SL-1

ISDN Primary Rate Interface

Description and administration

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December 20, 1990

This document is issued for X11 release 16. Traffic reports have been removed (see *Traffic measurement formats and output* (553-2001-450)). Due to the extent of the revisions, change bars in the margins are omitted.

December 1, 1991

This document is issued for X11 release 17. *ISDN Primary Rate Interface description* (553-2901-100) and *ISDN Primary Rate Interface administration* (553-2901-300) have been combined into one document called *ISDN Primary Rate Interface description and administration* (553-2901-100). Due to the extent of the changes, revision bars have been omitted.

December 31, 1992

This document is reissued to include updates to Trunk Route Optimization (TRO) and Network Call Redirection (NCRD), and a new module for Remote Virtual Queueing. Additionally, updates required for MSDL, and LD17 are included. Changes are noted with revision bars in the margins. Information from Product Bulletin 92034 (August 1992) is included in this document

February 1, 1993

This document is reissued to include information relating to X11 release 18 and option 81 systems. Due to the extent of changes, revision bars are omitted. Product Bulletin 93007 has been incorporated in this document.

August 1, 1993

This document is reissued to include changes for X11 release 19. Changes are noted with revision bars.

October 31, 1993

This document is issued to include technical updates. Changes are noted with revision bars in the margins.

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Introduction

Document overview

This document provides an introduction to the Integrated Services Digital Network (ISDN) and a description of the features available on the Meridian 1 with ISDN Primary Rate Interface (PRI). The chapters of this document cover the following topics.

— Introduction: lists Meridian 1 reference documents and explains the format of this document.

— ISDN PRI product overview: provides a functional overview of ISDN, as applied to the Meridian 1 environment.

— PRI configuring: shows how to configure ISDN PRI and the D-channel.

— PRI service verification: provides verification for a new PRI system.

— Coordinating PRI parameters: gives an overview of PRI parameters such as framing formats, line encoding, and error detection that must be coordinated with the far end PRI facility

— Correlation tables: provides correlation tables for Meridian 1 to Meridian 1, Meridian 1 to DMS-100, and Meridian 1 to DMS-250.

— Engineering guidelines: lists Meridian 1 ISDN requirements.

— ISDN feature description: provides a detailed description of PRI services and features. The features are described in feature modules which are arranged alphabetically by feature name. The Table of Contents lists these features. Feature descriptions are page numbered separately and the figures and tables within each module are numbered for that specific feature.

— Glossary: lists acronyms.

References

For a reference of all Northern Telecom Publications, see:

- *Master index of publications* (553-3001-000)

Refer to the following documents for system information.

- *Multi-purpose Serial Data Link description* (553-3001-195)
- *System installation* (553-3001-210)
- *Circuit card installation and testing* (553-3001-211)
- *Telephone and attendant console installation* (553-3001-215)
- *Upgrade system installation* (553-3001-250)
- *Disk drive upgrade procedures* (553-3001-251)

For ISDN documentation, see:

- *ISDN Primary Rate Interface installation* (553-2901-200)
- *ISDN Primary Rate Interface maintenance* (553-2901-500)

For software documentation, see:

- *Software conversion procedures* (553-2001-320)
- *X11 features and services* (553-3001-305)
- *X11 input/output guide* (553-3001-400)

For traffic reports documentation, see:

- *Traffic measurement formats and output* (553-2001-450)

For networking documentation, see:

- Meridian Networking Feature Document (P0710203)
- *Electronic Switched Network description* (309-3001-100)
- *Basic and Network Alternate Route Selection description* (553-2751-100)
- *Coordinated Dialing Plan description* (553-2751-102)
- *Network Queue description* (553-2751-101)
- MCDN Basic Call Service (555-8001-101)
- MCDN Integrated Services Access (555-8001-102)
- MCDN Network Ring Again (555-8001-103)

Note 1: Throughout this document Meridian 1 refers to both Meridian SL-1 ST, STE, NT, RT, XT, and Meridian 1 system options 21, 21E, 51, 61, 71, and 81 unless otherwise noted.

Note 2: ISDN is an evolving product. Features and connectivities improve with each software release. To plan your system for future expansions, please consult with your Northern Telecom representative.

ISDN product overview

What is ISDN?

Integrated Services Digital Network (ISDN) is a set of recommendations developed by the International Telegraph and Telephone Consultative Committee (CCITT). These recommendations form a standard in digital communications, providing digital interfaces between telephones, terminals, and telecommunication networks.

ISDN uses a single transport to carry multiple information types. What once required separate networks for voice, data, image or video conferencing is now combined onto one common high-speed transport.

User voice and data information is carried over bearer channels, or B-channels. The standard signaling protocol is transmitted over a dedicated data channel called the D-channel. The D-channel carries call set-up and feature activation information to the destination.

ISDN and the Meridian 1 environment

Meridian networking supplements the currently-defined CCITT ISDN recommendations with network functions, like alternate route selection, private numbering plans, class of service, and network access security. Also, Meridian networking extends the CCITT ISDN network functions defined for the interface to public ISDN connections, into the private network environment.

Network interfaces

The initial step in building a network is to define the network interfaces which physically and logically connect the switches in the network.

A network interface is physically composed of a collection of trunks, each of which carries signaling and/or user data information. Trunks are transmission channels which carry the users' voice and data traffic, together with signaling information, between switching systems in the network.

Trunks can be classified based on two parameters:

- the type(s) of service supported on the trunk
- the nature of the signal which is transmitted on the trunk, either digital or analog

There are a number of trunk types classified by the type of service they can provide. For example:

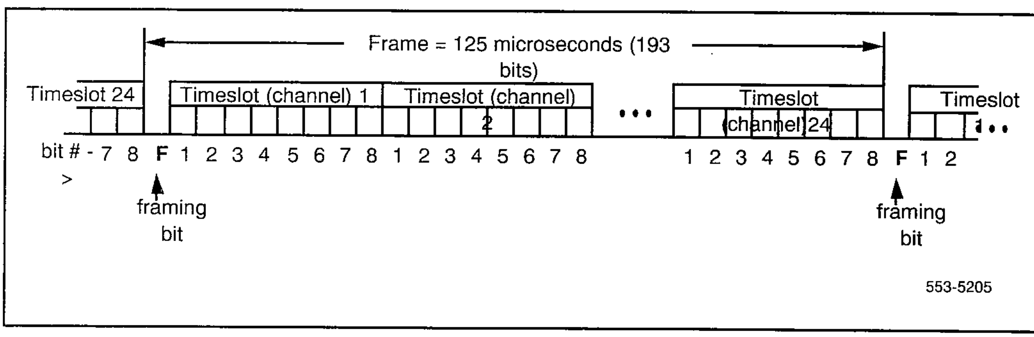
- PBX-to-Public Exchange trunks (also referred to as Central Office trunks or COTs) provide public switched telephone service to the PBX.
- TIE trunks connect PBXs directly without being switched at the intermediate Public Exchange(s) (although they may be).
- Foreign Exchange (FX) trunks provide the PBX with the equivalent of a local connection to a "foreign" or distant Public Exchange, bypassing switching at the local Public Exchange.
- Wide Area Telecommunications Services (WATS) trunks permit the PBX to receive (INWATS or "800" service) or originate (OUTWATS) long-distance calls at a lower rate than regular long-distance service, based on a bulk pricing arrangement with the long-distance service provider.
- Direct Inward Dial (DID) trunks provide a portion of the called party's number, signaled from the local Public Exchange to the PBX, enabling the call to be delivered without private network attendant intervention.

  Note: Due to CCITT regulations, any DID/COT connection by means of ISDN is two-way. There is no distinction between the two trunk types. The Central Office views them as public trunks and will not throttle.

Analog trunks are provided on voice-frequency (VF) facilities which operate in either a 2-wire or 4-wire transmission mode. In the 2-wire mode, both transmit and receive signals are carried on the same pair of wires. 4-wire mode uses separate wire pairs for each direction of transmission. The information-bearing capability of these trunks is sufficient to support speech or voice-grade data. A voice-grade channel is one with sufficient bandwidth to pass an analog voice signal, or approximately 3.1 kilohertz (kHz). Voice-grade data is a data signal which can be successfully passed through the same 3.1 kHz channel (for example, a modem).

A digital trunk is a 56 kbps data channel that can carry either voice or data information. In North America and some other international countries, the digital trunk is carried on the T-1 digital transmission facility. The T-1 carrier has a data rate of 1.544 MBit/s and can support up to 24 digital trunks. The digital trunk signal transmitted on these carriers is represented by a sequence of 8-bit digital words. Each word occupies one channel (called a "timeslot") in a larger structure called a "frame". The frame structure of the T-1 carrier's signal is shown in Figure 2-1.

Figure 2-1
The Frame Structure of T-1 Digital Carrier (from CCITT G.704)

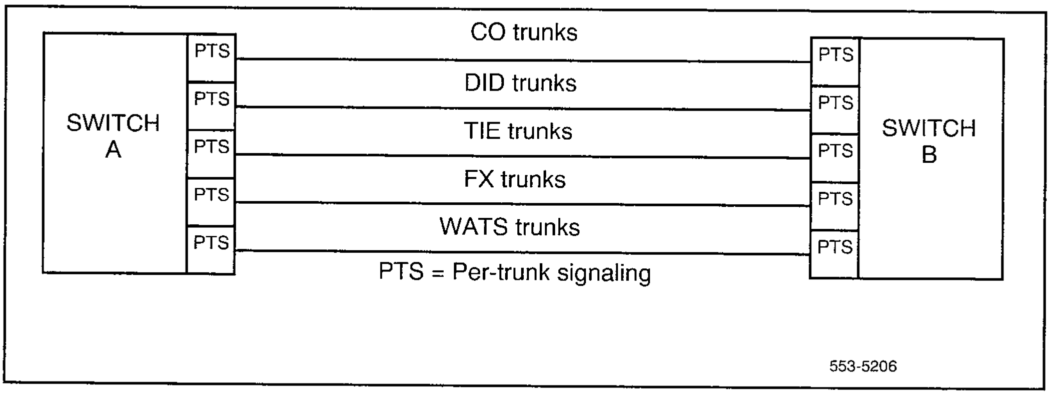


Signaling

Trunks provide the communication channels for the network interface; signaling permits these channels to be used effectively. Signaling is the process of transferring information between two or more switches of a communications network in order to control the establishment of connections and related operations.

Each trunk type (CO, TIE, FX, WATS, DID) requires its own particular form of signaling (loop start, 2-wire duplex, 4-wire duplex, E and M 2-wire, E and M 4-wire, loop dial repeating). Pre ISDN trunks (that is, analog or digital) carry this signaling information together with the user's information. This scheme, illustrated by Figure 2-2, is commonly referred to as per-trunk signaling (PTS), or inband signaling.

Figure 2-2
A functional view of per-trunk signaling



Meridian networking uses ISDN's common channel signaling capability to replace per-trunk signaling with an out-of-band computer-to-computer signaling channel which carries the signaling information for a number of trunks. This concept is illustrated by Figure 2-3.

Primary Rate Interface (PRI) integrates the signaling requirements of all the public exchange trunk types. Meridian networking supports this functionality, as illustrated by Figure 2-4. This is referred to as out-of-band signaling

Figure 2-3
A functional view of ISDN's common channel signaling capability

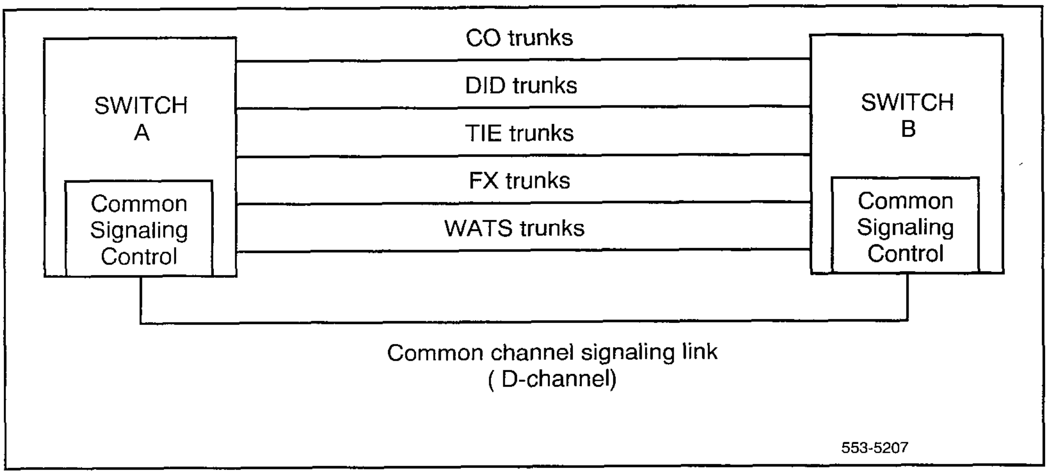
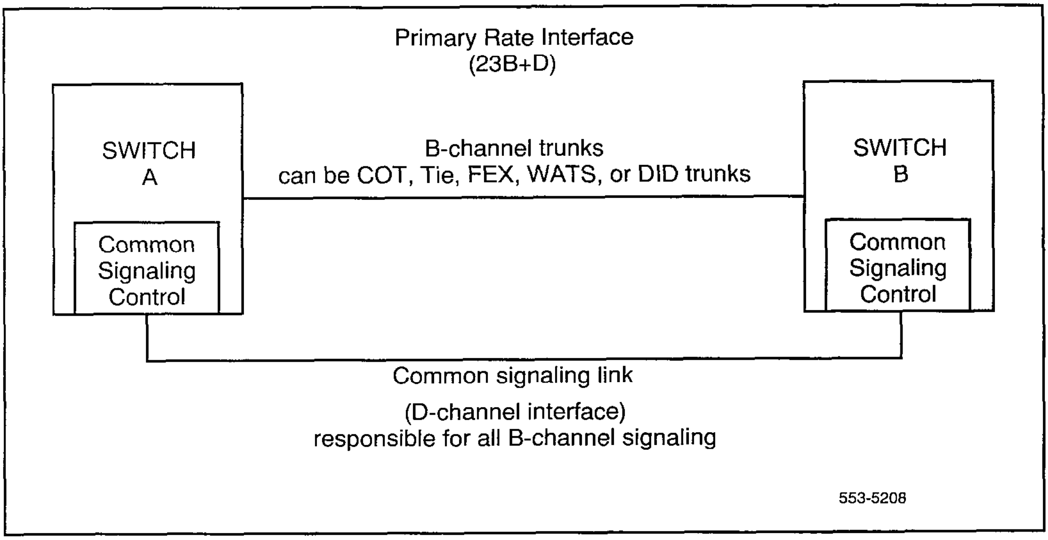


Figure 2-4
ISDN PRI's common channel signaling capability



Signaling protocols

Signaling protocols govern the format, timing, sequencing, and control of the exchange of signaling information between switches in the network.

Meridian networking uses the ISDN D-channel, out-of-band signaling protocols as defined by CCITT. These protocols are based on a model containing seven layers which was developed by the International Standards Organization (ISO). This seven-layer model, called the Open Systems Interconnection (OSI) model, was adopted by the CCITT and used as the basis for building sets of protocols for ISDN.

A detailed description of the OSI model and how it is applied in the Meridian networking signaling system is found in Appendix 1 of the Meridian Networking Feature Document (P0710203).

Types of ISDN network interface

Meridian networking currently supports three forms of ISDN network interface:

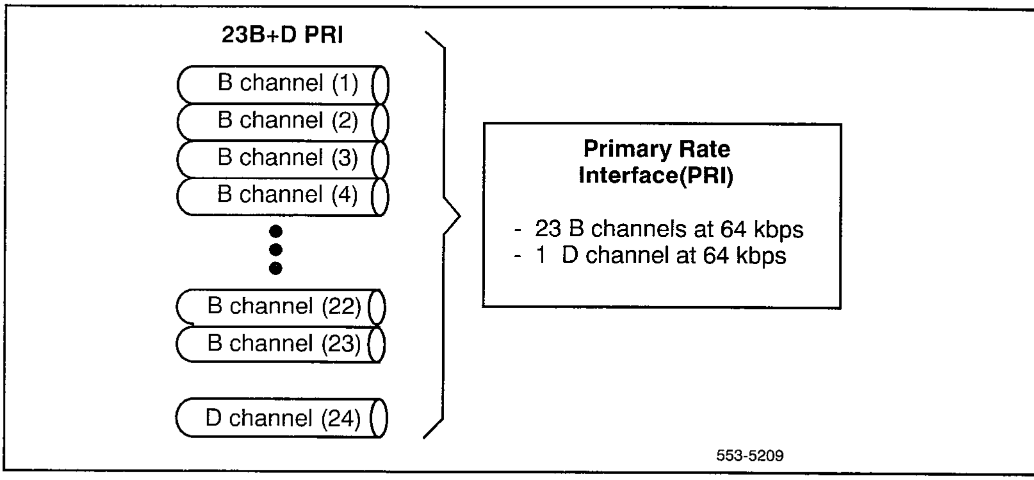
- Primary Rate Interface (PRI 23B+D)
- nB+D Primary Rate Interface (non-associated signaling)
- ISDN Signaling Link (ISL) interface

Primary Rate Interface (PRI 23B + D)

The Primary Rate Interface (PRI) is structured as a collection of 24 digital, 56 kbps/64 kbps channels. One of these channels is used to carry the D-channel signaling information. The other channels are for user voice and data transport and are referred to as Bearer Channels, or B-channels.

The physical (layer 1) specification for the PRI is defined in CCITT Recommendation I.431. This specification supports the standard electrical characteristics and frame structures of the 1.544 MBit/s T-1 digital carrier. PRI can therefore only support up to 23 B-channels and one D-channel. Figure 2-5 shows the PRI structure.

Figure 2-5
Primary Rate Interface structures



nB+D Primary Rate Interface (non-associated signaling)

Although the CCITT currently specifies the PRI layer 1 protocol for 23B+D interface structures, CCITT layer 3 (Q.931) supports the D-channel messages for call setup, feature activation, and call tear down. Meridian networking can also support a feature called non-associated signaling (nB+D). In this configuration, one active D-channel can provide signaling support for all the B-channels contained on up to 16 digital carriers. This translates to support for 382 B-channels and one D-channel and one backup D-channel with T-1 carriers. Figure 2-6 shows an nB+D PRI structure.

ISDN Signaling Link (ISL) interface

The CCITT currently limits the Layer 1 ISDN protocols to digital facilities only. Analog facilities can meet some customer applications more effectively. Meridian networking offers this flexibility in the form of the ISDN Signaling Link (ISL) interface.

The ISL interface is a configuration unique to Meridian networking for Meridian 1 to Meridian 1 systems. It extends the advantages of ISDN signaling to locations served by analog or digital facilities. The ISL interface can contain analog and/or digital trunks. The signaling information is carried on one of these trunks, called the ISDN Signaling Link, which is a D-channel. The other trunks are for user voice and data transport.

The signaling connection is a separate or synchronous data circuit which can be established over a leased line, or an existing trunk circuit using standard data communications equipment (DCE) interfaces (such as modems, multiplexers, or Meridian 1 data adapters). In the case of a failure on this link, signaling operation reverts to conventional, per-trunk signaling.

The ISL interface structure is illustrated by Figure 2-7. For more information on ISL, see the description module later in this document.

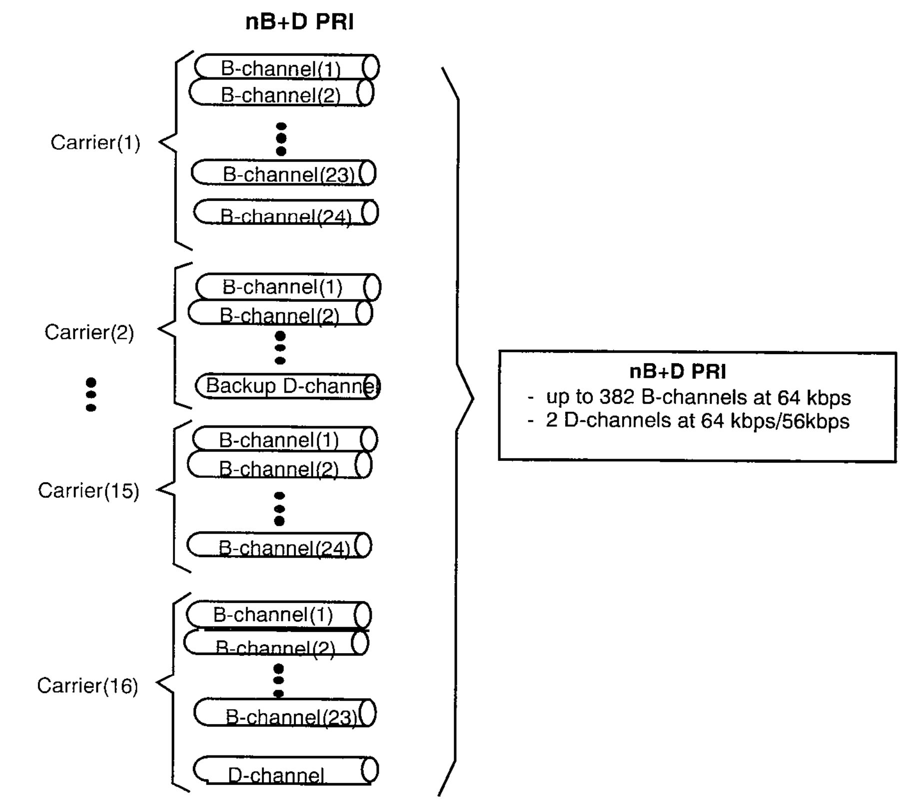
ISL Modes of operation

There are two modes of ISL operation: shared and dedicated.

Shared mode requires a PRI (either 23B+D or nB+D) between originating and terminating Meridian 1 systems. The ISDN D-channel is used as the vehicle to provide out-of-band signaling for the non-ISDN trunks. Since the PRI D-channel is shared between the PRI B-channels and the analog/digital trunks, this ISL configuration is called shared mode.

Dedicated mode is appropriate when no PRI exists between originating and terminating Meridian 1 systems or when it is not desirable to share an ISDN D-channel as described above. A dedicated signaling link (ISL) is established between originating and terminating Meridian 1 systems. The signaling information for the selected, analog/digital ISDN trunks is transported over the ISDN signaling link.

Figure 2-6
An example of the nB+D Primary Rate Interface structure



Note: If the maximum number of carriers are configured for nB+D (that is, 16), then it is necessary to have a backup D-channel, as shown. Otherwise, only 15 carriers can be configured per single D-channel.

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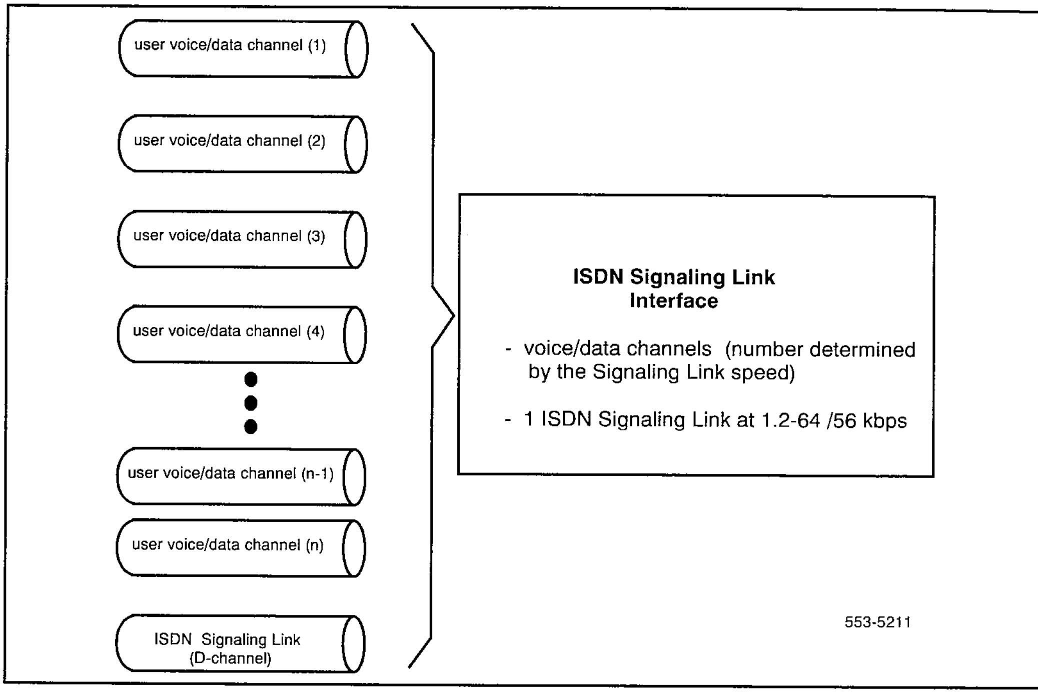
Figure 2-7
ISDN Signaling Link (ISL) interface structure



Backup D-channel

The signaling reliability on each of these ISDN network interfaces can be enhanced by adding the backup D-channel function.

In situations where the reliability of the D-channel signaling is critical, each of the PRI, and the nB+D PRI interfaces can be configured to use one active and one backup D-channel. If the active D-channel fails, then D-channel processing switches to the backup D-channel. When dealing with standard 23B+D PRI structures, it is necessary to have at least two T-1 spans in order to provide a backup D-channel. Figure 2-6 shows a backup D-channel configuration. (Configuration of backup D-channel is shown in "Configuring PRI" on page 4-1. For a more detailed description of the backup D-channel, see "Backup D-channel" on page 8-1.)

Integrated Trunk Access

Integrated Trunk Access (ITA) allows in-band A and B bit signaling trunks and out-of-band common channel signaling trunks to share the same digital carrier. ITA provides trunking efficiency when accessing a mix of ISDN and non-ISDN services from a Meridian 1 or an ITA-compatible public exchange switch (such as DMS-100).

Integrated Services Access

Integrated Services Access (ISA) allows different service or trunk types to be routed over any B-channel, on a call-by-call basis, rather than dedicating each B-channel to a specific service or trunk type. This is referred to as dynamic allocation of B-channels.

Trunk types or service designation is made by means of the Network Specific Facilities information element in the call set-up message. ISA service routes are configured through service change. An ISA master route contains a list of B-channels that can be shared. Different service route types, such as WATS, DID/CO, Foreign Exchange (FX) and TIE, are then created and associated with an ISA service route. These service routes are not allowed to have private B-channel members.

Note: Due to CCITT regulations, any DID/COT connection by means of ISDN is two-way. There is no distinction between the two trunk types. The Central Office views them as public trunks and will not throttle.

The number of simultaneous calls using an ISA route can be controlled by defining a maximum threshold for calls allowed for each service route type. Also, a minimum threshold can be defined for the number of B-channels that are ready for use by a service route. For a more detailed description of ISA, see the ISA module under ISDN features.

Coordinating PRI parameters

This chapter describes the major parameters that must be coordinated with the far end facility. These parameters are:

Frame format

Superframe format
Extended superframe format

Line encoding

B7 coding
B8ZS coding

Error detection

Yellow alarm (remote alarm)
Bit error rate
Frame alignment
Frame slip

Data rate parameters

56 Kbps inverted
64 Kbps clear and restricted

Channel parameters

B-channels
D-channels

Interface protocols

network to user

Frame format

The DS-1 basic format consists of 24 8-bit bytes with one byte per channel and one framing bit, or F-bit. This makes a total of 193 bits per frame. The nominal bit rate of the DS-1 signal is 1.544 Mb/s and the sampling rate for each channel is 8000 Hz.

Superframe format

A superframe format, the standard format, consists of 12 DS-1 frames. See Table 3-1. It is consistent with the channel bank formats D2, D3, and D4. The signaling bit is time-shared to identify both the channel and the signaling frame. The framing pattern is the repeated sequence 100011011100.

Channel framing identifies the location of timeslot one. The signaling frame identifies those frames in which two signaling states, A and B, are transmitted on a time-shared basis. The assignments of the F-bit and the A and B bits in the superframe format are shown in Table 3-1.

Table 3-1
The Superframe format table

Frame number	F-Bit		PCM coding bits	Signaling bit	Signal channel
	Terminal framing	Signaling framing			
1	1	—	1–8		
2	—	0	1–8		
3	0	—	1–8		
4	—	0	1–8		
5	1	—	1–8		
6	—	1	1–7	8	A
7	0	—	1–8		
8	—	1	1–8		
9	1	—	1–8		
10	—	1	1–8		
11	0	—	1–8		
12	—	0	1–7	8	B

Note: The most significant bit is defined as bit one and the least significant bit as bit eight.

Extended superframe format

The Extended superframe format (ESF) consists of 24 frames. The 8 Kbps F-bit channel is divided into three separate channels:

- Framing Pattern Sequence (FPS) – Beginning with frame 4 or ESF bit 579, the framing bit of every fourth frame forms FPS 001011, which is used to determine the mainframe, superframe, and robbed bit signaling synchronization. This sequence is a 2 Kbps channel.
- Facility Data Link (FDL) – This is a 4 Kbps channel, used to turn on a yellow alarm. Meridian 1 system software uses FDL to convey yellow alarm (remote alarm) information or to transmit all ones, as selected in service change.
- Cyclic Redundancy Check (CRC) – The CRC sequence is a 2 Kbps channel. CRC indicates one or more bit errors in a block, or bits from the received bit stream. CRC can be used as an end-to-end bit error rate indicator.

The assignments of the F-bit and the A, B, C, and D bits in ESF are shown in Table 3-2.

Table 3-2
Extended superframe format table (Part 1 of 2)

Frame number	F-Bit				Robbed bit signaling
	Bit number	Assignments			
		FPS	FDL	CRC	
1	0	—	m	—	
2	193	—	—	CB1	
3	386	—	m	—	
4	579	0	—	—	
5	772	—	m	—	
6	965	—	—	CB2	A
7	1158	—	m	—	
8	1351	0	—	—	
9	1544	—	m	—	
10	1737	—	—	CB3	
11	1930	—	m	—	
12	2123	1	—	—	B
13	2316	—	m	—	
14	2509	—	—	CB4	

Table 3-2
Extended superframe format table (Part 2 of 2)

Frame number	F-Bit				Robbed bit signaling
	Bit number	Assignments			
		FPS	FDL	CRC	
15	2702	—	m	—	
16	2895	0	—	—	
17	3088	—	m	—	
18	3281	—	—	CB5	C
19	3474	—	m	—	
20	3667	1	—	—	
21	3860	—	m	—	
22	4053	—	—	CB6	
23	4246	—	m	—	
24	4439	1	—	—	D

Line encoding

Line coding for DS-1 is bipolar, Alternate Mark Inversion (AMI). The general requirements for DS-1 code suppression are:

- a maximum of 15 consecutive zero binary bits
- a minimum average of 12.5 percent density of one binary bit over any 192 consecutive bits

To meet the maximum and minimum requirements, PRI provides B7 and B8ZS zero code substitution techniques as options.

B7 coding

B7 coding restricts the D-channel operating modes to 56 Kbps or 64 Kbps inverted (64KI).

When all eight PCM bits in a channel are zero and the eighth bit is not a signaling bit in state one, the seventh bit is substituted by a one. This means zero code suppression is done on a per byte basis.

Note: Do not invoke the seventh bit substitution when digital data is being transmitted as this causes data corruption.

B8ZS coding

The B8ZS coding format supports 64 Kbps clear channel (64 KC), or 64 Kbps inverted HDLC (64 KI).

When eight consecutive zeros appear on a channel and the last bit transmitted is positive, the eight bits are substituted by the following pattern:

Substituted word	0	0	0	+1	–1	0	–1	+1

If the last bit was negative, the polarity is reversed. This results in the following substituted word:

Reverse polarity	0	0	0	–1	+1	0	+1	–1

Bipolar violations occur in the fourth and seventh bit positions of the inserted code. Therefore, B8ZS coding can be used only when the receiving end is capable of recognizing that these are not bipolar violations or bit errors.

Error detection

This chapter describes the ISDN error detection. There are four types of error detection:

- yellow (remote) alarm
- bit error rate
- frame alignment
- frame slip

Yellow alarm (remote alarm)

A yellow alarm signal (received by the near end) indicates that the far end (the remote end) is not ready. If the PRI is receiving the yellow alarm pattern, it indicates that there is a T1 connection. When the PRI receives a yellow alarm signal from the far end, all 24 channels are disabled.

The yellow alarm method used depends on the framing format (D2, D3, D4, or ESF) selected. If D2, D3, or D4 framing formats are chosen, Digit 2 yellow alarm is automatically selected by software. If the ESF framing format is chosen, the yellow alarm method must be set through service change.

- Digit 2 (DG2) yellow alarm signaling is provided by external circuitry. This alarm is detected when each digit 2 in 63 contiguous channels is logic zero. Use DG2 yellow alarm signaling with D2, D3, and D4 frame formats in Canada and the U.S. Also use DG2 yellow alarm signaling with the ESF frame format in Canada, in compliance with Canadian standard CS03.
- Facility Data Link (FDL) yellow alarm signaling is a 4 Kbps channel. In the U.S., use FDL yellow alarm signaling when the ESF frame format is selected.

When the PRI stops receiving the yellow alarm, channels are placed into the idle state and made available for calls. (In comparison, TIE trunks using A&B bit signaling are made to match the state of the far end, as presented by the T1 port.)

Each time a yellow alarm is generated, a counter is incremented. When the remote alarm 24-hour threshold (prompt RALM in LD73) is reached, the PRI must be restored to service manually.

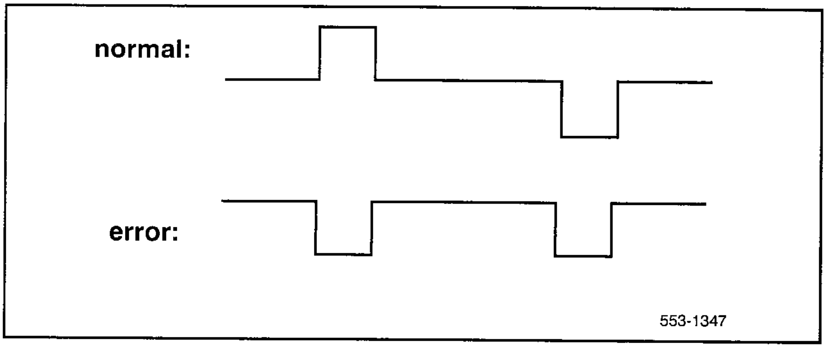
Bit error rate

Bit error rate monitoring detects errors in transmission. There are two methods of bit error rate monitoring, bipolar violation tracking and cyclic redundancy check (CRC). If the D2, D3, or D4 framing format is selected in LD17, prompt DLOP, bipolar violation tracking is implemented. If the Extended superframe format (ESF) is selected, CRC is implemented.

Bipolar violations (BPV) In a bipolar pulse stream, pulses alternate in polarity. A bipolar violation has occurred if, after transmission, two pulses of the same polarity are received in succession (this could be caused by an electrical disturbance, such as noise). See Figure 3-1.

> *Note:* Some bipolar violations are normal when using the B8ZS coding.

Figure 3-1
Bipolar violations



Cyclic redundancy check (CRC) The Extended Super Frame (ESF) format contains a checksum of all the data in the frame. The receiving side uses the checksum to verify that the data is correct.

The primary difference between BPV and CRC is that bipolar violations indicate errors on the local span, while CRC indicates errors on an end-to-end span. For example, on a satellite link, BPV only detects errors in the span between the Meridian 1 system and the satellite connection. Since CRC traverses the entire span, it detects errors from the Meridian 1 system to the satellite connection, then to the far end connection, indicating an end-to-end bit error rate.

Bit error rate thresholds PRI hardware detects BPV or CRC errors. It sends an overflow (OVFL) message to the Meridian 1 CPU each time 1024 BPV or CRC errors are detected. Running the midnight routines prints the number of overflows and clears the counter.

There are three bit error rate thresholds set in LD73. Setting BIPC to zero enables automatic recovery.

BIPV	1-(3)-4	maintenance threshold
	1-(2)-4	out of service threshold
BIPC	0-(2)-128	maximum number of times a DTI/PRI loop can be taken out of service in 24 hours.

Note: The BIPV values determine the sensitivity of the loop to errors, where BIPV = 1 is the least tolerant to errors, and BIPV = 4 is the most tolerant.

Frame alignment

Loss of frame alignment monitoring detects out-of-frame conditions on the DS-1 bit stream.

Loss of frame alignment thresholds PRI hardware detects out-of-frame conditions. Running the midnight routines prints the number of loss of frame alignment occurrences and clears the counters.

If a loss of frame alignment condition persists for three seconds, the affected PRI loop is taken out of service and a red alarm (local alarm) is raised. If the loss of frame alignment condition clears for at least 15 seconds, the PRI is automatically restored to service. Three frame alignment thresholds are set in LD73. Setting LFAC to zero enables automatic recovery.

LFAL	1-(17)-10240	maintenance threshold
	1-(511)-10240	out of service threshold
LFAC	0-(3)-128	24-hour out of service limit

Frame slip

Digital signals must have accurate clock synchronization for data to be interleaved into or extracted from the appropriate timeslot during multiplexing and demultiplexing operations. Frame slip monitoring detects frame deletion and repetition errors in clock synchronization.

Clock synchronization can either track on a primary or secondary reference clock, or operate in free run (non-tracking) mode. In LD73 (prompts PREF and SREF), one PRI may be defined as the primary clock reference. Another may be defined as the secondary clock reference.

Tracking mode PRI hardware detects frame slips in a tracking reference clock. Running the midnight routines prints the number of overflows and clears the counters.

There are two thresholds set in LD73.

SRTK	1-(5)-24	maintenance threshold (elapsed time in hours between frame slips)
	1-(30)-3600	out of service threshold (number of slips per hour)

Automatic recovery After the tracking mode or non-tracking mode out of service thresholds are exceeded, the slip rate is monitored for improvement. When the slip rate has improved, the trunks are returned to service.

There are two parameters set in LD73:

SRIM	(1) - 127	improvement timer in minutes
SRMM	1 - (2) - 127	improvement criteria

If the non-tracking mode maintenance threshold is exceeded SRMM or fewer timers in the duration of SRIM, then the trunks are returned to service. If not, the timer is restarted and monitoring continues.

Frame slippage is considered less important than alarms for loss of frame alignment persisting for 3 seconds, remote alarm, and bipolar violations exceeding the out of service threshold. If any of these alarms are reported while the slip rate is being monitored for improvement, then the monitoring stops. The trunks are returned to service only when the more serious alarm clears.

Free run (non-tracking) mode PRI hardware detects frame slips in the free run mode. Running the midnight routines prints the number of frame deletions and repetitions and clears the counters.

Data rate parameters

ISDN uses three types of data rates 56 Kbps inverted, 64 Kbps clear, and 64 Kbps restricted.

56 Kbps inverted

A 56 Kbps channel is specified with the Bearer Capability Information Element (IE).

- The information transfer capability is set to restricted digital information.
- The information rate is set to 56 Kbps.
- The layer and protocol identification in octet 5 is set to user information layer 1 protocol, rate adaptation, and the rate is encoded as 56 Kbps.

64 Kbps clear and restricted

The 64 Kbps inverted HDLC (64 Kbps restricted), or 64 Kbps clear (64C) is specified in the Bearer Capability IE in the SETUP message.

The 64 Kbps restricted (also called inverted HDLC) switched connections are supported by the Meridian 1 to DMS-100 protocol.

The Meridian 1 to Meridian 1 protocol supports 64 Kbps clear transmission.

Channel parameters

There are two types of ISDN channels, B-channels and D-channels.

B-channels

To minimize glare situations, Meridian 1 allocates B-channels from channel 23 down to channel 1; DMS-100 begins at channel 1 and goes up to channel 23.

Set outgoing trunk hunting on B-channels for the round robin searching method, rather than the linear method. Thus, when the system looks for an outgoing idle trunk, it looks for the next lower available trunk member, rather than the last member that was used.

The B-channel network loop, 0-511, and the PRI channel number, 1-23, are defined in LD14.

D-channels

The D-channel location must be coordinated with the far end. See the correlation tables in this guide for specific information.

To establish the PRI link, the D-channel interface port number and PRI loop numbers are associated in LD17. The DCHI port number must be an odd number between 1 and 15. PRI loop numbers may be between 0 and 511.

The D-channel can operate at 56 or 64 Kbps data rate. Its use may also be 64 Kbps clear, 64 Kbps restricted (inverted HDLC), or 56 Kbps. The selection of data rate is on a per PRI basis and is determined by service change. The B8ZS zero code suppression method is used to achieve 64 Kbps clear channel for the D-channel.

Interface protocols

User to network

The interface protocol between Meridian 1 and Central Office (CO) PRI equipment is a user-to-network protocol. If the far end is identified as a CO in service change (LD17), the Meridian 1 system is automatically designated as the "user."

The user to network protocol does not employ the same call states and state transactions at each end, and does not always send the same response to a given protocol message. In addition, the user to network protocol has an implicit master-slave relationship, relinquishing control to the network in cases such as glare resolution.

Symmetric

The interface protocol between a Meridian 1 and another Meridian 1 is a symmetric protocol. Call processing uses a master-slave relationship for glare resolution.

One PBX must be designated as the network (master), the other as the user (slave) (in LD17). If the master side of the interface sends a SETUP message as the slave initiates an outgoing call, priority is given to the call sent from the master switch. The outgoing call on that channel, the call initiated by the slave, is dropped and another virtual B-channel is selected for call origination.

Configuring PRI

Basic PRI configuration

PRI loops must be configured before defining DCH links or ISDN features. The following procedure outlines configuring the PRI loops, DCHI interface, DCH link and applications that are enabled as part of the overall configuration. These include:

— Basic Call Service

  - setting up and tearing down

— Electronic Switched Network (ESN) interworking

Default call types

When an ISDN call is made, a default call type is set initially. See Table 4-1. The call type is set depending on the dialing method used.

Modification of call types

The call type of an ISDN call can be modified automatically by software or you can use service change. See Table 4-1.

— Outgoing default UKWN or SPN call types over Central Office trunks go through automatic digit analysis of the final called number. This determines the call type according to North American Dialing Plans E.163 and E.164.

- Outgoing ISDN calls over CO trunks with LOC, CDP, SPN, and UKWN, a 10 or 11 digit dialing plan, the CLID automatically reflects 10 digits.
- The final call type of a direct dialed ISDN call (over a TIE trunk) can be modified in LD16. The CTYP prompt in LD16 permits you to modify the outgoing call types of PRI/ISL routes. This prompt, which is applicable only to TIE trunks, may have one of the aforementioned call types with UKWN as default.

Note: The CTYP prompt applies to Direct Trunk Access only.

Table 4-1
Default call types

Dial method	Default call type	Comment
Direct dial	UKWN (unknown)	Direct dial to trunks using Trunk Access Code
CDP (DSC/TSC)	CDP (Coordinated Dialing Plan)	Dial CDP number using DSC/TSC code
CDP (LSC)	UKWN	Dial CDP number using LSC code
ESN (LOC)	LOC (location code)	Dial NARS location code
ESN (HLOC)	UKWN	Dial ESN HLOC number
ESN (NPA)	NPA (national)	Dial ESN NPA number
ESN (NXX)	NXX (local)	Dial ESN NXX number
ESN (SPN)	SPN (special number)	Dial ESN SPN number

Configuring PRI capability and applications

Features enabled as part of basic PRI configuration, or are provided directly by DMS-100 are not included in this document. These include the following.

- Basic Call Service: configured as part of basic PRI
- Call Redirection and Call Forwarding: configured as part of basic PRI
- Private Network Hopoff: provided by DMS-100
- Private Network Overflow: provided by DMS-100
- Public Switched Telephone Network Equal Access and Special Number Service: provided by DMS-100

Descriptions given in the ISDN features description chapters.

- Backup D-channel
- Basic Call Service
- PSTN Equal Access and Special Number Services 64K Clear Data
- Calling Line Identification
- Data Packet Network access
- Digital Trunk Interface replacement
- Electronic Switched Network interworking
- Private Network Hopoff / Private Network Overflow
- Integrated Services Access
- ISDN Signaling Link
- Integrated Trunk Access
- Network Call Party Name Display/Network Name Delivery
- Network Call Redirection and Trunk Optimization
- Network Message Services
- Network Ring Again
- Remote Virtual Queueing
- Software Defined Network access

- Software Release ID
- T309 Timer

Note 1: Some networking features require a numbering plan in order to operate. Network Message Services, Network Ring Again, and Network ACD must be used with a Universal or Coordinated Dialing Plan (UDP, or CDP).

Note 2: The tariff is approved for ISDN PRI as of 1992.

PRI configuration

The following procedures show how to configure PRI only. For specific features (ISA or ISL, for example) refer to the individual feature modules found later in this document.

X11 release 18 and later requirements

X11 release 18 changes LD17 prompt and response sequences. The introduction of the MSDL card adds new options to LD17. Be sure to use the correct procedure to configure PRI for your system (X11 release 18 and later, or X11 release 17 and earlier). Pay close attention to the following guidelines.

- the primary and backup D-channels must be on the same card type (DCHI QPC757 or MSDL NT6D80)
- the parameters defined for the primary D-channel are automatically copied to the back-up D-channel (except for BCHL and RCVP)
- the D-channels must be disabled before making any changes
- changes to the D-channel pair should be made to the primary D-channel first (except for BCHL and RCVP)
- the backup D-channel must be removed prior to removing the primary D-channel
- when a backup D-channel is configured for a primary D-channel, the USR of the primary can be changed from SHA to ISLD or PRI, but not from ISLD to PRI or SHA

Use the following steps to configure PRI capability and applications.

1 LD73 Digital Data Block
Set error detection thresholds and clock synchronization control.
Required only when configuring PRI for the first time. Optional for subsequent configurations.

2 LD17 Configuration Record
Add a PRI loop.
X11 RELEASE 17 AND EARLIER

OR

3 LD17 Configuration Record
Add a PRI loop.
WITH X11 RELEASE 18 AND LATER

4 LD73 Digital Data Block
Change existing thresholds, or change tracking modes.
This can be done any time after Procedure 4-3.

5 LD17 Configuration Record
Add a DCHI card, and the D-channel link.
X11 RELEASE 17 AND EARLIER

OR

6 LD17 Configuration Record
Add a DCHI card, or an MSDL card and the D-channel link.
WITH X11 RELEASE 18 AND LATER

7 LD15 Customer Data Block
Define a PRI customer.
Required only when configuring a new PRI customer. If PRI is already defined, skip this procedure.

8 LD16 Trunk Route Administration
Configure PRI trunk routes.

9 LD14 Trunk Administration
Add PRI trunks.

Asynchronous port configuration procedures follow these procedures.

Procedure 4-1
The following prompts in LD73 require a response before adding PRI loops (Part 1 of 2)

Prompt	Response	Description
REQ	NEW	Create a PRI datablock
TYPE	DDB	Digital data block
PREF	loop	Primary reference source for clock controller (0-511)
	<cr>	Free run mode No primary or secondary reference source assigned X preceding the number deletes existing primary reference source
SREF	loop	Secondary reference source for clock controller (0-511) prompted only if PREF is not free run
	<cr>	Free run mode No primary or secondary reference source assigned X preceding the number deletes existing secondary reference source
TRSH	0-15	Create, or change a PRI threshold set Enter this number in LD17 when defining the PRI loop X preceding number deletes Threshold set.
RALM	1-(3)-128	Yellow alarm (remote alarm) 24-hour threshold number of remote alarm clear signals received in 24 hours If the threshold is reached, the PRI must be restored to service manually
BIPC	0-(2)-128	24-hour bit rate violation threshold **If zero is entered, trunks are restored to service automatically** with D2, D3, or D4 framing format, bipolar violation threshold with ESF, Cyclic Redundancy Check (CRC) threshold
LFAC	0-(3)-128	24-hour loss of frame alignment threshold **If zero is entered, trunks are restored to service automatically**
BIPV		Bit rate (bipolar violation and CRC) monitoring limits
	1-(3)-4	Maintenance threshold
	1-(2)-4	Out-of-service threshold

Procedure 4-1
The following prompts in LD73 require a response before adding PRI loops (Part 2 of 2)

Prompt	Response	Description
SRTK		Frame slip tracking monitoring limits
	1-(5)-24 1-(30)-3600	Maintenance threshold, the minimum time, in hours, between slips Out-of-service threshold, the maximum number of slips per hour
SRNT		Frame slip free run (non-tracking) monitoring limits
	1-(15)-1024	Maintenance threshold, the minimum time, in seconds, between 10 consecutive slips
	1-(3)-1024	Out-of-service threshold, the minimum time, in seconds, between 10 consecutive slips See "Coordinating parameters" and ISDN Primary Rate Interface maintenance (553-2901-500) for a description of the automatic recovery sequence.
LFAL		Loss of frame alignment monitoring limits
	1-(17)-10240 1-(511)-10240	Maintenance threshold Out-of-service threshold
SARR	YES-(NO)	Automatic recovery allowed after out of service condition
SRGT	1-(15)-30	Auto recovery guard timer in minutes (X11 release 14 and earlier only)
SRMM	1-(2)-127	Slip Rate exceeded maintenance limit

Procedure 4-2
Use LD17 to add a PRI loop (X11 release 17 and earlier) (Part 1 of 2)

Prompt	Response	Description
REQ	CHG	Change parameters in LD17.
TYPE	CFN	Configuration data block
CEQU	YES	Change common equipment options
DLOP	loop dd ff	PRI loop parameters: loop = Network loop number (0-159) dd = Number of data calls (0-24) ff = Fame format: D2, D3, D4, (ESF) Frame format must match the far end.
MODE	PRI	Primary Rate Interface mode
LCMT	(B8S), AMI	Line encoding method **must match the far end** B8S = B8ZS coding format AMI = B7 coding format (Alternate Mark Inversion)
YALM	FDL, DG2	Yellow alarm (remote alarm) method prompted only if the frame format is ESF **must match the far end.** If NOT prompted, DG2 was set automatically Use FDL with ESF in the U.S FDL or DG2 can be used in Canada.

Procedure 4-2
Use LD17 to add a PRI loop (X11 release 17 and earlier) (Part 2 of 2)

Prompt	Response	Description
TRSH	0-15	The maintenance and performance threshold set for this PRI, as defined by prompt TRSH in LD73
DTIC	0-159	Starting network loop slot for the PRI card This prompts asks the technician to tell the system what card slot is used by the T1. This makes these loops unavailable for other use. X preceding the loop number returns the loops for system use. The loop number must be even. In system option 21, each network slot has one superloop (four loops). Since the PRI card takes two slots, eight loops are used per PRI, and therefore unavailable. When installed on a Network expansion shelf, enter carriage return and ignore the SCH2035 message. This indicates that the T1 is not in an intelligent Bus. Do not input loop numbers that take the system out of its bounds.

Procedure 4-3
Use LD17 to add a PRI loop (X11 release 18 and later) (Part 1 of 2)

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel on logical port 0-63
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCHI, physical card address for MSDL
_PORT	x	Port number on MSDL cards, or option 81 I/O devices
USR	PRI, ISLD, SHA	D-channel mode
_ISLM	1-382	Number of ISL trunks controlled by the D-Channel
DCHL	0, 2, 4,...159	PRI loop number for D-Channel
GRP	0-4	Network group number for option 81 systems
OTBF	1-(32)-127	Number of output request buffers
_BPS	xxxx	Baud rate for ISL D-channel on MSDL port (default 64000)
_PARM	R232,(R422) DCE, (DTE)	ISL D-channel interface and transmission mode (MSDL only)
PRI	0-159 2-15	Additional PRI loops using the same D-channel, and interface ID
DRAT	(56K), 64KC, 64KI	D-channel transmission
IFC	aaa	Interface type: SL1, S100, (D100), D250, ESS4, ESS5, etc
SIDE	NET, (USR)	Meridian 1 node type
RLS	xx	Release ID of the switch at the far end of the D-Channel
RCAP	MSL, NCT, ND1, ND2, RVQ	Remote D-channel capabilities
_CLOK	INT, (EXT)	Internal or external clock on ISL D-channels

Procedure 4-3
Use LD17 to add a PRI loop (X11 release 18 and later) (Part 2 of 2)

Prompt	Response	Description
LAPD	Yes, (No)	D-channel LAPD parameters
__T23	1-(20)-31	Interface guard timer (DCHI only)
__T200	2-(3)-40	Retransmission timer
__N200	1-(3)-8	Maximum number of retransmissions
__N201	4-(260)	Maximum number of octets in information field
__T203	2-(10)-40	Maximum time (in seconds) without frames being exchanged
__K	1-(7)	Maximum number of outstanding frames
ADAN	NEW BDCH 0-63	Add a backup D-channel on logical port 0-63
PDCH	0-63	Primary D-channel
CTYP	DCHI, MSDL	Card type (automatically printed: must be the same as DCH)
DNUM	0-15	Physical port (odd) for D-channel, card number for MSDL
_PORT	x	Port number on MSDL cards, or option 81 I/O devices
BCHL	0,2,4 . . . 159	PRI loop number for back-up D-channel
GRP	0-4	Network group number for option 81 systems
RCVP	Yes, (No)	Auto-recovery to primary D-channel option
ADAN	<cr>,****	Go on to next prompt or exit overlay

Procedure 4-4
The following prompts in LD73 require a response to change tracking or thresholds (Part 1 of 2)

Prompt	Response	Description
REQ	CHG	Change a PRI datablock
TYPE	DDB	Digital data block
PREF	loop	Primary reference source for clock controller (0-511)
	<cr>	PFree run mode No primary or secondary reference source assigned X preceding the number deletes existing primary reference source
SREF	loop	Secondary reference source for clock controller (0-511) prompted only if PREF is not free run
	<cr>	Free run mode No primary or secondary reference source assigned X preceding the number deletes existing secondary reference source
TRSH	0-15	Create, or change a PRI threshold set Enter this number in LD17 when defining the PRI loop X preceding number deletes Threshold set.
RALM	1-(3)-128	Yellow alarm (remote alarm) 24-hour threshold number of remote alarm clear signals received in 24 hours If the threshold is reached, the PRI must be restored to service manually
BIPC	0-(2)-128	24-hour bit rate violation threshold **If zero is entered, trunks are restored to service automatically** with D2, D3, or D4 framing format, bipolar violation threshold with ESF, Cyclic Redundancy Check (CRC) threshold
LFAC	0-(3)-128	24-hour loss of frame alignment threshold **If zero is entered, trunks are restored to service automatically**

Procedure 4-4
The following prompts in LD73 require a response to change tracking or thresholds (Part 2 of 2)

Prompt	Response	Description
BIPV		Bit rate (bipolar violation and CRC) monitoring limits
	1-(3)-4	Maintenance threshold
	1-(2)-4	Out-of-service threshold
SRTK		Frame slip tracking monitoring limits
	1-(5)-24	Maintenance threshold, the minimum time, in hours, between slips
	1-(30)-3600	Out-of-service threshold, the maximum number of slips per hour
SRNT		Frame slip free run (non-tracking) monitoring limits
	1-(15)-1024	Maintenance threshold, the minimum time, in seconds, between 10 consecutive slips
	1-(3)-1024	Out-of-service threshold, the minimum time, in seconds, between 10 consecutive slips See “Coordinating parameters” and *ISDN Primary Rate Interface maintenance* (553-2901-500) for a description of the automatic recovery sequence.
LFAL		Loss of frame alignment monitoring limits
	1-(17)-10240	Maintenance threshold
	1-(511)-10240	Out-of-service threshold
SRMM	1-(2)-127	Slip Rate exceeded maintenance limit

Procedure 4-5
Use LD17 to add a DCHI card and the D-channel interface (X11 release 17 and earlier) (Part 1 of 3)

Prompt	Response	Description
REQ	CHG	
TYPE	CFN	Configuration data block
ISDN	YES	Change DCHI parameters
DCHI	1-15	DCHI port number, only odd numbers are allowed
BCHI	(0)-1-15	Back-up DCHI port number
USR	PRA	D-channel is for ISDN PRI only
	ISLD SHA	D-channel is for ISL in dedicated mode D-channel is for ISL in "shared" mode
IFC	aaaa	Interface type aaaa = (DMS1), D250, ESS4, ESS5, SL-1, S100
RCVP	YES, (NO)	Recovery to Primary D-channel option prompted only when BCHI has a number entered. When RCVP=YES, the primary D-channel automatically returns as the active D-channel when it recovers. When RCVP = No, the Back Up D-channel remains active even after the primary D-channel recovers. Both sides must be either YES or NO. If the two sides do not match, both sides default to NO. If IFC = D100, D250, SL100, or ESS4, RCVP defaults to No.
DCHL	0-511	PRI loop number for DCHI, one DCHI card can support up to 15 PRIs when Back Up D-channel is configured.
BCHL	0-159	PRI loop number for BCHI <cr> when BCHI = 0
OTBF	1-(16)-127	number of output request buffers

Procedure 4-5
Use LD17 to add a DCHI card and the D-channel interface (X11 release 17 and earlier) (Part 2 of 3)

Prompt	Response	Description
DRAT		D-channel transmission rate must match the far end
	56K	56 Kbps, default when LCMT is AMI
	64KC	64 Kbps clear, default when LCMT (LD17) is B8S
	64KI	64 Kbps inverted HDLC (64 Kbps restricted) In X11 release 15 and later DRAT is not prompted when configuring ISL D-channels because the speed is controlled by the modem baud rate
PRI	loop id	Additional loops using the same D-channel. loop = loop number (0-159) id = interface ID (2-15) Up to 16 loops can be supported, including the 14 loops that can be entered here and the primary and backup D-channel loops that are assigned automatically. The primary and backup D-channel IDs are 0 and 1. This cannot be changed.
SIDE	MAS, (SLAV)	Prompted only if IFC is set to Meridian 1. One side of the PBX-to-PBX interface must be set as the “master”, the other must be set as the “slave”
RLS	xx	X11 or BCS release of far end. Enter release only, not issue. For example, acceptable responses are 14, 15, 16, 17, 29, 30, 31, 32.
RCAP	aaa	Remote D-channel capability aaa = NCT, ND1, ND2 NCT = Network Call Trace ND1 = Network Name Delivery method 1 (X11 release 13 and greater) ND2 = Network Name Delivery method 2 (X11 release 17 and greater) Xaaa removes the capability.
CLOK	EXT	D-channel clock type source of primary clock is external to DCHI card Always use EXT for PRI.

Procedure 4-5
Use LD17 to add a DCHI card and the D-channel interface (X11 release 17 and earlier) (Part 3 of 3)

Prompt	Response	Description
LAPD	YES, (NO)	Change LAPD parameters Select YES to activate timers during system set up. The following prompts appear when LAPD = YES. **Note:** When adding a D-channel the MEM AVAIL data is output after this prompt, indicating the channel has been added. You can therefore abort the program without going to the REQ prompt.
_T23	1-(20)-31	Interface guard timer checks how long the interface takes to respond In units of 0.5 seconds, default of 20 = 10 seconds
_T200	2-(3)-40	Retransmission timer in units of 0.5 seconds, default of 3 = 1.5 seconds
_T203	2-(10)-40	Maximum time allowed without frames being exchanged in seconds
_N200	1-(3)-8	Maximum number of retransmissions
_N201	4-(260)	Maximum number of octets in information field
_K	1-(7)-31	Maximum number of outstanding unacknowledged frames (NAKS)

Procedure 4-6
Use LD17 to add a DCHI card, or an MSDL card and the D-channel interface (X11 release 18 and later) (Part 1 of 2)

Prompt	Response	Description
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel (can also CHG and OUT DCH)
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
USR	PRI, ISLD, SHA	D-channel mode
_ISLM	1-382	Number of ISL trunks controlled by the D-Channel
DCHL	0, 2, 4,...159	PRI loop number for DCHI
OTBF	1-(32)-127	Number of output request buffers
_BPS	xxxx	Baud rate for ISL D-channel on MSDL port (default 64000)
_PARM	R232,(R422) DCE, (DTE)	ISL D-channel interface and transmission mode (MSDL port only)
PRI	0-159 2-15	Additional PRI loops using the same D-channel, and interface ID
DRAT	(56K), 64KC, 64KI	D-channel transmission
IFC	aaa	Interface type: SL1, S100, (D100), D250, ESS4, ESS5
SIDE	NET, (USR)	Meridian 1 node type
RLS	xx	Release ID of the switch at the far end of the D-Channel
RCAP	MSL, NCT, ND1, ND2, RVQ	Remote D-channel capabilities
_CLOK	INT, (EXT)	Internal or external clock on ISL D-channels
LAPD	Yes, (No)	D-channel LAPD parameters

Procedure 4-6
Use LD17 to add a DCHI card, or an MSDL card and the D-channel interface (X11 release 18 and later) (Part 2 of 2)

Prompt	Response	Description
__T23	1-(20)-31	Interface guard timer (DCHI only)
__T200	2-(3)-40	Retransmission timer
__N200	1-(3)-8	Maximum number of retransmissions
__N201	4-(260)	Maximum number of octets in information field
__T203	2-(10)-40	Maximum time (in seconds) without frames being exchanged
__K	1-(7)	Maximum number of outstanding frames
ADAN	NEW BDCH 0-63	Add a backup D-channel
PDCH	0-63	Primary D-channel
CTYP	DCHI, MSDL	Card type (automatically printed because it must be the same as primary D-channel)
DNUM	0-15	Physical port (odd) for D-channel, card number for MSDL
_PORT	0-3	Port number on MSDL card
BCHL	0,2,4...,-159	PRI loop number for back-up D-channel
RCVP	Yes, (No)	Auto-recovery to primary D-channel option
ADAN	<cr>,****	Go on to next prompt or exit overlay

Procedure 4-7
Use LD15 to define a PRI customer (Part 1 of 2)

Prompt	Response	Description
REQ	NEW, CHG	Add or change a customer
TYPE	CDB	Customer data block
CUST	xx	Customer number (0-99)
LDN0	xxxx . . x	Listed Directory Number 0 length This value must be set to terminate all incoming ISDN/DID calls. Determines the number of digits to translate.
ANAT	xxxx . . x	Attendant billing number ANAT and ANLD combined must be 7 digits.
ANLD	xxxx . . x	ANI listed DN ANLD and ANAT combined must be 7 digits
AC2		Access Code 2 Enter call types (type of number) that use access code 2. This relates to ESN dialing plans. If you do not have a dialing plan, <cr> past this prompt. Multiple responses are permitted. If a call type is not entered here, it automatically defaults to access code 1.
	NPA NXX INTL SPN LOC	E.164 National E.164 Subscriber International Special number Location code Prompted only for NARS.
ISDN	Yes, (No)	Change ISDN options
_PNI	1-32700	Private Network Identifier (for CLID)

Procedure 4-7
Use LD15 to define a PRI customer (Part 2 of 2)

Prompt	Response	Description
_PFX1	xxxx	Prefix (area) code for International PRA (for CLID)
_PFX2	xxxx	Central Office Prefix for IPRA (for CLID)
_HNPA	100-999	Home Number Plan Area code (for CLID)
_HNXX	100-999	Prefix for Central Office (for CLID)
_HLOC	100-9999	Home Location Code (ESN) (for CLID)
_LSC	xxxx	Local steering code (for CLID)
_CNTP	LDN, (PDN)	Default for Calling Line ID (CLID)
_RCNT	0-(5)	Maximum inter-node hops in a network redirection call

Procedure 4-8
Use LD16 to define a PRI trunk route (Part 1 of 3)

Prompt	Response	Description
REQ	NEW	Add a PRI trunk route
TYPE	RDB	Type of data
CUST	0-99	Customer number
ROUT	0-511	Route number
TKTP	aaa	Trunk route type: DID, FEX, FGDT, ISA, ISL, RLM, RLR, TIE, WATS
PRIV	Yes, (No)	Route is (is not) a Private line route
ESN	Yes, (No)	ESN signalling
CNVT	Yes, (No)	Route to conventional switch
DDMI	xxx	Digit manipulation index
ATDN	(0) - xxxxxxx	Attendant DN of conventional main, ESN main, ESN node or ETN node
SAT	Yes, (No)	Trunk route via earth orbiting satellite transmission
RCLS	INT, (EXT)	Route classmarked as internal, (external)
DTRK	Yes, (No)	Digital trunk route
BRIP	Yes, (No)	ISDN BRI packet handler route
DGTP	aaa	Digital trunk type
ISDN	Yes, (No)	ISDN PRI option
_MODE	PRA, ISLD	Mode of D-Channel that controls the route
_DCHI	1-15	DCHI port number Prompted if Mode = ISLD
_PNI	0-32700	Customer Private ID (unique to a customer)
_IFC	xxxx	Interface machine type for this PRI route

Procedure 4-8
Use LD16 to define a PRI trunk route (Part 2 of 3)

Prompt	Response	Description
_SRVC	aaa	Service provisioned for AT&T ESS connections (NNSF), ACC, I800, LDS, M800, MEG, SDN, IWAT, WATM, WATB ***Note:*** NSF = services provided on a Call-by-Call basis.
_SRPM	0-(15)-255	Service parameter Prompted if SRVC = WATB
_NCNA	(Yes), No	Network call name allowed
_NCRD	(No), Yes	Network Call Redirection
_TRO	Yes, (No)	Trunk optimization allowed (denied) on the route
_NSF	Yes, (No)	Network Service Facility
_COTR	0-511	Incoming DID/CO route number
_TIER	0-511	Incoming Tie route number
_WATR	xxx	WATS route number
_CHTY	ABCH, (BCH)	Signaling type for B-channel digital routes
_CTYP	aaa	Call type for outgoing direct dialed Tie route
_INAC	Yes, (No)	Insert ESN access code to incoming private network call
NCOS	(0)-99	Network Call Of Service
CLS	aaa	Class of service restriction for tie route
TGAR	0-31	Trunk group access restrictions
IEC	000-999	Interexchange carrier ID
PTYP	aaa	Port type at far end
AUTO	Yes, (No)	Auto terminate trunks
ICOG	IAO, ICT, OGT	Incoming and/or outgoing trunk
SRCH	RRB, (LIN)	Round robin or linear outgoing trunk search
ACOD	xxx . . . x	Trunk route access code

Procedure 4-8
Use LD16 to define a PRI trunk route (Part 3 of 3)

Prompt	Response	Description
SIGO	aaa	Signaling arrangement
NEDC	ORG, ETH	Near end disconnect control
FEDC	ETH, FEC, JNT,(ORG)	Far end disconnect control
CPDC	Yes, (No)	Meridian 1 is the only controlling party on incoming calls
SPCT	DLY, (IMM)	Delayed or immediate cut-through speech path control
DLTN	Yes, (No)	Provide dial tone to the far-end
PSEL	TLNK, (DMDM)	T-link or DM-DM protocol selection
EQAR	Yes, (No)	Enable Equal Access on this route
_GCR	(Yes), No	Use General Carrier Restriction for Equal Access calls
_NTOL	ALOW, (DENY)	Allow or deny North American toll calls (1+ calls)
_ITOL	ALOW, (DENY)	Allow or deny international toll calls (011+ calls)
_SCR	Yes, (No)	Use Selective Carrier Restriction for Equal Access calls
AUTH	Yes, (No)	Authcode to be prompted for incoming tie callers
FGNO	(0)-127	Feature Group D block number
TDET	Yes, (No)	Tone detector required
TTBL	(0)-31	Tone table number

Procedure 4-9
Use LD14 to define a PRI trunk (Part 1 of 2)

Prompt	Response	Description
REQ	New	Create a PRI trunk
TYPE	aaa	Trunk Type DID, FEX, FGDT, ISA, ISL, RLM, RLR, TIE, WATS ***Note:*** Per FCC regulations, DID trunks must be designated for answer supervision. Refer to "FCC Compliance for DID Answer Supervision" in *X11 features and services* (553-3001-305).
TN	l s c u, l ch	Terminal Number, or loop and channel
XTRK	XUT, XEM	Universal trunk card, Enhanced E&M trunk card
SFEX	Yes, (No)	Special digital FEX trunk
CUST	0-99	Customer Number
NCOS	xx	Network Class of Service Group Number
RTMB	rrr mmm	Route number and Member number
CHID	xx	Channel ID for this trunk
MNDN	xxxx	Manual Directory Number
PRDN	xxxx	Private line directory number
CMF	Yes, No	Call modification for private lines
RLDN	xxxx	Release Link trunk Directory Number
NITE	xxxx	Night Service Directory Number
TGAR	(0)-31	Trunk group access restriction
SIGL	aaa	Trunk signaling
CDEN	SD, DD	Single or double card density
EMTY	TY1, (TY2)	4-wire E&M type 1 or 2

Procedure 4-9
Use LD14 to define a PRI trunk (Part 2 of 2)

Prompt	Response	Description
CPAD	CIN, (COUT)	Carrier interface pad in (out) for 4-wire E &M Tie trunks
LDOP	bop, (loop)	Loop Dial Outpulsing
TIMP	(600), 900, 1200	Termination impedance
BIMP	600, (3com)	Balance impedance 3-component or 600 ohms
CDEN	SD, DD	Single or double card density
STRI	aaa	Incoming start arrangement
STRO	aaa	Outgoing start arrangement
SUPN	Yes, No	Answer and disconnect supervision required
FCAR	Yes, (No)	Forced Charge account
CLS	aaa	Class of service options

Asynch port configuration (X11 release 17 and earlier)

The following procedure describes how to configure the asynchronous port of the QPC757 or the NT6D11AB D-channel card as a Serial Data Interface (SDI) port. This SDI port is able to serve as a QPC139 circuit. As defined here, the asynchronous port is only an even numbered port.

> *Note:* The port should be set for DCE and RS-232-C interface options. See *ISDN Primary Rate Interface installation* (553-2901-200) for the socket locations.

Procedure 4-10
Respond to the following prompts in LD17

Prompt	Response	Description
REQ	CHG	Change the configuration
TYPE	CFN	Configuration record
IOTB	YES	Change input/output device
ADAN	NEW TTY x	New TTY number
		x = TTY port address as set by the card switch settings
ESDI	YES	This port uses an ESDI card
SYNC	NO	This port is not in synchronous mode
_DUPX	HALF, (FULL)	Duplex rate
_BPS	1200, 2400, (4800), 9600, 19200, 48000, 56000, 64000	Baud rate
_BITL	7, (8)	7 or 8 data bit length
_STOP	(1), 1.5, 2	Number of stop bits
		Enter 1x5 for 1.5
_PRTY	ODD, EVEN, (NONE)	Parity
_FLOW	CTS, XON, (NONE)	Flow control
_USER	aaa	Output message types
		aaa = BUG, CDL, CTY, MTC, SCH, TRF
		(among others, see *X11 input/output guide* (553-3001-400))

Asynch port configuration (X11 release 18 and later)

The following procedure describes how to configure the asynchronous port on the QPC757 DCHI card as a Serial Data Interface (SDI) port. This SDI port is able to serve as a QPC139 circuit. As defined here, the asynchronous port is only an even numbered port.

> *Note:* The port should be set for DCE and RS-232-C interface options. See *ISDN Primary Rate Interface installation* (553-2901-200) for the socket locations

Procedure 4-11
Respond to the following prompts in LD17

Prompt	Response	Description
REQ	CHG	Change the configuration
TYPE	CFN	Configuration record
ADAN	NEW TTY x CHG TTY x	New or changed TTY number x = TTY port address as set by the card switch settings (even number)
CTYP	DCHI	This port uses a QPC757 DCHI card
DNUM	x	Device number automatically printed when ADAN = CHG
BPS	110, 150, 300, 600, (1200), 2400, 4800, 9600, 19200	Baud rate
PRTY	ODD, EVEN, (NONE)	Parity
STOP	(1), 2	Number of stop bits
BITL	7, (8)	7 or 8 data bit length
USER	aaa	Output message types aaa = BUG, CDL, CTY, MTC, SCH, TRF (among others, see *X11 input/output guide* (553-3001-400))

Service verification

Testing PRI

There are four tests used to test the Primary Rate Interface:

- the PRI local loop back test
- a PRI self-test performed manually
- the PRI automatic loop test
- the PRI remote loop-back test (must run in conjunction with a link diagnostic test at the far end)

Note: X11 release 18 changes the way you enter the card type for some commands. X11 release 17 and earlier uses ENL DCHI, DIS DCHI. X11 release 18 requires ENL DCH, DIS DCH. The X11 release 18 commands are reflected in this document.

PRI local loop back test

This test checks the communication path between the QPC414 Network card and QPC720 PRI card. It also checks the leads for the J4. It is often performed when the PRI cannot be enabled. The PRI card must be installed, and a cable connecting its J3 connector to a QPC414 Network card.

1 Disable the D-channel.

   LD96
   DIS DCH x

2 Disable the PRI loop:

   LD60
   DISL loop

3 Disconnect the cable connector from the QPC720 J4 (if attached). Several LEDs will light on the faceplate.

4 Attach a female 15 pin connector loopback plug to J4. The loopback plug must have pins 1 and 3, and pins 9 and 11 shorted together.

5 Enable the PRI loop:

   LD60
   ENLL loop

   The green ACT LED will light in a few seconds. If so, the test passed. Continue with the following steps.

   If the green ACT light does not come on, retest. Unseat the PRI card between steps 2 and 3.

   If the light still does not turn on, try replacing your QPC414 or QPC720 cards, or the connecting cable.

6 Remove the loopback plug from the J4 connector.

7 Replace cable connector to the QPC720 J4 (removed in step 3).

8 Enable the loop:

   LD60
   ENLL loop

9 Enable the DCH:

   LD96
   ENL DCH x

PRI self-test

The self-test checks speech path continuity, zero code suppression, remote alarm detection, and A&B bit signaling. This test is performed manually, on a per channel or a per frame (24 channels) basis.

The DCH and PRI must be disabled before performing the self-test or call processing is disrupted. To perform the self-test on a specific loop:

1 Disable DCH:

LD96

DIS DCH x

2 Disable the PRI loop and run the self-test:

LD60

DISL loop

SLFT loop

When the system returns OK, it indicates that the hardware is operable.

3 Re-enable the PRI loop:

LD60

ENLL loop

The D-channel will re-enable automatically.

PRI automatic loop test

The automatic loop test checks the same functions as the self-test. Unlike the self-test, it can be run automatically, as part of the midnight routines.

With the ATLP command set to one:

If all 23 channels are idle at midnight, the system disables the card and performs a self-test on all channels.

If any of the 23 channels are busy at midnight, the system disables one idle channel, chosen at random, and checks it while the card is enabled.

With the ATLP command set to zero, only one channel is tested. The channel tested is randomly selected by software; it cannot be specified.

To perform the remote loop-back test, use the following:

LD60
ATLP 1 or 0

When ATLP 1 is entered, the TTY prints out AUTO TEST ENBL. When ATLP 0 is entered, the TTY prints out AUTO TEST DSBL.

Link diagnostic and remote loop-back tests

The remote loop-back test and the link diagnostic test are performed manually on a per channel or a per frame (23 channels) basis.

Link diagnostic test

The link diagnostic test, also called the far end loop-back test, does not test the Meridian 1 PRI. It puts the PRI in loop-back mode at the far end so a remote loop-back test can be performed on far end equipment. The PRI channel, loop, or frame tested must be disabled.

Remote loop-back test

The remote loop-back test, also called the near end loop back test, checks the integrity of the PRI from the Meridian 1 system to the far end. The far end must be put into loop-back mode before this test can be performed. The PRI channel, loop, or frame tested must be disabled.

Coordinating the tests

When a technician at the far end asks for loop-back mode on the Meridian 1, perform the following steps.

1 Disable the D-channel.

LD96
DIS DCH x

2 Disable the PRI loop and activate loop-back mode.

LD60
DISL loop
RLBK loop
The QPC720 LBK LED lights.

When a technician at the far end asks for loop-back mode on the Meridian 1 to be disabled, perform this step.

Disable loopback mode.
LD60
DLBK loop
The LBK LED turns off.

When a technician at the far end asks for PRI and DCH to be re-enabled, perform this step.

Enable the PRI loop.

LD60

ENLL loop

OK will print out. The D-channel re-enables automatically.

To run the remote loop-back test on the Meridian 1, call a technician at the far end and ask for loop-back mode at that facility.

When loop-back mode at the far end is confirmed, the technician at the far end follows these steps.

1 Disable the D-channel.

LD96

DIS DCH N

2 Disable the PRI loop and run the loop-back test using.

LD60

DISL L

RMST L

SLFT OK prints out to indicate a successful test.

3 Call the far end technician to disable the loopback test, and to re-enable the PRI and DCH. The far end technician enables the PRI.

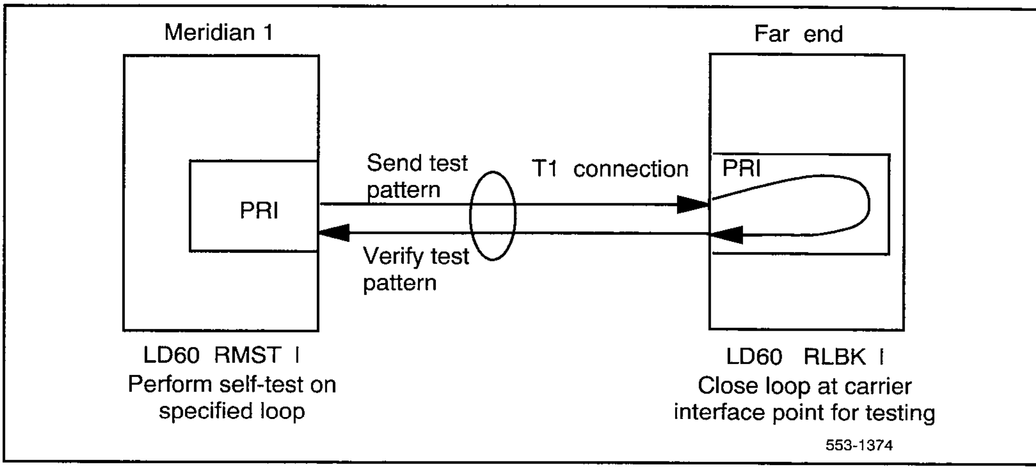
LD60

ENLL L

OK prints out, and the D-channel re-enables automatically.

Figure 5-1 shows the relationship between the remote loop-back test and the link diagnostic test.

Figure 5-1
PRI remote loop-back and link diagnostic tests



Testing DCH

This chapter describes the following DCH tests. These tests are supported on the QPC757 DCHI card only. MSDL card (NT6D80) tests are shown later in this chapter.

- Test 100: Interrupt generation
- Test 101: Loop-back mode
- Test 200: Interrupt handler
- Test 201: Interrupt handler-to-link interface

DCH tests 100 and 101 (QPC757 DCHI card only)

DCH tests 100 and 101 are isolated hardware tests. Test 100 checks interrupt generation on the DCHI card. Test 101 checks the DCHI loop-back capability. If either test fails, either a faulty DCHI or a contention problem is indicated. A test failure initiates DCH error messages. See Figure 5-2.

Tests 100 and 101 must be run in sequential order (tests 200 and 201 may follow). Established calls stay up, but new calls cannot be placed.

The DCH link must be in the reset state when these tests are run. Reset can be accomplished when the status of the D-channel is established (EST) or released (RLS).

To reset:

LD96
STAT DCH x (responds either EST or RLS)
RST DCH x

If the DCHI is disabled, it must be enabled before reset can be established.

To enable the DCHI:

LD96

STAT DCH x	(responds RST)
ENL DCH x	(if a problem caused the disabled state, RLS occurs; if the disabled state is cleared, status is EST)

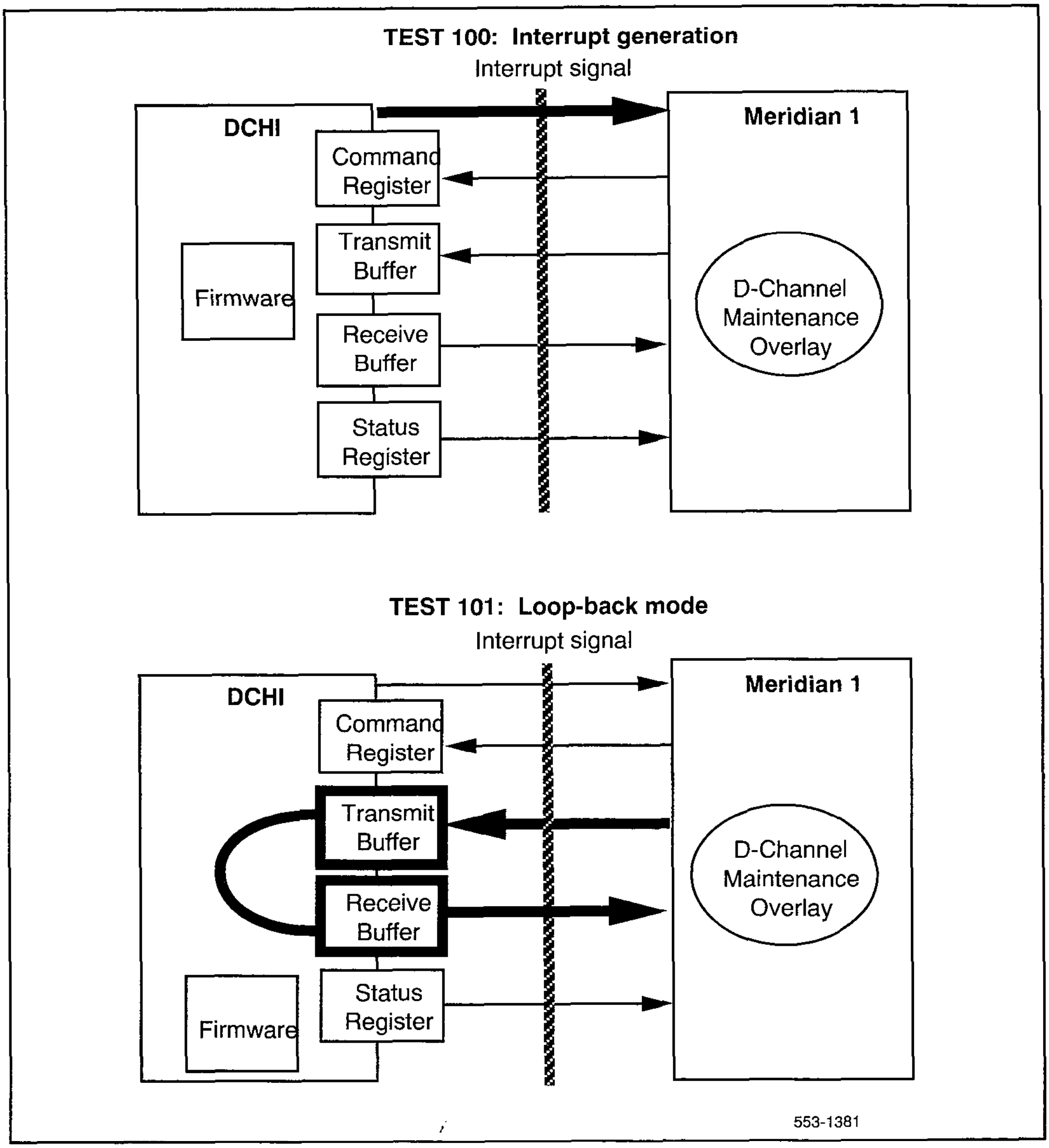
To run Test 100 and Test 101 after verifying that the DCH is reset:

TEST 100 x

TEST 101 x

OK appears when test passes successfully.

Figure 5-2
DCH tests 100 and 101 (QPC757 DCHI card only)



DCH tests 200 and 201 (QPC757 DCHI card only)

DCH tests 200 and 201 are software tests. See Figure 5-3. Test 200 monitors the DCHI interrupt handler. Test 201 checks the interrupt handler-to-link interface path. A failure of either test indicates software problems. A test failure initiates DCH error messages.

Tests 200 and 201 must be run sequentially after tests 100 and 101. Established calls stay up, but new calls cannot be placed.

The DCH link must be in the reset state when these tests are run. Reset can be established when the status of the D-channel is established (EST) or released (RLS).

To reset:

LD96
STAT DCH x (responds either EST or RLS)
RST DCH x

If the DCHI is disabled, it must be enabled before reset can be established.

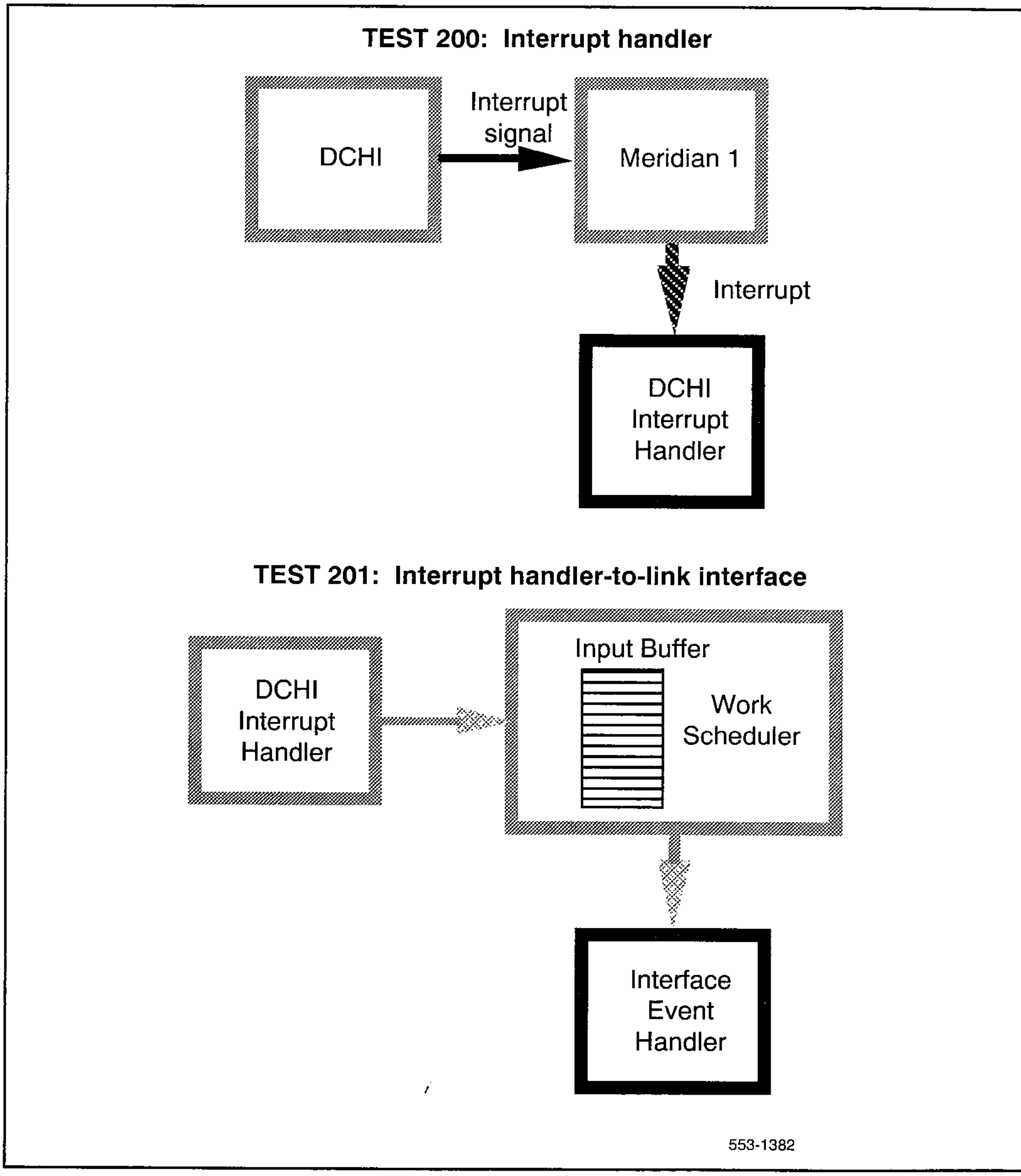
To enable the DCHI:

LD96	
STAT DCH x	(responds RST)
ENL DCH x	(if a problem caused the disabled state, RLS occurs; if the disabled state is cleared, status is EST)
RST DCH x	

To run Test 200 and Test 201 after verifying that the DCH is reset:

TEST 200 x
TEST 201 x
OK appears when test passes successfully.

Figure 5-3
DCH tests 200 and 201 (QPC757 DCHI card only)



MSDL local loopback test (NT6D80)

To start the local loopback test on the MSDL card, use the following steps. The test checks both MSDL expedited and normal (ring) interfaces.

1 Place MSDL in Test state. Enter

ENL TEST DCH x x = the D-channel logical address

2 Place the MSDL in local loopback mode. Enter

ENL LLB DCH x x = the D-channel logical address

3 Perform the test. Enter

TEST LLB DCH x x = the D-channel logical address

The response for the expedited interface that carries urgent signaling and maintenance messages between the Meridian 1 CPU and the MSDL MPU follows.

DCH : X XDU TEST CONFIRM TIME : <time of day>
TEST : PASS (or FAIL)

X is the D-channel logical address
XDU is the expedient message sent around the loop.

The response for the ring interface that transmits operation data between the Meridian 1 CPU and the MSDL MPU follows.

DCH : X DU TEST CONFIRM TIME : <time of day>
TEST : PASS (or FAIL)

1 If the test fails, check the status of the MSDL card, used by this DCH link, with the **STAT MSDL x FULL** command.

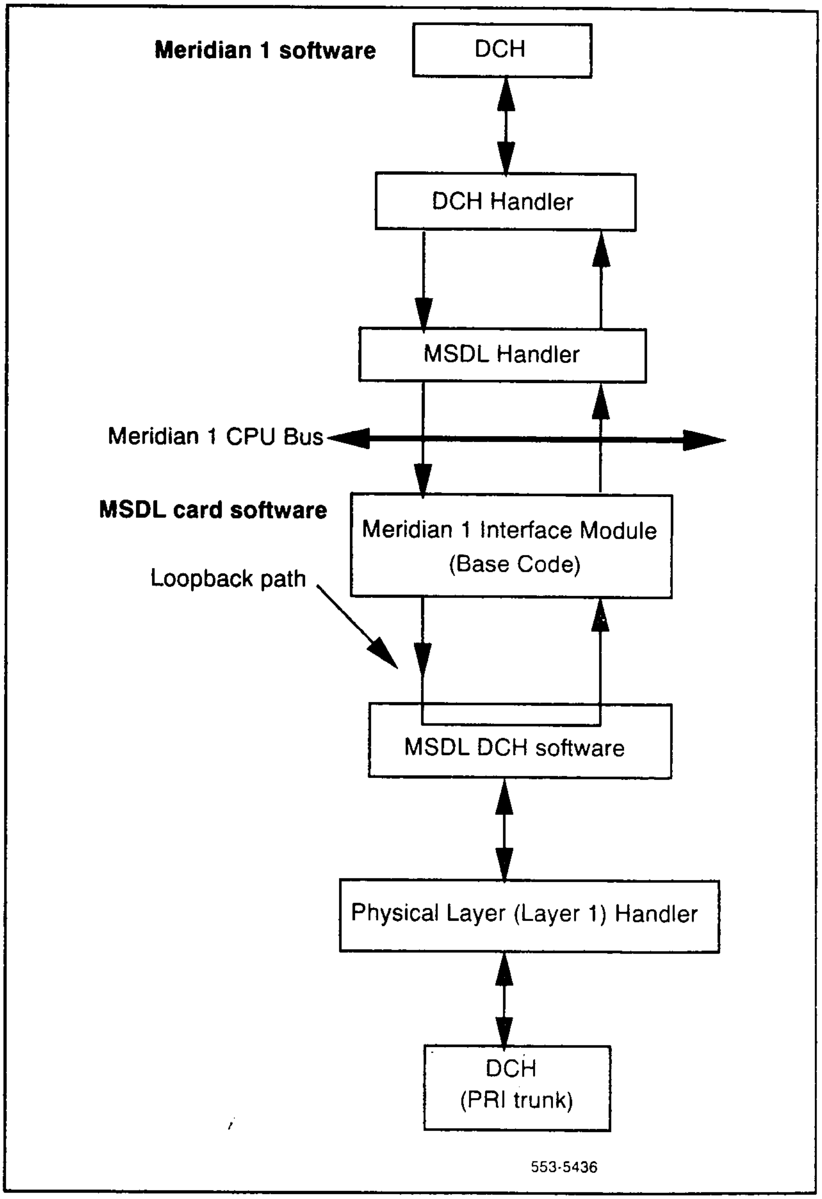
2 If the MSDL card may be faulty, disable the card and perform self-test.

DIS MSDL x x = the MSDL device number
SLFT MSDL x x = the MSDL device number

3 If the card passed the test, the problem may lie in incompatible software.

Refer to *Multi-purpose Serial Data Link description* (553-3001-195).

Figure 5-4
Local loopback test (NT6D80)



MSDL remote loopback tests (NT6D80)

Before beginning this test, verify the following.

- D-channels on both switches are configured on MSDL cards
- DCH links on both switches are set to TEST mode
- DCH at Switch B is in remote loopback mode (RLB)
- remote capability (RCAP) is MSDL

To place DCH links on both systems in TEST mode, enter ENL TEST DCH x on Switch A and ENL TEST DCH y on Switch B for the same DCH link (x is the logical address for the DCH link in Switch A and y is the corresponding DCH link in Switch B). The DCH link on both switches are automatically placed in idle state (IDLE).

1 Place the Switch B DCH link in remote loopback state (RLB) with **ENL RLB DCH x**. The DCH link in Switch A must stay in idle.

2 From Switch A, perform the loopback test with **TESTRLB x.**

   The result of the remote loopback test is displayed on Switch A's console in the following format.

   DCH : X RLB TEST CONFIRM TIME : <time of day>
   TEST : PASS
   TEST : FAIL - NO DATA RCV FAR END
   TEST : FAIL - CORPT DATA RCV FAR END
   TEST : FAIL - REASON UNKNOWN

   TEST : FAIL may indicate a problem in the physical link between the two switches, or faulty equipment in either switch. Check the connections, and verify the status of the MSDL and PRI trunk cards used for this link. Refer to *ISDN Primary Rate Interface maintenance* (553-2901-500) for detailed troubleshooting procedures.

3 Place the Switch B DCH link back to the idle state, with the **DIS RLB y** command.

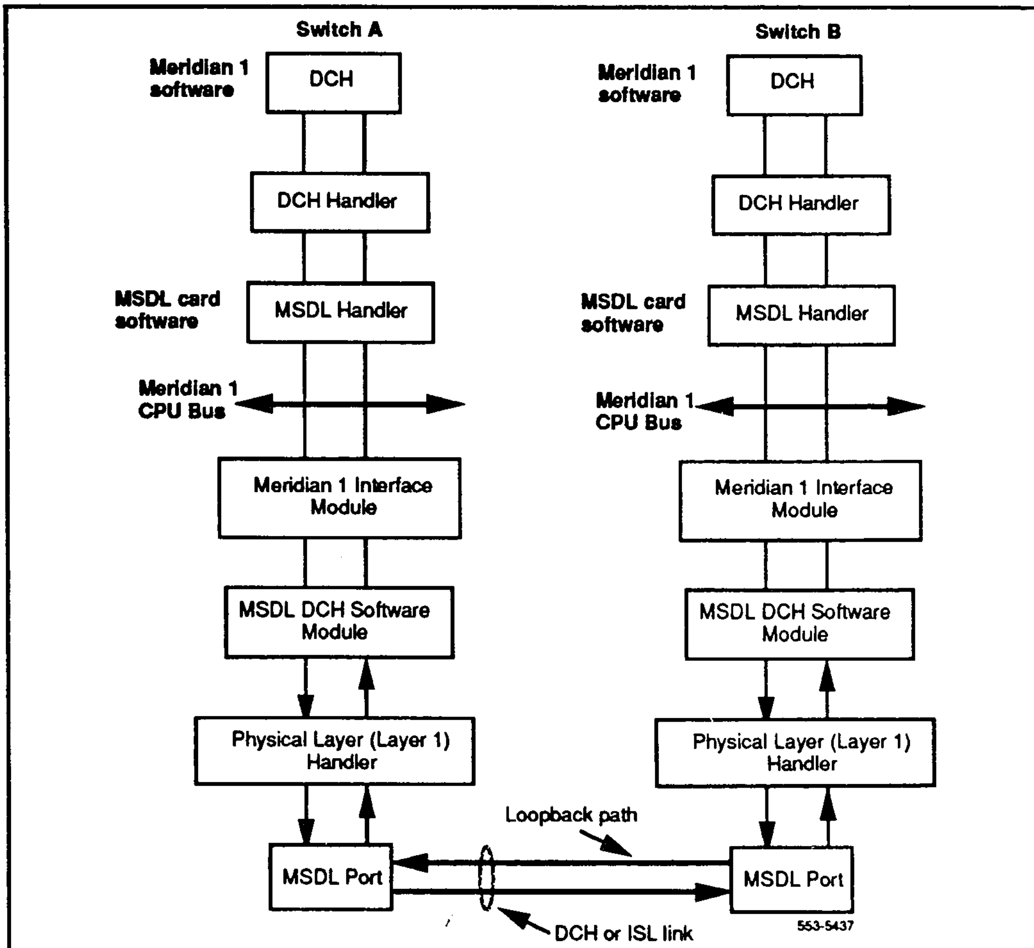
4 If you think the MSDL card used in either switch has failed, check the status of the DCH link and the status of the MSDL card by entering **STAT MSDL x FULL.**

5 If the MSDL card may be faulty, disable the card and perform self-test.

DIS MSDL x
SLFT MSDL x

6 If the card passed the test, the problem may lie in incompatible software. Refer to *Multi-purpose Serial Data Link description* (553-3001-195).

Figure 5-5
Remote loopback tests (NT6D80)



Correlation tables

The correlation tables are used to coordinate the software features between two switches.

The following correlation tables are contained in this chapter:

— Meridian 1 switch to another Meridian 1 switch

— Meridian 1 switch to DMS-100 switch

— Meridian 1 switch to DMS-250 switch

Note 1: The Meridian 1 to SL-100 datafill is the same as the Meridian 1 to DMS-100 datafill.

Note 2: Due to proprietary constraints, the Meridian 1 to AT&T 4ESS and AT&T 5ESS datafill is not available for publication in this document.

The following tables are provided for Meridian 1 to Meridian 1:

- Table 6-1 PRI database correlation (protocol layer 1)
- Table 6-2 DCH database correlation (protocol layer 2) (X11 release 17 and earlier)
- Table 6-3 DCH database correlation (protocol layer 2) (X11 release 18 and later)
- Table 6-4 Facility database correlation (protocol layer 3) (X11 release 17 and earlier)
- Table 6-5 Facility database correlation (protocol layer 3) (X11 release 18 and later)

The following tables are provided for Meridian 1 to DMS-100:

- Table 6-6 PRI database correlation (protocol layer 1)
- Table 6-7 DCH database correlation (protocol layer 2) (X11 release 17 and earlier)
- Table 6-8 DCH database correlation (protocol layer 2) (X11 release 18 and later)
- Table 6-9 Facility database correlation (protocol layer 3)

The following tables are provided for Meridian 1 to DMS-250:

- Table 6-10 PRI database correlation (protocol layer 1)
- Table 6-11 DCH database correlation (protocol layer 2) (X11 release 17 and earlier)
- Table 6-12 DCH database correlation (protocol layer 2) (X11 release 18 and later)
- Table 6-13 Facility database correlation (protocol layer 3)

Meridian 1 to Meridian 1 correlation tables

Tables 6-1 through 6-3 describe how to coordinate the software features between two Meridian 1 switches. The tables consist of three columns. The description column lists the software feature to be coordinated. The first Meridian 1 column lists the Meridian 1 software prompts and the proper responses for a corresponding feature. The second Meridian 1 column lists the software tables and the correct values for the fields in these tables. The Meridian 1 system information also corresponds to a particular feature.

Each of the three tables corresponds to one of three protocol layers.

> *Note:* Both near and far ends must match the parameters. For example, DLOP, LCMT, and YALM responses must be the same for both ends. This applies to all the following tables for Meridian 1 to Meridian 1 configuration.

