Meridian 1
Succession 1000
Succession 1000M
Succession 3.0 Software

ISDN Primary Rate Interface

Maintenance

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Revision history

October 2003

Standard 1.00 This document is a new NTP for Succession 3.0. It was created to support a restructuring of the Documentation Library, which resulted in the merging of multiple legacy NTPs. This new document consolidates information previously contained in the following legacy documents, now retired:

- *ISDN PRI: Maintenance* (553-2901-501)
- *1.5Mb DTI/PRI Description, Installation and Maintenance* (553-3011-310). Content from *1.5Mb DTI/PRI Description, Installation and Maintenance* (553-3011-310) also appears in *ISDN Primary Rate Interface: Installation and Configuration* (553-3001-201).
- *2.0Mb DTI/PRI Description, Installation and Maintenance* (553-3011-315 2.0). Content from *2.0Mb DTI/PRI Description, Installation and Maintenance* (553-3011-315 2.0) also appears in *ISDN Primary Rate Interface: Installation and Configuration* (553-3001-201).

Contents

About this document

This document is a global document. Contact your system supplier or your Nortel Networks representative to verify that the hardware and software described are supported in your area.

Subject

This document provides maintenance procedures for ISDN Primary Rate Interface (PRI) capability on Meridian 1, Succession 1000, and Succession 1000M systems.

Note on legacy products and releases

This NTP contains information about systems, components, and features that are compatible with Succession 3.0 Software. For more information on legacy products and releases, click the **Technical Documentation** link under **Support** on the Nortel Networks home page:

http://www.nortelnetworks.com/

Applicable systems

This document applies to the following systems:

- Meridian 1 Option 11C Chassis
- Meridian 1 Option 11C Cabinet
- Meridian 1 Option 51C
- Meridian 1 Option 61
- Meridian 1 Option 61C

- Meridian 1 Option 61C CP PII
- Meridian 1 Option 81
- Meridian 1 Option 81C
- Meridian 1 Option 81C CP PII
- Succession 1000
- Succession 1000M Chassis
- Succession 1000M Cabinet
- Succession 1000M Half Group
- Succession 1000M Single Group
- Succession 1000M Multi Group

Note that memory upgrades may be required to run Succession 3.0 Software on CP3 or CP4 systems (Options 51C, 61, 61C, 81, 81C).

System migration

When particular Meridian 1 systems are upgraded to run Succession 3.0 Software and configured to include a Succession Signaling Server, they become Succession 1000M systems. Table 1 lists each Meridian 1 system that supports an upgrade path to a Succession 1000M system.

Table 1
Meridian 1 systems to Succession 1000M systems (Part 1 of 2)

This Meridian 1 system...	Maps to this Succession 1000M system
Meridian 1 Option 11C Chassis	Succession 1000M Chassis
Meridian 1 Option 11C Cabinet	Succession 1000M Cabinet
Meridian 1 Option 51C	Succession 1000M Half Group
Meridian 1 Option 61	Succession 1000M Single Group
Meridian 1 Option 61C	Succession 1000M Single Group
Meridian 1 Option 61C CP PII	Succession 1000M Single Group

Table 1
Meridian 1 systems to Succession 1000M systems (Part 2 of 2)

This Meridian 1 system...	Maps to this Succession 1000M system
Meridian 1 Option 81	Succession 1000M Multi Group
Meridian 1 Option 81C	Succession 1000M Multi Group
Meridian 1 Option 81C CP PII	Succession 1000M Multi Group

Note the following:

- When an Option 11C Mini system is upgraded to run Succession 3.0 Software, that system becomes a Meridian 1 Option 11C Chassis.
- When an Option 11C system is upgraded to run Succession 3.0 Software, that system becomes a Meridian 1 Option 11C Cabinet.

For more information, see one or more of the following NTPs:

- *Small System: Upgrade Procedures* (553-3011-258)
- *Large System: Upgrade Procedures* (553-3021-258)
- *Succession 1000 System: Upgrade Procedures* (553-3031-258)

Intended audience

This document is intended for individuals responsible for maintaining ISDN PRI capability on Meridian 1, Succession 1000, and Succession 1000M systems.

Conventions

Terminology

In this document, the following systems are referred to generically as "system":

- Meridian 1

- Succession 1000
- Succession 1000M

The following systems are referred to generically as “Small System”:

- Succession 1000M Chassis
- Succession 1000M Cabinet
- Meridian 1 Option 11C Chassis
- Meridian 1 Option 11C Cabinet

The following systems are referred to generically as “Large System”:

- Meridian 1 Option 51C
- Meridian 1 Option 61
- Meridian 1 Option 61C
- Meridian 1 Option 61C CP PII
- Meridian 1 Option 81
- Meridian 1 Option 81C
- Meridian 1 Option 81C CP PII
- Succession 1000M Half Group
- Succession 1000M Single Group
- Succession 1000M Multi Group

The call processor in Succession 1000 and Succession 1000M systems is referred to as the “Succession Call Server”.

Related information

This section lists information sources that relate to this document.

NTPs

The following NTPs are referenced in this document:

- *Software Input/Output: System Messages* (553-3001-411)
- *Software Input/Output: Maintenance* (553-3001-511)

Online

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CD-ROM

To obtain Nortel Networks documentation on CD-ROM, contact your Nortel Networks customer representative.

PRI fault clearing

Contents

This section contains information on the following topics:

PRI red alarm (local alarm)

A PRI local alarm can indicate:

- 1.5 Mb/2.0 Mb digital transmission problems
- a PRI card fault

Under any of these alarm conditions, all 24/30 B-channels are taken out of service, and:

1 The PRI local alarm faceplate LED is lit.

2 Calls on the PRI are disconnected automatically.

3 All 24/30 B-channels are disabled.

4 After a pause of 2.5 seconds, the PRI sends a remote-alarm indication to the far-end switch.

5 The appropriate DTA message is printed and a minor alarm is raised on all attendant consoles within the same customer group.

System software checks every 0-15 minutes (programmable) to see if a clock-controller or reference-clock error has occurred.

If the 0-15 minute check finds the PRI in local alarm was a primary clock source, the software switches the clock controller to the secondary reference.

Channel restoration

When the alarm condition improves, the PRI is restored to service as follows:

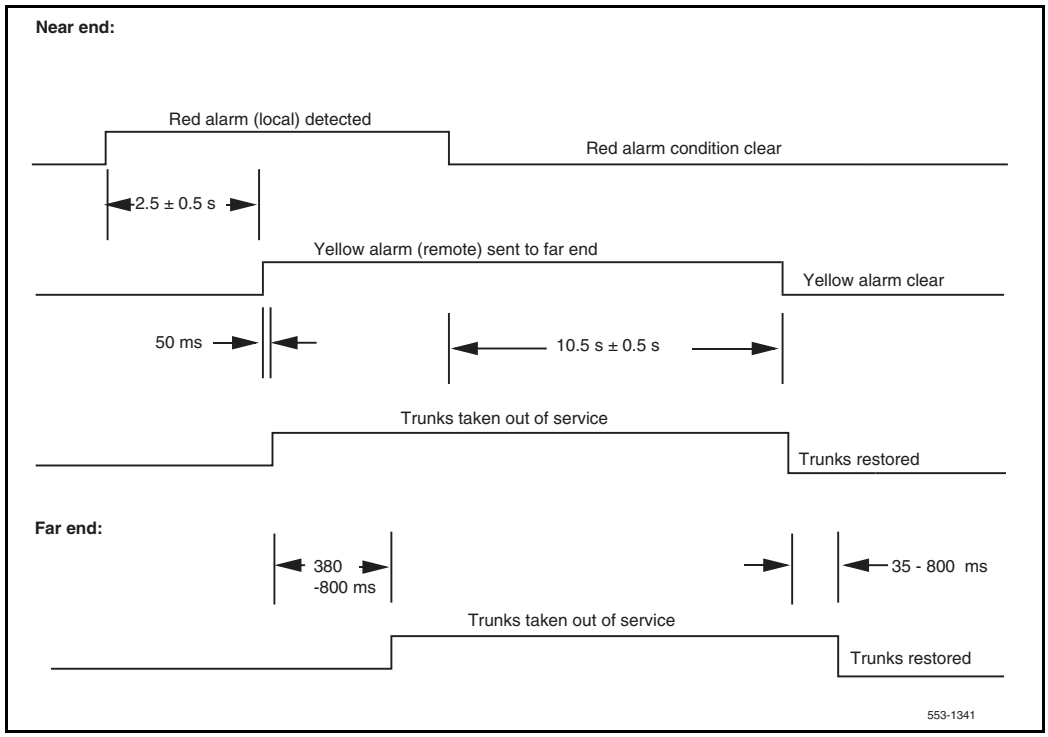
1 The local alarm is cleared.

2 After 11 seconds, the PRI stops sending a remote alarm indication to the far end.

3 The D-channel automatically attempts to re-establish. If this is successful, the B-channels are placed into the idle state and made available for calls.

Figure 1 shows the progression of the system red and yellow (local and remote) alarm timers.

Figure 1
PRI alarm timers



Procedure 1
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 remote alarm on the system indicates the far end is out of service. The fact that the PRI is receiving the remote-alarm pattern indicates that there is transmission integrity, but the far end is not ready.

When the PRI receives the remote-alarm signal from the far end, all 24/30 B-channels are disabled.

Channel restoration

When the PRI stops receiving the remote alarm, 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 LD 73) is reached, the PRI must be restored to service manually.

Procedure 2
Checking yellow alarm status

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) do the following:

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	reset 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 1.5 Mb/2Mb transmission cable is not physically connected to the far end, frame-alignment errors occur. The channels will be disabled, but the PRI will be in local-alarm mode.)	Use the Error Counter to verify the 1.5 Mb/2.0 Mb digital transmission directly from the PRI faceplate (RCV and XMT) to each connection (cross-connect, repeater, and other such equipment).
PRI fails self-test.	Replace the PRI card.
Far-end problems, usually indicated by a remote alarm.	Do a PRI status check and contact personnel at the far end for resolution.
PRI is connected but getting bit-rate or frame errors. This can be caused by: • a bad 1.5 Mb/2Mb transmission cable connection • electrical or electromagnetic interference • carrier problems (for example, defective repeater)	Use the Error Counter to verify the 1.5 Mb/2Mb digital transmission from the PRI faceplate (RCV and XMT) to each connection (cross-connect, repeater, and other such equipment).
Configuration settings do not match the far end. These problems can occur during initial start-up. They may be indicated by: • DTA 018Frame-slip out-of-service limit • DTA 021Loss-of-frame-alignment for 3 seconds • DCH 1003D-channel MDL errors	See that the PRI parameters correlate to the far-end parameters.

Table 2
PRI problem solving (Part 2 of 2)

Symptom	Action
Cannot enable the PRI. Two reasons follow: The far-end PRI is disabled, indicated by: • PRI 000PRI is responding • DTA 005 remote alarm occurred • DCH 1010 DCHI is software disabled Or, there is no 1.5 Mb/2Mb connection, indicated by: • PRI 000 PRI is responding • DTA 021 loss of frame alignment for 3 seconds • DCH 1010 DCHI is software disabled	Contact personnel at the far-end site to resolve the problem. See above, under **No connection to far end**.
The system initializes and there are no active B-channels.	When a PRI or ISL trunk interfaces with another system and the system initializes, you may have to disable and then re-enable each B-channel.

D-channel problems

D-channel problems are indicated when the DCHI releases after being enabled. This applies to both primary and backup D-channels. For example:

Command	Response	Description
LD 96 ENL DCH N		
	DCH 1003	MDL error
	DCH 1006	link establishment error
	DCH RLS	DCHI released

If these messages appear, follow the steps in Procedure 1 on page 21.

Procedure 1
D-channel status check

Step	Action	Response
1	Check the status of the D-channel's PRI.	
2	Clear any PRI problems.	
3	Contact the far end.	If the far-end D-channel is down, the DCH1006 message is printed.
4	Test the DCHI using tests 100, 101, 200 and 201 (the tests must be run in sequential order).	
5	Print the protocol log using: **LD 96** **PLOG DCH N**	
6	Check the DCHI to PRI cable.	
7	Check DCHI card jumper settings.	
8	Check to see that one system is designated as “master” (usually the larger system), and the other as “slave.”	

Quick reference to PRI operations

Contents

This section contains information on the following topics:

This chapter provides a quick-reference source for PRI maintenance operations.

PRI commands (LD 60)

Table 3 is a quick reference list of important PRI commands. For a more extensive list of PRI commands, see the section describing PRI maintenance.

Table 3
PRI commands (quick reference) (Part 1 of 2)

Command	Action
ATLP (0), 1	Disable (default) or enable midnight auto loop test
CDSP	Clear maintenance display to 00 or blank
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 loop when all channels are idle
DISL loop	Disable network and DTI/PRI cards of loop
DLBK loop	Disable remote loop back test per RLBK command
DLBK l ch	Disable remote loop back test per RLBK l ch command
DSCH l ch	Disable channel ch of loop
ENCH loop	Enable all channels on DTI/PRI
ENCH l ch	Enable channel ch of DTI/PRI loop
ENLL loop	Enable network and DTI/PRI cards of loop
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

Table 3
PRI commands (quick reference) (Part 2 of 2)

RMST loop	Perform self-test on loop
RMST l ch	Perform self-test on specified channel (2.0 Mb/s DTI/PRI only)
RLBK loop	Close loop at carrier interface point for testing
RLBK l ch	Close channel ch at carrier interface point
RSET l ch	Reset thresholds for channel ch
SLFT loop	Invoke hardware self-test on loop
SLFT l ch	Invoke partial hardware self-test on channel ch
STAT	Get status of all loops
STAT loop	Get status of DTI/PRI loop
STAT l ch	Get status of channel ch

PRI messages

Refer to *Software Input/Output: System Messages* (553-3001-411) for commonly encountered PRI messages.

DCHI quick reference

The D-channel Interface (DCHI) card provides an asynchronous port and the DCHI port. The D-channel performs the call set-up and call modification signaling for one or more 30-channel PRI cards. (Switch settings for the DCHI port are shown in the DCHI replacement section.)

D-channel commands (LD 96)

Table 4 is a partial list of DCHI and D-channel commands. For a complete list of DCHI and D-channel commands, see the *Software Input/Output: Maintenance* (553-3001-511).

Table 4
DCHI and D-channel commands (quick reference) (Part 1 of 3)

Command	Action
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 MSGI x FEAT CPNW	Disable incoming monitoring for the Network CPNW ISDN messages on D Channel x.
DIS MSGO x (options)	Disable the monitoring of outgoing messages on D-channel x
DIS MSGO x FEAT CPNW	Disable outgoing monitoring for the Network CPNW ISDN messages on D Channel x.
DIS SERV x	Disable service messages on D-channel x
DLIF DCH x	Force download of D channel x (For PRI UIPE application)
ENL AUTO x	Enable automatic recovery for DCH x
ENL DCH x (FDL)	Enable DCH x and attempt to establish the link, and force download to MSDL
ENL MSGI x (options)	Enable the monitoring of incoming messages on D-channel x
ENL MSGI x FEAT CPNW	Enable incoming monitoring for the Network CPNW ISDN messages on D Channel x.
ENL MSGO x (options)	Enable the monitoring of outgoing messages on D-channel x

Table 4
DCHI and D-channel commands (quick reference) (Part 2 of 3)

ENL MSGO x FEAT CPNW	Enable outgoing monitoring for the Network CPNW ISDN 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
EST ISPC l ch (N)	Start the data interface establishment process at the ISPC slave side an ISPC link (where “N” = the “number of tries” counter)
FDIS NCAL <DCH#> <conn_ID>	Force disconnect the specified call-independent connection
PLOG DCH x	Print protocol error log on DCH x
RLS DCH x	Release D-channel x
RLS ISPC l ch	Stop the data interface establishment process
RST DCH x	Reset D-channel x, inhibit signaling
RST MON	Reset or reactivate monitoring on D-channels with enabled monitors
SDCH DCH x	Switch to the standby D-channel x
SET MSGI x MON (0)-2	Set monitor output format level for incoming messages on D-channel x
SET MSGO x MON (0)-2	Set monitor output format level for outgoing messages on D-channel x
STAT DCH (x)	Get status of one or all D-channels
STAT ISPC l ch	Get status of data interface establishment process at ISPC slave side ISPC link which has been configured to convey D-channel signaling
STAT NCAL <DCH#>	List all current call-independent connections on a given PRI D-channel.

Table 4
DCHI and D-channel commands (quick reference) (Part 3 of 3)

STAT NCAL <DCH#> <conn_ID>	List information pertaining to a specific call-independent connection
STAT MON (x)	Display the incoming and outgoing monitoring status of one or all D-channels.
STAT SERV (x)	Get the enable/disable status of services messages for one or all D-channels
TEST 100 x	Perform interrupt generation test on DCH x
TEST 101 x	Perform loop back 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

DCH messages

Refer to *Software Input/Output: System Messages* (553-3001-411) for commonly encountered DCH messages.

MSDL commands

This is a partial list of MSDL D-channel commands. For a complete list of D-channel commands, see the *Software Input/Output: Maintenance* (553-3001-511).

Table 5
MSDL D-channel commands

Command	Action
DIS LLB x	Disable local loopback mode on MSDL DCH x
DIS RLB x	Disable remote loopback mode on MSDL DCH x
DIS TEST x	Disable TEST mode on MSDL DCH x
ENL LLB x	Enable local loopback mode on MSDL DCH x

Table 5
MSDL D-channel commands

ENL RLB x	Enable remote loopback 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 loopback test on MSDL DCH x
TEST RLB x	Start remote loopback test on MSDL DCH x
ENBL MSDL x	Enable MSDL device number x

Maintenance service messages

Service messages provide near-end 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 systems 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 systems.

Service and service acknowledge messages for B-channels and PRI only are supported between systems, and between systems and supported Central Office connectivities. The following are the three channel statuses reported by the service and service acknowledge messages for B-channels and ISL channels:

- in-service
- maintenance
- out-of-service

Near-end and far-end subcategories are defined for each maintenance status. See Table 6 for possible combinations of near and far-end status and the channel capability for each status. When the near-end status and far-end status do not match, the more severe maintenance status takes effect over the less severe maintenance status.

Table 6
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 LD 96.

This function is supported by network 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 LD 14 or the enabling or disabling of the associated loop, shelf, card or unit in LD 30, LD 32, LD 36, LD 41, or LD 60.

Channel status audit

LD 30 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

Activate the service messages in LD 96 on a per D-channel basis. The commands are as follows:

- 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.

  Note: The ENL SERV and DIS SERV commands apply to both the primary and backup D-channel. With backup D-channel configured, for example LD 17 DCHI = 5 and LD 17 BCHI = 7, ENL SERV 5 enables both D-channels 5 and 7. Similarly, DIS SERV 5 disables both channels.

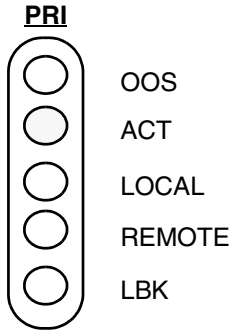
The FE MBSY, FE DSBL, and IDLE messages appear when either the B-channel or the ISL channel is idle. See “PRI fault clearing” on page 15 for more information about these responses.

PRI status check

This status check is used to verify that a PRI is working normally. It assumes the PRI and DCHI 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" on page 35.

Procedure 2
PRI status check (Part 1 of 3)

Step	Action	Response
1	Check the status LEDs on all PRI cards.	For normal operation, only the green ACT LED is lit.  553-1340
2	Note whether any other LED is lit and continue with the status check.	
3	Check the LED on the DCHI faceplate.	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.

Procedure 2
PRI status check (Part 2 of 3)

Step	Action	Response
4	Check the status of the DCHI port using: **LD 96** **STAT DCH x**	
5	Check the status of all PRIs using: **LD 60** **STAT**	Sample response: STAT (L) PRI LOOP L - ENBL REF CLK - DSBL SERVICE RESTORE - YES ALARM STATUS: ACCEPTABLE CH 01 - IDLE TIE * CH 02 - IDLE TIE * CH 03 - IDLE TIE * CH 04 - IDLE TIE * . . CH 31 - D-channel *

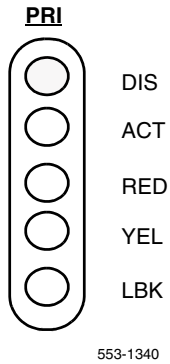
Procedure 2
PRI status check (Part 3 of 3)

Step	Action	Response
6	List PRI alarm counters using: **LD 60** **LCNT (L)** (Check the out-of-service counters to determine the number of out-of-service occurrences since the last execution of the midnight routines.)	PRI LOOP L MNT NNDC NNC OOS BVP- xxx xxx xxx xxx FAP- xxx xxx xxx xxx SLP- xxx xxx xxx xxx CRC- xxx xxx xxx xxx G2 xxx xxx xxx xxx TOTAL 24 HOUR BPV- xxxxxxxxx TOTAL 24 HOUR FAP- xxxxxxxxx TOTAL 24 HOUR SLP- xxxxxxxxx TOTAL 24 HOUR CRC- xxxxxxxxx TOTAL 24 HOUR G2 AIS - xxxxxxxxx TOTAL 24 HOUR G2 LFAS - xxxxxxxxx TOTAL 24 HOUR G2 LMAS - xxxxxxxxx TOTAL 24 HOUR G2 RAI - xxxxxxxxx TOTAL 24 HOUR G2 LOS - xxxxxxxxx
7	Check DCHI card and D-channel (DCH) link status using: **LD 96** **STAT DCH (N)** (N is the I/O port number)	the DCHI status should be OPER (operational) and EST (established)
8	Check to assure the following PRI cables are connected correctly: • PRI to DCHI cable • E1/T1 transmission cable from NT8D72AA to DSX (the digital cross connect)	

PRI start-up

This procedure provides the steps required to take the PRI and DCH from a disabled to an operational state.

Procedure 3
PRI status check (Part 1 of 2)

Step	Action	Response
1	Check the status of all PRI cards.	The PRI shown is disabled. 
2	If any other LEDs are lit, go to PRI fault clearing.	
3	Test all PRIs using: **LD 60** **DISL loop** **SLFT L**	SLFT OK

Procedure 3
PRI status check (Part 2 of 2)

Step	Action	Response	
4	Enable all PRIs using: **LD 60** **ENLL L**	PRI000 DTA005 DTA007 DTA023 DCH1010	Correct version ID remote alarm remote alarm cleared (provided the far-end is up) PRI loop is up D-channel is disabled
5	Enable the D-channel(s) using: **LD 96** **ENL DCH N** (N is the I/O port number)	DCH 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 at step 6.	
6	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 N** (N is the I/O port number)		

Network Call Trace

Network Call Trace is available 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 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 LD 17 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.

Enhanced Trace command output

A time stamp is available to the call trace output. This time stamp appears on the first line of the output.

The TN or digital trunk prints out only when there has been a change to the call register. The TN or trunk is printed only once.

