5ESS®-2000 Switch
DEFENSE SWITCHED NETWORK APPLICATIONS

Document: 235-200-300
Issue Date: August 1999
Issue Number: 3.00

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1. INTRODUCTION

1.1 PURPOSE

This document provides information about the *5ESS®*-2000 switch (with the 5E12 software release) as used in the Defense Switched Network (DSN). The DSN was previously known as the Automatic Voice Network (AUTOVON). The AUTOVON has evolved into the DSN which is implemented with digital switches, additional features, and modified system configurations. When the term DSN is used in this document, DSN/AUTOVON is implied.

The DSN network is used primarily by the military, and its requirements are specified by the Defense Information Systems Agency (DISA). The DSN features provide for routine and precedence telecommunications.

1.2 UPDATE INFORMATION

This document is being updated to add new information for the 5E12 software release.

In accordance with the 5ESS®-2000 switch Software Support Product Policy, information supporting software releases 5E10 and earlier is being removed from all documentation. The 5E10 and earlier software releases have been rated Discontinued Availability (DA); software release 5E10 is scheduled to be rated DA when software release 5E13 becomes standard. The actual removal of the information will occur over time instead of concurrently.

If you are supporting offices using a software release prior to 5E10 and therefore have a need for the information being removed, it is recommended that you retain the associated pages as they are removed from the document.

1.3 ORGANIZATION

This manual contains the following sections:

- ***Section 1 - INTRODUCTION:*** This section contains an introduction to this document.
- ***Section 2 - DSN OVERVIEW:*** This section contains terminology and the numbering plan for the DSN network.
- ***Section 3 - 5ESS®-2000 SWITCH APPLICATIONS:*** This section contains information about switch configurations, features, routing, screening, administration, and maintenance.
- ***GLOSSARY*** - This section provides the acronyms, terms, and abbreviations used in this document.

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1.7 NAMING CONVENTIONS FOR *5ESS*®-2000 SWITCH SOFTWARE RELEASES

Currently, three software releases are active and being supported for the *5ESS*®-2000 switch; however, the level of support may vary per release.

Depending on the number of issues and releases planned for a software release, only part of the name may be used. For example, if only one issue is planned, only the software release number is used.

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2. DSN OVERVIEW

2.1 GENERAL INFORMATION

The Continental United States (CONUS) Defense Switched Network (DSN) is a private military telecommunications network that provides its subscribers with services similar to those provided by the public network plus unique features specific to the government application.

The CONUS DSN uses a unique POLYGRID trunking arrangement to interconnect the four-wire DSN switching centers. This trunking arrangement ensures reliable and efficient telecommunications capability, even under extreme and/or adverse conditions.

The access lines to the DSN terminate on a DSN tandem switch. Currently, a DSN tandem switch supports four-wire subscribers directly connected to the switch, and two-wire or four-wire subscribers that connect via a DSN Private Branch Exchange (PBX). A DSN PBX appears to the tandem switch to be no different from a DSN Interface switch. The DSN tandem switch also interfaces with other DSN tandem switches and private networks such as the Federal Telecommunications System (FTS). Also, the DSN tandem switch must interface to a network management center that monitors all DSN tandem switches.

The Automatic Voice Network (AUTOVON) has evolved into the DSN which was initially available with the 5E3 software release. The DSN functions in a similar way to AUTOVON, plus it provides several new features and system configurations not previously supported on the AUTOVON network. The DSN is made up of the following three types of switches:

- DSN Interface-End Office (EO) switch
- DSN Stand-Alone Tandem (NODAL) switch
- DSN Multifunction switch (MFS).

From a feature point of view, all three switches provide a similar set of DSN features. The primary difference between the switches is their network application and size.

The DSN Interface-EO functions both as an end office and as an interface to the public network. Access to multifunction switches or stand-alone NODAL switches is provided by either access lines or interswitch trunks. A stand-alone NODAL switch functions primarily as a tandem switch in the DSN. A multifunction switch has the combined functions of a stand-alone NODAL switch and an end-office switch.

The DSN Multifunction switch (MFS) capability provides a set of features that allows the *5ESS*®-2000 switch to be configured as any of the three types of DSN switches. No attempt is made to treat the three switches as separate entities. Instead, the term Multifunction switch (MFS) is used to refer to the one common switch.

2.2 TERMINOLOGY

The following terms are defined as they are used in this document.

AUTOVON: This is a former government network that has evolved into the DSN. The Automatic Voice Network was put in place in the 1960s to serve the military in the CONUS and other allied countries. Network elements were then electro-mechanical and first generation electronic switches. The AUTOVON has been superseded by the DSN which is implemented with digital switches. The term is used in *5ESS*®-2000 switch documentation because *5ESS*®-2000 switches were part of AUTOVON in the past.

Precedence: This denotes either the entire hierarchy of DSN call precedence levels or a specific DSN call precedence level. There are five levels of precedence used within the DSN network. A sixth precedence level is available for intra-switch calls, and it is called Executive Override (EO). The EO level is between

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Priority and Routine. The precedence levels from highest (most important) to lowest are as follows:

- (FO) Flash override
- (F) Flash
- (I) Immediate
- (P) Priority
- (R) Routine.

Preemption: This refers to the action of a higher precedence call gaining access to the line or trunk being used by a lower precedence call. If the preemption is taking place because the line or trunk in question is to be used as part of the setup for the higher precedence call, the lower precedence call is said to be **preempted for reuse.** If the line or trunk is not to be used by the higher precedence call, but is being released because another line or trunk in the connection is needed, the lower precedence call is said to be **preempted to clear.**

Preemptable/Nonpreemptable: The lines and trunks on an MFS are marked as either preemptable or nonpreemptable. A line or trunk marked preemptable can be preempted for reuse or preempted to clear. A nonpreemptable line or trunk can only be preempted to clear.

DSN Subscriber/User: The DSN requirements make the distinction between users and subscribers to indicate which type of customer is subject to the restrictions of the Precedence Access Threshold (PAT) feature. A user is subject to PAT, whereas a subscriber is not. This document uses the two terms interchangeably unless PAT is being referenced (for example, user restricted by the PAT).

Precedence Alerting: The ringing signal given when a precedence call is terminating to an idle line.

Preemption Tone: The tone given to a subscriber when they are being preempted.

Precedence Audible: The audible tone supplied to the calling party of a precedence call while the terminating party is receiving **precedence alerting.**

2.3 NUMBERING PLAN

A uniform numbering plan that generally follows the North American commercial system is used in the DSN network. The DSN numbering plan specifies the dialing format for DSN subscribers and specifies the format of the outpulsed digits to other DSN switches and other non-DSN switches.

2.3.1 ACCESS LINES

The subscriber dialing format is as follows:

(A) + (P/S) + (1X) + (NYX) + NNX + XXXX

where (A) is the optional access digit, (P/S) is the optional precedence or service digit, (1X) is the optional Route Code, (NYX) is the optional area code, NNX is the switch code, and XXXX is the line number. The access digit is normally 9. The precedence/service digit is a digit 0 through 9 or the dual tone multifrequency tones generated by keys on a 16-button touch-tone station set for Flash Override precedence, Flash precedence, Immediate precedence, or Priority precedence. The X represents any digit 0 through 9, the Y represents the digit 0 or 1, and N represents any digit 2 through 9.

The access digit is used in combination with the precedence/service digit to allow subscribers on rotary or 10-/12-button telephones to dial precedence calls. The DSN numbering plan defines these two digits as follows:

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Access Digit	Precedence/ Service Digit	
9	0	Flash Override Precedence
9	1	Flash Precedence
9	2	Immediate Precedence
9	3	Priority Precedence
9	4	Routine Precedence
9	5-9	Spare
-	FO	Flash Override Precedence
-	F	Flash Precedence
-	I	Immediate Precedence
-	P	Priority Precedence
-	-	Routine Precedence

The use of access digits is typically assigned to subscribers on rotary or 10-/12-button telephones to allow them to place precedence calls. Subscribers with 16-button equipment are not required to dial an access digit to place a DSN precedence call. They request the precedence by using one of the precedence keys on their station set. If no precedence is needed on a given call, either type of subscriber simply dials a 7- or 10-digit Directory Number (DN) preceded by an optional Route Code. Routine is the default precedence level.

The optional Route Code is used to progressively inform switches during call setup of special routing or termination requirements. The Route Code is used to determine whether a call requires data- or voice-grade trunking or to indicate that the DN specified is on a different network. It is not necessary to dial a Route Code on voice calls that terminate on the DSN. A zero (0) is the default Route Code value. Subscriber-dialed Route Codes are defined as follows:

10	Voice-grade trunking
11	Data-grade trunking
12	Spare
13	Spare
14	Spare
15	Used for hot line, not manually dialable
16	Used for hot line, not manually dialable
17	FTS DN follows
18	Spare
19	Commercial Direct Distance Dialing (DDD) DN follows.

Subscribers can also be assigned abbreviated dialing lists.

The DSN subscribers are able to make calls to the Dial Service Assistance (DSA) operator. They can do so by dialing a code that would indicate a precedence call to the DSA operator. Dialing a 0 indicates a call to the attendant on the switch. If the attendant does not exist, then the call is routed to the DSA operator. The 0 can be optionally preceded by a precedence digit. In the MFS environment, the base level subscriber can dial 9 for an off-base access and dial 0 for the local off-base (commercial) operator.

2.3.2 ROUTE CONTROL DIGIT INTERSWITCH TRUNKS

The Route Control Digit (RCD) interswitch trunks are used with POLYGRID routing.

NOTE: The Route Control Digit (RCD) interswitch trunks do not apply for the Very Compact Digital Exchange (VCDX). The VCDX application does not support POLYGRID Routing.

These trunks can be Multifrequency (MF), Primary Rate Interface (PRI), or Signaling System 7 (SS7). The outpulsing format used on MF RCD trunks is as follows:

P + R + RCD + (NYX) + NNX + XXXX

where P is the precedence digit, R is the Route Code, RCD is the Route Control Digit, (NYX) is the optional area code, NNX is the switch code, and XXXX is the line number. For PRI trunks, the precedence level is indicated in a Precedence Information Element. For SS7 Stage-1 trunks, the precedence level is indicated in the Calling Party Category (CPC) parameter. For SS7 Stage-2 trunks, the precedence level is indicated

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in a Precedence parameter. The precedence digit can be any digit 0 through 4. The Route Code (RC) digit can be any digit 0 through 9. For PRI and SS7 (Stage 1 and Stage 2) trunks, the RC is prepended to the Called Party Number (called_dn) field. The RCD can be any digit 0 through 3. The X represents any digit 0 through 9, the N represents any digit 2 through 9, and the Y represents the digit 0 or 1. For additional SS7 information, refer to 235-190-120, *Common Channel Signaling Service Features.*

The precedence digit is a value indicating the precedence entered by the subscriber (or that in the subscriber's abbreviated dialing list), or a 4 if no precedence was dialed. The precedence levels FO, F, I, and P are converted to the digits 0, 1, 2, and 3, respectively.

The Route Code is the second digit of the two-digit Route Code entered by the DSN switch. [The first digit (1) is stripped off.] If no Route Code is dialed or obtained from an abbreviated dialing list, the Route Code sent on interswitch trunks is 0. The Route Code generated by a hot-line subscriber is either a 5 for voice-grade trunking or a 6 for data grade trunking.

The Route Control Digit is used for routing calls within the CONUS. This code is determined by each switch along the call path.

2.3.3 NON-ROUTE CONTROL DIGIT INTERSWITCH TRUNKS

Interswitch trunks not involved in POLYGRID routing are not required to use an RCD. These trunks are typically used when access to an overseas switch is required. The outpulsing format for these trunks does not contain the RCD. These trunks can be MF, PRI, or SS7 trunks. The outpulsing used for MF trunks is as follows:

P + RC + (NYX) + NNX + XXXX

where P is the precedence digit, RC is the Route Code, (NYX) is the optional area code, NNX is the switch code, and XXXX is the line number. For PRI trunks, the precedence level is indicated in a Precedence Information Element. For SS7 Stage-1 trunks, the precedence level is indicated in the Calling Party Category (CPC) parameter. For SS7 Stage-2 trunks, the precedence level is indicated in a Precedence parameter. The precedence digit can be any digit 0 through 4. The Route Code (RC) digit can be any digit 0 through 9. For PRI and SS7 (Stage 1 and Stage 2) trunks, the RC is prepended to the Called Party Number (called_dn) field. The X represents any digit 0 through 9, the N represents any digit 2 through 9, and the Y represents the digit 0 or 1.

The precedence digit is a value indicating the precedence entered by the subscriber (or that in the subscriber's abbreviated dialing list), or a 4 if no precedence was dialed. The precedence levels FO, F, I, and P are converted to the digits 0, 1, 2, and 3, respectively.

The Route Code is the second digit of the two-digit Route Code entered by the DSN switch. [The first digit (1) is stripped off.] If no Route Code is dialed or obtained from an abbreviated dialing list, the Route Code sent on interswitch trunks is 0. The Route Code generated by a hot-line subscriber is either a 5 for voice-grade trunking or a 6 for data grade trunking.

2.3.4 TRUNKS TO OTHER NETWORKS

The MFS must interface with trunks going off to other networks, for example, FTS, Defense Commercial Telecommunications Network, and the commercial DDD network. Outpulsing on these trunks consists of sending only the DN digits with no precedence, Route Code, or RCDs.

Calls coming in over commercial (DDD) trunks are limited to seven-digit DNs of subscribers on the DSN. If routing is required between DSN switches, a precedence of 4 and a Route Code of 0 are added. The DSN switch also applies the RCD of 0 at the point the call enters the DSN.

2.3.4.1 Automatic PBX Interface

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Access lines terminating to an automatic Private Branch Exchange (PBX) may be one of the following three types: Routine Network In-Dialing (RNID), Precedence Network In-Dialing (PNID), and Immediate Diversion Network Inward Dialing (INID). Calls originating over these access lines are treated as if they originated from an individual access line, that is, the authorized precedence is checked, Route Codes are accepted, etc. The main difference results when calls are terminated to the PBXs.

All traffic to a PBX over an RNID access line is treated as routine by the PBX. Therefore, if a precedence call is to be routed over an RNID access line (this usually results when all PNID lines to the same PBX are busy), the switch strips off the precedence digit before routing the call to the PBX. When calls are terminated over this class of access line, the switch cuts through the voice path to the PBX which then provides the audible ringing tones.

All traffic, routine and precedence, over a PNID access line is direct in-dialed to the PBX. The switch sends the precedence digit (0 to 4) to the PBX preceding the DN digits on every call. For a routine call, this digit is 4. Audible ringing is provided by the PBX as was the case with RNID access lines.

Traffic over INID access lines is treated differently depending on whether the call is routine or precedence. Routine traffic is direct in-dialed with no precedence digit. All precedence traffic is handled by the switch sending one of the following precedence alerting indicators to the PBX:

- Sending a wink consisting of 350 ms off-hook, then 350 ms on-hook, then continuous off-hook
- Sending 2-second cycles of 360 ms on-hook, 1640 ms off-hook.

The switch provides precedence audible on precedence calls, and the PBX provides audible on routine calls.

2.4 SWITCH INTERFACES

2.4.1 TWO-WIRE INTERFACE

An interface to two-wire subscribers is provided by the MFS. The switch provides standard audible ringing and uses 6-second cycle ringing for routine calls. For priority calls, the switch provides a precedence audible and precedence alerting (2-second cycles of 360 ms silence, 1640 ms ringing). Precedence alerting is provided as distinctive ringing for all lines, analog lines and Basic Rate Interfaces (BRIs), to maintain consistent treatment.

2.4.2 FOUR-WIRE AND MANUAL PBX INTERFACE

Special treatment is given to the different types of access lines at the time of termination.

The subscriber equipment is given the appropriate alerting signals by the switch for all traffic being routed to a manual PBX or a four-wire individual access line. This class of access line has the option of providing confirmed audible ringing or having the switch provide it. Routine alerting to these lines is performed by either sending continuous off-hook or sending the normal alerting of 6-second cycles of 2 seconds off-hook, 4 seconds on-hook. Precedence alerting is given as one of the following: (1) sending continuous off-hook, (2) sending a wink consisting of 350 ms off-hook, then 350 ms on-hook, then continuous off-hook, or (3) sending 2-second cycles of 360 ms on-hook, 1640 ms off-hook.

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3. *5ESS*®-2000 SWITCH APPLICATIONS

3.1 SWITCH CONFIGURATIONS AND INTERFACES

3.1.1 PUBLIC NETWORK END OFFICE WITH DSN/AUTOVON ACCESS

The Defense Switched Network/Automatic Voice Network (DSN/AUTOVON) Interface switch is a local office on the public network that has subscribers authorized to access the DSN/AUTOVON and has other subscribers who do not access the DSN/AUTOVON. The Interface Switch capability is provided by a DSN Interface - End Office.

3.1.1.1 External Interfaces to DSN/AUTOVON Interface Switch

The major external interfaces (Figure 3-1) to the DSN/AUTOVON Interface switch are as follows:

- Two-wire subscribers
- Two-wire multiline attendant consoles
- Integrated Services Digital Network (ISDN) attendant consoles
- Satellite Private Branch Exchange (PBX)
- Precedence Network In-Dialing (PNID) and Routine Network In-Dialing (RNID) DSN/AUTOVON trunks
- Direct Distance Dialing (DDD) trunks
- MLPPDQO (Primary Rate Interface [PRI] trunk between AUTOVON Interface/End-Office and DSN node)
- MLPPDQI (PRI trunk between DSN nodes without POLYGRID routing)
- MLPPQ (PRI trunk between DSN nodes with POLYGRID routing)
- MLPPS7O (Signaling System 7 [SS7] trunk between AUTOVON Interface/End-Office and DSN node)
- MLPPS7I (SS7 trunk between DSN nodes without POLYGRID routing)
- MLPPS7P (SS7 trunk between DSN nodes with POLYGRID routing).

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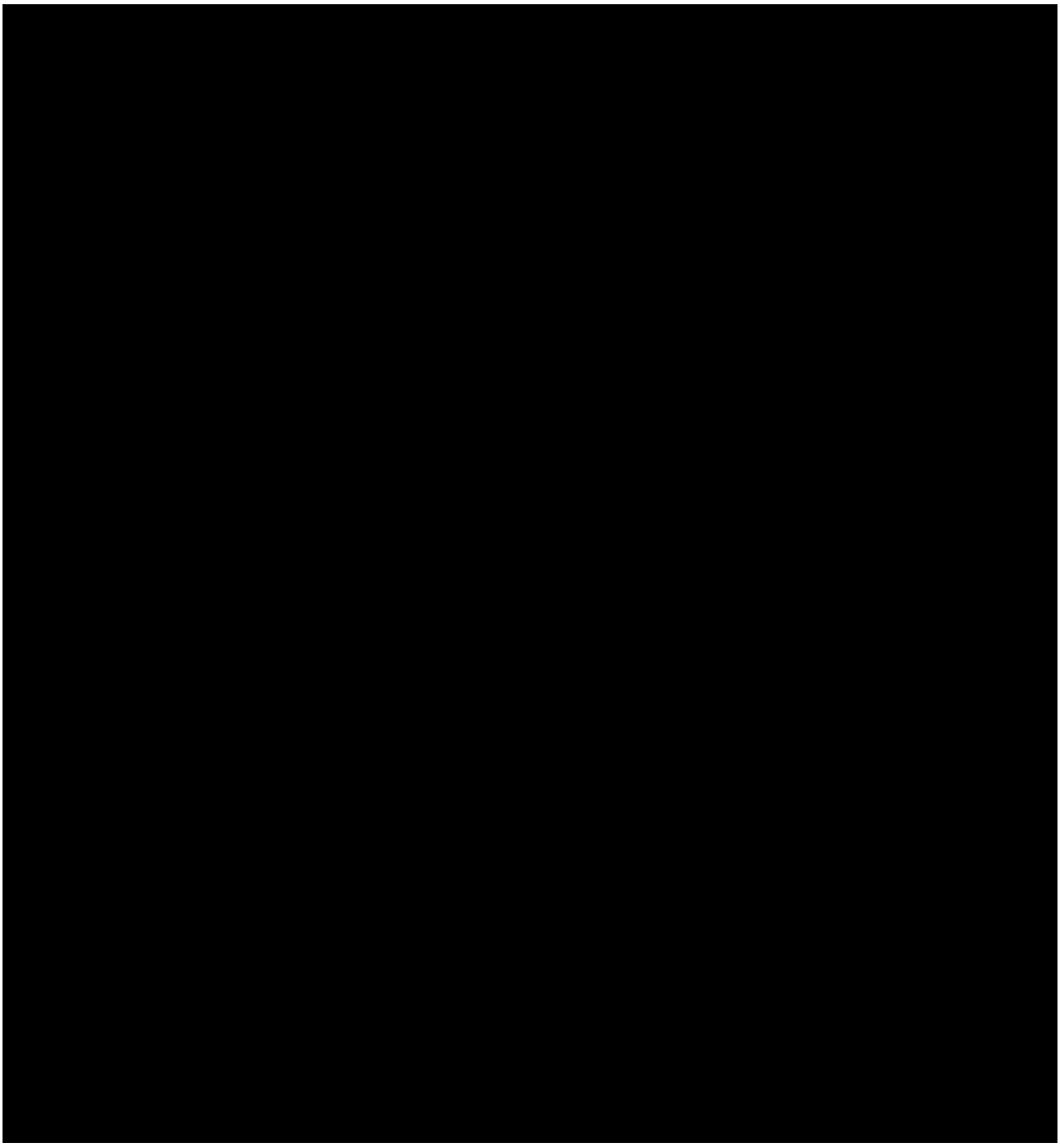

Figure 3-1 DSN MLPP Connection Arrangements

The two-wire subscribers are the set of customers allowed to access the DSN network as well as having centrex services. The Business and Residence Custom Services (BRCS) features provide these business features.

The two-wire multiline attendant consoles are the 50B consoles supported by the BRCS feature set. This console, which BRCS uses as a non-data-link console, supports the attendants who service DSN and non-DSN subscribers within the local switch.

The ISDN Attendant (ISAT) console provides the user with attendant-related call handling and processing functions, as well as system monitoring and administration capabilities for an ISDN system. Multiple attendant consoles may be used with an ISDN system for the higher traffic applications requiring additional (multiple attendants). Each console is connected to the switch via a custom Basic Rate Interface (BRI)

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which contains one B-channel and one D-channel. An optional selector console is available to operate with the ISDN attendant console. The optional selector console provides the Direct Extension Selection (DXS) with a Busy Lamp Field (BLF) feature. This feature provides the attendant with a visual indication of the busy or idle status of up to 3200 extension numbers assigned to the system.

Satellite PBXs are supported by the DSN/AUTOVON interface feature by giving those subscribers precedence access to the DSN/AUTOVON network via the DSN/AUTOVON attendants. Satellite PBXs are PBXs that connect to the DSN/AUTOVON Interface switch (local office).

The PNID and RNID trunks are four-wire tie trunks and provide access for the local DSN/AUTOVON Interface switch to the DSN. The DSN/AUTOVON Interface switch provides authorized subscribers access to the DSN/AUTOVON network over these trunks. Non-DSN/AUTOVON subscribers on the DSN/AUTOVON Interface switch are never allowed access to these trunks and experience no difference in service from subscribers served by a local *5ESS*®-2000 switch without the DSN/AUTOVON interface feature. Both PNID and RNID trunks connect the DSN/AUTOVON Interface switch to the DSN/AUTOVON tandem switch. Routine and precedence calls between the DSN/AUTOVON Interface switch and the DSN are completed using PNID and/or RNID trunks. Outgoing precedence calls are completed only via PNID trunks. Incoming and outgoing routine calls can be completed via either PNID or RNID trunks. Incoming precedence calls to the *5ESS*®-2000 switch (when provisioned). Outgoing precedence calls are allowed to preempt trunks when no idle trunk is available (when provisioned). Preemption of an incoming call is signaled by the DSN. The DSN/AUTOVON Interface switch processes the signal by preempting its end of the call.

The DDD trunks are the interfaces to the public network for DSN subscribers as well as the rest of the non-DSN subscribers served by the DSN/AUTOVON Interface switch.

3.1.2 DSN MULTIFUNCTION SWITCH

This feature allows a *5ESS*®-2000 switch to function as both a DSN Interface - End-Office and a DSN tandem (NODAL) switch. The end office is a dial central office that serves a military base, and the tandem performs the function of the DSN tandem switch. The adaptation of BRCS to the DSN/AUTOVON environment is included in this feature.

The Multifunction Switch (MFS) feature package requires the Universal BRCS, BRCS Centrex, BRCS Extended Centrex, and BRCS customization packages.

The DSN/AUTOVON MFS capability provides the following:

- Four-wire and two-wire subscriber access
- Four-wire tie trunk access
- Access to other networks
- DSN/AUTOVON numbering plan
- DSN/AUTOVON console
- Multilevel Precedence and Preemption (MLPP)
- MLPP on PRI
- MLPP on SS7 Stage-1
- MLPP on SS7 Stage-2
- Precedence Access Threshold (PAT)

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- Community of Interest (COI) Precedence Treatment
- Abbreviated Dialing (Speed Calling)
- Route Control Digit (RCD)
- Direct Station Selection (DSS)
- Route Code
- PNID
- Main-satellite DSN compatibility
- Hot-line service
- Answer delay for certain PBXs
- Dual homing of PBXs
- Special guard timing
- POLYGRID routing and its interaction with preemption
- Interface to in-dial PBXs
- Maintenance features
- Measurements
- Network Management (includes controls and an interface to a custom network management center)
- BRCS adaptation to DSN
- ISDN Attendant (ISAT) consoles
- ISDN BRCS compatibility.

3.2 SWITCH FEATURES

3.2.1 POLYGRID ROUTING

NOTE: POLYGRID routing does not apply for Very Compact Digital Exchange (VCDX).