Table 6-1
PRI database correlation (protocol layer 1) for Meridian 1 to Meridian 1 (Part 1 of 2)

Description	Meridian 1	Meridian 1
CARD TYPE	Program: LD17 Prompt: MODE Response: PRI	Program: LD17 Prompt: MODE Response: PRI
FRAME FORMAT Superframe Extended Superframe (ESF)	Program: LD17 Prompt: DLOP (field ff) Response: D3 ESF	Program: LD17 Prompt: DLOP (field ff) Response: D3 ESF
LINE ENCODING Zero code suppression Bit 8 zero suppression	Program: LD17 Prompt: LCMT Response: AMI B8S	Program: LD17 Prompt: LCMT Response: AMI B8S
BIT ERROR RATE BASE Bipolar violations CRC	Program: LD73 Prompt: n/a (preset to four classes of error rates)	Program: LD73 Prompt: n/a (preset)

Table 6-1
PRI database correlation (protocol layer 1) for Meridian 1 to Meridian 1 (Part 2 of 2)

Description	Meridian 1	Meridian 1
DATA LINK (yellow alarm method)	Program: LD17 Prompt: YALM Response: DG2 FDL	Program: LD17 Prompt: YALM Response: DG2 FDL
INHIBIT ALARM TRANSMISSION	Program: LD60 Prompt: DISY L (disable yellow alarm for loop L)	Program: LD60 Prompt: DISY L (disable Response: yellow alarm for loop L)
BIT ERROR RATE maintenance threshold	Program: LD73 Prompt: BIPV Response: 1-(3)-4	Program: LD73 Prompt: BIPV Response: 1-(3)-4
BIT ERROR RATE out of service threshold	Program: LD73 Prompt: BIPC Response: 1-(2)-4	Program: LD73 Prompt: BIPV Response: 1-(2)-4
BIT ERROR RATE 24-hour threshold (errored second threshold)	Program: LD73 Prompt: BIP Response: 0-(3)-128	Program: LD73 Prompt: BIPC Response: 0-(3)-128
FRAME ALIGNMENT maintenance threshold	Program: LD73 Prompt: LFAL Response: 1-(17)-10240	Program: LD73 Prompt: LFAL Response: 1-(17)-10240
FRAME ALIGNMENT out of service threshold	Program: LD73 Prompt: LFAL Response: 1-(511)-10240	Program: LD73 Prompt: LFAL Response: 1-(511)-10240
FRAME SLIP maintenance threshold	Program: LD73 Prompt: SRNT Response: 1-(15)-1024	Program: LD73 Prompt: SRNT Response: 1-(15)-1024
FRAME SLIP out of service threshold	Program: LD73 Prompt: SRNT Response: 1-(3)-1024	Program: LD73 Prompt: SRNT Response: 1-(3)-1024

Table 6-2
DCH database correlation (protocol layer 2) for Meridian 1 to Meridian 1 X11 Release 17 and earlier

Description	Meridian 1	Meridian 1
Associate D-channel with PRI	Program: LD17 Prompt: DCHI, DCHL Response: D-channel, PRI loop	Program: LD17 Prompt: DCHI, DCHL Response: D-channel, PRI loop
Associate backup D channel with PRI	Program: LD17 Prompt: BCHI Response: BCHL RCVP BCHI is the D-channel (or DCHI port number); BCHL is the associated PRI card (or PRI loop); RCVP requests recovery to the primary D channel.	Program: LD17 Prompt: BCHI Response: BCHL RCVP BCHI is the D-channel (or DCHI port number); BCHL is the associated PRI card (or PRI loop); RCVP requests recovery to the primary D channel.
Data rate of D-channel	Program: LD17 Prompt: DRAT Response: 64KC 56KI	Program: LD17 Prompt: DRAT Response: 64KC 56KI
DCHI mode	Program: LD17 Prompt: USR Response: PRA, SHA ISLD	Program: LD17 Prompt: USR Response: PRA, SHA ISLD

Table 6-3
DCH database correlation (protocol layer 2) for Meridian 1 to Meridian 1
X11 Release 18 and later

Description	Meridian 1	Meridian 1
Associate D-channel with PRI	Program: LD17 Prompt and Response: ADAN DCH xx DCHL PRI loop	Program: LD17 Prompt and Response: ADAN DCH xx DCHL PRI loop
Associate backup D-channel with PRI	Program: LD17 Prompt and Response: ADAN BDCH x is the backup D-channel number BCHL xx is the associated PRI card (or PRI loop); RCVP Yes requests recovery to the primary D-channel.	Program: LD17 Prompt and Response: ADAN BDCH x is the backup D-channel number BCHL xx is the associated PRI card (or PRI loop); RCVP Yes requests recovery to the primary D-channel.
Data rate of D-channel	Program: LD17 Prompt and Response: DRAT 64KC, 56KI	Program: LD17 Prompt and Response: DRAT 64KC, 56KI
DCH mode	Program: LD17 Prompt and Response: USR PRA, SHA, ISLD	Program: LD17 Prompt and Response: USR PRA, SHA, ISLD

Table 6-4
Facility database correlation (protocol layer 3) for Meridian 1 to Meridian 1 X11 Release 17 and earlier

Description	Meridian 1	Meridian 1
B-channel selection	Program: LD16 Prompt: SRCH Response: RRB	Program: LD16 Prompt: SRCH Response: RRB
Loss and level	preset	preset
User-user interface	Program: LD17 Prompt: SIDE Response: MAS	Program: LD17 Prompt: SIDE Response: SLAV
B-channels defined	Program: LD14 Prompt: TN Response: network loop and channel	Program: LD14 Prompt: TN Response: network loop and channel
Interface type	Program: LD17 Prompt: IFC Response: SL1	Program: LD17 Prompt: IFC Response: SL1
DCHI mode route	Program: LD16 Prompt: MODE Response: PRA, ISLD	Program: LD16 Prompt: MODE Response: PRA, ISLD

Table 6-5
Facility database correlation (protocol layer 3) for Meridian 1 to Meridian 1 X11 Release 18 and later

Description	Meridian 1	Meridian 1
B-channel selection	Program: LD16 Prompt: SRCH Response: RRB	Program: LD16 Prompt: SRCH Response: RRB
Loss and level	preset	preset
User-user interface	Program: LD17 Prompt: SIDE Response: MAS	Program: LD17 Prompt: SIDE Response: SLAV
B-channels defined	Program: LD14 Prompt: TN Response: network loop and channel	Program: LD14 Prompt: TN Response: network loop and channel
Interface type	Program: LD17 Prompt: IFC Response: SL1	Program: LD17 Prompt: IFC Response: SL1
DCH mode route	Program: LD16 Prompt: MODE Response: PRA, ISLD	Program: LD16 Prompt: MODE Response: PRA, ISLD

Meridian 1 to DMS-100 correlation tables

Tables 6-6 through 6-9 describe how to coordinate the software features between a Meridian 1 switch and a DMS-100 switch. The tables consist of three columns. The description column lists the software feature to be coordinated. The Meridian 1 column lists the Meridian 1 software prompts and the proper responses for a corresponding feature. The DMS-100 column lists the software tables and the correct values for the fields in these tables. The DMS-100 information also corresponds to a particular feature.

Each of the three tables corresponds to one of three protocol layers.

Table 6-6
PRI database correlation (protocol layer 1) for Meridian 1 to DMS-100 (Part 1 of 2)

Description	Meridian 1	DMS-100
Card type	Program: LD17 Prompt: MODE Response: PRI	Table: CARRMTC Field: CARD Value: NT6X50AA NT6X50AB
Frame format Superframe Extended Superframe	Program: LD17 Prompt: DLOP (field ff) Response: D3 ESF	Table: CARRMTC Field: FF Value: SF ESF
Line encoding Zero code suppression Bit 8 zero suppression	Program: LD17 Prompt: LCMT Response: AMI B8S	Table: CARRMTC Field: ZLG Value: ZCS B8ZS
Bit error rate base Bipolar violations CRC	Program: LD73 Prompt: n/a (preset to four classes of error rates)	Table: CARRMTC Field: BERB Value: BPV CRC
Data link (yellow alarm method) No data link	Program: LD17 Prompt: YALM Response: DG2 (Note) FDL	Table: CARRMTC Field: DLK Value: NILDL
Note: When the DMS-100 CARRMTC table has Field = FF and Value = SF, configure the Meridian 1 with DG2. When the DMS-100 CARRMTC table has Field = FF and Value = ESF, configure the Meridian 1 with FDL.		

Table 6-6
PRI database correlation (protocol layer 1) for Meridian 1 to DMS-100 (Part 2 of 2)

Description	Meridian 1	DMS-100
Inhibit alarm transmission	Program: LD60 Prompt: DISY L (disable yellow alarm for loop L)	Table: CARRMTC Field: IAT Value: Y N
Bit error rate maintenance threshold	Program: LD73 Prompt: BIPV Response: 1-(3)-4	Table: CARRMTC Field: BERML Value: 6
Bit error rate out of service threshold	Program: LD73 Prompt: BIPV Response: 1-(2)-4	Table: CARRMTC Field: BEROL Value: 3 (exponent)
Bit error rate 24-hour threshold (errored second threshold)	Program: LD73 Prompt: BIPC Response: 0-(3)-128	Table: CARRMTC Field: ES Value: 864
Frame alignment maintenance threshold	Program: LD73 Prompt: LFAL 1-(17)-10240	Table: CARRMTC Field: FRAMEML
Frame alignment out of service threshold	Program: LD73 Prompt: LFAL Response: 1-(511)-10240	Table: CARRMTC Field: FRAMEOL Value: 511 (exponent)
Frame slip maintenance threshold	Program: LD73 Prompt: SRNT Response: 1-(15)-1024	Table: CARRMTC Field: SLIPML Value: 4
Frame slip out of service threshold	Program: LD73 Prompt: SRNT Response: 1-(3)-1024	Table: CARRMTC Field: SLIPOL Value: 255 (exponent)

Table 6-7
DCH database correlation (protocol layer 2) for Meridian 1 to DMS-100
X11 Release 17 and earlier

Description	Meridian 1	DMS-100
Associate D-channel with PRI	Program: LD17 Prompt: DCHI DCHL Response: DCHI sets D-channel; DCHL is the associated PRI card.	Table: TRKSGRP Field: DCHNL Value: same as DS1 end point in table SPECCONN
Associate backup D-channel with PRI	Program: LD17 Prompt: BCHI BCHL RCVP Response: BCHI is the D-channel (or DCHI port number); BCHL is the associated PRI card (or PRI loop); RCVP requests recovery to the primary D-channel.	Table: TRKGRP Field: DCHBCKUP Value: Same as DS! and point in table SPECCONN
Data rate of D-channel	Program: LD17 Prompt: DRAT Response: 64KC 56KI	Table: STINV Field: CONTYPE Value: PRIBAUD Field: BAUD Value: 64 Kbps 56 Kbps

Table 6-8
DCH database correlation (protocol layer 2) for Meridian 1 to DMS-100
X11 Release 18 and later

Description	Meridian 1	DMS-100
Associate D-channel with PRI	Program: LD17 Prompt and Response: ADAN DCH xx DCHL PRI loop	Table: TRKSGRP Field: DCHNL Value: same as DS1 end point in table SPECCONN
Associate backup D-channel with PRI	Program: LD17 Prompt and Response: ADAN BDCH x is the backup D-channel number BCHL xx is the associated PRI card (or PRI loop); RCVP Yes requests recovery to the primary D-channel.	Table: TRKGRP Field: DCHBCKUP Value: Same as DS! and point in table SPECCONN
Data rate of D-channel	Program: LD17 Prompt and Response: DRAT 64KC, 56KI	Table: STINV Field: CONTYPE Value: PRIBAUD Field: BAUD Value: 64 Kbps 56 Kbps

Table 6-9
Facility database correlation (protocol layer 3) for Meridian 1 to DMS-100

Description	Meridian 1	DMS-100
Q.931 Interface identifier (used in CID IE)	n/a	Table: IACPSINV Field: IID Value: 0
Q.931 CALL REFERENCE VALUE LENGTH	n/a	Table: TRKSGRP Field: CRLENGTH Value: 2
B-channel selection	Program: LD16 Prompt: SRCH Response: RRB LIN	Table: TRKGRP Value: SELSEQ Field: MIDL ASEQ
Billing at Primary Rate Interface (PRI)	n/a	Table: TRKGRP Field: BILLDN Value: N
loss and level	preset	Table: TRKGRP Field: PADGRP Value: PRAC
User-network interface	Program: LD17 Prompt: IFC Response: D100 (sets user)	Table: TRKSGRP Field: IFCLASS Value: NETWORK
Q.931 progress indicator location	n/a	Table: TRKSGRP Field: LOCATION Value: USER
B-CHANNELS DEFINED	Program: LD14 Prompt: TN Response: 0-59 = network loop 1-23 = channel	Table: TRKMEM Field: EXTTRKMEM Value: IACCKTTS

Meridian 1 to DMS-250 correlation tables

Tables 6-10 through 6-13 describe how to coordinate the software features between a Meridian 1 switch and a DMS-250 switch. The tables consist of three columns. The description column lists the software feature to be coordinated. The Meridian 1 column lists the Meridian 1 software prompts and the proper responses for a corresponding feature. The DMS-250 column lists the software tables and the correct values for the fields in these tables. The DMS-250 information also corresponds to a particular feature.

Each of the three tables corresponds to one of three protocol layers.

Table 6-10
PRI database correlation (protocol layer 1) for Meridian 1 to DMS-250 (Part 1 of 2)

Description	Meridian 1	DMS-250
Card type	Program: LD17 Prompt: MODE Response: PRI	Table: CARRMTC Field: CARD Value: NT6X50AA NT6X50AB
Frame format Superframe Extended Superframe	Program: LD17 Prompt: FRM Response: D3 ESF	Table: CARRMTC Field: FF Value: SF ESF
Line encoding Zero code suppression Bit 8 zero suppression	Program: LD17 Prompt: LCMT Response: AMI B8S	Table: CARRMTC Field: ZLG Value: ZCS B8ZS
Bit error rate base Bipolar violations CRC	Program: LD73 Prompt: n/a (preset to four classes of error rates)	Table: CARRMTC Field: BERB Value: BPV CRC
Data link (yellow alarm method) No data link	Program: LD17 Prompt: YALM Response: n/a DG2 FDL	Table: CARRMTC Field: DLK Value: NILDL FDL1 FDL2

Table 6-10
PRI database correlation (protocol layer 1) for Meridian 1 to DMS-250 (Part 2 of 2)

Description	Meridian 1	DMS-250
Inhibit alarm transmission	Program: LD60 Prompt: DISL/X (disable yellow alarm for loop L)	Table: CARRMTC Field: IAT Value: YN
Bit error rate maintenance threshold	Program: LD73 Prompt: BIPV Response: 1-(3)-4	Table: CARRMTC Field: BERML Value: 6
Bit error rate out of service threshold	Program: LD73 Prompt: BIPV Response: 1-(2)-4	Table: CARRMTC Field: BEROL Value: 3 (exponent)
Bit error rate 24-hour threshold (errored second threshold)	Program: LD73 Prompt: BIPC Response: 0-(3)-128	Table: CARRMTC Field: ES Value: 864
Frame alignment maintenance threshold	Program: LD73 Prompt: LFAL 1-(17)-10240	Table: CARRMTC Field: FRAMEML Value: 17
Frame alignment out of service threshold	Program: LD73 Prompt: LFAL Response: 1-(511)-10240	Table: CARRMTC Field: FRAMEOL Value: 511 (exponent)
Frame slip maintenance threshold	Program: LD73 Prompt: SRNT Response: 1-(15)-1024	Table: CARRMTC Field: SLIPML Value: 4
Frame slip out of service threshold	Program: LD73 Prompt: SRNT Response: 1-(3)-1024	Table: CARRMTC Field: SLIPOL Value: 255 (exponent)

Table 6-11
DCH database correlation (protocol layer 2) for Meridian 1 to DMS-250 X11 Release 17 and earlier

Description	Meridian 1	DMS-250
Associated D-channel with PRI	Program: LD17 Prompt: DCHI DCHL PRI Response: loop and Interface ID	Table: TRKSGRP Field: PMTYPE Value: DTCI Field: DTCINO Value: Nil Field: DTCICKTNO Value: 16 Field: DTCICKTTS Value: 24
Data rate of D-channel	Program: LD17 Prompt: DRAT Response: 64KC56KI	Table: TRKSGRP Field: DCHRATE Value: 56 Kbps Value: 64 Kbps

Table 6-12
DCH database correlation (protocol layer 2) for Meridian 1 to DMS-250 X11 Release 18 and later

Description	Meridian 1	DMS-250
Associated D-channel with PRI	Program: LD17 Prompt and Response: ADAN DCH xx DCHL PRI loop	Table: TRKSGRP Field: PMTYPE Value: DTCI Field: DTCINO Value: Nil Field: DTCICKTNO Value: 16 Field: DTCICKTTS Value: 24
Data rate of D-channel	Program: LD17 Prompt and Response: DRAT 64KC, 56KI	Table: TRKSGRP Field: DCHRATE Value: 56 Kbps Value: 64 Kbps

Table 6-13
Facility database correlation (protocol layer 3) for Meridian 1 to DMS-250

Description	Meridian 1	DMS-250
Q.931 Interface identifier (used in CID IE)	n/a	Table: LTCTSINV Field: PSLNKTAB Value: O/DSIPRA/ Default/N/Nil
Q.931 CALL REFERENCE VALUE LENGTH	n/a	Table: TRKSGRP Field: CRLENGTH Value: 2
B-channel selection	Program: LD16 Prompt: SRCH Response: RRBLIN	Table: TRKGRP Value: SELSEQ Field: MIDLASEQ
Billing at PRI interface	n/a	Table: TRKGRP Field: BILLDN Value: N
Loss and level	preset	Table: TRKGRP Field: PADGRP Value: PRAC
User-network interface	Program: LD17 Prompt: IFC Response: D250 (sets user)	Table: TRKSGRP Field: IFCLASS Value: NETWORK
Q.931 progress indicator location	n/a	Table: TRKSGRP Field: LOCATION Value: USER
Back Up D-channels defined	Program: LD14 Prompt: TN Response: 0-159 = network loop1-23 = channel	Table: TRKMEM Field: PMTYPE Value: DTCI Field: DTCINO Value: Nil Field: DTCICKTNO Value: 16 Field: DTCICKTTS Value: 5

Engineering guidelines

This chapter contains guidelines for ISDN compatible software and hardware. This information includes the following:

- system compatibility
- configuration parameters
- data characteristics
- transmission characteristics
- software packages
- software/hardware compatibility
- hardware requirements
- disk hardware requirements
- cable information
- loss and level plan

A number plan must be in place for Network Message Services, Network ACD, and Network Ring Again.

System compatibility

The X11 release 17 ISDN software supports the following system types.

- Meridian 1 ST, NT, RT, and XT
- system options 21, 51, 61, and 71

The ST machine type requires the QPC814A memory card.

The X11 release 18 ISDN software supports the following system types.

- STE, NT, RT, and XT
- 21E, 51, 61, 71, and 81

Configuration parameters

There are three types of configuration parameters:

- line rate
- T1 compatibility

The line rate is 1.544 Mbps.

> *Note:* Lines have to be conditioned for 64K so the D-channel can be brought up.

The integrated voice and data can use a single medium to transmit speech and data between locations.

There are three advantages to T1 compatibility:

- T-link version 2 supports Meridian 1 to Meridian 1, Meridian 1 to SL-100, and Meridian 1 to DMS-100 for 56 or 64 kbps data
- includes capability to be configured as a standard T1 DS-1 link
- eliminates need for channel bank equipment when using digital network facilities

Data characteristics

PRI utilizes Northern Telecom's T-link Data Rate Adaptation protocol. There are three transmission modes:

- asynchronous 50 bps to 19.2 Kbps
- synchronous 1200 bps to 64 Kbps
- half or full duplex

Transmission characteristics

There are five types of transmission necessary for ISDN compatibility:

- carrier system compatibility
- synchronization
- signaling
- trunk types supported
- voice transmission

These transmission types are described by the lists that follow.

Carrier system compatibility:

- compatible with D2, D3, D4, B8ZS, and Extended superframe format (ESF) framing on T1 repeater cables
- compatible with systems that use a DS-1 interface, such as fiber optics, microwave, copper, satellite, and infrared
- meets CCITT Q.921 and Q.931 Recommendations
- complies with T1D1 minimal subset

Synchronization: stratum 3 compatible (accuracy, jitter, pull-in range)

Signaling:

- in PRI Mode: ISDN D-channel signaling
- in DTI Mode: loop start, ground start, E&M, DTMF, and dial pulse
- in ITA mode: PRI trunks use PRI mode and DTI trunks use DTI mode

Trunk types supported:

- CO, FX, WATS, DID, TIE (2-wire E&M, 4-wire E&M)

Voice transmission:

- meets EIA Digital PBX Draft Standard PN-1429 requirements such as loss and level, distortion, and delay

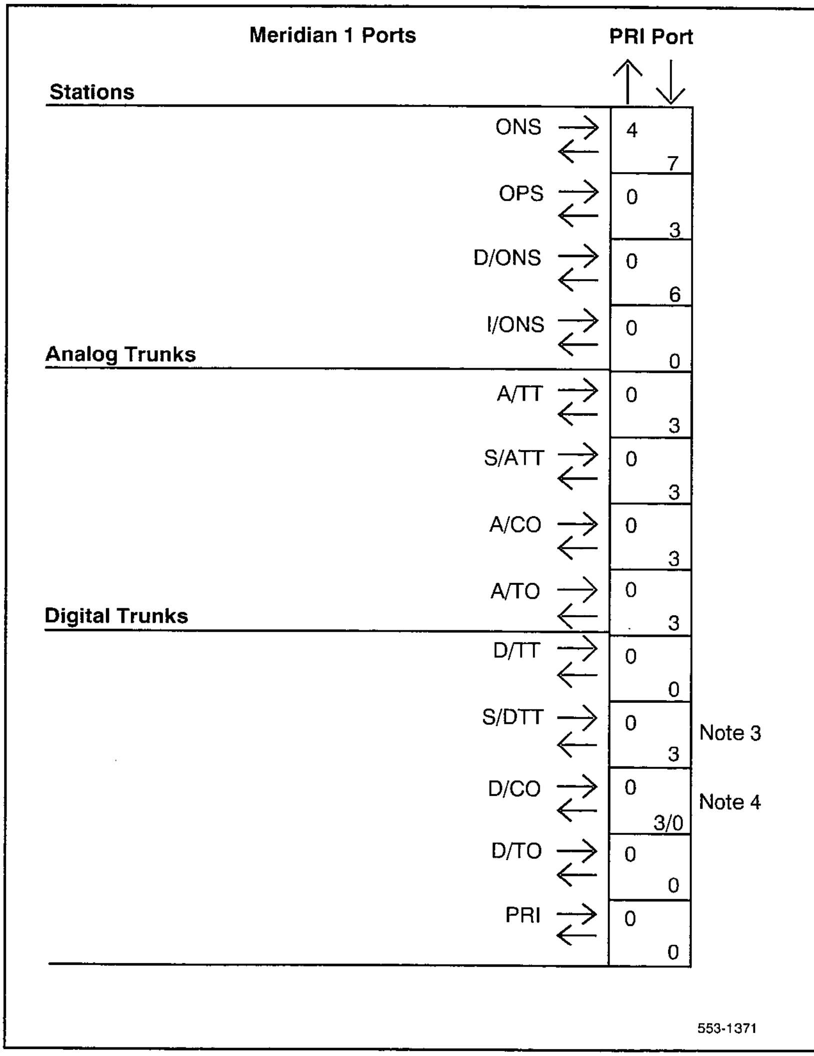
  Note: ISDN meets the Radio Frequency Interference (RFI) requirements.

Loss and level plan

The loss plan for PRI has been added to the existing Meridian 1 loss matrix (the EIA loss plan).

Figure 7-1 shows the connections on a port-to-port basis and the corresponding loss values (in dB) for both directions of transmission.

Figure 7-1
PRI loss and level plan



Note 1: The loss is bidirectional. For example, the A/TT coordinate indicates a nominal port-o-port loss of:
0 dB from the A/TT interface to the Primary Rate Interface (PRI)
3 dB loss from the Primary Rate Interface (PRI) to the A/TT interface

Note 2: The table column is shown; the loss table has a corresponding row.

Note 3: For echo control reasons, this connection cannot be loss-less.

Note 4: The value of 0 dB in the PRI-D/CO direction is the long-term objective. The value of 3 dB is to be used for connections to D/COs which have not been programmed for inserting receive-side loss on PRI to local loop connections.

Legend:

ONS	Line interface/on premise line
OPS	Line interface/off premise line
D/ONS	Digital line interface/on premise line
I/ONS	ISDN terminal (on premise)
A/TT	Analog trunk interface/analog TIE trunk
S/ATT	Analog trunk interface/analog satellite PBX TIE trunk
A/CO	Analog trunk interface/analog CO trunk
A/TO	Analog trunk interface/analog toll office trunk
D/TT	Digital Trunk Interface/digital or combination TIE trunk
S/DTT	Digital Trunk Interface/digital satellite PBX TIE trunk
D/CO	Digital Trunk Interface/digital or combination CO trunk
D/TO	Digital Trunk Interface/digital or combination toll office trunk
PRI	Primary Rate Interface

Software packages

The following tables list the software features and their corresponding packages. All Meridian 1 systems require disk drives to run ISDN software. Refer to the following notes.

To upgrade current ISDN software, see *Software conversion procedures* (553-2001-320).

Package 19 is required for receiving CLID or NCPND.

Package 75, PBX interface, is not required for ISL (Package 147), unless ISL is over DTI. For ISL over analog trunks, ESN # 2 or 3 signaling is required. ESN # 5 signaling can be used if package 75 is installed.

The QPC720B PRI card is needed instead of the QPC472 DTI card, with X11 release 17 and later.

CDP (package 59) requires packages 28 and 61.
Packages 28 and 61 are not required for NARS (package 58).

If the user dials a Location code, package 58 must be equipped at the originating and the receiving Meridian 1. If CDP is used, package 59 needs to be equipped at both sites.

Package 117 is also required in ISA configurations.

Multi-purpose Serial Data Link (MSDL) cards (NT6D80) require package 222 for D-Channel (and Application Module Link) operations.

Table 7-1
Software packages (Part 1 of 2)

Features	Package dependencies
64 Kbps Clear Data Transport	75, 145, 146
Backup D-channel	75, 145, 146 or 147
Basic Call Service	75, 145, 146 or 147
Calling Line Identification (CLID)	19, 75, 145, 146 or 147
CLID in CDR record	4, 5, or 6, 118, 75, 145, 146 or 147
Data Packet Network (DPN) access	75, 145, 146
DTI Backwards Compatibility	75
DTI with Extended Superframe (ESF)	75, 145, 146
ESN or ISL over Primary Rate Interface	14, 32, 37, 39, 58 or 59, 75, 145, 146
Integrated Services Access (ISA)	75, 117, 145, 146
Integrated Trunk Access (ITA)	75, 145, 146
ISDN Signaling Link (ISL)	75, 145, 147
Local trunk queuing over PRI/ISL (off-hook or call back queuing)	14, 28, 32, 37, 58 or 59, 62, 75, 145, 146 or 147
Multi-purpose Serial Data Link (MSDL)	222
NCOS over ISDN Signaling Link (ISL)	14, 32, 37, 39, 58 or 59, 75, 145, 147
NCOS over Primary Rate Interface to DMS-100	14, 32, 37, 39, 58 or 59, 75, 145, 146
Network Call Forwarding	14, 32, 58 or 59, 75, 145, 146 or 147
Network Call Party Name Display (NCPND)	19, 75, 95, 145, 146 or 147
Network Call Redirection (NCRD)	145, either 146 or 147
Network Message Services (NMS)	14, 32, 58 or 59, 75, 77, 145, 146 or 147, 148, 175
Network Ring Again (NRAG)	14, 32, 37, 58 or 59, 75, 145, 146 or 147,148

Table 7-1
Software packages (Part 2 of 2)

Features	Package dependencies
Non-Associated Signaling (nB +D)	75, 145, 146, or 147
PRI to DMS-250 or AT&T 4ESS	75, 145, 146, 149
Private Network Hopoff and Overflow	14, 28, 32, 58 or 59, 61, 75, 145, 146 or 147
Remote Virtual Queueing	192
T-1 Frame Slippage Auto-recovery	75, 145, 146
Trunk Optimization (TRO)	145, 146 or 147, 148

Software and hardware compatibility

The different configurations within an ISDN environment are supported by different sets of features and services. As ISDN evolves, more and varied configurations are supported. These different configurations have their own software and hardware dependencies, as listed in the following tables.

The tables in this chapter describe the following configurations:

- Meridian 1 software and hardware compatibility
- Meridian 1 connectivity to SL-100, DMS-100, and DMS-250, with software and hardware compatibility
- Meridian 1 connectivity to AT&T 4ESS and 5ESS software and hardware compatibility

Features in progressive releases of X11 software are compared with the hardware introduced per release – different versions of the QPC720 and the QPC757 cards. Remember that features are limited to the lowest software release supporting a particular feature.

For example, a Meridian 1 with QPC757A supports software up to X11 release 13 only. A node with QPC757C can support software up to X11 release 15 – and calls between these two nodes are only supported by the lowest software version, X11 release 13. Therefore, all nodes in the same network should support the same hardware and software.

> *Note:* QPC720C is introduced in X11 release 17. It is required for high speed data calls (56K) between a Meridian 1 with a QPC472 using DTI to a DMS-100 using PRI to a Meridian 1 with a QPC720.

Conventions within the following tables are:

- LF = Limited Functionality (the two items do interact, but call functions are somewhat limited compared to a different configuration)
- N = No, or "Not supported"
- NA = Not Applicable, or it does not apply to this configuration
- NR = Not Recommended for this configuration
- R = X11 release number
- Y = Yes, it is supported

Table 7-2
Meridian 1 software and hardware compatibility (Part 1 of 2)

Features	R14	R15	R16	R17	R18	R19	720A	720B	720C	757A	757B	757C	757D	757E	MSDL
Backup D-channel	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Basic Call Service	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Calling Line ID	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CLID in CDR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
DCH Error Report and Monitoring	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
DTI, ESF, CRC	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	NA	NA	NA	NA	NA
DTI Compatibility	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	NA	NA	NA	NA	NA
ESN over PRI	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ISL	Y	Y	Y	Y	Y	Y	Y	Y	Y	NR	NR	NR	Y	Y	Y
ISL (Conventional)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	N	Y	Y	Y
ITA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NACD	N	Y	Y	Y	Y	Y	N	Y	Y	N	N	N	Y	Y	Y
n B + D	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NCPND	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NND	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
NCRD	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— NCFAC	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
— NCFB	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
— NCFNA	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
— NHNT	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
— NXFER	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y

Table 7-2
Meridian 1 software and hardware compatibility (Part 2 of 2)

Features	R14	R15	R16	R17	R18	R19	720A	720B	720C	757A	757B	757C	757D	757E	MSDL
Network Call Trace	N	N	N	Y	Y	Y	N	Y	Y	N	N	N	N	Y	Y
B8ZS	N	N	N	N	N	Y	Y	Y	Y						
NMS-MC	N	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
NMS-MM	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
NRAG (no 500/2500)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
NRAG (All phones)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
64 K Clear Data	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Remote Virtual Queueing	N	N	N	N	Y	Y	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRO	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
T1 Frame Slip Auto-recovery	Y	Y	Y	Y	Y	Y	N	Y	Y	NA	NA	NA	NA	NA	NA
T309 Timer	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 7-3
Meridian 1 compatibility with connectivity to SL-100, DMS-100, DMS-250 (Part 1 of 2)

Features	R14	R15	R16	R17	R18	R19	720A	720B	720C	757A	757B	757C	757D	757E	MSDL
Backup D-channel	N	N	N	Y	Y	Y	N	Y	Y	N	N	N	Y	Y	Y
Basic Call Service	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Call-By-Call Service	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CLID (Calling Line ID)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
CLID in CDR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
DPN access	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
DTI + ESF, CRC	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	NA	NA	NA	NA	NA
DTI Compatibility	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	NA	NA	NA	NA	NA
ESN over PRI	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NCRD	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
— NCFAC **	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
— NCFB ***	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
— NCFNA **	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
— NHNT ***	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
— NXFER ***	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
NND ****	N	N	N	Y	Y	Y	N	Y	Y	N	N	N	N	Y	Y
NRAG (TIE)	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
Private Network Hopoff	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Private Network Overflow	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 7-3
Meridian 1 compatibility with connectivity to SL-100, DMS-100, DMS-250 (Part 2 of 2)

Features	R14	R15	R16	R17	R18	R19	720A	720B	720C	757A	757B	757C	757D	757E	MSDL
64 K Clear Data	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y
Remote Virtual Queueing	—	—	—	—	n	Y	—	—	—	NA	NA	NA	NA	NA	NA
T1 Frame Slippage, Auto-recovery	N	Y	Y	Y	Y	Y	N	Y	Y	NA	NA	NA	NA	NA	NA
B8ZS	N	N	N	N'	N	Y	NA	NA	NA						

**These features are supported with X11 release 14 and later.

***These features are supported with X11 release 16 and later.

****These features are supported with X11 release 17 and later.

Table 7-4
Meridian 1 compatibility with connectivity to AT&T 4ESS

Features	R14	R15	R16	R17	R18	R19	720A	720B	720C	757A	757B	757C	757D	757E	MSDL
ANI in CDR	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
ANI Station ID	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Backup D-channel	N	N	N	Y	Y	Y	N	Y	Y	N	N	N	Y	Y	Y
Basic Call Service	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
ISA (Call-By-Call Service)	N	N	Y	Y	Y	Y	N	Y	Y	N	N	N	Y	Y	Y
DTI + ESF, and B8ZS and CRC	Y	Y	Y	Y	Y	Y	N	Y	Y	NA	NA	NA	NA	NA	NA
n B + D	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y

Table 7-5
Meridian 1 software and hardware compatibility with connectivity to AT&T 5ESS

Features	R14	R15	R16	R17	R18	R19	720A	720B	720C	757A	757B	757C	757D	757E	MSDL
ANI/Station Identification (CLID)	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y
ISA (Call by Call Service)	N	N	N	Y	Y	Y	N	Y	Y	N	N	N	Y	Y	Y
Basic Call Service	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 7-6
Meridian 1 software and hardware compatibility

Services	**R13**	**R14**	**R15**	**R16**	**R17**	**R18**	**R19**	**720A**	**720B**	**720C**	**757A**	**757B**	**757C**	**757D**	**757E**	**MSDL**
Release 13	Y	LF	LF	LF	LF	LF	LF	Y	Y	Y	Y	LF	LF	LF	LF	N
Release 14	LF	Y	LF	LF	LF	LF	LF	NR	Y	Y	N	LF	Y	Y	Y	N
Release 15	LF	LF	Y	LF	LF	LF	LF	N	Y	Y	N	N	Y	Y	Y	N
Release 16	LF	LF	LF	Y	LF	LF	LF	N	Y	Y	N	N	LF	Y	Y	N
Release 17	LF	LF	LF	LF	Y	LF	LF	N	Y	Y	N	N	N	LF	Y	N
Release 18	LF	LF	LF	LF	LF	Y	LF	N	N	Y	N	N	N	N	Y	Y
Release 19	LF	LF	LF	LF	LF	LF	Y	N	N	Y	N	N	N	N	Y	Y
QPC720A	Y	NR	N	N	N	N	N	Y	LF	LF	Y	Y	LF	LF	LF	N
QPC720B	Y	Y	Y	Y	Y	N	N	LF	Y	LF	N	LF	Y	Y	Y	N
QPC720C	Y	Y	Y	Y	Y	Y	Y	LF	LF	Y	N	LF	Y	Y	Y	Y
QPC757A	Y	N	N	N	N	N	N	Y	N	N	Y	LF	LF	LF	LF	LF
QPC757B	LF	LF	N	N	N	N	N	Y	LF	LF	LF	Y	LF	LF	LF	LF
QPC757C	LF	Y	Y	LF	N	N	N	LF	Y	Y	LF	LF	Y	LF	LF	N
QPC757D	LF	Y	Y	Y	LF	N	N	LF	Y	Y	LF	LF	LF	Y	LF	Y
QPC757E	LF	Y	Y	Y	Y	Y	Y	LF	Y	Y	LF	LF	LF	LF	Y	Y
NT6D80 (MSDL)	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	Y	Y	Y

Y=Yes (supported); N=Not supported; NR=Not recommended; LF=Limited functionality (items interact, but call functions are comparatively limited)

Meridian 1 connectivity

Refer to *ISDN Primary Rate Interface installation* (553-2901-200) for complete instructions on hardware configuration. X11 release 17 and later software supports ISDN signaling between Meridian 1 and the following products:

- Meridian 1
- SL-100
- DMS-100 and DMS-250
- AT&T 4ESS
- AT&T 5ESS

General networking capabilities available with X11 release 17 General ISDN features available in X11 release 17 are listed below.

- Basic Call Service
- Calling Line Identification
- Calling Line Identification in Call Detail Recording (CDR) Record
- DTI Backwards Compatibility
- Trunk Route Optimization (before answer)

General networking capabilities available with X11 release 18 General ISDN features available in X11 release 18 are listed below.

- Remote Virtual Queueing

Hardware requirements

As shown by Figure 7-2, Table 7-7, and Table 7-8, the following hardware is required for ISDN.

– QPC720B Primary Rate Interface card(s), and for 64K data transmission between Meridian 1 and DMS-100

– QPC757C, or NT6D11AB D-channel Interface (one per 16 PRIs)

OR

– NT6D80AA Multi-purpose Serial Data Link (MSDL) supported on X11 release 18 and later

– QPC471 (vintage B or higher is recommended) or QPC775 Clock Controller (one per CPU)

– QPC471 vintage H or later is required for option 81 systems

– QPC414B Network Card (one loop per PRI)

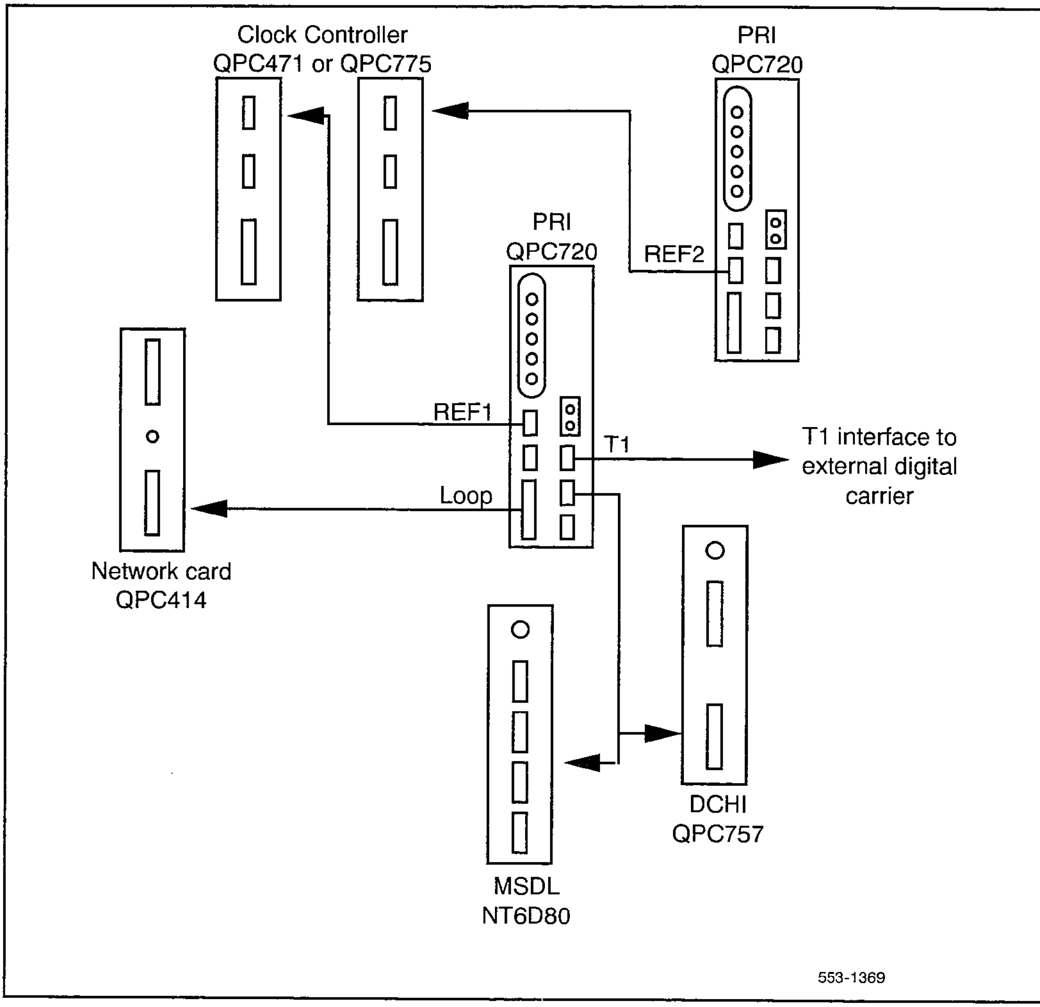
Note 1: For PRI, the QPC720B, QPC757C (or NT6D80), and QPC471 (or QPC775) cards are all required. For every destination, an independent D-channel is also needed, one for every 16 PRIs to the same destination.

QPC720C is introduced in X11 release 17. It is required for high speed data calls (56K) between a Meridian 1 with a QPC472 using DTI to a DMS-100 using PRI to a Meridian 1 with a QPC720.

Note 2: The QPC471 and QPC775 Clock Controller cards cannot be intermixed in one system.

Note 3: For every destination, an individual D-channel is required.

Figure 7-2
PRI hardware required



- Channel Service Unit (CSU): U.S.A. regulations (FCC Part 68), require Network Channel Terminating Equipment (NCTE) at the demarcation point to registered common carrier trunks. Use Digilink, Verilink or similar CSUs (one per PRI).
- Echo Canceller: for voice calls over satellite transmission, use a Tellabs 24-Channel Echo Canceller or the equivalent.
- Packet Assembler/Disassembler (PAD): for DPN capability, an X.25 Meridian 1 compatible PAD is required.
- Test Equipment: use a Thor Error Counter, or the equivalent, to test bipolar violations on PRI circuits.
- 2400-baud Modem with auto dial capability: may be used for ISL in dedicated mode. The recommended modem is the Hayes Smartmodem 2400. See *ISDN Primary Rate Interface installation* (553-2901-200) for information about how to configure the Hayes Smartmodem 2400.
- QMT11 Asynchronous/Synchronous Interface Module (ASIM) may be used for ISL in dedicated mode. This module has leased line capability.
- QMT21 High Speed Data Module (HSDM) must be used for 64K clear transmission (available between Meridian 1 systems). This also applies to the DMS-250 and the SL-100 using their data units.
- QPC237 4W TIE E&M Trunk may be used to support ISL uniform trunk hardware configuration.

Tables 7-7 and 7-8 shows current system hardware requirements.

Table 7-7
System hardware requirements with a Single D-Channel

System parameters	QPC757	NT6D11AB	
		Single port	Dual port
Maximum cards	8	15	8
Maximum DCHI	8	15	8
Maximum Asynch ports	8	15	8
Maximum PRI channels to each destination, by each D-channel port	23 with 1 PRI 47 with 2 PRI . . . 359 with 15 PRI	23 with 1 PRI 47 with 2 PRI . . . 359 with 15 PRI	23 with 1 PRI 47 with 2 PRI . . . 359 with 15 PRI
Maximum B-channels	2872	5385	2872

Table 7-8
System hardware requirements with a Backup D-Channel

System parameters	QPC757	NT6D11AB	
		Single port	Dual port
Maximum cards	8	15	8
Maximum DCHI	8	15	8
Maximum Asynch ports	8	15	8
Maximum PRI channels to each destination, by each D-channel port	23 with 1 PRI 47 with 2 PRI . . . 382 with 16 PRI	23 with 1 PRI 47 with 2 PRI . . . 382 with 16 PRI	23 with 1 PRI 47 with 2 PRI . . . 382 with 16 PRI
Maximum B-channels	1528	2674	1528

ROM requirements

Table 7-9 shows current ROM and Memory card requirements.

Table 7-9
ROM and Memory card requirements

X11 release	Card type	ST, 21	STE and 21E	RT	NT, 51, 61	XT, 71	81
14	Memory	QPC673 or QPC814	N/A	QPC583	QPC583	QPC583	N/A
	ROM	QPC717D or QPC937	N/A	QPC602	QPC602	QPC602	N/A
15/16/17	Memory	QPC814	N/A	QPC583A	QPC583	QPC583	N/A
	ROM	QPC940	N/A	QPC939A	QPC939	QPC939	N/A
18	Memory	N/A	NTND01	NTND09	NTND09	NTND09	Note
	ROM	N/A	NTND31	NTND08	NTND08	NTND08	Note

Note: ROM and memory requirements for the option 81, X11 release 18 and later, are fulfilled with the NT6D66 Call Processor (CP) card.

Cable information

The following lists contain cable and channel information. The cable type used is a 2-pair twisted wire.

Capacity per D-channel (with Backup D-channel):

- up to 382 B-channels with 16 PRIs:

  64 Kbps clear
  64 Kbps restricted
  56 Kbps unrestricted

- 2 D-channel:

  D-channel signaling
  D-channel backup

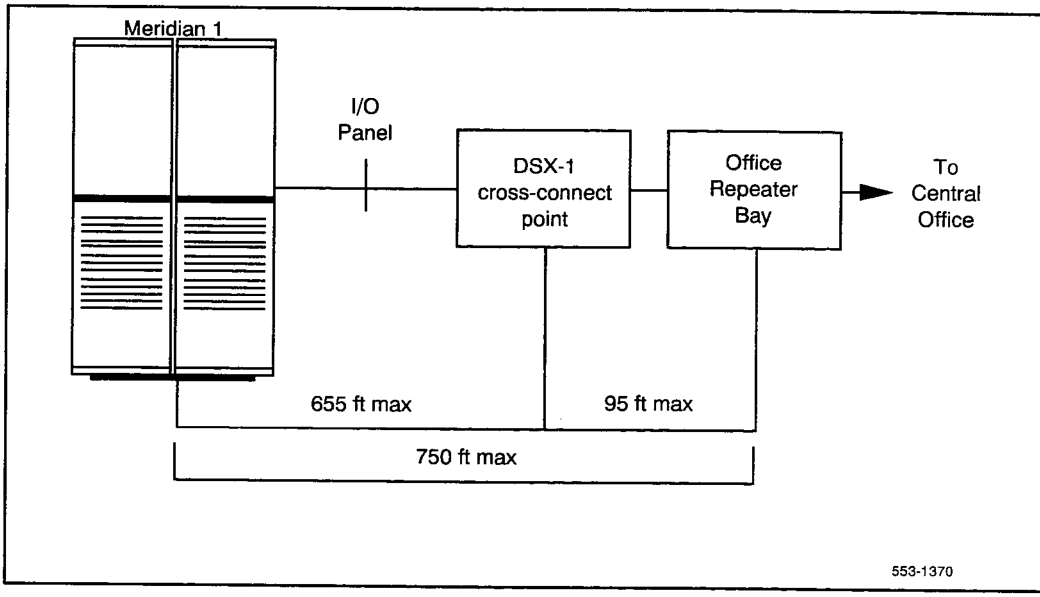
- Maximum of 8 D-channels per system with the QPC757
- Maximum of 16 D-channels per system with the NT6D11AB

Cable distance (see Figure 7-3)

- 655 ft (200 M) Meridian 1 to DSX-1 cross-connect point (using ARAM or ABAM equivalent shielded cable)
- 750 ft (229 M) from Meridian 1 to Office Repeater Bay

Specific cables are detailed in *ISDN Primary Rate Interface installation* (553-2901-200).

Figure 7-3
Cable distance to DSX-1 and office repeater bay



Backup D-channel

A second D-channel can be added to a Primary Rate Interface (PRI) link to provide a backup as shown in Figure 8-1. When the active D-channel goes down, two things automatically occur: the standby D-channel is brought into the In-service (active) state and the auto-recovery on the failed D-channel starts.

The backup D-channel is installed and configured the same way as the primary D-channel. See *ISDN Primary Rate Interface installation* (553-2901-200) for installation procedures.

In X11 releases 14 through 16, the backup D-channel supports Meridian 1 to Meridian 1 connectivity only. With X11 release 17 software, the backup D-channel provides connections from Meridian 1 to the following systems:

- Meridian 1
- SL-100
- DMS-100 (BCS32 and later)
- DMS-250 (BCS 32 and later)
- AT&T 4ESS

In X11 release 17, the backup D-channel conforms to the Meridian Customer Defined Networking (MCDN) protocol and AT&T's TR41449 and TR41459.

Backup D-channel capacity per PRI link

The maximum number of network loops per PRI link is 16. With 24 channels per loop, 16 network loops provide a maximum of 382 B-channels ((16 X 24) - 2) and 2 D-channels per PRI link. Using the maximum number of 16 network loops requires the ISDN backup D-channel functionality. With 15 or fewer network loops, the backup D-channel is not required but it is recommended. Without a backup D-channel, 15 network loops provide a maximum of 359 B-channels ((15 X 24) -1) and 1 D-channel.

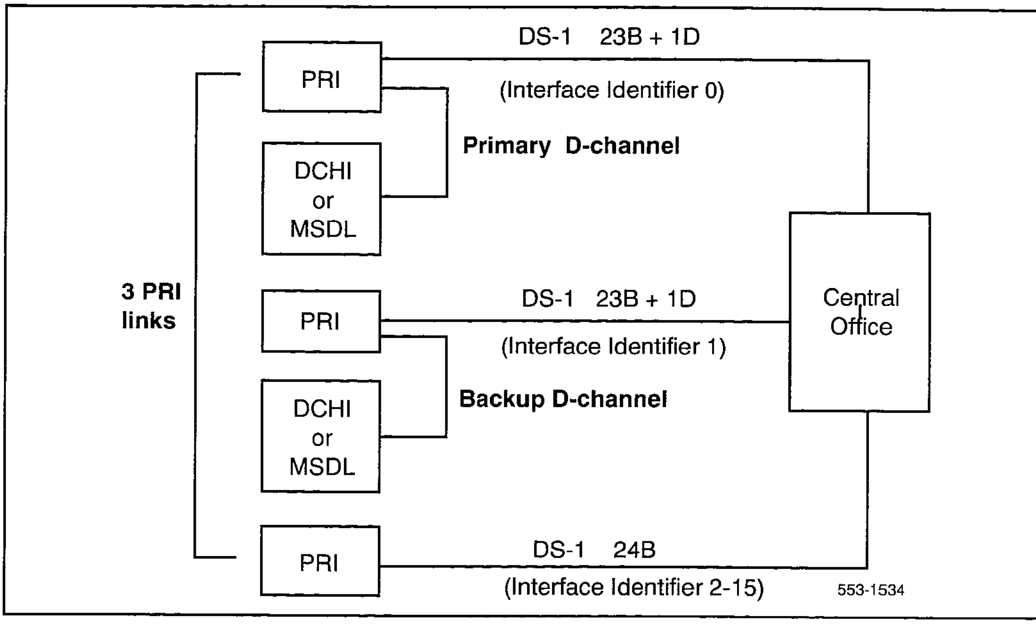
Total backup D-channel capacity

With X11 release 17 and earlier, a maximum of eight D-channels is allowed per system with the QPC757, a total of four active D-channels per system and four backup D-channels is available. This allows 4 PRI links per system, or 4 X 382 = 1528 B-channels. With the NT6D11AB, you can have up to 16 D-channels in your system. Eight can be used as primary, and eight as the back up D-channels. You can have eight PRI links per system (when all have a back up D-channel). You can, therefore, have 8 x 382 = 3056 B-channels.

X11 release 18 supports up to 64 D-channels with the MSDL card, providing a maximum of 32 active D-channels and 32 backup D-channels. This capacity allows for a great deal of system flexibility since some D-channels may require backup D-channels and others do not due to customer traffic configurations.

> *Note:* With X11 release 18 and later, primary and backup D-channels must be the same card type.

Figure 8-1
PRI with backup D-channel



Operating parameters

The active D-channel is responsible for call processing signaling for all B-channels in the route.

The backup D-channel does not perform any call processing signaling until it is active. Load sharing between the two D-channels is not allowed.

A switchover from the active D-channel to the backup D-channel is allowed only when the active D-channel goes down or is disabled.

Channel 24 of the first PRI loop is reserved for the primary D-channel. Channel 24 of the second PRI loop is reserved for the backup D-channel, if provisioned. The assignment of the primary and secondary D-channels must match at both ends to ensure that they try to bring up the primary D-channel first at start-up.

During the switchover from the active D-channel to the standby, call control messages received by the D-channel before it becomes active are ignored. Therefore, the calls which are in a transient state are not guaranteed completion. Established calls remain in active state. Some portion of the established calls, for example, message associated user-to-user information element, may be lost.

With a Meridian 1 to Meridian 1 interface, the active D-channel switches to the standby D-channel when a Service message is received in either of the following formats:

- the MCDN format
- the X11 release 13 format, even though it does not have the Channel Identification Information Element

With X11 release 16 and later, the backup D-channel attempts to bring the primary D-channel to the In-service state first during the start-up period. If the backup D-channel is established first, the X11 release 17 backup D-channel sends a Service message and enters into the WAIT state. During this time, if the primary D-channel is established, the primary D-channel of the X11 release 17 sends a Service message and it enters the WAIT state. The backup D-channel enters the Maintenance Busy state where it does not process or receive any messages. Thus, only the primary D-channel can receive the Service ACK message to become the active D-channel first. The backup D-channel is established as the standby D-channel afterwards.

Feature interactions

Timer 309—Timer 309 specifies a 90-second wait interval after a failure of Layer 2 before the active calls are removed from service. For Meridian 1 to Meridian 1, active calls remain whether the D-channel goes down or not. If the T309 expires for both the primary D-channel and the backup D-channel, active calls are terminated on the SL-100, DMS-100, DMS-250, and AT&T 4ESS interfaces.

Integrated Services Access—Integrated Services Access (ISA) in the Meridian 1 manages Call-by-Call service selection (CBC). After the switchover, transient calls might be lost, but the integrity of the minimum and maximum counters for each service route is maintained in the ISA.

D-channel establishment—Enter the ENL Serv command in LD96 when the associated D-link is not established. After the D-link is established, the Service message for B-channels is exchanged between the near end and the far end switch. This is recommended for all CO interfaces.

D-channel sanity polling—For the Meridian 1 interface only, if the active D-channel has been idle for 30 seconds, a Service message for the D-channel is sent to the far end to poll the sanity of the D-channel. If the far end does not return Service Ack message, the near end tears down this D-channel and switches to the backup D-channel. It then reestablishes the torn down D-channel. This function is invoked by using the ENL SERV command in LD96. If there is a mismatch of the active and backup D-channel at the two ends of the PRI, this function can be turned on to synchronize the D-channel state.

Note: Both the D-channel establishment and the D-channel sanity polling are addressed in LD96. Enable the SERV command only when both D-channels are not established. Regardless of the IFC, the SERV option should always be enabled.

Feature operation

The switchover from the primary D-channel to the backup D-channel is initiated when the backup D-channel receives either Release indication or Release confirmation from the active D-channel. A Service message is sent on the standby D-channel and the T321 timer (40 seconds) starts running. During this time, the system only processes Service messages and Service Ack messages, ignoring call control messages (for example, Restart message or Status Enquiry message).

If the far end responds with a Service Ack message on the backup D-channel, then the backup D-channel becomes the active D-channel. If the T321 timer expires, the system tries to bring the inactive D-channel into the In-service state.

Automatic switchover occurs in the following situations:

- The PRI loop of the active D-channel issues a red alarm or yellow alarm.
- The D-channel Interface card of the active D-channel fails, is unplugged, or is hardware disabled.
- The cable connection between the QPC720 and the QPC757 of the active D-channel is disconnected.

Manual switchover involves issuing the DIS or RST DCH commands in LD96 to the active D-channel. When this is done, the Primary Rate Interface (PRI) establishes the backup D-channel as the active D-channel.

When one D-channel is in the In-service state and the other D-channel is in the standby state, the active D-channel carries all call control messages. The standby D-channel ignores all messages other than Service and the Service Ack messages for the D-channel.

When using the QPC757 DCHI card, disable the backup D-channel software before disabling its hardware. This ensures that the QPC757 is in the reset condition before restoring it as the backup D-channel.

For Meridian 1 to Meridian 1 interfaces, RCVP can be set to YES or NO in LD17 as long as the near and the far ends match. When interfacing to anything other than a Meridian 1, set RCVP = NO in LD17.

Feature packaging

Backup D-channel is included in basic ISDN PRI/ISL functionality. No additional packages are required.

Feature implementation

Basic PRI or ISL administration must be performed before the backup D-channel is defined. The PRI loop must already be defined in LD17.

Procedure 8-1
Use LD17 to configure the backup D-channel (X11 release 17 and earlier)

Prompt	Response	Description
REQ	CHG	Change configuration record
TYPE	CFN	Configuration record
PWD2	xxxx	Password
ISDN	YES	Change ISDN options
DCHI	1-15	Primary D-channel port number
BCHI	1-15	Backup D-channel port number
USR	PRA, ISLD, SHA	D-channel mode PRA = D-channel for ISDN PRI only ISLD = D-channel for ISL only, in dedicated mode, without using the PRI channel SHA = Shared mode. D-channel used for both ISDN PRI and ISL. One of the above responses is required. There is no default.
RCVP	YES, (NO)	Recover to primary D-channel. When RCVP = YES, the primary D-channel is automatically forced to be the active channel after it is brought up from a released state. Both sides must be either YES or NO. If the two sides do not match, both sides default to NO. This prompt applies to Meridian 1 interfaces only. When IFC = D100, D250, SL100 or ESS4, set the RCVP prompt to NO.
DCHL	0-159	PRI loop number for primary D-channel
BCHL	0-159	PRI loop number for backup D-channel
RLS	xx	Release ID for D-channel. This is the current software release of the far end (X11 or BCS). If the far end has an incompatible release of the software, it prevents the sending of application messages. Refer to X11 input/output guide (553-3001-400) for compatible releases.

Table 8-1
Use LD17 to configure the backup D-channel (X11 release 18 and later)

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW BDCH 0-63	Add a backup D-channel (also CHG, MOV, and OUT BDCH)
PDCH	0-63	Primary D-channel
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
USR	PRI, ISLD, SHA	D-channel mode
_ISLM	1-382	Number of ISL trunks controlled by the D-Channel
DCHL	0, 2, 4,...159	PRI loop number for DCHI
OTBF	1-(32)-127	Number of output request buffers
_BPS	xxxx	Baud rate for ISL D-channel on MSDL port (default 64000)
_PARM	R232,(R422) DCE, (DTE)	ISL D-channel interface and transmission mode (MSDL port only)
BCHL	0,2,4...,-159	PRI loop number for back-up D-channel
RCVP	Yes, (No)	Auto-recovery to primary D-channel option
ADAN	<cr>,****	Go on to next prompt or exit overlay

Issued:	91 12 01
Status:	Standard
X11 Release:	14

Basic Call Service

Basic Call Service permits the transmission of the ISDN call. Basic Call Service consists of call progress signaling and voice and data transmission. Basic Call Service is supported for the following switch configurations:

— Meridian 1 to Meridian 1

— Meridian 1 to SL-100

— Meridian 1 to DMS-100

— Meridian 1 to DMS-250

— Meridian 1 to AT&T 4ESS

— Meridian 1 to AT&T 5ESS

See Figure 9-1 for an example of these configurations.

Call progress signaling PRI supports 56 and 64 Kbps out-of-band signaling (on the D-channel) for:

— call setup

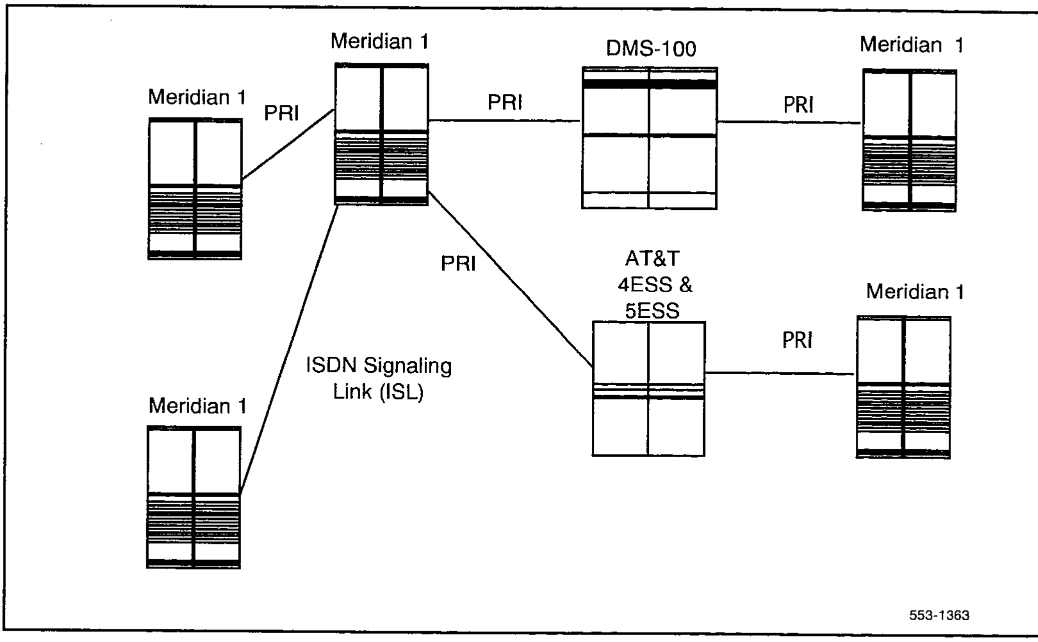
— call tear down

— feature activation

— local busy and reorder (overflow supplied locally)

Messages to generate tones are transmitted on the D-channel. Both out-of-band messages and in-band tones are provided for ringback.

Figure 9-1
ISDN Basic Call Service connections



Voice and data transmission High speed voice and data are transmitted on the B-channel and assigned on a per call basis. The following modes of transport are available:

- 56 Kbps circuit switched data transmission
- 64 Kbps circuit switched voice and data transmission
- 64 Kbps packet data transmission

Numbering plans Three numbering plans are supported:

- Coordinated Dialing Plan (CDP) of 3 to 10 digits
- North American 10-digit numbering plan
- Electronic Switched Network (ESN) 7-digit private numbering plan

Typically, the numbering plan for a customer's private network consists of a 3-digit location code (such as the LOC code) and a 4-digit extension. This allows the same extension to be used for private networks and for Direct Inward Dialing (DID) from the public network.

> *Note:* When using ISDN (without ESN), the caller dials a trunk access code(s) without waiting for a second (or third) dial tone. However, NRAG, NACD, and NMS require dialing plans. They are not supported using Direct Trunk Access.

PSTN Equal Access and Special Number Services

Public Switched Telephone Network (PSTN) Equal Access Service (EAS) allow a customer to select available carriers for long distance telephone service on a call-by-call basis. See Figure 9-2.

Inter-Exchange Carrier (IEC) The IEC access code can be defined for a trunk route which is part of the PRI.

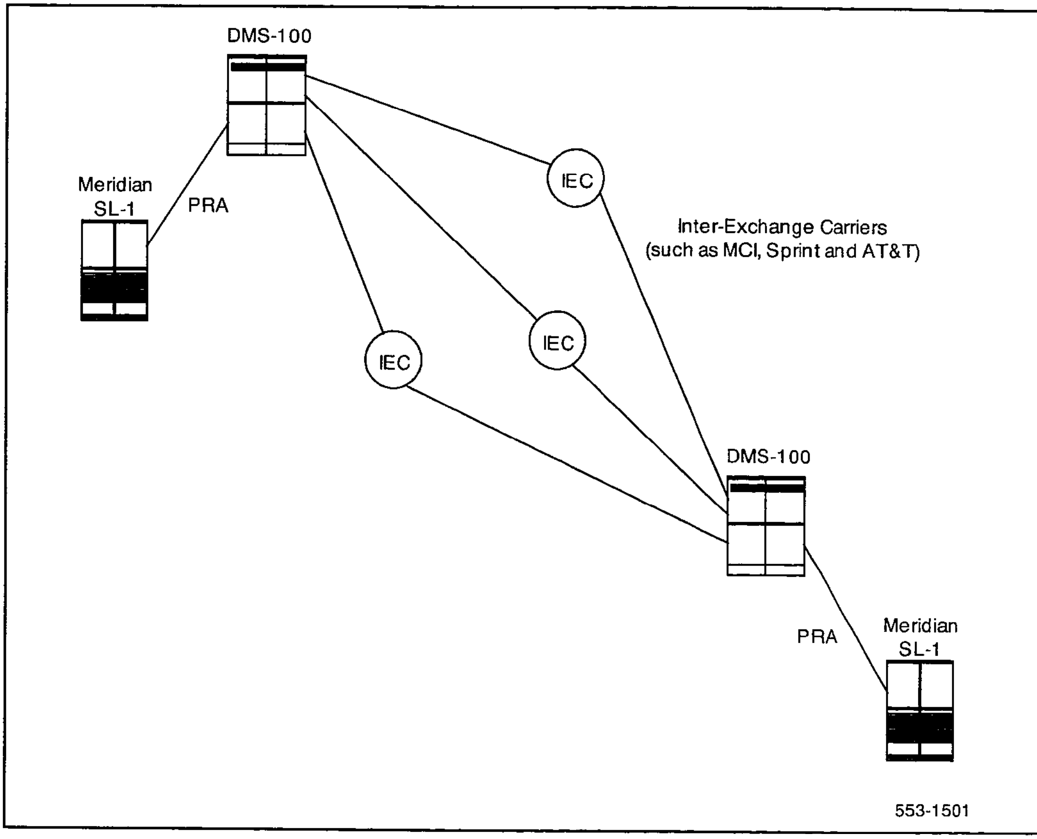
When the IEC is not specified in Meridian 1 software, the DMS-100 examines the Called Party Number and selects an appropriate outbound route.

PSTN Special Number Services These allow access to public network numbers such as:

- 411 for directory assistance
- 911 for emergencies

The user dials a public network access code followed by the special number.

Figure 9-2
Equal Access Service



64K Clear Data

64K Clear Data allows a customer to send 64 Kbps of clear data from the Meridian 1 to the following systems:

- Meridian 1
- SL-100
- DMS-100

64 Kbps of clear data can also pass through the AT&T 4ESS and DMS-250 switch as long as the AT&T tandem switch is transparent. See Figure 9-3 and Table 9-1 for an example of a configuration that permits the flow of 64 Kbps of clear data.

The version IDs of both the originating and the terminating systems must be 2 in order to transmit data at speeds of 64 Kbps through the T-Link version 2 protocol.

Selecting B8ZS line coding method allows the B-channel to transport 64 Kbps of clear data. The selection is made in LD17, the Configuration Record.

On the Meridian 1 side, the 64K clear data can only pass through the QMT21 High Speed Data Module. Therefore, this data module must be connected to each system configured. In addition, 64K Clear Data allows connection to High Speed Data Units (HSDU) through a DMS-100.

64K Clear Data supports ISDN data applications that require a clear 64 Kbps channel, such as communications between two Group IV facsimile machines set for that data rate.

Figure 9-3 shows the connection options for 64K Clear Data.

> *Note:* 64K Clear Data requires a B8ZS compatible facility format from the Telco and T1 B8ZS repeaters.

Figure 9-3
Connection options for 64K Clear Data

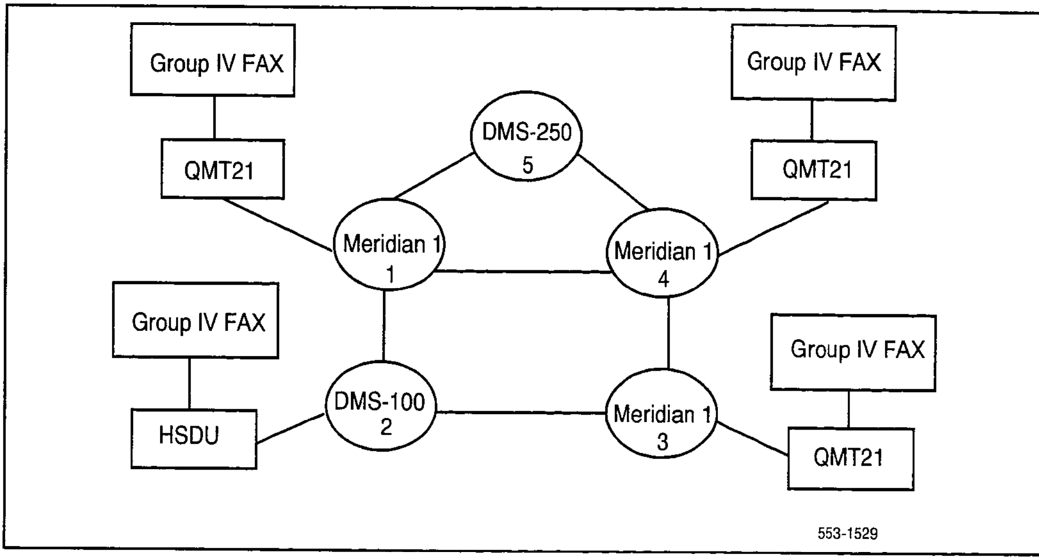


Table 9-1
Connection options for 64K Clear Data

Path	Originating	Terminating	See note below
1-2	1	2	1
1-4	1	4	3
1-2-3	1	3	1
1-4-3	1	3	1
1-5-4	1	4	1,2

Note 1: Requires same release software. X11 release 14 is equivalent to BCS release 29. X11 release 15 is equivalent to BCS release 30. X11 release 16 is equivalent to BCS release 31, and X11 release 17 is equivalent to BCS release 32.

Note 2: This connection only occurs if AT&T tandem switch is transparent.

Note 3: Requires X11 release 13 software or above.

Issued: 93 10 31
Status: Standard
X11 release: 19

BRI/PRI Basic Call Interworking

Overview

BRI/PRI Basic Call Interworking provides data connectivity between ISDN BRI and ISDN PRI. It does the following:

- Allows better high and low level compatibility checking between the calling and terminating equipment
- Supports the V.120 protocol between BRI TEs over PRI
- Supports a greater range of Bearer Capability, which is the network data transmission rate
- Allows end users to support many terminals on the same BRI DSL, such as Group IV fax, data monitor
- Propagates existing IEs with existing encodings over tandem PRIs between BRI TEs

The affected IEs are:

Bearer Capability — BRI and PRI propagate octet 4ab without modification.

Called Party Subaddress — Meridian 1 decodes and saves the called party subaddress when it is received from PRI, passing it to the terminating BRI. The system also sends the subaddress to PRI when the originating BRI or PRI includes it.

Calling Party Subaddress — Meridian 1 decodes and saves the calling party subaddress when it is received fro PRI, passing it to the terminating BRI. The system also sends the subaddress to PRI when the originating BRI or PRI includes it.

Cause — BRI and PRI propagate octet 4 without modification.

High Layer Compatibility — Meridian 1 decodes and saves high layer compatibility information received from PRI and passes it to the terminating BRI. The system also sends the information element, without interpreting it, to PRI after receiving it from the originating BRI or PRI.

Low Layer Compatibility — Meridian 1 decodes and saves low layer compatibility information received from PRI and passes it to the terminating BRI. The system also sends the information element, without interpreting it, to PRI after receiving it from the originating BRI or PRI.

BRI/PRI supports these interfaces:

- Meridian 1 PRI
- Japan D70 PRI
- 4ESS and 5ESS PRI

Operating parameters

New IEs and IEs with new encodings are only supported when the RCAP is configured in overlay 17. Existing IEs and encodings are supported end-to-end regardless of the RCAP value.

A call with new Bearer Capability encodings will only terminate to a BRI terminal. If the terminating terminal is not a BRI terminal, the call is blocked.

Voice calls are successful between BRI and PRI with no restrictions.

Feature interactions

The following feature interactions are unique to BRI/PRI basic data call interworking.

ISDN BRI Data Call— Added IEs (such as LLC and HLC) and the expanded set of supported data values for the Bearer Capability IE enhance BRI's ability to support a variety of circuit switched data calls.

ISDN PRI D-channel Error Reporting and Monitor— The DCH table supports the new IEs in the PRI call messages. The DCH monitor displays the new IEs and a label for monitor level 2.

Incoming Digit Conversion— If an incoming SETUP message with the new Bearer Capability encodings goes through incoming digit conversion, it must be translated to a BRI DN. If the terminating DN is not a BRI DN, the call will be blocked.

Network Alternate Route Selection— If an outgoing call contains a SETUP with a new Bearer Capability encoding, it can only be terminated on PRA/ISL trunks with RCAP configured. This means that at least one entry in the RLB must be PRA/ISL and have the DCH RCAP configured for BRI. NARS will continue to search the RLB until it finds RCAP=BRI. An outgoing call is blocked if RCAP is not configured, or if all trunks with RCAP configured are busy.

Feature packaging

BRI/PRI, as a feature, has no packaging requirements. However, the requirements for ISDN BRI and ISDN PRI must be met.

Feature implementation

Procedure 10-1
Use LD17 to configure far-end BRI support

Prompt	Response	Description
REQ	CHG	Change system data
TYPE	CFN	Configuration record
ADAN	CHG DCH X	
CTYP		
DNUM		
SIDE		
RLS	19	Release ID of the switch at the far end of the D-channel interface is Meridian 1
RCAP	BRI XBRI	Add far-end BRI support Remove far-end BRI support Valid only for IFC=SL1, D70, ESS4, ESS5

Procedure 10-2
Use LD22 to print the configuration record

Prompt	Response	Description
REQ	PRT	Print system data
RCAP	BRI	Far-end BRI support Valid only for IFC=SL1, D70, ESS4, ESS5

Feature operation

This feature operates in the background according to how the BRI TEs are configured and the RCAP value in overlay 17.

Calling Line Identification

Calling Line Identification (CLID) sends a telephone's designated number through the ISDN PRI network to the Digit Display on a receiving device. Both outgoing and incoming calls are supported. See Figures 11-1 and 11-2. The CLID display lasts for the duration of the call.

CLID display is supported over Meridian 1 to the following switches:

- Meridian 1 and SL-100
- DMS-100 and DMS-250
- Meridian 1 tandem through AT&T 4ESS and AT&T 5ESS

The following devices, if equipped with a Digit Display, can receive and display a CLID number:

- Attendant consoles
- Meridian 1 telephones with Digit Display
- Digital telephones (M2317)
- Meridian 1 Touch Sets (M3000)
- Meridian 1 Display telephones
- ASCII terminals with an Add-on Data Module (ADM)
- M2008, M2016S, M2216ACD, M2616 when equipped with displays

Display contents

Display contents are summarized below.

- If the CLID display is unavailable because the call was not routed on ISDN routes for the entire call, the trunk route access code and trunk route member number are displayed.
- For public networks, CLID displays the standard North American Numbering Plan 7 or 10-digit number, depending on the number dialed.
- For a private network over ESN, the CLID displays an "H" followed by an HLOC (Home Location Code) + xxxx, where xxxx = four-digit DN.
- For a private network over CDP, the CLID displays the LSC (Local Steering Code) followed by either:
  - the extension's trailing digits (forming the CDP DN) when CDP is equipped, or
  - the calling telephone's extension

See Figure 11-1 for digit display formats for CLID.

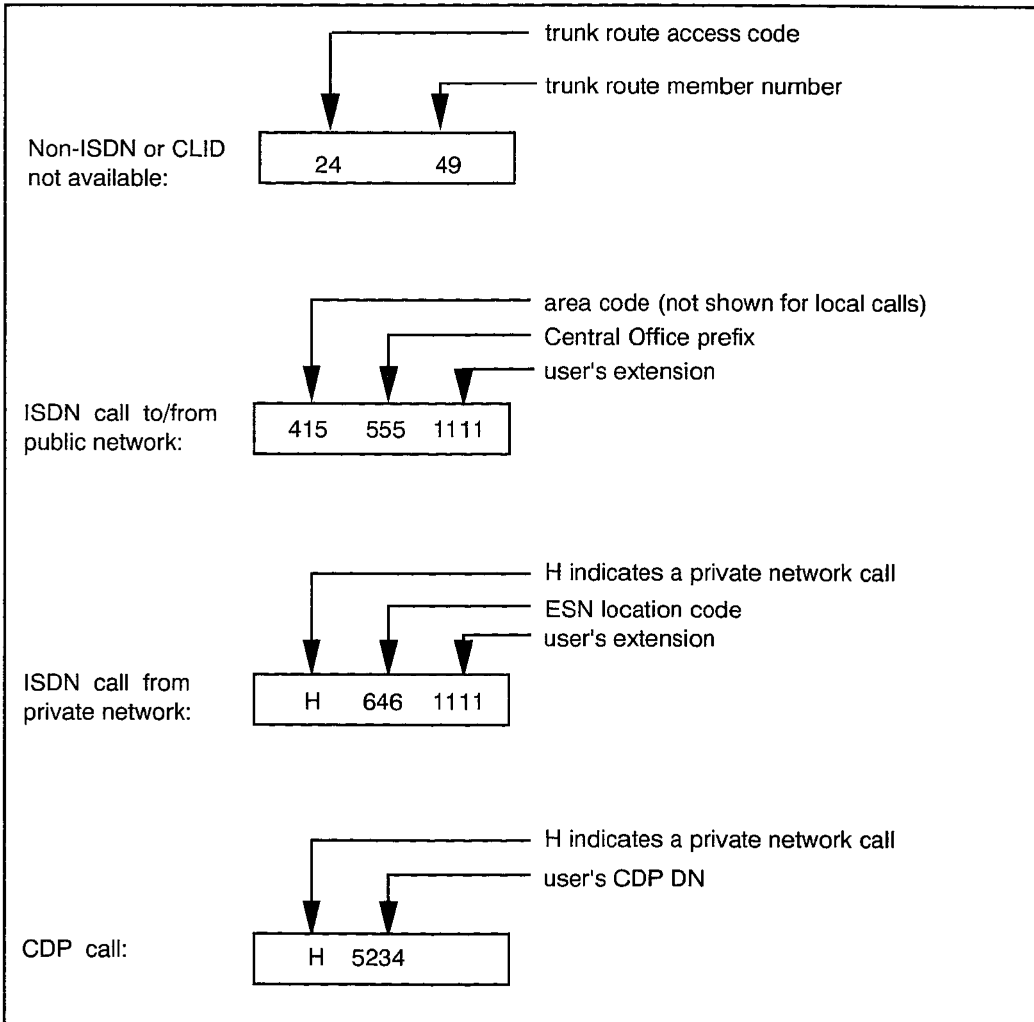
Outgoing calls

A telephone's Prime Directory Number (PDN) is assembled and sent out with the call SETUP message on the D-channel. For private network calls, the calling party number consists of either the Electronic Switched Network (ESN) location code and the DN or the Coordinated Dialing Plan (CDP) DN. For public network calls, it is the standard North American Numbering Plan 7 or 10-digit number.

For private network ESN calls, if the Prime DN is less than 4 digits, zeroes are appended to create a 4 digit DN. If it is more than 4 digits, the last four numbers are used to identify the DN.

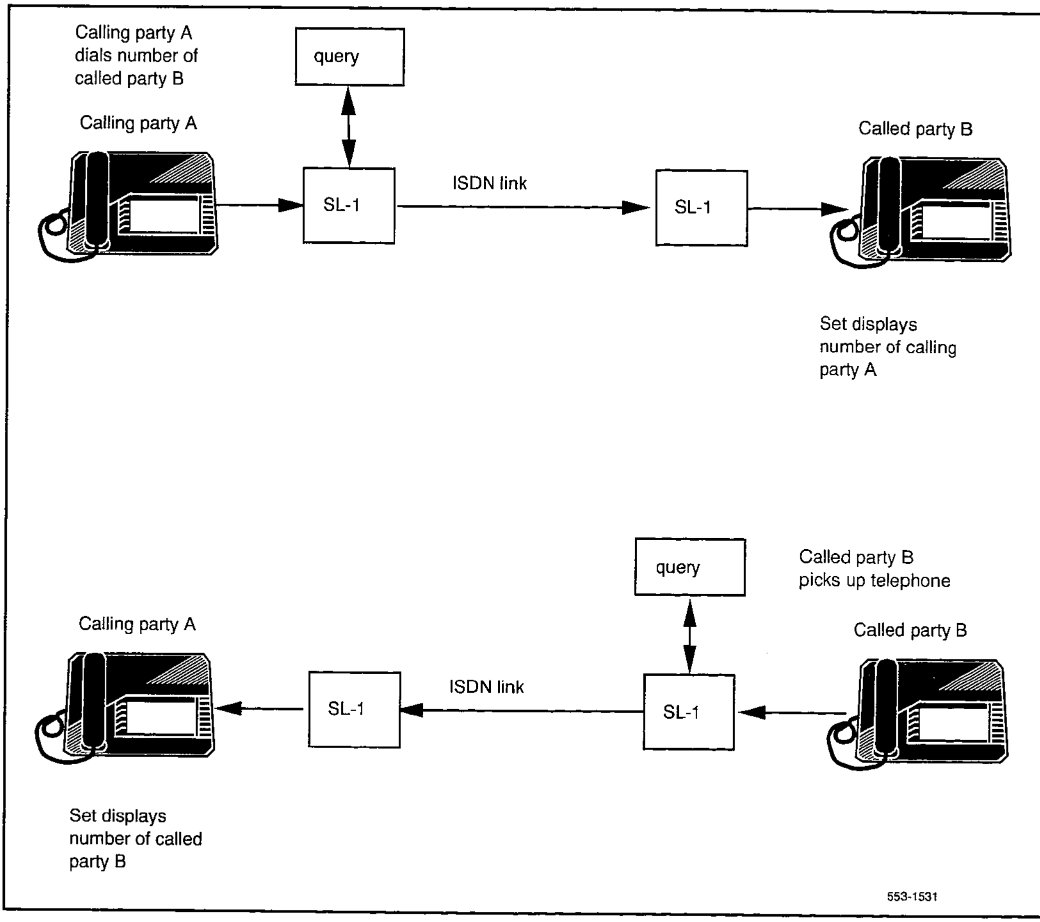
For private network calls, the Listed Directory Number (LDN) is sent if CNTP is set to LDN in LD15 on public calls; otherwise, the PDN is sent. If PDN is set in LD15, then either the Listed Directory Number or Prime Directory Number is sent, depending on the Class of Service (COS) assigned to the telephone in LD10 (Single-Line Telephone Set Administration) or LD11 (Multi-Line Telephone Set Administration). Figure 11-2 shows CLID number displays.

Figure 11-1
Digit Display format for Calling Line Identification



Note: The actual Digit Display does not show spaces between the numbers.

Figure 11-2
CLID number displays



CLID with SID/ANI

AT&T can pass the Service Identifier (SID) and Automatic Number Identification (ANI) from the originating network switch to the Meridian 1.

The SID is the number provided by the user (for example, a Meridian 1 switch) in the address digits field of the Calling Party Number. The ANI number is a customer billing number stored at a local switch or within the AT&T network.

If a customer subscribes to the AT&T services, either SID or ANI information is delivered on all incoming calls. The user may request that SID or ANI be provided on either an exclusive or preferred basis. Whether SID or ANI is requested, Meridian 1 CLID display the digits passed in the Calling Party Number identification.

Note: AT&T's ANI is comparable to Northern Telecom's CLID.

CLID in CDR

If this feature is enabled, the CLID number is included in Call Detail Recording (CDR) records. This gives customers the calling telephone's id, even through a tandem node. This information allows customers to charge the calling party for services rendered in connection with an incoming call. For example, calls to an attorney can be accurately charged to the client.

The CLID information in the Q.931 call SETUP message is added to all applicable CDR message types, in both TTY message format and the compressed binary formats for downstream processing. If the CLID information is not included in the SETUP message, it cannot be printed.

In the TTY output, the CLID information is printed on the second line, as shown in Table 11-1. The field is always 16 characters: the actual CLID digits, followed by Xs to total 16. For detailed information on CDR records, see *Call Detail Recording description and formats* (553-2631-100).

In the Electronic Switched Network (ESN), calls made from mains through the node can be tracked on CDR at the node. This eliminates the need for CDR hardware and software at all mains and allows an accurate billing of callers using the node's trunks, even when the calls are made from the attached mains. See *System overview* (553-3001-100) for more information about ESN.

Table 11-1
Calling Line Identification number in the TTY output

Rec Type	Rec No	Cust No	OrigID	TerID	AuxID lll.s.cc.uu	Date mm/dd	Time hh:mm	Duration hh:mm:s	Digits
N	001	05	DN499	A001000	027.1.02.1	06/28	10:14	00:00:20	95559124
			042	000 95552222xxxxxxxx					
N	001	04	T002001	DN5000		06/28	10:15	00:00:40	
	95552222xxxxxxxx								

Note: The CLID field always displays 16 characters. The feature inserts an "x" for each missing character.

Incoming Digit Conversion

Incoming Digit Conversion (IDC) is compatible with ISDN PRI. IDC allows the user to dedicate a translation table to a DID route so that the DNs received from the CO can be converted to related extension numbers within the Meridian 1. Each translation table is defined on a DID route basis. Digits dialed on ISDN calls with CLID are converted if IDC is active on that route.

Feature implementation

Basic PRI configuration must be performed before Calling Line Identification (CLID) is defined (see "Configuring PRI" on page 4-1.).

CAUTION

Third party software is not guaranteed if this feature is activated. If the Third party software does not recognize the CLID field, it may shut down.

To configure CLID and CLID in CDR, use the following procedures.

Procedure 11-1
Enable CLID in LD17

Prompt	Response	Description
CLID	YES	Enable CLID

Procedure 11-2
Configure CLID in LD15 (Part 1 of 2)

Prompt	Response	Description
REQ	NEW, CHG	Add or change a customer
TYPE	CDB	Customer data block
CUST	xx	Customer number (0-99)
ISDN	Yes, (No)	Change ISDN options
_PNI	1-32700	Private Network Identifier
_PFX1	xxxx	Prefix (area) code for International PRI
_PFX2	xxxx	Central Office Prefix for IPRA
_HNPA	100-999	Home Number Plan Area code
_HNXX	100-999	Prefix for Central Office
_HLOC	100-9999	Home Location Code (ESN)

Procedure 11-2
Configure CLID in LD15 (Part 2 of 2)

Prompt	Response	Description
_LSC	xxxx	Local steering code
_CNTP	LDN, (PDN)	Default for Calling Line ID
_RCNT	0-(5)	Maximum inter-node hops in a network redirection call

Procedure 11-3
Print CDR records on the TTY in LD17

Prompt	Response	Description
USER	CTY	Use the TTY for CDR records

Procedure 11-4
Allow CDR to print for the customer in LD15

Prompt	Response	Description
CDR	YES	Allow CDR records to print
CNTP	(PDN)	CLID displays the set's Prime Directory Number
	LDN	CLID displays the customer's Listed Directory Number
		Note: Attendant consoles have only a Listed Directory Number (LDN).

Procedure 11-5
Allow CDR in the Trunk Route datablock in LD16

Prompt	Response	Description
CDR	YES	Allow CDR
ICOG	ICT	Print CDR information for CLID on incoming trunks

Data Packet Network access

PRI connections to DMS-100 allow Meridian 1 users to access Data Packet Networks (DPNs) connected to the Central Office. The steps involved are listed below. Equipment configuration is shown in Figure 12-1.

1 In coordination with DMS-100 maintenance personnel, a Meridian 1 DN associated with a High Speed Data Module (HSDM) is specified as the port for DPN access.

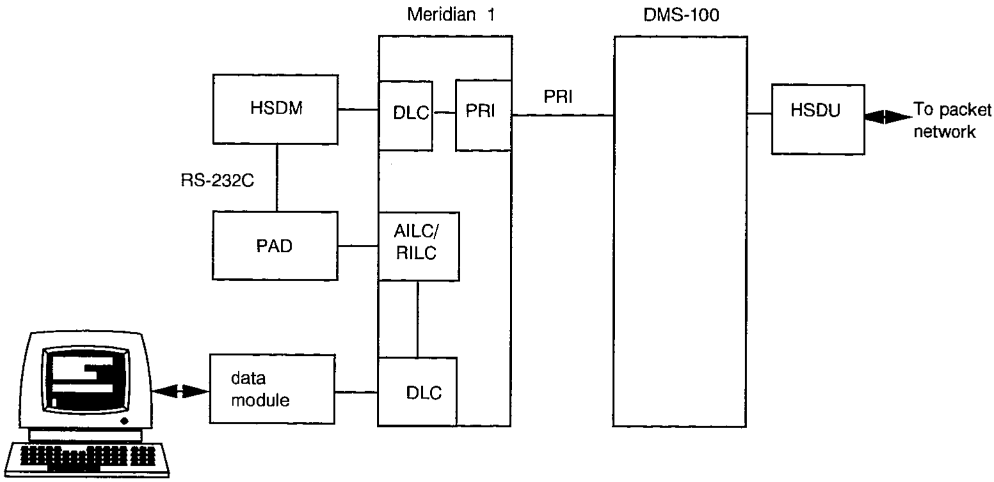
2 Meridian 1 software initiates a hotline call through the specified HSDM to a High Speed Data Unit (HSDU) connected to the DMS-100. The HSDU communicates with the Meridian 1 HSDM through the T-Link version 2 protocol. This requires the QPC720 PRI card.

3 Data is sent from the PRI through the B-channel. The call is set up using standard ISDN D-channel messaging.

4 The HSDU and HSDM go through T-Link protocol exchange.

5 The DN of a Packet Assembler/Disassembler (PAD) output port is associated with the HSDM. The Meridian 1 user accesses the Data Packet Network by dialing the DN of the PAD.

Figure 12-1
Meridian 1 PRI to DMS-100 Data Packet Network



Legend:

ADM - Add-on Data Module

AILC - Asynchronous Interface Line Card

DLC - Data Line Card

HSDU - High Speed Data Unit

HSDM - High Speed Data Module

PAD - Packet Assembler/Disassembler

RILC - RS-232 interface line card

PRI - Primary Rate Interface (QPC720)

553-1533

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Status:	Standard
X11 Release:	14

Digital Trunk Interface replacement

Digital Trunk Interface (DTI) provides the means for transmitting digital voice and data between a network loop and a DS-1 digital carrier terminal. See Figure 13-1. DTI interfaces to DS-1/D3 digital carriers, which may use infrared, fiber optic, microwave radio, satellite link, or leased T1 facilities. See *Digital Trunk Interface/Computer-to-PBX Interface description* (553-2811-100) for a detailed description of the DTI feature.

The QPC720 PRI circuit card can replace the QPC472 DTI card for DTI applications. The QPC720 PRI can work with X11 release 5 and later software. However, with Extended Superframe (ESF) format, and DTI, the QPC720 PRI requires X11 release 14 software and above.

X11 release 15 and later software provides an option for the following recoveries:

— automatic recovery from bit error rate occurrences

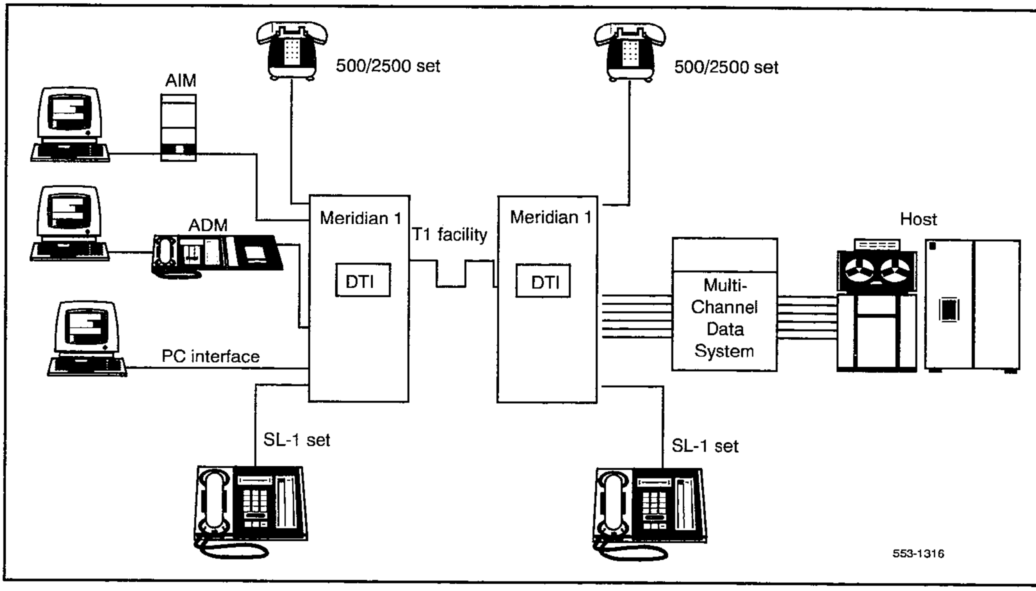
— automatic recovery from loss of frame alignment occurrences

— automatic recovery from frame slips (free-run non-tracking mode only)

— automatic clock recovery after a red alarm (local alarm) condition

— channel recovery set to the same state as the far end (TIE trunks only)

Figure 13-1
Digital Trunk Interface communication



Feature implementation

Use the following steps to configure PRI as DTI replacement. Refer to "Configuring PRI" on page 4-1 for a complete discussion.

1 LD73 Digital Data Block

Set error detection thresholds and clock synchronization control. Required only when configuring PRI for the first time. Optional for subsequent configurations.

2 LD17 Configuration Record

Add a PRI loop.
X11 RELEASE 17 AND EARLIER

OR

3 LD17 Configuration Record

Add a PRI loop.
WITH X11 RELEASE 18 AND LATER

4 LD73 Digital Data Block

Change existing thresholds, or change tracking modes.
This can be done any time after Procedure 2.

5 LD17 Configuration Record

Add a DCHI card, and the D-channel link.
X11 RELEASE 17 AND EARLIER

OR

6 LD17 Configuration Record

Add a DCHI card, or an MSDL card and the D-channel link.
WITH X11 RELEASE 18 AND LATER

7 LD15 Customer Data Block

Define a PRI customer.
Required only when configuring a new customer. If a customer is already defined, skip this procedure.

8 LD16 Trunk Route Administration

Configure PRI trunk routes.

9 LD14 Trunk Administration

Add PRI trunks.

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Electronic Switched Network interworking

The Electronic Switched Network (ESN) operates within ISDN, supporting Network Class of Service (NCOS) capability. The tables below describe which ESN features are available over ISDN and illustrate ESN capabilities over ISDN.

Network Class Of Service (NCOS) information is imbedded in SETUP messages, and provides the means to control a user's eligibility for the following:

— access routes

— access queuing

— receive Expensive Route Warning Tone (ERWT)

— access network speed call

When NCOS information, which includes Traveling Class of Service (TCOS) information, is sent to a DMS-100, the DMS switch can provide access to AT&T's Electronic Tandem Network (ETN).

For a general description of ESN operations and features, see *System overview* (553-3001-100) or *X11 features and services* (553-3001-305).

ESN translation

Currently, a Meridian 1 switch with a BARS or NARS package can have two (or one) separate ESN translators for handling BARS/NARS calls. NARS can have two translators and BARS can have only one translator (AC1). This is in addition to its standard translator which handles all other call types. Each NARS/BARS translator has its access code (ESN AC1/AC2) which itself is defined on the standard translator. The remaining digits, for example, NPA, NXX, LOC, and SPN, are defined on the NARS/BARS translator.

Therefore, a receiving switch must determine which translator to use and insert the needed NARS/BARS access code unless the receiving number is complete, that is, including proper NARS/BARS access code in its digit stream already. This can be done by configuring an ESN digit manipulation to insert the ESN access code in the sending switch.

To insert the needed BARS/NARS access code in the receiving switch, two route options in LD16 can be used:

- INST: An incoming route option that inserts the specified digits(s) to the incoming digit stream for all the calls received on that route.
- INAC: An incoming ISDN route option that inserts the needed NARS/BARS access code to the incoming digit stream. The insertion is based on the Type of Number of the received Called Number Information Element, bypassing the digit insertion (INST) of the route. The AC2 option in LD15 provides a mapping between the incoming Type of Number and the desired translator. This is used to determine which NARS/BARS access code is inserted.

ESN access code configuration with X11 release 14 and earlier

With Meridian 1 ISDN network configurations prior to X11 release 14, the ESN access code is inserted in one of the following ways:

- The originating PBX is configured with Digit Manipulation Index (DMI, LD86) to insert and send the ESN access code.
- The receiving PBX inserts the ESN access code in the Route Data Block (RDB, LD16) under the INST (Insert) prompt.

ESN access code configuration with Package 148 and X11 release 15 and later

For Meridian 1 configurations of X11 release 15 and later which utilize ISDN networking features, ESN access code insertion must be performed on the receiving Meridian 1. The originating Meridian 1 MUST NOT use digit manipulation to insert and send the ESN access code to the terminating Meridian 1.

Therefore, in order to accomplish networking feature transparency (requiring Package 148), the ESN access code insertion MUST be performed in the receiving Meridian 1, either by means of the INST prompt (X11 release 14 and earlier) or the INAC prompt (X11 release 15 and later) in the LD16. Although the INST or the INAC prompt can be used in X11 release 15 and later, the INAC prompt is the recommended method.

When the PBX is upgraded from X11 release 14 to X11 release 15 or later, the above database conversion is required to allow networking applications (such as NRAG) to function properly.

Figure 14-1 summarize these database configuration rules. Figure 14-2 shows the ESN capability within an ISDN network.

Figure 14-1
INAC configuration rules

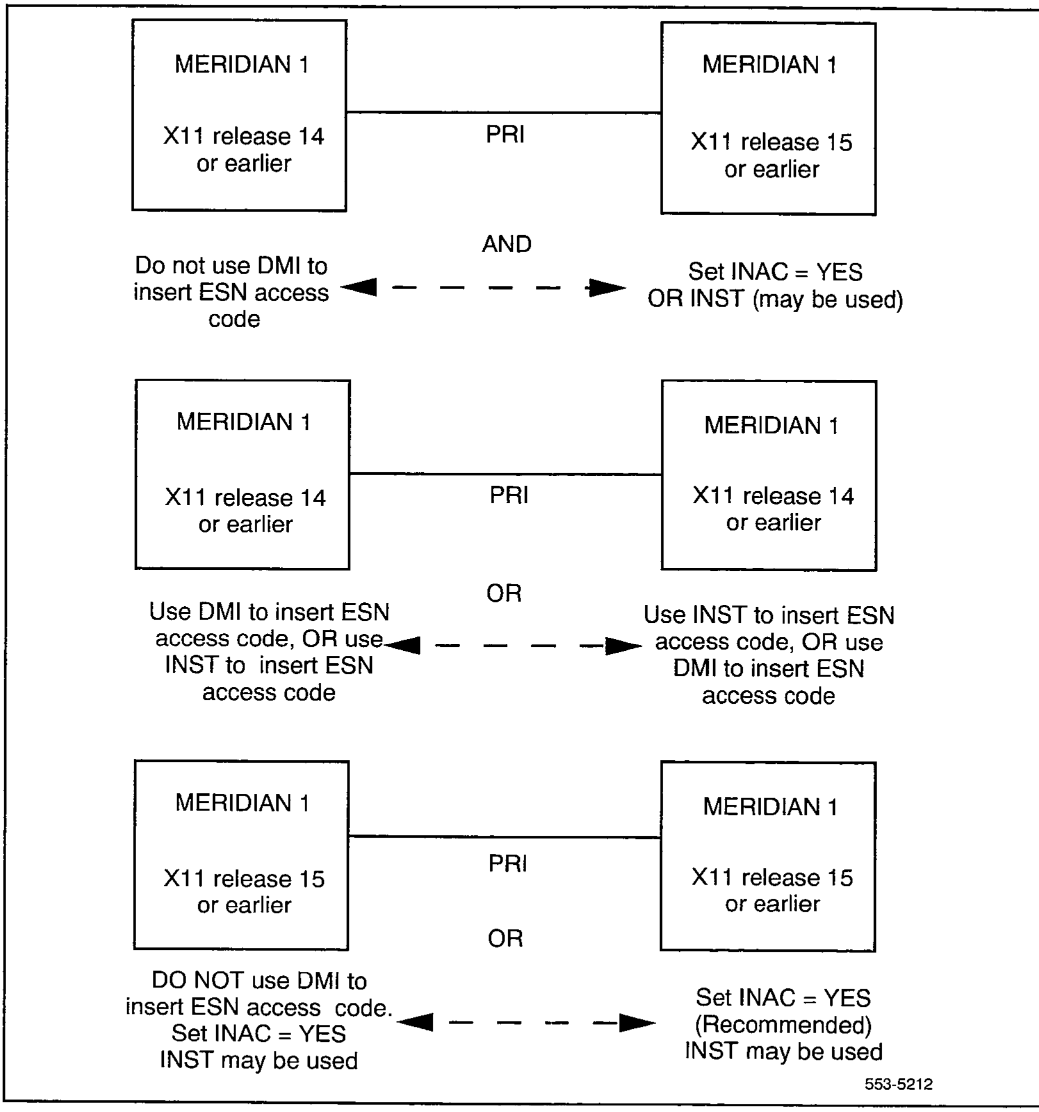
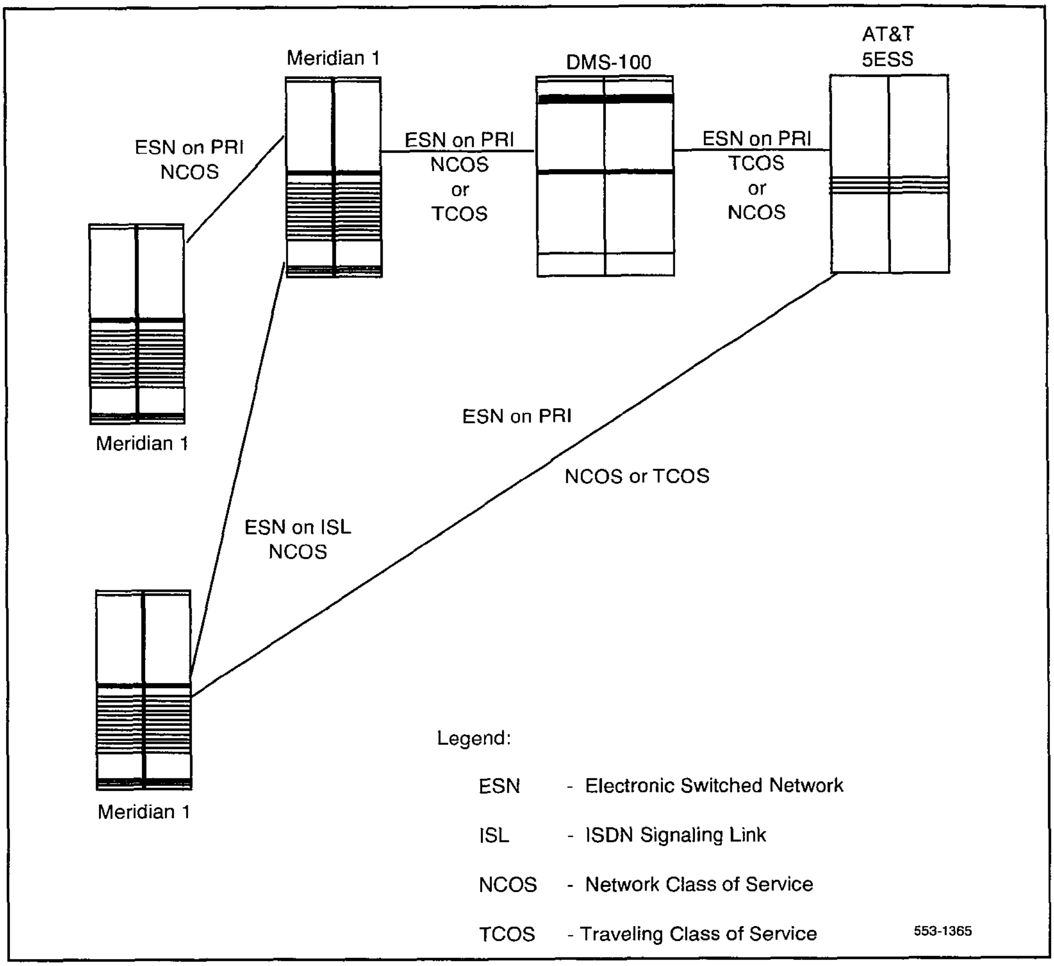


Table 14-1
ESN features available with ISDN

ESN features	X11 release 18 ISDN
Network Class of Service	yes
Network Control	
—NCOS	yes
—TCOS (ETN)	yes
Network Alternate Route Selection	
—NARS Access Codes	yes
—Time of Day Routing	yes
—Network Routing Controls	yes
—Satellite Link Control	yes
—Digit Screening	yes
—Digit Manipulation	yes
—Auto on-net to off-net overflow	yes
—Automatic Least Cost Routing	yes
—Network Speed Call	yes
—Automatic OCC Access	yes
—Expensive Route Warning Tone	yes
ESN Queuing	
Local queuing	
—Off-hook queuing	yes
—Call back queuing	yes
Network Queuing	
—Coordinated Call Back Queuing	Yes (Note)
—Coordinated Call Back Queuing to Conventional Main	Yes (Note)
Network Authorization Codes	yes
Coordinated Dialing Plan for up to 10 digits	yes
Network Call Transfer	no
Note: CCBQ and CCBQCM are available with Remote Virtual Queueing with X11 release 18 and later.	

