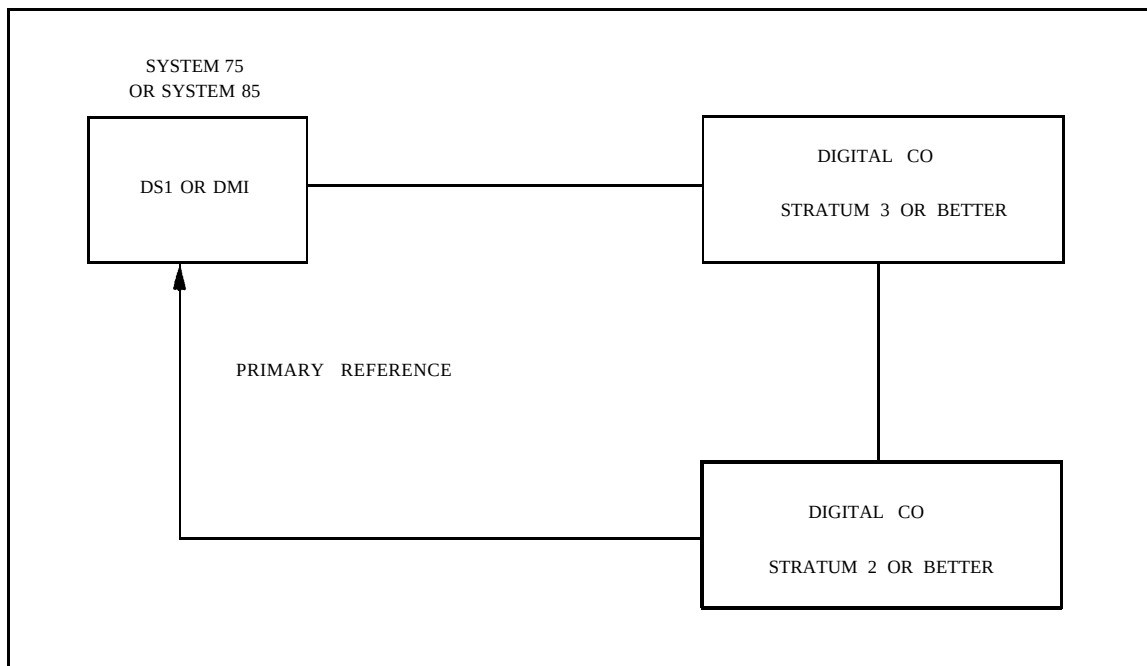


Figure B-14. Compatible Synchronization References

This is an extreme example since most digital COs derive their timing from the AT&T standard reference frequency. However, this example is a possibility when connecting to COs within smaller LECs. Resolution of this type problem is to provide stratum-2 or better clocking to the other CO.

DACS

Synchronization with the digital access and cross-connect system (DACS) is generally straightforward. A System 75 or System 85 will be synchronized to the DACS or higher-stratum clock. The only caution is with the DACS customer-controlled reconfiguration. This reconfiguration permits the customer to switch the DS1/DMI facility between other DS1 facilities at the DACS. During the switching interval, it is possible for System 75 or System 85 to change from its primary reference to its secondary reference, or even to its internal clock. If this should happen, it will only exist for a short period of time before reverting back to the primary reference. This problem should not occur

for System 85s that are configured with the ANN11C version 8 or later circuit pack. Figure B-15, *Synchronization from DACS Node*, shows a configuration that obtains synchronization from a DACS.

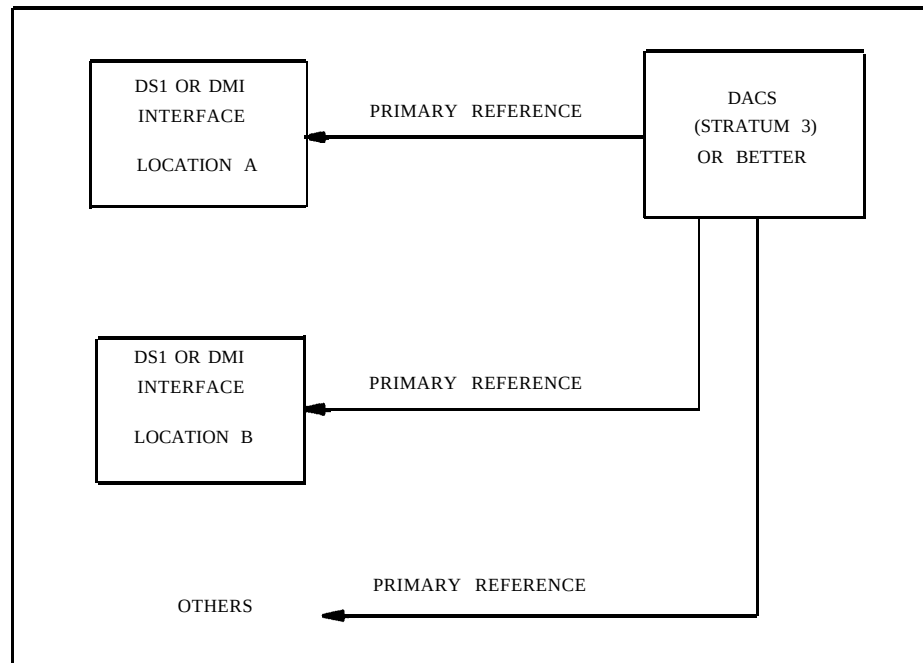


Figure B-15. Synchronization from DACS Node

TYPICAL PHYSICAL INTERFACE CONNECTION PROBLEMS

The physical interface from a DS1/DMI circuit pack carrier-cabinet to the transmission facility (such as the type of cable and cable group numbers) is primarily determined by:

- Version of the switch and vintage of the circuit pack
- Type of transmission facility (such as on-premises, off-premises, metallic, or nonmetallic)
- Any optional transmission products that might be in the circuit

Initially and for the first several System 85s that provided DS1 service, all DS1 connections were engineered using special shielded cable (type DCC-5/24-TSA cable). This arrangement was incompatible with the premises distribution system (PDS) and also presented problems for supporting DMI connections to compatible computers. There were other incompatibilities between various products in terms of connectors and connector pin assignments.

To fix these problems and establish compatibility across several products, new cable groups were developed. These cable groups specify a standard set of pin assignments for four different connector types. The connector and connection types are the:

- 25-pair flat ribbon connector (manufactured by Amphenol Products)
- 15-pin D-type connector
- Wire-lugs for screw terminal connections
- 8-pin modular jack

Table B-1, *50-Pin (25-Pair) Connector Configurations*, shows the 25-pair connector pin assignments. Table B-2, *System 75 Versus System 85 Cable Comparisons*, shows the various types of permitted cables.

TABLE B-1. 50-Pin (25-Pair) Connector Configurations

(INITIAL) SYSTEM 85 DS1 OR DMI PINOUT FOR 50-PIN CONNECTOR			(PDS COMPATIBLE) SYSTEM 75/85 PINOUT FOR 50-PIN CONNECTOR		
PIN NUMBERS		FUNCTION	PIN NUMBERS		FUNCTION
1	⋮ 26	RECEIVE	22	⋮ 47	RECEIVE
4	⋮ 5	TRANSMIT	23	⋮ 48	TRANSMIT
6	⋮ 31	LOOPBACK	24	⋮ 49	LOOPBACK
OTHERS NOT USED			OTHERS NOT USED		

TABLE B-2. System 75 Versus System 85 Cable Comparisons

CABLE/CONNECTORS (NOTE 1)	(INITIAL OR OLD)		(PDS COMPATIBLE)	
	SYSTEM 85	(NOTE 2)	SYSTEM 85 (NOTE 2)	SYSTEM 75
INTRACABINET	GR 335-337		GR 367-369 (NOTE 3)	N/A
50- TO 15-PIN	GR 117		GR 180 OR GR 380	C6C
50 TO WIRE-LUGS	GR 357		GR 370 OR GR 380	C6D
50- TO 50-PIN	GR 135		GR 181 OR GR 380	C6F (NOTE 4)

NOTES:

1. These are special purpose shielded cables. Cable specifications for 50- to 80-pin cables do not currently exist.
2. All System 85 DS1/DMI cables are from ED-1E433; specify required length. Certain restrictions apply regarding use of (or connecting) the old cable groups with the new cable groups. These restrictions apply because old cable groups use different cable pairs than the new cable groups. (Refer to table B-1.)
3. The groups 367, 368, and 369 carrier backplane to cabinet I/O field cables will not change when the group 380 cable is used. The group 380 25-pair Amphenol connector, which mates to the port cabinet, contains jumpers from pins 1 to 22, 4 to 23, 5 to 48, and 26 to 47. Therefore, transmit and receive leads for both CR 335-337 and GR 367-369 are tied together and the GR 380 cable will work regardless of the interconnect cable used.
4. System 75 has a 50-to 50-pin extension cable (C6E) which is available in 100-foot lengths.

Table B-3, *15-Pin Connector Arrangement (System 75/85 Perspective)*, shows the 15-pin connector arrangement.

TABLE B-3. 15-Pin Connector Arrangement (System 75/85 Perspective)

DS1 OR DMI PINOUT FOR 15-PIN CONNECTOR		
PIN NUMBERS COLOR		FUNCTION
1 BR	9 W/BR	TRANSMIT
3 GR	11 W/GR	RECEIVE
5/6 SL-?	13 W/SL	LOOPBACK
OTHERS NOT USED		

The loopback (remote test) leads are normally open (NO) between pins 5 and 13, and normally closed (NC) between pins 6 and 13. There are two types of 8-pin modular jacks. The RJ48X contains a shorting bar that is disconnected when the jack is inserted into the plug. The RJ48C jack is identical to the RJ48X except for the shorting bar. This interface has been accepted as the ISDN basic access connector and is now being recommended as an optional ISDN-PRI connector. Table B-4, *8-Position Modular Jack Pin Assignments (System 75 and System 85 Perspective)*, shows the 8-position connector pin assignments.

TABLE B-4. 8-Position Modular Jack Pin Assignments (System 75 and System 85 Perspective)

DS1 OR DMI PINOUT FOR 8-PIN MODULAR JACK (NOTE 1)		
PIN NUMBERS		FUNCTION
1	2	RECEIVE
3	6	LOOPBACK (NOTE 2)
4	5	TRANSMIT
OTHERS NOT USED		

NOTES:

1. The modular jack may be either the RJ48C or the RJ48X connector.
2. Signal leads 3 and 6 are unused or used for loop feedback.

Specific Cabling Options

System 75 only uses the new or PDS compatible pinouts. Therefore, cabling problems for two colocated System 75 switches are rare. The connection may be made using standard PDS cable (group 300) or via type DCC-5/24-TSA cable. In summary, the four applications that may use PDS cable are as follows:

1. Between two System 75s
2. Between a System 75 and a System 85 — dependent on other considerations
3. Between two System 85s — dependent on other considerations
4. Between a System 75/85 and a DMI host

Where colocated equipment and direct connections (such as to a DMI host) are involved, use a *null modem* cable. That is, the transmit pair on one end should connect to the receive pair on the opposite end. When NCTEs, CDMs, or CEMs are used, the transmit and receive signals are reversed automatically.

System 85 DS1/DMI to System 85 DS1/DMI — Colocated Arrangement

How this connection is made depends on the vintage or suffix of each DS1. The ANN11B or ANN11C line drivers do not comply with FCC emission standards. Therefore, if the ANN11B or ANN11C are used at one or both ends, this connection may only be implemented by using type DCC-5/24-TSA cable.

Type DCC-5/24-TSA cable is required when the ANN11B/C is used. Either PDS compatible or type DCC-5/24-TSA cable is applicable when the ANN11D or later suffix is used.

As a basic guide for the interconnection of any ANN11_ circuit pack, when group 380 cables are used, it is never necessary to determine the group number of the intracabinet cable. Therefore, the use of group 380 cables is the preferred option. When group 380 cables are not used, the interconnect cable used (GR 357 or GR 370) depends on the intracabinet cable used (GR 335-337 or GR 367-369). Refer to table B-1, *50-pin (25-pair) Connector Configurations*, for additional details. Cable group numbers must be coordinated at both ends. Any mixing of old and new cable groups will prohibit the connection from being established.

All cable groups are from drawing ED1E434-11.

Permitted Cabling Combinations
Using cable GR-380: ANN11C/D/E ↔ [335-337] ↔ GR-380 ↔ [335-337] ↔ ANN11C/D/E ANN11C/D/E ↔ [335-337] ↔ GR-380 ↔ [367-369] ↔ ANN11C/D/E ANN11C/D/E ↔ [367-369] ↔ GR-380 ↔ [367-369] ↔ ANN11C/D/E
Using old cable groups: ANN11C/D/E ↔ [335-337] ↔ 357 ↔ [335-337] ↔ ANN11C/D/E
Using new cable groups: ANN11C/D/E ↔ [367-369] ↔ 370 ↔ [367-369] ↔ ANN11C/D/E
NOTE: The null modem function must be locally engineered.

Permitted Cabling Combinations Using PDS

Using cable GR-380:

NOTE: When using PDS wiring, the easiest approach is to connect the port cabinets at each end to a cross-connect field (XCF) using GR-380 cables.

With this arrangement, it is not necessary to determine the group number of the intracabinet cable.

ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ GR-380 ↔ [335-337] ↔ ANN11D/E
 ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ GR-380 ↔ [367-369] ↔ ANN11D/E
 ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ GR-380 ↔ [367-369] ↔ ANN11D/E

When at least one end does not use the GR-380 cable, the following combinations will work.

ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ [367-369] ↔ ANN11D/E
 ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 357 ↔ [335-337] ↔ ANN11D/E
 ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ [367-369] ↔ ANN11D/E
 ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ [367-369] ↔ ANN11D/E
 ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 357 ↔ [335-337] ↔ ANN11D/E
 ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ [367-369] ↔ ANN11D/E

Using old cable groups:

ANN11D/E ↔ [335-337] ↔ 357 ↔ XCF ↔ PDS ↔ XCF ↔ 357 ↔ [335-337] ↔ ANN11D/E

Using new cable groups:

ANN11D/E ↔ [367-369] ↔ 300 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ [367-369] ↔ ANN11D/E
 ANN11D/E ↔ [367-369] ↔ 300 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ [367-369] ↔ ANN11D/E
 ANN11D/E ↔ [367-369] ↔ 370 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ [367-369] ↔ ANN11D/E

Using a mix of old and new cable groups:

ANN11D/E ↔ [335-337] ↔ 357 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ [367-369] ↔ ANN11D/E
 ANN11D/E ↔ [335-337] ↔ 357 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ [367-369] ↔ ANN11D/E

System 85 DS1/DMI to System 75 DS1/DMI — Colocated Arrangement

Permitted Cabling Combinations
Using cable GR-380: ANN11C/D/E ↔ [335-337] ↔ GR-380 ↔ System 75 ANN11C/D/E ↔ [367-369] ↔ GR-380 ↔ System 75
Using old cable groups: Connections using cable group 357 will not work.
Using new cable groups: ANN11C/D/E ↔ [367-369] ↔ 370 ↔ System 75

Permitted Cabling Combinations Using PDS
Using cable GR-380: ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ GR-380 (or C6D) ↔ System 75 ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ GR-380 (or C6D) ↔ System 75 ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ System 75 ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ System 75 ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ System 75 ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ System 75
Using old cable groups: Connections using cable group 357 will not work.
Using new cable groups: ANN11D/E ↔ [367-369] ↔ 300 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ System 75 ANN11D/E ↔ [367-369] ↔ 300 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ System 75 ANN11D/E ↔ [367-369] ↔ 370 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ System 75
Using a mix of old and new cable groups: ANN11D/E ↔ [335-337] ↔ 357 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ System 75 ANN11D/E ↔ [335-337] ↔ 357 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ System 75

System 85 DMI to Host Computer

Permitted Cabling Combinations
Using cable GR-380: ANN11D/E ↔ [335-337] ↔ GR-380 ↔ DMI-Host ANN11D/E ↔ [367-369] ↔ GR-380 ↔ DMI-Host Using old cable groups: Connections using cable group 357 will not work.
Using new cable groups: ANN11D/E ↔ [367-369] ↔ 370 ↔ DMI-Host

Permitted Cabling Combinations Using PDS
Using Cable GR-380: ANN11D/E ↔ [335-337] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ GR-380 ↔ DMI-Host ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ GR-380 ↔ DMI-Host ANN11D/E ↔ [335-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ DMI-Host ANN11D/E ↔ [335-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ DMI-Host ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ DMI-Host ANN11D/E ↔ [367-369] ↔ GR-380 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ DMI-Host
Using old cable groups: Connections using only group 357 cables will not work.
Using new cable groups: ANN11D/E ↔ [367-369] ↔ 300 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ DMI-Host ANN11D/E ↔ [367-369] ↔ 300 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ DMI-Host ANN11D/E ↔ [367-369] ↔ 370 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ DMI-Host
Using a mix of old and new cable groups: ANN11D/E ↔ [335-337] ↔ 357 ↔ XCF ↔ PDS ↔ XCF ↔ 300 ↔ DMI-Host ANN11D/E ↔ [335-337] ↔ 357 ↔ XCF ↔ PDS ↔ XCF ↔ 370 ↔ DMI-Host

System 85 DS1/DMI Direct to a NCTE

Permitted Cabling Combinations
Using Cable GR-380: ANN11C/D/E ↔ [335-337] ↔ GR-380 ↔ NCTE ANN11C/D/E ↔ [367-369] ↔ GR-380 ↔ NCTE
Using old cable groups: ANN11C/D/E ↔ [335-337] ↔ 117 ↔ NCTE
Using new cable groups: ANN11C/D/E ↔ [367-369] ↔ 180 ↔ NCTE

System 85 DS1/DMI-BOS to a CEM or CDM

Permitted Cabling Combinations
Using cable GR-380: ANN11C/D/E ↔ [335-337] ↔ GR-380 ↔ CEM/CDM ANN11C/D/E ↔ [367-369] ↔ GR-380 ↔ CEM/CDM
Using old cable groups: ANN11C/D/E ↔ [335-337] ↔ 135 ↔ CEM/CDM
Using new cable groups:" ANN11C/D/E ↔ [367-369] ↔ 81 ↔ CEM/CDM

C. ADMINISTRATION PROCEDURE SUMMARY

This appendix examines administrative procedures in DEFINITY® Generic 2 that relate to ISDN-PRI. It describes how pertinent administrative fields relate to ISDN-PRI level-3 message contents and general feature operation.

This appendix is organized in ascending administrative-procedure number. Differentiations are made between System 85 R2V4 and Generic 2 where appropriate.

PROCEDURE 000 WORD 3 (Generic 2 Only)

Field 1 of this word assigns the bearer capability (BC) class of service (COS) number for the extension number. One implication of this COS is the pattern or preference selected for this extension on outgoing calls (see the *Procedure 309 Word 5* and *Procedure 321 Word 5* sections later in this appendix).

The 10 BCs are defined in field 16 of procedure 014, word 1. This definition codes the BC information element (IE) in the setup message when the extension (entered in field 1 of procedure 000, word 3) accesses an ISDN-PRI trunk for an outgoing call.

The following defines the encoding of the BC IE for the 10 possible BCs.

Voice	Opcode: 4 (assuming no codeset mapping) Information transfer capability: speech Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode Layer and protocol identification: CCITT Mu-law speech (layer 1)
Mode 1	Opcode: 4 (assuming no codeset mapping) Information transfer capability: restricted digital information Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode Layer and protocol identification: rate adaption as specified in 1.461 (layer 1) User rate: 56K-bps Synch/asynch: synch
Mode 2	Opcode: 4 (assuming no codeset mapping) Information transfer capability: restricted digital information Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode

Mode 3	Opcode: 4 (assuming no codeset mapping) Information transfer capability: either unrestricted digital information or restricted digital information depending on the translation specified for the bearer capability COS in field 15 of procedure 014, word 1. Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode
Mode 0	Opcode: 4 (assuming no codeset mapping) Information transfer capability: either unrestricted digital information or restricted digital information depending on the translation specified for the bearer capability COS in field 15 of procedure 014, word 1. Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode
Voice Grade Data	Opcode: 4 (assuming no codeset mapping) Information transfer capability: 3.1 K-Hz audio (modem) Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode Layer and protocol identification: CCITT Mu-law speech (layer 1) User rate: coded according to the translation entered in field 14 of procedure 014, word 2. Synch/Asynch: coded according to the translation entered in field 11 of procedure 014, word 2.
Unknown Digital	Opcode: 4 (assuming no codeset mapping) Information transfer capability: either unrestricted digital information or restricted digital information depending on the translation specified for the BCCOS in field 15 of procedure 014, word 1. Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode Layer and protocol identification: CCITT Mu-law speech (layer 1) User rate: undefined Synch/Asynch: asynch
Unknown Analog	Opcode: 4 (assuming no codeset mapping) Information transfer capability: speech Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode Layer and protocol identification: CCITT Mu-law speech (layer 1)
Mode 3/2	Opcode: 4 (assuming no codeset mapping) Information transfer capability: restricted digital information Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode

X.25	Opcode: 4 (assuming no codeset mapping) Information transfer capability: unrestricted digital information Coding standard: CCITT Information transfer rate: coded to a 0 Transfer mode: packet mode Layer and protocol identification: recommendation X.25 link level (LAPD) (layer 2) Layer and protocol identification: recommendation X.25 packet level (layer 3)
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PROCEDURE 000 WORD 4 (System 85 R2V4 & Generic 2)

Field 4 of this word is used to assign an NPA-NXX designator to an extension or range of extensions. If an extension is not assigned an NPA-NXX designator, calls originated from this extension over ISDN-PRI trunks do not have a calling party number IE in the setup messages. Likewise, calls terminating to this extension over ISDN-PRI trunks do not have connected number IEs in the connect messages.

The same designator can be assigned to a range of extensions via one change execute operation if no unassigned numbers are within the entered range (see the *Procedure 354 Word 3* section in this appendix for more information).

PROCEDURE 010 WORD 4 (System 85 R2V4 & Generic 2)

This word is used to assign ISDN routing parameters to extensions for both System 85 R2V4 and Generic 2, and to associate a BC for extensions for System 85 R2V4.

ISDN Routing Parameters (System 85 R2V4 & Generic 2)

For System 85 R2V4, field 4 of this word applies; for Generic 2, it is field 3.

While many parameters are associated with route selection (for example, Facility Restriction Levels or FRLs, compatible match of BCs, and clear channel versus restricted channel), the effect of the ISDN routing parameter field as it relates to route selection is discussed next. There are three possible encodes that may be entered in the applicable field:

- 0 Use any available facility in a pattern. For example, based on the specific dialed digits, you could have a call routed to a specific pattern that may have one or more preferences. The first available trunk found in the highest preference will be used (for example, 1 is a higher preference than 2 and 2 is a higher preference than 3). Therefore, if an available trunk is found in preference 1, it is used.

- 1 Use an ISDN-PRI trunk exclusively. When routed to a specific pattern, the first available ISDN trunk found in the highest preference is used. Non-ISDN trunk group preferences are skipped in the routing algorithm. If an ISDN-PRI trunk group is not translated in this pattern, the calling party hears intercept tone.

This encode can be used to ensure that an ISDN digital trunk is used for a certain set of users (such as high-speed data endpoints).

- 2 Use an ISDN trunk if one is available; otherwise use a facility of another type. The routing algorithm selects the first available ISDN trunk of the highest preference; otherwise it selects the first available non-ISDN trunk of the highest preference associated with the pattern.

Using this encode can, when possible, provide user-to-user information for a particular call (such as transporting of calling party name and number). When it is not possible to provide this information, call completion can still be achieved by selecting a non-ISDN facility.

BC (System 85 R2V4 Only)

Field 3 of this word is used to assign a BC to a class of extensions. The available encodes specify a BC of :

- 0 Voice or voice-grade data
- 1 Mode-1 data
- 2 Mode-2 data
- 3 Mode-3 data
- 4 Mode-0 data

The assigned BC influences how the BC IE is coded for the setup message. The following defines the encoding of the BC IE for the 10 possible BCs.

Voice or Voice Grade Data

Opcode: 4
Information transfer capability: speech
Coding standard: CCITT
Information transfer rate: 64K-bps
Transfer mode: circuit mode
Layer and protocol identification: CCITT Mu-law speech (layer 1)

Mode 1

Opcode: 4
Information transfer capability: restricted digital information
Coding standard: CCITT
Information transfer rate: 64K-bps
Transfer mode: circuit mode
Layer and protocol identification: rate adaption as specified in I.461 (layer 1)
User rate: 56K-bps

Mode 2	Opcode: 4 Information transfer capability: restricted digital information Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode
Mode 3	Opcode: 4 Information transfer capability: restricted digital information Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode
Mode 0	Opcode: 4 Information transfer capability: restricted digital information Coding standard: CCITT Information transfer rate: 64K-bps Transfer mode: circuit mode

PROCEDURE 012 (System 85 R2V4 & Generic 2)

This procedure is used to assign names to extension users or trunk groups. This data is used in building the Display IE used in setup and connect messages. If data is not assigned for a calling party using an ISDN-PRI trunk, a display IE is not created.

The following are some basic rules on the display IE:

1. If an extension user originates a call over an ISDN-PRI trunk, the name assigned the user in procedure 012 is used for the Display IE.
2. On a call tandeming through the switch where both the calling and called trunks are ISDN-PRI, the display IE received over one trunk (if there is one) is tandemed over the other trunk. That is, on this type of call a display IE is never created by the switch.
3. On an interworked tandem call through the switch (that is, one trunk ISDN-PRI and one trunk not ISDN-PRI), the display IE is built from the name associated with trunk group of the non-ISDN-PRI trunk.
4. If an attendant originates or receives a call over an ISDN-PRI facility, the string operator is used to build the display IE.

PROCEDURE 100 WORD 1 (System 85 R2V4 & Generic 2)

Field 6 of this word is used to define the trunk type of a specific trunk group.

For ISDN trunk groups as well as other types of trunk groups, the entered type defines feature operation for the trunk group. For example, if a trunk group is assigned the type of 19, incoming calls over this trunk group are routed to the attendant console. On Direct Inward Dial (DID) trunk-type groups, the switch expects station-number digits on all incoming trunks; on tie-trunk-type groups, the switch can handle either station-number digits or network numbers.

For an ISDN trunk group, a dynamic trunk type (120) can be assigned to the group. This trunk type allows the group to process calls with a different trunk type on a call-by-call (CBC) basis. For example, one incoming call over the group may expect station number digits (such as a MEGACOM call), while the next call over the group may expect a network number (such as a Software Defined Network call, also called a SDN call).

This trunk type allows flexibility in processing calls as opposed to a static trunk type. Both an Automatic Alternate Routing/Automatic Route Selection (AAR/ARS) prefix digit (procedure 103) and a DID additional digit (procedure 101) can be administered for ISDN dynamic trunk groups. (This cannot be done for any other type of trunk group.) The dynamic trunk type is recommended in CBC service.

Rules for Trunk Type 120 (System 85 R2V4 & Generic 2)

The following rules are used to determine how to process an incoming call over a trunk group whose type is ISDN dynamic:

1. If a network-specific facility (NSF) IE is present in the setup message and the feature/service indication is service, then:
 - If the service indicated is SDN, electronic tandem network (ETN), or private line, process the call like a call with a trunk type of 46.
 - Otherwise, process the call like a call with a trunk type of 31.
2. If either an NSF IE is present in the setup message and the feature or service indication is feature, or there is no NSF at all, the following rules are used to determine trunk type (these rules are based on the interface endpoint translated for the applicable channel in field 10 of procedure 116):
 - If the endpoint specified is **PBX**, process the call with a trunk type of 41.
 - If the endpoint specified is **host computer**, process the call with a trunk type of 108.
 - If the endpoint specified is **network**, process the call with a trunk type of 31.

PROCEDURE 100 WORD 2 (Generic 2 Only)

Field 1 of this word specifies the trunk group number and field 2 specifies a BCCOS number for this trunk group.

For interworked tandem calls through the switch where the calling trunk is not ISDN-PRI trunk and the called trunk is, the BCCOS of the non-ISDN-PRI trunk is used to define a BC for the outgoing setup message over the ISDN-PRI trunk. (See the section in this appendix entitled *Procedure 000 Word 3*, for encodings of the BC IE.)

This COS also defines other routing parameters. These parameters are discussed in the *Procedure 309 Word 5* and *Procedure 321 Word 5* sections of this appendix.

PROCEDURE 100 WORD 3 (System 85 R2V4 & Generic 2)

- Field 2 Used to assign a trunk group as ISDN-PRI that has ISDN-PRI signaling (type 20). This causes ISDN-PRI message-oriented signaling (MOS) to occur for the trunk group.
- Field 3 Not applicable for ISDN-PRI trunk groups. ISDN-PRI specifications explain the procedures to be used when glare is encountered. These specifications are implemented in the ISDN-PRI feature code.
- Field 8 Used to prevent the sending of various IEs over the trunk group specified in field 1. If the entry in this field is 0, there is no restriction on sending IEs over the trunk group.

