ISDN Primary Rate Interface Maintenance
Avaya Communication Server 1000

7.5
NN43001-717, 05.04
November 2011

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Contents

Chapter 1: New in this release

The following sections detail what's new in this document for Avaya Communication Server 1000 Release 7.5.

Feature changes

There are no updates to the feature descriptions in this document.

Other changes

This section provides information about changes that are not feature-related.

Revision History

November 2011	Standard 05.04. This document is up-issued to reflect changes in technical content for the Introduction.
October 2011	Standard 05.03. This document is up-issued to support the removal of content for outdated features, hardware, and system types.
November 2010	Standard 05.02. This document is published to support Avaya Communication Server 1000 Release 7.5.
November 2010	Standard 05.01. This document is issued to support Avaya Communication Server 1000 Release 7.5.
June 2010	Standard 04.01. This document is up-issued to support Avaya Communication Server 1000 Release 7.0.
May 2009	Standard 03.01. This document is up-issued to support Communication Server 1000 Release 6.0.
December 2007	Standard 02.02. This document has been up-issued to support Communication Server Release 5.5.
June 2007	Standard 01.02. This document is up-issued to remove the Confidential statement.
May 2007	Standard 01.01. This document is issued to support Communication Server 1000 Release 5.0. This document contains information previously contained in the following legacy document, now retired: ISDN Primary Rate Interface Maintenance (NN43001-717). No new content has been added for Communication Server 1000 Release 5.0.

	All references to Communication Server 1000 Release 4.5 are applicable to Communication Server 1000 Release 5.0.
August 2005	Standard 3.00. This document is up-issued to support Communication Server 1000 Release 4.5.
September 2004	Standard 2.00. This document is up-issued for Communication Server 1000 Release 4.0.
October 2003	Standard 1.00 This document is a new technical document for Succession 3.0. It was created to support a restructuring of the Documentation Library, which resulted in the merging of multiple legacy technical documents. 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 *2.0Mb DTI/PRI Description, Installation and Maintenance, 553-3011-310* also appears in *Avaya ISDN Primary Rate Interface Installation and Commissioning (NN43001-301)*. • *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 *Avaya ISDN Primary Rate Interface Installation and Commissioning (NN43001-301)*.

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Chapter 3: Introduction

This document is a global document. Contact your system supplier or your Avaya 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 Avaya Communication Server 1000 systems.

Note on legacy products and releases

This technical document contains information about systems, components, and features that are compatible with Avaya Communication Server 1000 software. For more information on legacy products and releases, click the Technical Documentation link under Support & Training on the Avaya home page:

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Applicable systems

This document applies to the following systems:

- Communication Server 1000M Single Group (CS 1000M SG)
- Communication Server 1000M Multi Group (CS 1000M MG)
- Communication Server 1000E (CS 1000E)

System migration

When Meridian 1 systems are upgraded to run Avaya CS 1000 software and configured to include a Signaling Server, they become Avaya CS 1000M systems. Table 1: Meridian 1 systems to CS 1000 systems on page 14 lists each Meridian 1 system that supports an upgrade path to a CS 1000M system.

Table 1: Meridian 1 systems to CS 1000 systems

This Meridian 1 system...	Maps to this CS 1000 system
Meridian 1 PBX 11C Chassis	CS 1000E
Meridian 1 PBX 11C Cabinet	CS 1000E
Meridian 1 PBX 61C	CS 1000M Single Group
Meridian 1 PBX 81C	CS 1000M Multi Group

Intended audience

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

Conventions

Terminology

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

- Communication Server 1000E (CS 1000E)
- Communication Server 1000M (CS 1000M)
- Meridian 1

The following systems are referred to generically as "Large System":

- Communication Server 1000M Single Group (CS 1000M SG)
- Communication Server 1000M Multi Group (CS 1000M MG)
- Meridian 1 PBX 61C CP PIV
- Meridian 1 PBX 81C CP PIV

Related information

This section lists information sources that relate to this document.

Technical Documentation

The following technical publications are referenced in this document:

- *Avaya Features and Services Fundamentals (NN43001-106)*
- *Avaya Software Input Output Administration (NN43001-611)*
- *Avaya Software Input Output Reference - Maintenance (NN43001-711)*

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Chapter 4: 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 Digital Trunk Diagnostic (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: PRI alarm timers on page 18 shows the progression of the system Red and Yellow (local and remote) alarm timers.

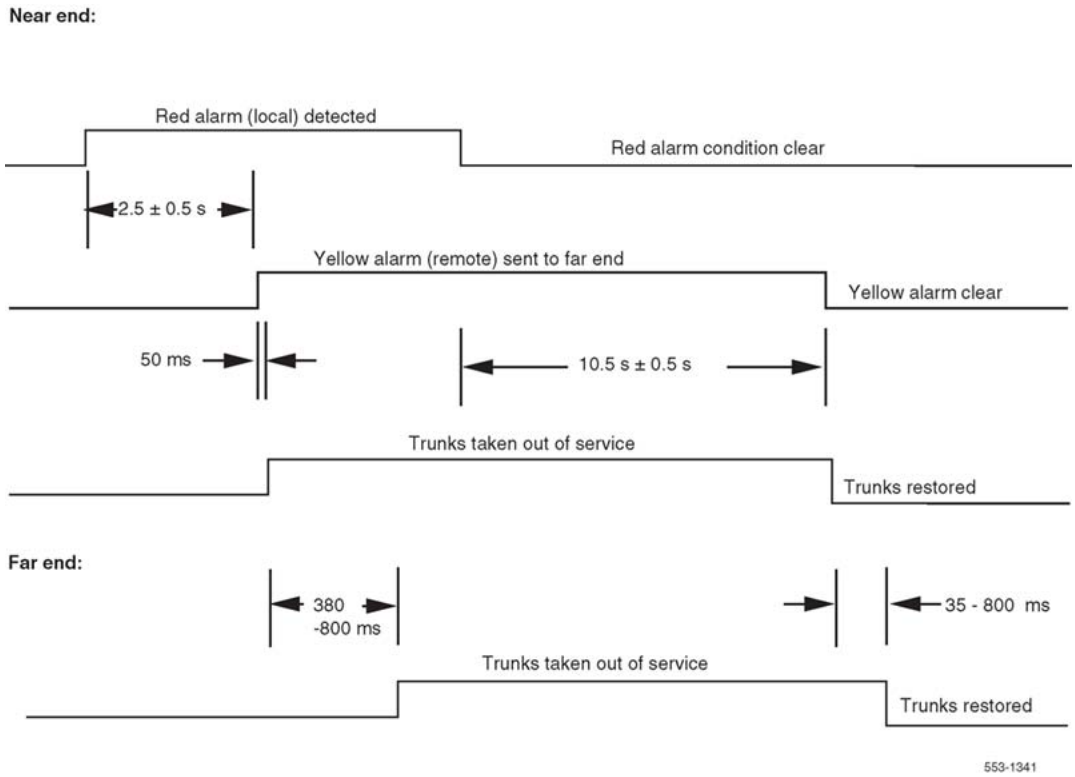


Figure 1: PRI alarm timers

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: PRI problem solving on page 20 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.

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:
3. Contact personnel at the far end to determine what action they are taking.
4. 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: PRI problem solving on page 20.

Table 2: PRI problem solving

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 startup. They may be indicated by: • DTA 018 Frame-slip out-of-service limit • DTA 021 Loss-of-frame-alignment for 3 seconds • DCH 1003 D-channel MDL errors	See that the PRI parameters correlate to the far-end parameters.
Cannot enable the PRI. Two reasons follow:	
The far-end PRI is disabled, indicated by: • PRI 000PRI is responding • DTA 005 remote alarm occurred	Contact personnel at the far-end site to resolve the problem.
DCH 1010 DCHI is software disabled Or, there is no 1.5 Mb/2Mb connection, indicated by:	See above, under No connection to far end.

Symptom	Action
• PRI 000 PRI is responding • DTA 021 loss of frame alignment for 3 seconds • DCH 1010 DCHI is software disabled	
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 D-channel Handler Interface (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 Table 3: Procedure 3 D-channel status check on page 21.

Table 3: Procedure 3 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	

Step	Action	Response
	`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."	

Chapter 5: 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.

Note:

Some cards have a switch on the faceplate to enable and disable the hardware. When removing a card, first disable the card in software, then disable the hardware by setting the switch to DIS. Before installing a card, hardware-disable it by setting the switch to DIS. After the card is locked into position, set the switch to ENB, and then enable the card in software. Disable and enable cards as described in *Avaya Software Input Output Administration, NN43001-711*.

PRI commands (LD 60)

Table 4: PRI commands (quick reference) on page 24 is a quick reference list of important PRI commands. For a more extensive list of PRI commands, see the section describing PRI maintenance.

Table 4: PRI commands (quick reference)

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.
RMST loop	Perform self-test on loop.

Command	Action
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 *Avaya Software Input Output Reference - System Messages (NN43001-712)* 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 setup 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 5: DCHI and D-channel commands (quick reference) on page 25 is a partial list of DCHI and D-channel commands. For a complete list of DCHI and D-channel commands, see the *Avaya Software Input Output Reference - Maintenance (NN43001-711)*.

Table 5: DCHI and D-channel commands (quick reference)

Command	Action
DIS AUTO x	Disable automatic recovery for DCH x.

Command	Action
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.
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.

Command	Action
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.
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 *Avaya Software Input Output Reference - System Messages (NN43001-712)* for commonly encountered D-channel (DCH) messages.

MSDL commands

Table 6: MSDL D-channel commands on page 28 is a partial list of Multi-purpose Serial Data Link (MSDL) D-channel commands. For a complete list of D-channel commands, see the *Avaya Software Input Output Reference - Maintenance (NN43001-711)*.

Table 6: 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.
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 ISDN Signaling Link (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 are supported only 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 7: Maintenance message status on page 29 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 7: 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.

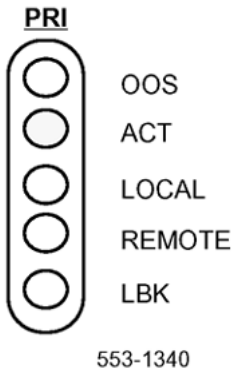
The FE MBSY, FE DSBL, and IDLE messages appear when either the B-channel or the ISL channel is idle. See PRI fault clearing on page 17 for more information about these responses.

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 startup on page 32.

Table 8: Procedure 4 PRI status check

Step	Action	Response
1	Check the status LEDs on all PRI cards.	For normal operation, only the green ACT LED is lit. 
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.

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 *

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

Step	Action	Response
		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).

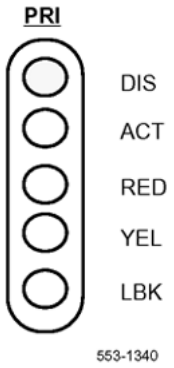
8	Check to assure the following PRI cables are connected correctly: • PRI to DCHI cable • E1/T1 transmission cable from NT8D72AA to DSX (the digital cross connect)	

PRI startup

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

Table 9: Procedure 5 PRI status check

Step	Action	Response
1	Check the status of all PRI cards.	The PRI shown is disabled.

Step	Action	Response
		
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

4	Enable all PRIs using:
	`LD 60`
	`ENLL L`
		PRI000 Correct version ID
		DTA005 remote alarm
		DTA007 remote alarm cleared (provided the far end is up)
		DCH1010 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 (NCT) 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 Special Prefix (SPRE) code and the NCT feature code (9912) before the network number. When this is done, call setup 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 Terminal Number (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 appears 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. To trace a call, dial the following:

SPRE + 9912 + xx + yyy...

- 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 Electronic Switched Network (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) 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)

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

- 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,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.

Chapter 6: 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 10: PRI card and channel commands in LD 60 on page 40 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 10: PRI card and channel commands in LD 60

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.
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

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 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 11: PRI alarm commands in LD 60 on page 41 for a list of PRI alarm commands and descriptions of these commands. These commands appear in LD 60.

Table 11: PRI alarm commands in LD 60

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.

Command	Description
LCNT	Prints content of all alarm counters of all PRI loops.
LCNT L	Prints content of all alarm counters of PRI loop L. The counters are: BPV Bipolar violation bit error rate counter. Indicates the number of times the loop has entered state due to excessive bipolar violations. FAP Number of times the loop has entered state due to excessive frame bit errors. SLP Frame slip repetition counter. The number of times the loop has entered state due to excessive frame slips. CRC Cyclic Redundancy Check (CRC) bit error rate counter. The number of times the loop has entered state due to CRC frame errors. G2 The number of times the loop has entered state due to excessive group 2 errors. TOTAL 24 HOUR BPV 24-hour bit error rate count TOTAL 24 HOUR FAP 24-hour frame bit error rate count TOTAL 24 HOUR SLP 24-hour slip count TOTAL 24 HOUR CRC 24-hour CRC error count TOTAL 24 HOUR G2 AIS 24-hour alarm indication signal count TOTAL 24 HOUR G2 LFAS 24-hour loss of frame alignment count TOTAL 24 HOUR G2 LMAS 24-hour loss of multiframe alignment count TOTAL 24 HOUR G2 RAI 24-hour remote alarm indication count TOTAL 24 HOUR G2 LOS 24-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.
RCNT L	Resets all alarm counters of PRI loop L.

PRI test commands

See Table 12: PRI test commands in LD 60 on page 42 for a list of the PRI test commands and a corresponding description of these commands. The PRI test commands are in LD 60.

Table 12: 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.