3.2.1.1 POLYGRID Network Overview

The DSN uses a POLYGRID network composed of overlapping grids of interconnected switching centers. The POLYGRID scheme described here is the method used for interswitch routing between DSN/AUTOVON switching centers. In contrast to the public network's hierarchical arrangement, all switches in the POLYGRID network have equal rank.

The basic POLYGRID pattern of interconnected switching nodes is shown in Figure 3-2 .

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Figure 3-2 Basic POLYGRID Routing Network Configuration

The fundamental unit of this structure is shown in Figure 3-3 as the Home Grid, which is a set of switches surrounding and directly connected to a destination center. The number of switching centers in a home grid can vary according to its location and traffic needs. In addition to this network of grids, direct long-haul trunk groups are established between widely separated centers when the traffic between those centers is enough to justify the expense.

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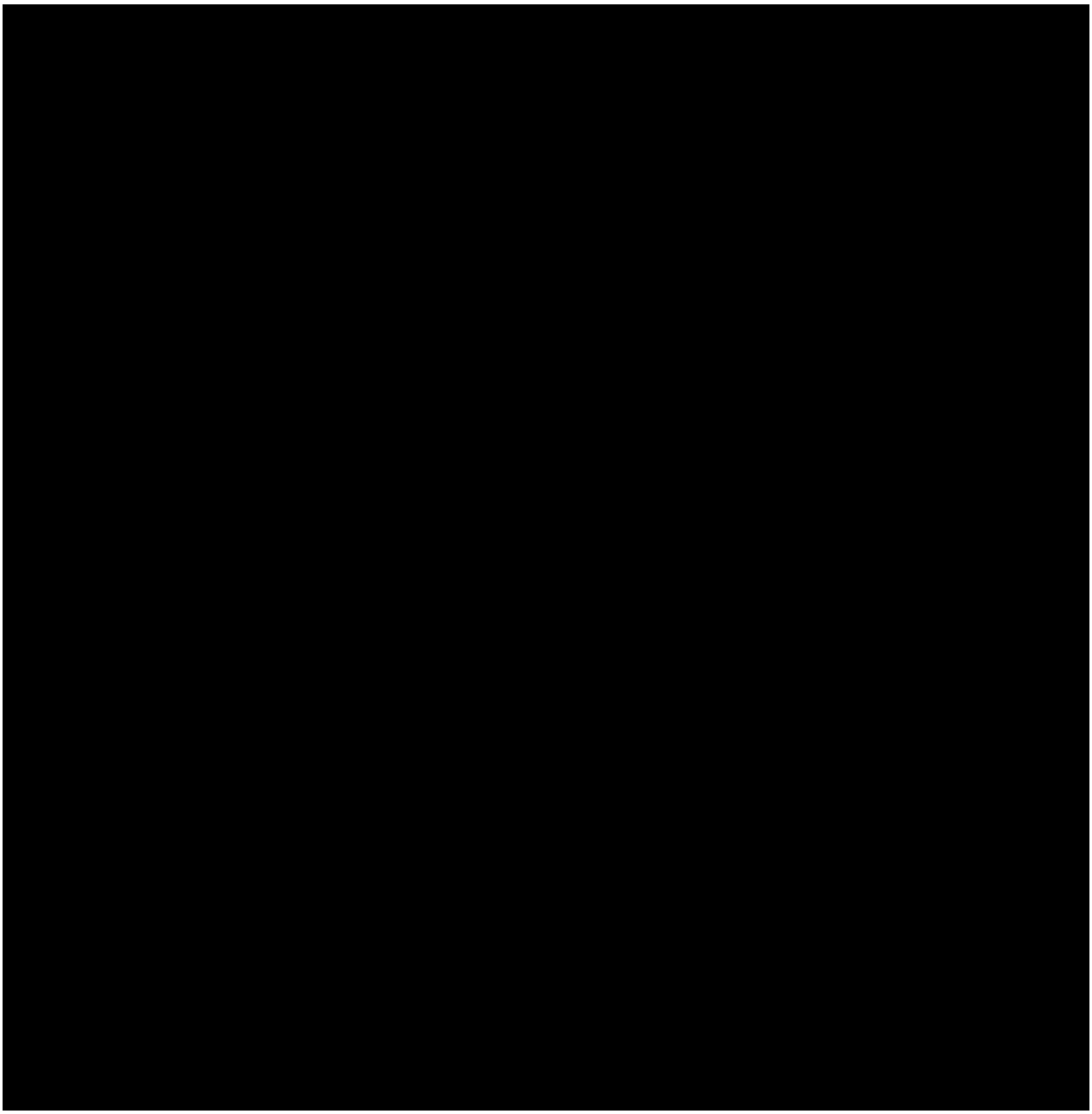

Figure 3-3 POLYGRID Routing Home Grid

For a given destination center, an originating switch checks all predefined routes until an available link is selected for the call. The far end of the link then becomes the controlling switch, while the previous switch relinquishes control of the routing. The selection process then repeats for the next link in the route.

The POLYGRID plan distinguishes between "exterior routing", used when the controlling switch is not in the home grid of the destination switch, and "interior routing", used when the originating switch is in the destination's home grid. There exist ten possible routes (the direct route plus three triples) that can be defined from the originating switch to the destination switch.

Route control in the POLYGRID network depends on the use of the Route Control Digit (RCD) assigned to each route. This digit is inserted by each DSN tandem switch along a call route. The RCD immediately precedes the address digits transmitted over interswitch trunks. The RCD performs the following functions:

- Exercises control over the alternate routing at the next switching center

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- Prevents "shuttle" and "ring around the rosy"
- Assists in limiting the number of interoffice trunk links that may be used on a call.

The RCDs are assigned based on the following POLYGRID rules:

- Route Control Digit 0 (RCD-0) is always used on forward routes.
- RCD-1, RCD-2, and RCD-3 must be used on lateral routes.
- RCD-1 and RCD-2 are used on the first lateral route, RCD-3 on the second or only lateral route.

A forward route is considered to be a route that advances a call to a switching center that is geographically nearer the destination. Once a call progresses to the home grid of the destination switch, the only forward route available is the direct route to the destination switch. Lateral routes are defined as routes that do not advance the call geographically by the factor required for forward routing.

3.2.1.2 Routing Data

The POLYGRID routing scheme centers around the data supplied to the switching system by the network administrators. This data must be consistent between switching offices to ensure that proper route control is performed at each office.

The network administrators supply the following information to the switching centers for each destination code reachable by that switch:

- Route type including interior, exterior A, exterior B, and exterior C (exterior B and exterior C are only used by some special offices in the DSN)
- Rotation indicator (yes or no)
- Immediate preempt (yes or no)
- Direct route (one route)
- First triple (three routes)
- Second triple (three routes)
- Third triple (three routes).

The "route type" indicates whether the destination is interior or exterior to the home grid. This is needed to determine which of the ten routes should be searched for a given call. The "rotation indicator" specifies whether the trunk groups making up the triples should be searched in a fixed or rotated order. Precedence calls use the "immediate preempt indicator" to determine if the idle search should be skipped, and routing should begin using an immediate preempt search.

A "route" specifies the trunk group and the RCD that is outpulsed on the trunks in the trunk group based on the received RCD (digit 0, 1, 2, or 3). A "route" consists of an indicator of the trunk group to use and an RCD to be outpulsed. The RCD outpulsed depends on the RCD received.

It is not necessary to specify trunk groups in all ten routes (direct and three triples). For example, interior routing only uses the direct route and the first two triples. Also, it is not necessary to have all three routes within a triple.

The MFS capability provides a method for doing a total network reconfiguration of routing data. The

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network administrators provide the new POLYGRID routing data, as output listings, to the administrators of each switch. This new routing data is entered at the switch according to recent change procedures. The new data is inhibited until the prearranged time when all switches simultaneously change over to the new routing data. All switches, using a manually coordinated procedure, put the new data into effect at the same time to avoid problems such as "shuttle" and "ring around the rosy."

3.2.1.3 Routine POLYGRID Routing

Routine calls in the POLYGRID network use different routing within the home grid than outside of it. The possible routes that are searched are controlled by the RCD received from the previous switch. (RCD-0 is assumed if the call is at the originating switch.) For interior routing, an RCD-0 causes the direct route and the first triple to be searched. An RCD-1, RCD-2, or RCD-3 indicates that only the direct route is to be used. For exterior A routing, an RCD-0, RCD-1, RCD-2, or RCD-3 indicates that the direct route and the first triple are to be searched.

For exterior B routing, RCD-0 indicates all routes are to be searched. An RCD-1 causes the direct route plus the first and second triples to be searched. An RCD-2 causes the direct route plus the first and third triples to be searched. An RCD-3 indicates only the direct and the first triple are to be searched.

For exterior C routing, RCD-0 indicates only the first triple is to be searched. An RCD-1 only causes the second triple to be searched. An RCD-2 only causes the third triple to be searched. An RCD-3 indicates only the direct route is to be searched.

On routine calls, the routes that make up the first triple are always searched in a fixed order. This search uses the network resources more efficiently, because the routes within a triple are typically arranged such that the first route advances the call nearer to the destination than the second, and the second advances nearer than the third.

3.2.1.4 Precedence POLYGRID Routing

Precedence calls in the POLYGRID network use different routing within the home grid than outside of it. The possible routes that are searched are controlled by the RCD received from the previous switch. (RCD-0 is assumed if the call is at the originating switch.)

For interior routing, RCD-0 causes the direct route plus the first and second triples to be searched. An RCD-1 searches the direct route and first triple, RCD-2 searches the direct route and the second triple, and RCD-3 searches the direct route only.

For exterior A and exterior B routing, RCD-0 searches all programmed routes. An RCD-1 searches the direct route plus the first and second triple, RCD-2 searches the direct route plus the first and third triple, and RCD-3 searches the direct route plus the first triple.

For exterior C routing, the possible routes that are searched for precedence calls are the same as routine calls.

A precedence call originating in an exterior office may have up to ten routes available for routing. This drops to seven available routes once inside the home grid. The search pattern for the best route is a two-stage process: the idle search and the preempt search. There are two alternatives for processing precedence calls: (a) the first indicates an idle search is performed followed by a preempt search, and (b) the second indicates an immediate preempt search. The choice of search alternative is specified for each destination office code.

Another alternative during the search process is the order in which the routes within a triple are searched. For precedence calls, the routes may be searched in a fixed order, as was the case for routine calls, or the search may use rotation to select the initial route to be hunted. The rotation of trunks ensures that the trunk groups making up the triple are searched in a random but uniformly distributed order.

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Figures 3-4 and 3-5 give a summary of the order in which routes are searched for interior and exterior routing.

3.2.1.4.1 Idle Search

The idle search for precedence calls is affected by the received RCD, the immediate preemption option, and whether the call is within the home grid or not. Inside the home grid, the direct route is first examined for an idle trunk. If none is found, calls with an RCD of 1 to 3 go immediately to the preempt search as will calls with RCD-0 if the immediate preemption option applies. If the immediate preemption option does not apply, calls with an RCD-0 continue the idle search to the routes in the first triple. These are examined for an idle trunk in a fixed or rotated order. Failing to find an idle trunk in the first triple, these calls are also sent to a preempt search.

If the immediate preemption option does not apply, exterior A routing of precedence calls examines the direct route plus the first triple during an idle search regardless of the received RCD. If no idle trunks are found, these calls enter the preempt search. If immediate preemption applies, a preempt search is done immediately after each idle search that fails to find an idle trunk.

Figure 3-4 Interior POLYGRID Routing

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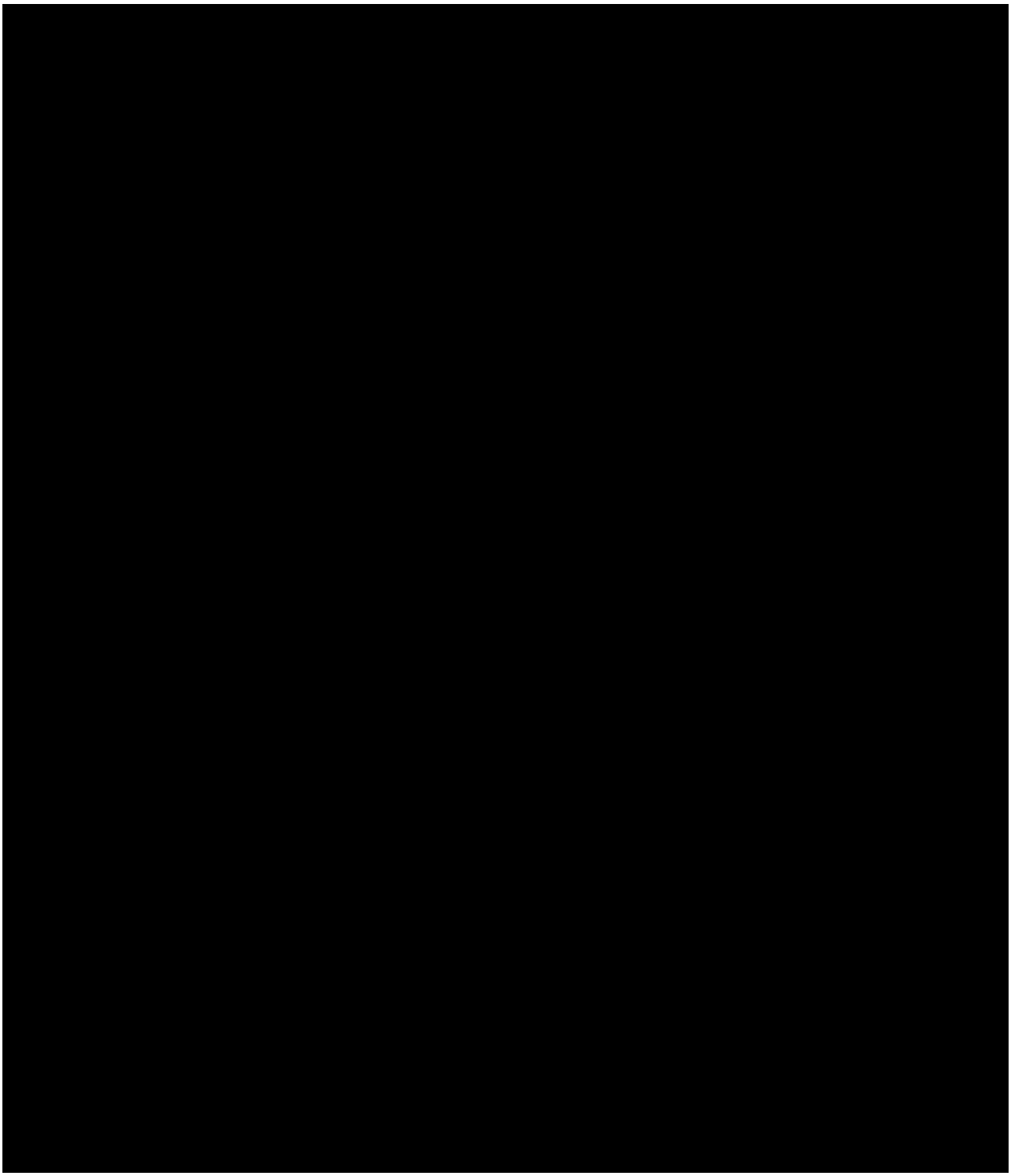

Figure 3-5 Exterior A POLYGRID Routing

For exterior B routing, if the immediate preemption option does not apply, RCD-0 does idle search for all routes. The RCD-1 does idle search for the direct route plus the first and second triples. RCD-2 does idle search for the direct route plus the first and second triples. The RCD-3 does idle search for the direct route and the first triple. If an idle trunk cannot be found, preempt search will follow. During the preempt search for exterior B routing, the number of routes to be searched is the same as for idle search.

3.2.1.4.2 Preempt Search

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During the preempt search, the switch examines the members of a trunk group for an idle member if an idle-only search has not been performed. If an idle member is found, it is selected for the call. If not, a search is done for routine calls. If a routine call is found, it is selected for preemption. If no routine calls are found, the program looks for a call of the next highest precedence level, and so on, until it has tested for the level immediately below the precedence level of the call looking for a route. If no lower-level preemptable calls are found, the preempt search advances to the next route in the search order, and so on, until all routes have been tested for all valid precedence levels below that of the current call. In the event of complete failure, the caller receives a blocked precedence announcement.

3.2.1.4.3 Precedence POLYGRID Routing Example

The following example is helpful in understanding the RCD translation process and the routes that are searched during a precedence POLYGRID call. Figure 3-6 is used throughout this discussion.

Figure 3-6 Precedence POLYGRID Routing Example

The following assumptions must be made for this example:

- A call is originating at switch A with a destination at switch E.
- Switches C and D are in the home grid of switch E, while switches A and B are exterior to the home grid of switch E.
- The exterior A routing algorithm is used throughout this example.
- All routes use rotated searches, and the immediate preempt indicator is set to "no." Several other routes would actually exist from these switches in the actual network, but a simple case is used in this example.

A customer at switch A originates a call with precedence "immediate" to a customer at switch E. Because this is the originating switch, 0 is sent as the received RCD to the routing process. Switch A is not in the home grid of switch E; therefore, exterior routing is indicated for this destination code. A 0 as the received RCD in exterior routing implies that routing should search all programmed routes the direct route plus all three triples. In the example, a direct route from switch A to switch E does not exist, so this stage of the routing is skipped. An idle search is performed on the trunk groups that make up the first triple, the group to switch C and the group to switch D. Because this is a precedence call, the search order of the trunk groups may use rotation to search the groups in the triple. Assume that the routes in the forward triple, C and D, are all busy and that an idle trunk is found in route B. After finding an idle trunk to switch B, the call is routed over this trunk. In this example, assume B is considered a lateral route with an RCD of 1 for a received RCD of 0.

The call arrives at switch B with an RCD of 1 indicating that the direct route plus the first two triples should be searched. Once again, no direct route exists between this switch and the destination switch. All trunk groups in the first triple are searched for an idle member. Failing to find an idle trunk in this triple, a preempt

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search begins. Again, all trunk groups in the first triple are searched. Each trunk group is searched first for any "routine" calls and then for any "priority" precedence calls. As was the case with the idle search, during the preempt search, the search may rotate the order in which the groups are checked. Failing to find a trunk containing a call lower than "immediate" precedence, the search proceeds to the second triple. Each group in this triple is searched for an idle trunk. In this example, assume an idle trunk is found to switch C in the first triple, and that the programmed RCD of switch C is 0 for a received RCD of 1 (this indicates a forward route).

Switch C is in the home grid of switch E, so interior routing is used for the remainder of routing this call. The call arrives at switch C with an RCD of 0 indicating that the search should use the direct route plus the first and second triples. At this switch, all trunks on the direct route to switch E are busy. The idle search continues at the first triple using the rotation scheme, if specified, on the trunk groups. For this call, an idle trunk is found to switch D with a programmed RCD of 3 for a received RCD of 0 (this indicates a lateral route).

Routing at switch D is limited to the direct route, because the received RCD 3 indicates not to allow any other lateral moves, and because the only forward move in the home grid is to the destination. An idle search is performed over all trunks in the direct route. After finding no idle member, routing searches for a routine call to preempt. If one is found, the switch preempts the call using that trunk and sends the call to switch E for completion. If a routine call is not found, a search is made for a priority call to preempt. If a call is found, the call goes to switch E for completion; if no trunk is found to preempt, block precedence is given to the call.

3.2.2 PRECEDENCE ACCESS THRESHOLD (PAT)

The Precedence Access Threshold (PAT) capability provides a means for limiting the number of simultaneous calls originated by selected "user" stations (including analog, ISDN and Attendant consoles), access lines, and inter-switch trunks. The PAT mechanism uses Precedence and Preemption (PP) Screening (RC 10.31), MC_Routing (RC 10.4), and Simulated Facility Groups (SFGs) (RC 7.3) Recent Change Views.

The PAT screening is accomplished through user classmarks (Screen Index), called destination, Code Index (CDI), and the Route Code and Precedence Level of the call. The PAT capability screens selected calls that are outgoing to the DISN/DSN Network. PAT does not screen calls that are intra-switch. PAT can be configured to not screen calls that are outgoing to an end-office or other locations.

For a given set of users, a PAT defines the maximum number of simultaneous calls that can be in progress at each precedence level to each destination. The PAT capability allows for overflow from a PAT slot for one level to a PAT slot of a higher level. Overflow can also occur from PAT slots for smaller areas to PAT slots for larger areas. The PAT slots for progressively wider calling areas and five precedence levels may be intermixed by controlling the order of searching PAT groups. When overflow occurs from a lower precedence PAT slot into a higher precedence PAT slot, this overflow will not block higher precedence calls from completing.

The PAT overflow allows lower precedence calls to use a facility not occupied by higher precedence calls to better utilize the capability of the network. Threshold counts can be variable and can be set via recent change messages. A call is allowed through a PAT when either of the following conditions are met:

- A call is permitted when the number of simultaneous calls at the same precedence level and call destination is lower than the assigned threshold.

- A call is permitted when the number of simultaneous calls at equal or higher precedence levels and equal or higher call destinations is lower than the assigned threshold.

If a user, subject to PAT restrictions, dials an attendant for help in placing a call (either at same precedence or has attendant elevate the precedence), the switch will screen the call through the PAT of the attendant

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classmark and the called destination.

Routine calls that are blocked by the PAT are given REORDER (120 IPM busy tone). Precedence calls that are blocked by the PAT are given a Precedence Access Limitation Announcement (as defined on RC 10.1 View, PPPAL).

The following scenarios cover the two types of conditions that allow a call to gain access through a PAT. For these scenarios, assume the PAT in question, for one call destination, has the thresholds and active calls as follows:

20 Routine calls are allowed.	20 Routine calls are occupying these 20 slots.
10 Priority calls are allowed.	9 Priority calls are occupying these slots.
3 Immediate calls are allowed.	2 Immediate calls are occupying these slots.
2 Flash calls allowed.	1 Flash call is occupying these slots.
1 Flash Override call is allowed.	0 calls are occupying this slot.

The number of active and allowed calls for these thresholds is listed in Table 3-1 . The dashes in this table indicate that the combination is not allowed, that is, the higher precedence calls are not allowed to use lower precedence slots.

Table 3-1 Precedence Access Threshold Scenario Data

THRESHOLD NAME	NUMBER ALLOWED	NUMBER ACTIVE				
		FO	F	I	P	R
Flash Override	1	0	0	0	0	0
Flash	2	-	1	0	0	0
Immediate	3	-	-	2	0	0
Priority	10	-	-	-	9	0
Routine	20	-	-	-	-	20

Using the listed values (initial conditions), scenarios are given for each type of precedence call that could be the next to enter screening for this PAT. Each precedence level set of calls is considered independently as if they were the next call to enter the PAT with the listed calls in progress.

PAT slots can be selected based on one of two conditions:

(1) The PAT for the calls precedence level has open slot(s).

(2) A PAT for a higher precedence level or wider area other than the initial PAT to which the call has access has vacant slot(s).

Routine Calls: A Routine call entering this PAT finds that all slots allocated to Routine calls are being used. However, overflow is allowed. Therefore, the call is not blocked (condition 2 is met) and is allowed access to the trunk routing. At this point, three more Routine calls (total of four) would successfully route via the overflow mechanism. The fifth Routine is blocked (REORDER) by having failed both conditions 1 and 2.

Priority Calls: A Priority call entering this PAT would find an idle Priority slot so condition 1 is met and all ten slots are marked used.

NOTE: Only three new Routine calls may be placed at this time.

The second Priority call entering this PAT finds that all slots allocated to Priority calls are being used. However, overflow is allowed. Therefore, the call is not blocked (condition 2 is met) and is allowed access to the trunk routing. At this point, two more Priority calls (total of four) would successfully route via the overflow mechanism. The fifth Priority call is blocked (PPPAL) by having failed both conditions 1 and 2.

Immediate Calls: An Immediate call entering this PAT would find an idle Immediate slot so condition 1 is met and all three slots are marked used. The second Immediate call entering this PAT finds that all slots allocated to Immediate calls are being used. However, overflow is allowed. Therefore, the call is not

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blocked (condition 2 is met) and is allowed access to the trunk routing. At this point, one more Immediate call (total of three) would successfully route via the overflow mechanism. The fourth Immediate call is blocked (PPPAL) by having failed both conditions 1 and 2.

Flash Calls: A Flash call entering this PAT would find an idle Flash slot so condition 1 is met and both slots are marked used. The second Flash call entering this PAT finds that all slots allocated to Flash calls are being used. However, overflow is allowed. Therefore, the call is not blocked (condition 2 is met) and is allowed access to the trunk routing. At this point, no more Flash calls would successfully route via the overflow mechanism. The third Flash call is blocked (PPPAL) by having failed both conditions 1 and 2.

Flash Override Calls: A Flash Override call entering this PAT would find an idle slot so condition 1 is met and the only available slot is marked used. If a second Flash Override call is received into the PAT, no idle slots are available and no alternative PATs are provided for Flash Override calls. Thus, the second Flash Override call is blocked (PPPAL) by having failed both conditions 1 and 2.

3.2.3 ROUTING TO ACCESS LINES

Access lines on an MFS may be set up as individual lines, Multiline Hunt Groups (MLHGs), or as line groups (using trunks) to PBXs. Routing to individual lines requires no special treatment by the MFS.

The RNID, PNID, and Immediate Diversion Network Inward Dialing (INID) access lines use trunks as their interface to the PBXs they serve. Routing to these access lines consists of finding an idle member in the appropriate trunk group that can handle the current call. This capability makes use of the flexible routing strategy developed for the DSN/AUTOVON Interface Capability that allows for routing to search preemptable or nonpreemptable groups first, and for doing preempt and idle searches.