For System 85 R2V4, this field controls whether the following IEs are sent or not sent:

- Connected number
- User-to-user
- Calling-party number
- Display
- Logical link identification
- Traveling class mark (TCM)
- Link-layer parameters
- Packet-layer parameters
- Look-Ahead Interflow

For Generic 2, this field allows or prevents the sending of the following IEs:

- Connected number
- Low-layer compatibility
- Calling-party number
- Display
- Logical-link identification
- TCM
- Link-layer parameters
- Packet-layer parameters
- Look-Ahead interflow

PROCEDURE 103

- Field 14 This field is called digit collection for both System 85 R2V4 and Generic 2. This field must be set to 1 for all trunk groups whose signaling type is DMI ISDN MOS (type 20). This insures that all outgoing address digits are collected before the switch selects an outgoing ISDN-PRI trunk and assuring that a correct called party number IE in the outgoing setup message.

Field 15 BC (System 85 R2V4 Only). For ISDN-PRI this field comes into play on interworked tandem calls through the switch where the calling trunk is non-ISDN-PRI and the called trunk is ISDN-PRI. Here, the BC of the non-ISDN trunk is used to define a BC that is used in the outgoing setup message over the ISDN-PRI trunk. See the *BC* section for encodings of the BC IE.

The BC is also used to determine which ARS/AAR route to select. This is discussed in the *Procedure 309 Word 5* and *Procedure 321 Word 5* sections later in this appendix.

PROCEDURE 107 WORD 1 (System 85 R2V4 & Generic 2)

This procedure is used to assign terminating test line telephone number digits to ISDN-PRI trunk groups. When placing a trunk verification by station (TVS) or trunk verification by customer (TVC) test call, these digits are used to build the called party number IE in the setup message for the trunk group under test. If digits are not translated for a trunk group and a TVC/TVS call is made for a channel in this trunk group, the resulting called party number IE will not contain address digits.

Called-Party Number IE (System 85 R2V4 & Generic 2)

The following rules are used in building this IE. These rules apply to all types of calls made out of the switch and not just test calls. The rules are checked by the system in the order shown below. The first true rule encountered results in the IE being built as shown for that rule.

For international calls (that is, a dial 011 calls)	Opcode: 7 (assuming no codeset mapping) Numbering plan identification: telephony numbering plan Type of address: international number (address digit octets follow)
For ARS calls	Opcode: 7 (assuming no codeset mapping) Numbering plan identification: telephony numbering plan Type of address: national number (address digit octets follow)
For calls placed over a channel whose interface endpoint in procedure 116 specifies network	Opcode: 7 (assuming no codeset mapping) Numbering plan identification: telephony numbering plan Type of address: national number (address digit octets follow)
For AAR calls and calls placed over a channel whose interface endpoint in procedure 116 specifies either host or PBX	Opcode: 7 (assuming no codeset mapping) Numbering plan identification: private numbering plan Type of address: unknown (address digit octets follow)

PROCEDURE 108 WORD 1 (System 85 R2V4 & Generic 2)

This procedure is used to assign the terminating test-line telephone digits to an ISDN-PRI trunk group. These are the address digits used to build the called party number IE in the setup message when making a demand test call via procedure 648 test 3. If digits are not translated, address digits do not appear in the IE.

The coding rules for the called party IE given in the *Procedure 107 Word 1* section of this appendix also apply to this word.

PROCEDURE 116 WORD 1 (System 85 R2V4 & Generic 2)

This procedure is used to assign ISDN-PRI B-channels to trunk groups.

NOTE: Ensure that the interface endpoint field is assigned correctly for each B-channel.

Field 10 determines the encoding of the called party IE as discussed in the *Procedure 107 Word 1* section of this appendix. If the B-channel is in an ISDN dynamic trunk group, this field determines how an incoming call over the trunk is processed (see the *Procedure 100 Word 1* section earlier in this appendix).

Field 11 (Generic 2 only) Specifies the D-channel group associated with the channel. This information is used in constructing the channel identification IE.

PROCEDURE 210 WORD 2 (System 85 R2V4 & Generic 2)

Field 5 of this word is used to assign an NPA-NXX designator to an attendant console. If an attendant console is not assigned this designator, calls originated from this console over an ISDN-PRI trunk do not have a calling party number IE in the setup message. Likewise, calls terminating to this console over ISDN-PRI trunks do not have connected number EIs in the connect messages (see the *Procedure 354 Word 3* section of this appendix).

PROCEDURE 260 WORD 1 (System 85 R2V4 & Generic 2)

This procedure is used to assign DS1 or ISDN characteristics to physical locations. Setting field 14 (application type) to 5 enables ISDN functionality for the specified physical location.

PROCEDURE 262 WORD 1 (System 85 R2V4 & Generic 2)

This procedure defines various ISDN board parameters. Default values are automatically assigned when a board is added in procedure 260 with an application type of **ISDN-PRI**.

Field 5 of this word specifies an interface type of network or user. For an ISDN-PRI point-to-point link to function, one end must be translated as network and the other end as user.

This field also determines how glare is handled on this board. The following rules apply to glare handling:

- P Requests the channel as a preferred channel (this is done in the channel identification IE of the setup message)
- E Requests the channel exclusively (this is done in the channel identification IE of the setup message)
- U Specifies that the switch's side of the interface is the user side
- N Specifies that the switch's side of the interface is the network side
- X Specifies that it is not important which is the network side or the user side
- 1 Specifies that the incoming call gets the channel and outgoing call waits to be negotiated
- 2 Specifies that the outgoing call gets the channel and the switch negotiates the incoming call to another channel
- 3 Outgoing call gets the channel and the switch gives a release (REL) complete (COM) on the incoming call
- 4 Specifies that the incoming call gets the channel and the switch waits for the other end of the interface to respond (the switch would expect the other end of the interface to reject its outgoing call attempt)

TABLE C-1. Internal Definition Translations

Internal Definition	Channel Characteristic on Outgoing Call From Switch	Channel Characteristic on Incoming Call to Switch	Result
X	P	E	1
X	E	P	2
N	P	P	2
U	P	P	1
N	E	E	3
U	E	E	4

NOTE: Generic 2 calls request channels as preferred except for ISDN-DCS calls which requests channels as exclusive.

Field 6 of this word controls whether level-2 and level-3 tests may be performed on this board via procedure 648.

Field 7 of this word identifies the terminal endpoint for an ISDN-PRI board (this must always be translated as 0).

Fields 8, 9, and 10 of this word define T203, T200, and N200 respectively. By varying these fields, the level-3 timer values can be changed. N200 and T200 affect the T303, T305, T308, and T313 timers according to the following equation:

$$(\text{timer value}) = (N200 + 1) * T200$$

The default value of these four timers is 4 seconds $[(3 + 1) * 1]$.

T321 is defined as $T203 + 10$ seconds. As T203 defaults to 30 seconds, T321 is defined as a 40 second timer.

Field 13 of this word applies only to Generic 2. If the physical location is part of an NFAS arrangement, field 13 identifies this interface from other interfaces in the arrangement. This information is also used in the coding of the channel identification IE.

PROCEDURE 262 WORD 3 (Generic 2 Only)

This word is used to enable or disable the codeset mapping and D-channel hyperactivity detection features for Generic 2. These features are defined on a PRI interface basis.

PROCEDURE 275 WORD 4 (System 85 R2V4 & Generic 2)

Field 14 of this word is used to enable ISDN. No ISDN messaging or feature processing occurs unless this field is set to a 1.

PROCEDURE 279 WORD 1 (Generic 2 Only)

This procedure defines information that is sent out in the NSF IE of the setup message for Generic 2. This IE requests a service or feature from the remote end of the ISDN link for a particular call.

All known features or services requested by or of the Generic 2 switch must be translated in this procedure. The correct encodings for the feature or service are to be obtained from the *AT&T ISDN Primary Rate Interface Specification, Issue 2.1*. Examples of such services are SDN, MEGACOM 800, MEGACOM, INWATS, WATS, and ACCUNET switched digital service.

The encoding of the NSF IE is discussed further in the *Procedure 309 Word 5* section of this appendix.

PROCEDURE 280 WORD 1 (Generic 2 Only)

This procedure can alter opcode values of EIs and affect the codeset associated with an IE. In System 85 R2V4 user-to-user information is associated with codeset 7 while in Generic 2 it is associated with codeset 6.

The following IEs have changed opcode values between System 85 R2V4 and Generic 2:

TABLE C-2. System 85 R2V4 to Generic 2 IE Opcode Translations

Information Element (IE) Name	IE Opcode Value	
	R2V4	G2
Link layer parameters	1	64
Packet layer parameters	2	62
Logical link identification	4	26

The next two user-to-user IEs kept the same opcode values when moved from codeset 7 to codeset 6:

TABLE C-3. User-to-User IE Opcodes

Information Element (IE) Name	Opcode Value
Traveling class mark	8
Display	40

Generic 2 switches map outgoing user-to-user information to codeset 7 if communicating with a System 85 R2V4. Also, incoming codeset 7 information from a System 85 R2V4 is mapped to codeset 6 for interpretation by a Generic 2 switch.

In general, the following mappings are recommended for Generic 2 switches when they are in a network that contains at least one System 85 R2V4 switch:

TABLE C-4. Codeset Map Number to Incoming and Outgoing Translations

Procedure 280			
Mapped From:	Mapped To:		
Codeset Map Number	Incoming/ Outgoing	Codeset/Opcode Value	Codeset/Opcode Value
X	I	7/1	6/64
X	I	7/2	6/62
X	I	7/4	6/26
X	I	7/8	6/8
X	I	7/40	6/40
X	O	6/64	7/1
X	O	6/62	7/2
X	O	6/26	7/4
X	O	6/8	7/8
X	O	6/40	7/40

NOTE: X represents any codeset map number

PROCEDURE 309 WORD 5 (System 85 R2V4 & Generic 2)

This word deals with the sending of a particular NSF IE in the setup message and with rules of route selection.

Field 4, ISDN Trunk Type

This field can only contain a value when the trunk group associated with the plan, pattern, or preference has a type of ISDN dynamic. Here, it must have a value entered or the outgoing call over this preference will fail. The selection of a trunk type is not crucial since the ARS feature determines code flow more so than does the trunk type. However, an appropriate trunk type should be selected for the calls associated with this plan, pattern, or preference.

Field 5, Network Service Value

The value entered in this field along with the value entered in field 12 of procedure 309, word 1, (the IXC/ISDN network identifier) determine the NSF IE for calls routed over this plan, pattern, or preference. An NSF IE is not sent if a value is not entered. If field 5 has no value but an IXC/ISDN network identifier is specified, the network identification is specified with the transit network selection IE instead of the network-specific facilities IE.

The following subsections examine the layout of this IE for both System 85 R2V4 and Generic 2.

NSF IE (System 85 R2V4)

For System 85 R2V4, the following values can be entered into field 5:

**33 through 288
(OUTWATS Band
NSFs)**

These values specify the plan, pattern, or preference is requesting service for OUTWATS bands 0-255 respectively. For example, 33 specifies OUTWATS band 0 and 34 specifies OUTWATS band 1.

Opcode: 2

The following three items are sent only if field 12 of procedure 309, word 1, is nonzero.

Network identification plan: carrier identification code
Type of network identification: national network identification
Network identification: (three octets show the value entered in field 12 of procedure 309, word 1)
Facility coding value: 1
Feature/service: service
Parameter/binary: parameterized
Parameterized field: (octets specifying band number)

352 (SDN NSF)

Opcode: 2

The following three items are sent only if field 12 of procedure 309, word 1, is nonzero.

Network identification plan: carrier identification code
Type of network identification: national network identification
Network identification: (three octets show the value entered in field 12 of procedure 309, word 1)
Facility coding value: 1
Feature/service: service
Parameter/binary: binary

**354 (MEGACOM
NSF)**

Opcode: 2

The following three items are sent only if field 12 of procedure 309, word 1, is nonzero.

Network identification plan: carrier identification code
Type of network identification: national network identification
Network identification: (three octets show the value entered in field 12 of procedure 309, word 1)
Facility coding value: 3
Feature/service: service
Parameter/binary: binary

356 (WATS NSF)

Opcode: 2

The following three items are sent only if field 12 of procedure 309, word 1, is nonzero.

Network identification plan: carrier identification code

Type of network identification: national network identification

Network identification: (three octets show the value entered in field 12 of procedure 309, word 1)

Facility coding value: 5

Feature/service: service

Parameter/binary: binary

357 (ACCUNET via encode 357)

This value requests ACCUNET switched digital service from a 4E13 or later generic.

Opcode: 2

The following three items are sent only if field 12 of procedure 309, word 1, is nonzero.

Network identification plan: carrier identification code

Type of network identification: national network identification

Network identification: (three octets show the value entered in field 12 of procedure 309, word 1)

Facility coding value: 6

Feature/service: service

Parameter/binary: binary

NSF IE (Generic 2)

In Generic 2, services and features are administered in procedure 279. The number entered in field 5 is not a fixed number as in System 85 R2V4; instead it is the ISDN network service value number assigned to the feature or service in procedure 279.

The list below defines how the following fields of the NSF are coded:

- Facility coding value
- Feature/service
- Parameter/binary
- Parameterized field

The following fields of the NSF follow the same rules as given for System 85 R2V4 NSFs:

- Network identification plan
- Type of network identification
- Network identification

Rules for requesting ACCUNET services from different generics of 4ESS are the same as those for System 85 R2V4. That is, when dealing with 4E13 or later, set up a definition of a binary service with a value of 6. This definition is used in field 6 of procedure 309, word 5, that sends an NSF (this is the parallel to the above example for System 85 R2V4 where a value of 357 was used).

For generics before 4E13, NSF is not sent; instead, the setup message needs a mode 1 code. For Generic 2, there is no special encode that causes message creation to do this automatically. Therefore, the calling party wishing to access ACCUNET from generics before 4E13 must have a BCCOS of mode 1.

BC (System 85 R2V4 and Generic 2)

BC is assigned with fields 6 through 10 for System 85 R2V4 and field 6 for Generic 2. These fields have implications as far as call routing is concerned. Some routing rules are discussed in the *Procedure 010 Word 4* section of this appendix. Additional routing rules based on the bearer capability translation associated with a plan, pattern, or preference are described next.

Fields 6-10 (System 85 R2V4)

These five fields represent each of the five BCs defined in System 85 R2V4. If a field is set to a 1, this preference may be used by a calling party having the BC represented by the field. If all bits are set, the preference can be used by all BCs.

If a calling party is routed to a plan, pattern, or preference that does not support the calling party's BC (that is, the appropriate field is set to a 0), later preferences are checked until a match is found. If none of the preferences support the calling party's BC, the call is denied.

Field 6 (Generic 2)

Field 16 of procedure 014, word 1, defines the BC for the calling party's COS. Fields 4 through 13 of procedure 014, word 1, define the bearer capability COS of the preference. Field 6 of procedure 309, word 5, defines how to handle calling parties. If a calling party with a particular BC is to be blocked from using this preference, the next preference is checked. If all preferences block this particular BC, the call is denied.

