Circuit Card Reference
Avaya Communication Server 1000

Release 7.6
NN43001-311
Issue 06.01
March 2013

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Contents

Chapter 1: New in this release

The following sections detail what is new in *Circuit Card Reference, NN43001–311* for Avaya Communication Server 1000 (Avaya CS 1000) Release 7.6.

- Features on page 23
- Other changes on page 23

Features

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

Other changes

There are no other changes for this release.

Revision history

March 2013	Standard 06.01. This document is up-issued to support Avaya Communication Server 1000 Release 7.6.
November 2012	Draft 06.01.AD. This document is up-issued to support Avaya Communication Server 1000 Release 7.6.
April 2012	Standard 05.07. This document is up-issued to include information about the installation of a surge suppressor cable with certain trunk cards.
January 2012	Standard 05.06. This document was up-issued to indicate the following changes: • Removal of End of Life (EoL) and Manufactured Discontinued (MD) hardware content and associated diagrams. • Global Analog Line Card updates

October 2011	Standard 05.05. This document was up-issued to support the removal of content for outdated features, hardware, and system types.
July 2011	Standard 05.04. This document is up-issued to include updates to the MGU chapter.
May 2011	Standard 05.03. This document is up-issued to include updates to the NT7K20 Global Analog Line 3 Card and Option settings chapters.
November 2010	Standard 05.02. This document is issued to support Avaya Communication Server 1000 Release 7.5.
November 2010	Standard 05.01. This document is up-issued to support Avaya Communication Server 1000 Release 7.5.
June 2010	Standard 04.02. Up-issued to correct a typographical error.
June 2010	Standard 04.01. Up-issued to reflect changes in technical content.
October 2009	Standard 03.07. Up-issued to reflect changes in technical content.
September 2009	Standard 03.06. Up-issued to reflect changes in technical content.
September 2009	Standard 03.05. Up-issued to reflect updates to content.
September 2009	Standard 03.04. Up-issued to reflect changes in technical content.
July 2009	Standard 03.03. This document is up-issued to correct the heading of table NT8D17 Conference/TDS card.
May 2009	Standard 03.02. This document is up-issued to include CP PM memory upgrade information.
May 2009	Standard 03.01. This document is up-issued to support Communication Server 1000 Release 6.0. This NTP may contain information on or refer to products and naming conventions that are not supported in this release. This information is included for legacy purposes and convenience only. This includes but is not limited to items such as: SSC; ISP 1100; ITG Pentium cards; and Media Cards running certain IP Line applications.
February 2010	Standard 02.09. This document is up-issued to update information about jumper settings for NT8D02GA, NT8D02HA, and NT8D02HAE5 Digital Line Cards.
July 2009	Standard 02.08. This document is up-issued to correct the heading of table NT8D17 Conference/TDS card.
April 2009	Standard 02.07. This document is up-issued to replace NTBK51AA with NTBK51AA/NTBK51CA for Release 5.5.

August 2008	Standard 02.06. This document is up-issued to include additional information in the section 'Jumper and switch settings' for Release 5.5.
December 2007	Standard 02.05. This document is up-issued to support Communication Server Release 5.5.
May 2008	Standard 01.04. This document is up-issued to include information in the NT8D02 and NTDK16 Digital Line cards on page 365 section.
February 2008	Standard 01.03. This document has been up-issued to include information about additional jumper settings for NT8D22AD/ NT8D22ADE5.
June 2007	Standard 01.02. This document is up-issued to reflect changes in technical content for CoreNet shelf supporting CP PII and CP PIV function.
May 2007	Standard 01.01. This document is up-issued to support Communication Server 1000 Release 5.0. This document contains information previously contained in the following legacy document, now retired, Circuit Card (553-3001-211).
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 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:

- *Line Cards: Description* (553-3001-105)
- *Trunk Cards: Description* (553-3001-106)
- *Serial Data Interface Cards: Description* (553-3001-107)
- *NT7D16 Data Access Card: Description and operation* (553-3001-191)
- *Multi-purpose Serial Data Link: Description* (553-3001-195)
- *Circuit Cards: Installation and Testing* (553-3001-211)
- *Option 11C and 11C mini Technical Reference Guide* (553-3011-100) (Content from *Option 11C and 11C mini Technical Reference Guide* (553-3011-100) also appears in *Avaya Telephones and Consoles Fundamentals , NN43001-567*
- *Circuit Card Reference* (553-3023-211)

Chapter 2: Customer service

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Navigation

- Getting technical documentation on page 27
- Getting product training on page 27
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Chapter 3: Introduction

Subject

This document describes the circuit cards supported for Avaya Communication Server 1000 (Avaya CS 1000).

Note on legacy products and releases

This technical publication contains information about systems, components, and features that are compatible with Avaya CS 1000 software. For more information about legacy products and releases, click **Documentation**, under **Support** on the Avaya home page:

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Applicable systems

This document applies to the following systems:

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

System migration

When particular Meridian 1 systems are upgraded to run Avaya CS 1000 Release 7.0 software and configured to include a Signaling Server, they become Communication Server 1000 systems. Table 1: Meridian 1 systems to Avaya CS 1000 systems on page 30 lists each Meridian 1 system that supports an upgrade path to a Communication Server 1000 system.

Table 1: Meridian 1 systems to Avaya CS 1000 systems

This Meridian 1 system	Maps to Avaya Communication Server 1000 system
Meridian 1 PBX 11C Chassis	Avaya Communication Server 1000E
Meridian 1 PBX 11C Cabinet	Avaya Communication Server 1000E
Meridian 1 PBX 61C	Avaya Communication Server 1000M Single Group
Meridian 1 PBX 81C	Avaya Communication Server 1000M Multi Group

For more information, see:

- *Avaya Communication Server 1000M and Meridian 1 Large System Upgrades Overview, NN43021-458*
- *Avaya Communication Server 1000E Software Upgrades , NN43041-458*,
- *Avaya Communication Server 1000E Upgrade — Hardware Upgrade Procedures , NN43041-464*

Intended audience

This document is intended for individuals responsible for maintaining Communication Server 1000 and Meridian 1 systems.

Conventions

Terminology

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

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

Unless specifically stated otherwise, the term Element Manager refers to the Communication Server 1000 Element Manager.

In this document, the Media Gateway 1000E (MG 1000E) and Media Gateway 1010 (MG 1010) are referred to generically as Media Gateway.

The following systems are referred to generically as Media Gateway:

- MG 1000E chassis (NTDK91) and Expander chassis (NTDK92) - legacy hardware
- MG 1000E chassis (NTDU14) and Expander chassis (NTDU15)
- MG 1010 chassis (NTC310)

Related information

This section lists information sources that relate to this document.

Technical documentation

This document references the following technical documents:

- *Features and Services Fundamentals, NN43001-106*
- *Unified Communications Management Common Services Fundamentals, NN43001-116*
- *IP Peer Networking Installation and Commissioning, NN43001-313*
- *Linux Platform Base and Applications Installation and Commissioning, NN43001-315*
- *Hospitality Features Fundamentals, NN43001-553*

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Chapter 4: Overview

Contents

This section contains information on the following topics:

Line cards

The following line cards are designed using the Intelligent Peripheral Equipment (IPE) architecture and are recommended for use in all new system designs.

Each of the line cards was designed to fit a specific system need. Table 2: Line card characteristics on page 34 lists the line card characteristics.

Table 2: Line card characteristics

Part Number	Description	Lines	Line Type	Message Waiting	Supervised Analog Lines	Architecture
NT1R20	Off-premise station analog line card	8	Analog	Interrupted dial tone	Yes	IPE
NT5D11	Lineside T1 Interface card	24	T1	None	Yes	IPE
NT5D33/34	Lineside E1 Interface card	30	E1	None	Yes	IPE
NT8D02	Digital Line card (16 voice/16 data)	16	Digital	Message waiting signal forwarded to digital phone for display	No	IPE
NT8D09	Analog Message Waiting Line card	16	Analog	Lamp	No	IPE

NT1R20 Off-Premise Station Analog Line card

The NT1R20 Off-Premise Station (OPS) Analog Line card is an intelligent eight-channel analog line card designed to be used with 2-wire analog terminal equipment such as analog (500/2500-type) telephones and analog modems. Each line has integral hazardous and surge voltage protection to protect the system from damage due to lightning strikes and accidental power line connections. This card is normally used whenever the phone lines leave the building in which the switch is installed. The OPS line card supports message waiting notification by interrupting the dial tone when the receiver is first picked up. It also provides battery reversal answer and disconnect analog line supervision and hook flash disconnect analog line supervision features.

NT5D11 and NT5D14 Lineside T1 interface card

The NT5D11/14 Lineside T1 Interface card is an intelligent 24-channel digital line card that is used to connect the switch to T1-compatible terminal equipment on the lineside. The T1-compatible terminal equipment includes voice mail systems, channel banks containing FXS cards, and key systems such as the Avaya. The Lineside T1 card differs from trunk T1 cards in that it supports terminal equipment features such as hook-flash, transfer, hold, and conference. It emulates an analog line card to the system software.

NT5D33 and NT5D34 Lineside E1 Interface card

The NT5D33/34 Lineside E1 Interface card is an intelligent 30-channel digital line card that is used to connect the switch to E1-compatible terminal equipment on the lineside. The E1-compatible terminal equipment includes voice mail systems. The lineside E1 card emulates an analog line card to the system software.

NT8D02 Digital Line card

The NT8D02 Digital Line card is an intelligent 16-channel digital line card that provides voice and data communication links between Avaya Communication Server (Avaya CS)1000E, Avaya CS 1000M, and Meridian 1switch and modular digital telephones. Each of the 16 channels support voice-only or simultaneous voice and data service over a single twisted pair of standard telephone wire.

NT8D09 analog message waiting line card

The NT8D09 Analog Message Waiting Line card is an intelligent 16-channel analog line card designed to be used with 2-wire terminal equipment such as analog (500/2500-type) telephones, modems, and key systems. This card can also provide a high-voltage, low-current signal on the Tip and Ring pair of each line to light the message waiting lamp on phones equipped with that feature.

Installation

This section provides a high-level description of how to install and test line cards.

IPE line cards can be installed in any slot of the NT8D37 IPE module. Figure 1: IPE line cards shown installed in an NT8D37 IPE module on page 36 shows where an IPE line card can be installed in an NT8D37 IPE module.

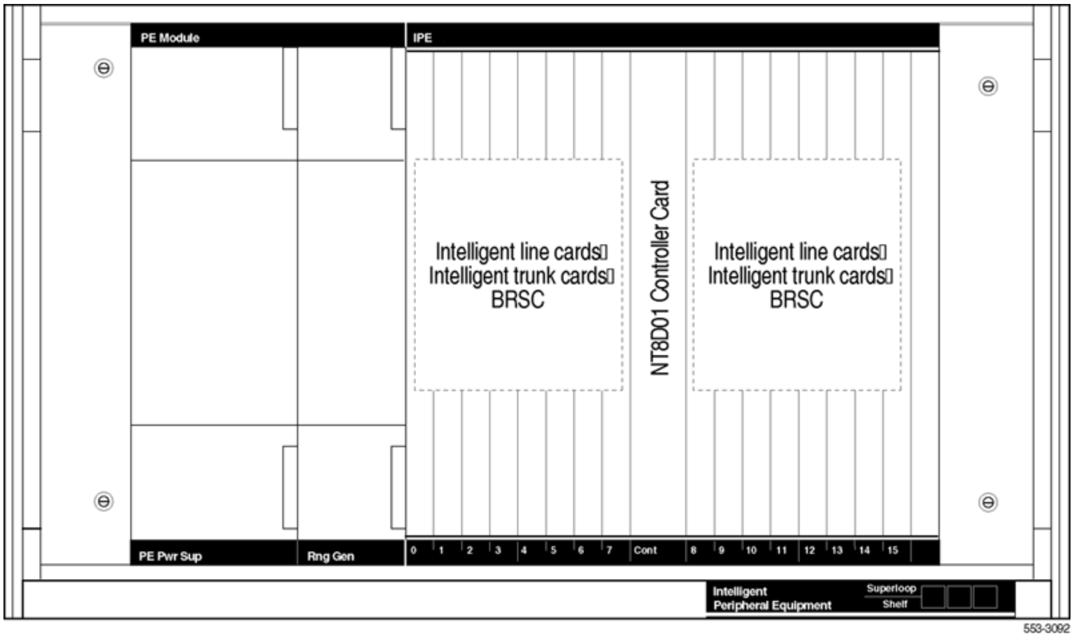


Figure 1: IPE line cards shown installed in an NT8D37 IPE module

When installing line cards, follow these general procedures:

1. Configure the jumpers and switches on the line card (if any) to meet system needs.
2. Install the line card into the selected slot.
3. Install the cable that connects the backplane connector on the IPE module to the module I/O panel.
4. Connect a 25-pair cable from the module I/O panel connector to the Main Distribution Frame (MDF).
5. Connect the line card output to the selected terminal equipment at the MDF.
6. Configure the individual line interface unit using the Analog (500/2500-type) Telephone Administration program LD 10 for analog line interface units and Multi-line Telephone Administration program LD 11 for digital line interface units.

Once these steps are complete, the terminal equipment is ready for use.

Operation

This section describes how line cards fit into the CS 1000E, CS 1000M, and Meridian 1 architecture, the busses that carry signals to and from the line cards, and how they connect to terminal equipment. These differences are summarized in Table 3: IPE module architecture on page 37.

Host interface bus

Cards based on the IPE bus use a built-in microcontroller. The IPE microcontroller is used to do the following:

- perform local diagnostics (self-test)
- configure the card according to instructions issued by the system
- report back to the system information such as card identification (type, vintage, and serial number), firmware version, and programmed configuration status)

Table 3: IPE module architecture

Parameter	IPE
Card Dimensions	31.75 x 25.4 x 2.2 cm (12.5 x 10.0 x 0.875 in.).
Network Interface	DS-30X Loops
Communication Interface	card LAN Link
Microcontroller	8031/8051 Family
Peripheral Interface card	NT8D01 Controller card
Modules	NT8D37 IPE module

Intelligent Peripheral Equipment

IPE line cards all share a similar architecture. Figure 2: Typical IPE analog line card architecture on page 39 shows a typical IPE line card architecture. The various line cards differ only in the number and types of line interface units.

The switch communicates with IPE modules over two separate interfaces. Voice and signaling data are sent and received over DS-30X loops, and maintenance data is sent over a separate asynchronous communication link called the card LAN link.

Signaling data is information directly related to the operation of the telephone line. Some examples of signaling commands include:

- off-hook/on-hook
- ringing signal on/off
- message waiting lamp on/off

Maintenance data is data relating to the configuration and operation of the IPE card, and is carried on the card LAN link. Some examples of maintenance data include:

- polling
- reporting of self-test status
- CP initiated card reset
- reporting of card ID (card type and hardware vintage)
- reporting of firmware version
- downloading line interface unit parameters
- reporting of line interface unit configuration
- enabling/disabling of the DS-30X network loop bus
- reporting of card status or T1 link status

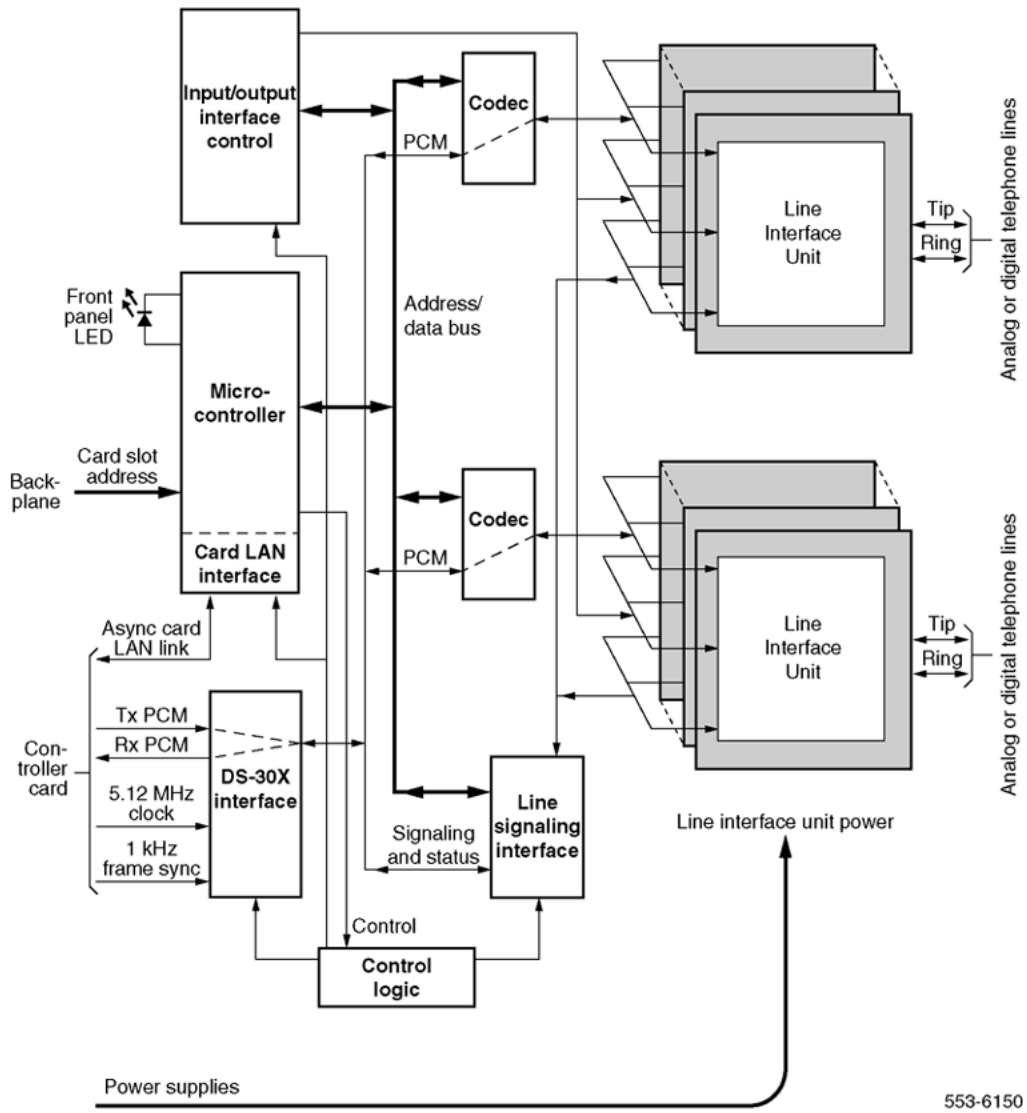


Figure 2: Typical IPE analog line card architecture

DS-30X loops

The line interfaces provided by the line cards connect to conventional 2-wire (tip and ring) line facilities. IPE analog line cards convert the incoming analog voice and signaling information to digital form and route it to the Call Server over DS-30X network loops. Conversely, digital voice and signaling information from the Call Server is sent over DS-30X network loops to the analog line cards where it is converted to analog form and applied to the line facility.

IPE digital line cards receive the data from the digital phone terminal as 512 kHz Time Compressed Multiplexed (TCM) data. The digital line card converts that data to a format compatible with the DS-30X loop and transmits it in the next available timeslot. When a word is received from the DS-30X loop, the digital line card converts it to the TCM format and transmits it to the digital phone terminal over the digital line facility.

A separate dedicated DS-30X network loop is extended between each IPE line/trunk card and the controller cards within an IPE module. A DS-30X network loop is composed of two synchronous serial data buses. One bus transports in the Transmit (Tx) direction towards the line facility and the other in the Receive (Rx) direction towards the CS 1000E, CS 1000M, and Meridian 1.

Each bus has 32 channels for Pulse Code Modulated (PCM) voice data. Each channel consists of a 10-bit word. See Figure 3: DS-30X loop data format on page 40. Eight of the 10 bits are for PCM data, one bit is the call signaling bit, and the last bit is a data valid bit. The eight-bit PCM portion of a channel is called a timeslot. The DS-30X loop is clocked at 2.56 Mbps (one-half the 5.12 MHz clock frequency supplied by the controller card). The timeslot repetition rate for a single channel is 8 kHz. The controller card also supplies a locally generated 1 kHz frame sync signal for channel synchronization.

Signaling data is transmitted to and from the line cards using the call signaling bit within the 10-bit channel. When the line card detects a condition that the switch needs to know about, it creates a 24-bit signaling word. This word is shifted out on the signaling bit for the associated channel one bit at a time during 24 successive DS-30X frames. Conversely, when the switch sends signaling data to the line card, it is sent as a 24-bit word divided among 24 successive DS-30X frames.

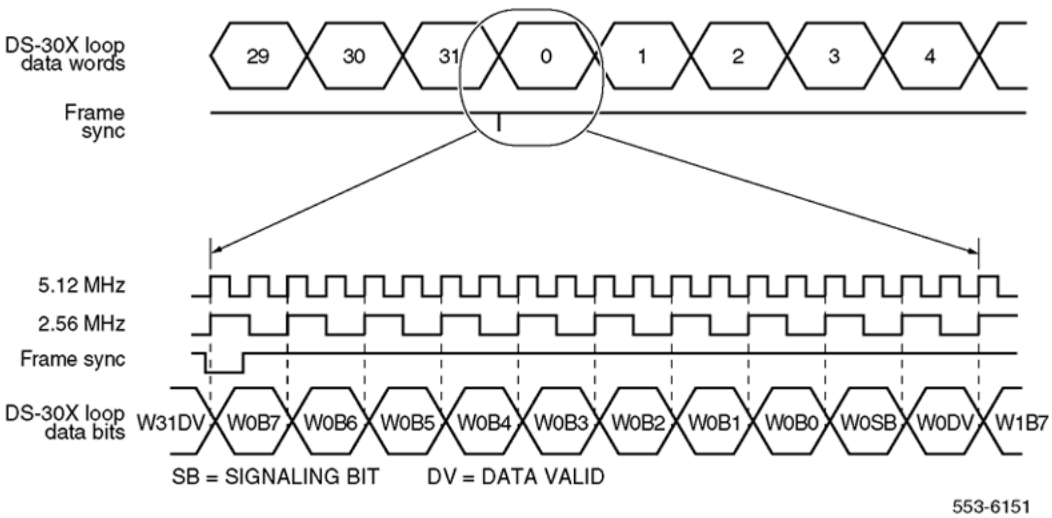


Figure 3: DS-30X loop data format

DS-30Y network loops extend between controller cards and superloop network cards in the Common Equipment (CE). They function in a manner similar to DS-30X loops. See Figure 5: Digital line interface unit block diagram on page 44.

A DS-30Y loop carries the PCM timeslot traffic of a DS-30X loop. Four DS-30Y network loops form a superloop with a capacity of 128 channels (120 usable timeslots). See Avaya Communication Server 1000M and Meridian 1 Large System Planning and Engineering (NN43021-220) for more information about superloops.

Card LAN link

Maintenance communication is the exchange of control and status data between IPE line or trunk cards and the Call Server by way of the NT8D01 Controller card. Maintenance data is transported through the card LAN link. This link is composed of two asynchronous serial buses (called the Async card LAN link in Figure 2: Typical IPE analog line card architecture on page 39). The output bus is used by the system controller for output of control data to the line card. The input bus is used by the system controller for input of line card status data.

A card LAN link bus is common to all of the line/trunk card slots within an IPE module. This bus is arranged in a master/slave configuration where the controller card is the master and all other cards are slaves. The module backplane provides each line/trunk card slot with a unique hardwired slot address. This slot address enables a slave card to respond when addressed by the controller card. The controller card communicates with only one slave at a time.

In normal operation, the controller card continually scans (polls) all of the slave cards connected to the card LAN to monitor their presence and operational status. The slave card sends replies to the controller on the input bus along with its card slot address for identification. In its reply, the slave informs the controller if any change in card status has taken place. The controller can then prompt the slave for specific information. Slaves only respond when prompted by the controller; they do not initiate exchange of control or status data on their own.

When an IPE line card is first plugged into the backplane, it runs a self-test. When the self-test is completed, a properly functioning card responds to the next controller card poll with the self-test status. The controller then queries for card identification and other status information. The controller then downloads all applicable configuration data to the line card, initializes it, and puts it into an operational mode.

Analog line interface units

Once the 8-bit digital voice signal is received by the analog line card, it must be converted back into an analog signal, filtered, converted from a 4-wire transmission path to a 2-wire transmission path, and driven onto the analog telephone line.

Figure 4: Typical analog line interface unit block diagram on page 42 shows a typical example of the logic that performs these functions. Each part of the analog line interface unit is discussed in the following section.

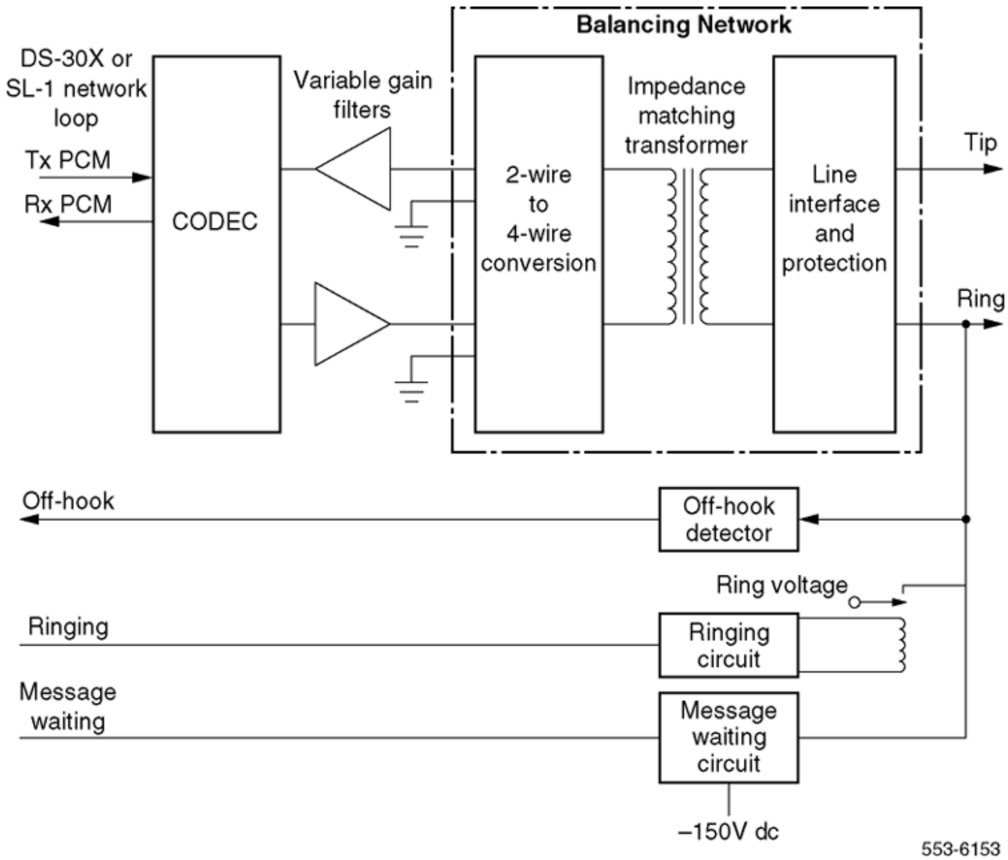


Figure 4: Typical analog line interface unit block diagram

Coder/Decoder circuit

The Coder/Decoder (CODEC) performs Analog to Digital (A/D) and Digital to Analog (D/A) conversion of the line analog voiceband signal to and from a digital PCM signal. This signal can be coded and decoded using either the A-Law or the µ-Law companding algorithm.

On some analog line cards, the decoding algorithm depends of the type of CODEC installed when the board is built. On others, it is an option selected using a software overlay.

Variable gain filters

Audio signals received from the analog phone line are passed through a low-pass A/D monolithic filter that limits the frequency spread of the input signal to a nominal 200 to 3400 Hz bandwidth. The audio signal is then applied to the input of the CODEC. Audio signals coming from the CODEC are passed through a low-pass A/D monolithic filter that integrates the amplitude modulated pulses coming from the CODEC, and then filters and amplifies the result. On some of the line cards, the gain of these filters can be programmed by the system controller. This allows the system to make up for line losses according to the loss plan.

Balancing network

Depending on the card type, the balancing network provides a 600 ¾, 900 ¾, 3COM or 3CM2 impedance matching network. It also converts the 2-wire transmission path (tip and ring) to a 4-wire transmission path (Rx/ground and Tx/ground). The balancing network is usually a transformer/analog (hybrid) circuit combination, but can also be a monolithic Subscriber Line Interface Circuit (SLIC) on the newer line cards.

Line interface and foreign voltage protection

The line interface unit connects the balancing network to the telephone tip and ring pairs. The off-premise line card (NT1R20) has circuitry that protects the line card from foreign voltage surges caused by accidental power line connections and lightning surges. This protection is necessary if the telephone line leaves the building where the switch is installed.

The line interface unit has a relay that applies the ringing voltage onto the phone line. See Figure 4: Typical analog line interface unit block diagram on page 42. The RSYNC signal from the 20 Hz (nominal) ringing voltage power supply is used to prevent switching of the relay during the current peak. This eliminates switching glitches and extends the life of the switching relay.

The off-hook detection circuit monitors the current draw on the phone line. When the current draw exceeds a preset value, the circuit generates an off-hook signal that is transmitted back to the system controller.

The message waiting circuit on message waiting line cards monitors the status of the message waiting signal and applies –150 V dc power to the tip lead when activated. This voltage is used to light the message waiting lamps on phones that are equipped with that feature. The high voltage supply is automatically disconnected when the phone goes off-hook. Newer line cards can sense when the message waiting lamp is not working and can report that information back to the system controller.

Digital line interface units

The NT8D02 Digital Line card provides voice and data communication links between a switch and modular digital telephones. These lines carry multiplexed PCM voice, data and signaling information as Time Compression Multiplexed (TCM) loops. Each TCM loop can be connected to an Avaya "Meridian Modular Digital" telephone.

The digital line interface card contains one or more digital line interface units. See Figure 5: Digital line interface unit block diagram on page 44. Each digital line interface unit contains a Digital Line Interface Circuit (DLIC). The purpose of each DLIC is to demultiplex data from the DS-30X Tx channel into integrated voice and data bitstreams and transmit those bitstreams as Bi-Polar Return to Zero, Alternate Mark Inversion (BPRZ-AMI) data to the TCM loop. It also does the opposite: receives BPRZ-AMI bitstreams from the TCM loop and multiplexes the integrated voice and data bitstream onto the DS-30X Rx channel.

The 4-wire to 2-wire conversion circuit converts the 2-wire tip and ring leads into a 4-wire (Tx and ground and RX and ground) signal that is compatible with the digital line interface circuit.

TCM loop interfaces

Each digital phone line terminates on the digital line card at a TCM loop interface circuit. The circuit provides transformer coupling and foreign voltage protection between the TCM loop and the digital line interface circuit. It also provides power for the digital telephone.

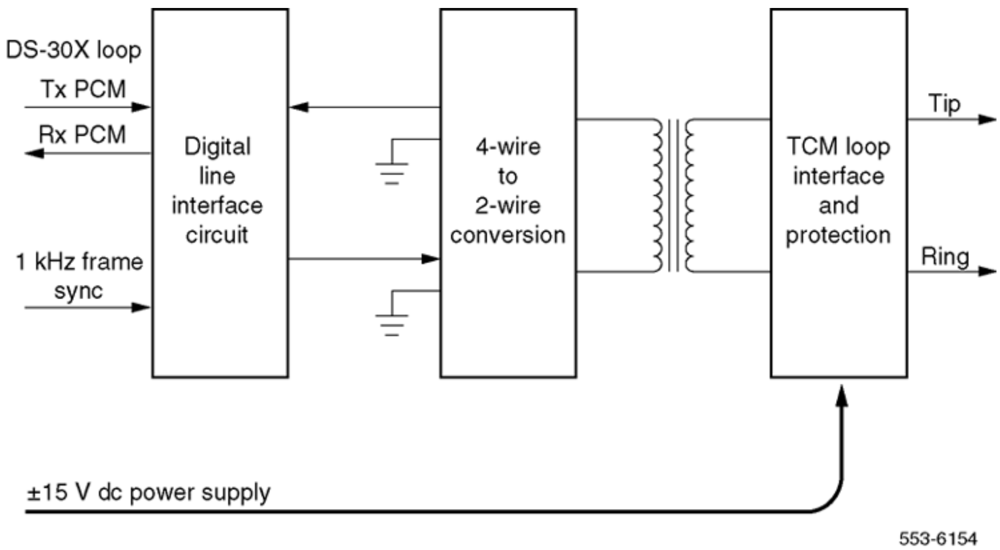


Figure 5: Digital line interface unit block diagram

To prevent undesirable side effects from occurring when the TCM loop interface cannot provide the proper signals on the digital phone line, the system controller can remove the ±15 V dc power supply from the TCM loop interface. This happens when either the card gets a command from the NT8D01 Controller card to shut down the channel, or when the digital line card detects a loss of the 1 KHz frame synchronization signal.

Each TCM loop interface circuit can service loops up to 3500 ft. in length when using 24 gauge wire. The circuit allows for a maximum ac signal loss of 15.5 dB at 256 KHz and a maximum DC loop resistance of 210 ohms.

Signaling

The digital line interface units also contain signaling and control circuits that establish, monitor, and take down call connections. These circuits work with the system controller to operate the digital line interface circuits during calls. The circuits receive outgoing call signaling messages from the controller and return incoming call status information to the controller over the DS-30X network loop.

Analog line call operation

The applications, features, and signalling arrangements for each line interface unit are configured in software and implemented on the card through software download messages. When an analog line interface unit is idle, it provides a voltage near ground on the tip lead and a voltage near –48 V dc on the ring lead to the near-end station. (The near-end station is the telephone or device that is connected to the analog line card by the tip and ring leads.) An on-hook telephone presents a high impedance toward the line interface unit on the card.

Incoming calls

Incoming calls to a telephone that is connected to an analog line card can originate either from stations that are local (served by the PBX), or remote (served through the Public Switched Telephone Network (PSTN)). The alerting signal to a telephone is 20 Hz (nominal) ringing. When an incoming call is answered by the near-end station going off-hook, a low-resistance dc loop is placed across the tip and ring leads (towards the analog line card) and ringing is tripped. See Figure 6: Call connection sequence - near-end station receiving call on page 46.

Outgoing calls

For outgoing calls from the near-end station, a line interface unit is seized when the station goes off-hook, placing a low-resistance loop across the tip and ring leads towards the analog line card. See Figure 7: Call connection sequence - near-end originating call on page 47. When the card detects the low-resistance loop, it prepares to receive digits. When the system is ready to receive digits, it returns dial tone. Outward address signaling is then applied from the near-end station in the form of loop (interrupting) dial pulses or DTMF tones.

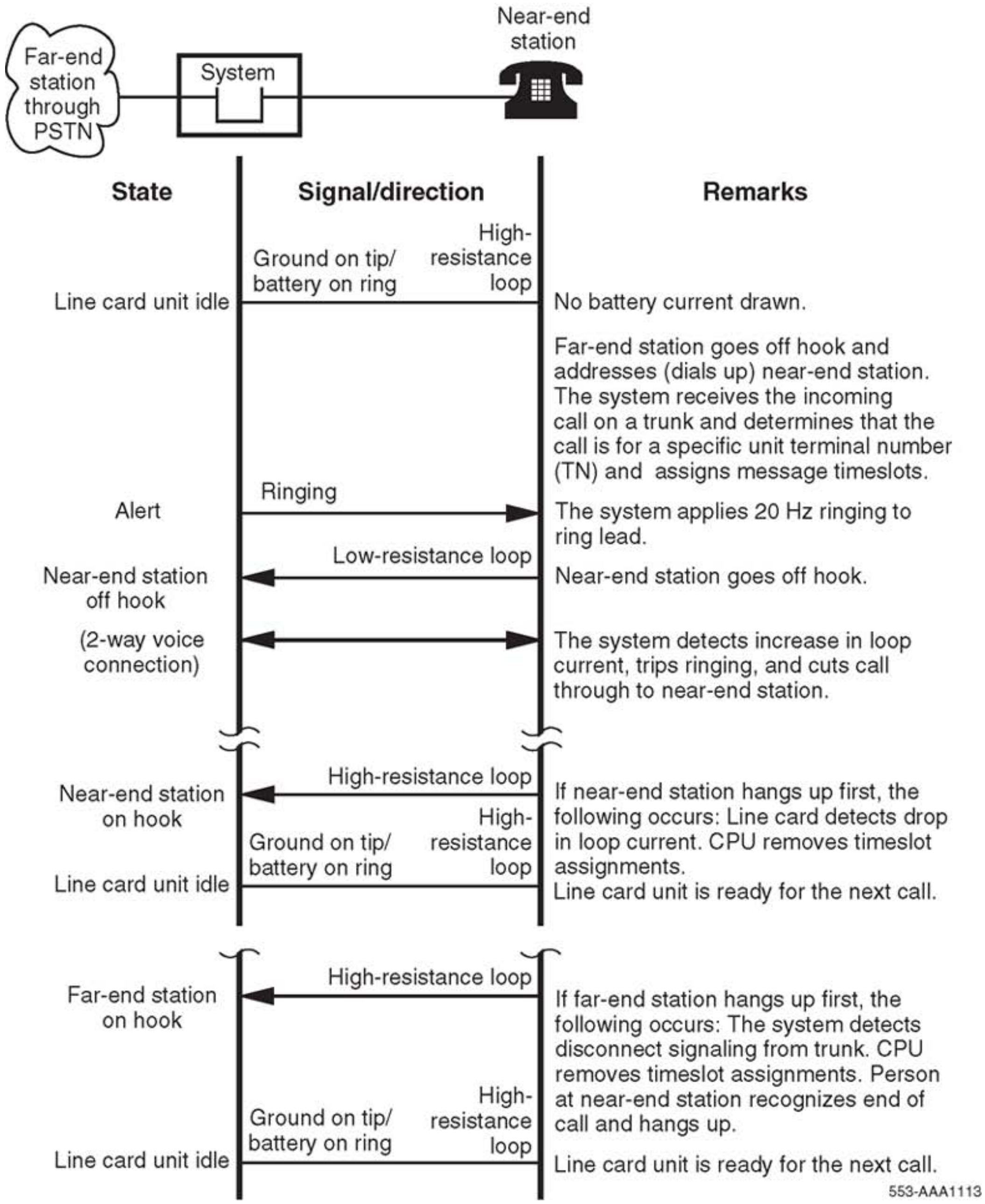


Figure 6: Call connection sequence - near-end station receiving call

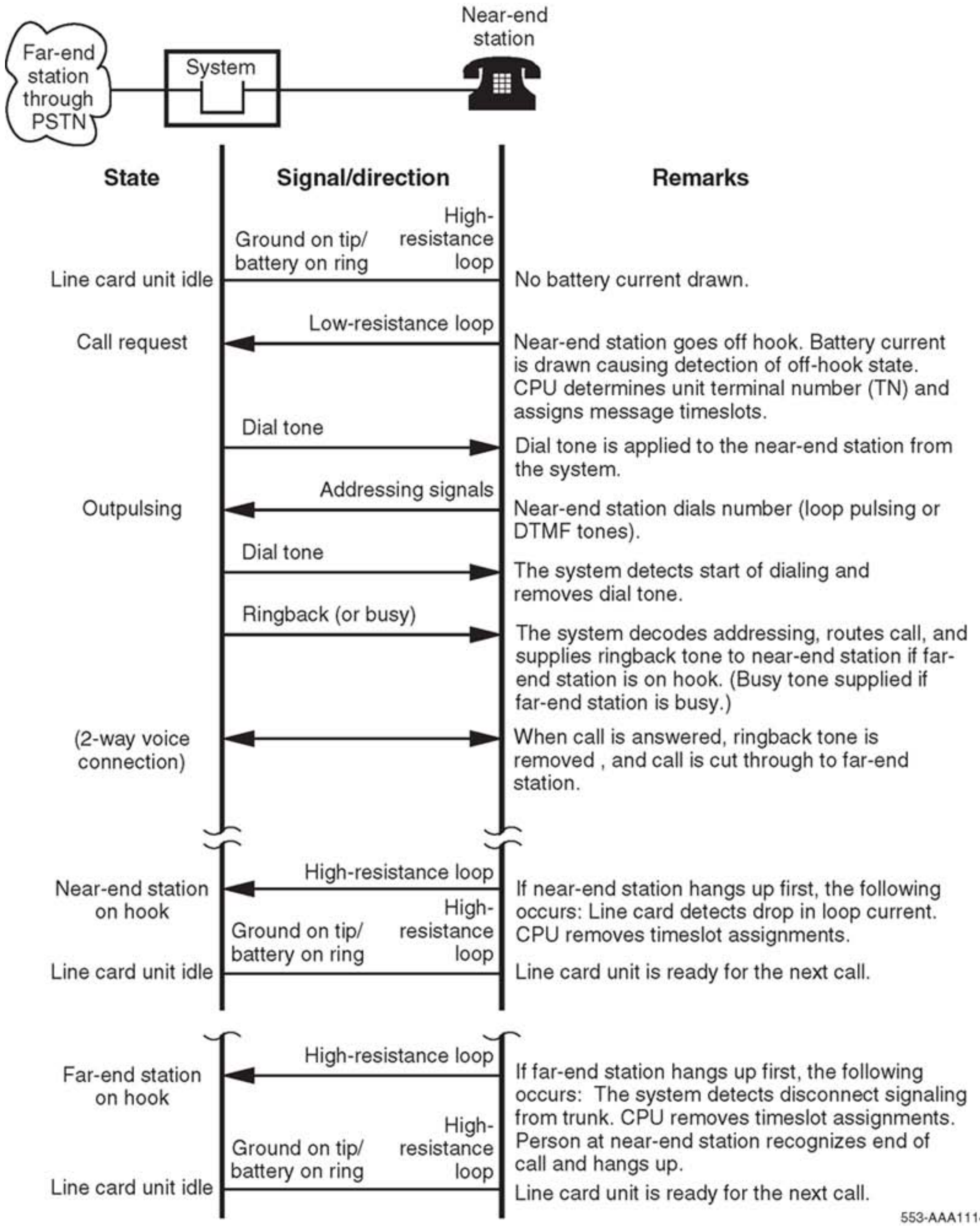


Figure 7: Call connection sequence - near-end originating call

Message waiting

Line cards that are equipped with the message waiting feature receive notification that a message is waiting across the Card LAN link (IPE cards). On cards that drive a message waiting light, the light is turned on by connecting the ring side of the telephone line to the –150 V dc power supply. When the line card senses that the telephone is off-hook, it removes the –

150 V dc voltage until the telephone goes back on-hook. Line cards that use an interrupted dial tone to indicate message waiting do nothing until the receiver is picked up. The line card then interrupts the dial tone at a regular interval to indicate that a message is waiting.