Figure 14-2
ESN capability in the ISDN network



Feature implementation

ESN default call types

When an ISDN call is made, a default Electronic Switched Network (ESN) call type is set initially. The call type is set depending on the dialing method used, that is, how the call is made. Table 14-2 shows the ISDN default call types. Procedure 14-1 describes how to define the default call types.

> *Note:* When a trunk access code is used to dial on an ISDN route, the caller dials all digits without waiting for subsequent dial tones.

Table 14-2
Default Call Types

Dial method	Default call type	Comment
Direct dial	UKWN (unknown)	Direct dial to trunks via access code
CDP (DSC/TSC)	CDP (Coordinated dialing plan)	Dial CDP number via DSC/TSC code
CDP (LSC)	UKWN	Dial CDP number via LSC code
ESN (LOC)	LOC (location code)	Dial NARS location code
ESN (HLOC)	UKWN	Dial ESN HLOC number
ESN (NPA)	NPA (national)	Dial ESN NPA number
ESN (NXX)	NXX (local)	Dial ESN NXX number
ESN (SPN)	SPN (special number)	Dial ESN SPN number

Procedure 14-1
Respond to the following prompts in LD86

Prompt	Response	Description
REQ	NEW, CHG	
CUST	0-99	Enter customer number
FEAT	DGT	Digit manipulation data block
DMI	1-255	Digit manipulation table index numbers for NARS/BARS
CTYP		Call type. Enter the call type to the manipulated digits. This call type must be recognized by the far end switch.
	(NCHG)	The call type will not be changed
	INTL	Special number in international format
	NPA	NPA
	NXX	NXX
	LOC	Location Code
	CDP	Coordinated Dialing Plan
	SPN	Special number
	UKWN	Unknown call type

ESN access code insertion

Procedures 14-2 and 14-3 describe how to automatically insert the needed NARS/BARS access code to the incoming digit stream. This is required for ISDN networking features such as Network Ring Again (NRAG) and Network Message Services (NMS).

ESN access code insertion is performed in the receiving switch either by the INST or INAC option in LD16. The INAC option is recommended. In other words, the called number may go through ESN digit manipulation which must not include the ESN access code in the sending switch. This rule applies to systems with X11 release 15 and higher.

Procedure 14-2
Enable INAC option in LD16

Prompt	Response	Description
REQ	NEW, CHG, END	
TYPE	RDB	Route data block
INAC	(NO), YES	Insert Access Code. Permit an ESN access code to be automatically added to an incoming ESN call from a private network. If INAC is YES, the digit insertion option (INST) is bypassed. This prompt only appears if the route type is a TIE trunk.

Procedure 14-3
Map NARS/BARS access code to the incoming call types in LD15

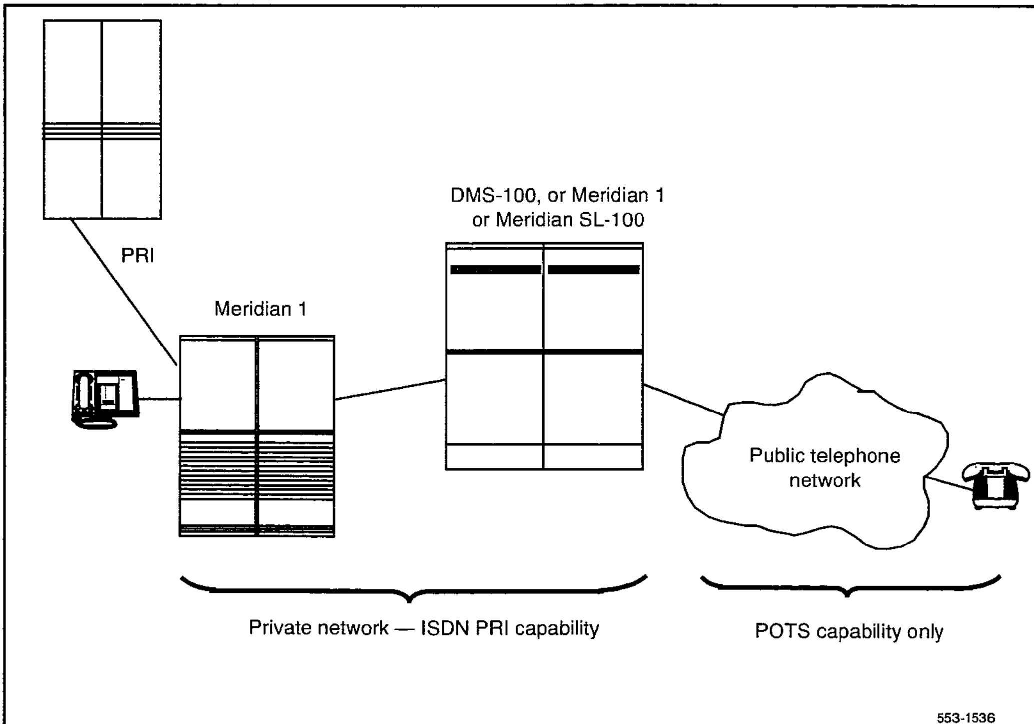
Prompt	Response	Description
REQ	NEW, CHG, END	
TYPE	CDB	Customer data block
AC2		Access Code 2. Enter call types (type of number) that use access code 2. Multiple responses are permitted. If a call type is not entered here, it is automatically defaulted to access code 1.
	NPA	E.164 National
	NXX	E.164 Subscriber
	INTL	International
	SPN	Special number
	LOC	Location code
ISDN	YES	
PNI	1-32700	Customer private identifier—unique to a customer. Within one network, use the same value for PNI in both the Customer Data Block (LD15) and the Route Data Block (LD16).

Private Network Hopoff

Private Network Hopoff is provided by the ESN feature. Private Network Hopoff allows ISDN callers to use the private network to complete public calls. The call is routed through the private network as far as possible before "hopping off" onto the public lines. See Figure 14-3.

Users select this service, on a per call basis, by dialing the private network facilities prefix digit, followed by the public network number. For example, the number 9 is often used as a private network facilities prefix digit before dialing a local number.

Figure 14-3
Private Network Hopoff

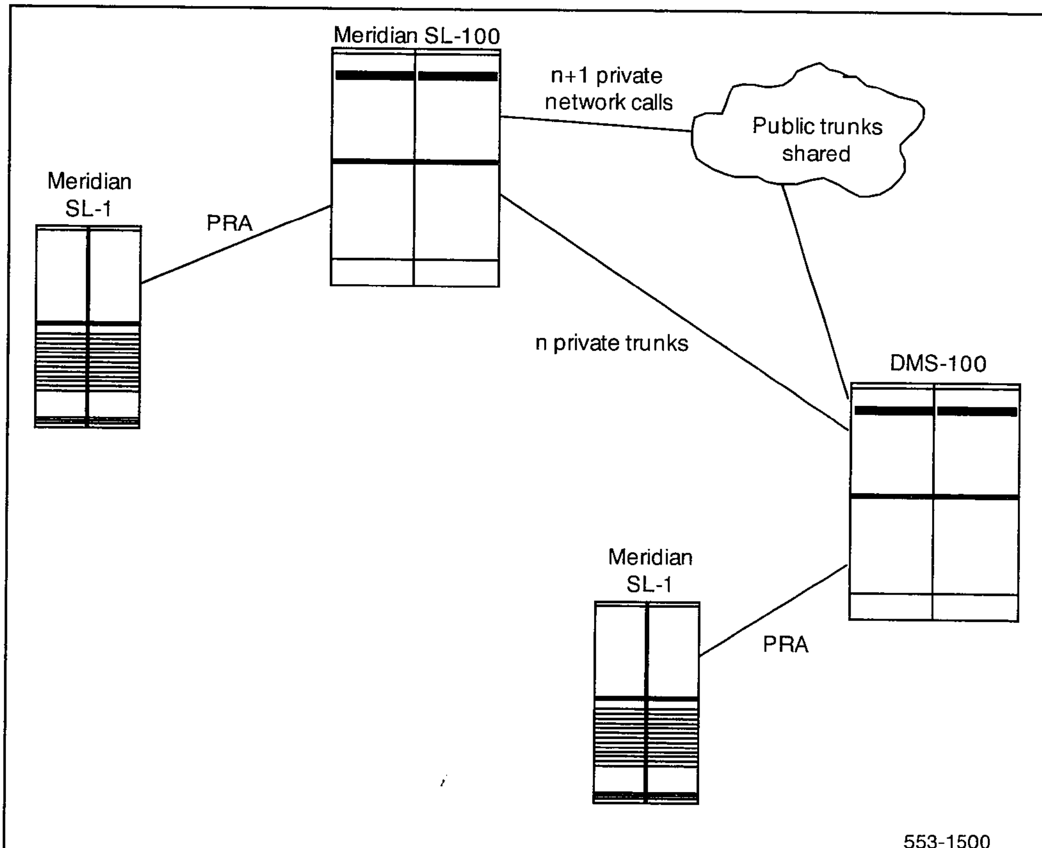


Private Network Overflow

This service allows overflow from a private network onto public network facilities. See Figure 14-4. On outgoing calls over a DMS-100 PRI connection, the DMS provides network overflow when all of a customer's private trunks are busy.

For outgoing calls which encounter blocking (all B-channels are busy), the network provides the capability to overflow to alternate trunks. This is provided by the Electronic Switched Network (ESN) feature. This access can be restricted using a trunk or set class of service.

Figure 14-4
Private Network Overflow



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Integrated Services Access

Integrated Services Access (ISA) is an ISDN PRI feature offered by Meridian 1 connecting to switches such as DMS-100 and DMS-250.

ISA allows multiple service routes to share the same common pool of B-channels. Unlike dedicated routes which require each service route to have its own trunks of the same trunk type, ISA trunks are shared among many service routes, and they can carry calls of different types. These call types can change on a per-call basis. In addition to taking on different trunk types, the service routes may also be uniquely configured for other features, such as Dialed Number Identification Services (DNIS), Incoming Digit Conversion (IDC), or Auto-Terminate.

Figures 15-1 and 15-2 compare dedicated service with ISA's multiple service routes sharing a common pool of B-channels.

AT&T's Call-by-Call nodal service offering is similar to Northern Telecom's DMS-250 ISA. Instead of multiple call/trunk types over a single ISDN PRI channel, AT&T offers services from the 4ESS Inter Exchange Carrier (IEC) such as MEGACOM, SDN, and ACCUNET.

Figure 15-1
Dedicated trunks

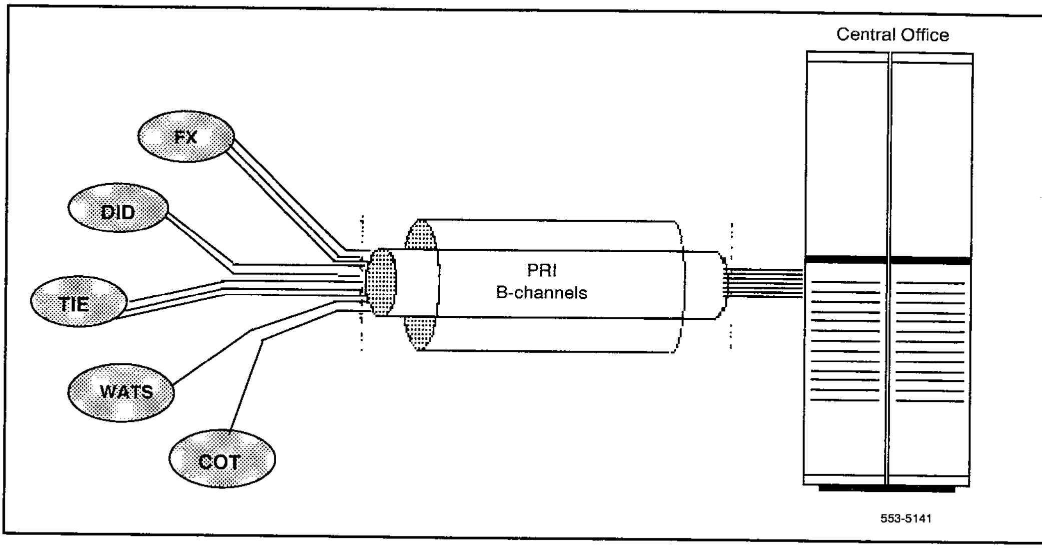
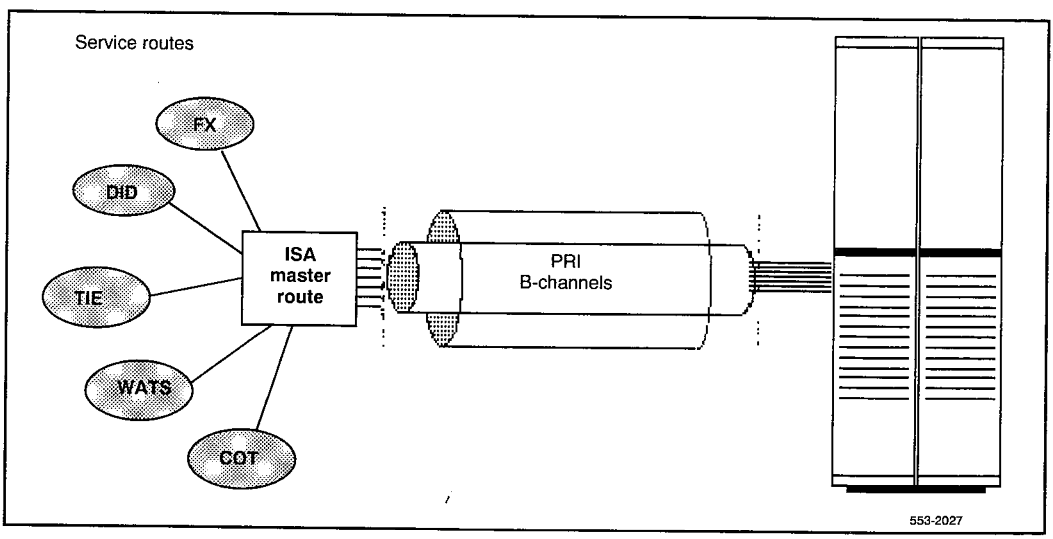


Figure 15-2
ISA trunks



Establishing ISA routes

Basic PRI configuration must be performed before Integrated Services Access (ISA) is defined (see "Overview" chapter). ISA routes and trunks must be defined to access Northern Telecom's ISA functionality or AT&T's Call-by-Call Service.

You cannot configure trunks for the service route that also accesses the ISA master route. With a single PRI (23B + D) configuration, all 23 B-channels can be configured for the ISA master route.

ISA routes cannot be accessed directly, so they must be blocked in the following programs, if applicable:

LD19	Code Restriction
LD27	Alternate Route Selection (ARS)
LD86	Network Alternate Route Selection (NARS) and Basic Alternate Route Selection (BARS)
LD93	Tenant Services

Accessing the ISA master route

The caller dials the access code of a service route to access an ISA master route. This access can also be achieved through digit manipulation by BARS or NARS or by means of Direct trunk access (TARG) values in LDs 10, 11, and 16. A route is configured as an ISA type through service change in LD16. The ISA master route contains a list of B-channels over PRI that can be shared.

Different service route types such as TIE or WATS are created and associated with an ISA master route type. Service routes are not permitted to have Private trunks or B-channel members. To access call-by-call capability, the caller uses NARS/BARS or CDP. Automatic stepping from a service route to an ISA master route is performed and the ISA master route searches for an idle ISA channel. The caller is prevented from dialing the access code of an ISA master route directly.

These ISA configurations prompts are described below.

– the Network Service Facility (NSF) option

– the Min/Max function

– the Service Identifier (SID)

Network Services Facility option

This option is configured on the Meridian 1 to indicate whether it expects the Network Services Facility (NSF) Identification Element (IE) from the DMS. The NSF information dictates which service route the Meridian 1 will use to terminate an incoming call.

Northern Telecom connectivity to DMS provides Public, Private, INWATS, OUTWATS, TIE, and FX call types. When specifying COT or DID, the default is Public call type. The call types determine the NSF values. (NSF = NO yields Public call type.)

The values for the COT/DID service route (COTR), the WATS service route (WATR), and the TIE service route (TIER) are for incoming call termination only. Predefined NARS, BARS or CDP allows multiple outgoing routes. The COTR can be a route number for a Central Office DID/DOD route. It is used for public calls. For incoming public calls, if COTR is a Central Office route, it is routed to the attendant. If it is a DID/DOD route, it translates the last "n" digits (as predefined in LD15). For Private and TIE calls, the called number can be translated as defined for the service route.

With NSF = NO:

- COTR = all incoming DID/COT calls
- TIER = all incoming TIE calls

Only Public and TIE calls can be terminated. Because there is no Min/Max throttling, one service route may use all the trunks in the pool. If the NSF is sent from the Central Office, a master route can still be configured with NSF = NO and the NSF is ignored.

With NSF = YES:

- COTR = all incoming DID/COT calls
- WATR = all incoming WATS calls (prior to X11 release 17),
  OR = incoming WATS calls without SID (X11 release 17)

Different TIE and FX calls can be terminated to multiple service routes. With X11 release 17, there can be multiple INWATS routes. These routes are distinguished by the unique SID defined in the service route. This number must be coordinated with the DMS for correct call termination.

Minimum and maximum counter function

The minimum and maximum counter (Min/Max) function allows customers more control and the ability to manage call patterns: you may define a minimum number of B-channels for a service route and you may define a maximum number of calls allowed per service route.

The sum of all the Min values must be less than or equal to the number of B-channels in the master route. The Max values for each service route must be equal to or less than the number of B-channels in the pool less all Min values from other service routes.

The sum of all Min values for the service route cannot exceed the number of B-channels defined for the ISA master route.

When the NSF prompt is YES and the Max value is reached in a service route, the All Trunks Busy (ATB) counter is incremented. The ATB count is not incremented when NSF is NO.

The ATB value is provided during the printing of traffic reports. The ATB is pegged against individual service routes when the maximum number of B-channels reserved for that call type has been reached. The ATB counter of an ISA master route is also incremented when the last B-channel of the ISA master route is busied. This occurs whether the NSF prompt is YES or NO.

Service identifier

In addition to the call type (route type), each call is identified by a service identifier (SID) which is used by the Meridian 1 and the Central Office for routing. The SID prompt is available when the NSF prompt is set to YES. These service identifiers must be set up in coordination with the Central Office for call type delivery and routing purposes.

The Service Identifier allows a call type with multiple SIDs such as INWATS to go to prespecified Directory Numbers.

Pre X11 release 17, the SID defaults to the route number, and the value range is 0–127. With X11 release 17, the SID no longer has a default value. Also, the range of value SIDs is expanded to support 0–511.

ISA capability

Note: Support of ISA for DMS switches and Call-by-Call Service Selection for AT&T switches has been withdrawn for X11 software releases prior to X11 release 16. Therefore, X11 release 16 is the minimum release to support ISA capability.

X11 release 16

Basic ISA functionality includes the following:

- Incoming Digit Conversion (IDC) is supported for DID call type only.
- All INWATS calls terminate to the attendant console.
- ISA supports 2-way DID trunk types (as do all PRI connections to a central office.)
- A total of 127 SID routes is allowed for all trunk types per customer.
- Multiple routes may be defined.
- Calls are routed based on Service Identifier (SID) value.

Meridian 1 to DMS-100

WATS

- Only one INWATS route may be defined.
- All INWATS calls terminate to the attendant console.
- OUTWATS services are not limited to a single outgoing route.

COT or DID

- Only one incoming route may be defined, either COT or DID, but not both.
- DID trunk type supports 2-way traffic (inbound and outbound).
- More than one outgoing route may be defined.
- DID operates like a 2-way COT.

TIE

- Multiple routes may be defined.
- They are routed according to the Service Identifier (SID) value.

  Note: In LD16, if NSF = NO, then only one TIE route may be defined.

FX

- Multiple routes may be defined.
- They are routed according to the Service Identifier (SID) value.

Meridian 1 to DMS-250

This includes basic ISA functionality as well as the following:

- Private call type is supported for DMS-250 interfaces to the Meridian 1 and are defined as TIE.

WATS

- Only one INWATS route may be defined.
- All INWATS calls terminate to the attendant console.
- OUTWATS services are not limited to a single outgoing route.

TIE

- Multiple routes may be defined.
- They are routed according to the Service Identifier (SID) value.

  Note: In LD16, if NSF = NO, then only one TIE route may be defined.

FX

- Multiple routes may be defined.
- They are routed according to the Service Identifier (SID) value.

COT or DID

- Only one incoming route may be defined, either COT or DID, but not both.
- DID trunk type supports 2-way traffic (inbound and outbound).
- More than one outgoing route may be defined.
- DID operates like a 2-way COT.

Meridian 1 to 4ESS

Meridian 1 supports the following AT&T 4ESS nodal service types:

- ACCUNET, a T1 access service for both voice or data
- SDN, Software Defined Network, an AT&T virtual networking package
- MEGACOM 800, inbound domestic bundling
- MEGACOM, outbound domestic bundling
- WATB, banded WATS. The user may specify a band, such as Band 3.
- WATM. The user may specify wide area service exclusive to Band 1 through 9. For example, Band 5 means 0 to 5.
- LDS, Long Distance Service, including "World Connect" (outbound international)
- IWAT, regular 800 service
- I800, International 800, anything outside the U.S.

X11 release 17

In X11 release 17, ISA is enhanced to provide the following:

- Private, INWATS, FX and TIE call types received from an ISA master route terminate to an individual set with or without Incoming Digit Conversion (IDC) for the DMS and AT&T interfaces.
- ISA service routes allow an auto-terminate DN to be defined in the route data block. Calls can terminate to an ACD queue using Dialed Number Identification Services (DNIS)for the DMS and AT&T interfaces.
- Private call type is supported for the DMS interface on a per route basis. (Specify Private in LD16.)

- Service Identifier (SID) is supported with INWATS call types for the DMS interface.
- The Service Identifier (SID) value no longer defaults to route number. A unique value must be specified by the user.
- When printing the route data block for an ISA master route, all the associated service routes are printed after the new prompt, SVRT, in LD21. Figure 15-3 shows how SVRT in LD21 prints the ISA service routes configured in LD16.

Figure 15-3
LD21 SVRT prompt (X11 release 17)

LD16

Prompt	Response
ROUT	50
TKTP	TIE
ISAR	YES
RTN	60

LD16

Prompt	Response
ROUT	51
TKTP	WAT
ISAR	YES
RTN	60

LD16

Prompt	Response
ROUT	52
TKTP	COT
ISAR	YES
RTN	60

LD21

Prompt	Response
ROUT	60
TKTP	ISA
SVRT	50
	51
	52

Note: The prompt SVRT does not appear in LD16. When the route is configured in LD16, this information is added automatically to the ISA master route.

553-5142

Operating parameters

ISA supports ST, STE, NT, RT, XT, 21, 21E, 51, 61, 71, and 81 system types.

SL-100 and DMS products require BCS 30 or later for ISA connectivity to the Meridian 1.

The X11 release 17 ISA enhancements are based on the following features:

- Dialed Number Identification Services (DNIS) offered on X11 release 10 or above.
- Incoming Digit Conversion (IDC) for Direct Inward Dialing (DID) offered on X11 release 12 or above.

Characteristics of the X11 release 17 ISA enhancements are detailed below:

- The range of the Service Identifier (SID) for the Meridian 1 to DMS interface is from 0 to 511. Each SID received in the ISA trunks uniquely corresponds to a service route defined in LD16. Also, each service route uniquely corresponds to a SID in the DMS machine type.
- The range of the Service Parameter for the Meridian 1 to ESS interfaces is from 0 to 9 for the parameterized WATS band service. WATR and COTR depend on the operation of service routes.
- For Meridian 1 to DMS interfaces, if there is no Network Specific Facility Information Element (NSF) (IE) received in the ISA master route, Meridian 1 treats the call using the service route configuration defined for the COTR prompt in LD16. If the trunk type of the COTR is COT, all the calls terminate to the Meridian 1 attendant. If the trunk type of the COTR is DID, each call terminates to its DID number. Similarly, if the trunk type of the WATR is WAT, all the calls terminate to the Meridian 1 attendant. If the trunk type of the WATR is DID, each call terminates to its DID number.
- For the Meridian 1 to ESS interfaces, if there is no NSF IE received in the ISA master route, Meridian 1 treats the call using the ISA service route configuration which is defined as the ACCUNET service for the SRVC prompt in LD16. If the trunk type of the ISA service route is Direct Inward Dialing (DID), each call terminates to its DID number.

- If an INWATS call or Public call received in the ISA master route is intended to be terminated to the Meridian 1 attendant, either IDC can be used to convert the incoming called number of the attendant DN, or the incoming called number must match the Listed Directory Number (LDN) in the Customer data block. You can also terminate one service route per ISA route by programming the service route number at the COTR and WATR prompts.
- For the Meridian 1 to DMS interfaces, the minimum and maximum counter (Min/Max) function is on a per service route basis. For example, route 40 (call type of OUTWATS with SID 9) or route 45 (call type of OUTWATS with SID 13), can each reserve its own minimum B-channels and limit its maximum B-channels to be used in the ISA pools.
- Since AT&T is limited to one service type per service route in a given ISA master route, for the Meridian 1 to ESS interfaces, the Min/Max counter function is on a per service route basis. That is, AT&T supports only one Min/Max function for the service types in a given ISA master route, not a Min/Max per band. Configure only one set of the minimum and the maximum B-channels in LD16 for all the bands of the WATB service.
- For AT&T interfaces, only 9 possible services may be used per ISA master route. With Northern Telecom DMS products, there are 512 possibilities, one for each SID value.

Tables 15-1 and 15-2 illustrate the Min/Max function, assuming 23 ISA B-channels.

Table 15-1
Example of Min/Max function for Meridian 1 to DMS

Call Type	Meridian 1 to DMS interface (WATR = 30, COTR = 10, NSF = YES)	MIN	MAX
Public	(rout 10, tkty DID, icog IAO)	10	13
Private	(rout 20, tkty TIE, sid 22, facy PRV, icog IAO)	1	3
INWATS	(rout 30, tkty WAT, icog ICT)	1	3
INWATS	(rout 35, tkty WAT, sid 30, icog ICT)	1	1
OUTWATS	(rout 40, tkty WAT, sid 9, icog OGT)	1	2
OUTWATS	(rout 45, tkty WAT, sid 13, icog IAO)	1	1
FX	(rout 60, tktp TIE, sid 60, facy TIE, icog IAO)	1	4
TIE	(rout 60, tkty TIE, sid 60, facy TIE, icog IAO)	2	3
TIE	(rout 65, tkty TIE, sid 65, facy TIE, icog IAO	2	3
	Total	20	

Note 1: See the Min/Max rules contained in this chapter.

Note 2: Service types are dominant over call types with AT&T interfaces.

Table 15-2
Example of Min/Max function for Meridian 1 to ESS

Service	Meridian 1 to ESS interface	MIN	MAX
ACCunet	(rout 10, tkty DID, icog IAO)	10	15
SDN	(rout 20, tkty TIE, icog IAO))	1	3
IWAT	(rout 30, tkty WAT, icog ICT)	1	3
WATB	(rout 40, tkty WAT, sprm 9, icog OGT)	1	2
WATM	(rout 45, tkty WAT, icog OGT)	1	2
LDS	(rout 70, tkty TIE, icog IAO)	2	3
I800	(rout 80, tkty TIE, icog IAO)	2	3
	Total	18	

Note: See the Min/Max rules contained in this chapter.

Feature interactions

Enbloc dialing—Enbloc dialing in ISDN PRI performs dialed digit analysis to determine the end of dialing before constructing the outgoing SETUP message. The Trunk Access Code applies to the service route, not to the ISA master route.

nB+D Primary Rate Interface—nB + D is an ISDN feature developed for Meridian 1 in X11 release 12. Meridian 1 allows 16 DS1 loops controlled by one Primary D-channel (on channel 24 of the first DS1 lop) and one backup D-channel (on channel 24 of the second DS1 loop). ISA can use the 382 B-channels as the ISA pool of trunks.

AT&T 4ESS SDN Access—Software Defined Network (SDN) is a service offered by AT&T 4ESS for the virtual private network. SDN can be offered on dedicated channels or ISA channels.

Incoming Digit Conversion (IDC)—Part or all of the digits received in the DID route are converted and terminated at the existing internal DN in the Meridian 1. With this enhancement, IDC applies to the incoming WATS route over the ISDN interface.

Dialed Number Identification Services (DNIS) – DNIS provides the last three or four digits of the dialed DN from DID or TIE trunk to be displayed in Meridian 1 set digit display when the DNIS call terminates on an ACD DN. DNIS is supported on the per route basis when using ISA feature. DNIS also applies to the INWATS service route over the ISDN interface.

Feature packaging

Table 15-3 shows the packages required for ISA. See *X11 features and services* (553-3001-305) for X11 release software packages and their dependencies.

Table 15-3
Package requirements for ISA enhancements

Package	Name of package	Mnemonic
117	Call-by-Call Service Selection Dependencies: 145, 146,149	CBC
145	ISDN Signalling	ISDN
146	ISDN Primary Rate Interface Dependencies: 75, 145, 19 [CLID]	PRI

Note 1: Package 149, IEC, is required for Inter-exchange carrier, that is DMS-250 and AT&T 4ESS.

Note 2: If Incoming Digit Conversion (IDC) is required (see Feature implementation), then Package 110, IDC for DID, is necessary. It is dependent on Package 49, New Flexible Code Restriction.

Note 3: If Dialed Number Identification Services (DNIS) is required (see Feature implementation), then Package 98, DNIS, is required.

Feature implementation

Configuring ISA routes

Basic PRI configuration must be performed before Integrated Services Access (ISA) is defined (see "Overview" chapter). ISA routes and trunks must be defined to access Northern Telecom's ISA functionality or AT&T's Call-by-Call Service.

To configure ISA, take the following steps:

1. LD16 Route Data Block (Procedure 15-1)
   Define the ISA master route, before other route types.
2. LD14 Trunk Data Block (Procedure 15-2)
   Define the associated list of ISA trunks.
3. LD16 Route Data Block (Procedure 15-3)
   Define all service routes.

Procedure 15-1
Use LD16 to create an ISA master route (Part 1 of 2)

Prompt	Response	Description
REQ	NEW,CHG, OUT	
TYPE	RDB	Route Data Block
CUST	0-99	Customer number
ROUT	0-511	Route number
TKTP	ISA	Create an ISA trunk route
		Note: Package 117, Call-By-Call Service, is required to define an ISA master route.
DTRK	YES	Digital trunk route
DGTP	PRI	Digital trunk type
ISDN	YES	ISDN option
MODE	PRA	D-channel mode controlling the route (ISA master route)
PNI	1-32700	Customer's Private ID

Procedure 15-1
Use LD16 to create an ISA master route (Part 2 of 2)

Prompt	Response	Description
IFC	aaaa	Interface type: (D100), ESS4, ESS5, SL1, S100, D250 ***Note:*** The IFC of an ISA master route and its associated service route must match.
NSF	(NO),YES	Network Service Facility (for TKTP = ISA and non-AT&T IFC. AT&T always has NSF.)
COTR	0-511	DID/Central Office route number Prompted if IFC = D100. Enter CO or DID route.
TIER	0-511	TIE route number Prompted if IFC = D100 and NSF = NO
WATR	0-511	WATS route number Prompted if IFC = D100 and NSF = YES
ICOG	IAO, ICT, OGT	Incoming and outgoing trunk, Incoming trunk, Outgoing trunk
SRCH	RRB	Round robin hunting for outgoing trunks
ACOD	xxxx	Trunk route access code

Procedure 15-2
Use LD14 to configure ISA trunks

Prompt	Response	Description
REQ	NEW, CHG, MOV, OUT	
TYPE	ISA	ISA trunk type
TN	loop ch	Terminal number address—use loop number created in LD17
	0-159	PRI loop number
	1-24	PRI channel
CUST	0-99	Customer number
RTMB	0-511, 1-254	Route and Member number for SL-1 NT, RT, XT and options 51, 61, 71, and 81.
	0-127, 1-254	For all other machine types.
B-CHANNEL SIGNALING		
TGAR	(0)-31	Trunk Group Access Restriction
CLS	aaa	Class of service options

Procedure 15-3
Use LD16 to configure ISA service routes (Part 1 of 2)

Prompt	Response	Description
REQ	NEW	Add an ISA service route
TYPE	RDB	Route data block
CUST	0-99	Customer number
ROUT	0-511	Route number
TKTP	aaaa	Types of service route allowed with ISDN
DTRK	YES	Digital trunk route
ISDN	YES	ISDN option
_MODE	PRA	PRA master route for ISA

Procedure 15-3
Use LD16 to configure ISA service routes (Part 2 of 2)

Prompt	Response	Description
IFC	aaaa	Interface type: (D100), ESS4, ESS5, SL1, S100, D250 ***Note:*** The IFC of an ISA master route and its associated service route must match.
SRVC	(ACC)	Service for AT&T ESS connections: NNSF, ACC, I800, LDS, M800, MEG, SDN, IWAT, WATM, WATB Prompted if IFC = ESS4 or ESS5 ***Note:*** NSF refers to the services provided on a Call-by-Call basis.
_SRPM	0-(9)	WATS band. Prompted only if SRVC = WATB.
ISAR	Yes, (No)	ISA service route
_RTN	0-511	Select route number of any configured ISA master route Prompted only when ISAR = YES.
_FACY	Yes, (No)	Facility for the call type Prompted when TKTP = TIE, ISAR = YES, and IFC = D100/D250/S100 TIE connection in the NSF IE Private connection in the NSF IE.
_SID	0-511	Service Identifier number.
_MIN	xx	Minimum number of channels reserved on the ISA master route
_MAX	xx	Max number of channels reserved on the ISA master route.
_PRIM	Yes, (No)	ISA route class of service
ICOG	IAO, ICT, OGT	Incoming and outgoing trunk, Incoming trunk, Outgoing trunk
ACOD	xxxx	Trunk route access code

Note: The Listed Directory Number (LDN0) value must be set in LD15, Customer data block, in order to terminate ISDN/DID incoming calls, such as ISA. See "Configuring PRI" on page 4-1.

Feature testing

Test each PRI trunk to ensure that the Meridian 1 completes an ISA call. Run the following test for each of the available call types: TIE, FX, COT, INWATS, OUTWATS, and DID.

Note: COT and DID are recognized as Public call types and they must be the same route. They can be used for incoming or outgoing routes.

To test ISA, use Steps 1 through 8.

1 Select a PRI to be tested.

2 Access LD60. Stat all pertinent B-channels

3 Set all the Min/Max values in all service routes to 1.

4 Make a test call on a trunk route that accesses the PRI being tested. Be sure the test call is to a valid destination.

5 Use LD80 to ensure a B-channel from the ISA pool is in use. Then:

- Place the call on hold.
- Make another call. You should receive an overflow signal (fast busy).
- Repeat this procedure for every outgoing service route.

6 Disconnect both calls.

7 Ask the terminating end to place an incoming call for each incoming call type. Then:

- Place the call on hold.
- Ask the terminating end to place another call. They should receive an overflow signal (fast busy).

8 Disconnect both calls.

Issued: 92 12 31
Status: Standard
X11 release: 14

ISDN Signaling Link

ISDN Signaling Link (ISL) provides the capability to replace both digital and analog conventional trunk signaling with out-of-band ISDN D-channel signaling. The following applications are supported by ISL:

- Calling Line Identification (CLID)
- CLID in Call Detail Recording (CDR)
- Electronic Switched Network (ESN) interworking
- Network Call Redirection (NCRD)
- Network Ring Again (NRAG)
- Network Message Services (NMS)
- Network Call Party Name Display (NCPND)
- Network ACD (NACD)

When the D-channel is inactive, ISL trunk calls can automatically revert to conventional trunk signaling. This applies to both primary and backup D-channels.

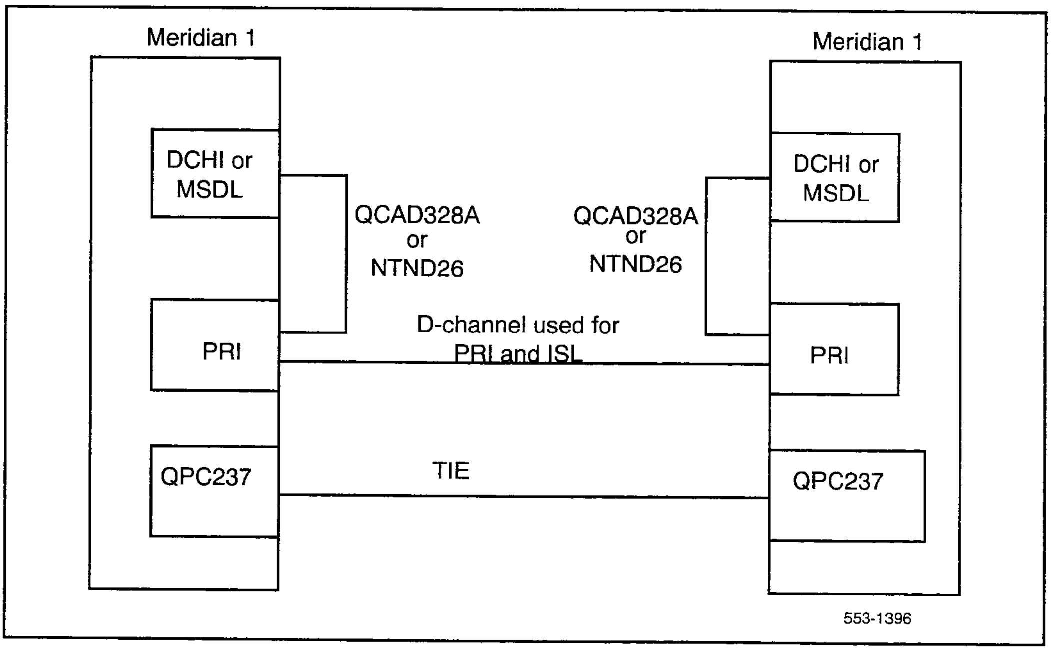
ISL supports TIE and ISA trunk types with Meridian 1 to Meridian 1 connectivity.

The TIE lines and trunk used for the D-channel may be leased from the Central Office (CO). With leased lines, the function of the CO is simply to provide the trunk wire facilities between Meridian 1 systems for circuit switched connections.

The ISDN Signaling Link supports a uniform trunk hardware configuration. This configuration uses the QPC237 4-wire E&M TIE trunk card in place of other analog trunk cards (such as the QPC71 TIE trunk card or the QPC72 DID/DOD trunk card).

Note: If the QPC237 TIE trunk card is not used, backup D-channel is not available.

Figure 16-1
ISDN Signaling Link: shared mode



There are two modes of ISL operation:

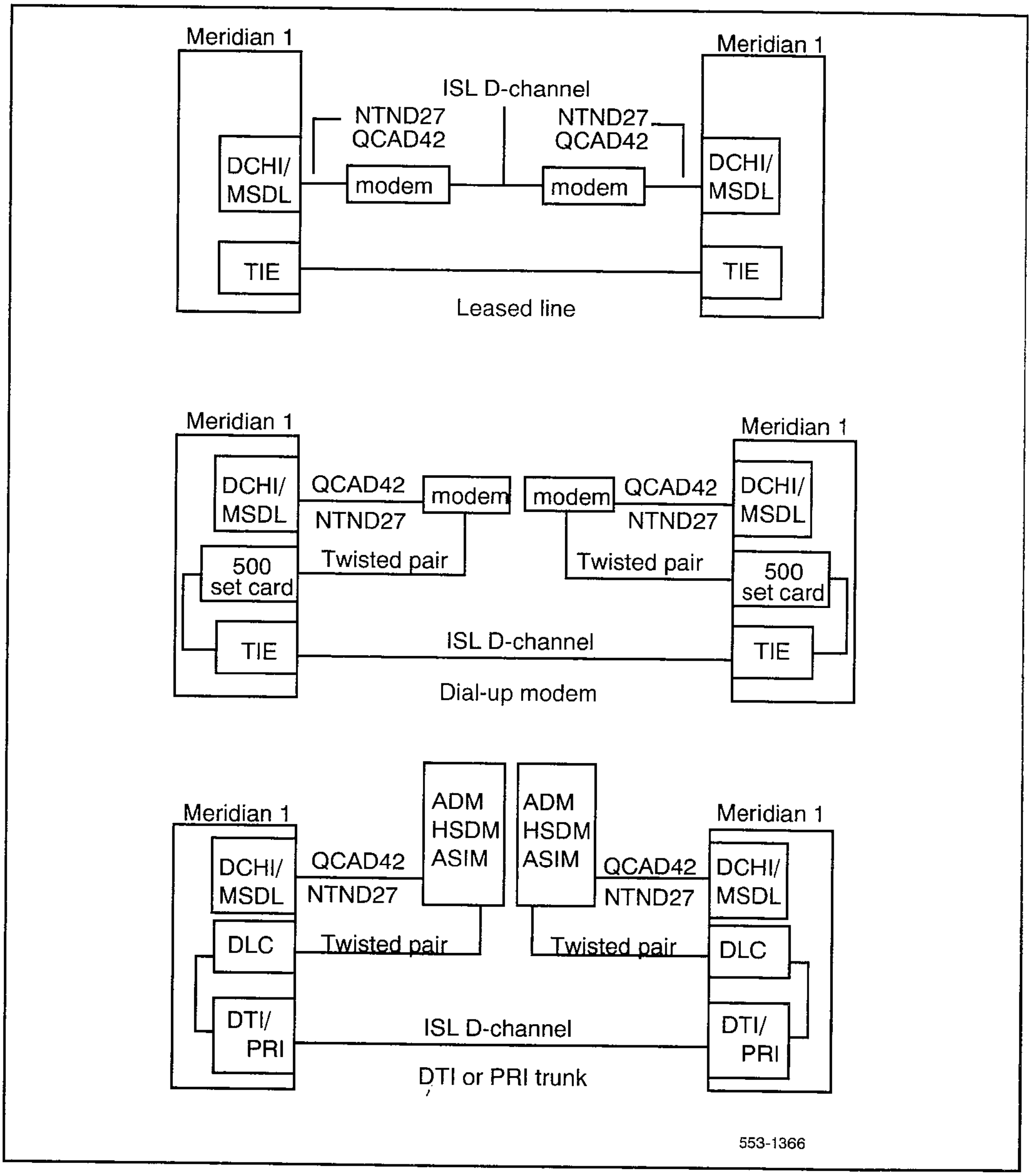
- Shared mode: The DCHI supports ISDN PRI signaling and ISL trunks. The configuration is basically the same as the PRI D-channel, with the D-channel also supporting ISL trunks. See Figure 16-1.
- Dedicated mode: The DCHI does not support ISDN PRI signaling. The DCHI is reserved for ISL use. The D-channel can communicate with the far end by means of a dedicated leased line, dial-up modem, or DTI/PRI trunk. See Figure 16-2.

For ISL to use an ISA route, the ISA route must be identified as ISL in LD16. This is done by assigning the MODE prompt to ISLD.

When an ISL call utilizes a Call-by-Call Service, the D-channel associated with the ISA route for the Call-by-Call Service is used for signaling.

> *Note:* In X11 release 15, the High Speed Data Module (HSDM) is used in place of both the Asynchronous/Synchronous Interface Module (ASIM) and the Add-On Data Module (ADM).

Figure 16-2
ISDN Signaling Link: dedicated mode configurations



Reverting to conventional trunk signaling This feature handles ISL trunk calls by reverting to conventional trunk signaling when the D-channel is inoperative. This applies to the primary and backup D-channels as well as ISA.

When a primary or backup D-channel goes down:

- Established ISL calls remain established, regardless of the signaling method used.
- Transient ISL calls that are set up using conventional trunk signaling are not disturbed.
- Transient ISL calls that are set up by means of D-channel signaling are dropped. The user must reinitiate the call. Then conventional trunk signaling is used if the D-channel remains inactive.
- ISL channels are not marked maintenance busy.

There are two scenarios that can occur when a D-channel is re-established, one with backup D-channel and one without. When a backup D-channel re-establishes:

- There is no impact. The other D-channel simply recovers. Since ISL calls still using D-channel signaling (in existing software) can bypass the restart procedure.

When a D-channel re-establishes that does not have a backup:

- Transient and established ISL calls that are set up using conventional trunk signaling are not disturbed.
- Established ISL calls that are set up using D-channels are disconnected.
- To disconnect an established ISL call, the system uses the same signaling method that the call was setup with.

When the ISL D-channel goes down, the following scenario occurs. Since ISL trunks can convert to conventional trunk signaling, the ISL route (which is associated with a D-channel) is bypassed using conventional trunk signaling.

Feature implementation

There are two modes of ISDN Signaling Link (ISL) operation:

1 **Shared mode**
The DCHI supports ISDN PRI signaling and ISL trunks. The configuration is basically the same as the PRI D-channel, with the D-channel also supporting ISL trunks.

2 **Dedicated mode**
The DCHI does not support ISDN PRI signaling. The DCHI is reserved for ISL use. The D-channel communicates with the far end by means of a dedicated leased line, dial-up modem, or DTI/PRI trunk.

ISDN Signaling Link (ISL) supports Calling Line Identification (CLID) and CLID in Call Detail Recording (CDR), Electronic Switched Network (ESN) interworking, and Network Ring Again (NRAG) applications. The ISL service is supported in the uniform trunk hardware configuration. For call-by-call service, an ISA route must be established and identified with the ISL interface.

Configuring ISL

To configure ISL, perform the following steps:

1 LD17 Configuration Record (See Procedure 16-1)
Configure the D-channel for ISL use.
X11 RELEASE 17 AND EARLIER

OR

2 LD17 Configuration Record (See Procedure 16-2)
Configure the D-channel for ISL use.
X11 RELEASE 18 AND LATER

3 LD15 Customer Data Block (See Procedure 16-3)
Define a PRI customer

4 LD16 Route Data Block (See Procedure 16-4)
Enable the ISL option on a per route basis, assign a D-channel for each route, and enable the ISL call-by-call service

5 LD14 Trunk Data Block (See Procedure 16-5)
Assign a channel identification to each trunk with the ISL option.

Procedure 16-1
Configure the D-channel for ISL in LD17 (X11 release 17 and earlier) (Part 1 of 2)

Prompt	Response	Description
REQ	CHG	
TYPE	CFN	Configuration record
.		
.		
parm		
ISDN	YES, (NO)	
DCHI	1-15	DCHI port number (remove with Xnn)—only odd numbers allowed
BCHI	1-15	Back-up DCHI port number
USR		Change DCHI parameters
	PRA	D-channel for ISDN PRI only
	ISLD	D-channel for ISL in “dedicated” mode
	SHA	D-channel for ISL in “shared” mode, used for both ISDN PRI and
		Note 1: One of the above responses is mandatory and there is no default.
		Note 2: Package 147, ISDN Signaling Link, is required.
DCHL	0-159	PRI loop for DCHI, not prompted with D-channel in dedicated mode (D-channel does not require a channel on the PRI)
BCHL	0-159	PRI loop number for BCHI
OTBF	1-(16)-127	Number of output request buffers—use default (16)

Procedure 16-1
Configure the D-channel for ISL in LD17 (X11 release 17 and earlier) (Part 2 of 2)

Prompt	Response	Description
DRAT		D-channel transmission rate
	56K	56 Kbps, default when LCMT (LD17) is AMI
	64KC	64 Kbps clear, default when LCMT (LD17) is B8S
	64KI	64 Kbps inverted HDLC (64 Kbps restricted)
		In X11 release 15 and later DRAT is not prompted when configuring ISL D-channels because the speed is controlled by the modem baud rate
PRI	loop ID	Not prompted if the D-channel is in dedicated mode (the D-channel does not require a channel on the PRI card)
ISLM	1-382	Number of ISL trunks controlled by the D-channel (no default value)
CLOK	(EXT), INT	D-channel clock type
		EXT = Source of primary clock is external to DCHI card. Normally, EXT is used with PRI/ISL.
		INT = Source of primary clock is internal to DCHI card. INT is used only during DCHI loop back testing, where one side is set to INT, the other side is set to EXT.

Procedure 16-2
Configure the D-channel for ISL in LD17 (X11 release 18 and later) (Part 1 of 2)

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel (can also CHG and OUT DCH)
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
USR	PRI, ISLD, SHA	D-channel mode
_ISLM	1-382	Number of ISL trunks controlled by the D-Channel
DCHL	0, 2, 4,...159	PRI loop number for DCHI
OTBF	1-(32)-127	Number of output request buffers
_BPS	xxxx	Baud rate for ISL D-channel on MSDL port (default 64000)
_PARM	R232,(R422) DCE, (DTE)	ISL D-channel interface and transmission mode (MSDL port only)
PRI	0-159 2-15	Additional PRI loops using the same D-channel, and interface ID
DRAT	(56K), 64KC, 64KI	D-channel transmission
IFC	aaa	Interface type: (D100), D250, ESS4, ESS5, SL1, S100
SIDE	NET, (USR)	Meridian 1 node type
RLS	xx	Release ID of the switch at the far end of the D-Channel
RCAP	aaa	Remote D-channel capabilities: MSL, NCT, ND1, ND2, RVQ
_CLOK	INT, (EXT)	Internal or external clock on ISL D-channels

Procedure 16-2
Configure the D-channel for ISL in LD17 (X11 release 18 and later) (Part 2 of 2)

Prompt	Response	Description
LAPD	Yes, (No)	D-channel LAPD parameters
__T23	1-(20)-31	Interface guard timer (DCHI only)
__T200	2-(3)-40	Retransmission timer
__N200	1-(3)-8	Maximum number of retransmissions
__N201	4-(260)	Maximum number of octets in information field
__T203	2-(10)-40	Maximum time (in seconds) without frames being exchanged
__K	1-(7)	Maximum number of outstanding frames
ADAN	NEW BDCH 0-63	Add a backup D-channel
PDCH	0-63	Primary D-channel
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Physical port (odd) for D-channel, card number for MSDL
_PORT	0-3	Port number on MSDL card
BCHL	0,2,4...,-159	PRI loop number for back-up D-channel
RCVP	Yes, (No)	Auto-recovery to primary D-channel option
ADAN	<cr>,****	Go on to next prompt or exit overlay

Procedure 16-3
Use LD15 to define a PRI customer (Part 1 of 2)

Prompt	Response	Description
REQ	NEW, CHG	Add or change a customer
TYPE	CDB	Customer data block
CUST	xx	Customer number (0-99)
LDN0	xxxx . . x	Listed Directory Number 0 length This value must be set to terminate all incoming ISDN/ DID calls. Determines the number of digits to translate.
ANAT	xxxx . . x	Attendant billing number ANAT and ANLD combined must be 7 digits.
ANLD	xxxx . . x	ANI listed DN ANLD and ANAT combined must be 7 digits
AC2		Access Code 2 Enter call types (type of number) that use access code 2 This relates to ESN dialing plans. If you do not have a dialing plan, <cr> past this prompt. Multiple responses are permitted. If a call type is not entered here, it automatically defaults to access code 1.
	NPA NXX INTL SPN LOC	E.164 National E.164 Subscriber International Special number Location code Prompted only for NARS.
ISDN	Yes, (No)	Change ISDN options
_PNI	1-32700	Private Network Identifier (for CLID)
_PFX1	xxxx	Prefix (area) code for International PRA (for CLID)
_PFX2	xxxx	Central Office Prefix for IPRA (for CLID)
_HNPA	100-999	Home Number Plan Area code (for CLID)

Procedure 16-3
Use LD15 to define a PRI customer (Part 2 of 2)

Prompt	Response	Description
_HNXX	100-999	Prefix for Central Office (for CLID)
_HLOC	100-9999	Home Location Code (ESN) (for CLID)
_LSC	xxxx	Local steering code (for CLID)
_CNTP	LDN, (PDN)	Default for Calling Line ID (CLID)
_RCNT	0-(5)	Maximum inter-node hops in a network redirection call

Procedure 16-4
Use LD16 to enable the ISL option on a per route basis (Part 1 of 3)

Prompt	Response	Description
REQ	NEW	Add a PRI trunk route
TYPE	RDB	Type of data
CUST	0-99	Customer number
ROUT	0-511	Route number
TKTP	ISL	Trunk route type:
ESN	Yes, (No)	ESN signalling
BRIP	Yes, (No)	ISDN BRI packet handler route
ISDN	Yes, (No)	ISDN PRI option
_MODE	ISLD	Mode of D-Channel that controls the route
_DCHI	1-15	DCHI port number Prompted if Mode = ISLD
_PNI	0-32700	Customer Private ID (unique to a customer)
_IFC	SL1	Interface machine type for this PRI route
_NCNA	(Yes), No	Network call name allowed

Procedure 16-4
Use LD16 to enable the ISL option on a per route basis (Part 2 of 3)

Prompt	Response	Description
_NCRD	(No), Yes	Network Call Redirection
_TRO	Yes, (No)	Trunk optimization allowed (denied) on the route
_NSF	Yes, (No)	Network Service Facility
_TIER	0-511	Incoming Tie route number
_CHTY	ABCH, (BCH)	Signaling type for B-channel digital routes
_CTYP	aaa	Call type for outgoing direct dialed Tie route
_INAC	Yes, (No)	Insert ESN access code to incoming private network call
_NCOS	(0)-99	Network Call Of Service
_CLS	aaa	Class of service restriction for tie route
_TGAR	0-31	Trunk group access restrictions
_IEC	000-999	Interexchange carrier ID
PTYP	aaa	Port type at far end
ICOG	IAO, ICT, OGT	Incoming and/or outgoing trunk
SIGO	aaa	Signaling arrangement
NEDC	ORG, ETH	Near end disconnect control
FEDC	ETH, FEC, JNT,(ORG)	Far end disconnect control
CPDC	Yes, (No)	Meridian 1 is the only controlling party on incoming calls
DLTN	Yes, (No)	Provide dial tone to the far-end
PSEL	TLNK, (DMDM)	T-link or DM-DM protocol selection
EQAR	Yes, (No)	Enable Equal Access on this route

Procedure 16-4
Use LD16 to enable the ISL option on a per route basis (Part 3 of 3)

Prompt	Response	Description
_GCR	(Yes), No	Use General Carrier Restriction for Equal Access calls
_NTOL	ALOW, (DENY)	Allow or deny North American toll calls (1+ calls)
_ITOL	ALOW, (DENY)	Allow or deny international toll calls (011+ calls)
_SCR	Yes, (No)	Use Selective Carrier Restriction for Equal Access calls
AUTH	Yes, (No)	Authcode to be prompted for incoming tie callers

Procedure 16-5
Respond to the following prompts in LD14

Prompt	Response	Description
REQ	NEW, CHG, MOV, OUT, END	
TYPE	TIE	Trunk type allowed
TN	loop ch	Use loop number created in LD17
RTMB	0-511 1-254	The route defined as an ISA route in LD16
CHID	1-382	Channel identifier for ISL channels (remove with Xnn)—must be coordinated with far end (no default value)

Feature testing

To verify the ISL, do the following:

1 Coordinate with far end personnel. Place a call over a Meridian 1 switch.

2 As you are dialing, the dialed DN appears on your telephone.

3 When the far end telephone is ringing, the CLID of your telephone is displayed on the far end telephone.

4 Both telephones continue to display the CLID when the far end goes off-hook.

Integrated Trunk Access

Integrated Trunk Access (ITA) allows common digital transmission facilities (such as a T1 link) to be shared by:

- B-channel trunks (ISL/PRI)
- traditional A&B bit signaling trunks

This feature removes some trunks from PRI exclusive use, to share between PRI and traditional A & B signaling. ITA supports the following configurations.

- Meridian 1 to Meridian 1
- Meridian 1 to SL-100
- Meridian 1 to DMS-100
- Meridian 1 to DMS-250

Note 1: Channels must match for both signaling and routing.

Note 2: A separate Route Data Block (LD16) must be configured for A/B channels. While PRI is operational, create a RDB for the A/B channels. Then remove the PRI trunks in LD14. Create new trunks with the same TNs for the new route.

Issued:	93 08 01
Status:	Standard
X11 release:	19

MWI Interworking with DMS

The Message Waiting Indication (MWI) feature allows a Message Center on either Meridian 1 or DMS-100 (Centrex) to exchange message waiting indicator information with phones serviced by either type of system on the network. Calls redirected to the Message Center can be from private or public network callers on either system. A caller served by Meridian 1 can use the Message Center on DMS. A caller served by DMS can use the Message Center (Meridian Mail) on Meridian 1.

MWI uses the non-call associated Facility messages on ISDN PRI for transporting the TCAP information.

The Meridian 1 and DMS systems can be connected directly or tandem to whichever system hosts the Message Center. When a caller from either system leaves a message on either system, the message waiting indicator is activated. When the receiver retrieves the message, the message waiting indicator is deactivated. The indicator is either a visual LED (Light Emitting Diode), icon, or an audible tone in the telephone handset.

Figure 18-1 shows a network in which Meridian 1 hosts the Message Center, which serves both Meridian 1 users and users of a DMS-100 in the same customer group.

Figure 18-2 shows a network in which DMS hosts the Message Center, which serves both Meridian 1 users and DMS users in the same or different enterprise groups.

Figure 18-1
Private corporate network with Meridian 1 hosting the Message Center

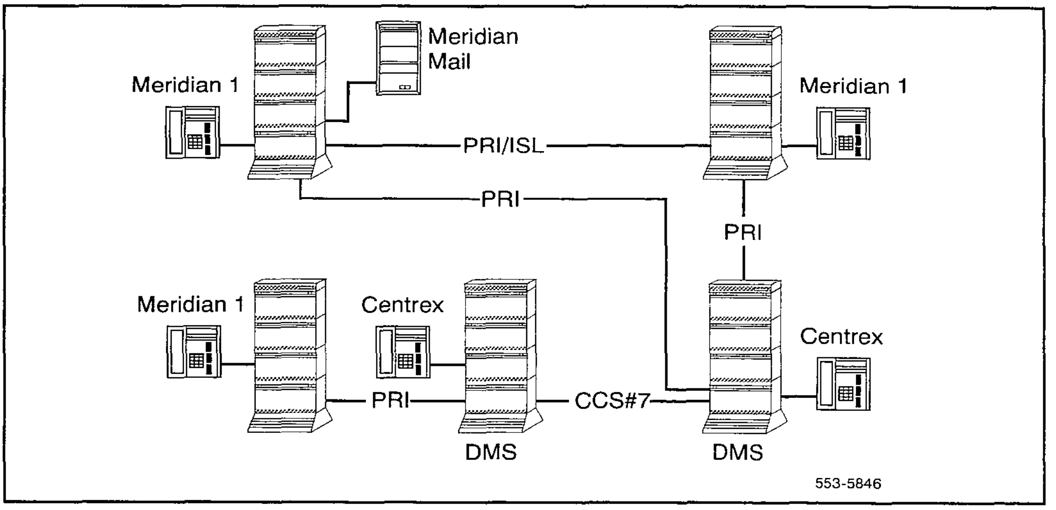
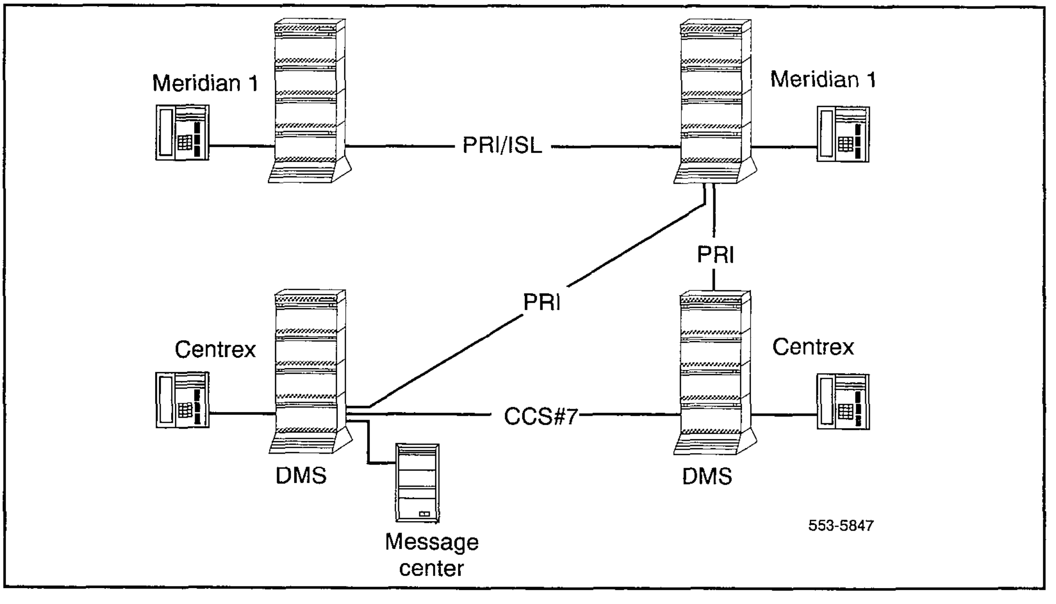


Figure 18-2
Private corporate network with DMS hosting the Message Center



Operating parameters

MWI supports DMS-100 and SL-100 as tandem switches, but no non-Northern Telecom switches as tandems.

Call redirection to Meridian Mail is based on the Network Call Redirection (NCRD) features in X11 release 16. It is subject to the operating parameters of the NCRD features. Refer to the feature description for NCRD in "Network Call Redirection" on page 20-1.

MWI is based on the X11 release 16 Network Message Services-Meridian Mail (NMS-MM). Refer to the feature description for NMS in "Network Message Services" on page 21-1.

Only Meridian Mail is supported as the Message Center on Meridian 1.

Both DMS-100 (using BCS 36) and Meridian 1 can transport Facility messages for MWI and can be tandem switches. DMS-100 can tandem Facility messages from Meridian 1 to Meridian 1 for features such as Call Sender activated by Meridian 1 users of Meridian Mail. Other Facility messages that DMS-100 can tandem are for updating the voice mail softkeys of a M2317 or M3000 set.

MWI allows public and private numbers for the Original Called Number (OCN) in the Setup message during call forwarding and for the Directory Numbers (DN) in the ORIG and DEST Information Elements (IE) of the Facility message to toggle the MWI indicator. The OCN refers to the user's mailbox DN. The OCN must be unique in the Meridian Mail database. If the call forwarding DN to the Message Center is a private number, then the OCN constructed in the setup message will contain a private number. If the call forwarding DN to the Message is a public number, then the OCN constructed in the setup message will contain a public number.

If Meridian Mail is on Meridian 1:

- For Meridian 1 users, Meridian Mail provides the same functions as for the X11 release 16 NMS-MM users, if a private number is used.
- For DMS users, some Meridian Mail features may not be available.

If the Message Center is on DMS:

- If a set on Meridian 1 does not have a DID number, the call forwarding DN to the Message Center should be private. Thus, the set that cannot receive DID calls will still be able to use the Message Center services provided that the DMS Message Center supports private numbers for the mailbox DNs.

End-to-End in-band signalling is required for accessing Message Center features for a local or remote switch.

The call forwarding connection from the caller to the Message Center on another switch must be PRI/ISL or CCS#7. This is for passing the OCN from the caller's switch to the switch which hosts the Message Center for leaving voice messages and for transporting TCAP messages to toggle the MWI indicator.

Feature interactions

Multiple Customer — Serving multiple customers requires multiple Meridian Mail servers. MWI itself does not support multiple customers.

Multi Tenant — Meridian Mail Phase 8 supports Multi Tenant. Tenants from the same customer can use one or more Message Center servers. Tenants from different customers cannot use the same Meridian Mail. The customer controls tenant access to MWI using the sets that belong to the tenant.

Network Message Services, Meridian Mail — Although the Facility message for MWI uses a different TCAP format from that used for NMS, the X11 release 16 functions continue to operate. X11 release 19 Meridian 1 converts the message format when exchanging MWI Facility messages with earlier releases.

DCH Error Monitoring — The X11 release 17 DCH Error Monitoring monitors ISDN messages on a per feature basis. NMS is one of the features monitored through Service Identifier H7C. X11 release 19 supports a new Service Identifier for NMS, H.70, which DMS also supports. DCH Error Monitoring will print out the Facility messages for either Service Identifier H.7C or H.70. If the MWI RCAP for the D channel is added or deleted in LD17, DCH Error Monitoring will not work properly for the NMS feature until the D channel message monitoring is disabled and then enabled.

Trunk Optimization Before Answer – There is no Trunk Optimization when the call is redirected to DMS, or answered by Meridian Mail. This applies to applications such as Auto Attendant.

ISDN/AP Link Recovery – ISDN/AP Link Recovery redirects the calls in the ACD queue to the ACD Night Forward DN when the ISDN/AP link goes down. This recovery is also available for calls in the Meridian Mail ACD queue on Meridian 1 when the AML link goes down.

Feature packaging

MWI Interworking depends on X11 release 19. See *X11 features and services* (553-3001-305) for X11 release software packages and their dependencies.

The package requirements for MWI are different for each node, as described next.

The originating node has Message Center users. Table 18-1 shows the originating node package requirements.

Table 18-1
Package requirements for an MWI originating node

Package	Name of package	Mnemonic
219	Message Waiting Indication (if connected to DMS/BCS36 for interworking)	MWI
10	End to End Signalling	EES
40*	Basic ACD	BACD
45*	ACD package A	ACDA
46	Message Center	MWC
145	ISDN Signalling	ISDN
146 or	ISDN Primary Rate Access	PRI
147	ISDN Signalling Link (for Meridian 1 to Meridian 1)	ISL
148	ISDN Network Service	NTWK
175	Network Message Service	NMS

* This package is required only if ACD DN is used as the Message Center DN.

The host node holds the Message Center. Table 18-2 shows the host node package requirements.

Table 18-2
Packages required for an MWI host node

Package	Name of package	Mnemonic
	X11 release 19 or above	
219	Message Waiting Indication (if connected to DMS/BCS36 for interworking)	MWI
10	End to End Signalling	EES
35	Integrated Message Service	IMS
40	Basic ACD	BACD
45	ACD package A	ACDA
46	Message Center	MWC
77	Command Status Link	CSL
145	ISDN Signalling	ISDN
146 or	ISDN Primary Rate Access	PRI
147	ISDN Signalling Link (for Meridian 1 to Meridian 1)	ISL
148	ISDN Network Service	NTWK
175	Network Message Service	NMS

The tandem node does not have Message Center users. Table 18-3 shows the tandem node package requirements

Table 18-3
Package requirements for an MWI tandem node

Package	Name of Package	Mnemonic
219	Message Waiting Indication (if connected to DMS/BCS36 for interworking)	MWI
145	ISDN Signalling	ISDN
146 or	ISDN Primary Rate Access	PRI
147	ISDN Signalling Link (for Meridian 1 to Meridian 1)	
148	ISDN Network Service	

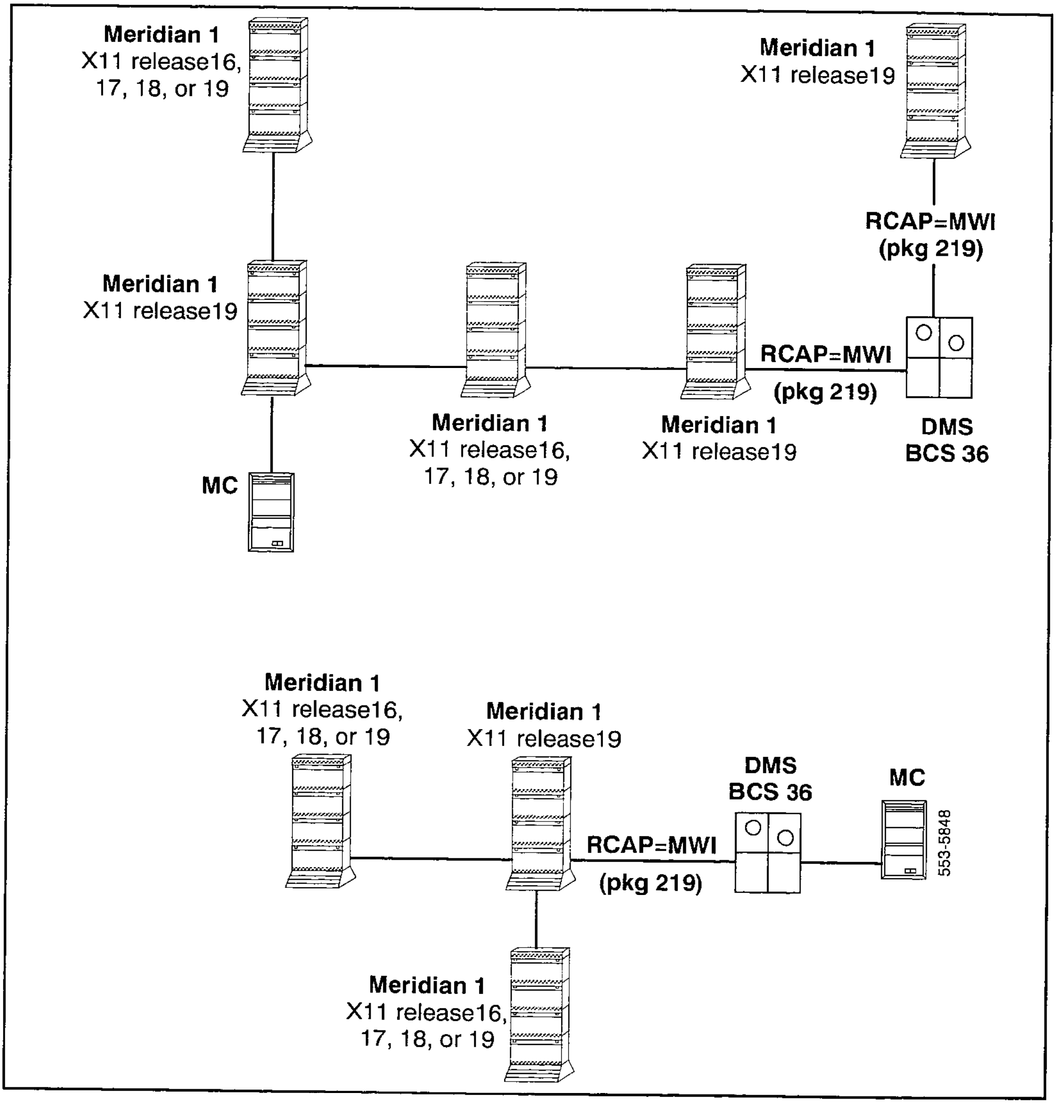
Feature implementation

Figure 18-3 shows the configuration requirements for MWI Interworking.

Procedure 18-1
Use LD17 to configure remote D-channel capability

Prompt	Response	Description
REQ	CHG	Change system data
TYPE	CFN	Configuration record
RLS	19, 36	Release ID of the switch at the far end of the D-channel interface. 19 is Meridian 1, 36 is DMS
RCAP	MWI XMWI	Add remote D-channel capabilities for MWI Remove remote D-channel capabilities for MWI

Figure 18-3
Configuration requirements for MWI Interworking



You can use one of two methods for configuring Meridian Mail users:

1 Use Procedure 18-3 to define an ACD DN as the Message Center DN.

Procedure 18-2
Use LD23 to configure a Message Center DN

Prompt	Response	Description
REQ	NEW, CHG	Add or change system data
TYPE	ACD	Automatic call distribution
CUST	xx	Customer number (0-99)
ACDN	xxxx	ACD Directory Number
MWC	YES	ACD DN message center DN
NCFW	xx . . . xx	Message Center DN: — a public DN (10 digits prefixed by an ESN access code) — if UDP is used, an ESN number prefixed by an ESN access code — a CDP number **Note:** Do not define an agent for this ACD group to allow for the automatic call redirection to the ACD Night Call Forward DN where the Message Center DN is defined.

Use LD10 or LD11 to assign the user's DN for Call Forward No Answer, Call Forward Busy, or Hunt, to the ACD DN.

2 Use LD10 or LD11 to assign the user's DN for Call Forward No Answer, Call Forward Busy, or Hunt, to the Message Center DN.

The Message Center DN can be one of the following:

– a public DN (10 digits prefixed by an ESN access code)

– if UDP is used, an ESN number prefixed by an ESN access code

– a CDP number

Procedure 18-3
Use LD22 to print the configuration record

Prompt	Response	Description
REQ	PRT	Print system data
TYPE	CFN	Configuration record
RLS	xx	Release ID of the switch at the far end of the D-channel
RCAP	MWI	Remote D-channel capabilities

Note: The mnemonic "WMI" is printed for overlay 22.

Feature operation

MWI performs two basic operations: 1) Activate the MWI at the caller's set; 2) Deactivate the MWI at the subscriber's telephone. Table 18-4 shows the sequence that activates the MWI. Table 18-5 shows the sequence that deactivates the MWI.

Table 18-4
When MWI is activated

Sequence	Caller	Receiver	Message Center
1	Calls receiver	Receiver not available	
2	Leaves a message		Records caller's message
3	Hangs up		Activates MWI on receiver's set

Table 18-5
When MWI is deactivated

Sequence	Receiver	Message Center
1	Notices MWI	
2	Calls the Message Center	Plays messages
3	Clears the mailbox	
4	Hangs up	Deactivates MWI on receiver's set

Some of the failures that can occur and how MWI handles them are:

– *AML/CSL link failure*
If the AML/CSL link fails between Meridian mail and its host Meridian 1, calls are redirected to the ACD Night Call Forward DN for the ACD queue involved.

– *D channel failure*
If the D channel is out of service, the Facility message is lost. For Meridian Mail, a MWI CSL message is sent to the Meridian Mail server.

– *Inconsistent data base*
If the Facility message that toggles MWI cannot be delivered to the caller's set because the DN is invalid or MWI is not supported in the remote switch, a MWI CSL message is sent to Meridian Mail.

Network Call Party Name Display/ Network Name Delivery

Network Call Party Name Display (NCPND) provides a network-wide visual display of names and telephone numbers to both parties of a call. For telephones equipped with an alphanumeric display, NCPND provides the display of the calling party's name on the terminating telephone and the called party's name on the calling telephone. The name and number display last for the duration of the call. See Figure 19-1.

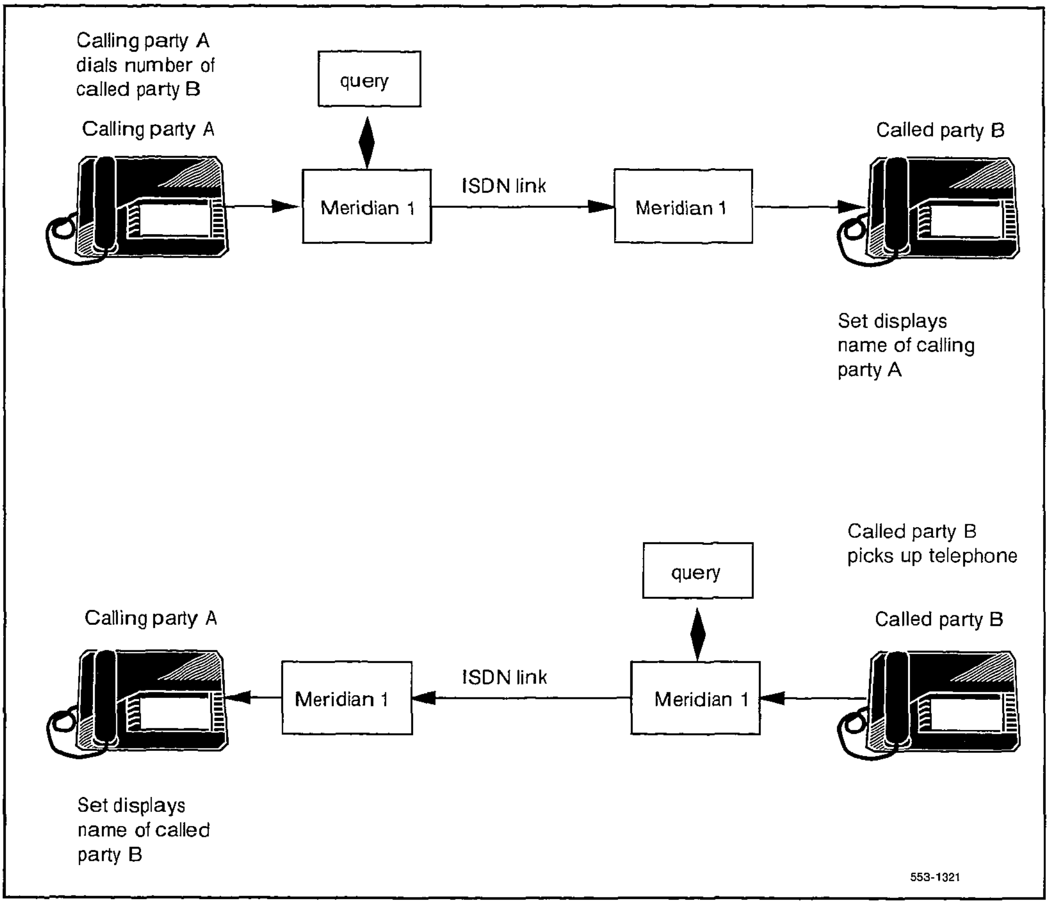
The sending of the names over the private network is an option set up on a per route basis. The name is provided by Calling Party Name Display (CPND) configured in each switch. For call redirections, a set option provides a display of the redirecting name instead of the calling name.

The following telephones and attendant consoles are supported:

- M2317 digital telephones
- M3000 Touchphone
- all Meridian Modular Telephone with digit display
- M1250 and M2250 attendant console

Network Name Delivery (NND) is the method used to send the names and numbers across the network. There are two NND methods available: ND1 and ND2.

Figure 19-1
Network Call Party Name Display



Operating parameters

Network Name Delivery method 1

Network Name Delivery method 1 (ND1) is available in X11 release 14 and later. The following list describes ND1 operating parameters.

- Meridian 1 to Meridian 1 connections only are supported.
- For X11 release 14, ND1 supports name display for redirected calls by Call Forward All Calls.
- With X11 release 16, ND1 supports the name display for call redirection by Call Forward No Answer, Hunt and Call Pickup if the redirection is done across the network. See "Network Call Redirection" for configuration.
- If the called party is at a remote switch, the called party name is displayed on the caller's display only after the call is answered unless there was a redirection. (See the chapter on Network Call Redirection for a discussion of call redirection with X11 release 16 and later hardware.)
- A CPND enhancement allows the display of the redirecting name on the terminating telephone instead of the calling name by a service change option only if the first redirecting party is on the terminating switch.
- Prior to X11 release 16, ND1 supports the name display for call transfer only for a local transfer over PRI. In that case, the name is displayed on the terminating telephone.
- The maximum number of characters in a displayed name is 24.

Network Name Delivery method 2

Network Name Delivery method 2 (ND2) is available in X11 release 17 and later. ND2 provides network-wide name display in compliance with the Meridian Customer Defined Networking (MCDN) protocol. It allows interworking among Meridian 1s and a DMS-100/250 Central Office.

The following list describes the ND2 operating parameters.

- All DMS-100s must be equipped with BCS32 or later software and all Meridian 1s with a direct connection to the DMS-100 must be quipped with X11 release 17 or later.
- For Meridian 1 to Meridian 1, the maximum number of characters in a displayed name is 24. When connecting to a Central Office, 15 characters only are supported. Names exceeding this length are truncated.
- ND2 supports name delivery for Call Pickup, Call Transfer, Hunt and Call Forward All Calls/No Answer/Busy.
- A CPND enhancement allows the display of the redirecting name on the terminating telephone instead of the calling name by a service change option only if the first redirecting party is on the terminating switch.
- In all cases when the name is available, the called party name is displayed on the caller's display during the ringing phase. This is an enhancement over ND1 which displays names on connect.
- ND2 enhancements are not supported on connections to Meridian 1 using ND1. ND1 is applicable for X11 release 14 through 16. ND2 is recommended for X11 release 17 and up. The far ends must match.

Feature interactions

Refer to Calling Party Name Display in *X11 features and services* (553-3001-305) for CPND feature interactions.

Feature packaging

NCPND requires these packages.

95	Calling Party Name Display	CPND
145	ISDN Signalling	ISDN
146	ISDN Primary Rate Interface Dependencies: 75, 145, 19 [CLID]	PRI

Feature implementation

LD95 – Configure the Calling Party Name Display feature

Refer to Calling Party Name Display in *X11 features and services* (553-3001-305) to implement CPND.

LD16 – Enable NCPND for each required trunk route

NCNA	Yes, (No)	Allow or deny Network Call Name Display. To prevent hit-and-miss name display or the dropping of calls in networks whose nodes have BCSS31 or earlier or X11 release 16 or earlier, enter No. For example, where a X11 release 17 Meridian 1 node has an adjacent DMS node with BCS31 or earlier, enter No.

LD17– Indicate the remote capability (which Network Name Delivery protocol is supported by the remote node/switch on this DCH interface)

RCAP	ND1/ND2	Network Name Delivery method 1 (ND1) Network Name Delivery method 2 (ND2) (X11 release 17 and later with BCS 32 and later)

Network Call Redirection

Network Call Redirection (NCRD) provides Network Call Forward No Answer (NCFNA) and Network Call Forward All Calls (NCFAC) over an ISDN PRI or ISL network. Calls can also be transferred over the network, but the Calling Line Identification (CLID) display does not reflect the reason for the transfer.

With X11 release 16 and later software, Network Call Redirection (NCRD) incorporates these features:

- Network Call Forward Busy — NCFB
- Network Hunt — NHUNT
- Network Transfer — NXFER
- Call Pick Up — PKUP
- Call Forward by Call Type — CFCT

Network Call Redirection (NCRD) is based on standard Call Redirection which permits call redirection within a Meridian 1. NCRD redirects calls through more than one PBX over ISDN. The Calling Line ID (CLID) shows a name and network DN in place of the local DN.

On a system level, NCRD supports Meridian 1 to Meridian 1, SL-100, and DMS-100 connections. Private numbering plans, Uniform Dialing Plans (UDPs) in ESN and the Coordinated Dialing Plan (CDP) are supported by both network configurations.

If the calling party's numbering plan is any other type, then Call Forward by Call Type (CFCT) calls use Route Class Marks (RCLS) to determine call type—internal or external. The features interfacing with Network services also support expanded DNs.

Some redirected calls can pass through or tandem one switch. If a call is redirected several times, only one CFNA (or NCFNA) is allowed, unless the forwarding telephone has Second Level CFNA defined.

The following telephone types are supported by this feature:

- Meridian 1 Digit Display telephones
- 500/2500 telephones (for redirection only without display)
- Attendant telephones
- M2000 and M3000 digital telephones
- M2317 Digital telephones
- M2008, M2016S, M2216ACD, M2616 when equipped with displays

Note: A redirected call over PRI that ends on a busy telephone cannot activate the Network Ring Again (NRAG) feature.

NCRD terminology

There are four types of parties in a call redirection scenario:

- the originating party
- the originally dialed DN
- the redirecting party
- the terminating party

In a simple call redirection, a call is redirected once. When A calls B, and B redirects the call to C, the following parties are identified.

A is the originating party
B is the originally called party and the redirecting party
C is the terminating party

With further call redirection, the party's terminology changes:

A calls B	A is the originating party B is the originally dialed DN
B redirects the call to C	C is the redirecting party
C redirects the call to D	D is the terminating party

Originating party notification

An originating party with CLID services can display a reason for the call redirection. Figure 20-1 shows the format on a Digit Display for the originating party on an internal redirection.

Figure 20-1
Display format for NCRD: Originating party with CLID

Originally called party DN	Terminating party DN	Reason for redirection	Terminating party name

The "Reason for redirection" field shows why the call is redirected. The mnemonic displayed is assigned by the customer in LD95. See the chapter on configuring PRI for the procedure to program Network Call Redirection (NCRD). For a complete description of the prompts and responses available, see the *X11 input/output guide* (553-3001-400).

In addition, NCRD uses Q.931 notification messages to indicate that a transfer has occurred. An extra message helps update telephone and telephone displays to show the reason for call redirection. Also, the displays for Attendant extended calls are complete to all call parties.

Terminating party notification

The Digit Display for a terminating party with CLID allowed shows the reason for call redirection. Figure 20-2 is an example of the format for a terminating party on an internal call redirection.

Figure 20-2
Display format for NCRD: Terminating party with CLID

Calling Line ID	Originally called number	Reason for redirection	Calling party name

If the originating party information is not available, the redirecting party DN is displayed instead.

Tones on redirection

Tones returned to the originating party are determined by the reason for call redirection. Table 20-1 lists which call redirections return a tone and which tone they return.

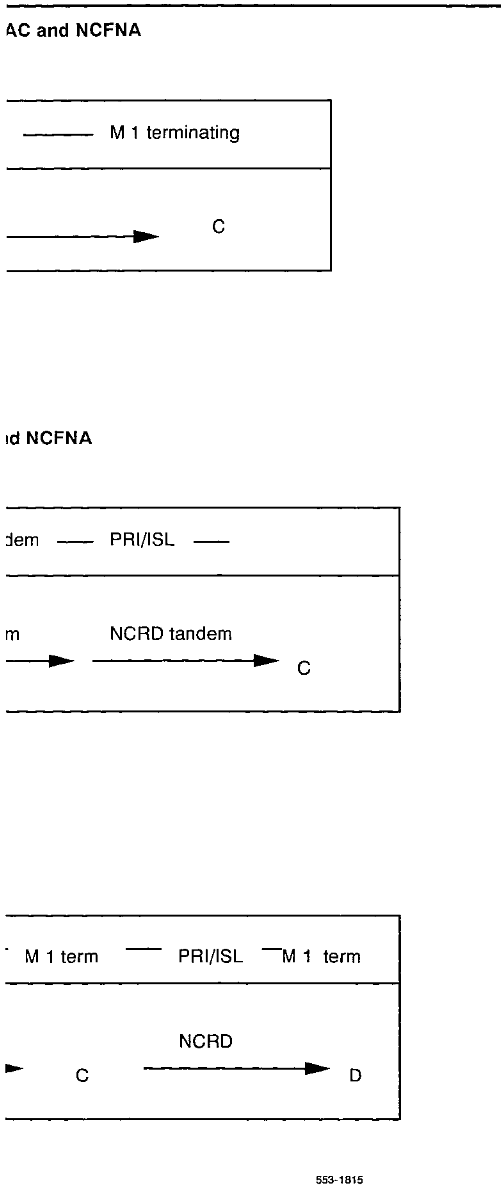
All the items in this table relate to Network Services only. Most of these features have similar or exact applications in the regular PBX network, without ISDN functionality.

A redirection counter is transmitted with the call forwarding information. When the count meets the redirection counter maximum, there are two possible scenarios:

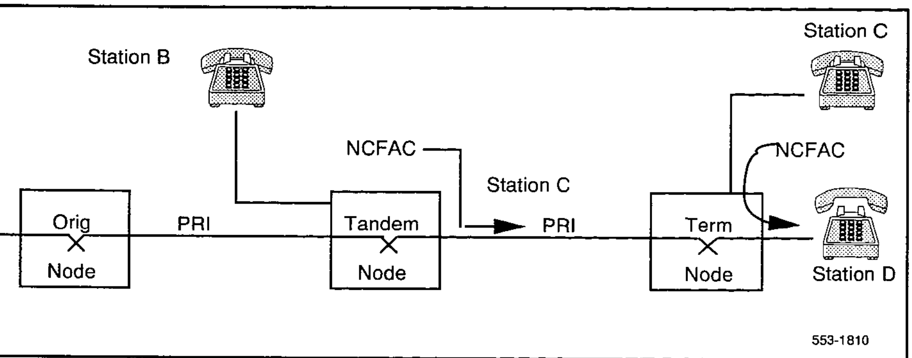
- Network Call Forward All Calls (NCFAC)
  If all call redirections are due to NCFAC, then the calling party receives overflow tone.
- Network Call Forward No Answer (NCFNA)
  If one of the redirections is due to NCFNA, then an attempt is made to re-ring the telephone that initiated the NCFNA.

Conditions
pt
ictive call in progress
ies again to ring the dialed DN
code, or invalid Pickup DN
swered by another Pickup group
mpt
ırty without XFER allowed
/ Hunt DN and no attendant is

s have calls forwarded to the Hunt DN.
inate. The exception is when the
NA.



FAC intranode



For ng

to

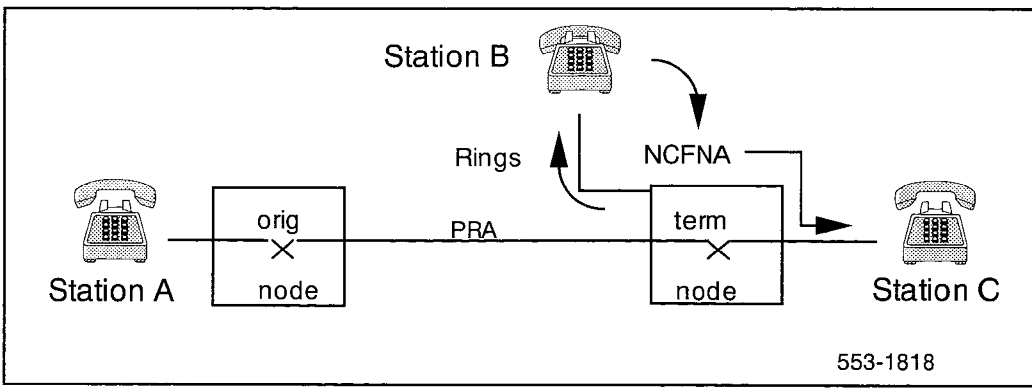
or

NCFNA redirection

The following occurs in a NCFNA redirection scenario. See Figure 20-8.

- Station A generates an internode call to Station B which has Call Forwarding No Answer and forwards to Station C.
- The call is forwarded to Station C when the ringing (or alerting) phase times out.
- The terminating node sends a message to the originating node that contains the redirection number (Station C) and the redirection reason (NCFNA).
- When Station C answers the call, the terminating node generates a message to the originating node indicating this response.

Figure 20-8
NCFNA



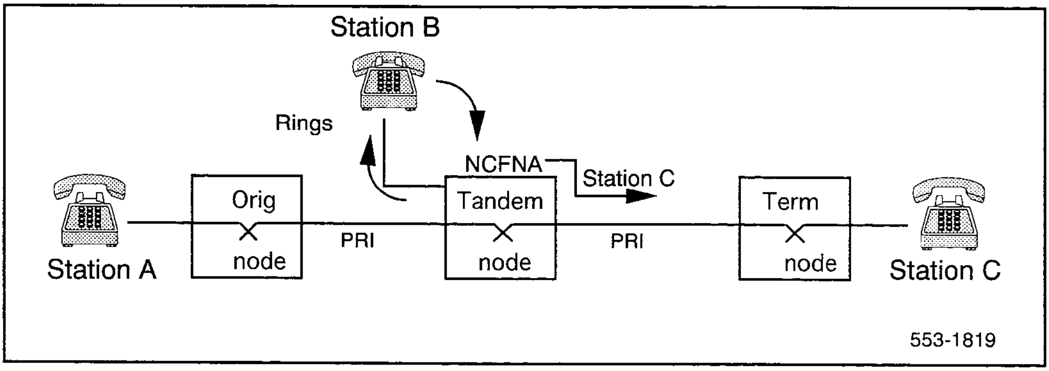
Note: Sets A, B, and C must have a display in order to see a reason for redirection, or a name or Digit Display.

Tandem NCFNA redirection

The following occurs in tandem NCFNA redirection. See Figure 20-9.

- Station A generates an internode call to Station B which has Call Forwarding No Answer and forwards to Station C.
- The call is transferred to Station C when the ringing (alerting) phase times out.
- The message sent to the terminating node contains the terminating party number (Station C), calling number (Station A), original called number (Station B), original reason for redirection (NCFNA), and the redirection counter with a value of 1.
- The terminating node sends a message to the tandem node which relays the message to the originating node with the redirection number (Station C) and the reason for redirection.

Figure 20-9
Tandem NCFNA



Note: Sets A, B, and C must have a display in order to see a reason for redirection, or a name or Digit Display.

Network Call Forward Busy

See Figures 20-10 through 20-13.

Figure 20-10
Remote NCFB

1 DID trunk A initiates a call to remote Station B (on a different node), who has NCFB enabled.

NCFB = Network Call Forward Busy

2 NCFB forwards the call to Station C, on a node local to the originally dialed telephone B.

3 Station C answers the call.

The terminating telephone receives the call information to display the reason for redirection, and if available, the originating number and name.

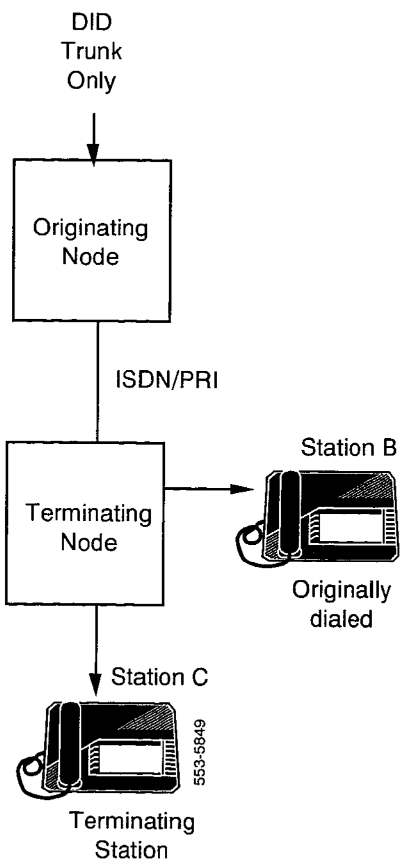


Figure 20-11
Internode NCFB

1 DID trunk A dials a local call to Station B with NCFB enabled.

NCFB = Network Call Forward Busy

2 The Originally dialed telephone forwards the call to Station C, on a remote node.

3 Station C answers the call.

The terminating telephone receives the call information to display the reason for redirection, and if available, the originating number and name.

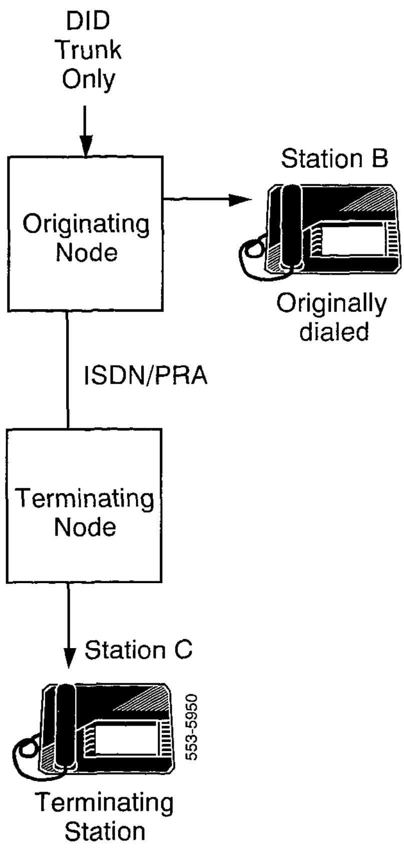


Figure 20-12
NCFB through a tandem node

1 DID trunk A initiates a call to Station B with NCFB, on a remote node.

NCFB = Network Call Forward Busy

2 The call is forwarded from one remote node (a Tandem node) to the Terminating telephone at a third different location.

3 Station C answers the call.

The terminating telephone receives the call information to display the reason for redirection, and if available, the originating number and name.

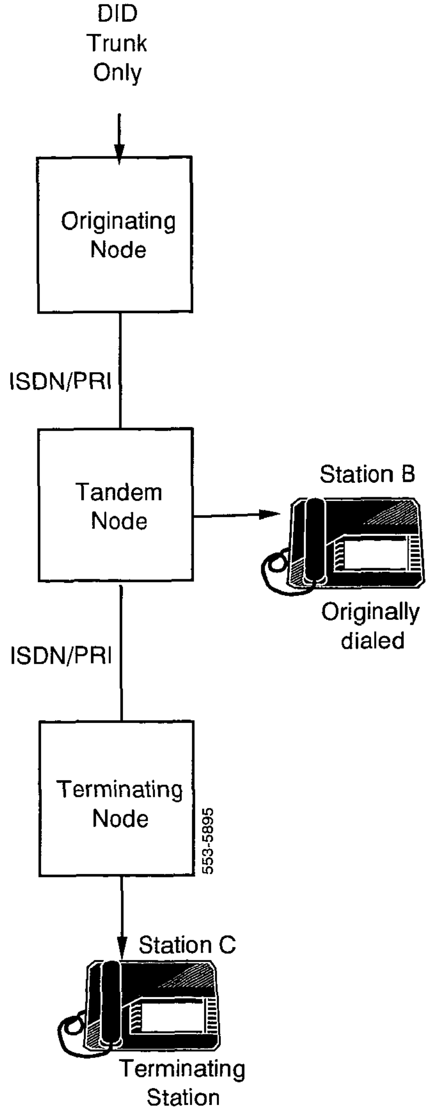


Figure 20-13
NCFB through a tadem node

1 DID trunk A initiates a internode call to Station B with NCFB.

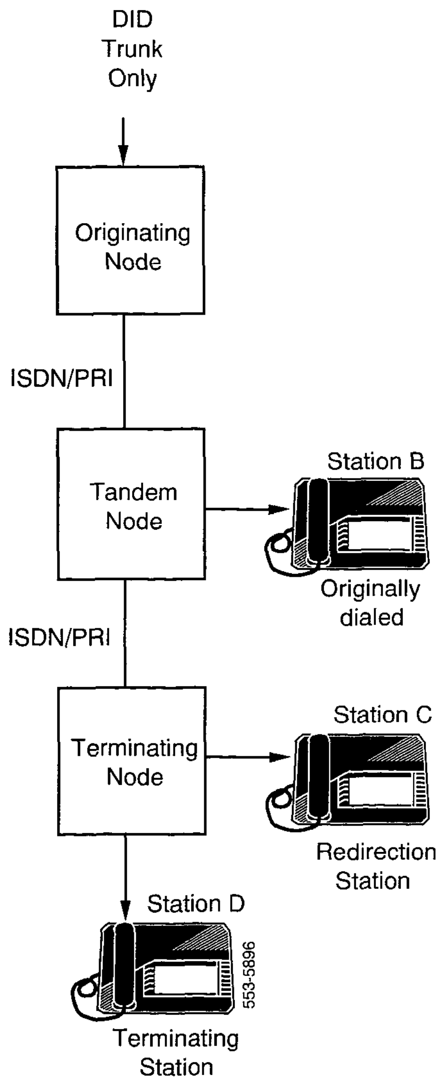
NCFB = Network Call Forward Busy

2 The call is forwarded through the Tandem node to Station C on another remote node.

3 Station C also has NCFB feature enabled.

The call is forwarded to the Terminating telephone and answered.