In addition, Generic 2 also implements the following routing rules:

- When searching the preferences, the highest preference number is used that can handle the call via circuit switching instead of using a modem pool member (where the number 1 is the highest possible preference). This is done to conserve the use of modem pool members. (Of course, all other routing rules discussed in this appendix must also be met for this preference.) If a circuit switched preference cannot be found, the highest non-circuit switched preference is used. Fields 4 through 13 of procedure 014, word 1, define circuit versus non-circuit switching for the BCCOS entered in field 6 of procedure 309, word 5.
- A calling party with clear channel characteristics is blocked from using a preference with restricted channel characteristics. All other calling party and preference clear or restricted combinations are allowed.

The calling party's clear or restricted characteristic of the calling party's BCCOS is defined in field 15 of procedure 014, word 1.

The preference's characteristic is found by examining field 3 for the BCCOS entered in field 6 of procedure 309, word 5.

PROCEDURE 321 WORD 5 (System 85 R2V4 & Generic 2)

This word defines for AAR patterns and preferences what procedure 309, word 5, defines for ARS plans, patterns, and preferences. The fields in these two procedures are similar. Refer to the *Procedure 309 Word 5* section earlier in this appendix for information on how to administer this procedure (all rules and field definitions are identical).

PROCEDURE 354 WORD 3 (System 85 R2V4 & Generic 2)

This word is used to assign up to 99 unique NPA-NXX pairs. For example, a location can have two distinct designators: one for voice extensions (such as 303-538) and one for data endpoints (such as 303-255).

Generic 2 sends out 10 address digits for calling party number and connected number. The NPA-NXX portion of the number is defined in this word via fields 2 and 3. These 6 digits are prepended to the last 4 digits of the extension number to create the 10 address digits. (If a console is involved, the last 4 digits of the assigned listed directory number (LDN) are used.)

In addition, a thousands digit can be assigned in field 4. This digit must be assigned in 3-digit switches for the calling party number and connected number to make sense. If assigned in a 4 or 5-digit switch, it is used for the thousands digit in the address digit stream regardless of what the thousands digit is for the extension or LDN.

Calling-party number IE	Opcode: 6C (assuming no codeset mapping in Generic 2) Numbering plan identification: telephony numbering plan (The exception to this is in Generic 2 on a BRI-to-BRI call within the switch where Private Numbering Plan is used) Type of address: national number (The exception to this is in Generic 2 on a BRI-to-BRI call within the switch where Unknown is used.) The 10 address-digit octets follow the above information.
Connected number IE	Opcode: C (assuming no codeset mapping in Generic 2) Numbering plan identification: telephony numbering plan Type of address: national number (the 10 address-digit octets follow the above information)

PROCEDURE 420 (System 85 R2V4 & Generic 2)

Type-2 data can be useful in determining which regular tasks are using an abnormally high amount of processor time. The data in field 3 of this procedure multiplied by 100 is the number of times this task has been interrupted by the 10-ms interrupt. An unusually high number in field 3 (compared to the other regular tasks) shows that the task number in field 2 is currently a processor-occupancy hog. This condition is normally an error condition and can point to problems with the feature controlled by the regular task.

The following are ISDN-related tasks and their task numbers for System 85 R2V4:

- Task 35 ISDN queue server task
- Task 47 ISDN level-3 timing task
- Task 55 ISDN JUMBO I/O task
- Task 61 ISDN incoming message-verification task

The following are ISDN-related tasks and their task numbers for Generic 2:

- Task 35 ISDN queue server task
- Task 47 ISDN level-3 timing task
- Task 55 ISDN JUMBO I/O task
- Task 61 ISDN incoming message-verification task
- Task 62 ISDN applications service element queue server
- Task 70 ISDN applications call-processing queue server
- Task 79 ISDN applications 100-ms timing task
- Task 85 ISDN applications 2-sec. timing task
- Task 93 ISDN BRI terminal initialization
- Task 108 SNC trunk group audit task

D. TRUNK TYPE AND SIGNALING TYPE COMPATIBILITY TABLES

This appendix contains three tables that define trunk type to signaling type compatibility for System 85 R2V1, R2V2, R2V3, R2V4, and Generic 2. Table D-1, *Trunk/Signaling Cross-references*, provides, on a trunk type basis, the default signaling type, the feature and direction compatibility, and the valid signaling types. Table D-2, *R2V4 Alternate Signaling Type Translations*, provides, on a trunk type basis, a translation of other than the default, valid signaling type to “standard” signaling type for R2V4 trunks. This translation is necessary to use table D-3, *Signaling Type Compatibility*. This table provides, on a signaling type basis, a compatibility matrix for the standard signaling types.

Table D-1, *Trunk/Signaling Cross-references*, shows for each trunk type what its default signaling type value is and what other possible signaling types can be assigned to it. This table is valid for System 85 R2V1, R2V2, R2V3, and Generic 2. R2V4 alternate signaling types (columns A1-A4) must be translated by table D-2, *R2V4 Alternate Signaling Type Translations*.

The headings for table D-1, *Trunk/Signaling Cross-references*, are defined as follows:

Trunk Type	TTYTYPE Value
EQU	COMPOOL EQU for trunk type (TTYTYPE)
Feature	Defines the feature of the trunk type. Trunk types of like feature are compatible. The feature abbreviations include: • APLT – advanced private-line termination (includes both CCSA and EPSCS) • CAS – Centralized Attendant Service • CO – central office • DID – Direct Inward Dialing • ETN – electronic tandem network • FX – foreign exchange • ISDN-PRI – Integrated Service Digital Network primary rate interface • MAIN/SAT – main/satellite • NA – Not applicable (trunk type doesn’t provide switch to switch connectivity) • NDMI – network digital multiplexed interface • RA – remote access • TIE – tie trunk • WATS – Wide Area Telecommunications Service

Direction	Defines if the trunk type is capable of both: • Incoming and outgoing calls — 2-way • Incoming calls only — 1-way in • Outgoing calls only — 1-way out
Default Signaling	The default SIG_TYPE value for the trunk type
EQU	COMPOOL EQU for default signaling type
A1 - A4	Values in these columns (if any) are the COMPOOL EQUs for other valid signaling types for this trunk type; at present, no trunk has more than five total valid signaling types (see table D-4, <i>Signaling Type Definitions</i> , for definitions).
Description	A description of this trunk type. A signaling type or trunk type value enclosed in parenthesis such as (automatic in) is not valid on a universal module.

TABLE D-1. Trunk/Signaling Cross References

Trunk Type	EQU	Feature	Direction	Default Signaling	EQU	A1	A2	A3	A4	Description
incom	0	NA	NA	no_signal_required	0					intercom
dp_dr	1	NA	NA	no_signal_required	0					dial pulse digit register
tt_dr	2	NA	NA	no_signal_required	0					touch-tone digit register
at_dr	3	NA	NA	no_signal_required	0					attendant digit register
sloop	4	NA	NA	no_signal_required	0					switched loop
6_way	(5)	NA	NA	no_signal_required	0					attendant conference
q_trk	6	NA	NA	no_signal_required	0					general purpose queuing trunks
dtd_trk	7	NA	NA	no_signal_required	0					dial tone detector trk
ccsa2wd_d	12	APLT	2-way	em_dd_in_wdd_out_w_dt	9					2 way ccsa delay dial in/out
ccsa1wo_d	13	APLT	2-way	em_ws_in_wdd_out_w_dt	10					2 way ccsa delay dial out/wink in
ccsa2w_d	14	APLT	2-way	em_dd_in_is_out	8					2 way ccsa dial tone out/delay dial in
ccsa2w	15	APLT	2-way	em_ws_in_is_out	5					2 way ccsa dial tone out/wink in
co1wi	16	CO	1-way in	ground_start	1	28	29	19	20	1 way incoming attendant completing (automatic in)
co1wo	17	CO	1-way out	ground_start	1	28	29	19	20	1 way outgoing dod
colwop	(18)	CO	1-way out	ground_start_w_pt	(2)					1 way out dod with party test
co_2w	19	CO	2-way	ground_start	1	28	29	19	20	2 way attendant completing in/dod

Trunk Type	EQU	Feature	Direction	Default Signaling	EQU	A1	A2	A3	A4	Description
co_2wp	(20)	CO	2-way	ground_start_w_pt	(2)					2 way with party test
fx1wi	21	FX	1-way in	ground_start	1	28	29	19	20	1 way incoming attendant completing (automatic in)
fxlwo	22	FX	1-way out	ground_start	1	28	29	19	20	1 way outgoing dod
fxlwop	(23)	FX	1-way out	ground_start_w_pt	(2)					1 way out dod with party test
fx_2w	24	FX	2-way	ground_start	1	28	29	19	20	2 way attendant completing in/dod
fx_2wp	(25)	FX	2-way	ground_start_w_pt	(2)					2 way with party test
wtlwi	26	WATS	1-way in	ground_start	1	28	29	19	20	1 way incoming attendant completing (automatic in)
wtlwo	27	WATS	1-way out	ground_start	1	28	29	19	20	1 way outgoing dod
wtlwop	(28)	WATS	1-way out	ground_start_w_pt	(2)					1 way out dod with party test
wtlwa	29	WATS	1-way in	ground_start	1					automatic in-WATS (not administered)
didis	30	DID	1-way in	loop_rev_battery_is	30	4	20			immediate start did
didws	31	DID	1-way in	loop_rev_battery_ws	3	11	20			wink start did
ttlidr	32	TIE	1-way in	em_is_in_is_out	4					1 way in dial repeating
ttloau	33	TIE	1-way out	em_is_in_auto_out	31	32	27			1 way out automatic
ttlodr	34	TIE	1-way out	em_is_in_is_out	4	1				1 way out dial repeating
ttliau	35	TIE	1-way in	em_auto_in_ws_out	28	1				1 way in automatic
tt2wdr	36	TIE	2-way	em_is_in_is_out	4					2 way dial repeating both ways
tt2wda	37	TIE	2-way	em_is_in_auto_out	31	32	27			2 way dial repeating in/auto out
tt2wad	38	TIE	2-way	em_auto_in_ws_out	28	1				2 way auto in/dial repeating out
tt2wau	39	TIE	2-way	em_auto_in_auto_out	32	1				2 way auto both ways
tt1idr_d	40	ETN	1-way in	em_dd_in_is_out	8					1 way in dial repeating-delay dial
tie2ddw	41	ETN	2-way	em_ws_in_wddfot_out	26	11	21	22	20	2-way,wink in/delay dial or wink out
tieliw	42	ETN	1-way in	em_ws_in_wddfot_out	26	11	21	22	20	1-way in, wink
tieloddw	43	ETN	1-way out	em_ws_in_wddfot_out	26	11	21	22	20	1-way out, delay dial or wink
tt2wdr_d	(44)	ETN	2-way	em_dd_in_is_out	8					2 way dial repeating-delay dial in
tt2wda_d	(45)	ETN	2-way	em_dd_in_is_out	8					2 way dial repeating in/auto out-delay dial in
tietm	46	ETN	2-way	em_is-in_wddfot_out	25	12	21	22	20	2-way delay-dial or wink out/dial repeating delay dial in
tt2wdd_d	47	ETN	2-way	em_dd_in_wddfot_out	24	23	21	22	20	two way delay dial in/delay dial out or wink out
ann_intintfc	48	NA	NA	no_signal_required	0					internal ann interface
ann_extintfc	49	NA	NA	no_signal_required	0					external ann interface
bcsacs	50	RA	1-way in	start	1	21	20			remote bcs access trunk
teldic	51	NA	NA	equipment	7					telephone dictation interface
recanc	52	NA	NA	equipment	7					recorded announcement interface
codec	53	NA	NA	equipment	7					code call interface
spage	54	NA	NA	equipment	7					loudspeaker paging interface

Trunk Type	EQU	Feature	Direction	Default Signaling	EQU	A1	A2	A3	A4	Description
tt-sender	55	NA	NA	no_signal_required	0					touch tone sender
caserv	56	NA	NA	no_signal_required	0					centralized attendant service interface
r1s_link	57	CAS	1-way out	em_rls_link_trunk_out	13					release link trunk for cas
anickt	58	NA	NA	ani_signaling	6					ani interface
s_ms_int	59	NA	NA	no_signal_required	0					sta_msg register interface
	60									unused
ucd_lamp_intf	61	NA	NA	no_signal_required	0					ucd lamp interface
music_intf	62	NA	NA	no_signal_required	0					music on hold interface
hw_rdctk	63	NA	NA	no_signal_required	0					hardware digit collection trunk
remac_vsg	64	NA	NA	no_signal_required	0					voice switched gain remote access trunk
contact_interface	65	NA	NA	no_signal_required	0					lc15 contact interface
inc_rlt	66	CAS	1-way in	em_rls_link_trunk_in	14					cas incoming release link trunk
audio	67	NA	NA	no_signal_required	0					audio
ucd_rc	68	NA	NA	no_signal_required	0					ucd delayed recorded announcement trunk
mslwiis	70	MAIN/SAT	1-way in	em_main_satellite_is	15					one way in immediate start
mslwais	71	MAIN/SAT	1-way out	em_main_satellite_is	15					one way out immediate start
ms2wis	72	MAIN/SAT	2-way	em_main_satellite_is	15					two way immediate start both ways
mslwiws	73	MAIN/SAT	1-way in	em_main_satellite_ws	16					one way in wink start
mslwows	74	MAIN/SAT	1-way out	em_main_satellite_ws	16					one way out wink start
ms2wws	75	MAIN/SAT	2-way	em_main_satellite_ws	16					two way wink start both ways
mslwidd	76	MAIN/SAT	1-way in	em_main_satellite_dd	17					one way in delay dial
mslwodd	77	MAIN/SAT	1-way out	em_main_satellite_dd	17					one way out delay dial
ms2wdd	78	MAIN/SAT	2-way	em_main_satellite_dd	17					two way delay dial both ways
co_2w_vsg	85	CO	2-way	no_signal_required	0					two way co with voice switch gain
inwats_vsg	86	WATS	1-way in	no_signal_required	0					one way in-WATS with voice switch gain
v_recanc	90	NA	NA	auxiliary_equipment	7					vectoring recorded announcement
acdrc_1	90	NA	NA	auxiliary_equipment	7					acd recorded announcement 1
acdrc_2	91	NA	NA	auxiliary_ equipment	7					acd recorded announcement 2
acdrcorg	92	NA	NA	auxiliary_equipment	7					acd queue of origin announcement
mct_rec	93	NA	NA	auxiliary_equipment	7					malicious call trace recorder
pm_intf	98	NA	NA	no_signal_required	0					power meter interface
alm_intf	99	NA	NA	no_signal_required	0					alarm interface
tone_det	100	NA	NA	no_signal_required	0					tone detector for modem pool
mp_mod	101	NA	2-way	analog_line_loop	27					modem trunk for modem pool

Trunk Type	EQU	Feature	Direction	Default Signaling	EQU	A1	A2	A3	A4	Description
dtlpdm	102	NA	2-way	s_channel_signaling	18					pooled data module trunk for modem pool
dtlha2w	103	NA	2-way	s_channel_signaling	18					host access trunk, 2-way, pim
dtlhaop	104	NA	2-way	s_channel_signaling	18					host access trunk off-premises, dtim
dtlap32	105	NA	2-way	s_channel_signaling	18					host access trunk, ap32
dtleia	106	NA	2-way	s_channel_signaling	18					host access trunk, eia
dtlisl	107	NA	2-way	s_channel_signaling	18					host access trunk, isl
dmi_a_wa	108	NA	2-way	em_ws_in_is_out	5	20				dmi a-bit, wink in/auto out
dmi_a_ww	109	NDM-I	2-way	em_ws_in_wdd_out	11	20				dmi a-bit, 2-way wink start
	110									reserved for dtl trunks
	111									reserved for dtl trunks
	112									reserved for dtl trunks
	113									reserved for dtl trunks
	114									reserved for dtl trunks
	115									reserved for dtl trunks
	116									reserved for dtl trunks
dtlresv	117									name defined for range check only
isdn_dyn	120	ISDN/PRI	2-way	dmi_isdn_mos	20					isdn dynamic trunk

Table D-2, R2V4 *Alternate Signaling Type Translations*, translates, where needed, the R2V4 alternate signaling type for each trunk type. This allows the table D-3, *Signaling Type Compatibility*, to be used for compatibility checks. Only trunk/signaling type pair requiring translation are given.