In both cases, the message waiting indication continues until the user checks his or her messages. At that time, the system cancels the message waiting indication by sending another message across the Card LAN link or network loop.

Analog line supervision

Analog line supervision features are used to extend the answer supervision and disconnect supervision signals when the line card is connected to an intelligent terminal device (Key system or intelligent pay phone). Two types of analog line supervision are provided:

- battery reversal answer and disconnect supervision
- hook flash disconnect supervision

Battery reversal answer and disconnect supervision

Battery reversal answer and disconnect supervision is only used for calls that originate from the terminal device. It provides both far-end answer supervision and far-end disconnect supervision signals to the terminal device. In an intelligent pay phone application, these signals provide the information necessary to accurately compute toll charges.

In the idle state, and during dialing and ringing at the far end, the line card provides a ground signal on the tip lead and battery on the ring lead. See Figure 8: Battery reversal answer and disconnect supervision sequence on page 50. When the far-end answers, these polarities are reversed. The reversed battery connection is maintained as long as the call is established. When the far-end disconnects, the system sends a message that causes the line card to revert the battery and ground signals to the normal state to signal that the call is complete.

Hook Flash disconnect supervision

Hook flash disconnect supervision is only used for incoming calls that terminate at the terminal device (typically a Key system). See Figure 9: Hook flash disconnect supervision sequence on page 51. The disconnect signal is indicated by the removal of the ground connection to the tip lead for a specific length of time. The length of time is programmed in LD10, and ranges from a minimum of 10 milliseconds to a maximum of 2.55 seconds. See Avaya Software Input/ Output Reference — Administration (NN43001-611) for more information.

Digital line call operation

Digital line call operation is controlled entirely by use of messages between the digital telephone and the system. These messages are carried across the TCM loop interface. There is no call connection sequence similar to the one used for analog telephone line operation.

Lineside T1 and E1 call operation

The lineside T1/E1 card's call operation is performed differently depending on whether the T1/E1 link is configured to process calls in loop start mode or ground start mode. Configuration is performed through dip switch settings on the lineside T1/E1 card.

The lineside T1/E1 card performs calls processing separately on each of its 24 channels. Signaling is performed using the "A/B robbed bit" signaling standard for T1/E1 communication.

A/B robbed bit signaling simulates standard analog signaling by sending a meaningful combination of ones and zeros across the line that correlates to the electrical impulses that standard analog signaling sends. For example, to represent that an analog line interface unit is idle, the analog line card provides a ground on the tip lead and –48Vdc on the ring lead. The lineside T1/E1 card accomplishes the same result by sending its A bit as 0 (translated as ground on the tip lead) and its B bit as 1 (translated as –48V dc on the ring lead). However, measuring the voltage of the ring lead on the T1/E1 line would not return –48V dc, because actual electrical impulses are not being sent.

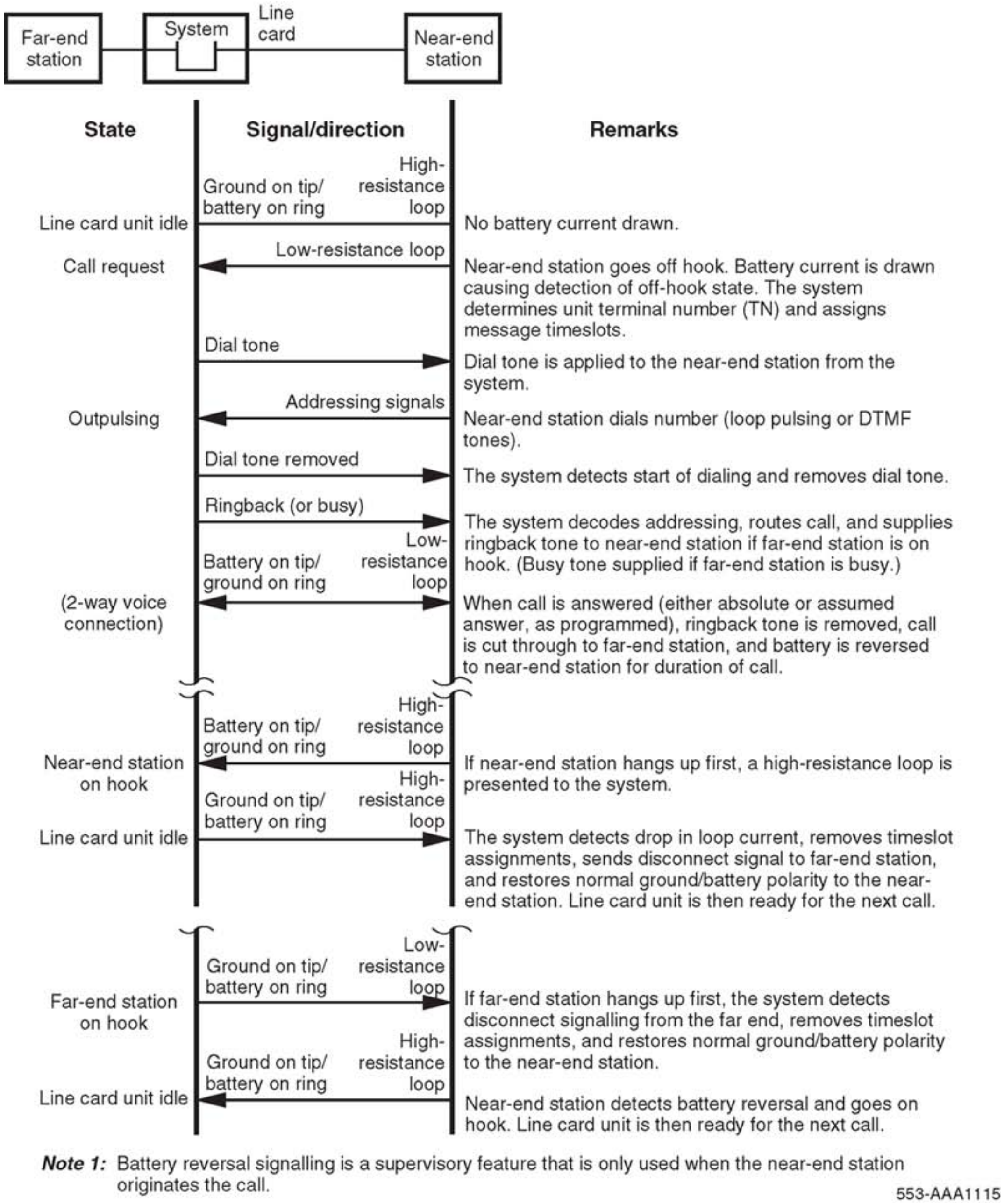


Figure 8: Battery reversal answer and disconnect supervision sequence

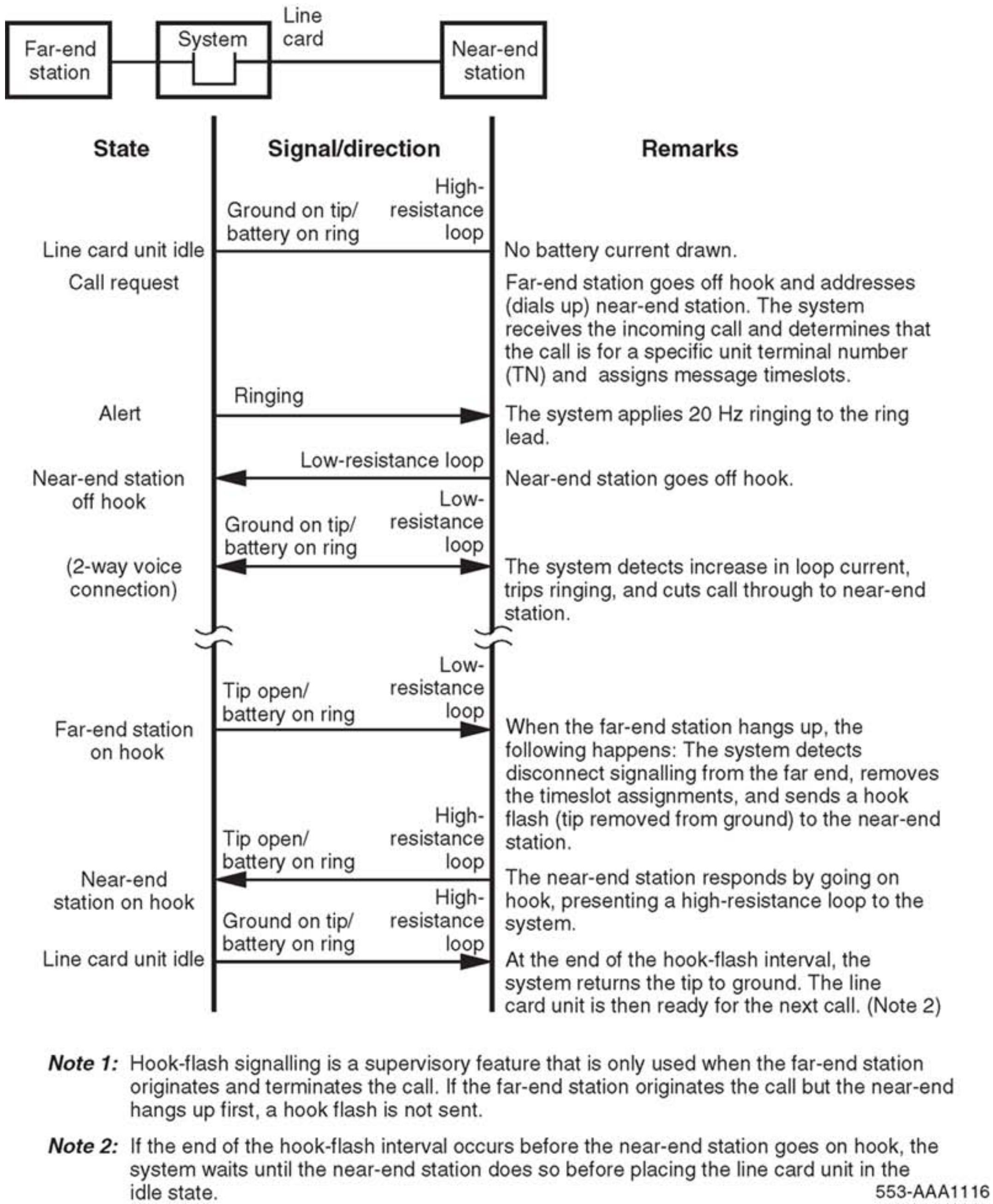


Figure 9: Hook flash disconnect supervision sequence

Call operation is described by categorizing the operation into the following main states:

- Idle (on-hook)
- Incoming calls
- Outgoing calls
- Calls disconnected by the CO
- Calls disconnected by the telephone

Loop Start Mode

In Loop Start mode, the A and B bits meaning is:

- Transmit from LTI:A bit = 0 (tip ground on); B bit = Ringing (0=on, 1=off)
- Receive to LTI: A bit = Loop (0=open, 1=closed); B bit = 1 (no ring ground)

When a T1 channel is idle, the Lineside T1 card simulates a ground on the tip lead and –48Vdc on the ring lead to the terminal equipment by setting its transmit A bit to 0 and transmit B bit to 1. Accordingly, an on-hook channel on the terminal equipment simulates an open loop toward the Lineside T1 card, causing the Lineside T1 card's receive bits to be set to A = 0 and receive B = 1.

Incoming calls

Incoming calls to terminal equipment attached to the Lineside T1 card can originate either from stations that are local (served by the PBX), or remote (served through the PSTN). To provide the ringing signal to a telephone the Lineside T1 card simulates an additional 90V on the ring lead to the terminal equipment by alternating the transmit B bit between 0 and 1 (0 during ring on, 1 during ring off). When an incoming call is answered by the terminal equipment going off-hook, the terminal equipment simulates tripping the ringing and shutting off ringing, causing the Lineside T1 card's receive A bit to be changed from 0 to 1.

Outgoing calls

During outgoing calls from the terminal equipment, a channel is seized when the station goes off-hook. This simulates a low-resistance loop across the tip and ring leads toward the Lineside T1 card, causing the lineside T1's receive A bit to be changed from 0 to 1. This bit change prepares the Lineside T1 to receive digits. Outward address signaling is then applied from the terminal equipment in the form of DTMF tones or loop (interrupting) dial pulses that are signaled by the receive A bit pulsing between 1 and 0.

Call disconnect from far end PSTN, private network or local Station

When a call is in process, the central office may disconnect the call from the CS 1000E, CS 1000M, and Meridian 1. If the Lineside T1 port is configured with the supervised analog line (SAL) feature, the Lineside T1 card responds to the distant end disconnect message by momentarily changing its transmit A bit to 1 and then returning it to 0. The duration of time that the transmit A bit remains at 1 before returning to 0 depends upon the setting that was configured using the SAL. If the terminal equipment is capable of detecting distant end disconnect, it responds by changing the Lineside T1 card's receive A bit to 0 (open loop). The call is now terminated and the interface is in the idle (on-hook) state.

For the Lineside T1 card to support distant end disconnect in loop start mode, the following configuration parameters must exist:

- The Supervised Analog Line (SAL) feature must be configured for each Lineside T1 port.

Note:

By default, the SAL feature opens the tip side for 750 m/s in loop start operation. This is configurable in 10 m/s increments.

- For outgoing trunk calls, the trunk facility must provide far end disconnect supervision.
- To detect distant end disconnect for calls originating on the Lineside T1 card, the battery reversal feature within the SAL software must be enabled. Enabling the battery reversal feature does not provide battery reversal indication but only provides a momentary interruption of the tip ground by asserting the A bit to 1 for the specified duration.
- To detect distant end disconnect for calls terminating on the Lineside T1 card, the hook flash feature within the SAL software must be enabled.
- To detect distant end disconnect for calls originating and terminating on the Lineside T1 card, both the battery reversal and hook flash features must be enabled within the SAL software.

Call disconnect from Lineside T1 terminal equipment

Alternatively, while a call is in process, the terminal equipment may disconnect by going on-hook. The terminal equipment detects no loop current and sends signaling to the Lineside T1 card that causes its receive A bit to change from 1 to 0. The call is now released.

Table 4: Loop Start Call Processing A/B Bit Settings on page 53 outlines the lineside T1's A and B bit settings in each state of call processing.

Table 4: Loop Start Call Processing A/B Bit Settings

State	Transmit		Receive	
	A	B	A	B
Idle	0	1	0	1
Incoming Calls:				
• Idle	0	1	0	1
• Ringing is applied from Lineside T1 card	0	1/0	0	1
• Terminal equipment goes off-hook	0	1/0	1	1
• Lineside T1 card stops ringing	0	1	1	1
Outgoing Calls:				
• Idle	0	1	0	1
• Terminal equipment goes off-hook	0	1	1	1
Call Disconnect from far end:				
• Steady state (call in progress)	0	1	1	1

State	Transmit		Receive	
	A	B	A	B
• Far end disconnects by dropping loop current and Lineside T1 card changes Transmit A bit to 1 momentarily.	1	1	1	1
• Terminal equipment responds causing Receive A bit to change to 0.	1	1	0	1
• Lineside T1 responds by changing its Transmit A bit to 0. Call is terminated and set to idle state.	0	1	0	1
Call disconnect from terminal equipment:				
• Steady state (call in progress)	0	1	1	1
• Terminal equipment goes on-hook causing the Receive A bit to change to 0. Call is terminated and set to idle state.	0	1	0	1

Ground Start Mode

In Ground Start mode, the A and B bits meaning is:

- Transmit from LTI:A bit = Tip ground (0=grounded, 1=not grounded); B bit = Ringing (0=on, 1=off)
- Receive to LTI: A bit = Loop (0=open, 1=closed); B bit = Ring ground (0=grounded, 1=not grounded)

When a T1 channel is idle, the Lineside T1 card simulates a ground on the tip lead and -48V dc on the ring lead to the terminal equipment by setting the transmit A bit to 1 and transmit B bit to 1. Accordingly, an on-hook telephone simulates an open loop toward the Lineside T1 card, causing the Lineside T1 card's receive bits to be set to A = 0 and B = 1.

Incoming Calls

Incoming calls to terminal equipment that is connected to the Lineside T1 card can originate either from stations that are local (served by the PBX), or remote (served through the public switched telephone network). To provide the ringing signal to the terminal equipment the Lineside T1 card simulates the 90V ring signal on the ring lead by alternating the transmit B bit between 0 and 1 (0 during ring on, 1 during ring off), and ground on the tip lead by setting the transmit A bit to 0. When an incoming call is answered (by the terminal equipment going off-hook), the terminal equipment simulates tripping the ringing and shutting off ringing by causing the lineside T1's receive A bit to change from 0 to 1. The Lineside T1 card responds to this message by simulating loop closure by holding the transmit B bit constant at 1.

Outgoing Calls

During outgoing calls from the terminal equipment, a channel is seized when the terminal equipment goes off-hook, simulating a ground to the ring lead toward the Lineside T1 card by causing the lineside T1's receive B bit to change from 1 to 0. In turn, the Lineside T1 card simulates grounding its tip lead by changing the transmit A bit to 0. The terminal equipment responds to this message by removing the ring ground (lineside T1's receive B bit is changed to 1) and simulating open loop at the terminal equipment (lineside T1's receive A bit is changed to 0).

Call disconnect from far end PSTN, private network or local station

While a call is in process, the far end might disconnect the call. If the Lineside T1 port is configured with the Supervised Analog Line (SAL) feature, the Lineside T1 responds to the distant end disconnect message by opening tip ground. This causes the Lineside T1 card to change the transmit A bit to 1. When the terminal equipment sees the transmit A bit go to 1, it responds by simulating open loop causing the lineside T1's receive A bit to change to 0. The call is terminated and the interface is once again in the idle condition.

For the Lineside T1 card to support distant end disconnect in ground start mode, the following configuration parameters must exist:

- The Supervised Analog Line (SAL) feature must be configured for each Lineside T1 port.

  Note:

  By default, the SAL feature opens the tip side for 750 m/s in loop start operation. This is configurable in 10 m/s increments.

- To detect distant end disconnect for calls originating on the Lineside T1 card, the "battery reversal" feature within the SAL software must be enabled. Enabling the battery reversal feature does not provide battery reversal indication when a call is answered; it only provides battery reversal indication when a call is disconnected.
- To detect distant end disconnect for calls terminating on the Lineside T1 card, the "hook flash" feature within the SAL software must be enabled.
- To detect distant end disconnect for calls originating and terminating on the Lineside T1 card, both the "battery reversal" and "hook flash" features within the SAL software must be enabled.

Call disconnect from Lineside T1 terminal equipment

Alternatively, while a call is in process, the terminal equipment may disconnect by going on-hook, causing the lineside T1's receive A bit to change to 0. The Lineside T1 card responds to this message by simulating the removal of ground from the tip by changing its transmit A bit to 1. The call is now terminated and the interface is once again in the idle condition.

Table 5: Ground Start Call Processing A/B Bit Settings on page 55 outlines the lineside T1's A and B bit settings in each state of call processing.

Table 5: Ground Start Call Processing A/B Bit Settings

State	Transmit		Receive	
	A	B	A	B
Idle	1	1	0	1
Incoming Calls (to terminal equipment):				
• Idle	1	1	0	1

State	Transmit		Receive	
	A	B	A	B
• Ringing is applied from Lineside T1 card by simulating ground on tip lead and ringing on ring lead.	0	0/1	0	1
• Terminal equipment goes off-hook by simulating ground on tip lead and ringing on ring lead.	0	0/1	1	1
Outgoing Calls (from terminal equipment):				
• Idle	1	1	0	1
• Terminal equipment goes off-hook.	1	1	0	0
• The Lineside T1 simulates grounding its tip lead	0	1	0	0
• Terminal equipment opens ring ground and closes loop	0	1	1	1
Call Disconnect from far end:				
• Steady state (call in progress)	0	1	1	1
• The Lineside T1 ungrounds tip	1	1	1	1
• Terminal equipment opens loop current	1	1	0	1
Call disconnect from terminal equipment:				
• Steady state (call in progress)	0	1	1	1
• Terminal equipment goes open loop current	0	1	0	1
• Lineside T1 card opens tip ground	1	1	0	1

Ground Start Restrictions

If the Lineside T1 card is used in ground start mode, certain restrictions should be considered. Because the system treats the Lineside T1 card as a standard loop start analog line card, the ground start operation of the Lineside T1 card has operational limitations compared to typical ground start interface equipment relating to start of dialing, distant end disconnect and glare potential.

Distant end disconnect restrictions

If the SAL feature is not available in the CS 1000 software, the Lineside T1 card is not capable of indicating to the Customer Premise Equipment (CPE) when a call is terminated by the distant end. In this case, the Lineside T1 card continues to provide a grounded tip indication (A=0) to the CPE until it detects an open loop indication (A=0) from the CPE, at which time it provides an open tip indication (A=1). Therefore, without SAL software, the Lineside T1 card is not capable of initiating the termination of a call to the CPE.

With the SAL software configured for each Lineside T1 line, the Lineside T1 card provides an open tip indication to the CPE when it receives an indication of supervised analog line from the system. This provides normal ground start protocol call termination.

Glare restrictions

In telephone lines or trunks, glare occurs when a call origination attempt results in the answering of a terminating call that is being presented by the far end simultaneously with the call origination attempt by the near end.

The Lineside T1 detects presentation of a terminating call (outgoing to Lineside T1 terminal equipment) by detecting ringing voltage. If application of the ringing voltage is delayed due to traffic volume and ringing generator capacity overload, the Lineside T1 ground start operation cannot connect the tip side to ground to indicate the line is seized by the system.

In ground start mode, glare conditions need to be considered if both incoming and outgoing calls to the Customer Premise Equipment (CPE) are going to be encountered. If the system and the CPE simultaneously attempt to use a Lineside T1 line, the system completes the call termination. It does not back down and allow the CPE to complete the call origination, as in normal ground start operation.

If both incoming and outgoing calls are to be handled through the Lineside T1 interface, separate channels should be configured in the system and the CPE for each call direction. This eliminates the possibility of glare conditions on call origination.

Voice frequency audio level

The digital pad for Lineside T1 card audio level is fixed for all types of call connection (0 dB insertion loss in both directions), and differs from the analog line. Audio level adjustments, if required, must be made in the Lineside T1 terminal equipment.

Off-premise line protection

Off-premise applications are installations where the telephone lines are extended outside the building where the PBX system is housed, but the lines are not connected to public access facilities. This application is commonly referred to as a "campus installation."

In off-premise applications, special protection devices and grounding are required to protect PBX and telephone components from any abnormal conditions, such as lightning strikes and power line crosses.

The NT1R20 Off-Premise Station Line card has built-in protection against lightning strikes and power line crosses. These should be the preferred cards for an off-premise application. Other cards can be used when external line protectors are installed.

When using the Lineside T1 card for an off-premise or network application, external line protectors must be installed. Install an isolated type Channel Service Unit (CSU) as part of the terminal equipment, to provide the necessary isolation and outside line protection. The CSU should be an FCC part 68 or CSA certified unit.

Line protectors

Line protectors are voltage-absorbing devices that are installed at the cross-connect terminals at both the main building and the remote building. The use of line protectors ensure that system and telephone components are not damaged from accidental voltages that are within the limit of the capacity of the protection device. Absolute protection from lightning strikes and other stray voltages cannot be guaranteed, but the use of line protection devices significantly reduces the possibility of damage.

Avaya has tested line protection devices from three manufacturers. See Table 6: Line protection device ordering information on page 58. Each manufacturer offers devices for protection of digital as well as analog telephone lines.

Table 6: Line protection device ordering information

Device order code		
Analog Line	**Digital Line**	**Manufacturer**
UP2S-235	UP2S-75	ITW Linx Communication 201 Scott Street Elk Grove Village, IL 60007 (708) 952-8844 or (800) 336-5469
6AP	6DP	Oneac Corporation 27944 North Bradley Road Libertyville, IL 60048-9700 (800) 553-7166 or (800) 327-8801 x555
ESP-200	ESP-050	EDCO Inc. of Florida 1805 N.E. 19th Avenue P.O. Box 1778 Ocala, FL 34478 (904) 732-3029 or (800) 648-4076

These devices are compatible with 66 type M1-50 split blocks or equivalent. Consult the device manufacturer if more specific compatibility information is required.

Line protection grounding

In conjunction with line protectors, proper system (PBX) grounding is essential to minimize equipment damage. Avaya recommends following the grounding connection requirements as described in *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Commissioning, NN43021-310*. This requirement includes connecting the ground for the protection devices to the approved building earth ground reference. Any variances to these grounding requirements could limit the functionality of the protection device.

Line and telephone components

Because testing of the line protectors was limited to the line cards and telephones shown below, only these components should be used for off-premise installations.

Telephones

- Meridian Modular Telephones (digital)
- Meridian Digital Telephones
- Standard analog (500/2500-type) telephones

Line cards

- NT1R20 Off-Premise Station Line card
- NT8D02 Digital Line card

Trunk cards

The following trunk cards are designed using the IPE architecture, and are recommended for use in all new system designs.

Each of the trunk cards was designed to fit a specific system need. Use Table 7: Trunk card characteristics on page 59 to select the trunk card that meets system needs.

Table 7: Trunk card characteristics

Part Number	Description	Trunks	Trunk Types	Architecture
NT8D14	Universal Trunk card	8	CO/FX/WATS trunks*, direct inward dial trunks, TIE trunks, Loop Dial Repeating trunks Recorded Announcement trunks, Paging trunks	IPE
NT8D15	E and M Trunk card	4	2-wire E and M Trunks, 4-wire E and M Trunks, 4-wire DX trunks, Paging trunks	IPE
NTCK16	Generic Central Office Trunk card	8	CO trunks	IPE

Part Number	Description	Trunks	Trunk Types	Architecture
* Central office (CO), Foreign Exchange (FX), and Wide Area Telephone Service (WATS) trunks.				

NT8D14 Universal Trunk card

The NT8D14 Universal Trunk card is an intelligent four-channel trunk card that is designed to be used in a variety of applications. It supports the following five trunk types:

- Central office (CO), Foreign Exchange (FEX), and Wide Area Telephone Service (WATS) trunks
- Direct Inward Dial (DID) trunks
- TIE trunks: two-way Loop Dial Repeating (LDR) and two-way loop Outgoing Automatic Incoming Dial (OAID)
- Recorded Announcement (RAN) trunks
- Paging (PAG) trunks

The universal trunk card also supports Music, Automatic Wake Up, and Direct Inward System Access (DISA) features.

NT8D15 E and M Trunk card

The NT8D15 E and M Trunk card is an intelligent four-channel trunk card that is designed to be used when connecting to the following types of trunks:

- 2-wire E and M Type I signaling trunks
- 4-wire E and M Trunks with:
    - Type I or Type II signaling
    - Duplex (DX) signaling
- Paging (PAG) trunks

The trunk type and function can be configured on a per port basis. Dialing outpulsing is provided on the card. Make and break ratios are defined in software and downloaded by software commands.

NTCK16 Generic Central Office Trunk card

The NTCK16 generic central office trunk cards support up to eight analog central office trunks. They can be installed in any IPE slot that supports IPE. The cards are available with or without the Periodic Pulse Metering (PPM) feature. The cards are also available in numerous countries.

Installation

This section provides a high-level description of how to install and test trunk cards.

IPE trunk cards can be installed in any IPE slot of the NT8D37 IPE module. Figure 10: IPE trunk cards installed in an NT8D37 IPE module on page 61 shows where an IPE trunk card can be installed in an NT8D37 IPE module.

When installing trunk cards, these general procedures should be used:

Installing a trunk card

1. Configure the jumpers and switches on the trunk card (if any) to meet the system needs.
2. Install the trunk card into the selected slot.

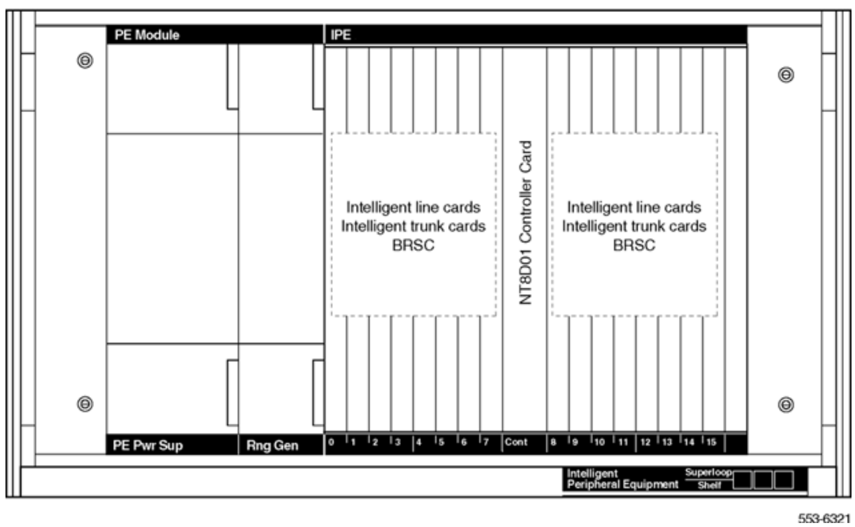


Figure 10: IPE trunk cards installed in an NT8D37 IPE module

3. Install the cable that connects the backplane connector on the IPE module to the module I/O panel.
4. Connect a 25-pair cable from the module I/O panel connector to the Main Distribution Frame (MDF).
5. Connect the trunk card output to the selected terminal equipment at the MDF.
6. Configure the individual trunk interface unit using the Trunk Administration program (LD 14) and the Trunk Route Administration program (LD 16).

Once these steps are complete, the trunk card is ready for use.

Installing a surge-suppression cable

Certain COT and DDI trunk cards also require a surge-suppression cable (700502846) to prevent transient voltages from damaging the equipment. The following trunk cards require the installation of a surge-suppression cable:

- NT5K17
- NT5K18
- NT5K70
- NT5K84
- NT5K99
- NTAG04
- NTCK16
- NTCK24

To install the surge-suppression cable, complete the following steps:

1. Unplug the existing trunk card cable from the Communication Server 1000 system.
2. Attach the female adapter end of the MDF 50–pin surge suppression cable to the card slot connector on the Media Gateway, as shown in the following figure:

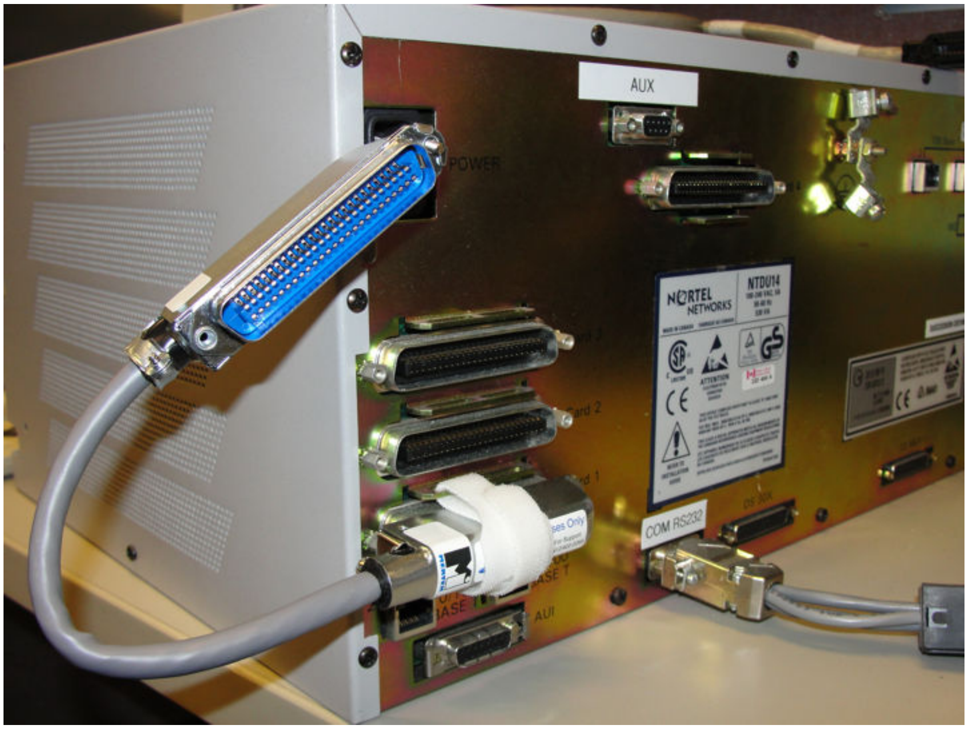


Figure 11: Connecting the surge suppression cable to the Media Gateway

3. Connect the other end or MDF 50–pin male surge-suppression cable adapter to the cable from the Communication Server 1000 system MDF, as shown in the following figure:

Figure 12: Connecting the surge suppression cable to the CS 1000 system MDF cable

Operation

This section describes how trunk cards fit into the CS 1000E, CS 1000M, and Meridian 1 architecture, the buses that carry signals to and from the trunk cards, and how they connect to terminal equipment. See Table 8: Differences between IPE parameters on page 63 for IPE parameters.

Host interface bus

Cards based on the IPE bus use a built-in microcontroller. The IPE microcontroller is used for the following:

- to perform local diagnostics (self-test)
- to configure the card according to instructions issued by the system processor
- to report back to the system processor information such as card identification (type, vintage, and serial number), firmware version, and programmed configuration status.

Table 8: Differences between IPE parameters

Parameter	IPE
Card Dimensions	31.75 x 25.4 x 2.2 cm. (12.5 x 10.0 x 0.875 in.)

Parameter	IPE
Network Interface	DS-30X Loops
Communication Interface	card LAN Link
Microcontroller	8031
Peripheral Interface card	NT8D01 Controller card
Modules	NT8D37 IPE module

Intelligent Peripheral Equipment

IPE trunk cards all share a similar architecture. Figure 13: Typical IPE trunk card architecture on page 65 shows a typical IPE trunk card architecture. The various trunk cards differ only in the number and types of trunk interface units.

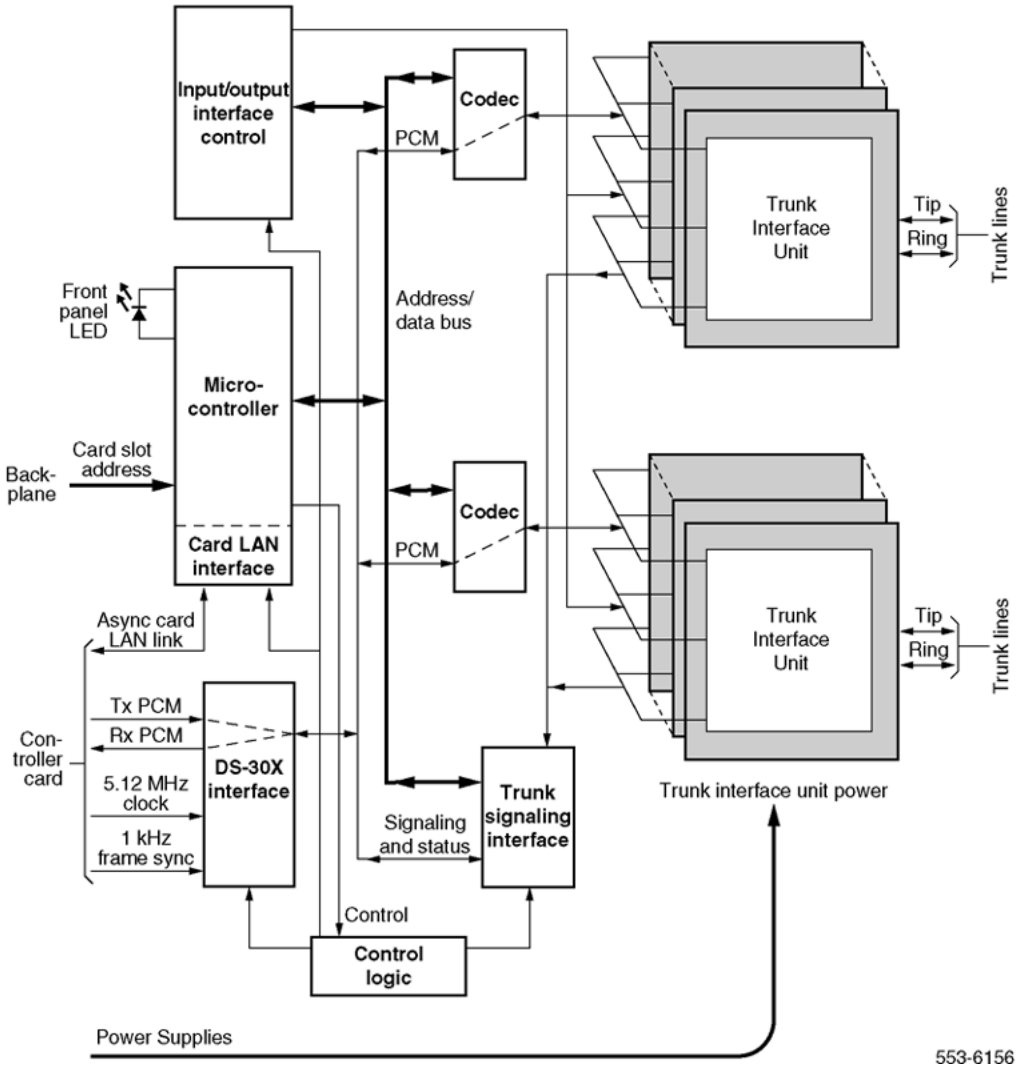


Figure 13: Typical IPE trunk card architecture

The switch communicates with IPE modules over two separate interfaces. Voice and signaling data are sent and received over DS-30X loops and maintenance data is sent over a separate asynchronous communication link called the card LAN link.