The terminating telephone receives the call information to display the reason for redirection, and if available, the originating number and name.



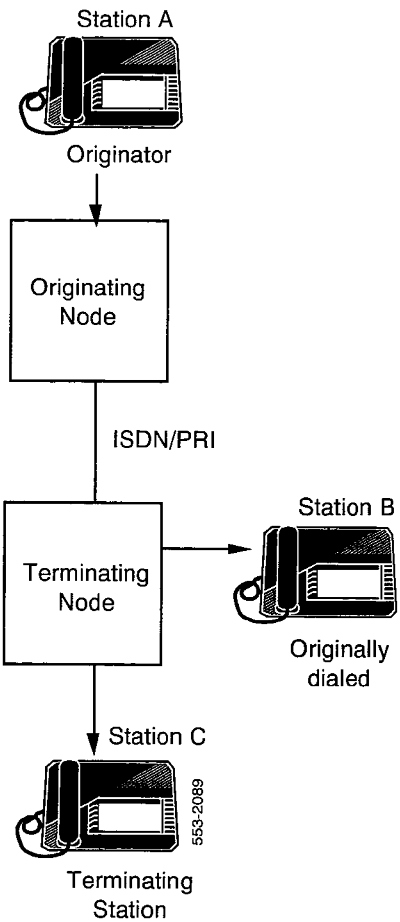
Network Hunt

See Figures 20-15 through 20-17.

Figure 20-14
Remote NHNT

1 Station A initiates a call to remote Station B (on a different node), who has NHNT enabled.

NHNT = Network Hunt



2 NHNT forwards the call to Station C, on a node local to the originally dialed telephone B.

3 Station C answers the call.

The terminating telephone receives the call information to display the originating number, name and reason for redirection.

Figure 20-15
Internode Hunting

1 Station A dials a local call to Station B with NHNT enabled.

NHNT = Network Hunt

2 The Originally dialed telephone forwards the call to Station C, on a remote node.

3 Station C answers the call.

The terminating telephone receives the call information to display the originating number, name and reason for redirection.

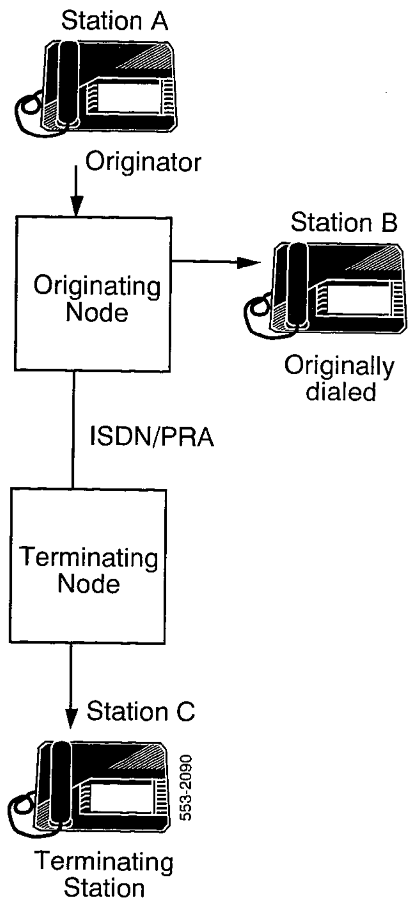


Figure 20-16
NHNT through a tandem node

1 Station A initiates a call to Station B with NHNT, on a remote node.

NHNT = Network Hunt

2 The call is forwarded from one remote node (a Tandem node) to the Terminating telephone at a third different location.

3 Station C answers the call.

The terminating telephone receives the call information to display the originating number, name and reason for redirection.

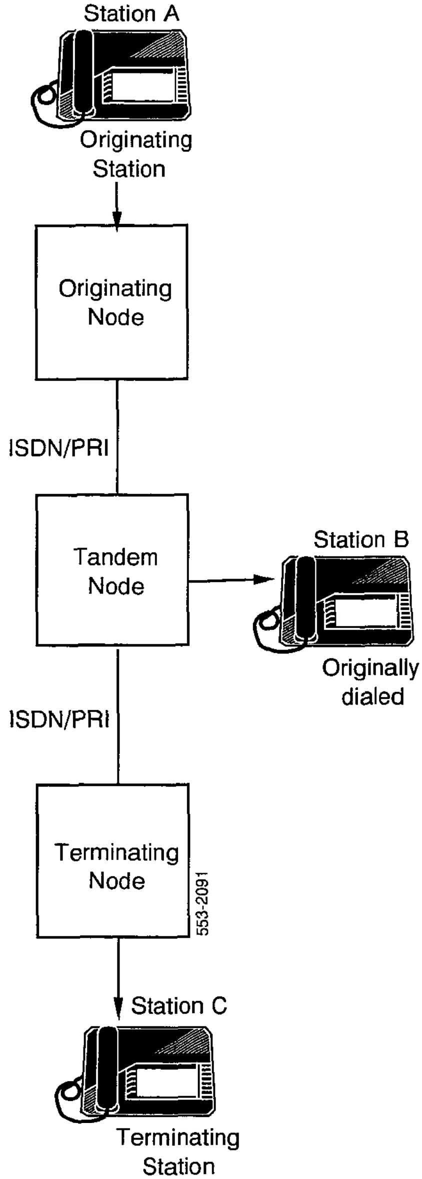


Figure 20-17
NHNT through a tandem node

1 Station A initiates a internode call to Station B with NHNT.

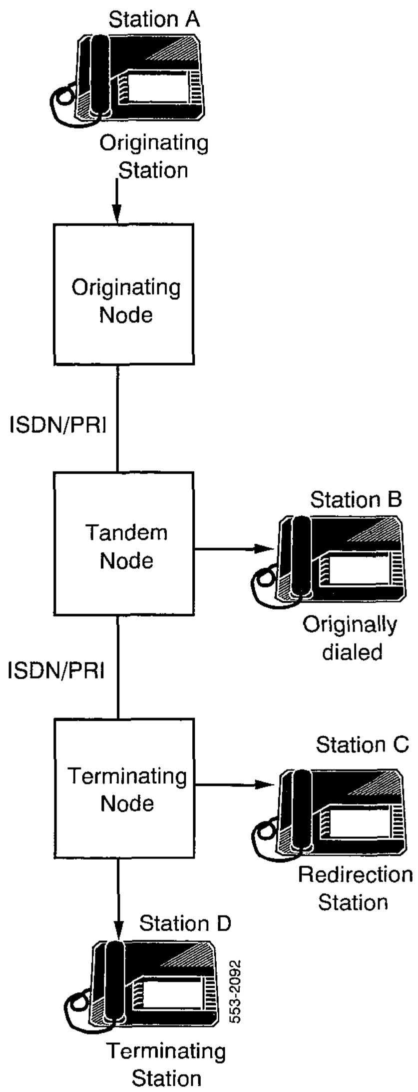
NHNT = Network Hunt

2 The call is forwarded through the Tandem node to Station C on another remote node.

3 Station C also has NHNT feature enabled.

The call is forwarded to the Terminating telephone and answered.

The terminating telephone receives the call information to display the originating number, name and reason for redirection.



Network Transfer

The originally dialed party can transfer a call over ISDN using Network Transfer (NXFER). As with regular call transfers, the incoming call is automatically placed on Hold while the transfer is being set-up. When the redirection is complete, the originally dialed telephone is automatically released. Refer to the figures in this chapter for examples of different Network Call Transfer (NXFER) scenarios.

Internal call redirections, where all parties are local on the same switch, do not show a reason for redirection on the Digit Display.

This function is not associated with Network Call Transfer, an ESN feature that operates only on analog or digital trunks.

See Figures 20-18 through 20-21.

Figure 20-18
NXFER internode call

1 Station A initiates a local call to Station B

2 Station B uses Call Transfer to redirect the call to Station C, which is on a remote node.

3 The originally dialed call is released from the originally dialed DN, and a "new" call is set-up between the Originating node and the Terminating telephone (Station C).

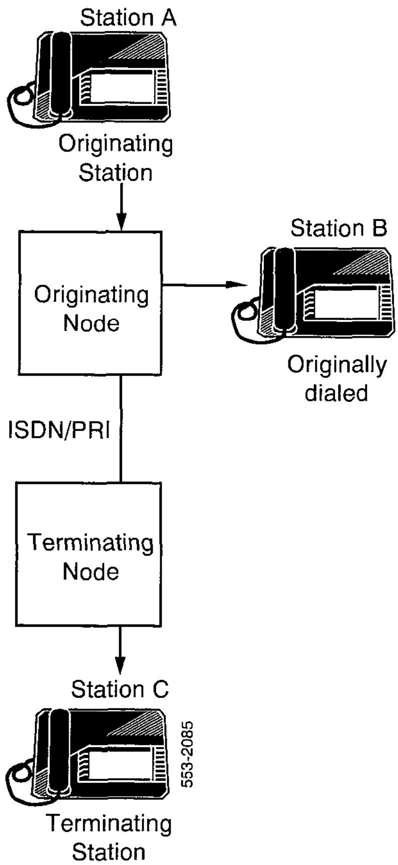


Figure 20-19
NXFER remote node call

1 Station A initiates a remote internode call to Station B.

2 Station B answers the call and generates a local Call Transfer to Station C.

3 Station B completes the Transfer, leaving A connected to C.

When the originally dialed telephone is released from the transfer, the terminating telephone receives the call information to display the originating number, name and reason for redirection.

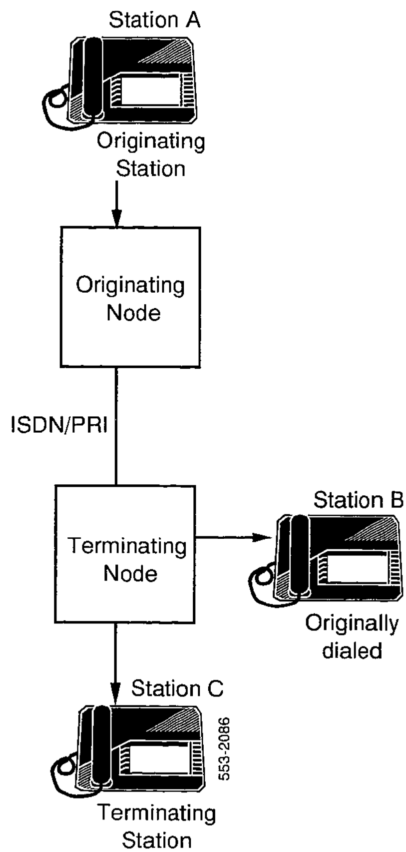


Figure 20-20
NXFER tandem node call

1 Station A initiates a remote internode call to Station B.

2 Station B, on a tandem node, transfers the call to Station C on another remote node.

3 The call transfer is completed to the terminating telephone, Station C.

When the originally dialed telephone is released from the transfer, the terminating telephone receives the call information to display the originating number, name and reason for redirection.

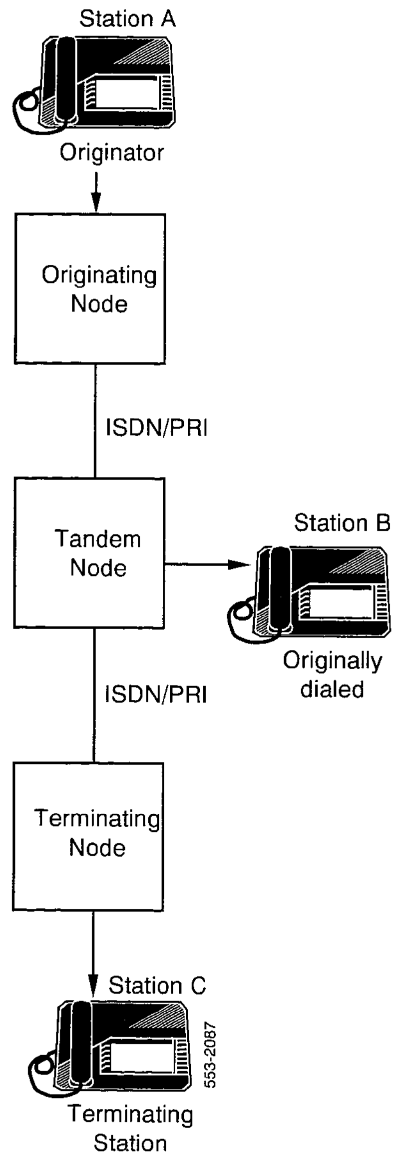
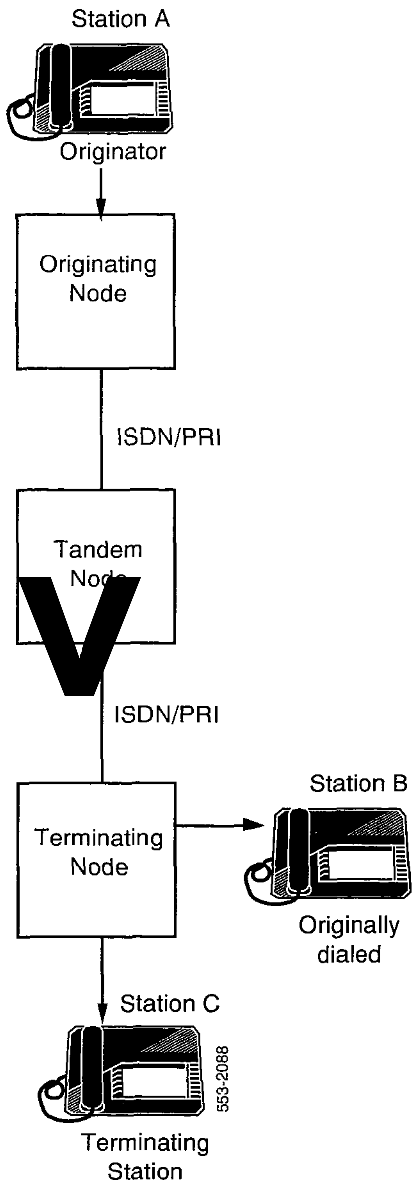


Figure 20-21
NXFER tandem node remote call

1 Station A initiates a tandem internode call to Station B.



2 Station B answers and transfers the call to a local Station C.

3 Station C is connected with the redirected call from Station A.

When the originally dialed telephone is released from the transfer, the terminating telephone receives the call information to display the originating number, name and reason for redirection.

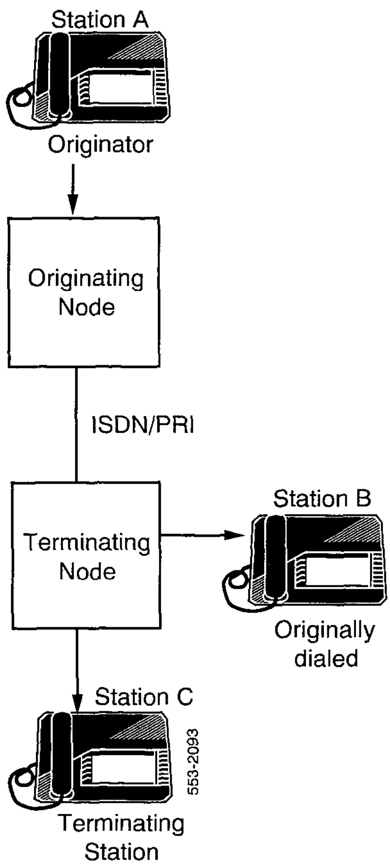
Network Call Pickup

Figure 20-22
Network Call Pick Up

1 Station A initiates a call to Station B, part of a remote Network Call Pick Up group.

2 Station B, the originally dialed telephone, rings.

3 Station C activates Call Pick Up and answers the call originally directed to Station B.



Feature implementation

The following procedures define the step-by-step procedures for the administration of these features within an ISDN environment.

Incoming calls can be redirected only if the trunk to trunk connection is already allowed. Refer to the *X11 input/output guide* (553-3001-400). These networking features are based on the regular features they are named after. For example NCFB is based on Call Forward Busy, and NCFNA is based on Call Forward No Answer. All the same operating parameters apply, refer to the *X11 features and services* (553-3001-305).

Follow the steps described here to implement features for Network Call Redirection:

- Network Call Forward Busy (NCFB)
- Network Hunting (NHNT)
- Network Transfer (NXFER)

To configure NCFNA, NHNT, NCFB, NXFER, use the following steps:

1. LD15 Configuration Record (Procedure 20-11)
   Forward calls to a forwarding DN.
2. LD16 Route Data Block (Procedure 20-2)
   Allow Network Call Redirection.
3. LD95 Call Party Name Display (Procedure 20-3)
   Display the reason calls are redirected.
4. LD95 Call Party Name Display (Procedure 20-4)
   Give each DN a name.
5. LD10 Single line telephone sets (Procedure 20-5)
   Enable the appropriate feature in the data block.
6. LD11 Multi-line telephone sets (Procedure 20-6)
   Enable the appropriate feature in the data block.

   Note: Responses in parentheses are default values throughout the procedure.

Procedure 20-1
Respond to the following prompts in LD15

Prompt	Response	Description
REQ	CHG	
TYPE	CDB	Customer data block
CUST	0-99	Customer number
FNAD	FDN	Call forward no answer DID calls—Flexible CFNA DN
FNAT	FDN	Treatment for External CFNA calls (non-DID—when FDN is selected, CFCT handles the call
FNAL	FDN	Requests treatment for CFNA—when FDN is selected, DID calls are forwarded
RCNT	0-(5)	Maximum number of inter-node hops allowed in a network redirection call. This field must be set to greater than 0 for a network redirection to take place. ***Note:*** The RCNT prompt is only checked for redirected calls when the ISDN prompt is yes in LD15.

Procedure 20-2
Respond to the following prompts in LD16

Prompt	Response	Description
REQ	CHG	
TYPE	RDB	Route data block
CUST	0-99	Customer number
ROUT	0-511	Route number
.		
.		
.		
srvc		
NCNA	YES, (NO)	Network Call Name is (is not) allowed
NCRD	YES, (NO)	Network Call Redirection. Allows network call redirection messages to be sent (or blocks messages if NCRD= NO) ***Note:*** Network Call Redirection can occur without answering YES to the NCRD prompt. This prompt only controls the sending of Network Call Redirection messages, not the actual redirection of the call. The message supplied when NCRD = yes provides the information for the CLID display. When NCRD is NO, the call is redirected without the CLID redirection information. It is appropriate to set NCRD = no when your network interfaces with a network that is equipped with an earlier version of ISDN than X11 release 14.
TRO	YES, (NO)	Trunk Optimization TRO economizes trunk use throughout the network as part of the NCRD feature.

Procedure 20-3
Respond to the following prompts in LD95

Prompt	Response	Description
REQ	CHG	
TYPE	CPND	Call Party Name Display data block
CUST	0-99	Customer number
ROUT	0-511	Route number
.		
.		
.		
des		
RESN	YES	Allow display of reason for redirecting calls
CFWD	xxxx, (F)	Display mnemonic for (Network) Call Forward All Calls. Default is "F." Enter the mnemonic that represents NCFAC on a set's CLID display.
CFNA	xxxx, (N)	Mnemonic for (Network) Call Forward No Answer display. Enter the mnemonic that represents NCFNA on a set's CLID display. Default is "N."
HUNT	xxxx, (B)	Mnemonic for Network Hunting display
PKUP	xxxx, (P)	Mnemonic to allow Call Pickup display
XFER	xxxx, (T)	Mnemonic for Call Transfer display

Procedure 20-4
Respond to the following prompts in LD95

Prompt	Response	Description
REQ	CHG	
TYPE	NAME	Call Party Name Display name entry
CUST	0-99	Customer number
DIG	xxx xx	An existing Dial Intercom Group number (0-253) and member number (0-99)
NAME	aaa...a	CPND name using ASCII characters. The DIG prompt is reprompted. Enter <CR> to get the DN prompt.
DN	xxxx	DN of eligible type.

Procedure 20-5
Respond to the following prompts in LD10

Prompt	Response	Description
REQ	CHG	
TYPE	500	Enter set type
HUNT	xxxx	Hunt DN for internal calls
FTR	EFD xxx	External Flexible call forward DN
		Only allowed if LD15 is properly configured: FNAD = FDN FNAL = FDN FNAT = FDN
		If the DNXP package is equipped, up to 7 digits are allowed; otherwise, only 4 digits can be entered. Accepted only if CLS is MWA or FNA.
	EHT xxxx	External Hunt DN
		Only allowed if CLS = CFTA
		Same digits defined as above
	FDN xxxxxxx	Flexible Call Forward No Answer DN (cannot be an LDN).
		Same digits defined as above

Procedure 20-6
Respond to the following prompts in LD11

Prompt	Response	Description
REQ	CHG	
TYPE	xxxx	Enter set type as appropriate
FDN	x..x	Flexible CFNA DN where xx is the MCDN. The FDN value should include AC1/AC2 when applicable (up to 13 digits).
EFD	xxxx	Network CFNA DN for External calls
HUNT	xxxx	Network Hunt DN for calls with CLS = CFTD
EHT	xxxx	Network Hunt DN for External calls.

Feature testing

To verify Network Call Redirection (NCRD), do the following:

1. Place a call from the Meridian 1 system over a PRI trunk to a digit display telephone at a far end facility. This far end facility must be on a different node.
2. To make sure that network redirection takes place, the first dialed number must be in an NCFNA or NCFAC condition.
3. Verify that the call is terminated correctly.

   Note: In order to do steps 4 and 5, both ends must be equipped with X11 release 15 or later ISDN software.

4. Verify that the display of the calling party contains the following:
   - Originally called party DN (or redirecting DN)
   - Connected Party DN
   - Reason for redirection
   - Connected Party Name
5. Verify that the display of the connected party contains the following information:
   - Calling party DN
   - Originally called party DN (or redirecting DN)
   - Reason for redirection
   - Calling Party Name
6. Verify that the call can be released properly from either end.
7. Then have the far end place a call that is redirected. Then repeat steps 4 through 6.

Network Message Services

Network Message Services (NMS) uses ISDN signaling capabilities to provide messaging services across an ISDN network. Meridian 1 systems interconnected with PRI or ISL can extend supported message services to all users within that network on a customer basis from a single, central location. Access to NMS and feature activation from the messaging system is transparent to the end user.

X11 release 15

For X11 release 15 and later, Network Message Services supports the Message Center (MC) feature. NMS-MC supports centralized manual message centers that use attendant consoles, Meridian 1 telephones, or ACD telephones as answering positions.

X11 release 16

A second distinct application, NMS-Meridian Mail (NMS-MM), is introduced to provide end-user and calling party access to centralized Meridian Mail services across the network.

NMS functions common to both applications are described here and details specific to each are described later in this chapter. Differences between Message Center and Meridian Mail functions are described under their headings below.

Within NMS operations, there are direct message calls and indirect message calls:

- Direct calls are initiated by the user accessing the Message Center to receive messages. Access is allowed by dialing the message facility directly or using the Message Waiting Key (MWK).
- Indirect calls occur when a redirection feature directs the call to a Message Center so the caller can leave a message.

An NMS call has two components: basic PRI call signaling and transaction signaling. The PRI portion of the call is supported by ISDN PRI or ISL and Network Call Redirection (NCRD) – subject to the requirements for PRI calls and the NCRD feature. NMS always uses non-call-associated, connectionless Transaction Signaling messages to turn on/off user set Message Waiting Indication (MWI) and to transport call information for certain Meridian Mail features, including Call Sender (that is, the transport of connectionless signaling information across the ISDN network).

There are three types of network nodes supporting NMS:

- originating node. For direct calls, the originating node is the PBX where the calling party resides. For indirect calls, the originating node is the node where the originally dialed party resides.
- tandem node. This switch can pass transaction signaling messages on to the next PBX. Stations on a tandem node do not have access to Network Message Services functionality.
- terminating node. This is the PBX where the Message Center or Meridian Mail server resides, and where the call terminates.

NMS supports Coordinated Dialing Plans (CDPs) and Uniform Dialing Plans (UDPs). All nodes must conform uniformly to the adopted dialing plan. NMS does not support mixed CDP-UDP across a network and limits CDP support to Distant Steering Codes.

Table 21-1 summarizes the packaging requirements for NMS.

Additional documentation

For network applications, you should have the Northern Telecom Publications (NTPs) supporting ISDN listed in the front of this document. There are additional sets of NTPs supporting the ACD D package, and ACD-MAX applications. Consult with your Northern Telecom representative for a complete list of supporting NTPs.

For NMS applications that use ACD, refer to these NTPs.

Automatic Call Distribution basic features description (553-2671-100)

Automatic Call Distribution advanced features description (553-2671-101)

Automatic Call Distribution ACD management reports (553-2671-102)

Automatic Call Distribution ACD load management commands (553-2671-103)

Network ACD description and operation (553-3671-120)

Network Message Services—Message Center

Network Message Services-Message Center (NMS-MC) allows a caller transparent access to a centralized message center over an ISDN PRI/ISL network.

These Message Center configurations are supported:

- ACD Message Center
- DN Message Center
- Attendant Message Center

For these types of Message Centers, the Message Indication Key (MIK) on a message taker's set is used to turn on Message Waiting Indication at a user telephone. The Message Cancellation Key (MCK) is used to turn off Message Waiting Indication.

The NMS-MC supports direct and indirect NMS-MC access across ISDN. Direct access is initiated by dialing the Message Center DN or pressing the Message Waiting Key (MWK). Indirect access occurs when a call is presented to the NMS-MC by any of the call redirection features supported by Network Call Redirection (NCRD) including

- Network Call Forward All Calls
- Network Call Forward No Answer.
- Network Call Forward Busy
- Network Hunting

See the NCRD section in this document for further details.

Network Message Services—Meridian Mail

NMS-MM provides transparent access to the Meridian Mail system across the network. NMS-MM operates only between system machines supported by a single Meridian Mail server facility. Users on remote nodes configured as part of the NMS-MM server base have access to all the Meridian Mail features available on the local switch.

See the NCRD chapter when you consider the redirections which apply to your particular environment. Since Message Center support is on a customer-by-customer basis, configure your network accordingly. See *Message Center description and operation* (553-2691-100). In Meridian Mail applications, different network PBXs (nodes) must be configured with the same Meridian Mail server for proper messaging support. See the Meridian Mail suite of NTPs.

Direct calls for NMS-MM are initiated by dialing the message facility directly or pressing MWK on a properly programmed telephone. Functionality mimics current operations, including Auto-log in with a user's password. See the appropriate NTP listed above for description of call functions.

Indirect calls are presented to the Meridian Mail server from call redirection services. NMS-MM relies on Network Call Redirection (NCRD) to provide the originally dialed and calling party numbers to the Meridian Mail server for message processing. NMS-MM supports Off-net Access through direct dialing.

Operating parameters

The following list describes the NMS operating parameters:

- PRI or ISL is needed for both direct and indirect Message Center calls.
- The NMS DN must be unique and still be able to be reached by means of PRI or ISL from all NMS users in the network, and vice versa.
- NMS supports Meridian 1 to Meridian 1 connections only.
- The local NMS-MM DN defined in each node must also be configured in the Meridian Mail server data base, in the VSDN table.
- In-band End-to-End Signaling (EES) is required for NMS-MM at terminating and originating nodes.
- NMS-MM requires X11 release 16 NCRD interworking to provide full service.
- NMS-MM requires Meridian Hospitality Voice Services package to provide link recovery enhancements for Meridian Link ISDN/AP.
- NMS-MM does not support international dialing.
- Only one Message Center DN can be defined for a telephone. Multiple Message Center types are not supported.
- The NMS does not support Trunk Steering Codes (TSCs).

Software – For complete functionality each node requires X11 release 16 or later software.

Feature interactions

Listed here are differences in networking applications which may impact Network Message Services operations.

Network Call Redirection (NCRD) – Indirect access to the NMS-Meridian Mail (NMS-MM) application is based on the NCRD package which is broken down into the following areas:

- Call Forward All Calls and Call Forward No Answer (X11 release 14) and Call Forward Busy, Network Call Transfer, and Network Hunting (X11 release 16) provide the base for NMS indirect access.

- Attendant Extended Call presents the same information to Meridian Mail as Network Call Transfer except that the DN Update message is sent to the NMS-MM when the attendant releases from the call. The connected party number is updated only when the attendant is released.
- NMS does not support incoming calls from CO Loop Start trunks because X11 release 14 NCRD does not redirect these calls. Calls that come into the switch from CO Loop Start trunk cannot be redirected to another trunk by means of attendant extension or call redirection; these calls are blocked when redirection is activated.

Barge-in Attendant — The attendant can barge-in a NMS-MM call at the terminating PBX. During barge-in, the user cannot use features that require switch effort, such as the Call Sender feature.

Trunks — When a call is presented to the NMS-MM by means of a non-PRI or ISL trunk, the call is treated as an external call even if it is an on-net call. The external greeting is applied and the message is announced as from an external number.

Meridian Hospitality Voice Services — NMS-MM requires the Meridian Hospitality Voice Services (MHVS) package in X11 release 16 to provide Meridian Link ISDN/AP protocol recovery treatment for link applications. All calls to the ACD Night Call Forward (NCFW) DN are redirected to the Meridian Mail server when the ISDN/AP link fails. Call treatment in NMS-MM is identical to the NCFW treatment. See the appropriate ACD NTP listed in this chapter.

ISDN requires that the network be equipped with either Coordinated Dialing Plan (CDP) or a Uniform Dialing Plan (UDP) throughout, but it does not support a mixture of both.

NMS does not support the following packages and options.

Packet Transport Equipment Meridian Mail (MP)
Multiple Message Center interworking

Feature packaging

Table 21-1 shows the packages NMS-Message Center requires per node. Table 21-2 shows the package requirements per node for NMS-Message Mail. See *X11 features and services* (553-3001-305) for X11 release software packages and their dependencies.

Table 21-1
Required feature packages for each NMS-Message Center node

Name	Mnem.	No.	Orig.	Tandem	Term.
End-to-End Signaling	EES	10	X		X
Basic Automatic Call Distribution *	BACD	40	X		X
Automatic Call Distribution Package A *	ACDA	45	X		X
Message Center	MWC	46	X		X
ISDN Signaling	ISDN	145	X	X	X
ISDN Primary Rate Access	PRA	146	X	X	X
OR					
ISDN Signaling Link	ISL	147	X	X	X
Advanced Network Services	NTWK	148	X	X	X
Network Message Services	NMS	175	X		X

* These packages may not be required for your particular Message Center application.

Table 21-2
Required feature packages for each NMS-Meridian Mail node

Name	Mnem.	No.	Orig.	Tandem	Term.
End-to-End Signaling	EES	10	X		X
Integrated Message Service	IMS	35			X
Basic Automatic Call Distribution *	BACD	40	X		X
Automatic Call Distribution Package A *	ACDA	45	X		X
Message Center	MWC	46	X		X
Meridian Link ISDN/AP	IAP3P	77			X
ISDN Signaling	ISDN	145	X	X	X
ISDN Primary Rate Access	PRA	146	X	X	X
OR					
ISDN Signaling Link	ISL	147	X	X	X
Advanced Network Services	NTWK	148	X	X	X
Network Message Services	NMS	175	X		X

* These packages may not be required for your particular Message Center application.

Feature implementation

For a description of all the prompts and responses for system software, see *X11 input/output guide* (553-3001-400).

Package 175, NMC, introduced in X11 release 15, was renamed NMS in X11 release 16 to cover both Meridian Mail and Message Center.

NMS operates only between Meridian 1 systems. NMS-MCs are configured on a customer-by-customer basis. NMS-MM operates only between machines supported by the same Meridian Mail server facility.

Note: In X11 release 15 and later, Network Message Services require ESN access code insertion. The configuration of ESN access code insertion is shown in Procedure 21-3 in this chapter. Also see "Electronic Switched Network interworking" on page 14-1.

To configure NMS, use Procedures 21-1 through 21-7. refer also to Table 21-3 for NMS DN information.

Note: All these procedures apply to both NMS-MM and NMS-MC except for Procedure 21-5 which is Meridian Mail only.

Procedure 21-1
Use LD17 to define the software release of each switch at the far end of each D-channel in the NMS network (X11 release 17 and earlier)

Prompt	Response	Description
REQ	NEW, CHG	
TYPE	CFN	Configuration database
ISDN	YES	
DCHI	1-15	D-channel to the far end
RLS	xx	Enter the X11 release of the far end. The minimum release for NMS-MC is 15, and for NMS-MM is 16.

Procedure 21-2
Use LD17 to define the software release of each switch at the far end of each D-channel in the NMS network (X11 release 18 and later)

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	CHG DCH 0-63	Change D-channel information
RLS	xx	Enter the X11 release of the far end. The minimum release for NMS-MC is 15, and for NMS-MM is 16.

Procedure 21-3
Use LD15 to enable Message Services

Prompt	Response	Description
REQ	CHG	
TYPE	CDB	Customer Data Block
OPT	MCI	Message Center is included. This prompt must be set to include the message center feature for both the user's telephone and the message center.

Procedure 21-4
Create an ISDN transport signaling database in LD16

Prompt	Response	Description
REQ	NEW, CHG	
TYPE	RDB	Route Data Block
CUST	xx	Customer number or range of customer numbers
ROUT		Route number
ISDN	YES	ISDN option
INAC	(NO),YES	Insert Access Code. INAC = YES is required for ISDN network features. This prompt only appears if the route type is a TIE trunk.
PNI	1-32700	Customer private identifier—unique to a customer. This is the private identifier of the target switch and must be the same number used for PNI in LD15 for remote customer. Matches PNI in LD16 at remote to PNI in LD15 at local site.
NCRD	YES	Network Call Redirection
TRO	YES	Trunk Route Optimization allowed (denied) on the route.

Procedure 21-5
Use LD23 to define Meridian Mail ACD group in the remote switch (NMS-MM only)

Prompt	Response	Description
REQ	aaa	Action request: NEW, CHG, PRT, END
TYPE	ACD	Automatic Call Distribution data block
CUST	xx	Customer number, 0-99
ACDN	xxxxxxx	The Meridian Mail DN
MWC	YES	Message Center services
MAXP	1	Maximum number of agent positions
NCFW	x..x	Night Call Forward DN, where x...x is the NMS-DN. If network DN, include AC1/AC2.

Note: Do not define any ACD agents for this ACD group to allow automatic redirection to the ACD Night Call Forward DN (NFCW).

Procedure 21-6
Use LD11 to define Network Message Services DN for each telephone

Prompt	Response	Description
REQ	CHG	
FDN	x..x	Flexible Call Forward No Answer NMS-DN. See Note below.
EFD	x..x	Call Forward by Call Type - External No Answer to NMS-DN.
EHT	x x	Call Forward by Call Type - External Hunt to NMS-DN
HUNT	x	Hunt to NMS-DN
KEY	xx MWK x...x	Message Waiting Key, where x..x i s the NMS-DN. See Note below.

Note: The NMS-DN may be the local or the network ACD DN.

Procedure 21-7
Use LD10 to define Network Message Services DN for each telephone

Prompt	Response	Description
REQ	CHG	
FTR	FDN x..x	Flexible call forward no answer NMS-DN, x..x is the NMS-DN. The NMS-DN may be the local or the network DN. If network DN, include AC1/AC2.

Table 21-3
Network Message Services DN (applies to both NMS-MC and NMS-MM)

Call type	Network Message Services DN (NMS-DN)	Number of digits
Private call using Uniform Dialing Plan (UDP)	ACC + LOC + XXXX	8 to 9
Private call using Coordinated Dialing Plan (CDP)	DSC + X..X	10 maximum
Public numbering plan	ACC + (1) + NPA + NXX + XXXX ACC + (1) + NXX + XXXX	14 maximum

Feature testing

To verify NMS-MM, do the following steps:

1 Coordinate with far end personnel. Place a call to a busy station at the far end over a PRI trunk.

2 Let the call forward to the Network Message Services and leave a message.

3 Verify that the message waiting lamp is lit on the called station.

4 Log on to Meridian Mail and listen to the message.

5 Use the Call Sender command to call the person who left the message.

6 Verify all Meridian Mail features are available by the far end user.

Network Ring Again

Network Ring Again (NRAG) provides Ring Again capability within the PRI/ISL network. NRAG allows a caller at location A, encountering a busy destination at location B anywhere in the ISDN PRI network, to press the Ring Again key and be notified when the busy station becomes idle.

NRAG operates in "free notification" mode. This means the terminating switch determines when the called party becomes idle and notifies the originating switch.

For Meridian electronic and digital sets, the caller's phone emits a buzz from the speaker and the Ring Again lamp flashes. To call the station, the caller presses a DN key and then the Ring Again key on the phone—the call is made automatically.

For 500/2500 sets, the caller's phone provides short bursts of ringing as a station-idle notification. To call the station, the caller lifts the phone's receiver during the ringing period—the call is made automatically.

When more than one caller activates NRAG on a terminating station, the calls are queued on a first-come, first-served basis. When the called station becomes idle, only the first caller in the queue is signaled. The second caller in the queue is signaled only after the Queue Advance Timer (4 seconds) expires.

Once NRAG has been activated, the Called Party status is monitored until one of the following events occurs:

- The line is idle and a new call set-up can be tried.
- The call is deactivated when a customer defined timer expires.
- The call is manually deactivated by the caller.

NRAG requires a number of timers to control the feature functions on both the originating and terminating switches. Tables 22-1 and 22-2 show the values defined and which timers are used by the Meridian 1.

Table 22-1
Originating Switch Timers

Timer code	Description	Duration
T2	Period for unanswered recall notify	30 seconds
T5	Message Response Timer	4 seconds
T6	Duration Timer	30 minutes
TR2	Recall Suspend Option Timer	9 minutes
Note: TR2 not applicable to Meridian 1		

Table 22-2
Terminating Switch Timers

Timer code	Description	Duration
T7	Duration Timer	30 minutes
GT	Guard Timer	6 seconds
QAT	Queue Advance Timer	4 seconds
Note: GT is not applicable to Meridian 1.		

X11 release 14

With X11 release 14, NRAG capability is extended to 500/2500 telephone types. (With X11 release 13, NRAG functions for Meridian 1 electronic and digital telephones only.)

X11 release 15 and later

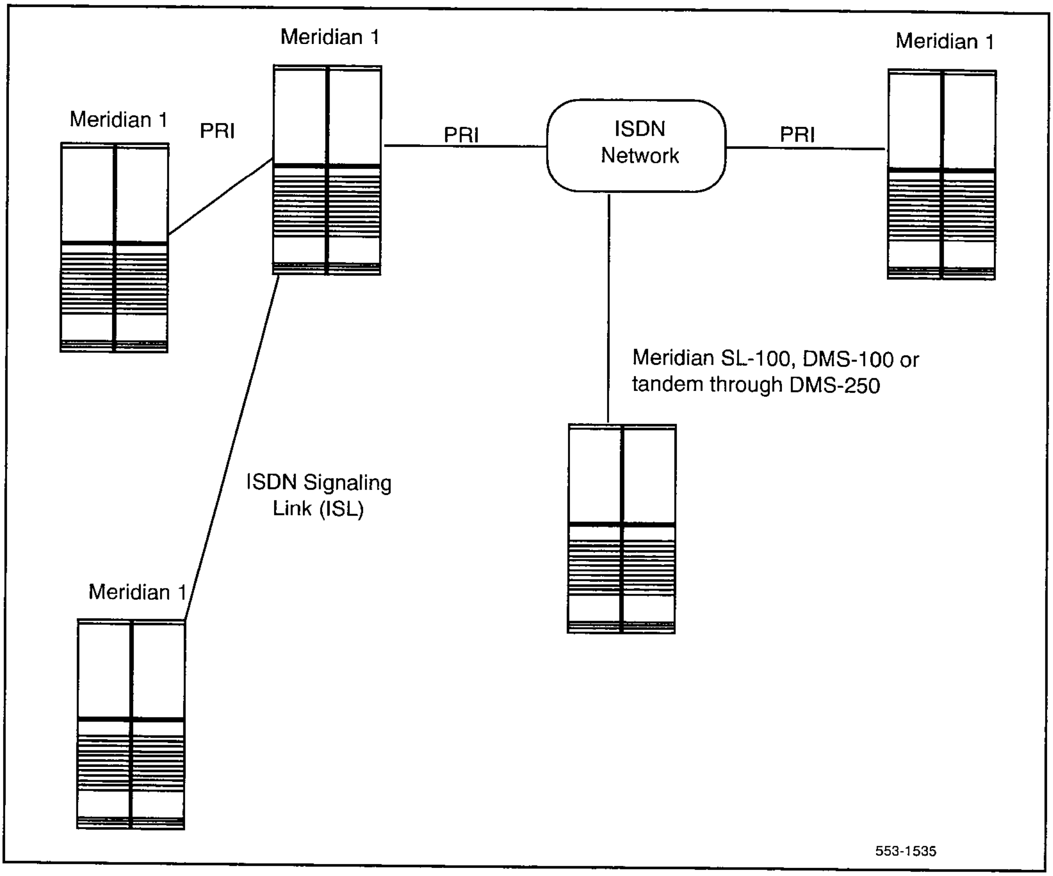
NRAG is compatible with the following systems:

- Meridian 1
- SL-100
- DMS-100
- DMS-250 supported as a tandem switch only

Note: SL-100, DMS-100 and DMS-250 support private numbering plans only.

Refer to Figure 22-1 for an NRAG configuration.

Figure 22-1
Network Ring Again configuration



Operating parameters

The following list describes the NRAG operating parameters:

- The interfaces must be Meridian 1 or DMS. NRAG is not supported for AT&T connections.
- The call must be PRI end to end.
- The calling and called party number provided for the PRI call must be within the same dialing plan.
- NRAG is supported with the Uniform Dialing Plan (UDP), typically with 3-digit location codes and 4-digit Directory Numbers.
- NRAG is supported in Coordinated Dialing Plan (CDP) networks with up to 4-digit directory numbers if the Distant Steering Codes do not exceed 2 digits. X11 release 14 and earlier support only up to 6 digit CDP. X11 release 15 and later support up to a 10-digit CDP.
- The appropriate package, such as NARS, BARS CDP, or ISDN, must be equipped.
- NRAG supports Private/TIE trunks but not public call types.
- The Calling Line Identification (CLID) for ACD sets is the ACD DN instead of ACD POS ID.
- NRAG is not compatible with an Add-On Data Module (ADM) trunk route.
- NRAG does not support Tandem TIE Trunk networks using Direct Trunk Access Codes or Trunk Steering Codes.
- NRAG is not supported for calls using a Trunk Access Code.
- NRAG, like Ring Again, is not supported on modem routes.
- NRAG cannot be invoked for a redirected call, a blocked call, or a modified call (for example, conference, transfer, or attendant calls).

The following features are not supported by NRAG:

- Call Redirection
- Trunk Group Busy Indication
- Flexible and Coordinated Call Back Queuing
- Network Facilities Blockage (Main CBQ)
- ACD Queue calls
- Attendant Console calls
- Maintenance Busy Mode
- Direct Inward System Access
- Directed Call Pickup

Feature interactions

Make Set Busy—NRAG can be originated by a station in the Make Set Busy (MSB) mode. It can also be activated against a station in the MSB mode, assuming no Call Forward All Calls DN.

Do Not Disturb—Ring Again originating from a station with Do Not Disturb (DND) active is supported; however, NRAG cannot be activated against a terminating station which has DND activated.

Call Waiting/Camp-On—If Call Waiting or Camp-On is active on the terminating station, no notification will be sent to the originating party until the terminating station becomes idle.

Call Forward All Calls—If the originating station activates Call Forward All Calls (CFAC) after activating NRAG, NRAG can still be received.

Data calls — NRAG is supported for data calls.

Calling Line Identification — NRAG is supported only if the Calling Line Identification (CLID) uses the prime DN.

Incoming Digit Conversion — If there is any conversion done to the called DN, NRAG is not supported.

CDP and NARS — For networks with CDP and NARS using the same route, turn off INAC and insert a DMI when needed.

Feature packaging

The option number for NRAG is 148 (NTWK). Table 22-3 shows the packages required for this feature. Consult the *X11 features and services* (553-3001-305) for X11 release software packages and their dependencies.

Table 22-3
Package requirements for Network Ring Again

Package	Name of package	Mnemonic
75	PBX Interface for DTI/CPI	PBXI
145	ISDN Signalling	ISDN
146 OR	ISDN Primary Rate Interface Dependencies: 75, 145, 19 [CLID]	PRI
147	ISDN Signalling Link Dependencies: 145	ISL

Note 1: Package 75 is not required for ISL (Package 147), unless ISL is over DTI.

Note 2: NRAG requires ISDN option Package 145 with 146 or 147.

Feature implementation

X11 release 14 added a new prompt, PNI, to LD15 to enter the Private Network Identifier value per customer. X11 release 14 also added the PNI prompt to LD16 along with a second new prompt to enter the NRAG service timer per route. For a description of the prompts and responses for Meridian 1 software, see the *X11 input/output guide* (553-3001-400).

The duration timer for Network Ring Again (NRAG) controls the amount of time between placing the call on Ring Again and timeout.

> *Note:* In X11 release 15 and later, Network Ring Again (NRAG) requires ESN access code insertion. The configuration of ESN access code insertion is provided in "Check Numbering Plan enhancement interaction" on page 22-9.

Configuration

All NRAG database configuration must be checked point to point, regardless of whether NRAG is activated point to point or it tandems through an intermediate node. Within one network, use the same value for customer private identifier (PNI) in both the Customer Data Block (LD15) and the Route Data Block (LD16) in all systems.

Check Numbering Plan enhancement interaction

If a Meridian 1 switch is running X11 release 15 or later and is interfacing with a X11 release 15 or later, then the originating switch must not use the digit manipulation (DMI) to insert the ESN access code. The ESN access code must be inserted at the terminating node. See example in Table 22-4.

Table 22-4
Inserting ESN access code

Originating Switch	Terminating Switch
X11 release 15 and above	X11 release 15 and above
LD86: DMI = 0	LD16: INAC = YES

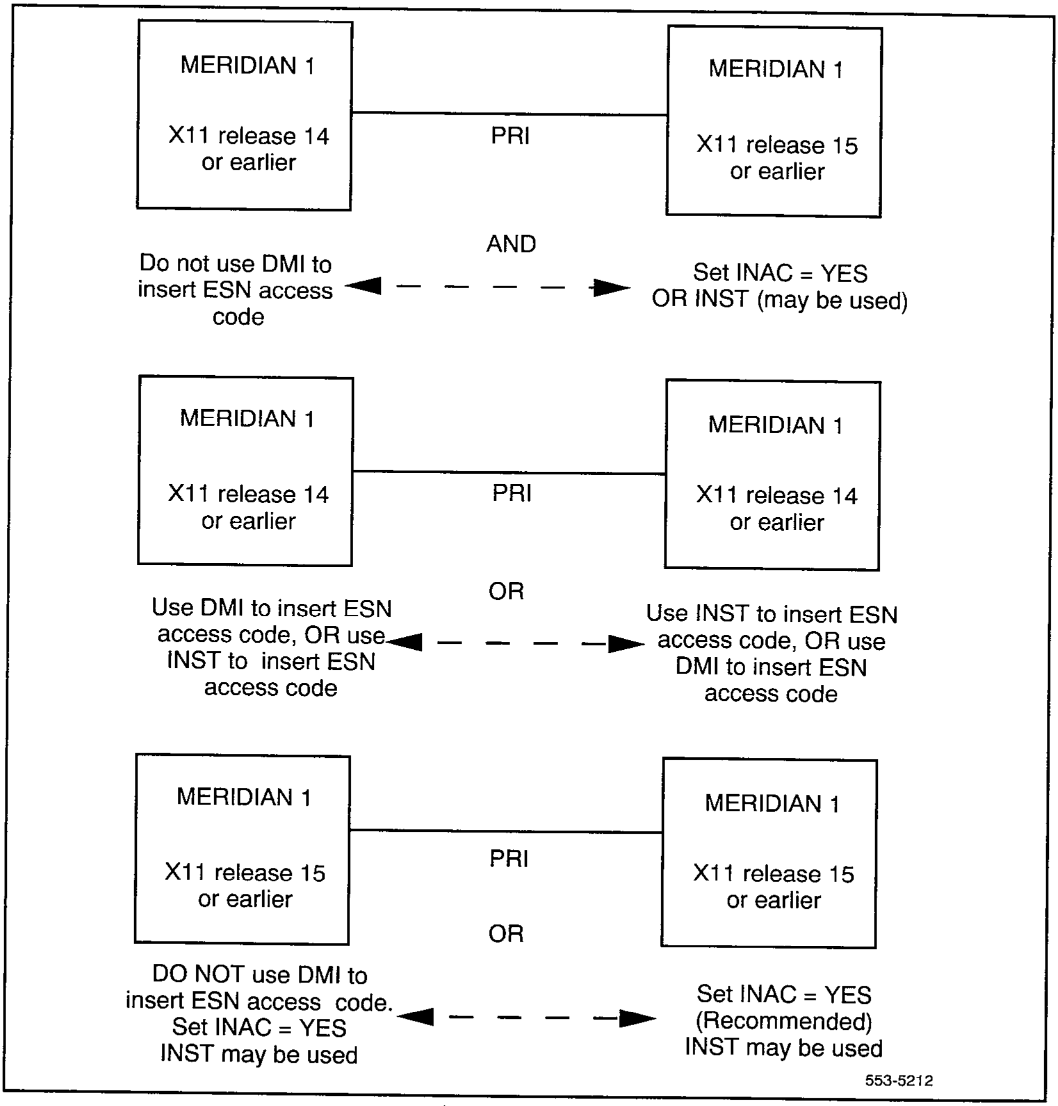
By default, making INAC = YES always inserts AC1. However, if your switch is receiving Public call types such as NXX or NPA over the same PRI route as the terminating switch, and you need to insert AC2, you must specify these call types under the AC2 prompt in the customer data block. For example, LD15: AC2 = NXX NPA.

Note 1: For X11 release 14 and earlier, use INST in LD16. For X11 release 15 and later, use INAC.

Note 2: The terminating PBX must Insert Net Access Code (INAC).

See Figure 22-2 for a summary of these rules.

Figure 22-2
Database conversion



Release identification

For Meridian 1 software load from X11 release 15 and later, the configuration record in LD17 must contain the Release ID of the corresponding switch. For DMS interfaces, it must contain the correct BCS load. For example, LD17:

RLS_ID = 15 (Meridian 1 interface).
RLS_ID = 28 (DMS interface).

Refer to *X11 input/output guide* (553-3001-400) for minimum compatible releases.

NARS calls

If NRAG is to be activated on a NARS call, verify that the Home Location Code is defined in the Customer Data block in LD15. For example,

LD15: HLOC = 646.

Coordinated Dialing Plan call

Follow these steps for a Coordinated Dialing Plan (CDP) call:

1 Check LD87 for all local steering codes and distant steering codes.

2 Check the ESN data block for the following prompts:

LD86: CDP = YES/NO

MXSC = Maximum number of Steering Codes
NCDP = Number of digits in CDP DN

Implementation procedures

Follow these steps to configure Network Ring Again:

1 LD17 Configuration Record (Procedure 22-1)
Set the software release ID of the far end.
X11 RELEASE 17 AND EARLIER

OR

1 LD17 Configuration Record (Procedure 22-1)
Set the software release ID of the far end.
X11 RELEASE 18 AND LATER

2 LD15 Customer Data Block (Procedure 22-3)
Set up Private Network Identifier (PNI) mapping between call type translator HLOC, LSC, HNPA or HNXX for proper CLID construction.

3 LD16 Route Data Block (Procedure 22-4)
Set up duration timer (NRAG), Private Network Identifier (PNI), insertion of ESN access codes (INAC).

Procedure 22-1
Use LD17 to define the software release ID (X11 release 17 and earlier)

Prompt	Response	Description
REQ	CHG	
TYPE	CFN	Configuration data block
ISDN	YES	
DCHI	1-15	D-channel number
.		
.		
RLS	xx	This is the current software release of the far end. If the far end has an incompatible release of software, it prevents the sending of application messages. The minimum X11 release is 14, the minimum BCS release is 28.

Procedure 22-2
Use LD17 to define the software release ID (X11 release 18 and later)

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel (can also CHG and OUT DCH)
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
RLS	xx	Release ID of the switch at the far end of the D-Channel

Procedure 22-3
Respond to the following prompts in LD15

Prompt	Response	Description
REQ	NEW, CHG, END	
TYPE	CDB	Customer data block
.		
.		
AC2		Access Code 2. Enter call types (type of number) that use access code 2. Multiple call types can be entered. Default is to access code 1.
	NPA	E.164 National
	NXX	E.164 Subscriber
	INTL	International
	SPN	Special number
	LOC	Location code
ISDN	YES	Change ISDN options
PNI	1-32700	Customer private identifier—unique to a customer. Within one network, use the same value for PNI in both the Customer Data Block (LD15) and the Route Data Block (LD16) in all PBXs.
HNPA	100-999	Area code for the Meridian 1 system
HNXX	100-999	Prefix for the Central Office
HLOC	100-999	Home location code (NARS)
LSC	1-9999	1- to 4-digit Local Steering Code established in the Coordinated Dialing Plan (CDP). The LSC prompt only appears if user has a 5- or 6-digit dialing plan.

Procedure 22-4
Respond to the following prompts in LD16

Prompt	Response	Description
REQ	NEW,CHG,OUT	
TYPE	RDB	Route data block
.		
.		
.		
CNTL	(NO),YES	Changes to controls or timers
TIMR		
	NRAG (30)-240	Network Ring Again duration timer (T6 and T7 timers)—time is in minutes. Currently, only a value of 30 minutes is supported.
	Note: Package 148, Advanced ISDN Features, is required.	
.		
INAC	(NO), YES	Insert Access Code. Permit an ESN access code to be automatically added to an incoming ESN call from a private network. If INAC is YES, the digit insertion option (INST) is bypassed. This prompt only appears if the route type is a TIE trunk.
PNI	1-32700	Customer private identifier—unique to a customer. Within one network, use the same value for PNI in both the Customer Data Block (LD15) and the Route Data Block (LD16) in all PBXs.

Feature testing

To verify NRAG, perform the following steps:

1. Coordinate with far end personnel. Place a call to a busy station at the far end over a PRI trunk.
2. Verify that the calling terminal can activate NRAG and that any Ring Again indicator lamps are lit.
3. When the far end call disconnects, verify that the calling terminal is notified.
4. Verify indication that the far end has disconnected.
5. Initiate NRAG capabilities.
6. Calling party answers.
7. Disconnect.

Note: Verify this procedure against different terminal types.

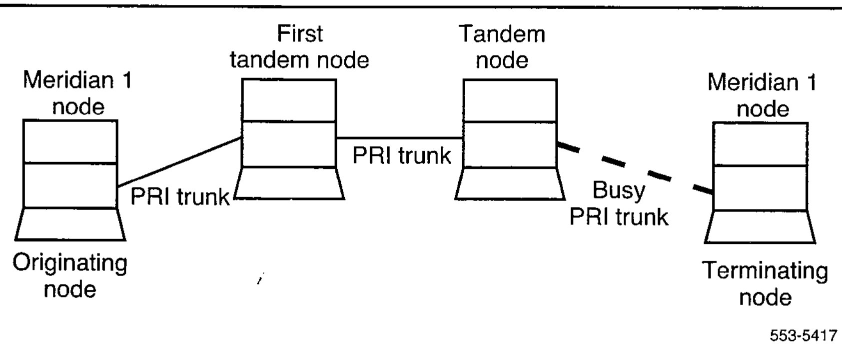
Remote Virtual Queueing

Remote Virtual Queueing (RVQ) allows you to perform queueing type functions on a busy trunk route (B-Channel) in your ISDN network. This feature is similar to the ESN features Coordinated Call-Back Queueing (CCBQ), and Call-Back Queueing to a Conventional Main (CBQCM). Prior to operating RVQ, you must have a working knowledge of the ESN features. Refer to *Electronic Switched Network description* (309-3001-100) for a complete description of these features.

Remote Virtual Queueing (RVQ) is supported on a private ISDN PRI/ISL network only.

When an outgoing network path is unavailable, Remote Virtual Queueing (RVQ) provides call back queueing. RVQ repeatedly scans ahead on the ISDN trunk to be sure the entire path from origination to termination is available. When a path becomes idle, you are notified and can ring the path again to terminate the call.

Figure 23-1
Remote Virtual Queueing example



Operating parameters

In addition to the function offered by CCBQ and CBQCM, RVQ provides the following:

- There is no limit to the number of nodes in the ISDN network that RVQ searches.
- The originating node has control of the call.

RVQ is supported in a private ISDN PRI/ISL network only. Any trunk other than an ISDN PRI or ISL trunk is considered a Non-RVQ Compatible (NRC) trunk. NRC trunks include analog trunks, T1 trunks, or public trunks. NRC also includes trunks connecting to a non-Meridian 1, non-ISDN, or Pre-Release 18 node.

The originating, tandem, and terminating nodes must run X11 release 18 or later software, and include all the required packages (refer to Feature packaging in this module).

Meridian Modular, 500/2500, SL-1, and Meridian digital telephones can activate and receive RVQ calls.

- Data terminals are supported.
- Attendants cannot activate RVQ.
- RVQ is activated only by telephones with Ring Again allowed.
- AUTHCODE is supported on the first tandem node only.
- Trunk Access codes are not supported.
- ACD DNs are supported as a terminating DN.
- Attendants are supported as terminating stations.

The RVQ retry timer is set for each NCOS. Setting a specific NCOS with a low retry timer searches for more connections more often. The lower the timer, the greater the chance to connect the call.

The maximum total amount of time RVQ searches for available paths is 30 minutes. The countdown begins as soon as the originator activates the Ring Again key.

Only one RVQ Ring Again attempt per set at a time is allowed. If Ring Again is pressed again, after activating it for RVQ, the most recent number dialed is the one attempted.

RVQ does not check the terminating telephone's status. The dialed DN may be invalid or busy. Once the path is available, the RVQ call can reach the dialed DN. It is possible the dialed telephone is busy, and Network Ring Again may be used if enabled. The tone indicating the trunks are busy is a fast busy tone. A busy DN is indicated by a standard busy tone.

RVQ searches throughout Meridian 1 networks only. Off-net trunks paths cannot be checked beyond the first NRC trunk.

RVQ is a virtual queueing feature. Each RVQ call is independent of another. It does not operate by first in first out policy. The first caller to initiate RVQ is not necessarily the first person connected.

It may take up to 30 seconds for notification to reach the originator. The network path is reserved while RVQ notifies the caller. In a private network, the path is reserved from the originating node to the terminating node. Otherwise the path is reserved up to the first NRC trunk.

RVQ supports Uniform Dialing Plan (UDP), and Coordinated Dialing Plan (CDP). For NRC trunks, the E.164 public numbering plan is supported.

RVQ supports the following trunk types:

- Private network ISDN trunks
  - TIE
  - COT
  - Direct Outgoing Dial (DOD)
  - WATS
  - ISA
  - FEX

RVQ supports only Meridian 1 machines in a private ISDN PRI/ISL network. A non-Meridian 1 machine functioning in tandem with a Meridian 1 machine is treated as a Non-RVQ Compatible (NRC) trunk.

- NRC trunks
  - COT
  - Direct Outgoing Dial (DOD)
  - WATS
  - FEX
  - ISA
  - TIE

RVQ is cancelled if the originating node system initializes.

If the originating node performs a cold start, RVQ is cancelled.

RVQ from a Conventional Main (RVQCM) requires a special configuration. See the Feature implementation discussion in this module.

With RVQ, callers cannot activate Ring Again to refuse expensive routes after the Expensive Route Warning Tone (ERWT) is given.

When using RVQ from a Conventional Main (RVQCM), the originating node seizes the same TIE trunk group that was used to initiate RVQCM for the callback. Thus, these trunk groups must be two-way (incoming/outgoing) and configured for far end disconnect.

Conventional mains must provide answer supervision on TIE trunks connected to the originating node. The system must also permit transmission or repetition of telephone dial pulses for RVQCM operation. This feature cannot be used with systems that operate in senderized mode. Operation may require adjustment of the interdigit timeout on systems that employ simulated cut-through operation.

Multiple callback queues are allowed per trunk group for the Conventional main by dialing any digits (up to 7) based on the availability of Meridian 1 call registers.

When utilizing RVQCM, do not call forward the calling telephone when awaiting callback. If the telephone is forwarded, it is possible that the TIE trunk will not be released at the end of the call.

Feature interactions

Coordinated Call-Back Queueing — CCBQ and RVQ can both be enabled on a single machine.

Call-Back Queueing to a Conventional Main — CBQCM and RVQ can both be enabled on a single machine.

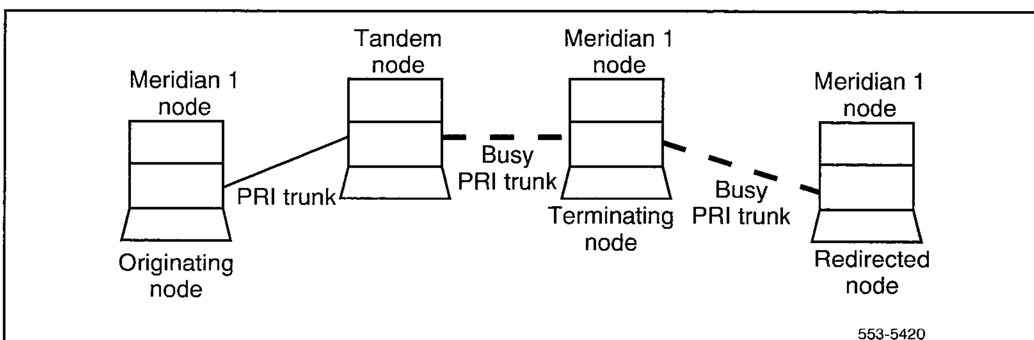
Direct Inward System Access — DISA DNs are not supported by RVQ.

Make Set Busy — RVQ can be originated by, and terminated on an ACD DN in Make Set Busy mode.

Network ACD — If a target agent is available on a remote node, RVQ cannot be activated if the busy trunk is found on its way to the target node.

Network Call Redirection — RVQ does not guarantee connection if the terminating telephone call forwards to a telephone on another node. When a terminating telephone call forwards to another node, that node is a redirected node. RVQ cannot search between terminating and redirected nodes.

Figure 23-2
RVQ and NCRD



Network Ring Again — Network Ring Again (NRAG) is activated only when the terminating telephone or console is busy. If both the network path and the terminating telephone are busy, RVQ is activated first. When the path is available, but the telephone is busy, then NRAG can be activated.

Off Hook Queueing — RVQ and Off Hook Queueing (OHQ) are compatible in a system. If OHQ is configured, it is implemented by leaving the handset off hook. RVQ is implemented by pressing the Ring Again key. Choosing one or the other method activates the specified feature.

Feature operation

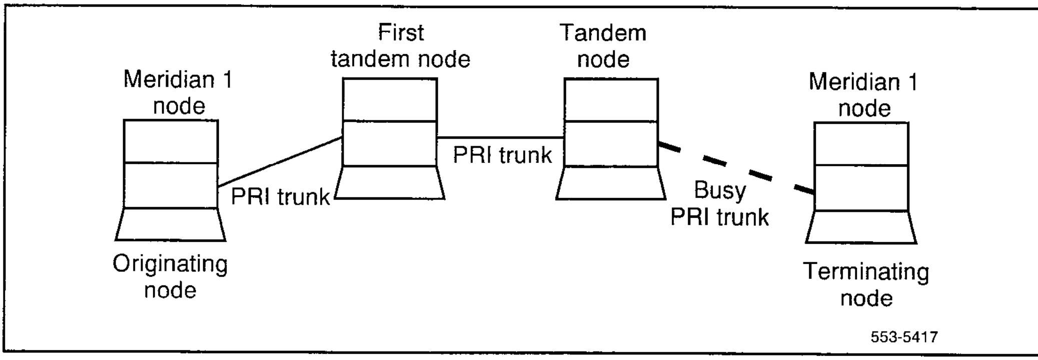
RVQ supports private ISDN PRI/ISL networks, non-RVQ compatible (NRC) blocked trunks, and conventional mains (RVQCM). RVQ supports Meridian 1 machines only. A non-Meridian 1 machine working in tandem with a Meridian 1 is treated as a Non-RVQ Compatible (NRC) trunk.

RVQ on a private network

RVQ is supported for Meridian 1 machines, running X11 release 18 on an ISDN PRI/ISL network only. RVQ follows this checklist before starting.

- The first tandem node must be a Meridian 1 node, running X11 release 18 or later software.
- The originating node's Network Class of Service (NCOS) must allow Call Back Queueing (CBQ).
- At least one route in the initial set of the route list must allow CBQ.
- The system has CBQ allowed at the Network Control Block.

Figure 23-3
RVQ configuration example on a private network



When the checks are complete, activate RVQ by pressing the Ring Again key. As soon as the key is pressed, the retry timer begins. When the retry timer expires, RVQ checks the path again. When a blocked path occurs, RVQ searches the network to ensure that the entire path will be clear once the blockage disappears. The total amount of time RVQ will spend on a search is 30 minutes.

The retry counter controls the number of times the initial set is checked before RVQ searches the extended set. The extended set search includes all the trunks in both the initial and extended sets.

Tandem nodes must recognize the RVQ messages and pass them on to another tandem or terminating node.

RVQ with NRC trunks

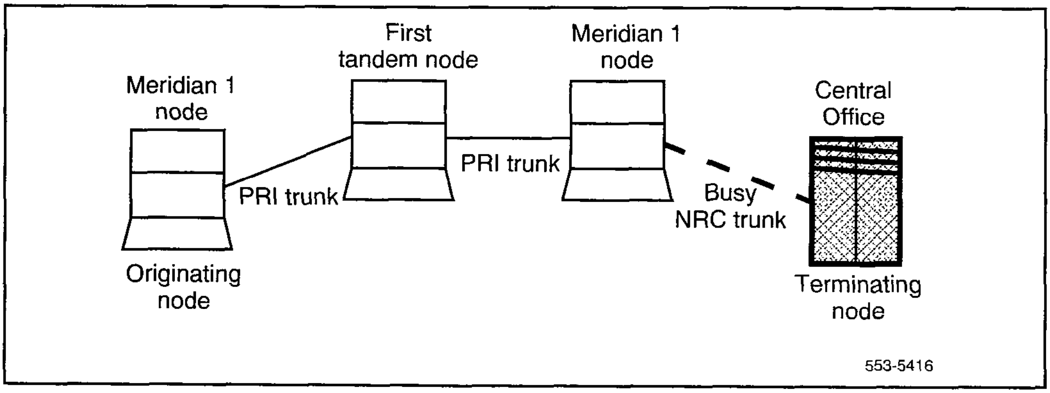
RVQ searches the path until it reaches the first Non-RVQ Compatible (NRC) trunk. RVQ notifies the originator when that trunk is available, but cannot search beyond it. It is possible that the path may be blocked beyond the NRC trunk, and the call cannot go through.

Any trunk other than an ISDN PRI or ISL trunk is considered an NRC trunk. NRC trunks include analog, T1, or public trunks, as well as trunks connecting to a non-Meridian 1, non-ISDN, or non-X11 release 18 node.

When an NRC trunk is busy, RVQ follows this checklist before implementing RVQ.

- First tandem node must be a Meridian 1 node, with X11 release 18 or later.
- Originating node's NCOS must allow Call Back Queueing (CBQ).
- At least one route in the initial set of the route list must allow CBQ.
- The system has CBQ allowed at the Network Control Block.

Figure 23-4
RVQ configuration example with an NRC trunks



When the checks are complete, activate RVQ by pressing the Ring Again key. As soon as the key is pressed, the retry timer begins. When the retry timer expires, RVQ checks the path again. The total amount of time RVQ will spend on a search is 30 minutes.

The retry counter controls the number of times the initial set is checked before RVQ searches the extended set. The extended set search includes all the trunks in both the initial and extended sets. Only the first NRC trunk is checked. RVQ cannot search beyond that trunk, even if the subsequent trunks are ISDN PRI/ISL.

RVQ on a conventional main (RVQCM)

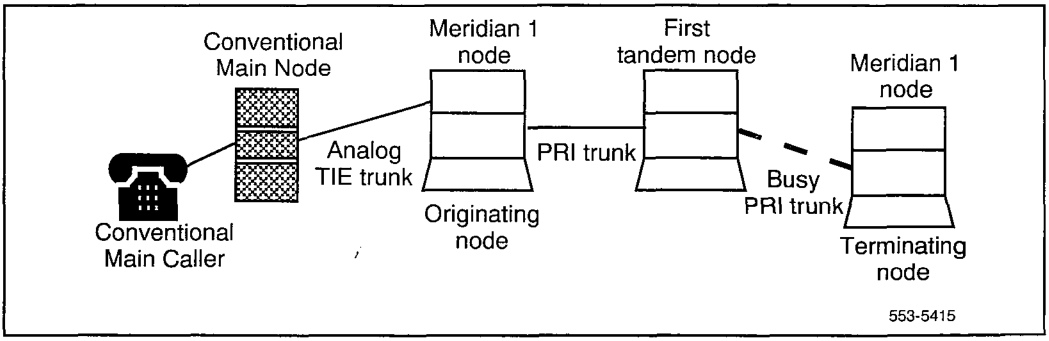
A conventional main call is one that comes from a non-Meridian 1 system into the private network through a TIE trunk to a Meridian 1 node.

When the conventional main call enters the network, the default NCOS is assigned to the TIE trunk to determine RVQCM eligibility. Use Authcode last to upgrade the NCOS if necessary.

When a conventional main call is blocked, RVQ checks the following at the first Meridian 1 node to ensure RVQCM can be activated. The Meridian 1 node is considered the Originating node, and controls the call.

- The tandem and terminating nodes must be Meridian 1 nodes, running X11 release 18 or later software.
- The originating node's Network Class of Service (NCOS) must allow Call Back Queueing (CBQ).
- At least one route in the initial set of the route list must allow CBQ.
- The system has CBQ allowed at the Network Control Block.
- The incoming TIE trunk allows CBQ.

Figure 23-5
RVQCM example with a conventional main



RVQCM is offered to the conventional main caller with a special offer tone (3 beeps). To accept RVQ, enter the calling number. After the same special confirmation tone (3 beeps) is heard, hang up. The originating node begins the retry timer and search process. When the retry timer expires, RVQ checks the path again. The maximum total amount of time RVQ will spend on a search is 30 minutes. When the path is free, the originating node calls the caller back (at the number entered). The phone rings, the same special callback tone (3 beeps) is heard, and the call is connected. RVQCM cannot be cancelled from the conventional main once started.

If the calling telephone is busy, or does not answer the callback, the RVQ callback is placed in a 5 minute suspense state. After 5 minutes have passed, RVQ attempts the callback again. If the calling telephone is still busy, or does not answer, RVQ is cancelled.

The retry counter controls the number of times the initial set is checked before RVQ searches the extended set. The extended set search includes all the trunks in both the initial and extended sets.

> *Note:* The calling number is accepted only if the database has been configured to accept the given number of digits. If not, or if the caller does not hang up, overflow tone is given, and the call is disconnected. RVQCM does not verify that the dialed DN is valid or free.

Once started, RVQ cannot be cancelled from the convention main. Operating parameters relating to Call Back Queueing for Conventional Mains (CBQCM) also apply to RVQCM as follows. Refer to the *Electronic Switched Network description* (309-3001-100) for complete discussions of CBQCM.

Users at Conventional Mains cannot activate Ring Again to refuse expensive routes after the Expensive Route Warning Tone (ERWT) is given.

The node seizes the same tie trunk group that was used to initiate RVQCM for the callback. These trunk groups must be two way (incoming/outgoing).

Conventional Mains must provide answer supervision on tie trunks connected to the node. These switches must also permit transmission, or repetition of telephone dial pulses for RVQCM operation. This feature cannot be used with systems that operate in senderized mode. Operation may require adjustment of the interdigit timeout on systems that employ simulated cut-through operation.

Multiple callback queues are allowed per trunk group for the Conventional Main by dialing up to 7 digits (any digits are allowed) based on the availability of Meridian 1 call registers.

CAUTION

Conventional Mains must not allow RVQCM callback calls to be modified by call transfer or call forward to an outside line. Call modifications like this can result in the tie trunk not being released at the end of the call.

Operating RVQ from a digital telephone

The following lists the steps required to activate RVQ from any Meridian digital, Meridian Modular, or SL-1 telephone.

1 Place a call to a DN on another node.

2 Hear overflow tone (fast busy) indicating a busy trunk along the call path.

3 Press the Ring Again (RGA) key. The RGA lamp lights, and the tone stops. If the lamp remains dark, RVQ may not apply.

4 Go on-hook.

5 The RGA lamp fast flashes, and a 1 second buzz indicates the path is available. If you are on another call, you hear the Ring Again tone.

6 Go off-hook (or press a DN key), and press the RGA key to connect the call. If the RVQ notice is not answered within 16 seconds, the RVQ notice stops, and the request is cancelled.

If the terminating telephone is busy, you hear regular busy tone. You may activate Network Ring Again (NRAG) at this point.

Cancel the RVQ request at any time by pressing the RGA key. The associated lamp goes dark.

Operating RVQ from a 500/2500 telephone

The following lists the steps required to activate RVQ from any 500/2500 telephone.

1. Place call to a DN on another node.
2. Hear overflow tone (fast busy) indicating a busy trunk route along the call path.
3. Switchhook flash, and hear special tone (3 beeps).
4. Dial the Ring Again SPRE or FFC, and hear confirmation tone. If RVQ is not enabled, intercept treatment is given.
5. Go on-hook.
   The RVQ search takes place only when the telephone is idle. RVQ searches only while you are on-hook. However, the timer runs while you are on-hook, or off-hook for a maximum of thirty minutes.
6. Special ringing cadence indicates the path is available.
7. Go off-hook to connect the call.
   If the RVQ notice is not answered within 16 seconds, the RVQ notice stops, and the request is cancelled.

Cancel the RVQ request at any time by going off hook and entering the Ring Again deactivation SPRE or FFC.

Operating RVQCM from conventional main telephone

The following lists the steps required to activate RVQCM from a conventional main telephone.

1 Place call to a DN on a Meridian 1 node.

2 Hear special dial tone (3 beeps), or RAN if configured, indicating a busy trunk along the call path.

3 Dial the calling DN, and hear the same special tone (3 beeps).

4 Go on-hook.

5 The phone rings when the originating node calls back.

6 Go off-hook, hear the same special tone (3 beeps). Stay off-hook, and the call is connected. If the RVQ notice is not answered within the time set in LD87 (CBTL prompt), the RVQ notice stops, and the request is cancelled.

RVQ cannot be cancelled from a conventional main telephone, but may time-out after 20 seconds.

If the calling telephone is busy, or does not answer the callback, the RVQ callback is placed in a 5 minute suspense state. After 5 minutes have passed, RVQ attempts the callback again. If the calling telephone is still busy, or does not answer, RVQ is cancelled.

Feature packaging

Remote Virtual Queueing (RVQ) is package 192. It requires the following packages as well. Refer to *X11 features and services* (553-3001-305) for a complete list of package dependencies.

- Main Network Queueing package 38
- Flexible Call Back Queueing package 61
- Digital Trunk Interface package 75
- ISDN signalling package 145
- ISDN PRI package 146 or ISL package 147
- Network Queueing Main package 38
- Advanced Network Services package 148 (for NRAG capability)

Feature implementation

All nodes supporting RVQ must have it enabled. Perform these procedures to configure RVQ on the originating node, and to check for RVQ on the tandem and terminating nodes.

RVQCM configuration begins with Procedure 23-5.

Procedure 23-1
Use LD87 to configure RVQ

Prompt	Response	Description
REQ	CHG	Change
CUST	nn	Customer number
FEAT	NCTL	Network Control
SCBQ	YES	Call Back Queueing allowed
NCOS	nn	Network Class of Service number. The originating telephone must have the same value.
OHQ	YES, (NO)	Off Hook Queueing allowed (not allowed) for this NCOS Both RVQ and OHQ can be enabled on a system. Only one can be activated at a time.
CBQ	YES	Call Back Queueing allowed for this NCOS
RETT	2-(10)-30	Time between searches (seconds) The maximum total search time is 30 minutes.
RETC	4-(5)-16	Number of times RVQ searches the initial set before moving on to the extended set.

Procedure 23-2
Use LD86 to configure the Route List Block for RVQ

Prompt	Response	Description
REQ	CHG	Change
CUST	nn	Customer number
FEAT	RLB	Route List data block
RLI	nn	Route List Index
ENTR	nn	Route List entry number
ROUT	nnn	Route number
DMI	nnn	Digit Manipulation table
OHQ	YES, (NO)	Off Hook Queueing allowed (not allowed) for this NCOS Both RVQ and OHQ can be enabled on a system. Only one can be activated at a time.
CBQ	YES	Call Back Queueing allowed

Procedure 23-3
Use LD16 to configure the routes for RVQ

Prompt	Response	Description
REQ	CHG	Change
TYPE	RDB	Route datablock
CUST	nn	Customer number
ROUT	nnn	Route number
ISDN	YES	ISDN PRI option
OHQ	YES, (NO)	Off Hook Queueing allowed (not allowed) for this NCOS
		Both RVQ and OHQ can be enabled on a system. Only one can be activated at a time.
CBQ	YES	Call Back Queueing allowed for this NCOS

Procedure 23-4
Use LD17 to be sure the remote nodes have RVQ enabled

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel (can also CHG and OUT DCH)
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
RCAP	RVQ	Remote D-channel capabilities. If this is not enabled, the trunks are considered NRC

Procedure 23-5
Use LD87 to configure RVQCM

Prompt	Response	Description
REQ	CHG	Change
CUST	nn	Customer number
FEAT	NCTL	Network Control
SCBQ	YES	Call Back Queueing allowed
CBTL	10-(20)-30	Call Back Time Limit CBTL should be set at 20 seconds or more to allow sufficient time to notify the caller. If this timer expires without receiving answer supervision, it is considered call-back no answer.
NCOS	nn	Network Class of Service number
OHQ	YES, (NO)	Off Hook Queueing allowed (not allowed) for this NCOS
		Both RVQ and OHQ can be enabled on a system. Only one can be activated at a time.
CBQ	YES	Call Back Queueing allowed for this NCOS
RETT	2-(10)-30	Time between searches (seconds) The maximum total search time is 30 minutes.
RETC	4-(5)-16	Number of times RVQ searches the initial set before moving on to the extended set.

Procedure 23-6
Use LD86 to configure the Route List Block for RVQCM

Prompt	Response	Description
REQ	CHG	Change
CUST	nn	Customer number
FEAT	RLB	Route List data block
RLI	nn	Route List Index
ENTR	nn	Route List entry number
ROUT	nnn	Route number
DMI	nnn	Digit Manipulation table
OHQ	YES, (NO)	Off Hook Queueing allowed (not allowed) for this NCOS Both RVQ and OHQ can be enabled on a system. Only one can be activated at a time.
CBQ	YES	Call Back Queueing allowed

Procedure 23-7
Use LD16 to configure the routes for RVQCM

Prompt	Response	Description
REQ	CHG	Change
TYPE	RDB	Route datablock
CUST	nn	Customer number
ROUT	nnn	Route number
ISDN	YES	ISDN PRI option
CNTL	YES, (NO)	Change control timers
FEDC	ETH	Far end disconnect control Must be ETH (either end) for RVQCM
DLTN	YES	Provide dial tone to the far end
OHQ	YES, (NO)	Off Hook Queueing allowed (not allowed) for this NCOS
		Both RVQ and OHQ can be enabled on a system. Only one can be activated at a time.
CBQ	YES	Call Back Queueing allowed for this NCOS

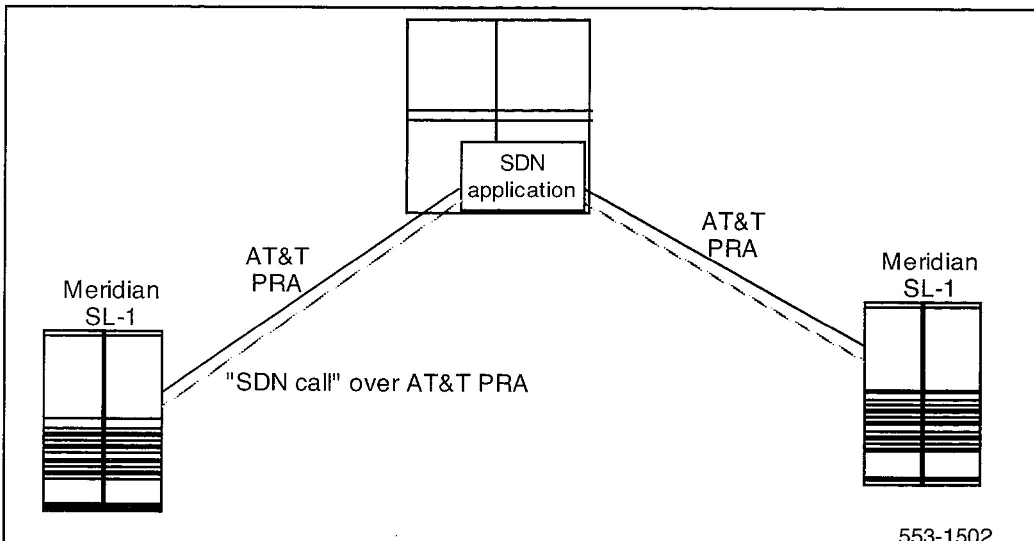
Procedure 23-8
Use LD17 to be sure the remote nodes have RVQCM enabled

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel (can also CHG and OUT DCH)
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
RCAP	RVQ	Remote D-channel capabilities. If this is not enabled, the trunks are considered NRC

Software Defined Network access

AT&T's Software Defined Network (SDN) provides the equivalent of a private network. The network is controlled by customized call-processing specifications stored in the AT&T network, rather than at customer sites. To access SDN, the customer uses access lines from their location to the AT&T network. See Figure 24-1.

Figure 24-1
Access to Software Defined Network



SDN can transmit voice, data, or graphics. Analog transmission to 9600 bps and 56 Kbps or 64 Kbps clear end-to-end digital data transmission are supported.

Feature implementation

Routes defined for access to AT&T services, such as SDN, must be TIE trunk routes. Use Procedures 24-1 and 24-2 to configure access to SDN service.

Note: The tariff is currently approved for ISDN as of 1992.

Procedure 24-1
Use LD17 to define the AT&T interface (X11 release 17 and earlier)

Prompt	Response	Description
REQ	CHG	
TYPE	CFN	Configuration data block
ISDN	YES	
_IFC	ESS4, ESS5	AT&T 4ESS or 5ESS **Note:** Package 149, Inter-exchange Carrier (IEC), is required to select interface to AT&T 4ESS.

Procedure 24-2
Use LD17 to define the AT&T interface (X11 release 18 and later)

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel (can also CHG and OUT DCH)
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
USR	PRI, ISLD, SHA	D-channel mode
PRI	0-159 2-15	Additional PRI loops using the same D-channel, and interface ID
IFC	aaaa	Interface type: (D100), D250, ESS4, ESS5, SL1, S100

Procedure 24-3
Use LD16 to configure a TIE route for SDN access.

Prompt	Response	Description
REQ	NEW,CHG,OUT	
TYPE	RDB	Route data block
CUST	0-99	Customer number
ROUT	0-511	Route number
TKTP	TIE	TIE trunk route
ISDN	YES	
_IFC	ESS4, ESS5	AT&T 4ESS or 5ESS
_SRVC	SDN	Software Defined Network

Software Release ID

Software Release ID uses the D-channel connection of your switch to identify the software release of an adjoining switch. This feature identifies the software release of the NRAG, NACD, NMS and NCRD features. The software release ID can be requested for all direct connections to the Meridian 1. However, the Software Release ID cannot be obtained for switches in a tandem configuration. The information provided by the Software Release ID depends on the interfacing switches. That is, a Meridian 1 switch provides an X11 release number and a DMS-100 switch provides a BCS number. See Table 25-1.

Table 25-1
Software Release ID information

ISDN feature	DCH interface type	Supported release
NRAG	Meridian 1, SL-100, DMS-100, DMS-250	Release 12 & above BCS 26 & above
NACD	Meridian 1 DMS-100, DMS-250	Release 15 & above BCS 29 & above
NMS-MC	Meridian 1	Release 15 & above
NMS-MM	Meridian 1	Release 16 & above
NCRD	Meridian 1, SL-100, DMS-100	Release 16 & above BSC 28 & above

Note: If the interface is changed, the release ID is also changed. The release ID must then be reconfigured.

This feature prevents software incompatibility between two switches. Different applications are supported by different releases, and for most of the ISDN applications, operations are invoked by sending messages back and forth. To prevent software incompatibility, the following occurs. The release ID of the connecting D-channel is checked before data is sent through the ISDN interface. If the connecting switch does not have the software to handle the feature requested, an application message is not sent. Instead, an error message is printed.

Table 1 shows the relationship between, the ISDN application, equipment and the Release ID (X11 or BCS) at the far end.

> *Note:* The Release ID information is required and supported for connection to Northern Telecom equipment only. For connections to AT&T ESS4/5 set RLS = 1.

Feature implementation

The Software Release ID feature is configured in LD17.

Procedure 25-1
Respond to the following prompts in LD17 (X11 release 17 and earlier)

Prompt	Response	Description
REQ	NEW,CHG	
TYPE	CFN	configuration data block
ISDN	YES	
DCHI	1-15	D-channel number
RLS	xx	This is the current software release of the far end. If the software is incompatible, it prevents the sending of application messages. Refer to X11 input/output guide (553-3001-400) for details concerning required releases.

Procedure 25-2
Respond to the following prompts in LD17 (X11 release 18 and later)

Prompt	Response	Description
REQ	CHG	Change
TYPE	CFN	Configuration Record
ADAN	NEW DCH 0-63	Add a primary D-channel (can also CHG and OUT DCH)
CTYP	DCHI, MSDL	Card type
DNUM	0-15	Device number: physical port (odd) for D-channel on DCH, physical card address for MSDL
_PORT	0-3	Port number on MSDL card
RLS	xx	Release ID of the switch at the far end of the D-Channel. Refer to *X11 input/output guide* (553-3001-400) for details concerning required releases.

Issued:	92 12 31
Status:	Standard
X11 release:	17

T309 Timer

The T309 timer provides a 90-second wait interval after a D-channel failure before the B-channels are cleared. When the D-channel is re-established before T309 expires, a STATUS ENQuiry message is sent by the network side. The user side responds with a STATUS message to report the status of the queried channel. If the call state matches, the call is preserved; otherwise, a RELease message is sent to the user side, clearing the call. If the user side does not respond with the STATUS message before the T322 timer expires, the call is cleared.

If T309 expires before the D-channel is re-established, indicating that there is a serious problem with the link, Meridian 1 clears all calls internally and sends a global RESTART when the D-channel is re-established.

For a Meridian 1 to Meridian 1 interface, the T309 timer is not used. The Meridian 1 keeps active calls established as long as possible and lets B-channel users decide when a call is to be dropped. The Meridian 1 specified as network side sends the STATUS ENQuiry message on all active calls when the D-channel is re-established.

Operating parameters

Prior to X11 release 17, the Meridian 1 does not support the T309 and sending the STATUS ENQuiry message for North American interfaces. All active calls are cleared with a global RESTART whenever a D-channel is reestablished.

The compatibility checking by means of the STATUS ENQuiry message might leave some channels with mismatched states, which are cleared only when trying to reuse the channel.

T309 is dependent on both network and user sides. If a side does not have a Timer T309, it sends a global RESTART when D-channel is re-established.

AT&T 4ESS and 5ESS do not clear transient calls when the D-channel fails. If T309 expires, the calls are not cleared until the D-channel is reestablished or the call is cleared by the far end.

Feature interactions

Integrated Services Access – Integrated Services Access (ISA) tracks the number of active calls. Prior to X11 release 17, the counter for active calls is reset when the D-channel comes back. With the implementation of T309, active calls are preserved if the ninety seconds does not expire; the counter for active calls is not reset since active calls need to be tracked during the D-channel failure and reset.

Feature packaging

The T309 and STATUS ENQuiry message are included in basic ISDN PRI/ISL functionality. No additional packages are required.

Feature implementation

The T309 timer is preset at 90 seconds and cannot be service changed.

Trunk Optimization (before answer)

Trunk Optimization before answer (TRO) enhances routing on PRI and ISL routes for redirected calls. Trunk Optimization before answer (TRO) occurs when a direct call is made from the originating to the redirection telephone, from Meridian 1 to Meridian 1 machines.

Trunk Optimization before answer (TRO) only operates when Network Call Redirection is also enabled in your system.

TRO applies to the following call redirections:

— Network Call Forward All Calls (NCFAC)

— Network Call Forward No Answer (NCFNA)

— Network Hunting (NHNT)

With supporting network call redirection features enabled on each node, TRO can work as shown in Figure 27-1.

Case 1

The originating telephone A calls a remote telephone B over a PRI/ISL route (1), and due to Network Call Forward All Calls (NCFAC), Network Call Forward No Answer (NCFNA), or Network Hunting (NHNT), the call is forwarded to telephone C over route (2).

When TRO is enabled at switch B, messages are sent from the redirecting node (B) to the originating node (A)with the following information:

— redirection number

— redirection reason

— redirection counter

If the originating node does not support Trunk Optimization, the node sends a message rejecting TRO, and the call proceeds on the current route. The redirecting node then cancels TRO routing.

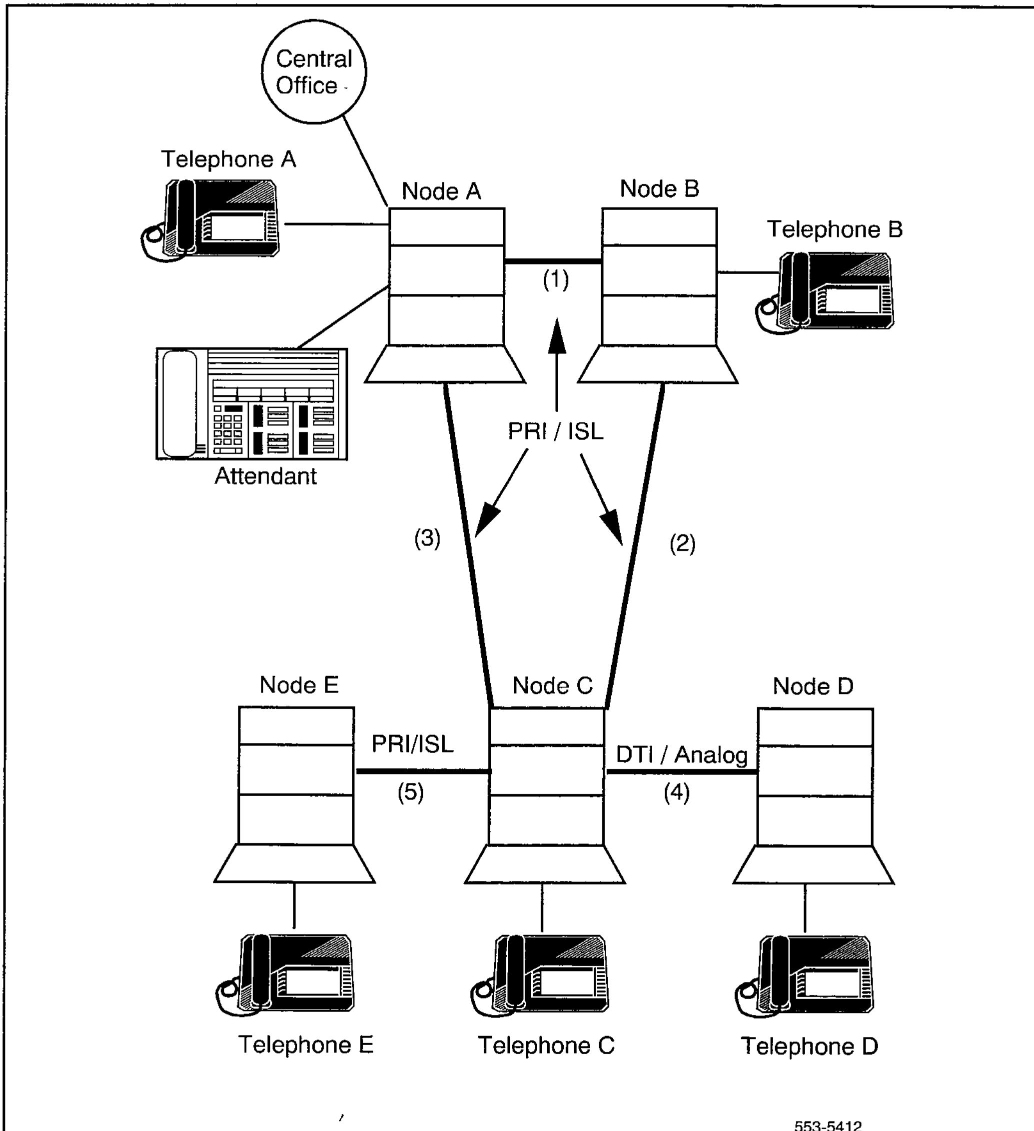
If Node A has TRO enabled, and has a first choice route member available, and the redirection counter does not exceed the limit, the system sends back a message accepting TRO. The redirecting node sends a message to release the connection, the originating node sends a message confirming that the original connection (1) is dropped. The originating node also establishes a direct connection to Telephone C over route 3.

In this case, the switch routes 1 and 2 are available for additional calls.

Case 2

The originating telephone A calls remote telephone E over PRI/ISL routes (3 and 5), and due to Network Call Forward All Calls (NCFAC), Network Call Forward No Answer (NCFNA), or Network Hunting (NHNT), the call forwards to telephone C over a PRI/ISL route (5). When Node A accepts the TRO request, node A establishes a direct connection to node C over route 3. In this case, both connections over route 5 are dropped, and available for other calls.

Figure 27-1
Trunk Optimization examples



Operating parameters

TRO is only supported before the call is answered.

TRO must be supported on all the nodes involved, by responding YES to the TRO prompt in the Route Data Block (RDB), LD16. Also, each telephone redirecting the call must have a Call Forwarding/Hunting feature allowed. The TRO operation is not supported if the originating telephone and the redirection telephone reside on the same node.

Trunk routes targeted for optimization must be listed in the Route List Index (RLI entry 0).

Only ISDN PRI/ISL trunks are supported. If an analog or digital trunk (not controlled by a D-Channel) is used between the originating and redirecting node, TRO does not operate. The call continues on the original path.

Trunk Optimization operates independently of the telephone type used for a call. TRO works for both voice and data calls between Meridian 1 machines.

Only Meridian 1 to Meridian 1 connections are supported. Non-Meridian 1 switches can operate as tandem switches if they can send along the TRO messages.

When the call is redirected, a 2 second timer begins within the redirecting system, waiting for a responding message from the originating node. If the timer expires, the call continues along the original path, and TRO does not operate.

Carefully analyze traffic estimates for all routes targeted for TRO to ensure that enough trunks and routes are available for all routing possibilities.

TRO is not supported with mixed dialing plans. Use caution when implementing TRO on a network using UDP and CDP at the same time. Because location codes are not used between CDP locations, TRO may direct calls to the wrong location. Duplicate CDP DNs at other TRO locations may cause TRO to redirect the call to the wrong DN.

In Figure 27-1, assume Nodes A and B share a CDP numbering plan, and Nodes C, D, and E share a second CPD numbering plan. If TRO is desired between the two CDP groups, then NO DN from EITHER CDP network can be duplicated in the other CDP network.

Trunk Optimization ***is not supported*** for the following call types.

- DID trunk call at Node A goes to Telephone B on Node B, that has NCFAC, NCFNA, NHNT to Telephone C
- DID trunk call from Node A to Telephone A, that has NCFAC, NCFNA, NHNT to Telephone B, having NFAC, NCFNA, NHUNT to Telephone C
- telephone D calls Telephone B, which is NCFAC, NCFNA, NHUNT to Telephone C when Node D is connected by non-ISDN link to Node C
- when the attendant extends a DID or Incoming trunk call to Telephone B and releases, and Telephone B is CFNA to Telephone C. After three rings, the call is forwarded, but not optimized, to Telephone C.

  If the attendant remains with the call, TRO functions.
- telephone A uses Transfer or Conference to Telephone B when Telephone B has NCFAC, NHUNT, NCFNA to Telephone C
- calls to Meridian Mail auto attendant functions are not optimized because the call is viewed as answered.
- if redirecting the call increments the network redirection counter beyond the limits
- AUTOVON calls
- ACD Night Call Forward calls
- ACD Interflow calls

Feature Interactions

With the exception of those discussed here, call redirection features are not affected or supported.

Attendant calls—Attendant extended calls can allow or restrict TRO as shown in the following.

- Telephone A, a DID trunk, or an incoming trunk calls the attendant, and the attendant extends the call to Telephone B, which has NCFAC, NHUNT to Telephone C. The call is optimized to Telephone C.
- A DID trunk, or an incoming trunk call to the attendant is extended to Telephone B, and the attendant does not release the call. Telephone B has NCFNA to Telephone C. After three rings, the call forwards to Telephone C, and the attendant releases the call. The call is optimized to Telephone C.

BARS/NARS—BARS/NARS operation is not changed. BARS/NARS is used to determine route availability to terminate the optimized call. Only Uniform Dialing Plan (UDP), and Coordinated Dialing Plan (CDP) are supported by TRO. Direct Trunk Access codes are not supported.

Call Party Name Display—When a call is optimized, the name or number may not appear on the receiving party's display.

Class of Service—It is important to program redirecting telephones with Class of Service (CLS) to allow call redirection.

Dialed number display—Calls modified by Network Call Redirection and TRO may affect the display results on the answering telephone. The dialed number/name will not appear on the called telephone's display, despite having it allowed.

Network Call Forward by Call Type (NCFCT) — Prior to X11 release 16, call type treatment (Internal or External) is determined by the Route Class of Service (RCLS) prompt in LD16, associated with the incoming trunk route. With X11 release 16 and later, for calls containing CLID in the setup message, the RCLS prompt is superseded by the numbering plan type identified within the setup message. Incoming trunk calls answered at node A prior to entering the Tie trunk link using call modification contain a CLID as a result of the call modification, and may result in Internal call treatment at the terminating node.

Refer to the Network Call Redirection discussion in this document. Be sure to consider this feature when configuring your network.

Network Call Redirection (NCFAC, NCFNA, NHNT) — TRO depends on Network Call Redirection (NCRD) messages over the D-channel. Be sure to allow NCRD for all routes targeted for TRO calls. When a call is redirected using TRO, the redirection information is passed to the originating node. The redirection is suspended, and a direct connection is established. If a route is not available when the call is placed, the call may be blocked.

Network Call Transfer — Trunk Optimization does not operate for Network Call Transferred calls. Station and attendant extended calls do not utilize TRO.

Network Message Service — TRO occurs when Meridian Mail Call Sender is activated. No optimization takes place when through dialing or operator revert features are used because the calling DN is not provided to Meridian Mail with these features. When a call is optimized, the original called party information is included in the a setup message of the call. This is the way Meridian Mail determines the intended receiver.

Feature packaging

TRO is packaged as an ISDN feature in Advanced Network Services (NTWK), package 148.

Feature implementation

Trunk optimization is configured in LD16.

Procedure 27-1
Respond to the following prompts in LD16

Prompt	Response	Description
REQ	CHG	
TYPE	RDB	Route data block
CUST	0-99	Customer number
ROUT	nnn	Route number 0-511 for NT, XT, 61, 71, and 81 0-127 for ST, 21, STE, 21E
DTRK	YES, (No)	Digital Trunk Route Must be Yes to prompt ISDN
ISDN	YES, (No)	ISDN option
NCRD	YES, (No)	Network Call Redirection. Allows network call redirection messages to be sent (or blocks messages if NCRD =no). Must be Yes to prompt TRO.
TRO	YES, (No)	Trunk Optimization

Glossary

This chapter lists, by alphanumeric order, the acronyms, abbreviations, and initializations used in this document.