TABLE D-2. R2V4 Alternate Signaling Type Translations

Trunk Type	EQU	R2V4 Sig. Type	G2 Equiv. Sig. Type
colwi	16	4	28
	16	21	29
colwo	17	4	28
	17	21	29
colwop	18	4	28
	18	21	29
co_2w	19	4	28
	19	21	29
co_2wp	20	4	28
	20	21	29
fx1wi	21	4	28
	21	21	29
fx1wo	22	4	28
	22	21	29
fx1wop	23	4	28
	23	21	29
fx_2w	24	4	28
	24	21	29
fx_2wp	25	4	28
	25	21	29
wt1wi	26	4	28
	26	21	29
wt1wo	27	4	28
	27	21	29
ttloau (Note)	33	4	27
tt2wda (Note)	37	4	27

NOTE: R2V4 must be equipped with SN243

Table D-3, *Signaling Type Compatibility*, provides the compatibility of standard signaling types. The first column is the frame of reference for the direction compatibility. Compatibility is either one way out, one way in, or bidirectional from this entry.

TABLE D-3. Signaling Type Compatibility

Signaling Type	Equ	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
no_signal_req	00	•																																	
ground_start	01		•																																
ground_start_w_pt	02			•																															
loop_rev_battery_ws	03				•																														
em_is_in_is_out	04					•	←			←				→															→		←			→	
em_ws_in_is_out	05					→					←	←	←	•									←		←	←	•	←		←		←		→	
ani_signaling	06							•																											
auxiliary_equipment	07								•																										
em_dd_in_is_out	08					→					←	←	←	•										←	←	←	•	←						→	
em_dd_in_wdd_out_w_dt	09					→	→				→	•	•	•	•									→	•	•	•	•	•						→
em_ws_in_wdd_out_w_dt	10					→	→				→	•	•	•	•									•	→	•	•	•	•		←			→	
em_ws_in_wdd_out	11					→	→				→	•	•	•	•									•	→	•	•	•	•		←			→	
em_is_in_wdd_out	12					•	•				•	→	→	→	→									→	→	→	→	→	→	←				→	
em_rls_link_trunk_out	13															→																			
em_rls_link_trunk_in	14															←																			
em_main_satellite_is	15																	•																	
em_main_satellite_ws	16																		•																
em_main_satellite_dd	17																			•															
s_channel_signaling	18																				•														
loop_start (DS1 only)	19																					•													
dmi_isdn_mos	20																						•												
em_ws_in_ws_out	21						→					←	•	•	←									•		←	←	←	•		←				
em_dd_in_dd_out	22										→	•	←	←	←										•	•	•	•	←	←					
em_dd_in_wdd_out	23					→	→				→	•	•	•	•									→	•	•	•	•	•						→
em_dd_in_wddfot_out	24						→				→	•	•	•	←									→	•	•	•	•	←	•					
em_is_in_wddfot_out	25					←	•				•	→	→	→										→	→	→	→	→	→	←					
em_ws_in_wddfot_out	26						→				→	•	•	•	←									•	→	•	•	•	←	•		←			
analog_line_loop	27																														•				
em_auto_in_is_out	28					→									→													→						•	←
em_auto_in_ws_out	29						→						→											→					→					←	←
loop_rev_battery_is	30																																•		
em_is_in_auto_out	31					←	←			←																					•	→			→
em_auto_in_auto_out	32																														→	→		←	•

The direction of compatibility is marked by:

• Two-way compatibility → One-way compatibility outgoing ← One-way compatibility incoming

Table D-4, *Signaling Type Definitions*, provides definitions for the signaling types used in the other three tables in this appendix.

TABLE D-4. Signaling Type Definitions

Mnemonic	EOU	Definition	Trad. Circuits	Hybrid Circuits
no_signal_req	00	no signaling required	NA	NA
ground_start	01	ground start	SN230, ANN11	TN747B, TN767
ground_start_w_pt	02	ground start with party test	SN230	None
loop_rev_battery_ws	03	loop/reverse battery, wink start	SN232, ANN11	TN753, TN767
em_is_in_is_out	04	e&m immed. start in and out	SN233, ANN11	TN760C, TN767
em_ws_in_is_out	05	e&m wink start in, immed. start out	SN233, ANN11	TN760C, TN767
ani_signaling	06	ani signaling	SN244	None
auxiliary_equipment	07	auxiliary equipment	SN232	TN763B
em_dd_in_is_out	08	e&m delay dial in and immed. start out	SN233, ANN11	TN760C, TN767
em_dd_in_wdd_out_w_dt	09	e&m delay dial in, wink/delay dial with dial tone out	SN233, ANN11	TN760C, TN767
em_ws_in_wdd_out_w_dt	10	e&m wink start in, wink/delay dial with dial tone out	SN233, ANN11	TN760C, TN767
em_ws_in_wdd_out	11	e&m wink start in, wink/delay dial out also known as universal sequence	SN233, ANN11	TN760C, TN767
em_is_in_wdd_out	12	e&m immed. start in, wink/delay dial out	SN233, ANN11	TN760C, TN767
em_rls_link_trunk_out	13	e&m release link trunk out	SN233, ANN11	TN760C, TN767
em_rls_link_trunk_in	14	e&m release link trunk in	SN233, ANN11	TN760C, TN767
em_main_satellite_is	15	e&m main satellite, immediate start	SN233, ANN11	TN760C, TN767
em_main_satellite_ws	16	e&m main satellite, wink start	SN233, ANN11	TN760C, TN767
em_main_satellite_dd	17	e&m main satellite, delay dial	SN233, ANN11	TN760C, TN767
s_channel_signaling	18	's' channel signaling, host access-gpp " channel signaling, host access-eia	SN270, SN238	TN754, TN726
loop_start	19	loop start	ANN11	TN767
dmi_isdn-mos	20	digital multiplex interface isdn mos	ANN35	TN767/TN555 pair
em_ws_in_ws_out	21	e&m wink start in, wink start out	SN233, ANN11	TN760C, TN767
em_dd_in_dd_out	22	e&m delay dial in, delay dial out	SN233, ANN11	TN760C, TN767
em_dd_in_wdd_out	23	e&m delay dial in, wink/delay dial out	SN233, ANN11	TN760C, TN767
em_dd_in_wddfot_out	24	e&m delay dial in, wink/delay dial out with fail on timeout	SN233, ANN11	TN760C, TN767
em_is_in_wddfot_out	25	e&m immediate start in, wink/delay dial out with fail on timeout	SN233, ANN11	TN760C, TN767
em_ws_in_wddfot_out	26	e&m wink start in, wink/delay dial out with fail on timeout	SN233, ANN11	TN760C, TN767
analog_line_loop	27	analog line loop	SN243	TN742
em_auto_in_is_out	28	e&m auto in immed. start out	SN233, ANN11	TN760C, TN767
em_auto_in_ws_out	29	e&m auto in wink start out	SN233, ANN11	TN760C, TN767
loop_rev_battery_is	30	loop/reverse battery immediate start	SN232, ANN11	TN753, TN767
em_is_in_auto_out	31	e&m immediate start in, auto out	SN233, ANN11	TN760C, TN767
em_auto_in_auto_out	32	e&m auto in, auto out	SN233, ANN11	TN760C, TN767

e&m — ear and mouth

ABBREVIATIONS

A	ampere
AAR	Automatic Alternate Routing
A/CO	Analog CO trunk
ADFTC	analog/digital-facility test circuit
AFRL	alternate facilities restriction level
AIOD	automatic identified outward dialing
ALU	arithmetic logic unit
ANI	automatic number identification
ARS	Automatic Route Selection
A/TO	analog toll office trunk
A/TT	analog tie trunk
AUTOVON	Automatic Voice Network
AVD	alternate voice/data
AWG	American Wire Gauge
B8ZS	bipolar with 8-zero substitution
BC	bearer capability
BCC	bearer capability class
BCCOS	bearer capability class of service
bps	bits per second
CBC	Call-by-Call
CCITT	Comité Consultatif International Telephonique et Telegraphique
CCR	Customer Controllable Reconfiguration
CCSA	Common-Control Switching Arrangement
CDM	channel-division multiplexer
CEM	channel-expansion multiplexer
COR	class of restriction
COS	class of service
CRC	cyclic redundancy check
CSU	channel-service unit (see NCTE)

DACS	digital-access and cross-connect system
dB	decibel
DCE	data circuit-terminating equipment
D/CO	digital CO trunk
DCP	Digital Communications Protocol
DID	Direct Inward Dialing
DIF	digital interface frame
DIP	dual in-line package
DMI	digital multiplexed interface
DMI-BOS	digital multiplexed interface with bit-oriented signaling
DMI-MOS	digital multiplexed interface with message-oriented signaling
DNIS	dialed-number identification service
DPO	dial-pulse originating
DS1	digital signal level 1
DSU	data service unit
DSX-1	digital signal level 1 cross-connect field
DTE	data terminal equipment
D/TO	digital toll office trunk
D/TT	digital tie trunk
E&M	Ear and mouth
EDSL	extended digital subscriber line
EIA	Electronics Industries Association
EPSCS	Enhanced Private Switched Communications Service
E S	errored second
E S F	extended superframe
FAS	facility associated signaling
FRL	facilities restriction level
F X	foreign exchange
FXO	foreign exchange office
FXS	foreign exchange subscriber
G R S	Generalized Route Selection
HDLC	High-Level Data Link Control
H z	hertz

IC	integrated circuit
IE	information element
INADS	Initialization and Administration System
ISDN	Integrated Services Digital Network
ISDN-BRI	Integrated Services Digital Network basic rate interface
ISDN-PRI	Integrated Services Digital Network primary rate interface
IXC	interexchange carrier
LAPD	link-access procedure on the D-channel
LATA	local access and transport area
LDN	listed directory number
LEC	local exchange company
LFA	loss of frame alignment
LOS	loss of signal
LSB	least-significant bit
MAAP	maintenance and administration panel
MFAT	multifunction analog terminal
MO	maintenance object
MPDM	module processor data module
MTBF	mean time between failures
MTCP	maintenance test controller panel
MTTR	mean time to repair
NCTE	network channel-terminating equipment
NEC	National Engineering Center
NFAS	nonfacility associated signaling
NPA	numbering plan area
NSF	network-specific facilities
ONS	on-premises station
OPS	off-premises station
OPX	off-premises extension
PAD	packet assembler/disassembler
PAM	pulse-amplitude modulation
PCM	pulse-code modulation
PDM	processor data module

PDS	premises distribution system
PRI	primary rate interface
RBS	robbed-bit signaling
REC	Regional Engineering Center
RFA	remote frame alarm
RGI	Remote Group Interface
RMATS	Remote Maintenance, Administration, and Traffic System
SAO	special-access office
SCS	system clock synchronizer (TN463)
SDN	Software Defined Network
S/DTT	ISL digital tie trunk
SID	station identification number
SLC	subscriber link code
SLIM	subscriber loop interface module
SMT	system-management terminal
SS 7	signaling system number 7
TCM	traveling class mark
TEG	terminating extension group
TMS	time-multiplexed switch
TSI	time-slot interchanger
TTL	terminating test line
TTTN	tandem tie-trunk network
TVC	trunk verification by customer
TVS	trunk verification by station
UDP	Uniform Dial Plan
UUI	user-to-user information
VMAAP	visual maintenance and administration panel
VNL	via-net loss
V	volt
VBR	variable bit robbed
W	watt
WATS	Wide Area Telecommunications Service
ZCS	zero code supression

GLOSSARY

1s density	See ones density .
24th-channel signaling	Digital signal level 1 (DS1) signaling in which the signaling for each of the first 23 channels is multiplexed onto the 24th channel, thereby providing a full 64K-bps for user data on each of the first 23 channels. Also called <i>alternate voice/data signaling</i> , <i>clear-channel signaling</i> , and <i>out-of-band signaling</i> . See also common-channel signaling and Integrated Services Digital Network primary rate interface .
800 service	A service that allows incoming calls to be made from certain geographical areas to an assigned number for a flat-rate charge based on expected usage. See also MEGACOM® .
access	In telecommunications, a call that is completed from a customer-premises location to the public network.
ACCUNET®	A trademarked name for a family of digital services offered by AT&T.
ACCUNET® digital service	A digital service offered by AT&T that provides switched digital connectivity via the public network to allow pairs of compatible endpoints to exchange data, video, digital encrypted voice, and/or graphics at up to 64K-bps.
ACCUNET® packet service	An X.25 packet-switching service provided by AT&T.
ACCUNET® reserved 1.5 service	A digital service offered by AT&T that provides 1.5M-bps digital facilities between two or more specified points at scheduled times.
ACCUNET®T1 service	A digital service offered by AT&T that provides a dedicated 1.5M bps digital facility, using terrestrial channels and one of two specified signal formats.
ADFTC	See analog/digital-facility test circuit .
AFRL	See alternate facilities restriction level .
AIOD	See automatic identified outward dialing .
alternate facilities restriction level (AFRL)	An assigned alternate number that reflects allowed access levels and determines both the kinds of calls that can be made and the kinds of facilities that can be used when accessing trunks via Automatic Alternate Routing (AAR). See also facilities restriction level .
alternate voice/data (AVD)	A digital signal level 1 (DS1) trunk-facility translation that defines the use of that facility for either voice and voice-grade data or data protocol modes. See also bearer capability class of service .
ALU	See arithmetic logic unit .
American Wire Gauge (AWG)	A numeric standard used to express the diameter of a wire. The higher the number, the smaller the diameter.