Signaling data is information directly related to the operation of the telephone line or trunk. Some examples of signaling commands are as follows:

- off hook/on hook
- ringing signal on/off
- message waiting lamp on/off

Maintenance data is data relating to the configuration and operation of the IPE card, and is carried on the card LAN link. Some examples of maintenance data are as follows:

- polling
- reporting of self-test status

- CPU initiated card reset
- reporting of card ID (card type and hardware vintage)
- reporting of firmware version
- downloading trunk interface unit configuration
- reporting of trunk interface unit configuration
- enabling/disabling of the DS-30X network loop bus
- reporting of card status

DS-30X loops

The interfaces provided by the line and trunk cards connect to conventional 2-wire (tip and ring) line facilities. IPE analog line and trunk cards convert the incoming analog voice and signaling information to digital form, and route it to the Common Equipment (CE) CPU over DS-30X network loops. Conversely, digital voice and signaling information from the CPU is sent over DS-30X network loops to the analog line and trunk cards where it is converted to analog form and applied to the line or trunk facility.

A separate dedicated DS-30X network loop is extended between each IPE line/trunk card and the controller cards within an IPE module (or the controller circuits on a network/DTR card in a CE module). A DS-30X network loop is composed of two synchronous serial data buses. One bus transports in the transmit (Tx) direction toward the line facility and the other in the receive (Rx) direction toward the common equipment.

Each bus has 32 channels for pulse code modulated (PCM) voice data. Each channel consists of a 10-bit word. See Figure 14: DS-30X loop data format on page 67.

Eight of the 10 bits are for PCM data, one bit is the call signaling bit, and the last bit is a data valid bit. The 8-bit PCM portion of a channel is called a timeslot . The DS-30X loop is clocked at 2.56 Mbps (one-half the 5.12 MHz clock frequency supplied by the controller card). The timeslot repetition rate for a single channel is 8 kHz. The controller card also supplies a locally generated 1 kHz frame sync signal for channel synchronization.

Signaling data is transmitted to and from the trunk cards using the call signaling bit within the 10-bit channel. When the line card detects a condition that the switch needs to know about, it creates a 24-bit signaling word. This word is shifted out on the signaling bit for the associated channel one bit at a time during 24 successive DS-30X frames. Conversely, when the switch sends signaling data to the line card, it is sent as a 24-bit word divided among 24 successive DS-30X frames.

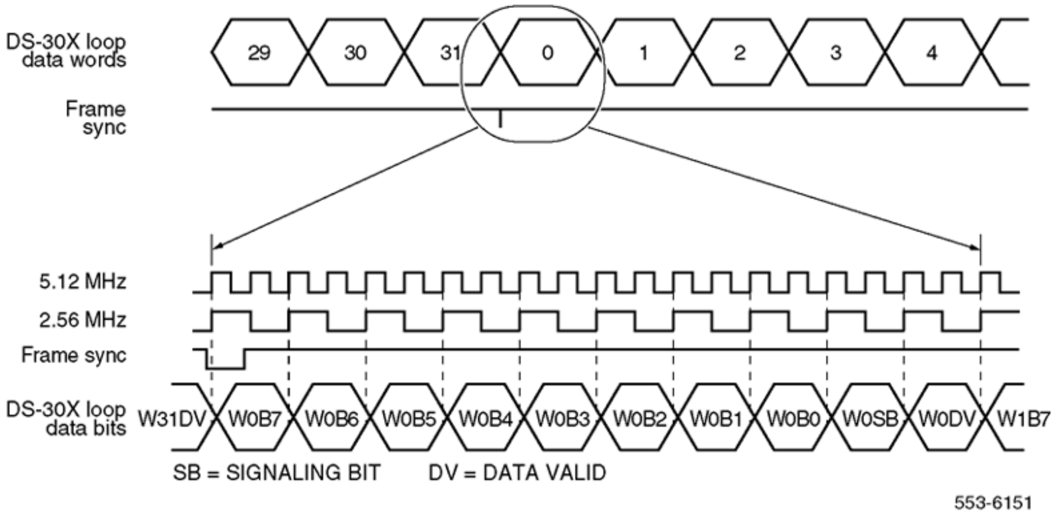


Figure 14: DS-30X loop data format

DS-30Y network loops extend between controller cards and superloop network cards in the common equipment, and function in a manner similar to DS-30X loops. See Figure 15: Network connections to IPE modules on page 68.

Essentially, a DS-30Y loop carries the PCM timeslot traffic of a DS-30X loop. Four DS-30Y network loops form a superloop with a capacity of 128 channels (120 usable timeslots).

See Avaya Communication Server 1000M and Meridian 1 Large System Planning and Engineering (NN43021-220) for more information about superloops.

Card LAN link

Maintenance communication is the exchange of control and status data between IPE line or trunk cards and the CE CPU by way of the NT8D01 Controller Card. Maintenance data is transported via the card LAN link. This link is composed of two asynchronous serial buses (called the Async card LAN link in Figure 13: Typical IPE trunk card architecture on page 65). The output bus is used by the controller for output of control data to the trunk card. The input bus is used by the controller for input of trunk card status data.

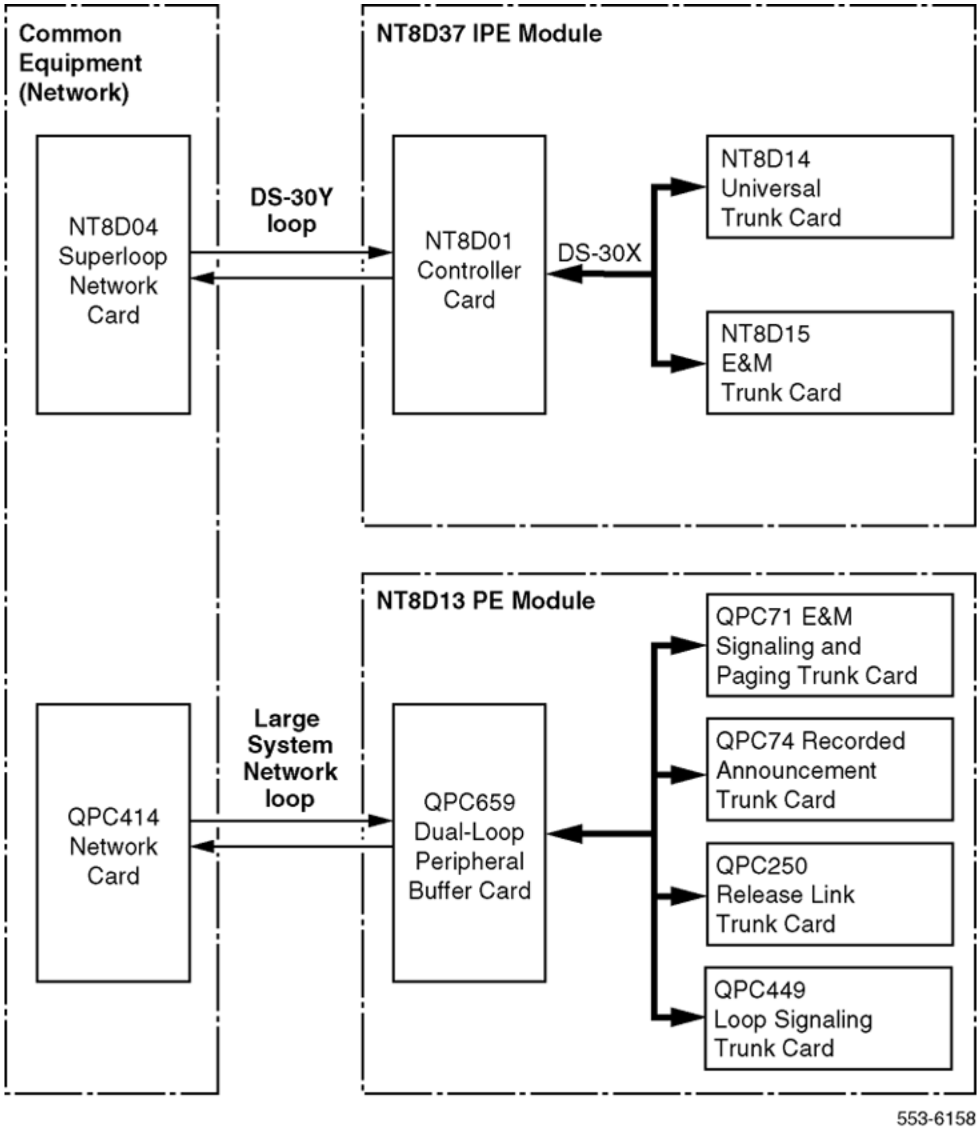


Figure 15: Network connections to IPE modules

A card LAN link bus is common to all of the line/trunk card slots within an IPE module (or IPE section of a CE module). This bus is arranged in a master/slave configuration where the controller card is the master and all other cards are slaves. The module backplane provides each line/trunk card slot with a unique hardwired slot address. This slot address enables a slave card to respond when addressed by the controller card. The controller card communicates with only one slave at a time.

In normal operation, the controller card continually scans (polls) all of the slave cards connected to the card LAN to monitor their presence and operational status. The slave card sends replies to the controller on the input bus along with its card slot address for identification. In this reply, the slave informs the controller if any change in card status is taken place. The controller can then prompt the slave for specific information. Slaves only respond when prompted by the controller; they do not initiate exchange of control or status data on their own.

When an IPE line or trunk card is first plugged into the backplane, it runs a self-test. When the self test is completed, a properly functioning card responds to the next controller card poll with the self-test status. The controller then queries for card identification and other status information. The controller then downloads all applicable configuration data to the line/trunk card, initializes it, and puts it into an operational mode.

The network card regularly polls the IPE cards during TS0 to see if any of them has a message to be sent. When an IPE card has a message waiting it responds to the poll by sending a series of 1s during the next five successive timeslot 0s. The network card responds by sending a "message send enable" message (all 1s). The IPE card replies by sending 1, 1, 1, 0, and then the message in successive timeslot 0s.

Trunk interface unit

Once the 8-bit digital voice signal is received by the trunk card, it must be converted back into an analog signal, filtered, and driven onto the analog trunk line through an impedance matching and balance network. The trunk interface also includes the logic necessary to place outgoing call signaling onto the trunk, or the logic to connect to special services such as recorded announcement and paging equipment.

Figure 16: Typical trunk interface unit block diagram on page 69 shows a typical example of the logic that performs these functions. Each part of the trunk interface unit is discussed in the following section.

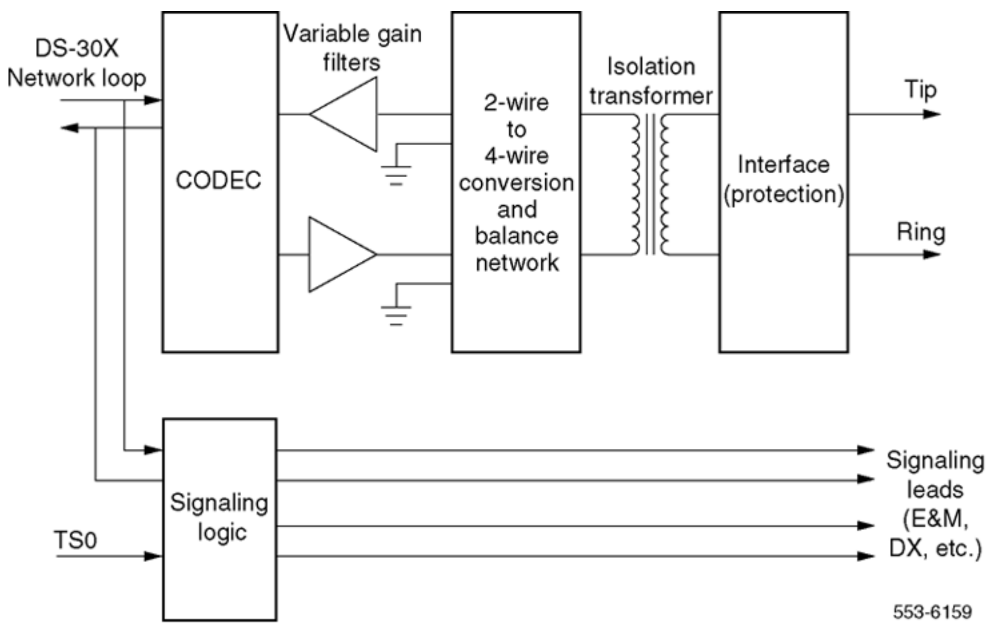


Figure 16: Typical trunk interface unit block diagram

Coder/Decoder circuit

The coder/decoder (codec) performs Analog to Digital (A/D) and Digital to Analog (D/A) conversion of the line analog voiceband signal to and from a digital PCM signal. This signal can be coded and decoded using either the A-Law or the μ-Law companding algorithm. On some trunk cards the decoding algorithm depends of the type of codec installed when the board is built. On others, it is an option selected using a software overlay.

Variable gain filters

Audio signals received from the analog phone trunk are passed through a low-pass A/D monolithic filter that limits the frequency spread of the input signal to a nominal 200–3400 Hz bandwidth. The audio signal is then applied to the input of the codec. Audio signals coming from the CODEC are passed through a low-pass A/D monolithic filter that integrates the amplitude modulated pulses coming from the CODEC, and then filters and amplifies the result.

On some of the trunk cards, the gain of these filters can be programmed by the system controller. This allows the system to make up for line losses according to the loss plan.

Balancing network

Depending on the card type, the balancing network is capable of providing either a 600 ohm or a 900 ohm (or both) impedance matching network. It also converts the 2-wire transmission path (tip and ring) to a 4-wire transmission path (Rx/ground and Tx/ground). The balancing network is a transformer/analog (hybrid) circuit combination.

Signaling circuits

Signaling circuits are relays that place outgoing call signaling onto the trunk. Signal detection circuits monitor the incoming call signaling.

Control signals

Control signals and logic are provided when the trunk is going to be connected to special services such as recorded announcement and paging equipment.

Serial Data Interface (SDI) cards

The QPC841 QSDI card also provides four bidirectional asynchronous serial ports for the system processor. Any device that conforms to the RS-232-C serial communication standard can be connected to these serial ports.

The electrical interface uses either standard RS-232-C signals or a special high-speed interface that combines the high-speed differential interface of the RS-422-A standard with the handshake signals of the RS-232-C standard.

The RS-232-C interface is normally used when data rates are less than 19.2 Kbps, and the cable length is less than 15.24 m (50 ft). The high-speed interface is used when the signal rates are greater than 19.2 kbps (up to 64 kbps) and/or when the cable length is greater than 15.24 m (50 ft).

Table 9: Serial data interface cards on page 71 shows compatibility between the three SDI cards and the various switch options.

Table 9: Serial data interface cards

			Compatible System Options	
Card	**Ports**	**Port types**	**51C, 61C**	**81C**
QPC841	4	RS-232-C asynchronous	X	X

The QPC841 Quad SDI card mounts in standard backplane slots and its serial interface connectors are located on the card front panels. A list of the modules that can be mounted in is given in the section on the individual card.

Uses

Examples of asynchronous devices that can be connected to the system processor using the QPC841 Quad SDI card are:

- an administration and maintenance terminal
- a background terminal for use in a hotel/motel
- the Automatic Call Distribution (ACD) feature
- the Call Detail Recording (CDR) feature

Features

The QPC841 QSDI card provide the following features:

- asynchronous serial data interface ports, each supporting
    - RS-232-C interface
    - 8–bit ASCII data with parity and stop bit
    - Asynchronous, start-stop operation
    - Data rates of 150, 300, 600, 1200, 2400, 4800, and 9600 baud
    - Data terminal equipment (DTE) emulation mode
    - Data communication equipment (DCE) emulation mode
- enable/disable switch and LED
- input/output (I/O) device address selectable by on-board switches.

Specifications

This section lists the specifications shared by all of the SDI cards. See the appropriate section in this document for information specific to any particular card.

Power consumption

The SDI cards obtain their power directly from the module backplane. Power consumption for each of the cards is shown in Table 10: Power consumption on page 72.

Table 10: Power consumption

Voltage	QPC841
+5 VDC ±5%	1.5 Amp
+12 VDC ±5%	100 mA
–12 VDC ±5%	100 mA

Environmental

The SDI cards operate without degradation under the conditions listed in Table 11: Environmental specifications on page 72.

Table 11: Environmental specifications

Specification	Operation	Storage
Ambient temperature	0° to 50°C; (32° to 122°F)	–55° to +70°C; (–58° to 158°F)
Relative humidity (non-condensing)	5% to 95%	0% to 95%
Altitude	3500m; (11 000 ft)	15 000m; (50 000 ft)

Electrostatic discharge

The SDI cards meet the requirements of the IEC 801-2, clause 8.0 procedure. They can withstand a direct discharge of ±5 to ±20 kV without being damaged.

Electromagnetic interference

The CS 1000E, CS 1000M, and Meridian 1 systems meet the requirements of FCC Part 15 and CSA C108.8 electromagnetic interference (EMI) standards as a class "A" computing device. To accomplish this, the SDI cables must exit the module through EMI filters on the I/O panel.

Reliability

The Mean Time Between Failure (MTBF) for all SDI cards is 55 years at 40¡C and 29 years at 55¡C.

Installation

To use a serial data interface card in a CS 1000E, CS 1000M, or Meridian 1 system, first install the card in the system, and then configure the system software to recognize it. These steps are discussed in the following sections.

Instructions for cabling the serial data interface cards to the various system consoles and peripherals are found in Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration (NN43021-310).

Configuring the system software

Once an SDI card is installed in the system, the system software needs to be configured to recognize it. This is done using the Configuration Record program LD 17. Instructions for the Configuration Record program are found in Avaya Software Input/Output Reference — Administration (NN43001-611).

Maintenance

The following maintenance programs are used to maintain individual SDI asynchronous ports. The program used depends on the application of the port.

- LD 37 Input/Output Diagnostics – Used for system terminal, printer, background terminal ports, and system monitor status.

The following maintenance program is used to maintain individual SDI synchronous ports.

- LD 48 Link Diagnostic – For checking Automatic Call Distribution (ACD) and Meridian Link ports.

Instructions for running the various maintenance programs are found in *Avaya Software Input/ Output Reference — Administration* (NN43001-611). System messages are interpreted in *Avaya Software Input/Output Reference — System Messages* (NN43001-712).

Chapter 5: Circuit card installation

Contents

This section contains information on the following topics:

Card slots - Large System

The following table in this chapter identifies card slot compatibility in the following modules:

- NT4N41 Core/Network module required for CS 1000M SG, CS 1000M MG, Meridian 1 PBX 61C Call Processor CP PIV, and Meridian 1 PBX 81C
- NT4N46 Core/Network module required for CS 1000M MG and Option 81C CP PIV
- NT8D35 Network module required for CS 1000M MG and Meridian 1 81C
- NT8D37 Intelligent Peripheral Equipment (IPE) module required for CS 1000M HG, CS 1000M SG, CS 1000M MG, Meridian 1 Option 51, Meridian 1 61C , and Meridian 1 81C

Circuit and installation

Table 12: System card slots

Component	System
A0786611 Call Processor Pentium II® card	81C Core/Net: "CP"
A0810486 Call Processor Pentium II	81C Core/Net: "CP"

Component	System
NT1P61 Fiber Superloop Network card	Core/Net: 0–7
NT1P62 Fiber Peripheral Controller card	IPE: "Contr"
NT1R52 Remote Carrier Interface	IPE: "Contr"
NT1R20 Off-Premise Station	IPE: any slot but "Contr"
NT4D18 Hybrid Bus Terminator	Core/Net: between 11 and 12
NT4D19 and NT423 Hybrid Bus Terminator	Core/Net: between 0 and 1
NT4D20 and NT422 Hybrid Bus Terminator	Core/Net: between 1 and 2
NT4N39 Call Processor Pentium IV card	61C Core/Net: CP PIV
NT4N39 Call Processor Pentium IV card	81C Core/Net: CP PIV
NT4N65 cPCI® Core to Network Interface card	81C Core/Net: c9–c12
NT4N66 cPCI Core to Network Interface Transition card	81C Core/Net cPCI Core backplane: 9–12
NT4N67 System Utility card	81C Core/Net: c15
NT4N68 System Utility Transition card	81C Core/Net cPCI Core backplane:
NT5D11 and NT5D14 Line side T1 Line card	IPE: any slot but "Contr"
NT5D12 Dual DTI/PRI card	Core/Net: 0–7
NT5K02 Analog Line card	IPE: any slot but "Contr"
NT5K07 Universal Trunk card	IPE: any slot but "Contr"
NT5K17 Direct Dial Inward Trunk card	IPE: any slot but "Contr"
NT5K18 Central Office Trunk card	IPE: any slot but "Contr"
NT5K19 E and M Trunk card	IPE: any slot but "Contr"
NT5K36 Direct Inward/Direct Outward Dial Trunk card	IPE: any slot but "Contr"
NT5K70 Central Office Trunk card	IPE: any slot but "Contr"
NT5K71 Central Office Trunk card	IPE: any slot but "Contr"
NT5K72 E and M Trunk card	IPE: any slot but "Contr"
NT5K82 Central Office Trunk card	IPE: any slot but "Contr"
NT5K83 E and M Trunk card	IPE: any slot but "Contr"
NT5K84 Direct Inward Dial Trunk card	IPE: any slot but "Contr"
NT5K90 Central Office Trunk card	IPE: any slot but "Contr"
NT5K93 Central Office Trunk card	IPE: any slot but "Contr"

Component	System
NT5K96 Analog Line card	IPE: any slot but "Contr"
NT5K99 Central Office Trunk card	IPE: any slot but "Contr"
NT6D70 S/T Interface Line card	IPE: any slot but "Contr"
NT6D71 U Interface Line card	IPE: any slot but "Contr"
NT6D73 Multi-purpose ISDN Signaling Processor card	Core/Net: 0–7
NT6D80 MSDL	Core/Net: 0–7
NT7R51 Local Carrier Interface	Core/Net: 0–7
NT8D01 Controller card	IPE: "Contr"
NT8D02 Digital Line card	IPE: any slot but "Contr"
NT8D09 Analog Message Waiting Line card	IPE: any slot but "Contr"
NT8D14 Universal Trunk card	IPE: any slot but "Contr"
NT8D15 E and M Trunk card	IPE: any slot but "Contr"
NT8D16 Digitone Receiver card	IPE: any slot but "Contr"
NT8D17 Conference/TDS card	Core/Net: 0–7
NTAG03 Central Office Trunk card	IPE: any slot but "Contr"
NTAG04 Central Office/Direct Inward Dial Trunk card	IPE: any slot but "Contr"
NTAG36 Avaya Integrated Recorded Announcer	IPE: any slot but "Contr"
NTBK51 Downloadable D-channel daughterboard	Connects to DDP card
NTCK16 Generic Central Office Trunk card	IPE: any slot but "Contr"
NTRE39 Optical Cable Management card	For 81C: Net module: the slot to the right side of 14, the slot to the left of the 3PE in slot 1
QPC43 Peripheral Signaling card	Core/Net: 10 Net: 4
QPC414 Network card	Core/Net: 0–7 Net: 5-12
QPC441 3-Port Extender card	Core/Net: 11 Net: 1
QPC578 Integrated Services Digital Line card	IPE: any slot but "Contr"
QPC841 4-Port Serial Data Interface card	Core/Net: 0-7

Precautions

To avoid personal injury and equipment damage, review the following guidelines before handling system equipment.

⚠ **Warning:**

Module covers are not hinged; do not let go of the covers. Lift covers away from the module and set them out of your work area.

⚠ **Warning:**

Circuit cards may contain a lithium battery. There is a danger of explosion if the battery is incorrectly replaced. Do not replace components on any circuit card; you must replace the entire card.

Dispose of circuit cards according to the manufacturer's instructions.

To avoid damage to circuit cards from static discharge, wear a properly connected antistatic wrist strap when you work on system equipment. If a wrist strap is not available, regularly touch one of the bare metal strips in a module to discharge static. Figure 17: Static discharge points on page 79 shows the recommended connection points for the wrist strap and the bare metal strips you should touch.

Handle circuit cards as follows:

- Unpack or handle cards away from electric motors, transformers, or similar machinery.
- Handle cards by the edges only. Do not touch the contacts or components.
- Set cards on a protective antistatic bag. If an antistatic bag is not available, hand-hold the card, or set it in a card cage unseated from the connectors.
- Store cards in protective packing. Do not stack cards on top of each other unless they are packaged.
- Keep cards installed in the system as much as possible to avoid dirty contacts and unnecessary wear.
- Store cards in a cool, dry, dust-free area.

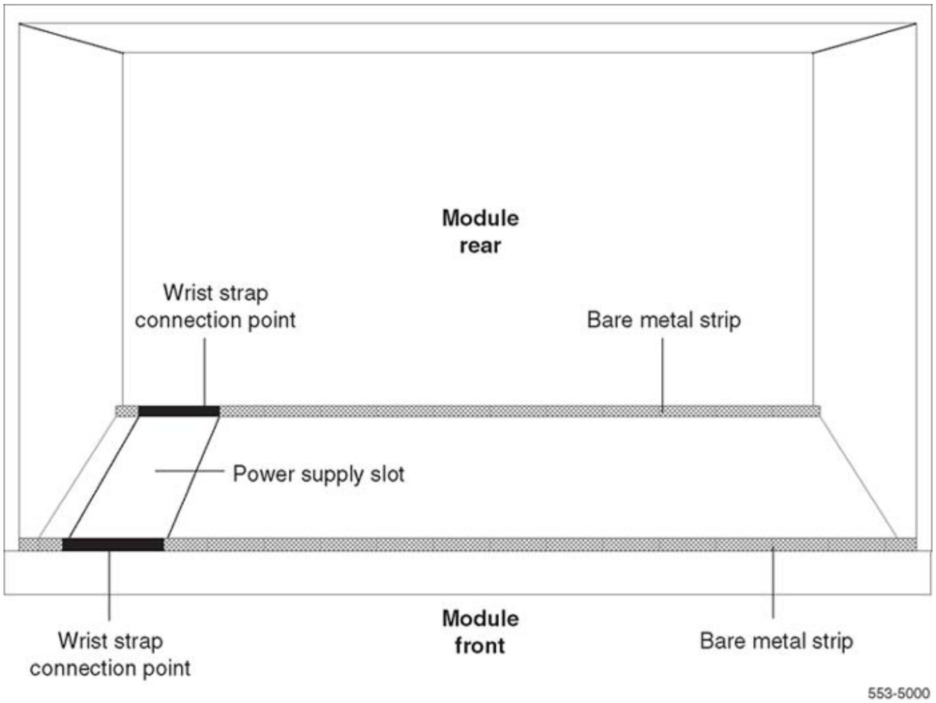


Figure 17: Static discharge points

During repair and maintenance procedures do the following:

- Turn off the circuit breaker or switch for a module power supply before the power supply is removed or inserted.
- In AC-powered systems, capacitors in the power supply must discharge. Wait five full minutes between turning off the circuit breaker and removing the power supply from the module.
- Software disable cards, if applicable, before they are removed or inserted.
- Hardware disable cards, whenever there is an enable/disable switch, before they are removed or inserted.
- Return defective or heavily contaminated cards to a repair center. Do not try to repair or clean them.

Installing a circuit card

This procedure provides detailed installation instructions for circuit cards.

Danger:

To avoid personal injury and equipment damage, read all of the guidelines in Circuit and installation on page 75 before you begin installation and follow all guidelines throughout the procedure.

Installing a circuit card

1. Open the protective carton and remove the circuit card from the antistatic bag. Return the antistatic bag to the carton and store it for future use.
2. Inspect the card components, faceplate, locking devices, and connectors for damage. If damaged, tag the card with a description of the problem and package it for return to a repair center.
3. Refer to the work order to determine the module and slot location for the card.
4. If there is an enable/disable (Enb/Dis) switch on the faceplate, set it to Dis.
5. If there are option switches or jumpers on the card, set them according to the work order (see Option settings on page 91).

    Caution:

    System Failure

    Incorrectly set switches on common equipment circuit cards may cause a system failure.

6. Squeeze the ends of the locking devices on the card and pull the tabs away from the latch posts and faceplate (see Figure 18: Installing the circuit card in the card cage on page 80).

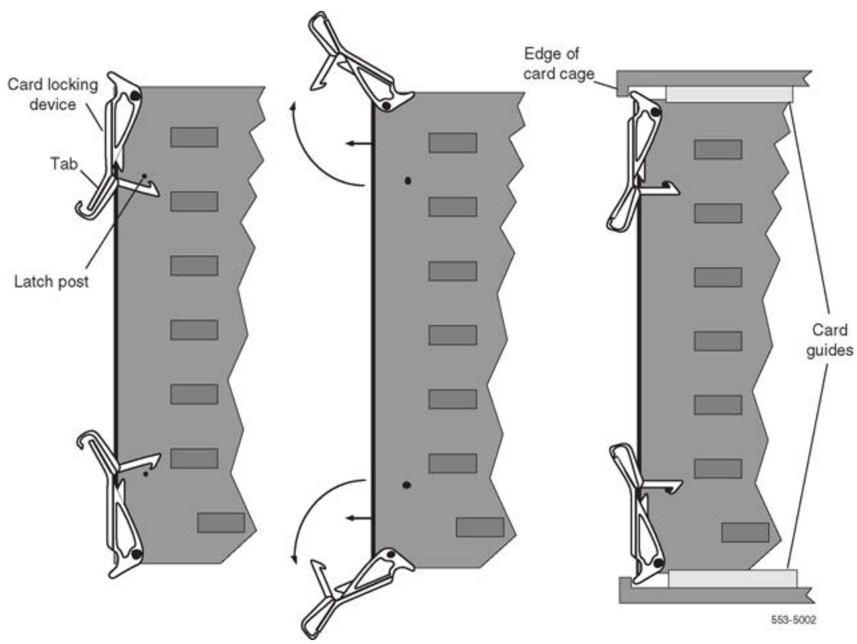


Figure 18: Installing the circuit card in the card cage

7. Insert the card into the card aligning guides in the card cage. Gently push the card into the slot until you feel resistance. The tip of the locking device must be behind the edge of the card cage (see Figure 18: Installing the circuit card in the card cage on page 80).
8. Lock the card into position by simultaneously pushing the ends of the locking devices against the faceplate.

   Note:

   When IPE cards are installed, the red LED on the faceplate remains lit for two to five seconds as a self-test runs. If the self-test is completed successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED does not follow the pattern described or operates in any other manner (such as continually flashing or remaining weakly lit), replace the card.
9. If there is an enable/disable switch, set it to Enb.

   Note:

   Do not enable the switch on an NT8D04 Superloop Network card or QPC414 Network card until network loop cables are installed.
10. If you are adding a voice, conference, or tone and digit loop, press the manual initialize (Man Int) button on the Call Processor if the card is associated with the active Call Processor:

    Note:

    An initialization causes a momentary interruption in call processing.
11. If you are installing the card in a working system, refer to the work order and the technical document, *Avaya Software Input/Output Reference — Administration* (NN43001-611) to add the required office data to the system memory.
12. Go to the appropriate test procedure in Acceptance tests on page 83.

Chapter 6: Acceptance tests

Contents

This section contains information on the following topics:

Introduction

Test procedures for most circuit cards require that internal and external cabling be installed. See the appropriate installation document for your system and Avaya Telephones and Consoles Fundamentals (NN43001-567) for cabling procedures.

Conference cards

Testing conference cards

Use this procedure to test a conference card or to test the conference function of an NT8D17 Conference/TDS Card.

1. Log into the system:

LOGI (password)

2. Request the status of a loop on the conference card:

   `LD 38 STAT loop`

   Conference status is formatted as follows:

   CNFC n DSBL n BUSY "n" represents the number of conference groups disabled and busy

   CHAN n DSBL n BUSY "n" represents the number of channels disabled and busy

   UNEQ card is not equipped in the system

   DSBL card is disabled in software

3. If the conference card loop is disabled, enable it.

   For an NT8D17 Conference/TDS Card, enter: **ENLX loop** (the conference loop is the odd loop of the conference.)

   Note:

   The conference is not enabled automatically when it is inserted. You must enable the card with the command ENLX. (This command is used in LD 34 and LD 46 to address even loops and in LD 38 to address odd loops.) Enabling the loops with the command ENLL does not enable the hardware for the card.

   For other than an NT8D17 Conference/TDS Card, enter: **ENLL loop** (the conference loop must be an even loop for cards other than the NT8D17)

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.

4. Test the conference loop for channel, group, and switching faults: **CNFC loop**

   If the conference loop passes the tests, the output is `OK` .

   If the system response is other than `OK` , see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.

5. Prepare the system for a manual conference call on a specified loop: **CNFC MAN loop c** Where "c" is the manual conference group (1-15)

   A manual conference test is performed by stepping through conference channels and groups and listening for noise that indicates a faulty card.

   The manual conference test can be performed through a system terminal or BCS maintenance telephone. If commands are entered from a maintenance telephone, this telephone automatically becomes part of the manual conference call.

   Only one manual conference call is allowed at one time. A manual conference consists of only two telephones, where one telephone acts as a signal source while the other acts as a listening monitor.

   After you enter the CNFC command, any two telephones (one may already be the maintenance telephone) dialing the special service prefix code (SPRE) and the digits 93 enter the manual conference call. The prime directory number (PDN) indicator, if equipped, lights on each telephone.

Going on-hook takes the telephone out of the manual conference call, and the test must be restarted.

See LD 38 in *Avaya Software Input/Output Reference — Administration* (NN43001-611) for more detailed information about using this command.

6. Test various channels and conference groups audibly with the command **`CNFC STEP`**

   When stepping through channels and groups, a clicking followed by silence is normal. Any distortion or other noises indicates a faulty card.

   Once the CNFC STEP command is entered, entering C on the system terminal or maintenance telephone steps through the conference channels. Entering G steps through the conference groups. There are 15 channels per group and 15 groups per conference card.

   Entering an asterisk (*) and END stops the test.

   See "LD 38" in *Avaya Software Input/Output Reference — Maintenance* (NN43001-711) for detailed information about using this command.

7. End the session in LD 38: **`****`**

Digitone receiver cards

Testing digitone receiver cards

Use this procedure to test a Digitone receiver (DTR) card, a DTR daughterboard.

1. Log into the system: **`LOGI`** (password)
2. See if the Digitone receiver to be tested is disabled: **`LD 34 STAT`**

   The system responds with the terminal number (TN), or numbers, of any disabled Digitone receivers.

3. If the Digitone receiver is disabled, enable it: **`ENLR l s c u`**loop, shelf, card, and unit numbers
4. Test the Digitone receiver: **`DTR l s c u`**loop, shelf, card, and unit numbers

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.

5. End the session in LD 34: **`****`**

Line cards

Testing line cards

Use this procedure to test a line card.

1. Log into the system: **`LOGI`** (password)
2. Perform a network memory test, continuity test, and signaling test on a specific loop and shelf: **`LD 30 SHLF l s`**loop and shelf numbers

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.
3. For a line card on a superloop, perform a signaling test on a specific card or unit:

   `UNTT l s c` loop, shelf, and card numbers

   For the NT8D02 Digital Line card, enter: **`UNTT l s c u`** loop, shelf, card, and unit numbers

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.
4. End the session in LD 30: **`****`**

Multifrequency sender cards

Testing multifrequency sender cards

Use this procedure to test a multifrequency sender (MFS) card or the MFS function of an NT8D17 Conference/TDS card.

1. Log into the system: **`LOGI`** (password)
2. Test and enable an MFS loop: **`LD 46 MFS loop`** (on the NT8D17 Conference/TDS card, the TDS/MFS loop is the even loop of the conference/TDS loop pair)

   Note:

   The conference/TDS card is not enabled automatically when it is inserted. You must enable the card with the command ENLX. (This command is used in LD 34 and LD 46 to address even loops and in LD 38 to address odd loops.) Enabling the loops with the command ENLL does not enable the hardware for the card.

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.
3. Access the system from a maintenance telephone; then enter: **`LD 46`**

Give the system approximately 20 seconds to load the program.

See "Communicating with the Meridian 1" in *Avaya Software Input/Output Reference — Administration* (NN43001-611) for details on accessing the system from a maintenance telephone.

4. Obtain 10-second bursts of digits 1 to 9, 0, and 11 to 15 (in that order) for all digits on the specified loop: **`TONE loop ALL`**

   Each burst should sound different. If the bursts do not sound different, replace the card.

5. End the session in LD 46: **`****`**

Multifrequency signaling cards

Testing multifrequency signaling cards

Use this procedure to test a multifrequency signaling card.

1. Log into the system: **`LOGI`** (password)
2. Test and enable the specified unit: **`LD 54 ATST l s c u`** (loop, shelf, card, and unit numbers)

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.

3. End the session in LD 54: **`****`**

Network cards

Testing network cards

Use this procedure to test a network card.

1. Log into the system: **`LOGI`** (password)
2. Perform a network memory test, continuity test, and signaling test: **`LD 30 LOOP <loop>`** where <loop> can be a specific loop number or **`ALL`**

   If ALL is specified, all enabled loops (except attendant console loops) and all shelves on each loop are tested.

   If only one loop is being tested and it is disabled, enter **`ENLL loop`** to enable and test a network card associated with the specified loop. (This command cannot enable network cards disabled by LD 32.)

If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.

3. End the session in LD 30: `****`

Trunk cards

Use the following procedures to test a trunk card.

Testing a trunk card using a maintenance telephone

1. Access the system from a maintenance telephone.

   See "Communicating with the Meridian 1" in *Avaya Software Input/Output Reference — Administration* (NN43001-611) for details on accessing the system from a maintenance telephone.
2. Test the trunk unit: **`LD 36 TRK l s c u`** (loop, shelf, card, and unit numbers)
3. If the maintenance telephone is hooked up to a monitor and the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration*, (NN43001-611) to analyze the messages.