Command	Description
RLBK L	Closes the loop at the carrier interface point of the PRI so the far end can perform an external loopback test. PRI loop L must be disabled because the test disrupts call processing.
DLBK L	Disables the remote loopback test per RLBK L. The loop remains disabled.
DLBK L CH	Disables the remote loopback 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.
RMST L	Performs self-test on loop L, providing the far end is in the remote loopback mode.
RMST L CH	Performs self-test on channel CH, providing the far end is in the remote loopback 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 PRI self-test on page 43.

PRI self-test

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, the loop test can be run automatically, as part of the midnight routines.

With the ATLP command set to one, follow Procedure 7.

PRI automatic loop test

1. If all 30 channels are idle at midnight, the 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 loopback 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 loopback 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 loopback test, does not test the local PRI. It puts the PRI in loopback mode so a remote loopback test can be performed on equipment at the far end.

The PRI channel or frame being tested must be disabled.

Remote loopback test

The remote loopback 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 loopback 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 loopback mode on the PBX:

Disable the DCHI using:

```
LD 96

DIS DCH N
```

Disable the PRI loop and activate loopback mode using:

```
LD 60

DISL L

RLBK L
```

To run the remote loopback test on the PBX, follow Remote loopback test on page 45.

Remote loopback test

1. Call a technician at the far end.
2. Ask for loopback mode at that facility.
3. When loopback mode at the far end is confirmed:

   Disable the DCHI using:

   ```
   LD 96

   DIS DCH N
   ```

   Disable the PRI loop and run loopback test using:

   ```
   LD 60

   DISL L

   RMST L
   ```

Figure 2: PRI link-diagnostic and remote loopback tests on page 46 shows the relationship between the remote loop-back test and the link-diagnostic test.

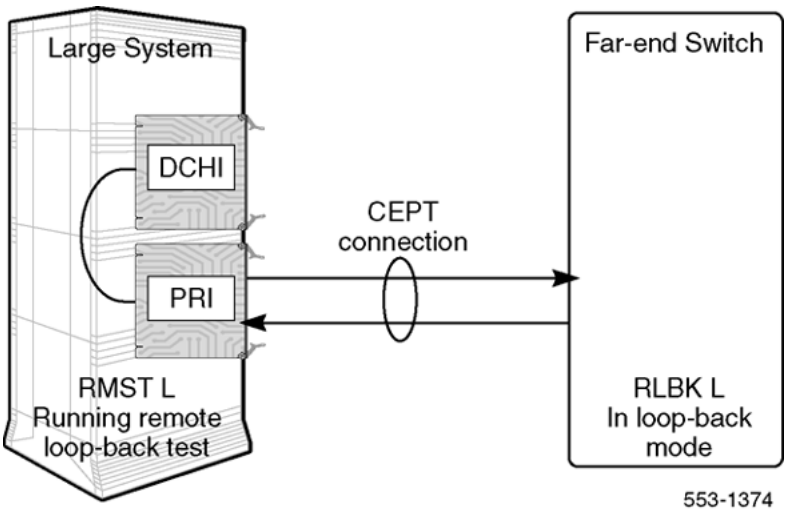


Figure 2: PRI link-diagnostic and remote loopback tests

PRI error detection

Bit error rate

Bit-error-rate monitoring detects errors in transmission. See Figure 3: Bipolar violations on page 47.

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).

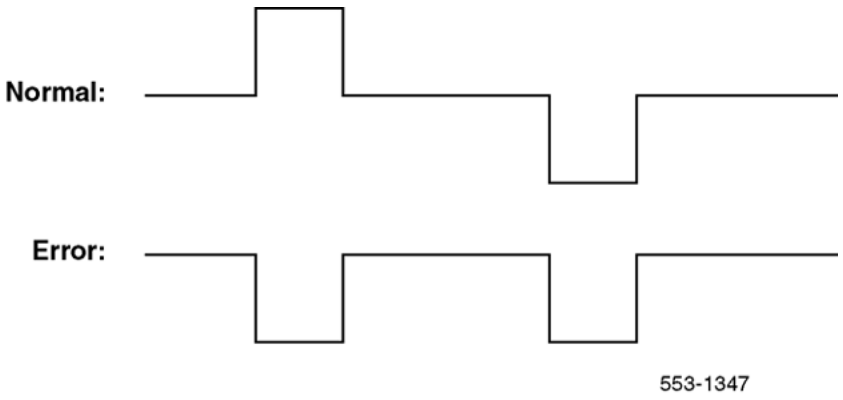


Figure 3: Bipolar violations

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: BIPV and BIPC thresholds on page 48.

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.

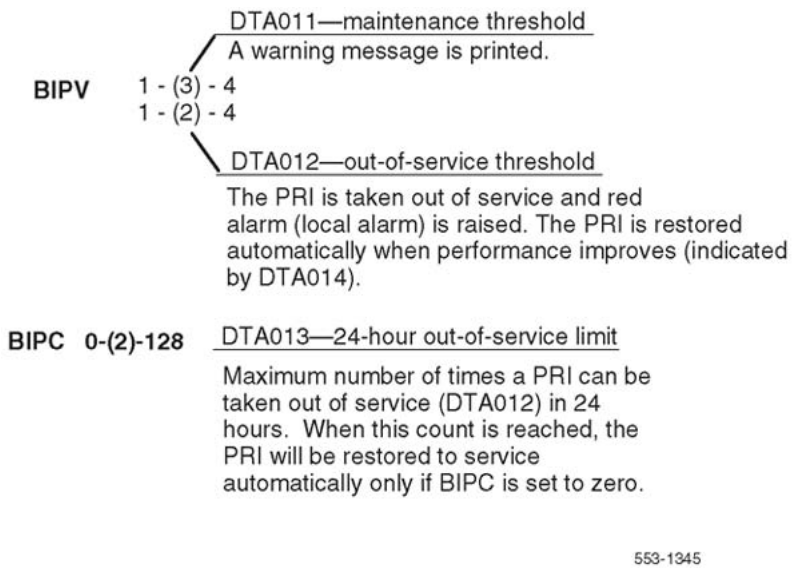


Figure 4: BIPV and BIPC thresholds

The BIPV thresholds are based on the number of errors in a given time. The threshold levels are shown in Table 13: BIPV thresholds on page 48.

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 13: 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: DTA messages on page 49.

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, as follows:

DTA015: Maintenance limit for frame slips in tracking mode.

DTA016: Out-of-service limit for frame slips in tracking mode.

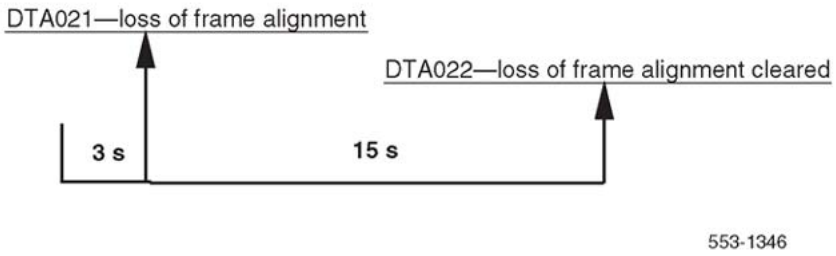


Figure 5: DTA messages

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: DTA thresholds on page 50.

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 three 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.

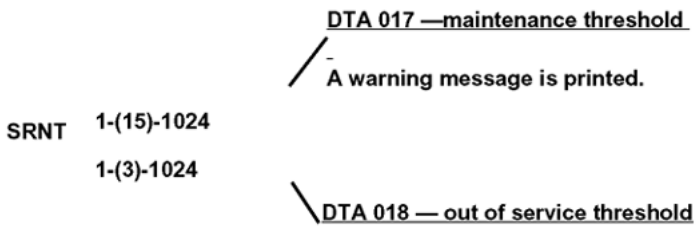


Figure 6: DTA thresholds

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 three 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: Frame alignment on page 51.

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 follows:

DTA019: Frame alignment maintenance limit

DTA020: Frame alignment out-of-service limit

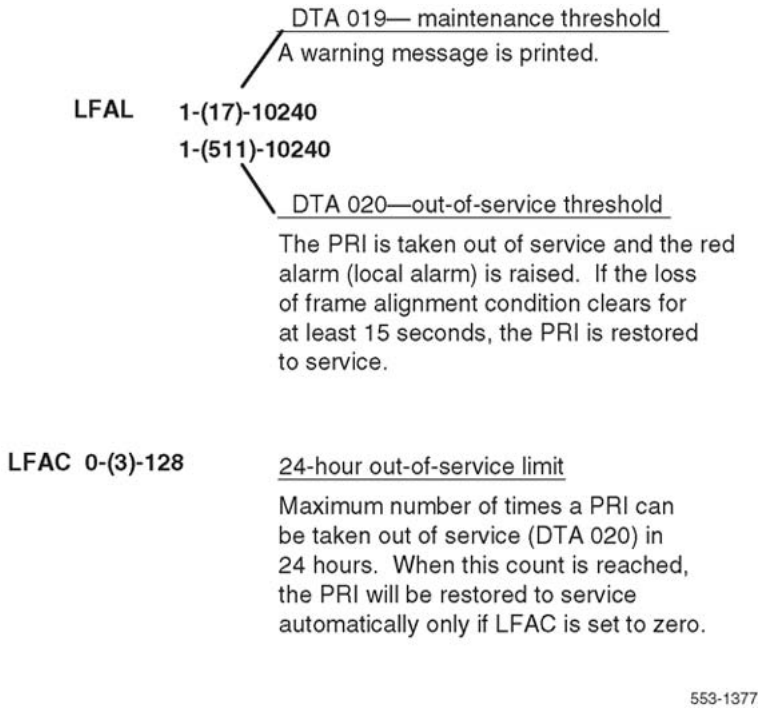


Figure 7: Frame alignment

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: Frame alignment loss on page 51.

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.

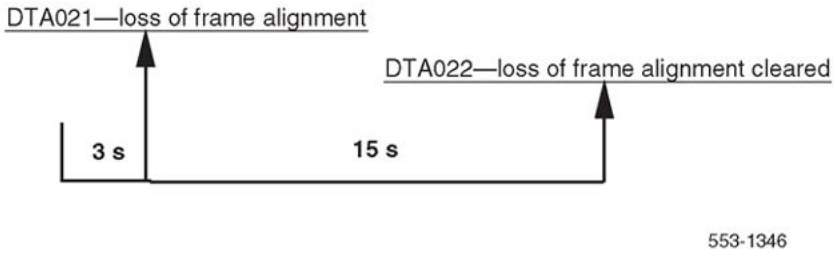


Figure 8: Frame alignment loss

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 in Table 14: PRI channel numbers and equivalent terminal numbers on page 52. 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 14: PRI channel numbers and equivalent terminal numbers on page 52.

Table 14: PRI channel numbers and equivalent terminal numbers

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
20	2 8 0	2 4 0

Channel number	D2 format TN (S C U)	D3, D4,E SF format TN (S C U)
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)

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.

Plug one end of a patch cord into the input jack of the test set.

1. Plug the other end of the patch cord into one of the monitor jacks (RCV and XMT) of the PRI card being tested.
2. Monitor the error counter LED indicators as described in Table 15: Error counter switch functions on page 53 and Table 16: Error counter display functions on page 54.

Table 15: 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 16: Error counter display functions

Display	Function
GOOD	Indicates the presence of an acceptable bipolar signal. (If bipolar violations, missing pulses, or an oscillating line are detected, the indicator is off.)
ERR	Flashes when bipolar violations are detected.
W/M	Indicates no input (absence of pulse) or an oscillating line.
O/R	Over range display turns on when the counter input has exceeded 9999 (the counter resets to 0000).
CNTR	With Error/Error-Second switch in the Error position, the unit counts errors at a maximum rate of 200 per second. With Error/Error-Second switch in the Error-Second position, the unit counts error seconds at a rate of one per second.

Replace the PRI

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.

Note:

Some cards have a switch on the faceplate to enable and disable the hardware. When removing a card, first disable the card in software, then disable the hardware by setting the switch to DIS. Before installing a card, hardware-disable it by setting the switch to DIS. After the card is locked into position, set the switch to ENB, and then enable the card in software. Disable and enable cards as described in *Avaya Software Input Output Administration, NN43001-711*.

Disable the D-channel using the following:

```
LD 96 DIS DCH x
```

1. Disable the PRI loop using the following:

   ```
   LD 60 DISL loop
   ```

2. Disconnect cables on PRI faceplate.
3. Remove the PRI card.

4. Make sure that the new PRI card switch settings are the same as the faulty PRI card.
5. Install the new PRI card in the appropriate slot.
6. 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).
7. Test the PRI card using the following:

   `LD 60 SLFT loop` If an error message results, see PRI fault clearing, beginning on page 15.
8. Enable the PRI using the following:

   ```
   LD 60 ENLL loop
   ```

Pulsed E and 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 on page 56 illustrates loop channel start-bits, pulsed-bits, and end-bits duration.

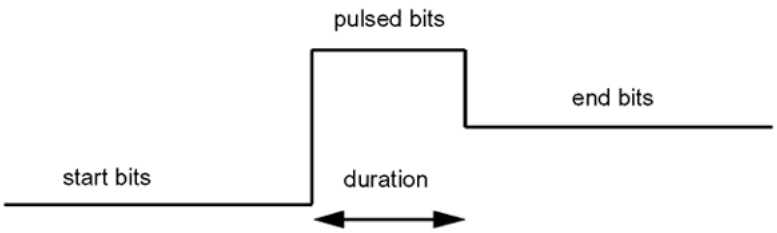


Figure 9: Loop channel start-bits pulsed-bits end-bits duration

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 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 SCR 0 401 2317 DIAL DN 401 MAIN PM ESTD TALKSLOT ORIG 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.