analog	The representation of information by means of continuously variable physical quantities such as amplitude, frequency, phase, or resistance.
analog/digital-facility test circuit (ADFTC)	A maintenance circuit resident in communications-system processor port carriers for use in testing the hardware associated with modem pooling.
arithmetic logic unit (ALU)	The area in a central processor that performs arithmetic and logic functions.
asynchronous data transmission	A method of transmitting data in which each character is preceded by a start bit and followed by a stop bit, thus permitting data characters to be transmitted at irregular intervals. Also called <i>asynchronous transmission</i> . See also synchronous data transmission .
AT&T ISDN basic rate interface (BRI)	An AT&T implementation of the CCITT specification that describes the level 1, level 2, and level 3 interfaces for ISDN-BRIs on AT&T products. See also AT&T ISDN primary rate interface and ISDN basic rate interface .
AT&T ISDN primary rate interface (ISDN-PRI)	An AT&T implementation of the CCITT specification that describes level 1, level 2, and level 3 interfaces for ISDN-PRIs on AT&T products. See also AT&T ISDN basic rate interface and ISDN primary rate interface .
AT&T standardized facility element	A codeset-6 information element (IE) used to indicate which of the AT&T standardized services or facilities is being requested or responded to. The ASF element also specifies the kind of control associated with the facility. See also codeset .
Automatic Alternate Routing (AAR)	A feature that provides optimum routing for private-network calls by selecting, in descending order of desirability, the best route available.
automatic identified outward dialing (AIOD)	An arrangement whereby a communications system can provide automatic number identification (ANI) data to a class-5 serving office to allow billing of central-office (CO) trunk calls to individual system extensions. An AIOD data link connects the class-5 serving office and the communications system that is used by the CO to query the system for billing data.
automatic number identification (ANI)	The process of automatically identifying the calling party's billing number and transmitting that number from the caller's local central office (CO) to another point on or off the public network. The term ANI is sometimes used for the billing number itself as well as for the process of identifying and transmitting that number. See also ISDN SID-ANI .
Automatic Route Selection (ARS)	A feature that provides optimum routing for public-network calls by selecting, in descending order of desirability, the best route available. See also high-volume tandem .
AUTOVON (Automatic Voice Network)	The U.S. Department of Defense private voice network. See also AUTOVON access .
AUTOVON access	The capability of a communications system to interface with special military voice circuits on the AUTOVON. See also AUTOVON .

AWG	See American Wire Gauge .
bandwidth	The difference, expressed in hertz, between the highest and lowest frequencies in a range of frequencies that determine channel capacity.
baud	In telecommunications applications, a unit of transmission speed equal to the number of signal events per second. See also bit rate and bits per second .
bit rate	The speed at which bits are transmitted, usually expressed in bits per second. Also called <i>data rate</i> . See also baud and bits per second .
bits per second (bps)	The number of binary units of information that are transmitted or received per second. See also baud and bit rate .
B8ZS	See bipolar with 8-zero substitution .
B-channel	For an Integrated Services Digital Network (ISDN), a 64K-bps channel accompanied by timing that is intended to carry a wide variety of digital information streams, such as voice at 64K-bps, data at up to 64K-bps, wideband voice encoded at 64K-bps, and voice at less than 64K-bps, alone or combined with other digital information streams. Also called <i>bearer channel</i> . See also D-channel and B-channel cut-through .
B-channel cut-through	The side, either user or network, of the Integrated Services Digital Network basic rate interface (ISDN-BRI) that the specified B-channel uses to transfer voice or data information. See also B-channel .
BCCOS	See bearer capability class of service .
BCCOS — unknown analog	An incoming call that is assumed by the communications system to be either voice or voice-grade data.
BCCOS — unknown digital	An incoming call that is assumed by the communications system to be either mode 0, mode 1, mode 2, or mode 3.
bearer capability	A term used with Integrated Services Digital Networks (ISDNs) to identify the kinds of service that are requested or are available for a call. See also bearer-capability class .
bearer capability class (BCC)	A term used with Integrated Services Digital Networks (ISDNs) to identify the kind of trunk service required for a call. See also bearer capability and bearer-capability routing .
bearer capability class of service (BCCOS)	A term used with Integrated Services Digital Networks (ISDNs) to identify a number that specifies call routing requirements transmitted within the bearer capability (BC) information element (IE). All line ports, each trunk group, and all Automatic Alternate Routing/Automatic Route selection (AAR/ARS) preferences have individual BCCOS number assignments. The same BCCOS number may be shared by lines, trunk groups, and AAR/ARS preferences. See also bearer capability and <i>class of service</i> .
bearer-capability routing	A method provided by bearer-capability classes (BCCs) for specialized routing of various trunk services using Integrated Services Digital Network primary rate interface (ISDN-PRI) and non-ISDN endpoints. See also bearer-capability class .

binary service format	One of two network specific facility (NSF) service types that are administered in conjunction with the Automatic Alternate Routing/Automatic Route Selection (AAR/ARS) routing patterns. The binary service format conveys in a single byte all the necessary information for the service or facility. See also parameterized service format .
bipolar with 8-zero substitution (B8ZS)	An <i>unrestricted</i> or <i>clear</i> channel line-coding format that detects strings of eight consecutive zeroes in the DS1's signal and encodes these zeros (including framing bits) into a unique bipolar pulse sequence that meets the ones-density requirement. This sequence is detected and decoded at the receiver. Therefore, digital data can be transmitted on these channels without concern about its content.
bit error rate	A unit of measure indicating how successfully a digital signal is being transmitted. Typically, bit error rate is expressed as a number of bit errors per 1,000 or 1,000,000 bits.
burstiness	A network transmission impairment where the error burst is 10^{-2} or worse and often results in an out-of-frame condition. A single error burst of 2.5 seconds or less will not generate an alarm.
BX.25	An AT&T version of the CCITT X.25 protocol for data communications. BX.25 adds a fourth level to the standard X.25 interface. This uppermost level combines levels 4, 5, and 6 of the International Standards Organization (ISO) reference model. See also CCITT, Flexible Assignment of BX.25 Signaling Ports, packet switching, and X.25 .
Call-by-Call (CBC) Service Selection	A feature that allows a communications system and/or service node to request, on a call-by-call basis, services and/or features for a particular call on an Integrated Services Digital Network primary rate interface (ISDN-PRI) facility. These services and/or features are selected with the call-setup message using network-specific facilities, bearer capability, and destination-address information elements (IEs). CBC allows various voice and data services, such as MEGACOM®, Software-Defined Network (SDN), and ACCUNET® digital service, to be integrated onto a single transmission facility with flexible assignment of trunks to services.
CCITT	(Comité Consultatif International Telephonique et Telegraphique) an international body that sets universal standards for data communications, including Integrated Services Digital Network (ISDN). CCITT members are from telecommunications companies and organizations around the world. See also BX.25 and Q recommendations .
CCSA	See Common-Control Switching Arrangement .
CDM	See channel-division multiplexer .

channel-division multiplexer (CDM)	A device that connects directly to a System 75 or a System 85 digital signal level 1 (DS1) port to provide point-to-point or multipoint nonswitched private-line data connections over the same digital facility that carries intercommunications system traffic. The CDM allows any number of preselected channels from a DS1 facility to bypass the communications system and/or terminate while passing the other channels to the system normally. The CDM is compatible with both robbed-bit (voice-grade) and alternate voice/data (AVD) signaling techniques, and provides a number of interface options, such as RS-232C, RS-449, and V.35.
channel-expansion multiplexer (CEM)	A device that doubles the channel capacity of a 1.544M bps digital signal level 1 (DS1) private-line facility by compressing up to 48 voice-band channels onto a single DS1 facility. Only 64K-bps voice, and voice-band data signals of up to 4.8K-bps, can be compressed; however, the CEM can be configured to pass selected 64K-bps channels uncompressed so that compressed and uncompressed channels can share the same DS1 facility.
channel negotiation	An ISDN capability that determines which B-channel is used for completing a call to a terminating communications system. For example, if the B-channel selected by the originating end is not acceptable to the terminating end (such as an inconsistency between the two ends or preplanned use of the selected channel by the terminating end), the terminating end can request a change in the channel to be used. Also called <i>exclusive-channel request</i> and <i>preferred-call reference</i> .
channel service unit (CSU)	See network channel-terminating equipment .
circuit-switched transport mode	The condition in which a communications channel appears as a wire connecting two endpoints. For each call that requests circuit-switched transport mode, the communications system provides a 56K-bps or 64K-bps channel that can be used to transmit either voice, non-packetized data, or packetized data. The Q.931 protocol is used to establish, maintain, and clear the connection. Each data application may have additional protocol requirements for providing end-to-end data transfer. For example, both Digital Communications Protocol (DCP) and basic rate interface (BRI) data modules use digital multiplexed interface (DMI) data modes to control the end-to-end data transfer.
class of restriction (COR)	On a System 75 or DEFTNITY® Communications System Generic 1, a feature that allows definition of up to 64 classes of call-origination and call-termination restrictions for telephones, telephone groups, data modules, and trunk groups. See also class of service .
class of service (COS)	1. On a System 75, a number (0 through 15) that specifies a group of feature-access permissions of a group of telephones. COS specifies whether telephone users can activate certain features such as Automatic Callback and Call Forwarding — All Calls, Data Privacy, and Priority Calling. See also class of restriction. 2. On a System 85, a numeric code that specifies a group of feature-access permissions and calling-privilege restrictions that together determine the privileges of a group of extension numbers. As many as 63 COSs are provided by System 85. See also class of restriction.

clear-channel signaling	See 24th-channel signaling and common-channel signaling .
clear channel transmission	A channel that does not use robbed-bit signaling and does not have the ones-density requirement for user data. For System 75 and System 85 applications, clear channel transmission happens whenever a channel's signaling bits are transmitted in a separate channel and whenever the facility is administered for B8ZS line coding. See also 24th-channel signaling , restricted channel , and unrestricted digital data .
codepoint	A numeric value for a specific field of an information element (IE) and used as part of a Q.931 message, thus allowing identification and processing of the IE. For example, in the network-specific facilities IE, the value 1 in the feature/service field means that the requested facility is a service. See also Q.930 and Q.931 .
codeset	A group of 133 information element (IE) identifiers. In the Integrated Services Digital Network (ISDN) message structure, there are eight possible codesets, numbered 0 through 7. Codeset 0 is the set of IEs defined by the CCITT. Codesets 1 through 4 are reserved for future standards. Codeset 5 is for national use. Codeset 6 is for IEs specific to the local serving network. Codeset 7 is for user-specific IEs. See also AT&T standardized facility element .
combination tie trunk	An end-to-end transmission facility consisting of both digital and analog facilities. Generally, combination tie-trunks are digital trunks that terminate on a channel bank.
common-channel interoffice signaling	Signaling in which signaling information for each of the 23 information channels is multiplexed into a separate "common" channel. For AT&T products, the 24th channel is used as the common channel. See also signaling system number 7 .
common-channel signaling	Signaling in which one channel of 24 carries signaling for the other 23 channels, permitting channels to be used to nearly full capacity. Also called <i>alternate voice/data signaling</i> , <i>clear-channel signaling</i> , or <i>out-of-band signaling</i> . See also 24th-channel signaling and clear-channel signaling .
Common-Control Switching Arrangement (CCSA)	A private telecommunications network using dedicated trunks and a shared switching center for interconnecting company locations.
CRC	See cyclic redundancy check .
cross coupling	In a duplicated system, the process where the off-line system clock synchronizer (SCS) checks the signal integrity of the on-line SCS.
CSU	See network channel-terminating equipment .
cyclic redundancy check (CRC)	A verification protocol that ensures transmitted data was received without transmission errors. Data are sent in blocks. CRC compares the block's appearance before and after transmission. If the appearance does not match, that block of data is resent. Data will usually be resent 10 times before transmission is abandoned.

D4 framing format	A format containing 12 frames. See also extended frame and frame .
D-channel	The 16K-bps or 64K-bps packet-switched channel on an Integrated Services Digital Network basic rate interface (ISDN-BRI) or 64K-bps on an Integrated Services Digital Network primary rate interface (ISDN-PRI) packet-switched channel that carries signaling messages and packet-switched user data. A D-channel is the (ISDN-PRI) Q.931 signaling channel. (A D-channel can also carry data, but this capability is not used on a DEFINITY Communications System Generic 2.) See also B-channel , Q.930 and Q.931 .
DACS	See digital-access and cross-connect system .
data module	An interconnection device between a basic rate interface (BRI) or Digital Communications Protocol (DCP) interface of System 75 and System 85 and data terminal equipment (DTE) or data circuit-terminating equipment (DCE).
data set	See modem .
data service unit (DSU)	A device designed to transmit digital data on transmission facilities. See also network channel-terminating equipment .
data terminal equipment (DTE)	The equipment that makes up the endpoints in a connection over a data circuit. For example, in a connection between a data terminal and a host, the terminal, the host, and their associated modems or data modules make up the DTE. DTE usually consists of the following functional units: control logic, buffer store, and one or more input or output devices or computers. DTE can also contain error control, synchronization, and telephone-identification capabilities.
dB	See decibel .
DCP	See Digital Communications Protocol .
decibel (dB)	A relative unit of measure that converts the power or voltage ratio for acoustic or electrical energy at each of two points to a useful and comparative form. For example, a 3-dB loss implies a loss ratio of one half and a 6-dB loss implies a ratio of one fourth.
dialed-number identification service (DNIS)	A display provided to the answering agent of a service or project, or of the number called by the caller, so that agents grouped in one split can answer calls appropriately for different services. DNIS can also be sent to a host computer or other adjunct.
dial pulse	Regular momentary interruptions by the sending end of a direct- or alternating-current path. The number of interruptions corresponds to the value of a digit or character. Also called <i>dial-pulse addressing</i> .
dial-pulse addressing	See dial pulse .
DID	See Direct Inward Dialing .
digital-access and cross-connect system (DACS)	A reconfigurable, central-office (CO) system used to cross-connect digital signal level 1s (DS1s). A DACS takes DS1s as inputs and also outputs DS1s.