Sample time stamp output which will appear on the first line:

```
.14:00:02 12/25/1992
```

Configure Network Call Trace

To configure Network Call Trace, log into the system and do the following:

- enter NCT in response to prompt RCAP in LD 17 for each D-channel
- enter CLTA in response to prompt CLS in LD 10 or LD 11 to allow a telephone to trace calls

Trace 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 LD 15)
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 following is the call trace data for function 01:

**** 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 (LD 17 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
- DTI = digital trunk interface–2.0 Mb/s
- ISL = ISDN Signaling Link
- PRI = 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 (LD 17)
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 (LD 10)
BCS = multi-line telephone (LD 11)
ATT = attendant console (LD 12)
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 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 LD 15)
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 PRI

```
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 the following:

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 system 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 system 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. These are the trunk types that are 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 system without NCT capability receives a Call Trace message, no call trace information is returned.

Primary Rate Interface maintenance

Contents

This section contains information on the following topics:

PRI commands (LD 60)

Primary Rate Interface (PRI) diagnostic commands are used to maintain both PRI and clock-controller operation. See Table 7 for a list of the PRI card and channel commands in LD 60. The commands are organized as follows:

- PRI card and channel commands
- Alarm and counter commands
- Test commands

Table 7
PRI card and channel commands in LD 60 (Part 1 of 4)

Command	Description
DISI L	PRI loop L is disabled only when all the channels are idle. The network and PRI cards are then disabled and status LEDs are lit. **Channel status is set to busy.** Enter END to abort.
DISL L	Disables network and PRI circuit packs of loop L. Active calls are automatically disconnected by on-hook simulation. **All channels are disabled** and status LEDs are lit.
DSCH L CH	All channels of loop L are disabled.
ENCH L CH	All channels of loop L are enabled.
ENLL L	Enables PRI loop L. Channel CH of PRI loop L is enabled. The channel is placed into the idle state and made available for calls.
STAT	Prints the status of all digital loops.

Table 7
PRI card and channel commands in LD 60 (Part 2 of 4)

Command	Description
STAT loop	Get status of digital loop. Sample output: AAA TRK LOOP x - BBBB SERVICE RESTORE: YES/NO YEL ALM PROCESS: YES/NO ALARM STATUS: NO ALARM/RED(local) ALARM Where: AAA may be: DTI DTI2 PRI PRI TIE DID DTI LINK (DTI link loop = DLI) Where: BBBB may be: DSBL = Hardware of specified digital loop is disabled ENBL = Hardware of specified digital loop is enabled RLBK = Hardware of specified digital loop is in remote loop back mode DISI PENDING = DSI command is in progress TRACKING = system clock is tracked to this loop

Table 7
PRI card and channel commands in LD 60 (Part 3 of 4)

Command	Description
	IDLE = Hardware of specified digital loop is idle When AAA = TIE, IDLE ISPC indicates that the channel is an established ISPC link ready to be used by any end-users having access to the associated ISPC route. SERVER RCVY = server has not recovered status of DTI LINK loop. Channels will not be allocated for call processing until this status is removed by the server BUSY = Hardware of specified digital loop is busy When AAA = TIE, BUSY ISPC indicates that the channel is an established ISPC link which is used by end users on the PBXs. When AAA = DID, BUSY ISPC indicates that the ISPC link is established to the Central Office. The status “BUSY” is independent to ISL feature usage of the ISPC link. MBSY = Hardware of specified digital loop is in make busy mode When AAA = TIE, MBSY ISPC indicates that the configured ISPC link is one of the following: **a** not established yet **b** established, but the ISL D-channel which controls its usage not established

Table 7
PRI card and channel commands in LD 60 (Part 4 of 4)

Command	Description
	Where: SERVICE RESTORE may be: YES = restore service automatically if alarm is removed NO = loop can only be manually enabled Where: YEL ALARM PROCESS may be: YES = yellow alarm processing is enabled NO = yellow alarm processing is disabled Where: ALARM STATUS may be: NO ALARM = no alarm active RED = red (local) alarm active

PRI alarm commands

See Table 8 for a list of PRI alarm commands and descriptions of these commands. These commands appear in LD 60.

Table 8
PRI alarm commands in LD 60 (Part 1 of 3)

Command	Description
CDSP	Clears the maintenance display on active CPU to 00 or blank.
CMIN C	Clears the minor alarm indicator for customer C.
CMIN ALL	Clears the minor alarm indicators for all customers.
LCNT	Prints content of all alarm counters of all PRI loops.

Table 8
PRI alarm commands in LD 60 (Part 2 of 3)

Command	Description
LCNT L	Prints content of all alarm counters of PRI loop L. The counters are: BPVBipolar violation bit error rate counter. Indicates the number of times the loop has entered state due to excessive bipolar violations. FAPNumber of times the loop has entered state due to excessive frame bit errors. SLPFrame slip repetition counter. The number of times the loop has entered state due to excessive frame slips. CRCCyclic Redundancy Check (CRC) bit error rate counter. The number of times the loop has entered state due to CRC frame errors. G2The number of times the loop has entered state due to excessive group 2 errors. TOTAL 24 HOUR BPV24-hour bit error rate count TOTAL 24 HOUR FAP24-hour frame bit error rate count TOTAL 24 HOUR SLP24-hour slip count TOTAL 24 HOUR CRC24-hour CRC error count TOTAL 24 HOUR G2 AIS24-hour alarm indication signal count TOTAL 24 HOUR G2 LFAS24-hour loss of frame alignment count TOTAL 24 HOUR G2 LMAS24-hour loss of multiframe alignment count TOTAL 24 HOUR G2 RAI24-hour remote alarm indication count TOTAL 24 HOUR G2 LOS24-hour loss of signal count
RSET L CH	Resets the thresholds for PRI loop L, trunk channel CH.
RCNT	Resets all alarm counters of all PRI loops.

Table 8
PRI alarm commands in LD 60 (Part 3 of 3)

Command	Description
RCNT L	Resets all alarm counters of PRI loop L.

PRI test commands

See Table 9 for a list of the PRI test commands and a corresponding description of these commands. The PRI test commands are in LD 60.

Table 9 (Part 1 of 2)
PRI test commands in LD 60

Command	Description
ATLP (0) 1	Automatic loop test enable (= 1) or disable (= 0) default. 1 = Loop test enable; this will cause far end to raise and clear remote alarm. 0 = Run the partial loop test; there is no interaction for the far-end loop (default value).
SLFT L	Invokes PRI self-test on loop L. The loop must be disabled because the test disrupts call processing.
SLFT L CH	Invokes partial PRI hardware self-test using channel CH of loop L.
RLBK L	Closes the loop at the carrier interface point of the PRI so the far end can perform an external loop-back test. PRI loop L must be disabled because the test disrupts call processing.
DLBK L	Disables the remote loop-back test per RLBK L. The loop remains disabled.
DLBK L CH	Disables the remote loop-back test per RLBK L CH. The channel remains disabled.
RLBK L CH	Per RLBK L, but performed on channel CH. This channel must be disabled prior to issuing the request.

Table 9 (Part 2 of 2)
PRI test commands in LD 60

Command	Description
RMST L	Performs self-test on loop L, providing the far end is in the remote loop-back mode.
RMST L CH	Performs self-test on channel CH, providing the far end is in the remote loop-back mode.

PRI tests

PRI self-test

The self-test checks speech-path continuity, zero-code suppression, and remote-alarm detection. This test is performed manually on a per-channel or a per-frame basis.

The DCHI and PRI must be disabled before performing the self-test or call processing will be disrupted. To perform the self-test on a specific loop, follow Procedure 4.

Procedure 4
PRI self-test

Step	Action
1	Disable the DCHI using: **LD 96** **DIS DCH N**
2	Disable the PRI loop and run the self-test using: **LD 60** **DISL L** **SLFT L**

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:

Procedure 5
PRI automatic loop test

Step	Action
1	If all 30 channels are idle at midnight, SL-1 software disables the card and performs a self-test on all channels.
2	If any of the 30 channels are busy at midnight, software 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:

LD 60

ATLP 1 or **0**

PRI midnight routines

The following PRI maintenance routines should be included in midnight routines:

- Overlay 45: Background signaling and switching diagnostic
- Overlay 95: Automatic trunk maintenance diagnostic
- Overlay 48: Link diagnostic

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 (30 channels) basis.

Link diagnostic test

The link-diagnostic test, also called the far-end loop-back test, does not test the local PRI. It puts the PRI in loop-back mode so a remote loop-back test can be performed on equipment at the far end.

The PRI channel or frame being 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 near-end to the far end. The far end must be in loop-back mode before this test can be performed.

The PRI channel or frame tested must be disabled.

Coordinating the tests

When a technician at the far end asks for loop-back mode on the PBX:

Disable the DCHI using:

LD 96

DIS DCH N

Disable the PRI loop and activate loop-back mode using:

LD 60

DISL L

RLBK L

To run the remote loop-back test on the PBX, follow Procedure 6.

Procedure 6
Remote loop-back test

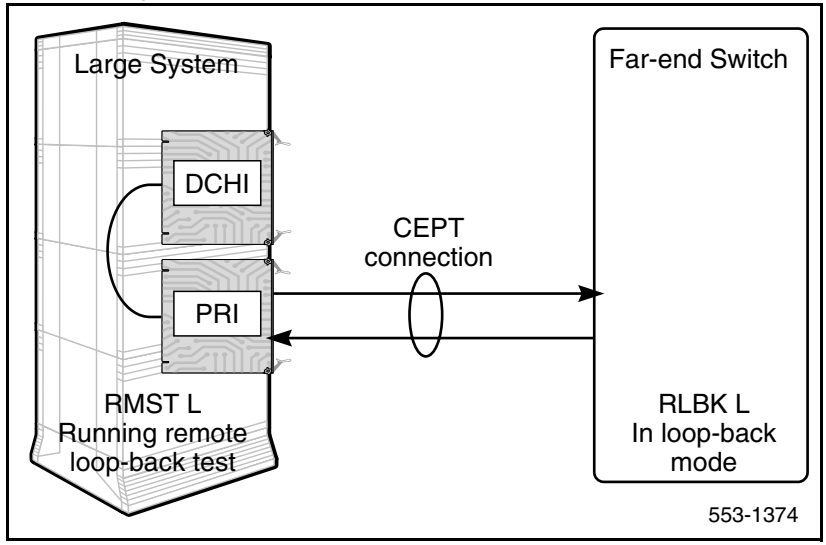
Step	Action
1	Call a technician at the far end.

Procedure 6 (Continued)
Remote loop-back test

2	Ask for loop-back mode at that facility.
3	When loop-back mode at the far end is confirmed: Disable the DCHI using: **LD 96** **DIS DCH N** Disable the PRI loop and run loop-back test using: **LD 60** **DISL L** **RMST L**

Figure 2 shows the relationship between the remote loop-back test and the link diagnostic test.

Figure 2
PRI link diagnostic and remote loop-back tests



PRI error detection

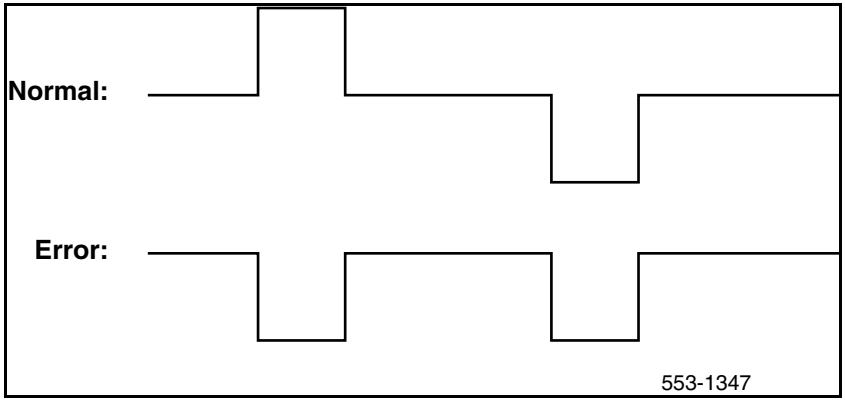
Bit error rate

Bit-error-rate monitoring detects errors in transmission. See Figure 3.

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).

Figure 3
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 system 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 LD 60 provided that loop L has been defined with ESF as a framing format. The framing format (D2, D3, D4, or ESF) is selected in LD 17 when the loop is configured.

Bit error rate thresholds

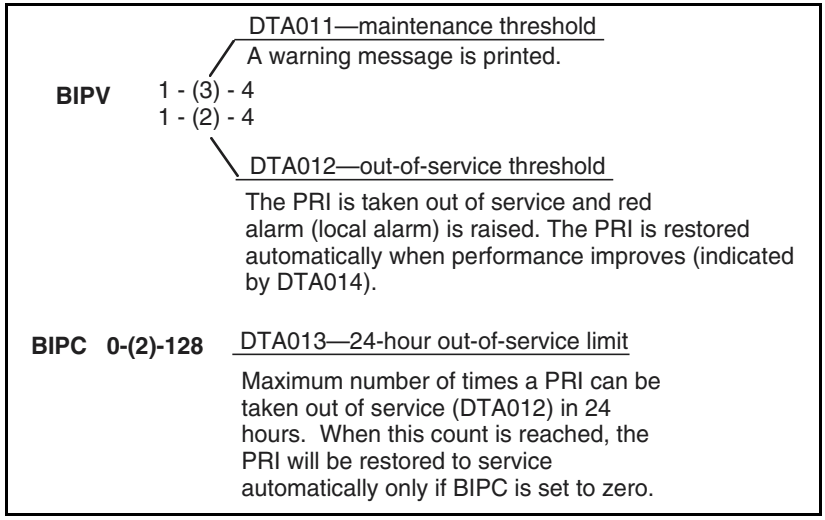
There are three bit error rate thresholds set in LD 73. When a threshold is reached, a DTA message is output. See Figure 4.

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.

Figure 4
BIPV and BIPC thresholds



The BIPV thresholds are based on the number of errors in a given time. The threshold levels are shown in Table 10.

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 exceeds 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 10
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)	6.639	1025
3	>10-5 (15.4 BPV per s)	66.39	1025
4	>10-6 (1.54 BPV per s)	663.9	1025
most tolerant			

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 5.

Clock synchronization can be either tracking, on the primary or secondary reference clock, or free run (non-tracking). In LD 73 (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.

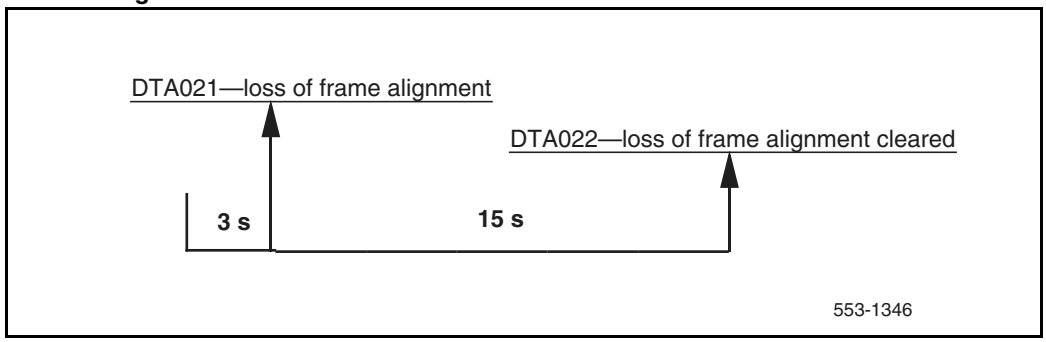
PRI hardware detects frame slips in tracking and free run modes. For tracking mode, running the midnight routines prints the number of overflows and clears the counter. For free run mode, running the midnight routines prints the number of frame deletions and repetitions and clears the counters.

Tracking mode There are two thresholds set in LD 73. 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 5
DTA messages



Free run (non-tracking) mode A maintenance threshold and an out-of-service threshold are set in LD 73. When these thresholds are reached, DTA messages are output. An option in LD 73 can enable automatic recovery after the out-of-service limit has been reached. Related DTA messages are described below. See Figure 6.

DTA017: Maintenance limit for frame slips in free run (non-tracking) mode. The default is 10 slips in 15 seconds.

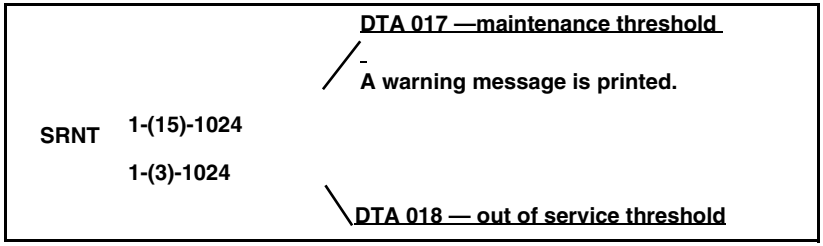
DTA018: Out-of-service limit for frame slips in free run (non-tracking) mode without automatic recovery selected. The default is 10 slips in 3 seconds.

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 LD 73.)

DTA029: Slip rate improvement criteria is met. Trunks being returned to service.

Figure 6
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 LD 73:

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

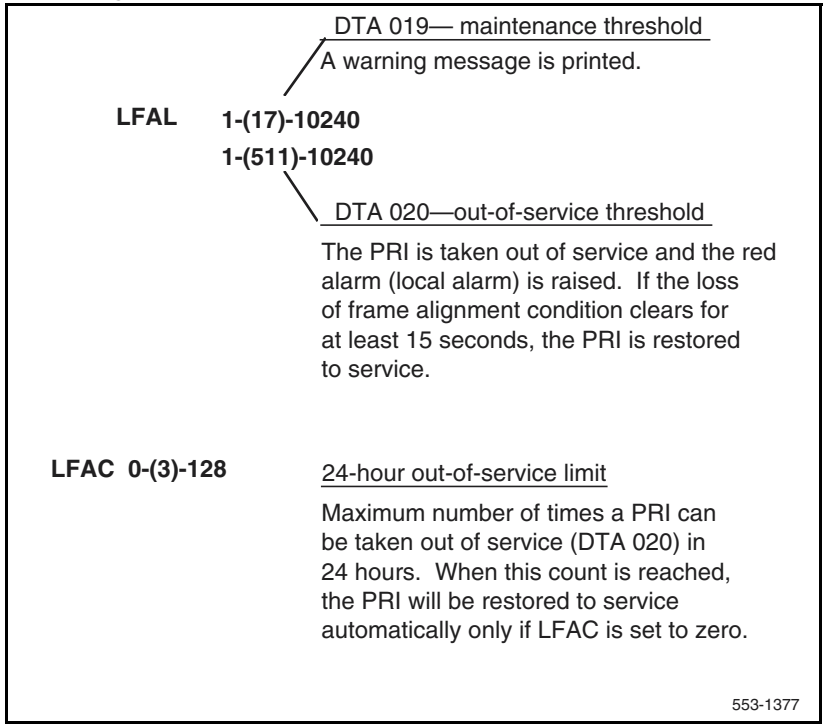
Loss of frame alignment monitoring detects out-of-frame conditions on the DS-1 bit stream. See Figure 7.

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 LD 73. 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 7
Frame alignment

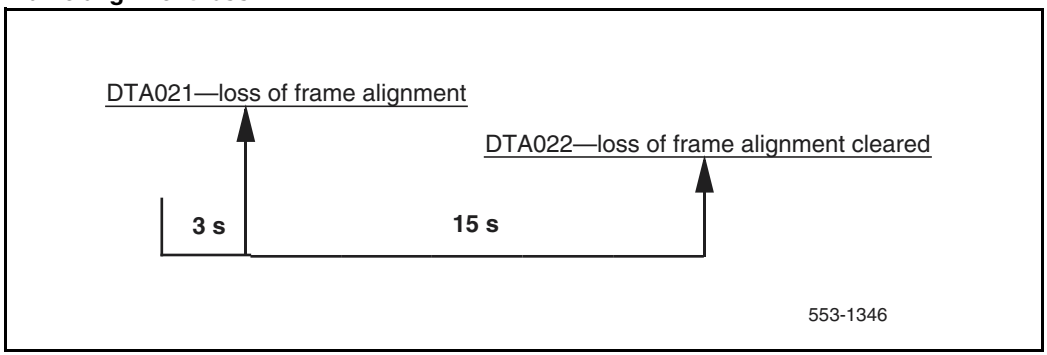


If a loss of frame alignment condition persists for three seconds, the affected PRI loop is taken out of service and a red alarm (local alarm) is raised. See Figure 8.

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 8
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 system 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 11 below.

Table 11
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
10	2 3 0	1 2 0
11	0 7 0	1 3 0
12	2 7 0	1 4 0
13	1 3 0	1 5 0
14	1 6 0	1 6 0
15	0 2 0	1 7 0
16	2 2 0	2 8 0
17	0 6 0	2 1 0
18	2 6 0	2 2 0
19	1 2 0	2 3 0

Table 11
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)
20	2 8 0	2 4 0
21	0 4 0	2 5 0
22	2 4 0	2 6 0
23	1 8 0	2 7 0
24	3 8 0	3 8 0

Use 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 portable test package, which consists of one each of the following items:

- the TTT2028 Mini-Error Counter, plus operation instruction card
- a cord equipped with a bantam plug at one end and minihooks at the other
- a loopback plug (shorts pins 3 to 1 and 11 to 9 of a 15-pin D connector)

Procedure 3
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 12
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 13
Error counter display functions (Part 1 of 2)

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.

Table 13
Error counter display functions (Part 2 of 2)

Display	Function
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.

Replace the PRI

Procedure 4
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 the following:
   LD 96
   DIS DCH x
2. Disable the PRI loop using the following:
   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 the following:
LD 60
SLFT loop If an error message results, see PRI fault clearing.

9 Enable the PRI using the following:
LD 60
ENLL loop

Pulsed E&M DTI2 signaling

Error messages

DTA322 loop channel start-bits pulsed-bits end-bits duration

An invalid pulsed signal has been received from the DTI.

loop = the loop number the signal was received on

channel = the channel number the signal was received on

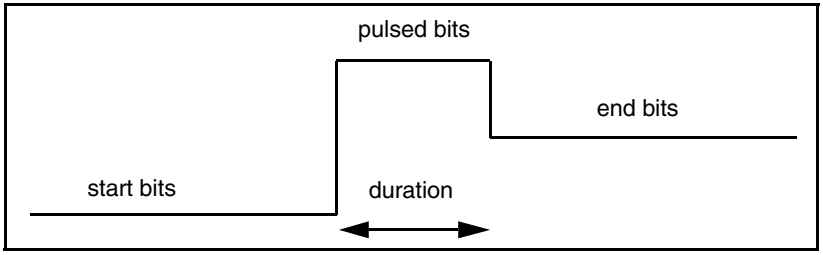
start-bits = the bit pattern before analysis of the pulse

pulsed-bits = the ABCD bit pattern which was possibly part of a pulsed signal

end-bits = the ABCD bit pattern received after the pulse

duration = the length of the pulse in msecs.

Figure 9
Loop channel start-bits pulsed-bits end-bits duration



DTRK500 loop channel

A forward release message has been sent but not acknowledged by a backward release. Check the configuration of the trunk at each end. loop = the loop number of the trunk which sent the forward release channel = the channel number of the trunk which sent the forward release.

DTA205 loop e

The CI-1 firmware has encountered a problem. Refer to DTIOO9 for CI-1 microprocessor error codes (e).

DTA205 loop 128

This error message may result from an attempt to use the software with DTI2 cards prior to QPC915C or QPC536E. New functionality has been introduced in the DTI2 cards. The old cards will ignore attempts to use the functionality introduced in these new cards.

Diagnostics

To print the last sent and received signal, use Overlay 80 - Call Trace. The following print format is used:

```
ACTIVE TN DTI 008 03
ORIG DTI 008 03 DID RMBR 33 1 CALL TYPE VOD
SICA 3
SENT CONN 0101 RECV CONN 0001
PDCA 1 PAD 15 2 PCML A A
TERM 004 0 03 01 0 SCR 0 401 2317
```

DIAL DN 401
MAIN PM ESTD
TALKSLOT ORIG 15 TERM 15
QUEU NONE

The SENT bits indicate the steady state on the line once the pulse is complete. The RECV bits indicate the last bit pattern received on the trunk channel.

D-channel maintenance

Contents

This section contains information on the following topics:

DCH commands (LD 96)

Table 14 contains the basic D-channel (DCH) commands in LD 96.

Table 14
D-channel commands, LD 96 (Part 1 of 5)

Command	Description
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 MSGI <dch> debg CH <loop><channel>	
	Disable the debugging of all monitored incoming messages from D-channel card. A maximum of 5 channels are monitored at a time. Only one channel number can be entered in one command.
DIS MSGI x FEAT CPNW	Disable incoming monitoring for the Network CPNW ISDN messages on D-channel x.
DIS MSGI <dch> debg MSG msg1 msg2 msg3	
	Disable the debugging of all monitored incoming messages from D-channel. This command can be entered more than once. Only 3 message mnemonics can be given in one command.
DIS MSGI <dch> debg SET	
	Disable debug SET on all incoming messages from D-channel. This set-based filtering is enhanced for UIPE proprietary messages.
DIS MSGO x (options)	Disable the monitoring of outgoing messages on D-channel x

Table 14
D-channel commands, LD 96 (Part 2 of 5)

Command	Description
DIS MSGO <dch> debg CH <loop><channel>	
	Disable the debugging of all monitored outgoing messages from D-channel card. A maximum of 5 channels are monitored at a time. Only one channel number can be entered in one command.
DIS MSGO x FEAT CPNW	Disable outgoing monitoring for the Network CPNW ISDN messages on D Channel x.
DIS MSGO <dch> debg MSG msg1 msg2 msg3	
	Disable the debugging of all monitored outgoing messages from D-channel. This command can be entered more than once. Only 3 message mnemonics can be given in one command.
DIS MSGO <dch> debg SET	
	Disable debug SET on all outgoing messages from D-channel. This set-based filtering is enhanced for UIPE proprietary messages.
DIS SERV x	Disable service messages on D-channel x
DLIF DCH x	Force download of D channel x (For PRI UIPE application)
ENL AUTO x	Enable automatic recovery for DCH x
ENL DCH x (FDL)	Enable DCH x and attempt to establish the link, and force download to MSDL
ENL MSGI x (options)	Enable the monitoring of incoming messages on D-channel x

Table 14
D-channel commands, LD 96 (Part 3 of 5)

Command	Description
ENL MSGI <dch> debg CH <loop><channel>	
	Enable the debugging of all monitored incoming messages from D-channel card. A maximum of 5 channels are monitored at a time. Only one channel number can be entered in one command.
ENL MSGI x FEAT CPNW	Enable incoming monitoring for the Network CPNW ISDN messages on D Channel x.
ENL MSGI <dch> debg MSG msg1 msg2 msg3	
	Enable the debugging of all monitored incoming messages from D-channel This command can be entered more than once. In one command, only 3 message mnemonics can be given.
ENL MSGI <dch> debg SET	
	Enable debug SET on all incoming messages from D-channel. This set-based filtering is enhanced for UIPE proprietary messages.
ENL MSGO x (options)	Enable the monitoring of outgoing messages on D-channel x
ENL MSGO <dch> debg CH <loop><channel>	
	Enable the debugging of all monitored outgoing messages from D-channel card. A maximum of 5 channels are monitored at a time. Only one channel number can be entered in one command.
ENL MSGO x FEAT CPNW	Enable outgoing monitoring for the Network CPNW ISDN messages on D-channel x.

Table 14
D-channel commands, LD 96 (Part 4 of 5)

Command	Description
ENL MSGO <dch> debg MSG msg1 msg2 msg3	
	Enable the debugging of all monitored outgoing messages from D-channel This command can be entered more than once. Only 3 message mnemonics can be given in one command.
ENL MSGO <dch> debg SET	
	Enable debug SET on all outgoing messages from D-channel. This set-based filtering is enhanced for UIPE proprietary messages.
ENL SERV x	Enable service messages on D-channel x
EST DCH x	Establish multiple frame operation on D-channel x
EST ISPC l ch (N)	Start the data interface establishment process at the ISPC slave side an ISPC link (where “N” = the “number of tries” counter)
FDIS NCAL <DCH#> <conn_ID>	Force disconnect the specified call-independent connection
PLOG DCH x	Print protocol error log on DCH x
RLS DCH x	Release D-channel x
RLS ISPC l ch	Stop the data interface establishment process
RST DCH x	Reset D-channel x, inhibit signaling
RST MON	Reset or reactivate monitoring on D-channels with enabled monitors
SDCH DCH x	Switch to the standby D-channel x
SET MSGI x MON (0)-2	Set monitor output format level for incoming messages on D-channel x

Table 14
D-channel commands, LD 96 (Part 5 of 5)

Command	Description
SET MSGO x MON (0)-2	Set monitor output format level for outgoing messages on D-channel x
SLFT TMDI x	Invoke self test x
STAT DCH (x)	Get status of one or all D-channels
STAT ISPC l ch	Get status of data interface establishment process at ISPC slave side ISPC link which has been configured to convey D-channel signaling
STAT NCAL <DCH#>	List all current call-independent connections on a given PRI D-channel.
STAT NCAL <DCH#> <conn_ID>	
	List information pertaining to a specific call-independent connection
STAT MON (x)	Display the incoming and outgoing monitoring status of one or all D-channels.
STAT SERV (x)	Get the enable/disable status of services messages for one or all D-channels
STAT TMDI (x FULL)	Get TMDI status x

DCH tests

There are four types of DCH tests. They are:

- DCH test 100
- DCH test 101
- DCH test 200
- DCH test 201

The DCH tests 100 and 101 are hardware tests, while the 200 and 201 test the DCH software.

DCH tests 100 and 101

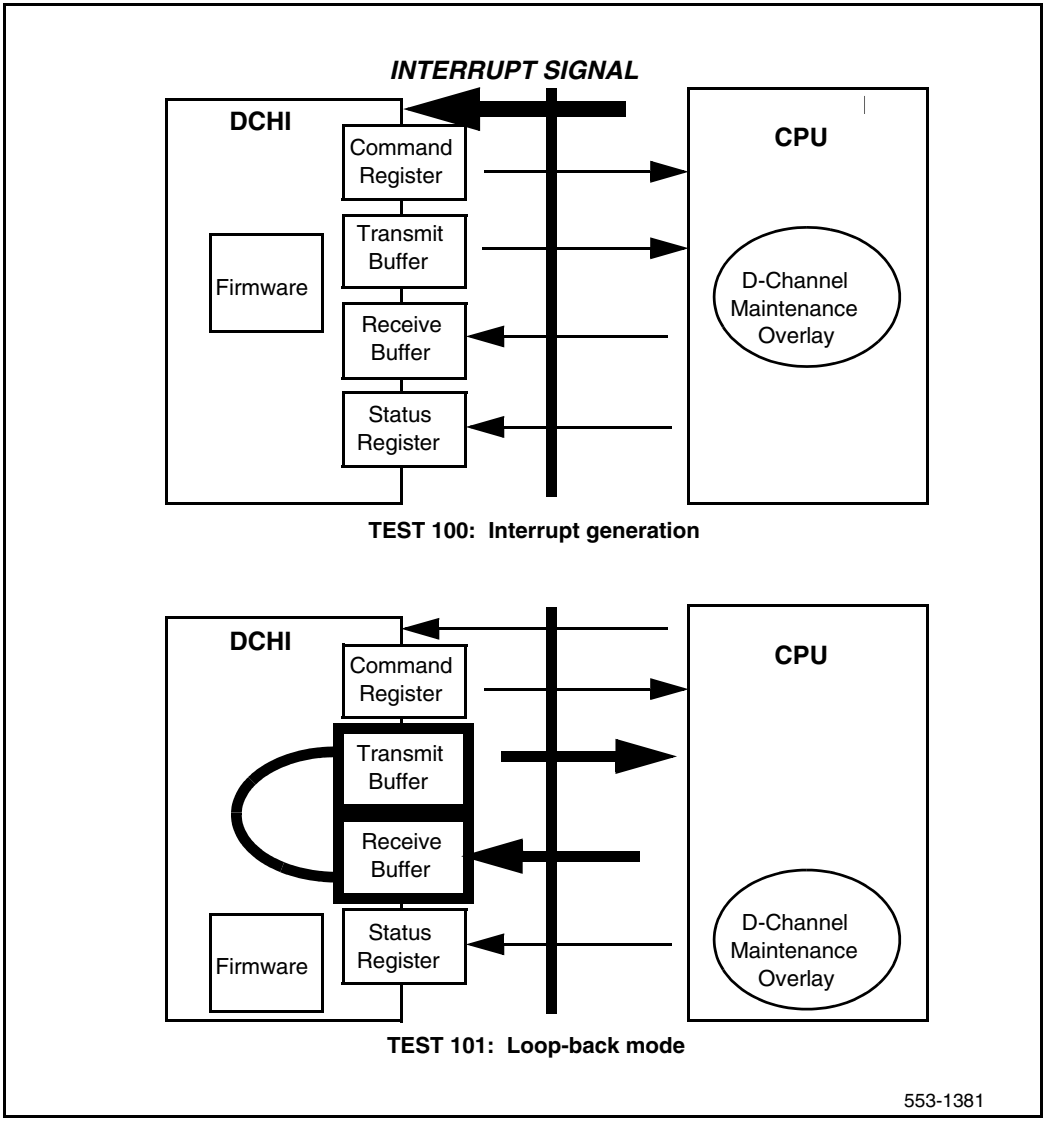
DCH tests 100 and 101 are isolated hardware tests. See Figure 10. Test 100 checks interrupt generation on the DCHI. Test 101 checks the DCHI loop-back capability. If either test fails, either a faulty DCHI or a contention problem is indicated. A test failure will initiate DCH error messages.

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.

Procedure 1
Testing DCHI hardware

Step	Action
1	Log in to the overlay system. Then, enter LD 96 by entering the command **LD 96**
2	If the DCHI link is disabled, it must be enabled by entering the commands **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**
3	Place the DCHI link in the reset state (from either the established or Released state) by entering the commands **STAT DCH N** (responds either **EST** or **RLS**) **RST DCH N**
4	Activate the first hardware test by entering the command **TEST 100 N**
5	Activate the second hardware test by entering the command **TEST 101 N**

Figure 10
DCH tests 100 and 101



DCH tests 200 and 201

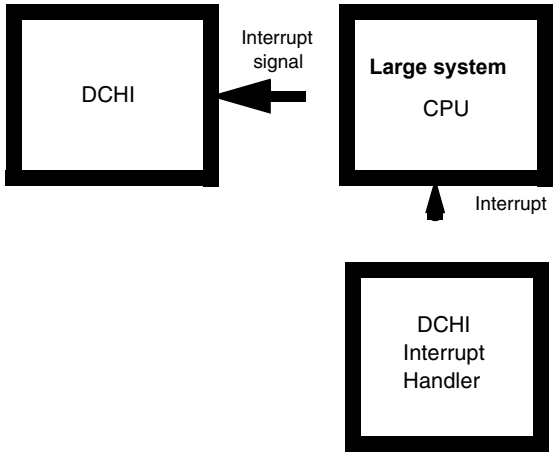
DCH tests 200 and 201 are software tests. See Figure 11. Test 200 monitors the DCHI interrupt handler. Test 201 checks the interrupt handler-to-link interface path. If either test fails, software problems are indicated. A test failure will initiate DCH error messages.

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

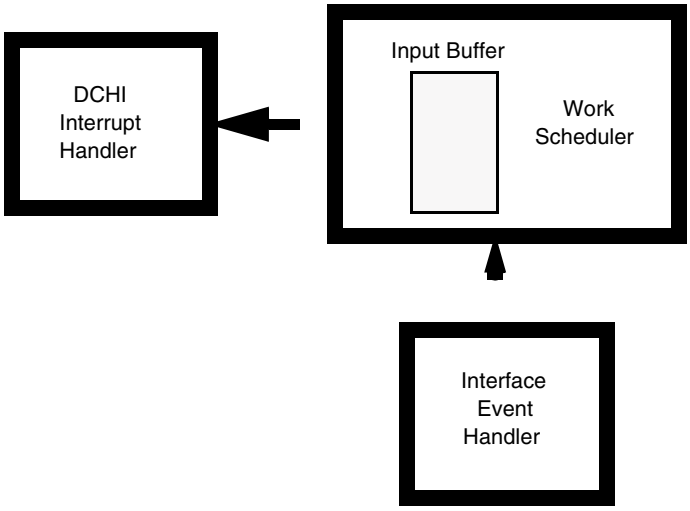
Procedure 2
Testing DCHI software

Step	Action
1	Log in to the overlay system. Then, enter overlay program 96 by entering the command **LD 96**
2	If the DCHI link is disabled, it must be enabled by entering the commands **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**
3	Place the DCHI link in the reset state (from either the established or Released state) by entering the commands **STAT DCH N** (responds either **EST** or **RLS**) **RST DCH N**
4	Activate the first software test by entering the command **TEST 200 N**
5	Activate the second software test by entering the command **TEST 201 N**

Figure 11
DCH tests 200 and 201



TEST 200: Interrupt handler



TEST 201: Interrupt handler-to-link interface

553-1382

DCH traffic (LD 2)

Traffic report TFS009 provides accumulated D-channel statistics. This report can be included in the scheduled traffic report, or printed on demand as described below.

To enable D-channel measurement in the scheduled traffic reports use the Set System Traffic Options (SOPS) command. For example, to enable option 9 for D-channel use:

LD 2

SOPS 9

To print current D-channel measurement use the Invoke System Traffic (INVS) command. For example, to enable option 9 for D-channel use:

LD 2

INVS 9

TFS009 D-channel

TFS009 reports traffic activity for D-channels. Eight fields report activity on the Multi-purpose Serial Data Link (MSDL) D-channel. Nine fields report activity associated with the QSIG Path Replacement feature.

Table 15
TFS009 D-channel report format

System ID DCH x	TFS009	
aaaa		nnnn
bbbb		oooo
cccc		pppp
dddd		qqqq
eeee		rrrr

Table 15
TFS009 D-channel report format

ffff		ssss
gggg		
hhhh		tttt
iiii		
jjjj		uuuu
yyyy		
kkkk (MSDL only)		vvvv (MSDL only)
llll (MSDL only)		wwww (MSDL only)
mmmm (MSDL only)		xxxx (MSDL only)
tat1 (MSDL only)		tat2 (MSDL only)
DIV_NB	DIV_NEW	DIV_OLD
CNG_NB	CNG_NEW	CNG_OLD
CON_NB	CON_NEW	CON_OLD
FLOW FLOWa	FLOWb	FLOWc FLOWd

Table 16
Legend for TFS0009 report (Part 1 of 4)

SYSTEM		
	aaaa	number of all incoming messages received on the D-channel
	bbbb	number of all incoming call processing messages received on the D-channel
	cccc	number of all incoming management messages received on the D-channel
	dddd	number of all incoming maintenance messages received on the D-channel

Table 16
Legend for TFS0009 report (Part 2 of 4)

	eeee	average number of incoming bytes per message
	ffff	accumulated real time a D-channel was busy transferring incoming messages in half-millisecond units (Divide the reported number by 2 for a result in milliseconds. For example: divide a reported number of 200 by 2 for a result of 100 milliseconds.)
	gggg	running average of the number of requests queued in request output message buffer
	hhhh	number of times when no request output message buffer was available
	iiii	number of PRA layer-3 protocol errors since the last traffic report
	jjjj	number of times the D-channel was down
	yyyy	number of established call-independent connections
	kkkk	average incoming link usage (given as a percentage of the link capacity)
	llll	average outgoing link usage (given as a percentage of the link capacity)
	mmmm	number of connected calls
	tat1	total number of anti-tromboning operations attempted since the D-channel traffic was last cleared
		Number of optimization requests with the diversion trigger
	nnnn	number of all outgoing messages sent on the D-channel
	oooo	number of all outgoing call processing messages sent on the D-channel
	pppp	number of all outgoing management messages sent on the D-channel
	qqqq	number of all outgoing maintenance messages sent on the D-channel
	rrrr	average number of outgoing bytes per message

Table 16
Legend for TFS0009 report (Part 3 of 4)

	ssss	accumulated real time a D-channel was busy transferring outgoing messages in half-millisecond units (Divide the reported number by 2 for a result in milliseconds. For example: divide a reported number of 200 by 2 for a result of 100 milliseconds.)
	tttt	number of times a message with no End of Message (EOM) mark was received
	uuuu	accumulated real time the D-channel was down since the last report in units of 2 seconds. For example, if the value is 10, the down time is 20 seconds
	vvvv	peak incoming link usage (given as a percentage of the link capacity) over a 5-second period
	wwww	peak outgoing link usage (given as a percentage of the link capacity) over a 5-second period
	xxxx	time (in seconds) since the MSDL D-channel traffic was last cleared
	tat2	total number of successful anti-tromboning operations since the D-channel traffic was last cleared
	CNG_NB	Number of optimization requests with the congestion trigger
	CNG_NEW	Number of optimization successful with the congestion trigger: a new path is used
	CNG_OLD	Number of optimization successful with the congestion trigger but the old path has been retained
	CON_NB	Number of optimization requests with the connected trigger
	CON_NEW	Number of optimization successful with the connected number trigger: a new path is used
	CON_OLD	Number of optimization successful with the connected number trigger but the old path has been retained
	DIV_NB	Number of optimization requests with the diversion trigger

Table 16
Legend for TFS0009 report (Part 4 of 4)

	DIV_NEW	Number of optimization successful with the diversion trigger: a new path is used
	DIV_OLD	Number of optimization successful with the diversion trigger but the old path has been retained
FLOW		To prevent any application from tying up buffer resources due to its abnormal conditions or misbehavior, a flow control mechanism is defined in the system and at the card level. This flow control mechanism only applies to the normal interface (receive and transmit ring buffers, not the expedited interface).
		This flow control mechanism is based on a common “window” mechanism. The basic concept is that the number of outstanding messages that are associated with a Socket ID in the transmit or receive ring cannot exceed a predefined number, “application threshold”. Note that the mechanism is based on the number of messages per application rather than the number of buffers per application.
	FLOWa	first flow control hit starts a 128ms timer to allow one more try
	FLOWb	second flow control hit requests the sending of OK_TO_SEDN_REQ message via a logged SSD message to MSDL loadware. Start the 128ms timer
	FLOWc	third flow control hit asks the data socket to be resynchronized by MSDL loadware. Start the 128ms timer
	FLOWd	fourth flow control hit starts a 128ms timer such that the link will be forced to disable after time out.

MSDL local loopback test (NT6D80)

See Figure 12. Before beginning this test, the D-channel must be in test state:

ENL TEST x, where **x** is the logical DCH number.

To start the local loopback test on the Multi-purpose Serial Data Link (MSDL) card, use the **ENL LLB x** command, where **x** is the logical DCH number.

Then perform the following test:

TEST LLB x

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 system CPU and the MSDL MPU follows:

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

X is the DCH logical number
XDU is the expedient message sent around the loop.

The response for the ring interface that transmits operation data between the system 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 y FULL** command, where **y** is the physical port (DNUM) of the MSDL card.
2. If the MSDL card may be faulty, disable the card and perform a reset self-test.

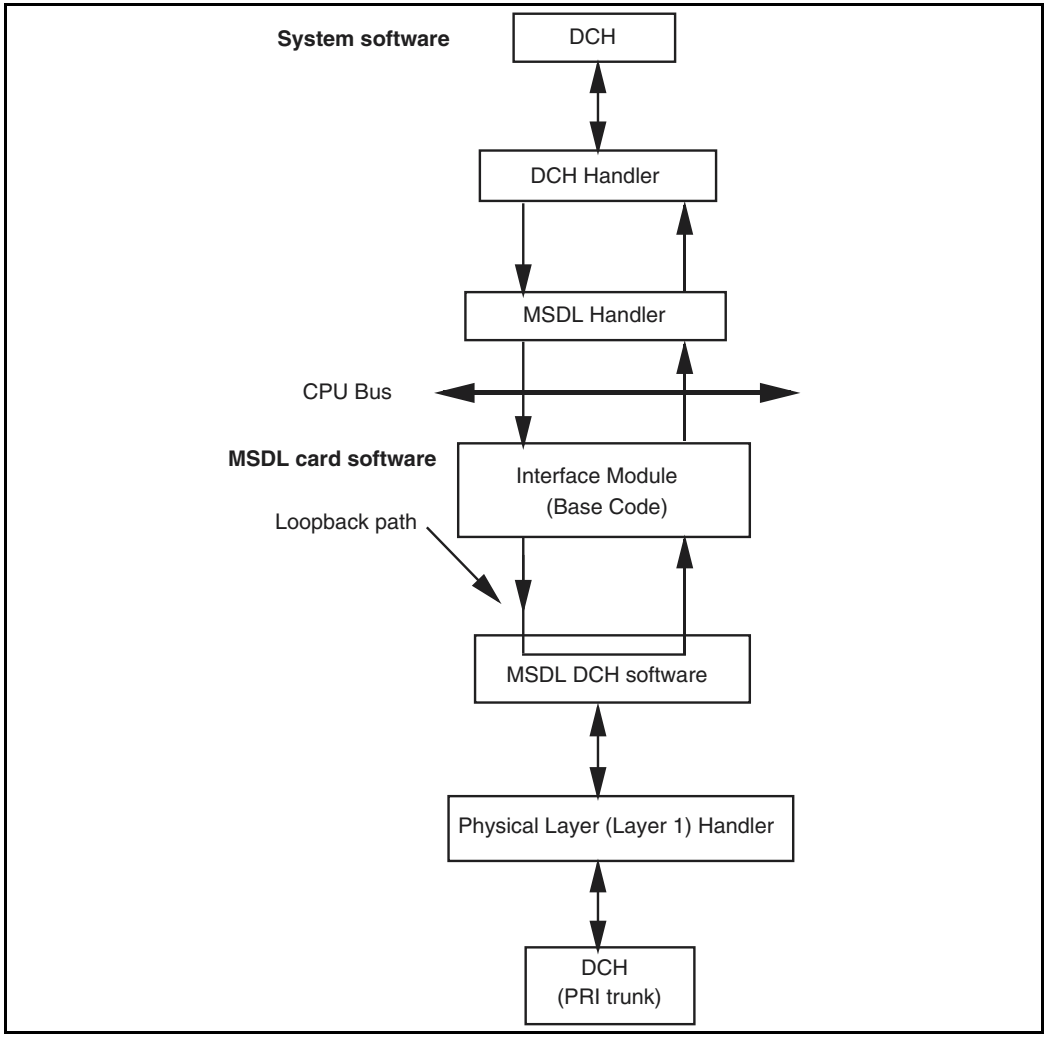
   DIS MSDL y
   RST MSDL y
   SLFT MSDL x
3. If the card passed the test, the problem may lie in incompatible software.

After completing the test, remove the D-channel from the test state:

DIS TEST x.

Refer to *Circuit Card: Description and Installation* (553-3001-211).

Figure 12
Local loopback test (NT6D80)



MSDL remote loopback tests (NT6D80)

See Figure 13 on page 90. 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

Procedure 5
Performing remote loopback tests

1. Place DCH links on both systems in TEST mode. Enter **ENL TEST x** on Switch A and **ENL TEST 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.

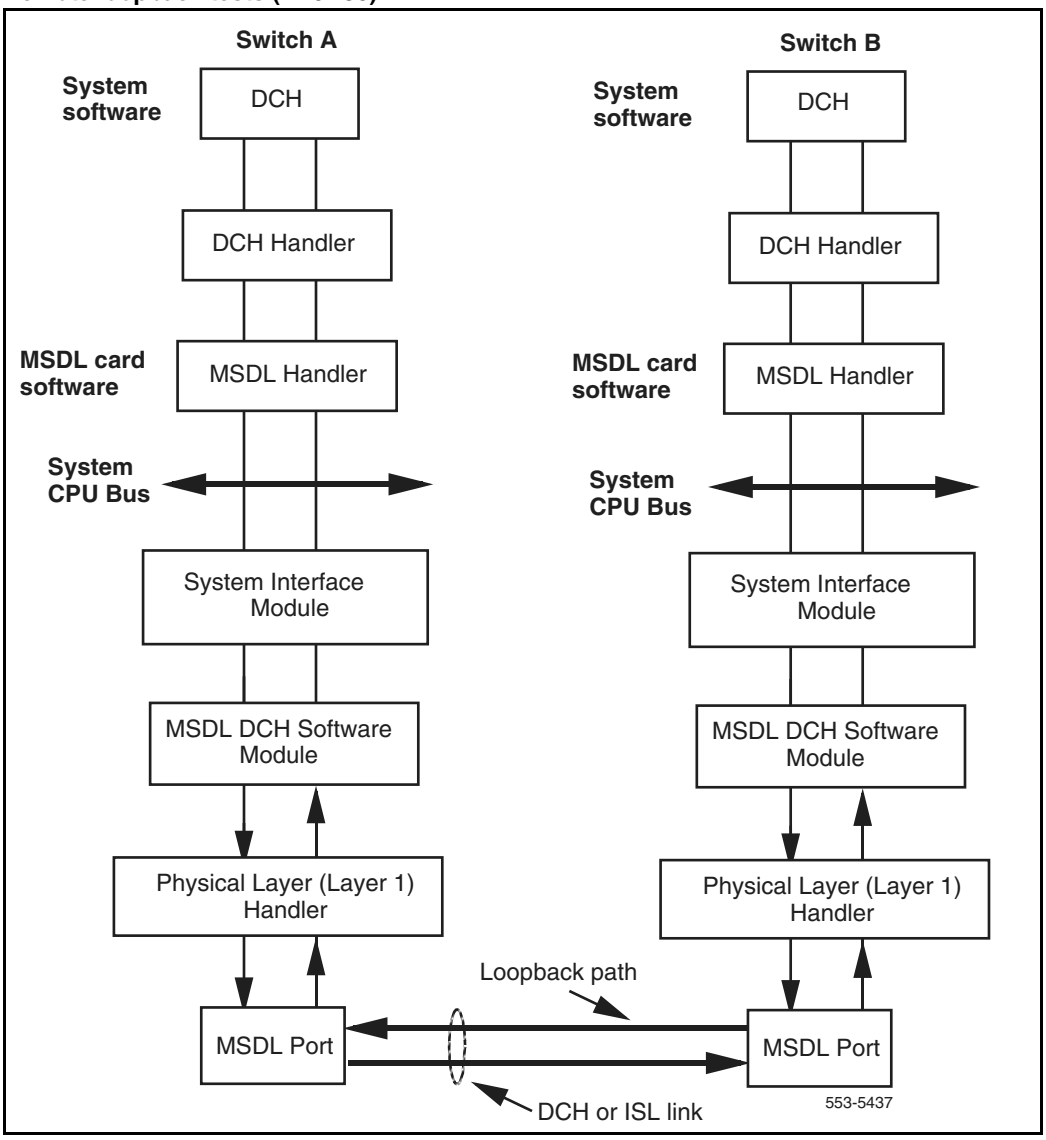
4. Place the Switch B DCH link back to the idle state, with the **DIS RLB y** command.
5. If you think the MSDL card used in either switch has failed, check the status of the DCH link and the status of the MSDL card by entering **STAT MSDL x FULL**.
6. If the MSDL card is faulty, disable the card and perform a self-test:

   DIS MSDL x
   SLFT MSDL x
7. If the card passed the test, the problem may lie in incompatible software. Refer to *Circuit Card: Description and Installation* (553-3001-211).

After the test is complete, remove both sides from the test state:

DIS TEST x
DIS TEST y

Figure 13
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 LD 96 as shown in the PLOG status check below.

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 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 Table 17 for the PLOG.

Procedure 6
Checking the PLOG status

1 Check the contents of the PLOG using the following:
LD 96
PLOG DCH x

Response:
DCH : XX MAINT CONFIRM TIME: <time of day>
COUNTERVALUE
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 17
Protocol log (Part 1 of 3)

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

Table 17
Protocol log (Part 2 of 3)

18	count of aborted frames
19	count of SABME frames received with incorrect C/R bit
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	number of times owner receiver busy condition was entered
28	number of times peer receiver busy condition was entered
29	count of messages with call reference length greater than 2
30	count of optional IEs received with invalid contents
31	count of mandatory IEs received with invalid contents
32	count of messages received with IEs not ordered correctly
33	count of IEs which were repeated in received messages, but are only allowed to appear once per message
34	count of IEs received with length exceeding the specified maximum length for the IE
35	count of layer 3 messages from far-end with invalid call reference flag value of 0
36	count of layer 3 messages from far-end with invalid call reference flag value of 1
37	count of layer 3 messages from far-end with invalid global call reference
38	count of layer 3 messages from system that are too short
39	count of layer 3 messages from system containing an undefined message type

Table 17
Protocol log (Part 3 of 3)

40	count of layer 3 messages from system missing mandatory IE(s)
41	count of layer 3 messages from system containing unsupported IE(s)
42	count of layer 3 messages from system containing invalid operational IE(s)
43	count of layer 3 messages from system containing invalid mandatory IE(s)
44	count of layer 3 messages from system with IE(s) out of order
45	count of layer 3 messages from system containing repeated IE(s)
46	count of layer 3 messages from far-end with an invalid call reference length
47	count of layer 3 messages from system with an invalid call reference flag value of 0
48	count of layer 3 messages from system with an invalid call reference flag value of 1
49	count of layer 3 messages from system with an invalid global call reference
50	count of unexpected layer 3 messages received from the far-end
51	count of unexpected layer 3 messages received from the system
52	count of unexpected layer 3 timer expirations
53	count of protocol messages received when D-channel is not in service or waiting for a Service Acknowledge message

Replace the DCHI

CAUTION
Firmly touch the metal frame of the cabinet to discharge static electricity from your body before handling circuit packs.

Procedure 1
Replacing the DCHI

Step	Action
1	Disable the D-channel using: **LD 96** **DIS DCH N**
2	Disable the asynchronous port on the DCHI card (if equipped) using: **LD 48** **DIS ESDI N**
3	Set the ENB/DIS switch to DIS.
4	Disconnect cables on DCHI faceplate.
5	Remove the DCHI from the shelf.
6	Make sure that the new DCHI card switch settings are the same as the faulty DCHI card. See *ISDN Primary Rate Interface: Installation and Configuration* (553-3001-201) and *Circuit Card: Description and Installation* (553-3001-211) for switch-setting information.
7	Install the new DCHI card in the appropriate slot.
8	Connect the faceplate cables to the new DCHI card.
9	Set the ENB/DIS switch to ENB.
10	Enable the D-channel using: **LD 96** **ENL DCH N**

LD 60 - Loop Maintenance for SYS-12, AXE-10, SWE, SWISSNET, NUMERIS, EuroISDN, NEAX-61, Asia-Pacific

If there is a loop configured with a SYS-12, AXE-10, SWE, SWISSNET, NUMERIS, EuroISDN, NEAX-61, or Asia-Pacific D-channel, LD 60 adds the D-channel type to the printout displayed upon entering the overlay. This printout alerts the technician to the relationship of the difference of the timeslot-to-channel mapping between the system and the D-channel type:

Table 18
Meridian 1SYS- 12, AXE- 10 SWE, NUMERIS, SWISSNET, EuroISDN, NEAX-61 channel timeslot mapping

Channel	Meridian 1	Network	Timeslot
B-channel	1-15 16-30	1-15 17-31	1-15 17-31
D-channel	31	16	16

Clock Controller maintenance

Contents

This section contains information on the following topics:

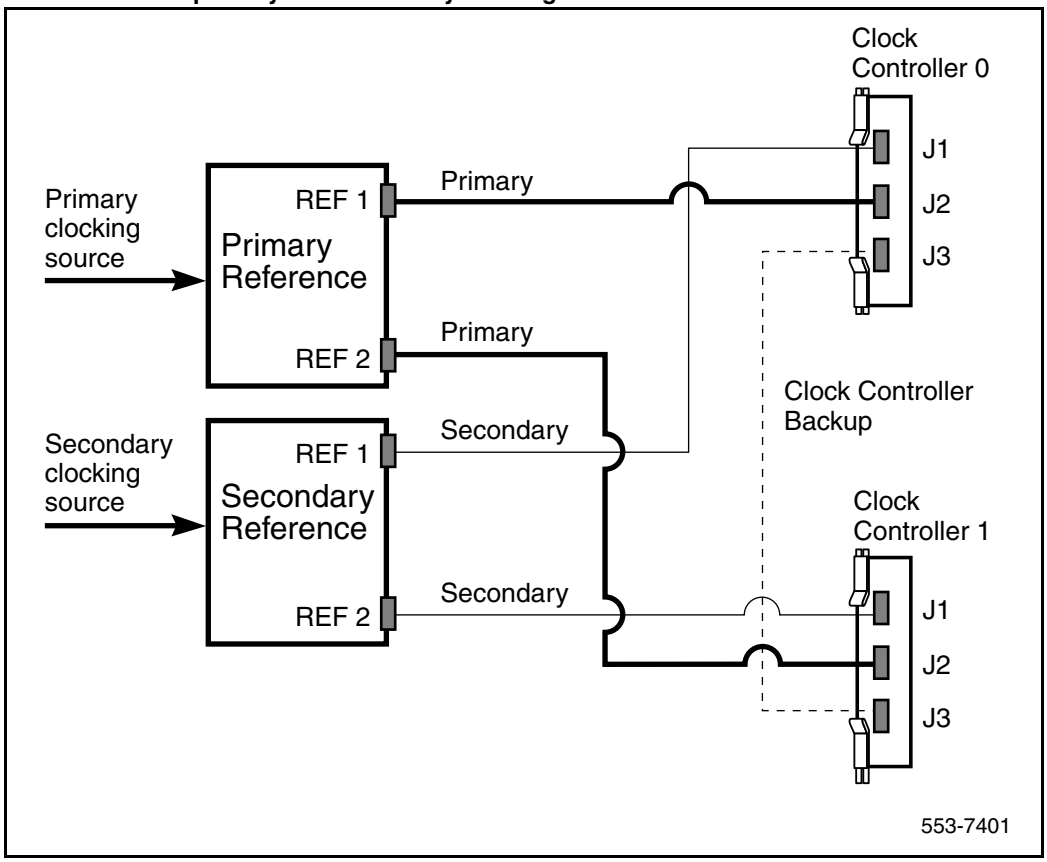
Clock operation

Tracking mode

In tracking mode, the PRI loop supplies an external clock reference to a clock controller (CC). See Figure 14 on page 98. 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.

As shown in Figure 14 on page 98, a system with a dual CPU can have two clock controllers (CC0 and CC1). One clock controller acts as a back-up to the other. The clock controllers should be locked to the reference clock.

Figure 14
Clock controller primary and secondary tracking



Free run (non-tracking) mode

The clock synchronization for a PRI loop can 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 local alarm

Reference clock errors

System software checks every 0-15 minutes (programmable) 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.

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.

Automatic clock recovery

An option for automatic clock recovery can be selected in LD 60 with the command EREF.

A PRI loop is disabled when it enters a local alarm condition. If the local 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 local alarm, tracking is restored to the secondary reference clock, if defined.