Testing a trunk card using a system terminal

1. Log into the system: **`LOGI`** (password)
2. Enter: **`LD 36`**
3. To test a trunk from a remote test center, seize a Central Office (CO) monitor trunk: **`CALL`** or **`CALL l s c u`**

   Seize the automatic number identification (ANI) trunk: **`TRK l s c u`** loop, shelf, card, and unit numbers

   When you see the **`DN?`** prompt, enter the directory number (DN) you want the system to dial.

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.
4. End the session in LD 36: `****`
5. Test an automatically identified outward dialing (AIOD) trunk card: **`LD 41 AIOD l s c`** (loop, shelf, and card numbers)

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.
6. End the session in LD 41: `****`

Tone and digit switch cards

Testing tone and digit switch cards

Use this procedure to test a tone and digit switch (TDS) card or to test the TDS function of an NT8D17 Conference/TDS card.

1. Log into the system: **`LOGI`** (password)
2. Obtain a list of terminal numbers (TNs) for disabled TDS cards: **`LD 34 STAD`**
3. If the TDS loop to be tested is disabled, enable it.

   For an NT8D17 Conference/TDS card, enter: **`ENLX loop`** (The TDS/MFS loop is the even loop of the conference/TDS loop pair.)

   Note:

   The conference/TDS card is not enabled automatically when it is inserted. You must enable the card with the command **ENLX**. (This command is used in LD 34 and LD 46 to address even loops and in LD 38 to address odd loops.) Enabling the loops with the command ENLL does not enable the hardware for the card.

   For other than an NT8D17 Conference/TDS card, enter: **`ENLL loop`**
4. Test the TDS loop: **`TDS loop`**

   If the system response is other than **OK**, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) to analyze the messages.
5. End the session in LD 34: **`****`**
6. Using a maintenance telephone, log into the system.

   See "Communicating with the Meridian 1" in *Avaya Software Input/Output Reference — Administration* (NN43001-611) for details on accessing the system using a maintenance telephone.
7. From the maintenance telephone, enter: **`LD#34##`**

   To test outpulsers and channels for the TDS loop, see Table 13: TDS tone tests on page 89 for a sample of the input commands used with the maintenance telephone. See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for all tones that can be tested.
8. Exit LD 34 from the maintenance telephone: **`****`**

Table 13: TDS tone tests

Input command	Dial pad equivalent	Description
BSY#loop##	279#loop##	Provides busy tone from TDS loop specified.

Input command	Dial pad equivalent	Description
C##	2##	Removes any active tone.
DIA#loop##	342#loop##	Provides dial tone from TDS loop specified.
OVF#loop##	683#loop##	Provides overflow tone from TDS loop specified.
RBK#loop##	725#loop##	Provides ringback tone from TDS loop specified.
RNG#loop##	764#loop##	Provides ring tone from TDS loop specified.
****		Exits TDS test program.

Chapter 7: Option settings

Contents

This section contains information on the following topics:

Circuit card grid

Some circuit cards contain option switches or jumpers, or both, that define specific functions. A switch or jumper can be identified by an alphanumeric coordinate (such as D29) that indicates a location on the card, or by a switch number (such as SW2) printed on the circuit board (see Figure 19: Circuit card grid on page 92). Positions on a switch (for example, positions 1, 2, 3, and 4 on SW2) are labeled on the switch block.

On a circuit card:

- ON may be indicated by the word "on," the word "up," the word "closed," the number "1," an arrow pointing up, or a solid dot (•).
- OFF may be indicated by the word "down," the word "open," the number "0," or an arrow pointing down.

Throughout this document, if neither ON nor OFF is given (there is a blank space) for a position on a switch, that position may be set to either ON or OFF because it has no function for the option described.

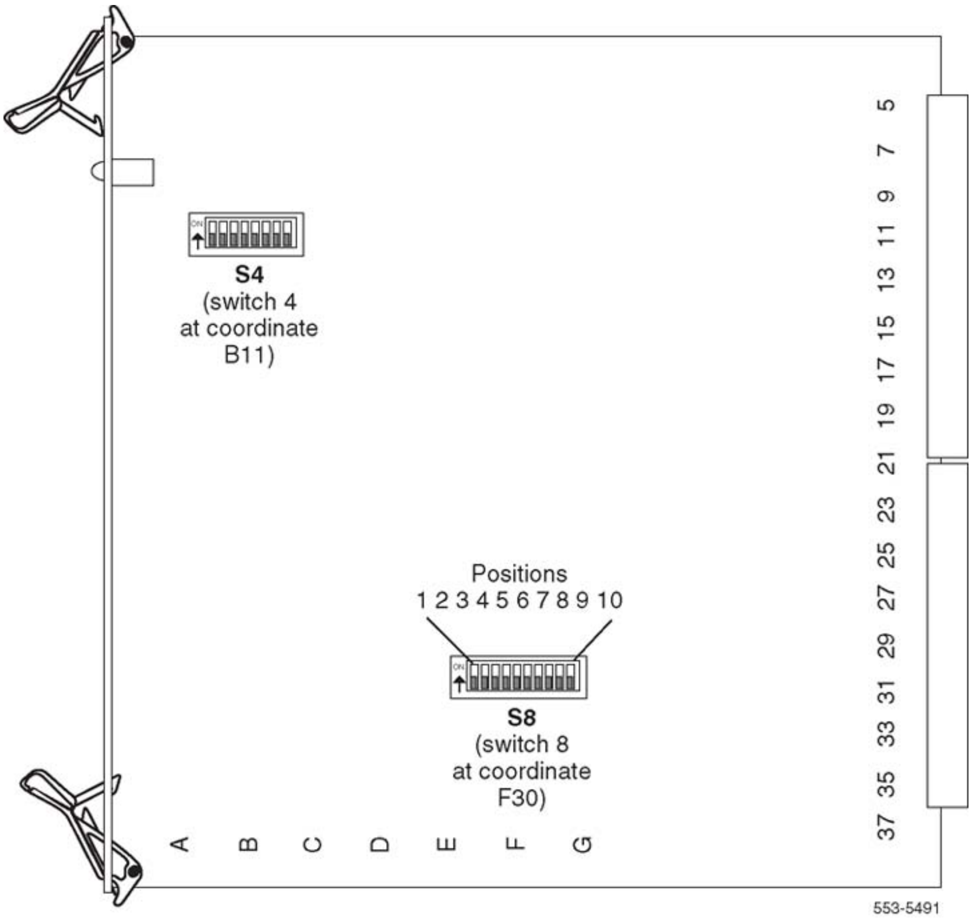


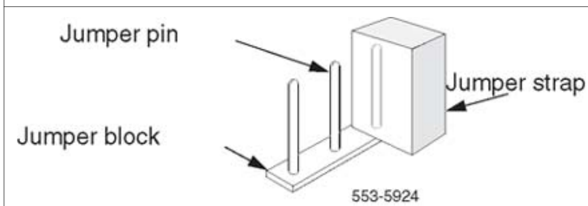
Figure 19: Circuit card grid

NT1R20 Off-Premise Station card

Table 14: OPS analog line card configuration on page 93 lists option settings for the NT1R20 Off-Premise Station analog card.

Table 14: OPS analog line card configuration

<table>
<tr><th>Application</th><th colspan="3">On-premise station (ONS)</th><th colspan="4">Off-premise station (OPS)</th></tr>
<tr><td>Class of Service (CLS) (Note 1)</td><td colspan="3">ONP</td><td colspan="4">OPX</td></tr>
<tr><td>Loop resistance (ohms)</td><td colspan="3">0–460</td><td colspan="4">0–2300 (Note 2)</td></tr>
<tr><td>Jumper strap setting (Note 6)</td><td colspan="3">Both JX.0 and JX.1 off</td><td colspan="2">Both JX.0 and JX.1 off</td><td colspan="2">Both JX.0 and JX.1 on</td></tr>
<tr><td>Class of Service (CLS) (Note 1)</td><td colspan="3">ONP</td><td colspan="4">OPX</td></tr>
<tr><td>Loop loss (dB) (Note 3)</td><td>0–1.5</td><td>>1.5–2.5</td><td>>2.5–3.0</td><td>0–1.5</td><td>>1.5–2.5</td><td>>2.5–4.5</td><td>>4.5–15</td></tr>
<tr><td>TIMP (Notes 1, 4)</td><td>600 ohms</td><td>600 ohms</td><td>600 ohms</td><td>600 ohms</td><td>600 ohms</td><td>600 ohms</td><td>600 ohms</td></tr>
<tr><td>Class of Service (CLS) (Note 1)</td><td colspan="3">ONP</td><td colspan="4">OPX</td></tr>
<tr><td>BIMP (Notes 1, 4)</td><td>600 ohms</td><td>3COM1</td><td>3COM2</td><td>600 ohms</td><td>3COM1</td><td>3COM2</td><td>3COM2</td></tr>
<tr><td>Gain treatment (Note 5)</td><td colspan="6">No</td><td>Yes</td></tr>
<tr><td colspan="8">Note:
Note 1:
Configured in the Analog (500/2500-type) Telephone Administration program (LD 10).
Note:
Note 2:
The maximum signaling range supported by the OPS analog line card is 2300 ohms.
Note:
Note 3:
Loss of untreated (no gain devices) metallic line facility. Upper loss limits correspond to loop resistance ranges for 26 AWG wire.
Note:
Note 4:
Default software impedance settings are:</td></tr>
</table>

Application	On-premise station (ONS)		Off-premise station (OPS)
	ONP CLS	**OPX CLS**	
TIMP:	600 ohms 600 ohms	600 ohms	
BIMP:	600 ohms	3COM2	
Note: Note 5: Gain treatment, such as a voice frequency repeater (VFR) is required to limit the actual OPS loop loss to 4.5 dB, maximum. VFR treatment of metallic loops having untreated loss greater than 15 dB (equivalent to a maximum signaling range of 2300 ohms on 26 AWG wire) is not recommended. **Note:** Note 6: Jumper strap settings JX.0 and JX.1 apply to all eight units; "X" indicates the unit number, 0–7. "Off" indicates that a jumper strap is not installed across both pins on a jumper block. Store unused straps on the OPS analog line card by installing them on a single jumper pin as shown below:			
			

NT5D12 Dual DTI/PRI (DDP) card

Switch setting tables for this card are listed in subsections according to their function. Bold font designates factory (default) settings.

General purpose switches

Use switch set SW9 for Trunk 0; use switch set SW15 for Trunk 1 (see Table 15: General purpose switch settings on page 95).

Table 15: General purpose switch settings

Switch	Description	SW9/SW15 switch setting
1	Framing Mode	off - ESF on - SF
2	Yellow Alarm Method	off - FDL on - Digit2
3	Zero Code Suppression Mode	off - B8ZS on - AMI
4	Unused	off

Trunk interface switches

A switch provides selection of T1 transmission. Use switch SW4 for Trunk 0; use switch SW10 for Trunk 1 (see Table 16: Trunk interface transmission mode switch settings on page 95).

Table 16: Trunk interface transmission mode switch settings

Description	SW4/SW10 switch setting
For future use	off
T1	on

A set of three switches provides selection of dB values. Use SW5, SW6, and SW7 for Trunk 0; use SW11, SW12, and SW13 for Trunk 1 (see Table 17: Trunk interface line build out switch settings on page 95).

Table 17: Trunk interface line build out switch settings

	Switch Setting		
Description	SW5/SW11	SW6/SW12	SW7/SW13
0 dB	off	off	off
7.5 dB	on	on	off
15 dB	on	off	on

A set of four DIP switches provides selection among three values for receiver impedance. Use SW8 for Trunk 0; use SW14 for Trunk 1 (see Table 18: Trunk interface impedance switch settings on page 96).

Table 18: Trunk interface impedance switch settings

Description	SW8/SW14 Switch Settings			
75 Ω	off	off	on	off
100 Ω	on	off	off	on
120 Ω	off	off	off	on

Ring ground switches

A set of four DIP switches selects which Ring lines are connected to ground (see Table 19: Ring ground switch settings on page 96).

Table 19: Ring ground switch settings

Switch	Description	S2 switch setting
1	Trunk 0 Transmit	off - Ring line is not grounded on- Ring line is grounded
2	Trunk 0 Receive	off - Ring line is not grounded on - Ring line is grounded
3	Trunk 1 Transmit	off - Ring line is not grounded on - Ring line is grounded
4	Trunk 1 Receive	off - Ring line is not grounded on - Ring line is grounded

DCH mode and address select switches

One switch selects an on-board NTBK51AA/NTBK51CA D-Channel daughterboard and an external MSDL/DCHI card. Four other switches provide the daughterboard address (see Table 20: DCH mode and address select switch settings on page 96).

Table 20: DCH mode and address select switch settings

Switch	Description	S3 Switch Setting
1-4	D-Channel daughterboard Address	See the next table.
5-7	For future use	off
8	External DCH or Onboard DDCH	off - MSDL or DCHI card on - Onboard DDCH daughterboard

Table 21: NTBK51AA/NTBK51CA daughterboard address select switch settings

Device Address[1]	Switch Setting			
0[2]	off	off	off	off
1	on	off	off	off
2	off	on	off	off
3	on	on	off	off
4	off	off	on	off
5	on	off	on	off
6	off	on	on	off
7	on	on	on	off
8	off	off	off	on
9	on	off	off	on
10	off	on	off	on
11	on	on	off	on
12	off	off	on	on
13	on	off	on	on
14	off	on	on	on
15	on	on	on	on

Note:

1. The maximum number of DCHI, MSDL, and DDCH devices in the system is 16. The Device Addresses are equivalent to the MSDL DNUM designations. For programming information about the MSDL, refer to technical document Avaya Software Input/Output Reference — Administration (NN43001-611) guide.

Note:

2. Device address 0 is commonly assigned to the System Monitor.

Illustrations of switch locations and settings

Figure 20: Switch functions and areas on page 98 displays functional areas for switches on the NT5D12 DDP card.

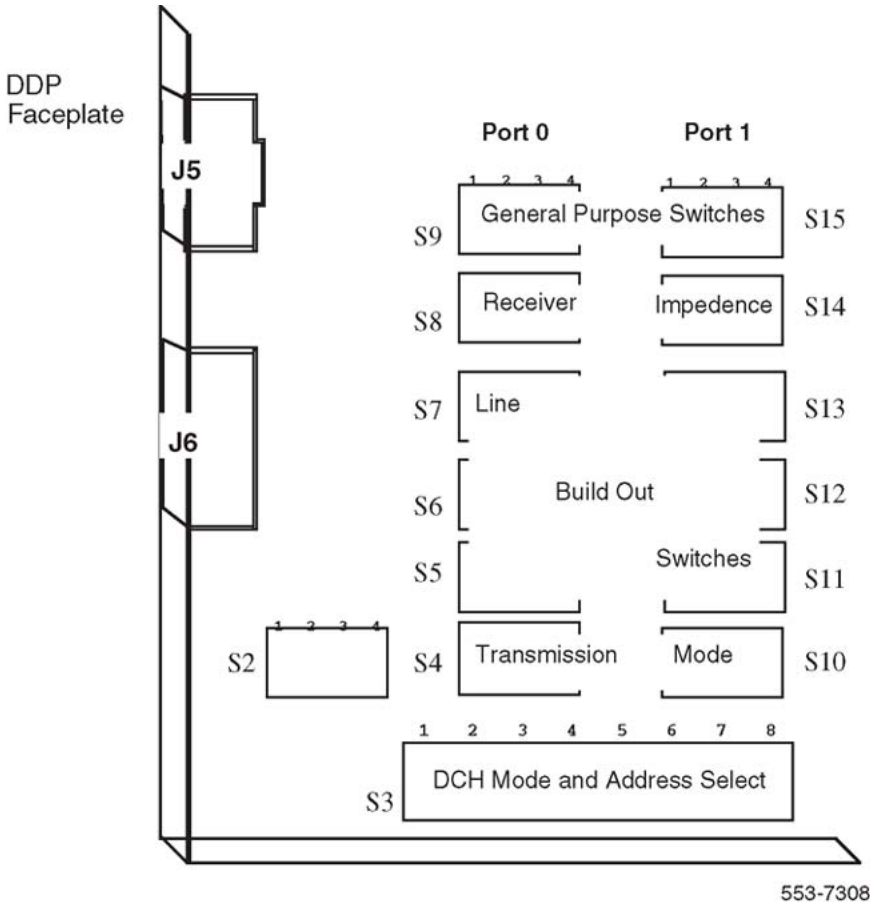


Figure 20: Switch functions and areas

Figure 21: Switch default settings on page 99 displays default settings for switches on the NT5D12 DDP card.

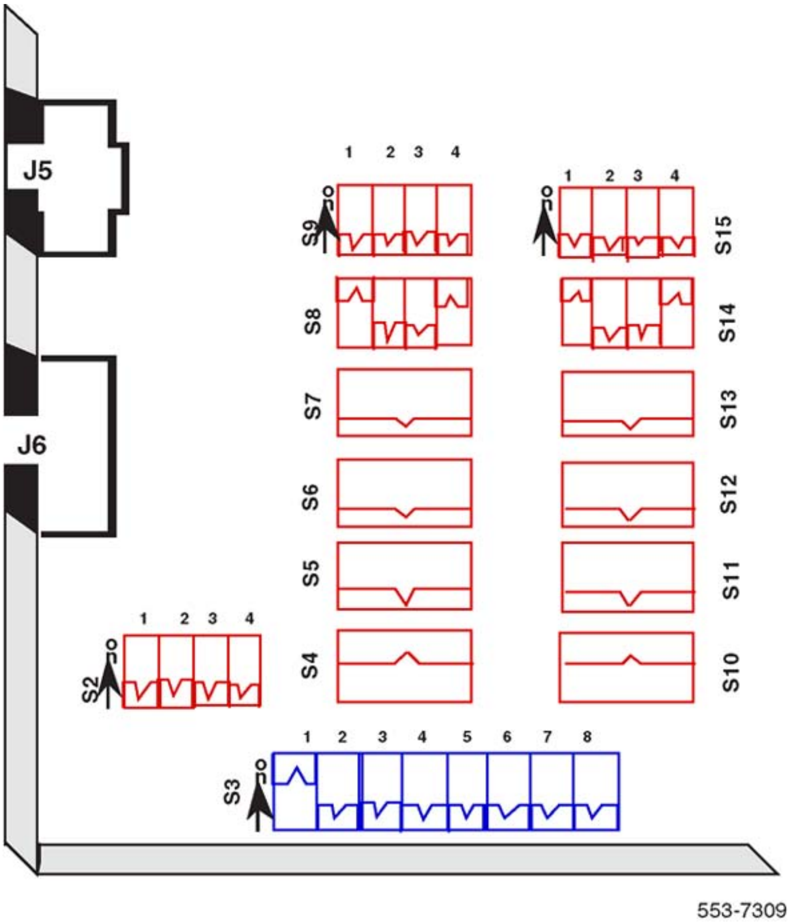


Figure 21: Switch default settings

NT6D42 Ringing Generator DC

Table 22: NT6D42 recommended options for North American and British Telecom on page 99 through Table 27: NT6D42CC SW2 on page 101 list option settings for the NT6D42 Ringing Generator.

Table 22: NT6D42 recommended options for North American and British Telecom

Application	Ringing frequency	Ringing voltage	Jumper locations	Ringing output
North America	20 Hz	86 V ac	P5 High voltage message waiting	Low impedance
British Telecom	25 Hz	80 V ac	P4 No high voltage	Low impedance

Application	Ringing frequency	Ringing voltage	Jumper locations	Ringing output
			message waiting	

Table 23: NT6D42 jumper locations P4 and P5

High voltage message waiting	Pin location
Disable	Jumper in P4
Enable	Jumper in P5
Note: One jumper must be installed.	

Table 24: NT6D42 jumper location J7

Ringing output	Jumper location J7
Low impedance (normal)	Connect pins 1 and 2
High impedance (Australia)	Connect pins 2 and 3

Table 25: NT6D42 SW1

Ringing frequency (Hz)	Position SW1
20	1
25	2
50	3

Table 26: NT6D42CB SW2

		SW2			
Ringing voltage	Message waiting voltage	1	2	3	4
86 V ac	–120 V dc	off	off	off	off
86 V ac	–150 V dc	off	off	off	on
80 V ac	–120 V dc	on	off	off	off
80 V ac	–150 V dc	on	off	off	on
75 V ac	–120 V dc	off	on	off	off
75 V ac	–150 V dc	off	on	off	on
70 V ac	–120 V dc	off	off	on	off
70 V ac	–150 V dc	off	off	on	on

Table 27: NT6D42CC SW2

		SW2			
Ringing voltage	**Message waiting voltage**	**1**	**2**	**3**	**4**
86 V ac	–100 V dc	off	off	off	off
86 V ac	–150 V dc	off	off	off	on
80 V ac	–100 V dc	on	off	off	off
80 V ac	–150 V dc	on	off	off	on
75 V ac	–100 V dc	off	on	off	off
75 V ac	–150 V dc	off	on	off	on
70 V ac	–100 V dc	off	off	on	off
70 V ac	–150 V dc	off	off	on	on

NT6D80 Multi-purpose Serial Data Link card

Table 28: NT6D80 Multi-purpose Serial Data Link card

	Port 0—SW4	**Port 0—SW8**
RS-232-D DTE or DCE* RS-422-A DTE (terminal) RS-422-A DCE (modem)	all off all off all on	all off all on all off
	Port 1—SW3	**Port 1—SW7**
RS-232-D DTE or DCE* RS-422-A DTE RS-422-A DCE	all off all off all on	all off all on all off
	Port 2—SW2	**Port 2—SW6**
RS-232-D DTE or DCE* RS-422-A DTE RS-422-A DCE	all off all off all on	all off all on all off
	Port 3—SW1	**Port 3—SW5**
RS-232-D DTE or DCE* RS-422-A DTE RS-422-A DCE	all off all off all on	all off all on all off
* RS-232-D DTE and DCE modes are software configured. RS-422-A DTE and DEC modes are switch configured.		

> **Note:**
> The device number for the MSDL card is configured in LD17 at the prompt DNUM. You must also set the device number, using switches S9 and S10, on the MSDL card. S9 designates ones and S10 designates tens. To set the device number as 14, for example, set S10 to 1 and S9 to 4.

NT8D14 Universal Trunk card

Table 29: NT8D14 vintage AA jumper strap settings on page 102 through Table 33: NT8D14 vintages BA/BB cable loop resistance and loss on page 104 list option settings for the NT8D14 Universal Trunk card.

Table 29: NT8D14 vintage AA jumper strap settings

Modes	Location	Jumper strap
Central Office (CO)	J1, J2	off
2-way tie trunk (loop dial repeat)	J1, J2	off
2-way tie trunk (outgoing/incoming dial)	J1, J2	off
Recorded announcement (RAN)	J1, J2	off
Paging trunk	J1, J2	off
Japan CO/DID operation	J1, J2	off
DID operation: loop length > = 2000 ¾	J1, J2	on
DID operation: loop length < 2000 ¾	J1, J2	off

> **Note:**
> off = no strap present.
>
> **Note:**
> Locations (J1, J2) apply to all eight units.

Table 30: NT8D14 vintages BA/BB jumper strap settings-factory standard

Trunk types	Loop length	Jumper strap settings			
		J1.X	J2.X	J3.X	J4.X
CO/FX/WATS	Zero–1524 m (5000 ft)	Off	Off	1–2	1–2
2-way tie (LDR)					
2-way tie (OAID)					

Trunk types	Loop length	Jumper strap settings			
		J1.X	J2.X	J3.X	J4.X
DID	Zero–600 ohms				
RAN: continuous operation mode	Not applicable: RAN and paging trunks should not leave the building.				
Paging					

Note:

Jumper strap settings J1.X, J2.X, J3.X, and J4.X apply to all eight units; "X" indicates the unit number, 0–7. "Off" indicates that no jumper strap is installed on a jumper block. Store unused straps on the universal trunk card by installing them on a single jumper pin as shown below:

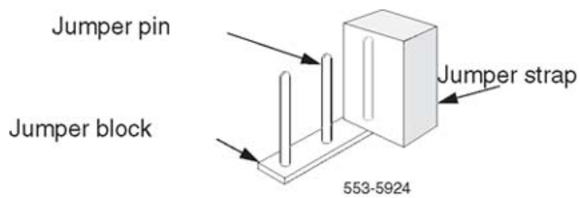


Table 31: NT8D14 vintages BA/BB jumper strap settings-extended range

Trunk types	Loop length	Jumper strap settings			
		J1.X	J2.X	J3.X	J4.X
CO/FX/WATS	> 1524 m (5000 ft)	Off	Off	1–2	2–3
2-way tie (LDR)					
2-way tie (OAID)					
DID	> 600 ohms	On	On	1–2	2–3
RAN: pulse start or level start modes	Not applicable: RAN trunks should not leave the building.	Off	Off	2–3	1–2

Note:

Jumper strap settings J1.X, J2.X, J3.X, and J4.X apply to all eight units; "X" indicates the unit number, 0–7. "Off" indicates that no jumper strap is installed on a jumper block.

Table 32: NT8D14 vintages BA/BB trunk types-termination impedance and balance network

Trunk types	Terminating impedance (Note 1)	Balance network for loop lengths (Note 2)		
		Zero–915 m (zero–3000 ft)	915–1524 m (3000–5000 ft)	> 1524 m (> 5000 ft)
CO/FX/WATS	600 or 900 ohms	600 ohms	3COM1	3COM2

Trunk types	Terminating impedance (Note 1)	Balance network for loop lengths (Note 2)		
		Zero–915 m (zero–3000 ft)	915–1524 m (3000–5000 ft)	> 1524 m (> 5000 ft)
2-way tie (LDR)	600 or 900 ohms	600 ohms	3COM1	3COM2
2-way tie (OAID)	600 or 900 ohms	600 ohms	3COM1	3COM2
DID (loop < 600 ohms)	600 or 900 ohms	600 ohms	3COM1	3COM2
DID (loop Š 600 ohms)	600 or 900 ohms	600 ohms	N/A	3COM2
RAN: continuous operation mode	600 or 900 ohms	600 or 900 ohms	N/A	N/A
Paging	600 ohms	600 ohms	N/A	N/A

Note:

The terminating impedance of each trunk unit is software selectable in LD 14 and should match the nominal impedance of the connecting equipment.

Note:

The balance network of each trunk unit is software selectable between resistive 600 or 900 ohms or 3COM and is jumper selectable between 3COM1 and 3COM2.

Table 33: NT8D14 vintages BA/BB cable loop resistance and loss

Cable length	Cable loop resistance (ohms)			Cable loop loss (dB) (non-loaded at 1kHz)		
	22 AWG	24 AWG	26 AWG	22 AWG	24 AWG	26 AWG
915 m (3000 ft)	97	155	251	0.9	1.2	1.5
1524 m (5000 ft)	162	260	417	1.6	2.0	2.5
2225 m (7300 ft)	236	378	609	2.3	3.0	3.7
3566 m (11700 ft)	379	607	977	3.7	4.8	6.0
5639 m (18500 ft)	600	960	1544	5.9	7.6	9.4

NT8D15 E and M Trunk card

Table 34: NT8D15 E and M Trunk card

Jumper (Note 1)	Mode of operation (Note 2)					
	2-wire trunk		4-wire trunk			
	Type I	Paging	Type I	Type II	DX tip & ring pair	
					M—rcv M—xmt	E—rcv M—xmt
J1.X	off	off	off	off	Pins 1–2	Pins 2–3
J2.X	on	on (Note 3)	on	on	off	off
J3.X	off	off	off	off	(Note 4)	(Note 4)
J4.X	off	off	off	off	Pins 2–3	Pins 1–2
J5.X	off	off	off	off	(Note 4)	(Note 4)
J6.X	off	off	off	off	on	on
J7.X	off	off	off	off	on	on
J8.X	off	off	off	off	on	on
J9.X	Pins 2–3	Pins 2–3	Pins 2–3	Pins 2–3	Pins 1–2	Pins 1–2

Note:

1. Jumper strap settings J1.X through J9.X apply to all 4 units; "X" indicates the unit number, 0–3.

Note:

2. Off indicates that no jumper strap is installed on a jumper block.

Note:

3. Paging trunk mode is not zone selectable.

Note:

4. Jumper strap installed in this location only if external loop resistance exceeds 2500 ohms.

Note:

5. Dot next to the jumper block indicates pin 1.

NT8D17 Conference/TDS card

Switch and jumper settings are used to select the companding law and to change the conference attenuation PAD levels. These PAD levels are used if prompt CPAD = 1 in LD 97. The J1 connector on the faceplate is reserved for future use.

You can enable or disable a warning tone for conference calls. When the option is enabled, the tone lets callers know they are entering a conference call. The switch for this option is preset to disable the warning tone.

Table 35: NT8D17 Conference/TDS card Companding law

Companding law	Jumper at J3
μ-law (North America), A-law	connect pins 2 and 3
Special cases	connect pins 1 and 2

Table 36: NT8D17 Conference/TDS card Attenuation levels

Attenuation levels	SW2 (see Note)		
	1	**2**	**3**3
10.2 dB	on	on	on
8.5 dB	on	off	on
6 dB	off	on	on
6 dB	off	off	on
4.5 dB	on	on	off
3 dB	on	off	off
0 dB	off	on	off
0 dB	off	off	off

Note:

Set SW2 position 4 to ON to disable the warning tone option. When the warning tone is enabled, select the warning tone level as shown below:

- 24 dB Connect pins 1 and 2
- 30 dB Connect pins 2 and 3

NT8D21 Ringing Generator AC

Frequency	Amplitude	Settings		
		P1	P2	P3
20 Hz	86 V ac	open	open	2–5 8–11
25 Hz	70 V ac	open	1–4 7–10	open
25 Hz	80 V ac	open	3–6 9–12	open
25 Hz	86 V ac	open	2–5 8–11	open
50 Hz	70 V ac	1–4 7–10	open	open
50 Hz	80 V ac	3–6 9–12	open	open

NT8D22 System Monitor

The master system monitor, located in the column with CP 0, must be numbered 0. Slave system monitors are numbered from 1 to 63.

For examples of system monitor option settings in basic configurations, see "Sample settings for NT8D22 System Monitors."

Configure the system monitor in Remote Peripheral Equipment (RPE) columns as slaves. There is no serial connection between RPE columns.

Table 37: NT8D22 SW1

SW1 function	Position							
	1	2	3	4	5	6	7	8
Not used Meridian 1 columns only	on off							
Position 1 is OFF (Meridian 1 columns only) Not used Position 1 is ON, master column contains CP:master slaves		off off on off						
DC-powered system AC-powered system			on off					

SW1 function	Position							
	1	2	3	4	5	6	7	8
PFTU is activated by this column due to over-temperature PFTU is not activated by this column				on off				
Position 1 is OFF (Meridian 1 columns only) Not used Not used					off on off			
Position 1 is OFF (Meridian 1 columns only) Not used Not used						off on off		
Not used Not used Not used Meridian 1 columns only							on on off off	on off on off

Table 38: NT8D22 SW2

SW2 indication	Position							
	1	2	3	4	5	6	7	8
Master system monitor Slave system monitor	on off							
For MG XPEC support: configure switches on the master XSM (NT8D22AEE5) to identify the connection to the MG XPEC card. **Note:** The NT8D22 is labeled Open or Closed. Therefore, Open=OFF and Closed=ON		SW1–1 switch to OFF (Open) postion SW2–2 switch to ON (Closed) postion						
For master, indicates total number of slaves			Configure 3–8 according to the Table 40: NT8D22 settings for total number of slaves-SW2 on master on page 109.					
For each slave, indicates the slave address			Configure 3–8 according to the Table 41: NT8D22AD/NT8D22ADE5 slave address-SW2 on slave on page 110.					

Table 39: NT8D22 SW3

SW3 indication		Position			
		1	2	3	4
CTA	master slave	on off			
CTR	master slave		on off		
FAIL	master slave			on off	
MAJOR	master slave				on off

Table 40: NT8D22 settings for total number of slaves-SW2 on master

How many slave units	Switch position						How many slave units	Switch position					
	3	4	5	6	7	8		3	4	5	6	7	8
0	on	on	on	on	on	on	32	off	on	on	on	on	on
1	on	on	on	on	on	off	33	off	on	on	on	on	off
2	on	on	on	on	off	on	34	off	on	on	on	off	on
3	on	on	on	on	off	off	35	off	on	on	on	off	off
4	on	on	on	off	on	on	36	off	on	on	off	on	on
5	on	on	on	off	on	off	37	off	on	on	off	on	off
6	on	on	on	off	off	on	38	off	on	on	off	off	on
7	on	on	on	off	off	off	39	off	on	on	off	off	off
8	on	on	off	on	on	on	40	off	on	off	on	on	on
9	on	on	off	on	on	off	41	off	on	off	on	on	off
10	on	on	off	on	off	on	42	off	on	off	on	off	on
11	on	on	off	on	off	off	43	off	on	off	on	off	off
12	on	on	off	off	on	on	44	off	on	off	off	on	on
13	on	on	off	off	on	off	45	off	on	off	off	on	off
14	on	on	off	off	off	on	46	off	on	off	off	off	on
15	on	on	off	off	off	off	47	off	on	off	off	off	off
16	on	off	on	on	on	on	48	off	off	on	on	on	on
17	on	off	on	on	on	off	49	off	off	on	on	on	off
18	on	off	on	on	off	on	50	off	off	on	on	off	on
19	on	off	on	on	off	off	51	off	off	on	on	off	off

How many slave units	Switch position						How many slave units	Switch position					
	3	4	5	6	7	8		3	4	5	6	7	8
20	on	off	on	off	on	on	52	off	off	on	off	on	on
21	on	off	on	off	on	off	53	off	off	on	off	on	off
22	on	off	on	off	off	on	54	off	off	on	off	off	on
23	on	off	on	off	off	off	55	off	off	on	off	off	off
24	on	off	off	on	on	on	56	off	off	off	on	on	on
25	on	off	off	on	on	off	57	off	off	off	on	on	off
26	on	off	off	on	off	on	58	off	off	off	on	off	on
27	on	off	off	on	off	off	59	off	off	off	on	off	off
28	on	off	off	off	on	on	60	off	off	off	off	on	on
29	on	off	off	off	on	off	61	off	off	off	off	on	off
30	on	off	off	off	off	on	62	off	off	off	off	off	on
31	on	off	off	off	off	off	63	off	off	off	off	off	off

Table 41: NT8D22AD/NT8D22ADE5 slave address-SW2 on slave

Slave unit address	Position						Slave unit address	Position					
	3	4	5	6	7	8		3	4	5	6	7	8
1	on	on	on	on	on	off	33	off	on	on	on	on	off
2	on	on	on	on	off	on	34	off	on	on	on	off	on
3	on	on	on	on	off	off	35	off	on	on	on	off	off
4	on	on	on	off	on	on	36	off	on	on	off	on	on
5	on	on	on	off	on	off	37	off	on	on	off	on	off
6	on	on	on	off	off	on	38	off	on	on	off	off	on
7	on	on	on	off	off	off	39	off	on	on	off	off	off
8	on	on	off	on	on	on	40	off	on	off	on	on	on
9	on	on	off	on	on	off	41	off	on	off	on	on	off
10	on	on	off	on	off	on	42	off	on	off	on	off	on
11	on	on	off	on	off	off	43	off	on	off	on	off	off
12	on	on	off	off	on	on	44	off	on	off	off	on	on
13	on	on	off	off	on	off	45	off	on	off	off	on	off
14	on	on	off	off	off	on	46	off	on	off	off	off	on
15	on	on	off	off	off	off	47	off	on	off	off	off	off

Slave unit address	Position						Slave unit address	Position					
	3	4	5	6	7	8		3	4	5	6	7	8
16	on	off	on	on	on	on	48	off	off	on	on	on	on
17	on	off	on	on	on	off	49	off	off	on	on	on	off
18	on	off	on	on	off	on	50	off	off	on	on	off	on
19	on	off	on	on	off	off	51	off	off	on	on	off	off
20	on	off	on	off	on	on	52	off	off	on	off	on	on
21	on	off	on	off	on	off	53	off	off	on	off	on	off
22	on	off	on	off	off	on	54	off	off	on	off	off	on
23	on	off	on	off	off	off	55	off	off	on	off	off	off
24	on	off	off	on	on	on	56	off	off	off	on	on	on
25	on	off	off	on	on	off	57	off	off	off	on	on	off
26	on	off	off	on	off	on	58	off	off	off	on	off	on
27	on	off	off	on	off	off	59	off	off	off	on	off	off
28	on	off	off	off	on	on	60	off	off	off	off	on	on
29	on	off	off	off	on	off	61	off	off	off	off	on	off
30	on	off	off	off	off	on	62	off	off	off	off	off	on
31	on	off	off	off	off	off	63	off	off	off	off	off	off
32	off	on	on	on	on	on							

NT8D22 jumper settings

EA-GND short (Pins 2 and 3 short) Accessing External EPROM. EA-VCC short (Pins 2 and 1 short) Accessing Internal EPROM.

QPC43 Peripheral Signaling card

Options (minimum vintage N)	Plug location
NT8D35 Network module	

QPC414 Network card

Application	Pin connection J3/S2 and J4/S1
T-1 facilities (including PRI/DTI),* channel service unit	connect pins 1 and 2 (pin 1 is next to the white dot)
Note: Possible jumper locations for vintage B (for different styles/series):	
J3—E11 or H11J4—H17 or E7S1 and S2—E33	
Note: Possible jumper locations for vintage A (for different styles/series). These cards can only be used in the option A setting:	
J3—H5 or E11J4—H17 or E7S1 and S2—E33	
Note: Connectors and loop relations:	
Even loop: J1 faceplate connector, jumper at J4 or S1Odd loop: J2 faceplate connector, jumper at J3 or S2	

QPC441 3-Port Extender cards

For CS 1000M SG and MG systems, QPC441 vintage F or later must be used in all modules.

Table 42: QPC441 3PE card installed in the NT4N41 Core Net modules

Jumper Settings: QPC441A thru QPC441F - Set Jumper RN27 at E35 to "A" QPC441G - Set Jumper J5 at E35 to "Default Setting"									
Switch Settings									
Module		D20 switch position							
NT4N41 CP Core/Net modules only		1	2	3	4	5	6	7	8
Core/Net 0 (Shelf 0)	Group 0	off	on	on	off	on	on	on	on
	Group 1	off	on	on	off	on	on	off	on

	Group 2	off	on	on	off	on	off	on	on
	Group 3	off	on	on	off	on	off	off	on
	Group 4	off	on	on	off	off	on	on	on
	Group 5	off	on	on	off	off	on	off	on
	Group 6	off	on	on	off	off	off	on	on
	Group 7	off	on	on	off	off	off	off	on
	Group 0	off	on	on	off	on	on	on	off
	Group 1	off	on	on	off	on	on	off	off
	Group 2	off	on	on	off	on	off	on	off
Core/Net 1 (Shelf 1)	Group 3	off	on	on	off	on	off	off	off
	Group 4	off	on	on	off	off	on	on	off
	Group 5	off	on	on	off	off	on	off	off
	Group 6	off	on	on	off	off	off	on	off
	Group 7	off	on	on	off	off	off	off	off

Table 43: QPC441 3PE card installed in the NT8D35 module

Jumper Settings: QPC441A thru QPC441F - Set Jumper RN27 at E35 to "A" QPC441G - Set Jumper J5 at E35 to "Default Setting"									
Switch Settings									
Modules		D20 switch position							
		1	2	3	4				
Option 81, 81C (Note 1)		off	on	on	on				
Shelf	Group					5	6	7	8
	0					on	on	on	on
	1					on	on	off	on
0	2					on	off	on	on
	3					on	off	off	on
	4					off	on	on	on
	5					off	on	off	on
	6					off	off	on	on
	7					off	off	off	on

	0		on	on	on	off
	1		on	on	off	off
1	2		on	off	on	off
	3		on	off	off	off
	4		off	on	on	off
	5		off	on	off	off
	6		off	off	on	off
	7		off	off	off	off

QPC841 4-Port Serial Data Interface card

Table 44: QPC841 port 1 and 2 address selection on page 114 through Table 47: QPC841 DTE or DCE selection on page 115 list option settings for the QPC841 4-Port SDI card.