Digital Communication Protocol (DCP)	An AT&T proprietary protocol used to transmit both digitized voice and digitized data over the same communications link. A DCP link is made up of two information (I-) channels and one signaling (S-) channel.
digital	The representation of information in discrete elements such as off and on or 0 and 1.
digital data	See digital .
digital multiplexed interface (DMI)	An interface that provides connectivity between a communications system and a host computer or between two communications systems using digital signal level 1 (DS1) 24th-channel signaling. DMI provides 23 64K-bps data channels and 1 common signaling channel over a twisted-pair connection. DMI is offered through two capabilities: bit-oriented signaling (DMI-BOS) and message-oriented signaling (DMI-MOS).
digital multiplexed interface with bit-oriented signaling (DMI-BOS)	DMI signaling in which the signaling in the 24th channel is based on the definitions of single bits. For example, a bit may indicate an on-hook/off-hook condition.
digital multiplexed interface with message-oriented signaling (DMI-MOS)	DMI signaling in which the signaling in the 24th channel is based on the definitions of strings of bits that form messages. DMI-MOS is similar to the Integrated Services Digital Network primary rate interface (ISDN-PRI).
digital signal level 1 (DS1)	A bit-oriented signaling (BOS) interface that multiplexes 24 channels into a single 1.544M bps stream. DS1 can be used for pulse-code modulation (PCM) for voice or voice-grade data and for mode-0, -1, -2, and -3 data protocols as well as for other voice or data transmission protocols.
Direct Inward Dialing (DID)	A feature that allows an incoming call from the public network (not FX or WATS) to reach a specific telephone without attendant assistance. DID calls to DID-restricted telephone lines are routed to an attendant or recorded announcement, depending on the option selected.
DNIS	See dialed-number identification service .
DS1	See digital signal level 1 .
DS1 robbed-bit signaling	See robbed-bit signaling .
DSX-1	1. A cross-connect field for digits signal level 1s (DS1s). 2. A specification that defines the signal shape and power level of the DS1 signal at a virtual or real point.
DTE	See data terminal equipment .
E&M	Ear and mouth.

EIA (Electronics Industries Association)	A trade association of the electronics industry that establishes electrical and functional standards.
EDSL	See extended digital subscriber line .
electronic tandem network (ETN)	A private network that consists of private and public trunking and switching resources. ETNs often span geographic areas and consist of private or leased transmission facilities that interconnect the customer's communications systems. An ETN uses Automatic Alternate Routing (AAR) with a uniform numbering plan to address the various communications systems and telephones in the ETN.
end-to-end ISDN connectivity	An administration attribute whereby the user can designate via an option whether or not ISDN facilities are required to complete the call. The three available options are as follows: ISDN facilities are required, ISDN facilities are preferred, and any facilities can be used. See also Integrated Digital Services Network .
Enhanced Private Switched Communications Service (EPSCS)	An analog private telecommunications network based on the No. 5 Crossbar and 1A ESS™ that provides advanced voice and data telecommunications services to companies with many locations.
EPSCS	See Enhanced Private Switched Communications Service .
errored second (ES)	A second in which at least one bit error occurs.
ES	See errored second .
ESF	See extended superframe .
ETN	See electronic tandem network .
exclusive- channel request	See channel negotiation .
extended digital subscriber line (EDSL)	The name used for the Integrated Digital Services Network primary rate interface (ISDN-PRI) provided by a 5ESS® central-office (CO) switching system.
extended superframe (ESF) framing format	A format of 24 frames. See also frame .
external clock reference	A high-accuracy clock reference used by switching nodes within a private network to maintain proper network synchronization when internal clocks prove inadequate (such as a direct connection to public-network-quality clocks).
facility associated signaling (FAS)	Signaling in which a D-channel carries the signaling only for those channels on the same physical interface. See also nonfacility-associated signaling .

final trunk group	A last-choice trunk group that receives overflow traffic and may receive first-route traffic. See also trunk group .
facilities restriction level (FRL)	An assigned number that determines both the kinds of calls that can be made and the kinds of facilities (trunks) that can be used when calls are routed via Automatic Alternate Routing (AAR). See also alternate facilities restriction level .
first-choice trunk group	The group of trunks on a communications system that is chosen first for a particular call. See also trunk group .
fixed-loss plan	An end-to-end office-transmission loss plan for the public network in which all connecting trunks and end offices are digital. For all tandem connections, a fixed loss of 6 dB is inserted in the receive path of each end office.
Flexible Assignment of BX.25 (DCIU/SCI) Signaling Ports	A feature that allows ports normally reserved for an application not needed for that communications system to be used for another application. In the initial implementation of data-communications interface unit switch communications interface (DCIU-SCI) signaling ports in System 75 and System 85, certain such ports were reserved for specific applications. See also BX.25 .
foreign exchange (FX)	A central office (CO) other than the one providing local access to the public network.
frame	One of several segments of an analog or digital signal that has a repetitive characteristic. For example, in a time-division multiplexed (TDM) system a frame is a sequence of time slots, each containing a sample from one of the channels served by the multiplex system. The frame is repeated at the sampling rate, and each channel occupies the same sequence position in successive frames. See also D4 framing format and extended superframe framing format .
FRL	See facilities restriction level .
functional signaling	The signaling method used to request specific operations, such as call setup and call conferencing. See also stimulus signaling .
FX	See foreign exchange .
Generalized Route Selection (GRS)	An enhancement to Automatic Alternate Routing/Automatic Route selection (AAR/ARS) that performs routing based on call attributes, such as bearer-capability classes (BCC), in addition to the address and facilities restriction level (FRL), thus facilitating a Uniform Dial Plan (UDP) that is independent of the type of call being placed.
glare	The simultaneous seizure of a two-way trunk by two communications systems, resulting in a standoff.
GRS	See Generalized Route Selection .
HDLC	See high-level data link control .
high-level data link control (HDLC)	A standard bit-oriented protocol, developed by the International Standards Organization (ISO), in which control information is always placed in the same position and specific bit patterns used for control differ from those used in representing data, so that errors are less likely to occur.

high-volume tandem	A tandem communications system that is used only to selectively route high-volume traffic to alternate routes. See also Automatic Route Selection .
hyperactivity	A failure condition in which a digital signal level 1 (DS1) facility generates on-hook and off-hook stimuli at a very high rate.
INADS	See Initialization and Administration System .
inband signaling	Signals transmitted within the same channel and frequency band used for message traffic. See also robbed-bit signaling .
information element (IE)	A logical block of data in a Q.931 message. IEs provide specific information related to either telephone or data-terminal capabilities, such as light and ring code information; button and switchhook state changes; data rates; message type; calling, called, and redirecting party identification; and data-rate and circuit- or packet-switching compatibility.
information transfer capability	The part of the bearer capability information element (IE) that specifies channel requirements in terms of voice, voice-grade data, restricted digital data, and unrestricted digital data. See also restricted channel and unrestricted channel .
information transfer rate	The data rate at which a channel operates. For B-channels the rate is 64K-bps; for wideband channels the rate is an integer multiple of 64K-bps. The exact rate is dependent on the type of the channel — for example, H_0 or H_{11} . See also wideband channel .
Initialization and Administration System (INADS)	A software and hardware tool used by AT&T Services personnel located at Customer Service Support Organizations (CSSOs) or the National Customer Support Center (NCSC) to initialize, administer, and troubleshoot customer communications systems remotely.
Integrated Services Digital Network (ISDN)	A public or private network that provides end-to-end digital connectivity for all services to which users have access by a limited set of standard multipurpose user-network interfaces defined by the CCITT. Through internationally accepted standard interfaces, ISDN provides digital circuit-switched or packet-switched connectivity within the network and links to other ISDNs to provide national and international digital connectivity. See also Integrated Services Digital Network basic rate interface and Integrated Services Digital Network primary rate interface .
Integrated Services Digital Network basic rate interface (ISDN-BRI)	The interface between a communications system and terminal that includes two 64K-bps B-channels for transmitting voice or data and one 16K-bps D-channel for transmitting associated B-channel call-control and out-of-band signaling information — an arrangement called 2B+1D. ISDN-BRI also includes 48K-bps for transmitting framing and D-channel contention information, for a total interface speed of 192K-bps. ISDN-BRI serves ISDN terminals and digital terminals fitted with ISDN terminal adapters. See also Integrated Services Digital Network , Integrated Services Digital Network primary rate interface , and out-of-band signaling .

Integrated Services Digital Network primary rate interface (ISDN-PRI)	The interface between multiple communications systems that in North America includes 24 64K-bps channels, corresponding to the North American digital signal level 1 (DS1) standard rate of 1.544M-bps. The most common arrangement of channels in ISDN-PRI is 23 64K-bps B-channels for transmitting voice and data and 1 64K-bps D-channel for transmitting associated B-channel call-control and out-of-band signaling information — an arrangement called 23B+1D, although with nonfacility-associated signaling (NFAS) ISDN-PRI can include 24 B-channels and no D-channel. See also 24th-channel signaling , Integrated Services Digital Network , Integrated Services Digital Network basic rate interface , nonfacility-associated signaling , and out-of-band signaling .
interexchange carrier (IXC)	The telecommunications company providing inter-LATA (local access and transport area) public network transmission, such as AT&T, MCI, or Sprint. See also ISDN network identifier .
interface	A common boundary between two systems or pieces of equipment.
internal clock reference	The internal high-accuracy clock reference used by switching nodes within a private network to maintain proper network synchronization. See also external clock reference .
interworking	The linking of dissimilar networks to provide end-to-end call or feature processing.
ISDN	See Integrated Services Digital Network .
ISDN dynamic trunk	The trunk type that permits a transmission facility to be used for a variety of different trunk types on a call-by-call basis. A dynamic trunk differs from the more conventional, fixed-usage arrangement where each transmission facility is only associated with a single trunk type.
ISDN network identifier	A 3-digit field in a call-detail record that identifies a tariffed public-network service such as WATS, MEGACOM®, and the Software-Defined Network (SDN), requested for a call. The INS value field is necessary to accommodate Call-by-Call (CBC) Service Selection in an Integrated Services Digital Network (ISDN), which allows a communications system to request services and/or features on a per-call basis. Also called <i>ISDN network-service value</i> .
ISDN network-service value	See ISDN network identifier .

ISDN SID-ANI	A capability that can provide to a called party either the station identification number (SID) or automatic number identification (ANI). The SID is passed as user information; ANI is passed via the call setup. If the SID is used to access internal network information about the calling party, the user obtains information such as the calling party's location, name, office number, and type of telephone — information that is administered on the communications system. ANI can be used to retrieve records such as customer accounts, field service records, and sales records, that are indexed by telephone number. The SID/ANI capability can be used in telemarketing, customer service, and other business applications. See also automatic number identification and station identification number.
LATA	Local access and transport area.
LFA	See loss of frame alignment .
link-access procedure on the D-channel (LAPD)	A link-layer protocol on the Integrated Services Digital Network basic rate interface (ISDN-BRI) and primary rate interface (ISDN-PRI) data-link layer (level 2). LAPD provides data transfer between two devices, and error and flow control on multiple logical links. LAPD is used for signaling and low-speed packet data (X.25 and mode 3) on the signaling (D-) channel and for mode-3 data communications on a bearer (B-) channel.
local exchange company (LEC)	A company franchised to provide public intra-LATA (local access and transport area) telephone service to subscribers within a defined geographical area. Also called a <i>local exchange carrier</i> or <i>local telephone company</i> .
Look-Ahead Interflow	A feature that enhances the forwarding of calls from a vector so that calls will be forwarded only to those remote locations that can accept the calls.
LOS	Loss of signal.
loss of frame alignment (LFA) alarm	The loss of frame alignment (RFA) alarm, when received at the far end switch, indicates that the near end switch is unable to frame up on the signal sent by the far end (the end sending this alarm). Also called the <i>red alarm</i> . See also remote frame alarm and loss of signal .
loss of signal (LOS) alarm	The loss of signal (LOS) alarm indicates that there is no bipolar signal present at the ISDN-PRI receiver input. This alarm will occur in parallel with the loss of frame alignment (LFA) alarm. See also remote frame alarm .
maintenance and administration panel (MAAP)	A device used by service technicians to administer a DIMENSION® PBX or a System 85. See also visual maintenance and administration panel .
maintenance object (MO)	A term used by the AT&T Services organization for a unit that can be maintained. An MO can be a hardware component — for example, a circuit card, telephone, or trunk — or a software process.
MEGACOM®	AT&T's tariffed digital WATS offering for outward calling. See also 800 service .

MEGACOM® 800	AT&T's tariffed digital 800-service offering for inward calling.
misframe	A condition that results when the receive endpoint fails to receive the correct framing pattern.
MO	See maintenance object .
mode 3	A data-communications protocol consisting of the International Standards Organization (ISO) link-access procedure on the D-channel (LAPD) at level 2 and the X.25 packet-layer procedure at level 3.
modem	A device that converts digital data signals to analog signals for transmission over telephone circuits. The analog signals are converted back to the original digital data signals by another modem at the other end of the circuit. Also called a <i>data set</i> .
modem pooling	A capability that provides shared conversion resources (modems and data modules) for cost-effective access to analog facilities by data terminals. When needed, modem pooling inserts a conversion resource into the path of a data call. Modem pooling serves both outgoing and incoming calls.
modular processor data module (MPDM)	A processor data module (PDM) that can be configured to provide several kinds of interfaces (RS-232C, RS-449, and V.35) to customer-provided data terminal equipment (DTE). See also processor data module .
MPDM	See modular processor data module .
multiplexer	A device used to combine a number of individual channels into a common bit stream for transmission.
NCTE	See network channel-terminating equipment .
network channel-terminating equipment (NCTE)	Equipment used at a customer's premises to provide facility terminations and signaling compatibility. Also called <i>channel-service unit</i> and <i>customer-service unit</i> . See also data service unit .
network feature	See network service .
network identifier	See ISDN network identifier .
network service	A number or value that is used on most ISDN outgoing calls to place a specific request on the network communications system. Also called <i>network feature</i> .
network side	See user side .
network-specific facilities (NSF)	An information element (IE) in an Integrated Services Digital Network primary rate interface (ISDN-PRI) message that specifies which public-network service is used. NSF applies only when Call-by-Call (CBC) Service Selection is used to access a public-network service, such as MEGACOM®, MEGACOM® 800, and the Software-Defined Network (SDN).