Note: If the system was put into free-run mode intentionally by the craftsperson, it will resume tracking on a reference clock at this time. This occurs unless the clock-switching option has been disabled (LD 60, command MREF), or the reference clock has been "undefined" in the database.

Automatic clock switching

If the EREF option is selected in LD 60, tracking on the primary or secondary reference clock is automatically switched in the following manner:

1. 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.
2. If software is unable to track on the assigned secondary reference clock, it switches to free-run mode.

Clock controller commands (LD 60)

Table 19
Clock controller commands in LD 60

Command	Description
DIS CC x	Disable specified system clock controller x (0 or 1).
DSCK L	Disables the clock for loop L.
DSYL L	Disables remote alarm processing for loop L.
ENL CC x	Enable specified system clock controller x (0 or 1).
ENYL L	Enables remote alarm processing for loop L.
EREF	Enables automatic switching and recovery of primary and secondary reference clocks when loops associated with these clocks are automatically enabled.
MREF	Disables automatic switching and recovery of the primary and secondary reference clocks when loops associated with these clocks are automatically disabled or in local alarm.

Table 19
Clock controller commands in LD 60

Command	Description
SSCK x	Provides status of system clock x (0 or 1). Indicates the active controller as well as active primary or secondary reference-clock source or free run.
SWCK	Switches the system clock from the active to the standby clock. The reference-clock source remains unchanged.
TRCK xxx	Set clock-controller tracking. Where xxx represents one of the following mnemonics: **PCK**track primary clock **SCLK**track secondary clock **FRUN**free-run mode

Replace the clock controller

Task summary list

The following is a summary of the tasks in this section:

1 Replace the clock controller. Refer to Procedure 2 on page 102.

CAUTION
Firmly touch the metal frame of the cabinet to discharge static electricity from your body before handling circuit packs.

CAUTION
Do not deviate from this procedure. Deviation will not cause the system to SYSLOAD or initialize, but will stop call processing.

Procedure 2
Replacing the clock controller (Part 1 of 2)

Step	Action
1	Make sure that the clock controller card being replaced is associated with an inactive CPU. Switch, if necessary, using: LD 35 SCPU
2	Disable the clock controller card being replaced using: LD 60 DIS CC x
3	On the clock controller card being replaced, set the ENB/DIS switch to DIS.
4	Disconnect cables from clock-controller card being replaced.
5	Remove card from shelf.

Procedure 2
Replacing the clock controller (Part 2 of 2)

Step	Action
6	Set the ENB/DIS switch to DIS on the clock-controller card being added.
7	Make sure that the switch settings are correct.
8	Install new clock-controller card in same slot as the defective card.
9	Reconnect cable(s) to clock-controller faceplate.
10	Set ENB/DIS switch on new clock controller to ENB.
11	Enable new clock-controller card using: **LD 60** **ENL CC x**
12	Verify normal service level; first, switch the active clock to standby using: LD 60 SWCK x If an error message results, refer to *Large System: Maintenance* (553-3021-500) for the interpretation. ***Note:*** Switching clock controllers using LD 60 will generate ERR20 messages. These can usually be ignored, but avoid excessive switching, especially when counters are near the maintenance or out-of-service thresholds. Excessive switching can generate maintenance or out-of-service threshold messages, or cause the PRI to be disabled. Check the counters in LD 60. If necessary, reset the counters using the RCNT command.

Set switches

Before installing a Clock Controller, set the switches as shown in Tables 20 and 21. Table 20 displays the settings for different vintages of the QPC471. Table 21 shows the settings for the QPC775.

Table 20
Clock Controller switch settings for QPC471 vintage H

System		SW1	SW2	SW4
51C, 61C		on on on on	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.				

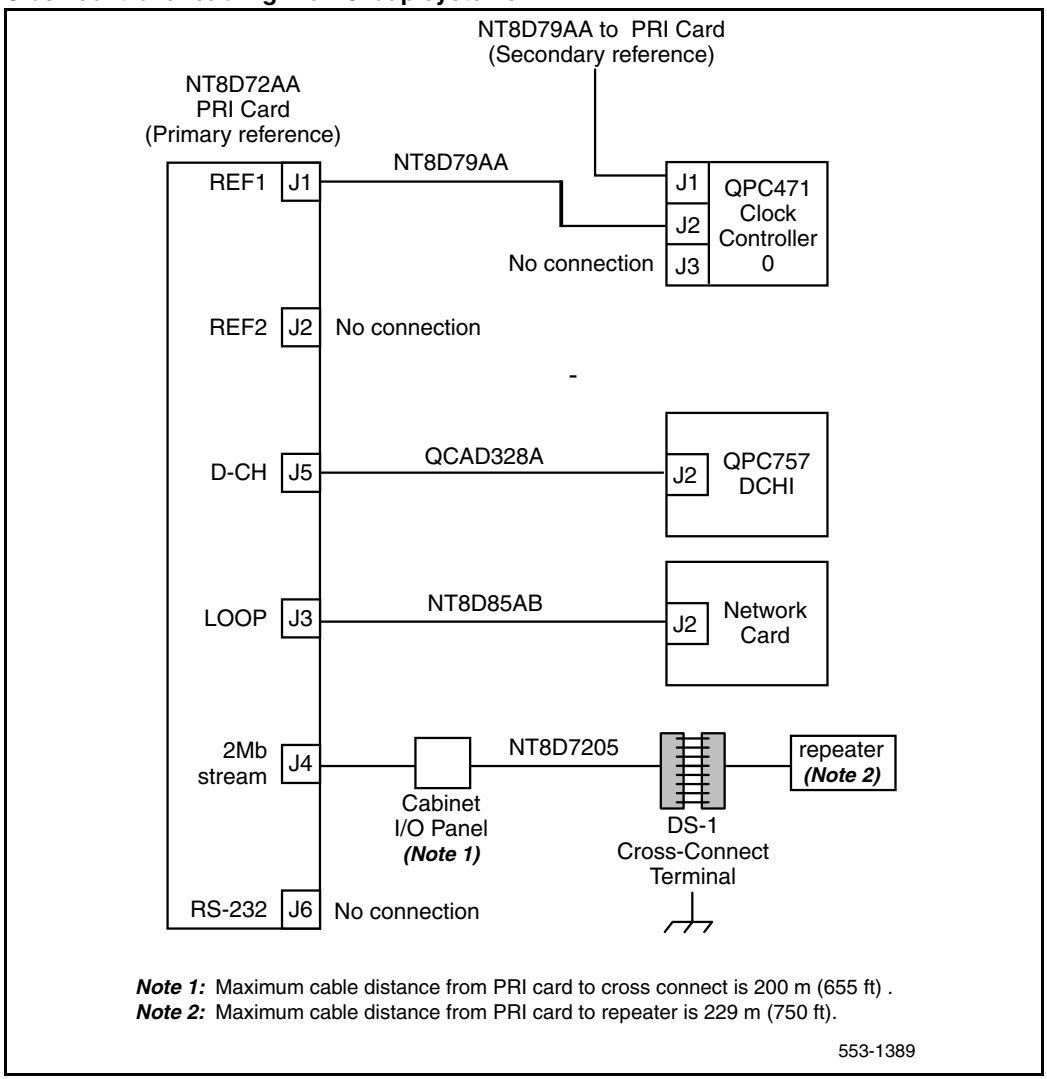
Table 21
Clock Controller switch settings for QPC775

System	SW2	SW3	SW4
51C, 61C	ON	OFF	ON
81C	OFF	OFF	ON

Clock controller cabling

The clock-controller cabling for system configurations is shown in the following diagrams. See Figures 15 to 17.

Figure 15
Clock controller cabling: Half Group systems



Note 1: Maximum cable distance from PRI card to cross connect is 200 m (655 ft) .
Note 2: Maximum cable distance from PRI card to repeater is 229 m (750 ft).

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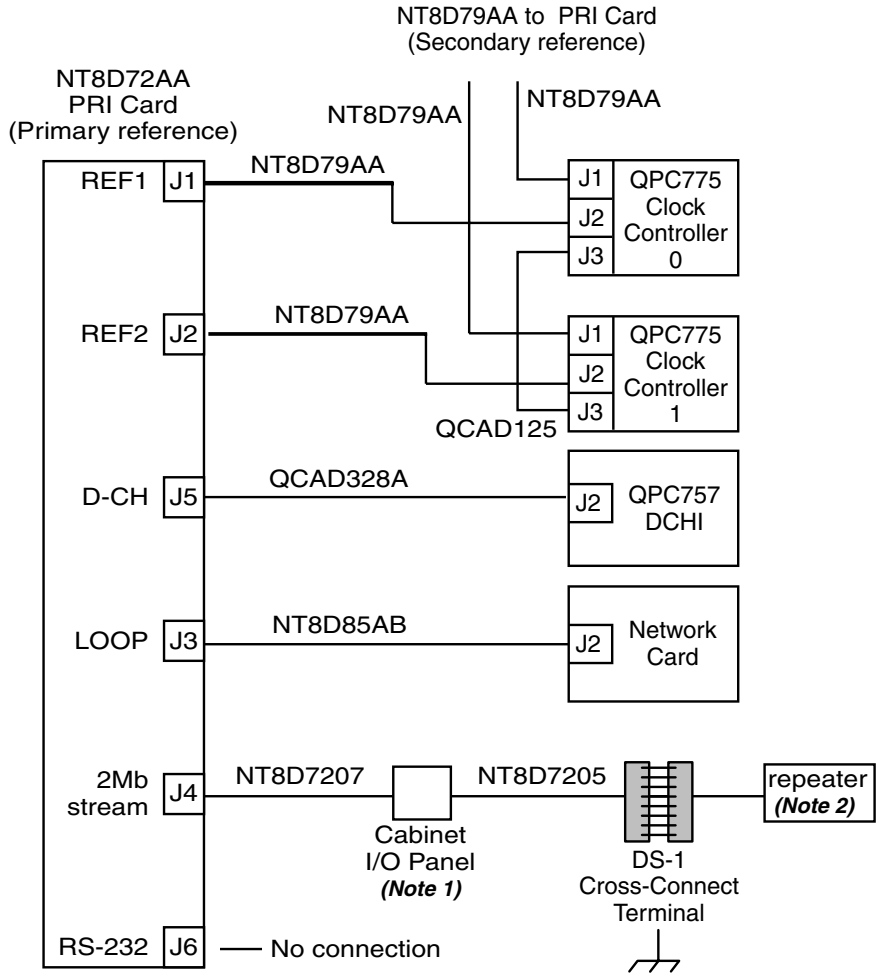
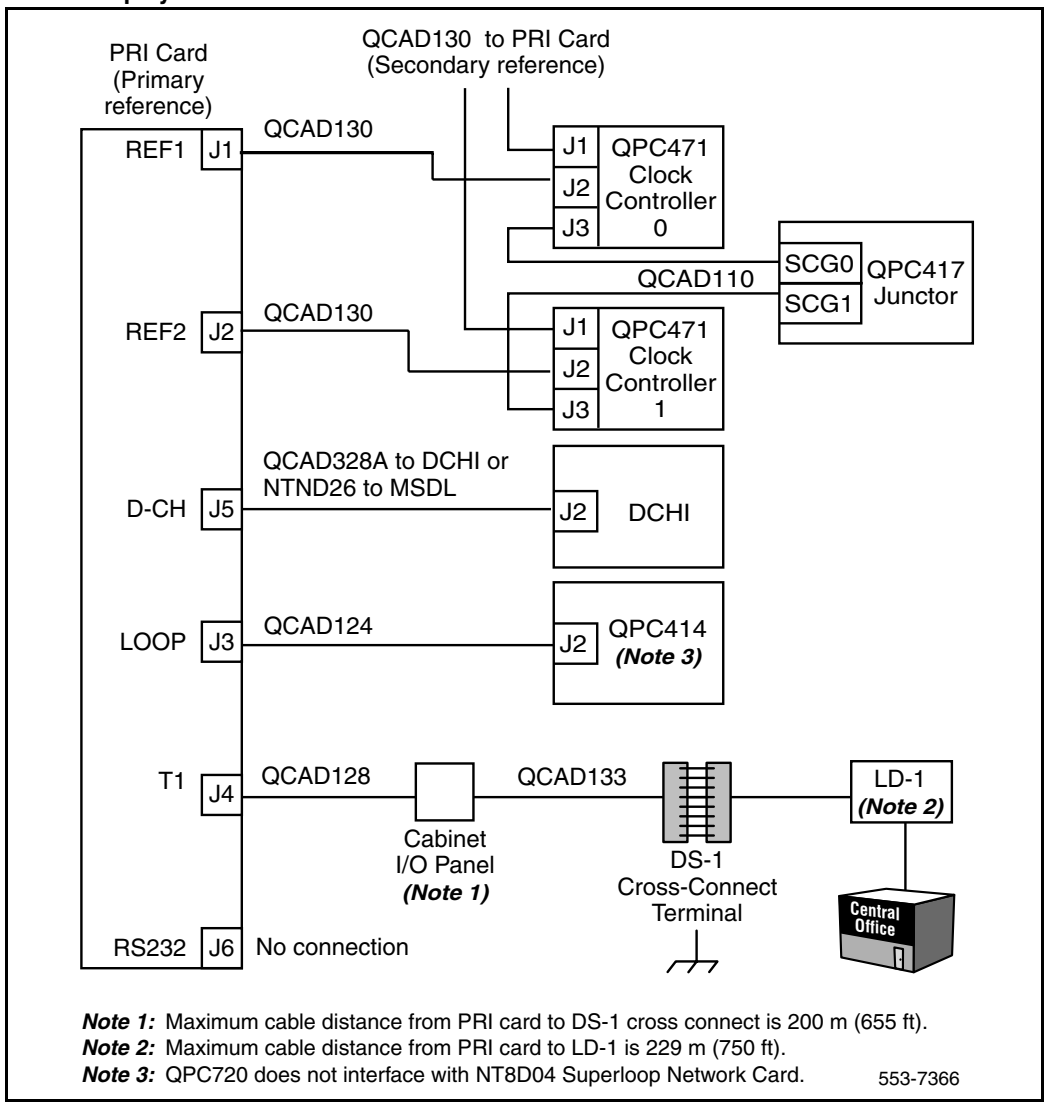
Figure 16
Clock controller cabling: Single Group systems



Note 1: Maximum cable distance from PRI card to cross connect is 200 m (655 ft) .
Note 2: Maximum cable distance from PRI card to repeater is 229 m (750 ft).

553-1391

Figure 17
Clock controller cabling
Multi Group systems



Note 1: Maximum cable distance from PRI card to DS-1 cross connect is 200 m (655 ft).
Note 2: Maximum cable distance from PRI card to LD-1 is 229 m (750 ft).
Note 3: QPC720 does not interface with NT8D04 Superloop Network Card.

553-7366

ISDN Signaling Link maintenance

Contents

This section contains information on the following topics:

ISL status formats

If a trunk unit is controlled by the ISL feature, the STAT commands in LD 32 and LD 36 will do the following:

- 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 22.

Table 22
ISL status check in LD 32 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 LD 60 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 23.

Table 23
ISL status check in LD 60

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 (LD 20, 21, 22)

Print programs LD 20, LD 21, and LD 22 (see Table 24) provide the following ISL information:

- LD 20 prints trunk information

- LD 21 prints route information
- LD 22 prints configuration record information

Table 24
ISL prompts in LD 20, LD 21, and LD 22

Program	Prompt	Description
LD 20	CHID nn	Channel ID
LD 21	MODE ISL/PRI DCHI x	ISL or PRI service route DCHI port number (printed if MODE = ISL)
LD 22	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

LD 21 also lists the ISL trunk terminal numbers (TNs) configured in the system and counts the number of ISL trunks controlled by the DCH (see Table 25). To list ISL trunk TNs use the following prompts:

REQPRT
TYPEISLL

Table 25
Additional ISL information provided in LD 21

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 the 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 goes down if the following occurs:

- the modem, ADM, ASIM, or HSDM power is off
- the hotline call between the system and the modem, ADM, ASIM, or HSDM is dropped

The system handles these possibilities in the following way:

1 The system 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.

1.5 Mb DTI/PRI maintenance

Contents

This section contains information on the following topics:

Overview

From a maintenance perspective, DTI/PRI operation consists of these major elements:

- hardware and software states
- near-end and far-end status
- link and/or span integrity
- clocking status
- frame alignment

PRI operation is monitored and reported on through maintenance messages, out-of-service alarms, and circuit card faceplate LEDs. Bantam monitor jacks are located on the faceplate of the NTAK09.

System maintenance provides several tools, either manual or automatic, for maintaining effective PRI operation. These tools are service change and maintenance commands that are accessible through the software overlays and resident diagnostic routines.

Monitor DTI/PRI operation

Maintenance messages

The following sections describe the maintenance messages that may appear on the system maintenance TTY as a result of DTI or PRI operation.

D-channel status and error conditions are reported as DCH messages. PRI status and error conditions are shown in Table 26. (Additional information on PRI and DCH messages can be found in the *Software Input/Output: System Messages* (553-3001-411).

Table 26
Maintenance messages

Message	Meaning
DTA	Digital Trunk Alarms (Resident Monitor)
DTC	Resident CC Monitor
DTI	Digital Trunk Interface and CC (LD60)
PRI	Primary Rate Interface

Message descriptions

Maintenance messages provide near-end and far-end switch status. Both service and service acknowledge messages are supported on PRI B-channels and ISL channels.

Service and service acknowledge messages for B-channels and ISL channels are supported between:

- System to system: ISL and PRI
- System to DMS-100: PRI only
- System to DMS-250: PRI only
- System to AT&T ESS4 and ESS5: PRI only

The status reported by the service and service acknowledge messages for B-channels and ISL channels are:

- in-service
- maintenance
- out-of-service

Near-end and far-end sub-categories are defined for each maintenance status. See Table 27 for possible combinations of near-end and far-end statuses, and the channel capability for each status. When the near-end and far-end status does not match, the more severe maintenance status takes effect over the less severe maintenance status.

Table 27
Maintenance message and status combinations

Near-end status	Far-end status	B or ISL channel capability
In-service	In-service	Incoming and outgoing call allowed
In-service	Maintenance	Incoming calls allowed only
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

Note: Enabling/Disabling of Service Messages must be coordinated between the two ends. Enabling Service Messages at one end and not the other results in B-channels being placed out-of-service.

Message functions

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 messaging allows the far-end to synchronize its channel states. The service messages are sent when the system brings up the D-channel automatically or an administrator brings up the D-channel manually by using LD 96.

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 master or 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 via a service message. Status change can occur through service change or maintenance operations, such as the addition or deletion of a channel in LD 14, or disabling of the associated loop, shelf, card or unit in LD 30, LD 32, LD 36, LD 41, or LD 60.

Channel status audit

LD 30 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 via service messages.

Activating service messages

Activate the service messages in LD 96 on a per D-channel basis. The backup D-channel (if equipped) automatically operates in the same mode as the primary D-channel. The commands are listed in Table 28.

Table 28
D-channel messages

Command	Description
ENL SERV N	turns on the support of service and service acknowledge messages for DCH link N.
DIS SERV N	turns off the support of service and service acknowledge messages for DCH link N.
STAT SERV (N)	displays the current service and service acknowledge message SERV setting for individual DCH N or DCH.

Note: D-channels on each side of the link must be disabled to enable service messages.

Alarms

DTI/PRI yellow alarm (remote alarm)

A yellow alarm on the system, indicated by the state of the YELLOW LED on the PRI/DTI circuit card, is notification of a red alarm at the far-end (remote end). The fact that the PRI/DTI circuit card is receiving the yellow alarm pattern indicates that there is a T1 connection, but the far-end is not ready.

It is possible, however, that the T1 connection is one-way only — that is, receiving only, since this end is receiving the alarm. The yellow alarm is transported in one of two ways: using digit-2 or the facility data link (DG2 or FDL).

When the PRI/DTI circuit card receives a yellow alarm, the channels are placed into the maintenance busy state.

Each time a yellow alarm is generated, a counter is incriminated. When the yellow alarm 24-hour threshold (prompt RALM in LD 73) is reached, the PRI/DTI circuit card must be restored to service manually.

DTI/PRI red alarm (local alarm)

A red alarm (local alarm) indicates that the digital trunks or B-channels have been taken out-of-service (OOS) due to a loss of frame alignment lasting more than three seconds, or due to some facility performance OOS threshold being exceeded.

Maintenance and OOS messages are discussed later in this chapter.

DTI/PRI maintenance tools

Maintenance commands

Table 29 on page 121 through Table 31 on page 123 provide quick reference lists of important DTI/PRI commands. Table 32 on page 124 and Table 33 on page 126 pertain to the NTRB51 TMDI card.

WARNING

The user must disable the D-channel and clock-controller daughterboards before unseating circuit cards. Otherwise, the system performs INIT and momentarily interrupts call processing.

WARNING

Extreme care must be taken when enabling the D-channel message monitoring option due to the possible heavy volume of messages during normal traffic. Use this command only during very light or no traffic conditions for trouble-shooting purposes. Remember to disable the monitoring tool when you are finished — it does not time-out. Monitor enabled status is saved by EDD and remains enabled even after a SYSLOAD.

The port (TTY) performing the monitoring **must** have MTC and BUG programmed.

Table 29
DTI/PRI commands (LD 60)

Command	Action
DISI C	Disable DTI/PRI card when idle.
DISL C	Force disable DTI/PRI card.
ENLL C	Enable DTI/PRI card.
LCNT (C)	List alarm counters.
RCNT (C)	Reset alarm counters.
SLFT (C)	Do DTI/PRI self-test.
STAT (C)	List DTI/PRI status.
RLBK	Remote loopback.

Table 30
D-channel commands (LD 96) (Part 1 of 2)

Command	Action
DIS DCH N	Disable DCHI port N.
DIS MSGI N	Disable monitoring of incoming D-channel messages on link N. Monitor remains active until disabled.
DIS MSGO N	Disable monitoring of outgoing D-channel messages on link N. Monitor remains active until disabled.
DIS AUTO N	Disable autorecovery of the D-channel. Hardware may still respond to recovery initiated from the far-end.
ENL AUTO N	Enable autorecovery of the D-channel. Software periodically commands hardware to establish the layer 2 link.
ENL DCH N	Enable DCHI port N.
ENL MSGI N	Enable monitoring of incoming D-channel messages on link N. Use only under light traffic.
ENL MSGO N	Enable monitoring of outgoing D-channel messages on link N. Use only under light traffic.
EST DCH N	Establish D-channel N.
PLOG DCH N	Print D-channel statistics log N.
RLS DCH N	Release D-channel N.
SDCH	Release a D-channel and switch D-channels.
RST DCH N	Reset D-channel N.
STAT DCH (N)	Print D-channel status (link status).
STAT MSGI (N)	Print incoming message monitor status.

Table 30
D-channel commands (LD 96) (Part 2 of 2)

Command	Action
STAT MSGO (N)	Print outgoing message monitor status.
TEST-100/101/200/201	See DCH tests in NTP.
STAT SERV	Print the current service and service acknowledge message for DCHI N.
ENL SERV N	Enable service messages for DCHI N.
DIS SERV N	Disable service messages for DCHI N.

Table 31
Downloadable D-channel (DDCH) commands (LD 96) (Part 1 of 2)

Command	Action
DIS MSDL X (ALL)	Disable DCHI card X.
ENL MSDL X (FDL, ALL)	Enable DCHI card X, with or without Force Download.
RST MSDL X	Reset MSDL card X.
STAT MSDL X (X (full))	Get MSDL status X, or a “FULL STATUS”.
SLFT MSDL X	Execute a self test on MSDL card X.
DIS LLB X	Disable local loop back on MSDL DCH X.
DIS RLB X	Disable remote loop back on MSDL DCH X.
DIS TEST X	Disable Test mode on MSDL DCH X.
ENL LLB X	Enable local loop on MSDL DCH X.
ENL RLB X	Enable remote loop on MSDL DCH X.
ENL TEST X	Enable Test mode on MSDL DCH X.
PCON DCH X	Print configuration parameters on MSDL DCH X.

Table 31
Downloadable D-channel (DDCH) commands (LD 96) (Part 2 of 2)

Command	Action
PMES DCH X	Print incoming layer 3 messages on MSDL DCH X.
PTRF DCH X	Print traffic report on MSDL DCHX.
TEST LLB X	Start local loop back test on MSDL DCH X.
TEST RLB X	Start remote loop back test on MSDL DCH X.

Note: "X" represents the D-channel device number.

TMDI maintenance commands

The Maintenance Overlays for the TMDI card have been enhanced. LD 60 is no longer used for TMDI card and loop maintenance. Only LD 96 is used to handle enabling and disabling of TMDI cards and their associated loop. Following are the descriptions of LD 96 command enhancements for TMDI:

Table 32
TMDI maintenance commands (Part 1 of 2)

Command	Description
DIS TMDI x	Disable TMDI card x.
DIS TMDI x ALL	Disables the TMDI card and various applications on the TMDI. If a DCH is configured on the TMDI, the DCH is released and the DCH application is disabled. The TMDI associated loop is also disabled. Active calls are force disconnected. All channels are disabled.

Table 32
TMDI maintenance commands (Part 2 of 2)

Command	Description
ENL TMDI x (FDL)	Enable TMDI card x and force a download. This command only works if TMDI is disabled (loop also disabled). It attempts to force download all required applications to TMDI card and then re-enable the card. When download is completed without error, ENL TMDI x ALL or ENLL x in Overlay 60 is required to re-enable the TMDI L1 application and the loop. Under normal conditions, option FDL to force download f/w to the TMDI card is not required. If the TMDI card does not have the latest f/w, the f/w is automatically downloaded after ENLTMDI x command is enabled. Force download f/w to the TMDI is only required if a new PSDL file is created for TMDI f/w. Once the f/w is downloaded, it burns into the flash on the card. If this card is disabled and re-enabled again, force download to the card is not necessary.
ENL TMDI x ALL	Enable the TMDI card and various applications on the card. Also enables the associated loop. If a DCH is configured on the TMDI, a background audit enables and establishes the DCH, once the loop is up. DCH layer 3 should be established within about 30 seconds.
RST TMDI x	Reset TMDI card x.
SLFT TMDI x	Invoke self-test on TMDI card x.
STAT TMDI (x FULL)	Get TMDI status.

D-channel monitoring on the TMDI card

Table 33
D-channel monitoring commands

Command	Action
DIS TMDI x MSGI	Disable monitoring of incoming D-channel messages on TMDI card x.
DIS TMDI x MSGO	Disable monitoring of outgoing D-channel messages on TMDI card x.
ENL TMDI x ALL MSGI	Enable monitoring of incoming D-channel messages on TMDI card x.
ENL TMDI x ALL MSGO	Enable monitoring of outgoing D-channel messages on link TMDI card x.
ENL TMDI x ALL DBG	Enable debugging on TMDI card x.
DIS TMDI x DBG	Disable debugging on TMDI card x.
PSWD TMDI	Print passwords.
STAT TMDI x MON	Print monitoring commands for TMDI card x.

D-channel status and error conditions are reported as DCH messages. These messages can be found in the *Software Input/Output: System Messages* (553-3001-411).

Table 34
Clock controller commands (LD 60) (Part 1 of 2)

Command	Action
DIS CC N	Disable clock controller N.
ENL CC N	Enable clock controller N.

Table 34
Clock controller commands (LD 60) (Part 2 of 2)

Command	Action
SSCK N	Status of clock controller N.
TRCK XXXX N	Set clock controller tracking. Where xxxx = PCK = Track primary clock reference source. SCLK = Track secondary clock reference source. FRUN = Free run mode.

NTAK09 DTI/PRI power on self-test

When power is applied to the NTAK09 DTI/PRI circuit card, the card performs a self test. The LEDs directly associated with the NTAK09 circuit card are DIS, ACT, RED, YEL, and LBK. The clock controller LED is also included in the power on self test. See Table 35.

Table 35 provides the state of the NTAK09 LEDs during the self-test procedure.

Table 35
NTAK09 LED states during self-test

Action	LED State
Power up system	Top five LEDs on for eleven seconds.
Self-test in progress	Top five LEDs go off for one second. If the self-test passes, the top five LEDs flash on and off three times. If the self-test detects a partial failure, the top five LEDs flash on and off five times. When the self-test is completed, the LEDs are set to their appropriate states.

NTAK20 power on self-test

The clock controller daughterboard LED is the second LED from the bottom on the faceplate of the NTAK09 DTI/PRI card.

When power is applied to the NTAK20 clock controller, the LED is initially off for two seconds. If the self-test passes, the LED turns red and flashes on and off twice.

When the self-test completes, the LED remains red until the clock controller is enabled. When enabled, the clock controller LED turns green or flashes green.

NTAK93 self-test

The NTAK93 DCHI daughterboard LED is the bottom LED on the faceplate of the NTAK09 DTI/PRI card.

The NTAK93 DCHI daughterboard does not perform a self-test when power is applied to it. When power is applied, it turns red and remains steadily lit, indicating the D-channel is disabled. When the D-channel is enabled, the LED turns green and remains steadily lit.

Self-tests of the NTAK93 daughterboard are invoked manually by commands in LD 96.

DTI/PRI local self-test

The local self-test, also called a local loopback test, checks speech path continuity, zero code suppression, remote alarm detection, and A and B bit signalling. This test is performed manually on a per-loop (or link 24 channels) or per-channel basis. The local loopback test performs a local logical loopback and does not require any external loopback of the T-1 signal.

Restrictions and limitations

Disable the DCHI and DTI/PRI before performing the self-test on the entire DTI/PRI card. Individual channels must be disabled before performing a self-test on a particular channel.

Procedure 7
Self-testing the DTI/PRI card

To perform a self-test on the entire DTI/PRI card:

1 Enter the following command in LD 96 to disable the DCHI:

```
DIS DCH N
```

2 Enter the following command in LD 60 to disable the DTI/PRI card and run the self-test:

```
DISL C
```

SLFT C (entire card)

To self-test individual channels, follow the same procedure as above, but use the following commands:

```
DSCH C CH
```

SLFT C CH (specific channel)

End of Procedure

DTI/PRI automatic local loopback test

There are two types of automatic local loopback tests:

- ATLP 0 (disable auto loop test in daily routine: LD 60)
- ATLP 1 (enable auto loop test in daily routine: LD 60)

The automatic loop test checks the same functions as the manual self-test, but runs automatically as part of the midnight routines.

ATLP 0 disables one idle channel at random and performs a single channel self-test. This channel cannot be specified; it is selected by software.

ATLP 1 attempts to test the whole DTI/PRI loop. If ATLP 1 finds all channels in the target link idle, it takes the whole link down and tests it. The node where the self-test is performed sends out a Yellow Alarm while the link is down.

Ensure that LD 73 TRSH RALM is not exceeded at the far-end due to the automatic loop test. If TRSH RALM (default = 3) is exceeded at the far-end, trunks remain out of service.

Remote loopback and remote self test

The remote loopback and the remote self-test are performed manually per loop (or per system card).

Remote loopback

The RLBK C command puts the DTI/PRI into loopback toward the far-end so a remote self-test can be performed on equipment at the far end.

Note: The DTI/PRI loop (card) being tested must be disabled.

Remote loopback test

The remote self test, also called the external loopback test, checks the integrity of the DTI/PRI through an external T-1 loopback. If the Remote Loopback command (RLBK) is executed at the far-end system prior to executing the Remote self-test command (RMST) at the near-end, the integrity of the DS-1 facility is tested from end-to-end.

Note: The DTI/PRI channel or loop (card) being tested must be disabled.

Procedure 8
Coordinating the tests

1. When a technician at the far-end requests a remote loopback on the local system:
   a. Enter the following command in LD 96 to disable the DCHI (for PRI DCHL or BCHL):

      ```
      DIS DCH N
      ```

   b. Enter the following command in LD 60 to disable the DTI/PRI card and activate remote loopback mode:

      ```
      DISL C

      RLBK C
      ```

2. To run the remote self-test (external loopback test) through a loopback on the far-end system:

a. Call a technician at the far-end. Ask for remote loopback mode on the facility to be tested.

b. When loopback mode at the far-end is confirmed, enter the following command in LD 96 to disable the DCHI (for PRI DCHL or BCHL):

```
DIS DCH N
```

c. Enter the following command in LD 96 to disable the DTI/PRI card and run loopback test:

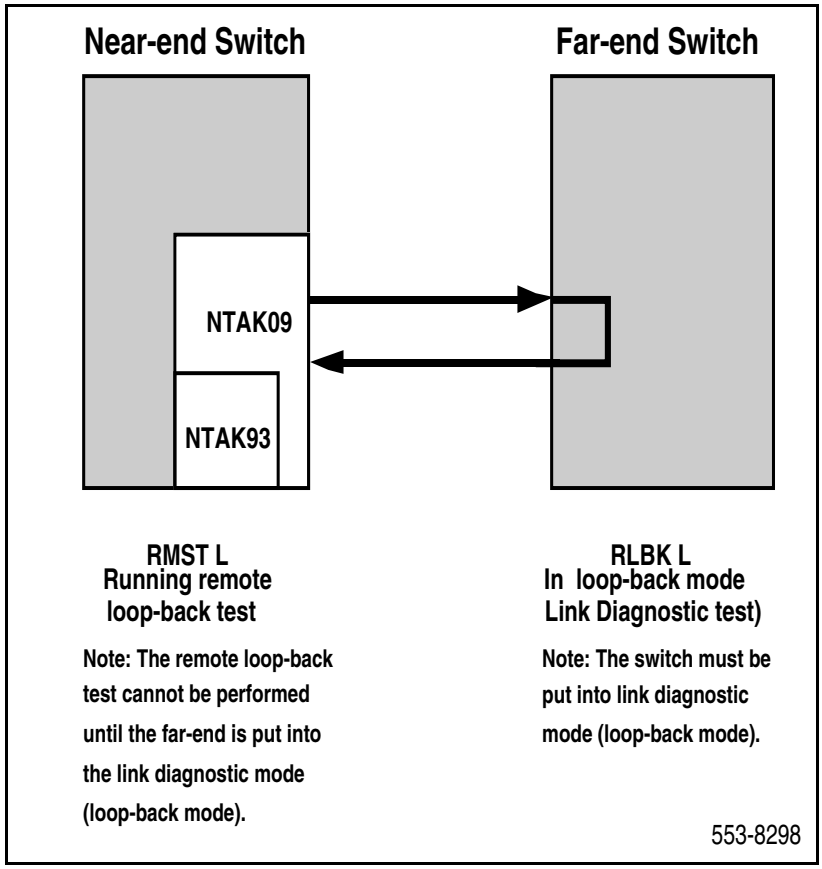
```
DISL C