3.2.4 DIALING PLAN

3.2.4.1 Individualized Dialing

Parts of the DSN numbering plan implemented on the *5ESS*®-2000 switch use Individualized Dialing Plan (IDP) groups. The precedence digits, Route Codes, and route control digits are translated only with the IDP for both trunks and lines using the PAUSE dialing state created for this purpose. The area and switch codes and line numbers can be translated within the IDP or more typically on a DSN switch within the Office Dialing Plan (ODP) by using IDP error treatment of escape to ODP. The DSN/AUTOVON Interface switches providing access to DSN/AUTOVON solely as a centrex service, where the ODP reflects the public (or DDD) numbering plan, must use dialed codes defined with the IDP as PPxAREA (x=1 to 5). More detailed translation information is available in 235-080-100, *TG-5-Translation Guide*, under IDP.

A precedence dialing sequence, such as 81-10-313-NXX-XXXX, would be supported in the IDP by first defining 81 to be a precedence action, such as Precedence Dial Tone-Flash (PDTF) for the flash precedence level, with the dialing state of PAUSE. Two different actions exist for each level, one that provides second dial tone such as PDTF and one such as Precedence No Dial Tone-Flash (PNTF) that does not. The Route Code sequence 8110, starting with the precedence code that precedes it, is then defined to be action Precedence Dial Tone Route Code (PDTRC) with the state PAUSE. Note that the same action is used for all Route Code digit sequences; it is the last digit, in this case 0, that determines the Route Code value. Also note that for lines, a Route Code of 10 is equivalent to the absence of the Route Code. The area code and line number translations are done within the ODP.

An equivalent example with the trunks using RCD is 1-0-0-313-NXX-XXXX. This would be supported in the IDP by first defining 1 to be a precedence action, such as PNTF for the flash precedence level, with the dialing state of PAUSE. The first 0 is the Route Code and the sequence 10, starting with the precedence code that precedes it, is then defined to be action Precedence No Dial Tone Route Code (PNTRC) with the state PAUSE. Note that the same action is used for all Route Code digit sequences. It is the last digit, in this case 0, that determines the Route Code value. The second 0 is the route control digit and the sequence 100, starting with the precedence code and Route Control Digit that precede it, is defined to be action Precedence Route Control Digit (PRCD) with state PAUSE. The area code and the line number

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translations are again done within the ODP.

Dialing restrictions can be done in a variety of ways. Any dialed code sequence that is defined within an IDP group can be allowed or denied to specific users of an IDP group via Dialing Plan Access Treatment (DPAT). Also, precedence levels are checked against each user or trunk authorized precedence level. For lines, Community of Interest (COI) treatment is also available. See Section 3.3.3 . Restrictions for any combination of precedence level, Route Code, and dialed destination can be performed using precedence screening. See Section 3.2.5 .

The individual dialing feature is made up of the following subfeatures:

- ***Speed Calling:*** Speed calling permits the user to place calls to selected numbers by either dialing a one-digit code, a two-digit code, or by pressing a feature button.
- ***Customer Changeable Speed Calling:*** This feature provides users with the ability to change their speed-calling lists directly from their own terminals by using dial codes or a feature button.
- ***Dial Access to Private Facilities:*** This feature allows customers access to private facilities that terminate at the switch by using dial codes or a feature button.
- ***Group Numbering Plan:*** The numbering plan allows stations in the same IDP group to call each other with intercom dialing (one to seven digits) and to access an attendant and private facilities. Customer access treatment code restrictions allow subgroupings of stations. The grouping is made so that various subgroups are denied or allowed to access certain features by dialing the feature access codes.
- ***Critical Interdigit Timing for Dialing Plan:*** This feature provides the switch with the timing to allow non-unique digit sequences - such as 32 and 3275 - to both be valid, though different, calls. Here, the switch begins a time-out after receiving only 32; if timer expires, then the switch makes a two-digit speed call.
- ***Intercom Dialing:*** This feature allows users to have a shortened dialing sequence to reach a group of destination numbers with common leading digits.
- ***Customer Access Treatment Code Restrictions:*** This feature allows the creation of subgroups that can be allowed or denied special privileges. Typically, these involve access to private facilities.
- ***Attendant Control of Facilities:*** This feature permits an attendant to restrict dial access to various private facilities by operating a key or dialing a code. Once control is activated, calls to these facilities are routed to the attendant, another directory number, or they are given reorder or an announcement.
- ***Single-Digit Dialing:*** Single-digit dialing permits station users to call any of a preselected group of numbers with a single-digit code or a feature button.

3.2.4.2 Abbreviated Dialing

This class of service enables the subscriber to use 2-digit keying (NX) ending with an "A" (16-button telephone set) or # key (12-button telephone used by most DSN users). The "A" key on the 16-button telephone corresponds to the # key on the 12-button telephone. A precedence code and/or route prefix code can be stored with the DN on a speed-calling list. A precedence code and Route Code prefix can also be dialed before the abbreviated dialing code.

3.2.4.3 Authorization Code Dialing

A station can be restricted in dialing privileges by requiring an authorization code to be dialed by all parties originating calls from the station. The authorization code can be dialed first or at the conclusion of normal dialing. In the second case, the calling party receives the prompt for authorization code, which may be an

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announcement or recall dial tone. The subscriber then enters the authorization code digits. If valid, the call is completed. The subscriber receives reorder or announcement if the authorization code is invalid.

By using the precedence and preemption feature with the authorization code feature, a station can be class marked with an authorized precedence level above ROUTINE, but only users knowing the valid authorization code are allowed to dial a precedence dialed code. This enables a location to restrict most users from dialing precedence codes from such a line while allowing those authorized users to make precedence calls from many such stations. The invalid authorization code announcement can also be programmed to state that denied users are not authorized to make precedence calls.

An "Out of Service" feature is available through authorization codes. A user can place a telephone out of service by requesting through a customer recent change or time of day that all calls from that phone begin with a Use Code followed by the valid authorization code. All non-emergency calls would be restricted until the user deactivates the restriction through another customer recent change or time of day.

If an authorization code feature is assigned to an MLPP line and it requires AMA billing as part of the feature parameters, then the length of the authorization code should be restricted to 7 digits if the 8-digit option is used, or 14 characters if the 15-character option is used. This is because the leftmost byte of this field is being used to record the precedence of the call.

3.2.4.4 Account Code Dialing

A subscriber with the Account Code feature can enter the account code after initial dial tone but before dialing the access code to signify access to the DSN. The account code is recorded in the Automatic Message Accounting (AMA) or Message Detail Recording (MDR) record associated with the call.

Constructed account code features for MLPP lines should restrict the length of the account code to 7 digits if the 8-digit option is constructed, or 14 characters if the 15-character option is constructed.

3.2.5 PRECEDENCE AND PREEMPTION SCREENING

Precedence screening provides a mechanism for mapping precedence levels, Route Code values, and destinations into desired call treatments for specified classes of users. Calls may be directed to different routes, to announcements, and to directory numbers that can be associated with attendant groups or denied based on any combination of precedence level, Route Code, dialed destination, and user screening index using precedence screening.

Precedence screening must be defined for every class of users that are assigned the precedence and preemption feature. A class of users is defined by the screening index assigned as part of the line class code. Most calls from lines and trunks assigned a precedence and preemption feature are directed through precedence screening in place of the screening data typically defined for a non-DSN office in the rate and route records. Calls that do not use precedence screening include calls using the private access and automatic route selection features.

Where users do not explicitly dial Route Codes, a Route Code of 0 is the default that is used to populate precedence screening. Also, if a route code value other than 0 can be dialed by users and it does not alter the desired route from the route chosen for Route Code 0, then data for that route code does not need to be explicitly populated. Calls for any Route Code use the data associated with the Route Code 0 unless data for that Route Code is explicitly defined.

Likewise, calls at precedence levels above ROUTINE use the data associated with a lower precedence level above the ROUTINE level unless data for that level is explicitly populated. For example, data is explicitly defined for a given destination, screening index, and Route Code for both PRIORITY and FLASH precedence levels. Calls at FLASH OVERRIDE would use data defined for FLASH while calls at IMMEDIATE would use data defined for PRIORITY.

3.2.6 DUAL HOMING

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The MFS can "dual home" access lines. Dual Homing is defined as a PBX having access lines homed to two different MFSs, and the PBX is accessible with one telephone number. These two switches are required to have a direct two-way trunk group between them. The trunk group must be two-way to ensure that originations and terminations between the dual home office are via the same group. A call destined for a dual-homed PBX that fails to complete over access lines homed on the first switch is rerouted to the second switch for completion. The call is never routed back to the first switch by the second switch if the second switch fails to find an idle access line.

A dual-homed PBX exists when the PBX is connected to two MFSs, and the two MFSs are directly connected with a group of two-way interswitch trunks. A typical setup for a split group (having preemptable and nonpreemptable access lines) dual-homed PBX is shown in Figure 3-7 .

Figure 3-7 Dual-Homed PBX

The DSN/AUTOVON interface capability provides a flexible routing strategy that allows searching trunk groups in orders such as preemptable before nonpreemptable, and idle searches before preempt searches. This same routing strategy is used for the dual-homed PBX case. For example, switch 1 could have its routing data configured so that routine calls search the RNID lines to the PBX first, followed by the PNID lines, and finally the group of two-way interswitch trunks. The data for precedence calls could indicate the following search order:

(1) Idle search of PNID lines

(2) Preempt search of PNID lines

(3) Idle search of RNID lines

(4) Idle search of interswitch trunks

(5) Preempt search of interswitch trunks.

One additional check is required in a dual-homed situation that is not normally of concern for regular calls. Switch 2's data is probably configured exactly like switch 1. Therefore, if all the RNID and PNID lines are busy and not preemptable at switch 2, it attempts to route the call back to switch 1 over the two-way interswitch trunk group. This is not acceptable if switch 1 routed the same call to switch 2. Thus, a check is

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made to ensure that routing is never sent back over the same trunk group over which the call arrived.

3.2.7 AUTOMATIC MESSAGE ACCOUNTING

The Automatic Message Accounting (AMA) feature provides the means to record *5ESS*®-2000 switch call information for billing, traffic, and study purposes. The existing billing features for the *5ESS*®-2000 switch are used to collect DSN call data in addition to the following:

- Trunk-originated calls for the end office and the DSN.
- Trunk-originated calls containing a trunk billing number to identify the originating trunk group.
- Interswitch trunk-originated calls containing a Route Code and RCD in the terminating number field.
- Line and end-office access line-originated calls containing dialed precedence digits in the terminating number field.
- All DSN recorded calls containing a precedence level indicator in the EBAF Module Code 043 (Precedence and Preemption Module Code). Specific precedence level values are as follows:
  - 0 Flash Override
  - 1 Flash
  - 2 Immediate
  - 3 Priority
  - 4 Routine or Executive Override.
- Character precedence digits in the terminating number.

3.2.7.1 Message Detail Recording

The MLPP calls for Message Detail Recording (MDR) are identified as follows:

- Any intercom dialing — Station-to-station
- Any line or end-office access line origination (non-intercom) — Originating private
- Any tie trunk or interswitch trunk origination — Incoming private.

For a DSN office, the precedence level of the call is placed in the FRL field of the MDR record.

3.2.8 TONES AND ANNOUNCEMENTS

An announcement is required for the PAT feature. This announcement is given when a customer is blocked by the PAT. A typical accouncement is as follows:

"Precedence access limitation has prevented the completion of your call. Please hang up and try again. This is a recording."

An announcement is required for Destination Code Cancellation (DCC). This announcement is given when a customer is blocked by a DCC control. A typical DCC announcement is as follows:

"AUTOVON service disruption has prevented the completion of your call. Please wait 30 minutes and try

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again. In case of emergency, call your operator. This is a recording."

When a call above routine level is blocked by a blocked precedence announcement during the hunting process, a typical announcement is as follows:

"Equal or higher precedence calls have prevented completion of your call. Please hang up and try again. This is a recording. Switched Service Bureau (SSB) number."

Other announcements that may occur while trying to use the DSN service are as follows:

- The vacant code announcement:

  "Your call cannot be completed as dialed. Please consult your directory, and call again; or ask your operator for assistance. This is a recording. SSB number."

- The unauthorized precedence announcement:

  "The precedence used is not authorized for your line. Please use an authorized precedence, or ask your operator for assistance. This is a recording. SSB number."

- The nonprecedence/preemption user preemption announcement:

  "Your call has been interrupted so that a priority government call can be completed. Please hang up, and try again later. This is a recording. SSB number."

- The blocked preemption announcement:

  "A nonpreemptable call prevents the completion of your precedence call. Please hang up, and try again. This is a recording. SSB number."

- The emergency announcement 1.

- The emergency announcement 2.

- The no circuit announcement.

3.2.9 REMOTE SWITCHING MODULE

Certain restrictions are placed on call processing when a remote switching module (RSM) is involved for the call. Most of these pertain to call processing in the RSM during stand-alone operation. These restrictions are in addition to those already provided by RSM call processing. The restrictions are as follows:

(a) ***No Local DSN/AUTOVON Interswitch Trunk Groups:*** An RSM is capable of routing calls to trunks, during stand alone, if all the members of the trunk group reside on the same RSM. Also, any call originating on any switching module (SM) that does not own the trunk group must be switched to the RSM to route the call. Because of the large number of alternate routes that POLYGRID routing provides, there is a strong need to centralize the routing process to avoid lengthy searches. If local groups were allowed, routing would need to switch to the RSM of the local group during the idle search and potentially back to the administrative module (AM) for the next route and then back to the RSM during the preempt search. By eliminating local trunk groups, the entire idle and preempt search takes place in the AM. Local MLHGs are allowed on an RSM because POLYGRID routing is not used for routing within these groups.

(b) ***Degraded Routing:*** Stand-alone (Multimodule RSMs) (MMRSMs) search all alternate routes before searching the next RSM. Also, members of hunted groups not on the RSM are not searched if the call originates in a stand-alone RSM. This leaves open the possibility that a line or trunk may be selected for preemption even though there are idle members of the group on other RSMs of the

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MMRSM or on other switch modules. Searching continues on the originating RSM through the entire set of routes in the direct route. This reduces the search time at the stand-alone RSM and avoids selecting a port in the first, second, or third triple, even though trunks in the direct route may be idle on other RSMs or switching modules.

(c) ***Dynamic Data:*** During linked processing, dynamic data is maintained in the AM indicating the current PAT status values. During stand-alone operation, this data is not required to be kept current in the RSM. All calls subject to PAT that originate on a stand-alone RSM are allowed access through the PAT. However, they may subsequently be blocked if no trunks exist on the RSM. When transition out of stand-alone takes place, this data is not required to be updated to its current values. The PAT audit is responsible for updating any incorrect counts.

When engineering an office that has an RSM, it is recommended that trunk groups not be set up as local groups on the RSM. This increases routing time if routing must switch processors during an extensive hunt involving preemption or POLYGRID routing.

Every busy line or trunk that has the precedence and preemption feature has a precedence level associated with the call using that line or trunk. For global hunted lines and trunks, a copy of this data is also kept in the AM to aid in hunting. During RSM stand-alone, this hunting data is maintained in the RSM. When an RSM goes from a stand-alone mode (no communication with the AM) to a linked (communications with the AM) mode, the precedence for RSM calls is not marked correctly in the AM. Because a large amount of data transfer would be needed to update the AM, no update is performed. These calls are marked purposely "routine" in the AM.

Setting the precedence levels of all busy lines and trunks to "routine" in the global line and trunk data allows a call on any line or trunk to be selected for preemption during a preempt search in the AM. When the preemption request is sent to the SM, the precedence of the preempting call is compared to the accurate local copy of the precedence associated with that line or trunk. If the existing call on that line or trunk has a precedence level that prevents preemption, the preemption is denied, and the correct precedence is returned to the AM. The precedence of the global hunted line or trunk data is updated, and the group is rehunted for another line or trunk if the limit on retries is not reached.

3.2.10 NETWORK MANAGEMENT

When call attempts in the network rise beyond the capability of that network, the overall performance of the network degrades. Network Management (NM) provides surveillance and control techniques to minimize this degradation, optimize call-carrying capacity, and maintain network integrity during periods of stress caused by either traffic overload or failure conditions.

Network Management surveillance, reports, and control application and removal are available by way of the Input/Output (I/O) channel and the Master Control Center (MCC). On-site switch personnel use these capabilities via the MCC and the Trunk and Line Work Station (TLWS). Network Management personnel at a remote work center likewise use these capabilities via the I/O channel to a remoted network management system.

The detailed descriptions of Network Management capabilities are found in the *5ESS*®-2000 manual 235-100-125, *System Description*. The material in this manual is provided as an overview of Network Management capability as it relates to the DSN. Note that in this context, the *5ESS*®-2000 switch is marked as a DSN switch, that is, global parameter GLDSNOPT = Yes.

In a DSN switch, two enhancements are made to account for the DSN MLPP feature. These enhancements are as follows:

- ***Calls affected by the NM controls:*** The Automatic Congestion Control (ACC) does not apply to precedence calls above ROUTINE, and CANT and CANF do not apply to FLASH and FLASH OVERRIDE calls. Calls without an assigned precedence level (calls with a precedence level of "none")

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receive the same NM treatment as ROUTINE calls for the NM controls Destination Code Cancellation (DCC), ACC, Trunk Reservation (TR), Re-route (RR), Cancel-To (CANT), Cancel-From (CANF), and SKIP.

- ***Interaction with Preemption:*** The NM controls apply during the friendly hunt (both pre- and post-hunt), and do not apply if doing a preemptive hunt on that trunk group.

The *5ESS*®-2000 switch NM controls are available for the following:

NOTE: No NM controls are available on the VCDX/Classic. This is a VCDX that uses the Classic SM instead of the SM-2000 SM.

- ***Alternate Route Cancellation (ARC):*** (Applicable to POLYGRID routing only)
- ***Destination Code Cancellation (DCC):*** Currently available on the full *5ESS*®-2000 switch, including the Compact Digital Exchange (CDX). Available for the VCDX/SM-2000 switch in the 5E12 software release.
- ***Essential Service Protection (ESP):*** ESP is not an NM control, but it is included because it provides some benefits to NM personnel.
- ***Automatic Congestion Control (ACC):*** Available in the 5E12 software release.
- ***Trunk Reservation (TR):*** Available in 5E12 software release.
- ***Re-route (RR):*** Available in 5E12 software release.
- ***Cancel-To (CANT):*** Available in 5E12 software release.
- ***Cancel-From (CANF):*** Available in 5E12 software release.
- ***Skip (SKIP):*** Available in 5E12 software release.

3.2.10.1 Alternate Route Cancellation

The ARC control is available only on the *5ESS*®-2000 switch and the*5ESS*®-2000 CDX switch. The ARC control is not available on the VCDX (neither Classic nor SM-2000). It is available only in networks using POLYGRID routing.

The ARC control is implemented at the switch that has direct trunk groups to the switch in congestion and is a manual, restrictive control. The ARC control is office selective, instead of trunk group selective. It provides one of the following controls:

- ***ARC-CANF:*** Traffic that terminates in a congested switch is not allowed to Alternate Route via other switches to reach the congested switch. However, the traffic that is switched through the congested switch is allowed to Alternate Route. This control restricts calls of a selected level (ROUTINE or all levels of precedence) terminating in the congested switch from overflowing from the direct route. The ARC-CANF control is provided to reduce the spread of the congestion.
- ***ARC-CANT:*** Traffic that does not terminate in the congested switch is not allowed to access the direct trunks to that switch. This control prevents calls of a selected level (ROUTINE or all levels of precedence) from being Alternate Routed via the switch in congestion to reach their destination offices. Therefore, through-traffic bypasses the direct trunk to the traffic congested office. This control relieves an overloaded office of traffic that can probably be completed by another route.

The ARC control can be overridden on either a specific control basis or an office-wide basis.

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3.2.10.2 Destination Code Cancellation

The DCC control limits traffic to particular destination codes that are difficult or impossible to reach. With this control, specific calls may be routed to an announcement to free-up resources for calls that are more likely to be completed. The DCC is an effective control for a focused overload where a large volume of calls are directed toward one destination.

The DCC control can be deleted on either a specific control basis or an office-wide basis.

The DCC control can be applied for traffic of either ROUTINE or Selected Precedence Levels. If the NM personnel want particular precedence levels exempted from the action of this control (that is, to exempt FLASH and FLASH OVERRIDE calls from DCC), then Recent Change Verify (RC/V) 10.31, *Precedence and Preemption Screening*, must reflect this. For example, to exempt FLASH and FLASH OVERRIDE from DCC, the NM personnel must provision RC/V 10.31 as:

CDCNTRL=N (field #13) for PREC LEVEL = F and FO (field #4);

while for the other three precedence levels, CDCNTRL=Y.

3.2.10.3 Essential Service Protection

The ESP feature restricts the availability of serving office equipment to essential subscribers. It is used to reduce the originating traffic loads placed on a switching system that is encountering delays in serving originating attempts. When this control is implemented, nonessential subscribers receive degradation or temporary denial of service, while essential subscribers are given priority service. The ESP feature does not affect incoming calls or calls already in progress.

The ESP feature is implemented at a switch overloaded by a large volume of originations. It is automatically triggered, if previously enabled, when certain overload conditions exist. It can be overridden on an office-wide basis.

3.2.10.4 Automatic Congestion Control

The ACC is the SS7 implementation of Common Channel Interoffice Signaling System Number 6 (CCIS6) Dynamic Overload Control (DOC). The ACC associated SS7 ISDN User Part (ISUP) parameters are called Automatic Congestion Control Level (ACCL) signals, where DOC associated parameters are called MC signals. Although the I/O commands continue to refer to DOC and MC, in reality, the operable NM control is ACC.

The ACC is an automatic, pre-hunt, restrictive control. It provides two components which are as follows:

- In response to exceeding overload thresholds, a switch in congestion sends congestion signals to connected switches.
- A switch that receives a congestion signal implements pre-programmed responses on a trunk-group basis.

A switch in congestion sends ACCL signals to connected switches in response to exceeding overload thresholds. Two ACCL signals are available: ACCL1 and ACCL2. These signals are included in SS7 ISUP messages. The transmission of these signals is enabled and disabled on a switch-wide basis.

Switches that receive the ACCL signals implement the pre-programmed response on a trunk-group basis. The pre-programmed response is enabled and disabled on a trunk-group basis.

The ACC control applies to ROUTINE calls only. Precedence calls above ROUTINE are exempted from the pre-programmed response actions.

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3.2.10.5 Trunk Reservation

The TR control is an automatic, pre-hunt, restrictive control. It is a trunk-group control that selectively limits per-call access to trunks in a two-way or one-way outgoing trunk group when the trunk group reaches one of two adjustable thresholds. As such, it may be used to hold traffic away from a switch experiencing a focused overload or to restrict traffic when trunk-group usage is high.

The TR is able to limit traffic depending on whether the call is using the trunk group as a direct or an alternate route. A TR relies on two reservation levels. Each reservation level has a control level obtained from the response table associated with it. A control level is triggered when the number of idle trunks in the trunk group falls to or below the respective threshold. When the control level is triggered, the call is either canceled or the trunk group skipped, depending on the option specified in the input command.

The TR control is pre-programmed on a trunk-group basis. This action sets threshold activation levels and selects the following:

- One of the five preset combinations of Direct and Alternate Routes
- The control response (CANT or SKIP)
- The option to inhibit the control until a subsequent I/O command.

The TR control may be enabled and inhibited both on a trunk group basis. Furthermore, all TR controls on the switch may be overridden on a switch-wide basis.

The TR applies to traffic of all levels of precedence.

3.2.10.6 Re-route

The RR control is a manual, post-hunt, expansive control. It modifies the normal in-chain route advance pattern by substituting an out-of-chain trunk group for the next in-chain trunk group. It affects a selectable percentage of traffic for direct or alternate routed traffic. If RR takes effect, then a substitute RR routing chain (via trunk groups) is traversed. When the RR routing chain is exhausted, routing continues in the normal routing chain unless the Cancel In-Chain Return (CICR) option is specified. With the CICR option, the call is canceled and connected to a No Circuit Announcement.

Pre-hunt controls and the post-hunt control CANF on trunk groups encountered while traversing an RR routing chain apply, but RR does not apply in this case. While traversing the Re-route routing chain, a friendly precedence hunt only is done, not a preemptive hunt.

The RR control is established on a trunk-group basis. The NM personnel can specify controlling action on the basis of Direct and Alternate Route traffic, from 0 to 100 percent, in increments of 12.5 percent. Other options available are as follows:

- Cancel In Chain Re-routing
- Re-route to Previously Re-routed Trunk
- Application to International Calls
- Ignoring Congestion Signaling
- Hunting Algorithms.

The RR control can be deleted on either a trunk-group basis or an office-wide basis.

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The RR control applies to traffic of all levels of precedence.

3.2.10.7 Trunk Group Controls

The CANT, CANF, and SKIP trunk-group controls are set on a trunk-group basis where they affect a selectable percentage of traffic on the basis of Direct and Alternate Routed traffic, from 0 to 100 percent, in increments of 12.5 percent.

The Cancel-To (CANT) control is a manual, pre-hunt, restrictive control that cancels traffic destined for a specified trunk group. If CANT takes effect, the call is canceled.

The Cancel-From (CANF) control is a manual, post-hunt, restrictive control that cancels traffic overflowing or skipping a specified trunk group. If CANF takes effect, the call is canceled.

SKIP is a manual, pre-hunt, restrictive control that causes a given trunk group to be skipped, with the affected traffic alternate routed to another trunk group in the routing chain. If SKIP takes effect, the trunk group is skipped; and if no post-hunt controls apply, alternate routing to the next in-chain trunk group occurs. If no alternate routing is available, that is, no more available in-chain trunk groups, the call gets the treatment defined for that case.

The CANT, CANF, and SKIP controls can be deleted on either a trunk-group basis or an office-wide basis. The CANT and CANF controls exempt FLASH and FLASH OVERRIDE precedence calls.

3.2.10.8 Network Management Application of Controls

A DSN switch may have the same number of simultaneous controls as a non-DSN switch, as described in 235-100-125, *System Description,* subject to the following:

- A DSN switch is limited to 120 trunk groups per SM/SM-2000 for DSN NM measurements.
- A DSN switch is limited to 400 Precedence and Preemption trunk groups per DSN office.