network synchronization plan	An engineering diagram that identifies each customer-premises switching node and specifies how each switching node is to obtain synchronization. Depending on the distribution of work, either the controlling Regional Engineering Center (REC) or the National Engineering Center (NEC) will provide the network synchronization plan.
nonfacility associated signaling (NFAS)	A method that allows multiple T1 links to share a single D-channel on one of the spans to form an Integrated Services Digital Network primary rate interface (ISDN-PRI). One T1 link is therefore configured as 23 B-channels plus 1 D-channel, while the other spans that share the D-channel are configured with 24 B-channels each. See also facility-associated signaling and Integrated Services Digital Network primary rate interface .
off-premises extension (OPX)	A trunk-side analog telephone line that has several capabilities not normally available to telephone lines. Among these are a collection of call-detail records and traffic data that are needed on telephone lines used to access host computers, and certain transmission characteristics desired for long-range, off-premises operation. See also off-premises station .
off-premises station (OPS)	A device that provides service between a communications system and a single-line analog telephone located beyond the normal communications-system analog-line signaling range. See also off-premises extension .
ones density	1. The requirement for digital transmission lines in the public network that eight consecutive 0s cannot be in a digital data stream. 2. A technique for inserting a 1 after every seventh-consecutive 0. See also zero code suppression.
OPS	See off-premises station .
OPX	See off-premises extension .
out-of-band signaling	Signaling that uses the same path as voice-frequency transmission and in which the signaling is outside the band used for voice frequencies. See also Integrated Services Digital Network basic rate interface and Integrated Services Digital Network primary rate interface .
packet	A group of bits — including a message element, which is the data, and a control information element (IE), which is the header — used in packet switching and transmitted as a discrete unit. In each packet, the message element and control IE are arranged in a specified format. In many systems, the packet is further encapsulated with additional header and trailer elements to form a frame. See also packet switching .
packet assembler/disassembler (PAD)	A functional unit that enables data terminal equipment (DTE) not equipped for packet switching to access a packet-switched network.

packet-switched transport mode	The condition in which a communications system or network provides packet switching of the user's data. See also <i>circuit-switched transport mode</i>. NOTE: Although the ISDN protocol defines the Packet Switched Transport Mode and the Generic 2 administration software provides for this transport mode — the switch hardware does not currently include a packet interface.
packet switching	A data transmission technique whereby user information is segmented and routed in discrete data envelopes called packets, each with its own appended control information for routing, sequencing, and error checking. Packet switching allows a channel to be occupied only during the transmission of a packet; on completion of the transmission, the channel is made available for the transfer of other packets. See also BX.25, packet, and X.25.
packetized data	The digital multiplexed interface (DMI) mode-3 data-channel protocol used in virtual-circuit service for the statistical multiplexing of data streams. See also LAPD Packetized Data.
PAD	See packet assembler/disassembler.
parameterized-service format	One of two network-specific facility (NSF) service types that are administered in conjunction with the Automatic Alternate Routing/Automatic Route Selection (AAR/ARS) routing patterns. The parameterized service format requires multiple bytes to convey all the necessary information about the requested service or facility. See also binary service format.
partitioning	The capability to impose restrictions on each tenant's users to limit their access to only a specified subset of the communications system's facilities and services. Partitioning allows a multitenant system to comply with state or federal regulations and to provide security and cost allocation between tenants. See also tenant service.
PAM	See pulse-amplitude modulation.
PC/PBX Connection	AT&T communications-management software for the MS-DOS® and UNIX® operating systems that integrates a digital multifunction telephone and a PC with a communications system via a Digital Communications Protocol (DCP) interface to provide enhanced voice and data communications services.
PCM	See pulse-code modulation.
PDM	See processor data module.
PDS	See premises distribution system.
preferred call reference	See channel negotiation.
premises distribution system (PDS)	A cabling system that consolidates wiring for a customer's on-site and remote telephones and data terminals, and channels transmissions to the communications system.
PRI	See primary rate interface.

primary rate interface (PRI)	A standard Integrated Services Digital Network (ISDN) frame format that specifies the protocol used between two or more communications systems. PRI runs at 1.544M bps and, as used in North America, provides 23 64K-bps B-channels (voice or data) and one 64K-bps D-channel (signaling). The D-channel is the 24th channel of the interface and contains multiplexed signaling information for the other 23 channels.
private network	A network used exclusively for handling the telecommunications needs of a particular multilocation customer.
processor data module (PDM)	A device that provides an RS-232C data circuit-terminating equipment (DCE) interface for connecting to data terminals, applications processors (APs), and host computers; and provides a Digital Communications Protocol (DCP) interface for connection to a communications system. See also modular processor data module .
protocol discriminator	The first part of every Integrated Services Digital Network (ISDN) message. The protocol discriminator serves to identify the function — either call control or maintenance — for that message.
public network	A network that is commonly accessible for local or long-distance calling.
pull-in range	The range of frequencies from which the switch-clock oscillator can establish synchronization.
pulse-amplitude modulation (PAM)	A modulation technique in which an analog signal, such as speech, modulates a carrier signal consisting of a series of precisely timed pulses of equal amplitude. See also pulse-code modulation .
pulse-code modulation (PCM)	An extension of pulse-amplitude modulation (PAM) in which carrier-signal pulses modulated by an analog signal, such as speech, are quantized and encoded to a digital, usually binary, format. See also pulse-amplitude modulation .
Q.920 and Q.921	The level-2 (link-layer) specification for use in an Integrated Services Digital Network (ISDN) recommended by the CCITT for message transmission. See also Q recommendations .
Q.930 and Q.931	The D-channel level-3 (network-layer) specification for use in an Integrated Services Digital Network (ISDN) recommended by the CCITT for basic telecommunications call control. See also codepoint and D-channel .
Q recommendations	Recommendations of the CCITT that affect an Integrated Services Digital Network (ISDN). The Q.700 series defines signaling system number 7, which is used for common-channel signaling across networks. Q.920 and Q.931 define a digital-access signaling system for signaling between the customer's equipment and the network. See also CCITT , Q.920 and Q.921 , and signaling system number 7 .
raw data	See unrestricted digital data .
remote frame alarm (RFA)	The remote frame alarm (RFA), when received at the near end switch, indicates that the far end switch is unable to frame up on the signal sent by the near end (the end receiving this alarm). Also called the <i>yellow alarm</i> . See also loss of frame alignment and loss of signal .

Remote Group	A feature that allows a group of port circuits — equivalent to one or more port circuit packs but fewer than one module — to be located up to 100 miles from a communications system, communicating through digital signal level-1 (DS1) facilities. Telephones and data terminals connected to these circuits operate as if they were installed at the central location. Digital and EIA-trunk interfaces can be made remote, but the Remote Group feature does not allow local analog trunk interfaces to the remote group. Also called <i>Remote Carrier</i> and <i>Remote Carrier Group</i> . See also remote module .
remote module	A hardware configuration that allows one or more network modules to be located up to 25,000 feet from the common control (CC) by using fiber-optic cable. See also Remote Group .
restricted channel	A B-channel that meets a ones-density requirement or uses zero code suppression (ZCS). See also clear channel .
restricted digital data	User data that is encoded so that the all-0s octet cannot occur before the data is presented to the transmission channel. Restricted digital data can be transmitted over linked facilities that use combinations of zero code suppression (ZCS) and bipolar with 8-zero substitution (B8ZS) line coding.
RFA	See remote frame alarm .
RG	See Remote Group .
robbed-bit signaling	Digital signal level-1 (DS1) signaling in which up to 8K-bps from each of the 24 64K-bps channels are used for signaling in every sixth frame. The least-significant bit of each 8-bit sample is replaced by a signaling bit. Also called <i>DS1 robbed-bit signaling</i> . See also inband signaling .
SDN	See Software Defined Network .
secondary synchronization reference	A high-quality transmission facility used for providing a backup source to the primary synchronization reference.
senderized operation	A method of collecting the called number in a sender buffer and then outputting the called number to the distant central office (CO) or communications system.
severely errored second	A 1-second interval for which at least 10^{-6} errors occur.
signaling system number 7	The standard being developed by the CCITT to provide interoffice signaling — for example, signaling from a central office (CO) to a toll office, a toll office to a toll office, and a toll office to a CO. When implemented, signaling system 7 will replace common-channel interoffice signaling (CCIS). See also common-channel interoffice signaling and Q recommendations .
slip	The deletion or repetition of a single frame caused by differences in clock frequencies. Generally, a slip involving the synchronization reference will result in most or all spans experiencing the repetition or deletion of an 8-bit word. Slips are not caused by noise on the transmission line.

Software Defined Network (SDN)	An AT&T private networking service created by specialized software within the public network. SDN is designed to carry voice and data traffic between customer locations as well as to off-network locations, and offers a pricing structure based on communications usage, distance, and access-line charges.
special access	A provision whereby a telephone, data terminal, or communications system can be provided with connections directly into a long-distance carrier service, bypassing the local central office (CO).
SS7	See signaling system number 7 .
station identification (SID) number	The direct distance dialing (DDD) address — consisting of 10 digits with the North American numbering plan (NANP) — of the originating party provided in the address-digits field of the calling-party-number information element (IE) in the Integrated Services Digital Network primary rate interface (ISDN-PRI) setup message. See also ISDN SID-ANI .
stimulus signaling	A signaling method that reports stimuli but does not request specific operations. With stimulus signaling, a button press is reported simply as a button press, not as the activation of the feature associated with the button, as with functional signaling. The signaling in the Digital Communications Protocol (DCP) message set is primarily stimulus signaling. See also functional signaling .
switched access	A call that originates from a local exchange carrier (LEC) to an inter-LATA (local access and transport area) carrier network.
synchronization	The process in which proper phase alignment to a transmitter is made so that the beginning and end of a character, message, time slot, or frame can be readily identified for information retrieval.
synchronous data transmission	A method of transmitting data in which discrete signal elements are transmitted at a fixed and continuous rate. Synchronous data transmission requires that the timing of the transmission be synchronized between the sending and receiving devices. Also called <i>synchronous transmission</i> . See also asynchronous data transmission .
synchronous transmission	See synchronous data transmission .
T1	A digital transmission standard that in North America carries traffic at the digital signal level-1 (DS1) rate of 1.544M bps.
T1 digital carrier	A type of digital transmission medium that transmits at 1.544M-bps and is capable of carrying 24 channels.
tandem tie-trunk network (TTTN)	A private network that interconnects several customer communications systems by dial-repeating tie trunks. Access to the various communications systems is dictated by codes that must be individually dialed for each system.
TCM	See traveling class mark .
tenant service	A service that allows a large communications system to appear to users as many small independent systems, allowing a single system to be shared among a wide assortment of user groups called tenants. Tenant Service is useful for major airports, industrial parks, large medical centers, and large office complexes. See also partitioning .

terminal balance	The measured echo-return and singing-return losses for a port when connected to a specific 2-wire central office (CO) or off-premises network interface. Those connections that have sufficiently high return loss are assigned reduced tie trunk connecting losses without impairing talker echo performance or violating stability criteria.
Terminating-Extension Group (TEG)	A feature that provides one-way terminating call service to an extension that can be shared by a group of analog and/or multifunction (digital or hybrid) telephones. All members of the group are normally alerted for a new call and any member can answer. An option for each multifunction-telephone TEG member provides both unique identification of TEG calls and a means for bridging onto a TEG call after it has been answered by another member of the group.
time-multiplexed switch (TMS)	An element of a time-division switching network that effectively operates as a very-high-speed space-division switch whose input-to-output paths can be changed to rearrange the interconnection of successive time-slot interchange time slots. See also time-slot interchanger .
time-slot interchanger (TSI)	An element of a time-division switching network that separates and switches time-division-multiplexed signals arriving from multiple calls. See also time-multiplexed switch .
TMS	See time-multiplexed switch .
toll office	A class 4, 3, 2, or 1 network switching center. For AT&T, the Toll Office is almost always a 4 ESS™ switching system.
transport mode	The bearer-capability information-element (IE) parameter that indicates how the channel is to be used. Transport mode can be either circuit switched or packet switched. See also circuit switched transport mode and packet switched transport mode .
traveling class mark (TCM)	A code used to modify the default facility restriction level (FRL) associated with a call at the distant communications system when an intertandem tie trunk is used to route the call. When the TCM is sent on robbed-bit trunks, it is appended as an additional touch-tone digit that follows the address. When the TCM is sent over Integrated Services Digital Network (ISDN) trunks, it is included in one of the Q.931 call-setup messages.
trunk group	Trunks that can be used interchangeably between two communications systems or central offices (COs). See also final trunk group and first-choice trunk group .
trunk type	A generic term or number that defines the trunk signaling and relates that type of trunk signaling to a particular feature or service.
TMS	See time-multiplexed switch .
TSI	See time-slot interchanger .
TTTN	See tandem tie-trunk network .
UDP	See Uniform Dial Plan .
Uniform Dial Plan (UDP)	A feature that allows a unique number assignment (4- or 5-digit) for each terminal in a multicomunications-system configuration such as a distributed communications system (DCS) or main-satellite-tributary configuration.

unrestricted channel	A B-channel that uses bipolar with 8-zero substitution (B8ZS) line coding and that does not have a ones-density requirement for user data. See also restricted channel .
unrestricted digital data	User data that is presented to a transmission facility without having been encoded to prevent an all-0s octet. Unrestricted digital data requires that the transmission facilities use bipolar with 8-zero substitution (B8ZS) line coding on an end-to-end basis; otherwise the data will potentially be destroyed. Also called <i>raw data</i> .
user-to-user information (UI) exchange	A capability that allows customers to send and receive user information transparently through an Integrated Services Digital Network (ISDN).
user-to-user information transfer	The transfer of special call-related information from the calling party to the called party during certain call setup and disconnect messages.
UUI	See user-to-user information exchange .
via-net loss (VNL)	One of the components used in the assignment of connecting losses for tie-trunk links. Via-net loss (VNL) is calculated by means of a formula that factors in the temporal delay experienced by a signal as it traverses the link. Networks designed in this manner are called VNL networks .
visual maintenance and administration panel (VMAAP)	A program running in the UNIX® operating system that emulates operations of the maintenance and administration panel (MAAP) used with a System 85 and DIMENSION® PBX. VMAAP can be used interactively like the MAAP. It can also be called by another program. See also maintenance and administration panel .
VNL	See via-net loss .
voice-grade data	Data that is transmitted over a digital facility in analog form using pulse code modulation (PCM). The data must pass through a modem, either at both ends or at a modem pool at the far-end.
WATS (Wide Area Telecommunications Service)	A service that allows calls to certain areas for a flat-rate charge based on expected usage.
wideband channel	More than one channel used to support a particular application. For example, six 64K-bps bandwidth channels can be grouped together to provide one 384K-bps bandwidth channel. NOTE: Wideband channel arrangements are not permitted with System 85 R2V4 phase 1.
X.25	A CCITT standard that specifies the interface between user data terminal equipment (DTE) and data circuit-terminating equipment (DCE). See also BX.25 and packet switching .
ZCS	See zero code suppression .

zero code suppression (ZCS) A binary-coding scheme that ensures that a data stream contains at least a minimum number of information bits to ensure receiver synchronization. While acceptable for voice transmission, ZCS may not be acceptable for data transmission. See also **ones density**.

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