Chapter 7: D-channel maintenance

Contents

This section contains information on the following topics:

DCH commands (LD 96)

Table 17: D-channel commands, LD 96 on page 57 contains the basic D-channel (DCH) commands in LD 96.

Table 17: D-channel commands, LD 96

Command	Description
DIS AUTO x	Disable automatic recovery for DCH x.
DIS DCH x	Disable DCH x.

Command	Description
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
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).

Command	Description
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 <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.
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.

Command	Description
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 D-channel 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.
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: DCH tests 100 and 101 on page 62. Test 100 checks interrupt generation on the DCHI. Test 101 checks the DCHI loopback capability. If either test fails, either a faulty DCHI or a contention problem is indicated. A test failure initiates DCH error messages.

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

Testing DCHI hardware

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
```

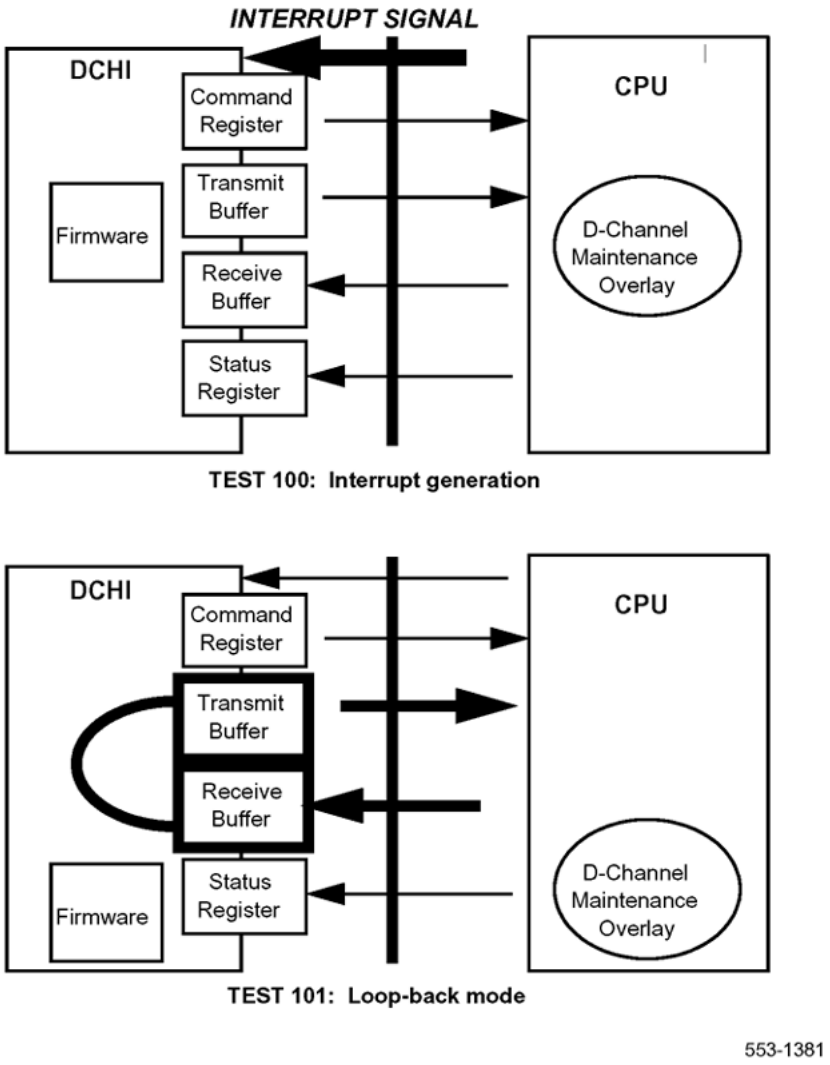


Figure 10: DCH tests 100 and 101

DCH tests 200 and 201

DCH tests 200 and 201 are software tests. See Figure 11: DCH tests 200 and 201 on page 64. Test 200 monitors the DCHI interrupt handler. Test 201 checks the interrupt handler-to-link interface path. If either test fails, software problems are indicated. A test failure initiates DCH error messages.

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

Testing DCHI software

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
   ```

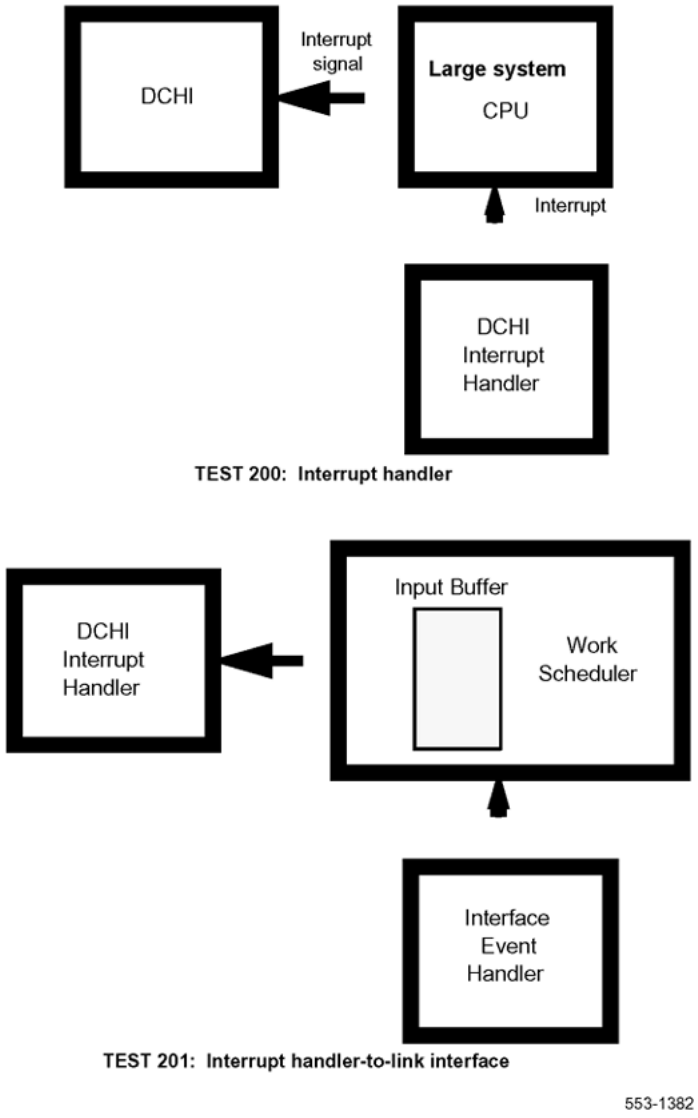


Figure 11: DCH tests 200 and 201

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. See Table 18: TFS009 D-channel report format on page 65 for TFS009 D-channel report format and Table 19: Legend for TFS0009 report on page 66 for report legend.

Table 18: TFS009 D-channel report format

System ID DCH x	TFS009	
aaaa		nnnn
bbbb		oooo
cccc		pppp
dddd		qqqq
eeee		rrrr
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 19: Legend for TFS0009 report

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
	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
	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
	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 applies only 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 is forced to disable after time out

MSDL local loopback test (NT6D80)

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 *Avaya Circuit Card Reference (NN43001-311)*. See Figure 12: Local loopback test (NT6D80) on page 70.

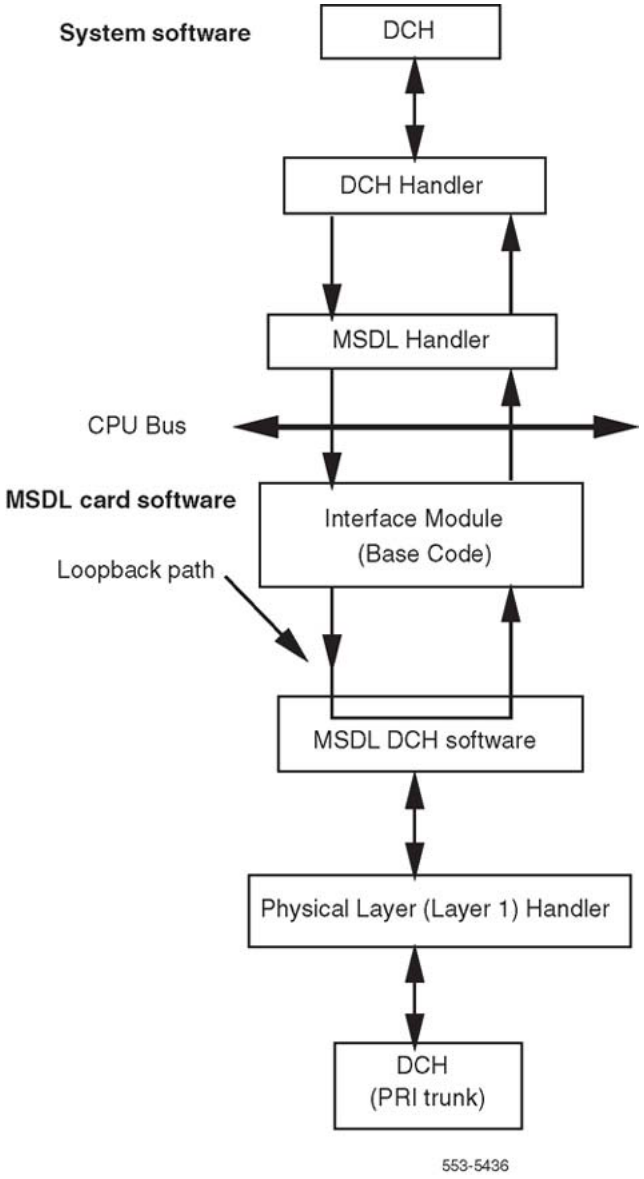


Figure 12: Local loopback test (NT6D80)

MSDL remote loopback tests (NT6D80)

Before beginning this test, verify the following:

- D-channels on both switches are configured on MSDL cards
- DCH links on both switches are set to TEST mode

- DCH at Switch B is in remote loopback mode (RLB)
- remote capability (RCAP) is MSDL

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 *Avaya Circuit Card Reference (NN43001-311)*.
8. After the test is complete, remove both sides from the test state:

   ```
   DIS TEST x DIS TEST y
   ```

See Figure 13: Remote loopback tests (NT6D80) on page 72.

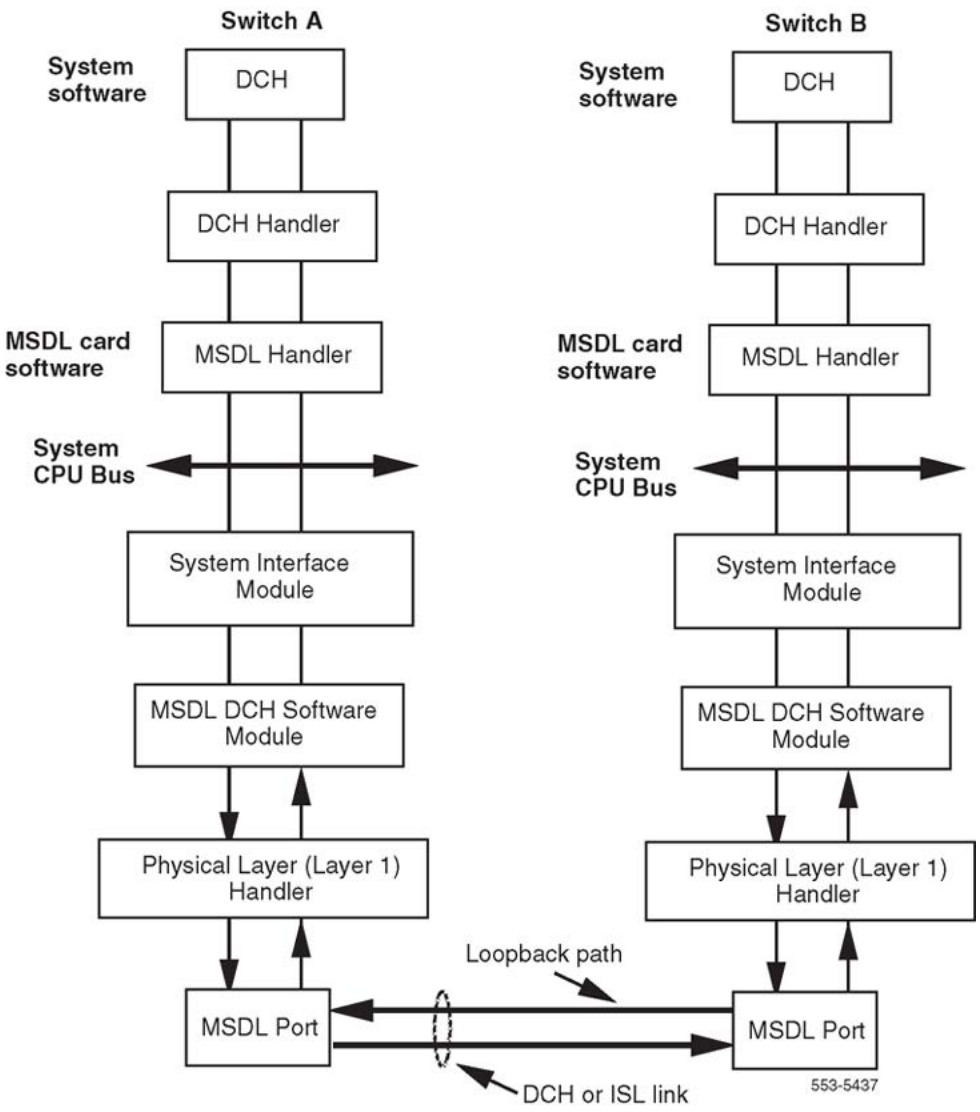


Figure 13: Remote loopback tests (NT6D80)

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 in Checking the PLOG status on page 73. See Table 20: Protocol log on page 73 for the PLOG.