RMST C
```

Note: The Remote self-test (external loopback test) can be run through any loopback that is external to the DTI/PRI card. The loopback can range from a loopback connector plugged into the NTBK04 cable to a remote loopback on the far-end DTI/PRI, or at any point in between on the DS-1 facility.

Figure 18 on page 132 shows the relationship between the remote loopback test and the link diagnostic test.

End of Procedure

Figure 18
DTI/PRI link diagnostic and remote loopback tests



DTI/PRI error detection

Bit error rate

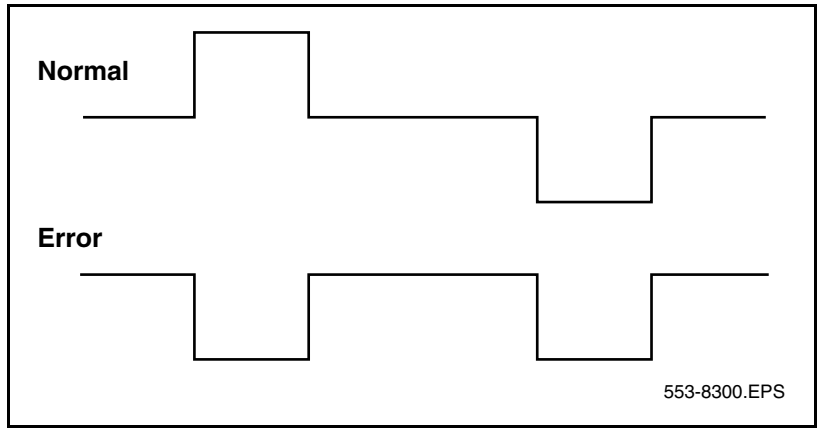
Bit error rate monitoring detects errors in transmission (see Figure 19). There are two methods of bit error monitoring: bipolar violation tracking and Cyclic Redundancy Check (CRC).

If the D2, D3, or D4 framing format is selected in LD 17 prompt DLOP, then bipolar violation tracking is implemented. If the Extended Superframe (ESF) format 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:*** Bipolar 8 Zero Substitution (B8ZS) introduces intentional bipolar violations. The T1 equipment must treat them as such and disregard them. This explains why B8ZS can only be used if all the equipment on the T1 span (end-to-end) supports it. Otherwise, the intentional BPVs take the link down.

Figure 19
Bipolar violations



Cyclic Redundancy Check (CRC)
The Extended Superframe Format (ESF) contains a checksum of all 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 in 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 system and the satellite connection. Since CRC traverses the entire span, it indicates an end-to-end bit error rate.

DTI/PRI hardware detects BPV or CRC errors. It sends an overflow (OVFL) message to the system CPU each time 1024 BPV or CRC errors are detected. Running the midnight routines prints the number of overflows and clears the counter.

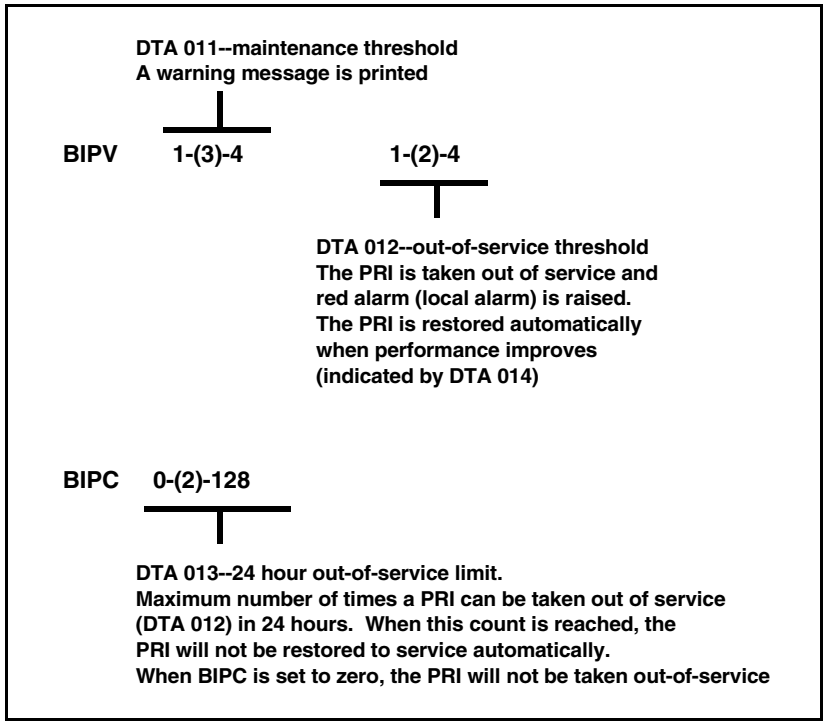
Bit error rate threshold messages

There are three bit error rate thresholds set in LD 73, using one of two prompts: BIPV or BIPC. When a threshold is reached, a DTA message is produced (see Figure 20 on page 135).

Table 36
Bit error rate messages

Message	Explanation
DTA011	Bit error rate maintenance threshold has been reached.
DTA012	Bit error rate out of service limit has been reached.
DTA013	Too many bit error rate out-of-service occurrences in the last 24 hours.

Figure 20
BIPV and BIPC thresholds



Frame slip

Digital signals must have accurate clock synchronization for data to be interleaved into, or extracted from, the appropriate timeslot during multiplexing and de-multiplexing operations. A frame slip is defined as the repetition or deletion of the 193 data bits of a DS-1 frame due to a sufficiently large discrepancy in the read and write rates at the buffer (clocks aren't operating at exactly the same speed).

When data bits are written into (added to) a buffer at a slightly higher rate than that at which they are being read (emptied), sooner or later the buffer overflows. This is a slip-frame deletion.

In the opposite situation, when data bits are written (added) into a buffer at slightly lower rate than that at which they are read (emptied), eventually the buffer runs dry or underflows. This is also a slip-frame repetition.

Either occurrence is called a slip (or a controlled slip). The system contains a buffer large enough to hold about 2 full DS-1 frames (193 * 2 = 386). It is normally kept half-full (1 frame). Slippage impacts data transfer as shown in Table 37. The degradations shown in Table 37 can be controlled or avoided with proper clock (network) synchronization.

Table 37
Impact of slip on service types

Service	Potential Impact
Encrypted Text	Encryption key must be resent.
Video	Freeze frame for several seconds. Loud pop on audio.
Digital Data	Deletion or repetition of Data. Possible Misframe.
Facsimile	Deletion of 4-8 scan lines. Drop Call.
Voice Band Data	Transmission Errors for 0.01 to 2 s. Drop Call.
Voice	Possible Click.

Types of synchronization

Clock synchronization can be either tracking on the primary or secondary reference clock or free run (non-tracking). In LD 73 (prompts PREF and SREF), the DTI/PRI which supports the clock controller daughterboard is defined as the primary clock reference.

Another DTI/PRI may be defined as the secondary clock reference. The clock controller synchronizes from the primary or secondary's incoming pulse stream. The clock controller supplies clocking to all the other DTI/PRI loops.

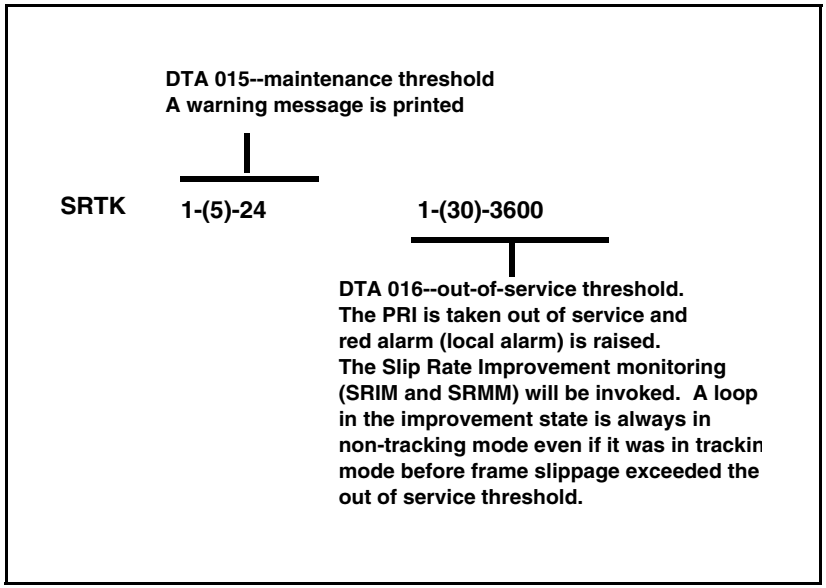
DTI/PRI hardware detects frame slips in tracking and free-run modes. For tracking mode, running the midnight routines prints the number of overflows and clears the counter. For free-run mode, running the midnight routines prints the number of frame deletions and repetitions and clears the counters.

Tracking mode
There are two thresholds set in LD 73 as described below.
Also see Figure 21 on page 138.

LD 73 — SRTK prompt

Prompt	Response	Description
SRTK	1-(5)-24 1-(30)-3600	Slip rate maintenance (in hours) and out-of-service threshold (per hour). These are the frame slip rate thresholds for the tracking mode. The first value is the maintenance threshold; the elapsed time (in hours) in which 2 frame slips occur (default is two slips in five hours). The second value is the out-of-service threshold; or the number of slips allowed in one hour (default is 30 slips in 1 hour). When a threshold is reached, a DTA messages is output as follows: DTA015:Frame slip --- tracking --- maintenance limit. DTA016:Frame slip --- tracking --- out of service limit.

Figure 21
Frame slip tracking thresholds



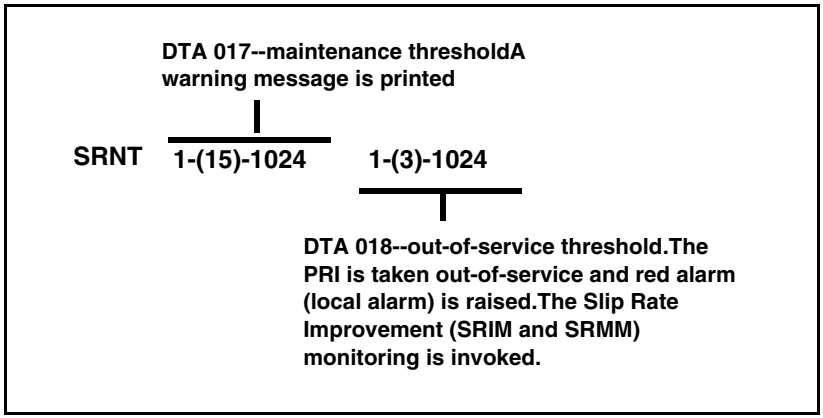
Free run (non-tracking) mode

A maintenance threshold and an out-of-service threshold are set in LD 73 as described below. Also, see Figure 22 on page 140 for additional information.

LD 73 — SRNT prompt

Prompt	Response	Description
SRNT	1-(15)-1024 1-(3)-1024	Non-tracking slip rate maintenance and out-of-service thresholds. These are frame slip rate thresholds for the non-tracking mode. The first value is the maintenance threshold in seconds, the amount of time in which 10 slips occur (default is 10 slips in 15 seconds). The second value is the out-of-service threshold in seconds, the amount of time in which 10 slips occur (default is 10 slips in three seconds). When these thresholds are reached, DTA messages are output. Related DTA messages are described below. See Figure 22. DTA017:Frame slip --- free run (non-tracking) --- maintenance limit. DTA018:Frame slip --- free run (non-tracking) --- out-of-service limit.

Figure 22
Frame slip non-tracking thresholds



Frame slippage improvement timers

Once the frame slip out-of-service threshold has been reached, the DTI/PRI software invokes a Slip Rate Improvement mechanism to monitor the slippage and return the DTI/PRI card to service if a specific criterion has been met. The criterion used to determine that the slip rate has improved enough to return a DTI/PRI card to service is that the maintenance threshold is exceeded less than M (the LD 73 prompt SRMM defines M) times in N (the LD 73 prompt SRIM defines N).

It is important to realize that this monitoring applies to both tracking and non-tracking modes. Note that a DTI/PRI card in the Slip Rate Improvement state is always in non-tracking mode, even if it was in tracking mode before frame slippage exceeded the out-of-service threshold.

There are two thresholds set in LD 73 as described in Table 38.

LD 73 — SRIM and SRMM prompts

Prompt	Response	Description
SRIM	(1)-127	Slip Rate Improvement time in minutes. After the tracking or non-tracking mode frame slippage out-of-service threshold is exceeded, the slip rate is monitored for improvement. If the non-tracking maintenance threshold exceeds SRMM or fewer times in the duration of this timer, then the trunks are returned to service. Otherwise, this timer is reset and monitoring continues.
SRMM	1-(2)-127	Slip Rate exceeded maintenance limit. Number of times the Slip Rate exceeds the maintenance limit while waiting for Slip Rate Improvement during the time window specified at the SRIM prompt. While waiting for Slip Rate Improvement one of three DTA messages is output as shown in Table 38 on page 141.

Table 38
Frame slip improvement timers (Part 1 of 2)

SRIM	**(1)-127**
	DTA 026 - Frame slip out-of-service limit has been reached while monitoring frame slip improvement. Trunks remain out-of-service, and improvement timer is restarted.
	DTA 028 - Frame slip maintenance limit has been reached while monitoring frame slip improvement. Trunks remain out-of-service, and improvement timer is restarted.

Table 38
Frame slip improvement timers (Part 2 of 2)

	DTA 029 - Frame slip improvement timer has expired, Slip Rate Improvement Criteria has been met. Trunks are being returned to service.
SRMM	**1-(2)-127**

Frame alignment

Loss of frame alignment occurs when the DTI/PRI card stops receiving the framing pattern on the DS-1 byte stream for a pre-defined period of time (three seconds). See Figure 23 on page 143 and Figure 24 on page 144. This condition can occur as a result of the far-end of the T1 span going completely out-of service or any other reason resulting in losing the incoming DS-1 pulse stream.

Loss of frame alignment thresholds

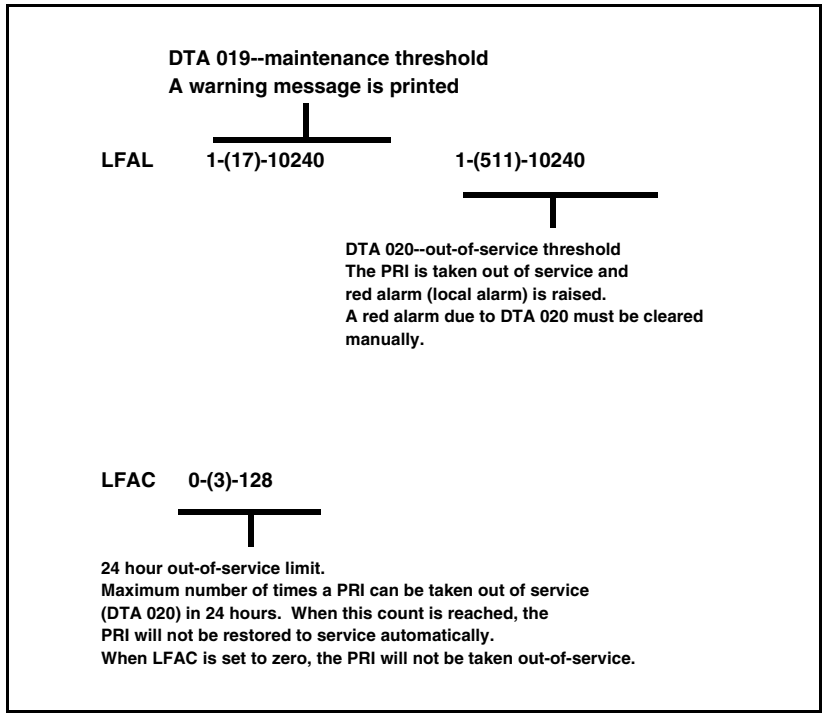
DTI/PRI hardware detects out-of-frame conditions. Running the midnight routines prints the number of occurrences when frame alignment was lost and clears the counters.

There are three frame alignment thresholds set in LD 73. When a maintenance or out-of-service threshold is reached, a DTA message is output as shown in Figure 23.

Table 39
DTA message output

DTA019	Frame alignment maintenance limit.
DTA020	Frame alignment out of service limit.

Figure 23
Frame alignment thresholds



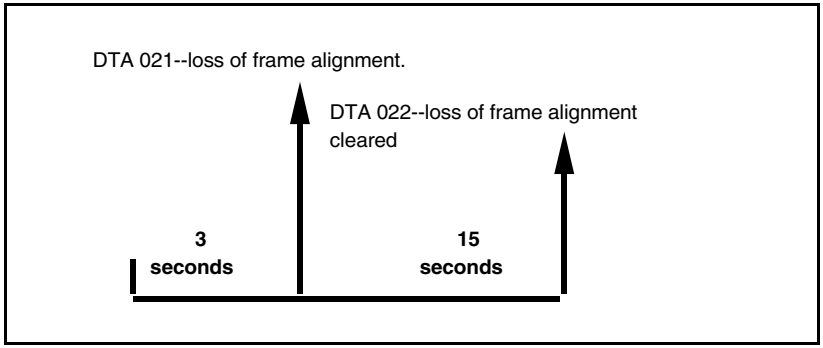
If a loss of frame alignment condition persists for three seconds, the affected DTI/PRI card is taken out-of-service and a red alarm (local alarm) is raised. See Figure 24.

If the loss of frame alignment condition clears at least 15 seconds, the DTI/PRI is automatically restored to service. The following DTA message is generated:

Table 40
DTA message output

DTA021	Loss of frame alignment has persisted for 3 seconds.

Figure 24
Loss of frame alignment



Alarm threshold recommendations for digital trunks

If a digital trunk is present in an IP expansion cabinet, link outages due to data network performance degradation between the main cabinet and the expansion cabinet causes alarms on the far-end of the digital trunk. If link outages are frequent, alarm thresholds on the far-end may need to be increased to prevent the trunk from being placed in a state requiring manual intervention to recover.

Clock operation

The system supports a single clock controller that can operate in one of two modes: tracking or non-tracking (also known as free-run).

Tracking mode

In tracking mode, one or possibly two DTI/PRI cards supply a clock reference to a clock controller daughterboard. When operating in tracking mode, one DTI/PRI is defined as the primary reference source for clock synchronization, while the other is defined as the secondary reference source (PREF and SREF in LD 73).

There are two stages to clock controller tracking:

- tracking a reference, and
- locked onto a reference.

When tracking a reference, the clock controller uses an algorithm to match its frequency to the frequency of the incoming clock. When the frequencies nearly match, the clock controller locks onto the reference. The clock controller makes small adjustments to its own frequency until both the incoming and system frequencies correspond.

If the incoming clock reference is stable, the internal clock controller tracks it, locks onto it, and matches frequencies exactly. Occasionally, however, environmental circumstances cause the external or internal clocks to drift. When this happens, the internal clock controller briefly enters the tracking stage. The green LED flashes momentarily until the clock controller locks onto the reference again.

If the incoming reference is unstable, the internal clock controller remains in the tracking stage, with the LED flashing green all the time. This condition does not present a problem, rather, it shows that the clock controller continually attempts to lock onto the signal. If slips occur, however, there is a problem with the clock controller or the incoming line.

Free-run (non-tracking)

In free-run mode, the clock controller does not synchronize on any source. It provides its own internal clock to the system. This mode can be used when the system serves as a master clock source for other systems in the network. Free-run mode is undesirable if the system is intended to be a slave. It can occur, however, when both the primary and secondary clock sources are lost due to hardware faults or when invoked by software commands.

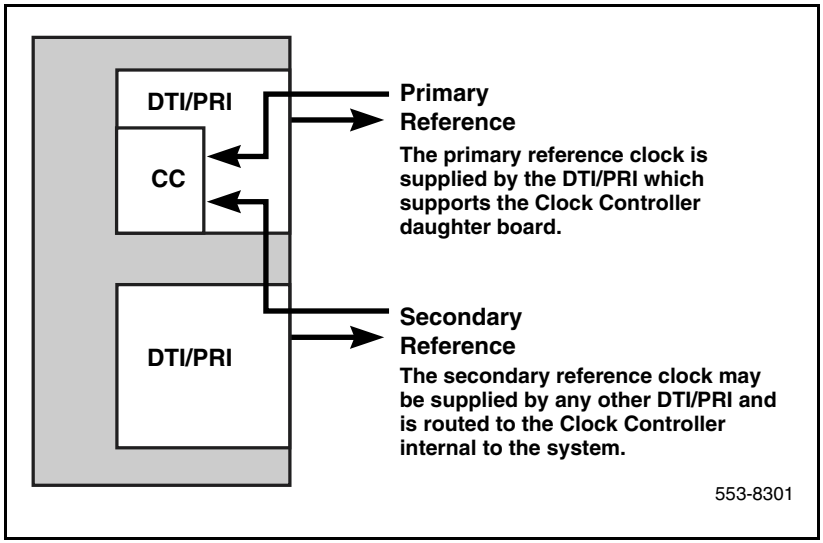
Reference clock errors

System software checks every 15 minutes to see if a clock controller or reference clock error has occurred.

In tracking mode, the clock controller tracks on one reference clock. If a clock controller error is detected, or if there is a problem with the reference clocks, the system switches to free-run mode.

A reference clock error occurs when there is a problem with clock driver or with the reference system clock at the far-end. If the clock controller detects a reference clock error, with only one of the reference clocks, the reference clock switches to the usable clock.

Figure 25
Clock controller primary and secondary tracking



Automatic clock recovery

Automatic switchover of the primary and secondary reference clocks is always *enabled* in the system.

Note: EREF and MREF commands in LD 60, which control the enabling and disabling of automatic clock recovery, are not supported on the system.

Procedure 9
Replacing equipment

Use the following procedure before reseating any one or more of the following: the NTAK09, the NTAK20, or the NTAK93.

1. If the NTAK93 DCHI daughterboard is installed, enter the following command in LD 96 to software disable the D-channel (DCHI):

   ```
   DIS DCH x
   ```

   Where X is the DCHI port number that was assigned in LD17.

2. If the NTAK20 Clock Controller daughterboard is installed, enter the following command in LD 60 to software disable it:

   ```
   DIS CC 0
   ```

   Where CC is the card slot number of the NTAK09 that supported the NTAK20 Clock Controller.

3. Enter the following command in LD 60 to software disable the DTI/PRI card:

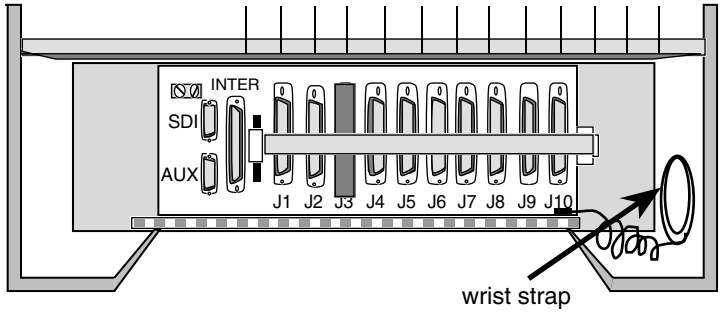
   ```
   DISL X
   ```

   Where X is the card slot number of the NTAK09 DTI/PRI.

4. To replace the NTAK09 by the lock latches, unlock the latches and slide the card out of the cabinet. Once out of the slot you can remove any of the daughterboards.

   Note: To avoid damage to the circuit cards from electrostatic discharge, wear the wrist strap connected to the inside of your cabinet when you handle the circuit cards. Figure 26 on page 148 shows the connection point for the wrist strap.

Figure 26
Wrist strap connection to the cabinet



553-8289.EPS

d. To remove the NTAK20 Clock Controller daughterboard, grasp the NTAK20 at opposite corners and gently "wiggle" it back and forth until all four corners are free. Do not bend the connector pins.

e. To remove the NTAK93 Clock Controller daughterboard, grasp the NTAK93 at opposite corners and gently "wiggle" it back and forth until all four corners are free. Once the corners are free of the stand-off, grasp the NTAK93 by its upper and lower right corners and slowly lift the right side of the NTAK93 up and away from the NTAK09 connectors, being careful not to bend any of the pins.

5 To replace the NTAK09 DTI/PRI card, NTAK20 Clock Controller or NTAK93 DCHI, refer to PRI implementation and DTI implementation in *ISDN Primary Rate Interface: Installation and Configuration* (553-3001-201). Be sure to set any switches and install any daughterboards as required.

6 Tag any defective or damaged equipment with a description of the problem and package it for return to a repair center.

End of Procedure

1.5 Mb ISL maintenance

Contents

This section contains information on the following topics:

Overview

From a maintenance perspective, ISL operation consists of these elements:

- hardware and software states
- near-end and far-end status
- link and/or span integrity

ISL operation is monitored and reported on through service messages.

System maintenance provides several tools, manual or automatic, for maintaining effective ISL operation. These tools are service commands (accessible through the software overlays) and diagnostic routines.

Maintenance messages

The following sections describe service messages that can appear on the system maintenance TTY as a result of ISL operation.

D-channel status and error conditions are reported as DCH messages. PRI status and error conditions are reported in the messages found in Table 41. Additional information on DCH and PRI messages can be found in the *Software Input/Output: System Messages* (553-3001-411).

Table 41
Status messages

Message	Meaning
DTA	Digital Trunks
DTI	Digital Trunk Interface
PRI	Primary Rate Interface

Message descriptions

Service messages provide near-end and far-end switch status. Both service and service acknowledge messages are supported on PRI B-channels and ISL channels.

Service and service acknowledge messages for B-channels and ISL channels are supported:

- System to system: ISL and PRI
- System to DMS-100: PRI only
- System to DMS-250: PRI only
- System to AT&T ESS4 and ESS5: PRI only

Service and service acknowledge messages for B-channels and ISL channels report the following status types:

- in-service
- maintenance
- out-of-service

Near-end and far-end sub-categories are defined for each maintenance status. See Table 42 for possible combinations of near-end and far-end status and the channel capability for each status. When near-end and far-end status do not match, the more severe maintenance status takes effect.

Table 42
Maintenance message and status combinations

Near-end status	Far-end status	B or ISL channel capability
In-service	In-service	Incoming and outgoing call allowed
In-service	Maintenance	Incoming calls allowed only
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

Message functions

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 services messages are sent when the D-channel is brought up automatically by the system or manually in LD 96.

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 master or 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 through a service message. Status change can occur through service change or maintenance operations, such as the addition or deletion of a channel in LD 14, or disabling of the associated loop, shelf, card or unit in LD 30, LD 32, LD 36, LD 41 or LD 60.

Channel status audit

LD 30 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 through service messages.

Activate service messages

Activate the service messages in LD 96 on a D-channel basis. The commands are listed in Table 43.

Table 43
D-channel messages

Command	Description
ENL SERV N	Turns on the support of service and service acknowledge messages for DCH link N.
DIS SERV N	Turns off the support of service and service acknowledge messages for DCH link N.
STAT SERV (N)	Displays the current service and service acknowledge message SERV setting for individual DCH N or DCH.

ISL maintenance tools

Maintenance commands

Table 44 on page 154 provides a quick reference list of important ISL commands.

WARNING

Ensure that other TTYs and D-channels residing on the NTAK02 are disabled.

IMPORTANT!

Extreme care must be taken when enabling D-channel message monitoring option due to the possible heavy volume of messages during normal traffic. Use this command only during very light or no traffic conditions for trouble-shooting purposes. Remember to disable the monitoring tool when you are finished.

The port (TTY) performing the monitoring must have MTTC programmed.

Table 44
D-channel commands (LD 96) (Part 1 of 2)

Command	Action
DIS DCH N	Disable DCHI port N.
DIS MSGI N	Disable incoming D-channel messages on link N *.
DIS MSGO N	Disable outgoing D-channel messages on link N *.
DIS AUTO ON	Disable the D-channel.
ENL AUTO ON	Auto enable the D-channel after SYSLOAD.
ENL DCH N	Enable DCHI port N.
ENL MSGI N	Enable incoming D-channel messages on link N *.
ENL MSGO N	Enable outgoing D-channel messages on link N *.
EST DCH N	Establish D-channel N.
PLOG DCHI N	Print D-channel statistics log N.
RLS DCH N	Release D-channel N.
SDCH	Release a D-channel and switch D-channels.

Table 44
D-channel commands (LD 96) (Part 2 of 2)

Command	Action
RST DCH N	Reset D-channel N.
STAT DCH (N)	Print D-channel status (link status).
STAT MSGI (N)	Print incoming message monitor status.
STAT MSGO (N)	Print outgoing message monitor status.
TEST-100/101/200/201	See DCH tests in NTP.
STAT SERV	Print the current service and service acknowledge message for DCHI N.
ENL SERV N	Enable service messages for DCHI N.
DIS SERV N	Disable service messages for DCHI N.

Maintenance messages

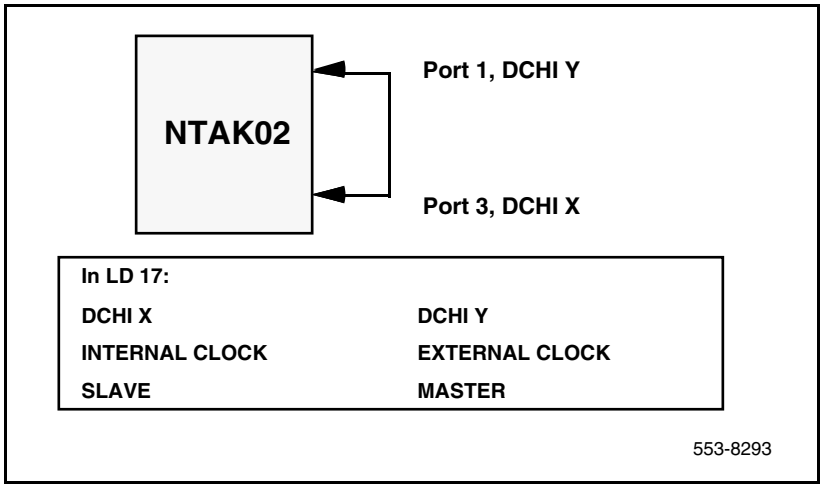
D-channel status and error conditions are reported as DCH messages. These messages can be found in the *Software Input/Output: System Messages* (553-3001-411).

Maintenance testing

ISL back-to-back (without modems)

For maintenance reasons or testing purposes it is sometimes necessary to connect ISL back-to-back (without modems). Use the diagram shown in Figure 27 on page 156 to accomplish the connection. This connection is normally done within the same system in a lab environment.

Figure 27
ISL back-to-back connection



2.0 Mb DTI maintenance

Contents

This section contains information on the following topics:

Overview

From a maintenance perspective, system DTI operation consists of the following major aspects:

- hardware and software states
- near-end and far-end status
- link and/or span integrity
- clocking status
- frame alignment

System DTI operation is monitored and reported on through maintenance messages, out-of-service alarms, and circuit card faceplate LEDs.

System maintenance provides several tools, either manual or automatic, for maintaining effective DTI operation. These tools are service change and maintenance commands that are accessible through the software overlays and resident diagnostic routines.

Procedure 10
Replacing the NTAK10 2.0 Mb DTI circuit card

To replace a DTI circuit pack, follow the procedure below:

1 Enter the following command in LD 60 to software disable the NTAK10 2.0 Mb DTI card(s):

```
DISL N
```

Where N is the 2.0 Mb DTI card number.

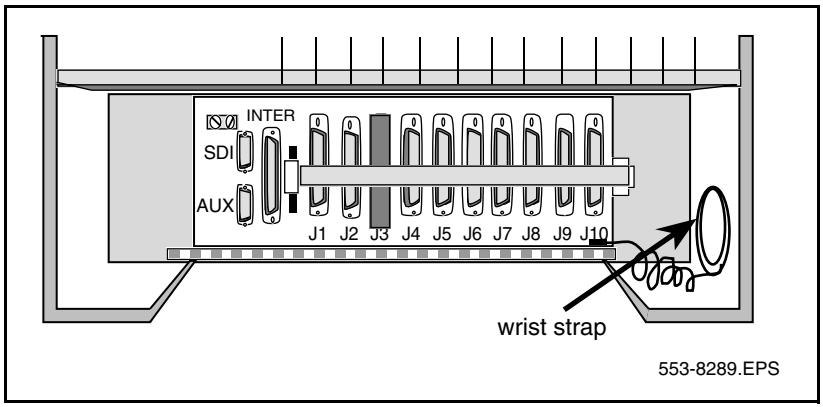
2 Enter the following command in LD 60 to software disable the clock controller:

```
DIS CC 0
```

3 Hold the NTAK10 by the lock latches, unlock the latches, and slide the card out of the shelf. Once out of the slot, the daughterboards can be removed.

To avoid damage to the circuit cards from electrostatic discharge, wear the wrist strap connected to the inside of the system whenever handling the circuit cards. Figure 28 on page 158 shows the location of the wrist strap in relation to a Small System cabinet.

Figure 28
Wrist strap connection to the Small System



4 Slide the new card into the shelf and lock the latches.

5 Enter the following command in LD 60 to software-enable all NTAK10 2.0 Mb DTI cards:

```
ENLL N
```

Where N is the 2.0 Mb DTI card number.

6 Enter the following command in LD 60 to software enable the clock controller:

```
ENL CC 0
```

7 Enable clock tracking on primary digital loop by issuing the following command:

```
TRCK PCK
```

End of Procedure

Monitor system DTI operation

Maintenance messages

The 2.0 Mb DTI status and error conditions are reported in the following types of messages, as shown in Table 45. Additional information on DTI messages is found in the *Software Input/Output: System Messages* (553-3001-411).

Table 45
Maintenance messages

Message	Meaning
DTA	Digital Trunk Alarms (Resident Monitor)
DTI	Digital Trunk Interface

2.0 Mb DTI error messages

The Digital Trunk Interface diagnostic program (LD 60) is used to maintain the NTAK10 2.0 Mb DTI Interface Card.

Comprehensive lists of the self-test failure codes for the NTAK10 2.0 Mb DTI follow the self-test description, which starts on page 168.

Grade-of-service messages

Grade-of-Service messages (DTA XXX) provide near-end and far-end switch status. A summary of these status messages is given in Table 46.

Table 46
Grade-of-service messages

Status	2.0 Mb DTI capability
Acceptable	Both incoming and outgoing calls allowed
Maintenance	Both incoming and outgoing calls allowed
No new data calls	No new outgoing data calls
No new calls	No new outgoing data or voice calls
Out of Service	2.0 Mb DTI is disabled

2.0 Mb DTI alarms

There are two groups of alarm indicators monitored by the 2.0 Mb DTI. Within these two alarm groups, there are several individual alarm types.

Group 1 alarms are event driven and include indicators that decrement a counter whenever an error is detected. Grade-of-service is changed based on how quickly the threshold of the counter is exceeded. The threshold count is determined in LD 73 and downloaded to the 2.0 Mb DTI. Group 1 alarms are:

1 Bipolar Violations (BPV) — Near-end alarm

2 Slips (SLP) — Near-end alarm

3 Frame Alignment Problems (FAP) — Near-end alarm

4 Cyclic Redundancy Check (CRC-4) — Near-end alarm

Group II alarm indicators are either continuous or discontinuous. Grade-of-service is changed based on the duration of the alarm within a defined period of time. A minimum persistence time is defined in LD 73 and downloaded to the 2.0 Mb DTI.

Group II alarm types are listed from high to low priority. A Group II alarm type might not be reported when a greater type is detected.

1 Alarm Indication Signal (AIS) — Far-end alarm

2 Loss of Frame Alignment Signal (LFAS) — Near-end alarm

3 Loss of Multiframe Alignment Signal (LMAS) — Near-end alarm

4 Loss of CRC-4 Multiframe Alignment Signal (CFAS) — Near-end alarm

5 Remote Alarm Indication (RAI, B3) — Far-end alarm

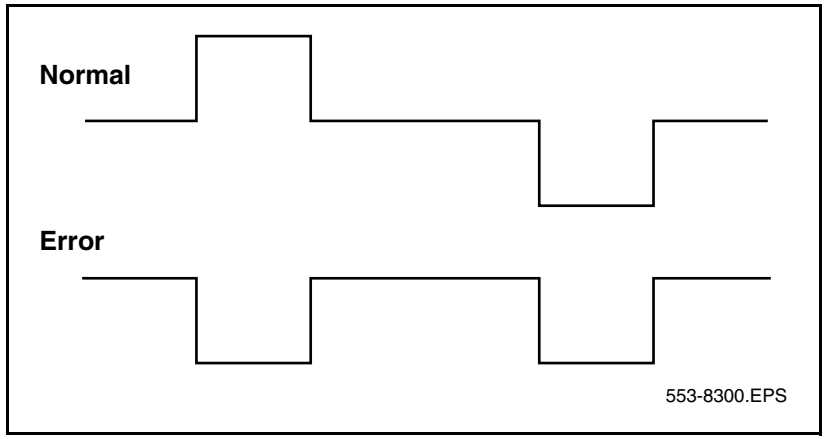
6 Remote Yellow Alarm (B6) — Far-end alarm

7 Alarm Indication Signal, 64 Kilobit (AIS 64) — Far-end alarm

Group 1

Bipolar Violation (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).

Figure 29
Bipolar violations



Cyclic Redundancy Check (CRC-4). When the 2.0 Mb DTI card runs in CRC-4 mode, the CRC-4 word contains a checksum of all data in the multiframe. The receiving side uses the checksum to verify the data.

The primary difference between BPV and CRC is that bipolar violation tracking indicates errors in 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 system and the satellite connection. Since CRC traverses the entire span, it indicates an end-to-end bit error rate.

Slip (SLP). Digital signals must have accurate clock synchronization for data to interleaf into, or extract from, the appropriate timeslot during multiplexing and demultiplexing operations. A Frame slip is defined as the repetition or deletion of 193 bits (one frame) due to a discrepancy in the read and write rates at the buffer (clocks aren't operating at EXACTLY the same speed).

When data bits write to (add to) a buffer at a slightly *higher* rate than they read (empty), sooner or later the buffer overflows. This is called slip-frame deletion.

In the opposite situation, when data bits write (add) to a buffer at a slightly *lower* rate than they read (empty), eventually the buffer runs dry or underflows. This is called slip-frame repetition.

All degradations shown in Table 47 can be controlled or avoided by proper clock (network) synchronization.

Table 47
Performance impact of one slip

Service	Potential impact
Encrypted Text	Encryption key must be resent.
Video	Freeze frame for several seconds. Loud pop on audio.
Digital Data	Deletion or repetition of Data. Possible Misframe.
Facsimile	Deletion of 4-8 scan lines. Drop Call.
Voice Band Data	Transmission Errors for 0.01 to 2 s. Drop Call.
Voice	Possible Click.

Clock synchronization can be tracking, on the primary or secondary reference clock, or non-tracking (free-run). In LD 73 (prompts PREF and SREF), the 2.0 Mb DTI which supports the active clock controller is defined as the primary clock reference. Another 2.0 Mb DTI can be defined as the secondary clock reference. The clock controller synchronizes from the primary or secondary's incoming pulse stream. The clock controller in turn supplies clocking to all other 2.0 Mb DTI cards.

2.0 Mb DTI 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 slips and clears the counters.

Frame Alignment Problem (FAP). A Frame Alignment Problem is counted when a bit error occurs within the framing pattern.

Group 2

Loss of Frame Alignment Signal (LFAS). A loss of Frame Alignment condition occurs when frame alignment is lost on three consecutive frame alignment errors. This condition can occur as a result of the far-end of the E1 span going completely out of serviced (due to a power interruption, for example) or any other reason resulting in the loss of the incoming pulse stream. The B3 alarm is sent to the far-end after the persistence time expires.

Loss of frame alignment thresholds. 2.0 Mb DTI hardware detects out-of-frame conditions. Running the midnight routines prints the number of occurrences when frame alignment was lost and clears the counters.

Alarm Indication Signal (AIS). AIS is defined as receiving all ones without framing. The detection algorithm for AIS is two or less zeros per two frames. This allows detection of AIS in the presence of a 10E-3 error rate, while not detecting all ones with framing as AIS.

When the AIS is detected, the prompt maintenance alarm indication associated with LFAS and excessive bit error rates are inhibited. B3 alarm is sent to the far-end after persistence time expires.

Alarm Indication Signal 64 Kilobit (AIS64). There are specific AIS requirements for CNET (France). The first requirement relates to the transmission of AIS in TS16. In that case, all ones should be transmitted in the event that abcd signaling is not supported.

With respect to the reception of AIS in TS16, AIS 64 Kbits must be detected when multiframe alignment has been lost and the binary content of TS16 is 95 percent 1, counting on 256 or 512 bits.

When AIS in TS16 is detected, then bit 6 of outgoing TS16 frame 0 should be set. When the fault disappears, it should be cleared. Setting and clearing bit 6 of TRS 16 frame 0 must follow changes in status of the fault by less than 100 msec.

Other requirements when AIS 64 Kbit is detected include setting an LED, printing a TTY message, and updating present status and history files. When a fault is detected, further changes in other error types should continue to be reported.

Loss of Multiframe Alignment Signal (LMAS). This condition is sometimes called a multiframe yellow alarm. An LMAS occurs when two consecutive multiframes contain errors in their Multiframe Alignment Signal, or when all TS16 bits are zero for at least one multiframe.

B6 alarm is sent to the far-end after the persistence time expires. If the option is enabled, a B3 alarm is also sent.

Loss of CRC-4 multiframe alignment signal. This condition is declared when the CRC-4 multiframe search fails to recognize two valid multiframe alignment words within 8 msec. This category is only relevant however, when the CRC-4 option is selected.

B6 alarm is sent to the far-end after persistence time expires. If the option is enabled, a B3 alarm is also sent.

Remote Alarm Indication (RAI). Bit 3 of TS0 in non-FAS frames is set to “1”. This alarm is sometimes called a yellow alarm. The far-end is receiving AIS.

Remote yellow alarm (B6). Bit 6 of TS16 in Frame 0 is "1". This alarm occurs when the far-end has detected a loss of MFA.

Alarm threshold recommendations for digital trunks

If a digital trunk is present in an IP expansion cabinet/Media Gateway, link outages due to data network degradation between a main cabinet/Call Server and an expansion cabinet/Media Gateway cause alarms on the far-end of the digital trunk. If link outages are frequent, increase alarm thresholds on the far-end to prevent the trunk from being placed in a state that requires manual intervention to recover.

NTAK10 faceplate LEDS

The NTAK10 2.0 Mb DTI circuit card has a total of six LEDs on its face. Five of the LEDs are directly associated with the operation of the NTAK10 2.0 Mb DTI circuit card. The remaining LED is associated with the on-board clock controller. Table 48 shows the LEDs found on the NTAK10 2.0 Mb DTI circuit card and the meaning of each.

Table 48
NTAK10 faceplate LEDs (Part 1 of 2)

LED	State	Definition
DIS	On (Red)	The NTAK10 2.0 Mb DTI circuit card is disabled.
	Off	The NTAK10 2.0 Mb DTI is not in a disabled state.
OOS	On (Yellow)	The NTAK10 2.0 Mb DTI circuit card is in an out-of-service state.
	Off	The NTAK10 is not in an out-of-service state.
NEA	On (Yellow)	A near-end alarm state has been detected.
	Off	No near-end alarm.
FEA	On (Yellow)	A far-end alarm state has been detected.

Table 48
NTAK10 faceplate LEDs (Part 2 of 2)

LED	State	Definition
	Off	No far-end alarm.
LBK	On (Yellow)	NTAK10 2.0 Mb DTI is in loop-back mode.
	Off	NTAK10 2.0 Mb DTI is not in loop-back mode.
CC	On (Red)	The clock controller is switched on and disabled.
	On (Green)	The clock controller is switched on and either locked to a reference or in free-run mode.
	Flashing (Green)	The clock controller is switched on and locked onto the primary reference.
	Off	The clock controller is switched off.

System DTI maintenance tools

The tables below provide DTI and clock controller maintenance commands.

WARNING

Disable the clock controller before unseating circuit cards. Otherwise, the system initializes and momentarily interrupts call processing.

DTI commands

Below is a quick reference list of important 2.0 Mb DTI commands in LD 60.

LD 60 — DTI commands

Command	Action
DLBK L	Disable “loopback mode” for 2.0 Mb DTI.
RLBK L	Enable “loopback mode” for 2.0 Mb DTI.
DISI L	Disable 2.0 Mb DTI when idle.
DISL L	Force disable 2.0 Mb DTI.
ENLL L	Enable 2.0 Mb DTI.
LCNT (L)	List alarm counters.
RCNT (L)	Reset alarm counters.
SLFT (L)	Do 2.0 Mb DTI self-test.
STAT (L)	List 2.0 Mb DTI status.

Clock controller commands

Below is a quick reference list of clock controller commands in LD 60.

LD 60 — Clock controller commands (Part 1 of 2)

Command	Action
DIS CC 0	Disable clock controller N.
ENL CC 0	Enable clock controller N.
SSCK 0	Status of clock controller N.

LD 60 — Clock controller commands (Part 2 of 2)

Command	Action
TRCK XXX	Set clock controller tracking. XXX can be: - PCK = track primary clock - SCLK = track secondary clock - FRUN = free run mode Track primary clock (PCK) or secondary clock (SCLK) as the reference clock or go to free run (FRUN) mode.
PCK	Track primary clock reference source.
SCLK	Track secondary clock reference source.
FRUN	Free run mode.

2.0 Mb DTI tests

Procedure 11
Performing Self test/local loopback

The NTAK10 self-tests when requested in LD 60. This procedure checks the sanity of the on-board processors, operation of memory, peripheral hardware, and per-channel as well as per-loop loopback.

Before this test is run, disable the loop as follows:

1 Enter the following command in LD 60 to disable the NTAK10.