Table 44: QPC841 port 1 and 2 address selection

Device number		SW14							
Port 1	**Port 2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0	1	off	off	off	off	off	on	on	on
2	3	off	off	off	off	off	on	on	off
4	5	off	off	off	off	off	on	off	on
6	7	off	off	off	off	off	on	off	off
8	9	off	off	off	off	off	off	on	on
10	11	off	off	off	off	off	off	on	off
12	13	off	off	off	off	off	off	off	on
14	15	off	off	off	off	off	off	off	off

Note:

On SW16, positions 1, 2, 3, and 4 must be OFF.

Note:

To avoid address conflicts, SW14 and SW15 can never show identical settings.

Note:

To disable ports 1 and 2, set SW14 position 1 to ON.

Table 45: QPC841 port 3 and 4 address selection

Device number		SW15							
Port 3	Port 4	1	2	3	4	5	6	7	8
0	1	off	off	off	off	off	on	on	on
2	3	off	off	off	off	off	on	on	off
4	5	off	off	off	off	off	on	off	on
6	7	off	off	off	off	off	on	off	off
8	9	off	off	off	off	off	off	on	on
10	11	off	off	off	off	off	off	on	off
12	13	off	off	off	off	off	off	off	on
14	15	off	off	off	off	off	off	off	off

Note:
On SW16, positions 1, 2, 3, and 4 must be OFF.

Note:
To avoid address conflicts, SW14 and SW15 can never show identical settings.

Note:
To disable ports 3 and 4, set SW15 position 1 to ON.

Table 46: QPC841 baud rate

Baud rate	Port 1 SW10				Port 2 SW11				Port 3 SW12				Port 4 SW13			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
150	off	off	on	on	off	off	on	on	off	off	on	on	off	off	on	on
300	off	on	off	on	off	on	off	on	off	on	off	on	off	on	off	on
600	off	off	off	on	off	off	off	on	off	off	off	on	off	off	off	on
1200	off	on	on	off	off	on	on	off	off	on	on	off	off	on	on	off
2400	off	off	on	off	off	off	on	off	off	off	on	off	off	off	on	off
4800	off	on	off	off	off	on	off	off	off	on	off	off	off	on	off	off
9600	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off

Table 47: QPC841 DTE or DCE selection

Mode	Port 1—SW8						Port 1—SW9					
	1	2	3	4	5	6	1	2	3	4	5	6
DTE (terminal)	on	on	on	on	on	on	off	off	off	off	off	off

Mode	Port 1—SW8						Port 1—SW9					
	1	2	3	4	5	6	1	2	3	4	5	6
DCE (modem)	off	off	off	off	off	off	on	on	on	on	on	on
NT1P61 (Fiber)	on	off	off	on	off	off	on	off	off	off	on	on
	Port 2—SW6						**Port 2—SW7**					
DTE	on	on	on	on	on	on	off	off	off	off	off	off
DCE	off	off	off	off	off	off	on	on	on	on	on	on
NT1P61 (Fiber)	on	off	off	on	off	off	on	off	off	off	on	on
	Port 3—SW4						**Port 3—SW5**					
DTE	on	on	on	on	on	on	off	off	off	off	off	off
DCE	off	off	off	off	off	off	on	on	on	on	on	on
	Port 4—SW2						**Port 4—SW3**					
DTE	on	on	on	on	on	on	off	off	off	off	off	off
DCE	off	off	off	off	off	off	on	on	on	on	on	on

Chapter 8: NT1R20 Off-Premise Station Analog Line card

Contents

This section contains information on the following topics:

Introduction

The NT1R20 Off-Premise Station (OPS) analog line card is an intelligent eight-channel analog line card designed to be used with 2-wire analog terminal equipment such as analog (500/2500-type) telephones and analog modems.

The NT1R20 Off-Premise Station (OPS) analog line card provides eight full-duplex analog telephone line interfaces. Each line has integral hazardous and surge voltage protection to protect the system from damage due to lightning strikes and accidental power line connections. This card is normally used whenever the phone lines must leave the building in which the switch is installed.

The NT1R20 OPS analog line card provides:

- line supervision
- hookflash
- battery reversal

Each unit is independently configured by software control in the Analog (500/2500 type) Telephone Administration program LD 10.

You can install this card in any IPE slot.

A maximum of four analog line cards can be installed in each Media Gateway and Media Gateway Expansion.

The NT1R20 OPS Analog Line Card can be installed in slots 1, 2, 3, and 4 of the Media Gateway and slots 7, 8, 9, and 10 of the Media Gateway Expansion.

Physical description

The OPS card measures 31.75 by 25.40 cm (12.5 by 10 in.) It connects to the IPE backplane through a 160-pin connector shroud. A 25-pair amphenol connector below the card is cabled to the cross connect terminal. Telephone lines from station equipment cross connect to the OPS analog line card at the cross connect using a wiring plan similar to trunk cards. See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for cross connect terminations.

The OPS analog line card mounts in any IPE slot.

Self Test

The faceplate of the NT1R20 OPS analog line card is equipped with a red LED. When an OPS analog line card is installed, the LED remains lit for two to five seconds while the self-test runs. If the self-test is completed successfully, the LED flashes three times and remains lit. When the card is configured and enabled in software; then the LED goes out. If the LED continues to flash or remains weakly lit, replace the card. See Figure 22: OPS analog line card - faceplate on page 119.

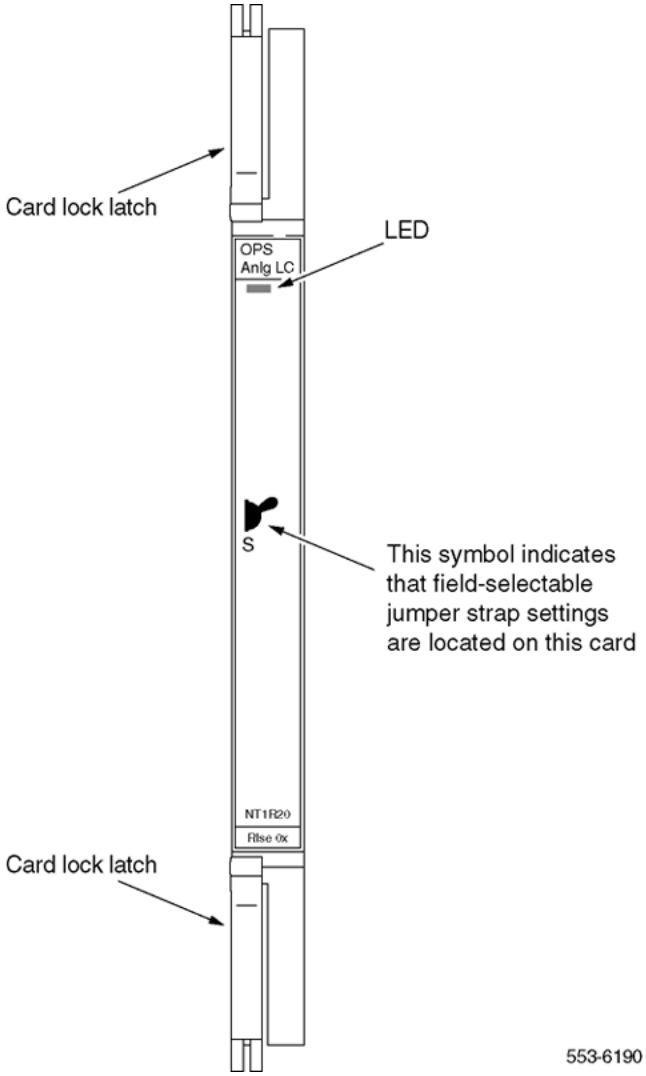


Figure 22: OPS analog line card - faceplate

Functional description

This functional description of the NT1R20 Off-Premise Station (OPS) analog line card is divided into two parts. First, a description of the card's control, signaling, and power interfaces is given, followed by a description of how the card itself functions. See Figure 23: OPS analog line card - block diagram on page 120.

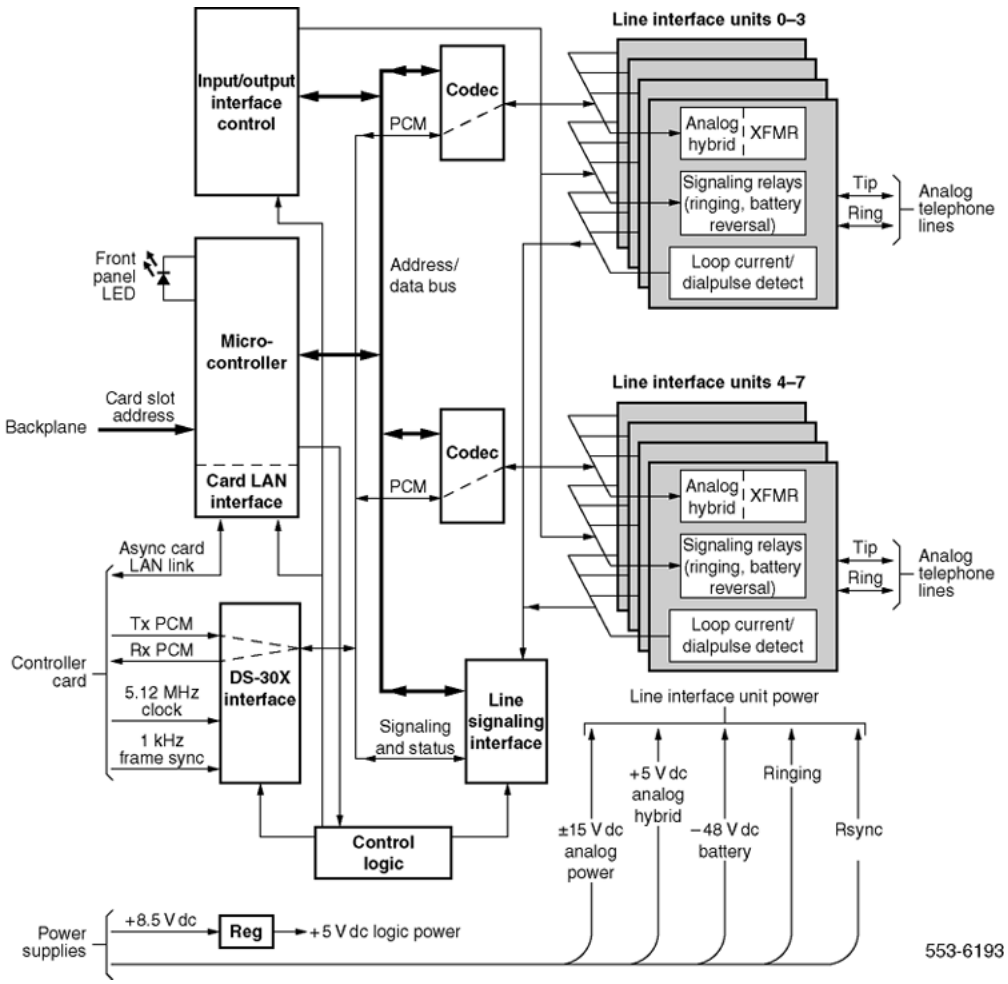


Figure 23: OPS analog line card - block diagram

Card interfaces

The OPS analog line card passes voice and signaling data over DS-30X loops and maintenance data over the card LAN link. See Intelligent Peripheral Equipment on page 64 for more details.

Voice and signaling interfaces

The eight line interfaces provided by the NT1R20 OPS analog line card connect to conventional, 2-wire (tip and ring), analog line facilities. Incoming analog voice and signaling information from a line facility is converted by the OPS analog line card to digital form and routed to the Avaya Communication Server 1000 (Avaya CS 1000) CPU over DS-30 network loops. Conversely, digital voice and signaling information from the CPU is sent over DS-30 network loops to the OPS analog line card where it is converted to analog form and applied to the line facility.

The OPS analog line card uses only eight of the 30 available timeslots for its eight line interfaces. The OPS analog line card can be configured in software to format PCM data in the µ-law or A-law conventions.

Maintenance communication

Maintenance communication is the exchange of control and status data between line or trunk cards and the Avaya CS 1000 CPU. Maintenance data is transported through the card LAN link.

The card LAN link supports the following functions on the NT1R20 OPS Analog Line Card:

- polling
- reporting of self-test status
- CPU initiated card reset
- reporting of card ID (card type and hardware vintage)
- reporting of firmware version
- reporting of line interface unit configuration
- enabling/disabling of the DS-30X network loop busy
- reporting of card status

Power interface

Power is provided to the OPS circuit card by the NTAK78 AC/DC or NTAK72 DC power supply.

The following card functions are described in this section:

- Line interface units
- Card control functions
- Circuit power
- Software service changes
- Port-to-port loss configuration
- Line interface units
- Card control functions
- Circuit power

- Software service changes
- Port-to-port loss configuration

Line interface units

The NT1R20 OPS analog line card contains eight independently configurable interface units. Relays are provided in each unit to apply ringing onto the line. Signal detection circuits monitor on-hook/off-hook signaling. Two codecs are provided for performing Analog/Digital (A/D) and Digital/Analog (D/A) conversion of analog voiceband signals to digital PCM signals.

Each codec supports four interface units and contains switchable pads for control of transmission loss on a per unit basis. The following features are common to all units on the card:

- OPS or ONS service configurable on a per unit basis
- terminating impedance (600 or 900 ohms) selectable on a per unit basis
- standard or complex balance impedance (600 or 900 ohms, 3COM1 or 3COM2) selectable on a per unit basis
- loopback of PCM signals over DS-30X network loop for diagnostic purposes

Signaling and control

This portion of the card provides circuits that establish, supervise, and take down call connections. These circuits work with the CPU to operate line interface circuits during calls. The circuits receive outgoing call signaling messages from the CPU and return incoming call status information over the DS-30X network loop.

Card control functions

Control functions are provided by a microcontroller, a card LAN interface, and signaling and control circuits on the NT1R20 OPS analog line card.

Microcontroller

The OPS analog line card contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the CE CPU through the card LAN link:
    - card identification (card type, vintage, and serial number)

   - firmware version
   - self-test status
   - programmed configuration status
- receipt and implementation of card configuration:
   - programming of the CODECs
   - enabling/disabling of individual units or entire card
   - programming of input/output interface control circuits for administration of line interface unit operation
   - enabling/disabling of an interrupted dial tone to indicate call waiting
   - maintenance diagnostics
   - transmission loss levels

Card LAN interface

Maintenance data is exchanged with the CPU over a dedicated asynchronous serial network called the Card LAN link. The Card LAN link is described in the section Intelligent Peripheral Equipment on page 37.

The NT1R20 OPS analog line card has the capability of providing an interrupted dial tone to indicate that a message is waiting or that call forwarding is enabled. The line card (optionally) receives messages stating that these conditions exist over the Card LAN Interface and interrupts the dial tone when either of these conditions are detected.

Software service changes

Individual line interface units on the NT1R20 OPS analog line card are configured to either OPS (for OPS application) or On-premises Station (ONS) (for ONS application) Class of Service (CLS) in the Analog (500/2500-type) Telephone Administration program LD 10. See Table 48: OPS analog line card configuration on page 124.

LD 10 is also used to select unit terminating impedance and balance network impedance at the TIMP and BIMP prompts, respectively.

The message waiting interrupted dial tone and call forward reminder tone features are enabled by entering data into the customer data block using LD 15.

See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 10 and LD 15 service change instructions.

Table 48: OPS analog line card configuration

Application	On-premise station (ONS)			Off-premise station (OPS)			
Class of service	ONS			OPS			
Loop resistance	0 - 460 ohm			0 - 2300 ohm			
Jumper strap setting[b]	Both JX. 0 and JX 1 off			Both JX. 0 and JX. 1 off		Both JX. 0 and JX. 1 on	
Loop loss dB[c]	0-1.5	>1.5-2.5	>2.5-3.0	0-1.5	>1.5-2.5	>2.5-4.5	>4.5-15
TIMP	600 ohm	600 ohm	600 ohm	600 ohm	600 ohm	600 ohm	600 ohm
BIMP	600 ohm	3COM	3CM2	600 ohm	3COM	3CM2	3CM2
Gain treatment [e]	No						Yes

a. Configured in the Analog (500/2500-type) Telephone Administration program (LD 10).
b. Jumper strap settings JX 0 and JX. 1 apply to all eight units; "X" indicates the unit number, 0-7. "OFF" indicates that a jumper strap is not installed across both pins on a jumper block. Store unused straps on the OPS analog line card by installing them on a single jumper pin.
c. Loss of untreated (no gain devices) metallic line facility. Upper loss limits correspond to loop resistance ranges for 26 AWG wire.
d. Default software impedance settings are:

ONS	CLSOPS	CLS
TIMP:	600 ohm	600 ohm
BIMP:	600 ohm	3COM2

e. Gain treatment, such as a voice frequency repeater (VFR) is required to limit the actual OPS loop loss to 4.5 dB, maximum. VFR treatment of metallic loops having untreated loss greater than 15dB (equivalent to a maximum signaling range of 2300 ohm on 26 AWG wire) is not recommended.

Port-to-port loss configuration

The loss plan for the NT1R20 OPS analog line card determines port-to-port loss for connections between an OPS analog line card unit (port) and other ports.

The transmission properties of each line unit are characterized by the OPS or ONS class of service assigned in the Analog (500/2500-type) Telephone Administration program LD 10.

The OPS analog line card provides transmission loss switching for control of end-to-end connection loss. Control of loss is a major element in controlling transmission performance parameters such as received volume, echo, noise, and crosstalk. The loss plan for the OPS analog line card determines port-to-port loss for connections between an OPS analog line card unit (port) and other IPE ports. LD 97 is used to configure systems for port-to-port loss.

See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 97 service change instructions.

Table 49: OPS analog line card - cable loop resistance and loss

Cable length	Cable loop loss (dB) (non-loaded at 1kHz)			Cable loop resistance (ohms)		
	26 AWG	24 AWG	22 AWG	26 AWG	24 AWG	22 AWG
847 m (2800 ft)	1.5	1.2	0.9	231.4	144.2	90
1411 m (4600 ft)	2.5	2	1.6	385.6	240.3	150
1694 m (5600 ft)	3	2.4	1.9	462.8	288.3	180
2541 m (8300 ft)	4.5	3.7	2.8	694.2	432.5	270
8469 m (27800 ft)	15	12.2	9.4	2313.9	1441.7	900

Electrical specifications

This section lists the electrical characteristics of the NT1R20 OPS analog line card.

Circuit power

The +8.5 V DC input is regulated down to +5 V DC for use by the digital logic circuits. All other power to the card is used by the line interface circuits.

The ±15.0 V DC inputs to the card are used to power the analog circuits. The +5 V DC from the module power supply is used for the analog hybrid. The –48.0 V DC input is for the telephone battery. Ringing power for telephones is 86 Vrms AC at 20 Hz on –48 V DC. The Rsync signal is used to switch the 20 Hz ringing on and off at the zero cross-over point to lengthen the life of the switching circuits.

Analog line interface

Table 50: OPS analog line card - electrical characteristics on page 126 lists the electrical characteristics of NT1R20 OPS analog line card line interface units.

Table 50: OPS analog line card - electrical characteristics

Characteristic	Specification
Terminal impedance (TIMP)	600 or 900 ohms
Balance impedance (BIMP)	600 or 900 ohms, 3COM, or 3CM2
DC signaling loop length (max)	2300 ohm loop (including resistance of telephone) with nominal battery of –48 V dc
Battery supply voltage	–42 to –52.5 V dc
Minimum detected loop current	16 mA
Ground potential difference	± 3 V
Line leakage	≥ 30k ohms, tip-to-ring, tip-to-ground, ring-to-ground
AC induction rejection	10 V rms, tip-to-ring, tip-to-ground, ring-to-ground

Power requirements

Table 51: OPS analog line card - power requirements on page 126 shows the maximum power consumed by the card from each system power supply.

Table 51: OPS analog line card - power requirements

Voltage	Tolerance	Current (max.)
±15.0 V dc	± 5%	150 mA
+8.5 V dc	± 2%	200 mA
+5.0 V dc	± 5%	100 mA
–48.0 V dc	± 5%	350 mA

Foreign and surge voltage protection

The NT1R20 OPS analog line card meets UL-1489 and CS03 over-voltage (power cross) specifications and FCC Part 68 requirements for hazardous and surge voltage limits.

Ringer limitations

The OPS line card supports up to three NE-C4A (3 REN) ringers on each line for either ONS or OPS applications. See Table 52: OPS analog line card - ringer limitations on page 127.

Table 52: OPS analog line card - ringer limitations

ONS Loop Range	Maximum Number of Ringers (REN)
0–10 ohms	3
> 10–460 ohms	2
0 – 10 ohms	3
> 10 – 900 ohms	2
> 900 – 2300 ohms	1

Environmental specifications

Table 53: OPS analog line card - environmental specifications on page 127 shows the environmental specifications of the OPS analog line card.

Table 53: OPS analog line card - environmental specifications

Parameter	Specifications
Operating temperature	0° to +60° C (+32 to +140° F), ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–40° to +70° C (–40° to +158° F)

Operation

The applications, features, and signaling arrangements for each unit on the NT1R20 OPS analog line card are assigned through LD 10 and/or jumper strap settings on the card.

The operation of each unit is configured in software and implemented in the card through software download messages. When the NT1R20 OPS analog line card unit is idle, it provides a ground on the tip lead and –48 V dc on the ring lead. The on-hook telephone presents a high impedance toward the line interface unit on the card.

Incoming calls

Incoming calls to a telephone connected to the NT1R20 OPS analog line card originate from stations that can be local (served by the PBX) or remote (served through the public switched telephone network). The alerting signal to telephones is 20 Hz (nominal) ringing. When an incoming call is answered, ringing is tripped as the telephone goes off-hook, placing a low-resistance DC loop across the tip and ring leads toward the OPS analog line card. (see Table 54: Call connection sequence-near-end station receiving call on page 128).

Table 54: Call connection sequence-near-end station receiving call

State	Signal / Direction Far-end / Near-end	Remarks
Line card unit idle	Group on tip, battery on ring High resistance loop	No battery current drawn. Far-end station goes off-hook and addresses (dials-up) the near-end station. The system receives the incoming call on a trunk and determine the TN.
Incoming call	Ringing →	The system applies 20 Hz ringing to ring lead.
Near-end station off-hook	Low resistance loop ←	
Two-way voice connection	↔	The system detects increase in loop current, tips ringing, and put call through to near-end station.
Near end station hangs up first	High-resistance loop ←	If near end station hangs-up first, the line card detects the drop in loop current.
Line card unit idle	Group on tip, battery on ring High resistance loop	Line card unit is ready for the next call.
Far end station hangs up first	High resistance loop →	If the far-end hangs-up first, the system detects disconnect signalling from the trunk. The person at the near-end recognizes the end of the call and hangs-up.
Line card unit idle	Ground on tip/battery on ring High resistance loop	Line card unit is ready for the next call.

Outgoing calls

For outgoing calls from a telephone, a line unit is seized when the telephone goes off-hook, placing a low-resistance loop across the tip and ring leads towards the NT1R20 OPS analog line card (see Table 55: Call connection sequence-near-end station receiving call on page 129). When the card detects the low-resistance loop, it prepares to receive digits. When the system is ready to receive digits, it returns a dial tone. Outward address signaling is then applied from the telephone in the form of loop (interrupting) dial pulses or DTMF tones.

Table 55: Call connection sequence-near-end station receiving call

State	Signal / Direction Far-end / Near-end	Remarks
Line card unit idle	Group on tip, battery on ring High resistance loop	No battery current drawn.
Call request	Low resistance loop ←	Near-end station goes off-hook. Battery current is drawn, causing detection of off-hook state.
	Dial Tone →	Dial tone is applied to the near end station from the system.
Outpulsing	Addressing signals ←	Near-end station dials number (loop pulsing or DTMF tones).
		The system detects start of dialing and remove dial tone.
	Ringback (or busy) ↔	The system decodes addressing, route calls, and supply ringback tone to near-end station if far-end is on-hook. (Busy tone is supplied if far-end is off-hook).
Two-way voice connection	←	When call is answered, ringback tone is removed, and call is put through to far-end station.
Near-end station hangs-up first	High resistance loop →	If near end station hangs-up first, the line card detects the drop in loop current.
Line card unit idle	Group on tip, battery on ring High resistance loop	Line card unit is ready for the next call.
Far end station hangs up first	High resistance loop ←	If the far-end hangs-up first, the system detects disconnect signalling from the trunk. The person at the near-end recognizes the end of the call and hangs-up.
Line card unit idle	Ground on tip/battery on ring High resistance loop	Line card unit is ready for the next call.

Connector pin assignments

The OPS analog line card brings the eight analog telephone lines to the IPE backplane through a 160-pin connector shroud. The backplane is cabled to the input/output (I/O) panel on the rear of the module, which is then connected to the Main Distribution Frame (MDF) by 25-pair cables.

Telephone lines from station equipment cross connect to the OPS analog line card at the MDF using a wiring plan similar to that used for trunk cards. A typical connection example is shown in Figure 24: OPS analog line card - typical cross connection example on page 131, and a list of the connections to the analog line card is shown in Table 56: OPS analog line card - backplane pinouts on page 130. See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for more detailed I/O panel connector information and wire assignments for each tip/ring pair.

Table 56: OPS analog line card - backplane pinouts

Backplane Connector Pin	Signal	Backplane Connector Pin	Signal
12A	Unit 0, Ring	12B	Unit 0, Tip
13A	Unit 1, Ring	13B	Unit 1, Tip
14A	Unit 2, Ring	14B	Unit 2, Tip
15A	Unit 3, Ring	15B	Unit 3, Tip
16A	Unit 4, Ring	16B	Unit 4, Tip
17A	Unit 5, Ring	17B	Unit 5, Tip
18A	Unit 6, Ring	18B	Unit 6, Tip
19A	Unit 7, Ring	19B	Unit 7, Tip

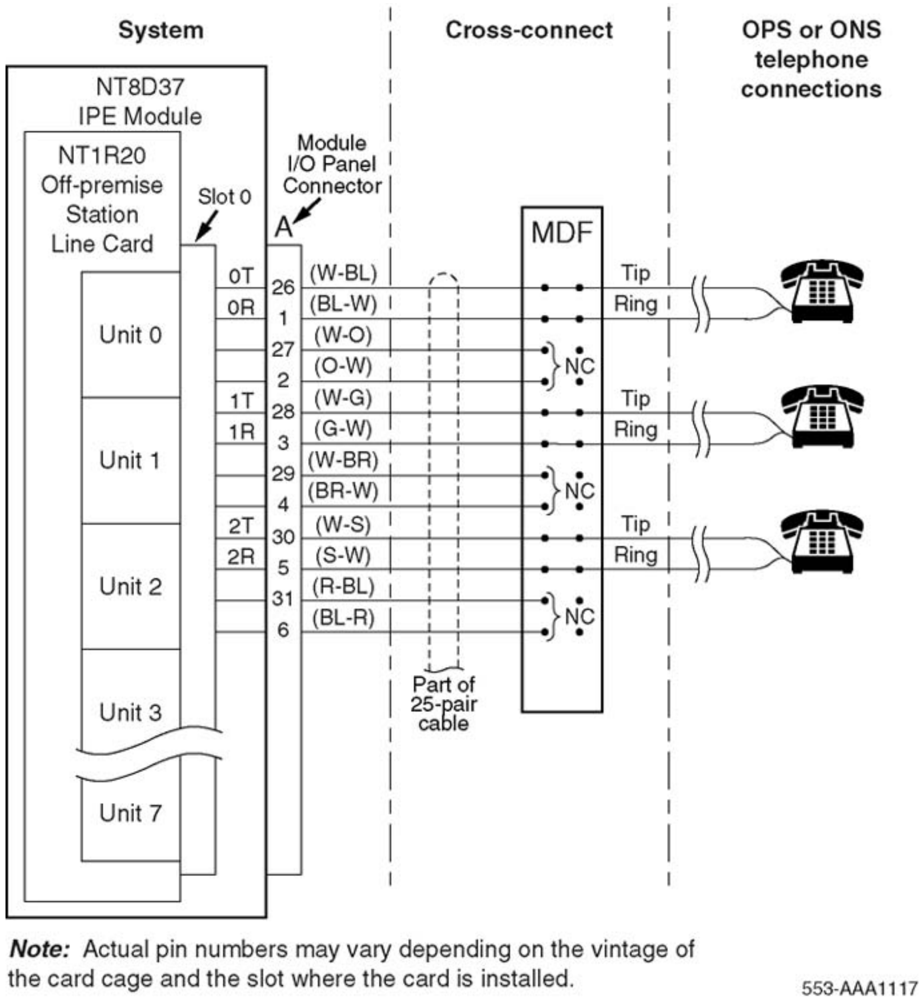


Figure 24: OPS analog line card - typical cross connection example

Configuring the OPS analog line card

The line type, terminating impedance, and balance network configuration for each unit on the card is selected by software service change entries at the system terminal and by jumper strap settings on the card.

Jumper strap settings

Each line interface unit on the card is equipped with two jumper blocks that are used to select the proper loop current depending upon loop length. See Table 57: OPS analog line card - configuration on page 132.

For units connected to loops of 460 to 2300 ohms, both jumper blocks must be installed. For loops that are 460 ohms or less, jumper blocks are not installed. Figure 25: OPS analog line card - jumper block locations on page 134 shows the location of the jumper blocks on the OPS analog line card.

Table 57: OPS analog line card - configuration

Application	On-premise station (ONS)			Off-premise station (OPS)			
Class of Service (CLS) (Note 1)	ONP			OPX			
Loop resistance (ohms)	0–460			0–2300 (Note 2)			
Jumper strap setting (Note 6)	Both JX.0 and JX.1 off			Both JX.0 and JX.1 off		Both JX.0 and JX.1 on	
Loop loss (dB) (Note 3)	0–1.5	>0–3.0	>2.5–3.0	0–1.5	>1.5–2.5	>2.5–4.5	>4.5–15
TIMP (Notes 1, 4)	600 ohms	600 ohms	600 ohms	600 ohms	600 ohms	600 ohms	600 ohms
BIMP (Notes 1, 4)	600 ohms	3COM	3CM2	600 ohms	3COM	3CM2	3CM2
Gain treatment (Note 5)	No						Yes

Note:

1. Configured in the Analog (500/2500-type) Telephone Administration program LD 10.

Note:

2. The maximum signaling range supported by the OPS analog line card is 2300 ohms.

Note:

3. Loss of untreated (no gain devices) metallic line facility. Upper loss limits correspond to loop resistance ranges for 26 AWG wire.

Note:

4. The following are the default software impedance settings:

	ONP CLS	OPX CLS
Termination Impedance (TIMP):	600 ohms	600 ohms

Application	On-premise station (ONS)	Off-premise station (OPS)

	ONP CLS	OPX CLS
Balanced Impedance (BIMP):	600 ohms	3CM2

Note:

5. Gain treatment, such as a Voice Frequency Repeater (VFR) is required to limit the actual OPS loop loss to 4.5 dB, maximum. VFR treatment of metallic loops having untreated loss greater than 15 dB (equivalent to a maximum signaling range of 2300 ohms on 26 AWG wire) is not recommended.

Note:

6. Jumper strap settings JX.0 and JX.1 apply to all eight units; "X" indicates the unit number, 0 – 7. "Off" indicates that a jumper strap is not installed across both pins on a jumper block. Store unused straps on the OPS analog line card by installing them on a single jumper. pin.

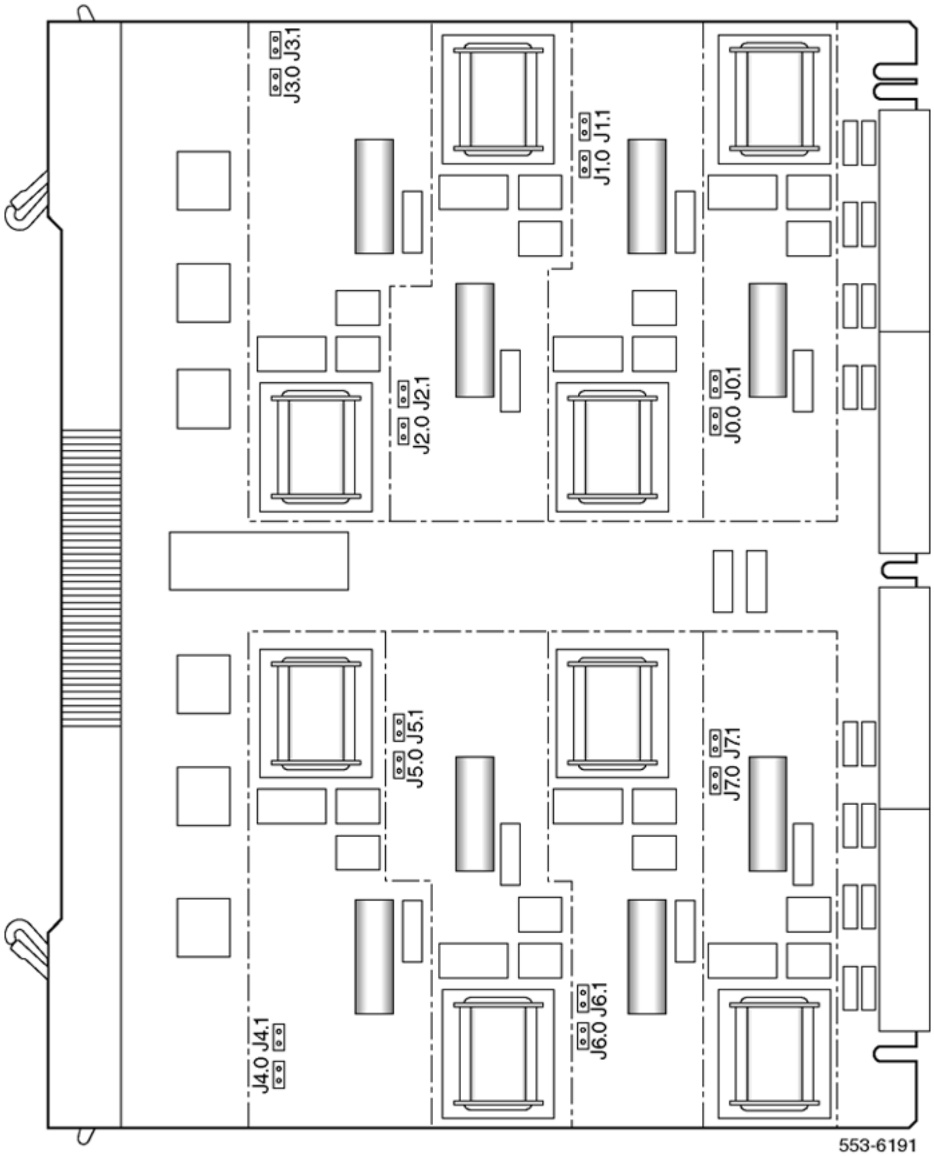


Figure 25: OPS analog line card - jumper block locations

Before the appropriate balance network can be selected, the loop length between the near-end (Meridian 1) and the far-end station must be known. To assist in determining loop length, Table 49: OPS analog line card - cable loop resistance and loss on page 125 shows some typical resistance and loss values for the most common cable lengths for comparison with values obtained from actual measurements.

1. Set the jumpers on the NT1R20 OPS card.
2. Insert the OPS card in its assigned slot
3. Cross-connect off-premise telephones.

Application

Off-premise station application

The NT1R20 OPS analog line card is designed primarily to provide an interface for off-premise station lines. An OPS line serves a terminal – usually, but not exclusively, a telephone – remote from the PBX either within the same serving area as the local office, or through a distant office. The line is not switched at these offices; however, depending on the facilities used, the local office serving the OPS station can provide line functions such as battery and ringing. Facilities are generally provided by the local exchange carrier (usually, OPS pairs are in the same cable as the PBX-CO trunks). The traditional OPS scenario configuration is shown in Figure 26: Traditional OPS application configuration on page 136.

Note:

Do not confuse OPS service with Off-Premise Extension (OPX) service. OPX service is the provision of an extension to a main subscriber loop bridged onto the loop at the serving CO or PBX. Do not confuse CLS OPS (assigned in the Analog (500/2500-type) Telephone Administration program LD 10) with OPX, which denotes Off-Premise Extension service.

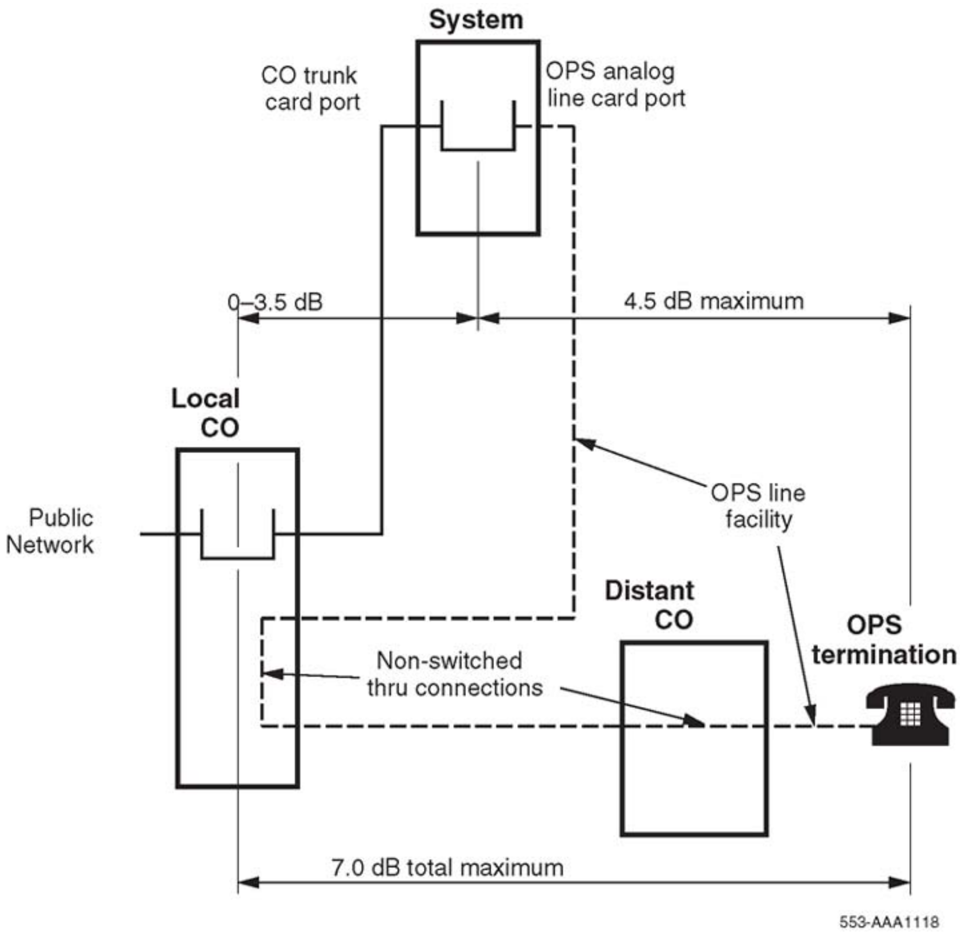


Figure 26: Traditional OPS application configuration

Other applications

The operating range and built-in protection provisions of the NT1R20 OPS analog line card make it suitable for applications which are variants on the traditional configuration shown in

Figure 26: Traditional OPS application configuration on page 136. Examples of such applications are:

- a PBX in a central building serving stations in other buildings in the vicinity, such as in an industrial park, often called a campus environment. Facilities can be provided by the local exchange carrier or can be privately owned. Protection could be required.
- termination to other than a telephone, such as to a fax machine or a key telephone system.
- individual circuits on the NT1R20 OPS analog line card can also be configured as On-Premise Station (ONS) ports in LD 10:
  - ONS service with hazardous and surge voltage protection (not available on other analog line cards)
  - to use otherwise idle NT1R20 OPS analog line card ports

Transmission considerations

The transmission performance of OPS lines depends on the following factors:

- the port-to-port loss for connections between OPS ports and other ports
- the transmission parameters of the facilities between the OPS port and the off-premise station or termination
- the electrical and acoustic transmission characteristics of the termination

These factors must be considered when planning applications using the NT1R20 OPS analog line card. They are important when considering configurations other than the traditional OPS application as shown in Figure 26: Traditional OPS application configuration on page 136. The following sections provide basic transmission planning guidelines for various OPS applications.