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 20: Protocol log

Format DCH : XX MAINT CONFIRM TIME: <time of day> COUNTERVALUE	
Protocol counters	
1	count of missing PRI handshakes
2	count of peer-initiated re-establishment link
3	count of unsuccessful retransmit N200 of SABME
4	count of unsuccessful retransmit N200 of DISC
5	count of N(R) errors
6	count of information fields with length greater than N201
7	count of undefined frames
8	count of information fields that are not allowed to contain information
9	count of FRMR frames received from the far end
10	count of CRC error frames received from the far end
11	count of REJ frames received from the far end

12	count of layer 3 messages with less than 4 octets
13	dummy counter, always zero
14	count of undefined layer 3 message types
15	count of layer 3 messages missing one or more mandatory information elements
16	count of layer 3 messages missing one or more undefined information elements
17	count of layer 1 reports of no external clock being received
18	count of aborted frames
19	count of SABME frames received with incorrect C/R bit
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
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.

Replacing the DCHI

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 *Avaya ISDN Primary Rate Interface Installation and Commissioning (NN43001-301)* and *Avaya Circuit Card Reference (NN43001-311)* 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. See Table 21: Meridian 1SYS- 12, AXE- 10 SWE, NUMERIS, SWISSNET, EuroISDN, NEAX-61 channel timeslot mapping on page 76

Table 21: 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

Chapter 8: 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: Clock controller primary and secondary tracking on page 78. Two PRI loops can operate in tracking mode, with one defined as the primary reference source for clock synchronization, the other defined as the secondary reference source. The secondary reference acts as a backup to the primary reference.

As shown in Figure 14: Clock controller primary and secondary tracking on page 78, a system with a dual CPU can have two clock controllers (CC0 and CC1). One clock controller acts as a backup to the other. The clock controllers should be locked to the reference clock.

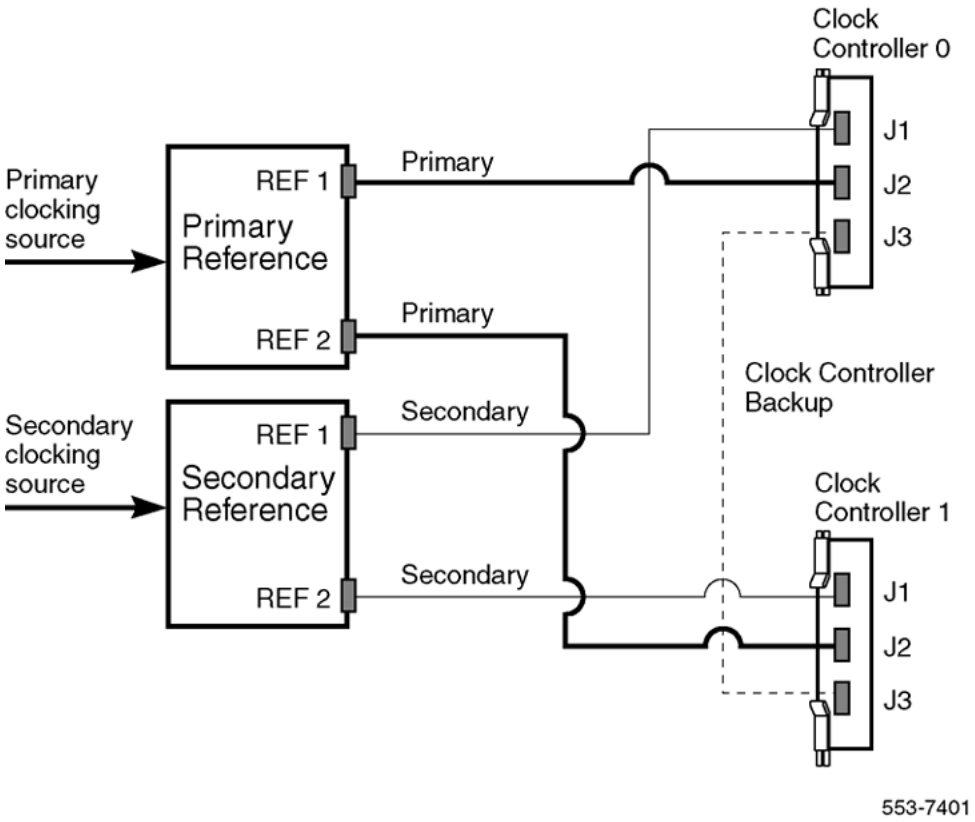


Figure 14: Clock controller primary and secondary tracking

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 backup clock controller, without affecting which reference clock is being tracked.

A reference-clock error occurs when there is a problem with the clock driver or with the reference system clock at the far end. If the clock controller detects a reference-clock error, the reference clocks are switched.

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 resumes 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.

See Table 22: Clock controller commands in LD 60 on page 80 for clock controller commands in LD 60.

Clock controller commands (LD 60)

Table 22: 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.
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: PCKtrack primary clock SCLKtrack secondary clock FRUNfree-run mode

Replace the clock controller

Task summary list

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

Replace the clock controller. Refer to Replacing the clock controller on page 81.

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.

Replacing the clock controller

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.
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 *Avaya Communication Server 1000M and Meridian 1 Large System Maintenance (NN43021-700)* 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 Table 23: Clock controller switch settings for QPC471 vintage H on page 82 and Table 24: Clock controller switch settings for QPC775 on page 83. Table 23: Clock controller switch settings for QPC471 vintage H on page 82 displays the settings for different vintages of the QPC471. Table 24: Clock controller switch settings for QPC775 on page 83 shows the settings for the QPC775.

Table 23: 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

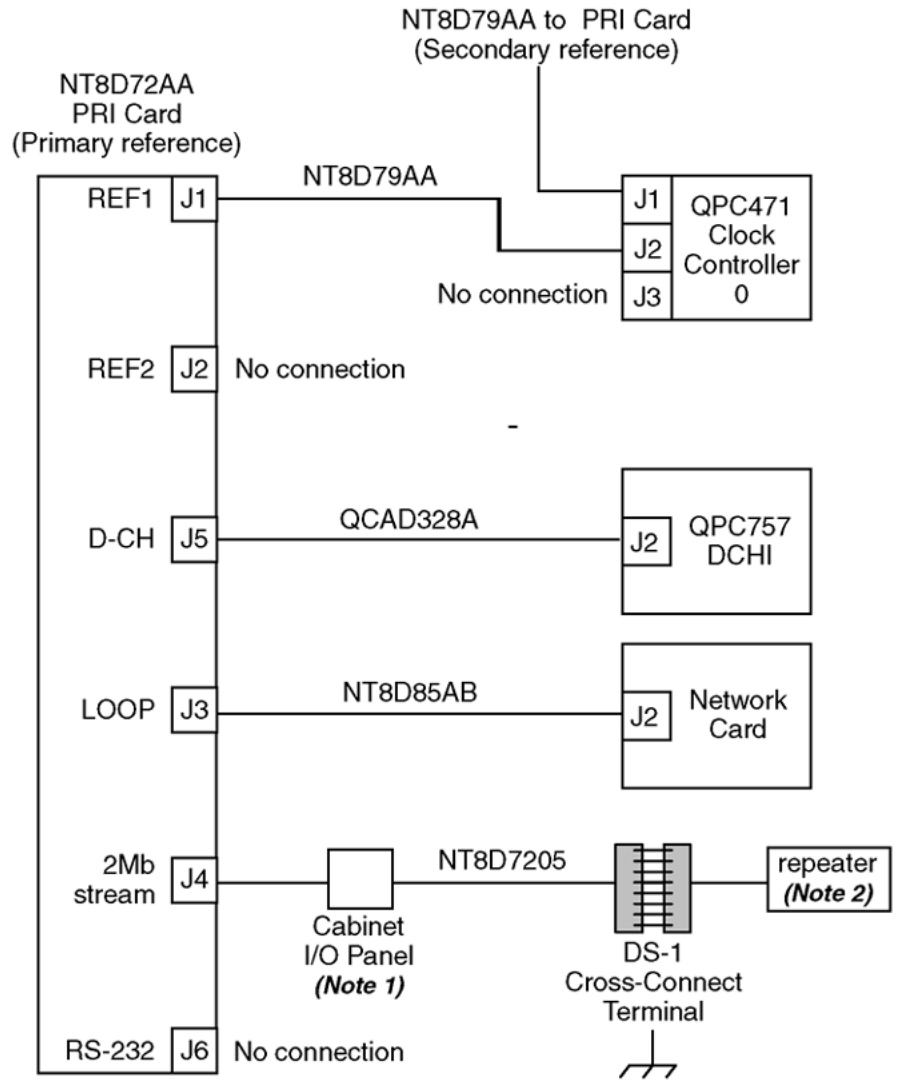
System	SW1	SW2	SW4
If there is only one clock controller card in the system, set to OFF. If there are two clock controller cards, set to match the cable length between the J3 faceplate connectors. Determine the total cable length (no single cable can exceed 25 ft.) between the J3 connectors. Both cards must have the same setting.			

Table 24: Clock controller switch settings for QPC775

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

Clock controller cabling

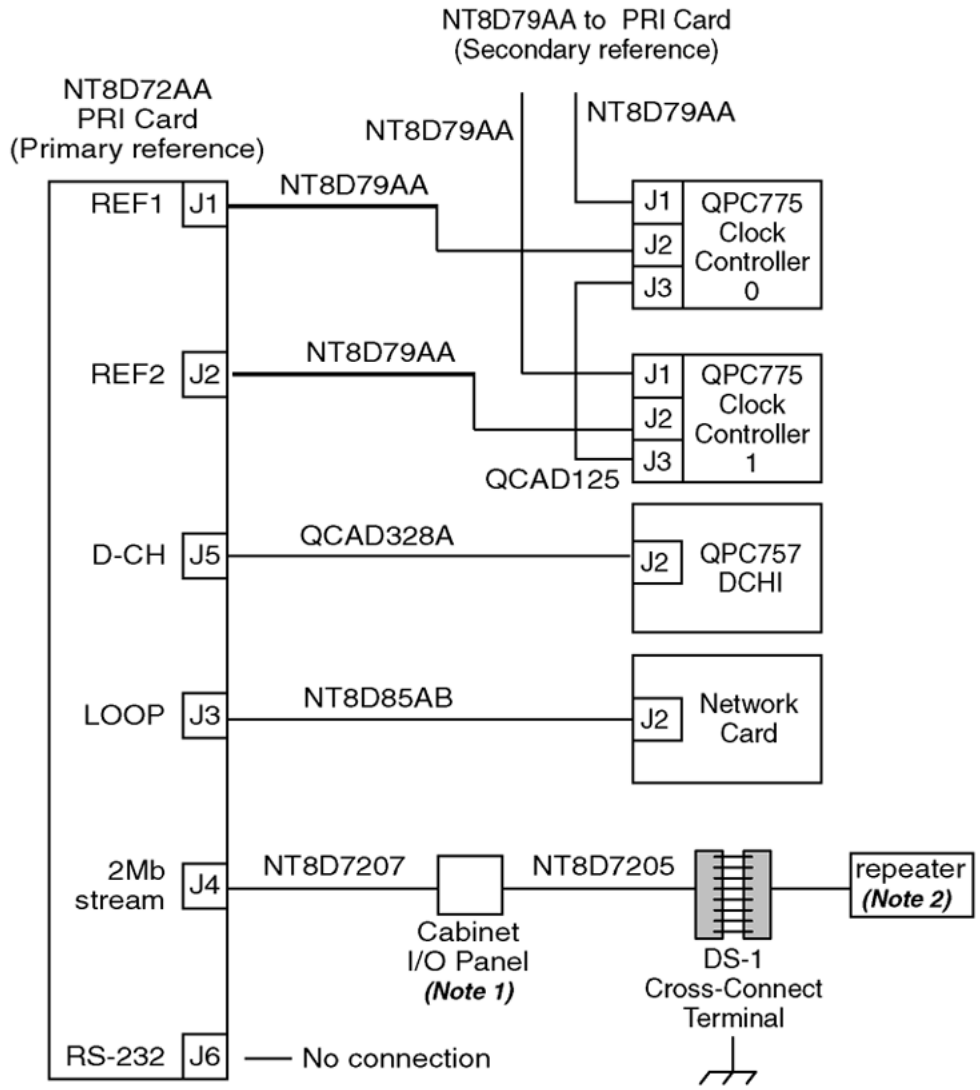
The clock-controller cabling for system configurations is shown in Figures 15 to 17, beginning on page 105.



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).