```
LD 60
DISL L CH
```

2 Enter the following command in LD 60 to run the self-test.

SLFT L (for the entire loop)
SLFT L CH (for a specific channel)

Local loopback may also be performed on a per-channel basis without having to disable the entire loop. In this case, only the tested channel must be disabled. The procedure for this test is as follows:

3 Enter the following command in LD 60 to disable the 2.0 Mb DTI channel:

```
DISL L CH
```

4 Enter the following command in LD 60 to run the self-test:

SLFT L CH (for a specific channel

For self testing individual channels, follow the same procedure as above, but use the following commands:

DSCH C CH
SLFT C CH (specific channel)

End of Procedure

Table 49
Self-test failure codes for NTAK10 2.0 Mb DTI (Part 1 of 6)

DTI009 loop ch	DTI/PRI loop or channel failed hardware self test. For DTI009 L M E, the output data is L = loop M = N for NI microprocessor M = C for CI microprocessor E = error code for debug purposes.
DTI009C ch	DTI Card C or channel ch of Card C failed hardware self-test. **Error codes for NI microprocessor (M = N):** 00 = NI self test has finished. 01 = Undefined MESSOUT received. 02 = Problem with group 2 error handling (invalid level). 03 = NI to CI FIFO full (128 messages lost). 04 = CI-1 Micro failed to initialize on power-up. 05 = NI group 1 error handling - undefined condition found. 06 = Bad MESSOUT number 6 encountered. 07 = NI MESSOUT queue is full. 08 = NI MESSIN queue full.

Table 49
Self-test failure codes for NTAK10 2.0 Mb DTI (Part 2 of 6)

	09 = NI priority MESSIN queue is full. 10 = Bad MESSOUT number 10 encountered. 11 = TN = 0 read from regular queue. 12 = TN = 0 read from priority queue. 14 = Bad TN associated with MESSOUT number 14. 15 = Bad TN associated with MESSOUT number 15. 50 = External RAM in range 880h-8EFH failed (MESSIN queue). 51 = Internal RAM test failed. 52 = Pad RAM test failed. 53 = External RAM test failed. 54 = 8253 or DALLAS timer/counter test failed. 55 = Slip counter test failed. 56 = Loopback of TS16 frame 0 failed. 57 = Loopback of non fas TSO failed. 58 = Echo test to CI-1 micro failed. 60 = A07 device failed. 61 = Motorola DUART failed. 62 = Multiframe loopback test failed. 255 = Loss of NI FIFO synchronization (Stop byte = 0 not found). **DTI009 error codes for CI microprocessor (M=C):** 03 = A complete message was not received from NI micro.

Table 49
Self-test failure codes for NTAK10 2.0 Mb DTI (Part 3 of 6)

	128 = Message received by CI-1 through FIFO requested an undefined task. 129 = Request for a timed two-state pulse was received, with the TN of TS 0 or 16. 130 = An attempt was made to set the flag to invoke the pulse timer for TS 0. 131 = A request for a task defined under MESSOUT 30 has been received with the TN of TS 0. 132 = Attempt was made to enable outpulsing TS 0 or TS16. 133 = A MESSOUT 31 has been received for TS 0 or TS 16 with the pulse hold time not = 0. 134 = An attempt has been made to set the bit to invoke the pulse timer for TS 0 or TS 16. 135 = A request for outpulsing was received, but outpulsing data was not downloaded. 137 = A request for PPM counting was received, but the was not downloaded. 138 = A MESSOUT 30 was received requesting a task to be performed for DTI TS 16 which is not allowed.
DTI009C ch	**DTI009 error codes for CI microprocessor (M=C):** 139 = The 8031 on CHIP RAM failed self test. 140 = The TS 16 signaling RAM and/or the TS 16 pick up buffer failed self test. 141 = The CI-1 micro external RAM failed self test. 142 = Attempt was made to set/clear the flag used to invoke PPM pulse timing for DTI timeslot 0 or 16.

Table 49
Self-test failure codes for NTAK10 2.0 Mb DTI (Part 4 of 6)

	143 = CI-2 micro responded to echo request message but response was in error. 144 = CI-2 micro failed to respond to request echo message. 145 = The request for self test received did not have the TN of TS 0. 146 = The TN of MESSOUT 26 received was not that or TS 0. 147 = The TN of MESSOUT 28 received was not that of TS 0. 148 = The TN of MESSOUT 29 received was not that of TS 0. 149 = Upon enabling the DTI card, the CI-1 was unable to write Frame 0, TS 16 with '0B'. 150 = MESSOUT 26 was received with the PPM counting bit (abcd) all equal to zero. 151 = MESSOUT 28 was received with the outpulsing bit (abcd) equal to zero. 152 = CI-2 failed to respond to the CI-1 watch dog message. 153 = The CI-2 failed to respond to five consecutive watchdog messages and is assumed to be out of service. 154 = MESSOUT received requesting the lower nibble of MFAS pattern to be written with something other than '0000'. 155 = MESSOUT received requesting '0000' to be written into an 'abcd' state. 156 = MESSOUT received with a TN outside the range shelf 0, card 8-1, unit 3-0.

Table 49
Self-test failure codes for NTAK10 2.0 Mb DTI (Part 5 of 6)

DTI009C ch	DTI009 error codes for CI microprocessor (M=C): 157 = CI-1, NI FIFO overflowed, and has been cleared. 128 message were lost. 255 = TS16-DS30X FIFO overflowed, and has been cleared. 128 messages were lost. 147 = The TN of MESSOUT 28 received was not that of TS 0. 148 = The TN of MESSOUT 29 received was not that of TS 0. 149 = Upon enabling the DTI card, the CI-1 was unable to write Frame 0, TS 16 with '0B'. 150 = MESSOUT 26 was received with the PPM counting bit (abcd) all equal to zero. 151 = MESSOUT 28 was received with the outpulsing bit (abcd) equal to zero. 152 = CI-2 failed to respond to the CI-1 watch dog message. 153 = The CI-2 failed to respond to five consecutive watchdog messages and is assumed to be out-of-service. 154 = MESSOUT received requesting the lower nibble of MFAS pattern to be written with something other than '0000'. 155 = MESSOUT received requesting '0000' to be written into an 'abcd' state. 156 = MESSOUT received with a TN outside the range shelf 0, card 8-1, unit 3-0.
DTI009C ch	**DTI009 error codes for CI microprocessor (M=C):**

Table 49
Self-test failure codes for NTAK10 2.0 Mb DTI (Part 6 of 6)

	157 = CI-1, NI FIFO overflowed, and has been cleared. 128 message were lost. 255 = TS16-DS30X FIFO overflowed, and has been cleared. 128 messages were lost.

Near-end trunk loopback test

The near-end trunk loopback test checks the integrity of the 2.0 Mb link from the system to the far-end. Either a per-loop or per-channel test may be run, with the far-end device placed in the respective mode of remote loopback. Refer to Figure 30 on page 175.

The commands for a near-end per-loop loopback test are as follows:

Table 50
LD 60 – Perform a near-end per-loop loopback test.

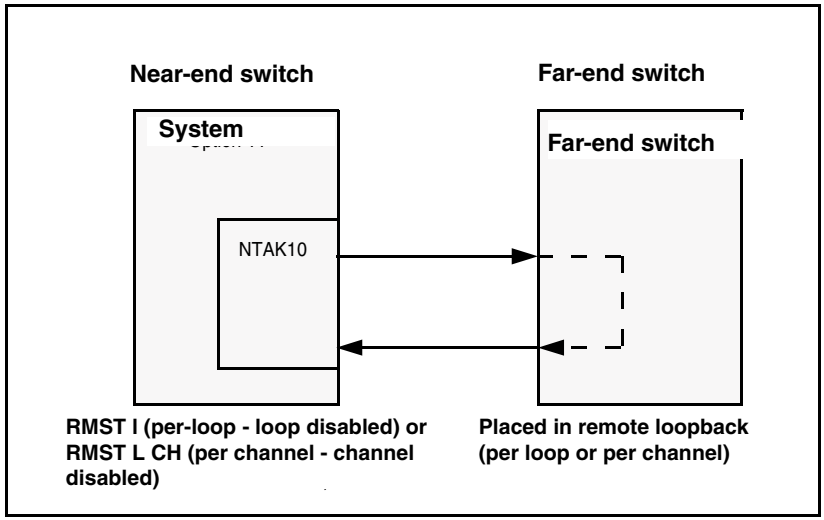
Command	Description
Disable the 2.0 Mb DTI card.	DISL L
Run the loopback test.	RMST L

The commands for a near-end per-channel loopback test are as follows:

Table 51
LD 6o - Perform a near-end per-channel loopback test.

Command	Description
Disable the 2.0 Mb DTI channel.	DSCH L CH
Run the loopback test.	RMST L CH

Figure 30
Near-end trunk loopback



Far-end trunk loopback test

The far-end trunk loopback test checks the integrity of the 2.0 Mb link from the far-end to the carrier interface of the 2.0 Mb DTI (it does not test the 2.0 Mb DTI card). Either a per-loop or per-channel test may be run, with the near-end device placed in the respective mode of remote loopback. Refer to Figure 31 on page 176.

The commands for a near-end per-loop loopback test are as follows:

Table 52
LD 60 – Perform a near-end per-channel loopback test.

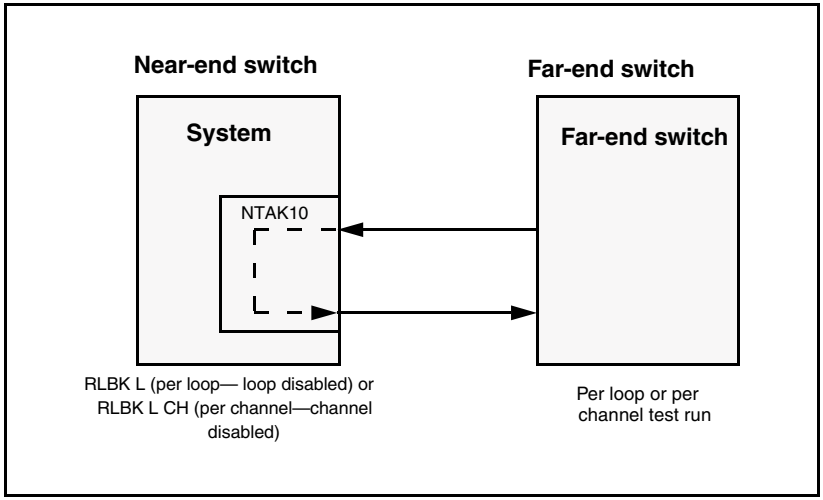
Command	Description
Disable the 2.0 Mb DTI card.	DISL L
Place the 2.0 Mb DTI card in remote per-loop loopback.	RLBK L

The commands for a far-end per-loop loopback test are as follows:

Table 53
LD 60 – Perform a far-end per-channel loopback test.

Command	Description
Disable the 2.0 Mb DTI card.	DSCH L CH
Place the 2.0 Mb DTI card in remote per-loop loopback.	RLBK L CH

Figure 31
Far-end trunk loopback



2.0 Mb PRI maintenance

Contents

This section contains information on the following topics:

Overview

This chapter provides an overview of the maintenance tools available for 2.0 Mb PRI or ISL features:

- Commands used to maintain PRI, DDCH, DCHI and clock controller hardware.
- Tests for 2.0 Mb PRI operation.
- Error detection for 2.0 Mb PRI, including the various thresholds found in the 2.0 Mb PRI loop timers in LD 73.

Enable the 2.0 Mb PRI after installation

To enable an NTAK79 or NTBK50 PRI circuit pack, complete one of the following procedures.

Procedure 12
Enabling the NTAK79 PRI

1 Enter the following command in LD 60 to software enable all 2.0 Mb PRI cards:

```
ENLL N
```

The DCHI enables automatically.

2 Enter the following command in LD 60 to software enable the clock controller:

```
ENL CC 0
```

3 Enter the following command to enable clock tracking on primary digital loop:

```
TRCK PCK
```

Within about 30 seconds, the D-channel layer 3 should be established.

4 You can request the current status of the D-channel by issuing the command **STAT DCH**. The system should respond `DCH N EST` in LD 96 (meaning that the D-channel is established and operational).

End of Procedure

Procedure 13
Enabling the NTBK50 PRI

1 If using the NTBK51 DDCH daughterboard, enter the following command in LD 96 to enable the DDCH:

```
ENL MSDL X
```

2 Enter the following command in LD 60 to software enable all 2.0 Mb PRI cards:

```
ENLL N
```

The DCHI enables automatically.

3 Enter the following command in LD 60 to software enable the clock controller:

```
ENL CC 0
```

4 Enter the following command to enable clock tracking on primary digital loop:

TRCK PCK

Within about 30, seconds the D-channel layer 3 should be established.

5 You can request the current status of the D-channel by issuing the command **STAT DCH**. The system should respond DCH N EST in LD 96 (meaning that the D-channel is established and operational).

End of Procedure

Disable the 2.0 Mb PRI before removal

To disable a PRI circuit pack, follow the appropriate procedure below.

Procedure 14
Disabling the NTAK79 PRI

1 Enter the following command in LD 96 to software disable the DCHI:

DIS DCH N

Where N is the D-channel device number.

2 Enter the following command in LD 60 to software disable the clock controller:

DIS CC 0

3 Enter the following command in LD 60 to software disable the PRI card:

DISL N

Where N is the PRI card number.

End of Procedure

Procedure 15
Disabling the NTBK50 PRI

1 Enter the following command in LD 96 to software disable the DCHI:

DIS DCH N

Where N is the D-channel device number.

2 If using the NTBK51 DDCH daughterboard, enter the following command in LD 96:

```
DIS MSDL N
```

3 Enter the following command in LD 60 to software disable the clock controller:

```
DIS CC 0
```

4 Enter the following command in LD 60 to software disable the PRI card:

```
DISL N
```

Where N is the PRI card number.

End of Procedure

Monitor system PRI operation

Maintenance messages

Service messages report on near-end and far-end switch status. Both service and service acknowledge messages are supported on PRI B-channels and ISL channels. These messages are used for backup D-channel and D-channel sanity polling. The status can be in-service and out-of-service.

Service and service acknowledge messages for B-channels and ISL channels are supported between:

- system to system: ISL and PRI
- system to CO: PRI only

The status of these messages is reported by the service and service acknowledge messages for B-channels and ISL channels:

- in-service
- maintenance
- out-of-service

Near-end and far-end subcategories are defined for each maintenance status. See Table 54 for possible combinations of near-end and far-end status, and

channel capability for each status. When the status of the near-end and far-end does not match, the more severe maintenance status takes effect.

Table 54
Maintenance message status

Near-end status	Far-end status	B channel capability
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 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 enables the far-end to synchronize its channel states. The service messages are sent when the system brings up the D-channel automatically or an administrator brings up the D-channel manually by using LD 96.

D-channel sanity polling

If a D-channel has been idle for 30 seconds, a service message is sent to poll the link sanity. The service message is sent whether or not the near-end is configured as master or slave.

B-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 in a service message. Status change can occur through service change or maintenance operations, such as the addition or deletion of a channel in LD 14, or the disabling of the associated loop, shelf, card or unit in LD 30, LD 32, LD 36, LD 41 or LD 60.

Channel status audit

LD 30 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 service messages.

Service message commands

Activate the service messages in LD 96 on a per D-channel basis. The commands are:

- ENL SERV N: Turns on the support of service and service acknowledge messages for DCH link N. The command should only be executed when the specified D-channel is in the disabled state.
- DIS SERV N: Turns off the support of service and service acknowledge messages for DCH link N.
- STAT SERV (N): Displays the current service and service acknowledge message SERV setting for individual DDCH N or for DCHIs.

Two new statuses are added for maintenance messages: FE MbSY = Far-end maintenance and FE DSBL = Far-end disabled.

2.0 Mb PRI error detection

The Primary Rate Interface categorizes errors and alarm conditions into two main groups, Group I and Group 2 errors.

Group I errors

These are real-time calculated error-rate thresholds. Group I errors can include:

- Bipolar Violations (BPV)

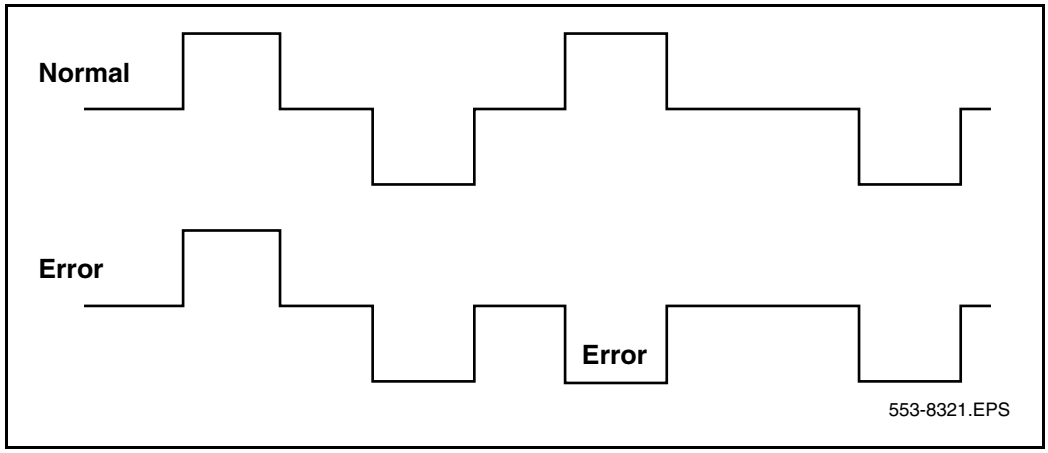
- Frame Bit Errors (FBER)
- CRC-4 Word Errors (CRC)
- Controlled Frame Slips

Bipolar Violations (BPV)

In an Alternate Mark Inversion (AMI) bipolar pulse stream, pulses alternate in polarity. A bipolar violation has occurred when two pulses of the same polarity are received in succession, as shown in Figure 32 on page 183. This might be caused by an electrical disturbance such as noise, a low signal level or a faulty repeater. Bipolar violations indicate the integrity of the local span from the system to the first repeater.

The PRI card, following the CEPT PCM-30, uses a zero code suppression technique known as HDB3, which introduces intentional bipolar violations onto the carrier. The bipolar violations are recognized by the receiver and disregarded as bipolar violation errors.

Figure 32
Bipolar violations



Frame bit errors

The NTAK79/NTBK50 PRI CEPT PCM-30 stream is structured into a frame of 32 8-bit timeslots. To maintain alignment of this frame structure, alternate timeslot zeros have a specific frame alignment pattern (X0011011).

A frame bit error is acknowledged when any bit in the received pattern is in error. This error rate indicates the integrity of the end-to-end span.

CRC-4 word errors

When operating in the CRC-4 multiframe format (CRC), frames are bundled into groups of 16. This format includes a specific multiframe alignment pattern in bit 0 of every even frame's timeslot 0 (001011XX).

Each odd frame timeslot 0 includes a CRC-4 cyclic redundancy checksum of the previous 8 frames (sub-multiframe). This transmitted checksum is compared against a calculated checksum at the receiver. If the two checksums do not match, a CRC-4 word error is indicated.

Group I error rates are processed on the PRI card based on software downloadable parameters N1 and N2 (for each BPV, CRC, and FBER). The values for N1 are scaled on the card as follows:

- BPV = N1•16
- CRC = N1• 4
- FBER = N1• 1

N2 values are not scaled. These parameters can be set in LD 73 on a per-card basis, or they can be left at their default values.

Parameters N1 and N2 provide for the following error rate thresholds reported to the system:

- **Severely errored second**: When the number of occurrences of the error exceeds the value of N1 in the previous second. This error is reported and counted (LCNT), but no action is taken by the system.

- **Unavailable condition**: This is reported when 10 severely errored seconds are received in 10 consecutive seconds. This is equivalent to an error rate worse than 10^{-3} with the default value. When this condition is reached, the 2.0 Mb PRI is put into an out-of-service condition until the Group I OOS guard timer expires and the error condition has ceased or improved.
- **No new call condition**: When the number of occurrences of the error exceeds the value of (10 x N2) in the previous minute. This corresponds to an error rate of 10^{-3} to 10^{-5} using the default N2 value. When this condition is reported, the system records the error (LCNT) and places the PRI card into a "no new call" condition, with all idle channels set to MbSY. The card automatically returns to normal state when the condition improves after the Group I NNC guard timer expires.
- **Maintenance condition**: This condition exists when the number of occurrences of the error exceeds the value of N2 in the previous minute. This corresponds to an error rate between 10^{-5} and 10^{-6} based on the N2 default values. When this condition is reported, the system records the error (LCNT) and places the 2.0 Mb PRI card into a maintenance alarm state. This state has no effect on call processing, it simply indicates line degradation. The card automatically returns to normal state when the condition improves after the Group I MAINT guard timer expires.

  There is no error report for the error rates below 10^{-6} (10xN2) as such rates are considered satisfactory.

Program group I thresholds

To set the LD 73 Group I thresholds, use the following commands.

LD 73 – Program group I thresholds (Part 1 of 2)

Prompt	Response	Description
REQ	CHG	Request a Change.
TYPE	PRI2	Primary Rate Interface 2.
FEAT	LPTI	Loop Timer.
...		

LD 73 – Program group I thresholds (Part 2 of 2)

Prompt	Response	Description
BPV	N1 N2	Bipolar Violation thresholds. Default: 128 122
CRC	N1 N2	Cyclic Redundancy Check thresholds. Default: 201 97
FBER	N1 N2	Frame Bit Errors. Default: 28 1
...		
OOS1	1 - 60 M	Out-of-Service Threshold time. Default: 15
NNC1	1 - 60 M	No New Calls Threshold time. Default: 15
MNT1	1 - 60 M	Maintenance Threshold time. Default: 15

Frame slips

Digital signals must have accurate clock synchronization for data to be interleaved into, or extracted from, the appropriate timeslot during multiplexing and demultiplexing operations. A Frame Slip is defined (for 2.0 Mb links) as the repetition or deletion of the 256 data bits of a CEPT frame due to a sufficiently large discrepancy in the read and write rates at the buffer (clocks are not operating at exactly the same speed).

When data bits write (add) to a buffer at a slightly *higher* rate than they read (empty), sooner or later the buffer overflows. This is called slip-frame deletion.

In the opposite situation, when data bits write (add) to a buffer at a slightly *lower* rate than they read (empty), eventually the buffer runs dry or underflows. This is also called slip-frame repetition.

A 2.0 Mb PRI contains a buffer large enough to contain two full frames (256 x 2 = 512 bits), and is normally kept half full (1 frame). See Table 55 on page 187 for the impact of one slip on various types of data.

All of the degradations shown in Table 55 can be controlled or avoided by proper clock (network) synchronization.

Table 55
Performance impact of one slip

Service	Potential impact
Encrypted Text	Encryption key must be resent.
Video	Freeze frame for several seconds. Loud pop on audio.
Digital Data	Deletion or repetition of Data. Possible Misframe.
Facsimile	Deletion of 4-8 scan lines. Drop Call.
Voice Band Data	Transmission Errors for 0.01 to 2 s. Drop Call.
Voice	Possible Click

Clock synchronization can be either tracking, on the primary or secondary reference clock, or non-tracking (free-run). In LD 73 (prompts PREF and SREF), the 2.0 Mb PRI which supports the clock controller is defined as the primary clock reference. Another 2.0 Mb PRI (or DTI) may be defined as the secondary clock reference. The clock controller synchronizes from the incoming bit stream of the primary or secondary references. The clock controller in turn supplies a synchronized reference for the rest of the system, including all 2.0 Mb PRIs and DTIs.

The 2.0 Mb PRI card detects and reports frame slips (repetitions and deletions) to the system. The count of slips is recorded (LCNT), printed out, and cleared at each midnight routine.

Frame slips have two alarm thresholds as defined in LD 73. They are as follows:

- **Slip — out-of-service threshold.** When this threshold (variable count versus variable time) is reached, the PRI card is placed in an out-of-service state. The card automatically returns to a normal state if the slip rate improves after the Group I OOS guard timer expires.
- **Slip — maintenance threshold.** When this threshold is reached, the PRI card is placed in a maintenance state that has no impact on call processing. The maintenance state is simply an indication that a degraded condition exists. The card automatically returns to a normal state if the slip rate improves after the Group I MAINT guard timer expires.

Define slip thresholds

To define the slip thresholds, use the following commands in LD 73. Times range from 1M to 24H (one 1 minute to 24 hours). Counts are 1 to 255.

LD 73 — Define slip thresholds

Prompt	Response	Description
REQ	CHG	Request a Change.
TYPE	PRI2	Primary Rate Interface 2.
FEAT	LPTI	Loop Timer.
	5 24H	This entry establishes a maintenance threshold of 5 slips in 24 hours.
SLIP	20 1H	This entry establishes an OOS threshold of 20H [32] slips in 1 hour.

Group 2 errors

Group 2 errors are event-based alarms that can be separated into Red (local) and Yellow (far-end) alarms.

Yellow (far-end) alarms

A Yellow alarm on the 2.0 Mb PRI card indicates that the card is receiving an alarm indication from the far-end.

This type of alarm may be received in two ways:

1 Remote Alarm Indication (RAI) — Bit 3 of non-FAS frame set.

2 Alarm Indication Signal (AIS) — All 1s on the carrier.

Since the 2.0 Mb PRI is receiving a Yellow alarm signal, that indicates that there is a carrier connection, but the far-end is not ready. It is possible, however, that the carrier connection is one-way only (2.0 Mb PRI receiving).

When the 2.0 Mb PRI receives a Yellow alarm signal, all channels are placed in a maintenance busy mode (MBSY). Group 2 Yellow alarms are recorded (LCNT) on each occurrence, but the card is not placed into an out-of-service state.

Red (local) alarms

A Red alarm on the PRI card indicates that the card is having problems synchronizing with the incoming bit stream.

This type of alarm may be caused by the following:

- Loss of Signal (LOS)
- Loss of Frame Alignment (LFAS)
- Loss of CRC-4 Multiframe Alignment (LMAS)

When the 2.0 Mb PRI is in a Red alarm state, RAI is transmitted to the far-end.

For both Group 2 Red and Yellow alarm states, action is taken after the condition has persisted for a downloaded persistence (PERS) threshold. The parameter is set in LD 73 in multiples of 2 msec, with 2 x 50 = 100 msec as the default.

For Group 2 Red alarm conditions, there are four definable time thresholds that can be set in LD 73 on a per-loop basis. The first parameter sets an aggregate time in multiples of 128 msec (default 20 = 2.5 sec). The next four parameters provide time thresholds for MAINT, NNDC, NNC, and OOS.

For example, if the total cumulative time that an error has been present reaches the aggregate time (2.5 sec default) in less than the time set in OOS, the card is put into an out-of-service state. If it took more than the preset time for the error condition to register, the card could be put into NNDC, NNC, or MAINT states. The card remains in the alarm condition until the error has improved and after the Group 2 guard timers expire.

Define group 2 error thresholds

You can define Group 2 error thresholds in LD 73. Only the highest priority Group 2 alarm condition is active at a time. The order of priority (from highest to lowest) is: LOS, AIS, LFAS, LMAS, RAI.

LD 73 — Define group 2 error thresholds (Part 1 of 2)

Prompt	Response	Description
REQ	NEW	New.
TYPE	DTI2	2.0 Mb/s DTI data block.
FEAT	LPTI	Loop Timer.
...		
GP2	20 100s 12s 12s 4s	Where: 20 = Error count value 100s = Maintenance threshold 12s = NNDC threshold 12s = NNC threshold 4s = OOS threshold (Aggregate count default [20x128ms = 2.5sec])
...		
OOS2	1-(15)-255s	Out-of-Service threshold.

LD 73 — Define group 2 error thresholds (Part 2 of 2)

Prompt	Response	Description
NNC2	1-(15)-255s	No New Calls threshold.
MNT2	1-(15)-255s	Maintenance Threshold.
PERS	50	Alarm persistence timer (in multiples of 2ms).
CLRS	50	Clearance persistence timer (in multiples of 2ms).
OOSC	1-(5)-255	Out of service count limit. After this number is reached, the card does not auto-enable.

Alarm threshold recommendations for digital trunks

If a digital trunk is present in an IP expansion cabinet/Media Gateway, link outages due to data network degradation between a main cabinet/Call Server and an expansion cabinet/Media Gateway cause alarms on the far-end of the digital trunk. If link outages are frequent, you can increase alarm thresholds on the far-end to prevent the trunk from being placed in a state that requires manual intervention to recover.

NTAK79 faceplate LEDs

The NTAK79 circuit card has a total of seven faceplate LEDs. Five of the LEDs are directly associated with the operation of the Primary Rate interface (PRI). The remaining two LEDs are associated with the on-board Clock Controller and the on-board D-channel interface (DCHI). Refer to Table 56.

Table 56
NTAK79 faceplate LEDs (Part 1 of 3)

LED	State	Definition
OOS	On (Red)	The NTAK79 2.0 Mb PRI circuit card is either disabled or out-of-service.
	Off	The NTAK79 2.0 Mb PRI is not in a disabled state.

Table 56
NTAK79 faceplate LEDs (Part 2 of 3)

LED	State	Definition
ACT	On (Green)	The NTAK79 2.0 Mb PRI circuit card is in an active state.
	Off	The NTAK79 2.0 Mb PRI is in a disabled state. The OOS LED is red.
RED	On (Red)	A red alarm state has been detected. This represents a local alarm state of Loss of Carrier (LOS), Loss of Frame (LFAS) or Loss of CRC Multiframe (LMAS).
Red	Off	No red (local) alarm.
YEL	On (Yellow)	A yellow alarm state has been detected. This represents a remote alarm indication from the far-end. The alarm may be either Alarm Indication (AIS) or Remote Alarm (RAI).
	Off	No yellow (remote) alarm.
LBK	On (Green)	NTAK79 2.0 Mb PRI is in loop-back mode.
	Off	NTAK79 2.0 Mb PRI is not in loop-back mode
CC	On (Red)	The clock controller is switched on and software disabled.
	On (Green)	The clock controller is enabled and either locked to a reference or in free-run mode.
	Flashing (Green)	The clock controller is enabled and is locking onto a reference.

Table 56
NTAK79 faceplate LEDs (Part 3 of 3)

LED	State	Definition
	Off	The clock controller is switched off (by switch SW3).
DCH	On (Red)	DCHI is switched on and disabled.
	On (Green)	DCHI is switched on and enabled, but not necessarily established.
	Off	DCHI is switched off (by switch SW1).

NTBK50 faceplate LEDs

The NTBK50 circuit card has a total of seven faceplate LEDs. Five of the LEDs are directly associated with the operation of the Downloadable D-channel handler and D-channel interface. The remaining two LEDs are associated with the Clock Controller. Refer to Table 57.

Table 57
NTBK50 faceplate LEDs (Part 1 of 3)

LED	State	Definition
OOS	On (Red)	The NTBK50 2.0 Mb PRI circuit card is either disabled or out-of-service. Also, the state of the card after power-up, completion of self test, and exiting remote loopback.
	Off	NTBK50 is not in a disabled state.
ACT	On (Green)	NTBK50 PRI circuit card is in an active state.
	Off	NTBK50 2.0 Mb PRI is in a disabled state. The OOS LED is red.

Table 57
NTBK50 faceplate LEDs (Part 2 of 3)

LED	State	Definition
RED	On (Red)	A red alarm state has been detected. This represents a local alarm state of Loss of Carrier (LOS), Loss of Frame (LFAS), or Loss of CRC Multiframe (LMAS).
	Off	No red (local) alarm.
YEL	On (Yellow)	A yellow alarm state has been detected. This represents a remote alarm indication from the far-end. The alarm may be either Alarm Indication (AIS) or Remote Alarm (RAI).
	Off	No yellow (remote) alarm.
LBK	On (Green)	NTBK50 2.0 Mb PRI is in loop-back mode.
	Off	NTBK50 2.0 Mb PRI is not in loop-back mode.
CC	On (Red)	The clock controller is software disabled.
	On (Green)	The clock controller is enabled and either locked to a reference or in free-run mode.
	Flashing (Green)	NTAK20 is equipped and attempting to lock (tracking mode) to a reference. If the LED flashes continuously over an extended period of time, check the CC STAT in LD 60. If the CC is tracking this may be an acceptable state. Check for slips and related clock controller error conditions. If none exist, then this state is acceptable, and the flashing is identifying jitter on the reference.

Table 57
NTBK50 faceplate LEDs (Part 3 of 3)

LED	State	Definition
DCH	Off	The clock controller is not equipped.
	On (Red)	DCH is disabled.
	On (Green)	DCH is enabled, but not necessarily established.
	Off	DCH is not equipped.

System PRI maintenance tools

Table 58
2.0 Mb PRI commands (LD 60)

Command	Action
DISI L	Disable 2.0 Mb PRI when idle.
DISL L	Force disable PRI.
ENLL L	Enable PRI.
LCNT (L)	List alarm counters.
RCNT (L)	Reset alarm counters and clear alarms.
SLFT (L)	Do 2.0 Mb PRI self-test (2.0 Mb PRI must be disabled first).
STAT (L)	List 2.0 Mb PRI status.
RLBK L (C)	Enable remote loopback.
DLBK L (C)	Disable remote loopback.
RMST L (C)	Perform remote loopback.

PRI status and error conditions are reported in the Primary Rate Interface messages in *Software Input/Output: System Messages* (553-3001-411).

DCHI commands

D-channel commands are found in LD 96. Table 59 provides a quick reference list of D-channel commands.

Table 59
DCHI commands

Command	Action
DIS DCHI N	Disable DCHI port N.
ENL DCHI N	Enable DCHI port N.
EST DCH N	Establish D-channel N.
PLOG DCHI N	Print D-channel statistics log N.
RLS DCH N	Release D-channel N.
SDCH DCH N	Release a D-channel and switch D-channels.
RST DCH N	Reset D-channel N.
STAT DCH (N)	Print D-channel status (link status).
TEST 100/101	DCH tests.
STAT SERV	Print the current service and service acknowledge message for DCHI N.
ENL SERV N	Enable service messages for DCHI N.
DIS SERV N	Disable service messages for DCHI N.

D-channel status and error conditions are reported as DCH messages. These messages can be found in the *Software Input/Output: Maintenance* (553-3001-511).

DDCH commands

Downloadable D-channel commands are found in LD 96. Table 60 provides a quick reference list of D-channel commands with minor modification.

Table 60
DDCH commands

Command	Action
DIS MSDL X (ALL)	Disable DCHI card X.
ENL MSDL X (FDL, ALL)	Enable DCHI card X, with or without Force Download.
RST MSDL X	Reset MSDL card X.
STAT MSDL X (X (full))	Get MSDL status X, or a “FULL STATUS”.
SLFT MSDL X	Execute a self test on MSDL card X.
DIS LLB X	Disable local loop back on MSDL DCH X.
DIS RLB X	Disable remote loop back on MSDL DCH X.
DIS TEST X	Disable Test mode on MSDL DCH X.
ENL LLB X	Enable local loop on MSDL DCH X.
ENL RLB X	Enable remote loop on MSDL DCH X.
ENL TEST X	Enable Test mode on MSDL DCH X.
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 DCHX.
TEST LLB X	Start local loop back test on MSDL DCH X.
TEST RLB X	Start remote loop back test on MSDL DCH X.

Note: “X” represents the D-channel device number.

D-channel status and error conditions are reported as DCH messages. These messages can be found in the *Software Input/Output: Maintenance* (553-3001-511).

Clock Controller (CC) commands

Clock Controller (CC) commands are accessed in LD 60. Table 61 provides a quick reference list of clock controller commands.

Table 61
Clock controller commands

Command	Action
DIS CC X	Disable clock controller.
ENL CC X	Enable clock controller.
SSCK X	Status of clock controller.
TRCK XXX N	Set clock controller tracking where XXX can be: PCK — track primary clock reference source SCLK — track secondary clock reference source FRUN — free run mode

NTAK79/NTBK50 power on self test

When power is applied to the NTAK79/NTBK50 2.0 Mb PRI circuit card, the card performs a power-on self-test. The self-tests verify the operation of most of the on-board hardware.

If all the self-tests pass, the upper five LEDs blink simultaneously three times. If any of the self-tests fail, the LEDs do not blink. Only the OOS LED illuminates. The corresponding error code is then printed on the TTY.

Self-test error codes

Table 62 lists the self-test failure codes for the NTAK79/NTBK50 2.0 Mb PRI. These codes can be returned on card power-up in the form “DTA105 L X” (where X is the failure code), or during a self-test procedure in LD 60 as “DTI009 L X” (where X is the error code).

Failure codes 1-14 are hardware failures on the NTAK79/NTBK50 card. Codes 15-16 might be due to carrier span problems or lack of loopback activation at the far end.

Table 62
Self-test error codes (Part 1 of 2)

Failure code	Associated error
0	Self test passed.
1	Self test general failure.
2	LCAs failed to program correctly.
3	8031 code checksum failure.
4	8031 internal RAM failure.
5	8031 external RAM failure.
6	PAD RAM failure.
7	AO7 signaling interface failure.
8	UART (card LAN) failure.
9	CEPT transceiver failure.
10	Line interface failure.
11	Receiver framing failure.
12	Transmit/receive (inter)national bit failure.
13	Yellow (remote) alarm failure.
14	PCM path integrity failure.

Table 62
Self-test error codes (Part 2 of 2)

Failure code	Associated error
15	Loop remote loopback failure.
16	Channel remote loopback failure.

Procedure 16
Self-testing the 2.0 Mb PRI

This self-test can be run manually on a per-loop or per-channel basis using LD 60. The DCHI/DDCH and 2.0 Mb PRI must be disabled before performing the self-test.

To self-test the entire loop:

1 Enter the following command in LD 96 to disable the DCHI/DDCH:
DIS DCH N

2 Enter the following command in LD 60 to disable the 2.0 Mb PRI card and run the self-test:
DISL L
SLFT L (entire loop)

To self-test a specific channel:

1 Enter the following command in LD 60 to disable the idle channel:
DSCH L CH

2 Enter the following command in LD 60 to run the self-test on the channel:
SLFT L CH

End of Procedure

2.0 Mb PRI automatic loop test

This procedure is not recommended since it causes yellow at the far-end and can cause some B-channels to not re-enable once the test is completed. Therefore, set the ATLP command to 0.

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.

2.0 Mb PRI automatic loop test

With ATLP command set to one and if all 30 channels are idle at midnight, the system software disables the card and performs a self-test on all channels. This causes a yellow alarm to be generated to the far-end. If any one of the 30 channels are busy at midnight, the software randomly disables one idle channel, 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.

Enter the following command in LD 60 to perform the automatic loop test as part of midnight routines**:**

```
ATLP 1 or 0
```

Link diagnostic and remote loop back tests

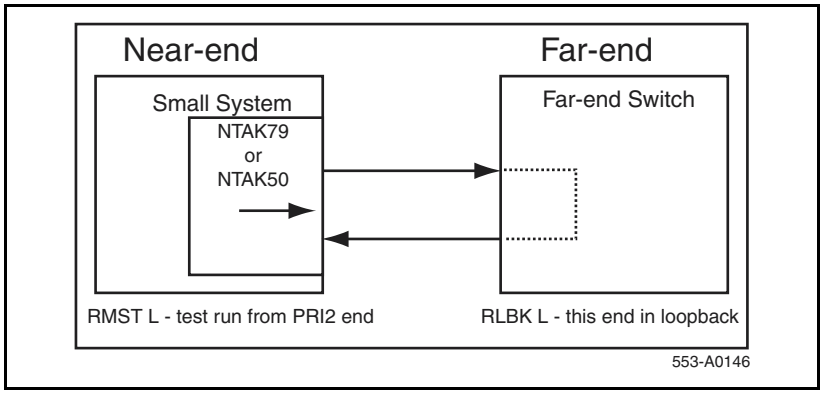
The remote loop-back and the link diagnostic test are performed manually on a per channel or per loop (or card) basis.

Link diagnostic test

The link diagnostic test, also called the far-end loop-back test, does not test the system 2.0 Mb PRI. It puts the 2.0 Mb PRI in loop-back mode so a remote loop-back test can be performed on equipment at the far-end. Refer to Figure 33 on page 202.

The 2.0 Mb PRI channel or loop (card) tested must be disabled.

Figure 33
2.0 Mb PRI link diagnostic (far-end loopback) test



Procedure 17
Running the link diagnostic test

To run the link diagnostic test on the system:

1 Call a technician at the far-end. Ask for loopback mode at that facility.

2 When loop-back mode at the far-end is confirmed:

a. Enter the following command in LD 96 to disable the DCHI/DDCH:

```
DIS DCH N
```

b. Enter the following command in LD 60 to disable the 2.0 Mb PRI card and run loop-back test:

```
DISL L
RMST L or RMST L C
```

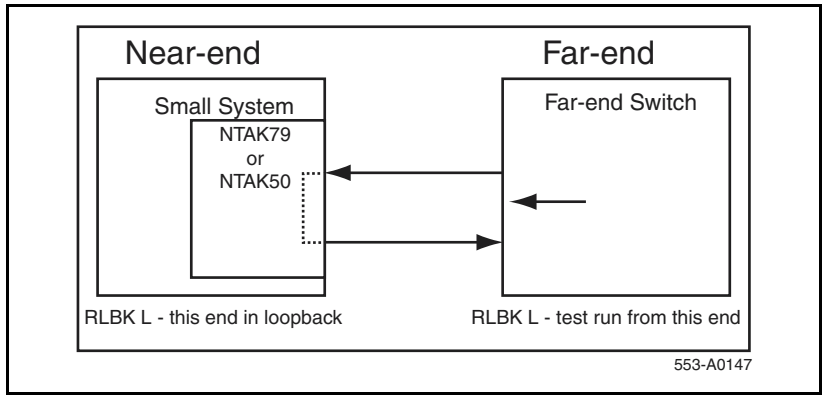
End of Procedure

Remote loop-back test

The remote loop-back test, also called the near-end loop-back test, checks the integrity of the 2.0 Mb PRI from the system to the far-end. The far-end must be in loop-back mode before this test can be performed. Refer to Figure 34 on page 203.

The 2.0 Mb PRI channel or loop (card) tested must be disabled.

Figure 34
2.0 Mb PRI remote loopback test



Coordinating the remote loopback tests

When a technician at the far-end asks for loop-back mode on the system, enter the following command in LD 96 to disable the DCHI/DDCH:

```
DIS DCH N
```

Enter the following command in LD 60 to disable the 2.0 Mb PRI card and activate loopback mode:

```
DISL L
RLBK L or RLBK L C
```

2.0 Mb ISL maintenance

Contents

This section contains information on the following topics:

Overview

This chapter provides a DCHI reference list of D-channel commands, an NTP reference for maintenance messages, and maintenance testing information.

ISL maintenance

DCHI quick reference

Below is a quick reference list of D-channel commands (LD 96).

Table 63
D-channel commands (LD 96) (Part 1 of 2)

Command	Action
DIS DCHI N	Disable DCHI port N.
ENL DCHI N	Enable DCHI port N.
EST DCH N	Establish D-channel N.

Table 63
D-channel commands (LD 96) (Part 2 of 2)

Command	Action
PLOG DCHI N	Print D-channel statistics log N.
RLS DCH N	Release D-channel N.
SDCH DCH N	Release a D-channel and switch D-channels.
RST DCH N	Reset D-channel N.
STAT DCH (N)	Print D-channel status (link status).
TEST-100/101	DCH tests.
STAT SERV	Print the current service and service acknowledge message for DCHI N.
ENL SERV N	Enable service messages for DCHI N.
DIS SERV N	Disable service messages for DCHI N.

Maintenance messages

D-channel status and error conditions are reported as DCH messages. These messages can be found in the *Software Input/Output: System Messages* (553-3001-411).

Maintenance testing

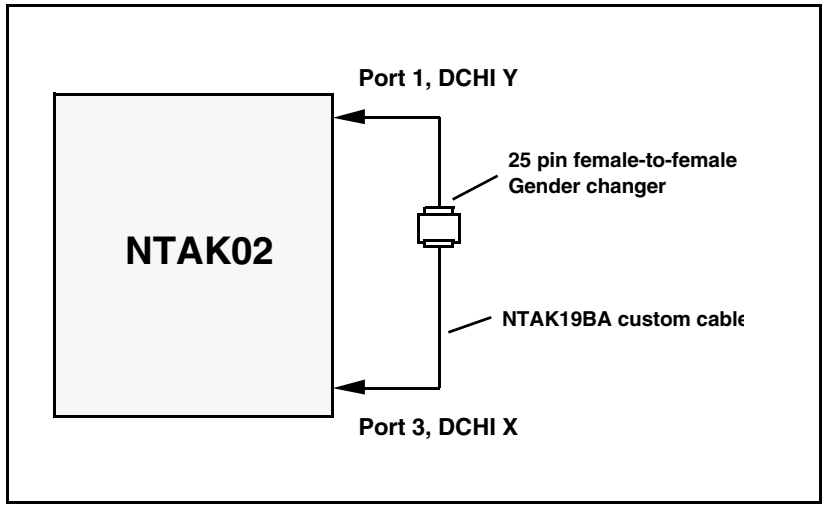
ISL back-to-back testing (without modems)

For maintenance reasons or testing purposes, it is sometimes necessary to connect ISL back-to-back (without modems). This connection is normally done within the same system in a lab environment.

Hardware requirements:
A 25-pin female-to-female gender changer is required to connect the NTAK19BA cable back-to-back. The gender changer is not supplied with the system. Figure 35 on page 207 illustrates the connection.

Note: Protocol converters AO378652 and AO381016 supplied with the system are not gender changers.

Figure 35
ISL back-to-back connection



Port settings:

- For port 3, DCHI X, program the following settings in LD 17:
  - — CLOK = INT (Internal clock)
  - — SIDE = SLAV (Slave)

  Set NTAK02 port 3 jumper plugs to DCE and RS-422.
- For port 1, DCHI Y, program the following settings in LD 17:
  - — CLOK = EXT (External clock)
  - — SIDE = MAS (Master)

  Set NTAK02 port 1 jumper plugs to DTE and RS-422.

Meridian 1, Succession 1000,
Succession 1000M

ISDN Primary Rate Interface

Maintenance

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