3.2.10.9 Network Management Surveillance and Discrete Data

Two types of Network Management data, Surveillance and Discrete, are provided on-site and to a remote NM work center via the I/O channel. The function of these two types of data is as follows:

- ***Traffic Surveillance Data:*** These are counts of events over a 5-minute interval. Refer to 235-070-100, *Appendix I, Administration and Engineering Guidelines*, for a list of the counts that are provided.
- ***Status Discrete Data:*** These are binary indicators that show the presence or absence of associated events in a 30-second interval. The data is shown on MCC Page 129 (DSN Network Management Exception Page) and MCC Page 130 (Network Management Exception Page). The Network Management Exception Page is available in the 5E12 software release.

3.3 LINE FEATURES

3.3.1 MULTILEVEL PRECEDENCE AND PREEMPTION

There are two types of authorized precedence levels: one for all users assigned the local MLPP feature and an additional authorized precedence level for calls to members of their community of interest. The authorized precedence levels define the maximum level of precedence that the MLPP user can dial. The switch accommodates five levels [Flash Overide (FO), Flash (F), Immediate (I), Priority (P), and Executive Override (EO)] of precedence above routine with preemption for local calls (intraswitch precedence calls). The switch accommodates four levels (FO, F, I, and P) above routine for DSN calls. Intraswitch precedence calls (precedence calls that originate and terminate on the switch) can use an additional precedence level,

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the EO level which is less than "P" but greater than "R."

Preemption automatically disconnects an established connection for reuse to complete a higher precedence call when no idle circuit is available. The MLPP feature incorporates the following capabilities:

- Precedence
- Precedence digit
- Preemption
- Preemption of subscribers attached to conference circuits
- PNID
- RNID
- INID
- Preemption and precedence tones
- Precedence audible ringing
- Precedence alerting.

Precedence alerting is provided via the Distinctive Ringing Precedence and Preemption (DRPP) preconstructed feature. In order to provide precedence alerting on precedence calls to lines with the precedence and preemption feature, the DRPP feature must also be assigned to the line.

The DSN/AUTOVON Interface Capability provides the ability to preempt two-wire subscribers and tie trunks to a DSN (NODAL) tandem switch. The MFS expands on the preemption feature to include preemption of four-wire access lines and preemption of interswitch trunks. The terms "preempt for reuse" and "preempt to clear" remain consistent with the DSN/AUTOVON Interface capability preemption definition.

Also see Sections 3.4.1.3 and 3.4.1.4 for a description of the use of the MLPP feature with SS7 and PRI trunks.

3.3.1.1 Two-Wire Access Lines

A two-wire subscriber line selected for preemption for reuse while in the talking state (the station must be class marked preemptable) receives a preemption tone until it returns on-hook. When on-hook is detected, the precedence alerting is sent.

If the subscriber line is being preempted to clear while in the talking state (the station may be class marked preemptable or nonpreemptable), it receives preemption tone until it returns on-hook.

When a two-wire subscriber line is receiving audible ringing and it is preempted for reuse or preempted to clear, the switch removes audible ringing and gives preemption tone. If the line is preempted for reuse, precedence alerting is given.

If a two-wire subscriber line is receiving alerting and it is preempted for reuse or preempted to clear, the switch removes the alerting. If the line is preempted for reuse, precedence alerting is then supplied.

3.3.1.2 Four-Wire Access Lines

The preemption sequence for four-wire access lines differs slightly from the two-wire case in that the switch sends preemption winks to the access lines to inform the equipment at the other end of what is taking place. Different preemption sequences exist for the various types of access lines. Four wink variations are

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used (wink No. 1 through 4) as shown in Figure 3-8 .

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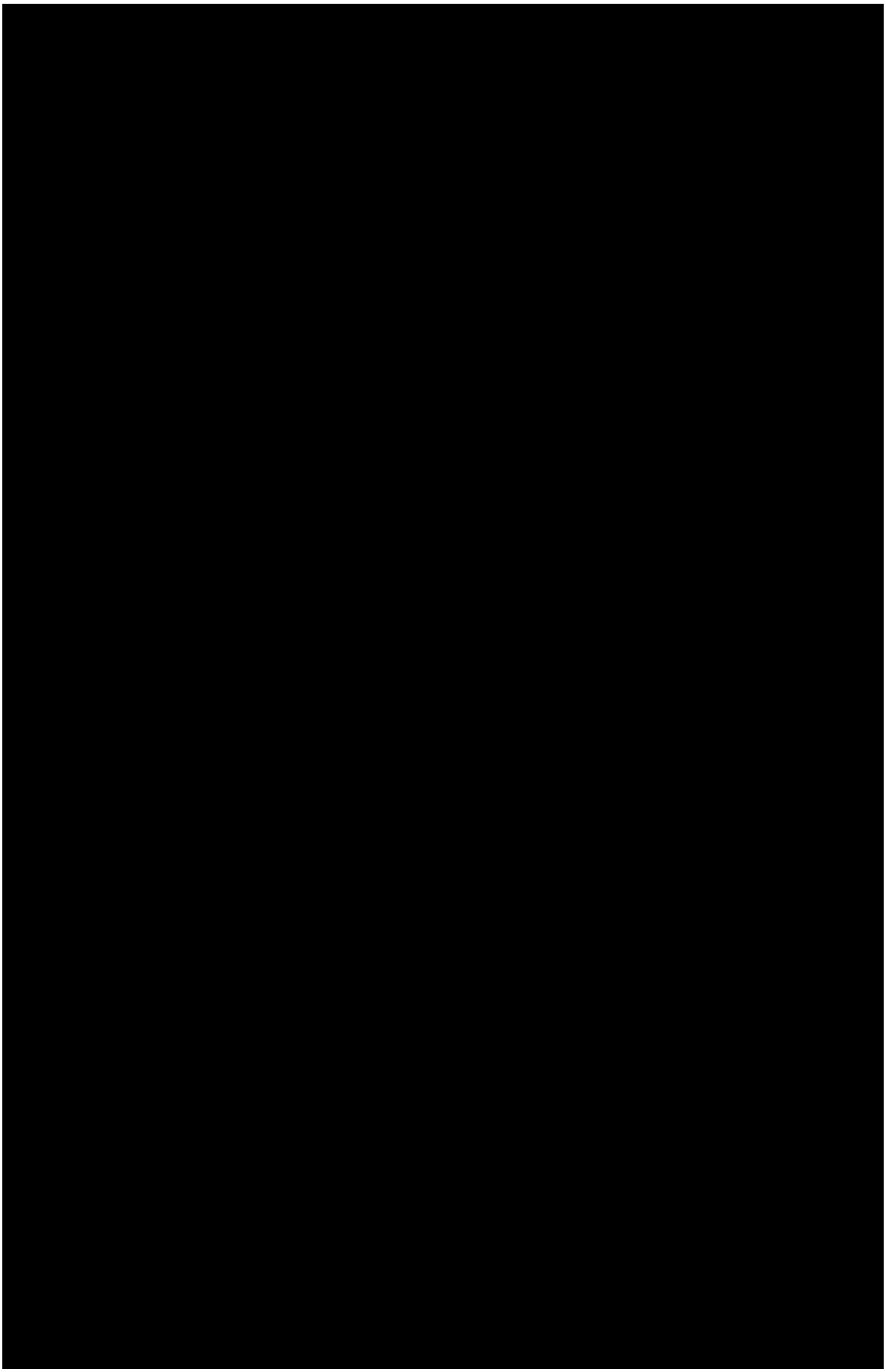

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Figure 3-8 Preempt Signals Transmitted by a DSN Office

All four-wire access lines use the same preemption to clear actions. If a four-wire access line is preempted to clear while in the talking state, the switch sends a preemption wink No. 2 followed by the preemption tone until the access line returns on-hook. When the originating party of a call in the ringing state is preempted to clear, the switch sends preemption wink No. 4 followed by the preemption tone until the access line returns on-hook. If the party is the called end in the ringing state and is being preempted to clear, preemption wink No. 2 is sent. If the called party is off-hook at the end of the wink, preemption tone is given until going on-hook.

Preemption for reuse is similar for each type of access line except the wink signal sent to the access line. Also, RNID access lines or any other nonpreemptable access line cannot be preempted for reuse. A four-wire access line is preempted for reuse in the talking state by sending a preemption wink (see Table 3-2) followed by preemption tone until the access line returns on-hook. If the four-wire access line is the originating party of a call in the ringing state, it is preempted for reuse by sending a preemption wink followed by preemption tone until the access line returns on-hook. A four-wire access line on the called end of a call in the ringing state is preempted to reuse by sending a preemption wink. If the access line is off-hook at the end of the wink, preemption tone is given until on-hook is returned.

Table 3-2 summarizes the preemption wink numbers given to the different types of access lines during preemption for reuse as follows:

Table 3-2 Access Line Preemption Winks

TYPE OF ACCESS LINE	TALKING STATE	RINGING STATE	
		ORIGINATING	TERMINATING
Manual/Individual	2	4	2
INID	1	3	1
PNID	1	3	1

3.3.1.3 ISDN Lines

The MLPP feature can be assigned only to a Custom BRI, not to a national BRI. Only Circuit Switched Voice (CSV) calls can be made with a precedence level. Precedence Circuit Switched Data (CSD) calls are not supported. A CSD call is marked as a non-precedence call if it is routed over an MLPP trunk. However, it appears to the far switch as a routine precedence call, and it is subject to preemption from the far switch but not from the originating switch.

A call on an ISDN line with multiple call appearances is preempted whenever all call appearances available for termination are busy and at least one call appearance is busy at a level less than the precedence level of the new incoming call. The call of the lowest precedence level is selected for preemption. Calls in the active, or talking state, alerting calls, or calls on hold may be selected based solely on the relative precedence levels. When an active call is selected, a preemption display is provided, if the terminal allows, along with preemption tone.

If the immediate preemption option is selected, a preemptive search of all call appearances is performed prior to termination to an ISDN line that has idle call appearances. Preemption occurs if any of the busy call appearances have a precedence level lower than the incoming call with the call at the lowest level selected for preemption.

3.3.2 DSN/AUTOVON FOUR-WIRE SUBSCRIBER ACCESS

This feature allows four-wire trunks to receive line-type services. The DSN provides service to four-wire telephone sets via the four-wire trunk interface at the serving office.

3.3.3 COMMUNITY OF INTEREST

A Community of Interest (COI) in the DSN is defined as a grouping of subscribers who generate most of

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their traffic in calls to each other. The COI may be related to a geographic area or to an administrative organization. A user belonging to a COI has a separate authorized precedence level that is used in place of their normal authorized precedence level any time they call a member of their COI. This separate precedence level may be higher or lower than their normal level.

The MFS supports up to 20 different COIs. Each user on the switch can belong to, at most, one COI. A user is not required to be a member of any COI.

Each MFS is capable of defining the COIs. These can consist of area codes or switch center codes and the codes are grouped by code index. A code index may be assigned to as many COIs as required.

3.3.3.1 Community of Interest Precedence Treatment

The COI precedence treatment limits the authorized precedence of a station according to the switching center code or area code dialed. The station line may be service-treatment marked to indicate one of two conditions. The first condition authorizes the station to exercise a precedence level higher than the level normally authorized. The second condition prevents the station from using a higher precedence for calling in the communities of interest.

This scenario provides a few examples of COI screening. Assume the following two COIs are defined with code indexes containing the following:

COI 1	COI 2
312	312
414-979	414-979
979	977
977	

Also assume there are two users with the following characteristics.

User:	A	B
Authorized Precedence	Routine	Immediate
COI	1	2
COI Authorized Precedence	Immediate	Routine
Phone Number	978-2222	977-1234

This example illustrates two important points about COIs. First, COIs are not required to be reciprocal (that is, just because user B is in user A's COI, does not imply that user A is in B's COI). Second, COIs may be overlapping (that is, both COIs contain area code 312).

Assume user A dials a priority call to number 312-979-1111. Normally, the call is blocked because user A is not allowed to dial anything but routine calls. However, in this case, the called number in user A's COI (an area code of 312 implies that all numbers in 312 are in the COI); therefore, the call is allowed because user A can dial as high as Immediate when placing a call to COI 1.

If user B attempts to place the same call, using a precedence of priority, the call is blocked because the called number is in COI 2 of which user B is a member, and user B is only allowed to make routine calls when calling within that COI.

3.3.4 MULTILINE HUNT GROUPS

The MLHG incoming queuing feature provides queuing for calls when all members of an MLHG are busy. A call waits off-hook until a member becomes idle. There is no time limit for remaining on the queue. When a member becomes idle, a call is removed from the queue and assigned to the idle MLHG member. Only calls to the main Directory Number (DN) of the MLHG are queued.

An attendant may transfer a call to a busy MLHG with this feature activated. In this case, the attendant can drop off the call once initial delay treatment is received. The calling party is then queued as if the call was directly dialed.

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3.3.4.1 Interaction with Preemption

Precedence calls first perform a preemptive search for an MLHG member being used by a lower precedence call. If unable to preempt, the call queues on a first-come, first-served basis ignoring precedence. Once dequeued, the call completes at the original precedence. If a call being serviced by an MLHG member is preempted, that call is not requeued. The preempted subscriber must redial to resume service or be placed on the queue.

3.3.4.2 Call Processing

The calling party remains off-hook while in the MLHG queue. During this time, the subscriber receives call delay treatment. Initial treatment may be audible ringing. After a predefined amount of time, this initial treatment is replaced with a delay announcement. The cycle of audible ringing or delay announcement can be repeated a specified amount of times. If the call is still not serviced, the call receives audible ringing until serviced.

When a member of the MLHG becomes idle, the queue is examined. The call queued the longest is selected, regardless of precedence. This call is removed from the queue and assigned to the idle MLHG member. The calling party is connected to audible ringing, and the MLHG member is alerted. Precedence audible and precedence alerting are used for precedence calls. The talking connection is established on answer.

If the calling party abandons from the queue or is preempted, the call is removed from the queue and normal abandon procedures are in effect. A call is queued only if the queue itself is not already full.

3.3.4.3 Preemptable Multiline Hunt Group

The Preemptable Multiline Hunt Group (PMHG) is a multiline hunting arrangement that provides a sequential hunt over terminal members that may be a mixture of both non-preemptable and preemptable. The non-preemptable circuits must always be the lowest member numbers in the group. The preemptable circuits must be assigned member numbers equal to or higher than the "first preempt" member entered on the MLHG recent change view.

The lead DN for the MLHG is assigned to the first member; the other members may have a DN assigned if desired. The hunting method used is circular, starting at the called DN and continuing, if necessary, until all members have been hunted. An incoming call (either routine or precedence) will terminate to the first idle member. If there is no idle member, a routine call receives busy tone (assuming no queuing).

If the incoming call is a precedence call and there is no idle member, a preempt hunt is made. This hunt first looks at the existing calls on the preemptable members for a routine call and will preempt if it finds one. If no routine calls are found, the preempt hunt continues searching for the next level of precedence up to one level below the incoming call. For example, if the incoming call is a flash precedence level, the preempt hunt will search the preemptable members for a call to preempt up to including the immediate level. If all preemptable members are busy with equal or higher precedence calls, the incoming call will be given a Blocked Precedence Announcement.

3.3.5 DIRECT STATION SELECT

This feature provides the capability of initiating a call over a dedicated DSN telephone to any of 12 preprogrammed subscriber numbers by pressing only 1 button on a 12-button touch-tone set. A stored number is associated with each of the buttons. Each stored number may be any prefix and DN combination allowed for an individual DSN subscriber. Each may include a precedence code. A direct station user is only able to direct dial 10 numbers on a rotary dial telephone, 12 numbers on the 12-button telephone, or 12 numbers on 16-button telephones. No more than 1 digit is recognized by the switch for any single call. Direct station select lists are not user changeable.

Calls that are routed over the four-wire tie trunks to the DSN may use the direct station select feature.

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3.3.6 HOT-LINE SERVICE

This service is provided to selected subscribers to automatically establish a predesignated connection the moment the calling line goes off-hook. There is a designated primary and secondary subscriber for each pair of hot-line subscribers, who talk only to each other. The Route Code digits "5" and "6" are for protection against unauthorized access to hot-line subscribers and are generated by the switch for hot-line service.

Selected DSN individual subscriber lines are designated as having hot-line service. This class of service allows the subscriber to pick up the handset and have the call placed without dialing.

The switch detects the off-hook condition and processes the call using the stored address for that hot line. No dial tone is given and no address information is keyed in by the subscriber. The stored address contains an optional precedence and an optional Route Code of 15 for voice or 16 for data, as well as a 7- or 10-digit DN. A Route Code of 15 or 16 is only required when the forward number is that of another hot line. The default precedence and Route Code, if not dialed, are taken from feature parameters assigned to the hot-line port.

Calls to hot lines can be originated from other hot lines or from subscribers with abbreviated dialing lists (these abbreviated dialing lists are not subscriber changeable). No subscriber is allowed to dial a hot-line Route Code (15 or 16). However, a hot-line Route Code can be stored along with the hot-line number as part of an abbreviated dialing list number.

The terminating switch screens all calls incoming to a hot-line subscriber. Calls without a hot-line Route Code are not allowed to terminate to a hot line and are given reorder treatment. If a hot-line call is placed to a non-hot-line station, no screening is done; and the call is allowed to complete.

3.3.6.1 Master Slave Treatment

Hot-line subscribers are class marked as either a "master", a "slave", or neither. Typically, hot-line subscribers are paired, that is, each hot line has the DN of the other stored as its forward address. When both subscribers attempt to originate calls at the same time, the master/slave class mark is used to determine how to handle the glare condition.

As an example, assume master and slave both go off-hook, trying to call each other. The switch serving each subscriber routes the call based on the stored number. When the call originated by the slave reaches the switch serving the master, that switch recognizes that the master is in the setup state. This means that the call is being set up in the other direction, and it cannot be completed on this end. The switch serving the master must hold the call and return busy tone.

When the call originated by the master reaches the switch serving the slave, the switch recognizes that the hot-line slave is in the setup state. This means, for the switch to complete the call, it must tear down the call path setup to the switch serving the master. This is somewhat analogous to the preemption of the slave without giving the slave the preemption wink or preemption tone. The switch serving the master and any other switches in the call path treat the tearing down of the call path, originally set up by the slave switch, as a calling party abandon. Because both parties are off-hook, neither party receives audible ringing or alerting.

If two hot lines are not paired with one being the master and the other the slave (this is the case if either party is class marked neither or if both parties are class marked the same), then simultaneous origination by the two parties is given no special treatment.

3.4 TRUNK FEATURES

3.4.1 MULTILEVEL PRECEDENCE AND PREEMPTION

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3.4.1.1 DSN/AUTOVON Interswitch MF Trunks

The preempt to clear actions for interswitch MF trunks are the same as access lines with the following exception. Instead of sending preemption notification tone after the preemption wink and waiting for an on-hook, as is done with access lines, the switch sends the preemption wink over the trunk, then does guard timing before idling the trunk.

Preemption for reuse actions for interswitch MF trunks is also similar to access lines with the following exceptions. Instead of sending preemption notification tone after the preemption wink and waiting for an on-hook, the switch sends the preemption wink over the trunk then either (1) waits for the other end to go on-hook, followed by the start dial wink (if the call is in the talking state or if the call is in the ringing state with the other switch being the originating end), or (2) waits for the start dial wink (if the switch was the originating side of a call in the ringing state).

The preempt signals shown in Figure 3-8 are used on the Interswitch MF trunks.

3.4.1.2 Interswitch Trunks to Other Networks

Interswitch trunks to other networks are marked nonpreemptable. Therefore, these trunks are never preempted for reuse. The preempt to clear actions for these trunks consists of sending preemption tone for 3 seconds and then disconnecting. The DSN/AUTOVON interface capability allows for an optional announcement to be given to non-DSN/AUTOVON subscribers when they are preempted to clear.

3.4.1.3 Signaling System 7 (SS7) Trunks

The Multilevel Precedence and Preemption (MLPP) for the SS7 feature offers the following capabilities:

- MLPP on SS7 Stage-1, SFID=196, Feature Number 99-5E-2844
- MLPP on SS7 Stage-2, SFID=197, Feature Number 99-5E-2845.

These capabilities are available on the following platforms:

- *5ESS*®-2000 Switch
- *5ESS*®-2000 Switch CDX
- *5ESS*®-2000 Switch VCDX.

Released as an update for software release 5E11 and later releases, the Multilevel Precedence and Preemption (MLPP) on SS7 service provides MLPP prioritized call handling service for SS7 trunks. The MLPP service has two main parts: Precedence and Preemption.

Precedence involves assigning a precedence level to a call.

Preemption involves one of the following:

- ***Preemption for Reuse:*** The seizing of resources of an in-use access interface or inter-switch connection from a lower precedence call by a higher level precedence call; this is done in the absence of idle resources.
- ***Preemption-to-Clear:*** The clearing of access and/or network resources involved in the preempted call.

An MLPP feature must be assigned on both ends of an interswitch SS7 trunk connection. The switch

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administrator needs to configure SS7 trunks as MLPP trunks that can transport precedence information and be preempted-for-reuse and be preempted-to-clear. For supported trunking connections in the DSN, see Figure 3-1 . In order for an SS7 trunk group to handle MLPP traffic, it is necessary to define an MLPP on SS7 trunk group and assign an MLPP and an Individualized Dialing Plan (IDP) feature to the trunks. Refer to *Recent Change Procedures* 235-118-252 for detailed instructions.

The MLPP on SS7 features addresses the issue of using SS7 facilities for the following:

- Transmitting a precedence level for a call which includes the following:
  - Information about the precedence level of a call which is carried in the SS7 ISUP Initial Address Message (IAM) when a call is transmitted over an SS7 trunk
  - Route Code (RC) which is carried in the IAM message
  - Route Control Digit (RCD) which may also be carried in the IAM message.
- Preempting an SS7 trunk which involves the following:
  - The preemption-for-reuse which is the release and reservation for immediate reseizure of a trunk reserved for reuse
  - The preemption-to-clear which is the release of a trunk not intended to be reused.

Information about this preemption is transmitted in the SS7 ISUP RELease (REL) message sent over the trunk(s) being preempted.

The MLPP on SS7 trunk types introduced with this feature are as follows:

- ***MLPPS7O:*** The SS7 trunk between AI/EO office and DSN node
- ***MLPPS7I:*** The SS7 trunk between DSN nodes without POLYGRID routing
- ***MLPPS7P:*** The SS7 trunk between DSN nodes with POLYGRID routing.

3.4.1.3.1 MLPP on SS7 Stage-1

The MLPP on SS7 Stage-1 feature provides the *5ESS*®-2000 switch with the ability to use the MLPP feature on Signaling System 7 (SS7) trunks, using the SS7 ISDN User Part protocol and procedures in American National Standards Institute (ANSI) T1.113-1988. The precedence level of the call is carried in the Calling_Party_Category parameter.

3.4.1.3.2 MLPP on SS7 Stage-2

The MLPP on SS7 Stage-2 feature is an enhancement to the MLPP on SS7 Stage-1 feature and requires that the MLPP on SS7 Stage-1 feature be enabled on the switch. The MLPP on SS7 Stage-2 feature adds support for MLPP on SS7 trunks using the SS7 ISDN User Part protocol and procedures in ANSI T1.619-1992 and ANSI T1.619a-1994a, along with interworking between the Stage-1 and Stage-2 protocols. The precedence level of the call is carried in the MLPP parameter.

3.4.1.4 Primary Rate Interface Trunks

The MLPP on PRI feature number 99-5E-2336 has been included in software release 5E9.2 and later releases. Figure 3-1 shows the supported trunking connections in the DSN. The Primary Rate Interfaces (PRIs) are indicated by the dashed lines between switches, and other existing trunks are indicated by solid

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lines. Each trunk is further identified by the assigned trunk type. Note that some trunks are identified differently at each switch, that is, a VONPNID trunk at the AI/EO switch is an EOPNID trunk at the tandem switch. The MLPP on PRI trunk types introduced by this feature are as follows:

- ***MLPPDQO:*** The PRI trunk between the AI/EO office and the DSN node
- ***MLPPDQI:*** The PRI trunk between DSN nodes without POLYGRID routing
- ***MLPPQ:*** The PRI trunk between DSN nodes with POLYGRID routing.

The MLPP, as specified in Bellcore T1.619, includes the ability of a call with a higher priority to preempt a PRI B-channel. If the preempted B-channel is needed for the preempting connection, it is preempted for reuse. If it is not needed for preempting connection, it is preempted to clear (idled). The MLPP includes the ability to mark each B-channel with a precedence level which uniquely identifies the current call. It also provides the transport of precedence level across the PRI.

The precedence levels, from lowest to highest priority, are as follows: Routine, Priority, Immediate, Flash, and Flash Override. Each B-channel supports the five precedence levels. The MLPP is assigned to PRI B-channels as a Business and Residence Custom Services (BRCS) feature.

3.4.1.4.1 MLPP Primary Rate Interface Support

The MLPP on PRI provides the *5ESS*®-2000 switch with the ability to serve in the following roles:

- Acting as a Local Exchange (LE) serving one or more PBXs in the traditional network to user configuration
- Acting as a PBX interconnected with one or more PBXs in a peer-to-peer arrangement as provided in the software release for tandem functionality
- Acting as a PBX connected to a LE
- Acting as a LE connected to a LE.

3.4.1.4.2 MLPP on Primary Rate Interface Connection Arrangements

Support is provided for the following connection arrangements:

- Analog to PRI
- BRI to PRI
- PRI to PRI
- PRI to DP/MF trunk
- PRI to SS7 trunk.

3.4.1.4.3 MLPP on Primary Rate Interface Routing

The *5ESS*®-2000 switch can route an MLPP call over either a Dial Pulse (DP)/MF trunk, a PRI B channel, or an MLPP on SS7 trunk, depending how the route indexes are provisioned.