553-1389

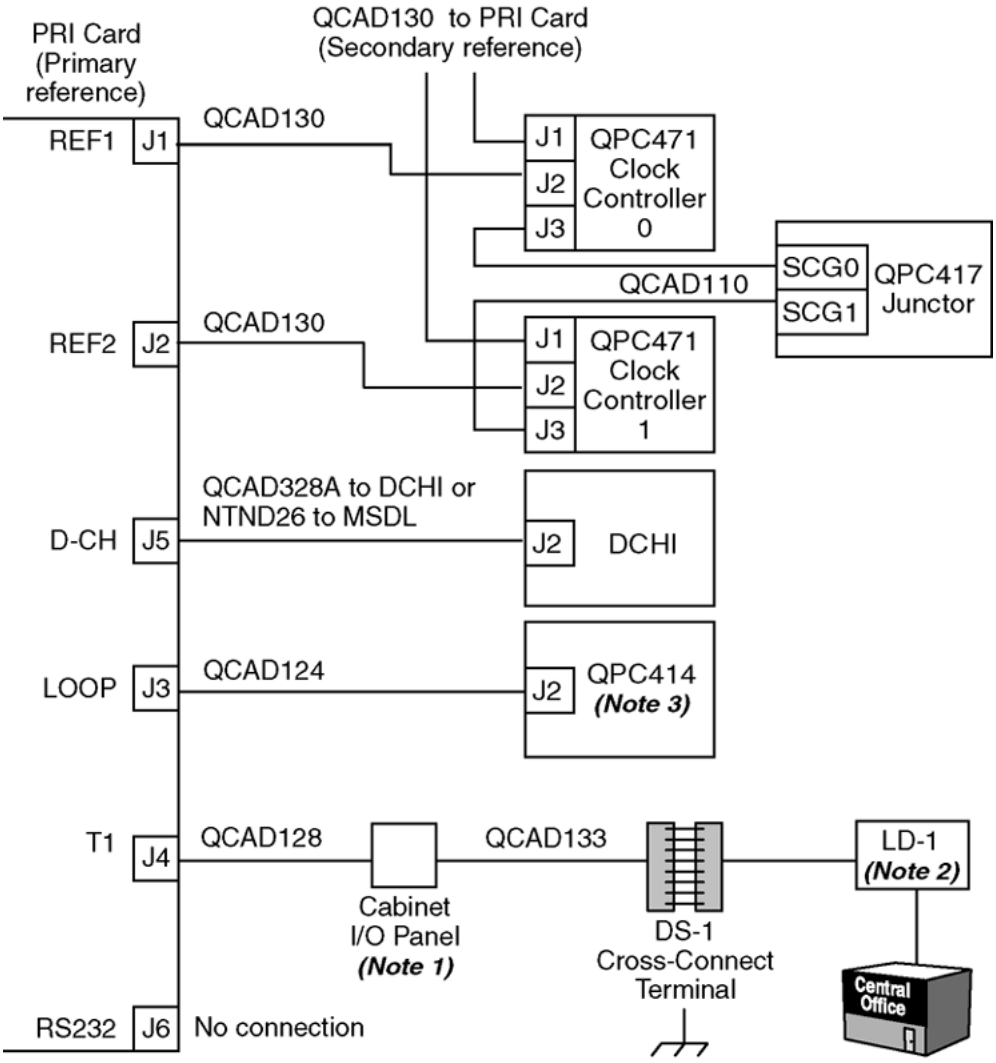
Figure 15: Clock controller cabling: Half Group systems



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).

553-1391

Figure 16: Clock controller cabling: Single 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

Figure 17: Clock controller cabling Multi Group systems

Chapter 9: 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 25: ISL status check in LD 32 and 36 on page 87.

Table 25: 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 26: ISL status check in LD 60 on page 88.

Table 26: 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 27: ISL prompts in LD 20, LD 21, and LD 22 on page 88) provide the following ISL information:

- LD 20 prints trunk information
- LD 21 prints route information
- LD 22 prints configuration record information

Table 27: 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 28: Additional ISL information provided in LD 21 on page 88). To list ISL trunk TNs, use the following prompts:

```
REQPRT TYPEISLL
```

Table 28: 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 startup

In general, the procedures for bringing up the D-channel are the same as the ISDN PRI interface (see the PRI startup 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.

Chapter 10: Universal Digital Trunk card maintenance

Contents

This section contains information on the following topics:

Enable UDT card

Enable the UDT card in Call Server, as described in the following sections.

Enable UDT card configured as PRI/PRI2

1. In LD 60 enable the 2.0 Mb PRI loop:

   ENLL L
2. In LD 96 enable the MSDL (implemented on board):

   ENL MSDL l s c
3. In LD 96 enable the D-channel:

   ENL DCH X
4. In LD 96 check the current status of the D-channel (the system should respond with DCH x EST meaning that the D-channel is established and operational).

   STAT DCH X

Enable UDT card configured as DTI/DTI2

In LD 60 enable the 2.0 Mb DTI loop:

ENLL L

Enable UDT card configured as DPNSS/DASS

1. In LD 75 enable DDCS loop:

   ENL DDCS l
2. In LD 75 enable DDSL:

   ENL DDSL n
3. In LD 75 start the DDSL:

   STRT n
4. In LD 75 check the current status of the DDSL (the system should respond with ENBL ACTIVE meaning that the DDSL is established and operational).

   STAT DDSL n

Enable clock controller functionality

In LD 60 enable the clock controller, if the UDT CC daughter board is installed:

1. Enable system clock controller on specified superloop and shelf:

   ENL CC l s
2. Enable clock tracking on MG 1000E specified by the superloop and shelf tracking to primary, secondary or free run:

   TRCK aaa l s (Where aaa is: PCK = track primary clock SCLK = track secondary clock FRUN = free run mode)
3. Check the status of the system clock on the specified superloop and shelf

   SSCK l s

Maintenance and diagnostics

This section describes the maintenance and diagnostic programs used on the Call Server for the UDT card.

LD programs

LD 60 Digital trunk loop and clock controller maintenance

Table 29: LD 60 Digital trunk loop maintenance

Commands	Description
DISI loop	Disable loop when all channels are idle
DISL loop	Disable network and DTI/PRI cards of loop
DSCH l ch	Disable channel ch of loop
DSYL loop	Disable yellow alarm processing for loop
ENCH loop	Enable all channels on 2.0 Mb/s DTI/PRI
ENCH l ch	Enable channel ch of DTI/PRI loop
ENLL loop	Enable network and DTI/PRI cards of loop
ENYL loop	Enable yellow alarm processing for loop
SLFT loop	Invoke hardware self-test on loop.
SLFT l ch	Invoke partial hardware self-test on channel ch.
LCNT (loop)	List contents of alarm counters on one or all DTI/PRI loops
RLBK loop	Performs external loop back test on loop. (Card must be disabled.)
RLBK loop ch	Performs external loop back test on channel ch of loop. (Channel must be disabled.)
STAT	Get status of all loops
STAT loop	Get status of DTI/PRI loop
STAT loop ch	Get status of channel

Table 30: LD 60 Clock controller maintenance

Commands	Description
DIS CC l s	Disable system clock controller on specified superloop and shelf.
ENL CC l s	Enable system clock controller on specified superloop and shelf.
SSCK l s	Get status of system clock on specified superloop and shelf
TRCK aaa l s	Set the clock controller tracking to primary, secondary or free run Where aaa is: PCK = track primary clock SCLK = track secondary clock FRUN = free run mode

LD 96 D-Channel and MSDL maintenance

Table 31: LD 96 D-Channel and MSDL maintenance

Commands	Description
DIS DCH x	Disable DCH x.
ENL DCH x (FDL)	Enable DCH x and attempt to establish the link, and force download to MSDL.
EST DCH x	Establish multiple frame operation on D-channel x.
RLS DCH x	Release D-channel x.
RST DCH x	Reset D-channel x, inhibit signaling.
STAT DCH (x)	Get status of one or all D-channels
STAT MON (x)	Display the incoming and outgoing monitoring status of one or all D-channels.
DIS MSDL l s c (ALL)	Disable MSDL card X
ENL MSDL l s c (FDL,ALL)	Enable MSDL card X, with or without Force Download
RST MSDL l s c	Reset MSDL card X
STAT MSDL (l s c (full))	Get MSDL status X, or a “FULL STATUS”

LD 75 IDA (DPNSS/DASS2) loop and D-channel maintenance

Table 32: LD 75 IDA (DPNSS/DASS2) loop and D-channel maintenance

Commands	Description

ENL DDSL n	Enable DDSL, port n
ENL DDCS l	Enable DDCS loop l
ENL DTRC l c	Enable real channel (loop, channel)
DIS DDSL n	Disable DDSL, port n
DIS DDCS l	Disable DDCS loop n
DISI DDCS l	Disable all channels, loop l as they become idle.
DIS DTRC l c	Disable real digital channel (loop, channel}
STAT DDSL	Give status of entire DDSL
STAT DDSL n	Give status of DDSL port n
STAT DDCS	Give status of all DDCS loops
STAT DDCS l	Give status of DDCS loop l, and a count of the number of channels in each state
STAT DTRC l c	Give status of real digital channel (loop, channel)
STRT n	Start DDSL, port n. The message “OK STARTING” is displayed and further commands may be entered. Message DTM301 is displayed when the link is started successfully.

UDT card startup and status check

UDT card PRI

Table 33: PRI startup procedure

Step	Action	Response
1	Check the status of the UDT card	The EN/DIS LED is red
2	Test the PRI loop: LD 60 DISL loop SLFT loop	SLFT OK
3	Enable the PRI loop: LD 60 ENLL loop	PRI loop is up - Remote alarm cleared
4	Enable the MSDL: ENL MSDL l s c	MSDL is enabled
5	Enable the D-channel: LD 96 ENL DCH X	DCH EST - D-channel is established (provided far-end D-channel is OK). If you do not get the DCH EST response, perform EST DCH x
6	Perform a PRI status check.	

If the PRI status is not as shown in the following table, complete the check and proceed to PRI fault clearing procedures.

Table 34: PRI status check procedure

Step	Action	Response
1	a) Check the EN/DIS status LED on UDT b) Check the associated DCH LED	The EN/DIS LED is green If the LED is Red, the MSDL is disabled.
2	Check the status of the DCH: LD 96 STAT DCH x	
3	Check the status of the PRI loop: LD 60 STAT L	
4	List PRI alarm counters: LD 60 LCNT (L) (Check the out-of-service counters)	For example: 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
5	Check the status of the DCH and MSDL: LD 96 STAT MSDL l s c FULL	The DCH status should be OPER (Operational) and EST (established).

UDT card DTI

Table 35: DTI startup procedure

Step	Action	Response
1	Check the status of the UDT card	The EN/DIS LED is red
2	Test the DTI loop: LD 60 DISL loop SLFT loop	SLFT OK
3	Enable the DTI loop: LD 60 ENLL loop	DTI loop is up - Remote alarm cleared

If the DTI status is not as shown in the following table, complete the check and proceed to DTI fault clearing procedures.

Table 36: DTI status check procedure

Step	Action	Response
1	Check the EN/DIS status LED on UDT	The EN/DIS LED is green .
2	Check the status of the DTI loop: LD 60 STAT L	
3	List DTI alarm counters: LD 60 LCNT (L) (Check the out-of-service counters)	

UDT card DPNSS/DASS2

For IDA Startup, follow the steps in the following table.

Table 37: DPNSS/DASS2 startup procedure

Step	Action	Response
1	Check the status of the DPNSS/DASS2	The EN/DIS LED is red The DCH LED is red
2	Enable DDCS: LD 75 ENL DDCS l	DDCS l is enabled
3	Enable the DDSL: LD 75 ENL DDSL n	ENBL IDLE (DDSL enabled, but all channels are disabled)
4	Enable the LAP protocols for each real and virtual channel configured on the DPNSS1/DASS2 link: LD 75 STRT n Both ends of the link should be started within 5 minutes of each other.	ENBL STARTING (The configured LAP protocols for each real and virtual channel configured on the DPNSS1/DASS2 link are being enabled) ENBL ACTIVE (The configured LAP protocols for each real and virtual channel configured on the DPNSS1/DASS2 link are enabled)

If the IDA status is not as shown in Table 38: IDA status check procedure on page 97, complete the check and proceed to IDA fault clearing procedures.

Once all problems are cleared, go to IDA start-up Table 37: DPNSS/DASS2 startup procedure on page 97.

Table 38: IDA status check procedure

Step	Action	Response
1	Check the EN/DIS and DCH LEDs on UDT card	For normal operation, both LEDs are green.
2	Check the status of DDSL: LD 75 STAT DDSL	The DDSL status should be ENBL ACTIVE (DDSL enabled, and all configured channels are normally enabled)
3	Check the status of DDCS: LD 75 STAT DDCS (n)	

Chapter 11: 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 39: Maintenance messages on page 100. Additional information on PRI and DCH messages can be found in the *Avaya Software Input Output Reference - System Messages (NN43001-712)*.

Table 39: 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 40: Maintenance message and status combinations on page 101 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 40: 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 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.

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 41: D-channel messages on page 102.

Table 41: 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 42: DTI/PRI commands (LD 60) on page 104 through Table 44: Downloadable D-channel (DDCH) commands (LD 96) on page 105 provide quick-reference lists of important DTI/PRI commands. Table 45: TMDI maintenance commands on page 106 and Table 46: D-channel monitoring commands on page 107 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 42: 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 43: D-channel commands (LD 96)

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.

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 technical document.
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 44: Downloadable D-channel (DDCH) commands (LD 96)

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.

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 45: TMDI maintenance commands

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.
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 46: 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 *Avaya Software Input Output Reference - System Messages (NN43001-712)*.

Table 47: Clock controller commands (LD 60)

Command	Action
DIS CC N	Disable clock controller N.
ENL CC N	Enable clock controller N.
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 48: NTAK09 LED states during self-test on page 108.

Table 48: NTAK09 LED states during self-test on page 108 provides the state of the NTAK09 LEDs during the self-test procedure.

Table 48: 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.

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)

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

   ```
   DSCH C CH
   ```

   `SLFT C CH` (specific channel)

DTI/PRI automatic local loopback test

There are two types of automatic local loopback tests:

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

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: DTI/PRI link diagnostic and remote loopback tests on page 111 shows the relationship between the remote loopback test and the link diagnostic test.