Port-to-port loss

Loss is inserted between OPS analog line card ports and other ports in accordance with the loss plan. This plan determines the port-to-port loss for each call.

When a port is configured for CLS OPS, loss is programmed into the OPS analog line card on a call-by-call basis. When configured for CLS ONS, an OPS analog line card port is programmed to a value that is fixed for all calls. The loss in the other port involved in the call can vary on a call-by-call basis to achieve the total loss scheduled by the plan.

For satisfactory transmission performance, particularly on connections between the public network and an OPS termination, it is recommended that facilities conform to the following:

- Total 1 kHz loss from the local serving CO to the OPS terminal should not exceed 7.0 dB. The total loss in the facility between the PBX and the terminal must not exceed 4.5 dB. See Figure 26: Traditional OPS application configuration on page 136.

The following requirements are based on historic Inserted Connection Loss (ICL) objectives:

- PBX – CO trunk: 5 dB with gain; 0 – 4.0 dB without gain
- OPS line: 4.0 dB with gain; 0 – 4.5 dB without gain. In recent times economic and technological considerations led to modifications of these historic objectives. As the loss provisions in the PBX for OPS are constrained by regulatory requirements as well as industry standards, they are not designed to compensate for modified ICL designs in the connecting facilities.

• Avaya recommends that the attenuation distortion (frequency response) of the OPS facility be within ±3.0 dB over the frequency range from 300 to 3000 Hz. It is desirable that this bandwidth extend from 200 to 3200 Hz.

• The terminating impedance of the facility at the OPS port be approximately that of 600 ohms cable.

If the OPS line facility loss is greater than 4.5 dB but does not exceed 15 dB, line treatment using a switched-gain Voice Frequency Repeater (VFR) extends the voice range.

The overall range achievable on an OPS line facility is limited by the signaling range (2300 ohms loop including telephone resistance). The signaling range is unaffected by gain treatment; so gain treatment can be used to extend the voice range to the limit of the signaling range. For example, on 26 AWG wire, the signaling range of 2300 ohms corresponds to an untreated metallic loop loss of 15 dB. Gain treatment (such as a VFR) with 10.5 dB of gain would maintain the OPS service loss objective of 4.5 dB while extending the voice range to the full limit of the signaling range.

	15.0 dB	(loss corresponding to the maximum signaling range)
–	4.5 dB	(OPS service loss objective)
=	10.5 dB	(required gain treatment)

The use of dial long line units to extend signaling range of OPS analog line cards beyond 15 dB is not recommended.

Termination transmission characteristics

The loss plan for OPS connections is designed so that a connection with an OPS termination provides satisfactory end-to-end listener volume when the OPS termination is a standard telephone. The listener volume at the distant end depends on the OPS termination transmit loudness characteristics; the volume at the OPS termination end depends on the OPS termination receive loudness characteristics.

A feature of many (though not all) standard telephones is that the loudness increases with decreased current. So as the line (PBX to OPS termination) facility gets longer and loss increases, the increased loudness of the telephone somewhat compensates for the higher loss, assuming direct current feed from the PBX with constant voltage at the feeding bridge. However, this compensation is not available when:

- the termination is a non-compensating telephone
- the OPS port is served by a line card using a constant-current feeding bridge
- the OPS termination is to telephones behind a local switch providing local current feed, such as a fax machine or a key telephone system

OPS line terminations with loudness characteristics designed for other applications can also impact transmission performance. For example, wireless portables loudness characteristics are selected for connections to switching systems for wireless communication systems; if used in an OPS arrangement without consideration for these characteristics, the result could be a significant deviation from optimum loudness performance.

Chapter 9: NT4N39AA CP Pentium IV Card

Contents

This section contains information on the following topics:

Introduction

The NT4N39AA Call Processor Pentium IV (CP PIV) System processor card was introduced in Avaya Communication Server 1000 (Avaya CS 1000) Release 4.5. It features the following:

- a PCI-based design architecture
- an Intel Pentium processor
- two CompactFlash (CF) sockets (one on-board and one hot-swappable on the faceplate). The on-board CF is referred to as the Fixed Media Disk (FMD), and the faceplate CF is referred to as the Removable Media Disk (RMD). See Figure 27: CP PIV card (front) on page 143 and Figure 28: CP PIV card (side) on page 144.
- 512 MBytes of Double Data Rate (DDR) memory

Physical description

The NT4N39AA card measures 23 cm by 16 cm (9,2 in. by 6.3 in.). See Figure 27: CP PIV card (front) on page 143 and Figure 28: CP PIV card (side) on page 144.

The CP PIV front panel is equipped with an EMC gasket and two ejector/injector handles. A reset button and two double LED packages (four LEDs in total) are placed at the front panel as well. The front panel features the following:

- stacked dual standard DB9 Serial ports
- USB Connector
- stacked dual RJ-45 Ethernet ports with LEDs
- power good LED
- LEDs indication for activity on CompactFlashes and secondary IDE interface
- reset Switch
- INI switch
- front panel handle part# 3688785, 3688784 (replacement for customer suggested parts 3686134, 3686135 which are now obsolete)

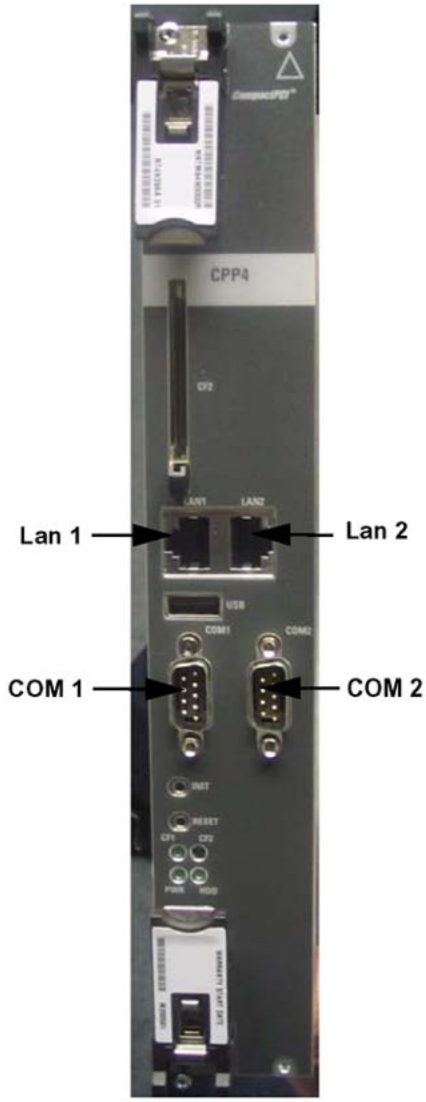


Figure 27: CP PIV card (front)

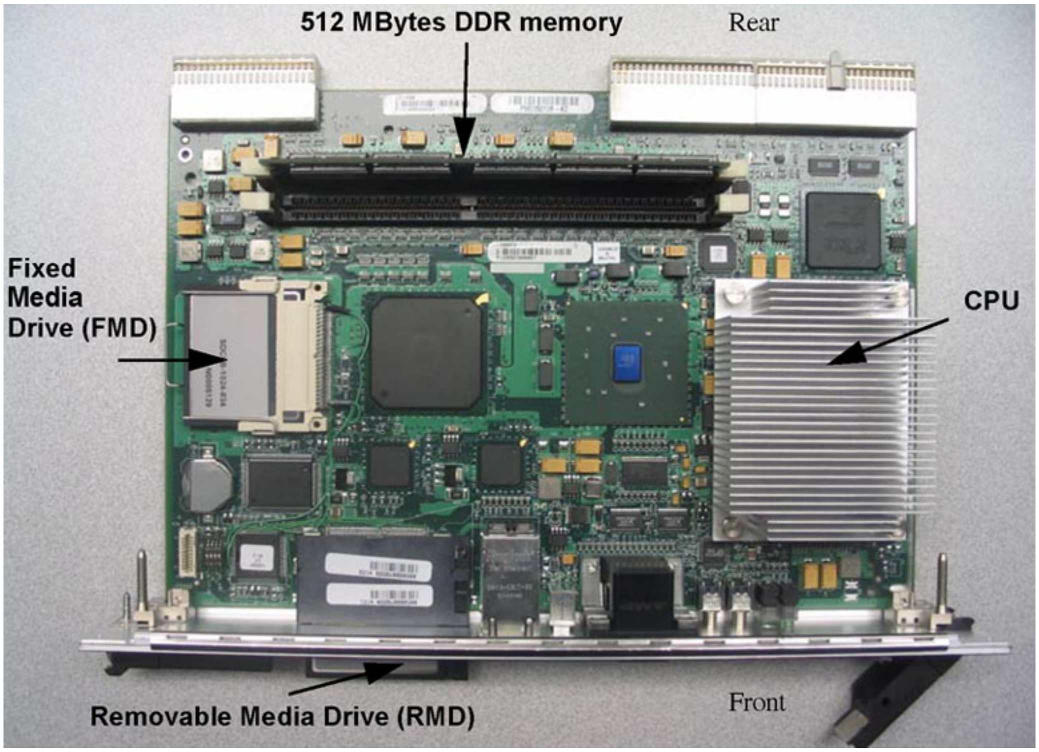


Figure 28: CP PIV card (side)

Functional description

The card employs an Intel Pentium Processor as the central processing unit. The internal core clock frequency reaches from 600MHz to1.1GHz. The processor is manufactured in 0.09 um process technology and provides 32 KB of on die data and instruction cache as well as 1 MB of on die L2 cache running at core clock frequency. The processor is a mobile processor with a 478 pin FCBGA package with a maximum junction temperature of 100 ûC. Processor power dissipation must not exceed 12 W.

The front side bus runs at 400 MHz and uses an AGTL+ signaling technology. The quad pumped data interface (data running at 4*100 MHz = 400 MHz) is 64 bit wide providing a total bandwidth of 3.2 GBytes/s. The double pumped address bus (addresses running at 2*100 MHz = 200 MHz) is 32 bit wide supporting an address range of up to 4 GBytes. The processor voltage specification is compliant with IMVP IV specification.

Memory

CP PIV memory uses DDR SDRAM technology. The CP PIV provides a maximum of two GBytes using two verticall DIMM sockets to install off-the-shelf DIMM modules. CP PIV only supports DDR SDRAM DIMM memory with a supply voltage of +2.5 V.

are supportedThe memory data path is 72-bit wide. The Intel 855GME Host Bridge supports 64 Mbit, 128 MByte, 256 MByte and 512 Mbyte SDRAM technologies with a maximum ROW page size of 16 Kbytes and CAS latency of 2 or 2.5. The maximum height of the DIMM modules possible on CP PIV is one inch or 25.4 mm.

The DDR interface runs at 100 MHz synchronously to the front side bus frequency. The SPD (Serial Presents Detect) -SROM available on DIMM modules provide all necessary information (speed, size, and type) to the boot-up software. The SPD-SROM can be read via SMBUS connected to the Intel Hance Rapids South Bridge.

Front panel connector pin assignments

COM1 and COM2 ports

The physical interface for the COM1 and COM2 ports to the front panel is through a stacked dual Male DB9 Connector. The corresponding pin details are shown in Table 58: COM1 and COM2 pin assignments on page 145.

Table 58: COM1 and COM2 pin assignments

Pin number	Pin name
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

USB port

The physical interface for thetwo USB ports to the front panel is through a standard USB connector. The corresponding Pin details are shown in Table 59: USB connector pin outs on page 146.Table 27. USB Connector Pin Outs

Table 29. ITP CONNECTOR Pin Outs

Table 59: USB connector pin outs

Pin number	Pin name
1	USB VCC
2	USB-
3	USB+
4	USB GND

10/100/1000 Mbps Ethernet ports

The physical interface for the two 10/100/1000 Mbps Ethernet ports to the front panel is through a stacked dual RJ 45 connector with magnetics and LEDs. The corresponding pin details are shown in Table 60: Ethernet connector pin outs on page 146.

Table 60: Ethernet connector pin outs

Pin number	Pin name
1	AX+
2	AX-
3	BX+
4	CX+
5	CX-
6	BX-
7	DX+
8	DX-

Front panel LED indicators

The CP PIV card has a total of four LEDS on the front panel. Two of the LEDs are 15 KV ESD protected and can be controlled via CPLD. Table 61: Front panel LED functionality on page 146 explains the function of each LED.

Table 61: Front panel LED functionality

LED	Color	Functionality	Default
LED1	Green	Power ON LED	Off

LED	Color	Functionality	Default
LED2	Green	Secondary IDE HD activity	Off
LED3	Green	CompactFlash activity	-Off
LED4	Green	CompactFlash activity	-Off

ITP connector (25 PIN, Debug Only)

Table 62: ITP connector pin outs

Pin	Signal Name	Pin	Signal Name
P1	GND	P2	GND
P3	BPM0N	P4	NC
P5	BPM1N	P6	RESETN
P7	BPM2N	P8	GND
P9	BPM3N	P10	TDI
P11	BPM4N	P12	TMS
P13	BPM5N	P14	TRSTN
P15	ITP_CPURSTN	P16	TCK
P17	TCK	P18	NC
P19	CLK	P20	GND
P21	CLKN	P22	PWR
P23	BPM5N	P24	TDO
P25	GND		

Post 80 Debug LEDs (Optional)

CP PIV has post 80 debug LEDs to assist in debugging the board and solving boot related problems. Using a GPCS from Super I/O X-bus, data lines are latched using latch 74F374. These help identify Post 80 codes. This feature is available only in debug boards.

Chapter 10: NT5D11 and NT5D14 Lineside T1 Interface cards

Contents

This section contains information on the following topics:

Introduction

This section describes the Lineside T1 interface cards NT5D11 and NT5D14.

Note:

Unless otherwise stated, the information in this section applies to both the NT5D11 and NT5D14 Lineside T1 interface cards.

The NT5D11 Lineside T1 Interface card is an intelligent 24-channel digital line card that is used to connect the switch to T1-compatible terminal equipment on the lineside. The T1-compatible terminal equipment includes voice mail systems, channel banks containing FXS cards, and key systems such as the Avaya. The Lineside T1 card differs from trunk T1 cards in that it supports terminal equipment features such as hookflash, transfer, hold, and conference.

This card occupies two card slots in the main or expansion cabinets. The Lineside T1 card can be installed in the system's main cabinet or one of the expansion cabinets (there are no limitations on the number of cards that can be installed in the Cabinet system).

The Lineside T1 card emulates an analog line card to the system software; therefore, each channel is independently configurable by software control in LD 10. The Lineside T1 card also comes equipped with a Man-Machine Interface (MMI) maintenance program. This feature provides diagnostic information regarding the status of the T1 link.

The NT5D11 Lineside T1 interface card is an IPE line card that can be installed in the NT8D37 IPE module. Up to eight cards can be installed.

Physical description

The Lineside T1 card mounts into any two consecutive IPE slots. The card consists of a motherboard and a daughterboard. The motherboard circuitry is contained on a standard 31.75 by 25.40 cm. (12.5 by 10.0 in) printed circuit board. The daughterboard is contained on a 5.08 by 15.24 cm (2.0 by 6.0 in) printed circuit board and mounts to the motherboard on six standoffs.

Card connections

The Lineside T1 card uses the NT8D81AA Tip and Ring cable to connect from the IPE backplane to the 25-pair amphenol connector on the IPE I/O input/output (I/O) panel. The I/O panel connector then connects directly to a T1 line, external alarm, and an MMI terminal or modem using the NT5D13AA Lineside T1 I/O cable available from Avaya.

Faceplate

The faceplate of the card is twice as wide as the other standard analog and digital line cards, and occupies two card slots. It comes equipped with four LED indicators. See Figure 29: Lineside T1 card faceplate on page 151.

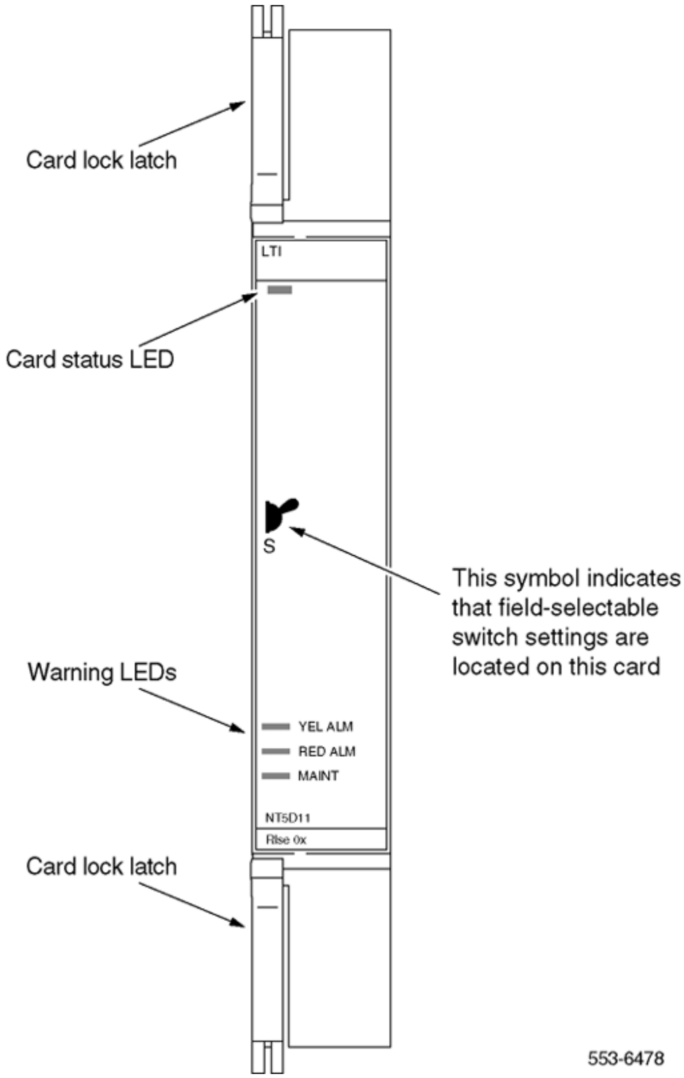


Figure 29: Lineside T1 card faceplate

In general, the LEDs operate as shown in Table 63: NT5D14AA Lineside T1 faceplate LEDs on page 151.

Table 63: NT5D14AA Lineside T1 faceplate LEDs

LED	State	Definition
STATUS	On (Red)	The NT5D14AA card either failed its self-test or it hasn't yet been configured in software.
	Off	The card is in an active state.
RED	On (Red)	A red alarm is detected from the T1 link. (This includes, but is not limited to: not receiving a signal, the signal has exceeded bit error thresholds or frame slip thresholds.)

LED	State	Definition
	Off	No red alarm exists.
YEL	On (Yellow)	A yellow alarm state is detected from the terminal equipment side of the T1 link. If the terminal equipment detects a red alarm condition, it may send a yellow alarm signal to the Lineside T1 card (this depends on whether or not your terminal equipment supports this feature).
	Off	No yellow alarm.
MAINT	On (Red)	The card detects whether tests are being run or that alarms are disabled through the Man-Machine Interface. The LED remains lit until these conditions are no longer detected.
	Off	The Lineside T1 card is fully operational.

The STATUS LED indicates that the Lineside T1 card has successfully passed its self test, and is functional. When the card is installed, this LED remains lit for two to five seconds as the self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit. When the card is configured and enabled in software, the LED goes out. If the LED flashes continuously, or remains weakly lit, replace the card.

Note:

The STATUS LED indicates the enabled/disabled status of both card slots of the Lineside T1 card simultaneously. To properly enable the card, both the motherboard and the daughterboard slots must be enabled. The STATUS LED turns off as soon as either one of the Lineside T1 card slots are enabled. No LED operation is observed when the second card slot is enabled. To properly disable the card, both card slots must be disabled. The LED does not turn on until both card slots are disabled.

The RED ALARM LED indicates that the Lineside T1 card has detected an alarm condition from the T1 link. Alarm conditions can include such conditions as not receiving a signal or the signal has exceeded bit error thresholds or frame slip thresholds. See Man-Machine T1 maintenance interface software on page 176 for information about T1 link maintenance.

If one of these alarm conditions is detected, the red LED lights. Yellow alarm indication is sent to the far-end as long as the near-end remains in a red alarm condition. Depending on how the Man-Machine Interface (MMI) is configured, this LED remains lit until the following actions occur:

- If the "Self-Clearing" function is enabled in the MMI, the LED clears the alarm when the alarm condition is no longer detected. This is the factory default.
- If the "Self-Clearing" function hasnot been enabled or it is subsequently disabled in the MMI, the LED stays lit until the command "Clear Alarm" is typed in the MMI, even though the carrier automatically returned to service when the alarm condition was no longer detected.

The YELLOW ALARM LED indicates that the Lineside T1 card has detected a yellow alarm signal from the terminal equipment side of the T1 link. See Man-Machine T1 maintenance interface software on page 176 for information about T1 link maintenance. If the terminal equipment detects a red alarm condition, such as not receiving a signal or the signal has exceeded bit error thresholds or frame slip thresholds, it can send a yellow alarm signal to the Lineside T1 card, depending on whether or not the terminal equipment supports this feature. If a yellow alarm signal is detected, the LED lights.

The MAINT LED indicates if the Lineside T1 card is fully operational because of certain maintenance commands being issued through the MMI. See Man-Machine T1 maintenance interface software on page 176 for information about T1 link maintenance. If the card detects that tests are being run or that alarms are disabled through the MMI, the LED lights and remains lit until these conditions are no longer detected, then it turns off.

Functional description

Figure 30: Lineside T1 card - block diagram on page 153 shows a block diagram of the major functions contained on the Lineside T1 card. Each of these functions is described on the following pages.

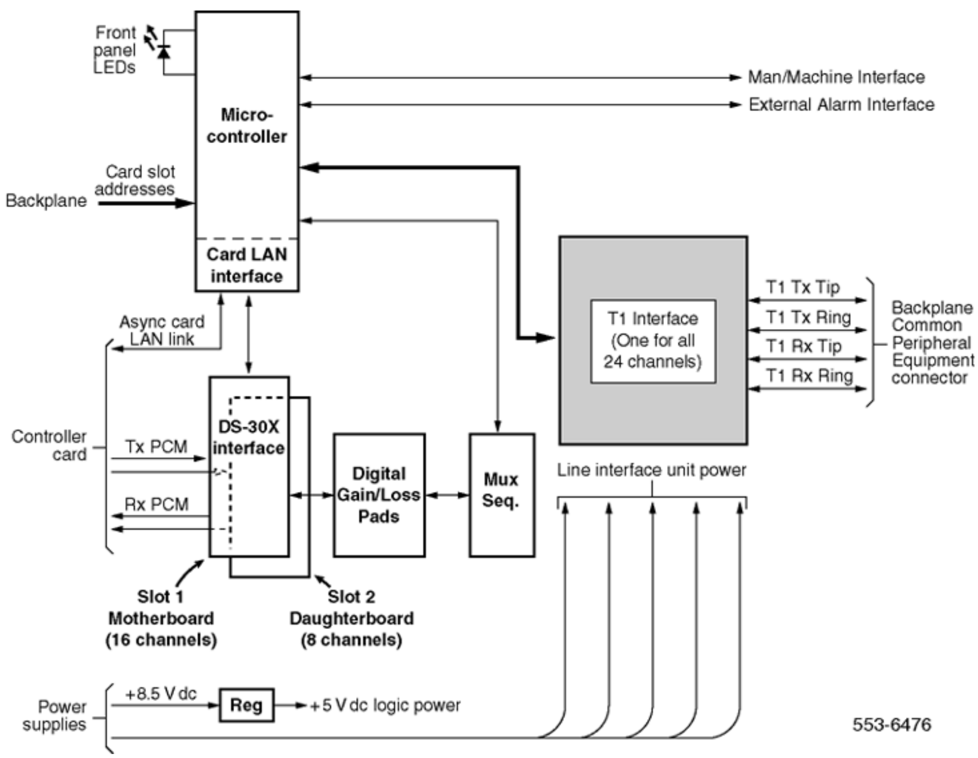


Figure 30: Lineside T1 card - block diagram

The NT5D14AA provides the following features and functions:

- Card interfaces
- T1 interface circuit

- Signaling and control
- Card control functions
- Microcontroller
- Card LAN interface
- Sanity Timer
- Man-Machine Interface (MMI)

The Lineside T1 card is an IPE line card that provides a cost-effective all-digital connection between T1-compatible terminal equipment (such as voice mail systems, voice response units, and trading turrets) and the system. The terminal equipment is assured access to analog (500/2500-type) telephone type line functionality such as hook flash, SPRE codes and ringback tones generated from the switch. Usually, the Lineside T1 card eliminates the need for channel bank type equipment normally placed between the switch and the terminal equipment. This provides a more robust and reliable end-to-end connection. The Lineside T1 card supports line supervision features such as loop and ground start protocols. It can also be used in an off-premise arrangement where analog (500/2500-type) telephones are extended over T1 with the use of channel bank equipment.

The Lineside T1 interface offers significant improvement over the previous alternatives. For example, if a digital trunk connection were used, such as with the DTI/PRI interface card, lineside functionality would not be supported. Previously, the only way to achieve the lineside functionality was to use analog ports and channel bank equipment. No channel bank equipment is required, resulting in a more robust and reliable connection.

The Lineside T1 interface offers a number of benefits when used to connect to third-party applications equipment:

- It is a more cost-effective alternative for connection because it eliminates the need for expensive channel bank equipment.
- The Lineside T1 supports powerful T1 monitoring and diagnostic capability.
- Overall costs for customer applications can also be reduced because the T1-compatible IPE is often more attractively priced than the analog-port alternatives.

The Lineside T1 card is compatible with all IPE based systems and standard public or private DSX-1 type carrier facilities. Using A/B robbed bit signaling, it supports D4 or ESF channel framing formats as well as AMI or B8ZS coding. Because it uses standard PCM in standard T1 timeslots, existing T1 test equipment remains compatible for diagnostic and fault isolation purposes.

Card interfaces

The Lineside T1 card passes voice and signaling data over DS-30X loops through the DS-30X Interfaces circuits and maintenance data over the card LAN link.

T1 interface circuit

The Lineside T1 card contains one T1 line interface circuit which provides 24 individually configurable voice interfaces to one T1 link in 24 different time slots. The circuit demultiplexes the 2.56 Mbps DS-30X Tx signaling bitstreams from the DS-30X network loop and converts it into 1.544 mHz T1 Tx signaling bitstreams onto the T1 link. It also does the opposite, receiving Rx signaling bitstreams from the T1 link and transmitting Rx signaling bitstreams onto the DS-30X network loop.

The T1 interface circuit performs the following:

- Provides an industry standard DSX-1 (0 to 655 ft./200 meters) interface.
- Converts DS-30X signaling protocol into FXO A and B robbed bit signaling protocol.
- Provides switch-selectable transmission and reception of T1 signaling messages over a T1 link in either loop or ground start mode.

Signaling and control

The Lineside T1 card also contains signaling and control circuits that establish, supervise, and take down call connections. These circuits work with the system controller to operate the T1 line interface circuit during calls. The circuits receive outgoing call signaling messages from the controller and return incoming call status information to the controller over the DS-30X network loop.

Card control functions

Control functions are provided by a microcontroller and a Card LAN link on the Lineside T1 card. A sanity timer is provided to automatically reset the card if the microcontroller stops functioning for any reason.

Microcontrollers

The Lineside T1 card contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the CPU via the card LAN link:
  - card identification (card type, vintage, serial number)
  - firmware version
  - self-test results

  - programmed unit parameter status
- receipt and implementation of card configuration:
  - control of the T1 line interface
  - enabling/disabling of individual units or entire card
  - programming of loop interface control circuits for administration of channel operation
  - maintenance diagnostics
- interface with the line card circuit:
  - converts on/off-hook, and ringer control messages from the DS-30X loop into A/B bit manipulations for each time slot in the T1 data stream, using robbed bit signaling.
- the front panel LED when the card is enabled or disabled by instructions from the NT8D01 controller card.

Card LAN interface

Maintenance data is exchanged with the CPU over a dedicated asynchronous serial network called the Card LAN link.

Sanity timer

The Lineside T1 card also contains a sanity timer that resets the microcontroller in the event of a loss of program control. The microcontroller must service the sanity timer every 1.2 seconds. If the timer is not properly serviced, it times out and causes the microcontroller to be hardware reset.

Man-Machine Interface

The Lineside T1 card provides an optional Man-Machine Interface (MMI) that is primarily used for T1 link performance monitoring and problem diagnosis. The MMI provides alarm notification, T1 link performance reporting and fault isolation testing. The interface is accessed through connections from the I/O panel to a terminal or modem.

The MMI is an optional feature because all T1 configuration settings are performed through dip switch settings or preconfigured factory default settings.

The Lineside T1 card provides an optional Man-Machine Interface (MMI) that is primarily used for T1 link performance monitoring and problem diagnosis. The MMI provides alarm notification, T1 link performance reporting and fault isolation testing. The interface is accessed through connections from the I/O panel to a terminal or modem. Multiple cards (up to 64) can be served through one MMI terminal or modem by cabling the cards together.

Electrical specifications

T1 channel specifications

Table 64: Lineside T1 card - line interface unit electrical characteristics on page 157 provides specifications for the 24 T1channels. Each characteristic is set by dip switches. See Installation and configuration on page 158 for the corresponding dip switch settings.

Table 64: Lineside T1 card - line interface unit electrical characteristics

Characteristics	Description
Framing	ESF or D4
Coding	AMI or B8ZS
Signaling	Loop or ground start A/B robbed-bit
Distance to Customer Premise Equipment (CPE) or Channel Service Unit	0-199.6 meters (0–655 feet)

Power requirements

The Lineside T1 card requires +15 V, –15 V, and +5 V from the backplane. One NT8D06 IPE Power Supply AC or NT6D40 IPE Power Supply DC can supply power to a maximum of eight Lineside T1 cards. See Table 65: Lineside T1 card - power required on page 157.

Table 65: Lineside T1 card - power required

Voltage	Current (max.)
+ 5.0 V dc	1.6 Amp
+15.0 V dc	150 mA.
–15.0 V dc	150 mA.

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the Lineside T1 card. It does protect against accidental shorts to –52 V dc analog lines.

When the card is used to service off-premise terminal equipment through the public telephone network, install a Channel Service Unit (CSU) as part of the terminal equipment to provide external line protection.

Environmental specifications

Table 66: Lineside T1 card - environmental specifications on page 158 lists the environmental specifications of the Lineside T1 card.

Table 66: Lineside T1 card - environmental specifications

Parameter	Specifications
Operating temperature-normal	15° to +30° C (+59° to 86°F), ambient
Operating temperature-short term	10° to +45° C (+50° to 113°F), ambient
Operating humidity-normal	20% to 55% RH (non-condensing)
Operating humidity-short term	20% to 80% RH (non-condensing)
Storage temperature	–50° to +70° C (–58° to 158°F), ambient
Storage humidity	5% to 95% RH (non-condensing)

Installation and configuration

Installation and configuration of the Lineside T1 card consists of six basic steps:

1. Configure the dip switches on the Lineside T1 card for the environment.
2. Install the Lineside T1 card into the selected card slots in the IPE shelf.
3. Cable from the I/O panel to the Customer Premise Equipment (CPE) or CSU, MMI terminal or modem (optional), external alarm (optional), and other Lineside T1 cards for daisy chaining use of MMI terminal (optional).
4. Configure the MMI terminal.
5. Configure the Lineside T1 card through the system software and verify self-test results.
6. Verify initial T1 operation and configure MMI (optional).

Steps 1-5 are explained in this section. Step 6 is covered in Man-Machine T1 maintenance interface software on page 176.

Dip switch settings

Begin the installation and configuration of the Lineside T1 card by selecting the proper dip switch settings for the environment. The Lineside T1 card contains two dip switches, each containing eight switch positions. They are located in the upper right corner of the motherboard circuit card as shown in Figure 31: Lineside T1 card - T1 protocol dip switch locations on page 159. The configuration for these switches are shown in Table 67: Lineside T1 card-T1 Switch 1 (S1) dip switch settings on page 161 through Table 70: Lineside T1 card - CPE or CSU distance dip switch settings (Switch S2, positions 3 - 5) on page 163.

When the line-side T1 card is oriented as shown in Figure 31: Lineside T1 card - T1 protocol dip switch locations on page 159, the dip switches are ON when they are up, and OFF when they are down. The dip switch settings configure the card for the following parameters:

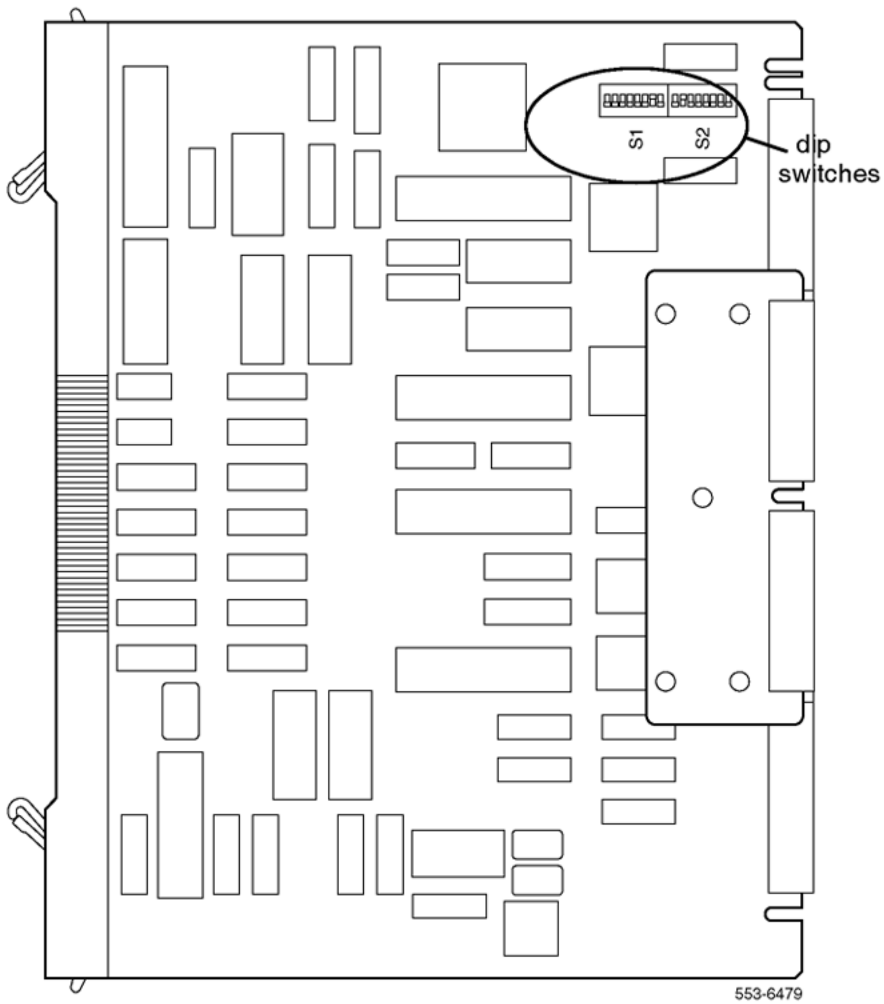


Figure 31: Lineside T1 card - T1 protocol dip switch locations

MMI port speed selection

This dip switch setting selects the appropriate baud rate for the terminal or modem (if any) that is connected to the MMI.

Line Supervisory Signaling protocol

As described in Functional description on page 153, the Lineside T1 card is capable of supporting loop start or ground start call processing modes. Make the selection for this dip switch position based on what type of line signaling the CPE equipment supports.

Address of Lineside T1 card to the MMI

The address of the Lineside T1 card to the MMI is made up of two components:

- The address of the card within the shelf
- The address of the shelf in which the card resides

These two addresses are combined to create a unique address for the card. The MMI reads the address of the card within the shelf from the card firmware; however the address of the shelf must be set by this dip switch.

The shelf address dip switch can be from 0 – 15. 16 is the maximum number of Lineside T1 IPE shelves (a maximum of 64 Lineside T1 cards) capable of daisy chaining to a single MMI terminal. For ease, it is recommended that this address be set the same as the address of the peripheral controller identifier in LD 97 for type: XPE. This is not possible because the dip switch is limited to 16; however, this is not mandatory.

T1 framing

The Lineside T1 card is capable of interfacing with CPE or CSU equipment either in D4 or ESF framing mode. Make the selection for this dip switch position based on what type of framing the CPE or CSU equipment supports.

T1 coding

The Lineside T1 card is capable of interfacing with CPE or CSU equipment using either AMI or B8ZS coding. Make the selection for this dip switch position based on what type of coding the CPE or CSU equipment supports.

DSX-1 length

Estimate the distance between the Lineside T1 card and the hardwired local CPE, or the Telco demarc RJ48, for the carrier facility connecting the Lineside T1 and the remote CPE. Make the selection for this dip switch position based on this distance.

Line supervision on T1 failure

This setting determines in what state all 24 ports of the Lineside T1 card appears to the Avaya Communication Server (Avaya CS 1000M), Avaya CS 1000E and Meridian 1 in case of T1 failure. Ports can appear as either in the on-hook or off-hook states on T1 failure.

Note:

All idle Lineside T1 lines go off-hook and seize a Digitone Receiver when the off-hook line processing is invoked on T1 failure. This may prevent DID trunks from receiving incoming calls until the Lineside T1 lines time-out and release the DTRs.

Daisy-chaining to MMI

If two or more Lineside T1 cards are installed and the MMI is used, daisy-chain the cards together to use one MMI terminal or modem, See Figure 33: Lineside T1 card - connecting two or more cards to the MMI on page 170. Make the selection for this dip switch position based on how many Lineside T1 cards are installed.