3.4.1.4.4 DSN Network Feature Support

Network support is provided by MLPP on PRI for Precedence Access Threshold (PAT) and POLYGRID

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Routing as they perform the following:

- The PAT limits the number of calls at each precedence level which can be offered to the DSN. Calls from lines on the AI/EO or DSN switch are limited, as are calls from PBXs into the AI/EO or DSN switch for the case where the PBX does not have the PAT feature.
- POLYGRID Routing is a robust, redundant trunking scheme where, in the limiting case, all network DSN switches are interconnected with each other.

3.4.1.5 Preemption Function

The following paragraph explains how preemption works when several facilities are involved on a call. Figure 3-9 is used throughout this explanation. The figure depicts a routine call in the talking state between party A, a four-wire individual user, and party B, a two-wire user. The call is set up using MF trunks between offices 1, 2, 3, 4, and 5.

Assume party C goes off-hook and dials a precedence call to party D. After going through the appropriate POLYGRID routing searches, switch 2 determines that the trunk to switch 3, being used by the call between parties A and B, is going to be preempted. Because this is a DSN/AUTOVON Interswitch trunk and the call is in the talking state, switch 2 sends preemption to reuse wink signal No. 1 to switch 3. At the same time, switch 2 must clear the remaining trunk in the connection, the trunk to switch 1. This is done by sending preempt to clear wink signal No. 2 to switch 1 and beginning guard timing waiting for disconnect from switch 1. Switch 2 continues to wait for switch 3 to return on-hook followed by the start dial wink.

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Figure 3-9 Precedence and Preemption Example

Switch 3 receives the preemption wink and immediately returns on-hook (disconnect followed by the start dial wink. Switch 2 receives the start dial wink and begins to outpulse. While setting up the connection with switch 2, switch 3 must clear the connection to switch 4 by sending preemption to clear wink No. 2. This is the same process that switch 2 is going through clearing the connection to switch 1.

After outpulsing is completed between switches 2 and 3, switch 3 begins to search for a connection to switch 4. It may or may not use the same trunk just cleared by the previous preemption sequence. Once a trunk to switch 4 is seized, outpulsing takes place and switch 4 finally makes the connection.

While all the outpulsing and connections are taking place for this new call, preemption is still continuing on the first call. Switches 1 and 5 have received the preemption to clear from switches 2 and 4, respectively. Each switch returns on-hook to the switch requesting the clear and then begins the preemption to clear process at the subscriber lines. Switch 1 has to preempt party A, a four-wire individual user. This is done by sending preemption wink signal No. 2 followed by preemption tone until party A goes on-hook. Switch 5 is preempting party B, a two-wire user. This is done by sending only the preemption tone and waiting for on-hook.

One important point to remember in this example is that both parties A and B could have been nonpreemptable. Because they were using an interswitch trunk that was preemptable, it caused them to be preempted.

3.4.2 FOUR-WIRE TIE TRUNK ACCESS

This feature provides access between a PBX and DSN switch using one-way or two-way trunks. Calls originating at, or terminating to, the PBX are routed over trunks that terminate on trunk units in the *5ESS*®-2000 switch.

3.4.3 ACCESS TO DSN NETWORK OVER FOUR-WIRE TRUNKS

Calls that are routed from the DSN/AUTOVON Interface switch into the DSN network are routed over tie trunks. In order for calls to be routed over these trunks and access the DSN networks, they must be dialed to conform with the DSN dialing plan. An individualized dialing plan is provided for 2-wire subscribers with rotary dial telephones, 12-button touch-tone telephones, and 16-button telephones. A dialing plan for the attendant console is also provided.

For calls that are routed over the tie trunks to the DSN, the precedence and preemption subscriber has an authorized precedence level (service order recent changeable) assigned that is the maximum precedence level that the subscriber can dial.

3.4.4 PRECEDENCE NETWORK IN-DIALING (PNID)

The PNID feature provides the DSN/AUTOVON Interface switch with routine and precedence telecommunications to the DSN. Incoming routine calls (those with a precedence digit of 4) and outgoing routine calls can be completed via either RNID or PNID trunks. Outgoing precedence calls (those with a precedence digit of FO, F, I, or P) are completed only via PNID trunks. Incoming precedence calls to the DSN/AUTOVON Interface switch are recognized and treated as precedence calls only when incoming over PNID trunks. If a precedence call is completed to the DSN/AUTOVON Interface switch via an RNID trunk, the call is not recognized by the DSN/AUTOVON Interface switch as a precedence call and is treated as a routine call.

The DSN/AUTOVON Interface switch accepts precedence calls from the DSN (NODAL) tandem switch and stores the call precedence level for the trunk for future preemption searches. For idle stations, the switch applies precedence ringing and sends precedence audible ringing back to the calling party.

The precedence audible ringing tone is the mixed frequencies of 440 and 480 Hz. This tone has a minus 16

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dBm0 power level in each frequency with a composite level of minus 13 dBm0. The precedence audible ringing tone is sent with 1.6 seconds of tone followed by 0.4 seconds of silence.

3.4.4.1 Completing Calls on a Precedence Network In-Dialing Basis

The PNID feature provides for precedence and routine calls from the DSN/AUTOVON (NODAL) tandem switch. The level of precedence of each call is based on a precedence digit that is transmitted with the incoming digits. The tie trunks that connect the DSN (NODAL) tandem and DSN/AUTOVON Interface switch are PNID and RNID trunks. On RNID trunks, no precedence digit is sent by the DSN (NODAL) tandem switch; only the address digits (switch center code + line number). On PNID trunks, a precedence plus the address digits are transmitted for a precedence call.

Incoming precedence calls from the DSN network are analyzed using the DSN dialing plan. The precedence digit received on these calls is recognized and if the called line is busy, the precedence of the call is compared to the precedence of the incoming call. Based on this comparison, the *5ESS*®-2000 switch preempts the existing stable call if the precedence level on the incoming call is higher than the existing call (unless call forwarding or call waiting is used). The *5ESS*®-2000 switch routes the call to the blocked precedence announcement if the incoming call has an equal or lower precedence than the existing stable call. The call may also be routed to the local attendant on the *5ESS*®-2000 switch if the incoming call is equal or lower to the precedence of the stable call depending on the telephone company's definitions in translations for this type of call.

Precedence alerting is given to the called party for all precedence calls and precedence audible ringing is given to the calling party on all precedence calls.

Lines on the DSN/AUTOVON Interface switch may be arranged as a Multiline Hunt Group (MLHG), consisting of both preemptable and nonpreemptable lines. When calls are routed to these groups, routine calls do an idle search of the nonpreemptable lines followed by an idle search of the preemptable lines. Precedence calls do an idle search over all lines followed by a preempt search of the preemptable lines if necessary. If a precedence call fails to find an idle or preemptable member of the group, the call is routed to an attendant if the precedence and preemption Call Forward on Busy feature is assigned to the MLHG. Otherwise, the call is routed to the blocked precedence announcement.

3.4.4.2 Completing Calls on a Precedence Network Outward Dialing (PNOD) Basis

Within the DSN/AUTOVON Interface switch, precedence calls can be made to the DSN. The subscriber and/or attendant can request a precedence call by using an IDP. If all trunks to the DSN are busy, a lower precedence call on PNID trunks may be preempted to complete this precedence call.

All outgoing calls, that originate on the DSN/AUTOVON Interface switch and are routed to the DSN, follow the DSN dialing plan. This includes the precedence digit, the Route Code, area code, switch center code, and line number. The precedence digit, Route Code, and area code are optional.

The DSN/AUTOVON Interface switch access to the DSN (NODAL) tandem switch is typically senderized. In the senderized operation, the DSN/AUTOVON Interface switch collects the customer-dialed digits, then seizes the appropriate trunk and outpulses the dialed digits.

3.4.5 SPECIAL GUARD TIMING

This feature is for use with circuits that operate on facilities with a round trip propagation time of 400 ms or more between a DSN *5ESS*®-2000 switch and some type of automatic switching equipment. It extends the interval that a *5ESS*®-2000 switch waits to receive an on-hook from the distant switch after it has transmitted an on-hook toward that switch.

3.5 ATTENDANT FEATURES

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3.5.1 ISDN ATTENDANT CONSOLE

The following paragraphs describe features that are available on the ISDN attendant console. For more detailed information about the ISDN attendant console, refer to 533-700-210, *5ESS*®-2000 Switch ISDN Attendant Console User Operation.

(a) ***Attendant Call Queuing:*** This feature permits calls to the attendants to be equally distributed among consoles. Calls are distributed to the most idle console. Attendants are alerted that there are calls waiting in queue; however, calls unanswered by the attendant are not redistributed to another console. Each attendant position is able to operate on a common queue sized to a maximum capacity of 255 calls. If the entire queue is full, the switch routes all new incoming calls to busy treatment. DSN calls can be queued on a precedence level, first-in first-out basis, with the flexibility to also distinguish the queuing priority level based on the incoming call type.

(b) ***Attendant Console Groups and Call Routing:*** The ISDN attendant console is capable of being configured in at least 2000 separate attendant groups. The switch is able to select attendant console groups for routing incoming and outgoing attendant-assisted calls. This feature permits calls originating from certain class-marked stations, or from stations with specified customer groups that require attendant assistance, to be routed to a specific attendant console group or groups.

(c) ***Attendant Console Operational Features:***

- ***Attendant Call-Through Tests on Trunks:*** This feature allows the attendant to set up a test call over a specific physical trunk to determine if the trunk is operating properly.

- ***Attendant Call Transfer:*** This feature, provided by the ISDN attendant console, allows the attendant, on request, to transfer calls from any trunk or station to any trunk or station line. Trunk calls may be transferred to a conference circuit.

  Call transfer allows the attendant to transfer a call to a DN. The DN can be an extension in the business group, a number outside the business group, or another attendant position in a multiposition environment. There are two customer options for how the transferred party is bridged onto a call, automatically or manually.

  With the automatic option, no attendant interaction is required. The party being transferred is bridged onto a call automatically by the switch when the called party's station begins alerting. With the manual option, the party being transferred is bridged onto a call by the attendant. If the called party is in the same business group as the attendant, the switch will bridge the call only if the called station is alerting (for example, if status is not busy, reorder, or out of service). If the called station is served by another switch, the caller is bridged onto the call after the switch has outpulsed the digits of the called party. When the switch bridges the connection, the attendant and the called party can talk.

  For manual and automatic bridging, if the attendant disconnects before the call is transferred or before the caller is bridged, the switch completes the transfer. The caller can hear all call progress tone associated with the call. If the called party answers and the attendant has not disconnected, a three-way call is established by the switch.

- ***Attendant Camp-On:*** The switch and the ISDN attendant console provide an automatic or manual Attendant Camp-on feature. Automatic camp-on is activated by the switch and manual camp-on is activated by the attendant.

  This feature allows incoming calls to be transferred to a busy station by the attendant. When the attendant uses the camp-on feature in transferring a call to a busy station, the busy station receives a tone each time the attendant attempts a completion. The call being transferred is held waiting and receives audible ringing while waiting for the busy station to answer the call. The called party can answer the call by either flashing or going on-hook and being rung back.

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- ***Attendant Paging System:*** Code call and voice paging features are provided with the attendant console.
  - ***Code Call:*** This feature allows attendants to the dialing access code and a two- or three-digit called party code to activate signaling devices (bells, gongs, horns, etc.) with a coded signal corresponding to the called code. The called party is connected to the caller by dialing an answering code from any station with the appropriate access treatment within the customer group.
  - ***Voice Paging:*** This feature allows dial and access to loudspeaker paging equipment (answer-back option available as in code calling).

- ***Attendant Recall:*** Attendant calls extended to a busy DN are given the attendant busy treatment. The attendant may hold the calling number and make another attempt to extend the call.

- ***Busy Verification:*** Using the ISDN attendant console, the attendant can determine whether a line or trunk within the Direct Station Selection (DSS) is busy or idle. If the line or trunk is busy, the attendant can bridge onto the connection to do the following:

  (1) Determine if it is busy or if there is a problem.

  (2) Talk with the parties.

  (3) Override (disconnect) the parties.

  When the attendant enters a conversation, a warning tone is given to the parties. The attendant can be denied break-in to selected stations and to selected trunk groups. An optional direct extension selection/busy lamp field console provides the attendant with a visual indication of the busy/idle status of up to 1600 extension numbers assigned to the system.

- ***Call Hold:*** The switch allows an active call to be put on hold so that the attendant can originate another call, answer a waiting call, return to a held call, etc. The attendant can place a call on hold that has one or more parties connected to the attendant. When on hold, the calling party is connected to silence, tone, or announcement. Calls placed on hold may activate a timed reminder. When the attendant removes a call from hold, the timed reminder is deactivated; the tone, silence, or announcement is removed from the held party; and the attendant and the called party can talk. An unanswered call cannot be placed on hold.

- ***Class-of-Service Override:*** When the attendant places a call for a party on hold, the restrictions on the attendant call are independent of any restrictions on the held party. That is, the ability of the attendant to place a call is strictly a function of the restrictions, if any, assigned to the attendant line. The attendant does have display, however, of the class of service and authorized precedence level of the held party.

- ***Lockout:*** The ability to prevent the attendant from reentering a call held on the console is not provided. If the call is not held by the attendant, then the attendant can be prevented from reentering the call.

- ***Night Service:*** This feature routes calls normally directed to the attendant to a different location. Night service can be activated and deactivated from a designated console. Routing may be provided in one of the following ways:
  - ***Fixed:*** Calls are routed from the major listed directory number to a preselected night station.

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- ***Trunk Answer from Any Station:*** Calls activate a night bell or other indicators so that calls may be answered at any station by dialing an answer access code for the Call Pickup feature.

- ***Flexible:*** The attendant can use the call forwarding variable feature to arrange routing.

Routing to different night service locations may be based on the incoming call identifier. Timed reminder is automatically canceled when the console is placed into night service. When a position is in night service, the attendant can originate calls. Only the designated console is capable of deactivating the night service. When deactivated, the switch informs all consoles in the attendant group that night service has been deactivated. Routing is still provided to the customer on a fixed single number.

- ***Position Busy:*** Position busy allows the attendant position to be made busy to prevent the switch from offering calls to the position. When position busy is activated in a multiple position arrangement, the switch directs new calls to a different console in the same attendant group as the position. Position busy cannot be activated in a multiple position arrangement if the position is the last nonbusy position. Position busy cannot be used in a single position arrangement. When a position is in a position busy state, the attendant can serve calls on hold or calls already alerting the console. The position busy condition can be removed at any time. The attendant can originate new calls after the position has been made busy.

  The attendant is able to make busy-out incoming calls current calls until cleared. After busy-out is activated, incoming calls are distributed to other consoles. Removing headsets from the console activates busy-out.

- ***Serial Calls:*** The Automatic Dropback to Attendant (Serial Calling) feature allows an attendant to complete a call from an incoming trunk to two or more stations in succession without requiring the calling party to redial the attendant. When the attendant is recalled, the called party can disconnect, and the calling party can give further instructions for the next call.

- ***Speed Calling:*** The switch's BRCS features and the ISDN attendant console provide the attendant with speed calling. Speed calling allows an attendant to specify a speed calling list containing DNs, each associated with a unique abbreviation dialing code. On reception of a valid abbreviation dialing code from a line arranged with this feature, the system attempts to complete the call to the associated DN. The number stored on the speed call list can contain precedence digits and Route Code digits in addition to the DN. Each console is capable of having a speed calling list of 30 numbers.

- ***Attendant Control of Facilities (ACOF):*** The attendant can restrict dial access of all stations within the government subscriber group to certain trunk groups, simulated facilities, and special services by operating special keys. Calls to these facilities may be routed to an attendant for subsequent completion, to a recorded announcement, or to an intercept tone trunk.

- ***Split Calling:*** This feature allows the attendant to consult privately with a called or calling party before transferring a call, without the other party hearing the conversation. There are two forms of call splitting: two-way and one-way.

  Two-way call splitting allows the attendant to toggle between two parties for private conversation with one party without the other hearing.

  One-way call splitting allows the attendant to privately talk with the called party only. With the manual bridging option, it is equivalent to call transfer with a manual bridging option.

  Both forms of call splitting can be used with either the manual or automatic bridging transfer options. The attendant can join the parties manually or by disconnecting. If the attendant disconnects from the call using **[RELEASE]**or **[RELEASE LOOP]**while the parties are split, the

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switch joins the split parties together. Once the parties are joined, they cannot be split again.

A manual exclusion option is provided for customers that have the automatic bridging transfer option. Manual exclusion allows the attendant to inhibit automatic bridging for one call. This allows the attendant to use call splitting to privately announce the caller to the called party. When manual exclusion is used, the attendant must join the parties manually.

- ***Through Dialing:*** The ISDN attendant console provides a through-dialing feature that allows the attendant to access an outgoing facility for station users having restrictions or difficulty in placing outgoing calls. If the attendant is successful in obtaining an outside facility, the calling party can complete the call without further assistance from the attendant.

- ***Two-party Hold on Console:*** The Attendant Call Hold feature allows the attendant to hold a call in progress to originate another call, answer a call, or pick up a call on hold. A timed reminder is activated when the call is placed on hold by the attendant. The attendant can have five 2-party holds in progress simultaneously.

(d) ***Attendant Listed Directory Number:*** A maximum of eight Listed DNs (LDNs) can be assigned to an attendant group. These LDNs can be used to reach the attendant from distant as well as locally. (The attendant would normally be reached locally by dialing "0".) In addition, each attendant can be assigned a unique DN, other than the LDN, which typically may be used for attendant-to-attendant calling.

(e) ***Centralized Attendant Service:*** The DSN Centralized Attendant Service feature (99-5E-4634) extends the existing ISDN attendant features Dial Through Attendant and Source Billing for Attendant Handled Calls to include calls that originate from an incoming MLPP on SS7 trunk. The Dial Through Attendant feature transfers the dial tone to the originator. The Source Billing for Attendant Handled Calls substitutes the DN of the originator for the attendant DN in billing records for attendant transferred calls.

(f) ***Console Self-Test:*** The attendant console allows the attendant to perform a lamp and alphanumeric display test and the proper operation of the function keys. The audible alerting functions can be verified by intra-attendant calling and are verified for each call handled by the attendant position if the volume is not set to "0".

(g) ***Dialing Equipment:*** The attendant console is provided with 12-button, Dual Tone Multifrequency (DTMF). The 12-button DTMF provides all the features provided by the 16-button DTMF.

(h) ***Full Access:*** The ISDN attendant console has full access to all trunks and stations in the switching system, the ability to complete calls between trunks and stations, and supervisory appearance in both directions. The switch attendant consoles have the capability of being restricted from accessing selected trunking facilities by access code.

(i) ***SCOF (Selective Control of Facilities):*** The attendant can make an individual facility group inaccessible to outgoing traffic from all stations within the government subscriber group, including the attendants.

(j) ***Interposition Transfer:*** This feature allows an attendant to transfer a call or to call a specific attendant in the attendant group. An attendant can transfer a call or originate a call to another attendant position by dialing the DN of the desired attendant. This DN is different from the LDN of the attendant group. Each attendant position may have a unique DN assigned to it. When a call is made to this DN, the switch offers the call only to the specified attendant and does not provide any hunting or queuing if the attendant is busy on that DN. When an attendant answers a call from another attendant, the incoming call indicator shows that the call is from an attendant.

(k) ***Remote Attendant Consoles:*** The ISDN attendant consoles are capable of being remoted up to 22,000 feet from the host switch over BRI facilities or can be located at a Remote Switching Module

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(RSM) up to 150 miles from the host over a DS1 digital transmission facility. The console is assigned a DN and is accessible by a DN from a trunk group.

(l) ***Supervisory Indicators:*** The consoles have keys with lights and audible indicators to show to the attendant that calls are terminating.

- ***Alphanumeric Display:*** An integral visual display of 40 alphanumeric characters in length is provided on the attendant console. The following information is displayed:
  - Calling number in 10-character field
  - Trunk groups and trunk member identity in a 8-character field; trunk group = 4 characters; trunk member = 4 characters
  - Station class of service (originating permission) in a 3-character field
  - Call type in a 4-character field
  - Precedence level of call in a 1-character field
  - Authorized precedence level of call in a 1-character field
  - All dialed digits in a 15-character field
  - Time of day in hours and minutes in a 14-character field.

- ***Audible Call Alerting:*** The ISDN attendant console provides three audible tone volume control switches. The switches are located at the lower end of the console and used to adjust the volume of the alerting, calls waiting, and timed reminder tones. The capability to switch off audible ringing is provided by turning the volume down to zero.

- ***Call Identification:*** The ISDN attendant console has several keys and associated status lamps. Detailed information about the console is covered in 533-700-210, *5ESS*®-2000 Switch Attendant Console User Operation. The distinct areas of the console are as follows:
  - Call processing area (dialing pad, Cancel/Start/Release buttons)
  - Call appearance area (6 appearances with Hold/Active lamps)
  - Feature button area (24 Feature Buttons and Status lamps)
  - Trunk group select area (12 buttons with Status lamps)
  - Display area (40-character alphanumeric display and display feature button area).

  Call indicator lamps are programmable to provide the attendant with a visual indication of trunk group status (idle, busy, or lockout).

- ***Timed Reminder:*** The console may alert the attendant to one of the following conditions:
  - ***Emergency:*** Informs the attendant that an emergency call is waiting. When the attendant answers the emergency call, the switch determines if any more emergency calls exist. If emergency calls still exist, then no new alerting indication is sent to the console until all emergency calls have been answered.
  - ***Timed Reminder:*** Informs the attendant that a timed reminder for a held call of an unanswered transferred call has expired. When all emergency calls have been answered,

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the switch determines if the timed reminder has expired for a call. If the timed reminder has expired, the switch sends the console a timed reminder alerting indication.

- ***Calls Waiting:*** Informs the attendant that calls are in queue waiting to be answered. When all calls on timed reminder have been answered or if no calls were on timed reminder, the switch determines if there are any calls waiting on queue. If there are calls in queue, the switch sends the console a call-waiting alerting indication.

- ***Alerting:*** Informs the attendant that a call is alerting the console. When all calls in queue have been answered or if no calls are in queue, the switch determines if any calls are to normally alert the attendant. If the attendant should be alerted because of an incoming call, the switch sends the console a normal alerting indication.

The emergency, timed reminder, calls waiting, and alerting tones described here are not tones applied by the switch. These tones are generated by the console. The signal ceases on the attendant's response to the service request.

(m) ***Switched Loop Operation:*** The attendant console has an ISDN line appearance at the switch and uses multiple call appearances to provide the capability to have several calls being handled at the console. For the call that the attendant is actively handling, the attendant has a switched loop connection from the ISDN B-channel to the customer. The attendant can release a call from the console on a call transfer operation and make the call appearance available for a new incoming call, or can hold the call at the console.

3.5.1.1 Precedence and Preemption ISDN Attendant Displays

The precedence of the incoming call, the authorized precedence of the originator, and the authorized Precedence and Preemption (PP) originating permissions (Screen Index) of the originator are provided in a display for all intraswitch calls terminating to a Precedence and Preemption ISDN attendant. These are provided in addition to the call appearance identifier and the ICI which is provided for non-PP ISDN attendants. The PP Screen Index originating permissions are provided in place of the originating permissions that are provided for non-PP ISDN attendants.

The precedence of the outgoing call, the authorized precedence of the terminator., and the authorized PP originating permissions of the terminator are provided in a display for all intraswitch calls originated by a PP ISDN attendant. These are provided in addition to the call appearance identifier and the ICI that are provided for non-PP ISDN attendants. The PP originating permissions are provided in place of the originating permissions that are provided for non-PP ISDN attendants.

3.5.1.2 Attendant Queuing by Precedence Levels

Calls to PP ISDN attendants can be queued by precedence level. Having a queue reserved for any of the precedence levels is provided as an alternative to queuing using the ICI of a call.

3.5.1.3 Attendant Calls

Calls terminating to the attendant contain additional information for PP calls. The PP display information for the dialed precedence of the call, the user's authorized precedence for the call, and the authorized PP originations permissions of the originator of the call are added to the normal attendant display before sending the display information to the terminal of the attendant. The authorized PP originations permissions replace the originating permissions for non-PP attendants.

Calls originated by the attendant also contain additional display information for the PP calls. The PP display information for the dialed precedences of the call, the terminators authorized precedence, and the authorized PP originating permissions of the terminator of the call for outgoing intragroup calls are added to

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the normal attendant display. This is done before sending the display information to the terminal of the attendant. The authorized PP originations permissions replace the originating permissions provided for non-PP attendants. Calls to the attendant can be preempted for clear; preemption for reuse of an attendant is not allowed.

3.5.2 50B (DSN/AUTOVON) CONSOLE

The DSN/AUTOVON Interface switch uses attendant consoles, which are non-data-link 50B consoles used by BRCS. Sixteen lines can be associated with each console. These lines appear as 16-line terminations on the *5ESS*®-2000 switch. Each BRCS console is only allowed six call types. For reliability reasons, BRCS guidelines suggest splitting the 16-line terminations across multiple SMs.

Call distribution to the different attendant consoles is provided by the Multiple Position Hunt (MUPH) feature. This feature provides uniform distribution of calls among the different consoles. Each MUPH group allows six different call types.

There is a limitation of 16 positions per position hunt group. Position hunt groups count against the total of 999 hunt groups that can be defined for a *5ESS*®-2000 switch.

3.5.2.1 Attendant Service

Attendant services are provided with the 50B non-data-link console that can identify up to six different call types. An incoming call is indicated to the attendant by an audible signal and an incoming call identification display. There are two types of 50B consoles:

- Electronic Console (EC)
- Multibutton Electronic Telephone (MET).

Both 50B consoles are compatible with the DSN/AUTOVON Interface switch software; however, the 50B MET is recommended because of the methods used for local queuing and incoming call identification between the two types of consoles.

3.5.2.2 Incoming Call Identification

An incoming call is indicated to the attendant by an audible signal and an incoming call identification display. The non-data-link 50B MET identifies the incoming call by blinking a lamp next to the loop on which the call is arriving. The attendant can identify the incoming call by reading the label printed on the key associated with the blinking lamp. For the 50B MET set, the 16 attendant loop pairs and 16 loop buttons are provided on a one-to-one basis, each loop button being assigned to show the category of call to which it is dedicated.