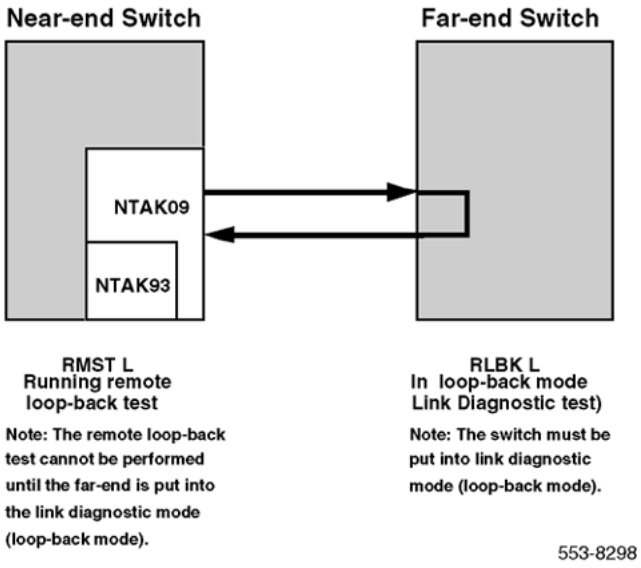


Figure 18: DTI/PRI link diagnostic and remote loopback tests

DTI/PRI error detection

Bit error rate

Bit error rate monitoring detects errors in transmission (see Figure 19: Bipolar violations on page 112). 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 tracking In a bipolar pulse stream, pulses alternate in polarity. A bipolar violation (BPV) 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 be used only if all the equipment on the T1 span (end-to-end) supports it. Otherwise, the intentional BPVs take the link down.

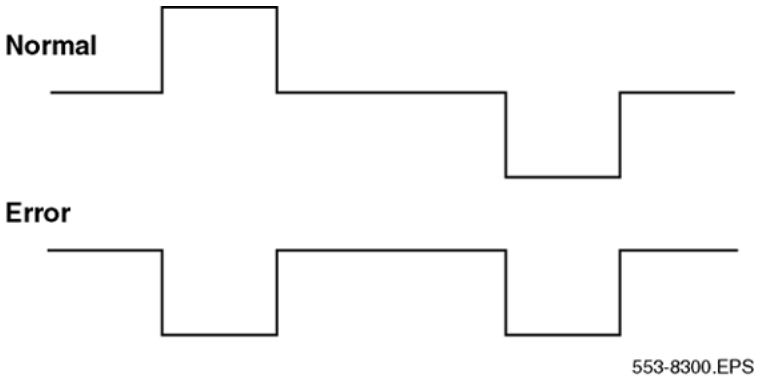


Figure 19: Bipolar violations

Cyclic Redundancy Check The 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 cyclic redundancy check (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 detects errors only 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 Table 49: Bit error rate messages on page 112.

Table 49: 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.

Refer to Figure 20: BIPV and BIPC thresholds on page 113 for BIPV and BIPC thresholds.

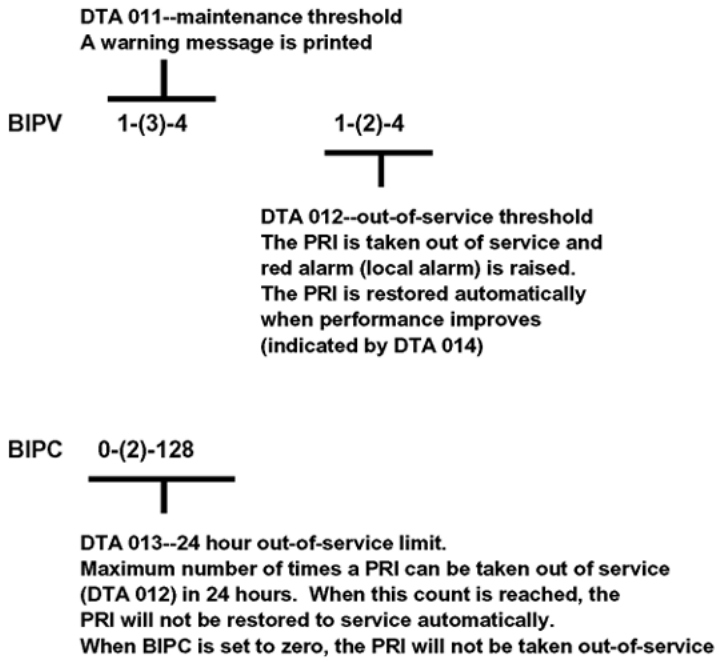


Figure 20: BIPV and BIPC thresholds

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 50: Impact of slip on service types on page 114. The degradations shown in Table 50: Impact of slip on service types on page 114 can be controlled or avoided with proper clock (network) synchronization.

Table 50: 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 the SRTK prompt. Refer to the description in LD 73. Also see Figure 21: Frame slip tracking thresholds on page 115.

Table 51: 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.

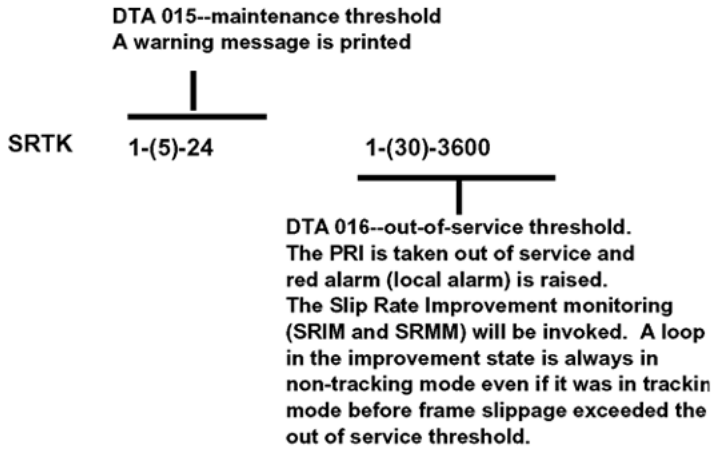


Figure 21: Frame slip tracking thresholds

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: Frame slip non-tracking thresholds on page 116 for additional information.

Table 52: 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: Frame slip non-tracking thresholds on page 116. DTA017:Frame slip — free run (non-tracking) — maintenance limit. DTA018:Frame slip — free run (non-tracking) — out-of-service limit.

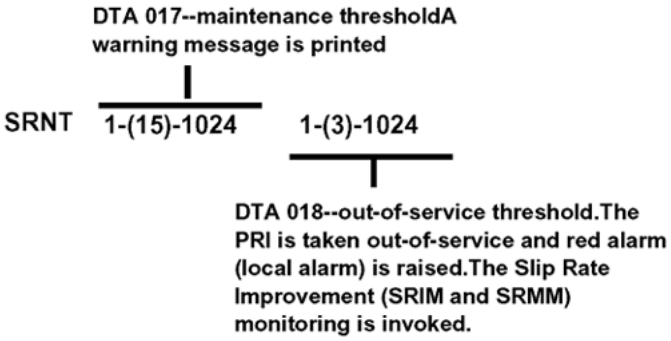


Figure 22: Frame slip non-tracking thresholds

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 54: Frame slip improvement timers on page 117.

Table 53: 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.

Prompt	Response	Description
		While waiting for Slip Rate Improvement one of three DTA messages is output as shown in Table 54: Frame slip improvement timers on page 117.

Table 54: Frame slip improvement timers

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. 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: Frame alignment thresholds on page 118 and Figure 24: Loss of frame alignment on page 118. 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: Frame alignment thresholds on page 118.

Table 55: DTA message output

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

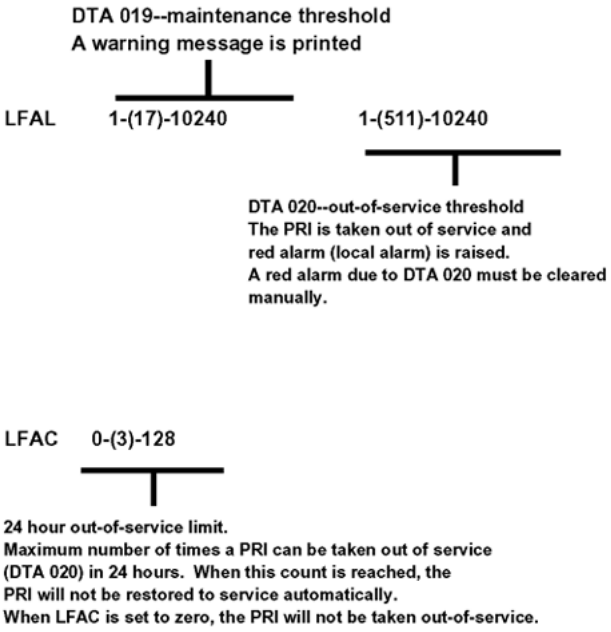


Figure 23: Frame alignment thresholds

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: Loss of frame alignment on page 118.

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 56: 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.

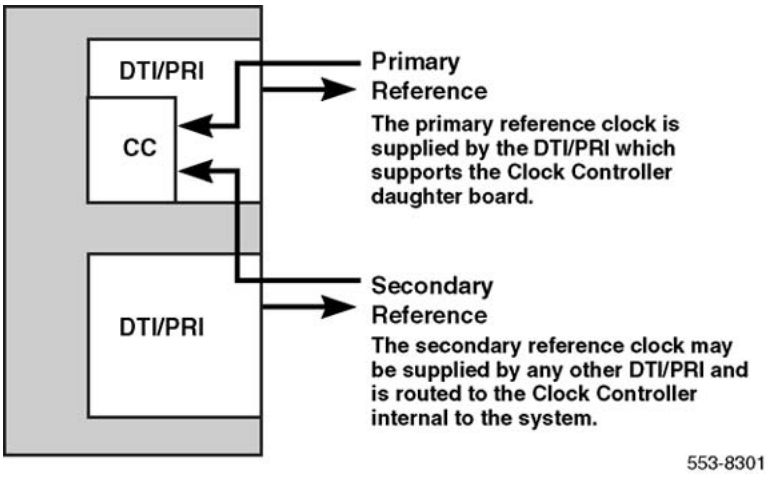


Figure 25: Clock controller primary and secondary tracking

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.

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*

   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**

   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*

   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: Wrist strap connection to the cabinet on page 122 shows the connection point for the wrist strap.

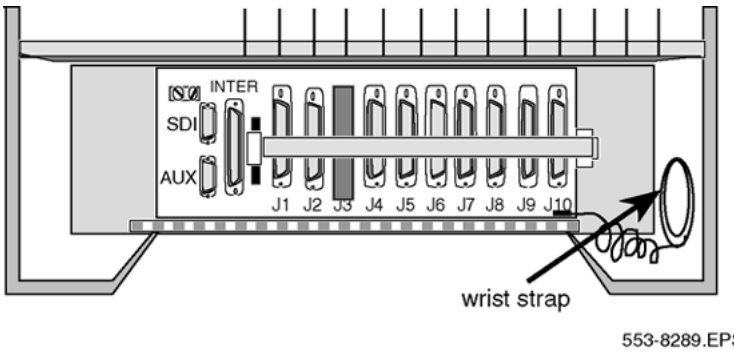


Figure 26: Wrist strap connection to the cabinet

a. 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.

b. 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 *Avaya ISDN Primary Rate Interface Installation and Commissioning (NN43001-301)*. 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.

Chapter 12: 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 57: Status messages on page 124. Additional information on DCH and PRI messages can be found in the *Avaya Software Input Output Reference - System Messages (NN43001-712)*.

Table 57: 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 58: Maintenance message and status combinations on page 124 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 58: 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 59: D-channel messages on page 125.

Table 59: 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.

Command	Description
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 60: D-channel commands (LD 96) on page 126 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 60: D-channel commands (LD 96)

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.

Command	Action
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.
STAT MSGO (N)	Print outgoing message monitor status.
TEST-100/101/200/201	See DCH tests in technical document.
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 *Avaya Software Input Output Reference - System Messages (NN43001-712)*.

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: ISL back-to-back connection on page 128 to accomplish the connection. This connection is normally done within the same system in a lab environment.

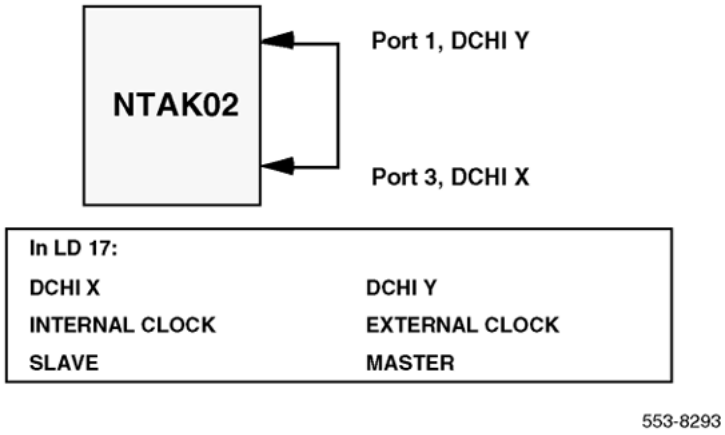


Figure 27: ISL back-to-back connection

Chapter 13: 2.0 Mb DTI maintenance

Contents

This section contains information on the following topics:

Overview

From a maintenance perspective, system Digital Trunk Interface (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.

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: Wrist strap connection to the Media Gateway Cabinet on page 130 shows the location of the wrist strap in relation to a Media Gateway cabinet.