A/B

A and B bit signaling

AC

Access Code

ACB

Automatic Call Back

ADM

Add-On Data Module

AIM

Asynchronous Interface Module

AMI

Alternate Mark Inversion

ANI

Automatic Number Identification

ASE

Application Service Element

AR

Automatic Recall

B8ZS

Bipolar 8 Zero Substitution (provides 64 Kbps clear channel capability)

BARS

Basic Alternate Route Selection

BC

Bearer Capability

BCH

B-channel

BISI

Busy Idle Status Indication

BRA

Basic Rate Access

BRI

Basic Rate Interface

CALLATTR

Call Attribute table or index

CARRMTC

Carrier Maintenance

CBC

Call-by-Call Service

CBQ

Call-back Queuing

CC

Central Controller

CCBQ

Coordinated Call-back Queuing

CCITT

International Telegraph and Telephone Consultative Committee

CDN

Called Party Number

CDP

Coordinated Dialing Plan

CDPA

Called Party Address

CDR

Coordinated Detail Recording

CFB

Call Forward Busy

CFD

Call Forward Don't Answer

CFI

Call Forward Intragroup

CFU

Call Forward Universal

CGN

Calling Number

CGPA

Calling Number Address

CHID

Channel Identifier

CLID

Calling Line Identification

CLLI

Common Language Location Identifier

CO

Central Office

COS

Class of Service

COT

Central Office Trunk (Meridian 1 only)

CPB

Call Processing Busy

CPF

Called Party Free

CPU

Central Processing Unit

CPV

Command Protocol Violation

CR

Call Reference

CRC

Cyclic Redundancy Check

CUSTNTWK

Customer Networking

D2/D3/D4

Channel banks which handle A0 bit signaling

DCH

D-channel Handler, D-channel interface on the MSDL card

DCHI

D-channel Interface on the QPC747 DCHI card

DDD

Direct Distance Dialing

DID

Direct Inward Dialing

DISA

Direct Inward System Access

DMI

Digit Manipulation Index

DMS

Digit Manipulation System

DNATTR

Directory Number Attributes

DND

Do Not Disturb

DNGRP

Directory Number Groups

DOD

Direct Outward Dialing

DPC

Destination Point Code

DPN

Digital Packet Network

DRAM

Digitally Recorded Announcement

DSL

Digital Subscriber Loop

DTCI

ISDN Digital Trunk Controller

DTI

Digital Trunk Interface

DTRID

Terminating Transaction Identifier

DU

Data Unit

E.163

Telephony Numbering Plan

E.164

North American public dialing plan

ERWT

Expensive Route Warning Tone

ESF

Extended superframe format

ESN

Electronic Switching Network

ETN

Electronic Tandem Network

FDL

Facility Data Link

FNPACONT

Foreign Numbering Plan Area Control table

FPS

Frame Pattern Sequence

FX

Foreign Exchange trunk

GNCT

Generalized No Circuit Treatment

GT

Guard Timer

GTTO

Guard Timer Time Out

GTT

Global Title Translations

HNPACONT

Home Numbering Plan Area Control table

IAC

ISDN Access Controller

IAM

Initial Address Message

IBN

Integrated Business Network

IBNRTE

IBN Routing Table

IBNTO

IBN Trunk Outgoing

IBNTI

IBN Trunk Incoming

IBNT2
IBN Trunk 2-way

IBNXLA
IBN Translation Table

IE
Information Element

IEC
Interexchange Carrier

IFC
Interface Type

IID
Interface Identifier

INWATS
Inward Wide Area Telephone Service

ISA
Integrated Services Access

ISDN
Integrated Services Digital Network

ISL
ISDN Signaling Link

ISO
International Standards Organization

ISUP
ISDN User Part

ITA
Integrated Trunk Access

KSETLINE

Keyset Line table

LAPD

Link Access Procedure on the D-channel

LATA

Local Access and Transport Area

LDN

Listed Directory Number

LEC

Local Exchange Carrier

LEN

Line Equipment Number

LINEATTR

Line Attributes table

LOC

Location Code

LTCALLS

Logical Terminal Calls table

LTAP

Logical Terminal Access Privilege

LTCALLS

Logical Terminal Calls table

LTCLASS

Logical Terminal Class table

LTDATA

Logical Terminal Data table

LTDEF

Logical Terminal Definition table

LTGRP

Logical Terminal Group table

LTID

Logical Terminal Identifier

LTKEY

Logical Terminal Key

LTMAP

Logical Terminal Map table

LTNUM

Logical Terminal Number

MADN

Multiple Appearance Directory Number

MAP

Maintenance and Administration Position

MBG

Multiple Business Group

MCDN

Meridian Customer Defined Networking

MDC

Meridian Digital Centrex

MSB

Make Set Busy

MSDL

Multi-purpose Serial Data Link card (NT6D80)

MSGRTE

Message Route

NACD

Network ACD

NARS

Network Alternate Route Selection

NFWD

Network Call Forward

NCFB

Network Call Forward Busy

NCFNA

Network Call Forward No Answer

NCOS

Network Class of Service

NCPND

Network Call Party Name Display

NCT

Network Call Transfer

NCTE

Network Customer Terminating Equipment

NAUT

Network Authorization Code

NETID

Network Identifier

NETNAME

Network Name

NHNT

Network Hunt

NMS

Network Message Services

NN

National Number

NINTNRAG

Non-interworking Network Ring Again

NMRTNRAG

No Message Route Network Ring Again

NPA

Numbering Plan Area

NPI

Numbering Plan Indicator

NRAG

Network Ring Again

NSF

Network Specific Facility

NSC

Network Speed Call

NSIG

Network Signaling

NXFR

Network Call Transfer

OAM

Operations, Administration, and Maintenance

OFRT

Office Routing table

OHQ

Off-hook Queuing

OPC

Originating Point Code

OSI

Open Systems Interconnection

OTRID

Originating Transaction Identifier

PI

Progress Indicator

PBX

Private Branch Exchange

PDN

Primary Directory Number

PHI

Packet Handler Interface

PI

Progress Indicator

PIC

Preferred Inter-LATA Carrier

PNI

Private Number Identifier

PRI

Primary Rate Interface

PSTN

Public Switched Telephone Network

PTS

Per Trunk Signaling

PUB

Public (call type)

PVN

Private Virtual Network

PVT

Private (call type)

PX

PBX trunks

Q.921

CCITT recommendation for Layer 2 of ISDN

Q.931

CCITT recommendation for Layer 3 of ISDN (protocol for D-channel messages)

QAT

Queue Advance Timer

RAGT

Reserve Agent Timer

RAN

Recorded Announcement

ROSE

Remote Operations Service Element

RTEID

Route Identification Index

RTEREF
Route Reference table

RTESEL
Route Selector

RVQ
Remote Virtual Queueing

SAPI
Service Access Point Identifier

SCCP
Signaling Connection Control Part

SID
Service identifier

SELSEQ
Selection Sequence

SETUP
Q.931 message type

SID
Service Identifier

SPECCONN
Special Connections (table)

SPN
Special Number

SS7
Signaling System #7

SSN
Subsystem Number

SSP

Service Switching Point

STDPRTCT

Standard Pretranslator Control Table

STINV

Signaling Terminal Inventory Table

STP

Signal Transfer Point

SWERR

Software Error

TARG

Trunk Group Access Restrictions

TCAP

Transaction Capabilities Application Part

TCOS

Traveling Class of Service

TEI

Terminal Endpoint Identifier;
Terminal Equipment Interface

TFMI

Traffic Mix Information

THOUGRP

Thousands Group table

TIE

Terminal Interexchange line or trunk

TN

Transit Number

TNCOS

Terminal Number Class of Service

TNS

Transit Network Selector

TO

Time Out

TON

Type of Number

TRKGRP

Trunk Group table

TRKSGRP

Trunk Subgroup table

TRO

Trunk Route Optimization (before answer)

UDP

Uniform Dialing Plan

VF

Voice Frequency

VFG

Virtual Facility Group

VIRTGRPS

Virtual Facility Groups Table

WATS

Wide Area Telecommunications Service

XLAIBN

Translate call as private network call

XLAIEC

Interexchange Carrier translation

XLALEC

Local Exchange Carrier translation

XLARTE

Translation Route

Index

N

Y

SL-1

ISDN Primary Rate Interface

Description and administration

Release 8.0
Standard
October 31, 1993
Printed in the U.S.A.

northern telecom

SL-1

Feature Group D

Description and operation

Publication number: 553-2901-102
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Document release: 1.0
Document status: Standard
Date: December 1, 1991

Revision history

December 1,1991

This is a new document issued for X11 release 17.

Contents

Introduction

The purpose of Feature Group D (FGD) interface is to provide access to corporate networks from off-net sources.

Feature Group D defines interconnection rules between the Local Exchange Carrier (LEC) and an Interexchange carrier (Carrier) like AT&T, or MCI.These rules provide Equal Access (EA), which determine the same level of service and quality of transmission for all carriers.This guarantees that all carriers are processed equally.Generally, Feature Group D (FGD) provides the following:

– routing interLATA calls from telephones presubscribed (individual calling customers have the option to designate one Carrier to whom interLATA calls should be routed) to the carriers Point of Termination (POT)

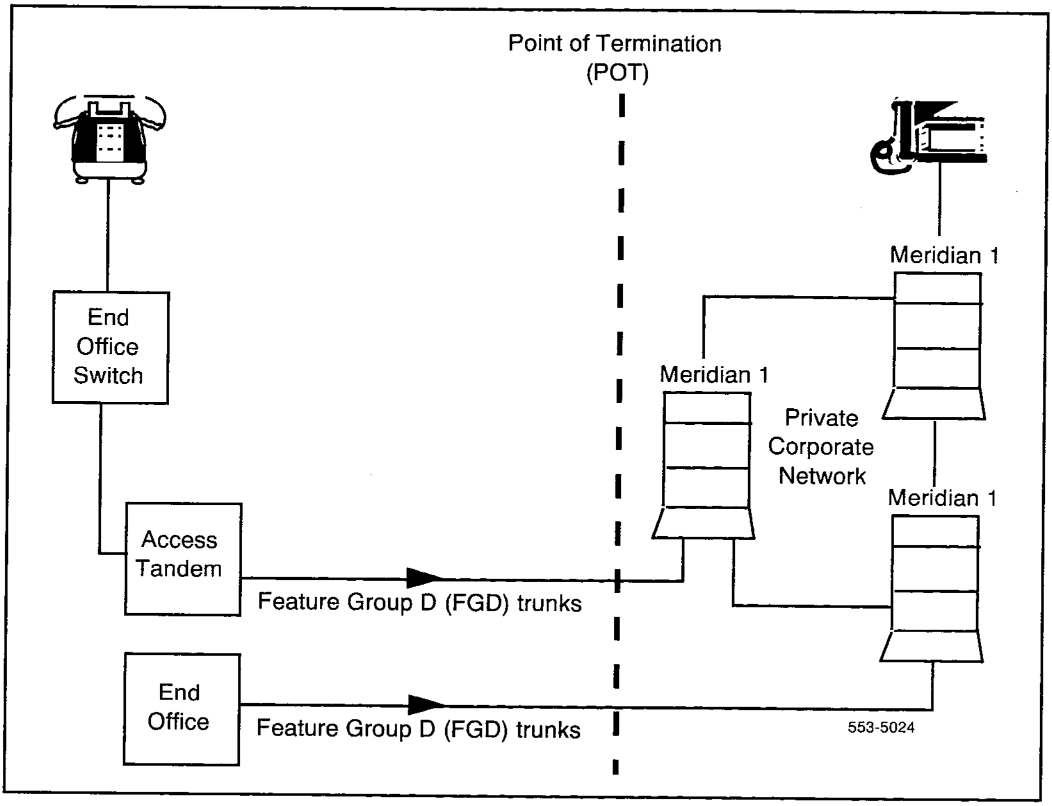
– routing all calls prefixed by the Carrier Access Code to the carrier selected by the user

– passing dialed digits, Automatic Number Identification (ANI) digits, and other information to the Carrier for billing, screening, routing, and other call services

Equipping Meridian 1 switches with Feature Group D (FGD) allows the network owner to operate as an Interexchange Carrier (Carrier), subject to Local Exchange Carrier (LEC) regulations.

A typical Feature Group D (FGD) configuration is shown in Figure 1.In this case, the corporate network contains Meridian 1 switches.

Figure 1
Configuration example



Packaging

Feature Group D (FGD) package number 158, must be ordered with the following required packages:

- Basic Alternate Route Selection (BARS), package 57
  - Network Alternate Route Selection (NARS), package 58, is recommended to support greater flexibility and translation capability
- Network Class of Service (NCOS), package 32
- Basic Routing (BRTE), package 14

The packages listed below are required for additional optional capabilities:

- Call Detail Recording Expansion (CDRE), package 151, provides Automatic Number Identification (ANI) information in the records.
- Digit Display (DDSP), package 19 allows Automatic Number Identification (ANI) display.
- Network Authorization Code (NAUT), package 63, provides Network Authorization functions.
  - NAUT requires Basic Authorization Code (BAUT), package 25, and Charge Account (CAB), package 24.
- Automatic Trunk Maintenance (ATM), package 84, allows Automatic Trunk Maintenance capabilities.(ATM cannot be invoiced on trunks controlled by "D Channel".)
  - ATM requires Tone Detector (TDET), package 65.
- ISDN Primary Rate Interface (PRI) package 146, or ISDN Signaling Link (ISL) package 147, is required to provide Automatic Number Identification (ANI) digits as Calling Line Identification (CLID).
  - ISDN Signaling (ISDN), package 145, is required for either PRI or ISL.

Related documentation

Refer to the following documents for additional information:

— *X11 features and services* (553-3001-305)

— *X11 input/output guide* (553-3001-400)

— *Meridian Customer Defined Networking Network Software Services (NSS) reference manual* (555-8001-115)

— *Call Detail Recording Description* (553-2631-100)

— *Traffic measurement* (553-2001-450)

Description

Local network and end office switching

A *calling customer* is the Local Exchange Carrier (LEC) customer that requests an end-to-end connection (originating call.) A *called customer* is the LEC customer with whom the calling customer wants to speak (terminating access call).

The Local Exchange Carrier (LEC) for FGD has two levels.

- The End Office is where the calling customer lines are connected.
- The Access Tandem is where the switching system (any switch that provides FGD features) distributes traffic among the end offices that use the tandem within the LATA.

Access to FGD can be either directly from an end office or through an access tandem.Services provided for direct and tandem access are the same since calling customer differences are not noted.

Originating features

A calling customer can place only Domestic call types, known as call categories.A Domestic call originates and terminates within World Zone 1 (WZ1).

> *Note:* Currently, the customer may not dial outside the North American Dialing Plan.Certain locations outside of the continental United States, but still within World Zone 1 (WZ1), may require international dialing and are not supported under the domestic dialing plan.For example, the Caribbean is within WZ1 but requires international dialing capabilities.Therefore, the calling customer in this particular location cannot use the plan.

Domestic dialing plan

Use the following sequence for Domestic calls through FGD.

(10XXX) + (0/1) +7/10D

Legend:

() Parenthesis	Indicates the numbers within the parenthesis may not be required for dialing.
/ Slash	Indicates either one or the other may be used.
10XXX	Designates that the call be handled by the Carrier network.
0	Requests Northern Telecom Dial 0 services.
1	May be required for some 7 or 10 digit calls.For example, a 1 may indicate 10 digit dialing.
7/10D	Represents the 7 or 10 directory number for the Called Customer.

Presubscription

A presubscription Carrier is a designated Carrier which the Calling Customer selects to route Domestic calls without a 10XXX designator.By dialing the 10XXX code, you can override this presubscribed Carrier.

Service Access Code

Service Access Codes (SACs) are Number Plan Area (NPA) codes assigned for special use.Normally NPA codes are used to identify specific geographical areas.However, some NPA codes within the North American Numbering Plan (NANP) are designated as SAC codes to indicate generic services or access capability.

Currently four NPA codes are designated as SAC codes: 610, 700, 800, and 900.Each is associated with a specific service or access capability:

- 610 SAC is assigned to Canada for TWX service
- 700 SAC is reserved for the Carrier
- 800 SAC is assigned for toll-free numbers
- 900 SAC is reserved for special services such as pay-subscription.

Further, SACs provide the option to assign access capability to the LEC and Carrier network.SACs subdivide into categories that define the Carrier identification requirements.

Ancillary Carrier identification (10 digit translation)

Access this category by dialing (1) + SAC-NXX-XXXX.Do not enter the 10XXX access code.The full 10 digits are translated to determine the Carrier.

Embodied Carrier identification (6 digit translation)

Access this category by dialing (1) + SAC-NXX-XXXX.Do not enter the 10XXX access code.The 6 digits (SAC-NXX) are translated to determine the Carrier.

External Carrier identification

Access this category by dialing (10XXX) + (0/1) + SAC-NXX-XXXX.The Carrier is determined by the 10XXX access code.If the 10XXX is not dialed, the presubcribed Carrier routes the call.

ANI

For billing and screening purposes, the Carrier can have ANI digits precede the called party address.The ANI will include two information digits, followed by the Calling customer's area code and billing number.If the billing number is not available, the ANI digits are followed by the area code only.

Signaling protocol

FGD can use the following signaling protocols for originating (LEC to Carrier) calls.

- Exchange Access North American (EANA)
- Terminating protocol – for test calls only

Carrier test lines

The only test lines supported by FGD are those supported by the Meridian 1 system.For a complete description of the carrier test lines, refer to *Transmissión Testing Capabilities* (553-2001-325).

Outpulsing

Exchange access signaling is implemented with overlap signaling or outpulsing.

Terminating features

Only test calls are supported for outgoing FGD calls.

LEC test lines

The following types of test lines may be provided by the LEC.

- balance (100 type)
- nonsynchronous or synchronous
- automatic transmission
- data transmission (107 type)
- measuring (105 type)
- loop around
- short circuit
- open circuit

Interface protocol

Direction

Trunks are characterized according to the direction that supervisory and address signals are applied.

- A one way outgoing trunk from the LEC carries the originating calls.

  Note: One way outgoing trunks, from the LEC to the Carrier, do not provide Carrier test capability.

- A one way incoming trunk carries terminating calls.
- A two way, both incoming and outgoing, carries both originating and terminating calls.

Signaling protocol

The signaling protocols supported are Terminating protocol for outbound test lines only and Exchange Access North American (EANA) signaling.

Terminating protocol

In addition to the originating signaling protocol, there is one terminating protocol for line tests as follows:

1. The Carrier seizes a trunk to the LEC and applies a connect (off-hook) signal to the trunk.
2. The LEC responds with a wink-start signal which informs the Carrier that the LEC is ready to receive the address field.
3. On receipt of this wink-start signal from the LEC, the Carrier will MF outpulse the address field.
4. The LEC screens and translates the address field.If the terminating call is delivered to the appropriate end office, the LEC completes the call to the proper called customer.A Carrier may have to establish more than one POT to obtain access to an entire LATA.
5. When the called customer answers, answer supervision (off hook) is passed to the Carrier from the LEC.The time that the off hook signal is received by the LEC is recorded by Automatic Message Accounting (AMA) as the customer answer time.
6. When the call is over, the disconnect sequence is initiated.The time that the on-hook signal is received is recorded by AMA as the disconnect time.

Exchange Access North American Signaling (EANA)

Exchange Access North American Signaling (EANA) signaling consists of two fields: the identification field, and the address field.

- **The Identification field** contains the calling customer's identification number, or ANI digits.
- **The Address field** contains the called number.

This arrangement allows the identification field (ANI digits) to be pulsed to the Carrier before the called number.With the addition of overlap pulsing, which initiates pulsing to the Carrier before the customer has completed dialing, post-dialing delay is minimized.The originating call process follows:

1 After the customer receives all but the last four digits of the called number, the LEC initiates actions to seize a trunk to the Carrier.
2 The Carrier responds to the trunk seizure with a wink-start signal when ready to receive pulsing.The time that the wink-start signal is received is recorded by Automatic Message Accounting (AMA) as the Carrier connect time.
3 After receiving the wink-start signal from the Carrier, the LEC starts MF outpulsing the identification field.
4 When both customer dialing and outpulsing of the identification field are completed, the LEC outpulses the address field.
5 When the Carrier receives all the pulsing information, it responds with an acknowledgment wink.
6 After receiving the acknowledgment wink, the LEC connects the talking path from the calling customer to the Carrier.
7 After the called customer answers, the answer off-hook signal is sent from the Carrier to the originating LEC.The time that the off-hook signal is received is recorded by AMA as the customer answer time.
8 When the call is completed, the disconnect sequence is initiated.The time that the on-hook signal is received is recorded by AMA as the disconnect time.

Carrier classification

Interexchange Carrier (IC) provides connections between LATAs and serving areas where the calling and called customers are located in World Zone 1.

International Carrier (INC) provides connections between a customer located in the contiguous 48 United States and a customer located outside World Zone 1.

Consolidated Carrier (IC & INC) are carriers that provide connections as described in both of the above.

When calls are being forwarded to Carriers using exchange access signaling, the protocol is influenced by the classification of the receiving Carrier.The IC and IC & INC receive calls destined for customers located in World Zone 1 with EANA signaling.

Call categories and pulsing formats

The call categories are based on the information dialed by the originating customer.Table 1 identifies the applicable call categories for FGD switched access service.

Table 1
Call categories

Customer dials	Call category
(10XXX)+(1)+(NPA)+NXX+XXX - NPA is in area covered by North American Numbering Plan	(Inside WZ1) 1+
(10XXX)+0+(NPA)+NXX+XXXX - NPA is in area covered by North American Numbering Plan	(Inside WZ 1) 0+
(1)+SAC+NXX+XXXX	1+(Embodied SAC)
(10XXX)+(1)+SAC+NXX+XXXX	1+(External SAC)
(10XXX)+(0)+SAC+NXX+XXXX	0+(External SAC)
95Y+XXXX y = 8 or 9	Test (7 digits)
10X	Test (3 digits)

Legend:

() = variable inclusion whole contents may not be required
NPA = area code in North American Numbering plan
NXX = end-office code in North American Numbering plan
SAC = service access code
WZ = World Zone

Table 2 shows the protocols available for each call category depending on the Carrier classification.

Table 2
Interface protocols

Call category	IC	IC & INC
(Inside WZ1) 1+	EANA	EANA
(Inside WZ1) 0+	EANA	EANA
10XXX+0	EANA	EANA
1+(Embodies SAC)	EANA	EANA
1+(External SAC)	EANA	EANA
0+(External SAC)	EANA	EANA
Test	EANA	EANA

Legend:

IC = Interexchange Carrier
IC & INC = Consolidated Carrier
EANA = Exchange Access North American Signaling
OS-1 = Operator Services Signaling - Inside World Zone 1
OS-O = Operator Services Signaling - Outside World Zone 1

Tables 3 and 4 summarize the pulsing formats by call category for EANA and terminating protocols, respectively.

Table 3
Access North American signaling

Call category	Identification field	Address field
(Inside WZ 1) 1+	KP+(II+3/10D)+ST	KP+(NPA)+NXX+ XXXX+ST
(Inside WZ 1) 0+	KP+(II+3/10D)+ST	KP+0+(NPA)+NXX +XXXX+ST
10XXX+0	KP+(II+3/10D)+ST	KP+0+ST
1+(Embodied SAC)	KP+(II+3/10D)+ST	KP+SAC+NXX+X XXX+ST
	KP+(II+3/10D)+ST	KP+SAC+NXX+X XXX+ST
0+(External SAC)	KP+(II+3/10D)+ST	KP+0+SAC+NXX+ XXXX+ST
Test (7D)	none	KP+95Y+XXXX+S T
Test (3D)	none	KP+10X+ST

Legend:

II = 2-digit code for ANI information
3/10D = 3 or 10 digit
Y = 8 or 9
3D = 3 digits
7D = 7 digits

Table 4
Terminating protocols

Call category	Address field
IC calls to directory numbers within LATA	KP+(NPA)+NXX+XXX+ST
IC calls to Directory Assistance Service (555+1212)	KP+(NPA)+555+1212+ST
IC calls to LEC Test Lines -see note 1	KP+95Y+XXXX+ST - Y=8 or 9 or KP+10X+ST
Note: End-office codes other than 95Y can be used with LEC test lines in some areas.	

EANA protocol specifications

LEC-to-Carrier pulsing

The format restrictions on the pulsing combinations for calls in the (Inside WZ 1) 1+ and (Inside WZ 1) 0+ categories are:

Identification field	Address field
KP+(II+3/10D)+ST	KP+(0)+7/10D+ST

The format restrictions on the pulsing combinations are:

- The first digit in the identification field after KP is never 1.
- The start pulse at the end of the identification sequence is not primed.
- The 7/10 D in the address field conforms with the NANP.

Variations

Identification Field —When ANI is being provided, the structure of the identification field is:

- KP+(II+3/10D)+ST

The variations in the field are:

- Information digits (II)

Table 5 is the default table that shows the digit pair default assignments.

Table 5
Information digits (II)

Information digits	Explanation
00	Regular line
01	4- and 8-party
06	Hotel/Motel
07	Coinless
10	Test call
12 - 19	cannot be assigned because of conflicts with 1NX used as first digits in international calls
20	AIOD listed directory number sent
27	Coin
95	Test Call

Alternative arrangements

ANI – The Carrier may elect to receive ANI or not to receive ANI.

The ANI digits are the full 10-digit billing number, including the numbering plan area (NPA), except when the calling line's billing number cannot be identified.When calling line's billing number cannot be obtained, a 3-digit NPA, associated with the originating end office, is sent.

Without ANI, the basic format of the pulsing stream received by the Carrier is as follows:

– KP+ST+KP+(0)+7/10D+ST

The identification field without ANI, is reduced to KP+ST.By eliminating ANI, the two information digits (II) are also eliminated.

Time limits

Wink-Start — The Carrier returns the wink-start signal within 3.5 seconds (CSWT) of the trunk seizure.

Wink-Start Guard – The end of the wink-start signal must not occur before 210 ms (CSWT) after receipt of the incoming seizure signal.The Carrier must be prepared to receive MF pulses 35 ms after the end of the wink-start signal.The LEC waits for 50 ms (BSWT) after the end of the wink-start signal before initiating MF pulsing.

Acknowledgment Wink – The Carrier responds with the acknowledgment wink between 200 ms (CSWT) and 3.5 seconds (CSWT) after receipt of the complete address field.The Carrier should not attempt to use the talking path for communication with the calling customer before returning the acknowledgment wink.

Answer – The Carrier provides an on-hook state continuing for at least 250 ms (CSWT) between the acknowledgment wink and the steady off-hook signal indicating called party answer.

EANA protocol example

Tables 6 and 7 show examples of several originating calls using EANA protocol.

Table 6
EANA protocol - customer dials a World Zone 1 number

Situation		
Customer dials (10990)+(1)+815+NXX+XXXX Trunk group uses exchange access North American signaling protocol		
Interface interactions		
LEC	POT	Meridian 1
Customer finishes dialing all but last 4 digits		
Seize	---------->------------	
	----------<------------	Wink
Identification field KP+00+212+555+XXXX+ST	---------->------------	
Customer finishes dialing		
Address Field KP+815+NXX+XXXX+ST	---------->------------	
	----------<------------	Acknowledgement Wink
LEC connects talking path		
	----------<------------	Answer
Disconnect	---------->------------	
	----------<------------	Disconnect
Interpretation		
Class of service of calling line is Regular (II=00). Billing number of calling line is 212+555+XXXX. Dial 0 calling service are not requested (1+call). Called number is 815+NXX+XXXX.		

Terminating protocol example

Table 7 shows an example of a call to a LEC test line using the FGD Terminating Protocol.

Table 7
Terminating protocol - carrier call to a LEC test line

Situation		
Carrier's craftsperson to connect to a LEC test line Trunk group uses terminating signaling protocol		
Interface interactions		
Meridian 1	POT	LEC
Seize	---------->------------	
	----------<------------	Wink
Address Field		
KP+95Y+XXXX+ST	---------->------------	
	----------<------------	Answer
Test		
Disconnect	---------->------------	
	----------<------------	Disconnect
Interpretation		
Requests connection of incoming trunk to text line 95Y+XXXX, where Y=8 or 9. Carriers should note that office codes other than 95Y can be used with LEC test lines in some areas.		

Hardware

This section describes the Meridian 1 hardware requirements for FGD.

Trunks

Any trunk hardware supporting EAM, EM4 or LDR line signaling can be used for FGD trunks including digital channels.

MF signaling

FGD trunks need MF tone receiving hardware for incoming calls and MF tone sending hardware for outgoing calls.

MF tone sending is provided by the existing MF loop or by the Meridian 1 Conference/TDS card.

MF tone receiving is provided by a new OPC 916 MF Receiving Card (MFRC).

MF senders

For the non-Meridian 1 environment, the existing MF-loop provides MF sending capability.In a Meridian 1 environment, the MF sending capability of the Conference/TDS card is used.The generic abbreviation MFS is used throughout this document to denote both kinds of senders.

The Meridian 1 feature provides support for Conference/TDS and MF-loop coexistence and coordinated operation:

- Both MF-loops and Conference/TDS loops are eligible when MF sending is needed for an outgoing trunk.(This was needed for CAMA and CCSA type trunks only prior to the present feature).
- Both MF loops and Conference/TDS loops can serve Meridian 1 and/or non-Meridian 1 trunks.
- The MF sending services provided by the Meridian 1 feature is used for terminating calls on FGD trunks.Only terminating test calls are supported.

MF receivers

A new MF Receiver Card (MFRC) is available - the QPC916.The MFRC is used to service incoming calls on all current FGD trunks.

General description

Each MFRC contains two independent MF receivers that use digital signal processing technology.The card can be plugged into any standard EPE shelf.Table 8 provides the MFR specifications:

Table 8
MFR specifications

Parameter	Limits	Conditions
1.General: — # of receivers — coding	 2 U Law	
2.Input frequencies (HZ)	700 900 1100 1300 1500 1700	Unless otherwise noted. hi tone: -7 dbm lo tone: -7 dbm Freq: nominal Noise: -25 dbm, white Signal duration: 50 ms Pause duration: 50 ms
3.Frequency discrimination: — must accept	+/- (1.5%+5Hz)	Noise: -30 dbm
4.Input level: — must accept — must reject	 0 to -25 dbm per tone below -35 dbm per tone	
5.Signal duration: — must accept — must reject — must accept (KP) — may accept (KP) — must reject (KP)	 >30 ms <10 ms >55 ms >30 ms <10 ms	 All signal except KP KP signal KP signal KP signal
6.Signal interruption — ignore interruption	 <10 ms	 After minimum length signal has been received
7.Time Shift between two frequencies: — must accept Coincidence between the two frequencies: — must reject	 <4 ms <10 ms	
8.Inter-digit pause — must accept	 >25 ms	A pause means: signal <-35 dbm
9.Max dialing speed	10 digits per second	

— continued —

Table 8
MFR specifications (continued)

Parameter	Limits	Conditions
10.Tolerance to twist: — must accept	<6 db	One tone relative to the other tone.
11.Reception in presence of disturbances:		
12.Error rate in presence of white noise	< 1/2500 calls	Nominal freq: -23 dbm/tone On/Off = 50/50 ms Signal to noise ratio = (-20 db all digits each call) - (10 digits)
13.Immunity to impulse noise error rate	< 1/2500 calls	Nominal freq: -23 dbm/tone On/Off = 50/50 ms Signal to noise ratio = -12 db ATT Digit simulation test tape #291m from pub. 56201 Duration: 1 hour
14.Power lines: — error rate	< 1/2500 calls	60 Hz signal at -9 dbm or 180 Hz signal at -22 dbm
15.Third freq: — must accept in the presence of third freq. if it is:	< -28 db	Below each frequency
Note: Digit is accepted if there are only 2 valid frequencies.		

Feature interactions

The following paragraphs describe the interactions between the listed features and Feature Group D only.For a complete explanation of these features, see *X11 features and services* (553-3001-305).

Access restriction

FGD trunks must have Answer Supervision and Disconnect Supervision.

Outgoing FGD trunks are supported for testing purposes only.

Incoming FGD trunks have Unrestricted Access (UNR) with the following limitation:

– FGD trunks cannot terminate to FR1 TIE trunks or FR1 stations because they are, by definition, denied access to and from the exchange network.

Table 9 shows the access summary from FGD trunks for the listed functions.

Table 9
Access summary from FGD trunks

	Conference, Privacy release, Mixed sets	Hunting, Direct Access	Night Posting, Call Pickup, TAFAS, Call Forward	Attendant extended	Hold, Call Transfer
WATS	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
FX	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
CCSA UNR TO SRE	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
CCSA FRE	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
CCSA FR1	Access not allowed	Access not allowed	Access not allowed	Access not allowed	Access not allowed
CCSA FR2	Access not allowed	Access not allowed	Access not allowed	Access not allowed	Access not allowed
DID	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
CO	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit

— continued —

Table 9
Access summary from FGD trunks (continued)

	Conference, Privacy release, Mixed sets	Hunting, Direct Access	Night Posting, Call Pickup, TAFAS, Call Forward	Attendant extended	Hold, Call Transfer
TIE UNR TO SRE	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
TIE FRE	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
TIE FR1	Access not allowed	Access not allowed	Access not allowed	Access not allowed	Access not allowed
TIE FR2	Access not allowed	Access not allowed	Access not allowed	Access not allowed	Access not allowed
STN UNR TO SRE	Access allowed if signaling arrangements permit	No restrictions	No restrictions	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
STN FRE	Access allowed if signaling arrangements permit	No restrictions	No restrictions	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
STN FR1	Access not allowed	Access not allowed	Access not allowed	Access not allowed	Access not allowed
STN FR2	Access not allowed	Access not allowed	Access not allowed	Access not allowed	Access not allowed
PAG	Access not allowed	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console	Only consultation-hold allowed
DICT	Access not allowed	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console	Only consultation-hold allowed

— continued —

Table 9
Access summary from FGD trunks (continued)

	Conference, Privacy release, Mixed sets	Hunting, Direct Access	Night Posting, Call Pickup, TAFAS, Call Forward	Attendant extended	Hold, Call Transfer
RAN	Access not allowed	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console	Only consultation-hold allowed
AIOD	Access not allowed	Access not allowed	Access not allowed	Access not allowed	Access not allowed
CCSA ANI	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit
CAMA	Access allowed if signaling arrangements permit	TGAR restricted only	TGAR restricted only	Access allowed, but call is held on console loop if signaling is not permitted	Access allowed if signaling arrangements permit

When a fully restricted party receives calls through an unrestricted FGD trunk, the restriction still applies.Table 10 shows that though calling parties have various levels of access (FRE, FR1, and FR2), the restrictions for the FGD trunk apply.

Table 10
Restricted access summary from FGD trunks

Connection type	Allowed or Denied		
	FRE	FR1	FR2
Direct Access	A	D	D
Conference or Transfer	A	D	D
CFO	A	D	D
CFF	A	A	A
Call Forward No Answer	A	D	D
Call Forward Busy	Not applicable		
Hunt	A	D	D
MIX, MULT, Private Line	A	D	D
TAFAS (of W by Z)	A	D	D
Call Pick Up (of W by Z)	A	D	D

Automatic Trunk Maintenance (ATM)
FGD trunks support Automatic Trunk Maintenance (ATM).Automatic test lines are provided by the LEC for T100 and loop lines using a reference and a test trunk.For more information, see LD92 in the *X11 input/output guide* (553-3001-400).

Barge-In

Barge-In is not supported on an FGD trunk.

Call Detail Recording (CDR)

ANI information can be included in the CDR records.For a complete discussion, see *Call Detail Recording reports and formats* (553-2631-100).

Calling Line ID (CLID)

When an FGD call is routed over ISDN PRI or ISL, the complete 10 digit ANI number is provided as the CLID.Three Digit ANI numbers are not treated as CLID.

Call Party Disconnect Control (CPDC)

On an incoming FGD route, you can allow Call Party Disconnect Control.We recommend that you do not allow CPDC.If CPDC = YES, any disconnect signal received from the LEC is ignored.

This does not apply to test calls.

Call Party Name Display (CPND)

The name defined for the incoming FGD trunk access code will be displayed.

Customer Controlled Routing (CCR)

The ANI is used as the CLID when sent to the CCR processor for displaying the calling party number.

Digit Display

FGD supports Digit Display where allowed.

Direct Number Identification Service (DNIS)

To support DNIS on an FGD route define the route with DNIS = YES and NDGT = 3 or 4.This enables the last three or four digits in the FGD address field to act as the DNIS number.For every incoming FGD call, the DNIS is saved.Normal FGD termination uses NARS to reach an ACD DN.

Incoming Digit Conversion (IDC)

Incoming Digit Conversion (IDC) is not supported on FGD trunks.

ISDN PRI and ISL

FGD calls should use ISDN networking capability once a call has reached the network.

Network Alternate Route Selection (NARS)

FGD relies on NARS routing features for call termination.NARS is enhanced by FGD to allow local termination.

Network Call Redirection (NCRD)

If an FGD call is redirected for any reason supported by NCRD, ANI is used for updating the terminating telephone's display.

Malicious Call Trace (MCT)

A new field is added to the MCT record output.It now prints the identification field (II+ANI) received from the LEC, thus identifying the caller.A second line is added to the MCT printout that lists a header "ANI," the II, and the ANI digits.If no ANI digits are received, an unmodified Malicious Call Trace (MCT) report is printed.An example of the new MCT printout is shown below:

```
MCT CUST0    TN 117 3 10 4   *TN 109 3 10 2    15:30:05    12/11/91
      ANI  00-2134159661
```

If an incomplete identification code is given, the printout includes all the digits received.

```
MCT CUST0    TN 117 3 10 4   *TN 109 3 10 2    15:30:05    12/11/91
      ANI  00-213
```

Minor Alarm

The minor alarm on the attendant console lights up whenever one or more MFR units fails testing.

Private line service

FGD trunks should not be defined as Private Lines.

Traffic measurements

See *Traffic measurement* (553-2001-450) for a complete description of the traffic measurement printouts.

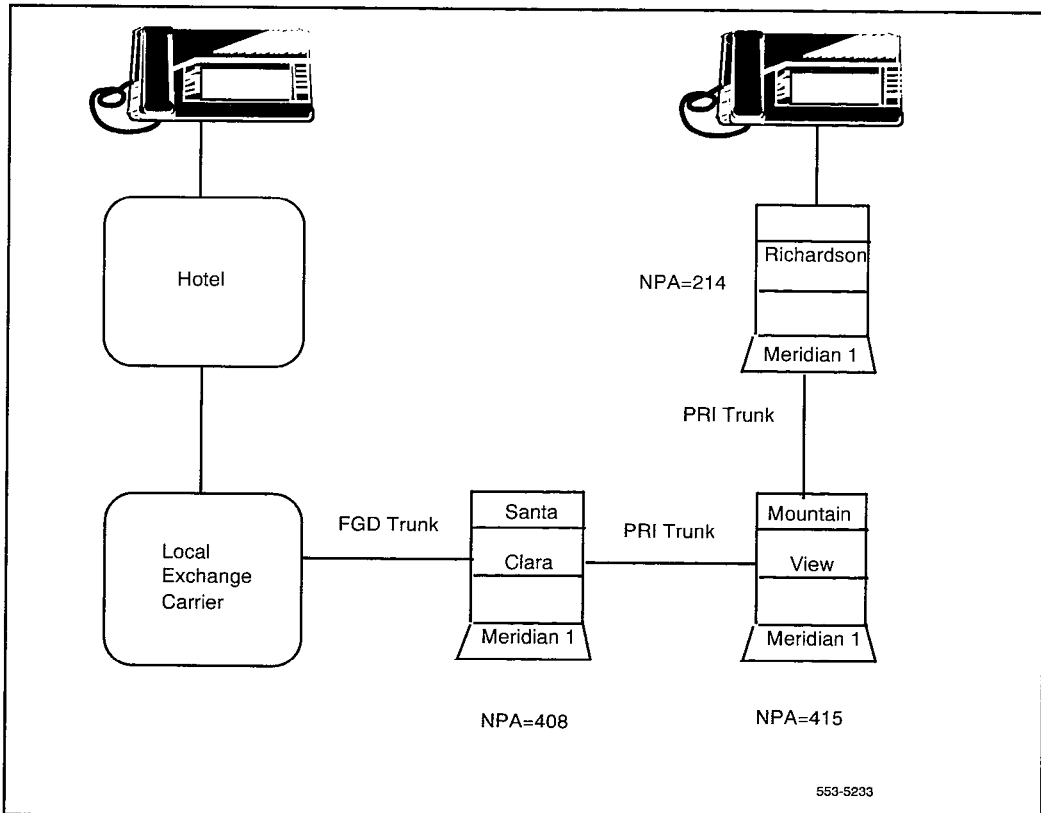
Trunk Group Distinctive Ringing

Trunk Group Distinctive Ringing is supported by FGD trunks when DRNG = YES in the FGD data block.

Trunk Verification from a Station (TVS)

Sets with Trunk Verification from a Station Allowed (TVA) can access FGD trunks and use the MF capability to dial test numbers of three or seven digits.There is usually no dial tone provided on FGD trunks.

Figure 2
Trunk verification



Feature operation

In the remainder of this document call direction is covered from the Meridian 1 point of view.Incoming calls are calls from the Local Exchange Carrier (LEC) to the Carrier (Meridian 1), and outgoing calls are from the Carrier to the Local Exchange Carrier (LEC).Therefore, incoming calls are *calls coming into* the Meridian 1 network.

Example of using the FGD feature

How to initiate a call

Presubscribed user: prior arrangements must be made to use a specific long distance network or local telco (for example SPRINT, MCI, or the carrier being served by the SL1 with FGD capability).Then, when the user picks up his/her presubscribed home or work phone and dials a long distance call in the normal way (for example, 1+area code+phone number), the LEC will route that call to the carrier presubscribed for termination over the carrier's network.

Non-presubscribed user: The user dials a 5-digit CARRIER ACCESS code (10XXX) before the address digits.This alerts the LEC that this call only should be routed to the requested long distance carrier for completion.SPRINT, MCI, AT&T and others have their own carrier access codes that are recognized by all LECs

Incoming call routing

Incoming call processing

Call processing of incoming FGD calls is designed to provide maximum flexibility in call routing to external or local DNs.

For call types other than 3-digit test calls and operator calls, FGD uses the existing NARS translation table(s).There are usually two translation tables if NARS package is equipped:

- The first contains routing and other information about NPAs.
- The second contains similar information about NXXs in the home NPA.

NARS accesses these tables by using two different access codes: AC1 and AC2.However, there is no built-in constraint in relating AC1 (or AC2) to the NPA (or NXX) table.

The FGD database identifies the NARS access codes (AC1 or AC2) as being the LDAC (Long Distance Access Code - the one leading to the desired NPA translation table) or the LAAC (Local Area Access Code - the one leading to the NXX translation table).

If the Basic Automatic Route Selection (BARS) and not NARS package is equipped, then one translation table exists and LDAC and LAAC are identical.This could also be true if the NARS package is equipped but only one translation table is configured.

In order to convert the addressing information obtained from the FGD trunk into a digit sequence that can be processed by NARS, the FGD software prefixes the access code as either LDAC or LAAC.

Incoming FGD calls are processed as follows:

1. Digit collecting phase in which all incoming MF digits(ID field and Address field) are collected.
2. Address format validation check for valid NPA and NXX and checks that the address fields contain the correct number of digits.

The first three digits (or the first four, if the first is a 0) must comply with the restrictions shown below:

- NPA or NXX, with 2<=N<=9, P=0 or P=1, A or X = 0 to 9

  Invalid Address field leads to call interception, except for the cases in which too many digits are received, or no ST is received.In these cases, the MF receiver will be released, the trunk locked out and no intercept treatment will be given.

3 ANI field format validation

The call category determines if the LEC provides the ANI data.

4 II (information digits) screening

The first two digits of the ID field are the II digits.A list of allowed II digits is contained in the FGD block.If the II digits are not defined, the call is intercepted and an error message is (optionally) issued.

5 ANI screening (optional)

ANI digits are checked, and an NCOS is attached to the call.In case of undefined ANI, call interception can occur, and an error message can (optionally) be issued.

6 Address preparation

The address field is retrieved, and one of the NARS access codes is prefixed to it, to make the number conform to the existing Meridian 1 translation tables.

7 Translation and termination

The final address, resulting from the previous steps, is processed by the existing NARS routing.

Local termination

If the FGD call is to be routed to some other node in the network, the NARS feature can make the conversion.The NARS access code is prefixed to the digits and some additional digit manipulation also occurs.

However, the existing NARS feature is not capable of making the conversion if the call terminates on a DN in the local switch that serves as an interface to the LEC using FGD, and full digit conversion (more than four digits) is required.

The solution is a new entry—Local Termination (LTER), in the NARS route list block.This entry is used for local translation, and is not related to any trunk group.

The LTER entry may appear in any route list and can be accessed when route-selection takes place.The existing restriction facilities TOD (Time Of Day schedule), FRL and FCAS can be applied as usual.

When a LTER entry is selected, NARS considers it a success, regardless of the result of the termination (busy, vacant number).When the LTER entry is not restricted by the facilities mentioned above, the entries following it in the route list will never be selected.

Calls inside World Zone 1 (7 digits)

These calls are characterized by an address field of 7 digits.Meridian 1 inserts the NARS LAAC access code before the address field.

Calls inside World Zone 1 (10 digits)

These calls are characterized by an address field of 10 digits.The Meridian 1 inserts the NARS LDAC access code before the address field, thus allowing routing of the call within the corporate network.

Calls inside World Zone 1 (0+ and 0-)

A call to the operator is distinguished by a digit sequence where the first digit of the address field is 0.

The address field dialed by the incoming FGD trunk should use one of the following sequences:

– 0+ type call : KP + 0 + (NPA) + NXX + XXXX + ST

– 0- type call : KP + 0 + ST

– 0+ type call : KP + 0 + SAC + NXX + XXXX + ST

An operator DN (or up to 16 digits) is defined through a Service Change and all "0-" and "0+" calls are directed to this DN.This can be either the local attendant DN or any DN in the network.

During call processing in the address preparation, the address field received from the FGD trunk is replaced with the operator DN described above.The call is then processed by the DN translation tables.

An option is provided to intercept all "0+" and "0-" calls to a Recorded Announcement Trunk route.

An address field sequence beginning with 0, but followed by an incorrect number of digits, or containing an invalid NPA, will lead to call intercept (invalid address format).In addition, the rest of the address field that follows the "0" is ignored.

Table 11 provides an example of a 0-call.

Table 11
EANA protocol - customer dials 10XXX+0

Situation		
Customer dials 10990+0		
Trunk group uses exchange access North American signaling protocol		
Interface interactions		
LEC	POT	Meridian 1
Customer finishes dialing		
Seize	---------->------------	
	----------<------------	Wink
Identification field KKP+00+212+555+XXXX+ST	---------->------------	
Address Field KP+0+ST	---------->-------------	
	----------<------------	Acknowledgement Wink
LEC connects talking path		
	----------<------------	Answer
Disconnect	---------->------------	
	----------<------------	Disconnect
Interpretation		
Class of service of calling line is regular (II=00). Billing number of calling line is 212+555+XXXX. Customer did not provide a destination address.		

Information digits screening for incoming calls

The FGD feature allows flexible II type assignment.Table 12 shows the II digits defined as defaults.The interpretation of the various II codes (00 - 99) is defined by the customer through service changes.The flexibility is per route: the customer defines independent FGD blocks (up to 128) containing the II definitions, then specifies for each FGD route one block index.Each number in the 00-99 range can be defined as pertaining to one of the II-types listed in table 12.Numbers in the 00-99 range that have not been defined are considered as denied.

Information digit pairs 10, 12-19, and 95 are not generated as ANI information digits by LEC originating end offices.

Because the identification field precedes the address field for exchange access signaling, and because there is no identification field on test calls, the first two digits of the address field for test calls appear to the Carrier as ANI information digits.Either a 10 or a 95 in this position tells the Carrier that the incoming call is a test call.

Digits 12 to 19 are used for calls outside World Zone 1.These are not used by EANA.

Table 12
Information digits (II)

Information digits	Explanation
00	Regular line
01	4- and 8-party
06	Hotel/Motel
07	Coinless
10	Test call
12 - 19	Not to be assigned because of conflicts with 1NX used as first digits in international calls
20	AIOD listed directory number sent
27	Coin
95	Test Call

In addition, a NCOS number may be attached to an II.This allows it to bypass ANI screening.If an II has an NCOS attached to it, then:

- ANI screening will not be done on calls initiated by customers with II.
- The incoming FGD trunk will have the NCOS stated above.

In the II processing phase, the information related to the call type is retrieved from the FGD block.If interception treatment is needed (for the invalid II case), intercept treatment is applied as defined for "invalid II."

FGD call intercept

Intercept treatment is supplied for the following invalid calls:

- Invalid address field format
- Invalid II
- Invalid ANI

The intercept treatment for each of these calls can be defined by Service Change to be Overflow Tone (OVF), a Recorded Announcement (RAN), or termination on a network or local DN.

Incoming test calls (7 and 3 digits)

The line testing facilities currently provided by Meridian 1 to incoming trunks are:

- A 100 Test Termination DN, that may be accessed simultaneously by up to four trunks.There is one 100 Test Termination DN per customer.

- Four pairs of Reference Trunk Termination DN and Test Trunk Termination DNs.

A test call digit sequence is a 3-digit or 7-digit sequence of the form 10X (3 digits) or 95Y-XXX (7 digits), where Y is either 8 or 9 (the 10 and 95 prefixes may be modified by service change).There is no identification field, therefore digits 95 or 10 appear to the carrier as an II code (information digits).The processing after the II type has been identified as test call type is described below.Also refer to the section "Information digits screening for incoming calls."

In the FGD blocks, there are actually two types of test call information digits (II):

- TST3, typically digits 10
- TST7, typically digits 95

In the remainder of this section, reference may be made to either TST3 or TST7 or their corresponding digits 10 and 95.

The two types of call information are treated differently:

– **10X calls** are interpreted as calls to the T100-line test DN.

– **95Y-calls** are routed via NARS/BARS using the LAAC access code.

The possible situations are:

– Digits KP + 10X + ST are received on an incoming FGD trunk:

  100 is dialed (X=0), it triggers the T100 line test. Normally an incoming TIE dials the T100 test DN.If X is not 0, the call receives an invalid address treatment.

  Invalid Address format - digit sequences starting with 10 but containing either less or more than 3 digits leads to call intercept.

– Digits KP + 95Y + XXXX + ST are received on an incoming FGD trunk.

  The whole number is treated as an address: The LAAC access code is inserted, invoking NARS/BARS translation.The call can be forwarded to the network or handled by local test equipment.

  Digit sequences starting with 95 but containing less or more than 7 digits invokes a call intercept (invalid address format).

Authorization Code prompting

FGD routes may be defined to prompt for Authorization Code.

An NCOS is attached to an incoming FGD trunk by one of the following:

– If ANI screening is being bypassed, then an NCOS is associated with the II type.

– If ANI screening has been configured, then an NCOS is defined by the ANI screening process.

– The NCOS of the call is the NCOS of the FGD trunk.

LEC trunk grouping and ANI provision by call category

LEC trunk grouping

Calls intended to terminate on a Carrier POT can be assigned by the LEC to different trunk groups (for example, trunk routes) according to their category and the class of service (for example, II type) of the calling customer.Up to four such groups may exist.

On the Meridian 1, the FGD block associated with an FGD trunk route contains data regarding the call categories expected.This data can be service changed to conform to the agreement between the LEC and the Carrier.This data, together with the II screening data, serves to verify correct trunk grouping as agreed with the LEC.

The appropriate error message is issued when a call of an unexpected call category reaches the Carrier.

For a list of call categories refer to Table 1.

A Carrier switch cannot distinguish between the following two categories:

- Embodied SAC calls
- External SAC calls

If one of them is expected, all SAC calls are considered expected.Test calls are considered as expected.

ANI provisions

ANI digits are provided by the LEC based on call category according to the agreement with the Carrier.

The FGD block associated with an FGD trunk route determines whether ANI data is to be received on such a call.

> *Note:* ANI data is never received on test calls.

An error message is issued when:

- ANI is *not* received on a call when expected.
- ANI is received on a call when *not* expected.

ANI digits screening

This section covers the screening function to be performed on the ANI digits in an Identification Field.

After the complete digit string (both Identification and Address fields) is collected, and the call passes the II (information digits) screening, the ANI bypass option is attached to the call's information digits.

If ANI screening is not configured, the call proceeds with the NCOS of the incoming trunk.Otherwise, ANI screening is performed as described below.

If the ANI provision is selected by the Carrier, the ANI digits are normally 10 digits (or 3 digits when the calling party cannot be identified).

– NPA+NXX+XXXX (normal case)

– NPA (calling party not identified)

Calls (with the associated ANI digits) from FGD trunks are screened against the ANI database as defined in the Meridian 1 access node.

For each allowed (or recognized) NPA, ANI screening is defined in three levels:

– NPA (3 digits)

– NPA+NXX (6 digits)

– NPA+NXX+XXXX (10 digits)

Each valid ANI is associated with a specific NCOS which is the calling party's initial NCOS (to be used for determining call termination through ESN).

10 ANI digits

If the 10 ANI digits (NPA+NXX+XXXX) are received from an incoming FGD trunk, call validation is based on the screening level defined in the ANI database:

– NPA (3 digits) Screening Level

The received ANI digits NPA must match a defined area code in the database.

- NPA+NXX (6 digits) Screening Level

  The received ANI digits NXX must be within the defined end office number range under the NPA.

- NPA+NXX+XXXX (10 digits) Screening Level

  The received ANI digits XXXX must be within the defined subscriber number range under the NPA+NXX.

  A match yields a NCOS to be used later for called number screening and routing.Otherwise, apply invalid ANI treatment.

Partial ANI digits

If only 3 ANI digits (NPA) are received from an incoming FGD trunk and:

- The NPA is defined in the ANI database (regardless of the screening level defined):

  3-digit ANI allowed—*Pass:* extract the specified NCOS.

  3-digit ANI not allowed—*Fail:* apply invalid ANI treatment.

- The NPA is not defined in the ANI database—*Fail:* apply invalid ANI treatment.

Invalid ANI treatment

Either route to OVF, RAN, or a network or local DN.Or consider it as passed and map it to a NCOS that is specified for invalid ANI.

ANI digits as Calling Line ID (CLID)

If an incoming FGD call is routed to a neighboring switch via an ISDN PRI or ISL, the complete 10-digit ANI is used as the Calling Line ID (CLID).It is then sent (in a SETUP message) to the neighboring switch for CLID display.An incomplete 3-digit ANI is not treated as CLID.

If the SHAN field of the FGD data block associated with the incoming route indicates that the ANI should not be displayed on the terminating telephone, the ANI still is sent over ISDN PRI or ISL as the CLID.However, the presentation indicator field of the calling party number information element is set to presentation restricted so the CLID will not be displayed on the terminating telephone.

ANI display

For FGD calls terminating in the local switch, the received ANI number is displayed instead of the route access code and member number as is currently displayed for a trunk call.The option is per FGD block.

The implementation of this capability does not modify the operation of the existing Digit Display feature.

The formats of the received ANI number are:

- KP + II + 10 + ST.The display is the 10 digits string.
- KP + II + 3D + ST.The display is the route access code and member number.
- KP + ST (no ANI).The display is the route access code and member number.

The rules and limitations of the digit display feature are used.

ANI display for FGD has the same format and interactions with other features as the CLID display of an E.163 number (as opposed to a private network number).

ANI number display devices

The following devices support ANI number display:

- QCW4, M1250 and M2250 Attendant consoles
- SL-1 display set
- M3000
- M2009, M2018, M2018S, M2112 and M2317
- M2006, M2008 and M2016S
- M2216ACD-1, -2
- M2616

Dialpulse dialing on FGD trunks

DP outpulsing on trunks is not allowed on either incoming or outgoing FGDT trunks.

Outgoing test calls

Outgoing test calls are generated by:

- dialing the FGD route access code from some Meridian 1 station and then any test number consisting of 3 or 7 digits
- dialing the TVS access sequence from some Meridian 1 station to select a specific FGD trunk.For example, dial a special prefix DN, plus the TVS special function code, plus the route access code, plus the trunk member number, and then any test number (3 or 7 digits).
- dialing automatically from the Automatic Trunk Maintenance overlay (test numbers must contain either three or seven digits)

CDR records

CDR records of calls in which an incoming FGD trunk was involved can include (optionally) an ANI digits field.The option is per route, defined in its FGD block.

If the ANI digits field is desired, the CDRE package is required.

For a detailed discussion of CDR output see *Call Detail Recording description and formats* (553-2631-100).

Transmission characteristics

For the purposes of transmission losses and gains, FGD trunks are treated as TIE trunks: analog FGD trunks have PTYP = ATT (port type in LD16) and digital FGD trunks have PTYP = DTT.These values are imposed by service change when defining an FGDT route.In case of a connection between an analog FGDT trunk and a PRI channel, the PRI channel is treated as a digital tie (DTT), overriding the definition for PRI channels.

Operating parameters

Parameters

The maximum number of Multi-Frequency Receivers (MFRs) that can be defined in the Meridian 1 system is 255.

The maximum number of FGD blocks that can be defined in the Meridian 1 system is 128.

An FGD route can be configured as a DNIS route.In this situation, the route should carry ACD calls only.

FGD trunks will use MF signaling only to establish a call. DTMF signaling can be used for in-band signaling after establishing an end-to-end connection, for example, Authorization code entry.

Terminating protocol is limited to test calls only.

FGD is available on all machine types supported by X11 release 17.However, the available protected data store and the disk storage is limited to the maximum amount of FGD data, particularly ANI data that can be configured for a given machine type.

For system option 21 and SL-1 ST, the theoretical maximum is 64K words, and, if FGD ANI share the same physical page with other features, the actual Protected Data Store (PDS) available for FGD ANI is much smaller.For other systems, there is virtually no limit (approximately 2 million words).

The linear and cyclic search methods supported by Meridian 1 are acceptable for FGD trunks.

Transitional configurations

On a transitional basis, if full Meridian 1 support is not available for FGD, systems with Meridian 1 hardware can have non-Meridian 1 MFRC in a non-Meridian 1 peripheral shelf installed (together with non-Meridian 1 PE buffer) in a Meridian 1 cube, with Meridian 1 power supply.In that case, MF tone receiving is performed by QPC916 receivers only, whereas MF sending can be performed by both MF loops and/or Conference/TDS cards.

MF Receiver guidelines

The MF Receiver receives 26 MF digits from the Equal Access End Office.Holding time for the MF Receiver is estimated at 13 seconds (about 0.5 second per digit).When the number of MF trunks are known, the following procedures can be used to estimate the MFR requirements:

- Calculate the number of FGD calls from MF trunks:

  FGD calls (FGDC) = # of MF trunks * 30 * 100/180 = 16.67 * # of MF trunks

  Where 30 CCS per trunk and 180 seconds holding time are assumed.

- Calculate MFR traffic:

  MFR traffic in CCS = FGDC * 13/100

  Where 13 seconds receiver holding time is assumed.

Refer to the following tables to determine the number of MFRs to support your system.

Table 13 provides information on Multifrequency receiver load capacity with 6 to 15 second holding times.

Table 13
Multifrequency receiver load capacity - 6 to 15 second holding time

Average holding time in seconds	6	7	8	9	10	11	12	13	14	15
Number of MFR										
1	0	0	0	0	0	0	0	0	0	0
2	3	2	2	2	2	2	2	2	2	2
3	11	10	10	9	9	9	9	8	8	8
4	24	23	22	21	20	19	19	19	18	18
5	41	39	37	36	35	34	33	33	32	32
6	61	57	55	53	52	50	49	49	48	47
7	83	78	75	73	71	69	68	67	66	65
8	106	101	91	94	91	89	88	86	85	84
9	131	125	120	116	113	111	109	107	106	104
10	157	150	144	140	136	133	131	129	127	126
11	185	176	170	165	161	157	155	152	150	148
12	212	203	196	190	185	182	178	176	173	171
13	241	231	223	216	211	207	203	200	198	196
14	270	259	250	243	237	233	229	225	223	220
15	300	228	278	271	264	259	255	251	248	245
16	339	317	397	298	292	286	282	278	274	271
17	361	346	335	327	310	313	319	306	392	298
18	391	377	365	356	348	342	336	331	327	324
19	422	409	396	386	378	371	364	359	355	351
20	454	438	425	414	405	398	393	388	383	379

—continued—

Table 13
Multifrequency receiver load capacity - 6 to 15 second holding time (continued)

Average holding time in seconds	6	7	8	9	10	11	12	13	14	15
Number of MFR										
21	1487	469	455	444	435	427	420	415	410	406
22	517	501	487	475	466	456	449	443	438	434
23	550	531	516	504	494	487	479	472	467	562
24	583	563	547	535	524	515	509	502	497	491
25	615	595	579	566	555	545	537	532	526	521
26	647	628	612	598	586	576	567	560	554	548
27	680	659	642	628	618	607	597	589	583	577
28	714	691	674	659	647	638	628	620	613	607
29	746	724	706	690	678	667	659	651	644	637
30	779	758	738	723	709	698	690	682	674	668
31	813	792	771	755	742	729	719	710	703	696
32	847	822	805	788	774	761	750	741	733	726
33	882	855	835	818	804	793	781	772	763	756
34	913	889	868	850	836	825	812	803	795	787
35	947	923	900	883	867	855	844	835	826	818
36	981	957	934	916	900	886	876	866	857	850
37	1016	989	967	949	933	919	909	898	889	881
38	1051	1022	1001	982	966	951	938	928	918	912
39	1083	1055	1035	1015	999	984	970	959	949	941
40	1117	1089	1066	1046	1029	1017	1002	990	981	972

Note: Load capacity is measured in CCS.

Table 14 provides information on the Multifrequency receiver load capacity with 16 to 25 second holding times.

Table 14
Multifrequency receiver load capacity - 16 to 25 second holding time

Average holding time in seconds	16	17	18	19	20	21	22	23	24	25
Number of MFR										
1	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	2
3	8	8	8	8	8	8	8	8	8	8
4	18	18	18	18	18	17	17	17	17	17
5	31	31	31	30	30	30	30	30	30	29
6	47	46	46	45	45	45	45	44	44	44
7	64	63	63	62	62	62	61	61	61	60
8	83	82	82	81	80	80	79	79	79	78
9	103	102	101	100	100	99	99	98	98	97
10	125	123	122	121	121	120	119	119	118	118
11	147	145	144	143	142	141	140	140	139	138
12	170	168	167	166	165	164	163	162	161	160
13	193	192	190	189	188	186	185	184	184	183
14	218	216	214	213	211	210	209	208	207	206
15	243	241	239	237	236	234	233	232	231	230
16	268	266	264	262	260	259	257	256	255	254
17	294	292	290	288	286	284	283	281	280	279
18	322	319	317	314	312	311	309	308	306	305
19	347	344	342	339	337	335	334	332	331	329
20	374	371	368	366	364	361	360	358	356	355
21	402	399	396	393	391	388	386	385	383	381
22	431	427	424	421	419	416	414	412	410	409

—continued—

Table 14
Multifrequency receiver load capacity - 16 to 25 second holding time (continued)

Average holding time in seconds	16	17	18	19	20	21	22	23	24	25
Number of MFR										
23	458	454	451	448	445	442	440	438	436	434
24	486	482	478	475	472	470	467	465	463	461
25	514	510	506	503	500	497	495	492	490	488
26	544	539	535	532	529	526	523	521	518	516
27	573	569	565	561	558	555	552	549	547	545
28	603	598	594	590	587	584	581	578	576	573
29	631	626	622	618	614	611	608	605	602	600
30	660	655	651	646	643	639	636	633	631	628
31	690	685	680	676	672	668	665	662	659	656
32	720	715	710	705	701	698	694	691	688	686
33	751	745	740	735	731	727	724	721	718	715
34	728	776	771	766	761	757	754	750	747	744
35	813	807	801	796	792	788	784	780	777	774
36	341	835	829	824	820	818	814	810	807	804
37	872	865	859	854	849	845	841	837	834	831
38	902	896	890	884	879	875	871	867	863	860
39	934	927	921	914	909	905	901	897	893	890
40	965	952	952	945	940	936	931	927	923	920

Note: Load capacity is measured in CCS.

Table 15 provides the Multifrequency receiver requirements with the Poisson 0.1 percent blocking information.

Table 15
Multifrequency receiver requirements - Poisson 0.1 percent blocking

Number of MFR	MFR load (CCS)	Number of MFR	MFR load (CCS)	Number of MFR	MFR load (CCS)
1	0	18	276	35	703
2	2	19	299	36	729
3	7	20	323	37	756
4	15	21	346	38	783
5	27	22	370	39	810
6	40	23	395	40	837
7	55	24	419	41	865
8	71	25	444	42	892
9	88	26	469	43	919
10	107	27	495	44	947
11	126	28	520	45	975
12	145	29	545	46	1003
13	165	30	571	47	1030
14	187	31	597	48	1058
15	208	32	624	49	1086
16	231	33	650	50	1115
17	253	34	676		

Implementation

Engineering guidelines

When estimating the total number of call registers required by the system (NCR in LD17), the following requirements should be taken into account:

- An incoming FGD call uses one additional call register for the whole duration of the call.
- An outgoing FGD call uses one additional call register for the outpulsing stage only (including the subscriber's dialing).

Since the FGD block is per system, the RAN route number(s) and/or network or local DNs given in response to prompts OPER, ADFT, IIT, and ANIT (in overlay 19) are not associated with any customer.All customers using the FGD feature must define their RAN routes and/or DNs in accordance with FGD block definitions.

The following service change information shows how to configure FGD capabilities on the Meridian 1 system.The loads shown here are only partial, and apply to FGD only.Only new prompts or prompts and responses required for FGD are shown here.

For a complete description of the service change prompts and responses, see *X11 input/output guide* (553-3001-400).

LD13—Digitone receiver and tone detector

Prompt	Response	Definition
REQ	NEW, CHG	Add, or change
TYPE	MFR	Multifrequency receivers A maximum of 255 MFR units can be defined.
TN	LL S C U	loop, shelf, card, unit Only units 0 and 1 can be defined, and the card must be single density.

LD14—Trunk data block

Prompt	Response	Definition
REQ	NEW, CHG	Add, or change
TYPE	FGDT	Feature Group D trunk
TN	l s c u	loop, shelf, card, unit Loop Channel is accepted for Digital loops
CUST	0-99	Customer number
NCOS	0-99	Network Class of Service
RTMB	nn nn	Route and Member number FGD trunks must belong to FGDT type routes.
MNDN	nnnn	Manual directory number to delete
TGAR	nn	Trunk group access restriction
SIGL	EAM, EM4, LDR	Signal type Only these values are accepted for FGD.
CDEN	(DD), SD	Card Density
STRI	WNK	Start Arrangement must be WNK for FGD trunks.
STRO	WNK	must be WNK for FGD trunks.
CLS	MFR	CLS must be MFR for FGD.

LD16—Route data Block

Prompt	Response	Definition
REQ	NEW, CHG	Add or change
TYPE	RBD	Route Data Block
CUST	0-99	Customer number
ROUT	nnnn	FGD route number
TKTP	FGDT	feature Group D route
CNTL	(NO), YES	Change controls or timers
_TIMR	ICF 0-(512)-32640	Incoming flash timer
_TIMR	OGF 0-(512)-32640	Outgoing flash timer
_TIMR	DDL 0-(70)-511	Dial delay timer
_TIMER	DSI 128-(34944)-499200	Disconnect supervision timer Only these timers are allowed for FGD trunks.
FGNO	(0)-127	FGD block number

LD19 – Code restriction

Note: Ensure that numeric zero is used for mnemonics INO, NAO, and SAO

Prompt	Response	Definition
REQ	NEW, CHG	Add or change
TYPE	FGDB	Feature Group D data block
FGNO	0-127	FGD block number IF REQ = NEW, no response is allowed.The next free block number is always defined.
CIC	0000-9999	Carrier ID Response must be 3 or 4 digits.<CR> not allowed when REQ = NEW.
CCLS	IC, CONS	Carrier class Interexchange, or Consolidated <CR> not allowed when REQ = NEW.
PRES	(YES), NO	Presubscription
OVLP	(YES), NO	Overlapped outpulsing by the LEC
CCAN	xxx (YES), NO	Call categories expected on calls to Carrier (xxx), and if ANI is provided (Yes or No).XXX must be one of the following:
	NAM	1 + calls (inside WZ1)
	NA0	0 + calls (inside WZ1)
	INT	1 + calls (outside WZ1)
	IN0	0 + calls (outside WZ1)
	OPR	0 - calls
	SAM	1 + calls (embodied SAC)
	SAX	1 + calls (external SAC)
	SA0	0 + calls (external SAC)
	CUT	cut-through calls
	ALL	All calls (Default when REQ = NEW) When REQ = NEW, default is ALL.

—continued —

LD19—Code restriction (continued)

Prompt	Response	Definition
SAC	xxx xxx . . .	Service Access Code Up to 8 SACs can be defined.700, 800, 900, and 610 are the defaults defined.X removes the access code.
ANII	xx	ANI data block index 0 - 31 0 = no ANI screening.Default when REQ = NEW.
CDAN	YES, (NO)	ANI digits provided in CDR
SHAN	YES, (NO)	Show ANI digits on terminal displays
PRTD	(NO), ALL, REJ	Printout control for invalid II, ANI NO = no printouts issued ALL = printout on all invalid II, ANI REJ = printout on all invalid II, but no printout for invalid ANI if ANI screening assigned an NCOS to the call
LDAC	AC1, AC2	Long Distance Access Code Only if NARS is equipped
LAAC	AC1, AC2	Local Area Access Code Only if NARS is equipped
OPER		Treatment for 0+, 0- calls
	DN xxxx. . xx	1-16 digit network or local DN
	RAN xxx	RAN route (0-511)
INTR	(NO), YES	Intercept treatment specified
_ADFT	(OVF), RAN xxx, DN xxx . . xx	for invalid address format (overflow, RAN, or local or network DN)
_IIT	(OVF), RAN xxx, DN xxx . . XX	for invalid IIs (overflow, RAN, or local or network DN)

—continued—

LD19 – Code restriction (continued)

Prompt	Response	Definition
IITP	xx yyyy zz	Valid II, II type, and NCOS for ANI screening XX is an II range 00-99 YYYY must be one of the following:
	REGU	Regular II
	4A8P	4 and 8 party II
	HOTL	Hotel/Motel II
	CLES	Coinless II
	TST3	Test3 II
	AIOD	AIOD II
	COIN	Coin II
	TST7	Test7 II
		ZZ is an optional NCOS number defining ANI screening bypass range 00-99.ANI screening bypass defaults to 'NO" if an NCOS is not entered.
CPAR	(NO), YES	Call Processing parameters
_INIT	0-(7)9	Length of initial string of dialed digits on outgoing calls (enbloc dialing)
_ENBL	1-(12)-30	Long enbloc dialing timeout (before initial string is complete) in seconds
_ENBS	1-(5)30	Short enbloc dialing timeout (after initial string is complete) in seconds
_IFTO	2-(120)-255	Inter FGD field timeout (max time between two FGD fields) in seconds
_DGTO	128-(640)-5000	Inter digit timeout (max time between two FGD digits in same field) in Msec
_MONT	0-(256)-2048	Minimum on-hook time (min time between acknowledgment wink and answer off hook signal) in Msec

— continued —

LD19 — Code restriction (continued)

Prompt	Response	Definition
REQ	new, chg, out, prt	Create, change, remove or print
TYPE	ANI	FGD ANI data block
ANII	xx	ANI data block index (1-31)
These prompts are given when REQ = NEW or CHG:		
ANIT		Invalid ANI treatment:
	OVF	overflow tone (default)
	RAN xxx	Recorded announcement route (0-511)
	DN xxx..xx	1-16 digits, typically a Meridian 1 internal DN
	NCOS xx	NCOS value (0-99)
NPA	xxx	First 3 digits of ANI (in NPA format)
	<CR>	to reprompt REQ
3ANI	DENY	3-digit ANI not allowed (default)-apply invalid ANI treatment
	NCOS xx	3-digit ANI allowed: NCOS value (0-99)
SLV3	NXX	Use 6 or 10 digit screening level; prompt NXX next
	NCOS xx	3-digit screening: all NXX+XXXXs map to NCOS value xx (0-99); reprompt NPA
NXX	xxx "yyy"	Range of end office numbers (NXX) Prompted only if SLV3=NXX xxx - starting or only NXX yyy - ending NXX (optional);
	<CR>	to reprompt NPA
— continued —		

LD19 – Code restriction (continued)

Prompt	Response	Definition
SLV6	SUB	Use 10 digits screening level; prompt SUB next; not allowed if yyy entered.
	NCOS xx	Use 6 digits screening level; all xxxxs map to NCOS value xx (0-99); to reprompt NXX.
SUB	xxxx "yyyy"	Range of subscriber numbers (XXXX); prompted if SLV6=SUB xxxx - starting or only subscriber # xxxx - end subscriber # (optional)
	<CR>	to reprompt NXX
NCOS	xx	NCOS value (0-99) for the subscribers; reprompt SUB
These prompts are given when REQ = PRT:		
NPA	xxx	Specified NPA printed; prompt NXX next
	ALL	All NPAs defined printed; reprompt REQ
	<CR>	to reprompt REQ
NXX	xxx [yyy]	Range of end office numbers (NXX); xxx - starting or only NXX yyy - ending NXX (optional) reprompt NXX if yyy entered. Prompt SUB next if only xxx entered
	<CR>	to reprompt NPA
SUB	xxxx [yyyy]	Range of subscriber numbers (XXXX); xxxx - starting or only subscriber # xxxx - end subscriber # (optional) reprompt SUB.
	<CR>	to reprompt NXX

— continued —

LD19 — Code restriction (continued)

Prompt	Response	Definition
These prompts are given when REQ = OUT		
ENTER YES TO CONFIRM	YES	To confirm the OUT request - the entire ANI data block is deleted for OUT request.
	(NO)	The OUT request is not executed

Note: To remove (undefine) an NPA, NXX or a SUB number, precede the number with X.To remove a range of NXX or subscriber numbers, precede the starting number with X.

Note: To abort the current line of data entered, press the * key.The system will reprompt the current prompt.

Note: To abort the current incomplete prompting sequence, press the * key twice (**).REQ will be reprompted.All the data entered in the previous and complete prompting sequences will remain in the system.

Note: To abort active overlay program, enter ****, or END in response to the system prompt REQ.All the data entered in the previous and complete prompting sequences will remain in the system.

Table 16 defines the information digits (II) that are used as defaults in the LD19 code restriction program.

Table 16
Default IITP values

II	II type	ANI screening bypass
00	REGU	NO
01	4A8P	NO
06	HOTL	NO
07	CLES	NO
10	TST3	NO
20	AIOD	NO
27	COIN	NO
95	TST7	NO

LD20—Print routine

Prompt	Response	Definition
REQ	PRT	Print
TYPE	TNB FGD MFR	Includes FGD trunks and MFRs Print FGD trunks Print Multifrequency units
TN	LL S C U	loop, shelf, card, unit

LD21 – Print routine

This print routine is modified to print FGDT route data blocks as defined using LD16.

LD22 – Print routine

"FGD" is printed if package 158 is equipped.

LD29 – Memory management

Prompt	Response	Definition
REQ	ADD	Add, or change
TYNM	MFRR 1-255	Number of multifrequency receivers
	FGD xxx yyy	FGD data blocks xxx = FGD data blocks (1-128) yyy = average number of II entries
	ANI xxx yyyy zzzzz	FGD ANI blocks xxx = number NPAs (1-160) yyyy = number of NXXs (0-9999) zzzzz = number XXXXs (0-30,000)

LD86 – ESN

Changes are made to LD86 to allow for definition and print out of a new type of Route List Entry, which is the Local Termination (LTER) entry.The prompts and responses.are listed below.

Prompt		Definition
REQ	new, out, chg, prt, end	
FEAT	rlb	
RLI	0 - 255	
ENTR	0 - 63	
LTER	yes/(no)	Local Termination entry
If "yes" is entered, only the following prompts appear for this entry (there is no change in prompt responses):		
TOD		Time of Day Schedule
FRL		minimum Facility Restriction Level
DMI		Digit Manipulation table Index
FCI		Free Calling Area Screening table index
The following prompts do not appear for this entry and they are set to the specified values.This is also true when changing a regular entry to a LTER entry:		
ROUT	0	Route Number
TDET	no	Tone Detector Used
CNV	no	conversion to LDN required
EX[	no	expensive route
OHQ	no	off hook queueing allowed
CBQ	no	call-back queueing allowed
***Note*:** No new SCH error codes are required in this LD.		

Maintenance and diagnostics

The Meridian 1 software provides maintenance and diagnostics for the Multifrequency Receiver (MFR).They are performed similarly to the Tone Detector (TDET) or Digit Tone Receiver (DTR).

Maintenance and diagnostics are provided by the Meridian 1 software as service change programs that can be run either automatically upon Meridian 1 CPU request or manually.

They involve the following:

- enabling/disabling an MFR to allow card installation and removal
- self-testing of the MFR card
- test of all tones with the help of an MFS loop
- signaling test

LD 34 - Tone and digital switch

The maintenance of MFRs are integrated into LD34 (maintenance of DTR, TDET).

A new MFR test command is being introduced.

The following commands in table 17 apply to MFRs:

Table 17
MFR commands

ENLR	LSC (U)	enable the specified DTR/MFR card/unit	Note 1
DISR	LSC (U)	disable the specified DTR/MFR card/unit	Note 1
SDTR	LSC (U)	display the status of the specified DTR/MFR	Note 1
SDTR		list all the disabled DTR/MFR units	Note 1
STAT		list all the disabled DTR/MFR units (duplicate of SDTR with no parameters)	Note 1
MFR	LSC (U)	test the specified MFR card/unit	Note 2
MFR	L	test all the specified MFR units on loop L.	Note 2
MFR	<CR>	test all MFR units	Note 2

Note 1: The existing command (for DTR) is used for both DTR and MFR.

Note 2: Faulty MFR cards are disabled and an MFRxxx error message is output.Only 50% of all MFR cards in the system may be disabled at one time.If the failure occurred during the midnight routine, a minor alarm is initiated.

Commands Description

The following commands are used for maintaining the MFR.They perform enabling, disabling, perform tests, and print the current status.

- ENLR n - enable MFR "n"
- DISR n - disable MFR "n"
- SDTR n - print MFR "n" status
- MFR n - test MFR "n"

The following commands are used for printing disabled MFR units.

- STAT - print disabled MFR units
- SDTR - print disabled MFR units

The ENLR, DISR, STAT and SDTR commands are used for both DTRs and MFRs.The Meridian 1 software can distinguish between the two types of receiver, where necessary.

Disabling an MFR (DISR command) that is at present active in a call, disconnects the call.No error messages are given (as for TDET and DTR).

The MFR command performs the following tests:

- response test
- self-test - Internal test of the card by its processor
- valid reception test of all MF tones:
  An MFS is connected to the MFR through a network timeslot.The MFS is triggered to send MF tones to the MFR, and the correct reception is checked.

If the MFR is busy, no test is performed (as for TDET and DTR), and the TDS315 message is printed.

During midnight routines, the MFR command is performed.

The following are additional comments on the above section:

- For commands ENLR and DISR: "n"can only be LSC or LSCU
- For command STAT: no other parameters can be given
- For command SDTR: if "n" is specified, it can only be LSC or LSCU.If "n" is not specified, all disabled MFR units are printed.
- For command MFR: "n" can be one of LSC, LSCU, L or <CR> If <CR> is requested, a test is performed on all MFRs

LD30 - Network and signaling diagnostics

- Signaling test of MFRs is supported by this overlay.
- Signaling test of FGDT trunks are supported.The test is performed for all trunks.For example, if all units of the FGDT trunk card are idle, an "existence" message is sent to the card.It is then required to return the same message to the CPU.

During midnight routines, testing of FGDT trunks and MFRs is supported.

LD32 - Network peripheral equipment diagnostics

Standard enable, disable and status commands are supported for MFRs.For FGDT trunks, all trunk applicable commands are supported.

Changes are made for this program to include the following responses where applicable, for example, status of specific card.

Normal responses include:

MFR	(Multi-frequency receiver)

Mnemonics for trunk types include:

FGDT	(Feature Group D trunk)

List of terms

AIOD

Automatic Identification of Outward Dialing

ANI

Automatic Number Identification

ATM

Automatic Trunk Maintenance

BARS

Basic Alternate Route Selection

BOC

Bell Operating Company

BSWT

BOC Switch Time

Called customer

The Local Exchange Carrier (LEC) customer receiving the FGD call placed by the calling customer.The called customer is usually identified by a public directory number used by the calling customer when requesting the connection

Calling customer

The LEC customer that initiates the FGD call

Carrier
An entity that maintains a public or private long distance network.An example of a public long distance carrier is AT&T or U.S. Sprint.Northern Telecom would be considered a private long distance carrier.

CDR
Call Detail Recording

CDRE
Call Detail Recording Expansion

CE
Common Equipment

CIC
Carrier Identification code.This is the three or four digit number dialed by LEC customers to reach a specific Carrier's facilities.

CLID
Calling Line Identification

Consolidated carrier (IC&INC)
Carriers that combine the services of the Interexchange and International carriers.

COS
Class of Service

CPND
Call Party Name Display

CSWT
Carrier Switch Time

DDD
Direct Distance Dialing

DMI
Digit Manipulation Table Index

DNIS
Dialed Number Identification Services

DTMF

Dual Tone Multifrequency

EA

Equal Access

EAEO

Equal Access End Office

EAIN

Exchange Access International signaling

EANA

Exchange Access North American signaling

Embodied

Embodied Carrier Identification - 6-digit translation.A 6-digit translation is performed by the LEC to determine the Carrier

ESN

Electronic Switched Network

E.163

Standard North America Telephony numbering plan

FGD

Feature Group D

FGDT

Feature Group D Trunk

II

Information Digits

IC

Interexchange Carrier

IDC

Incoming Digit Conversion

INC

International Carrier

IC&INC

Consolidated Carrier

ISDN

Integrated Service Digital Network

ISL

ISDN Signaling Link

Interexchange carrier (IC)

Carriers providing connections between LATAs.They also serve areas where calling and called customers are in World Zone 1.

International carrier (INC)

Carriers that provide connections from customers in the United States and customers outside World Zone 1.They may also provide connections to customers within World Zone 1, but outside of the U.S.

LAAC

Local Area Access Code, the NARS access code leading to the NXX translation tables

LATA

Local Access and Transport Area

LDAC

Long Distance Access Code, the NARS access code leading to the NPA translation tables

LEC

Local Exchange Carrier, for example, Pacific Bell

KP

Key Pulse

MF

Multifrequency

MFR

Multifrequency Receiver (MFRC) QPC916

MFRC

Multifrequency receiver without DTMF receiving capability

MFS

Multifrequency Sender

NANP

North American Numbering Plan

NARS

Network Alternate Route Selection

NCOS

Network Class of Service

NN

National Number

NPA

Numbering Plan Area N=2-9 P=0 or 1 A=any

NXX

Office Code N=2-9 X=0 or 1 x=any

Originating access

Establishing the connection between the calling customer and the Point of Termination.

Originating call

A call placed by a calling customer.

OS

Operator Services

PE

Peripheral Equipment

POP

Point of Presence

POT

Point of Termination

PRES

Presubscription between the LEC and the Carrier

PRI

ISDN Primary Rate Interface

RBOC

Regional Bell Operating Company

SAC

Service Access Code

ST

Start Transmission

TAFAS

Trunk Access from Any Station

TDET

Tone Detector

Terminating access

Establishing the connection between the Point of Termination and the called customer.

Terminating call

A call presented by the Carrier to the LEC for connection to the called customer.

TGAR

Trunk Group Access Restriction

TVA

Trunk Verification from a Station Allowed

TVS

Trunk Verification from a Station

WATS

Wide Area Telecommunications Service

World Zone 1

All countries participating in the North American Numbering Plan (NANP), and are dialed with a ten digit address.

WZ1

World Zone 1

SL-1

Feature Group D

Description and operation

Release 1.0
Standard
December 1, 1991
Printed in USA

northern telecom

SL-1

ISDN Primary Rate Interface

Installation

Publication number: 553-2901-200
Product release: X11 release 19
Document release: 7.0
Document status: Standard
Date: October 31, 1993

Revision history

December 20, 1989

Standard, X11 release 15.

December 20, 1990

This document was issued for X11 release 16.

December 1, 1991

This document is issued to include changes and updates for X11 release 17. Due to the extent of changes, revision bars are omitted.

December 31, 1992

This document is reissued to include additions for X11 release 18 updates, including Multi-purpose Serial Data Link (MSDL) card information. Updates are noted with change bars in the margins.

April 1, 1993

This document is reissued for Option 81, updates noted with revision bars in the margins.

August 1, 1993

This document is reissued to include information relating to X11 release 19. Due to the extent of changes, revision bars are omitted.

October 31, 1993

This document has been reissued to include updated technical information. It has been slightly reorganized to enhance ease of use. Technical changes are noted with revision bars in the margins.

Contents

List of figures

Introduction

This document provides procedures to install, replace, or remove Primary Rate Interface (PRI) circuit cards, D-channel Interface (DCHI) cards, Multi-purpose Serial Data Link (MSDL) cards, Clock Controller cards, and ISDN Signaling Link (ISL) equipment.

> *Note:* ISDN is an evolving product. To plan your system for future expansions, please consult with your Northern Telecom representative.

The document is organized as follows:

PRI equipment overview

QPC757 DCHI
NT6D80 MSDL
QPC720 PRI
Clock Operation

DCHI installation

All Meridian 1 systems
Installing the QPC757 DCHI
Removing the QPC757 DCHI

MSDL installation

All Meridian 1 systems
Installing the NT6D80 MSDL
Removing the NT6D80 MSDL

PRI installation

The ST and system option 21
Installing the QPC720 PRI
Removing the QPC720 PRI

RT

Installing the QPC720 PRI
Removing the QPC720 PRI

NT, and system options 51 and 61

Installing the QPC720 PRI
Removing the QPC720 PRI
Installing an additional network shelf

XT, and system option 71

Installing the QPC720 PRI
Removing the QPC720 PRI

System option 81

Installing the QPC720 PRI
Removing the QPC720 PRI

Clock Controller

Installing the QPC471 and 775
Removing the QPC471 and 775

Echo Canceller

All Meridian 1 systems
PRI to Echo Canceller pin assignments
Echo Canceller operating parameters
Echo Canceller initialization settings

ISL installation

All systems
ISL configurations
DCHI switch settings
MSDL switch settings
Shared mode
Dedicated mode using leased line
Dedicated mode using dial-up modem
Dedicated mode using DTI or PRI trunk

PRI wire list

Nonstandard cables
QCAD128
QCAD129
QCAD133
QCAD328
NTNT26 (X11 release 18 and later)
NTND27 (X11 release 18 and later)
NTND98 (X11 release 18 and later)

Throughout this document, Meridian 1 refers to both ST, STE, NT, RT, and XT, as well as system options 21, 21E, 51, 61, 71, and 81 unless otherwise noted.

References

Refer to the following documents for additional information.

- *ISDN Primary Rate Interface description and administration* (553-2901-100)
- *Software conversion procedures* (553-2001-320)
- *Circuit card installation and testing* (553-3001-211)
- *Spares planning* (553-3001-153)
- *ISDN Primary Rate Interface maintenance* (553-2901-500)
- *X11 input/output guide* (553-3001-400)

Note to installers

Before beginning an installation, do the following:

- Consult the *Spares planning* (553-3001-153) document and follow the instructions.
- Bring spares of all cables and boards.
- Tables 34 and 35 at the end of this document illustrate acceptable positions for the QPC720, QPC414, QPC741, QPC775, QPC757, and NT6D80 cards. Use this chart to determine where you are placing your cards before you actually begin your installation.
- Refer to *ISDN Primary Rate Interface description and administration* (553-2901-100) and *X11 input/output guide* (553-3001-400) for database implementation.

Primary Rate Interface equipment: overview

The following machines support Primary Rate Interface (PRI):

— Beginning with X11 release 14, Meridian SL-1 ST, RT, NT, XT

— Beginning with X11 release 15, system options 21, 21A, 51, 61, and 71

— Beginning with X11 release 18, STE, 21E, and 81

This document describes the equipment and procedures needed to install the following ISDN PRI hardware on Meridian 1 systems.

— QPC757 D-channel Interface (DCHI)

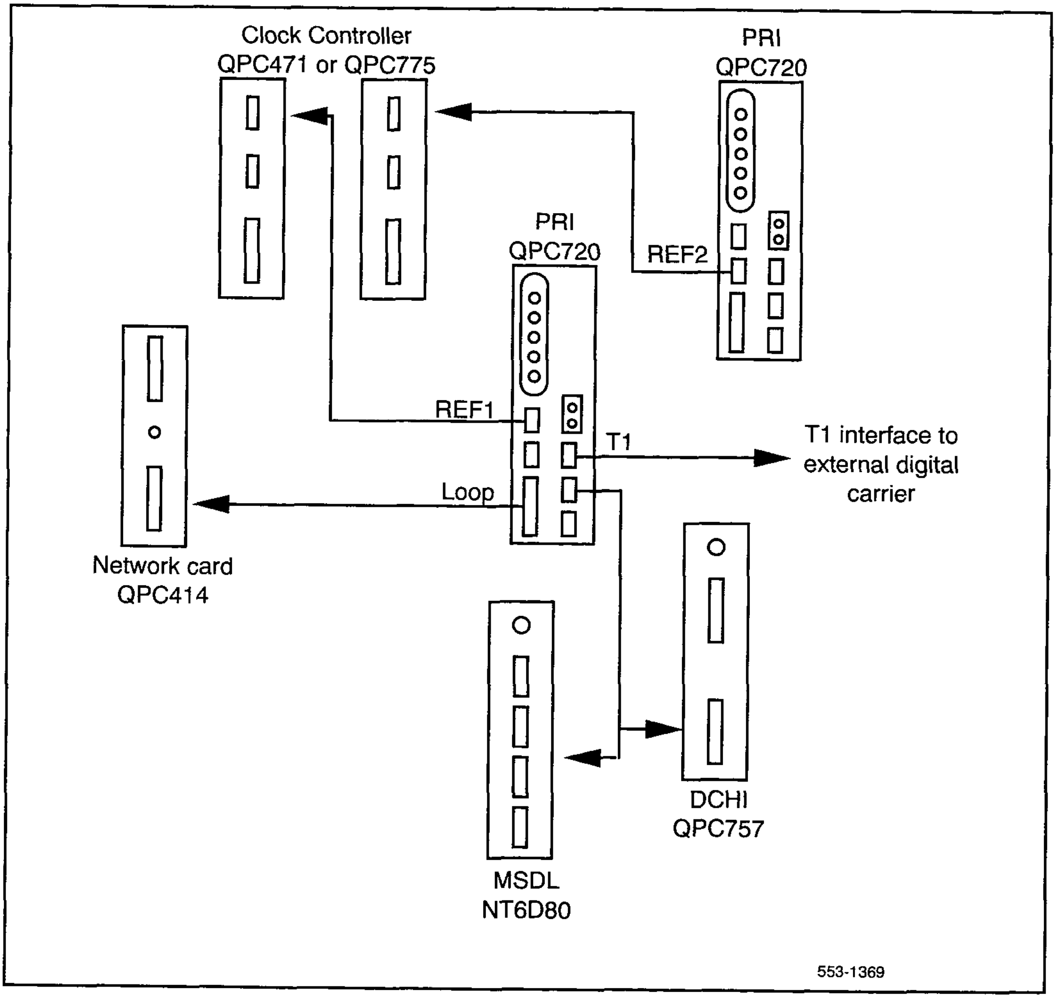
— NT6D80 Multi-purpose Serial Data Link (MSDL)

— QPC720 Primary Rate Interface (PRI)

— QPC471 or QPC775 Clock Controller

The QPC775 Clock Controller is currently not available for U.S. markets. The QPC471 and QPC775 Clock Controllers cannot be mixed in one system. Vintages A through G of the QPC471 Clock Controller can be used in one system; vintage H of QPC471 Clock Controllers cannot be mixed with Clock Controllers of other vintages. See Figure 1.

Figure 1
PRI hardware



Refer to *ISDN Primary Rate Interface description and administration* (553-2901-100) for hardware vintage requirements and compatibilities, as well as packaging information.

> *Note:* Either the QPC757 DCHI, NT6D80 MSDL, or the QPC720 PRI may be installed first. However, PRI loops must be configured in software before defining DCHI links.

The following hardware is required for PRI capability and applications:

– QPC414 network card

  Refer to *Circuit card installation and testing* (553-3001-211)

– Channel Service Unit (CSU)

  Refer to information received from manufacturer

– ROM and memory, as shown in Table 1.

  See also *Software conversion procedures* (553-2001-320)

The NT and RT can use one QPC583A board while the XT can use up to three QPC583A boards. X11 release 15 and later software requires at least two QPC583A boards in XT machines. Systems with less than 420K data storage require an additional memory board.

Table 1
Minimum ROM requirements by machine type and X11 release

X11 release	ST, 21	STE, 21E	RT	NT, 51, 61	XT, 71	81
14	QPC717D or QPC937	N/A	QPC602	QPC602	QPC602	N/A
15/16/17	QPC940	N/A	QPC939A	QPC939	QPC939	N/A
18	N/A	NTND31	NTND08	NTND08	NTND08	

ISDN Signaling Link hardware

Equipment required for shared mode.

- QPC757 DCHI or NT6D80 MSDL
- QPC720 PRI
- QPC471 or QPC775 Clock Controller

  A Clock Controller is not needed for analog applications. Both QPC471 and QPC775 Clock Controllers cannot be in one system.

Equipment required for dedicated mode using leased lines.

- QPC757 DCHI or NT6D80 MSDL
- Modem set in synchronous mode

This equipment is required for dedicated mode using a DTI.

- QPC757 DCHI or NT6D80 MSDL
- QMT11 Asynchronous/Synchronous Interface Module (ASIM)
- QMT21 High Speed Data Module (HSDM)
- Meridian Communications Unit (X11 release 18 and later)
- Data line card
- QPC472 DTI

Equipment required for dedicated mode using a dial-up modem.

- QPC757 DCHI or NT6D80 MSDL
- Modem with auto-dial capability

  Note: This configuration is the least reliable because of lockup problems inherent in smart modems from power splices and noisy lines. To increase the reliability on this configuration, use a constant power source when powering the modems. Also, verify that TIE lines meet data grade specifications. Northern Telecom takes no responsibility for ISL D-channel outages due to modem lockup.

The following equipment is recommended for modem connections:

Hayes Smartmodem 2400
Concord Data System CDS 224 Trispeed Series II
Anderson Jacobson AJ 2441-1 or
Racal-Vadic 2400 PA

QPC720 PRI

The QPC720 PRI card is required for PRI operation in all machine types.

Power requirements

The QPC720 PRI uses power and ground from the backplane. This card does not require an intelligent bus. Power requirements are

+5 volts at 6 amperes

+12 volts at 50 milliamperes

–12 volts at 50 milliamperes

QPC720 faceplate

Table 2 gives information about the external connectors located on the QPC720 PRI faceplate.

The QPC720 PRI contains five LEDs and six external connectors. Figure 2 shows the faceplate layout.

Table 2
QPC720 PRI: external connectors

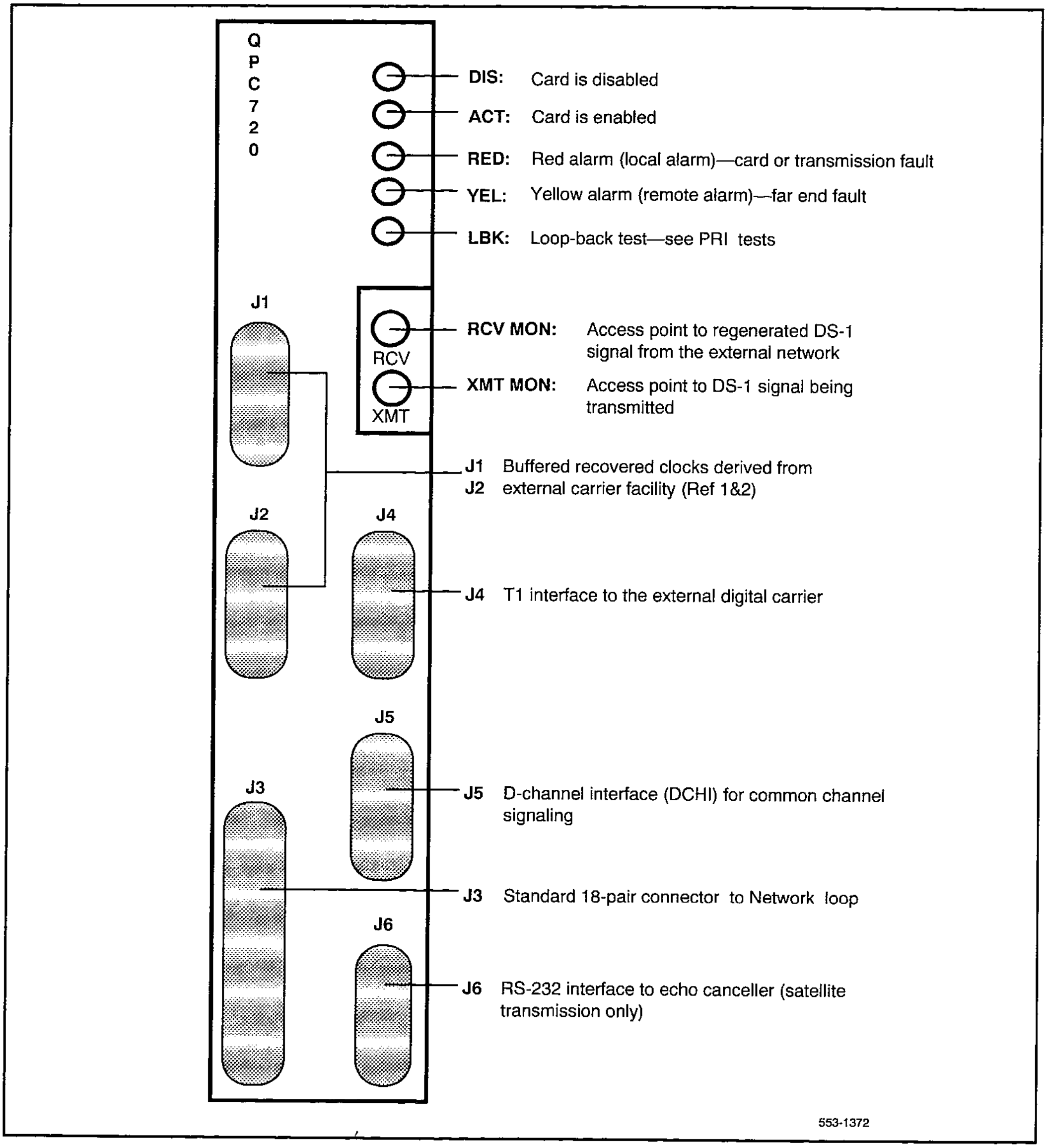
Faceplate destination	Type
J1	9-pin female, D-connector
J2	9-pin female, D-connector
J3	36-pin connector
J4	15-pin male, D-connector
J5	15-pin male, D-connector
J6	15-pin female, D-connector
RCV MON	Miniature bantam jack
XMT MON	Miniature bantam jack

Cable requirements

Table 3 lists the types of cable used and the lengths required for external QPC720 PRI connections.

> *Note:* No additional cabling is required for nB+D configurations. Multiple PRIs and the D-channel are associated through software in LD17, prompt PRI.

Figure 2
QPC720 PRI faceplate layout



Carrier interface

The QPC720 PRI provides an interface to the DS-1 Channel either directly, through an office repeater, or through an Echo Canceller.

The T1 Channel Service Units listed below are compatible with the QPC720 PRI card and the 64K Clear Data feature as well as with PRI connection parameters such as the Superframe format, the Extended superframe format, and the B7 and B8ZS Alternate Mark Inversion (AMI) line coding. See *ISDN Primary Rate Interface description and administration* (553-2901-100) for more information about the connection parameters.

- Digital Link 551A
- Digital Link 551C
- Digital Link 551E
- Tellabs Model 441
- Verilink Model 551V ST

In the U.S.A., FCC Part 68 regulations require Network Channel Terminating Equipment (for example, the NT QRY551 Channel Service Unit) installed at of the point of connection between a system and a registered common carrier trunk.

Echo Canceller interface

Echo Cancellers are required only with satellite transmission. The Echo Canceller detects the length of the loop, then cancels reflected transmission (callers do not hear their own voices echoed).

The QPC720 PRI provides both a T1 line interface and a control interface to link to a signal format compatible with EIA standard RS-232-C. Both the PRI and the Echo Canceller act as Data Terminal Equipment (DTE). The Echo Canceller's control protocol must conform to that of the Tellabs Model 251.

64 T-link version 2 protocol

The QPC720 card supports the 64 T-link version 2 protocol. The QPC720 together with the QMT21 High Speed Data Module supports the 64K Clear Data feature. The QPC720 card provides a trunk that ties two switches together. This trunk allows 64K Clear Data to pass from the Meridian 1 to an outside network. The QMT21 module allows Data Terminal Equipment (DTE) to send and receive 64K Clear Data. See *ISDN Primary Rate Interface description and administration* (553-2901-100) for more information about the 64K Clear Data feature.