Call distribution to more than one console is normal. The existing BRCS feature that provides call distribution in a multiple console arrangement is the MUPH feature. This feature provides uniform distribution of calls (and call types) for up to six call types and 16 consoles. The possible call types are as follows:

- Listed DN, DSN precedence call
- Listed DN, DSN routine call
- Listed DN, non-DSN call
- Call forwarding busy for DSN precedence call
- Call forwarding idle for DSN precedence call

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- Dial 0.

3.5.2.3 Attendant Console Features

The following features are available for attendants using either the 50B MET or 50B EC. (These features already exist in BRCS and are not specific to DSN.)

- ***Directed Call Pickup (With Barge In):*** An attendant is able to barge into an existing call and interrupt the conversation to make a request.

- ***Call Transfer Attendant:*** This feature allows a station to flash and to be routed to the attendant when receiving a call from outside the Government Business Group. A Government Business Group can consist of DSN subscribers and non-DSN subscribers at a particular business location. If the terminal also has a Call Hold feature assigned, the user will have to dial an attendant access code after flashing. Depending on subsequent actions, a three-way call may be formed. A typical call would consist of the station user disconnecting and transferring the call to the attendant for further disposition.

- ***Attendant Through Dialing:*** This feature provides the attendant with the ability to dial an access code, receive dial tone, and then be removed from the call so that the station requesting access can complete the dialing. The requesting station must be in the same government subscriber group and Individualized Dialing Plan (IDP) group as the attendant. This feature is available to DSN subscribers as a means of reaching the DSN at a time when the Attendant Control of Facilities (ACOF) is being enforced.

- ***Attendant Call Transfer:*** This feature allows the attendant (or any station marked with this feature) to transfer any established call to any other station.

- ***Attendant Conference:*** This feature allows the attendant to connect a maximum of five parties (not including the attendant) to a conference facility in order that they may converse over a common talking path.

- ***Attendant Camp-On:*** The Attendant Camp-on feature allows a call, that an attendant attempts to complete to a busy station within the attendant's government subscriber group, to be held waiting (camped-on) until either the called party answers, or the calling party abandons, or the attendant reenters the calls.

- ***Night Service:*** The Night Service feature provides arrangements to route incoming calls, that are normally directed to an attendant, to preselected station lines within the government subscriber group. This feature is activated by either a dialed access code or by the night service key on the console.

- ***Power Fail Transfer:*** The Power Fail Transfer feature provides for routing of calls, that are normally directed to the attendant, to a preassigned DN during a commercial power failure at the customer's location.

- ***Trunk Group Busy Lamps:*** The Trunk Group Busy Lamps feature provides a console attendant with a visual indication when all trunks in a trunk group are busy.

- ***ACOF:*** The attendant can restrict dial access of all stations within the government subscriber group to certain trunk groups, simulated facilities, and special services by operating special keys. Calls to these facilities may be routed to an attendant for subsequent completion, to a recorded announcement, or to an intercept tone trunk.

- ***Selective Control of Facilities (SCOF):*** The attendant can make an individual facility group inaccessible to outgoing traffic from all stations within the government subscriber group, including the attendants.

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- ***Main-Satellite Service:*** The Main-Satellite Service has been described previously under "Main-Satellite DSN/AUTOVON Compatibility" in this section.

- ***Position Busy:*** The Position Busy feature allows an attendant to inform the DSN/AUTOVON Interface switch that the position is busy and that no new calls should be directed to this console. This console key action marks the console busy in the MUPH hunt group.

- ***Local Queuing with Call Waiting Lamp:*** This feature provides for the queuing of incoming calls to the attendant console. Incoming calls are queued when the attendant is involved with an active call. As the incoming calls are queued, a visual indication is given to the attendant that calls exist. If the 50B MET has a call active at the console and a second call is directed to another loop, the lamp associated with that loop blinks additional loop lamps. A waiting call hears audible ring until the attendant disposes of the active call and accesses the waiting call. In the 50B EC, if a call is locally queued, a call waiting lamp lights. Several calls may be queued when using either the 50B MET or 50B EC. Calls are presented to the attendant using the 50B EC console one by one, preserving the order of arrival. With the 50B MET, the attendant knows the number and incoming call identification of the calls queued. The order of arrival is not displayed with the 50B MET. The attendant using the 50B MET may manually give precedence treatment to certain classes of calls.

The following features, available on the 50B EC only, are provided by hardware and firmware on the 50B EC:

- Direct Station Selection and Busy Lamp Field (This is not the same feature as the DSN/AUTOVON Direct Station Selection feature.)

- Repertory Dialing

- Time of Day

- Traffic Measurements and Display.

3.5.3 MAIN-SATELLITE DSN/AUTOVON COMPATIBILITY

The term "main-satellite" is used to denote the relationship between the *5ESS*®-2000 switch providing the DSN/AUTOVON Interface feature package and any other switching system to which incoming DSN/AUTOVON precedence calls may be routed by the *5ESS*®-2000 switch via tie trunks. With the "main-satellite" arrangement, the *5ESS*®-2000 switch providing the DSN/AUTOVON Interface feature package is referred to as the "main" switching system. Any other switching system (for example, PBXs) to which incoming DSN precedence calls may be routed via the *5ESS*®-2000 switch is referred to as the "satellite" switching system. The *5ESS*®-2000 switch serves as the "main" switching system for DSN calls to a "satellite" switching system.

The Main-Satellite DSN/AUTOVON Compatibility feature provides two DSN/AUTOVON precedence options for completing incoming DSN/AUTOVON precedence calls that are directed to customer stations served by another switching system. These two options are INID service and PNID service.

The INID service option allows the DSN/AUTOVON Interface switch to do the following:

- Intercept automatically an incoming precedence call directed to a satellite switching system

- Reroute the precedence call to a customer-specified DN (such as the DSN/AUTOVON Interface attendant).

With the INID option, after a precedence call has been intercepted and routed to the preassigned number, it is treated as if the preassigned number had been dialed originally. The preassigned number may be

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associated with either a user station or an attendant position. If the preassigned number is associated with a user station, the call receives the same treatment as a precedence call originally directed to that number. For example, the called party may be preempted, or the call could be routed to an attendant after no answer. If the preassigned number is associated with an attendant position, the call is routed to the attendant; if all the positions are busy, the call is given appropriate busy treatment.

The PNID service option allows precedence calls to complete to a satellite switching system. With the PNID service option, if a precedence call routed to a satellite switching system is not answered within a certain period of time, the precedence call is automatically rerouted by the DSN/AUTOVON Interface switch to a customer-specified DN. This customer-specified DN can be the number of the DSN subscriber group attendant.

3.6 FEATURE INTERACTIONS

3.6.1 FEATURE PRIORITIES

Feature priorities refer to the order in which BRCS features are invoked with a line assigned the MLPP feature. For example, the feature priorities for an MLPP line with precedence call waiting, dial call waiting, call forwarding variable, and auto callback, refer to the sequence or succession in which each of these features is invoked or called.

The following examples are given to indicate feature priority. A precedence call terminating to a busy line can receive one of several treatments. The order in which the features are called is shown in the following flowcharts (Figure 3-10) and described in the following steps.

(1) If Dial Call Waiting (DCW) is in effect, the call is handled by the DCW feature.

(2) If not, the precedence level is checked.

(3) If the precedence level is greater than ROUTINE, the call is handled by the Call Forwarding Variable - Precedence (CFV-P) feature.

(4) If CFV-P is not in effect or the precedence level is ROUTINE, Call Forwarding Variable (CVF) handles the call if it is in effect.

(5) If CFV is not in effect and the precedence level is ROUTINE or none, Call Waiting Terminating (CWT) handles the call.

(6) If CFV is not in effect and the precedence level is greater than ROUTINE, and the IMMEDIATE PREEMPTION indicator is not allowed, CWT-R handles the call if it is in effect. If CWT-R is not in effect, then PPBUSY handles the call. If PPBUSY is not in effect, then CWT handles the call.

(7) If CFV is not in effect and the precedence level is greater than ROUTINE, and IMMEDIATE PREEMPTION indicator is allowed, preemption takes place.

(8) If CFV is not in effect and the precedence level is less than or equal to ROUTINE, then CWT-R handles the call if it is in effect. If not, then PPBUSY handles the call. If not, then CWT handles the call.

(9) If CWT is not in effect and the precedence level is greater than ROUTINE, Call Forwarding Busy - Precedence (CFB-P) handles the call.

(10) If CWT is not in effect and the precedence level is ROUTINE or if (CFB-P) is not in effect, then Call Forwarding Busy (CFB) handles the call.

(11) If CFB is not in effect, then Call Waiting Originating (CWO) handles the call.

(12) If CWO is not in effect, then preemption takes place. ROUTINE, CFB-P (MLPP Call Forwarding

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Busy) handles the call.

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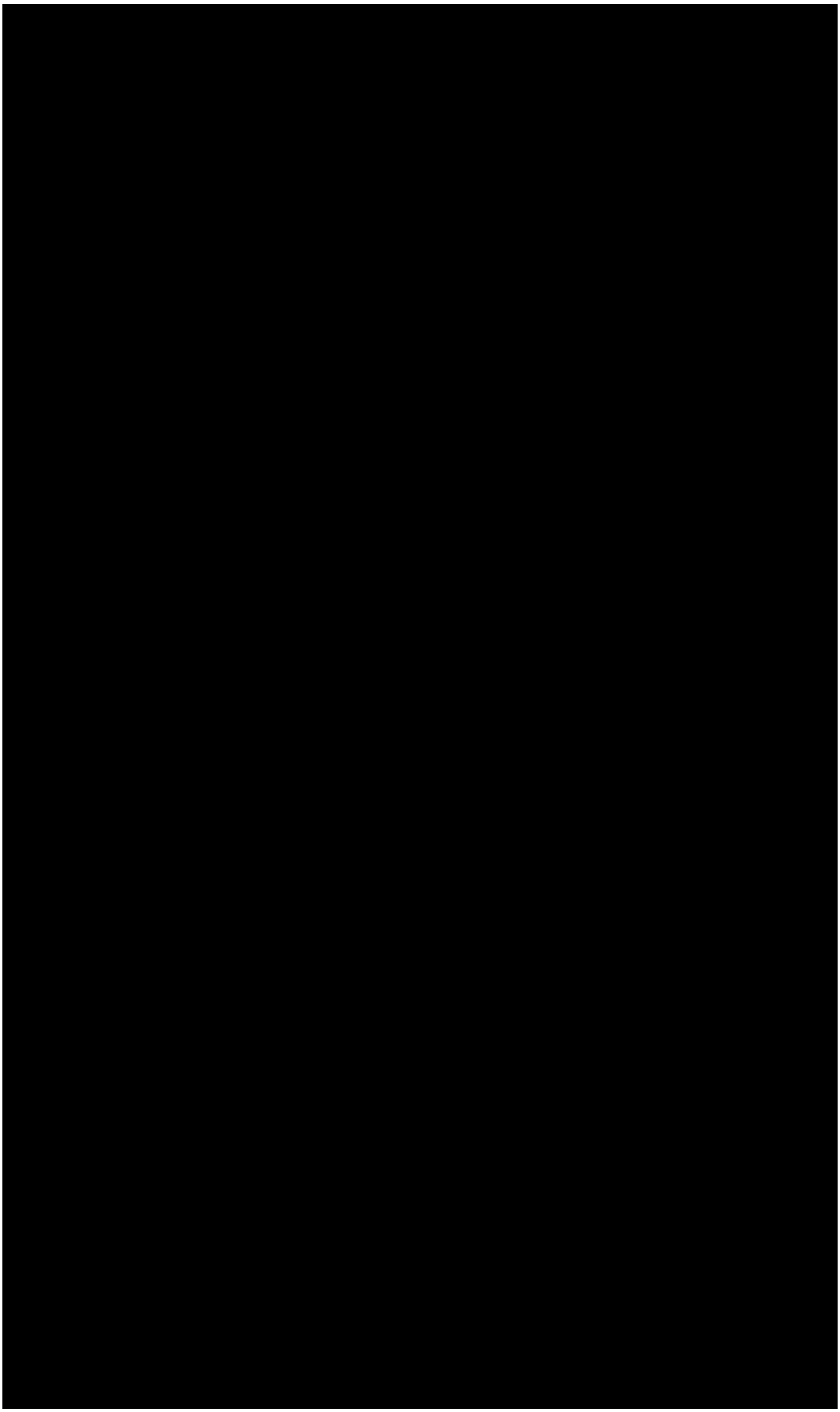

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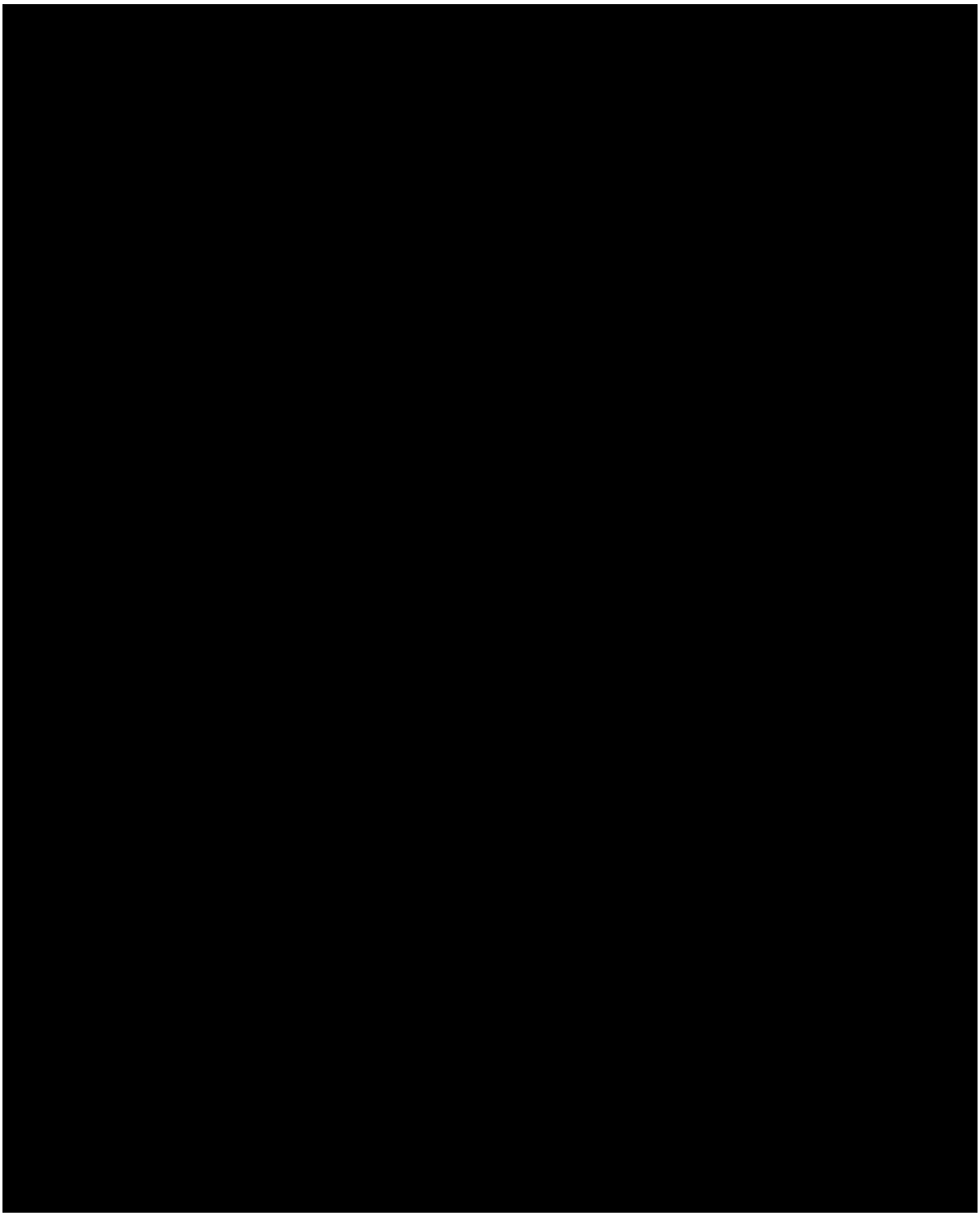

Figure 3-10 5ESS -2000 Switch Analog Busy Feature Selection

A routine call terminating to a busy line can receive one of the following treatments listed in order of priority. The order in which the features are called is shown in the following flowchart (Figure 3-11) and described in the following steps.

(1) If the precedence level is greater than ROUTINE, the call is handled by the CFV-P feature.

(2) If CFV-P is not in effect or the precedence level is ROUTINE, CFV handles the call if it is in effect.

(3) If the status of the call appearances is ALL IDLE and the precedence level is greater than

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ROUTINE, Call Forwarding Don't Answer - Precedence (CFDA-P) handles the call.

(4) If CFDA-P is not in effect or the precedence level is ROUTINE, Call Forwarding Don't Answer (CFDA) handles the call.

(5) If the status of the call appearances is ALL BUSY and the precedence level is greater than ROUTINE, CFB-P handles the call.

(6) If CFB-P is not in effect or the precedence level is ROUTINE, CFB handles the call if it is in effect.

(7) If CFB is not in effect, then preemption takes place.

(8) If the status of the call appearances is SOME BUSY, the IMMEDIATE PREEMPTION indicator is allowed, and the precedence level is greater than IMMEDIATE, then preemption takes place.

(9) If the status of the call appearances is SOME BUSY, the IMMEDIATE PREEMPTION indicator is allowed, and the precedence level is IMMEDIATE, then CFDA-P handles the call.

(10) If the status of the call appearances is SOME BUSY, the IMMEDIATE PREEMPTION indicator is allowed, and the precedence level is ROUTINE, or if CFDA-P is not in effect, then CFDA handles the call.

(11) If the status of the call appearances is SOME BUSY, the IMMEDIATE PREEMPTION indicator is not allowed, and the precedence level is greater than ROUTINE, then CFDA-P handles the call.

(12) If the status of the call appearances is SOME BUSY, the IMMEDIATE PREEMPTION indicator is not allowed, and the precedence level is ROUTINE; or if CFDA-P is not in effect, then CFDA handles the call.

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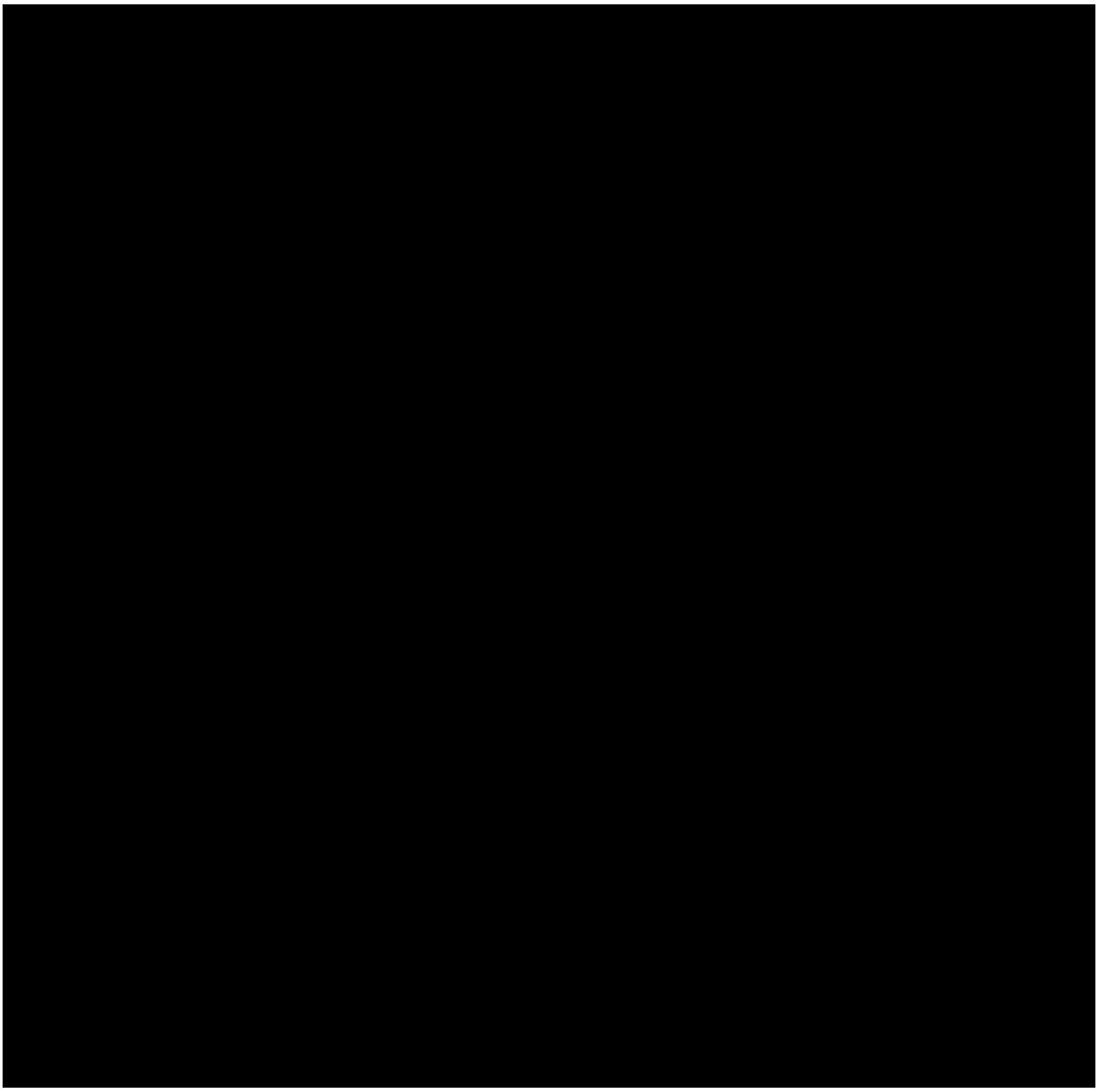

Figure 3-11 5ESS -2000 Switch ISDN Feature Selection

A precedence call terminating to an idle line can receive one of the following treatments listed in order of priority:

(1) Dial call waiting (with distinctive ringing)

(2) Call waiting originating (with distinctive ringing)

(3) Call forwarding variable

(4) MLPP call forwarding for don't answer

(5) Call forwarding for don't answer.

A routine call terminating to an idle line receives no special MLPP treatments but may receive one of several existing BRCS treatments. These are listed in order of priority as follows:

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(1) Dial call waiting (with distinctive ringing)

(2) Call waiting originating (with distinctive ringing)

(3) Call forwarding variable

(4) Call forwarding for don't answer.

3.6.2 LINE FEATURES

3.6.2.1 Feature Interactions

The precedence and preemption feature adapts portions of the BRCS feature packages, for example, Call Forwarding and Call Waiting, to operate in the DSN environment. This provides interactions between unique DSN requirements, such as precedence and preemption, and the BRCS features.

The DSN/AUTOVON Interface capability provides the ability to assign several BRCS features to DSN/AUTOVON subscribers. This list consists of the following BRCS features:

- Abbreviated Dialing
- Auto-Callback
- Call Forwarding - Variable
- Call Pickup
- Call Waiting
- Multiway Calling.

A description of the interaction of these features and precedence and preemption follows.

3.6.2.1.1 Abbreviated Dialing

An entry in an abbreviated dialing list can optionally include an access code, the precedence digit, and/or route code prefix along with the DN digits. If a precedence digit is stored in an abbreviated dialing list entry, and a precedence digit is dialed followed by that abbreviated dialing code, the dialed precedence overrides the stored precedence.

Abbreviated dialing users are allowed to make calls at a higher precedence than their authorized precedence when the numbers are stored in their list. Higher precedence levels can be stored in the list via recent change or stored by another user with a higher authorization level who is sharing the speed calling list. Abbreviated dialing is supported for calls routed over tie trunks.

3.6.2.1.2 Automatic Callback Calling

When a calling party receives busy treatment while attempting an intraoffice call, the caller may signal for dial tone and dial a feature code to request automatic callback. Confirmation tone is provided if the caller is permitted to camp-on to the busy terminating station. When both stations become simultaneously idle for 6 seconds, the station from which the automatic callback code was dialed is rung back. On origination, the answering party is given audible, and the terminating station is rung. If the camp-on is not permitted, reorder is given. This feature cannot be used by attendants.

The precedence of the callback call is the same as the precedence of the original call that received busy treatment.

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When both the automatic callback feature initiator's line and the camped onto line remain idle for 6 seconds, the initiator's line is rung back. In this example, assume that the camped-on line becomes busy on a lower precedence call during the ringback period. On answer of the ringback by the feature initiator, a call is placed to the busy line. The lower precedence call in progress is preempted. Precedence is preserved during a camp-on.

Preemption of a busy line that is being camped-on does not disturb the camped-on call, regardless of whether it is preempted for reuse or preempted to clear. The automatic callback originator is rung after the preempting call ends and both stations have been idle for 6 seconds.

3.6.2.1.3 Call Forwarding

A precedence call forwarded to another DSN user that encounters busy can cause preemption to occur if the preemption would be allowed normally. The extra call forwarding step does not affect the final preemption decision.

3.6.2.1.4 Call Pickup

A precedence call terminating to a line marked "no precedence pickup" is not allowed to be picked up, even if call pickup is assigned to that line.

A routine call terminating to a line marked "no precedence pickup" can be picked up if the station trying to answer the call and the called line are in the same call pickup group.

3.6.2.1.5 Call Waiting

Call waiting is available for precedence and preemption users attempting to make a precedence call.

If the call waiting feature is active on a line, incoming nonprecedence and preemption feature calls receive the call waiting treatment when the line is busy.