MMI master or slave

This setting is used only if daisy-chaining the cards to the MMI terminal or modem. This setting determines whether this card is a master or a slave in the MMI daisy-chain. Select the master setting if this card is the card that is cabled directly into the MMI terminal or modem; select the slave setting if this card is cabled to another Lineside T1 card in a daisy chain.

Table 67: Lineside T1 card-T1 Switch 1 (S1) dip switch settings on page 161 through Table 70: Lineside T1 card - CPE or CSU distance dip switch settings (Switch S2, positions 3 - 5) on page 163 describes the proper dip switch settings for each type of T1 link. After the card is installed, the MMI displays the DIP switch settings the command **`Display Configuration`** is used. See QPC43 Peripheral Signaling card on page 111 for details on how to invoke this command.

Table 67: Lineside T1 card-T1 Switch 1 (S1) dip switch settings

Dip Switch Number	Characteristic	Selection
1	MMI port speed selection	On = 1200 baud Off = 2400 baud
2	T1 signaling	On = Ground start Off = Loop start
3–6	XPEC Address for the Lineside T1 card	See Table 68: Lineside T1 card - XPEC address dip

Dip Switch Number	Characteristic	Selection
		switch settings (Switch S1, positions 3 - 6) on page 162
7	Not Used	Leave Off
8	Reserved for SL-100 use	Leave Off

Table 68: Lineside T1 card - XPEC address dip switch settings (Switch S1, positions 3 - 6)

XPEC Address	S1 Switch Position 3	S1 Switch Position 4	S1 Switch Position 5	S1 Switch Position 6
00	Off	Off	Off	Off
01	Off	Off	Off	On
02	Off	Off	On	Off
03	Off	Off	On	On
04	Off	On	Off	Off
05	Off	On	Off	On
06	Off	On	On	Off
07	Off	On	On	On
08	On	Off	Off	Off
09	On	Off	Off	On
10	On	Off	On	Off
11	On	Off	On	On
12	On	On	Off	Off
13	On	On	Off	On
14	On	On	On	Off
15	On	On	On	On

Table 69: Lineside T1 card - T1 Switch 2 (S2) dip switch settings

Dip Switch Number	Characteristic	Selection
1	T1 framing	On = D4 Off = ESF
2	T1 Coding	On = AMI Off = B8ZS

Dip Switch Number	Characteristic	Selection
3–5	CPE or CSU distance	See Table 70: Lineside T1 card - CPE or CSU distance dip switch settings (Switch S2, positions 3 - 5) on page 163
6	Line processing on T1 link failure	On = On-hook Off = Off-hook
7	Daisy-chaining to MMI	On = Yes Off = No
8	MMI Master or Slave	On = Master Off = Slave

Table 70: Lineside T1 card - CPE or CSU distance dip switch settings (Switch S2, positions 3 - 5)

Distance	S2 Switch Position 3	S2 Switch Position 4	S2 Switch Position 5
0–133	On	Off	Off
134–266	Off	On	On
267–399	Off	On	Off
400–533	Off	Off	On
534–655	Off	Off	Off

Installation

This section describes how to install and test the Lineside T1 card.

When installed, the Lineside T1 card occupies two card slots. It can be installed into an NT8D37 IPE module.

When installing the Lineside T1 card into NT8D37 IPE module, determine the vintage level module. If the 25-pair I/O connectors are partially split between adjacent IPE card slots, the Lineside T1 card works only in card slots where Unit 0 of the motherboard card slot appears on the first pair of the 25-pair I/O connector.

Certain vintage levels carry dedicated 25-pair I/O connectors only for card slots 0, 4, 8, and 12. These vintage levels are cabled with only 16 pairs of wires from each card slot to the I/O panel. Some of the 25-pair I/O connectors are split between adjacent card slots. Other vintage levels cable each card slot to the I/O panel using a unique, 24-pair connector on the I/O panel. In these vintage levels, the Lineside T1 card can be installed in any available pair of card slots. However, because of the lower number of wire pairs cabled to the I/O panel in the lower vintage level, only certain card slots are available to the Lineside T1 card.

See Table 71: Lineside T1 card - NT8D37 IPE module vintage level port cabling on page 164 for the vintage level information for the NT8D37 IPE modules.

Table 71: Lineside T1 card - NT8D37 IPE module vintage level port cabling

Vintage Level	Number of ports cabled to I/O panel
NT8D37AA	16 ports
NT8D37BA	24 ports
NT8D37DC	16 ports
NT8D37DE	16 ports
NT8D37EC	24 ports

Vintage levels cabling 24 ports

For modules with vintage levels that cabled 24 ports to the I/O panel, the Lineside T1 card can be installed in any pair of card slots 0–15.

Vintage levels cabling 16 ports

For modules with vintage levels that cabled 16 ports to the I/O panel, the Lineside T1 card can be installed into the following card slot pairs:

Available:	Motherboard/Daughterboard
	0 and 1
	1 and 2
	4 and 5
	7 and 8
	8 and 9
	9 and 10
	12 and 13
	13 and 14

The Lineside T1 card cannot be installed into the following card slot pairs:

Restricted:	Motherboard/Daughterboard
	2 and 3
	3 and 4
	6 and 7
	10 and 11
	11 and 12

14 and 15

If the Lineside T1 card must be installed into one of the restricted card slot pairs, rewire the IPE module card slot to the I/O panel by installing an additional NT8D81 cable from the Lineside T1 card motherboard slot to the I/O panel. Rearrange the three backplane connectors for the affected card slots. This permits the connection of the NT5D13AA Lineside T1 card carrier and maintenance external I/O cable at the IPE module I/O panel connector for card slots that are otherwise restricted.

Also, all Lineside T1 card connections can be made at the main distribution frame instead of connecting the NT5D13 Lineside T1 card external I/O cable at the I/O panel. This eliminates these card slots restrictions.

The Lineside T1 card cannot be installed into the following card slot pairs:

Cabling the Lineside T1 card

After configuring the dip switches and installing the Lineside T1 card into the selected card slots, the Lineside T1 card is ready to be cabled to the CPE or CSU equipment. Connections can also be made to the MMI terminal or modem (optional), an external alarm (optional), and other Lineside T1 cards for daisy-chain use of the MMI terminal (optional).

The Lineside T1 card is cabled from its backplane connector through connections from the motherboard circuit card only (no cable connections are made from the daughterboard circuit card) to the input/output (I/O) panel on the rear of the IPE module. The connections from the Lineside T1 card to the I/O panel are made with the NT8D81AA Tip and Ring cables provided with the IPE module.

Cabling from the I/O panel with the NT5D13AA Lineside T1 I/O cable

Usually, the I/O panel is connected to the T1 link and other external devices through the NT5D13AA Lineside T1 I/O cable. See Figure 32: Lineside T1 card - connection using the NTSD13AA Lineside T1 cable on page 166. This cable consists of a 25-pair amphenol connector (P1) on one end which plugs into the I/O panel. The other end has 4 connectors:

1. a DB15 male connector (P2) which plugs into the T1 line
2. a DB9 male connector (P3) which plugs into an external alarm system
3. a second DB9 male connector (P5) which connects to an MMI terminal or modem
4. a DB9 female connector (P4) that connects to the next Lineside T1 card's P4 connector for MMI daisy chaining

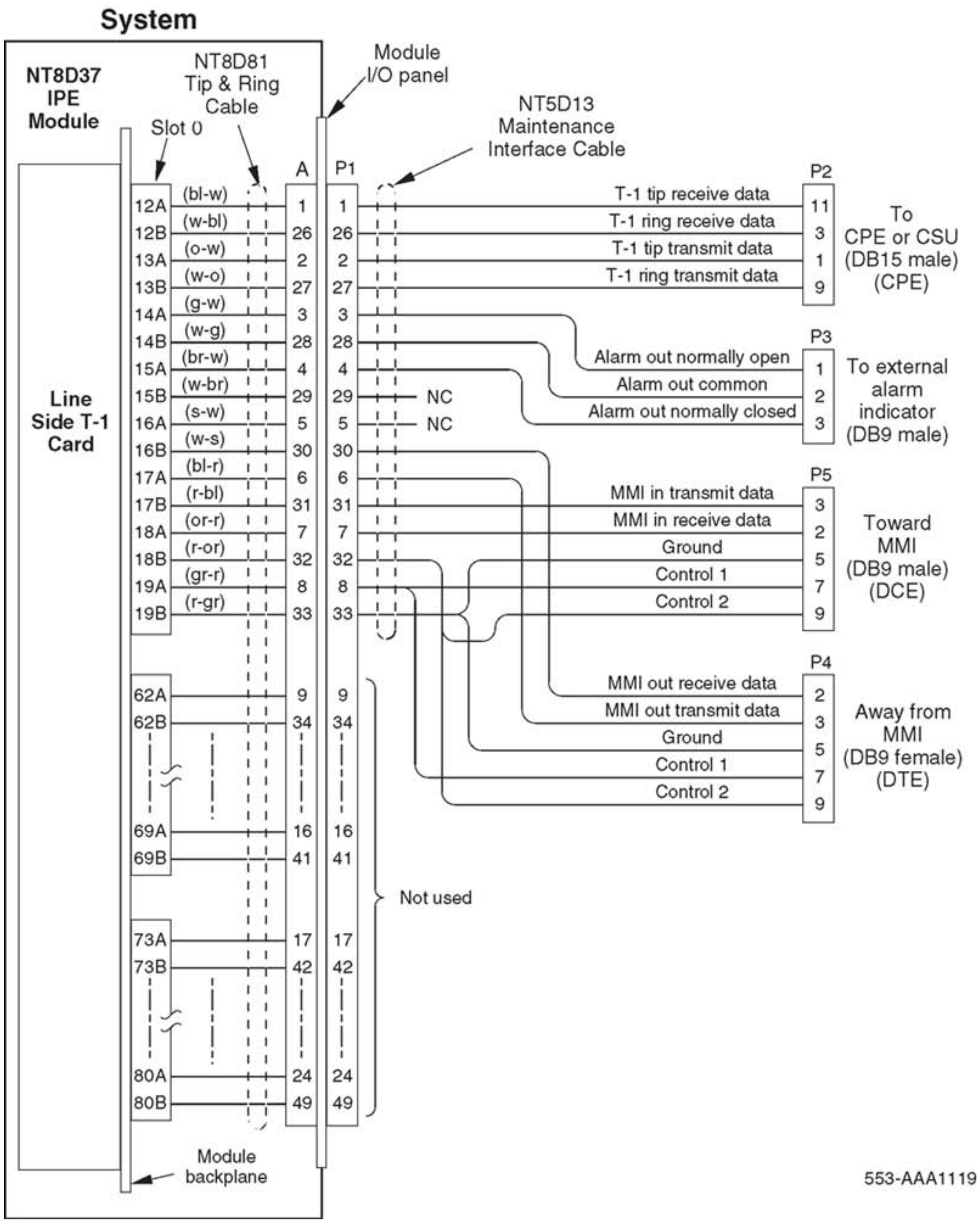


Figure 32: Lineside T1 card - connection using the NTSD13AA Lineside T1 cable

Cabling from the I/O panel at the Main Distribution Frame

All Lineside T1 connections can be made at the main distribution frame (MDF) if it is preferred to not use the NT5D13AA Lineside T1 I/O cable at the I/O panel.

Connecting to the MDF

To make the connections at the MDF, follow this procedure:

1. Punch down the first eight pairs of a standard telco 25-pair female-connectorized cross-connect tail starting with the first tip and ring pair of the Lineside T1 motherboard card slot on the cross-connect side of the MDF terminals.
2. Plug the NT5D13AA Lineside T1 I/O cable into this 25-pair cross-connect tail at the MDF, regardless of the card slot restrictions that exist from the vintage level of IPE or CE module used. This connection can also be made at the MDF without using the NT5D13 Lineside T1 I/O cable, by cross-connecting according to the pinouts in Table 72: Lineside T1 card - backplane pinouts on page 167.
3. Turn over the T1 transmit and receive pairs, where required for hardwiring the Lineside T1 card to local CPE T1 terminal equipment.

The backplane connector is arranged as an 80-row by 2-column array of pins. Table 72: Lineside T1 card - backplane pinouts on page 167 shows the I/O pin designations for the backplane connector and the 25-pair Amphenol connector from the I/O panel. Although the connections from the I/O panel only use 14 of the available 50 pins, the remaining pins are reserved and cannot be used for other signaling transmissions.

The information in Table 72: Lineside T1 card - backplane pinouts on page 167 is provided as a reference and diagnostic aid at the backplane, because the cabling arrangement can vary at the I/O panel. See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for cable pinout information for the I/O panel.

Table 72: Lineside T1 card - backplane pinouts

Backplane Connector Pin	I/O Panel Connector Pin	Signal
12A	1	T1 Tip, Receive Data
12B	26	T1 Ring, Receive Data
13A	2	T1 Tip, Transmit Data
13B	27	T1 Ring, Transmit Data
14A	3	Alarm out, Normally open
14B	28	Alarm out, Common
15A	4	Alarm out, Normally closed
15B	29	No Connection
16A	5	No Connection
16B	30	Away from MMI terminal, Receive Data
17A	6	Away from MMI terminal, Transmit Data
17B	31	Towards MMI terminal, Transmit Data
18A	7	Towards MMI terminal, Receive Data

Backplane Connector Pin	I/O Panel Connector Pin	Signal
18B	32	Daisy-chain Control 2
19A	8	Daisy-chain Control 1
19B	33	Ground

Table 73: Lineside T1 card - NT5D13AA connector pinouts on page 168 shows the pin assignments when using the NT5D13AA Lineside T1 I/O cable.

Table 73: Lineside T1 card - NT5D13AA connector pinouts

I/O pane connect or pin	Lead designations	NT5D13AA Lineside T1 I/O connector pin	Lineside T1 cable connector to external equipment
1	T1 Tip Receive Data	11	DB15 male to T1 (P2) Lineside T1 card is CPE transmit to network and receive from network
26	T1 Ring Receive Data	3	
2	T1 Tip Transmit Data	1	
27	T1 Ring Transmit Data	9	
3	Alarm out common	1	DB9 male to external alarm (P3)
28	Alarm out (normally open)	2	
4	Alarm out (normally closed)	3	
7	Towards MMI terminal Receive Data	2	DB9 male towards MMI (P5) Wired as DCE Data is transmitted on pin 2 (RXD) and received on pin 3 (TXD)
31	Towards MMI terminal Transmit Data	3	
33	Ground	5	
8	Control 1	7	
32	Control 2	9	
33	Ground	5	DB9 female away from MMI (P4) Wired as DTE Data is transmitted on pin 2 (TXD) and received on pin 3 (RXD)
8	Control 1	7	
32	Control 2	9	
30	Away from MMI terminal Transmit Data	3	
6	Away from MMI terminal Receive Data	2	

T1 connections

T1 signaling for all 24 channels is transmitted over P2 connector pins 1, 3, 9, and 11 as shown in Table 73: Lineside T1 card - NT5D13AA connector pinouts on page 168. Plug the DB15 male connector labeled "P2" into the T1 link. T1 transmit and receive pairs must be turned over between the Lineside T1 card and CPE equipment that is hardwired without carrier facilities. If the Lineside T1 card is connected through T1 carrier facilities, the transmit and receive pairs must be wired straight through to the RJ48 at the Telco demarc, the CSU, or other T1 carrier equipment. The T1 CPE equipment at the far end has transmit and receive wired straight from the RJ48 demarc at the far end of the carrier facility.

External alarm connections

P3 connector pins 3, 4, and 28 can be plugged into any external alarm hardware. Plug the male DB9 connector labeled "P3" into the external alarm. These connections are optional, and the functionality of the Lineside T1 card is not affected if they are not made.

The MMI (described in detail in Man-Machine T1 maintenance interface software on page 176) monitors the T1 link for specified performance criteria and reports on problems detected.

One of the ways it can report information is through this external alarm connection. If connected, the Lineside T1 card's microprocessor activates the external alarm hardware if it detects certain T1 link problems that it has classified as alarm levels 1 or 2. See Man-Machine T1 maintenance interface software on page 176 for a detailed description of alarm levels and configuration. If an alarm level 1 or 2 is detected by MMI, the Lineside T1 card closes the contact that is normally open, and opens the contact that is normally closed. The MMI command Clear Alarm returns the alarm contacts to their normal state.

MMI connections

P5 connector pins 2, 3, 5, 7 and 9 are used to connect the Lineside T1 card to the MMI terminal and daisy chain Lineside T1 cards together for access to a shared MMI terminal. When logging into a Lineside T1 card, "control 2" is asserted by that card, which informs all of the other cards not to talk on the bus, but rather to pass the data straight through. The pins labeled "control 1" are reserved for future use. As with the external alarm connections, MMI connections are optional. Up to 128 Lineside T1 cards, located in up to 16 separate IPE shelves, can be linked to one MMI terminal using the daisy chaining approach.

If only one Lineside T1 card is being installed, cable from the DB9 female connector labeled "P5" (towards MMI terminal) to one of the COM ports on the back of any TTY, a PC running a terminal emulation program, or a modem. For installations of only one card, no connection is made to the DB9 male connector labeled "P4" (away from MMI terminal).

If two or more Lineside T1 cards are being installed into the system, the MMI port connections can be daisy-chained together so that only one MMI terminal is required for up to 128 Lineside T1 cards. See Figure 33: Lineside T1 card - connecting two or more cards to the MMI on page 170. Cards can be located in up to 16 separate IPE shelves. Any card slot in the IPE shelf can be connected to any other card slot; the card slots connected together do not need to be consecutive.

Connecting two or more Lineside T1 cards to the MMI terminal

Follow this procedure for connecting two or more Lineside T1 cards to the MMI terminal:

1. Cable the DB9 male connector labeled "P5" (towards MMI terminal) to one of the COM ports on the back of any TTY, a PC running a terminal emulation program, or a modem.
2. Make the connection from the first card to the second card by plugging the DB9 female connector labeled "P4" (away from MMI terminal) from the first card into the DB9 male connector of the second card labeled "P5" (towards MMI terminal).
3. Repeat Step 2 for the remaining cards.
4. When the last card in the daisy chain is reached, make no connection to the DB9 male connector labeled "P4" (away from MMI terminal).
5. If two Lineside T1 cards are located too far apart to connect the "P4" and "P5" connectors together, connect them together with an off-the-shelf DB-9 female to DB-9 male straight-through extension cable, available at any PC supply store.

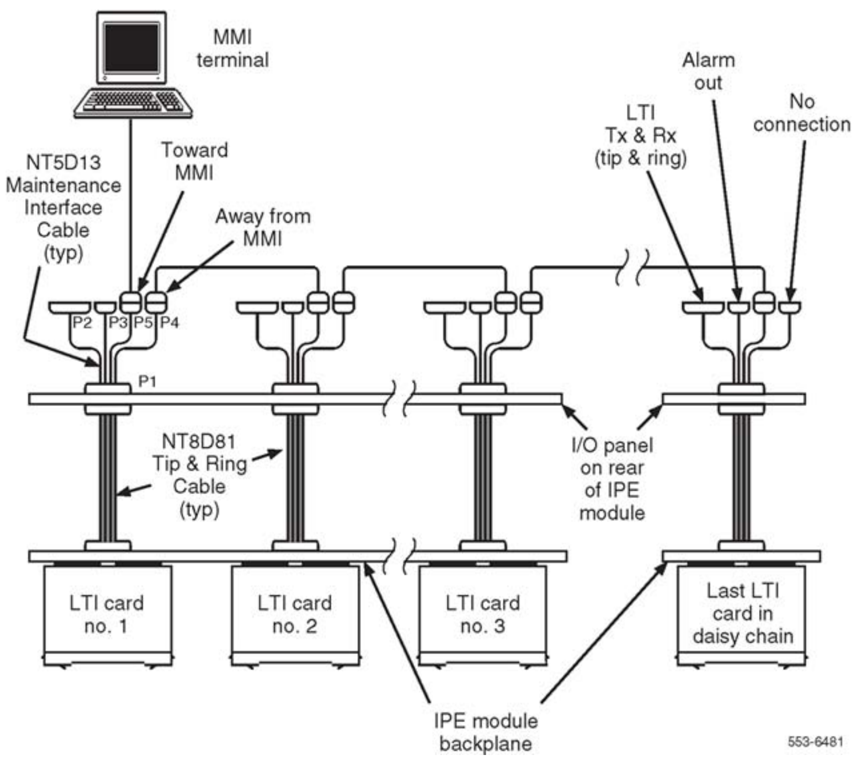


Figure 33: Lineside T1 card - connecting two or more cards to the MMI

Terminal configuration

For the MMI terminal to be able to communicate to the Lineside T1 card, the interface characteristics must be configured to the following:

- Speed – 1200 or 2400 bps, depending on the setting of switch position 1 of Switch 1
- Character width – 8 bits
- Parity bit – none
- Stop bits – one
- Software handshake (XON/XOFF) – off

Software configuration

Although much of the architecture and many of the features of the Lineside T1 card differ from the analog line card, the Lineside T1 card is designed to emulate an analog line card to the CS 1000 software. Because of this, the Lineside T1 card software configuration is performed the same as two adjacent analog line cards.

All 24 T1 channels carried by the Lineside T1 card are individually configured using the Analog (500/2500-type) Telephone Administration program LD 10. Use Table 74: DX-30 to T1 time slot mapping on page 171 to determine the correct unit number and the technical document Avaya Software Input/Output Reference — Administration (NN43001-611) for LD 10 service change instructions.

The Lineside T1 card circuitry routes 16 units (0-15) on the motherboard and eight (0-7) units on the daughterboard to 24 T1 channels. The motherboard circuit card is located in the left card slot, and the daughterboard circuit card is located in right card slot. For example, if the Lineside T1 card is installed into card slots 0 and 1, the motherboard would reside in card slot 0 and the daughterboard would reside in card slot 1. To configure the terminal equipment through the switch software, the T1 channel number must be cross-referenced to the corresponding card unit number. This mapping is shown in Table 74: DX-30 to T1 time slot mapping on page 171.

Table 74: DX-30 to T1 time slot mapping

Item	TN	T1 Channel Number
Motherboard	0	1
Motherboard	1	2
Motherboard	2	3
Motherboard	3	4
Motherboard	4	5
Motherboard	5	6

Item	TN	T1 Channel Number
Motherboard	6	7
Motherboard	7	8
Motherboard	8	9
Motherboard	9	10
Motherboard	10	11
Motherboard	11	12
Motherboard	12	13
Motherboard	13	14
Motherboard	14	15
Motherboard	15	16
Daughterboard	0	17
Daughterboard	1	18
Daughterboard	2	19
Daughterboard	3	20
Daughterboard	4	21
Daughterboard	5	22
Daughterboard	6	23
Daughterboard	7	24

Disconnect supervision

The Lineside T1 card supports far-end disconnect supervision by opening the tip side toward the terminal equipment upon the system's detecting a disconnect signal from the far-end on an established call. The Supervised Analog Line feature (SAL) must be configured in LD 10 for each Lineside T1 port. At the prompt FTR, respond:

`OSP <CR>`

and against FTR respond:

`ISP <CR>`

The Lineside T1 card treats OSP and ISP for both originating and terminating calls as hook flash disconnect supervision, also known as cut-off disconnect. Originating calls are outgoing from the terminal equipment. Terminating calls are incoming to the terminal equipment. The Lineside T1 card does not support battery reversal answer and disconnect supervision on originating calls.

After the software is configured, power up the card and verify the self test results. The STATUS LED on the faceplate indicates whether or not the Lineside T1 card has passed its self test, and is functional. When the card is installed, this LED remains lit for two to five seconds as the self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit. When the card is configured and enabled in software, the LED goes out. The LED goes out if either the motherboard or daughterboard is enabled by the software. If the LED flashes continuously or remains weakly lit, replace the card.

Clocking Requirement

The clocking for the NT5D14 Lineside T1 Interface card in the Communication Server 1000 system (Release 5.0 and later) is as follows:

- Lineside T1 cards are clock master of their T1 link, which has a clock accuracy requirement of +/-50ppm
- MGC does not provide a backplane clock with +/-50ppm accuracy at freerun
- An accurate clock source is needed for Lineside T1 application

The following are the two methods to bring an accurate clock source to MCG:

- Configure a digital trunk card with Clock Controller within the same cabinet/chassis as Lineside T1 cards.

  With Clock Controller enabled, in both freerun or locked state, an accurate clock will be provided to MGC.
- Use an MGC DECT Clock Reference Cable (NTDW67AAE5) to bring a clock source from other CS 1000 cabinet/chassis that has a Central Office Link.

  With accurate clock source available, MGC locks to the reference and provide an backplane clock as accurate as the clock source.

Connecting MGC DECT Clock Reference Cable

The following sections elaborate on how to connect an MGC DECT Clock Reference Cable.

Prerequisites

The prerequisites for connecting an MGC DECT Clock Reference Cable are the following:

- **MGC DECT Clock Reference Cable ---** NTDW67AAE5.

  Figure 34: MGC DECT Clock Reference Cable on page 174 shows the MGC DECT Clock Reference Cable. It is used to provide clock reference between CS 1000 Media Gateway Cabinet/chassis.

Figure 34: MGC DECT Clock Reference Cable

Connecting MGC DECT Clock Reference Cable

1. Connect the MGC DECT Clock Reference Cable to the AUI port of the back of the MG1000 chassis. Figure 35: MG1000 chassis on page 174 shows the AUI port of the MG1000 chassis.

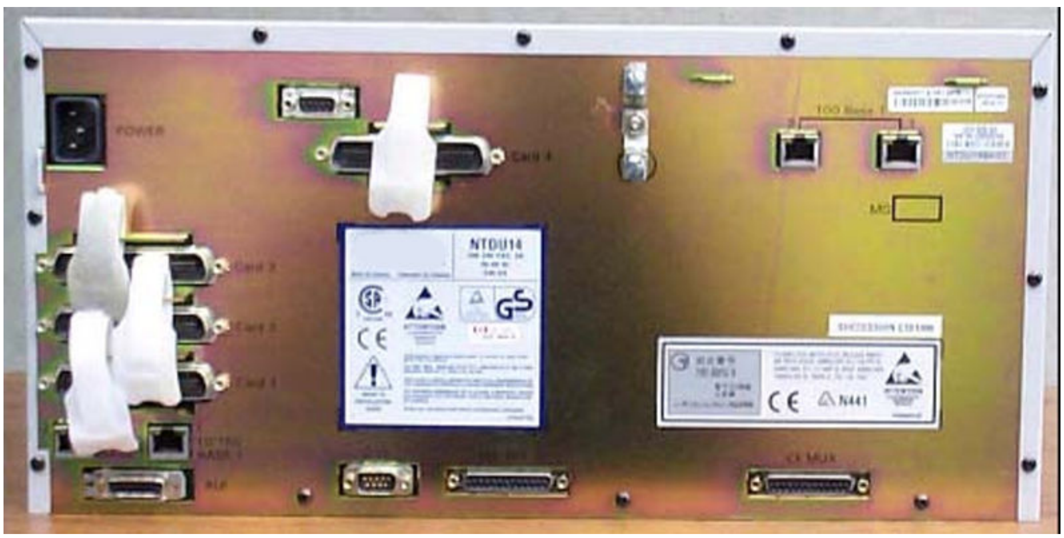


Figure 35: MG1000 chassis

2. In the chassis, connect to 15-pin DSUB connector on the back panel formerly used for the 10Base-T AUI connection. Figure 36: Chassis on page 175 shows the 10Base-T AUI connection of the chassis.

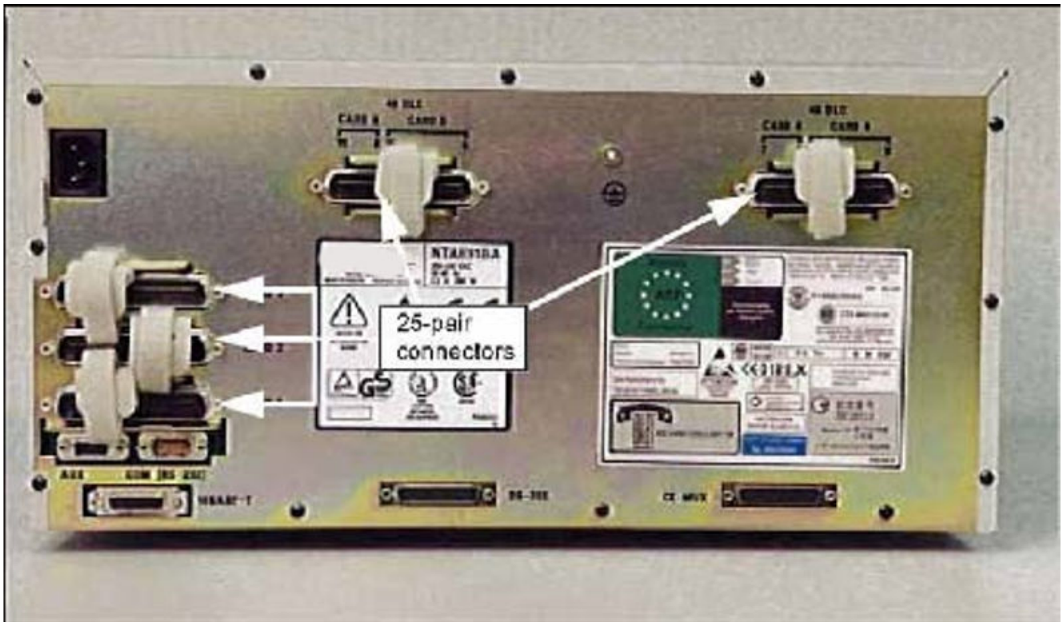


Figure 36: Chassis

3. Use an MGC Breakout Adapter for card.

    • Connect the adapter to 25 pairs MDF connector at Slot 0

    • Connect the MGC DECT Clock Reference Cable (NTDW67AAE5) to 15-pin DSUB connector on the Breakout AdapterFigure 37: Cabinet on page 175 shows the Cabinet.

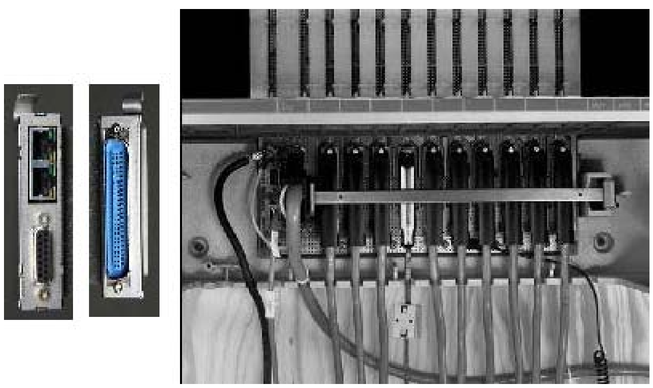


Figure 37: Cabinet

Man-Machine T1 maintenance interface software

Description

The Man-Machine Interface (MMI) supplies a maintenance interface to a terminal that provides T1 link diagnostics and historical information. See Installation and configuration on page 158 for instructions on how to install the cabling and configure the terminal for the MMI.

This section describes the features of MMI and explains how to configure and use the MMI firmware.

The MMI provides the following maintenance features:

- default and reconfigurable alarm parameters
- notification of T1 link problems by activating alarms
- Reports on current and historical T1 link performance
- T1 tests for T1 verification and fault isolation to Lineside T1 card, T1 link, or CPE equipment

Alarms

MMI activates alarms for the following T1 link conditions:

- excessive bit error rate
- frame slip errors
- out of frame condition
- loss of signal condition
- blue alarm condition

The alarms are activated in response to pre-set thresholds and error durations. Descriptions of each of these T1 link alarm conditions, instructions on how to configure alarm parameters, and access alarm reporting can be found in Alarm operation and reporting on page 184.

Two levels of alarm severity exist for bit errors and frame slip errors. For these conditions, two different threshold and duration configurations are established.

When the first level of severity is reached (alarm level 1), the MMI does the following:

- activates the external alarm hardware
- lights the appropriate LED on the faceplate (either RED ALARM or YELLOW ALARM)

- displays an alarm message on the MMI terminal
- creates entry in the alarm log

When the second level of severity is reached (alarm level 2), the MMI performs all of the same functions as alarm level 1, and in addition, forces the Lineside T1 card to enter trunk processing mode. In this mode, the terminal equipment sends either "on-hook" or "off-hook" signals for all 24 ports to the CS 1000M, and Meridian 1, depending on how the dip switch for trunk processing was set (dip switch #2, position #6).

If the MMI detects T1 link failures for any of the remainder of the conditions monitored (out of frame condition, loss of signal condition, and blue alarm condition), the Lineside T1 card automatically performs all alarm level 2 functions. The MMI also sends a yellow alarm to the distant end CPE or CSU.

Alarms can be configured to self-clear or not self-clear when the alarm condition is no longer detected.

All alarms activated produce a record in an alarm log. The alarm log maintains records for the most recent 100 alarms and can be displayed, printed and cleared. The alarm log displays or prints the alarms listing the most recent first in descending chronological order. The alarms are stamped with the date and time they occurred.

T1 performance counters and reports

The MMI maintains performance error counters for the following T1 conditions:

- errored seconds
- bursty seconds
- unavailable seconds
- framer slip seconds
- loss of frame seconds

It retains the T1 performance statistics for the current hour, and for each hour for the previous 24 hours. Descriptions of each of these performance error counters, and instructions on how to report on them and clear them can be found in Performance counters and reporting on page 186.

T1 verification and fault isolation testing

The MMI performs various tests to verify that the T1 is working adequately, or help to isolate a problem to the Lineside T1 card, the T1 link, or the CPE equipment. Descriptions of all of these tests and instructions on how to run them can be found in Testing on page 188.

Login and password

The MMI can be accessed through a TTY, a PC running a terminal emulation program, or a modem. After installing the MMI terminal and card cables, the MMI firmware can be accessed.

For single card installations, log in by entering:

`L<CR>`

For multiple card installations connected in a daisy-chain, log in by entering:

`L <address>`

where the four-digit address is the two-digit address of the IPE shelf as set by dip switch positions (dip switch #1, positions 3-6) on the card (as opposed to the address set in the CS 1000 software), plus the two-digit address of the card slot that the motherboard occupies. For example, to login to a card located in shelf 13, card slot 4, type:

`L 13 4 <CR>`

A space is inserted between the login command (L), the shelf address, and the card slot address.

The MMI then prompts for a password. The password is "LTILINK", and it must be typed all in capital letters.

After logging in, the prompt looks like the following:

- `LTI:::>` for single-card installations
- `LTI:ss cc>` for multi-card installations, where ss represents the two-digit address, and cc represents the two-digit card slot address

Basic commands

MMI commands can now be executed. There are seven basic commands that can be combined together to form a total of 19 command sets. They are:

- Alarm
- Clear
- Display
- Set
- Test

- Help
- Quit

If **?<CR>** is typed, the MMI lists the above commands along with an explanation of their usage. A screen similar to the following appears. The help screen also appears by typing **H<CR>**, or **HELP<CR>**.

ALARM	USAGE: Alarm [Enable | Disable]
CLEAR	USAGE: Clear [Alarm] | [Error counter] [Log]
DISPLAY	USAGE: Display [Alarm | Status | Perform | History] [Pause]
HELP	USAGE: Help | ?
SET	USAGE: Set [Time | Date | Alarm | Clearing | Name | Memory]
TEST	USAGE: Test [Carrier All]
QUIT	USAGE: Quit

Notation Used:

CAPS - Required Letters   [ ] - Optional | - Either/Or

Each of these commands can be executed by typing the first letter of the command or by typing the entire command. Command sets are entered by typing the first letter of the first command, a space, and the first letter of the second command or by typing the entire command. Table 75: MMI commands and command sets on page 179 shows all the possible command sets, listed in alphabetical order. These commands are described by subject later in this section.

Table 75: MMI commands and command sets

Command	Description
A D	Alarm Disable Disables all alarms.
A E	Alarm Enable Enables all alarms.
C A	Clear Alarm Clears all alarms, terminates line processing, and resets the T1 bit error rate and frame slip counters.
C A L	Clear Alarm Log Clears the alarm log.
C E	Clear Error Clears the error counter for the T1.
D A [P]	Display Alarms [Pause] Displays the alarm log – a list of the most recent 100 alarms along with time and date stamps.
D C	Display Configuration Displays the configuration settings for the cards including: • the serial number of the card • MMI firmware version • date and time

Command	Description
	• alarm enable/disable setting • self-clearing enable/disable setting • settings entered in Set Configuration • dip switch settings
D H [P]	Display History [Pause] Displays performance counters for the past 24 hours.
D P	Display Performance Displays performance counters for the current hour.
D S [P]	Display Status [Pause] Displays carrier status, including whether the card is in the alarm state, and what alarm level is currently active.
H or ?	Help Displays the help screen.
L	Login Logs into the MMI terminal when the system has one Lineside T1 card.
Q	Quit Logs the terminal user out. If multiple Lineside T1 cards share a single terminal, logout after using the MMI. Because of the shared daisy-chained link, if a Lineside T1 card is logged in, it occupies the bus and no other Lineside T1 cards are able to notify the MMI of alarms.
S A	Set Alarm parameters Alarm parameters include the allowable bit errors per second threshold and alarm duration.
S C	Set Clearing Sets the alarm self-clearing function to either enable or disable.
S D	Set Date Sets date or verifies current date.
S T	Set time Sets time or verifies current time.
T x	Test Initiates the T1 carrier test function. To terminate a test in process, enter the STOP TEST (S) command at any time.

Configuring parameters

The MMI is designed with default settings so that no configuration is necessary. However, it can be configured to suit a specific environment.

Set Time

Before configuring the MMI, login to the system and enter the current time. Do this by typing in the Set Time (S T) command set. The MMI then displays the time it has registered. Enter a new time or press "Enter" to leave it unchanged. The time is entered in the "hh:mm:ss" military time format.

Set Date

The current date must be set. Do this by typing in the Set Date (S D) command set. The MMI then displays the date it has registered. Enter a new date or press "Enter" to leave it unchanged. The date is entered in the "mm/dd/yy" format.

Alarm parameters

The Set Alarm (S A) command set establishes the parameters by which an alarm is activated, and its duration. There are three alarm activation levels:

- Alarm Level 0 (AL0) consists of activity with an error threshold below the AL1 setting. This is a satisfactory condition and no alarm is activated.
- Alarm Level 1 (AL1) consists of activity with an error threshold above the AL1 setting but below AL2 setting. This is a minor unsatisfactory condition. In this situation, the external alarm hardware is activated by closing the normally open contact. The RED ALARM LED on the faceplate lights and an alarm message is created in the alarm log and the MMI terminal.
- Alarm Level 2 (AL2) consists of activity with an error threshold above the AL2 setting. This is an unsatisfactory condition. In this situation, the external alarm hardware is activated by closing the normally open contact. The RED ALARM LED on the faceplate lights, an alarm message is created in the alarm log and the MMI terminal. The Lineside T1 card enters line processing mode and a yellow alarm message is sent to the CPE/CSU. The Line processing sends the CS 1000E, CS 1000M, and Meridian 1either all "on-hook" or all "off-hook" signals depending on the dip switch setting of the card.

When the Set Alarm command is used, a prompt appears to configure the threshold level and duration period for alarm levels 1 and 2.

The threshold value indicates the number of bit errors detected per second that is necessary to activate the alarm. The T1 link processes at a rate of approximately 1.5 mb/s. The threshold value can be set between 3 and 9 and can be different for each alarm level. Any other value entered causes the software to display a "Parameter Invalid" message. The threshold number entered represents the respective power of 10 as shown in Table 76: T1 bit error rate threshold settings on page 182.