Table 3
QPC720 PRI: cables and cable lengths

Cable type	From	To	Maximum length (feet)	Maximum length (meters)
QCAD130	QPC720	QPC471/QPC775 (CC-0)	7	2.13
QCAD130	QPC720	QPC471/QPC775 (CC-1)	7	2.13
QCAD328A	QPC720	QPC757 DCHI	6	1.8
QCAD328B	QPC720	QPC757 DCHI	18	5.5
QCAD328C	QPC720	QPC757 DCHI	35	10.67
QCAD328D	QPC720	QPC757 DCHI	50	15.24
QCAD124	QPC720	QPC414 Network	50	15.24
QCAD128	QPC720	Bulkhead I/O panel	25	7.62
RS-232	QPC720	Echo Canceller	50	15.24
NTND26AA	QPC720	NT6D80 MSDL	6	1.8
NTND26AB	QPC720	NT6D80 MSDL	18	5.5
NTND26AC	QPC720	NT6D80 MSDL	35	10.67
NTND26AD	QPC720	NT6D80 MSDL	50	15.24
NTND98	QPC720	Input/output panel	6	15.24
22AWG ABAM	Echo Canceller	DSX-1	655	199.64

Note: The QPC775 Clock Controller is currently available in Canada only. There can be no mixing of QPC775 and QPC471 in one system.

QPC757 DCHI/NT6D80 MSDL

The QPC757 DCHI or NT6D80 MSDL card is required in all machine types.

Power requirements

The QPC757 DCHI/NT6D80 MSDL power requirements

+5 volts at 3 amperes
+12 volts at 50 milliamperes
12 volts at 50 milliamperes

Interface to PRI

The QPC757 DCHI connects to the QPC720 PRI via a RS-422 cable. The following signals are transmitted across the interface:

RCV DATA
RCV CLOCK
XMIT CLOCK
XMIT READY
PRI READY
DCHI READY

PRI READY and DCHI READY are handshake signals.

QPC757/NT6D80 faceplate

The QPC757 DCHI as shown in Figure 3, has one light-emitting-diode (LED) to indicate an active or inactive state and two external connectors as follows:

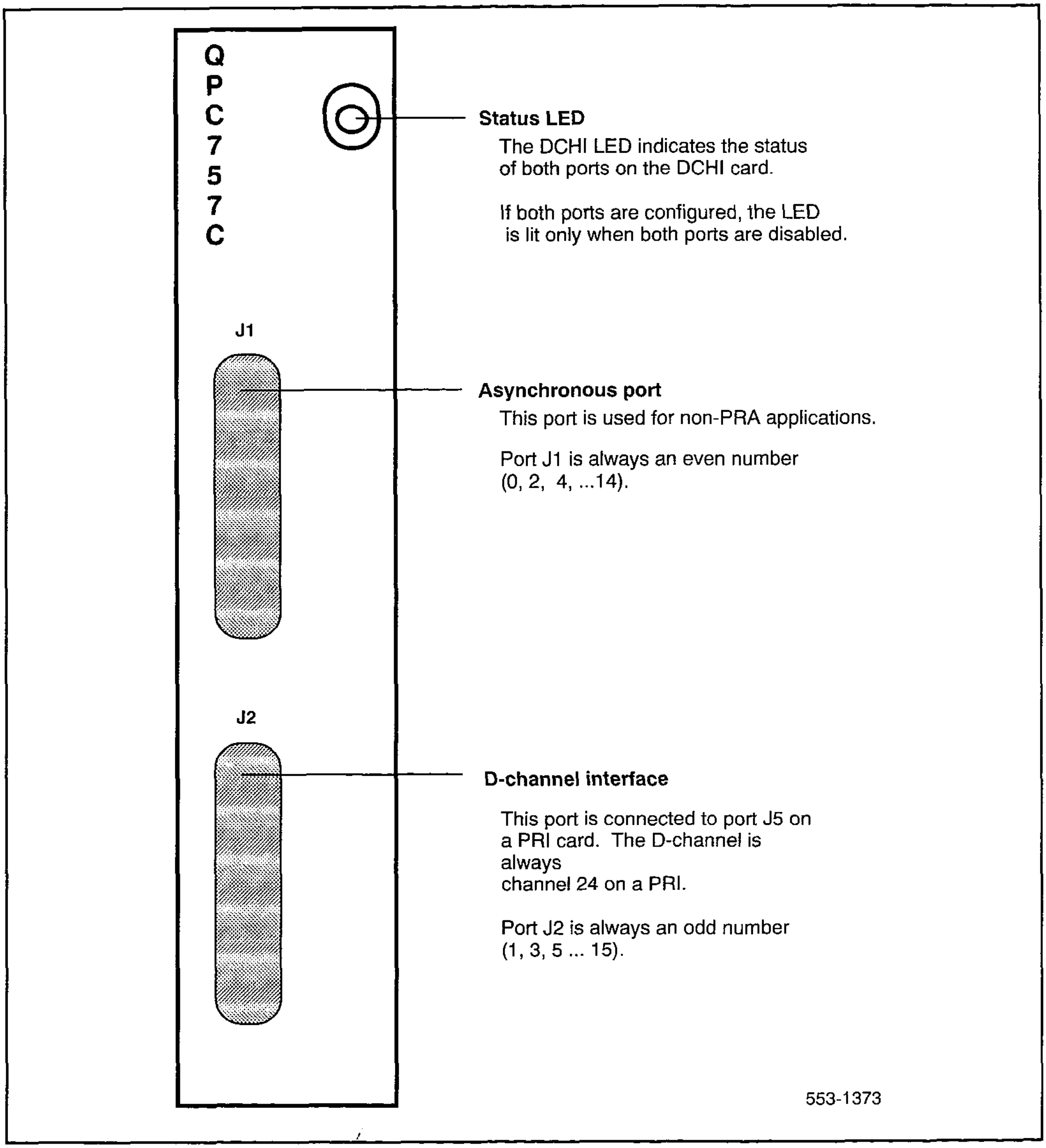
1 Port J1 is a standard asynchronous port in LD48

Note: This connection does not support an Add-on Data Module (ADM) terminal.

2 Port J2 is the D-channel Interface port.

Note: X11 release 14 requires QPC757 vintage B or higher. A QPC757 vintage C is required if the ISL Revert to Conventional Signaling feature is configured. X11 release 15 requires a QPC757 vintage C or later. The QPC757 vintage D is recommended for combination ISL/PRI networks using NACD or Network Message Services and ISL networks using modems.

Figure 3
QPC757 DCHI faceplate layout



NT6D80 MSDL

The NT6D80 MSDL card can be used in all machines supporting X11 release 18. It can be used in conjunction with, or independently from, the QPC757 card.

Power requirements

The NT6D80 MSDL power requirements are

Voltage (VAC)	Current (Amps)	Power (Watts)	Heat (BTUs)
+5	3.20	16.00	55.36
+12	0.10	1.20	4.15
–12	0.10	1.20	4.15

MSDL/PRI interface

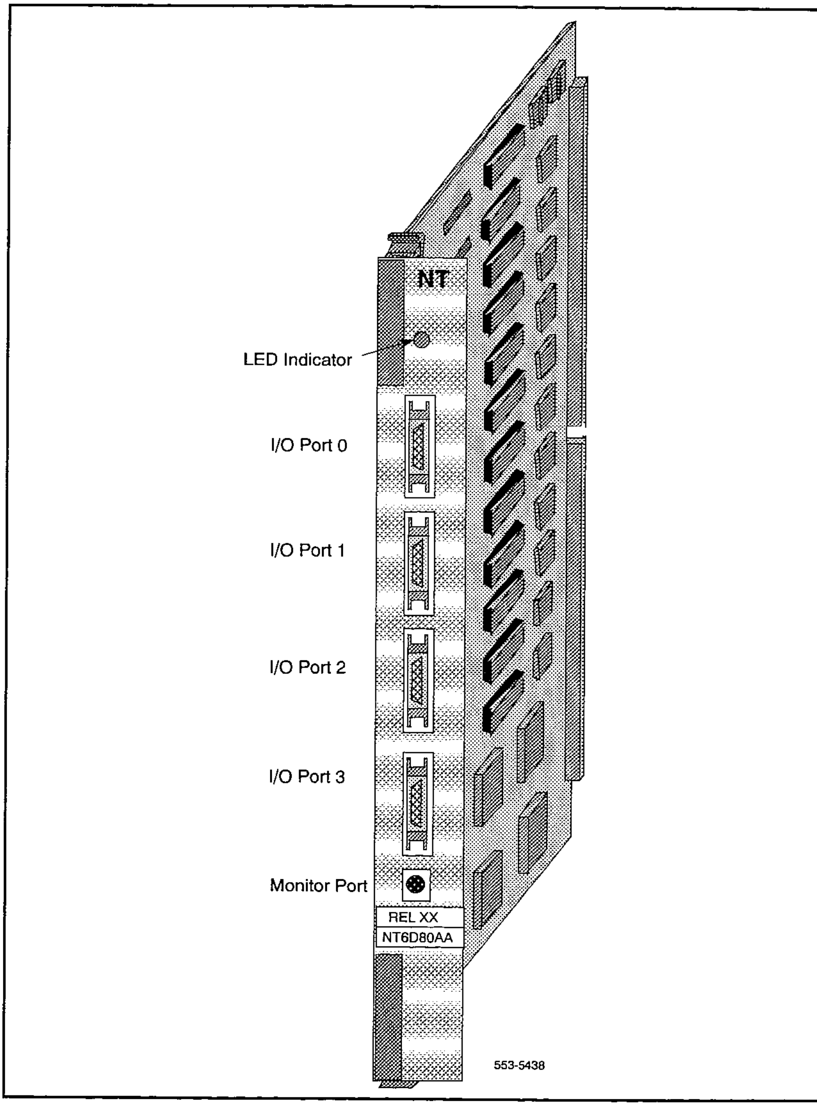
MSDL can connect to PRI trunks through RS-422 or RS-232 interfaces. The interfaces are switch configurable.

MSDL faceplate

The NT6D80 MSDL as shown in Figure 4 has one light-emitting-diode (LED) that indicates its state (active or inactive) and four external connectors.

Each port can be RS-422 or RS-232 connectors, with either DCE or DTE interfaces.

Figure 4
NT6D80 MSDL faceplate layout



Clock operation

There are three types of clock operation: tracking mode, free run mode, and holdover mode.

Tracking mode

In tracking mode, the PRI loop supplies an external clock reference to a Clock Controller. Two PRI loops can operate in tracking mode, with one defined as the primary reference source for clock synchronization, the other defined as the secondary reference source. The secondary reference acts as a back-up to the primary reference. Both the primary and secondary references are assigned in LD73. Each should have its own clocking source.

As shown in Figure 5, a Meridian 1 system with dual CPUs may have two Clock Controllers (CC-0 and CC-1). One Clock Controller acts as a back-up to the other. The Clock Controllers should be completely locked to the reference clock.

Free run (non-tracking) mode

The clock synchronization for a PRI loop may operate in free run mode if the following conditions are true:

- The loop is not defined as the primary or secondary clock reference.
- The primary and secondary references are disabled.
- The primary and secondary references are in red alarm (local alarm).

Holdover mode

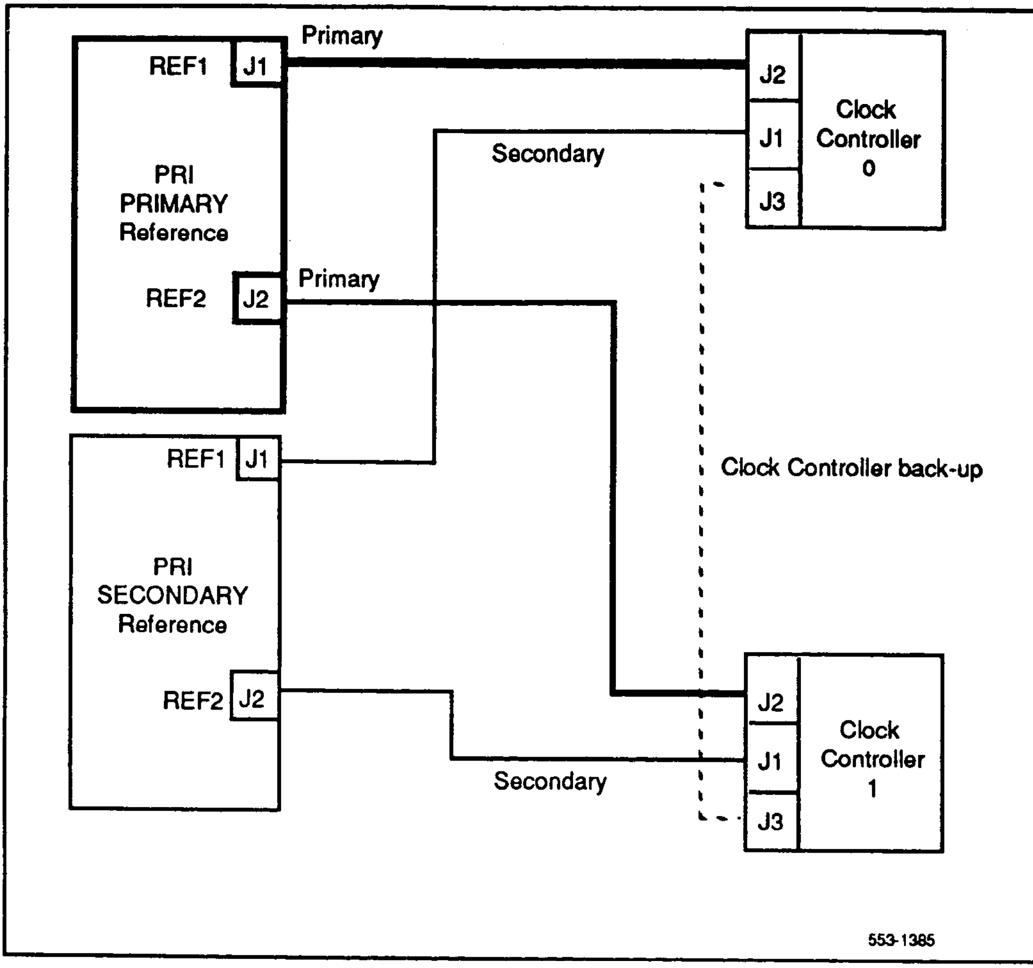
Holdover mode, available for vintages G and H, saves clock references, remembering the last position and retaining it if system operation is interrupted. Holdover mode maximizes synchronization accuracy.

Reference clock errors

Meridian 1 software checks every 15 minutes to see if a Clock Controller or reference clock error has occurred.

In tracking mode, at any one time, there is one active Clock Controller, which is tracking on one reference clock. If a Clock Controller error is detected, the system switches to the back-up Clock Controller without affecting which reference clock is being tracked.

Figure 5
Clock controller primary and secondary tracking



Automatic clock recovery

Automatic clock recovery provides for the clocking devices, down due to a PRI loop problem, to return to operation as soon as the PRI loop recovers

With X11 release 14, you must enable the Auto recovery in LD60 with the command EREF as well as in LD70 with AUTO = YES. With X11 release 15 and later, enable it in LD73 with AUTO = YES, LD60 is not required.

A PRI loop is disabled when it enters a red alarm (local alarm) condition. If the red alarm is cleared, the loop is enabled automatically. When the loop is enabled, clock tracking is restored in the following conditions:

1. If the loop is assigned as the primary reference clock but the Clock Controller is tracking on the secondary reference or in free run mode, it is restored to tracking on primary.
2. If the loop is assigned as the secondary reference clock but the Clock Controller is in free run mode, it is restored to tracking on secondary.

If the 15-minute clock check indicates the system is in free run mode:

1. Tracking is restored to the primary reference clock (if defined).
2. If the primary reference is disabled or in red alarm (local alarm), tracking is restored to the secondary reference clock if defined.

   If the system was put into free run mode intentionally by the craftsperson, it resumes tracking on a reference clock at this time unless the clock-switching option has been disabled (LD60, command MREF), or the reference clock has been undefined in the database.

Automatic clock switching

Tracking on the primary or secondary reference clock is automatically switched in the following manner, when clock recovery is enabled.

If software is unable to track on the assigned primary reference clock, it switches to the secondary reference clock.

If software is unable to track on the assigned secondary reference clock, it switches to free run.

DTI to PRI conversion

The QPC720 PRI circuit card can be used in Digital Trunk Interface (DTI) mode. If the circuit card is switched from DTI mode to PRI mode, use Procedure 1.

Procedure 1
DTI to PRI conversion

1 Disable the QPC720 PRI using LD60, prompt DISL x.

2 Change option switch settings on the PRI circuit card as required. Refer to Figure 6 and Table 4.

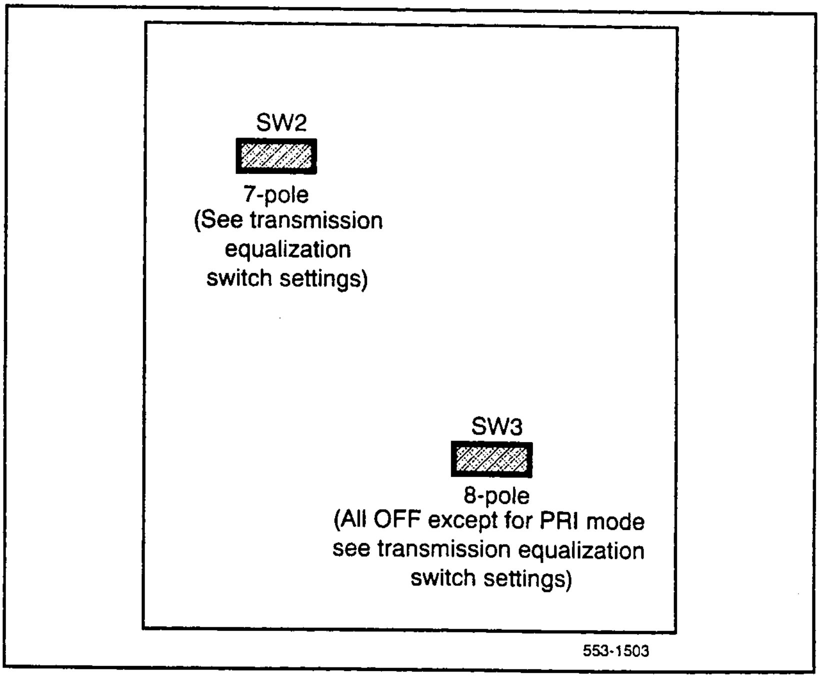
3 If the PRI links the D-channel, connect J5 to QPC757 DCHI J2 with a QCAD328A cable. You can also connect the PRI to an MSDL card with the cables noted in Table 3 (with X11 release 18 and later).

If this PRI does not supply the D-channel (it is one of multiple PRIs in an nB+D configuration), no additional cabling is required. The D-channel is associated through software in LD17, prompt PRI.

The LEDs flash three times to indicate the QPC720 is operable.

4 Configure your database. Refer to *ISDN Primary Rate Interface description and administration* (553-2901-100) and *X11 input/output guide* (553-3001-400) for database implementation.

Figure 6
PRI circuit card (QPC720) option settings



Use the settings in the table below for transmission equalization with Primary Rate Interface (PRI) and Digital Trunk Interface (DTI) applications.

Table 4
Transmission equalization switch settings for PRI/DTI

Switch S2 settings	To repeated facility	To cross-connect point
5 ON	0–45 m (0–150 ft)	0–30 m (0–100 ft)
2, 4, 6 ON	46–135 m (151–450 ft)	31–100 m (101–355 ft)
1, 3, 7 ON	136–225 m (451–750 ft)	101–200 m (356–655 ft)

Switch 3 options for PRI/DTI with ESF

SW3-1	ON	=	extended superframe format (ESF)
	OFF	=	superframe format (SF)
SW3-2	ON	=	B8ZS line encoding (required for 64K clear option)
	OFF	=	AM1 line encoding
SW3-3	ON	=	facility data link (FDL) yellow alarm method (cannot be used in Canada)
	OFF	=	Digit 2 yellow alarm method

Note 1: All switch positions for S2 (location B22) are OFF except as shown under the column labeled "Switch S2 settings." The 8-pole SW3 (location E37) switch positions are OFF except as shown for "Switch 3 options for PRI/DTI with ESF."

Note 2: For D2, D3, or D4 framing formats (superframe formats), set all SW3 options to OFF.

PRI installation: ST, STE, 21, 21E

X11 release 18 requires ST and 21 upgrade to STE or 21E. This chapter includes the PRI installation procedure for all four systems.

PRI circuit card locations

Each PRI circuit card requires two adjacent slots on a shelf. PRI cards can be placed in the following slots:

- for ST/STE, slots in Common Equipment (CE) shelf and DTI Expansion Tier
- for 21/21E, slots in NT8D11 Common/Peripheral Equipment Module

Cable requirements

Shielded 22 AWG (0.644 mm) cable is recommended for connecting the PRI to the cross-connect point. This cable consists of two shielded twisted-pair conductors and two shields.

The transmit and the receive pairs must be individually shielded and enclosed in a polyvinyl jacket. This type of cable is commonly referred to as "6-conductor" cable. T1 cable shielding should be grounded at the cross-connect point.

To manufacture cables of different lengths than the standard cables provided, refer to "PRI cabling information" on page 113.

See Figures 7 and 8 for cabling arrangements with and without an Echo Canceller.

The recommended order of PRI connections for the Universal I/O Panel (P0715058) for NT8D11 CE/PE Module (system option 21) follows:

- with Echo Canceller, J4 and J12 for the T1, J8 for the Echo Canceller
- without Echo Canceller, J4, J8, and J12 for the T1s

Installing the QPC720 PRI

This procedure describes how to install the QPC720 PRI card in an ST, STE, 21, or 21E.

Procedure 2
Installing the QPC720 PRI in an ST, STE, 21, 21E

1 Determine the cabinet and shelf location of the circuit card to be installed. The following slots can be used if they are not required for other cards. See Table 5.

Table 5
Shelf and slot location of QPC720 in ST and option 21

System	Shelf	Slot
ST	CE DTI Exp Tier	5–13 Note 1 2–10 Note 2
	QSD81 ST Upgrade	5–15 Note 2
21	NT8D11 CE Cube	4–9 Note 2
	NT8D35 DTI Exp Cube	2–3 Note 2 5–14 Note 2
	NT8D47 RPE Cube	1, 11, 12

Note 1: If a DTI/PRI pack is installed in slot 13, then PE slot 1 cannot be used.

Note 2: DTI/PRI packs require two slots. The slot indicated is the maximum slot that the pack resides in. For example, the slot 14 pack uses slots 13 and 14.

2 Unpack and inspect circuit cards.

3 Set option switches on the PRI circuit card. See Figure 9 and Table 6.

4 Install PRI circuit card in the assigned shelf and slot.

5 Install network circuit card (if no network loop connection is available).

6 If required, install I/O adapters in I/O panel.

7 Run and connect PRI cables. Figures 7 and 8 show ST, STE, 21, 21E PRI cabling. Refer also to Table 7.

8 If required, install connecting blocks at MDF or wall mounted cross-connect terminal.

9 If required, designate connecting blocks at MDF or wall mounted cross-connect terminal.

10 If required, install CSU or Echo Canceller.

11 Cross-connect PRI circuits.

12 Add related office data into system memory. Refer to the work order.

13 Run PRI verification tests.

Table 6
Transmission equalization switch settings for PRI

Switch S2 settings	To repeated facility	To cross-connect point
5 ON	0–45 m (0–150 ft)	0–30 m (0–100 ft)
2, 4, 6 ON	46–135 m (151–450 ft)	31–100 m (101–355 ft)
1, 3, 7 ON	136–225 m (451–750 ft)	101–200 m (356–655 ft)

Switch 3 options for PRI/DTI with ESF

SW3-1	ON	=	extended superframe format (ESF)
	OFF	=	superframe format (SF)
SW3-2	ON	=	B8ZS line encoding (required for 64K clear option)
	OFF	=	AM1 line encoding
SW3-3	ON	=	facility data link (FDL) yellow alarm method (cannot be used in Canada)
	OFF	=	Digit 2 yellow alarm method

Note 1: All switch positions for S2 (location B22) are OFF except as shown under the column labeled "Switch S2 settings." The 8-pole SW3 (location E37) switch positions are OFF except as shown for "Switch 3 options for PRI/DTI with ESF."

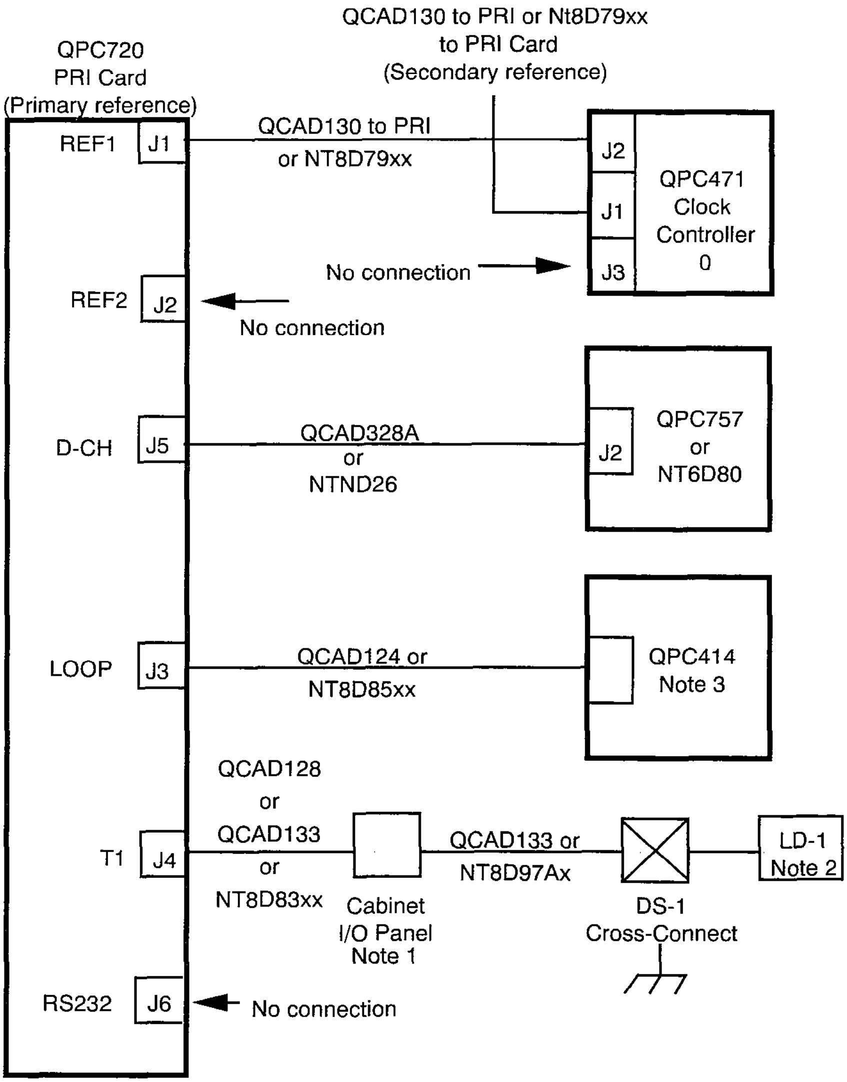
Note 2: For D2, D3, or D4 framing formats (superframe formats), set all SW3 options to OFF.

Table 7
Cable connections and destinations for ST, STE, 21, 21E

Cable	From	Con.	To	Des.	Con.	Notes
QCAD130 NT8D79xx	QPC720	J1	QPC471/QPC775	CC-0	J2	Only when primary clock source.
QCAD130 NT8D79xx	QPC720	J1	QPC471/QPC775	CC-0	J1	Only when secondary clock source.
NTND26	QPC720	J5	MSDL (NT6D80)			X11 release 18 and later.
QCAD124 NT8D85xx	QPC720	J3	Network			Run directly to network card.
QCAD328A	QPC720	J5	DCHI		J2	Run directly to DCHI card.
QCAD133 NT8D83xx	I/O Panel		Patch panel			Run via cabinet I/O panel to CSU, Echo Canceller, or cross-connect terminal.
QCAD129 NT8D93xx	QPC720	J6	I/O Panel			Echo Canceller.
RS-232 NT8D89Ax	I/O Panel		Echo canceller			
RS-232	QPC720	J6	Echo canceller			
QCAD133 Nt8D83xx	QPC720	J4	Patch panel			Run via cabinet I/O panel to cross-connect terminal or Echo Canceller from non-shielded system.

Note: No additional cabling is required for multiple PRIs. The D-channel is associated through software in LD17, prompt PRI.

Figure 7
ST, STE, 21, 21E cabling without Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
***Note 3*:** QPC720 does not interface with NT8D04 Superloop Network Card.

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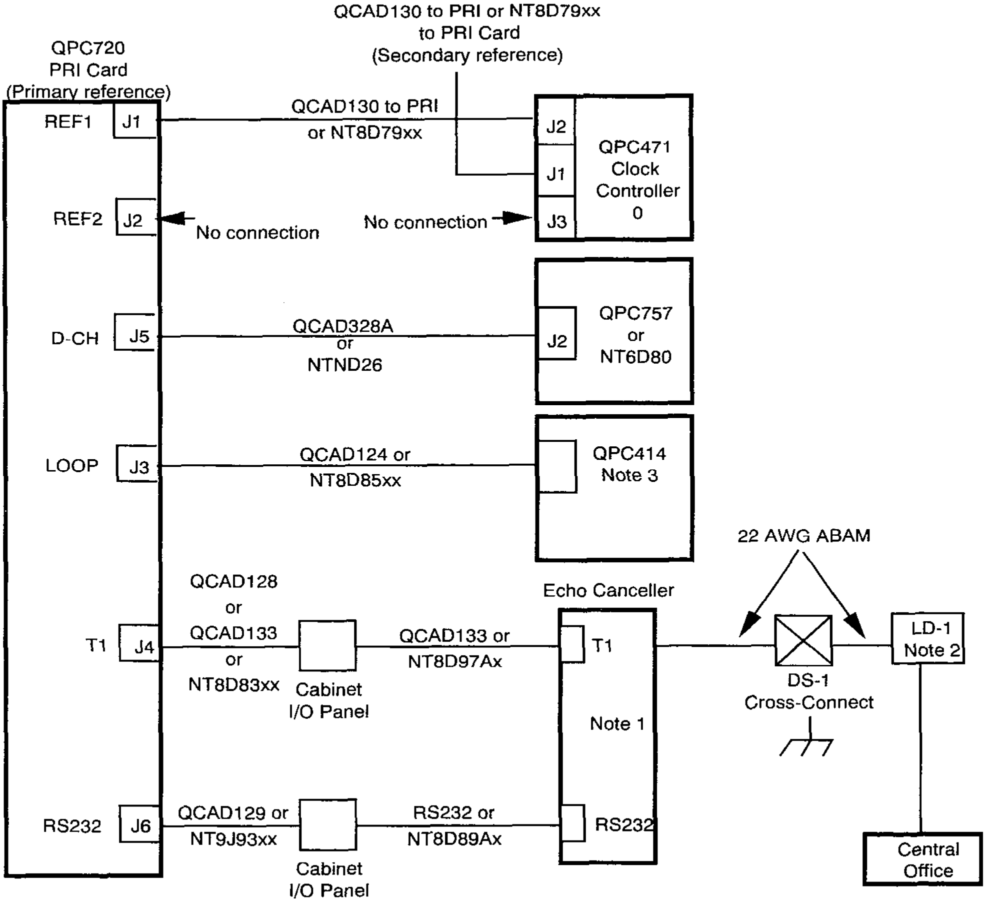
Figure 8
ST, STE, 21, 21E cabling with Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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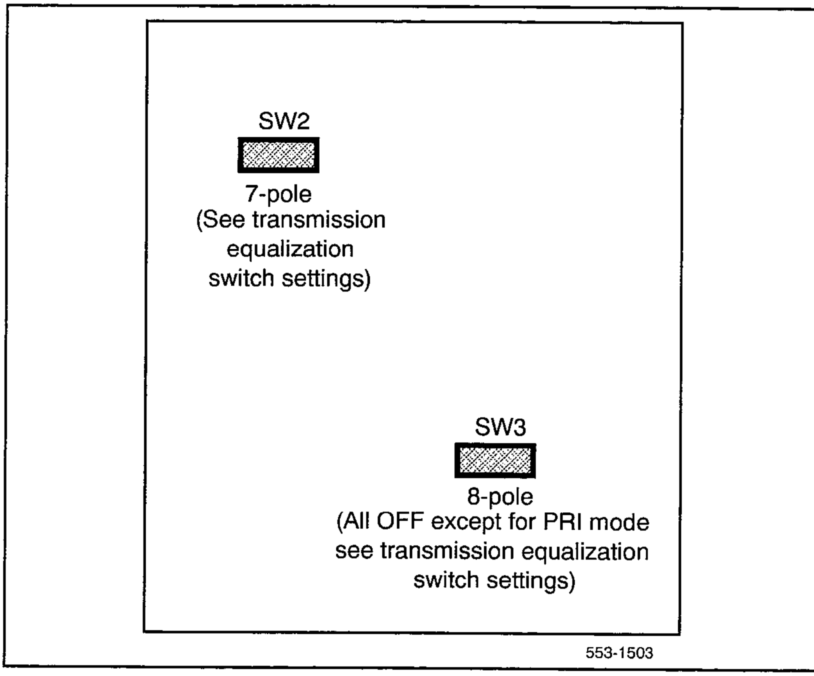
Figure 9
PRI card (QPC720) switch settings



Removing the QPC720 PRI

The following procedure describes how to remove the QPC720 PRI card from the ST, STE, 21, 21E.

Procedure 3
Removing the QPC720 PRI from the ST, STE, 21, 21E

1 Disable the D-channel in LD96.

2 Disable Network Loop using LD60. The command is DISL x.

3 If the circuit card is being completely removed, not replaced, remove data from memory. See ISDN Primary Rate Interface description and administration (553-2901-100).

4 Determine the location of the circuit cards to be removed.

5 Remove cross connections at MDF to wall-mounted cross-connect terminal.

6 Disconnect PRI cables at Echo Canceller and at carrier interface (for example, Office Repeater and NCTE equipment).

7 Tag and disconnect cables from card. Rearrange Clock Controller card cables if required. This will affect call processing on DTI/PRI loops.

8 Remove PRI and network circuit cards. If the other circuit of a dual network card is in use, DO NOT remove the network card.

9 Pack and store circuit card.

PRI installation: RT

PRI circuit card locations

Each PRI circuit card requires two adjacent slots on a shelf. As many as five circuit cards can be plugged into an empty network shelf, along with the power converter card, depending on the shelf type. See Tables 34 and 35.

Cable requirements

Shielded 22 AWG (0.644 mm) cable is recommended for connecting the PRI to the cross-connect point. This cable consists of two shielded twisted-pair conductors and two shields.

The transmit and the receive pairs must be individually shielded and enclosed in a polyvinyl jacket. This type of cable is commonly referred to as "6-conductor" cable. T1 cable shielding should be grounded at the cross-connect point.

To manufacture cables of different lengths than the standard cables provided, refer to "PRI cabling information" on page 113.

See Figures 10 and 11 for cabling arrangements with and without an Echo Canceller.

The recommended order of PRI connections for the Universal I/O Panel (P0715058) for NT8D11 CE/PE Module (system option 21) follows:

— with Echo Canceller, J4 and J12 for the T1, J8 for the Echo Canceller

— without Echo Canceller, J4, J8, and J12 for the T1s

Installing the QPC720 PRI

This procedure describes how to install the QPC720 PRI card in an RT.

Procedure 4
Installing the QPC720 PRI in an RT

1 Determine the cabinet and shelf location of the circuit card to be installed. The following slots can be used if they are not required for other cards.

Table 8
Shelf and slot location of QPC720 in RT

Shelf	Slot
Network	5–12
DTI Expansion tier	2–9

2 Unpack and inspect circuit cards.

3 Set option switches on the PRI circuit card. See Figure 12 and Table 9.

4 Install PRI circuit card in the assigned shelf and slot.

5 Install network circuit card (if no network loop connection is available).

6 If required, install I/O adapters in I/O panel.

7 Run and connect the PRI cables. Figures 11 and 12 show the RT PRI cabling. Refer also to Table 10.

8 If required, install connecting blocks at MDF or wall mounted cross-connect terminal.

9 If required, designate connecting blocks at MDF or wall mounted cross-connect terminal.

10 If required, install CSU or Echo Canceller.

11 Cross-connect PRI circuits.

12 Add related office data into system memory. Refer to the work order.

13 Run PRI verification tests.

Note: No additional cabling is required for multiple PRIs. The D-channel is associated through software in LD17, prompt PRI.

Table 9
Transmission equalization switch settings for PRI

Switch S2 settings	To repeated facility	To cross-connect point
5 ON	0–45 m (0–150 ft)	0–30 m (0–100 ft)
2, 4, 6 ON	46–135 m (151–450 ft)	31–100 m (101–355 ft)
1, 3, 7 ON	136–225 m (451–750 ft)	101–200 m (356–655 ft)

Switch 3 options for PRI/DTI with ESF

SW3-1	ON	=	extended superframe format (ESF)
	OFF	=	superframe format (SF)
SW3-2	ON	=	B8ZS line encoding (required for 64K clear option)
	OFF	=	AM1 line encoding
SW3-3	ON	=	facility data link (FDL) yellow alarm method (cannot be used in Canada)
	OFF	=	Digit 2 yellow alarm method

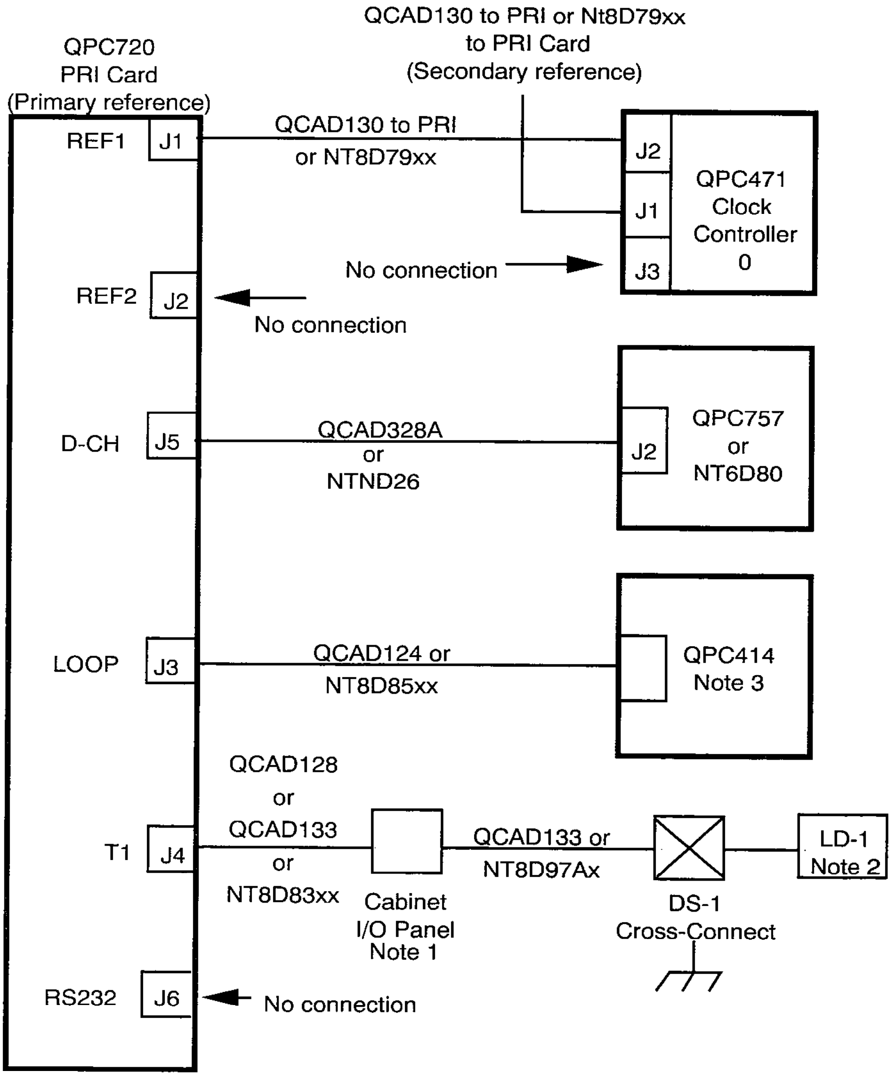
Note 1: All switch positions for S2 (location B22) are OFF except as shown under the column labeled "Switch S2 settings." The 8-pole SW3 (location E37) switch positions are OFF except as shown for "Switch 3 options for PRI/DTI with ESF."

Note 2: For D2, D3, or D4 framing formats (superframe formats), set all SW3 options to OFF.

Table 10
Cable connections and destinations for RT

Cable	From	Con.	To	Des.	Con.	Notes
QCAD130 NT8D79xx	QPC720	J1	QPC471/QPC775	CC-0	J2	Only when primary clock source.
QCAD130 NT8D79xx	QPC720	J1	QPC471/QPC775	CC-0	J1	Only when secondary clock source.
NTND26	QPC720	J5	MSDL (NT6D80)			X11 release 18 and later.
QCAD124 NT8D85xx	QPC720	J3	Network			Run directly to network card.
QCAD328A	QPC720	J5	DCHI		J2	Run directly to DCHI card.
QCAD133 NT8D83xx	I/O Panel		Patch panel			Run via cabinet I/O panel to CSU, Echo Canceller, or cross-connect terminal.
QCAD129 NT8D93xx	QPC720	J6	I/O Panel			Echo canceller.
RS-232 NT8D89Ax	I/O Panel	J6	Echo canceller			
RS-232	QPC720	J6	Echo canceller			
QCAD133 Nt8D83xx	QPC720	J4	Patch panel			Run via cabinet I/O panel to cross-connect terminal or Echo Canceller from non-shielded system.

Figure 10
RT cabling without Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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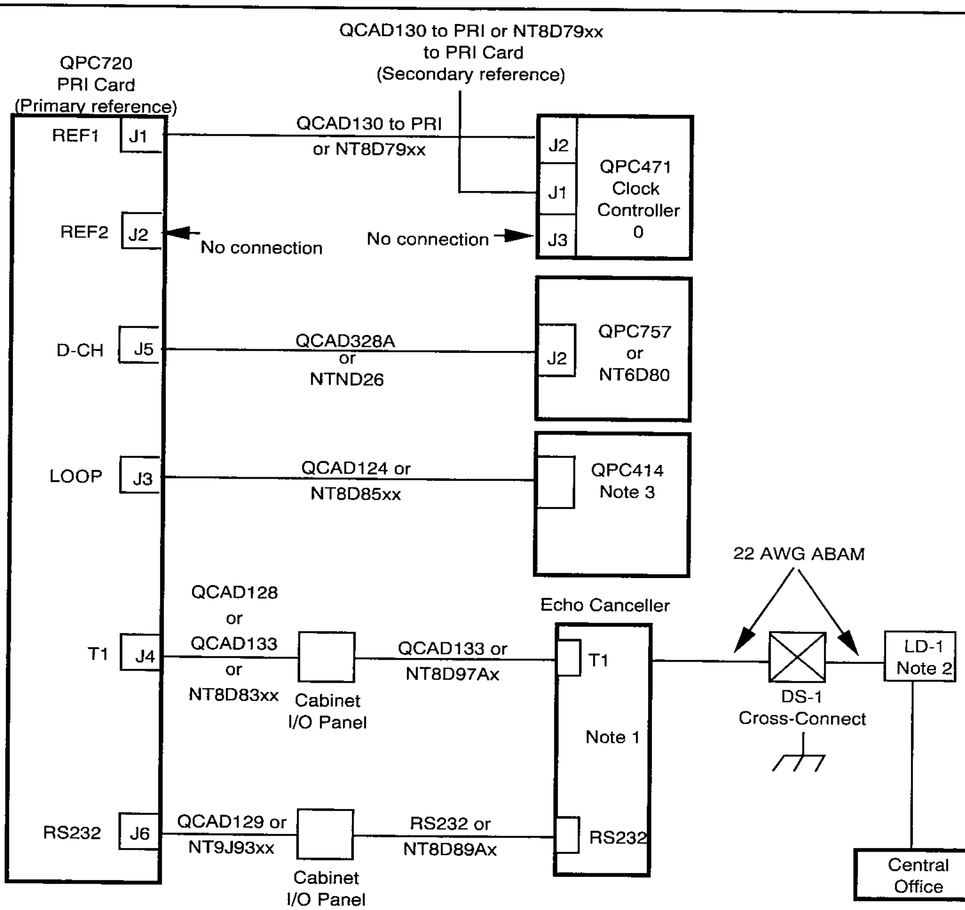
Figure 11
RT cabling with Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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Removing the QPC720 PRI

The following procedure describes how to remove the QPC720 PRI card from the RT.

Procedure 5
Removing the QPC720 PRI from the RT

1 Disable the D-channel in LD96.

2 Disable Network Loop using LD60. The command is DISL x.

3 If the circuit card is being completely removed, not replaced, remove data from memory. See ISDN Primary Rate Interface description and administration (553-2901-100).

4 Determine the location of the circuit cards to be removed.

5 Remove cross connections at MDF to wall-mounted cross-connect terminal.

6 Disconnect PRI cables at echo canceller and at carrier interface (for example, Office Repeater and NCTE equipment).

7 Tag and disconnect cables from card. Rearrange Clock Controller card cables if required. This will affect call processing on DTI/PRI loops.

8 Remove PRI and network circuit cards. If the other circuit of a dual network card is in use, DO NOT remove the network card.

9 Pack and store circuit card.

PRI installation: NT, 51, 61

PRI circuit card locations

Each PRI circuit card requires two adjacent slots on a shelf. As many as five circuit cards can be plugged into any empty network shelf, along with the power converter card, depending on the shelf type. See Tables 34 and 35.

If additional network shelves are required, use the NT8D35 Network Module. See *System installation* (553-3001-210).

Cable requirements

Shielded 22 AWG (0.644 mm) cable is recommended for connecting the PRI to the cross connect point. This cable consists of two shielded twisted-pair conductors and two shields.

The transmit and the receive pairs must be individually shielded and enclosed in a polyvinyl jacket. This type of cable is commonly referred to as "6-conductor" cable. T1 cable shielding should be grounded at the cross-connect point.

To manufacture cables of different lengths than the standard cables provided, see "PRI cabling information" on page 113.

The recommended order of PRI connections for the Universal I/O Panel (P0715058) for the NT6D39 CE/Network Module (system option 51/61) is as follows:

- with Echo Canceller, J4, J12, and J24 for the T1 and J8, J20, and J28 for the Echo Canceller
- without Echo Canceller, J8, J12, J20, J24, and J28 for the T1s

Installing the QPC720 PRI

This procedure describes how to install the QPC720 PRI card in an NT, 51, or 61.

Procedure 6
Installing the QPC720 PRI in NT, 51, 61

1 Determine the cabinet and shelf location of the circuit card to be installed. The following slots can be used if they are not required for other cards.

Table 11
Shelf and slot location of QPC720 in NT or option 61

System	Shelf	Slot
NT	QSD39 Network (LH)	4–10 Note 1
	QSD40 Network (RH)	5–10 Notes 1, 2
	QSD39 DTI/PRI only	2–10 Notes 1, 4 12–14
	QSD40 DTI/PRI only	2–3 Note 1 5–13
61	NT6D39 CPU/NET	3–8 Note 1 18 Note 3
	NT8D35 DTI Exp Cube	2–3 Note 1 5–14 Note 1
	NT8D47 RPE Cube	1, 11, 12

Note 1: DTI/PRI packs require two slots. The slot indicated is the maximum slot that the pack resides in. For example, the slot 14 pack uses slots 13 and 14.

Note 2: The DTI/PRI pack cannot be installed in slot 11. The pack would come in contact with the BTU installed between slots 11 and 12.

Note 3: Slot 18 is only available on CPU shelf, which has no MDU/FDU.

Note 4: DTI/PRI pack could reside in slots 10 and 11, but cannot reside in slots 11 and 12 because of powering restrictions.

Removing the QPC720 PRI

The following procedure describes how to remove the QPC720 PRI card from the NT, 51, 61.

Procedure 7
Removing the QPC720 PRI in the NT, 51, 61

1 Disable the D-channel in LD96.

2 Disable Network Loop using LD60. The command is DISL x.

3 If the circuit card is being completely removed, not replaced, remove data from memory. See ISDN Primary Rate Interface description and administration (553-2901-100).

4 Determine the location of the circuit cards to be removed.

5 Remove cross connections at MDF to wall-mounted cross-connect terminal.

6 Disconnect PRI cables at Echo Canceller and at carrier interface (for example, Office Repeater and NCTE equipment).

7 Tag and disconnect cables from card. Rearrange Clock Controller card cables if required. This will affect call processing on DTI/PRI loops.

8 Remove PRI and network circuit cards. If the other circuit of a dual network card is in use, DO NOT remove the network card.

9 Pack and store circuit card.

Note: No additional cabling is required for multiple PRIs. The D-channel is associated through software in LD17, prompt PRI.

Table 12
Transmission equalization switch settings for PRI

Switch S2 settings	To repeated facility	To cross-connect point
5 ON	0–45 m (0–150 ft)	0–30 m (0–100 ft)
2, 4, 6 ON	46–135 m (151–450 ft)	31–100 m (101–355 ft)
1, 3, 7 ON	136–225 m (451–750 ft)	101–200 m (356–655 ft)

Switch 3 options for PRI/DTI with ESF

SW3-1	ON	=	extended superframe format (ESF)
	OFF	=	superframe format (SF)
SW3-2	ON	=	B8ZS line encoding (required for 64K clear option)
	OFF	=	AM1 line encoding
SW3-3	ON	=	facility data link (FDL) yellow alarm method (cannot be used in Canada)
	OFF	=	Digit 2 yellow alarm method

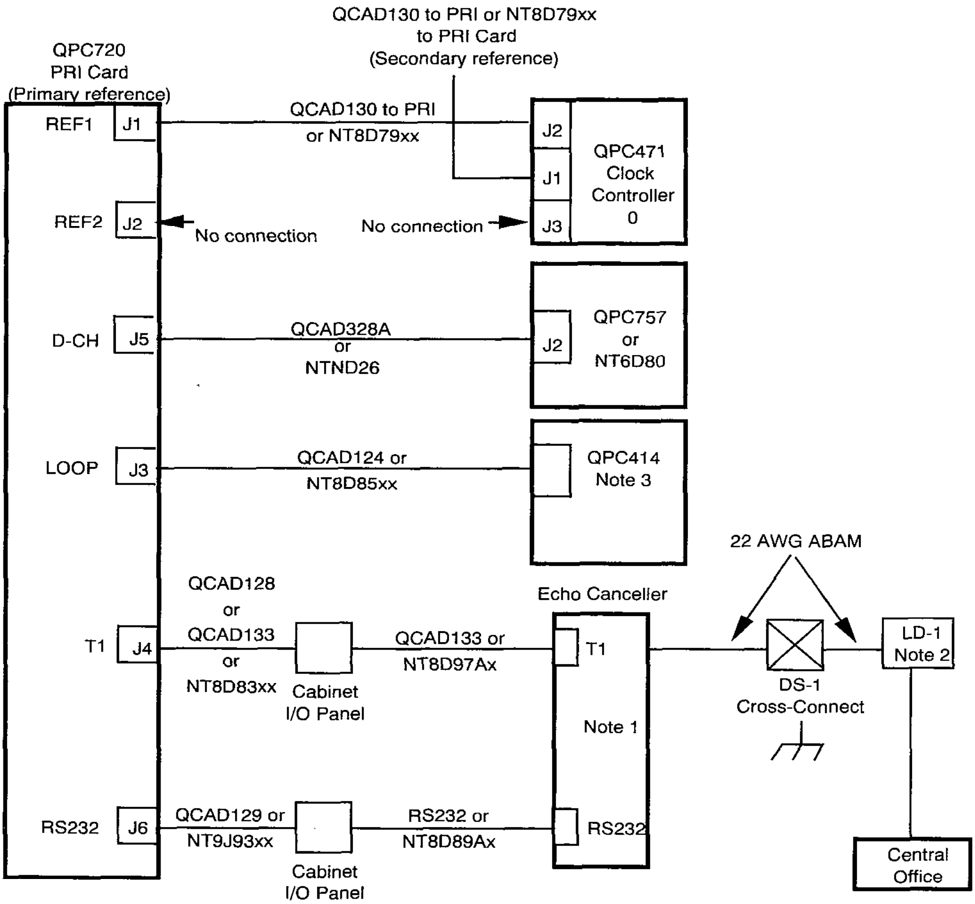
Note 1: All switch positions for S2 (location B22) are OFF except as shown under the column labeled "Switch S2 settings." The 8-pole SW3 (location E37) switch positions are OFF except as shown for "Switch 3 options for PRI/DTI with ESF."

Note 2: For D2, D3, or D4 framing formats (superframe formats), set all SW3 options to OFF.

Table 13
Cable connections and destinations for NT, 51, 61

Cable	From	Des.	Con.	To	Des.	Con.	Notes
For half group only							
QCAD130 NT8D79xx	QPC720		J1	QPC471/ QPC775	CC-0	J2	Only when primary clock source.
QCAD130 NT8D79xx	QPC720		J1	QPC471/ QPC775	CC-0	J1	Only when secondary clock source.
NTND26	QPC720		J5	NT6D80			X11 release 18 and later.
For single group only							
QCAD130 NT8D79xx	QPC720		J2	QPC471/ QPC775	CC-1	J2	Only when primary clock source.
QCAD130 NT8D79xx	QPC720		J2	QPC471/ QPC775	CC-1	J1	Only when secondary clock source.
QCAD125 NT8D75xx	QPC471/ QPC775	CC-0	J3	QPC471/ QPC775	CC-1	J3	Clock controller back-up.
QCAD124 NT8D85xx	QPC720		J3	Network			Run directly to network card.
QCAD328A	QPC720		J5	QPC757		J2	Run directly to DCHI card.
NTND26	QPC720		J5	NT6D80			X11 release 18 and later.
QCAD133	I/O Panel			Patch panel			Run via cabinet I/O panel to CSU, Echo Canceller, or cross-connect terminal.
QCAD129	QPC720		J6	I/O Panel			
RS-232	I/O Panel			Echo canceller			
RS-232	QPC720		J6	Echo canceller			
QCAD133 NT8D83xx	QPC720		J4	Patch panel			Run via cabinet I/O panel to cross-connect terminal or Echo Canceller from non-shielded system.

Figure 14
Half group cabling with Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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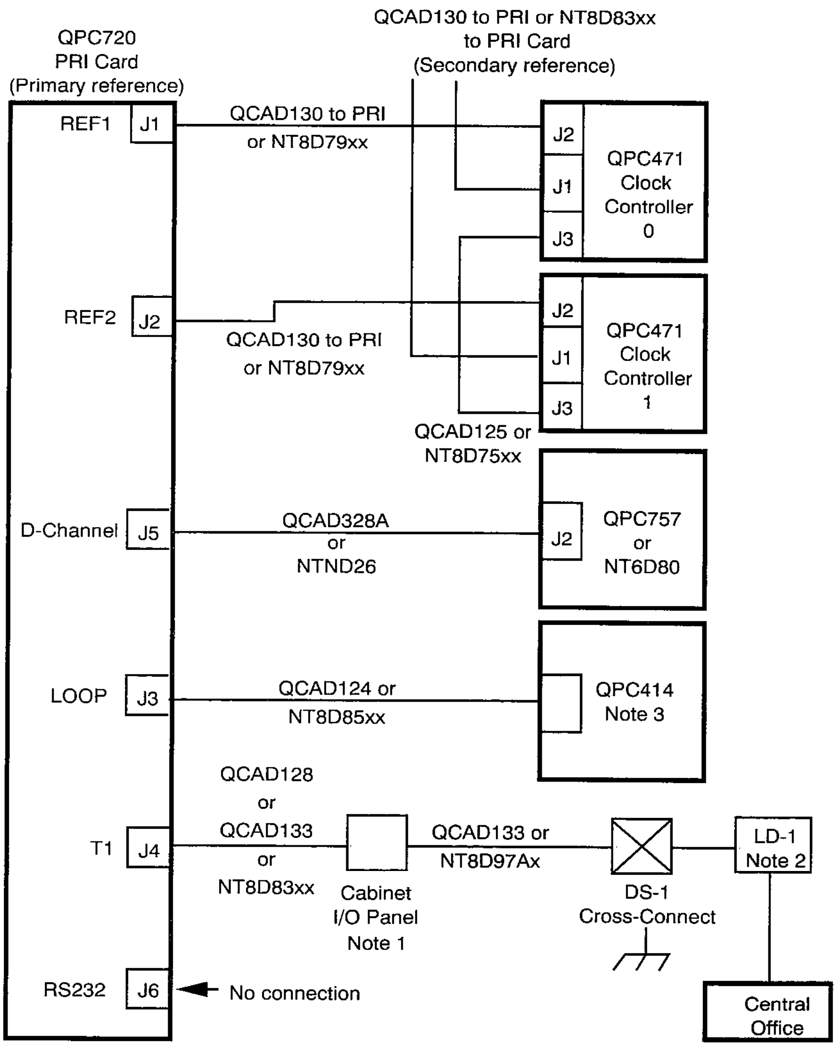
Figure 15
Single group cabling without Echo Canceller (NT, 61)



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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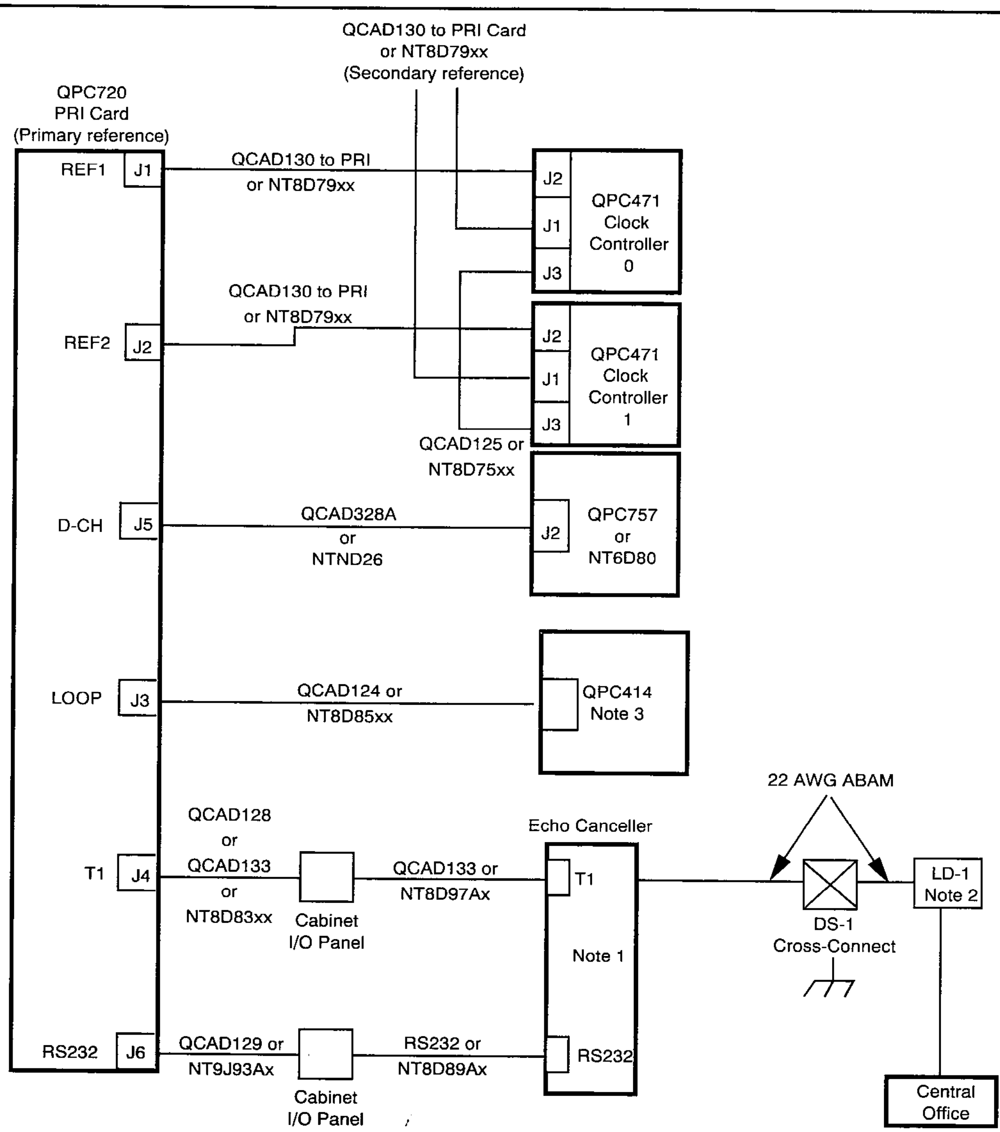
Figure 16
Single group cabling with Echo Canceller (NT, 61)



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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PRI installation: XT, 71

PRI circuit card locations

Each PRI circuit card requires two adjacent slots on a shelf. As many as five circuit cards can be plugged into an empty network shelf, along with the power converter card, depending on the shelf type. See Tables 34 and 35.

Cable requirements

Shielded 22 AWG (0.644 mm) cable is recommended for connecting the PRI to the cross-connect point. This cable consists of two shielded twisted-pair conductors and two shields.

The transmit and the receive pairs must be individually shielded and enclosed in a polyvinyl jacket. This type of cable is commonly referred to as "6-conductor" cable. T1 cable shielding should be grounded at the cross-connect point.

To manufacture cables of different lengths than the standard cables provided, refer to "PRI cabling information" on page 113.

See Figures 18 and 19 for cabling arrangements with and without an Echo Canceller.

Installing the QPC720 PRI

This procedure describes how to install the QPC720 PRI card in an XT, 71.

Procedure 8
Installing the QPC720 PRI in an XT, 71

1 Determine the cabinet and shelf location of the circuit card to be installed. The following slots can be used if they are not required for other cards.

Table 14
Shelf and slot location of QPC720 in XN, XT, and option 71

System	Shelf	Slot
XN/XT	QSD39 Network (LH) QSD40 Network (RH)	4–10 Note 1 5–10 Notes 1, 2
	QSD39 DTI/PRI only	2–10 Notes 1, 3 12–14
	QSD40 DTI/PRI only	2–3 Note 1 5–13
	NT7D44 Mass Storage QCA 55/58 CAB	2–8 Notes 1, 4
	NT7D45 Mass Storage QCA 23/24 CAB	5–10 Notes 1, 4
71	NT8D35 CPU/NET	5–10 Note 1 13–14
	NT8D35 DTI Exp Cube	2–3 Note 1 5–14
	NT8D47 RPE Cube	1, 11, 12

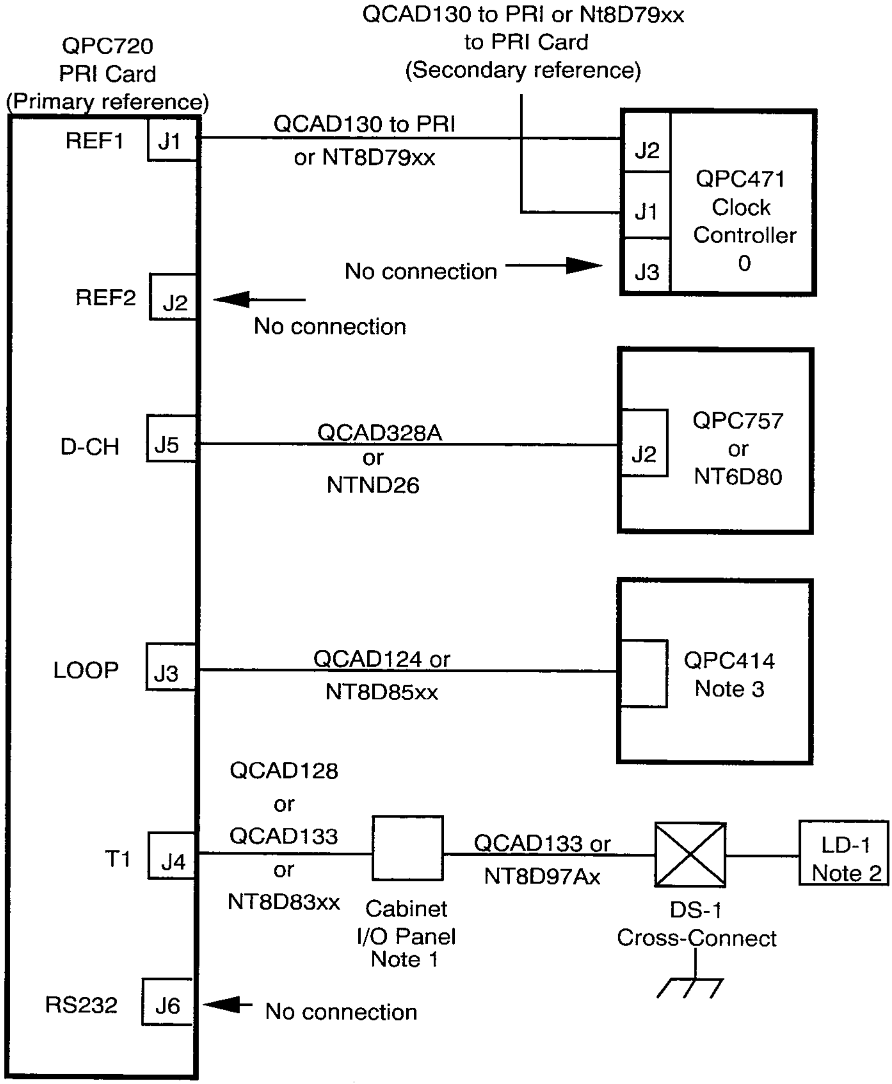
Note 1: DTI/PRI packs require two slots. The slot indicated is the maximum slot that the pack resides in. For example, in slot 14, the pack uses slots 13 and 14.

Note 2: A DTI/PRI pack cannot be installed in slot 11. The pack would come in contact with the BTU installed between slots 11 and 12.

Note 3: A DTI/PRI pack could reside in slots 10 and 11, but cannot reside in slots 11 and 12 because of powering restrictions.

Note 4: The power regulator (NT6D81AA) may be substituted by the DTI/PRI packs, provided the balance of equipment in card slots 1 through 8 are already equipped.

Figure 18
XT, 71 cabling without Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
***Note 3*:** QPC720 does not interface with NT8D04 Superloop Network Card.

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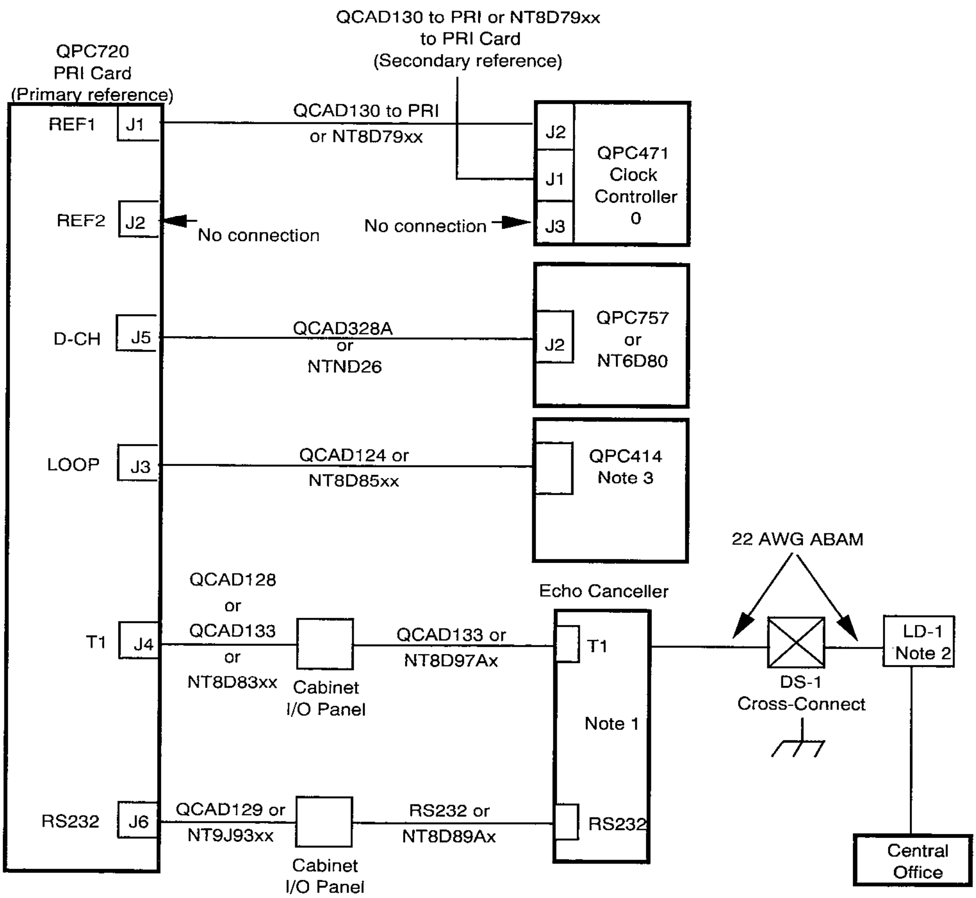
Figure 19
XT, 71 cabling with Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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Figure 20
Option switch settings for PRI circuit card

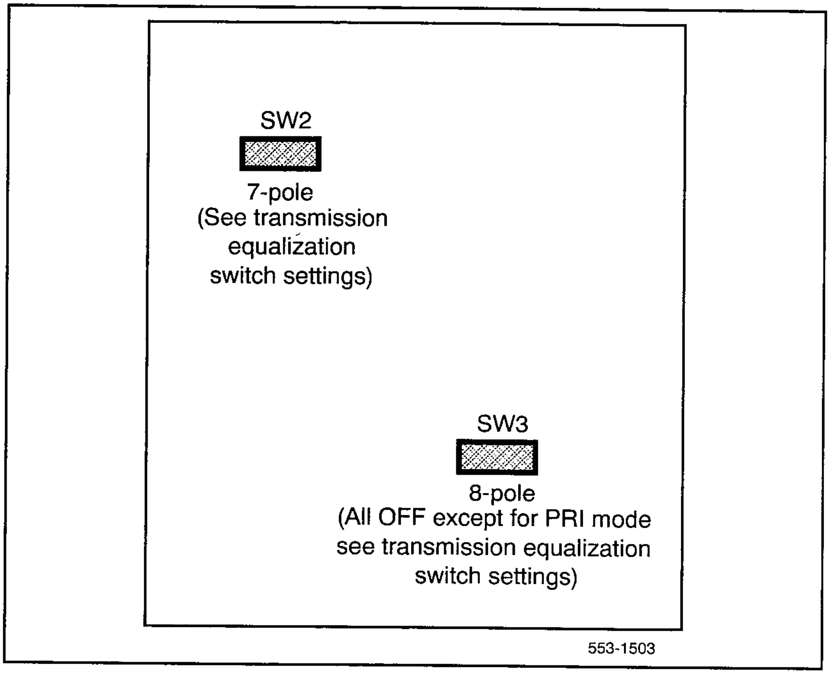


Table 16
Cable connections and destinations for XT, 71 (Part 1 of 2)

Cable	From	Des.	Con.	To	Des.	Con.	Notes
QCAD130 NT8D79xx	QPC720			J1	QPC471QC P775	CC-0	1
QCAD130 NT8D79xx	QPC720			J1	QPC471 QCP775	CC-0	2
QCAD130 NT8D79xx	QPC720			J2	QPC471 QCP775	CC-1	1
QCAD130 NT8D79xx	QPC720			J2	QPC471 QCP775	CC-1	2
QCAD110 NT8D74xx	QPC471 QCP775	CC-0	J3	QPC417	JCTR	J11	3
QCAD110 NT8D74xx	QPC471 QCP775	CC-1	J3	QPC417	JCTR	J12	
QCAD124 NT8D85xx	QPC720		J3	Network			4
QCAD328A	QPC720		J5	QPC757		J2	5
NTND26	QPC720	J5		NT6D80			X11 release 18 and later
QCAD128 NT8D83xx	QPC720		J4	I/O Panel			6
QCAD133 NT8D97Ax	I/O Panel			Patch Panel			6
QCAD129 NT9J93xx	QPC720		J6	I/O Panel			6
RS-232	I/O Panel			Echo Canceller			

Table 16
Cable connections and destinations for XT, 71 (Part 2 of 2)

Cable	From	Des.	Con.	To	Des.	Con.	Notes
RS-232	QPC720		J6	Echo Canceller			7
QCAD133 NT8D83xx	QPC720		J4	Patch Panel			7
RS-232	QPC720		J6	Echo Canceller			7

Note 1: Only when primary clock source.

Note 2: Only when secondary clock source.

Note 3: Multi-group junctor board connection.

Note 4: Run to connector on network pack.

Note 5: Run directly to DCHI card.

Note 6: Run by means of cabinet I/O panel to CSU, Echo Canceller, or cross-connect terminal.

Note 7: Run by means of cabinet I/O panel to cross-connect terminal or Echo Canceller from non-shielded system.

Removing the QPC720 PRI

The following procedure explains how to remove the PRI card from the XT, 71.

Procedure 9
Removing the QPC720 PRI from XT, 71

1. Disable the D-channel in LD96.
2. Disable Network Loop using LD60. The command is DISL x.
3. If the circuit card is being completely removed, not replaced, remove data from memory. See ISDN Primary Rate Interface description and administration (553-2901-100).
4. Determine the location of the circuit cards to be removed.
5. Remove cross connections at MDF to wall mounted cross-connect terminal.
6. Disconnect PRI cables at Echo Canceller and at carrier interface (for example, Office Repeater and NCTE equipment).
7. Tag and disconnect cables from card. Rearrange Clock Controller card cables if required. This will affect call processing on DTI/PRI loops.
8. Remove PRI and network circuit cards. If the other circuit of a dual network card is in use, DO NOT remove the network card.
9. Pack and store circuit card.

Procedure 10
Installing the QPC720 PRI in an 81

1 Determine the location of the circuit card to be installed. The following slots can be used if they are not required for other cards.

Table 17
Shelf and slot location of QPC720 in 81

System	Shelf	Slot
81	Core	0-3
	Network Module	5-9, 13-14
	RPE	1, 11, 12

2 Unpack and inspect circuit cards.

3 Set option switches on the PRI circuit card, Figure 23 and Table 18.

4 Install PRI circuit card in the assigned shelf and slot.

5 Install network circuit card (if no network loop connection is available).

6 If required, install I/O adapters in I/O panel.

7 Run and connect the PRI cables. Figures 21 and 22 show the 81 PRI cabling. Refer also to Table 19.

8 If required, install connecting blocks at MDF or wall mounted cross-connect terminal.

Note: No additional cabling is required for multiple PRIs. Prompt PRI in LD17 associates the D-channel.

9 If required, designate connecting blocks at MDF or wall mounted cross-connect terminal.

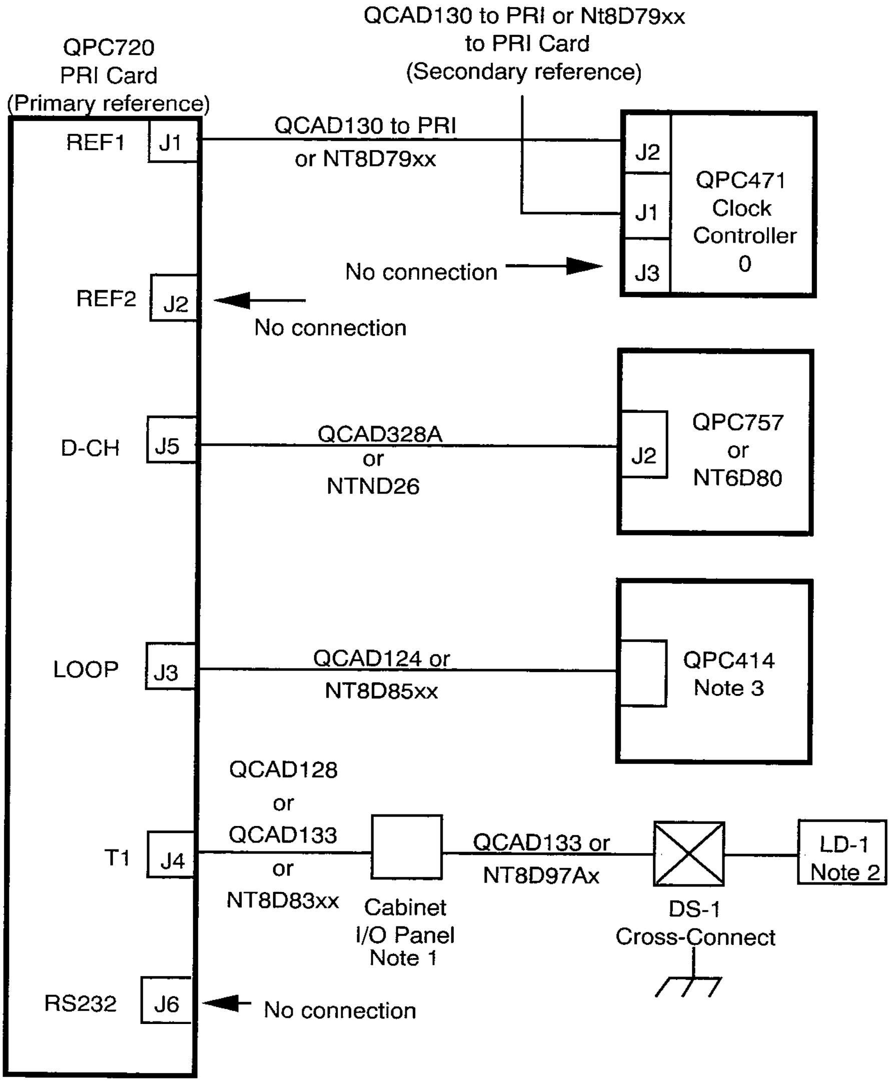
10 If required, install CSU or Echo Canceller.

11 Cross-connect PRI circuits.

12 Add related office data into system memory. Refer to the work order.

13 Run PRI verification tests.

Figure 21
Option 81 cabling without Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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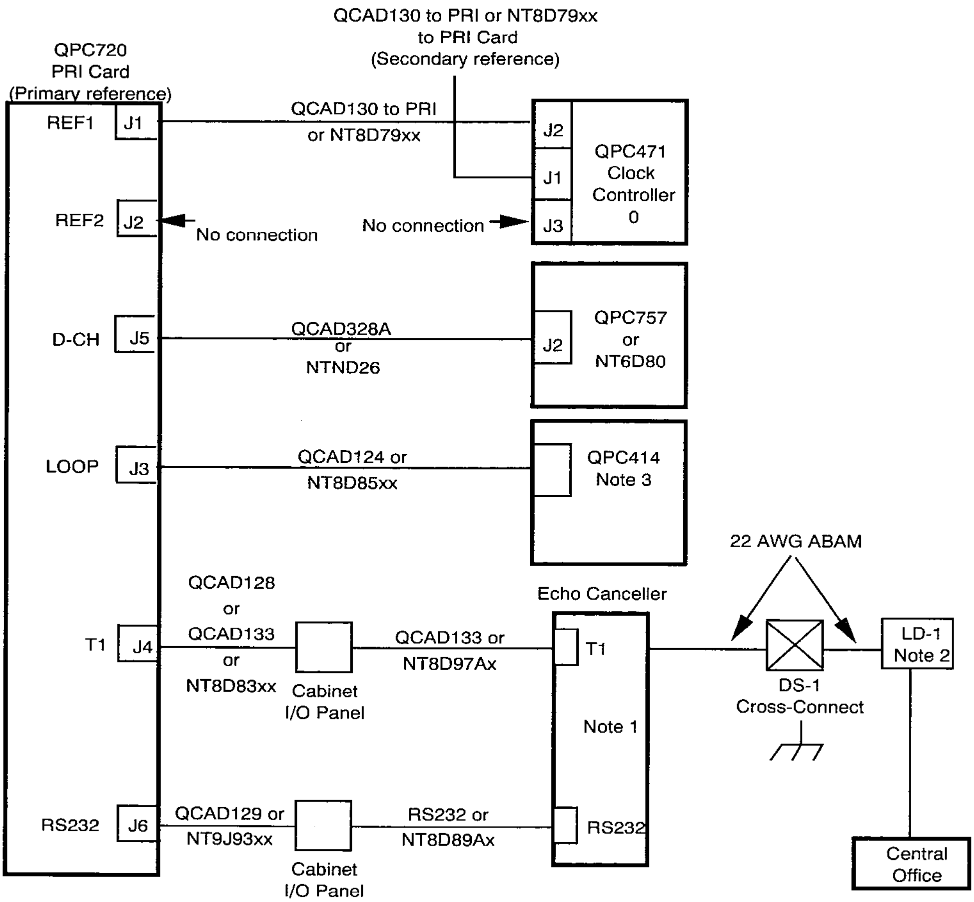
Figure 22
81 cabling with Echo Canceller



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 655 ft.
Note 2: Maximum cable distance from PRI card to LD-1 is 750 ft.
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

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Table 18
Transmission equalization switch settings for PRI

Switch S2 settings	To repeated facility	To cross-connect point
5 ON	0–45 m (0–150 ft)	0–30 m (0–100 ft)
2, 4, 6 ON	46–135 m (151–450 ft)	31–100 m (101–355 ft)
1, 3, 7 ON	136–225 m (451–750 ft)	101–200 m (356–655 ft)

Switch 3 options for PRI/DTI with ESF

SW3-1	ON	=	extended superframe format (ESF)
	OFF	=	superframe format (SF)
SW3-2	ON	=	B8ZS line encoding (required for 64K clear option)
	OFF	=	AM1 line encoding
SW3-3	ON	=	facility data link (FDL) yellow alarm method (cannot be used in Canada)
	OFF	=	Digit 2 yellow alarm method

Note 1: All switch positions for S2 (location B22) are OFF except as shown under the column labeled "Switch S2 settings." The 8-pole SW3 (location E37) switch positions are OFF except as shown for "Switch 3 options for PRI/DTI with ESF."

Note 2: For D2, D3, or D4 framing formats (superframe formats), set all SW3 options to OFF.

Table 19
Cable connections and destinations for 81 (Part 1 of 2)

Cable	From	Des.	Con	To	Des.	Con.	Notes
QCAD130 NT8D79xx	QPC720			J1	QPC471 QCP775	CC-0	Only when primary clock source
QCAD130 NT8D79xx	QPC720			J1	QPC471 QCP775	CC-0	Only when secondary clock source
QCAD130 NT8D79xx	QPC720			J2	QPC471 QCP775	CC-1	Only when primary clock source
QCAD130 NT8D79xx	QPC720			J2	QPC471 QCP775	CC-1	Only when secondary clock source
QCAD110 NT8D74xx	QPC471 QCP775	CC-0	J3	QPC417	JCTR	J11	Multi-group junctor board connection
QCAD110 NT8D74xx	QPC471 QCP775	CC-1	J3	QPC417	JCTR	J12	
QCAD124 NT8D85xx	QPC720		J3	Network			Run to connector on network pack
QCAD328	QPC720		J5	QPC757		J2	Run directly to DCHI card
NTND26	QPC720	J5		NT6D80			X11 release 18 and later
QCAD128 NT8D83xx	QPC720		J4	I/O Panel			Run via cabinet I/O panel to CSU, Echo Canceller, or cross-connect terminal

Table 19
Cable connections and destinations for 81 (Part 2 of 2)

Cable	From	Des.	Con	To	Des.	Con.	Notes
QCAD133 NT8D83xx	I/O Panel			Patch Panel			Run via cabinet I/O panel to CSU, Echo Canceller, or cross-connect terminal
QCAD129 NT9J93xx	QPC720		J6	I/O Panel			Run via cabinet I/O panel to CSU, Echo Canceller, or cross-connect terminal
RS-232	I/O Panel			Echo Canceller			
RS-232	QPC720		J6	Echo Canceller			Run via cabinet I/O panel to Echo Canceller or cross-connect terminal from non-shielded system
QCAD133 NT8D83xx	QPC720		J4	Patch Panel			Run via cabinet I/O panel to Echo Canceller or cross-connect terminal from non-shielded system
RS-232	QPC720		J6	Echo Canceller			Run via cabinet I/O panel to Echo Canceller or cross-connect terminal from non-shielded system

Clock Controller Installation

There are three steps to installing a Clock Controller:

1 Determining the location of the Clock Controller card (shelf and slot).

2 Setting the switches on the card.

3 Inserting the card and connecting the cables. This step may also entail removing an old card.

This chapter describes the details of this process.

CAUTION

Do not deviate from the procedures described in this section, as deviation stops call processing.

Determining slots and shelves

The Clock Controller card installation site varies from system to system. Table 20 shows the systems, the shelves used, and the available slot or slots.

Table 20
Clock Controller shelves and slots

System	Shelf	Slot(s)
ST, STE	CE	5-12
RT	network	13
NT, 51	QSD39 network (LH) QSD40 network (RH)	13 2
XN	QSD17 CPU	14
XT	QSD62	15
21, 21E	NT8D11 CE	4-5
61	NT6D39 CPU/NET	9
71	NT8D34 CE Cube	14
81	core	6

Before installing a Clock Controller, set the switches as shown in Table 21, Table 22, Table 23, and Table 24 below. The first three tables display the settings for different vintages of the QPC471. Table 24 shows the settings for the QPC775.

Table 21
Clock Controller switch settings for QPC471 vintage A

System	Switch	Setting
NT, RT	SW2	ON
XN, XT	SW2	OFF
Vintage A applies only to these systems		

Table 23
Clock Controller switch settings for QPC471 vintage H

System	SW1				SW2				SW4			
ST, STE, 21A, 21, 21E	on	on	on	on	off	off	off	off	off	off	off	off
SN	on	on	on	on	on	on	on	on	off	off	off	off
RT, NT, 51, 61	on	on	on	on	off	off	off	off	off	on	*	*
XN, XT, 71, 81	off	off	off	off	off	off	off	off	off	on	*	*
Cable length between the J3 faceplate connectors:												
0-4.3 m (0-14 ft.)											off	off
4.6–6.1m (15–50 ft.)											off	on
6.4–10.1m (21–33 ft.)											on	off
10.4–15.2 m (34–50 ft.)											on	on

• If there is only one Clock Controller card in the system, set to OFF. If there are two Clock Controller cards, set to match the cable length between the J3 faceplate connectors. Determine the total cable length (no single cable can exceed 25 ft.) between the J3 connectors. Both cards must have the same setting.

Table 24
Clock Controller switch settings for QPC775

System	SW2	SW3	SW4
NT, RT, ST, STE, 21, 21A, 21E, 51, 61	ON	OFF	ON
SN	ON	ON	OFF
XN, XT, 71, 81	OFF	OFF	ON

Replacing a Clock Controller

Step 2 in the following procedures explains how to replace a card.

Do not disable an active clock or a clock associated with an active CPU.

Installing a Clock Controller

Be sure to inspect the Clock Controller card before installing it. Refer to the tables at the beginning of this chapter for shelf, slot, and switch setting information. Remember not to use both the QPC471 and the QPC775 on a single system. QPC471 vintage H cards cannot be mixed with cards of an earlier vintage.

Starting the Clock Controller

The Clock Controller, when first enabled, is in free run mode. It stays in this mode for several minutes before being switched to tracking mode. Manual mode setting is possible via LD60.

For the earlier QPC471 vintages, up to 20 minutes may pass before the clock actually locks and tracks. The QPC471 vintage G and H cards begin tracking within five minutes.

Clock Controller commands

During the installation procedure you will use some of the Clock Controller commands available in LD60. In the list of commands below, "x" refers to the Clock Controller number: 0 for the card associated with the CPU0, 1 for the card associated with CPU1.

- DIS CC x: Disable system Clock Controller x
- DSCK loop: Disable clock for specified loop
- DSYL loop: Disable yellow alarm processing for loop
- ENCK loop: Enable clock for specified loop
- ENL CC x: Enable system Clock Controller x
- ENYL loop: Enable yellow alarm processing for loop
- EREF: Enable automatic switchover of system clocks
- SSCK x: Obtain status of system clock x

- SWCK: Switch system clock between active and standby
- TRCK aaa: Set Clock Controller track where aaa can be PCK (the primary DTI/PRI reference), SCLK (the secondary DTI/PRI reference) or FRUN (free running)

Procedure 12
Installing the Clock Controller in the ST, STE, 21, 21E, RT, 51, and NT half group

Note: Refer to the tables in this section to be sure you are using the correct vintage.

1 Set the ENL/DIS toggle switch to DIS (disable) on the new circuit card.

2 If replacing an existing card, do the following:

- Perform a status check on the clock with the SSCK command in LD60. The new controller should have the same status.
- Disable the old card using LD60.

Note: ERR20 messages may be generated. These can usually be ignored. However, excessive clock switching should be avoided, especially when counters are near the maintenance or out-of-service thresholds. Excessive switching could generate threshold-exceeded messages or cause the PRI to be automatically disabled. Check the counters in LD60. If necessary, reset the counters using the RCNT command.

- Set the old card's faceplate ENL/DIS switch to DIS.
- Disconnect cables from the old Clock Controller card and remove the card from the shelf.

Note: The Clock Controller status display in this mode indicates NO UART (no universal async receiver transmitter). Do not perform a clock status check when receiving this code.

3 Install the new Clock Controller in the selected slot.

4 Connect the cables to the new card.

- Connect the primary reference to J2.
- If applicable, connect the secondary reference to J1.

5 Set the faceplate ENL/DIS switch to ENL (enable).

Installing the Clock Controller in a single group

Procedure 13
Installing the Clock Controller in the NT, 61

1. Set faceplate ENL/DIS switch to DIS (disable) on the new circuit card.

2. If replacing an existing card, do the following:

   — Perform a status check on the clock with the SSCK command. The new card should have the same status.

   — Disable the old card using LD60. (Only a card in standby state associated with a standby CPU can be disabled using software.)

   Note: ERR20 messages may be generated. These can usually be ignored. However, excessive clock switching should be avoided, especially when counters are near the maintenance or out-of-service thresholds. Excessive switching could generate threshold-exceeded messages or cause the PRI to be automatically disabled. Check the counters in LD60. If necessary, reset the counters using the RCNT command.

   — Set the old card's faceplate ENL/DIS switch to DIS.

   — Disconnect the cables from the old Clock Controller card and remove the card from the shelf.

   Note: The Clock Controller status display in this mode indicates NO UART (no universal async receiver transmitter).Do not perform a clock status check when receiving this code.

3. If the 3PE switches have not been modified to recognize the Clock Controller card, adjust them as follows:

   QSD39 (left-hand side) SW1 OFF (Option 61 shelf 0)
   SW2 ON
   SW4 OFF

   QSD40 (right-hand side) SW1 OFF (Option 61 shelf 1)
   SW2 ON
   SW4 OFF
   SW8 OFF

4. Set faceplate ENL/DIS switch to DISABLE.

5. Install Clock,Controller in the selected slot.

6 Run and connect cables

— Connect the primary reference to J2.

— If available, connect the secondary reference to J1.

— Connect the cable between the two clocks to J3 on each controller card.

7 Set the faceplate ENL/DIS switch to ENL.

8 Enable the Clock Controller by entering ENL CC x in LD60.

9 Set the error detection thresholds and clock synchronization controls in LD73. (Optional with card replacement; required with new installation.)

10 To track on a primary or secondary reference clock, use LD60. Use the following command:

TRCK	PCK	(for primary)
	SCLK	(for secondary)
	FRUN	(for free-run)

11 Issue the status check command, SSCK.

12 (Optional) Activate the new Clock Controller with the LD60 SWCK command.

13 Repeat, if necessary, for the second Clock Controller.

Procedure 14
Installing the Clock Controller in the XN, XT, 71, and 81

Note: The option 81 system requires a vintage H Clock Controller

1 Set faceplate ENL/DIS switch to DIS on new circuit card.

2 If replacing an existing card, do the following:

— Perform a status check on the clock with the SSCK command. The new card should have the same status.

— Disable it using LD60. (Use software only to disable a card in standby state associated with the standby CPU.)

Note: ERR20 messages may be generated. These can usually be ignored. However, excessive clock switching should be avoided, especially when counters are near the maintenance or out-of-service thresholds. Excessive switching could generate threshold-exceeded messages or cause the PRI to be automatically disabled. Check the counters in LD60. If necessary, reset the counters using the RCNT command.

— Set the old card's faceplate ENL/DIS switch to DIS.

— Disconnect the cables from the old Clock Controller card and remove it from the shelf.

Note: The Clock Controller status display in this mode indicates NO UART (no universal async receiver transmitter). Do not perform a clock status check when receiving this code.

3 Set the faceplate ENL/DIS switch to DIS.

4 Install the Clock Controller in the selected slot.

5 Run and connect the cables

— Connect the primary reference to J2.

— If available, connect the secondary reference to J1.

— Connect the cable between the two clocks to J3 on each controller card.

6 Set the faceplate ENL/DIS switch to ENL.

DCHI installation for all systems

Installing the QPC757 DCHI

Installation instructions for the QPC757 DCHI are the same for the ST, STE, RT, NT, and XT, as well as 21, 21E, 51, 61, 71, and 81. See Figures 24 and 25 for option switch settings per port number of the DCHI card in Primary Rate Interface.

Refer to *X11 input/output guide* (553-3001-400) for administration and maintenance programs. The following procedures describe how to install the QPC757 DCHI card.

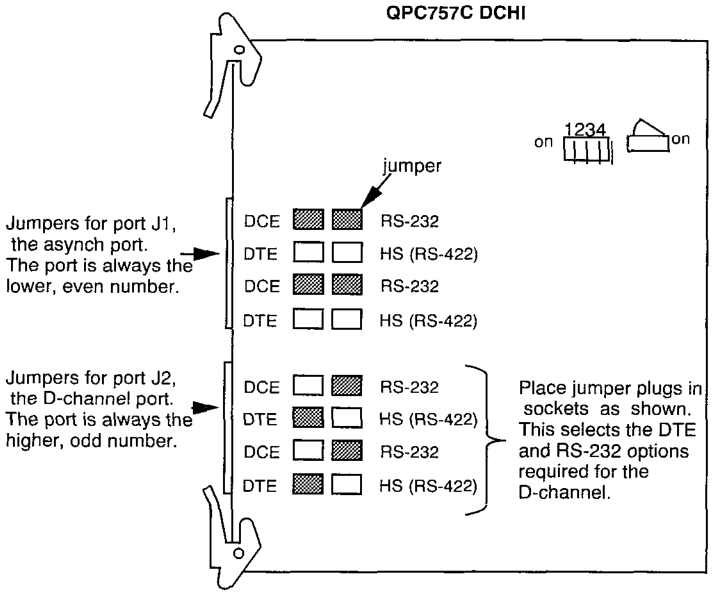
Procedure 15
Installing the QPC757 DCHI

1. Determine the cabinet and shelf location of the circuit card to be installed.

   The QPC757 DCHI card can be installed in any slot appropriate for an I/O port card on a network shelf. For single CPU systems only, the QPC757 DCHI card can be located on the Common Equipment (CE) shelf. Refer to Tables 34 and 35 for your system capabilities.

2. Unpack and inspect card.
3. Set option switches and jumper plugs on the DCHI card. For PRI capability, set port J2 to odd. For ISL capability, set port J2 for high speed or low speed programming.
4. Set faceplate toggle switch to DISABLE.
5. Install DCHI card into the assigned shelf or module and slot.
6. Run and connect DCHI cables: connect QPC757 J2 to QPC720 PRI J5 with a QCAD328A cable.
7. Set faceplate toggle switch to ENABLE.
8. Enable the loop in LD60.
9. Coordinate start-up and verification of the DCHI with the start-up of the PRI. See ISDN Primary Rate Interface description and administration (553-2901-100). Enable the DCHI card using LD96, command ENL DCH x.

Figure 25
QPC757 option switch settings for PRI/ISL low speed programming



Meridian SL-1 I/O Port Selection: Port Address Switch Settings					
Port Number		Switch 1	Switch 2	Switch 3	Switch 4
J1	J2				
0	1	Off	Off	Off	Off
2	3	Off	Off	On	Off
4	5	Off	On	Off	Off
6	7	Off	On	On	Off
8	9	On	Off	Off	Off
10	11	On	Off	On	Off
12	13	On	On	Off	Off
14	15	On	On	On	Off

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D-channel parameter downloading

Beginning with X11 release 14, system upgrades often contain changes to D-channel parameters. The Meridian 1 software automatically downloads the new parameters to each D-channel Interface (DCHI) circuit card upon SYSLOAD. When this occurs, the D-channel is temporarily disabled and then automatically re-enabled.

Three situations require manual disabling and re-enabling of each DCHI to ensure parameter downloading:

- Performing a parallel load and switching over to the second CPU
- Following an alarm condition for the T1 loop carrying the D-channel (but the D-channel is still operational)
- Following SYSLOAD when using ISDN Signaling Link (ISL)

Removing the QPC757 DCHI

The following procedure explains how to remove the QPC757 DCHI card.

CAUTION

The QPC757 DCHI must be software disabled before it is hardware disabled to prevent initialization.

Procedure 16
Removing the QPC757 DCHI

1. Disable the QPC757 DCHI using LD96, command DIS DCH x.
2. Disable asynchronous port J1 in LD48 to prevent initialization.
3. Disable loop in LD60.
4. If the circuit card is being removed, not replaced, remove data from memory. See the *ISDN Primary Rate Interface description and administration* (553-2901-100) document.
5. Determine the cabinet and shelf location of the card to be removed.
6. Set faceplate toggle switch to DISABLE.
7. Disconnect QPC757 DCHI cables.
8. Remove QPC757 DCHI card.
9. Pack and store circuit card.

Procedure 17
Installing the MSDL card

1 Determine module and slot location for the MSDL card. Refer to the list above.

2 Unpack and inspect the MSDL card.

3 Set the MSDL switch settings to correspond to Table 25 and Figure 26.

4 Insert the MSDL card into the selected card slot of the module following the card guides.

5 Observe the red LED on the MSDL faceplate. If it turns on, flashes three times, and stays on continuously, the MSDL is operating correctly but is not yet enabled.

If the LED turns on and stays on continuously without flashing three times, the card may be defective. Go to step 8.

6 Run and connect the cables: NTND80 to QPC720 PRI J5 with a NTND26 cable.

7 Enable the MSDL card in LD96.

8 Unplug the MSDL card and reinsert it. If the red LED still does not flash three times, leave the card installed for approximately 10 minutes to allow the card to be initialized.

9 After 10 minutes unplug the card, reinsert it, and if the card still does not flash three times, the card is defective and must be replaced.