If the terminating precedence call has a higher precedence than the existing call, a special call waiting tone is given. If the terminating precedence call has a precedence lower than or equal to the existing call, a different special call waiting tone is given. If the terminating call is a nonprecedence and preemption call (for example, an incoming DDD call), the normal call waiting tone is given.

If immediate preemption is on for this line, a terminating precedence call causes preemption to occur if its precedence level is higher than that of the existing call regardless of the call waiting feature being active. Immediate preemption allows a precedence and preemption user to receive higher precedence calls by being preempted, regardless of call waiting.

3.6.2.1.6 Multiway Calling

A DSN call cannot be involved in a multiway call with nonprecedence and preemption users without DSN access privileges, unless the multiway call is originated by a line class marked to allow network crossover (attendants are always allowed crossover privileges). A DSN call cannot be transferred to lines without the DSN call reception privilege, unless the transfer is performed by a line class marked for network crossover. This restriction is called "Network Crossover" and applies to all calls, including multiway calls.

Any precedence and preemption line with 6-way calling can complete a 6-way call involving nonprecedence and preemption user parties within that user's dialing restrictions. Any attempt by a precedence and preemption user, who is not class marked for network crossover, to add a DSN call to a non-DSN multiway call results in reorder tone. A precedence and preemption attendant can originate multiway calls involving both DSN and non-DSN parties.

For a precedence and preemption feature call, if the first call is a precedence call, then that precedence is given to the second call, unless the feature is invoked by the precedence and preemption attendant. The

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attendant is able to override the precedence on a call to complete precedence calls for other users. The attendant can place calls at precedence levels higher than the user's authorized precedence.

If one of the noncontrolling parties on a multiway precedence and preemption feature call is preempted, that party receives normal preemption treatment. If the call originator is preempted, parties receive preempt to clear treatment, regardless of call transfer being active.

3.6.2.1.7 Distinctive Ringing

A user subscribing to this feature may have distinctive ringing cycles based on the type of incoming call. The options available for the type of incoming call include the following:

- Intraterminal group calls
- Interterminal group calls
- Interoffice calls
- Calls completing over private facilities
- Calls originated by call waiting originating
- Calls originated by dial call waiting
- Calls originated from an attendant because of an active call forwarding feature
- Calls originated from an attendant with any multiway feature
- Precedence call.

3.6.3 ISDN LINE FEATURES

The following subsections provide details about the interactions that precedence and preemption have with the following ISDN features:

- Shared DN
- Multiple call appearances
- Terminal displays
- Distinctive ringing
- ISDN lines.

NOTE: The MLPP feature can be assigned only to a custom BRI and cannot be assigned to a National BRI. Only the CSV calls can be made with a precedence level. ISDN Circuit Switched Data calls are supported, but these calls cannot be made with a precedence level.

3.6.3.1 Shared DN

The following are the interactions that precedence and preemption have with shared DN. The ISDN lines assigned to an MLPP feature are allowed to be configured as part of a shared DN arrangement; however, they must be marked as non-preemptable. The ISDN lines assigned an MLPP feature are allowed to be configured as part of a Multi-Point arrangement, but preemption of the D-channel is not supported. If three MLPP-ISDN users are configured on the same DSL, and two of the users are busy on Routine calls, the third user will not be allowed to originate/terminate calls even if a higher precedence call is attempted.

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- Manual exclusion does not prevent ISDN precedence and preemption.
- If a call appearance is preempted, any shared call appearances (shared DNs) are also preempted.
- Since precedence and preemption precedence ringing is provided as a distinctive ringing pattern, delayed or abbreviated ringing interactions with precedence are transparent to the precedence and preemption feature.
- Distinctive ringing patterns are applied to terminals with delayed/abbreviated ringing features if applicable during the period or they would otherwise be receiving normal ringing.

3.6.3.2 Multiple Call Appearances (MCA)

The interactions of multiple call appearances with precedence and preemption are as follows:

- A priority termination can be picked up like a normal termination.
- For a precedence and preemption precedence call to a DN assigned the precedence and preemption feature, a preemptive hunt of the busy call appearances is performed when all call appearances for that DN are considered busy.
- Precedence and preemption routing and precedence calls observe the rules of subaddress reservation provided by MCA and are treated as priority terminations.

  For example, a DN has a total of four subaddresses with one subaddress reserved for origination only and the nonreserved subaddresses are busy. An incoming routine call to this DN receives busy treatment. An incoming precedence call to this DN does not terminate to the idle subaddress, but instead preempts one of the busy subaddresses, if the precedence levels allow. If preemption cannot occur, the blocked precedence announcement is given.
- Calls on hold can be preempted.
- A call appearance in a preempted state is receiving preemption tone. If an attempt is made to put a call appearance on hold while the call appearance is receiving preemption tone, the switch sends a message to a terminal indicating that the attempt is rejected. This also applies to analog lines in a key system group.
- When ringing line preference is in effect, precedence and preemption precedence calls replace the oldest alerting call in order of precedence. A precedence call only replaces a lower-level precedence call.

3.6.3.3 Terminal Displays

The Incoming Call Line Identification (ICLID) display and Outgoing Called Line Identification (OCLID) display provide the following additional display information for precedence and preemption:

- Dialed precedence of incoming calls of incoming and outgoing calls to station sets.
- Dialed precedence, authorized precedence of originator, authorized calling areas, and precedence and preemption origination permissions of the originator of calls to the attendant. The precedence and preemption origination permissions replace the origination permissions for nonprecedence and preemption attendants.
- Dialed precedence, authorized precedence of terminator, authorized calling areas of the terminator, and precedence and preemption origination missions of the terminator for outgoing intragroup calls from an attendant that has the precedence and preemption feature. The precedence and preemption

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origination permissions replace the origination permissions for nonprecedence and preemption attendants.

DN privacy does not affect dialed precedence, authorized precedence, authorized calling areas, and originating permissions.

A display is sent to a station set whenever a call on that set is preempted. This display is sent in the NORMAL display mode and uses the entire display field.

3.6.3.4 Distinctive Ringing

The user scenarios are the same as earlier product releases with the following exceptions:

- The terminals now do the actual alerting in the manner specified by the terminal vendor. Thus, two different terminals with the same Distinctive Ringing feature may alert the user differently.
- Every terminal sharing the Logical Test Port (LTP) with a Distinctive Ringing feature assigned will alert according to the terminal vendor's specification (based on receiving the same alerting pattern).

3.6.3.5 ISDN Lines

The Precedence and Preemption (PP) capabilities provided for ISDN terminals are as follows:

- Allowing PP originations via feature buttons and providing the feature lamp interactions for precedence dialed codes behind feature buttons
- Providing PP users with precedence display information
- Administering different precedence-level calls on each call appearance of a terminal
- Providing precedence alerting by using the Distinctive Ringing (DR) feature
- Selecting a Call Appearance for a called DN handling the lowest precedence call for preemption
- Providing in-band preemption tone along with a preemption display to the preempted party.

3.6.3.5.1 PP Calls Originating via Feature Buttons

The ISDN PP feature allows a PP ISDN user or PP ISDN attendant to specify a precedence level for a PP call origination by pressing a feature button while off-hook on a PP call appearance. This call appears to the switch as a precedence dialed code. One PP precedence level feature button corresponds to one and only one precedence level.

3.6.3.5.2 PP User Precedence Display

Each PP ISDN user with a display feature is shown the precedence of the originating call via the OCLID display and the precedence of any terminating call via the ICLID display.

Figure 3-12 shows examples of ICLID and OCLID displays to and from PP users and PP attendants. Assume the call examples originate at Priority (P) precedence level and that the following conditions exist:

User-1 = 630-979-5095, rcv 1.31 PRECREG = F, Screen Index = 724

User-2 = 630-979-5142, rcv 1.31 PRECREG = FO, Screen Index = 724

User-3 = 630-713-4476, rcv 1.31 PRECREG = FO, Screen Index = 100

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Attendant = 630-979-5800, Screen Index = 724

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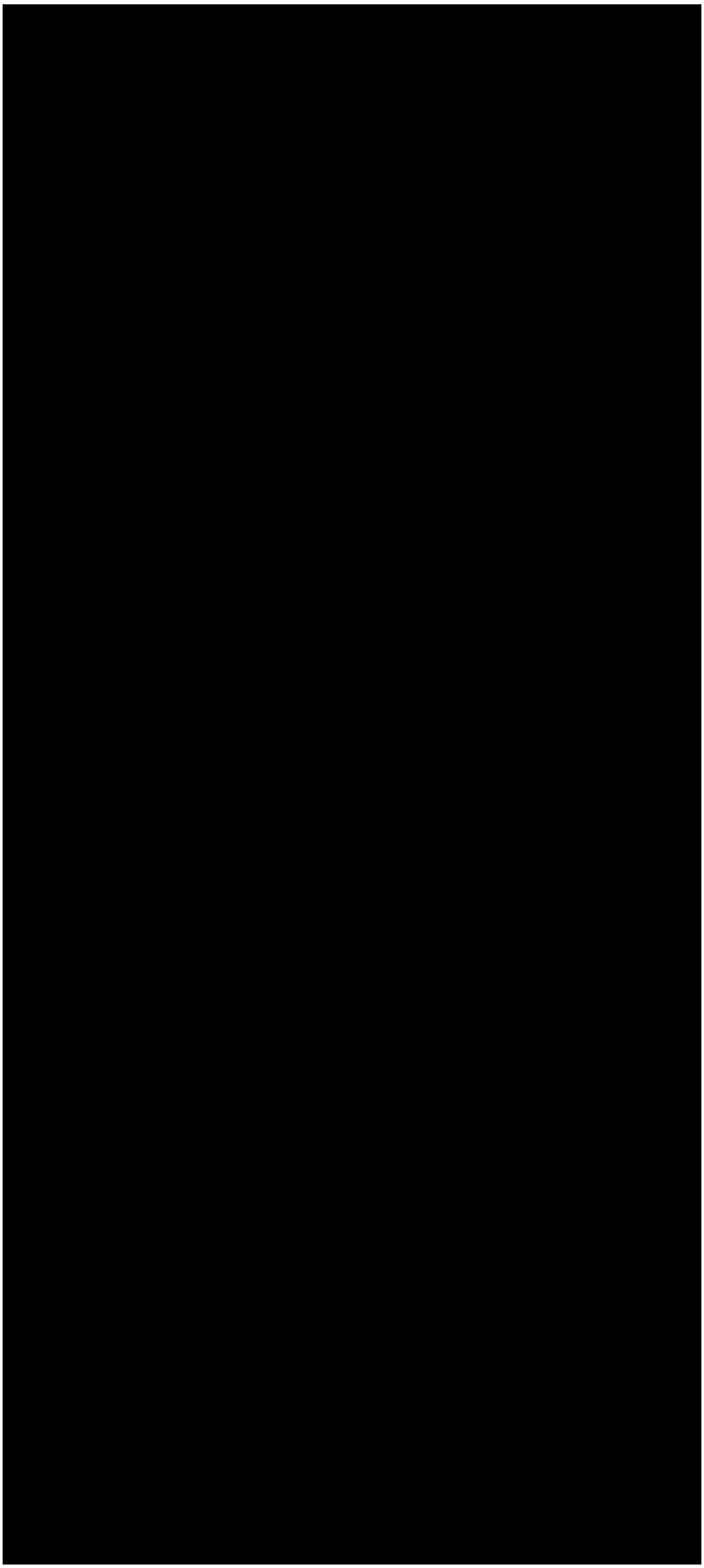

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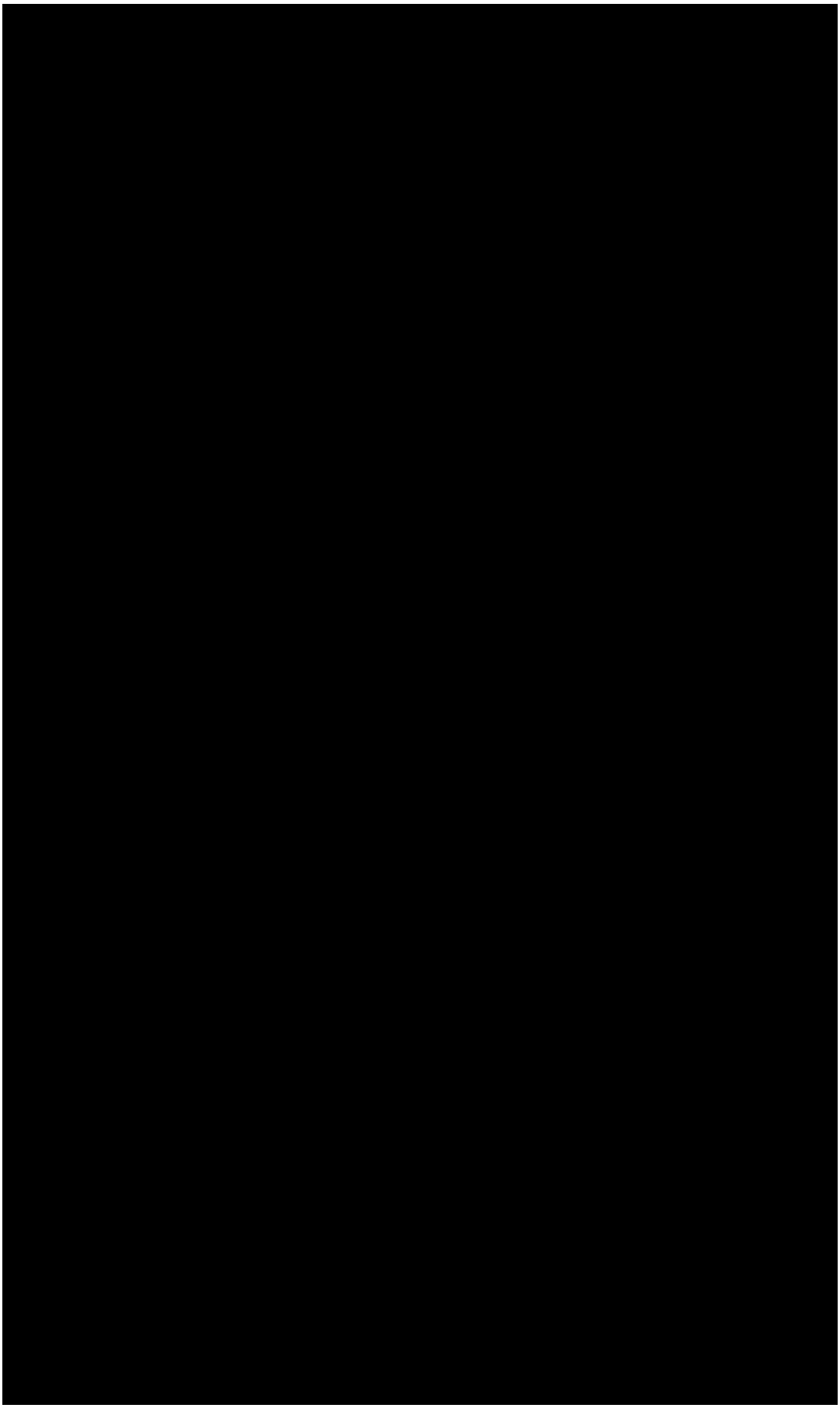

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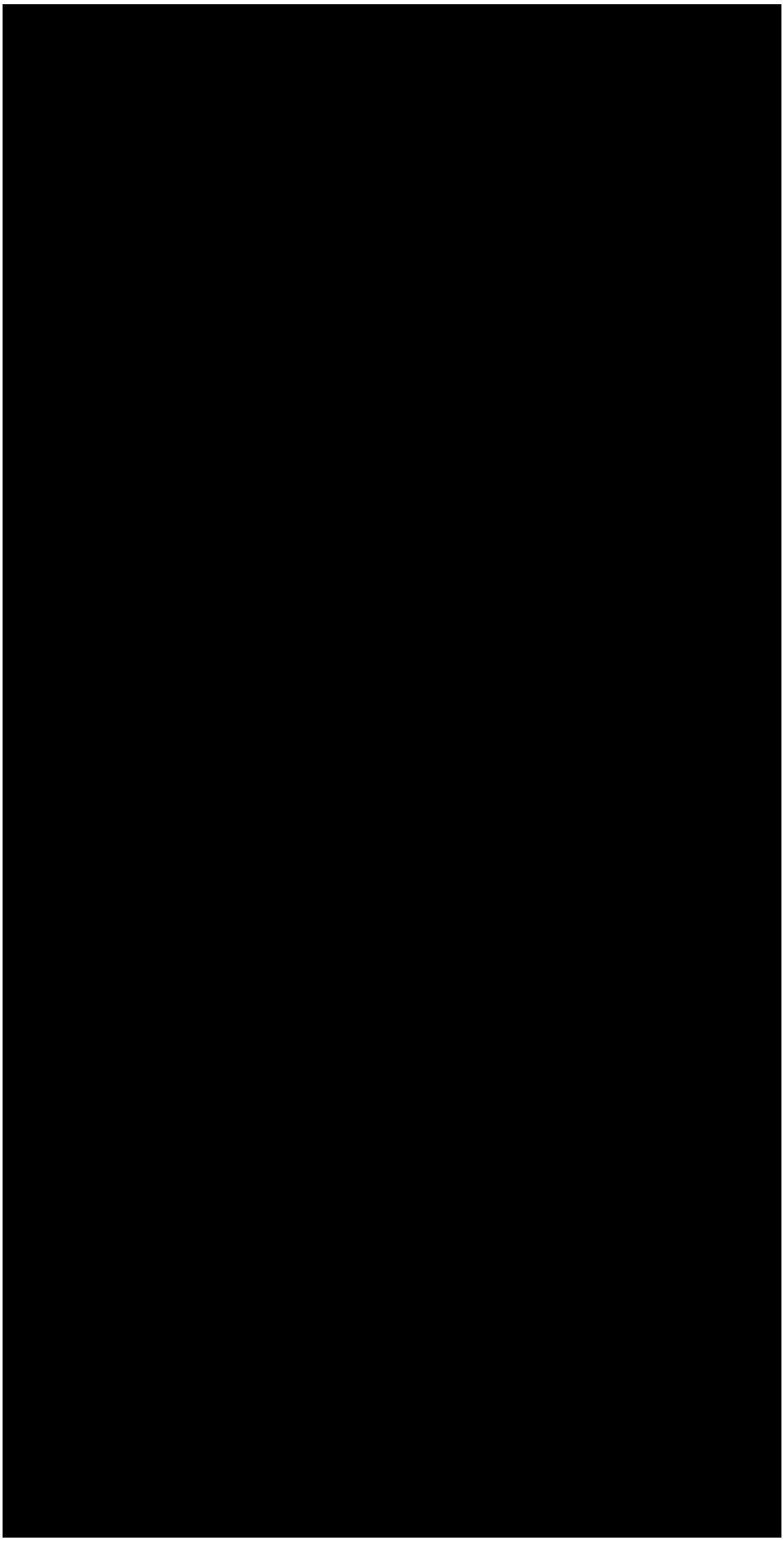

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Figure 3-12 PP ICLID and OCLID Displays

The special display information required for the PP feature consists of the following:

- The precedence of the call
- The PP calling area permissions of the user
- The authorized precedence of the user.

The ICI is not affected by the PP feature but the normal originating permissions are replaced by the PP calling area for attendants with the PP feature. The PP calling area is determined by a user's screening index.

3.6.3.5.3 Precedence Record Storage for MCAS

For each call (PP or non-PP) originating from or terminating to a PP call appearance for a DN with MCAs, the precedence of the call is stored as new dynamic data for that call appearance.

3.6.3.5.4 Precedence Alerting as Distinctive Ringing

Special alerting can be provided for precedence calls to an ISDN terminal using the Distinctive Ringing feature. The type of alerting that is appropriate for a terminating call is sent in the Q.931 message from the switch to the terminal.

3.6.3.5.5 PP Call Terminating Treatment

The precedence level of a PP call is stored for each call appearance for a successful termination. The precedence of the incoming call is displayed for PP users having the ICLID feature.

3.6.3.5.6 Providing a Preemption Display

For MLPP-ISDN lines provisioned with display features, there are two distinct displays for preemption. INCOMING PREEMPTION indicates this ISDN line is being preempted for reuse. PREEMPTED indicates this ISDN line was preempted-to-clear.

3.6.3.5.7 PP Subaddress Reservation

Subaddress Reservation (SAR) allows certain Call Appearances (CA) to be reserved for specific call types when an ISDN line is provisioned for Multiple Call Appearances (MCA). One specific type is for PP calls. For example, certain conditions will occur if an MLPP-ISDN user is assigned three CAs and RC View 23.2 fields are provisioned as follows:

- SAR_QTY = 1
- SAR_ORIG = Y
- SAR_TERM = Y
- PP = Y.

  When this occurs, the MLPP-ISDN user is only allowed to terminate two routine calls. The CA 3 is dedicated to receive-only calls which are greater than Routine. When this MLPP-ISDN user is idle, three calls greater than routine are allowed to terminate. For further information, refer to *Subaddress Reservation* in 235-190-104.

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3.6.4 QUEUING FEATURES

3.6.4.1 Multiline Hunt Group Incoming Queuing

A call that is queued for service may be preempted at a prior trunk connection in the DSN or locally for reuse at the same switch. When this occurs, the call is removed from the queue.

3.6.4.2 Ringback Queuing

This feature is not compatible with MLPP calling. However, MLPP lines can use this feature for non-PP calls.

The four-wire subscriber lines using this feature must be rung back once a trunk is obtained. The Ringback Queuing feature chooses the type of ringback based on the trunk obtained. This is inadequate for queuing initiated for four-wire subscriber lines. Routine ringing is provided for ringback.

3.7 SIGNALING INTERFACES

3.7.1 SUBSCRIBER EQUIPMENT SIGNALING

Subscriber access line (four-wire line) terminates with the *5ESS*®-2000 switch on a trunk port.

All supervisory signaling over access lines to the switch is E&M (Type I or II) signaling.

An MFS recognizes the following three start-dial options for an access line to a PBX:

- Wink start
- Delay dial
- Immediate dial.

When the immediate dial option is used to terminate a call to an access line, a 250 ms interval is required between seizing and outpulsing digits to the subscriber equipment. An off-hook during this interval is considered glare.

3.7.1.1 Subscriber Equipment to Office Supervision

The switch recognizes the following two options for customer-to-office supervision for start-dial signals:

- Wink start
- Cancel wink start.

These are standard options for a *5ESS*®-2000 switch.

Ringing is directed toward the subscriber equipment by M lead pulses at the switching center. Some subscriber equipment recognize an off-hook as an indication to alert. These are standard *5ESS*®-2000 switch options.

Address signaling from individual four-wire subscriber stations to the MFS is DTMF pulses. Address signaling from PBXs to the MFS is DTMF or dial pulses.

Unique DSN disconnect timing occurs on an on-hook received from a terminating access line when the originator remains off-hook. This on-hook must last for 10 seconds before the terminating office sends a disconnect (providing the "Called Party Hold feature") to the originating office. When an off-hook is received

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before this 10-second time-out, the call is left in the talking state and the on-hook report is ignored. If the call originator hangs up first, the call is immediately disconnected.

3.7.1.2 Office to Subscriber Equipment Supervision

Address signaling to a PBX is dial pulse or Dual Tone Multifrequency (DTMF). The switch recognizes stop-go signaling from the subscriber equipment. These are standard *5ESS*®-2000 switch options.

The switch sends preemption wink signals to subscribers to signal preemption. In general, a preemption is treated like a disconnect with the addition of the preemption tone to inform the preempted subscribers as to why they were disconnected. The switch uses four different preemption wink signals to allow for the four combinations of current supervisory state and the supervisory state desired after preemption. The four preemption wink signals are shown in Figure 3-8 .

- Preemption wink signal number 1 is sent when the current supervisory state is off-hook and the final supervisory state desired after preemption is also off-hook. In this case, a preemption wink of 328 to 363 ms on-hook is sent.
- Preemption wink signal number 2 is sent when the current supervisory state is off-hook and the final supervisory state desired after preemption is on-hook. A preemption wink of 328 to 363 ms is sent, followed by a 95 to 105 ms off-hook (defining the trailing edge of the preemption wink), before returning to on-hook as a final supervisory state.
- Preemption wink signal number 3 is sent when the current supervisory state is on-hook and the final supervisory state desired after preemption is off-hook. An off-hook pedestal of 95 to 105 ms is sent to define the start of the preemption wink of 328 to 363 ms before returning to off-hook as the final supervisory state.
- Preemption wink signal number 4 is sent when the current supervisory state is on-hook and the final supervisory state desired after preemption is also on-hook. This signal consists of two off-hook pedestals each of 95 to 105 ms duration defining the intervening preemption wink of 328 to 363 ms of on-hook.

3.7.2 INTERSYSTEM SIGNALING

All intersystem DC signaling consists of E&M (Type I or II).

The intersystem supervisory start dial signaling uses wink start. This is a standard *5ESS*®-2000 switch option.

Preemption signaling uses the same preemption signals described in the previous section.

After passing hit timing and operator recall, an on-hook received over any DSN interswitch trunk causes an immediate disconnect.

For more information about signaling and DSN/AUTOVON switch and trunk combinations, see Tables 3-3 , 3-4 , and 3-5 .

3.8 HARDWARE

3.8.1 TONE GENERATION

To provide the preemption tone, offices with the Local Digital Service Unit - model 1 (LDSU1) require the universal tone generator (TN892) to generate the frequency pair. Offices equipped with the LDSU2 require no modification since the tone is included within the unit. This tone is made available for both the LDSU1 and LDSU2.

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3.8.2 TEST EQUIPMENT

There is no special test equipment required.

3.9 ADMINISTRATION

The administrator of an MFS is responsible for engineering three-port conference circuits, six-port conference circuits, and any other circuits for which usage may increase or decrease as a result of activating various features.

3.9.1 RECENT CHANGE AND VERIFY

Office personnel responsible for performing recent change and verify functions will encounter items in existing Recent Change/Verify (RC/V) views associated with class marks, PAT, COI, and routing data. These views have been modified to include data items required by an MFS. Additional views exist for some of the data items.