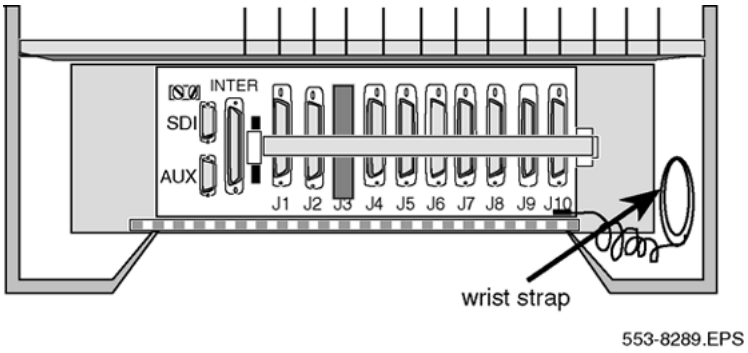


Figure 28: Wrist strap connection to the Media Gateway Cabinet

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
   ```

Monitor system DTI operation

Maintenance messages

The 2.0 Mb DTI status and error conditions are reported in the types of messages, shown in Table 61: Maintenance messages on page 131. Additional information on DTI messages is found in the *Avaya Software Input Output Reference - System Messages (NN43001-712)*.

Table 61: 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 2.0 Mb DTI tests on page 137.

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 62: Grade-of-service messages on page 131.

Table 62: 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). See Figure 29: Bipolar violations on page 133.

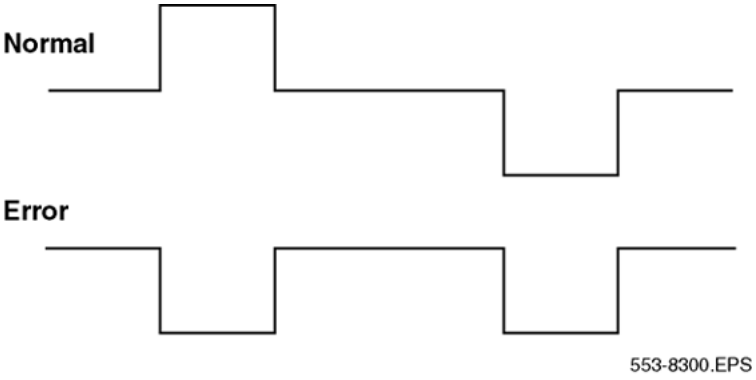


Figure 29: Bipolar violations

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 detects errors only 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 63: Performance impact of one slip on page 133 can be controlled or avoided by proper clock (network) synchronization.

Table 63: 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.

Service	Potential impact
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 "one". 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 64: NTAK10 faceplate LEDs on page 136 shows the LEDs found on the NTAK10 2.0 Mb DTI circuit card and the meaning of each.

Table 64: NTAK10 faceplate LEDs

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.
	Off	No far-end alarm.
LBK	On (Yellow)	NTAK10 2.0 Mb DTI is in loopback mode.
	Off	NTAK10 2.0 Mb DTI is not in loopback 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 LD 60 tables on page 167 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.

Table 65: 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.

Table 66: LD 60 - Clock controller commands

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

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.

Performing Self-test/local 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)

The self-test failure codes for NTAK10 2.0 Mb DTI are outlined in Table 67: Self-test failure codes for NTAK10 2.0 Mb DTI on page 138.

Table 67: Self-test failure codes for NTAK10 2.0 Mb DTI

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.

	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. 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. 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.
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): 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: Near-end trunk loopback on page 142.

The commands for a near-end per-loop loopback test are shown in Table 68: LD 60 - Perform a near-end per-loop loopback test. on page 142.

Table 68: 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 shown in Table 69: LD 6o - Perform a near-end per-channel loopback test. on page 142.

Table 69: 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

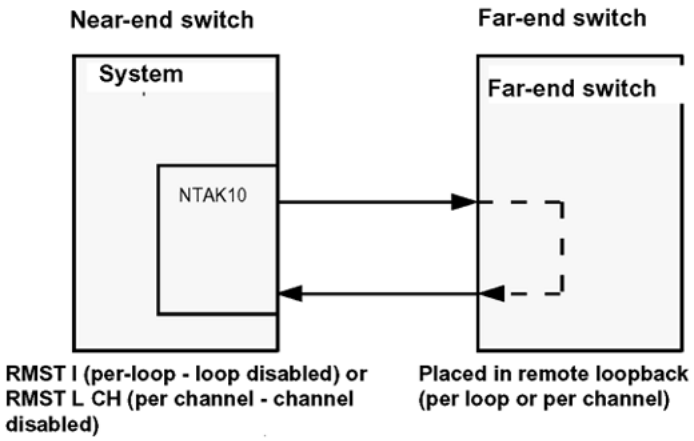


Figure 30: Near-end trunk loopback

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: Far-end trunk loopback on page 143.

The commands for a near-end per-loop loopback test are shown in Table 70: LD 60 - Perform a near-end per-channel loopback test. on page 143.

Table 70: 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 shown in Table 71: LD 60 - Perform a far-end per-channel loopback test. on page 143.

Table 71: 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

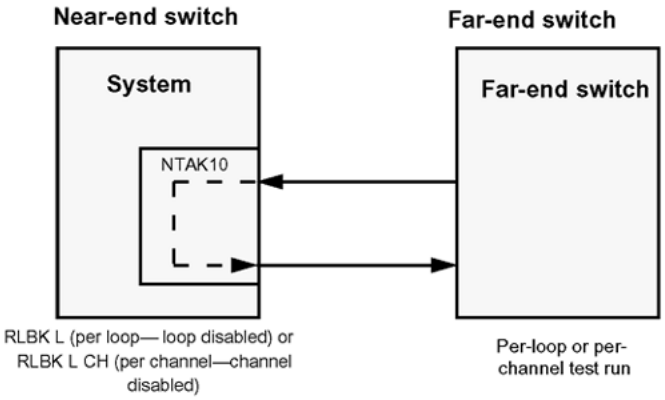


Figure 31: Far-end trunk loopback

Chapter 14: 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.

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).

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).

Disable the 2.0 Mb PRI before removal

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

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.

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.

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 72: Maintenance message status on page 148 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 72: 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 PRI 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: Bipolar violations on page 150. 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.

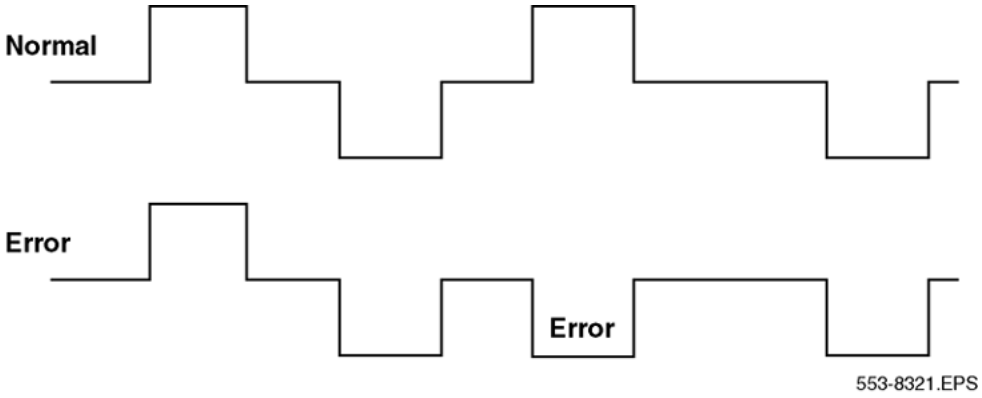


Figure 32: Bipolar violations

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.

Table 73: LD 73 - Program group I thresholds

Prompt	Response	Description
REQ	CHG	Request a Change
TYPE	PRI2	Primary Rate Interface 2
FEAT	LPTI	Loop Timer
...		
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 74: Performance impact of one slip on page 153 for the impact of one slip on various types of data.

All the degradations shown in Table 74: Performance impact of one slip on page 153 can be controlled or avoided by proper clock (network) synchronization.

Table 74: 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.

Table 75: 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.

Table 76: LD 73 - Define group 2 error thresholds

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	• 20 = Error count value • 100s = Maintenance threshold • 12s = NNDC threshold • 12s = NNC threshold • 4s = OOS threshold (Aggregate count default [20x128ms = 2.5sec])

Prompt	Response	Description
...		
OOS2	1-(15)-255s	Out-of-Service threshold
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 77: NTAK79 faceplate LEDs on page 156.

Table 77: NTAK79 faceplate LEDs

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.
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.

LED	State	Definition
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 loopback mode.
	Off	NTAK79 2.0 Mb PRI is not in loopback 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.
	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 78: NTBK50 faceplate LEDs on page 157.

Table 78: NTBK50 faceplate LEDs

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 out-of-service LED is Red.

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 loopback mode.
	Off	NTBK50 2.0 Mb PRI is not in loopback 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.
	Off	The clock controller is not equipped.
DCH	On (Red)	DCH is disabled.
	On (Green)	DCH is enabled, but not necessarily established.
	Off	DCH is not equipped.

System PRI maintenance tools

Table 79: 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.

Command	Action
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 *Avaya Software Input Output Reference - System Messages (NN43001-712)*.

DCHI commands

D-channel commands are found in LD 96. Table 80: DCHI commands on page 159 provides a quick-reference list of D-channel commands.

Table 80: 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 *Avaya Software Input Output Reference - Maintenance (NN43001-711)*.

DDCH commands

Downloadable D-channel commands are found in LD 96. Table 81: DDCH commands on page 160 provides a quick-reference list of D-channel commands with minor modification.

Table 81: 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 *Avaya Software Input Output Reference - Maintenance (NN43001-711)*.

Clock controller commands

Clock controller (CC) commands are accessed in LD 60. Table 82: Clock controller commands on page 161 provides a quick-reference list of clock controller commands.

Table 82: 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 83: Self-test error codes on page 161 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 83: Self-test error codes

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.

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

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.

Self-testing the 2.0 Mb PRI

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
   ```

2.0 Mb PRI automatic loop test

This procedure is not recommended since it causes a Yellow alarm 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 loopback 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 loopback test, does not test the system 2.0 Mb PRI. It puts the 2.0 Mb PRI in loopback mode so a remote loopback test can be performed on equipment at the far end. Refer to Figure 33: 2.0 Mb PRI link diagnostic (far-end loopback) test on page 163.

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

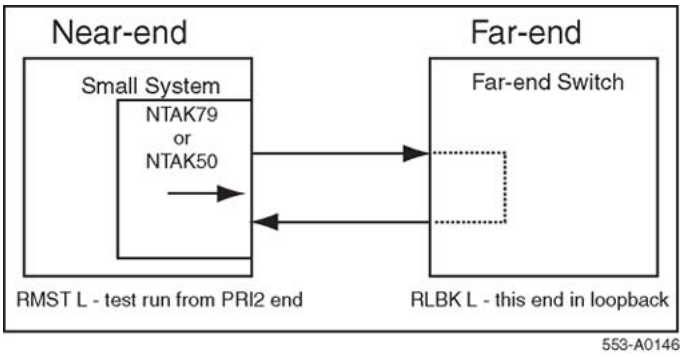


Figure 33: 2.0 Mb PRI link diagnostic (far-end loopback) test

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 loopback 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 loopback test:

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

Remote loopback test

The remote loopback test, also called the near-end loopback test, checks the integrity of the 2.0 Mb PRI from the system to the far end. The far end must be in loopback mode before this test can be performed. Refer to Figure 34: 2.0 Mb PRI remote loopback test on page 164.