Figure 26
MSDL card layout

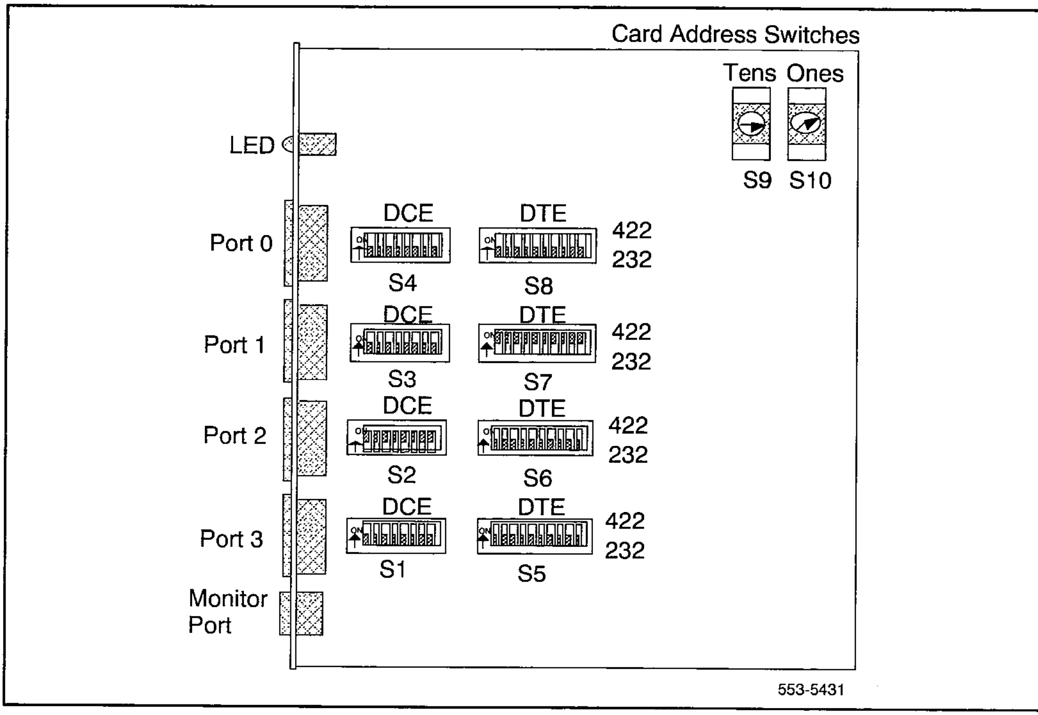
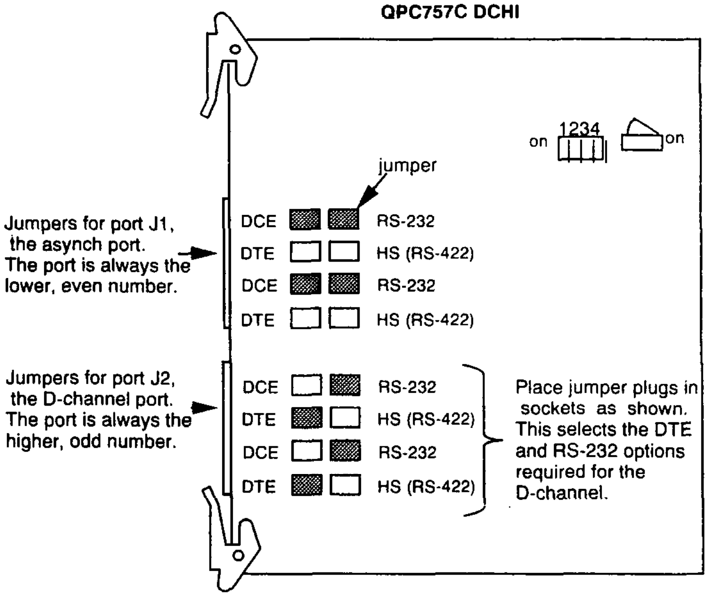


Table 25
MSDL switch settings

	Port 0 — SW4								Port 0 — SW8									
RS-232-D	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off
RS-422-A DTE	off	off	off	off	off	off	off	off	on	on	on	on	on	on	on	on	on	on
RS-422-A DCE	on	on	on	on	on	on	on	on	off	off	off	off	off	off	off	off	off	off
	Port 1— SW3								**Port 1— SW7**									
RS-232-D	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off
RS-422-A DTE	off	off	off	off	off	off	off	off	on	on	on	on	on	on	on	on	on	on
RS-422-A DCE	on	on	on	on	on	on	on	on	off	off	off	off	off	off	off	off	off	off
	Port 2— SW2								**Port 2— SW2**									
RS-232-D	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off
RS-422-A DTE	off	off	off	off	off	off	off	off	on	on	on	on	on	on	on	on	on	on
RS-422-A DCE	on	on	on	on	on	on	on	on	off	off	off	off	off	off	off	off	off	off
	Port 2— SW2								**Port 2— SW2**									
RS-232-D	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off
[redacted]-422-A DTE	off	off	off	off	off	off	off	off	on	on	on	on	on	on	on	on	on	on
[redacted]-422-A DCE	on	on	on	on	on	on	on	on	off	off	off	off	off	off	off	off	off	off

Figure 25
QPC757 option switch settings for PRI/ISL low speed programming



Meridian SL-1 I/O Port Selection:
Port Address Switch Settings

Port Number		Switch 1	Switch 2	Switch 3	Switch 4
J1	J2				
0	1	Off	Off	Off	Off
2	3	Off	Off	On	Off
4	5	Off	On	Off	Off
6	7	Off	On	On	Off
8	9	On	Off	Off	Off
10	11	On	Off	On	Off
12	13	On	On	Off	Off
14	15	On	On	On	Off

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D-channel parameter downloading

For X11 release 14 and later, often software upgrades on the Meridian 1 contain changes to the D-channel parameters. The Meridian 1 software automatically downloads the new parameters to each D-channel Interface (DCHI) circuit card upon SYSLOAD. When this occurs, the D-channel is temporarily disabled and then re-enabled.

However, there are three exceptions to this automatic downloading of DCH parameters. Manual disabling and re-enabling of each DCHI is required to ensure parameter downloading in these situations:

- when performing a parallel load and switching over to the second CPU
- when the T1 loop carrying the D-channel is in alarm condition (but the D-channel is still operational) and the alarm condition is cleared
- after SYSLOAD when using ISDN Signaling Link (ISL)

Removing the QPC757 DCHI

The following procedure explains how to remove the QPC757 DCHI card.

CAUTION

The QPC757 DCHI must be software disabled before it is hardware disabled; otherwise, initialization occurs.

Procedure 25
Removing the QPC757 DCHI

1 Disable the QPC757 DCHI using LD96, command DIS DCH x.

2 Disable asynchronous port J1 in LD48, or initialization occurs.

3 Disable loop in LD60.

4 If the circuit card is being removed, not replaced, remove data from memory. See the *ISDN Primary Rate Interface description and administration* (553-2901-100) document.

5 Determine the cabinet and shelf location of the card to be removed.

6 Set faceplate toggle switch to DISABLE.

7 Disconnect QPC757 DCHI cables.

8 Remove QPC757 DCHI card.

9 Pack and store circuit card.

ISL installation for all systems

ISL configurations

The ISDN Signaling Link (ISL) feature operates in two modes (Figure 28):

- Shared mode—One DCH supports PRI with DTI or analog.
- Dedicated mode—In this mode, the DCH supports *only* ISL trunks using ISDN PRI signaling. The D-channel communicates with the far end using a dedicated leased line, dial-up modem, or DTI trunk.

It is recommended that Leased Lines be data conditioned from the Central Office to ensure the integrity of the ISL configuration.

DCHI switch settings

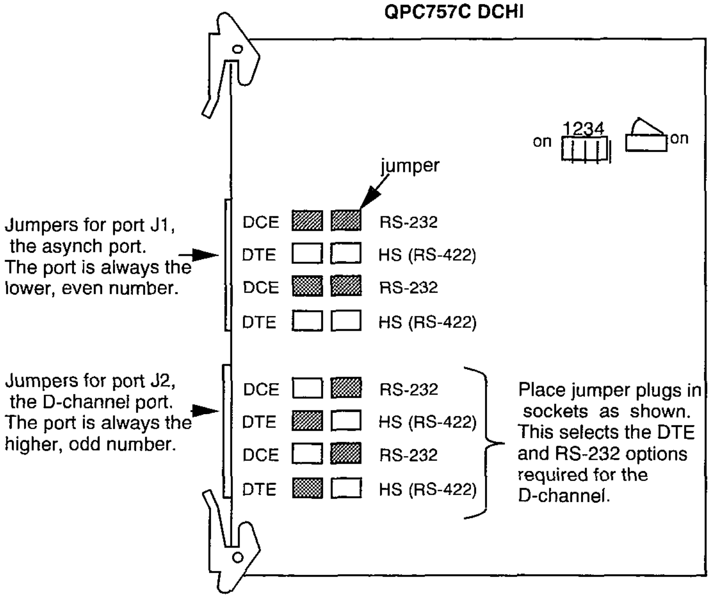
For ISL functions, use the following switch settings for the J2 port:

- DTE for high speed programming

  Note: For ISL low speed programming, see the DCHI installation section of this document.

- RS-232 for 19.2 Kbps and below
- HS for speed above 19.2 Kbps
- External clock (in LD17) provided by modem, ADM, or ASIM, otherwise DCH runs at 64 Kbps

Figure 28
ISL settings



Meridian SL-1 I/O Port Selection: Port Address Switch Settings

Port Number J1	Port Number J2	Switch 1	Switch 2	Switch 3	Switch 4
0	1	Off	Off	Off	Off
2	3	Off	Off	On	Off
4	5	Off	On	Off	Off
6	7	Off	On	On	Off
8	9	On	Off	Off	Off
10	11	On	Off	On	Off
12	13	On	On	Off	Off
14	15	On	On	On	Off

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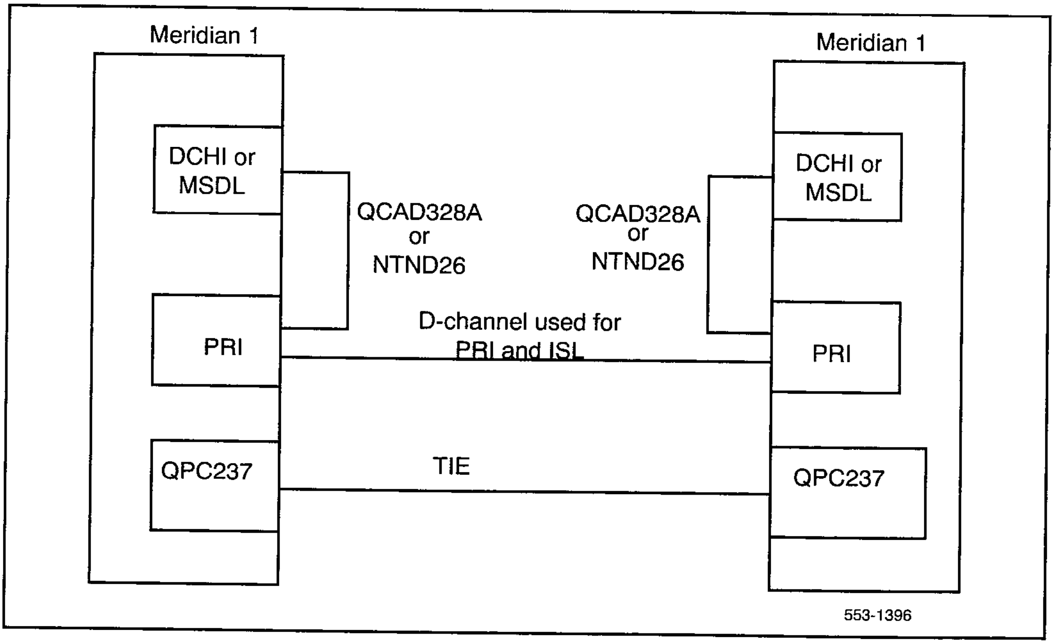
Shared mode

In shared mode, the D-channel is provided by the DCHI or MSDL card and PRI. The hardware configuration is basically the same as the ISDN PRI D-channel. See Figure 30.

Shared mode is established through service change in LD17, prompt USR, with the response SHA.

In the shared mode, the DCH can share signaling for no more than 382 trunks, including digital and analog.

Figure 30
ISL in shared mode

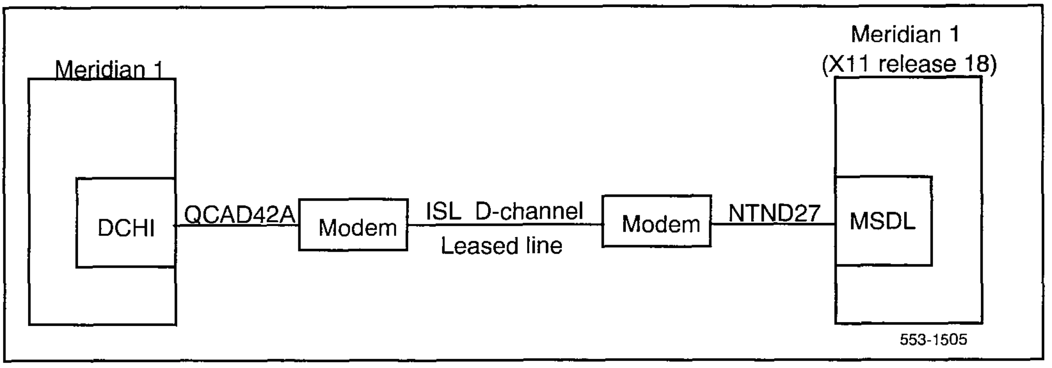


Dedicated mode using leased line

In this configuration, the D-channel connects the DCHI or MSDL to a modem, which communicates with a far-end modem over a dedicated leased line. See Figure 31. A 2400 baud D-channel can support signaling for approximately 700 trunks without non-call associated messages.

Both modems should be set in the synchronous mode.

Figure 31
ISL dedicated mode: using leased line



Dedicated mode using dial-up modem

In this configuration, the DCHI or MSDL is connected to a modem, which is connected to a 500 set line card. See Figure 32. The call is connected to the far end through the 500 set-to-TIE trunk path.

To set up the D-channel, program the modem at one end in the auto-dial mode, so it automatically initiates a call to the other end at power up. The auto-dial DN must be coordinated with personnel at the far end switch.

Installing the Hayes Smartmodem 2400

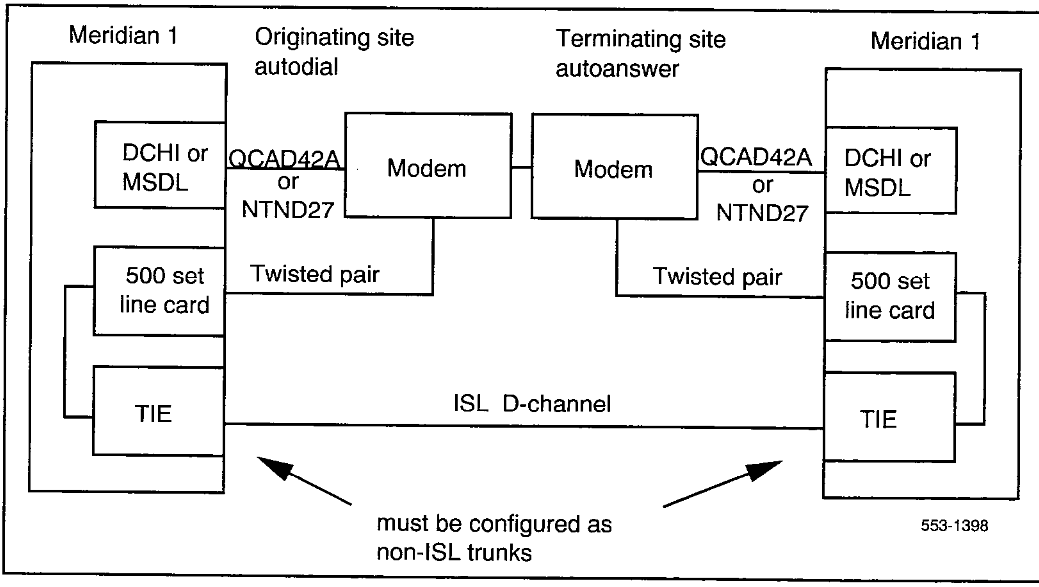
The software and hardware of the Hayes Smartmodem 2400 must be installed sequentially. The Hayes Smartmodem 2400 software must be defined before the hardware connection between the Hayes Smartmodem 2400 and the Meridian 1 can be made. Within the software installation, either the autodial or the autoanswer software can be set up first.

Examples of parameters used for actual autoanswer and autodial sites are shown on the following pages. The *Hayes Smartmodem 2400 User's Guide* contains explanations of the parameters used.

After the software parameters have been set up, the JP1 jumpers behind the front faceplate of the Hayes Smartmodem 2400 must be dumb strapped on both modems. Then see the *Hayes Smartmodem 2400 Getting Started Guide* to set up the hardware between the Meridian 1 and the modem.

> *Note:* The Hayes Smartmodem 2400 cannot be used on leased, conditioned lines.

Figure 32
ISL dedicated mode: using dial-up Hayes Smartmodem 2400



Dedicated mode using PRI/DTI trunks

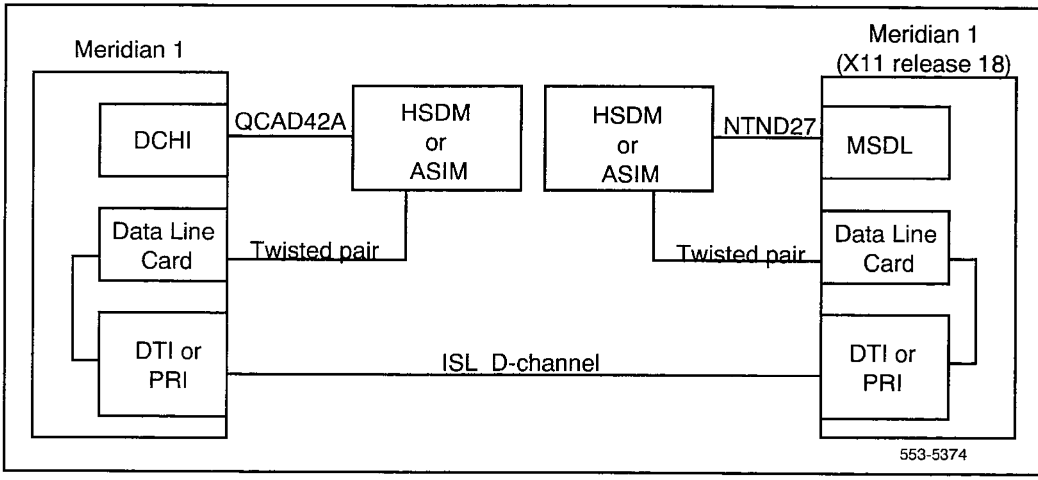
In this configuration, the DCHI or MSDL is connected to an High Speed Data Module (HSDM) or Asynchronous/Synchronous Interface Module (ASIM). See Figure 33. The HSDM or ASIM is connected to a Data Line Card (DLC). The call is then connected to the far end through the DLC to DTI trunk path.

To establish the D-channel in this configuration, set up the HSDM or ASIM at one end in hot line mode. The hot line DN must be coordinated with personnel at the far end, then programmed in LD11. The preprogrammed hot line DN is dialed by the Meridian 1. If the call cannot be established, the Meridian 1 continues to dial the hot line number continuously until the call is connected.

Set the HSDM or ASIM in synchronous mode. A data rate of 9.6 Kbps is recommended because it provides internal error detection and correction. The following data rates are also supported: 1.2 Kbps, 2.4 Kbps, 3.6 Kbps, 4.8 Kbps, 7.2 Kbps, 14.4 Kbps, 19.2 Kbps, 38.4 Kbps, and 56 Kbps for ASIM. The High Speed Data Module (HSDM) supports 64 Kbps.

> *Note:* This configuration is the least reliable because of the lockup problems inherent in Smart Modems from power splices and noisy lines. To increase the reliability on this configuration, a constant power source can be used when powering the modems. Also ensure that the TIE lines meet data grade specifications. Northern Telecom takes no responsibility for ISL D-channel outages due to modem lockup.

Figure 33
ISL dedicated mode: using PRI/DTI trunk



QMT11 switch settings—If using the QMT11 ASIM, set the dip switches, located on top of the unit under the flip-up, as follows:

— Hotline	On; See Note 1.
— Forced DTR	On; See Note 2.
— FDX (full duplex)	On
— SYNC	On
— INTernal CLK	On
— Modem/Network	Modem
— Auto Answer	On
— Loopback	Off

Note 1: Set only one side of the interface to originate the hot line.

Note 2: Forced Data Terminal Ready (DTR) automatically reinitiates a dropped hot line call.

QMT21C switch settings—If using the QMT21 HSDM, set the dip switches, located on top of the unit under the flip-up, as follows.

— Hotline	On; See Note 1.
— Forced DTR	On; See Note 2.
— FDX (full duplex)	On
— SYNC	On
— INTernal CLK	On
— Modem/Network	Modem
— Auto Answer	On
— Loopback	Off

Note 1: Set only one side of the interface to originate the hot line.

Note 2: Forced Data Terminal Ready (DTR) automatically reinitiates a dropped hot line call.

PRI cabling information

This section provides information required to build cables of nonstandard lengths for ISDN Primary Rate Interface (PRI) applications.

QCAD128/NT8D83xx

This cable transports the T1 signal from the PRI pack to the I/O panel. See Table 30.

- Standard length — 10 ft (3.05 m)
- Construction — 15-conductor ribbon, 28 AWG (0.321 mm), stranded
- P1 Connector — 15-pin, male, subminiature D, with jack-screws
- P2 Connector — 15-pin, male, subminiature D, with jack-screws

Table 30
QCAD128/NT8D83xx wire list

From	To	Signal
P1-1	P2-1	XTIP (transmit tip) to telephone company
P1-2	P2-2	GND (ground)
P1-3	P2-3	RTIP (receive tip) from telephone company
P1-4	P2-4	GND (ground)
P1-5	P2-5	
P1-6	P2-6	
P1-7	P2-7	
P1-8	P2-8	
P1-9	P2-9	XRING (transmit ring) to telephone company
P1-10	P2-10	
P1-11	P2-11	RRING (receive ring) from telephone company
P1-12	P2-12	
P1-13	P2-13	
P1-14	P2-14	
P1-15	P2-15	

QCAD133/NT8D83xx

For cabinets **with** an I/O filter assembly, this cable transports the T1 signal from the I/O filter to the Network Channel Terminating Equipment (NCTE) telephone company interface. See Table 32.

For cabinets **without** an I/O filter assembly, this cable transports the T1 signal from the QPC720 PRI pack to the NCTE telephone company interface.

- Standard length – 50 ft (15.3 m)
- Construction – Individually foil-shielded, twisted pairs, 24 AWG (0.511 mm), stranded
- P1 Connector – 15-pin, female, subminiature D with jack-screws
- P2 Connector – 15-pin, male, subminiature D, with slide-latch (optional spring-latch loose-packed with cable assembly)

Table 32
QCAD133/NT8D83xx wire list

Color	From	To	PRI signal
WHITE	P1-1	P2-1	XTIP (transmit tip) to telephone company
BLACK	P1-9	P2-9	XRING (transmit ring) to telephone company
GRN SHLD	P1-2	nc	GND (ground)
RED	P1-3	P2-3	RTIP (receive tip) from telephone company
BLACK	P1-11	P2-11	RRING (receive ring) from telephone company
RED SHLD	P1-4	nc	GND (ground)

QCAD328

This cable connects the PRI pack to the D-channel interface card, the QPC757 DCHI. There are two types of QCAD328 cables, QCAD328A and QCAD328B. See Table 33.

- QCAD328A – 6 ft (1.8 m)
- QCAD328B – 18 ft (5.5 m)
- QCAD328C – 35 ft (10.67 m)
- QCAD328D – 50 ft (15.24 m)
- Construction – 24 AWG (0.511 mm), stranded
- P1 Connector – 25-pin male, subminiature D
- P2 Connector – 15-pin male, subminiature D

Table 33
QCAD328 wire list

From	To	Signal
P1-2	P2-2	SDA+
P1-13	P2-10	SDB-
P1-20	P2-15	TR
P1-15	P2-9	STA+
P1-14	P2-11	STB-
P1-3	P2-4	RDA+
P1-16	P2-12	RDB-
P1-17	P2-5	RTA+
P1-12	P2-13	RTB-
P1-8	P2-8	RR
P1-5	P1-8	CS
P1-7	P1-1	SG
P1-1	P2-1	GND

NT8D74 Clock Controller to InterGroup cable

This cable connects the QPC471 Clock Controller card to the NT8D36 InterGroup Module.

This cable is available in the following lengths:

– NT8D74AC	1.2 m (4 ft)
– NT8D74AD	1.8 m (6 ft)
– NT8D74AE	2.4 m (8 ft)
– NT8D74AF (QCAD110B)	3 m (10 ft)
– NT8D74AJ	4.8 m (16 ft)

NT8D75 Clock Controller to Clock Controller cable

This cable interconnects QPC471 Clock Controller cards.

This cable is available in the following lengths:

– NT8D75AC	1.2 m (4 ft)
– NT8D75AD	1.8 m (6 ft)
– QCAD125	3 m (10 ft)

NT8D79 PRI/DTI to Clock Controller cable

This cable connects the PRI/DTI card to the QPC471 Clock Controller card.

This cable is available in the following lengths:

– NT8D79AB	0.6 m (2 ft)
– NT8D79AC	1.2 m (4 ft)
– NT8D79AD	1.8 m (6 ft)
– NT8D79AE	2.4 m (8 ft)
– NT8D79AF (QCAD130)	3 m (10 ft)

NT8D86 Network to I/O cable

This cable connects the following to the I/O connector panel:

– QPC414 Network card

– PRI/DTI card

– QPC659 Dual Loop Peripheral Buffer card

– NT8D47 RPE

This cable is available in the following lengths:

– NT8D86AC 1.5 m (5 ft)

– NT8D86AD 1.8 m (6 ft)

NT8D97AX PRI/DTI I/O to MDF cable

This cable connects the PRI/DTI card to the MDF through the I/O connector panel. It is 15.2 m (50 ft) long.

NT9J93AD PRI/DTI Echo Canceller to I/O cable

This cable connects the PRI/DTI Echo Canceller port to the I/O connector panel. It is 1.8 m (6 ft) long.

NTND26 PRI to MSDL cables

These cables connect the MSDL card to the PRI cards.

– NTND26AA 6 feet

– NTND26AB 18 feet

– NTND26AC 35 feet

– NTND26AD 50 feet

NTND27 MSDL to I/O panel cables

These cables connect the MSDL card to the I/O panel.

– NTND27 6 feet

NTND98 PRI to I/O panel cables

These cables connect the PRI trunk card to the I/O panel.

– NTND98 6 feet

ISDN card slot positions

The following tables illustrate acceptable positions for the QPC720, QPC414, QPC741, QPC775, QPC757, and NT6D80 cards.

Use this chart to determine where you are placing your cards before you actually begin your installation.

Table 34
Card slot positions for 21, 21E, 51, 61, 71, and 81

	21	21E	51/61	71	81
QPC414 1 slot **Net: 5-12**	CE/PE: 4-9 (Net)	CE/PE: 4-9 (Net)	CPU/Net: 1-8	Net: 5-12	
QPC720 2 slots	CE/PE: 4-8 (Net) RPE: 1, 11-12	CE/PE: 4-8 (Net) RPE: 1, 11-12	CPU/Net: 3-7 RPE: 1, 11-12	CPU: 8-12, 15-16 Net: 5-9, 13-14 RPE: 1, 11-12	Core: 0-3 Net: 5-9, 13-14 RPE: 1, 11-12
QPC471 QPC775 1 slot per CPU	CE/PE: 4-7 (Net)	CE/PE: 4-7 (Net)	CPU/Net: 9	CPU: 14	Core: 6
QPC757 1 slot	CE/PE: 4-9 (Net)	CE/PE: 4-9 (Net)	CPU/Net: 1-9, 13	Net: 5-13	Net: 5-13
NT6D80 1 slot	— —	CE/PE: 4-9 (Net)	CPU/Net: 1-8, 13	Net: 5-12	Net: 5-12

Table 35
Card slot positions for ST, STE, RT, NT, XT

	ST QCA136	STE QCA136	RT QCA147	NT QCA58	XT QCA55
QPC414 1 slot	CE: 5-12	CE: 5-12	QSD76: 3-10	QSD39: 3-10 QSD40: 5-12	QSD39: 3-10 QSD40: 5-12
QPC720 2 slots	CE: 5-12 QSD73: 2-9	CE: 5-12 QSD73: 2-9	QSD76: 5-12 QSD73: 2-9	QSD39: 5-12 QSD40: 2-10	QSD39: 5-12 QSD40: 2-10
QPC471 QPC775 1 slot per CPU	CE: 5-12	CE: 5-12	QSD76: 13	Shelf 0, QSD39: 13 for half group Shelf 1, QSD40: 2 for single group	QSD62: 14 or 15
QPC757 1 slot	CE: 5-13	CE: 5-13	QSD76: 2-10, 12	QSD39: 2-10, 12 QSD40: 5-13, 2, 3	QSD39: 2-10 QSD40: 5-13, 2, 3
NT6D80 1 slot	——	CE: 5-13	QSD76: 2-10, 12	QSD39: 2-10, 12 QSD40: 5-13, 2, 3	QSD39: 2-10 QSD40: 5-13, 2, 3

SL-1

ISDN Primary Rate Interface

Installation

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SL-1

ISDN Primary Rate Interface

Maintenance

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Standard, X11 release 15.

December 20, 1990

This document was updated to include X11 release 16 ISDN features and technical corrections. The traffic reports have been removed; see Traffic measurement (553-2001-450).

December 1, 1991

This document is issued to include changes and updates for X11 release 17. Due to the extent of changes, revision bars are omitted.

December 31, 1992

This document is reissued to include updates for X11 release 18 and MSDL cards. Changes are noted with revision bars in the margins.

April 1, 1993

This document is reissued to include information relating to X11 release 18 and option 81. Due to the extent of changes, revision bars are omitted.

August 1, 1993

This document is reissued for X11 release 19. Revisions are noted with change bars in the margins.

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Introduction

This document provides operation and maintenance procedures for ISDN Primary Rate Interface (PRI) capability on the Meridian 1. It covers the following topics:

- PRI operations guide: presents quick references for Primary Rate Interface (PRI) and D-channel (DCH) maintenance, a PRI status check, and PRI start up procedures.
- PRI fault clearing: gives steps for clearing alarm conditions, and for handling PRI and DCH problems.
- Primary Rate Interface (PRI) maintenance: covers PRI maintenance commands, tests, system messages, error detection, and cabling.
- D-channel (DCH) maintenance: covers DCH maintenance commands, tests, system messages, and tracking information.
- Clock Controller (CC) maintenance: describes clock controller operation, maintenance commands, system messages, and cabling.
- ISDN Signaling Link (ISL) maintenance: covers ISL interfaces, status formats, start-up procedures, and recovery procedures.

References

Refer to the following documents for additional information.

- *ISDN Primary Rate Interface description and administration* (553-2901-100)
- *ISDN Primary Rate Interface installation* (553-2901-200)
- *System installation and maintenance guide*
- *Multi-purpose Serial Data Link description* (553-3001-195)
- *Basic and Network Alternate Route Selection description* (553-2751-100)
- *System overview* (553-3001-100)

PRI operations guide

Primary Rate Interface (PRI) provides a digital connection from the Meridian 1 system to another Meridian 1 and to Central Office equipment (DMS-100 or AT&T 4ESS and 5ESS).

The Primary Rate Interface (PRI) circuit card, the QPC720, provides 24 channels to PRI equipment. Voice and data are transmitted over B-channels. Call control is supported out-of-band over a D-channel.

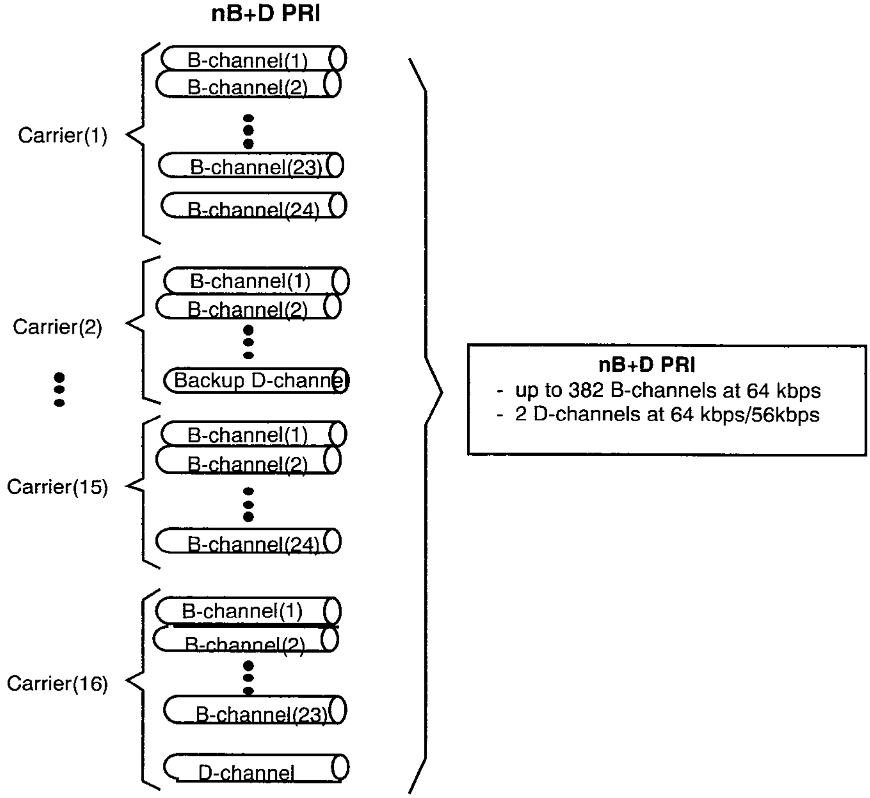
The B-channel is the fundamental channel in PRI. It carries user information to the far end, by means of T1 transmission, without carrying any signaling messages.

The D-channel transmits the standard signaling protocol, carrying the call set-up and feature activation information to the destination.

Each D-channel is physically connected to a QPC757 or NT6D11AB D-channel Interface (DCHI) card, or a NT6D80 Multi-purpose Serial Data Link (MSDL) card. The MSDL and DCHI cards provides the PRI link capability.

Refer to *ISDN Primary Rate Interface description and administration* (553-2901-100) for further explanation of the D-channel configuration.

Figure 1
Meridian 1 system PRI capacity



Note: If the maximum number of carriers are configured for nB+D (that is, 16), then it is necessary to have a backup D-channel, as shown. Otherwise, only 15 carriers can be configured per single D-channel.

553-5210

PRI quick reference

The Primary Rate Interface (PRI) card provides a 24-channel digital trunk to another telephone switch.

With X11 release 15 and later, supporting nB+D capability, the D-channel interface must configured as shown in Figure 1.

PRI commands

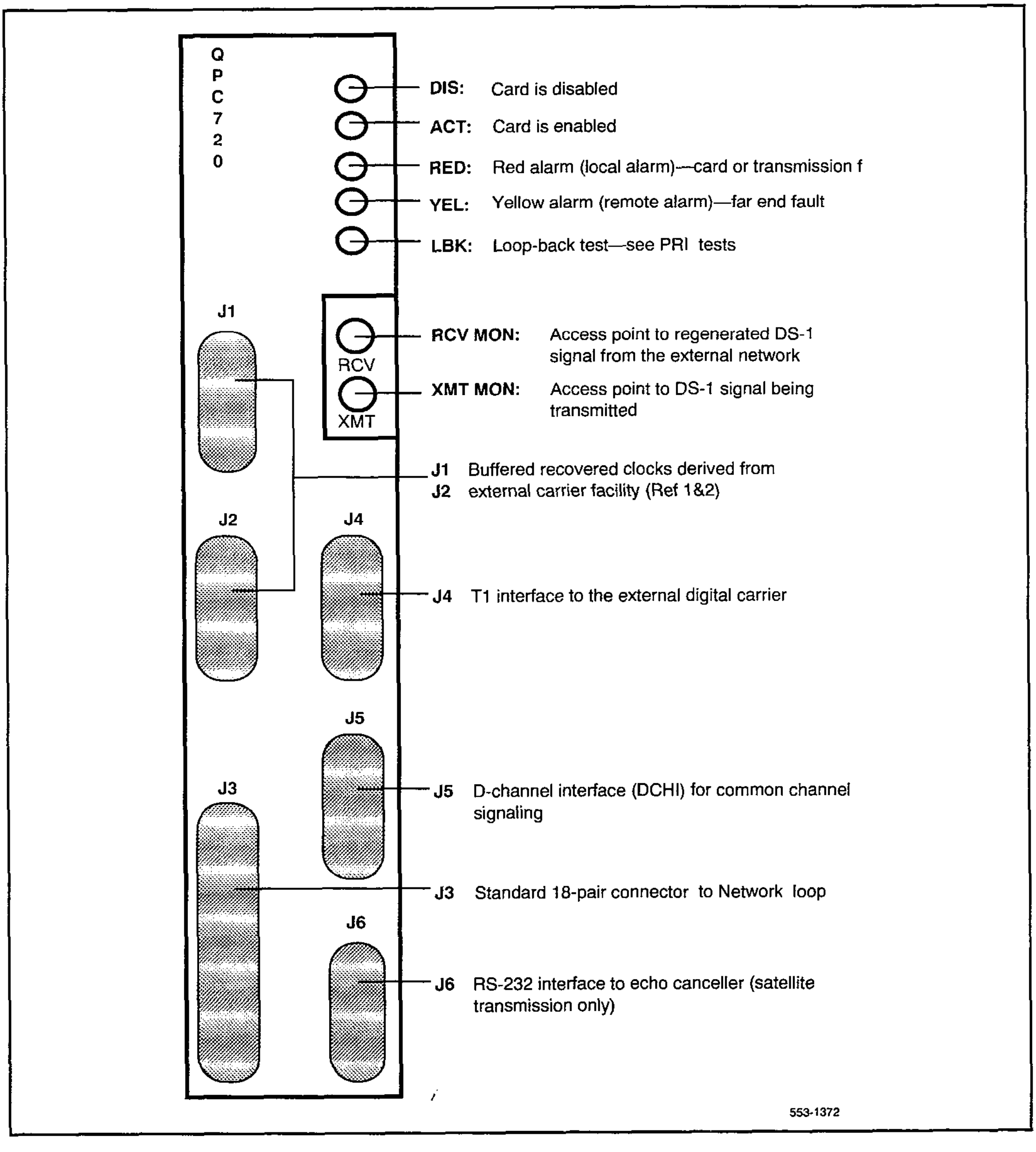
This is a quick reference list of important PRI commands. For a more extensive list of PRI commands, see the section describing PRI maintenance.

Command	Action
DISI loop	disable PRI when idle
DISL loop	force disable PRI
ENLL loop	enable PRI
LCNT (loop)	list alarm counters
RCNT (loop)	reset alarm counters
SLFT loop	do PRI self-test
STAT (loop)	list PRI status

PRI messages

PRI status and error conditions are reported with PRI messages. These messages are described at the end of this document, and in the *X11 input/ output guide* (553-3001-400).

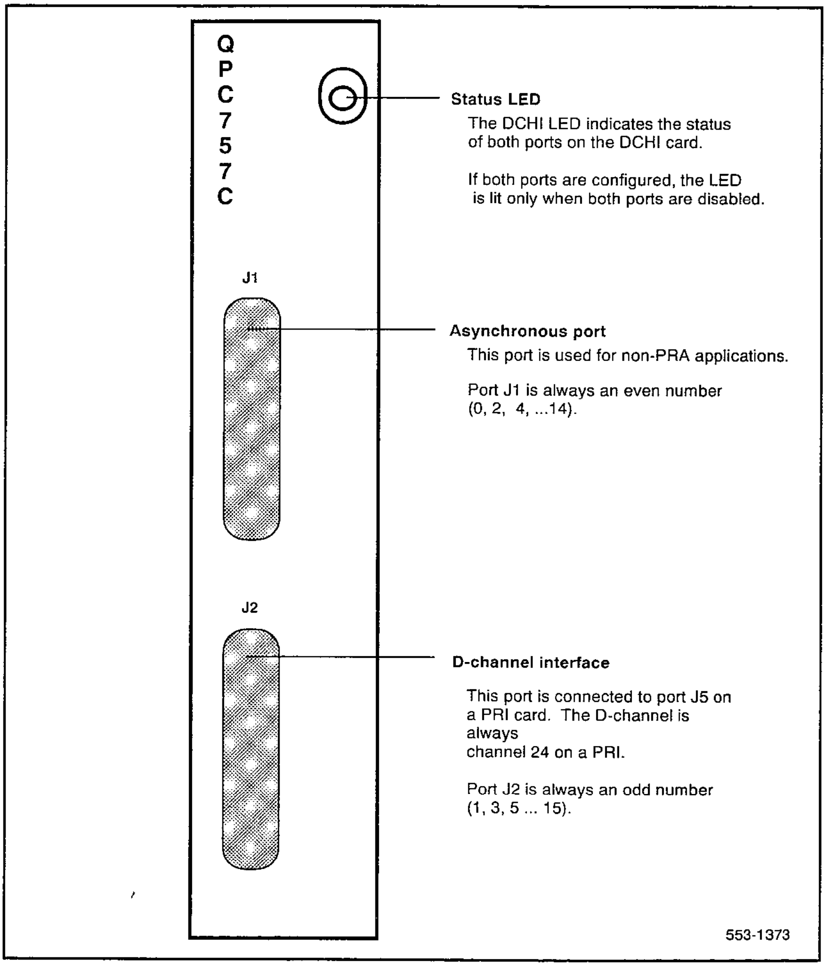
Figure 2
QPC720B PRI faceplate



DCHI quick reference

The D-channel Interface (DCHI) card provides an asynchronous port and the DCHI port. See Figure 3. The D-channel performs the call set-up and modification signaling for one or more 24-channel PRI cards. Switch settings for the DCHI port are provided in *ISDN Primary Rate Interface installation* (553-2901-200).

Figure 3
QPC757C DCHI faceplate



MSDL quick reference

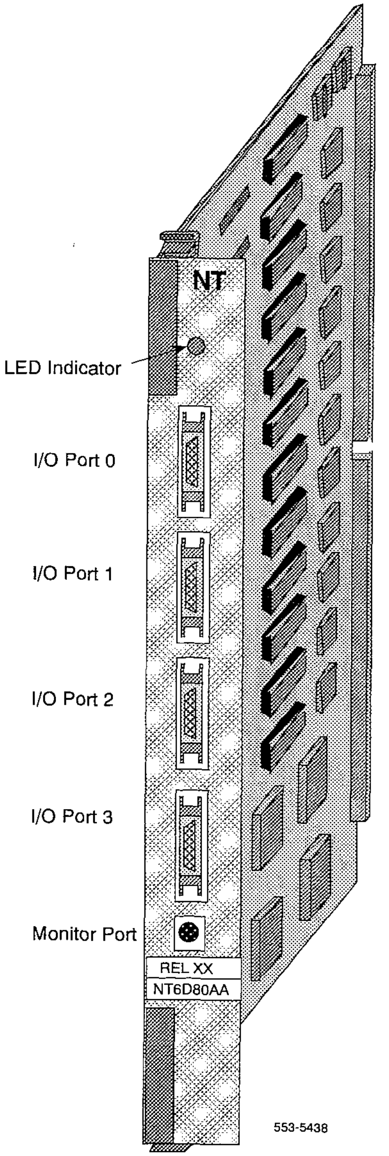
The Multi-purpose Serial Data Link (MSDL) card provides four I/O ports in a single device. Each port can be configured for asynchronous or synchronous interface, with switch settings for DTE or DCE for each port. Like the QPC757, the MSDL card performs call set up and connections with the PRI QPC720 cards. Refer to *ISDN Primary Rate Interface installation* (553-2901-200) for information regarding the switch settings.

D-channel commands (X11 release 17 and earlier)

This is a quick reference list of D-channel commands with X11 release 17 and earlier only. For a complete list of D-channel commands, refer to *X11 input/ output guide* (553-3001-400).

Command	Action
DIS DCHI x	disable DCHI port x
ENL DCHI x	enable DCHI port x
EST DCH x	establish D-channel x
PLOG DCHI x	print D-channel statistics log x
RLS DCH x	release D-channel x
SDCH DCH x	Switch to back-up D-channel x
RST DCH x	reset D-channel x
STAT DCH (x)	print D-channel status (link status)
STAT DCHI (x)	print DCHI port status (hardware status)
TEST 100/101/200/201	see DCH tests

Figure 4
NT6D80 MSDL faceplate



D-channel commands (X11 release 18 and later)

This is a quick reference list of D-channel commands for X11 release 18 and later. For a complete list of D-channel commands, refer to *X11 input/output guide* (553-3001-400).

Command	Action
DIS AUTO x	Disable automatic recovery for DCH x
DIS DCH x	Disable DCH x
ENL AUTO x	Enable automatic recovery for DCH x
ENL DCH x	Enable DCH x and attempt to establish the link
PLOG DCH x	Print error log on DCH x
RLS DCH x	Release D-channel x
RST DCH x	Reset D-channel x, inhibit signaling
SDCH DCH x	Switch to the standby D-channel x
STAT DCH (x)	Get status of one or all D-channels
TEST 100 x	Perform interrupt generation test on DCH x (QPC757 only)
TEST 101 x	Perform loopback mode test on DCH x (QPC757 only)
TEST 200 x	Perform interrupt handler test on DCH x (QPC757 only)
TEST 201 x	Test interrupt handler-to-link interface path (QPC757 only)

MSDL commands (X11 release 18 and later)

This is a quick reference list of D-channel commands for X11 release 18 and later. For a complete list of D-channel commands, refer to *X11 input/output guide* (553-3001-400).

Command	Action
DIS LLB x	Disable local loop back mode on MSDL DCH x
DIS RLB x	Disable remote loop back mode on MSDL DCH x
DIS TEST x	Disable TEST mode on MSDL DCH x
ENL LLB x	Enable local loop back mode on MSDL DCH x
ENL RLB x	Enable remote loop back mode on MSDL DCH x
ENL TEST x	Enable TEST mode on MSDL DCH x
PCON DCH x	Print configuration parameters on MSDL DCH x
PTRF DCH x	Print traffic report on MSDL DCH x
TEST LLB x	Start local loop back test on MSDL DCH x
TEST RLB x	Start remote loop back test on MSDL DCH x

D-channel messages

D-channel status and error conditions are reported DCH messages These messages are described at the end of this document and the*X11 input/output guide* (553-3001-400).

Maintenance service messages

Service messages provide near and far end switch status. Both service and service acknowledge messages are supported on PRI B-channels and ISL channels. In addition, service and service acknowledge messages for D-channels are supported between Meridian 1 and Meridian 1 only. These messages are used for backup D-channel and D-channel sanity polling. The status may be in-service and out-of service.

Service and service acknowledge messages for B-channels and ISL channels are supported between:

- Meridian 1 to Meridian 1

Service and service acknowledge messages for B-channels and PRI only are supported between:

- Meridian 1 to DMS-100
- Meridian 1 to DMS-250
- Meridian 1 to AT&T 4ESS and 5ESS

Three channel statuses are reported by the service and service acknowledge messages for B-channels and ISL channels. They are:

- in-service
- maintenance
- out-of-service

Near end and far end subcategories are defined for each maintenance status. See Table 1 for possible combinations of near and far end status, and the channel capability for each status. When the near end and far end status do not match, the more severe maintenance status takes effect over the less severe maintenance status.

Table 1
Maintenance message status

Near end status	Far end status	B or ISL channel capability for near end
In-service	In-service	both incoming and outgoing calls allowed
In-service	Maintenance	only incoming calls allowed
In-service	Out-of-service	not allowed to use
Maintenance	n/a	not allowed to use
Out-of-service	n/a	not allowed to use

Service message function

Service messages are used to monitor the following:

- D-channel establishment
- D-channel sanity polling
- B-channel or ISL channel status change
- Channel status audit

D-channel establishment

When the D-channel establishes, the B-channel status is supported by sending service messages for each B-channel controlled by a D-channel. This allows the far end to synchronize its channel states. These service messages are sent when the D-channel is brought up automatically by the system or manually by using LD96.

This function is supported by Meridian 1 to Meridian 1 connections only.

D-channel sanity polling

If a D-channel has been idle for 30 seconds, a service message is sent to poll the sanity of the link. The service message is sent regardless of whether the near end is configured as a master or a slave.

B-channel or ISL channel status change

Whenever there is a status change for a B-channel or an ISL channel, the new status is reported to the far end by means of a service message. Status change can occur through service change or maintenance operations, such as the addition or deletion of a channel in LD14, or the enabling or disabling of the associated loop, shelf, card or unit in LD30, LD32, LD36, LD41, or LD60.

Channel status audit

LD30 is enhanced to allow channel status audit to be initiated. The channels associated with each D-channel are examined and their status is reported to the far end by means of service messages.

Service message commands

You activate the service messages in LD96 on a per D-channel basis. The commands are:

- ENL SERV x: Turns on the support of service and service acknowledge messages for D-channel x. The primary and backup D-channels must be disabled before enabling service messages.
- DIS SERV x: Turns off the support of service and service acknowledge messages for D-channel x.
- STAT SERV (x): Displays the current service and service acknowledge message SERV setting for individual DCH n or for all D-channels.

When configuring these messages, the SERV command should only be enabled if both switches are equipped with X11 release 15 software.

> *Note:* The ENL SERV and DIS SERV commands apply to both the primary and backup D-channel. With backup D-channel configured, for example LD17 DCHI = 5 and LD17 BCHI = 7, ENL SERV 5 enables both D-channels 5 and 7. Similarly, DIS SERV 5 disables both channels.

Two new statuses are added in X11 release 15 for maintenance messages, FE MBSY, Far end maintenance, and FE DSBL, Far end disabled. The FE MBSY, FE DSBL, and IDLE messages appear when either the B-channel or the ISL channel is idle. See "PRI fault clearing" on page 37 for more information about these responses.

PRI status check

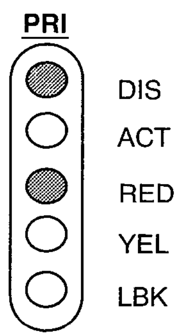
This status check is used to verify that a PRI is working normally. It assumes the PRI and DCHI/MSDL are properly installed (for example, correctly cabled) and operational. If the PRI status is not as shown in the steps below, complete the check and proceed to PRI fault clearing procedures.

Once all problems are cleared, go to PRI start-up.

Procedure 1
PRI status check

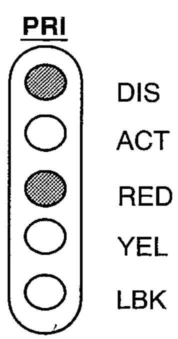
1 Check the status LEDs on all PRI cards.

For normal operation, only the green ACT LED is lit. Note if any other LED is lit and continue with the status check



553-1340

2 Check the LED on the DCHI or MSDL faceplate.



553-1340

If the LED is lit, the D-channel is disabled.

Note: The DCHI LED indicates the status of both ports on the DCHI card. If both ports are configured, the LED is lit only when both ports are disabled.

Check the status of the DCH port using:
LD 96
STAT DCH (x)

3 Check the status of all PRI cards using:
LD 60
STAT (loop)

sample response:

PRI TRK LOOP L: ENBL
SERVICE RESTORE: YES
YELLOW ALARM PROCESS: YES
ALARM STATUS: NO ALARM
CH 1 IDLE DID
CH 2 BUSY TIE
.
.
CH 24 D-channel

4 List PRI alarm counters using:
LD 60
LCNT (loop)

(Check the out of service counters to determine the number of out of service occurrences since last execution of the midnight routines.)

response:

BVP xxxx
SLIPR xxxx
CRC xxxx
LOSFA xxxx
OS _BVP xxxx
OS_LOSF xxxx
OS_YEL xxxx

5 Check DCHI or MSDL card and D-channel (DCH) link status using:
LD 96
STAT DCH (x)
(x is the I/O port number)

the D-channel status should be
OPER (operational)

the DCH status should be
EST (established)

6 Check to assure the following PRI cables are connected correctly:

— PRI to DCHI or MSDL cable

— T1 cable from QPC720B to DSX (the digital cross connect)

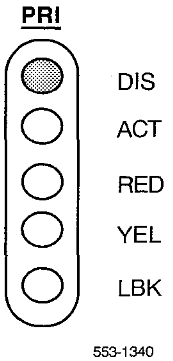
PRI start-up

This procedure shows how to take the PRI and DCH from disabled to operational.

Procedure 2
PRI start-up

1 Check the status of all PRI cards.

The PRI shown is disabled.
If any other LEDs are lit, go to PRI fault clearing.



2 Test all PRI cards using:
LD 60
ISL loop
LFT loop

response:
SLFT OK

3 Enable all PRI cards using:
LD 60
ENLL loop

response:

PRI000	Correct version ID
DTA005	yellow alarm (remote alarm)
DTA007	yellow alarm cleared (provided the far end is up)
DTA023	PRI loop is up
DCH1010	D-channel is disabled

4 Enable the D-channel(s) using:
LD 96
ENL DCH x
(x is the I/O port number)

response:

DCH x EST Time and Date

D-channel is established (provided far end D-channel is OK).

If you do not get the DCH EST response, see the note in step 5.

5 Perform a PRI status check.

Note: If the status check response is RLS, establish the link at this point by entering the command:

EST DCH x

Network Call Trace

Network Call Trace is available with X11 release 17 and later to trace a network call and to diagnose network problems. When a network call is blocked, trace data is output indicating the reason the call was blocked and the X11 software procedure responsible.

A network call can be traced by dialing a SPRE code and the NCT feature code (9912) before the network number. When this is done, call set-up and status information is output to the system terminal as the call tandems through the network. The trace information is output to all the system terminals designated in LD17 as ADAN = TTY and USER = MTC.

NCT provides useful information such as the following.

- the route used
- the facility accessed
- the routing control imposed
- the call-blocked location

There are two Network Call Trace functions: 01 and 02. They output different information as shown in the following sections.

Configuring Network Call Trace

To configure Network Call Trace on the Meridian 1, log in to the system and:

- enter NCT in response to prompt RCAP in LD17 for each D-channel (only required when the remote end is Meridian 1 with X11 release 17)
- enter CLTA in response to prompt CLS in LD10 or LD11 to allow a telephone to trace calls

Tracing a call

A call can be traced from any attendant console or a telephone with CLTA class of service (CLS). To trace a call dial the following.

SPRE + 9912 + xx + yyy...

where

SPRE = special function access code (defined in LD15)
9912 = NCT feature code
xx = call trace function (01, 02)
Dial tone is provided after "xx" is dialed.
yyy... = digits normally dialed for the network call

Trace function 01

This function provides the common information related to ESN routing. It is the recommended function. The call trace data for function 01 is:

```
**** NCT xx ****
<switch specific data>
--- OUT ---
<outgoing data>
--- IN ---
<incoming data>
--- STATE ---
<call state>
```

Where xx is the call trace ID for a traced call. The output data depends on the type of call and can be the following.

CAUSE xxxx – call reject cause
CREF xxxx – call reference number
DCH – D-channel number
DGT xxxxx... – outgoing: digits outpulsed
DGT xxxxx... – state: digits received (NODE=TBD), or
digits dialed when the call is rejected (STAT=REJ)
DN xxx – DN of ringing set
ENT xx – entry in the outgoing route list
FCI x – free calling area index
FRL x – facility restriction level

IFC xxx – outgoing D-channel interface (LD17 prompt IFC)
- D100 = Meridian DMS-100
- D250 = Meridian DMS-250
- ESS4 = AT&T ESS4
- ESS5 = AT&T ESS5
- SL1 = Meridian SL-1
- S100 = Meridian SL-100
- SS12 = Norwegian SYS-12
- AXEA = AXE-10 (Australia)
- UNKN = unknown data received

LOC xxxx – call reject software location

MODE xxx – outgoing termination
- ALOG = analog trunk
- DTI = digital trunk interface–1.5 Mb/s
- DTI2 = digital trunk interface–2.0 Mb/s
- ISL = ISDN Signaling Link
- PRA = Primary Rate Interface
- UNKN = unknown data received

NCOS xx – Network class of service

NODE xxxx – type of node
- ORIG = originating node
- TAND = intermediate node (tandem)
- TERM = terminating node
- TBD = node undetermined

RLI xxx – ESN outgoing route list index

RLS xx xx – software release, issue number of node switch

RTE xxx – incoming or outgoing route number

SID xxxx – system identification (LD17)

STAT xxxx – call state, where xxxx can be
- ANS = call answered
- BUSY = termination busy
- DIAL = call state is dialing (mainpm)
- ERR = error detected in this message
- OPULSE = digit outpulsing
- PROC = call proceeding through this node (tandem)
- REJ = call rejected or blocked
- REOR = call state is dialing (mainpm)
- RING = call ringing
- SEIZ = trunk seized

STYP xx – terminating station type
500 = single line telephone (LD10)
BCS = multi-line telephone (LD11)
ATT = attendant console (LD12)
TKTP TIE,COT,WAT... – incoming or outgoing trunk type
TKTN loop ch, l s c u – incoming or outgoing B-channel, ISL trunk TN
TN l s c u
TN of originating telephone
TOD x – time of the day schedule
TYP I,E – Initial/Extended set
XLT NPA,NXX,LOC... – ESN translation type

Example 1: Successful call with trace function 01

In this example, the following digits are dialed from a telephone at TN 0 0 5 1.

1+9912++01+78+6000

where,

1 = SPRE (defined in LD15)
9912 = NCT feature code
01 = call trace function 01
78 = PRI route access code (ACOD)
6000 = remote extension

The resulting trace information is output on the maintenance terminal:

```
**** NCT # 22 ****
NODE ORIG (SL1)
SID 0
RLS 17 53
--- OUT ---
TNS 0 0 5 1
DCH 5
IFC SL1
CREF 22
MODE PRA
RTE 24
TKTP TIE
TKTN 18 22
DGT 6000
--- STATE ---
 STAT PROC
```

```
**** NCT # 22 ****
NODE ORIG (SL1)
SID 0
RLS 17 53
--- OUT ---
DCH 5
RTE 24
TKTP TIE
TKTN 18 22
DGT 6000
--- STATE ---
STYP BCS
DN 6000
STAT RING
```

Example 2: Unsuccessful call with trace function 01

In this example, the same call is made as in example 1, but in this case the D-channel is down.

The resulting trace information is output on the maintenance terminal:

```
**** NCT # 22 ****
NODE ORIG (SL1)
SID 0
RLS 17 53
--- OUT ---
TNS 0 0 5 1
MODE UNKN
--- STATE ---
DGT 786000
STAT REJ
LOC 99
```

Trace function 02

Call trace function 02 provides the information from the active (main) call register, the incoming call state, and the outgoing call state (if any). Trace function 02 is intended as a debugging tool for system designers.

The information output by function 02 includes:

NODE ORIG,TAND,TERM,TBD
SID xxxx – system identifier
RLS xx xx – release of software, issue number of node
TNS l s c u – TN of the originating set
CREF xxxx – call reference number

Incoming call:

ISTATPM x – incoming state progress mark
ITRKPM x – incoming trunk progress mark
LOC xxxx – call reject software location

Outgoing Call:

OSTATPM x – outgoing state progress mark
OTRKPM x – outgoing trunk progress mark
LOC xxxx – call reject software location

Main call register:

Word 0 – MainPM/AuxPM
Word 1 – CRlink
Word 2 – Queue_In
Word 3,4 – Son_Types/Processes
Word 5 – Aux_CRlink
Word 6 – OrigType/TerType
Word 7 – TTR_TN
Word 8 – OrigTN
Word 9 – TerTN
Word 10 – CallFwdTN
Word 11 – DISA_Call/XFER_indication
Word 12,13 – CR_Dialed_DN
Word 14 – Digitload/Digitunload
Word 15-20 – digits

Feature requirements

Network Call Trace is limited to basic ISDN PRI/ISL calls across Meridian 1 private networks.

NCT collects information only during initial call setup. It does not report on further call modification, such as Call Transfer.

Network call information is lost and the call trace ceases when any of the Meridian 1 nodes in which the call is being traced is initialized or any of the D-channels fails.

Although NCT requires PRI or ISL, calls can be traced to nodes that do not support Network Call Trace. Calls can also be traced to DTI or analog trunks. However, only the local node information is provided. Trunk types not supported: ADM, AWU, DIC, MDM, MUS, PAG, RAN, RLM and RLR.

Call trace information is still output if the call is blocked before the trunk is seized. If queuing (Ring Again, CBQ or OHQ) is available, then the original call trace function is activated when the call is offered to the user.

When a remote Meridian 1 without NCT capability receives a Call Trace message, no call trace information is returned.

PRI fault clearing

PRI red alarm (local alarm)

A PRI red alarm (local alarm) can indicate T1 transmission problems, the PRI is disabled, or the PRI card is faulty.

Under any of these alarm conditions, all 24 channels are taken out of service as follows:

1. Meridian 1 software checks every 15 minutes to see if a clock controller or reference clock error has occurred.

   If the 15-minute check finds the PRI in red alarm (local alarm) was a primary clock source, the software switches the clock controller to the secondary reference.
2. The PRI red alarm (local alarm) faceplate LED is lit.
3. Calls on the PRI are disconnected automatically.
4. The PRI card and all 24 channels are disabled.
5. After a pause of 2.5 seconds, the PRI sends a yellow alarm (remote alarm) signal to the far end.
6. The appropriate DTA message is printed and a minor alarm is raised on all attendant consoles within the same customer group.

Channel restoration

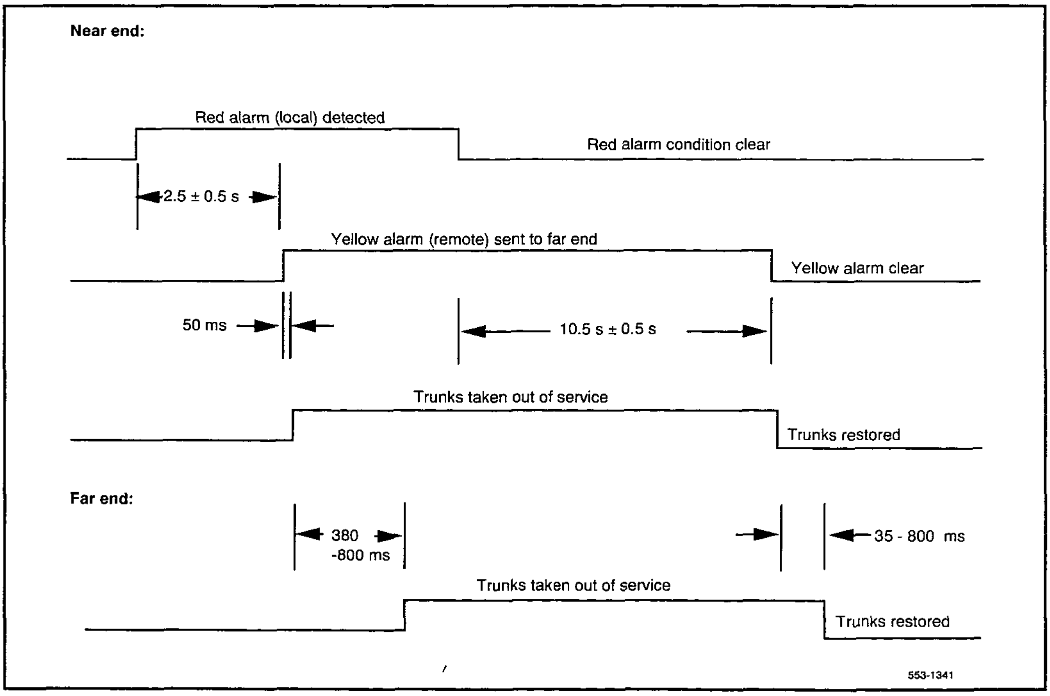
When the alarm condition improves, the PRI is restored to service as follows:

1. The Red alarm (local alarm) is cleared.
2. After 11 seconds, the PRI stops sending a yellow alarm (remote alarm) pattern to the far end.
3. With B-channel signaling (and the D-channel is established), channels are placed into the idle state and made available for calls.

   With A&B bit signaling, TIE trunks are made to match the state of the far end (as presented by the T1 port).

Figure 5 shows the progression of the Meridian 1 system red and yellow (local and remote) alarm timers.

Figure 5
PRI alarm timers



Procedure 3
Red alarm status check

1 Check PRI status using the following prompts:
LD 60
STAT (loop)

2 Check PRI alarm counters using the following prompts:
LD 60
LCNT (loop)

3 See Table 2 for solutions to possible PRI problems.

PRI yellow alarm (remote alarm)

A yellow alarm on the Meridian 1 indicates a problem at the far end (the remote end). The fact that the PRI is receiving the yellow alarm pattern indicates that there is a T1 connection, but the far end is not ready.

When the PRI receives the yellow alarm (remote alarm) signal from the far end, all 24 channels are disabled.

Channel restoration

When the PRI stops receiving the yellow alarm, and the D-channel is established, the channels are placed into the idle state.

Each time a yellow alarm is generated, a counter is incremented. When the yellow alarm 24-hour threshold (prompt RALM in LD73) is reached, the PRI must be restored to service manually.

Procedure 4
Yellow alarm status check

1. Perform a PRI status check.
2. Contact personnel at the far end to determine what action they are taking.

When the yellow alarm (remote alarm) 24-hour threshold is reached (DTA006 is printed):

1. Contact personnel at the far end to determine what action they are taking.
2. When the far end troubles are cleared, reset the alarm counters and disable, then enable the PRI. To do this, use the following commands:

LD 60	
LCNT loop	list alarm counters
RCNT loop	list alarm counters
DISL loop	disable loop
ENLL loop	enable loop

PRI problems

The PRI can have any of the following problems. Determine the cause of the problem and follow the recommended actions provided in Table 2.

Table 2
PRI problem solving (Part 1 of 2)

Symptom	Action
No connection to far end. If the T1 cable is not physically connected to the far end, frame alignment errors occur. The channels will be disabled, but the PRI will be in red alarm (local alarm) mode.	Use the Error Counter to verify the T1 transmission from the PRI faceplate (RCV and XMT) to each connection (cross-connect, LD-1 repeater, CSU, and such equipment).
PRI fails self-test	— Reset the PRI card and network loop cable — Add a loopback plug (with pin 1 jumpered to pin 3 and pin 9 to 11) to J14 on the PRI card. — Replace the PRI card — Replace the network card
Far end problems, usually indicated by a yellow alarm (remote alarm).	Do a PRI status check and contact personnel at the far end.
PRI T1 is connected but getting bit rate or frame errors. This can be caused by: — a bad T1 cable connection — electrical interference — carrier problems (for example, defective repeater or cross talk)	Use the Error Counter to verify the T1 transmission from the PRI faceplate (RCV and XMT) to each connection (cross-connect, LD-1 repeater, CSU, and such equipment).
Cannot enable the PRI.	Problem due to one of: The far end PRI is disabled, indicated by: — PRI000PRI is responding — DTA005loop enabled, with yellow alarm — DCH1010DCHI is software disabled — DTI031yellow alarm (remote alarm)

Table 2
PRI problem solving (Part 2 of 2)

Symptom	Action
	There is no T1 connection, indicated by: — PRI000PRI is responding — DTI030loop enabled with red alarm — DTA021loss of frame alignment for 3s — DCH1010DCHI is software disabled
Meridian 1 initializes and there are no active B-channels.	When a PRI or ISL trunk interfaces with a DMS-100, Meridian SL-100, or AT&T 4ESS/ 5ESS and the Meridian 1 initializes, you may have to disable and then enable each B-channel.
Configuration settings do not match the far end. These problems can occur during initial start-up. They may be indicated by: — DTA 018, Frame slip out of service limit — DTA 021, Loss of frame alignment for 3 seconds — DCH 1003, D-channel MDL errors	See that the following Meridian 1 PRI parameters correlate to the far end: **Frame format** LD17 prompt: DLOP response: D2, D3, D4, or ESF **Line coding** LD17 prompt: LCMT response: B8ZS or AMI **D-channel transmission rate** LD17 prompt: DRAT response: 56K, 64KC, or 64KI **Yellow alarm (remote alarm) method** LD17 prompt: YALM response: FDL or DG2

D-channel problems

D-channel problems are indicated when the DCHI or MSDL releases after being enabled. This applies to both primary and backup D-channels. For example:

LD 96

ENL DCH x	DCH 1003	protocol error
	DCH 1006	link establishment error
	DCH RLS	DCHI released

Procedure 5
D-channel status check

1 Check the status of the D-channel's PRI. Clear any PRI problems.

2 Contact the far end. If the far end D-channel is down, the DCH1006 message is printed.

3 Test the QPC757 DCHI (only) using tests 100, 101, 200 and 201 (the tests must be run in sequential order).

4 Print the protocol log using:
LD 96
PLOG DCH x

5 Check the DCHI or MSDL to PRI cable.

6 Check DCHI card jumper settings.a

7 Check to see that one Meridian 1 is designated as "master" (usually the larger system), the other as "slave."

Note: This applies only to a Meridian 1 to Meridian 1 configuration.

PRI local loop back test

This test checks the communication path between the QPC414 Network card and QPC720 PRI card. It also checks the leads for the J4. It is often performed when the PRI cannot be enabled. The PRI card must be installed, and a cable connecting its J3 connector to a QPC414 Network card.

1 Disable the DCHI:
LD96
DIS DCH x

2 Disable the PRI loop:
LD60
DISL loop

3 Disconnect the cable connector from the QPC720 J4 (if attached). Several LEDs will light on the faceplate.

4 Attach a female 15 pin connector loopback plug to J4. The loopback plug must have pins 1 and 3, and pins 9 and 11 shorted together.

5 Enable the PRI loop:
LD60
ENLL loop

The green ACT LED will light in a few seconds. If so, the test passed. Continue with the following steps.

If the green ACT light does not come on, retest. Unseat the PRI card between steps 2 and 3.

If the light still does not turn on, try replacing your QPC414 or QPC 720 cards, or the connecting cable.

6 Remove the loopback plug from the J4 connector.

7 Replace the cable removed at Step 3.

8 Enable the loop:
LD60
ENLL loop

9 Enable the DCHI card:
LD96
ENL DCH x

PRI self-test

The self-test checks speech path continuity, zero code suppression, remote alarm detection, and A&B bit signaling. This test is performed manually, on a per channel or a per frame (24 channels) basis.

The DCHI and PRI must be disabled before performing the self-test or call processing is disrupted. To perform the self-test on a specific loop:

1. Disable DCHI:
   LD96
   DIS DCHI x
2. Disable the PRI loop and run the self-test:
   LD60
   DISL loop
   SLFT loop
   When the system returns OK, it indicates that the hardware is operable.
3. Re-enable the PRI loop:
   LD60
   ENLL loop
   The D-channel will re-enable automatically.

PRI automatic loop test

The automatic loop test checks the same functions as the self-test. Unlike the self-test, it can be run automatically, as part of the midnight routines.

With the ATLP command set to one:

If all 23 channels are idle at midnight, the system disables the card and performs a self-test on all channels.

If any of the 23 channels are busy at midnight, the system disables one idle channel, chosen at random, and checks it while the card is enabled.

With the ATLP command set to zero, only one channel is tested. The channel tested is randomly selected by software; it cannot be specified.

To perform the remote loop-back test, use the following:

LD60
ATLP 1 or 0

When ATLP 1 is entered, the TTY prints out AUTO TEST ENBL. When ATLP 0 is entered, the TTY prints out AUTO TEST DSBL.

Link diagnostic and remote loop-back tests

The remote loop-back test and the link diagnostic test are performed manually on a per channel or a per frame (23 channels) basis.

Link diagnostic test

The link diagnostic test, also called the far end loopback test, does not test the Meridian 1 PRI. It puts the PRI in loop-back mode at the far end so a remote loop-back test can be performed on far end equipment. The PRI channel, loop, or frame tested must be disabled.

Remote loop-back test

The remote loop-back test, also called the near end loopback test, checks the integrity of the PRI from the Meridian 1 system to the far end. The far end must be put into loop-back mode before this test can be performed. The PRI channel, loop, or frame tested must be disabled.

Coordinating the tests

When a technician at the far end asks for loop-back mode on the Meridian 1, perform the following steps.

1 Disable the DCHI:
LD96
DIS DCH x

2 Disable the PRI loop and activate loop-back mode:
LD60
DISL loop
RLBK loop
The QPC720 LBK LED lights.

When a technician at the far end asks for loop-back mode on the Meridian 1 to be disabled, perform this step.

Disable loopback mode:
LD60
DLBK loop
The LBK LED turns off.

When a technician at the far end asks for PRI and DCHI to be re-enabled, perform this step.

Enable the PRI loop:
LD60
ENLL loop
OK will print out. The D-channel re-enables automatically.

To run the remote loop-back test on the Meridian 1, call a technician at the far end and ask for loop-back mode at that facility.

When loop-back mode at the far end is confirmed, the technician at the far end follows these steps.

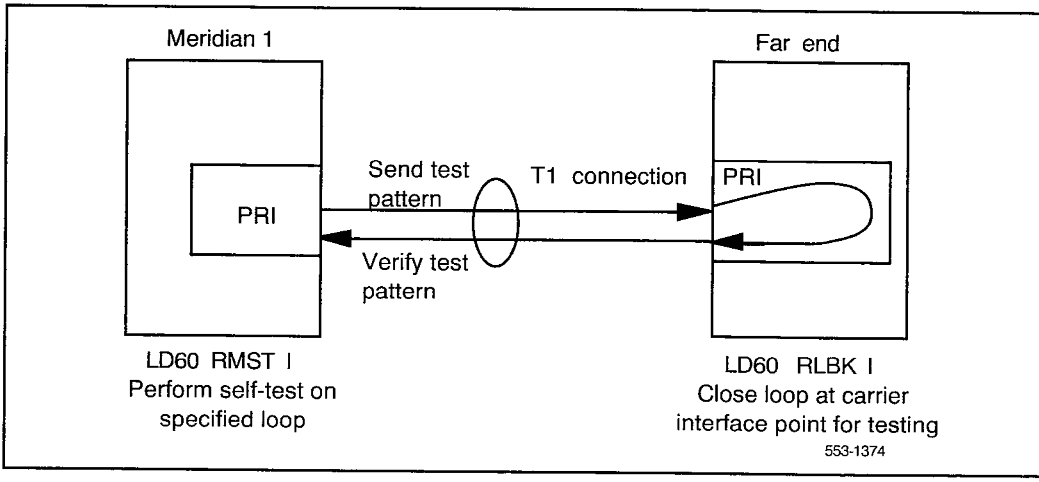
1 Disable the DCHI:
LD96
DIS DCH N

2 Disable the PRI loop and run the loop-back test using:
LD60
DISL L
RMST L
SLFT OK prints out to indicate a successful test.

3 Call the far end technician to disable the loopback test, and to re-enable the PRI and DCHI. The far end technician enables the PRI:
LD60
ENLL L
OK prints out, and the D-channel re-enables automatically.

Figure 6 shows the relationship between the remote loopback test and the link diagnostic test.

Figure 6
PRI remote loop-back and link diagnostic tests



PRI commands (LD60)

PRI diagnostic commands are used to maintain both PRI and clock controller operation. See LD60 at the end of this document for a list of the PRI card and channel commands in LD60. PRI midnight routines

The following PRI maintenance routines should be included in midnight routines:

- LD30: Network and signaling diagnostic
- LD60: Digital trunk interface diagnostic
- LD95: Automatic trunk maintenance diagnostic
- LD48: Link diagnostic

PRI messages

There are three types of system messages—DTA messages, DTI messages, and PRI messages. These messages are provided at the end of this document.

PRI error detection

There are four types of error detection:

- Yellow (remote) alarm
- Bit error rate
- Frame alignment
- Frame slip

PRI hardware detects BPV or CRC errors. It sends an overflow (OVFL) message to the Meridian 1 CPU each time 1024 BPV or CRC errors are detected. Running the midnight routines prints the number of overflows and clears the counter.

Yellow alarm (remote alarm)

A yellow alarm indicates that the far end (the remote end) is not ready. If the PRI is receiving the yellow alarm pattern, it indicates that there is a T1 connection. When the PRI receives a yellow alarm signal from the far end, all 24 channels are disabled.

The yellow alarm method used depends on the framing format (D2, D3, D4, or ESF) selected. If D2, D3, or D4 framing formats are chosen, Digit 2 yellow alarm is automatically selected by software. If the ESF framing format is chosen, the yellow alarm method must be set through service change.

- Digit 2 (DG2) yellow alarm signaling is provided by external circuitry. This alarm is detected when each digit 2 in 63 contiguous channels is logic zero. Use DG2 yellow alarm signaling with D2, D3, and D4 frame formats in Canada and the U.S. Also use DG2 yellow alarm signaling with the ESF frame format in Canada, in compliance with Canadian standard CS03.
- Facility Data Link (FDL) yellow alarm signaling is a 4 Kbps channel. In the U.S., use FDL yellow alarm signaling when the ESF frame format is selected.

When the PRI stops receiving the yellow alarm, channels are placed into the idle state and made available for calls. (In comparison, tie trunks using A&B bit signaling are made to match the state of the far end, as presented by the T1 port.)

Each time a yellow alarm is generated, a counter is incremented. When the remote alarm 24-hour threshold (prompt RALM in LD73) is reached, the PRI must be restored to service manually.

Maintenance and out-of-service thresholds are used to monitor the performance of PRI bit error rate, frame alignment and frame slips. These thresholds are defined in LD73. When a threshold is reached, the following actions are taken:

- Maintenance threshold: PRI warning message is output
- Out-of-service threshold:
  loop is placed in red alarm
  yellow alarm sent to far end
  PRI warning message is output
  minor alarm is lit at the customers attendant consoles

Bit error rate

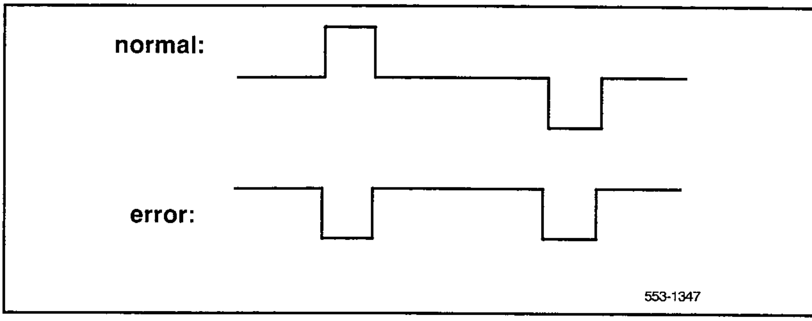
Bit error rate monitoring detects errors in transmission. See Figure 7. There are two methods of bit error rate monitoring, bipolar violation tracking and Cyclic Redundancy Check (CRC). If the D3 framing format is selected in LD17, prompt DLOP, bipolar violation tracking is implemented. If the Extended Superframe Format (ESF) is selected, CRC is implemented.

Bipolar violation (BPV) tracking

In a bipolar pulse stream, pulses alternate in polarity. A bipolar violation has occurred if, after transmission, two pulses of the same polarity are received in succession (this could be caused by an electrical disturbance such as noise).

Note: Some bipolar violations could result from a far end using B8ZS line coding while the near end expects AMI line coding.

Figure 7
Bipolar violations



Cyclic redundancy check (CRC)

The Extended Superframe Format (ESF) contains a checksum of all the data in the frame. The receiving side uses the checksum to verify the data.

The primary difference between BPV and CRC is that bipolar violation tracking indicates errors on the local span, while CRC indicates errors on an end-to-end span. For example, on a satellite link, BPV only detects errors in the span between the Meridian 1 and the satellite connection. Since CRC traverses the entire span, it indicates an end-to-end bit error rate.

The CRC error counter is displayed with the LCNT L command in LD60 provided that loop L has been defined with ESF as a framing format. The framing format (D2, D3, D4, or ESF) is selected in LD17 when the loop is configured.

Bit error rate thresholds

There are three bit error rate thresholds set in LD73. When a threshold is reached, a DTA message is output. See Figure 8.

DTA011:	Bit error rate maintenance threshold.
DTA012:	Bit error rate out of service limit.
DTA013:	Too many bit error rate out of service occurrences in 24 hours.

The BIPV thresholds are based on the number of errors in a given time. The threshold levels are shown in Table 3.

For example, if the default BIPV thresholds are used, DTA011 is output when the number of errors exceed 15.4 per second. DTA012 is output when the number of errors exceed 154 per second.

When the error rate improves two levels, the PRI is restored to service unless the 24 hour out-of-service counter was exceeded.

Table 3
BIPV thresholds

Level	Error rate	Elapsed time (seconds)	Number of BPV allowed during elapsed time
least tolerant			
1	>10-3 (1544 BPV per s)	0.6639	1025
2	>10-4 (154 BPV per s)	.639	025
3	>10-5 (15.4 BPV per s)	6.39	025
4	>10-6 (1.54 BPV per s)	663.9	1025
most tolerant			

Figure 8
BIPV and BIPC thresholds

DTA 011—maintenance threshold
A warning message is printed.

BIPV 1 - (3) - 4
1 - (2) - 4

DTA 012—out of service threshold
The PRI is taken out of service and red alarm (local alarm) is raised. The PRI is restored automatically when performance improves (indicated by DTA 014).

BIPC 0-(2)-128 DTA 013—24 -hour out of service limit
Maximum number of times a PRI can be taken out of service (DTA 012) in 24 hours. When this count is reached, the PRI will be restored to service automatically only if BIPC is set to zero.

553-1345

Frame slip

Digital signals must have accurate clock synchronization for data to be interleaved into or extracted from the appropriate timeslot during multiplexing and demultiplexing operations. Frame slip monitoring detects frame deletion and repetition errors in clock synchronization. See Figure 9.

Clock synchronization can be either tracking, on the primary or secondary reference clock, or free run (non-tracking). In LD73 (prompts PREF and SREF), one PRI may be defined as the primary clock reference. Another may be defined as the secondary clock reference. All others are defined as free run.

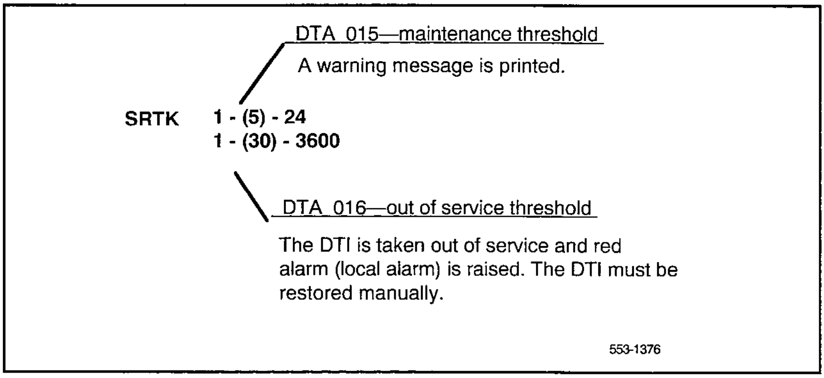
PRI hardware detects frame slips in tracking and free run modes. For tracking mode, running the midnight routines prints the number of overflows and clears the counter. For free run mode, running the midnight routines prints the number of frame deletions and repetitions and clears the counters.

Tracking mode There are two thresholds set in LD73. When a threshold is reached, a DTA message is output as shown below.

DTA015: Maintenance limit for frame slips in tracking mode.

DTA016: Out of service limit for frame slips in tracking mode.

Figure 9
DTA messages



Free run (non-tracking) mode A maintenance threshold and an out of service threshold are set in LD73. When these thresholds are reached, DTA messages are output. An option in LD73 can enable automatic recovery after the out of service limit has been reached. Related DTA messages are described below. See Figure 10.

DTA017: Maintenance limit for frame slips in free run (non-tracking) mode. The default is 10 slips in 15s seconds.

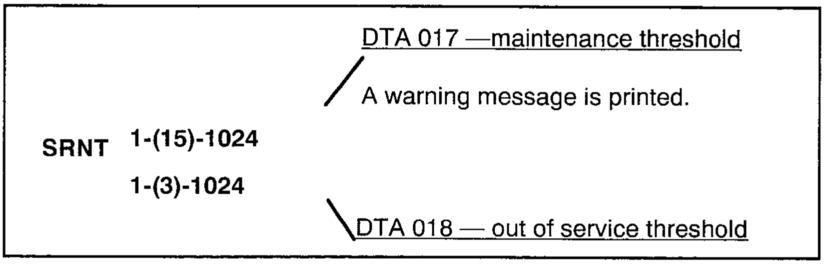
DTA018: Out of service limit for frame slips in free run (non-tracking) mode without automatic recovery selected. The default is 10 slips in 3 seconds.

DTA026: Non-tracking frame slip out of service threshold reached while monitoring frame slip rate for improvement. Trunks remain out of service. Reset improvement timer.

DTA028: Slip rate improvement criterion is met. Trunks are brought back into service. Reset improvement timer. (Duration of timer selected in LD73.)

DTA029: Slip rate improvement criteria is met. Trunks being returned to service.

Figure 10
DTA thresholds



Automatic recovery After the tracking mode or non-tracking mode out of service thresholds are exceeded, the slip rate is monitored for improvement. When the slip rate has improved, the trunks are returned to service.

There are two parameters set in LD73:

SRIM	(1) - 127	improvement timer in minutes
SRMM	1 - (2) - 127	improvement criteria

If the non-tracking mode maintenance threshold is exceeded SRMM or fewer timers in the duration of SRIM, then the trunks are returned to service. If not, the timer is restarted and monitoring continues.

Frame slippage is considered less important than alarms for loss of frame alignment persisting for 3 seconds, remote alarm, and bipolar violations exceeding the out of service threshold. If any of these alarms are reported while the slip rate is being monitored for improvement, then the monitoring stops. The trunks are returned to service only when the more serious alarms clear.

Frame alignment

Loss of frame alignment monitoring detects out-of-frame conditions on the DS-1 bit stream. See Figure 11.

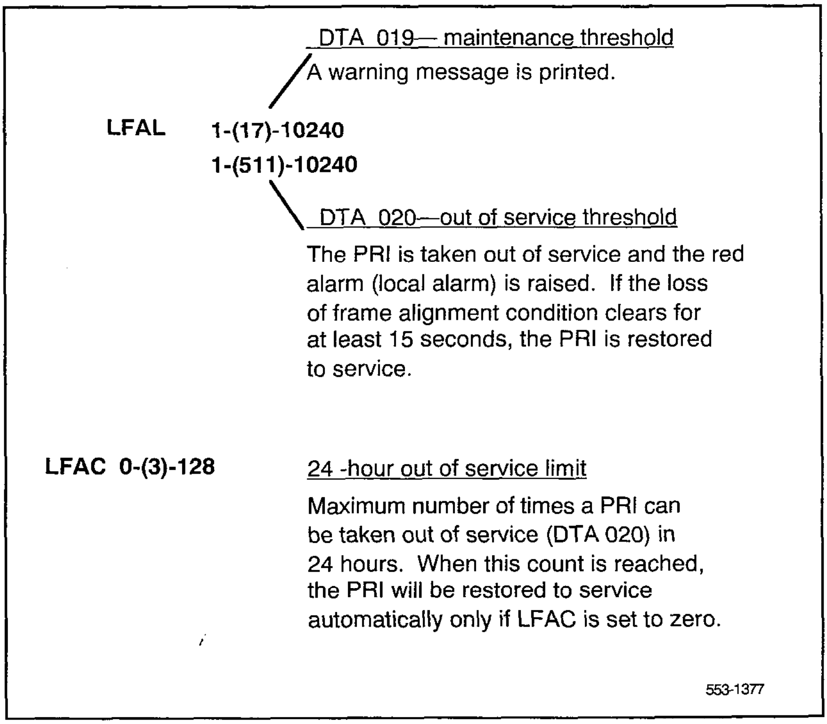
Loss of frame alignment thresholds PRI hardware detects out-of-frame conditions. Running the midnight routines prints the number of occurrences when frame alignment was lost and clears the counters.

There are three frame alignment thresholds set in LD73. When a maintenance or out of service threshold is reached, a DTA message is output as shown below.

DTA019: Frame alignment maintenance limit

DTA020: Frame alignment out of service limit

Figure 11
Frame alignment

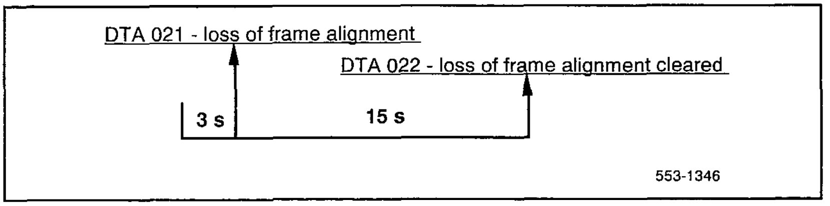


If a loss of frame alignment condition persists for three seconds, the affected PRI loop is taken out of service and a red alarm (local alarm) is raised. See Figure 12.

If the loss of frame alignment condition clears for at least 15 seconds, the PRI is automatically restored to service. The following DTA message is generated:

DTA021: Loss of frame alignment has persisted for 3 seconds.

Figure 12
Frame alignment loss



TN to channel number conversion

PRI channel numbers have an equivalent terminal number (TN). The TN is output instead of the channel number in some Meridian 1 messages. The TN to channel number translation is shown below. Note that the translation is different for the D2 framing format than formats for D3, D4 or ESF.

Terminal numbers are identified in software by Loop (L), Shelf (S), Card (C), and Unit (U) numbers. Each TN is applied to an individual channel on the PRI card. See Table 4 below.

Table 4
PRI channel numbers and equivalent terminal numbers (Part 1 of 2)

Channel number	D2 format TN (S C U)	D3, D4,E SF format TN (S C U)
1	1 4 0	0 1 0
2	1 5 0	0 2 0
3	0 1 0	0 3 0
4	2 1 0	0 4 0
5	0 5 0	0 5 0
6	2 5 0	0 6 0
7	1 1 0	0 7 0
8	1 7 0	1 8 0
9	0 3 0	1 1 0
0	2 3 0	1 2 0
1	0 7 0	1 3 0
2	2 7 0	1 4 0
3	1 3 0	1 5 0
4	1 6 0	1 6 0
5	0 2 0	1 7 0
6	2 2 0	2 8 0
7	0 6 0	2 1 0
8	2 6 0	2 2 0
9	1 2 0	2 3 0

Table 4
PRI channel numbers and equivalent terminal numbers (Part 2 of 2)

Channel number	D2 format TN (S C U)	D3, D4,E SF format TN (S C U)
0	2 8 0	2 4 0
1	0 4 0	2 5 0
2	2 4 0	2 6 0
3	1 8 0	2 7 0
4	3 8 0	3 8 0

Using the error counter

The Error Counter detects bipolar violations or no-signal periods. It counts, stores, and displays these occurrences to a maximum of 9999.

The PRI fault detection and isolation procedures described in this section are performed using a Thor portable test package, which consists of one each of the following items:

- the Thor TTT2028 Mini-Error Counter, plus operation instruction card
- a cord equipped with a bantam plug at one end and minihooks at the other
- a loop-back plug (shorts pins 3 to 1 and 11 to 9 of a 15 pin D connector)

Procedure 6
Using the error counter

> **CAUTION**
> To prevent injury from voltage on the span, always connect the patch cord into the test set before connecting the other end to the external signal source.

1 Plug one end of a patch cord into the input jack of the test set.

2 Plug the other end of the patch cord into one of the monitor jacks (RCV and XMT) of the PRI card being tested.

3 Monitor the Error Counter LED indicators as described below:

Table 5
Error Counter switch functions

Switch	Function
Display Enable	When held down, the switch enables the Counter display and the GOOD and O/R LED displays
Reset	Used to zero the counter
Error/Error	Used to select error counting seconds for bipolar violations or error-seconds

Table 6
Error Counter display functions

Display	Function
GOOD	Indicates the presence of an acceptable bipolar signal (if bipolar violations, missing pulses, or an oscillating line are detected, the indicator is off)
ERR	Flashes when bipolar violations are detected
W/M	Indicates no input (absence of pulse) or an oscillating line
O/R	Over range display turns on when the counter input has exceeded 9999 (the counter resets to 0000)
CNTR	With Error/Error-Second switch in the Error position, the unit counts errors at a maximum rate of 200 per second
	With Error/Error-Second switch in the Error-Second position, the unit counts error seconds at a rate of one per second

Replacing the PRI

Procedure 7
Replacing the PRI circuit card

> **CAUTION**
> Firmly touch the metal frame of the cabinet to discharge static electricity from your body before handling circuit cards.

1 Disable the D-channel using:
LD 96
DIS DCH x

2 Disable the PRI loop using:
LD 60
DISL loop

3 Disconnect cables on PRI faceplate.

4 Remove the PRI card.

5 Make sure that the new PRI card switch settings are the same as the faulty PRI card.

6 Install the new PRI card in the appropriate slot.

7 Connect the network loop cable, the carrier interface cable, and the echo canceller cable. If the PRI card is defined as a primary or secondary clock source, connect the clock controller cable(s).

8 Test the PRI card using:
LD 60
SLFT loop If an error message results, see PRI fault clearing.

9 Enable the PRI using:
LD 60
ENLL loop

D-channel maintenance

There are four types of DCH tests for the QPC757 DCHI card. The MSDL card performs local and remote loopback tests.

TEST 100 N	Perform interrupt generation test on DCHI N.
TEST 101 N	Perform loop-back mode test on DCHI N.
TEST 200 N	Perform interrupt handler test on DCHI N.
TEST 201 N	Perform interrupt handler-to-link interface path test

The DCH tests 100 and 101 are hardware tests, while the 200 and 201 test the DCH software.

CAUTION
The DCHI tests must be executed in sequential order.

DCH tests 100 and 101 (QPC757 DCHI card only)

DCH tests 100 and 101 are isolated hardware tests. See Figure 13. Test 100 checks interrupt generation on the DCHI. Test 101 checks the DCHI loop-back capability. If either test fails, either a faulty DCHI or a contention problem is indicated. A test failure initiates DCH error messages.

Tests 100 and 101 must be run in sequential order (tests 200 and 201 may follow). Established calls will stay up, but new calls cannot be placed.

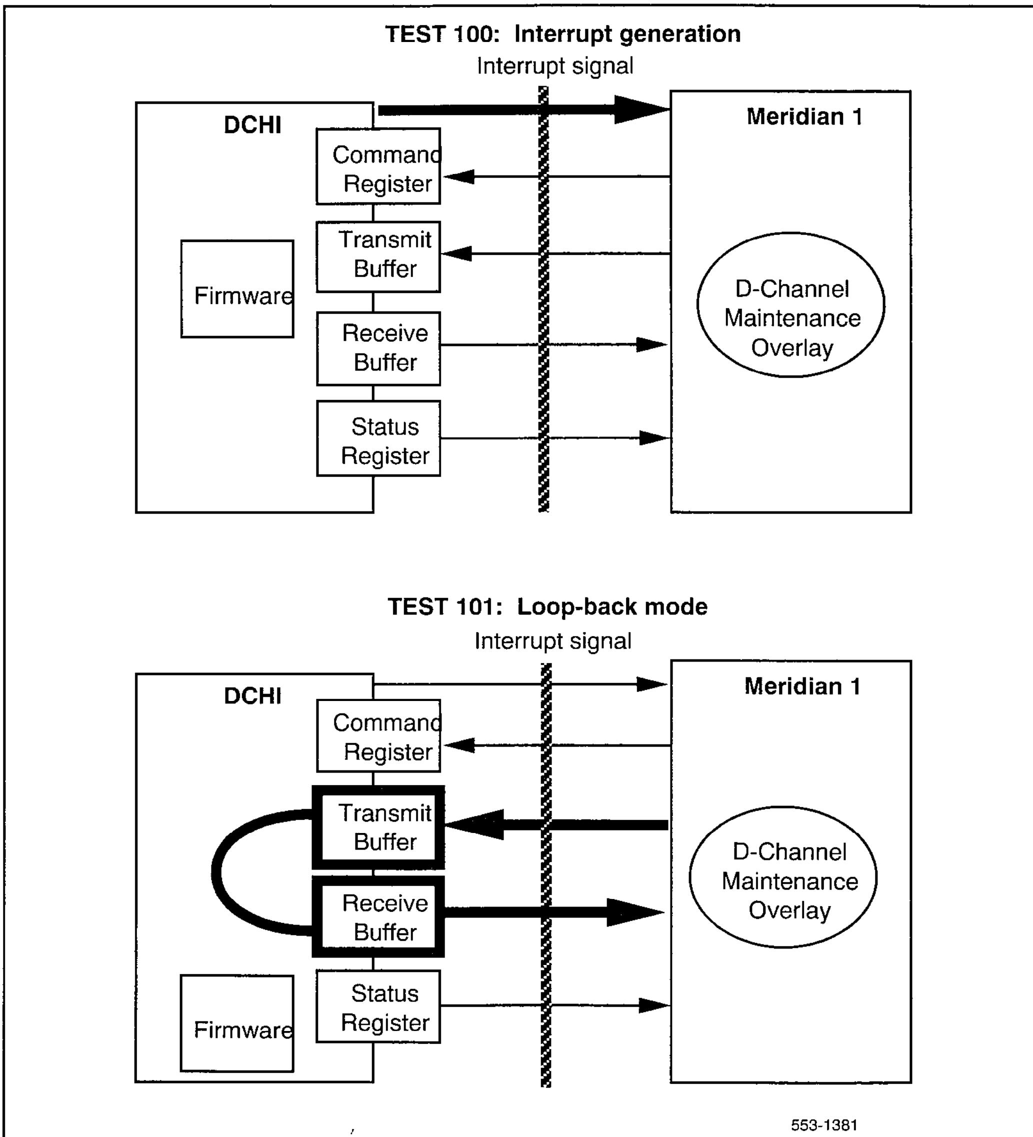
The DCH link must be in the reset state when these tests are run. The reset state can be established when the status of the D-channel is "established" (EST) or "released" (RLS) by using:

LD 96
STAT DCH N (responds either EST or RLS)
RST DCH N

If the DCHI is disabled, it must be enabled before reset can be established by using:

LD 96	
STAT DCH N	responds DSBL
ENL DCH N	if a problem caused the disabled state, RLS will occur; if the disabled state is cleared, status will be EST
RST DCH N)	

Figure 13
DCH tests 100 and 101 (QPC757 DCHI card only



DCH tests 200 and 201 (QPC757 DCHI card only)

DCH tests 200 and 201 are software tests. See Figure 14. Test 200 monitors the DCHI interrupt handler. Test 201 checks the interrupt handler-to-link interface path. If either test fails, software problems are indicated. A test failure initiates DCH error messages.

Tests 200 and 201 must be run sequentially after tests 100 and 101. Established calls will stay up, but new calls cannot be placed.

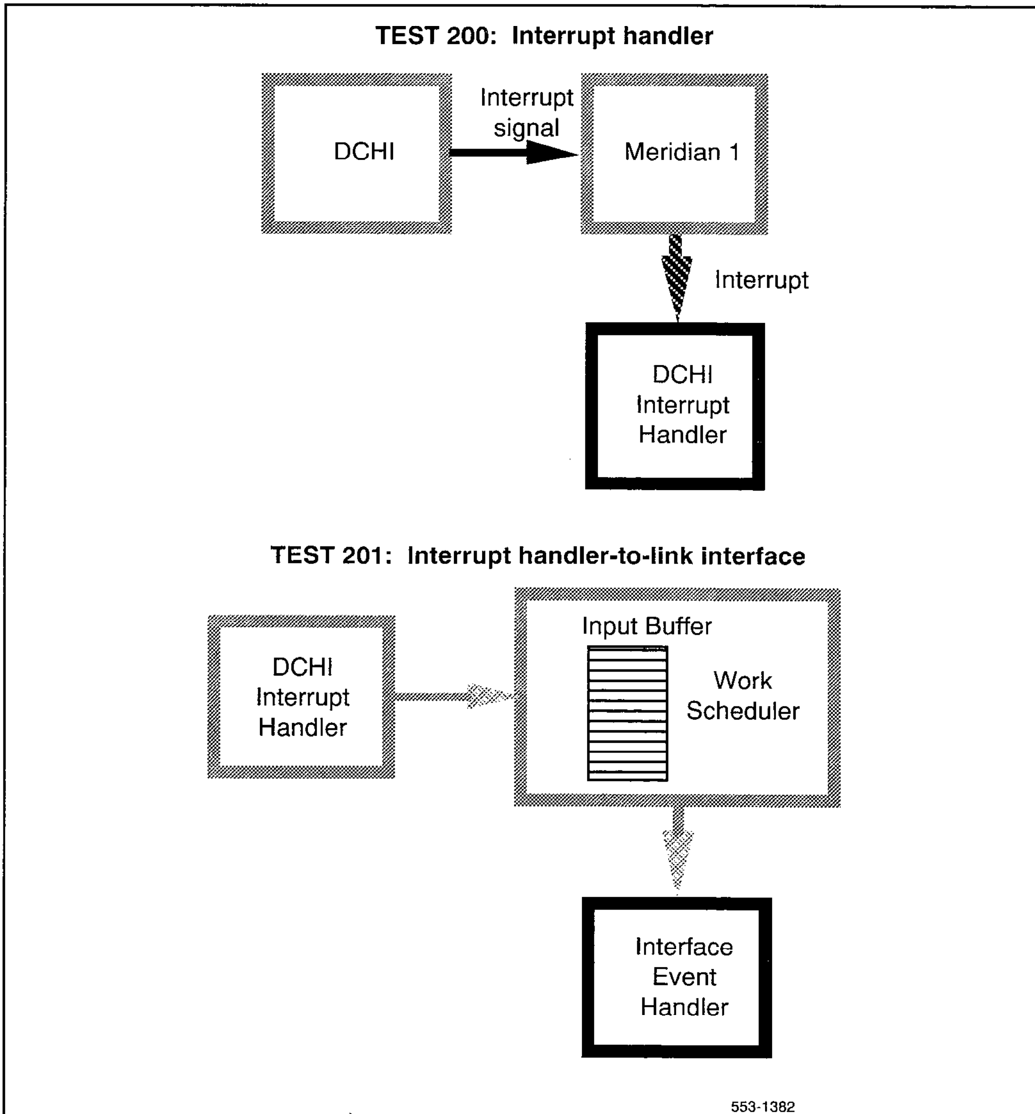
The DCH link must be in the reset state when these tests are run. Reset can be established when the status of the D-channel is established (EST) or released (RLS). Use:

LD 96
STAT DCH N (responds either EST or RLS)
RST DCH N

If the DCHI is disabled, it must be enabled before reset can be established. Use:

LD 96	
STAT DCH N	responds DSBL
ENL DCH N	if a problem caused the disable state, RLS will occur; if the disabled state is cleared, status will be EST
RST DCH N	

Figure 14
DCH tests 200 and 201 (QPC757 DCHI card only)



MSDL local loopback test (NT6D80)

Prior to beginning this test, the D-channel must be in test state:
ENL TEST DCH x.

To start the local loopback test on the MSDL card, use the **TEST LLB DCH x** command. The test checks both MSDL expedited and normal (ring) interfaces.

The response for the expedited interface that carries urgent signaling and maintenance messages between the Meridian 1 CPU and the MSDL MPU follows.

DCH : X XDU TEST CONFIRM TIME : <time of day>
TEST : PASS (or FAIL)

X is the DCH logical address
XDU is the expedient message sent around the loop.