3.9.1.1 Translation Data

The translation data necessary to provide the DSN feature can be made via the initial Office Data Administration System (ODA) run or by the RC/V capability of the *5ESS*®-2000 switch.

Table 3-3 DSN/AUTOVON Switch and Trunk Combination

OFC_A	TRK_TYP_A	COS_A	PREC_LIM	IN_SIG	OUT_SIG	OUTPLS_to_B	OFC_B
DSN	EOPNID[a]	TTOLLCON	R,P,I,F, FO	TT	TT,MF, DP[b]	P NNX XXXX	AI/EO
DSN	EORNID[c]	TTOLLCON	R,P,I,F, FO	TT	TT,MF, DP[b]	P NNX XXXX	AI/EO
DSN	NONRCD[a]	PRINTOLL	FO	DP,MF	TT	P RC NNX XXXX	AI/EO
DSN	NONRCD[a]	PRINTOLL	FO	DP,MF	TT	P RC NNX XXXX	DSN
DSN	RCD[a]	PRINTOLL	FO	DP,MF	DP,MF	P RC RCD NNX XXXX	DSN
DSN	EOINID[d]	TTOLLCON	R,P,I,F, FO	DP,MF, TT	DP,MF	NNX XXXX	NON*5ESS*®-2000
DSN	OFFNET[a]	LTOLLCON	R	DP,MF, TT	DP,MF	NNX XXXX	FTS
DSN	SATPID[c]	PBXDID	FO	-	DP,MF	NNX XXXX	SATPBX
DSN	SATINID[c]	PBXDID	FO	-	DP,MF	NNX XXXX	SATPBX
DSN	NONE	TTOLLCON		DP,MF, TT	DP,MF	NNX XXXX	DDD
AI/EO	VONRNID[c e]	LTOLLCON	R,P,I,F, FO	DP,MF, TT	TT	NNX XXXX	DSN
AI/EO	VONPNID[a]	LTOLLCON	R,P,I,F, FO	DP,MF, TT	TT	[Q] [1X] [NXX] NNX XXXX	DSN
AI/EO	NONRCD[a]	PRINTOLL	FO	DP,MF	DP,MF	P RC NNX XXXX	DSN
AI/EO	TIERNID[c]	LTOLLCON	R,P,I,F, FO	DP,MF, TT	DP,MF	NNX XXXX	AI/EO
AI/EO	TIEPNID[a]	LTOLLCON	R,P,I,F, FO	DP,MF, TT	DP,MF	P NNX XXXX	AI/EO
AI/EO	SATINID[c]	PBXDID	FO	-	DP,MF	NNX XXXX	SATPBX
AI/EO	SATPID[c]	PBXDID	FO	-	DP,MF	NNX XXXX	SATPBX

Notes:

OFC_A Office A, or switch A, Class of DSN office
TRK_TYP_A PP trunk type assigned to trunk on switch A
COS_A Class of service assigned to trunk on switch A
PREC_LIM Precedence limit assigned to trunk on switch A
IN_SIG Type of address signaling from B to A

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OUT_SIG	Type of address signaling from A to B
OUTPLS_to_B	Format of address sent from A to B
OFC_B	Office B, or switch B, Class of DSN office
P	Any digit 0-4
RC	Any digit 0,1,5,6,7,9
RCD	Any digit 0-3
N	Any digit 2-9
Q	TT digit FO,F,I,P
X	Any digit 0-9
[]	Optional digit
a	If trk_dir = 2w, hunt type must be PRFL, PLFL, or PLBL or If trk_dir = out, hunt type must be PRFF or PLFF
b	OUT_SIG for one way outgoing trunk
c	Hunt type !=PRFL, PRBL, pLFL, PLBL, PRFF, PLFF
d	Switch B must be a Non *5ESS*®-2000 switch
e	COS can also be PFITT or PFLASH.

Table 3-4 PRI Multilevel Precedence and Preemption Trunk Characteristics

SW_A	TRKTYPE	TRK CLASS	PREC_LIM	PL IE	CPN	SW_B
DSN	MLPPDQO	EDSL	R to FO	Yes	RD [NXX] NNX XXXX	AI/EO
AI/EO	MLPPDQO	EDSL	R to FO	Yes	RD [NXX] NNX XXXX	DSN
AI/EO	MLPPDQO	EDSL	R to FO	Yes	RD [NXX] NNX XXXX	AI/EO
DSN	MLPPDQI	EDSL	R to FO	Yes	RD [NXX] NNX XXXX	DSN
PBX	MLPPDQO	EDSL	R to FO	Yes	RD [NXX] NNX XXXX	AI/EO
PBX	MLPPDQO	EDSL	R to FO	Yes	RD [NXX] NNX XXXX	DSN
DSN	MLPPPQ	EDSL	R to FO	Yes	RD RCD [NXX] NNX XXXX	DSN

Notes:

SW_A	Switch A □ A type of DSN office
TRKTYPE	PRI MLPP trunk type assigned to a trunk group on SW_A
TRK CLASS	A class of service assigned to trunk group on SW_A
PREC_LIM	A Precedence Limit assigned to trunk group on SW_A; themaximum incoming precedence allowed by SW_A
PL IE	Is a Precedence Level (PL) Information Element (IE) in the SETUP message?
CPN	The called party number digits in the SETUP message
SW_B	Switch B; a type of DSN or commercial office
RD	A route digit; any digit: 0, 1, 5, 6, 7, 9
RCD	A route control digit; any digit: 0-3
N	Any digit: 2-9
X	Any digit: 0-9
[]	Optional digits

Table 3-5 SS7 Multilevel Precedence and Preemption Trunk Characteristics

SW A	TRK TYPE	MDR TYPE	TRK CLASS	PREC LIMIT	CPC/ PREC	CdPN	SW B
DSN	MLPPS7O	OPR	LTOLLCON or TTOLLCON	R to FO	Yes	RC [NXX] NNX XXXX	AI/EO
AI/EO	MLPPS7O	OPR	LTOLLCON or TTOLLCON	R to FO	Yes	RC [NXX] NNX XXXX	DSN
AI/EO	MLPPS7O	OPR	LTOLLCON or TTOLLCON	R to FO	Yes	RC [NXX] NNX XXXX	AI/EO
DSN	MLPPS7I	IPR	PRINTOLL	R to FO	Yes	RC [NXX] NNX XXXX	DSN
DSN	MLPPS7P	IPR	PRINTOLL	R to FO	Yes	RC RCD [NXX] NNX XXXX	DSN

Notes:

SW A	Switch A □ A type of DSN office
TRK TYPE	An SS7 MLPP trunk type assigned to a trunk group on Switch A
MDR TYPE	Message Detail Recording Type
TRK CLASS	A class of service assigned to trunk group on Switch A
PREC LIMIT	A precedence limit assigned to trunk group on Switch A; the maximum incoming precedence allowed by Switch A
CPC/PREC	Is A Calling Party Category (CPC) or precedence parameter in the IAM message? When SS7 trunks are configured as Stage-1, precedence level is sent in CPC. When SS7 trunks are configured as Stage-2, precedence level is sent in PREC.
CdPN	Called party number digits in the IAM message
SW B	Switch B; a type of DSN office
IPR	Incoming Private Record
OPR	Outgoing Private Record
RC	A route code; any digit: 0, 1, 5, 6, 7, 9

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RCD	A route control digit; any digit: 0-3
N	Any digit: 2-9
X	Any digit: 0-9
[]	Optional digits

Some of the translation data that is service order recent changeable for the DSN/AUTOVON Interface switch subscribers is as follows:

- ***Precedence and Preemption Feature:*** This feature may be assigned to each member of a precedence and preemption group. This information is used when calls are originated by, or terminated by, the precedence and preempting user.
- ***Pseudo-Precedence Level:*** One of the five precedence levels can be specified to indicate the treatment to be given to calls originated by non-DSN customers in preemption situations.
- ***Dialable Precedence Digits:*** For a precedence and preemption group, a precedence digit is assigned to each precedence level above routine.
- ***Authorized Precedence Level for DSN Calls:*** This data is the maximum precedence level that the precedence and preemption user can dial for DSN calls.
- ***Authorized Precedence Level for Local MLPP Calls:*** This data is the maximum precedence level that the local MLPP user can dial for local precedence calls.
- ***Immediate Preemption:*** This data allows a precedence and preemption user to receive higher precedence level calls by being preempted, regardless of call waiting being active.
- ***Preemptable or Nonpreemptable:*** A precedence and preemption line is either nonpreemptable or preemptable. A line marked preemptable can be given "preempt to clear" or "preempt for reuse" treatment. A line class marked nonpreemptable can only be given preempt to clear treatment.
- ***No Precedence Pickup:*** Each precedence and preemption user is class marked to indicate whether or not precedence calls to that line can be answered via call pickup by other precedence and preemption users.
- ***Forward Intragroup Precedence:*** This data indicates if an intragroup precedence call to an idle line that is not answered should be forwarded to the number associated with precedence and preemption call forwarding feature. The number associated with the precedence and preemption call forwarding feature may be the attendant.
- ***Number of Seconds Before No Answer:*** This data indicates the number of ringing cycles for a precedence call terminating to a precedence user, before "forward no answer" to a third party is performed. The third party may be the local precedence and preemption attendant.
- ***Number of Seconds Before Forward from Satellite - Precedence In-Dialing (PID):*** On a satellite tie-trunk basis, the number of seconds for a precedence call attempting to terminate on a satellite PBX, before "forward no answer" to attendant (if required) is performed.
- ***Call Forward Address:*** This data stores the address or number of the calls forwarded or routed to a particular line. Calls to a line may be only call forwarded when the line is busy with call forwarding on busy.
- ***Satellite PBX Treatment:*** This data indicates whether INID or PID service is in effect for a trunk group to a satellite PBX.
- ***Direct Station Selection:*** This data indicates whether the precedence and preemption line had the Direct Station Select feature.
- ***Off-Hook Service Class Mark:*** Precedence and preemption lines can be marked as being direct

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connect.

- ***Off-Hook Service Stored Number:*** This data contains the Stored Address for the Direct Connect feature.
- ***DSN Access Privileges:*** This data indicates whether a precedence and preemption line can receive and/or originate DSN calls.
- ***DSN/AUTOVON Trunk Type:*** This data indicates the trunk type for trunks that are assigned the MLPP feature. Valid entries are RNID and PNID for trunks between the DSN/AUTOVON Interface switch and the DSN tandem.

Other data assignments can be made for the DSN/AUTOVON Interface features that are not listed in this section. Refer to 235-118-200, *RC Menu Mode*; 235-118-202, *RC Text Mode*; and 235-080-100 *Translation Guide for 5ESS®-2000 switch*) for information about data assignments and RC information.

3.9.1.2 Feature Assignment

The following are the known interactions between the feature assignment capability and ISDN BRCS Compatibility (IBC):

(a) ***Modular Feature Type Categories:*** Each modular type can be assigned to a subset of the following entities:

- Unshared analog terminals (telephone)
- ISDN terminals and attendant consoles
- ISDN LTports
- Shared analog terminals (an analog terminal that shares its LTport with one or more ISDN terminals)
- Shared analog LTports (an analog LTP that is shared by one analog terminal and one or more ISDN terminals).

Each modular feature type must fall into one of the five categories represented by the rows of Table 3-6 . Features in categories 2, 3, and 4 are sometimes called "terminal features," and features in category 5 are sometimes called "LTP features." Features in category 1 are not assignable to anything; currently "MLHG" and "QU" are such features.

Table 3-6 ISDN Feature Assignment Table

	ISDN TERM	SHARED ANALOG TERM	UNSHARED ANALOG	SHARED ANALOG LTPORT	ISDN LTPORT
Category 1					
Category 2	x	x	x		
Category 3		x	x		
Category 4	x				
Category 5			x	x	x

Table 3-7 shows the assignment decisions for the modular feature types.

For feature assignment views, the modular feature type uniquely determines the feature assignment. Any restrictions based on the specific constructed feature must be done in the feature specific cross-check code, which the feature assignment view calls as a subview. This is also true of any restriction based on the type of terminal, such as the attendant console.

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(b) ***Where Features Are Stored:*** Features that are assigned to unshared analog terminals (lines) are stored in a BRCS terminal feature relation that is keyed by port. Also, features that are assigned to an ISDN terminal or a shared analog terminal are stored in that same BRCS terminal feature relation. But features that are assigned to an ISDN LTP or a shared analog LTP are stored in a BRCS DN feature relation keyed by some logical representation of a DN.

Table 3-7 ISDN BRCS Feature Assignments

FEATURE TYPE	ISDN TERM	ISDN OR SHARED LTPORT	SHARED ANALOG TERM	ATTENDANT [a] TERM	LTPORT
Automatic Callback-Calling	X		X		
Account Codes	X		X		
Authorization Codes	X		X		
Automatic Route Selection	X		X	X	
Call Forwarding		X			
Call Pickup Originating	X		X	X	
Call Pickup Terminating		X			
Distinctive Ringing		X			X
Individualized Dialing	X		X	X	
Multiline Hunting Additions and Attendant Services 0 Only Toll Diversion to Attendant	X		X	X	
Multiway	X		X	X	
Precedence and Preemption		X			X
Private Facilities Access	X		X	X	
Terminal Group Station Restriction		X			X
Time of Day	X		X	X	

Notes:

a. The feature assignment capability does not distinguish attendants from other ISDN terminals or DNs.

3.9.2 NETWORK MANAGEMENT

The DSN network management controls can be entered locally from the Maintenance TTY (MTTY) at the switching office in response to verbal directives issued by the network manager at the Network Management Center (NMC). These controls can also be initiated or removed remotely at the NMC providing that it has remote access to the switch. The network management controls in effect at the switching system can be removed through input messages entered from the MTTY. Reports of the 5-minute surveillance data and the 30-second discrete data can be requested from the MTTY. In addition, input messages may be entered to request the status of all network management controls currently in effect.

3.9.3 AUTOMATIC MESSAGE ACCOUNTING

The existing billing features of the *5ESS*®-2000 switch are used to collect DSN call data. These features are Automatic Message Accounting and Station Message Detail Recording to the Revenue Accounting Office.

Refer to Section 3.2.7 for additional information on automatic message accounting.

3.9.4 MEASUREMENTS

Measurements for this feature are described in 235-070-100, *5ESS*®*-2000 Switch Administration Guidelines*.

3.10 MAINTENANCE

3.10.1 TRUNK AND LINE MAINTENANCE

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There are two universal codes in the MFS that must be reserved for maintenance use. These access codes are used for test terminations from customer stations.

The following are the access codes and descriptions for their usage with this capability:

(a) Typically, code 550 provides access to test line (service codes). The test line code is determined by each switch. This code is used by installers or repair persons to obtain access to test circuits or to access trunks. The test lines can be accessed by dialing 550-10X1, where X is the third digit of the three-digit test line. The following are the test lines that are required for the MFS. Although the descriptions of these test lines refer to trunks, the tests are also applicable for access lines. The following test lines can be used:

- ***100-Type Test Line - Balance:*** This line is used as a quiet termination for making noise and balance tests on both lines and trunks. Transmission and noise measurements are checked.
- ***101-Type Test Line - Toll Testboard Trunk:*** The line provides a communication and test path into a test position (toll testboard) for any trunk or line incoming to the switching system served by the test position.
- ***102-Type Test Line - Milliwatt Test:*** One-way transmission testing of lines and trunks is accomplished by this test line.
- ***103-Type Test Line - E&M Test:*** This line is used for testing signals on interoffice trunks. Testing of the preemption signals is also accomplished by this test line.
- ***105-Type Test Line - Far-end Transmission and Noise Test:*** A test termination for two-way loss measurement and one-way noise checking is provided by this line.
- ***106-Type Test Line - Loop Around Test:*** This is used with Code 102 for loop around or two-transmission testing. Test termination for two-way loss measurements is provided by this line.

NOTE: The prefixes 980, 550, and the 4-digit line numbers used in this section are sample numbers and are not fixed test codes. The DSN switch could use other prefixes and line numbers.

(b) Code 980 is used for the Station Ringer and Touch-Tone Test. This test function is accessed by dialing 980-XXXX, where XXXX are the last 4 digits of the access line to be tested.

The numbers 550-2118 and 550-3118 are sample numbers required to be assigned to telephone test sets that are to be located at the switch. The treatment of these phones is analogous to typical access lines with similar class marks.

The following list summarizes the standard seven-digit assignments required in each DSN switch. The numbers 550-1211, 550-1311, and 550-1611 are available to all access lines. If desired, these numbers may be reassigned by the DCA. The remaining numbers are reserved for use by authorized test and maintenance personnel at DSN switch sites and service transmission nodes only.

- 550-1001 Noise Balance Termination
- 550-1011 Toll Testboard
- 550-1021 Milliwatt Test
- 550-1031 Supervisory and Signal Test
- 550-1051 Far-End Transmission/Noise Test

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- 550-1061 Loop Around Termination Test
- 550-2118 Switchroom Test Phone
- 550-3118 Switchroom Test Phone
- 550-1211 Inward Operator
- 550-1311 Information Operator
- 550-1611 Trouble Reporting
- 0 DSA Operator
- 980-XXXX Station Ringer Test.

3.10.1.1 103-Type Test Line Requirements

The function of checking the E&M signaling capability of outgoing and two-way interoffice trunks in the far- to near-end direction is provided by the 103-type test line. This line measures the distortion occurring on pulses and determines the ability of the far office to generate accurate preempt signals.

The following actions are provided by the 103-test line (from the near office viewpoint) to test the E&M signaling of interoffice trunks:

(1) Code 103 is outpulsed to the far office from the near office after a translation check is made to ensure that the trunk is two-way or outgoing.

(2) Test Progress Tone (TPT) at 2225 Hz is sent from the far office on connection to the line. The near office then sends the first ring forward signal (100 ms on-hook).

(3) The TPT is turned off by the far office after receiving the first ring forward signal.

(4) When the near office detects the absence of TPT, a second ring forward signal is sent to the far office that causes the far-end office to send the following:

- A six-transition pulse sequence: 200 ms on-hook, 100 ms off-hook, 150 ms on-hook, 200 ms off-hook, 100 ms on-hook.
- TPT for 3 seconds at 120 IPM.
- A preemption wink [Preemption wink No. 1 (currently used by the 1 *ESS*^{TM} switch), 350 ms (328-363 ms) on-hook].

(5) The TPT is sent from the far office to the near office until disconnect or ring forward signal at which point the entire test is cycled through again.

3.10.1.2 106-Type Test Line Requirements

The 106-type test line provides the function of checking the transmission loss of outgoing and two-way interoffice trunks in the far- to near-end and the near- to far-end directions.

The following actions can be performed using the 106-type test line (from the near office viewpoint) to test transmission loss of interoffice trunks:

(1) Code 106 is outpulsed to the far office from the near office after a translation check is made to

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ensure that the trunk is two-way or outgoing.

(2) The far office sends 10 seconds of 1004-Hz tone at 0dbM on connection, allowing the near office to make a far-to-near transmission loss measurement.

(3) The far office stops the tone after 10 seconds and loops the receive path onto the transmit path until disconnect is detected, allowing the near office to make a two-way transmission loss measurement.

(4) The near office can then compute the near-to-far transmission loss measurement.

3.10.1.3 Station Ringer and Touch-Tone Test Requirements

The station ringer and touch-tone test is used by the plant personnel when the station set is installed or repaired. The test can be used for testing the transmission of tone frequencies for each of the 16 touch-tone buttons on the telephone set and testing the response of the telephone set to routine alerting. It also tests the response of the set to precedence alerting signals and tests the station equipment's ability to generate confirmed audible tone, such as the precedence audible ringing tone.

After completing the testing of the touch-tone key frequencies, the station ringer tests can be performed. One flash from the test personnel results in the station receiving regular (routine) interrupted ringing. Two flashes in succession cause the precedence (fast interrupted) ringing to be tested. The appropriate signals are sent to the station equipment denoting the type of ringing desired (determined by the number of flashes) when the test person hangs up. If the station is equipped with confirmed audible in the line circuit, a Tone Decoder (TD) is connected to the line during the ringing state to check the audible signal. When the test person answers, a pass/fail signal is given to indicate results of the audible tests.

3.10.2 OPERATING COMPANY PERSONNEL

The maintenance personnel is able to manually request preemption tone. This is accomplished through a command entered at the TLWS.

The maintenance personnel can run the station ringer and touch-tone test when a telephone is installed or repaired.

GLOSSARY

The following is a list of abbreviations, acronyms, and terms used in this document.

ACC
Automatic Congestion Control

ACCL
Automatic Congestion Control Level

ACOF
Attendant Control of Facilities

AI
AUTOVON Interface

AM
Administrative Module

AMA
Automatic Message Accounting

ANSI

American National Standards Institute

ARC
Alternate Route Cancellation

AUTOVON
Automatic Voice Network

BLF
Busy Lamp Field

BRCS
Business and Residence Custom Services

BRI
Basic Rate Interface

CA
Call Appearances

CANF
Cancel-From

CANT
Cancel-To

CCIS6
Common Channel Interoffice Signaling System Number 6

CDAR
Customer Dialed Account Recording

CDI
Code Index

CDX
Compact Digital Exchange

CFB
Call Forwarding Busy

CFB-P
Call Forwarding Busy - Precedence

CFDA
Call Forwarding Don't Answer

CFDA-P
Call Forwarding Don't Answer - Precedence

CFV
Call Forwarding Variable

CFV-P
Call Forwarding Variable - Precedence

CIC
Customer Information Center

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CICR
Cancel In-Chain Return

COI
Community of Interest

COS
Class of Service

CPC
Calling Party Category

CONUS
Continental United States

CSD
Circuit Switched Data

CSV
Circuit Switched Voice

CVF
Call Forwarding Variable

CWO
Call Waiting Originating

CWT
Call Waiting Terminating

CWT-R
Call Waiting Terminating - Routine

DA
Discontinued Availability

DCC
Destination Code Cancellation

DCW
Dial Call Waiting

DDD
Direct Distance Dialing

DISA
Defense Information Systems Agency

DN
Directory Number

DOC
Dynamic Overload Control

DP
Dial Pulse

DPAT
Dialing Plan Access Treatment

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DR
Distinctive Ringing

DRPP
Distinctive Ringing Precedence and Preemption

DRZ
Directionalization

DSA
Dial Service Assistance

DSN
Defense Switched Network

DSS
Direct Station Selection

DTMF
Dual Tone Multifrequency

DXS
Direct Extension Selection

E&M
Ear and Mouth

EC
Electronic Console

EO
End Office

EO
Executive Override

ESP
Essential Service Protection

F
Flash

FO
Flash Override

FTS
Federal Telecommunications System

I
Immediate

I/O
Input/Output

IAM
Initial Address Message

IBC
ISDN BRCS Compatibility

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ICLID
Incoming Call Line Identification

IDP
Individualized Dialing Plan

IE
Information Element

INID
Immediate Diversion Network Inward Dialing

IPR
Incoming Private Record

ISAT
ISDN Attendant

ISDN
Integrated Services Digital Network

ISUP
ISDN User Part

LDN
Listed Directory Number

LDSU
Local Digital Service Unit

LE
Local Exchange

LLC
Line Load Control

LTP
Logical Test Port

MCA
Multiple Call Appearances

MCC
Master Control Center

MDR
Message Detail Recording

MET
Multibutton Electronic Telephone

MF
Multifrequency

MFS
Multifunction Switch

MLHG

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Multiline Hunt Group

MLPP
Multilevel Precedence and Preemption

MMRSM
Multimodule RSM

MUPH
Multiple Position Hunt

MTTY
Maintenance TTY

NM
Network Management

NMC
Network Management Center

OA&M
Operations, Administration, and Maintenance

OCLID
Outgoing Called Line Identification

ODA
Office Data Administration System

ODP
Office Dialing Plan

OOS
Out of Service

OPR
Outgoing Private Record

P
Priority

PAT
Precedence Access Threshold

PBX
Private Branch Exchange

PDTF
Precedence Dial Tone-Flash

PDTRC
Precedence Dial Tone Route Code

PID
Precedence In-Dialing

PL
Precedence Level

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PMHG
Preemptable Multiline Hunt Group

PNI
Precedence Network Inward Dialing

PNID
Precedence Network In-Dialing

PNOD
Precedence Network Outward Dialing

PNTF
Precedence No Dial Tone-Flash

PNTRC
Precedence No Dial Tone Route Code

POTS
Plain Old Telephone Service

PP
Precedence and Preemption

PRCD
Precedence Route Control Digit

Precedence
Either the entire hierarchy of DSN/AUTOVON call levels or one of five specific DSN/AUTOVON call levels

Precedence Alerting
The ringing signal given when a precedence call is terminating to an idle line

Precedence Audible
The audible tone supplied to the calling party of a precedence call while the terminating party is receiving precedence alerting

Preemption
The action of a higher precedence call gaining access to the line or trunk being used by a lower precedence call

Preemption Tone
The tone given to subscribers when they are being preempted

PRI
Primary Rate Interface

R
Routine

RC
Route Code

RC/V
Recent Change/Verify

RCD
Route Control Digit

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RCD-0
Route Control Digit 0

REL
RELease Message

RMAS
Remote Memory Administration System

RNI
Routine Network Inward

RNID
Routine Network In-Dialing

RR
Re-route

RSM
Remote Switching Module

RTAC
Regional Technical Assistance Center

SAR
Subaddress Reservation

SBAC
Source Billing for Attendant Handled Calls

SCOF
Selective Control of Facilities

SFG
Simulated Facility Groups

SKIP
Skip

SM
Switching Module

SS7
Signaling System 7

SSB
Switched Service Bureau

STLWS
Supplementary Trunk and Line Work Station

TD
Tone Decoder

TG-5
Translation Guide for the *5ESS*®-2000 Switch

TLWS

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Trunk and Line Work Station

TPT
Test Progress Tone

TR
Trunk Reservation

TTY
Teletypewriter

VCDX
Very Compact Digital Exchange

WATS
Wide Area Telephone Service

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