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

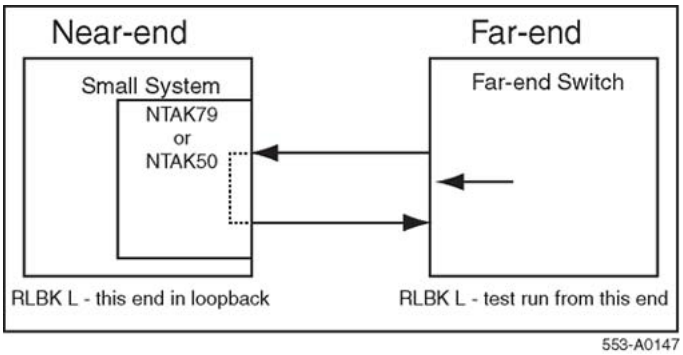


Figure 34: 2.0 Mb PRI remote loopback test

Coordinating the remote loopback tests

When a technician at the far end asks for loopback 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
```

Chapter 15: 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 technical document reference for maintenance messages, and maintenance testing information.

This chapter provides the information required to implement ISL on the system including:

- hardware and software installation
- implementation of components needed to provide basic call service

ISDN features are treated separately in the chapter devoted to ISDN feature implementation.

This chapter assumes that ESN implementation is already in place. It also assumes that the reader has a basic understanding of NARS and CDP.

Two modes of ISL are available: shared and dedicated. This chapter covers ISL installation in dedicated mode using dedicated and leased lines. Shared mode installations are done according to the instructions supplied for PRI, with the noted exceptions.

ISL hardware requirements

ISL, regardless of the operation mode, uses analogue or digital TIE lines as B-channels.

ISL in shared mode

In shared mode, PRI hardware is required in addition to the existing TIE lines interface cards.

- NT8D15 Analogue trunk card(s)
- NTAK02 SDI/DCH, NTAK10 2.0 Mb DTI, NTAK79 2.0 Mb PRI, or NTBK50 2.0 Mb PRI card(s)

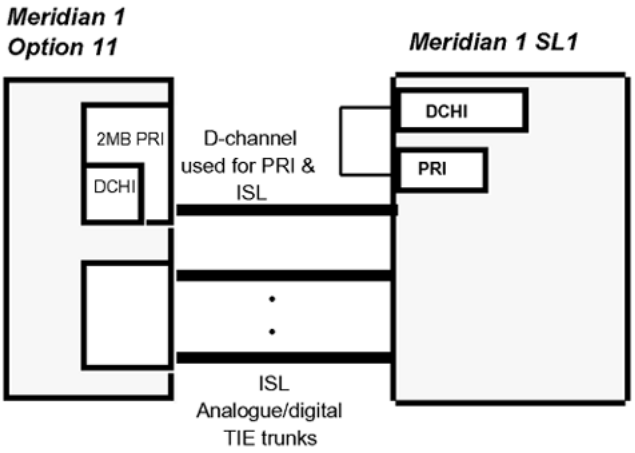


Figure 35: ISL in shared mode

ISL in dedicated mode using leased line

The following hardware is required:

- NTAK02 SDI/DCH D-channel handler interface
- A modem capable of the following: (such as Ventel 2400-33 or 2400 Plus II)
  - minimum of 2400 baud
  - synchronous operation
  - must support leased line (also known as private line or point-to-point) operation

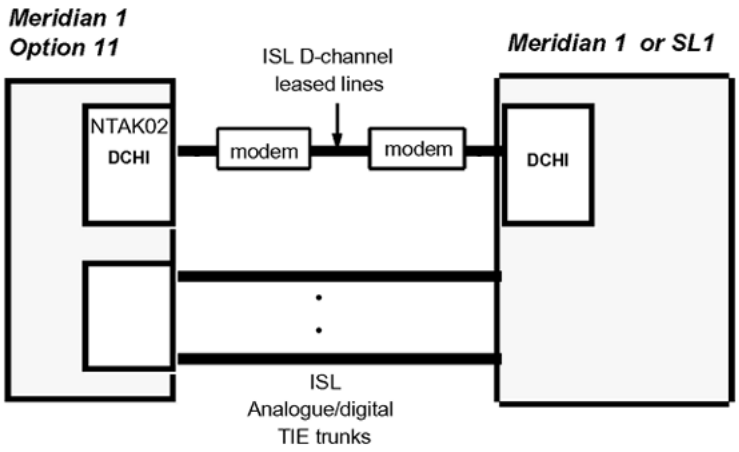


Figure 36: ISL in dedicated mode using leased line

ISL in dedicated mode using dial-up modem

The requirements are as follows:

- NTAK02 SDI/DCH D-channel handler interface.
- Modems such as the Ventel 2400, Hayes 2400 (the Hayes Smartmodem 2400 cannot be used on leased lines) or Gandalf 2400 that can support 2 or 4-wire leased line operation. 4-wire operation must be specified when ordering. Otherwise, modems are factory shipped for 2-wire operation. Modems capable of the following:
  - autodial capability
  - minimum of 2400 baud
  - synchronous operation
  - programmable so that one modem originates the call while the other auto-answers
- NT8D09 500 set line card.

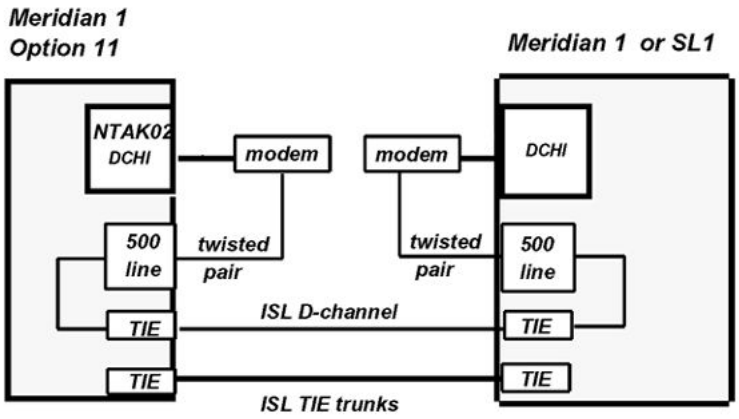


Figure 37: ISL in dedicated mode using dial-up modem

ISL hardware installation

Shared mode

The hardware installation is identical to the PRI installation, with the addition of analogue or digital TIE trunks (or both).

Dedicated mode

Installing the NTAK02

The NTAK02 connects to the modem through the NTAK19BA 4-port cable. Only ports 1 and 3 are available for use as DCHIs.

1. Set option switches/jumpers on the DCHI card, as shown in Table 84: NTAK02 switch settings on page 169 and Table 85: NTAK02 jumper settings on page 169, for mode of operation that is, RS232 or RS422 and DTE or DCE.
2. Install the NTAK02 in any spare slot 1-9 of the Option 11C main cabinet or slots 11-14 of the Media Gateway.
3. Install the NTAK19BA four port cable on the 50-pin Amphenol connector associated with the slot holding the NTAK02.

Table 84: NTAK02 switch settings

Port 0	Port 1	SW1-1	SW1-2
SDI	DCH	OFF	OFF
SDI	DPNSS1	OFF	ON
—	ESDI	ON	ON

Port 2	Port 3	SW1-3	SW1-4
SDI	DCH	OFF	OFF
SDI	DPNSS1	OFF	ON
—	ESDI	ON	ON

Table 85: NTAK02 jumper settings

Unit	Jumper location	Strap for DTE	Strap for DCE	Jumper location	RS422	RS232
Unit 0	J10	C - B	B - A			
Unit 1	J7 J6	C - B C - B	B - A B - A	J9 J8	C - B C - B	B - A B - A
Unit 2	J5	C - B	B - A			
Unit 3	J4 J3	C - B C - B	B - A B - A	J2 J1	C - B C - B	B - A B - A

Setting up the D-channel

If this is a dedicated mode installation using leased line modems, the D-channel connects the DCHI with the far-end modem over a dedicated leased line. Synchronous modems with a minimum 2400 baud data rate must be configured. Modems must support leased line capability and synchronous mode. The Hayes Smartmodem 2400 cannot be used on leased lines.

If this a dedicated mode using dial-up modems, modems such as Hayes 2400, Ventel 2400 or Gandalf 2400 can be used. In this configuration, the DCHI connects to a modem which is connected to a 500 set line card. The call connects to the far-end through the 500 set-to-TIE trunk path.

Program the modem at one end in the auto-dial mode, so it automatically initiates a call to the other end at power up. The auto-dial number must be coordinated with the far-end switch. The originating modem has this auto-dial number stored internally as part of the modem configuration routine.

The far-end modem need only be set up for auto-answer.

ISL software implementation

There are two modes of ISDN Signaling Link (ISL) operation, shared mode and dedicated mode.

Shared mode

The NTAK79 on-board DCHI supports ISDN PRI signaling and ISL trunks. The configuration is basically the same as the PRI D-channel, with the D-channel also supporting ISL trunks.

The DTI/PRI software implementation sequence can be used (refer to the appropriate chapters for more information) with the following exceptions.

Table 86: LD 17 - Shared mode

Prompt	Response	Description
USR	SHA	D-channel for ISL in "shared" mode, used for both ISDN PRI and ISL.
ISLM	1-240	Number of ISL B-channel (trunks) controlled by the D-channel (no default value).

Table 87: LD 16 - Interface type

Prompt	Response	Description
IFC	SL1	Interface type must be SL1 (this is the only type supported for ISL).
MODE	ISLD	TIE route used for ISL members.

Table 88: LD 14 - Channel identifier

Prompt	Response	Description
CHID	1-240	Channel identifier for ISL channels. Must be coordinated with the far-end.

Dedicated mode

The DCHI uses the NTAK02 circuit card and does not support ISDN PRI signaling. The DCHI is reserved for ISL use only. The D-channel can communicate with the far-end by means of a dedicated leased line modem or dial-up modem.

Note that the following implementation relates to analogue TIE trunks being used as B-channels. In the case where DTI/PRI trunks are also used, then LD 17 digital loop (2.0 Mb PRI) and LD73 (2.0 Mb PRI/SYTI) must also be configured with the appropriate clocking and threshold settings.

For ISL dedicated mode using a dial-up modem, a 500 set, TIE trunk route and member must be programmed (used for D-channel). Table 89: Configuring basic ISL capability on page 171 summarizes the required steps.

Table 89: Configuring basic ISL capability

Step	LD	Action
1	17	Configure the D-channel for ISL use.
2	15	Enable ISDN option.
3	16	Enable the ISL option on a per route basis, assign a D-channel for each route.
4	14	Assign a channel identification to each trunk with the ISL option.

Table 90: LD 17 - Configure the D-channel for ISL

Prompt	Response	Description
REQ	CHG	Change data.
TYPE	CFN	Configuration data block.
ADAN	NEW DCH 0-79	Add primary D-channel.
CTYP	DCHI	D-channel card type.
CDNO	Option 11C: 1-9, 11-19, 21-29, 31-39, 41-49 CSE 1000: 11-14, 21-24, 31-34, 41-44	Card slot in which the card supporting the DCHI resides.
PORT	1	Must be set to 1.
USR	PRI	D-channel for ISDN PRI only.
IFC	SL1	Interface type.
DCHL	1-9	PRI2 card number. (Must match entry for CDNO).
SIDE	NET (USR)	Net: network, the controlling switch. User: slave to controller.
RLS	XX	Software release of far-end. This is the current software release of the far-end. If the far-end has an incompatible release of software, it prevents the

Prompt	Response	Description
		sending of application messages. For example, for Network Ring Again.
CLOK		D-channel clock type for signaling.
	EXT	Source of D-channel clock is external to DCHI card (in this case the DTI/PRI circuit card). Normally, EXT is used for PRI/ISL. **Note:** Do not confuse this clock with the E1 span Clock Controller found on the NTAK10/79. This clock is in reference to the DCHI synchronous mode of operation. **Note:** If directly connecting two DCHI ports with out the use of modems, set "CLOK" to "EXT" on one side and "INT" on the other.
LAPD	YES,(NO)	Change LAPD parameters. Simply carriage return if timers are to be left at default value. The following timers are prompted only if LAPD is set to YES. The following can all be left at default during initial set-up.
T23	1-(20)-31	Interface guard timer checks how long the interface takes to respond. In units of 0.5 seconds (default 20 = 10 seconds).
T200	2-(3)-40	Retransmission timer in units of 0.5 seconds (default 3 = 1.5 seconds).
N200	1-(3)-8	Maximum number of retransmissions.
N201	4(260)	Maximum number of octets in information field.
K	1-(7)-32	Maximum number of outstanding unacknowledged frames (NAKS).

Table 91: LD 15 - Enable the ISDN option

Prompt	Response	Description
REQ:	NEW CHG	Add new data. Change existing data.
TYPE:	NET	Networking data.
CUST	0-31	Customer number.
ISDN	YES	Customer is equipped with ISDN.
PNI	1-32700	Customer private network identifier. MUST be unique to this customer in the private network. Used as part of the setup message for feature operation such as Network Ring Again and Network ACD.

Prompt	Response	Description
HNPA	NPA	Telephone area code for this system. Sent as part of setup message as CLID.
HNXX	NXX	Telephone local exchange code for this system. Sent as part of setup message for calling line identification.
HLOC	XXX	Home location code (NARS).
LSC	1-9999	One to four digit Local Steering Code established in the Coordinated Dialing Plan (CDP). The LSC prompt is required for Calling Line ID and Network ACD.
AC2		Access Code 2. Enter call types (type of number) that use access code 2. Multiple responses are permitted. This prompt only appears on NARS equipped systems. If a call type is not entered here, it is automatically defaulted to access code 1.
	NPA	E.164 National.
	NXX	E.164 Subscriber.
	INTL	International.
	SPN	Special Number.
	LOC	Location Code.

Table 92: LD 16 - Enable the ISL option

Prompt	Response	Description
REQ	NEW CHG	Add new data. Change existing data.
TYPE	RDB	Route data block.
CUST	0-31	Customer number.
ROUT	0-127	Route number.
TKTP	TIE	TIE trunk route.
DTRK	YES NO	Enter YES if this is a Digital Trunk Interface (DTI or PRI).
ISDN	YES	ISDN option.
MODE	ISLD	Route for ISL application.
DCHI	XX	DCHI port number in CFN to carry the D-channel for this TIE trunk route.
PNI	1-32700	Customer private network identifier. Must be the same as the CDB PNI at the fa- end.
IFC		Interface type.

Prompt	Response	Description
	SLI	System to system.
CTYP	aaa <CR>	Call Type. Enter the call type to be associated with the outgoing route for direct dialing using the trunk access code (instead of NARS access code).
INAC	YES	Insert Access Code. Permits the NARS AC1 or AC2 access code to be re-inserted automatically on an incoming ESN call.

Table 93: LD 14 - Assign a channel identifier

Prompt	Response	Description
REQ	NEW CHG	Add new data. Change existing data.
TYPE	TIE	TIE trunk type.
TN	c u	Card and unit to be associated with this trunk.
RTMB	0-127 1-510	Route number and member number.
CHID	1-240	Channel identifier for ISL channels (remove with Xnn). Must be coordinated with far-end (no default value).

ISL maintenance

DCHI quick reference

Table 94: D-channel commands (LD 96) on page 174 provides a quick-reference list of D-channel commands (LD 96).

Table 94: D-channel commands (LD 96)

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.

Command	Action
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 *Avaya Software Input Output Reference - System Messages (NN43001-712)*.

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 38: ISL back-to-back connection on page 176 illustrates the connection.

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

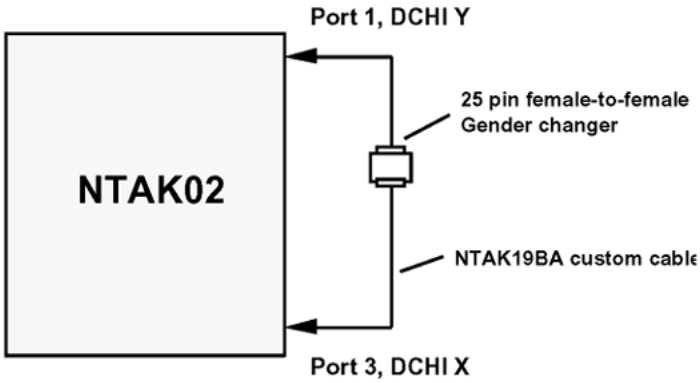


Figure 38: ISL back-to-back connection

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.

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