The response for the ring interface that transmits operation data between the Meridian 1 CPU and the MSDL MPU follows.

DCH : X DU TEST CONFIRM TIME : <time of day>
TEST : PASS (or FAIL)

1 If the test fails, check the status of the MSDL card, used by this DCH link, with the **STAT MSDL x FULL** command.

2 If the MSDL card may be faulty, disable the card and perform s self-test.
DIS MSDL x
SLFT MSDL x

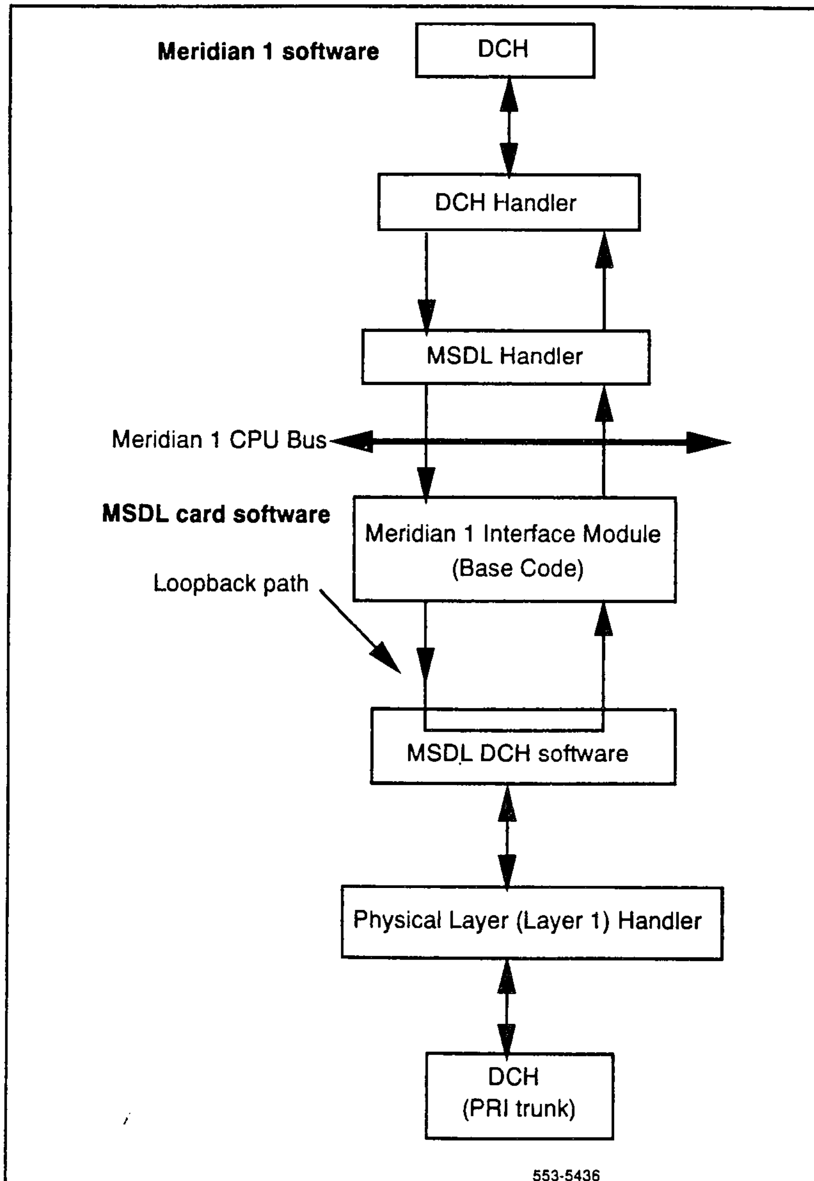
3 If the card passed the test, the problem may lie in incompatible software.

After completing the test, remove the D-channel from the test state:

DIS TEST DCH x.

Refer to *Multi-purpose Serial Data Link description* (553-3001-195).

Figure 15
Local loopback test (NT6D80)



MSDL remote loopback tests (NT6D80)

Before beginning this test, verify the following.

- D-channels on both switches are configured on MSDL cards
- DCH links on both switches are set to TEST mode
- DCH at Switch B is in remote loopback mode (RLB)
- remote capability (RCAP) is MSDL

1. Place DCH links on both systems in TEST mode. Enter **ENL TEST DCH x** on Switch A and **ENL TEST DCH y** on Switch B for the same DCH link. The DCH links on both switches are automatically placed in idle state (IDLE).
2. Place the Switch B DCH link in remote loopback state (RLB) with ENL RLB DCH x. The DCH link in Switch A must stay in idle.
3. From Switch A, perform the loopback test with TEST RLB DCH x.

   The result of the remote loopback test is displayed on Switch A's console in the following format.

   DCH : X RLB TEST CONFIRM TIME : <time of day>
   TEST : PASS
   TEST : FAIL - NO DATA RCV FAR END
   TEST : FAIL - CORPT DATA RCV FAR END
   TEST : FAIL - REASON UNKNOWN

   TEST : FAIL may indicate a problem in the physical link between the two switches, or faulty equipment in either switch. Check the connections, and verify the status of the MSDL and PRI trunk cards used for this link. Refer to *ISDN Primary Rate Interface maintenance* (553-2901-500) for detailed troubleshooting procedures.
4. Place the Switch B DCH link back to the idle state, with the **DIS RLB y** command.
5. If you think the MSDL card used in either switch has failed, check the status of the DCH link and the status of the MSDL card by entering **STAT MSDL x FULL.**

6 If the MSDL card may be faulty, disable the card and perform self-test.

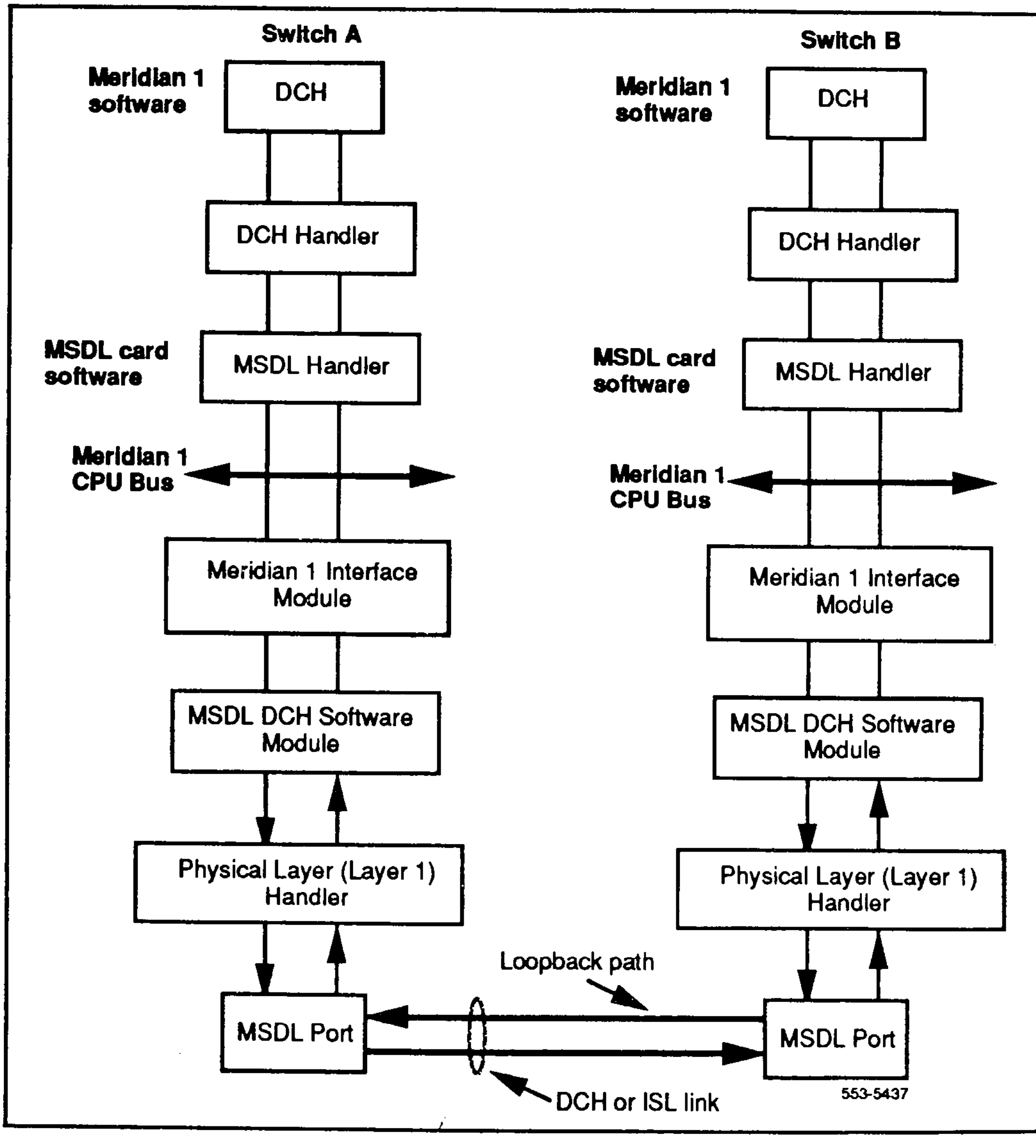
DIS MSDL x
SLFT MSDL x

7 If the card passed the test, the problem may lie in incompatible software. Refer to *Multi-purpose Serial Data Link description* (553-3001-195).

After the test is complete, remove both sides from the test state:

DIS TEST DCH x
DIS TEST DCH y

Figure 16
Remote loopback tests (NT6D80)



Protocol Log (PLOG)

The count of D-channel errors is stored in the Protocol Log (PLOG). The PLOG is printed by using LD96 as shown in the PLOG status check.

Protocol errors can be the result of PRI transmission problems and re-start procedures, or a protocol mismatch with the far end. The PLOG counters are cleared after the PLOG is printed, or the DCHI/MSDL card is enabled.

> *Note:* When a protocol counter overflows, the PLOG is printed automatically and the counters are cleared.

When the PLOG has non-zero counters, check the PRI status and alarms as shown. See Figure 17.

Procedure 8
PLOG status check

1 Check the contents of the PLOG using:
LD96
PLOG DCH x

Response with **X11 release 17 and earlier:**
DCH x I xxxx
yy zz 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

where:
I = incoming
xxxx = system real time (in hexadecimal)
yy = maintenance indication primitive ID
zz = maintenance indication task ID
00 00 ... = protocol error counters

Response with X11 release 18 and later:
DCH : XX MAINT CONFIRM TIME: <time of day>

COUNTER	VALUE
1:	12
12:	8
20:	15
N:	XX

2 If there are PRI bit rate or frame errors, assume there is a PRI problem.

3 If there is no problem with the PRI but there are a large number of protocol errors, report a protocol problem.

Table 7
Protocol log (X11 release 17 and earlier)

Form at	
DCH x I xxxx yy zz 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	
Protocol counters	
1	count of missing PRI handshakes
2	count of peer initiated re-establishment link
3	count of unsuccessful retransmit N200 of SABME
4	count of unsuccessful retransmit N201 of DISC
5	count of N(R) errors
6	count of information fields with length greater than N201
7	count of undefined frames
8	count of I fields but not allowed
9	count of FRMR frames
10	count of CRC error frames
11	count of REJ frames
12	count of messages with less than 4 octets
13	count of undefined protocol discriminators
14	count of undefined message types
15	count of messages missing one or more mandatory information elements
16	count of messages with one or more undefined information elements

Table 8
Protocol log (X11 release 18 and later) (Part 1 of 2)

Format	
DCH : XX MAINT CONFIRM TIME: <time of day> COUNTERVALUE	
Protocol counters	
1	count of missing PRI handshakes
2	count of peer initiated re-establishment link
3	count of unsuccessful retransmit N200 of SABME
4	count of unsuccessful retransmit N200 of DISC
5	count of N(R) errors
6	count of information fields with length greater than N201
7	count of undefined frames
8	count of information fields that are not allowed to contain information
9	count of FRMR frames received from the far end
10	count of CRC error frames received from the far end
11	count of REJ frames received from the far end
12	count of layer 3 messages with less than 4 octets
13	dummy counter, always zero
14	count of undefined layer 3 message types
15	count of layer 3 messages missing one or more mandatory information elements
16	count of layer 3 messages missing one or more undefined information elements
17	count of layer 1 reports of no external clock being received
18	count of aborted frames
19	count of SABME frames received with incorrect C/R bit

Table 8
Protocol log (X11 release 18 and later) (Part 2 of 2)

20	count of supervisory frames received with F = 1
21	count of unsolicited DM responses with F = 1
22	count of unsolicited UA responses with F = 1
23	count of unsolicited UA responses with F = 0
24	count of DM responses with F = 0
25	count of times that no response was received from the far end after N200 transmissions retransmissions of RR or RNR
26	count of frames received with incorrect header length
27	count of messages received with call reference length greater than 2
28	count of optional information elements received with invalid contents
29	count of mandatory information elements received with invalid contents
30	count of messages received with information elements not ordered correctly
31	count of information elements repeated in received messages, but only appeared once
32	count of information elements receive with length exceeding maximum specified length

Replacing the DCHI or MSDL

Follow this procedure to replace the QPC757 DCHI, or NT6D80 MSDL card.

Procedure 9
Replacing the DCHI or MSDL card

> **CAUTION**
> Firmly touch the metal frame of the cabinet to discharge static electricity from your body before handling circuit cards.

1 Disable the D-channel.

LD 96
DIS DCH x

2 Disable the asynchronous port on the card (if equipped).

X11 release 18 and later
LD 37
DIS TTY x

X11 release 17 and earlier
LD 48
DIS ESDI x

3 Set the ENB/DIS switch to DIS (if equipped).

4 Disconnect cables on faceplate.

5 Remove the DCHI or MSDL from the shelf.

6 Make sure that the new card switch settings are the same as the ones on the old DCHI card.

7 Install the new card in the appropriate slot.

8 Connect the faceplate cables to the new card.

9 Set the ENB/DIS switch to ENB (if equipped).

10 Enable the D-channel.

LD 60
ENL DCH x

Clock Controller maintenance

Tracking mode

In tracking mode, the PRI loop supplies an external clock reference to a clock controller. See Figure 17. Two PRI loops can operate in tracking mode, with one defined as the primary reference source for clock synchronization, the other defined as the secondary reference source. The secondary reference acts as a backup to the primary reference.

As shown Figure 17, a Meridian 1 system with dual CPUs may have two clock controllers (CC0 and CC1). One clock controller acts as a backup to the other. The clock controllers should be completely locked to the reference clock.

Free run (non-tracking) mode

The clock synchronization for a PRI loop may operate in free run mode if:

- the loop is not defined as the primary or secondary clock reference
- the primary and secondary references are disabled
- the primary and secondary references are in red alarm (local alarm)

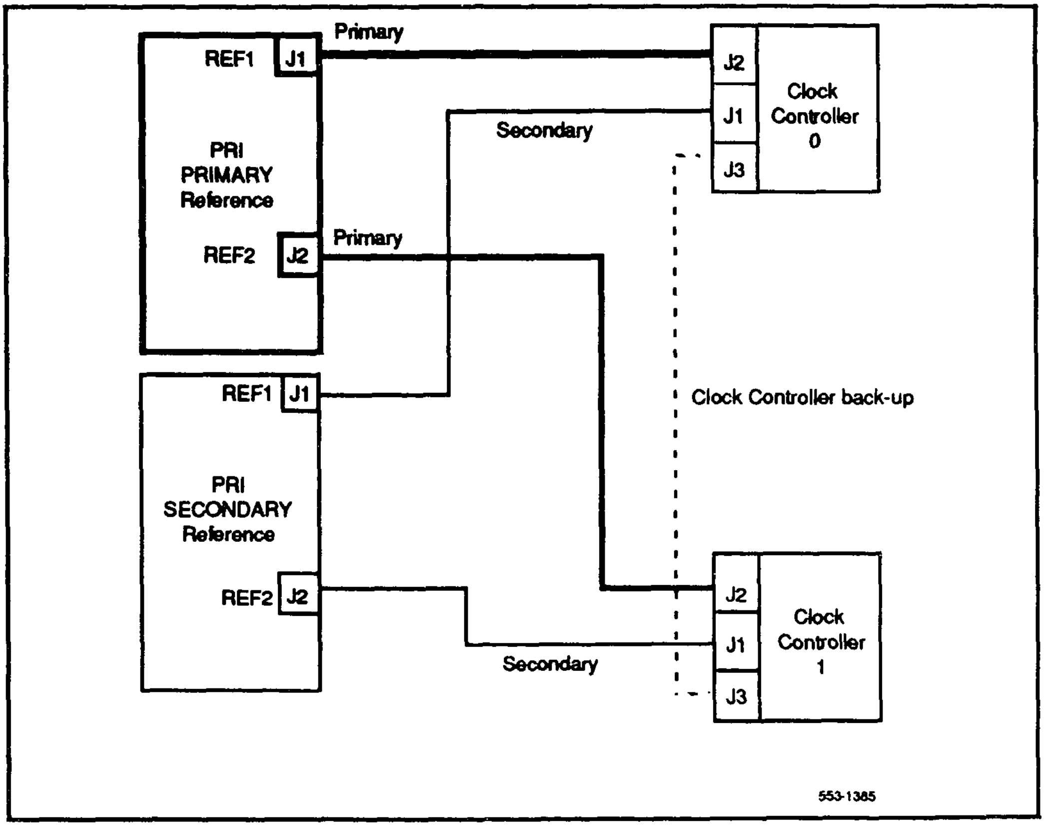
Reference clock errors

Meridian 1 software checks every 15 minutes to see if a clock controller or reference clock error has occurred.

In tracking mode, at any one time, there is one active clock controller which is tracking on one reference clock. If a clock controller error is detected, the system switches to the backup clock controller, without affecting which reference clock is being tracked.

A reference clock error occurs when there is a problem with the clock driver or with the reference system clock at the far end. If the clock controller detects a reference clock error, the reference clocks are switched.

Figure 17
Clock controller primary and secondary tracking



Automatic clock recovery

An option for automatic clock recovery can be selected in LD60 with the command EREF.

A PRI loop is disabled when it enters a red alarm (local alarm) condition. If the red alarm is cleared, the loop is enabled automatically. When the loop is enabled, clock tracking is restored in the following conditions:

- If the loop is assigned as the primary reference clock, but the clock controller is tracking on the secondary reference or in free run mode, the clock is restored to tracking on primary.
- If the loop is assigned as the secondary reference clock but the clock controller is in free run mode, it is restored to tracking on secondary.

If the 15-minute clock check indicates the system is in free run mode:

- Tracking is restored to the primary reference clock, if defined.
- If the primary reference is disabled or in red alarm (local alarm), tracking is restored to the secondary reference clock, if defined.

  Note: If the system is put into free run mode intentionally by the craftsperson, it resumes tracking on a reference clock at this time. This occurs unless the clock-switching option has been disabled (LD60, command MREF), or the reference clock has been "undefined" in the database.

Automatic clock switching

If the EREF option is selected in LD60, tracking on the primary or secondary reference clock is automatically switched in the following manner:

- If software is unable to track on the assigned primary reference clock, it switches to the secondary reference clock and sends appropriate DTC maintenance messages.
- If software is unable to track on the assigned secondary reference clock, it switches to free run mode.

QPC471, QPC775 Clock Controller Card

Use this procedure to replace a clock controller (CC) card.

> *Note:* The QPC775 Clock Controller is used in Canadian and International applications. QPC775 and QPC471 cards may not be combined in one system.

When using the QPC471 clock controller, vintage H must be used with option 81 systems.

Refer to *X11 input/output guide* (553-3001-400) for a description of all maintenance commands and system messages.

WARNING
Module covers are not hinged; do not let go of the cover. Lift the cover away from the module and set it out of your work area.

Removing equipment

1 Disable the clock controller card:

- The card you are removing must be inactive. To switch the clock:

  LD 60
  SWCK

- Disable the clock controller card:

  DIS CC x "x" is the card number – 0 or 1

2 Set the ENB/DIS switch to DIS on the card you are removing.

CAUTION
To avoid interrupting service, set ENB/DIS switches to DIS before disconnecting or connecting cables.

3 Tag and disconnect cables to the card you are removing.

4 Unhook the locking devices on the card; pull it out of the card cage.

Installing equipment

1 Set the ENB/DIS switch to DIS on the replacement card.

2 Set option switches on the replacement card the same as on the card you removed. To check switch settings, see *Circuit card installation and testing* (553-3001-211).

3 Insert the replacement card into the vacated slot and hook the locking devices.

4 Connect the cable to the replacement card.

5 Set the ENB/DIS switch to ENB on the replacement card.

6 Enable and test the card:

ENL CC x
SWCK

End the session in LD60:
****

If there is a problem, a DTC system message is generated and the red LED lights on the faceplate of the card.

7 Tag defective equipment with a description of the problem and package it for return to a repair center.

ISDN Signaling Link maintenance

ISL interfaces

The ISDN Signaling Link (ISL) feature provides the capability to replace both digital and analog conventional trunk signaling with out-of-band ISDN D-channel signaling. Call-by-Call (CBC) Service, Calling Line Identification (CLID) and CLID in Call Detail Recording (CDR), Electronic Switched Network (ESN) interworking, and Network Ring Again (NRAG) applications are supported.

The ISL feature supports TIE and ISA trunk types with Meridian 1 to Meridian 1 connectivity. The TIE lines and the trunk used for the D-channel may be leased from the Central Office (CO). With leased lines, the function of the CO is simply to provide the trunk facilities between Meridian 1 systems for circuit switched connections.

There are two modes of ISL operation:

- Shared mode: In the shared mode, the DCHI or MSDL supports ISDN PRI signaling as well as ISL trunks. See Figure 18. The configuration is basically the same as the PRI D-channel, but the D-channel also supports ISL trunks (analog or DTI).
- Dedicated mode: In the dedicated mode, the DCHI or MSDL does not support ISDN PRI signaling. See Figure 19. The DCHI or MSDL is reserved for ISL use. The D-channel can communicate with the far end by means of a dedicated leased line, dial-up modem, or DTI/PRI trunk.

Figure 18
ISDN signaling link: shared mode

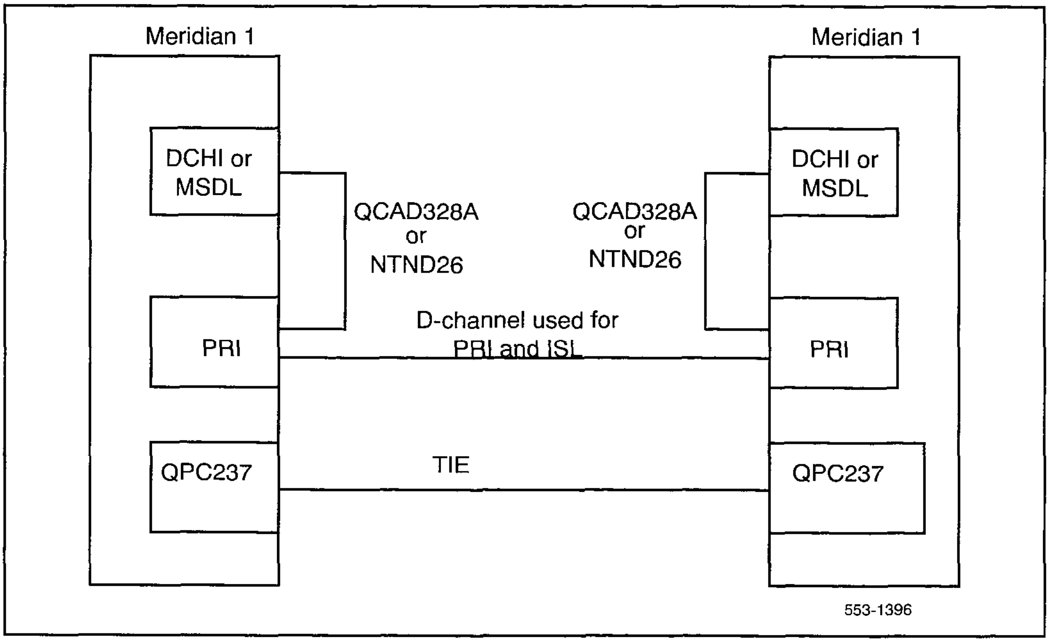
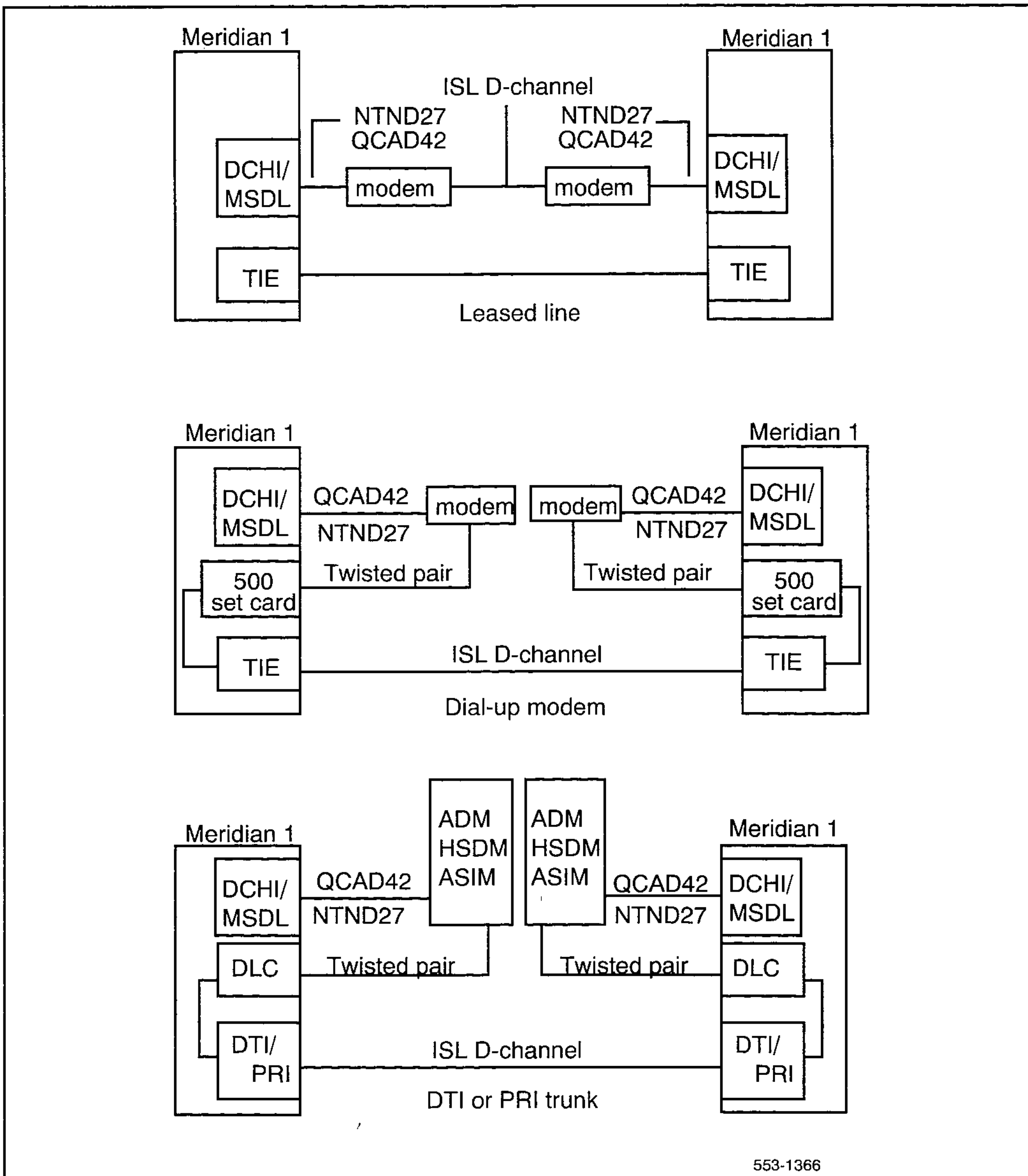


Figure 19
ISDN signaling link: dedicated mode configurations



ISL status formats

If a trunk unit is controlled by the ISL feature, the STAT commands in LD32 and LD36 will:

- indicate the trunk is an ISL trunk, and
- display the status of the D-channel

The display format is the same for both programs. See Table 9.

Table 9
ISL status check in LD32 and 36

Command	Response
STAT L S C	UNIT 00 = IDLE ISL TRK D-CH <ch #> <status> UNIT 01 = IDLE ISL TRK D-CH <ch #> <status>
STAT L S C U	IDLE ISL TRK D-CH <ch #> <status>

When a trunk unit is controlled by ISL, the STAT L command in LD60 indicates the trunk is an ISL trunk. The STAT L CH command indicates the trunk is an ISL trunk and displays the status of the D-channel. The display format is shown in Table 10.

Table 10
ISL status check in LD60

Command	Response
STAT L	CH 1 = IDLE ISL TIE CH 2 = UNEQUIP
STAT L CH	CH 1 = IDLE ISL TIE?D-ch <ch #> <status>

Print programs (LD20-22)

Print programs LD20, LD21, and LD22 provide the following ISL information:

- LD20 prints trunk information
- LD21 prints route information
- LD22 prints configuration record information

Table 11
ISL prompts in LD20, LD21, and LD22

Program	Prompt	Description
LD20	CHID nn	Channel ID
LD21	MODE ISL/PRI DCHI x	ISL or PRI service route DCHI port number (printed if MODE = ISL)
LD22	USR PRI/ISL/SHA	D-channel for PRI only, ISL D-channel for (dedicated mode), or SHA= D-channel shared between PRI and ISL
	ISLM x	maximum number of ISL trunks

LD21 also lists the ISL trunk terminal numbers (TNs) configured in the system and counts the number of ISL trunks controlled by the DCH. To list ISL trunk TNs use the following prompts:

REQ PRT
YPE ISLL

Table 12
Additional ISL information provided in LD21

Cust #	ISL Trunk TN	Channel ID	DCH #	Route #
xx	l s c u	xxx	xx	xxx
xx	l s c u	xxx	xx	xxx

ISL start-up

In general, the procedures for bringing up the D-channel are the same as the ISDN PRI interface (see the PRI start-up section). However, some additional procedures are required when ISL is configured in the dedicated mode using DTI or PRI trunks.

Dedicated D-channel using DTI or PRI

When the D-channel is configured in the dedicated mode using a DTI or PRI trunk, an Asynchronous Data Module (ADM), an Asynchronous/ Synchronous Interface Module (ASIM), or a High Speed Data Module (HSDM) is required between the DCHI or MSDL cards, and the Data Line Card (DLC).

> *Note:* The configuration with a DTI or PRI meets Radio Frequency Interference (RFI) requirements. The RFI filter connectors are attached to the QCAD42A cable. To install the RFI filters, see the instructions for installing the EMI filters in the system installation documents.

The following signaling sequence is required between the DCHI or MSDL cards, and ADM, HSDM, or ASIM to establish the D-channel.

1. The ADM, ASIM, or HSDM is already powered up.
2. The ADM, ASIM, or HSDM raises clear to send (CTS) and data set ready (DSR) signals to the DCHI or MSDL.
3. The DCHI or MSDL raises the data terminal ready (DTR) signal to the ADM, ASIM, or HSDM.
4. The ADM, ASIM, or HSDM makes the hotline call (the programmed auto-dial DN) to the far end switch using a DTI or PRI trunk line, depending on the DN configured.
5. The call is established and the CONNECT lamp on the ADM, ASIM, or HSDM is lit.
6. The D-channel is established.

ISL recovery

The D-channel will go down if:

- the modem, ADM, ASIM, or HSDM power is off
- **the hotline call between the Meridian 1 and the modem, ADM, ASIM, or HSDM is dropped**

The Meridian 1 system handles these possibilities in the following way:

1. The Meridian 1 CPU schedules a data link diagnostics program which runs in background mode.
2. If this program finds that the link is not established, it requests the maintenance program to reestablish the data link by reinitializing the hotline connection.
3. The hotline call is brought up as it is during installation.

   The ASIM can automatically reinitiate the hotline call with the Forced DTR option set to ON.

   A modem with auto-dial capability is required to automatically bring up the D-channel in the configuration below.

   Note: The Radio Frequency Interference (RFI) filter connectors are attached to the QCAD42 cable. To install the RFI filters, see the instructions for installing the EMI filters in the system installation documents.

Digital Trunk/Primary Rate Interface (LD60)

LD is used to maintain the following

- QPC471/775 Clock Controller
- QPC472 1.5 Mb/s Digital Trunk Interface (DTI)
- QPC536 2.0 Mb/s Digital Trunk Interface (DTI2)
- QPC720 Primary Rate Interface (PRI)

This diagnostic program can be can be run in midnight routines or loaded manually to enter commands. The following lists describe the commands available with LD60.

DTI and PRI commands

ATLP (0), 1	Disable (0) or enable (1) daily routine auto loop test
CDSP	Clear maintenance display on the active CPU
CMIN ALL	Clear minor alarm indication on all attendant consoles
CMIN c	Clear minor alarm indication on attendant consoles for customer c
DISI loop	Disable DTI/PRI loop when all channels are idle
DISL loop	Disable network loop (LD17 DLOP) and associated DTI/PRI cards
DLBK loop	Disable remote loopback test previously set by RLBK loop command
DLBK loop ch	Disable remote loopback test previously set by RLBK loop ch command
DSCH loop ch	Disable channel ch of DTI/PRI loop
ENCH loop ch	Enable channel ch of DTI/PRI loop
ENCH loop	Enable all channels on loop (DTI2 only)
ENLL loop	Enable network loop (LD17 DLOP) and associated DTI/PRI cards
LCNT (loop)	List contents of alarm counters on one or all DTI/PRI loops
LOVF c r	List threshold overflows for customer c (0-99) and route r (0-511)
RCNT	Reset alarm counters of all DTI/PRI loops
RCNT loop	Reset alarm counter of DTI/PRI loop
RMST loop	Perform self-test on specified loop
RMST loop ch	Perform self-test on specified channel (DTI2 only)
RLBK loop	Close loop at carrier interface point for testing
RLBK loop ch	Close channel at carrier interface point
RSET loop ch	Reset thresholds for channel ch
SLFT loop	Invoke DTI/PRI hardware self-test on loop
SLFT loop ch	Invoke partial hardware self-test on channel ch
STAT	Get status of all PRI loops
STAT loop	Get status of PRI loop
STAT loop ch	Get status of channel ch

Clock Controller commands

DIS CC 0, 1	Disable system clock controller 0 or 1
DSYL loop	Disable yellow alarm processing for specified loop
ENL CC 0, 1	Enable system clock controller 0 or 1
ENYL loop	Enable yellow alarm processing for specified loop
EREF	Enable automatic switchover of system clocks
MREF	Disable switchover of system clocks
SSCK 0, 1	Get status of system clock 0 or 1
SWCK	Switch system clock from active to standby
TRCK aaa	Set clock controller tracking to primary, secondary or free run

D-channel diagnostic (LD96)

The D-channel diagnostic program is used to test and maintain D-channel links and the QPC757 or NT6D11AB D-channel Interface (DCHI) card.

In X11 release 18, D-channels can also reside on Meridian Serial Data Link (MSDL) cards. A new set of LD96 commands are provided to support MSDL cards.

Monitoring

D-channel message monitoring is used to analyze the Layer 3 protocol messages traveling between the near and far end D-channels.

Up to and including X11 release 16, message monitoring can be performed only on a per D-channel basis using LD96. That is, once the message monitor is turned on, all messages are output for that D-channel. The messages output might be excessive.

X11 release 17 provides additional commands in LD96 that allows selective message monitoring based on

— the D-channel

— the B- or ISL channel

— the message types for a specific feature

— any specific message

The following sections describe the various command formats.

Note 1: During high traffic some of the monitored messages may be lost.

Note 2: In order to get the D-channel monitor messages to display, the system terminal must be have LD17 prompt USER defined as MTC (X11 release 17).

D-channels

All message types, features and channels associated with a particular D-channel can be monitored. Up to and including X11 release 16, only one D-channel can be monitored for outgoing messages and one for incoming messages. X11 release 17 allows the monitoring of multiple D-channels for both incoming and outgoing messages.

The LD96 commands to enable or disable monitoring of all incoming or outgoing messages on a D-channel are listed here.

ENL MSGI x – enable monitoring of incoming messages
ENL MSGO x – enable monitoring of outgoing messages
DIS MSGI x – disable monitoring of incoming messages
DIS MSGO x – disable monitoring of outgoing messages

Where x is the DCHI or MSDL port address (I/O address). For example, to enable monitoring of incoming messages on D-channel 5, enter

ENL MSGI 5

The output includes all messages, features and channels for D-channel 5.

All monitor commands in LD96 require a primary D-channel to be defined. If a backup D-channel number is entered for monitor definitions, an error is given and the command is aborted. Once the monitoring options are configured for the primary D-channel, they apply to the backup as well. For example, if a D-channel switchover takes place, and the backup becomes active, the monitor option set for the primary are effective for the backup.

B-channels and ISL channels

You can monitor up to 5 ISL or B-channels, for each direction. If there is no specific channel selected, all channels are monitored. The commands are listed below.

For B-channels:

ENL MSGI x CH loop channel
ENL MSGO x CH loop channel
DIS MSGI x CH loop channel
DIS MSGO x CH loop channel

For ISL channels:

ENL MSGI x CH l s c u
ENL MSGO x CH l s c u
DIS MSGI x CH l s c u
DIS MSGO x CH l s c u

Where,

ENL = enable monitoring
DIS = disable monitoring
MSGI = incoming messages
MSGO = outgoing messages

ISDN features

You can select specific ISDN applications, such as Network Ring Again, for message monitoring. Only one or all ISDN applications can be monitored per D-channel at one time. The LD96 commands are listed below, where x is the D-channel (DCHI or MSDL) port number.

ENL MSGI x FEAT feature
ENL MSGO x FEAT feature
DIS MSGI x FEAT feature
DIS MSGO x FEAT feature

Where "feature" can be

NCT = Network Call Trace
NRAG = Network Ring Again
NACD = Network Automatic Call Distribution
TRO = Trunk Optimization
NMS = Network Message Services

Message types

You can select specific types of messages to be monitored on a D-channel. The LD96 commands are listed below, where x is the D-channel (DCHI or MSDL) port number.

ENL MSGI x MSG msg1 msg2 msg3
ENL MSGO x MSG msg1 msg2 msg3
DIS MSGI x MSG msg1 msg2 msg3
DIS MSGO x MSG msg1 msg2 msg3

Up to three message types (msg1, msg2, msg3) can be entered per command. The default is "ALL", which is all message types except SVC and SVCA. The message types are:

ALER = alerting
ALL = all primitives and all messages except SVC and SVCA
CAPR = call proceeding
CON = connect
CONA = connect ack
DISC = disconnect
FAC = facility
FACA = facility ack
FACR = facility reject
INFO = information
NOTF = notify
PRIM = all primitives (such as release indication)
PROC = call proceeding
PROG = progress
RLS = release
RLSC = release complete
RST = restart
RSTA = restart ack
STAT = status
STEN = status enquiry
STP = setup
STPA = setup ack
SVC = service
SVCA = service ack
UI = user information

Setting output format levels

There are three levels (0-2) of message decoding. The level determines the format of the data output to the system terminal. To set the output level enter the following.

SET MSGI x MON (0)-2
SET MSGO x MON (0)-2

Level 0 outputs the message as shown below.

DCH x y MSG msgtype REF xxxxxxx CH zzzz TOD hh:mm:ss
<more data>

Where,

x = D-channel number
y = "I" for incoming messages, "O" for outgoing messages
xxxxxxxx = the call reference number
zzzz = the loop and channel number (or TN for ISL channels)
<more data> = additional lines of information, such as
CALLED # = called number
CALLING # = calling number of originator
CAUSE = reason for action taken (e.g., unassigned number)
CONNECT # = connected number
FEAT = feature (such as Network Ring Again)
NUM PLAN = Numbering plan used (such as private)
PROGRESS = call progress description
REDIR REASON = reason the call was re-directed
REDN # = call redirection number
STATE = call state
STATUS = channel status
TYPE = type of channel

Level 1 outputs the raw data (as was done in X11 release 16). The format is

DCH x y MSG msgtype REF xxxxxxxx TN zzzzzz CH# x CK x
<more data in hexadecimal>

Level 2 output identifies the individual Information Elements (IE) in the messages and their hexadecimal values.

BCAP = bearer capability
CAST = call state
CHGA = charge advice
CHID = channel ID
CHST = change status
CLED = called number
CLES = called party subaddress
CLNG = calling number
CLNS = calling party subaddress
CNS5 = codeset 5 connected number subaddress
CON# = connect number
CON5 = codeset 5 connected number
CSE = cause
DES6 = codeset 6 Destination IE
DISP = display
FAC = facility IE for codeset 0
FAC6 = codeset 6 facility IE
FIND = feature Indication
HLYR = higher layer compatibility
INFO = information request
KYPD = keypad
LLYR = low layer compatibility
LS5 = locking Shift to codeset 5
LS6 = locking shift to codeset 6
LS7 = locking Shift to codeset 7
NLS5 = codeset 5 non locking shift
NLS6 = codeset 6 non locking shift
NLSO = non-locking shift to codeset 0
NOTI = notify indicator
NSF = network specific facility
ORG# = originating called number
ORG6 = codeset 6 Originating IE
PROG = progress indicator
RDG6 = codeset 6 redirecting number

REDG = redirecting number
REDN = redirection number
RETR = codeset 6 reason for return
RSTI = restart indicator
SHFT = shift
SIGN = signal
TACG = codeset 6 TTC advice charge
TNS = transit network selection
UNKN = unknown
UUI = user-user information

Deactivate monitor from a maintenance telephone

Once the system has been tied up or flooded with the monitored messages, it is very difficult, if not impossible, to use LD96 to disable the monitors. In this case, a maintenance telephone with MTA class of service can be used to deactivate the monitor.

To activate or deactivate the monitor from a maintenance telephone, simply dial: SPRE 9913 x 01

Where,

SPRE = special function access code (defined in LD15)
9913 = feature code to activate or deactivate the monitor
x = 0 to deactivate, 1 to activate
01 = DCH monitor ID

Note 1: Dial tone is provided if successful.

Note 2: Use RST MON to reactivate the monitor from LD96.

Note 3: Deactivating the monitor by the maintenance telephone does not disable the monitor, but simply halts the output. If the monitor is deactivated and not disabled using the DIS MSGI and DIS MSGO commands, then the monitor becomes re-activated after a data dump and sysload.

Get monitor status

To determine the current status of the D-channel monitor, enter the following command, where x is the D-channel (DCHI or MSDL) port number.

STAT MON x

Output format:

***DCH MSGI x LEVEL y ACTV (where, y = format level)
MSG - msg1 msg2 ...
FEAT - feat
CH - loop channel (or l s c u for ISL)

***DCH MSGO x LEVEL y ACTV
MSG - msg1 msg2 ...
FEAT - feat
CH - loop channel (or l s c u for ISL)

Note: If the monitor had been deactivated by the maintenance telephone, INACTV is output instead of ACTV.

D-channel command summary

The following commands are used to enable, disable, test and get the status of a D-channel. Refer to the LD96 introduction for details on the use of these commands.

In X11 release 18 all commands use DCH instead of DCHI. For example: use ENL DCH x instead of ENL DCHI x. The STAT DCH and STAT DCHI commands have been combined to STAT DCH.

DIS AUTO x	Disable automatic recovery for DCH x
DIS DCH x	Disable DCH x
DIS MSGI x (options)	Disable the monitoring of incoming messages on D-channel x
DIS MSGO x (options)	Disable the monitoring of outgoing messages on D-channel x
DIS SERV x	Disable service messages on D-channel x
DWNL DCH x (t)	Down load layer 3 message configuration table t and LAPD parameters from DCH x
ENL AUTO x	Enable automatic recovery for DCH x
ENL DCH x	Enable DCH x and attempt to establish the link
ENL MSGI x (options)	Enable the monitoring of incoming messages on D-channel x
ENL MSGO x (options)	Enable the monitoring of outgoing messages on D-channel x
ENL SERV x	Enable service messages on D-channel x
EST DCH x	Establish multiple frame operation on D-channel x
MAP DCH x	Get physical address and switch settings for D-channels
PLOG DCH x	Print protocol error log on DCH x
PTAB DCH x (t)	Display layer 3 message configuration table t and LAPD parameters from DCH x
RLS DCH x	Release D-channel x
RST DCH x	Reset D-channel x, inhibit signaling
RST MON	Reactivate monitoring on D-channels
SDCH DCH x	Switch to the standby D-channel x
STAT DCH (x)	Get status of one or all D-channels

STAT MON (x)	Display the incoming and outgoing monitoring status of one or all D-channel
STAT SERV (x)	Get the status of services messages for one or all D-channels
TEST 100 x	Perform interrupt generation test on DCH x
TEST 101 x	Perform loopback mode test on DCH x
TEST 200 x	Perform interrupt handler test on DCH x
TEST 201 x	Test interrupt handler-to-link interface path

Multi-purpose Serial Data Link (MSDL) commands

The NT6D80 MSDL card provides 4 ports for ISDN Primary Rate D-channel (DCH) and Application Module Link (AML)

The MSDL commands are listed below, where x is the MSDL device number (defined by prompt DNUM in LD17). These are provided in Link Diagnostic (LD48) and D-channel Maintenance (LD96), and I/O Diagnostic (LD37).

DIS MSDL x (ALL) – Disable MSDL card
ENL MSDL x (FDL, ALL) – Enable MSDL card
RST MSDL x – Reset MSDL card
STAT MSDL [x (FULL)] – Get MSDL status
SLFT MSDL x – Execute a selftest on MSDL card x

These commands are provided in Link Diagnostic (LD48) and D-channel Maintenance (LD96), and I/O Diagnostic (LD37). See *X11 input/output guide* (553-3001-400) for a complete description of these commands.

MSDL D-channel command summary

The following commands are available only for D-channels on MSDL ports.

DIS LLB x	Disable local loop back mode on MSDL DCH x
DIS RLB x	Disable remote loop back mode on MSDL DCH x
DIS TEST x	Disable TEST mode on MSDL DCH x
ENL LLB x	Enable local loop back mode on MSDL DCH x
ENL RLB x	Enable remote loop back mode on MSDL DCH x
ENL TEST x	Enable TEST mode on MSDL DCH x
MAP DCH x	Get physical address and switch settings for D-channels
PCON DCH x	Print configuration parameters on MSDL DCH x
PMES DCH x	Print incoming layer 3 messages on MSDL DCH x
PTRF DCH x	Print traffic report on MSDL DCH x
TEST LLB x	Start local loop back test on MSDL DCH x
TEST RLB x	Start remote loop back test on MSDL DCH x

Alphabetical list of commands

The following is an alphabetical list, and brief description of all the commands found in LD96. These are brief descriptions only. For complete discussions refer to *X11 input/output guide* (553-3001-400).

DIS AUTO x	Disable automatic recovery for DCH x.
DIS DCH x	Disable DCH x.?X11 release 17 and earlier uses command format is: ENL DCHI x.
DIS LLB x	Disable local loop back mode on MSDL DCH x.
DIS MSGI x (options)	Disable the monitoring of incoming messages on D-channel x.
DIS MSGO x (options)	Disable the monitoring of outgoing messages on D-channel x.
DIS RLB x	Disable remote loop back mode on MSDL DCH x.
DIS SERV x	Disable service messages on D-channel x.
DIS TEST x	Disable TEST mode on MSDL DCH x.
ENL AUTO x	Enable automatic recovery for DCH x.
ENL DCH x (FDL)	Enable DCH x and attempt to establish the link. FDL (optional), and force downloads D-channel loadware to MSDL card. X11 release 17 and earlier uses command format is: ENL DCHI x.
ENL LLB x	Enable local loop back mode on MSDL DCH x.
ENL MSGI x (options)	Enable the monitoring of incoming messages on D-channel x.
ENL MSGO x (options)	Enable the monitoring of outgoing messages on D-channel x.
ENL RLB x	Enable remote loop back mode on MSDL DCH x.
ENL SERV x	Enable service messages on D-channel x.
ENL TEST x	Enable TEST mode on MSDL DCH x.
EST DCH x	Establish multiple frame operation on D-channel x. X11 release 17 and earlier uses command format is: EST DCHI x.

MAP DCH (x)	Get physical address and switch settings for D-channels.
PCON DCH x	Print configuration parameters on MSDL DCH x
PLOG DCH x	Print protocol error log on DCH x. X11 release 17 and earlier uses command format is: PLOG DCHI x.
PMES DCH x	Print incoming layer 3 messages on MSDL DCH x.
PTRF DCH x	Print traffic report on MSDL DCH x.
RLS DCH x	Release D-channel x. X11 release 17 and earlier uses command format is: RLS DCHI x.
RST DCH x	Reset D-channel x, inhibit signaling. X11 release 17 and earlier uses command format is: RST DCHI x.
RST MON	Reset or reactivate monitoring on D-channels witl enabled monitors.
SDCH DCH x	Switch to the standby D-channel x. X11 release 17 and earlier uses command format is: SDCH DCHI x.
SET MSGI x MON (0)-2	Set monitor output format level for incoming messages.

SET MSGO x MON (0)-2	Set monitor output format level for outgoing messages.
STAT DCH (x)	Get status of one or all D-channels. X11 release 17 and earlier uses STAT DCHI to get the status
STAT MON (x)	Display the monitoring status of one or all D-channel.
STAT SERV (x)	Get the status of services messages for one or all D-channels.
TEST 100 x	Perform interrupt generation test on DCH x.
TEST 101 x	Perform loopback mode test on DCH x.
TEST 200 x	Perform interrupt handler test on DCH x.
TEST 201 x	Test interrupt handler-to-link interface path.
TEST LLB x	Start local loop back test on MSDL DCH x.
TEST RLB x	Start remote loop back test on MSDL DCH x.

DCH messages

A report is output when the D-channel is released or established. The format of this report follows.

DCH x EST hh:mm:ss mm/dd/yyyy
DCH x RLS hh:mm:ss mm/dd/yyyy

Where x is the D-channel number and RLS or EST indicates if the channel was released or established. The time and date is also output.

X11 release 17 introduces enhanced D-channel reports.

Note: Complete operation of enhanced reporting requires X11 release 17 or later, and QPC757 vintage E and later.

The format of this report is:

DCH x EST REASON hh:mm:ss mm/dd/yyyy
DCH x RLS REASON hh:mm:ss mm/dd/yyyy

The REASON indicates why the D-channel was released or re-established. The following reasons may be output when the D-channel is released.

- CONFIRM = Released a D-channel due to a request from SL-1 software.
- CTS DOWN = Released a D-channel because a Clear To Send signal from the DCE interface has dropped. Check the DCE interface (PRI or modem) and associated cables.
- NO EXT CLK = No external clock received from the DCE interface. Check the DCE interface (PRI or modem) and associated cables.
- NO RESPONSE = No response from far end after N200 transmissions. No action required, problem is at the far end.
- RED ALRM = Red (local) alarm has occurred. Check the PRI loop.

- REMOTE = Release was initiated by the far end. No action required, problem is at the far end.
- SABME WDM = Far end responded to SABME with DM. No action required, problem is at the far end (X11 release 18).
- TEST MODE = Release prior to entering test mode (X11 release 18).
- WRONG MODE = Release a D-channel due to an incorrect master/slave configuration (see prompt SIDE in LD17).
- YEL ALRM = Yellow (remote) alarm has occurred.

The following reasons may be output when the D-channel is re-established.

- AUTO REC = Re-established a D-channel due to auto-recovery.
- CONFIRM = Established a D-channel due to a request from SL-1 software.
- DMFO FRAME REC = Re-established a D-channel after receiving a DM frame in the timer recovery state (X11 release 18).
- FRAME REC = Re-established a D-channel after receiving an undefined frame from the far end.
- FRMR REC = Re-established a D-channel after receiving a Frame reject from the far end.
- INDICATION = Established a D-channel.
- INFO FRAME REC = Re-established a D-channel after receiving a frame type with an information field not allowed (X11 release 18).
- N(R) REC = Re-established a D-channel after receiving a bad N(R) from the far end.
- N201 REC = Re-established a D-channel after receiving a frame with an information field longer than N201 from the far end.
- N2X4 RNR REC = Re-established a D-channel after receiving a N2X4 consecutive RNR frames (X11 release 18).
- TIMER REC = Re-established a D-channel due to timer recovery.
- WRONG HDRL REC = Re-established receiving a frame with a incorrect header length (X11 release 18).

With MSDL D-channels the layer 2 can respond with a reason for link reset or disable condition. The output is:

DCH : xx I PRIMI : RESET_IND TIME: hh:mm:ss
RESET_IND - rrrrrr

DCH : xx I PRIMI : DSBL_IND TIME: hh:mm:ss
DSBL_IND - rrrrrr

Where, rrrrrr is the reason for the reset or disable as follows.

NO RESOURCES – Reset the MSDL and try again. If the NO RESOURCES reason is still received, then configure the D-channel on a different card.

DTE/DCE or RS232/R422 – Check switch settings on MSDL card and far end.

LAYER 2 ERROR – Disable the DCH and enable with force download option.

The following is a brief discussion of the messages relating to D-Channel operation. For a complete discussion, refer to *X11 input/output guide* (553-3001-400).

DCH001	ISDN package is not equipped.
DCH002	Command not allowed.
DCH003	DCHI is disabled.
DCH004	Prior to X11 release 17, only one link can be monitored at one time.
DCH005	Undefined link/DCHI state. There is a software/hardware mismatch. Action: 1. Disable and re-enable the DCHI card. 2. Check DCHI status.
DCH006	DCHI not responding. Action: 1. Disable and re-enable the DCHI card. 2. Check DCHI status.
DCH007	Command invalid at this state.
DCH008	Invalid source to the overlay.
DCH009	Invalid command entered.
DCH010	Invalid parameter #1.
DCH011	Invalid number of parameters.
DCH012	DCHI is not configured.
DCH013	Invalid message type.
DCH014	Invalid IE type.
DCH015	Invalid link monitor status.
DCH016	Invalid link/DCHI number.
DCH017	Invalid key entered.
DCH018	Invalid total keys entered.
DCH019	Invalid table number.
DCH020	Transmit buffer is not empty.
DCH021	Receive buffer not ready. Action: Check DCHI status.
DCH022	Invalid Octet number.
DCH023	Unexpected loop input.
DCH024	Backup DCH is not configured.

DCH025	DCH is already active. When using the SDCH DCH x command, be sure to enter the standby D-channel number.
DCH026	Specified DCH is not established. DCH must be in established state before switch command can be carried out.
DCH027	DCH already established.
DCH028	Command only valid for D-channels on MSDL card.
DCH029	DCH has to be enabled first.
DCH030	DCH has to be in Test Mode first.
DCH031	Unable to enable the local loopback substate because the sub state is not idle.
DCH032	Unable to disable the local loopback sub state because it is not in the local loopback sub state.
DCH033	Unable to enable the remote loopback sub state because the sub state is not idle.
DCH034	Unable to disable the remote loopback sub state because it is not in the remote loopback sub state.
DCH035	Unable to run the local loopback test because the link is not in a local loopback sub state.
DCH036	Unable to run the remote loopback test because the link is not in a idle sub state.
DCH038	Invalid DCH number for ENL command.
DCH039	Invalid DCH state for enabling the link.
DCH040	Wrong number of input parameters for the enable command.
DCH041	Input enable command not recognized.
DCH042	MSDL card has to be in operational state.
DCH043	Invalid DCH number.
DCH044	Test or DCH maintenance command is not supported for D-channels configured on the MSDL card.
DCH045	MSDL card is disabled.
DCH046	Invalid maintenance request for DCH link.
DCH300	Test 200, interrupt handler interface, failed. Action: If test continues to fail, report software problem.
DCH301	Test 201, interrupt handler-to-link interface, failed. Action: If test continues to fail, report software problem.
DCH302	DCHI test 101 failed. No interrupt, but good data. Action: Replace DCHI.

DCH303	DCHI test 101 failed. There is interrupt, but bad data. Action: Replace DCHI.
DCH304	DCH test 101 failed. No interrupt and bad data. Action: Replace DCHI.
DCH305	DCHI test 100 failed. Stuck interrupt. Action: Replace DCHI.
DCH401	That command is not allowed. This is a single octet information element.
DCH402	Only three message types can be specified in one command.
DCH403	Only one feature can be monitored at one time.
DCH404	Invalid TN or no TN was entered.
DCH405	Only five TNs can be specified for incoming or outgoing messages.
DCH406	This TN has been specified already.
DCH407	TN does not associate with the selected D-channel.
DCH408	Backup D-channel is not allowed; primary D-channel should be used.
DCH410	The ENL SERV command cannot be executed when the primary D-channel and, if equipped, the backup D-channel are in the established state. Disable both D-channels before entering the ENL SERV command.
DCH411	SDCH command is allowed only when IFC= SL1 and RCVP = No in LD17.
DCH1001	Invalid primitive-ID. Action: Check DCHI status.
DCH1002	Unexpected primitive. Action: Check DCHI status.
DCH1003	Protocol error. Action: 1. If the error continues, check DCHI card status. 2. If the problem still continues, report it.
DCH1004	PRI is out of service.
DCH1005	Link release error. Action: 1. Check DCHI status 2. Check the PRI-to-DCHI cable 3. Check PRI status
DCH1006	Link establishment error. Action: 1. Check DCHI status 2. Check the PRI-to-DCHI cable 3. Check PRI status
DCH1007	Interrupt was lost. Action: If more than 10 times per day, run DCHI tests 200 and 201.

DCH1008	Output request buffer overflow. Action: If more than five times per day, reset D-channel output buffer size in LD17, using prompt OTBF.
DCH1009	PRI reported DCHI is out of service. Action: 1. Check DCHI status 2. Check PRI status 3. Check the PRI-to-DCHI cable
DCH1010	DCHI is software disabled.
DCH1011	Late link establishment. Action: 1. If the far end is disabled, no action needed 2. If the far end is active, increase the timer threshold in LD17, using prompt T200
DCH1012	Late link release. Action: 1. If the far end is disabled, no action needed 2. If the far end is active, increase the timer threshold in LD17, using prompt T200
DCH1013	Invalid DCHI status due to software/hardware mismatch. Action: 1. Disable and re-enable the DCHI card 2. Check DCHI status
DCH1014	Invalid DCHI status due to software/hardware mismatch. Action: 1. Disable and re-enable the DCHI card 2. Check DCHI status
DCH1015	Receive buffer full. Action: If more than five times per day, disable and re-enable DCHI.
DCH1016	Transmit buffer full. Action: Check the DCHI card.
DCH1017	No end-of-message. Action: Definitely a DCHI problem. Check the DCHI card.

DCH1018	No transmit buffer available. Action: 1. Check PRI to DCHI cable 2. Check PRI status 3. Check DCHI status
DCH1019	DCHI is hardware disabled.
DCH1024	The DCH port on the MSDL card could not be enabled because the MSDL card is not in an operational state.
DCH1025	Did not receive a confirmation from Layer 2 for a MSDL DCH test state event, therefore a timeout has occurred.
DCH1026	An invalid timeout occurred for the DCH test state. No further action is required for this event.
DCH1027	A invalid test confirmation was received from layer 2. No further action is required for this event.
DCH1028	The DCH has to be on the MSDL card for the maintenance task requested.
DCH1029	Resynchronization of the flow control counters failed when a flow control condition was detected by the MSDL DCH Handler application.
DCH1030	Output request buffer overflow for D channels on the MSDL card. Increase the size of the output request buffer.
DCH4283	Both D-channels have been released. Action: Establish the D channel.

DTA messages

These messages relate to the commands used in LD60. They support the following hardware.

- QPC472 Digital Trunk Interface (DTI)
- QPC536 2.0 Mb/s Digital Trunk Interface (DTI)
- QPC720 Primary Rate Interface (PRI)
- QPC471 and QPC775—Clock Controller
- QPC785 2.0 Mb/s Digital Trunk Interface (DTI)

The following is a brief discussion of the messages relating to DTA. For a complete discussion, refer to *X11 input/output guide* (553-3001-400).

DTA001 loop	Define the datablock threshold in LD73.
DTA002 loop	Message received with wrong chip field.
DTA003 loop	Power up message received.
DTA004 loop	Phase lock loop (PLL) clear message is received without phase lock loop alarm.
DTA005 loop	Yellow alarm (remote alarm) has occurred.
DTA006 loop	Yellow alarm (remote alarm) 24-hour threshold has been exceeded. Manual intervention is required.
DTA007 loop	Yellow alarm (remote alarm) is cleared.
DTA008 loop	Yellow alarm (remote alarm) is disabled.
DTA009 loop	Phase lock loop alarm has occurred.
DTA010 loop	Phase lock loop alarm has cleared.
DTA011 loop	Bit error rate warning threshold reached.
DTA012 loop	Bit error rate out of service limit reached.
DTA013 loop	Too many bit error rate out of service occurrences in 24 hours.
DTA014 loop	Bit error rate alarm has cleared.
DTA015 loop	Frame slip – tracking – maintenance limit.
DTA016 loop	Frame slip – tracking – out of service limit.
DTA017 loop	Frame slip – free run (non-tracking) – maintenance limit.
DTA018 loop	Frame slip – free run (non-tracking) – out of service limit.
DTA019 loop	Frame alignment maintenance limit.
DTA020 loop	Frame alignment out of service limit.
DTA021 loop	Frame alignment alarm persisted for 3 seconds.
DTA022 loop	Frame alignment alarm has cleared for at least 15 seconds.
DTA023 loop	PRI loop is up.
DTA024 loop	System initiated (automatic, LD45 or LD60) self-test on PRI loop failed. All channels are disabled, loop is put into red alarm (local alarm).

DTA025 loop	System initiated (automatic, LD45 or LD60) self-test on PRI loop L passed. Channels were previously disabled due to self-test fault or a loop-level self-test. Channels are enabled and red alarm (local alarm) is removed.
DTA026 loop	Non-tracking frame slip out of service limit is reached while monitoring frame slip improvement. Trunks remain out of service and the improvement timer (prompt SRIM in LD73) is restarted.
DTA027	The non-tracking frame slip guard timer has expired. The trunks affected are kept out of service. Software is checking for slip rate improvement. The improvement criterion is the number of maintenance messages the system gets during the guard time.
DTA028 loop	Slip rate improvement criterion is not met. Trunks remain out of service, improvement timer is reset (prompt SRIM in LD73).
DTA029 loop	Non-tracking frame slip rate improvement criterion is met. Trunks being returned to service.
DTA100 l s c u	Far-end hardware corresponding to Virtual Terminal l s c u is disabled.
DTA101 l s c u	Far-end hardware corresponding to Virtual Terminal l s c u is enabled.
DTA102 loop	Power is up on the PRI2 board.
DTA103 loop	Problem in loop or channel message of PRI2.
DTA104 loop	Channel self-test report for PRI2.
DTA105 loop	Loop self-test report for PRI2.
DTA106 loop	PRI2 Loop is in acceptable state.
DTA107 loop	PRI2 Loop is in G1 MNT state.
DTA108 loop	PRI2 Loop is in G1 NNC state.
DTA109 loop	PRI2 Loop is in G1 OOS state.
DTA110 loop	PRI2 Loop is in G2 MNT state.
DTA111 loop	PRI2 Loop is in G2 NNC state.
DTA112 loop	PRI2 Loop is in G2 OOS state.
DTA113 loop	PRI2 Loop is in OOS state with no auto-start.
DTA114 loop	PRI2 loop is disabled, and message received is not power up.
DTA115 loop	Unsolicited PRI2 message received.
DTA116 loop	PRI2 loop is in G1 NNDC state.

DTA117 loop	PRI2 loop is in G2 NNDC state.
DTA200 loop	The DTI2 (NI and CI-1) firmware has initialized.
DTA201 loop	The Carrier Interface (CI-1) firmware has initialized.
DTA202 loop	The Network Interface (NI) firmware has initialized.
DTA203 loop e	A Group 2 error was detected by the DTI card. Error (e) = 0 to 1F (HEX).
DTA204 loop e	The NI firmware has encountered a problem. Refer to DTI009 for NI microprocessor error codes (e).
DTA205 loop e	The CI-1 firmware has encountered a problem. Refer to DTI009 for CI-1 microprocessor error codes (e).
DTA206 loop	Response to channel status poll has timed out. The channel was disabled.
DTA207 loop s c	An invalid signal has been received from the DTI, where, s = ABCD signal received from DTI; c = channel.
DTA208 loop s c	An invalid signal has been requested to be sent to the DTI, c = channel s = signal type requested.
DTA209 loop	DTI loop is in acceptable state.
DTA210 loop e	DTI loop is in Group 1 MNT state, where error (e) is one or more of: BV–Bipolar Violation FV–Frame Alignment Violation SV–Slip Violation
DTA211 loop e	DTI loop is in Group 1 NNC state, where error (e) is one or more of: BV–Bipolar Violation FV–Frame Alignment Violation SV–Slip Violation
DTA212 loop e	DTI loop L is in Group 1 OOS state, where error (e) is one or more of: BV–Bipolar Violation FV–Frame Alignment Violation SV–Slip Violation

DTA213 loop e	DTI loop is in Group 2 MNT state, where error (e) is one or more of: C3–B3 TSO non-FAS (far-end Out of Service) C6–B6 TS16 frame 0 (far-end lost MFA signal) AS–64-Kbit Alarm indication signal AI–Alarm Indication signal LM–Loss of Multi-frame alignment LF–Loss of Frame alignment
DTA214 loop e	DTI loop is in voice Group 2 NNC state, where error (e) is one or more of: C3–B3 TSO non-FAS (far-end Out of Service) C6–B6 TS16 frame 0 (far-end lost MFA signal) AS–64-Kbit Alarm indication signal AI–Alarm Indication signal LM–Loss of Multi-frame alignment LF–Loss of Frame alignment
DTA215 loop e	DTI loop is in Group 2 OOS state, where error (e) is one or more of the following: C3–B3 TSO non-FAS (far-end Out of Service) C6–B6 TS16 frame 0 (far-end lost MFA signal) AS–64-Kbit Alarm indication signal AI–Alarm Indication signal LM–Loss of Multi-frame alignment LF–Loss of Frame alignment
DTA216 loop e	DTI loop is in Group 1 MNT state, where error (e) is one or more of: BV–Bipolar Violation FV–Frame Alignment Violation SV–Slip Violation
DTA217 loop e	DTI loop is in Group 1 NNC state, where error (e) is one or more of: BV–Bipolar Violation FV–Frame Alignment Violation SV–Slip Violation
DTA218 loop	DTI loop is in Group 1 data OOS.

DTA219 loop e	DTI loop is in Group 2 MNT state, where error (e) is one or more of the following: C3–B3 TSO non-FAS (far-end Out of Service) C6–B6 TS16 frame 0 (far-end lost MFA signal) AS–64-Kbit Alarm indication signal AI–Alarm Indication signal LM–Loss of Multi-frame alignment LF–Loss of Frame alignment
DTA220 loop e	DTI loop is in Group 2 NNC state, where error (e) is one or more of the following: C3–B3 TSO non-FAS (far-end Out of Service) C6–B6 TS16 frame 0 (far-end lost MFA signal) AS–64-Kbit Alarm indication signal AI–Alarm Indication signal LM–Loss of Multi-frame alignment LF–Loss of Frame alignment
DTA221 loop	DTI loop is in G2 data OOS.
DTA222 loop	DTI loop is in OOS state with no auto-start.
DTA223 loop s ch	An invalid signal has been received from the DTI. It matches CCITT fault signal. Far end may be disabled. c = channel, s = ABCD signal received from DTI.
DTA224 loop ch	DTI loop audit has found channel (ch) to be in an invalid HALFDISCONNECT state (trunk lock-up). An disconnect attempt is being made on the CHNL.
DTA225 loop	DTI loop is in G1 NNDC state.
DTA226 loop	DTI loop is in G2 NNDC state.
DTA300 loop	A slip repetition has occurred on PRI2 loop.
DTA301 loop	A slip deletion has occurred on PRI2 loop.
DTA302 loop	A slip repetition overflow has occurred on PRI2 loop.
DTA303 loop	A slip deletion overflow has occurred on PRI2 loop.
DTA304 loop	A BPV unavailable condition has occurred on PRI2 loop.
DTA305 loop	A CRC unavailable condition has occurred on PRI2 loop.
DTA306 loop	A FAP unavailable condition has occurred on PRI2 loop.
DTA307 loop	A BPV no-new-calls condition exists on PRI2 loop.

DTA308 loop	A CRC no-new-calls condition exists on PRI2 loop.
DTA309 loop	A FAP no-new-calls condition exists on PRI2 loop.
DTA310 loop	A BPV maintenance condition has occurred on PRI2 loop.
DTA311 loop	A CRC maintenance condition exists on PRI2 loop.
DTA312 loop	A FAP maintenance condition exists on PRI2 loop.
DTA320 loop	DTI loop error reporting was disabled due to an overload of input messages.
DTA321 loop	Error reporting reenabled on DTI loop after being disabled by an input overload (DTA320).

DTC messages

The following is a brief discussion of the messages relating to DTC. For a complete discussion, refer to *X11 input/output guide* (553-3001-400).

DTC001	Clock controller tracking on primary source loop.
DTC002	Clock controller tracking on secondary source loop.
DTC003	Clock controller cannot be accessed.
DTC004	Clock controller indicates clock aging error (not locked on in 5 seconds).
DTC005	Reference clock switched to secondary source from primary.
DTC006	Reference clock switched to free run mode from secondary or primary.
DTC007	Active reference clock is set to retrack primary.
DTC008	Active reference is free run or the clock controller cannot be accessed.
DTC009	Clock controller has been switched.
DTC010	UART error is detected. Active CC cannot contact other CC.
DTC011	Clock controller self-test failed; error exists.
DTC012	Clock controller has reference clock problem.
DTC013	Clock controller has tracking problem.
DTC014	Clock controller set to free run.
DTC015	Clock controller set to secondary.
DTC016	Clock controller restored from free run or secondary to tracking on primary.
DTC017	Clock controller restored from free run to tracking on secondary.
DTC018	Cannot switch or restore to a reference clock because automatic reference clock switching option is disabled.
DTC100	An invalid error message was received from the clock controller.
DTC101	You can only disable the secondary clock reference.

DTC102	You can only enable the secondary clock reference.
DTC103	System is locked to primary clock reference.
DTC104	System is locked to secondary clock reference.
DTC105	System is locked to free run.
DTC106	Supposed to free run but hardware is tracking to primary.
DTC107	Supposed to free run but hardware is tracking to secondary.
DTC108	Supposed to track on primary but hardware is tracking to secondary.
DTC109	Supposed to track on secondary but hardware is locked to primary reference clock.
DTC110	Supposed to track on secondary but hardware is tracking to primary.

DTI messages

The following is a brief discussion of the messages relating to DTI For a complete discussion, refer to *X11 input/output guide* (553-3001-400).

DTI000	LD60 identifier.
DTI001	Invalid input character.
DTI002	Invalid command.
DTI003	Incorrect number of parameters.
DTI004	Incorrect customer number.
DTI005	Invalid parameter.
DTI006	Loop specified is not a DTI/PRI loop.
DTI007	DISI request already active.
DTI008	DISI command is completed.
DTI009 loop ch	DTI/PRI channel failed hardware self test. For DTI009 L M E, the output data is L = loop M = N for NI microprocessor (see Table 1, in *X11 input/output guide* (553-3001-400)) M = C for CI microprocessor (see Table 2 in *X11 input/output guide* (553-3001-400)) E = error code for debug purposes.
DTI010 loop c	System clock c cannot be switched in to replace active clock; or another loop is already in loopback mode.
DTI011 c	System clock c cannot be switched in because loss of service will result to the peripheral signaling pack listed.
DTI012 loop	Network card does not respond from IOTEST; loop is disabled.

DTI013 loop	No channel is available on loop for diagnostic test. No self-test is performed on this loop.
DTI014 loop	Loop is in remote loop-back mode; command not allowed.
DTI015 loop	Loop is not specified as primary or secondary clock reference source.
DTI016	The DTI package is restricted; LD60 is not allowed to load.
DTI017	Previous command in progress; enter END to abort.
DTI018 loop	DISI command aborted.
DTI019	The loop/channel is not disabled for self-test or it is already in the requested set/reset loop-back mode.
DTI020 loop	Loop is already disabled. No action is taken.
DTI021	Attempt was made to disable input TTY loop.
DTI022 loop	Loop is already enabled or the Peripheral Signaling card is disabled.
DTI023 loop ch	Cannot disable/enable the specified channel.
DTI024	Loop is enabled but no response from hardware.
DTI025 loop ch	Terminal is not equipped.
DTI026 c r	Invalid input parameter to LOVF command for customer c, route r.
DTI027 loop	Loop is not in loopback test mode.
DTI028 loop ch	No test result received before timeout from the specified loop or channel.
DTI029 loop	Loop is enabled but red (local) and yellow (remote) alarms exist.
DTI030 loop	Loop is enabled but red alarm (local alarm) exists.
DTI031 loop	Loop is enabled but yellow alarm (remote alarm) exists.
DTI032 loop	Loop is in yellow alarm (remote alarm) state or is waiting for "yellow alarm sending ceased" message from hardware. Do not perform automatic self-test.
DTI033 loop	Loop is in red/yellow/audit state. Command not allowed.
DTI034 loop	Switching of clock controller is not allowed for this machine type.
DTI034 loop m	Loop microprocessor m failed echo message selftest; m = N for NI microprocessor, m = C for CI microprocessor.
DTI035	Clock controller does not exist.

DTI035 loop ts	Network map in software indicates that timeslot ts of network loop is idle but the connection memory word for that slot on network pack is not idle. Probably a software fault
DTI036 loop	Continuity checker on loop is faulty. Network pack probably faulty.
DTI037 loop	Unable to read partial alarm counts from DTI hardware on loop. Following alarm counts are not complete.
DTI038 loop	No channel is available on loop for diagnostic. Self-test was not performed.
DTI038 loop	Loop not responding. Check enable switch on Network card (P1).
DTI039 loop	Continuity test failed on loop.
DTI040 loop ch	Loopback test failed on loop and channel.
DTI041 loop	Network memory test failed. Replace network pack.
DTI042 loop ch	No timeslots available for loopback test. Loopback test not tested on channel. If loop level test, all channels greater than and including channel ch not tested.
DTI043	Another channel already in loopback mode.
DTI044 loop	Loop enabled by midnight routine.
DTI045 loop	Self-test not performed on loop because loop was disabled manually.
DTI046 loop	Self-test not performed on loop because unable to access the loop.
DTI047 loop	Self-test not performed on loop since loop in remote loop back mode.
DTI050 loop	Continuity checker on loop is faulty. The network pack is probably faulty.
DTI051	Data link is not defined.
DTI052	Tracking rejected. Reference primary is not specified.
DTI053	Unable to track on primary.
DTI054	Tracking rejected. Reference secondary is not specified.
DTI055	Unable to track on secondary.
DTI056	Unable to access clock controller.
DTI057	Unable to free run.
DTI058	Supposed to free run but hardware is tracking on primary.
DTI059	Supposed to free run but hardware is tracking on secondary.
DTI060	Supposed to track on primary but hardware is tracking on secondary.
DTI061	Supposed to track on primary but hardware is free run.

DTI062	Supposed to track on secondary but hardware is tracking on primary.
DTI063	Supposed to track on secondary but hardware is free run.
DTI064	Cannot determine which CPU is in use.
DTI065	System clock must be switched before proceeding.
DTI066	Idle CPU must be switched in for active CPU before proceeding.
DTI067 c	System clock generator specified is already enabled.
DTI068 c	System clock generator specified is not responding.
DTI069 loop	Unable to track on Loop.
DTI070	Clock cannot be switched. Unable to track the reference loop.
DTI071	The ENCH L C command is not allowed here because the channel is busy.
DTI072	The ENCH L C command is not allowed because the associated D-channel is not established.
DTI073 loop	If loop is a QPC720, then the pack is not responding. If loop is a QPC472, then ignore this message.
DTI081	B-Channel cannot be enabled until a DCH Link is established.
DTI098	Command entered applies to 1.5 Mb DTI only.
DTI099	Command entered applies to 2.0 Mb DTI only.
DTI100 loop	DTI link loop is associated with an indirect command and Status Link. This loop cannot be disabled until the CSL is disabled.
DTI101	Server using channel for maintenance, cannot Remove Link.
DTI200	Warning: There is an active Clock Controller on board of the digital trunk card. If your intend is to remove the card from the shelf, please disable the Clock Controller before removing the card from the shelf.
DTI4130	Incompatible protocol between the interfaces. If this error continues, report it.
DTI4131	Incompatible protocol between the interfaces. If this error continues, report it.
DTI4132	ENCH L C command is not allowed because the associated D channel is not established.

MSDL messages

The MSDL provides 4 ports for applications such as

— ISDN Primary Rate D-channel (DCH)

— Application Module Link (AML)

— Input/Output devices (TTY)

The MSDL messages report problems with the MSDL card and its applications. The MSDL commands are provided in LD37, LD48, and LD96.

The following is a brief discussion of the messages relating to MSDL. For a complete discussion, refer to *X11 input/output guide* (553-3001-400).

MSDL001	The number of parameters for the MSDL command is incorrect.
MSDL002	The card number in the command is out of range or invalid.
MSDL003	Since this command is only valid for use on the MSDL card in this overlay, the first parameter must be MSDL.
MSDL004	Cannot reset the card (or execute self tests) right now because the card is not in Manually Disabled state (MAN DSBL).
MSDL005	Failed to reset; could not write command to card. Card is probably not present, or the switch settings on the card do not agree with the database.
MSDL006	Cannot enable the card unless it is in Manually Disabled (MAN DSBL) state.
MSDL007	Cannot disable card unless it is in the ENBL state.
MSDL008	Cannot reset the card (or execute self tests) on the card right now since the device enabled bit is set, meaning a message response is currently pending.
MSDL011	No response received to the enable card command.
MSDL012	The response message from the card to the overlay indicates failure to enable/disable.

MSDL014	No response received to the disable card command. The card is set to the Manually Disabled (MAN DSBL) state anyway.
MSDL015	The command that was entered requires that a message be sent to the MSDL. The Meridian 1 was unable to build the message since the buffer was not free. Try again later.
MSDL016	Failed enable attempt. If this message is not accompanied by any other error message, the card may be in the process of performing self-tests or the self-tests may have already failed. Wait a few minutes, then execute the self-tests with the SLFT MSDL x command. If self-tests pass, try to enable the card again.
MSDL017	At least one of the ports on the MSDL is currently enabled. Disabling the card is disallowed when ports are enabled unless the DIS MSDL x ALL command is used.
MSDL018	The fourth parameter of the command is unrecognized or unimplemented.
MSDL019	The command entered required that information be read from the MSDL. The specified MSDL is not present in the system, and the information could not be read.
MSDL020	The command entered required that the application information block on the MSDL be read by the Meridian 1. The block is currently being updated by the MSDL, and the system could not read the block. Try again.
MSDL021	Began to download the MSDL basecode but stopped before finishing. There should be an SDL error message; refer to the information on that message as to the reason for the failure.
MSDL022	The rest of the information output in response to this command is resident on the card. The card is not enabled, and the information can not be read.
MSDL024	The Meridian 1 began to download an MSDL application but stopped before finishing. There should be an SDL error message; refer to the information on that message as to the reason for the failure.
MSDL025	There is currently maintenance activity on the application in question. Wait a few minutes and try again.
MSDL026	Disabling the MSDL when the active TTY is supported by it is not allowed.

MSDL027	Time out waiting for the self tests to complete. Wait at least five minutes, then try again. *Note:* Under certain unusual circumstances, self tests can take approximately five minutes, but this should only occur when the flash EPROM on the card is new or has been completely erased.
MSDL028	Unable to enable the card as it is not present in the system. If the card in question is believed to be present, check if the switch settings on the card agree with the device number entered in this command.
MSDL029	Incorrect password entered in response to the ENL MSDL x DBG command.
MSDL030	The debug option for this card has already been turned on.
MSDL031	The ENL MSDL x ALL command is only valid when the MSDL is in the ENBL or MAN DSBL state.
MSDL032	The MSDL card was removed from its slot, or the card reset itself during the self-tests. If the card was removed, execute the self-tests again and do not remove the card from its slot until the tests are complete. If the card was not removed, execute the self-tests again. If this message appears more than twice, replace the MSDL card.
MSDL100 x	The CSTAT and CSUBSTAT fields on MSDL x indicate the card is Manually Disabled. The Meridian 1 believes the card is Enabled. The card is placed in the System Disabled - Selftests Passed state, and within the next few minutes, the Meridian 1 will attempt to enable the card.
MSDL101 x	The CSTAT field on MSDL x indicates the card is no longer Enabled. The Meridian 1 will attempt to return the card to an Enabled state within a few minutes. Under certain conditions, this message is output at the same time as MSDL302.
MSDL102 x	No response was received from MSDL x to a background polling message sent periodically to each MSDL card. The purpose of this message is to ensure that the card is capable of receiving and sending messages.
MSDL103 x	An overlay was waiting for a message from MSDL x. Most likely, the overlay is no longer loaded. The message the overlay was waiting for was never received.
MSDL104 x	The MSDL background audit sent a message to MSDL x, and did not receive a response.

MSDL105	The CSTAT value read from the MSDL is invalid. This indicated one of two error conditions: – The card has encountered a severe hardware fault so that it is unable to report the error to the Meridian 1. – There May be multiple cards in the system with the same device number (switch settings) as the MSDL. When the CSTST is read from the MSDL, it may not be the MSDL card that is responding. Be sure no other cards in the system share the device number. If so, change the device numbers. If not, replace the card.
MSDL106 x appl	The MSDL audit detected that there was no response to a maintenance message originated by application "appl" on MSDL x.
MSDL107 x appl	The Meridian 1 was unable to determine if downloading was necessary. Three fields accompany this message: the MSDL card number, and the application name. The third field contains a value for internal use only.
MSDL108 x appl	Application "appl" on MSDL x needs to be downloaded to the card. Downloading begins as soon as there is no overlay loaded.
MSDL112 x	MSDL x has been reset in order to begin automatic recovery. Immediately following this message, the card is executing self tests. When they are finished, provided they pass, the Meridian 1 will attempt to enable the card.
MSDL201 x appl	MSDL x sent a message to the Meridian 1 indicating application "appl" data space has been corrupted.
MSDL202 x appl	MSDL x sent a message to the Meridian 1 indicating that application "appl" on the card unexpectedly disabled itself (performed a "close").
MSDL204 x appl	The Meridian 1 searched the system disk to find a version of an application "appl" for MSDL x, and found none.
MSDL205 x appl	An error was encountered when searching the system disk to find a version of application "appl" for MSDL x. Refer to an accompanying SDL error message for the exact error reason. This message indicates that Meridian 1 attempts to enable the application in question if a version exists on the card.
MSDL206 x appl y z	An error was encountered when comparing a version of application "appl" on the system disk with a version on MSDL x. Refer to an accompanying SDL error message for the exact error reason. This message indicates that the Meridian 1 will attempt to enable the application in question if a version exists on the card.

MSDL207 x appl y z	An error was encountered when downloading application "appl" to MSDL x. Refer to an accompanying SDL error message for the exact error reason. The entire enable sequence has been aborted.
MSDL208 x	When preparing to download the base software to MSDL x the card indicated that some kind of fatal error was encountered. Execute selftests before attempting any other action regarding this card.
MSDL209 x y z	Some memory was reclaimed for from the MSDL for future use. An application on MSDL x requested that a buffer pool be freed. When this occurred, there was at least one outstanding buffer. The Basecode waited for the buffer(s) to be returned to the pool before freeing it, but it never returned. The buffer pool was forcibly freed by the Basecode.
MSDL210	Failed to enable the MSDL for one of the following reasons: – The card in question is not an MSDL card. For example, there may be a card in the system with switch settings that correspond to the MSDL, but is in fact not an MSDL card. – There is at least one other card in the system with switch setting identical to the MSDL's. Remove the card with the same device number as the MSDL.
MSDL300 data	The MSDL background audit has changed the card state. In the cases where the card was previously enabled and now is no longer enabled, another MSDL message will indicate the reason for the state change. When making a state transition due to a fatal error on the card, the reason for the fatal error is displayed in this message. This is an informational message and requires no action by the craftsperson.
MSDL301 x y z	An expedited data unit was received. The Meridian 1 is not expecting MSDL x to generate any messages in its current state. Following transition to disabled state, a pending message may cause this message to be displayed.
MSDL302 x y	Access to the memory space shared by the Meridian 1 CPU and the MSDL (Shared RAM) has been momentarily suspended by MSDL x. There is no specific action to be taken as a result of this message, however it indicates that message transfer between the Meridian 1 and the card ceased momentarily.
MSDL303 x y	The Meridian 1 detected corruption in either the receive ring, transmit ring, or both, causing access to the memory space shared by the Meridian 1 CPU and MSDL x (Shared RAM) to be momentarily suspended. Take no action because of this message, however it indicates that message transfer between the Meridian 1 and the card ceased momentarily.

MSDL305 x	The Meridian 1 has received 50 or more messages from the MSDL x within two seconds. At this level of message transfer, there may be some impact to the overall system performance. The level of message transfer does not warrant removing the card from service. Y indicates the rate of message transfer from the card to the Meridian 1 (in terms of messages per second).
MSDL306 x y	The Meridian 1 has received 50 or more messages from MSDL x within two seconds. At this level of message transfer, there may be some impact to the overall system performance. The level of message transfer warrants removing the card from service. Y indicates the rate of message transfer from the card to the Meridian 1 (in terms of messages per second).
MSDL307 x data	MSDL x encountered a fatal error. The output data is information read from the card regarding the error and is intended for internal use only.
MSDL308 x y appl data	MSDL x reported that it received a message with an invalid (bad) Socket ID (y). Appl is the application name, and data is up to 8 words of hex data representing the message sent.

PRI messages

PRI messages are provided for, and give information concerning, the following.

- Responses to commands entered in LD 60
- Database errors relevant to PRI interfaces
- Protocol errors associated with a PRI link

The following is a brief discussion of the messages relating to PRI. For a complete discussion, refer to *X11 input/output guide* (553-3001-400).

PRI000 loop v	No problem. Correct version ID (s) was received from PRI loop.
PRI001 loop	No problem. DCHI ready to transmit, PRI ready to receive.
PRI002 loop	PRI channel 24 not ready to receive. Action: 1 Check PRI status. 2 Check PRI to DCHI cable.
PRI003 loop	DCHI not ready to transmit. Action: 1 Check PRI status. 2 Check PRI to DCHI cable. 3 Check the DCHI status.
PRI004 loop	PRI not ready and DCHI not ready.
PRI005 loop v	Incorrect version ID (v) was received from PRI loop. The X11 software release is not compatible with the PRI hardware vintage.
PRI006 loop	Response timeout, no version ID received. Action: 1 Be sure QPC720 is being used, not QPC472. 2 Be sure PRI hardware and software are correctly installed. 3 Check PRI status.
PRI010 loop	Disabling of this loop not allowed. Associated DCHI must be disabled first.

PRI011 loop	DCH port number mismatch between PDCH block and PPRI loop block. Action: This is a software problem. Report it to the technical assistance center.
PRI100 loop ch	The B-channel indicated in the outgoing SETUP is locked out because the far-end is using an alternate B-channel.
PRI101 loop ch c	The B-channel (ch) is locked out because a RELCOMP or RELEASE message has been received with one of the following cause (c) values: 82 = channel does not exist 44 = requested channel is not available 6 = alternate channel acceptable
PRI200	Protocol Error: A Global CREF number is needed for any service message. Format: DCH: x DATA: y x = D-channel number y = Message type Action: Report problem if condition persists.
PRI201	Protocol Error: Invalid maintenance state in the service message. Output data: DCH: x DATA: y x = D-channel number y = Message type Action: Report problem if condition persists.
PRI202	Protocol Error: Incorrect value for extension bit. Output data: DCH: x DATA: y z x = D-channel number y = Message type z = Information Element (IE) Action: Report problem if condition persists.
PRI203	Protocol Error: Mandatory Notification description invalid. Output data: DCH: x DATA: y z x = D-channel number y = Message type z = Information Element (IE) Action: Report problem if condition persists.

PRI204

Database Error: Feature is not allowed for this interface.
Output data: DCH: x DATA: y z
x = D-channel number
y = D-channel interface ID
z = ESL or ISA
Action: Verify data is correct in the configuration record and the route data block.

PRI205

Protocol Error: NSF IE is missing from the SETUP message received from the far end.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Check the database in the far end switch to ensure the NSF IE is included as part of the call origination.

PRI206

Protocol Error: The length of the incoming call reference value was incorrect. The length allowed in North America is 1 or 2. For some other interfaces only a length of 2 is allowed. There may be a compatibility problem with the far end.
Output data: DCH: x DATA: y
x = D-channel number
y = Call reference length
Action: Report problem if condition persists.

PRI207

Protocol Error: Wrong message type.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI208

Protocol Error: Wrong information element (IE) for message type.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI209

Protocol Error: Undefined information element (IE) for message type.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI210 Protocol Error: Wrong coding standard.
Output data: DCH: x DATA: y
x = D-channel number
y = Coding standard
Action: Report problem if condition persists.

PRI211 Protocol Error: Incorrect extension bit.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI212 Protocol Error: Bearer capability (BC) – Information transfer not supported.
Output data: DCH: x DATA: y
x = D-channel number
y = Transfer capability
Action: Report problem if condition persists.

PRI213 Protocol Error: Bearer capability (BC) – Information transfer rate/mode not supported.
Output data: DCH: x DATA: y
x = D-channel number
y = Transfer rate
Action: Report problem if condition persists.

PRI214 Protocol Error: Bearer capability (BC) – Layer 1 protocol ID not correct.
Output data: DCH: x DATA: y
x = D-channel number
y = Protocol ID
Action: Report problem if condition persists.

PRI215 Protocol Error: Bearer capability (BC) – Rate is not correct.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI216 Protocol Error: Bearer capability (BC) – Rate is not correct.
Output data: DCH: x DATA: y
x = D-channel number
y = Rate
Action: Report problem if condition persists.

PRI217	Protocol Error: General location not supported. Output data: DCH: x DATA: y x = D-channel number y = General location number Action: Report problem if condition persists.
PRI218	Protocol Error: Cause value not supported. Output data: DCH: x DATA: y x = D-channel number y = Cause information element (IE) Action: Report problem if condition persists.
PRI219	Protocol Error: Channel ID octet 3 error. Output data: DCH: x DATA: y x = D-channel number y = Octet 3 Action: Report problem if condition persists.
PRI220	Protocol Error: Channel ID octet 5 error. Output data: DCH: x DATA: y x = D-channel number y = Message type Action: Report problem if condition persists.
PRI221	Protocol Error: Channel ID octet 5 error. Incorrect BCH standard. Output data: DCH: x DATA: y x = D-channel number y = B-channel standard Action: Report problem if condition persists.
PRI222	Protocol Error: Channel number does not exist. Output data: DCH: x DATA: y x = D-channel number y = B-channel number Action: Report problem if condition persists.
PRI223	Protocol Error: CREF flag in SETUP message is incorrect. Output data: DCH: x DATA: y x = D-channel number y = Call reference number Action: Report problem if condition persists.

PRI224	Protocol Error: State message error, protocol violation. The state IE is not appropriate for the current state. Output data: DCH: x DATA: a b c d e x = D-channel number a = Pointer to PRI message call register b = UTN c = StatePM d = Message type e = Call reference number Action: Report problem if condition persists.
PRI225	Protocol Error: State message error, protocol violation. Release complete received in U11 or U31 state. Output data: DCH: x DATA: y x = D-channel number y = Message type Action: Report problem if condition persists.
PRI226	Protocol Error: No RESTart ACK message received. Output data: DCH: x DATA: y x = D-channel number y = UTN Action: Report problem if condition persists.
PRI227	Protocol Error: Message received in NULL state. Output data: DCH: x DATA: y x = D-channel number y = Message type Action: Report problem if condition persists.
PRI228	Protocol Error: Mandatory Channel ID missing in ALERTing. Output data: DCH: x DATA: y x = D-channel number y = NONE Action: Report problem if condition persists.
PRI229	Protocol Error: Mandatory Channel ID missing in incoming CONNect message. Output data: DCH: x DATA: y x = D-channel number y = NONE Action: Report problem if condition persists.

PRI230	Protocol Error: Incoming NSF contains a mismatch between the route defined by the SID and the call type defined for that route. Output data: DCH: x DATA: a b c x = D-channel number a = Facility value b = ISA service type c = Route number Action: Report problem if condition persists.
PRI231	Database Error: NSF error. Invalid service or feature type. Output data: DCH: x DATA: y x = D-channel number y = Message type Action: Coordinate fields with far end switch.
PRI232	Protocol Error: PROGRESS INDICATOR not supported. Output data: DCH: x DATA: y x = D-channel number y = Message type Action: Report problem if condition persists.
PRI233	Protocol Error: ZERO length for mandatory information element (IE). Output data: DCH: x DATA: y x = D-channel number y = Information element (IE) identifier Action: Report problem if condition persists.
PRI234	Protocol Error: ZERO length for optional information element (IE). Output data: DCH: x DATA: y x = D-channel number y = Information element (IE) identifier Action: Report problem if condition persists.
PRI235	Protocol Error: Bearer capability (BC) – Layer ID is not correct. Output data: DCH: x DATA: y x = D-channel number y = Layer ID Action: Report problem if condition persists.

PRI236 Protocol Error: Incorrect Transit Network Selection (TNS) Network ID
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI237 Protocol Error: Message length exceeds buffer size.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI238 Protocol Error: Protocol discriminator is not compatible with the message received.
Output data: DCH: x DATA: y
x = D-channel number
y = Protocol discriminator
Action: Report problem if condition persists.

PRI239 Protocol Error: Maintenance message is not allowed for this DCH interface.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI240 Protocol Error: No service ack message received.
Output data: DCH: x DATA: y
x = D-channel number
y = UTN
Action: Report problem if condition persists.

PRI241 Protocol Error: No response from far end to this PRI call.
Output data: DCH: x DATA: y
x = D-channel number
y = B-channel number
Action: Report problem if condition persists.

PRI242 Protocol Error: Received a PRI message with an unsupported service identifier.
Output data: DCH: x DATA: y
x = D-channel number
y = Service identifier
Action: Report problem if condition persists.

PRI243 Protocol Error: Service discriminator is not supported by PRI.
Output data: DCH: x DATA: y
x = D-channel number
y = Service discriminator
Action: Report problem if condition persists.

PRI244 Protocol/Database Error: Facility reject message received.
Output data: DCH: x DATA: a b c d e
x = D-channel number
a = Originating PNI
b = Originating number
c = Destination PNI
d = Destination number
e = Reason
Action: Verify that the PNI values are correct in the customer and route data blocks and are consistent with the switch on the other end of the link.

PRI245 Database Error: Missing PNI number in the customer data block.
Output data: DCH: x DATA: y z
x = D-channel number
y = Customer number
z = Service ID
Action: Look into the customer data block to configure the PNI.

PRI246 Protocol Error: Received bad facility information element (IE).
Output data: DCH: x DATA: y
x = D-channel number
y = Error indication
Action: Report problem if condition persists.

PRI247 Database Error: PNI missing in Route Data Block.
Output data: DCH: x DATA: y
x = D-channel number
y = Service identifier
Action: Configure the PNI in the route data block.

PRI248	Protocol Error: ROSE component sent is being rejected. Output data: DCH: x DATA: y x = D-channel number y = Service identifier Action: Report problem if condition persists.
PRI249	Protocol Error: ISDN: Received a Status message with CAUSE = 30. This is normally received in response to a Status Enquiry but the Meridian 1 did not send out a Status Enquiry message. The Status message is ignored. Output data: DCH: x DATA: y x = D-channel number y = D-channel interface ID Action: Report problem if condition persists.
PRI250	Protocol Error: Received information element (IE) is in the wrong codeset. Output data: DCH: x DATA: y x = D-channel number y = Information element (IE) identifier Action: Report problem if condition persists.
PRI251	Protocol Error: The Presentation Method of Protocol Profile (PMPP) is wrong in the High Layer Compatibility IE. Output data: DCH: x DATA: y x = D-channel number y = High Layer Compatibility PMPP Action: Report problem if condition persists.
PRI252	Protocol Error: The Interpretation of High Layer Characteristics ID is wrong in the High Layer Compatibility IE. Output data: DCH: x DATA: y x = D-channel number y = High Layer Compatibility INTERPRT Action: Report problem if condition persists.
PRI253	Protocol Error: The High Layer Characteristic ID is wrong in the High Layer Compatibility IE. Output data: DCH: x DATA: y x = D-channel number y = High Layer Compatibility CHAR ID Action: Report problem if condition persists.

PRI254

Database Error: The DCH is interfacing with a software issue not supported by the application.
Output data: DCH: x DATA: y z
x = D-channel number
y = Release ID
z = Service identifier
Action: Verify that the release ID in the configuration record is the same as the software release running on the far end switch.

PRI255

Protocol Error: Information request type is not supported. A message error or a protocol error will be generated depending on whether the I.E. is mandatory or not.
Output data: DCH: x DATA: y z
x = D-channel number
y = Message type
z = Information element (IE) identifier
Action: Report problem if condition persists.

PRI256

Protocol Error: Wrong length for information request I.E. The length on the received I.E. is beyond the range. A message error or a protocol error will be generated depending on whether the I.E. is mandatory or not.
Output data: DCH: x DATA: y z
x = D-channel number
y = Message type
z = Information element (IE) identifier
Action: Report problem if condition persists.

PRI257

Protocol Error: Information request specific is not supported. A message error or a protocol error will be generated depending on whether the I.E. is mandatory or not.
Output data: DCH: x DATA: y z
x = D-channel number
y = Message type
z = Information element (IE) identifier
Action: Report problem if condition persists.

PRI258

Protocol/Database Error: An attempt is being made to insert more that 8 digits in the calling party number for a call originating or tandeming through this switch. Only eight(8) digits can be included in the calling party number, or the digits are truncated to the right (AXE-10 Australia interface only).
Output data: DCH: x DATA: TANDEM or ORIG
x = D-channel number
Action: For originating calls, modify LD 15 PFX1 and PFX2 so that PFX1+PFX2+DN is less than 8 digits. For tandeming calls, notify far end of incoming trunk that more than 8 digits are being sent.

PRI261

Database Error: The D-channel interface for routing Network Message Service (NMS) facility messages is not an Meridian 1 interface.
Output data: DCH: x DATA: a b c d
x = D-channel number
a = Operation code for TCAP protocol
b = Originating digits
c = Terminating digits
d = Customer number
Action: Verify database configuration.

PRI262

Protocol Error: Invalid value for the interface identifier field of channel ID information element from an incoming message.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI263

Protocol Error: Invalid value for the class field of restart indicator information element from an incoming message.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI264

Protocol Error: Received an invalid call reference from far-end switch.
Output data: DCH: x DATA: y
x = D-channel number
y = Message type
Action: Report problem if condition persists.

PRI265 Database Error: A Facility Reject message was received. Destination digits cannot be translated.
Output data: DCH: x DATA: a b c d e
x = D-channel number
a = TCAP package type
b = Problem (NOXLAN/NONMS)
c = Originating digits
d = Destination digits
e = Customer number
Action: Verify numbering plan databases are consistent between the near and far end switches.

PRI266 Protocol Error: TCAP Package type is not recognized by Network Message Center (NMC) feature.
Output data: DCH: x DATA: a b c d e f
x = D-channel number
a = TCAP package type
b = TCAP component type
c = Problem
d = Originating digits
e = Destination digits
f = Customer number
Action: Report problem if condition persists.

PRI267 Protocol Error: TCAP Package type is not recognized by Network Message Center (NMC) feature.
Output data: DCH: x DATA: a b c d
x = D-channel number
a = TCAP package type
b = Originating digits
c = Destination digits
d = Customer number
Action: Report problem if condition persists.

PRI268	Protocol Error: TCAP Component is not recognized by Network Message Center (NMC) feature. Output data: DCH: x DATA: a b c d e x = D-channel number a = TCAP package type b = TCAP component type c = Originating digits d = Destination digits e = Customer number Action: Report problem if condition persists.
PRI269	Protocol Error: TCAP Operation is not recognized by Network Message Center (NMC) feature. Output data: DCH: x DATA: a b c d e f x = D-channel number a = TCAP package type b = TCAP component type c = Operation d = Originating digits e = Destination digits f = Customer number Action: Report problem if condition persists.
PRI270	Protocol Error: TCAP parameter is not recognized by Network Message Center (NMC) feature. Output data: DCH: x DATA: a b c d e f g x = D-channel number a = TCAP package type b = TCAP component type c = Operation d = Parameter e = Originating digits f = Destination digits g = Customer number Action: Report problem if condition persists.

PRI271	Database Error: LDNO must be defined for the customer for ISDN DID calls in order to determine the number of digits expected for successful call termination. Output data: DCH: x DATA: y x = D-channel number y = Customer number Action: Configure LDNO in the customer data block.
PRI272	Message is ping-pong between 2 nodes.

SL-1

ISDN Primary Rate Interface

Maintenance

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