Note:

The error rate threshold for a level 2 alarm must be greater (a smaller power of 10) than for a level 1 alarm.

Table 76: T1 bit error rate threshold settings

Alarm threshold bit errors per second in power of 10	Threshold to set alarm	Allowable duration periods
10^{-3}	1500/second	1–21 seconds
10_{-4}	150/second	1–218 seconds
10^{-5}	15/second	1–2148 seconds
10^{-6}	1.5/second	1–3600 seconds
10^{-7}	1.5/10 seconds	10–3600 seconds
10^{-8}	1.5/100 seconds	100–3600 seconds
10^{-9}	1.5/1000 seconds	1000–3600 seconds

The duration value is set in seconds and can be set from 1 to 3600 seconds (1 hour). This duration value indicates how long the alarm lasts. Low bit error rates (10-7 through 10-9) are restricted to longer durations because it takes more than one second to detect an alarm condition above 10-6. Higher bit error rates are restricted to shorter durations because the MMI error counter fills at 65,000 errors.

If the Set Clearing (S C) "Enable Self Clearing" option is set, the alarm indications (LEDs and external alarm contacts) clear automatically after the duration period expires. Otherwise, the alarm continues until the command set Clear Alarm (C A) is entered.

When an alarm is cleared, the following activity caused by the alarm is cleared:

- the external alarm hardware is deactivated (the contact normally open is reopened)
- the LED light turns off
- an entry is made in the alarm log of the date and time when the alarm clears
- carrier fail line supervision ceases (for alarm level 2 only)

If self-clearing alarm indications are disabled, carrier fail line supervision terminates when the alarm condition ceases, but the alarm contact and faceplate LED remain active until the alarm is cleared.

Note:

A heavy bit error rate can cause 150 bit errors to occur in less than 100 seconds. This causes the alarm to be activated sooner.

An alarm is not automatically cleared until the system no longer detects the respective bit error threshold during the corresponding duration period. For example, if an AL1 threshold of 6 (representing 10–6) and a duration period of 100 seconds is specified, an alarm is activated if more than 150 bit errors occur in any 100 second period (1.5 seconds X 100 seconds = 150/100 seconds). As soon as the alarm is activated, the bit counter is reset to 0. If the next 100 seconds pass, and less than 150 bit errors are detected, then the alarm clears after the duration period. However, if more than 150 bit errors are detected in the next 100 seconds, the alarm continues for the designated duration period. The alarm finally clears when the alarm condition is no longer detected for the designated duration period either by self-clearing (if this function is enabled), or when the Clear Alarm (C A) command set is entered.

In addition to bit errors, the Set Alarm function configures parameters for detecting frame slip errors, by establishing a threshold necessary to activate an alarm. If the threshold value is exceeded, a level 2 alarm is activated. The frame slip threshold can be specified from 1 to 255 frame slips per time period. The duration time period can be specified from 1 to 24 hours.

When entering the Set Alarm command set, the MMI scrolls through the previously described series of alarm options. These options are displayed along with their current value. Enter a new value or press Enter to retain the current value. Table 77: Set alarm options on page 183 outlines the options available in the Set Alarm function.

Table 77: Set alarm options

Option	Description
AL1 Threshold	Sets the allowable bit errors per second (from 3 to 9) before alarm level 1 is activated. Factory default is 10^{-6}.
AL1 Duration	Sets the duration in seconds (from 1 to 3,600 seconds) that alarm level 1 is activated. Factory default is 10 seconds.
AL2 Threshold	Sets the allowable bit errors per second (from 3 to 9) before alarm level 2 is activated. Factory default is 10^{-5}.
AL2 Duration	Sets the duration in seconds (from 1 to 3,600 seconds) that alarm level 2 is activated. Factory default is 10 seconds.
Frame Slip Threshold	Sets the allowable frame slips per time period (from 1 to 255) before alarm level 2 is activated. Factory default is 5.
Frame Slip Duration	Sets the duration in hours (from 1 to 24) that the frame slips are counted. After this time period, the counter is reset to 0. Factory default is 2 hours.

Note:

If the duration period is set too long, the Lineside T1 card can be slow to return to service automatically even when the carrier is no longer experiencing any errors. The Clear Alarm command must be entered manually to restore service promptly. To avoid this, the duration period should normally be set to 10 seconds.

Set Clearing

Use the Set Clearing (S C) command set to enable or disable alarm self-clearing. Answer Y or N to the question: "Enable Self Clearing? (YES or NO)". If "Enable Self-Clearing" is chosen (the factory default condition), the system automatically clears alarms after the alarm condition is no longer detected for the corresponding duration period.

The "Disable Self-Clearing" option causes the system to continue the alarm condition until the Clear Alarm (C A) command set is entered. Line processing and the yellow alarm indication to the CPE is terminated as soon as the alarm condition clears, even if "Disable Self-Clearing" is set.

Display Configuration

The Display Configuration (D C) command set displays the various configuration settings established for the Lineside T1 card. Entering the Display Configuration (D C) command set causes a screen similar to the following to appear:

```
LTI S/N 1103 Software Version 1.01    3/03/95 1:50
Alarms Enabled: YES      Self Clearing Enabled: YES
Alarm Level 1 threshold value: E-7      Threshold duration
(in seconds): 10
Alarm Level 2 threshold value: E-5      Threshold duration
(in seconds): 1
Frame slips alarm level threshold: 5    Threshold duration
(in hours): 2
Current dip switch S1 settings (S1..S8) On Off Off On Off
Off Off On
Current dip switch S2 settings (S1..S8) On Off On Off Off
Off On Off
```

Alarm operation and reporting

The MMI monitors the T1 link according to the parameters established through the Set Alarm command set for the following conditions:

- Excessive bit error rate
- Frame slip errors
- Out of frame condition
- Loss of signal condition
- Blue alarm (AIS) condition

Descriptions of the excessive bit error rate and frame slip errors conditions can be found in Configuring parameters on page 180. Bit errors may activate either a level 1 or level 2 alarm. The remaining conditions, when detected, always cause the system to activate a level 2 alarm.

An out of frame condition is declared if two out of four frame bits are in error. If this condition occurs, the hardware immediately attempts to reframe. During the reframe time, the T1 link is declared out of frame, and silence is sent on all receive timeslots.

A loss of signal condition is declared if a full frame (192 bits) of consecutive zeros is detected at the receive inputs. If this condition occurs, the T1 link automatically attempts to resynchronize with the distant end. If this condition lasts for more than two seconds, a level 2 alarm is declared and silence is sent on all receive timeslots. The alarm is cleared if, after two seconds, neither a loss of signal, out of frame condition, nor blue alarm condition occurs.

If a repeating device loses signal, it immediately begins sending an unframed all 1's signal to the far-end to indicate an alarm condition. This condition is called a blue alarm, or an Alarm

Indication Signal (AIS). If an AIS is detected for more than two seconds, a level 2 alarm is declared, and silence is sent on all receive timeslots. The alarm is cleared if, after two seconds, neither a loss of signal, out of frame condition, nor blue alarm condition occurs.

Alarm Disable

The Alarm Disable (A D) command disables the external alarm contacts. When this command is typed, the MMI displays the message "Alarms Disabled" and the MAINT LED turns on. In this mode, no yellow alarms are sent and the Lineside T1 card does not enter line processing mode. Alarm messages are still sent to the MMI terminal and the LED light continues to indicate alarm conditions.

Alarm Enable

The Alarm Enable (A E) command set does the opposite of the Alarm Disable command set. It enables the external alarm contacts. When this command set is typed in, the MMI displays the message "Alarms Enabled." In this mode, yellow alarms can be sent and the Lineside T1 card can enter line processing mode.

Clear Alarm

The Clear Alarm (C A) command set clears all activity initiated by an alarm: the external alarm hardware is deactivated (the contact normally open is reopened), the LED light goes out, an entry is made in the alarm log of the date and time when the alarm clears, and line processing ceases (for alarm level 2 only). When this command set is typed in, the MMI displays the message "Alarm acknowledged." If the alarm condition still exists, the alarm is declared again.

Display Alarms

A detailed report of the most recent 100 alarms with time and date stamps can be displayed by entering the Display Alarms (D A) command set into the MMI. Entering the Display Alarms (D A) command set causes a screen similar to the following to appear:

```
Alarm Log
3/03/95 1:48 Yellow alarm on T1 carrier
3/03/95 1:50 Initialized Memory
3/03/95 2:33 T1 carrier level 1 alarm
3/03/95 3:47 T1 carrier level 2 alarm
3/03/95 4:43 T1 carrier performance within thresholds
3/03/95 15:01 Log Cleared
```

The Pause command can be used to display a full screen at a time by entering D A P.

Clear Alarm Log

Clear all entries in the alarm log by typing in the Clear Alarm Log (C A L) command set.

Display Status

The Display Status (D S) command set displays the current alarm condition of the T1 link as well as the on-hook or off-hook status of each of the 24 ports of the Lineside T1 card. Entering the Display Status (D S) command set causes a screen similar to the following to appear:

```
LTI S/N   Software Version 1.01    3/03/95 1:50
In alarm state: NO
T1 link at alarm level 0
Port 0 off hook, Port 1 on hook, Port 2 on hook,
Port 3 on hook,
Port 4 on hook, Port 5 on hook, Port 6 off hook,
Port 7 off hook,
Port 8 off hook, Port 9 on hook, Port 10 on hook,
Port 11 on hook,
Port 12 off hook, Port 13 on hook, Port 14 on hook,
Port 15 on hook,
Port 16 on hook, Port 17 on hook, Port 18 off hook,
Port 19 off hook,
Port 20 off hook, Port 21 on hook, Port 22 on hook,
Port 23 on hook
```

Performance counters and reporting

The MMI monitors the performance of the T1 link according to several performance criteria including errored, bursty, unavailable, loss of frame and frame slip seconds. It registers the performance of these criteria by reading their status every second and counting their results. These counts are accumulated for an hour, and then they are reset to 0. Previous hour count results are maintained for each hour for the previous 24 hours.

Performance counts are maintained for the following:

- Errored seconds – one or more CRC-6 errors, or one or more out of frame errors in a second.
- Bursty seconds – more than one and less than 320 CRC-6 errors in a second.
- Unavailable seconds – unavailable state starts with 10 consecutive severely errored seconds and ends with 10 consecutive severely errored seconds (excluding the final 10 non-severely errored seconds). Severely errored seconds are defined as more than 320 CRC-6 errors, or one or more out of frames in a second.
- Loss of frame seconds – loss of frame or loss of signal for three consecutive seconds.
- Framer slip seconds – one ore more frame slips in a second.

The MMI also maintains an overall error counter that is a sum of all the errors counted for the five performance criteria listed above. The error counter can only be cleared by entering the "Clear Error" command. It stops counting at 65,000. The error counter provides an easy method to determine if an alarm condition is corrected. Simply clear the error counter, wait a few minutes, and display performance to see if any errors occurred because the counter was cleared.

Display the reports on these performance counters by entering the Display Performance (D P) or the Display History (D H) command sets into the MMI.

Display Performance

Enter the Display Performance (D P) command set to display performance counters for the past hour. A screen similar to the following appears:

```
LTI T1 Interface Performance Log
3/03/95 1:37
Data for the past 37 Minutes
Errored   Bursty   Unavailable  Loss        Frame       Error
ble          Frame       Slip
Seconds   Seconds  Seconds      Seconds     Seconds     Counter
2263      0         2263        2263        352         321
```

Each column, except the error counter, indicates the number of errors in the current hour and is reset to zero every hour on the hour. When these counters are reset to zero, the performance counter values are put into the history log. The error counter indicates the number of errors that occurred because the error counter was cleared.

Display History

Enter the Display History (D H) command set to display performance counters for each hour for the past 24 hours. A screen similar to the following appears:

```
LTI T1 Interface History Performance Log
3/03/95 1:35
Hour    Errored   Bursty   Unavailable   Loss     Frame    Error
Frame    Slip
Ending  Seconds   Seconds  Seconds       Seconds  Seconds  Counter
20:00   139       0        129           139      23       162
19.00   0         0        0             0        0        0
18.00   0         0        0             0        0        0
17.00   0         0        0             0        0        0
16.00   0         0        0             0        0        0
```

Use the pause command to display a full screen at a time by entering D H P.

Clear Error

Reset the error counter to zero by entering the Clear Error (C E) command set. The error counter provides a convenient way to determine if the T1 link is performing without errors because it can be cleared and examined at any time.

Testing

The Test Carrier (T C) command set enables tests to be run on the Lineside T1 card, the T1 link, or the CPE device. These three tests provide the capability to isolate faulty conditions in any one of these three sources. See Table 78: MMI Tests on page 188 for additional information about these three test types.

After entering the T C command set, select which test to start. The prompt appears, similar to the following:

```
Test 1: Local Loopback Test
Test 2: External Loopback Test
Test 3: Network Loopback Test
(1,2,3 or S to cancel):
```

Tests can be performed once (for 1 through 98 minutes), or continuously (selected by entering 99 minutes) until a "Stop Test" command is entered. Tests continue for the duration specified even if a failure occurs, and terminate at the end of the time period or when a "Stop Test" command is issued. Only a "Stop Test" command stops a test with a duration selection of 99. After entering the test number selection, a prompt similar to the following appears:

```
Enter Duration of Test (1-98 Mins, 0 = Once, 99 = Forever)
Verify DS-30A Links are disabled.
Hit Q to quit or any Key to Continue
```

Before a test is run, verify that DS-30A links are disabled because the tests interfere with calls currently in process.

During a test, if an invalid word is received, a failure peg counter is incremented. The peg counter saturates at 65,000 counts. At the end of the test, the Test Results message indicates how many failures, if any, occurred during the test.

Table 78: MMI Tests on page 188 shows which test to run for the associated equipment.

Table 78: MMI Tests

Test number	Equipment tested	Test description
1	Lineside T1 card	Local loopback
2	T1 link, Lineside T1 card and T1 network	External loopback
3	CPE device and T1 network	Network loopback

Test 1, local loopback, loops the T1 link signaling toward itself at the backplane connector, and test data is generated and received on all timeslots. If this test fails, it indicates that the Lineside T1 card is defective. Figure 38: MMI local loopback test on page 189 demonstrates how the signaling is looped back toward itself.

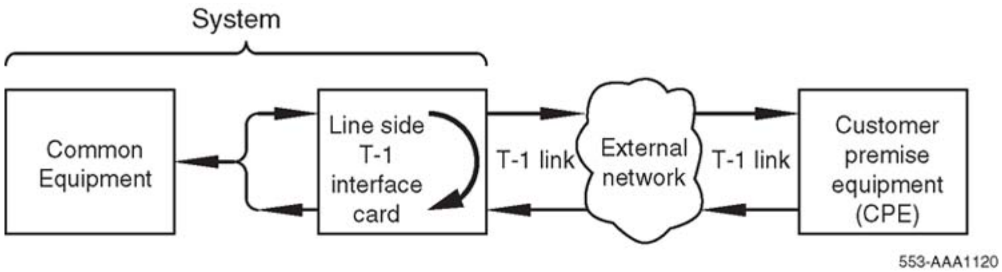


Figure 38: MMI local loopback test

Test 2, external loopback, assumes an external loopback is applied to the T1 link. Test data is generated and received by the Lineside T1 card on all timeslots. If test 1 passes but test 2 fails, it indicates that the T1 link is defective between the Lineside T1 card and the external loopback location. If test 1 was not run and test 2 fails, the T1 link or the Lineside T1 card could be defective. To isolate the failure to the T1 link, tests 1 and 2 must be run in tandem. Figure 39: MMI external loopback test on page 189 demonstrates how an external loopback is applied to the T1 link.

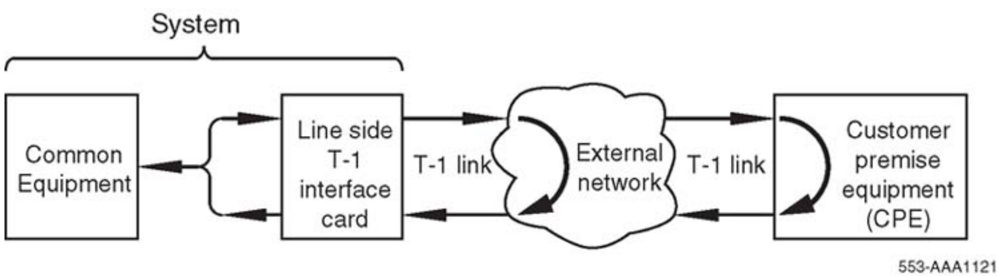


Figure 39: MMI external loopback test

Test 3, network loopback, loops the received T1 data back toward the CPE equipment. No test data is generated or received by the Lineside T1 card. If test 2 passes but test 3 fails, it indicates that the CPE device is defective. If test 2 was not run and test 3 fails, the T1 link or the CPE device could be defective. To isolate the failure to the CPE device, tests 2 and 3 must be run in tandem. Figure 40: MMI network loopback test on page 189 demonstrates how the signaling is looped back toward the CPE equipment.

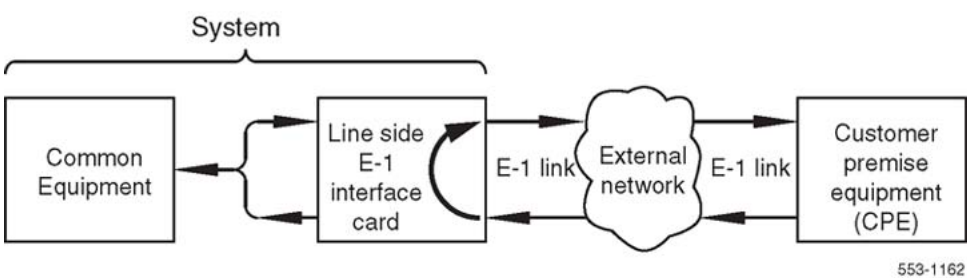


Figure 40: MMI network loopback test

Applications

The Lineside T1 interface is an IPE line card that provides cost-effective connection between T1-compatible IPE and a system or off-premise extensions over long distances.

Some examples of applications where a Lineside T1 card can be interfaced to a T1 link are:

- T1-compatible Voice Response Unit (VRU) equipment
- T1-compatible turret systems
- T1-compatible wireless systems
- Remote analog (500/2500-type) telephones through T1 to a channel bank
- Remote Norstar sites behind CS 1000E, CS 1000M, and Meridian 1 over T1

The Lineside T1 card is appropriate for any application where both T1 connectivity and "lineside" functionality is required. This includes connections to T1-compatible voice response units, voice messaging and trading turret (used in stock market applications) systems. See Figure 41: Lineside T1 interface connection to IPE on page 190.

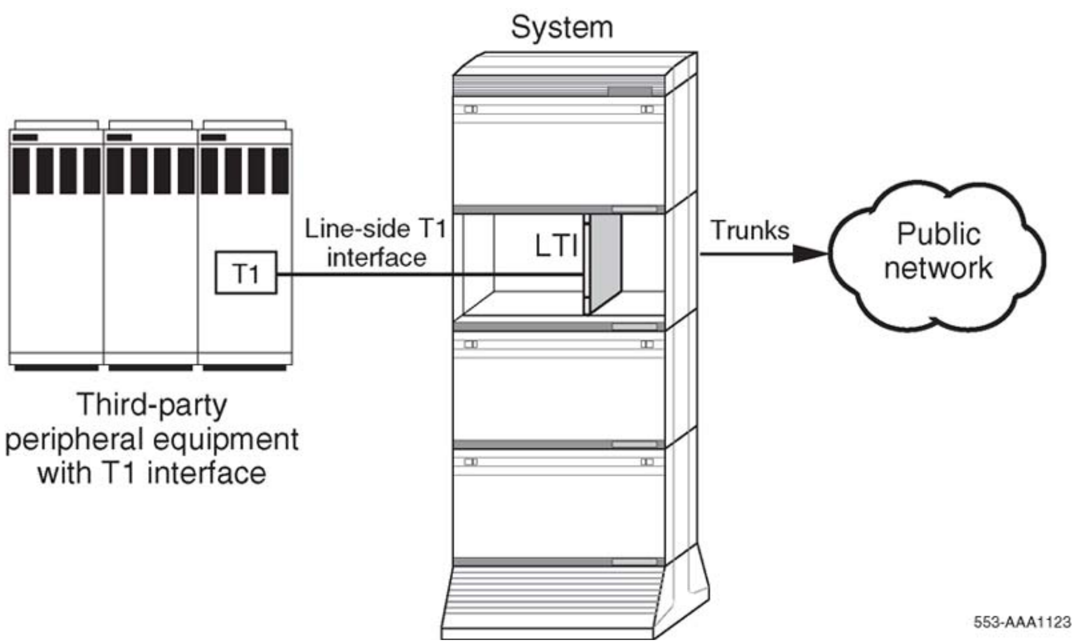


Figure 41: Lineside T1 interface connection to IPE

For example, the Lineside T1 card can be used to connect the system to a T1-compatible VRU. An example of this type of equipment is Avaya Open IVR system. In this way, the system can send a call to the VRU. Because the Lineside T1 card supports analog (500/2500-type) telephones, the VRU can send the call back to the system for further handling.

The Lineside T1 card can also be used to provide off-premise extensions to remote locations (up to 500 miles from the system). In this application, the analog telephone functionality is extended over T1 facilities, providing a telephone at a remote site with access to analog (500/2500-type) telephone lines. See Figure 42: Lineside T1 interface in off-premise application on page 191. An audible message-waiting indicator can be provided as well.

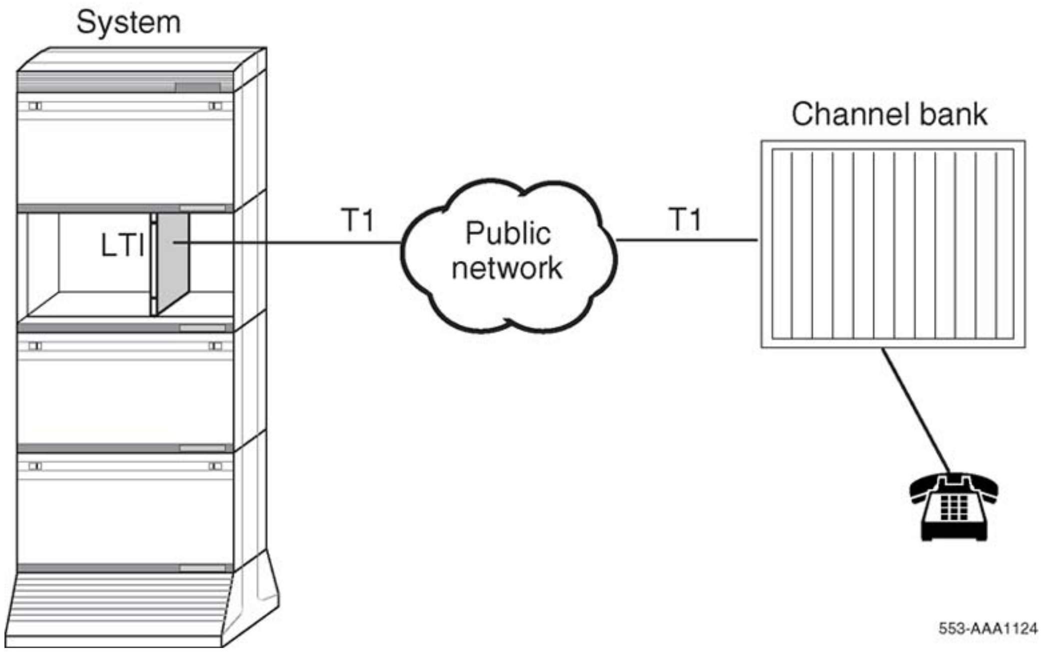


Figure 42: Lineside T1 interface in off-premise application

Similarly, the Lineside T1 can be used to provide a connection between the system and a remote Norstar system. See Figure 43: Lineside T1 interface connection to Norstar system on page 192. In this case, channel banks would not be required if the Norstar system is equipped with a T1 interface.

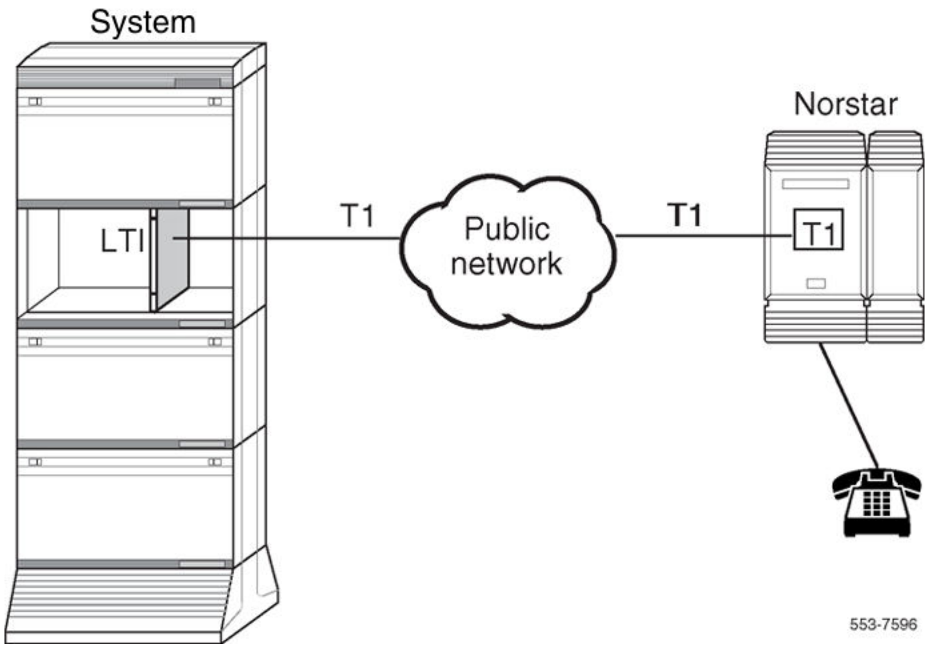


Figure 43: Lineside T1 interface connection to Norstar system

Note:

The Lineside T1 card audio levels must be considered when determining the appropriateness of an application.

Chapter 11: NT5D33 and NT5D34 Lineside E1 Interface cards

Contents

This section contains information on the following topics:

Introduction

Two vintages of NT5D33 and NT5D34 cards are supported:

- NT5D33AB/NT5D34AB – standard Lineside E1 Interface (LEI) cards

  The LEI card is an IPE line card that provides an all-digital connection between E1–compatible terminal equipment (such as a voice mail system) and Avaya Communication Server 1000E (Avaya CS 1000E), Avaya CS 1000M, or Meridian 1.

  The LEI interfaces one E1 line, carrying 30 channels, to the CS 1000E, CS 1000M, or Meridian 1, and emulates an analog line card to the system software. Each channel is independently configured by software control in the Analog (500/2500-type) Telephone Administration program LD 10. The LEI also comes equipped with a Man-Machine

Interface (MMI) maintenance program, which provides diagnostic information regarding the status of the E1 link.

- NT5D33AC/NT5D34AC – Enhanced Lineside E1 Interface (ELEI) cards

  The ELEI card is similar to an LEI card, but is enhanced to allow the capability of transporting caller information using the proprietary signaling interface Channel Associated Signaling (CAS+).

  ELEI cards can operate in one of two modes: LEI mode, or enhanced (ELEI) mode. In LEI mode, this card is fully compatible with, and provides the same functionality as, the standard LEI card. In ELEI mode, this card can be connected to any CAS+ compliant systems. This includes wireless server hosting Digital Enhanced Cordless Telephones (DECTs), voice response units, voice messaging systems, and trading turret systems (used in stock market applications). More information regarding CAS+ can be obtained through Avaya Development Partner program.

  Note:

  As the ELEI cards provide identical functionality to LEI cards, references to LEI cards in this chapter also apply to ELEI cards unless specified otherwise.

Install the NT5D33 version of the LEI/ELEI card in the NT8D37 IPE module.

Install the NT5D34 version of the LEI/ELEI card in:

- the NT1P70 Small Remote IPE Main Cabinet

Physical description

The LEI mounts in two consecutive card slots in the IPE shelf. It uses 16 channels on the first slot and 14 channels on the second. The LEI includes a motherboard (31.75 by 25.40 cm (12.5 by 10 in) and a daughterboard (5.08 by 15.24 cm (2 by 6 in).

Card connections

The LEI uses the NT8D81AA Tip and Ring cable to connect from the IPE backplane to the 25-pair Amphenol connector on the IPE Input/Output (I/O) panel. The I/O panel connector connects to a E1 line, external alarm and an MMI terminal or modem, using the NT5D35 or NT5D36 lineside I/O cable available from Avaya.

Faceplate

The LEI faceplate is twice as wide as the other standard analog and digital line cards. It occupies two card slots. The LE1 faceplate has four LEDs. SeeFigure 38: MMI local loopback

test on page 189 Figure 44: NT5D33AB LEI card - faceplate on page 196 (IPE version), and Figure 45: NT5D34AB LEI card - faceplate on page 197 (Cabinet system).

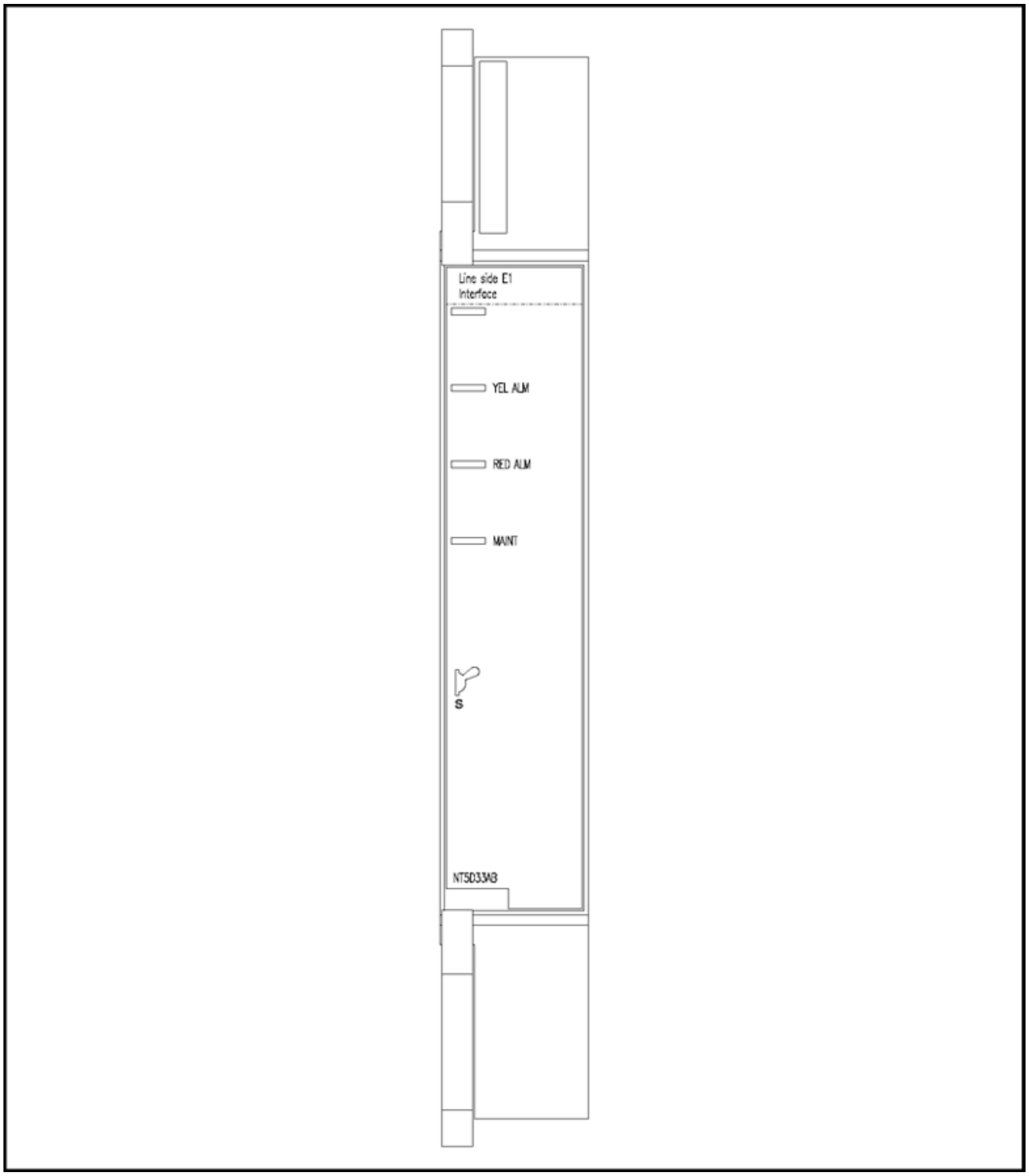


Figure 44: NT5D33AB LEI card - faceplate

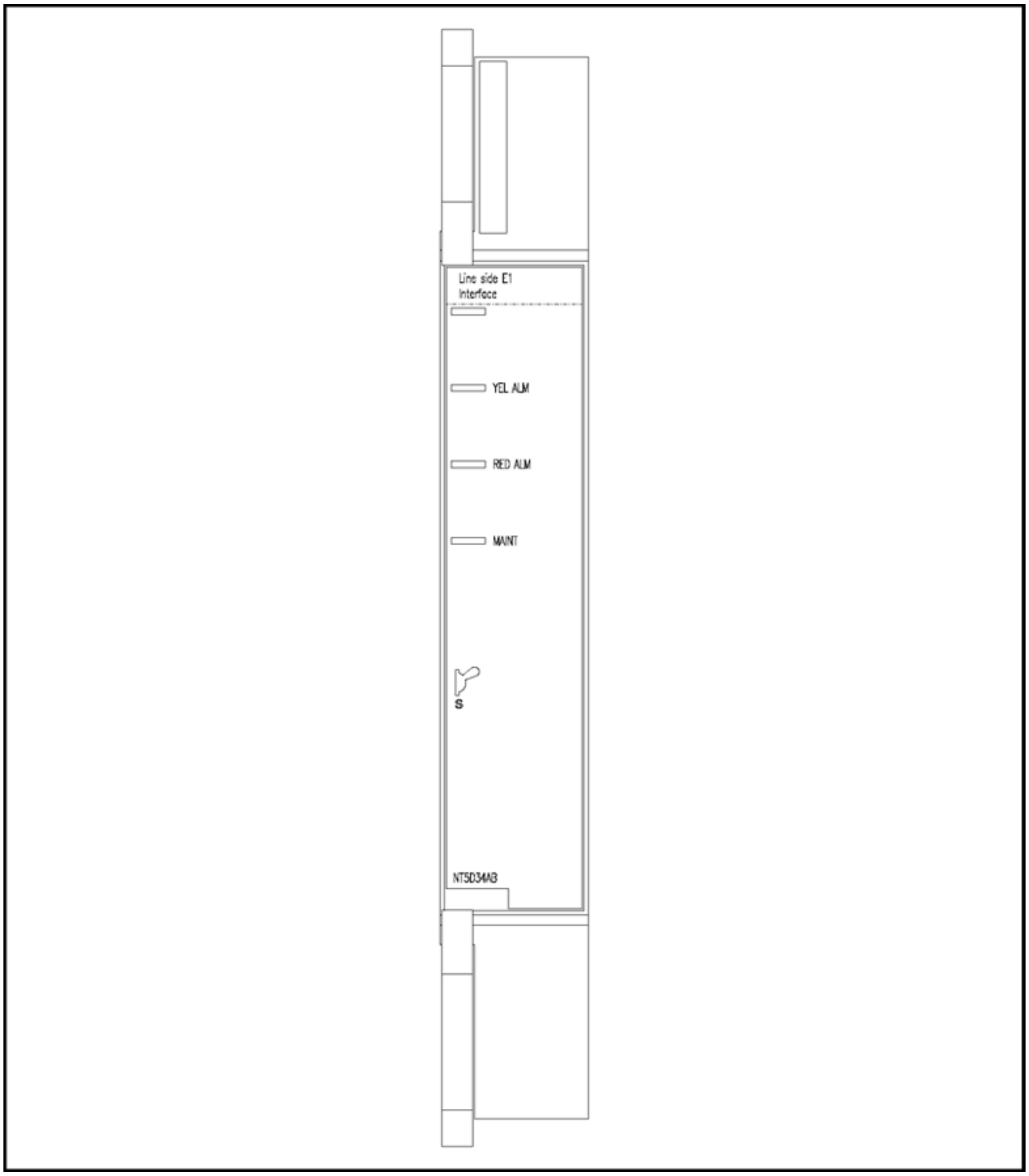


Figure 45: NT5D34AB LEI card - faceplate

The LEDs give status indications on the operations as described in Table 79: LEI card LED operation on page 197.

Table 79: LEI card LED operation

LED	Operation
Status	Line card
Red alarm	E1 near end
Yellow alarm	E1 far end

LED	Operation
Maint	Maintenance

The STATUS LED indicates if the LEI has successfully passed its self test, and therefore, if it is functional. When the card is installed, this LED remains lit for two to five seconds as the self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit. When the card is configured and enabled in software, the LED goes out. If the LED continually flashes or remains weakly lit, replace the card.

The STATUS LED indicates the enabled/disabled status of both card slots of the LEI simultaneously. To properly enable the card, both the motherboard and the daughterboard slots must be enabled. The STATUS LED turns off as soon as either one of the LEI slots are enabled. No LED operation is observed when the second card slot is enabled. To properly disable the card, both card slots must be disabled. The LED does not turn on until both card slots are disabled.

The RED ALARM LED indicates if the LEI has detected an alarm condition from the E1 link. Alarm conditions can include such conditions as not receiving a signal, the signal has exceeded bit error thresholds or frame slip thresholds. See Man-Machine E1 maintenance interface software on page 222 for information about E1 link maintenance.

If one of these alarm conditions is detected, this LED turns on. Yellow alarm indication is sent to the far end as long as the near end remains in a red alarm condition. Depending on how the Man Machine Interface (MMI) is configured, this LED remains lit until one of the following actions occur:

- If the "Self-Clearing" function is enabled in the MMI, the LED clears the alarm when the alarm condition is no longer detected. This is the factory default configuration.
- If the "Self-Clearing" function is not enabled or it is subsequently disabled in the MMI, the LED alarm indication stays lit until the command "Clear Alarm" is typed in the MMI, even though the carrier automatically returned to service when the alarm condition was no longer detected.

The YELLOW ALARM LED indicates that the LEI has detected a yellow alarm signal from the terminal equipment side of the E1 link. See Man-Machine E1 maintenance interface software on page 222 for information about E1 link maintenance. If the terminal equipment detects a red alarm condition such as not receiving a signal, or the signal exceeds bit-error thresholds or frame-slip thresholds, a yellow alarm signal is sent to the LEI, if the terminal equipment supports this feature. If a yellow alarm signal is detected, the LED turns on.

The MAINT LED indicates if LEI is fully operational because of certain maintenance commands that are issued through the MMI. See Man-Machine E1 maintenance interface software on page 222 for information about E1 link maintenance. If the card detects that tests are being run or that alarms are disabled through the MMI, the LED lights and remains lit until these conditions are no longer detected, then it turns off.

Functional description

Figure 46: LEI card - block diagram on page 199 shows a block diagram of the major functions contained on the LEI card. Each of these functions is described on the following pages.

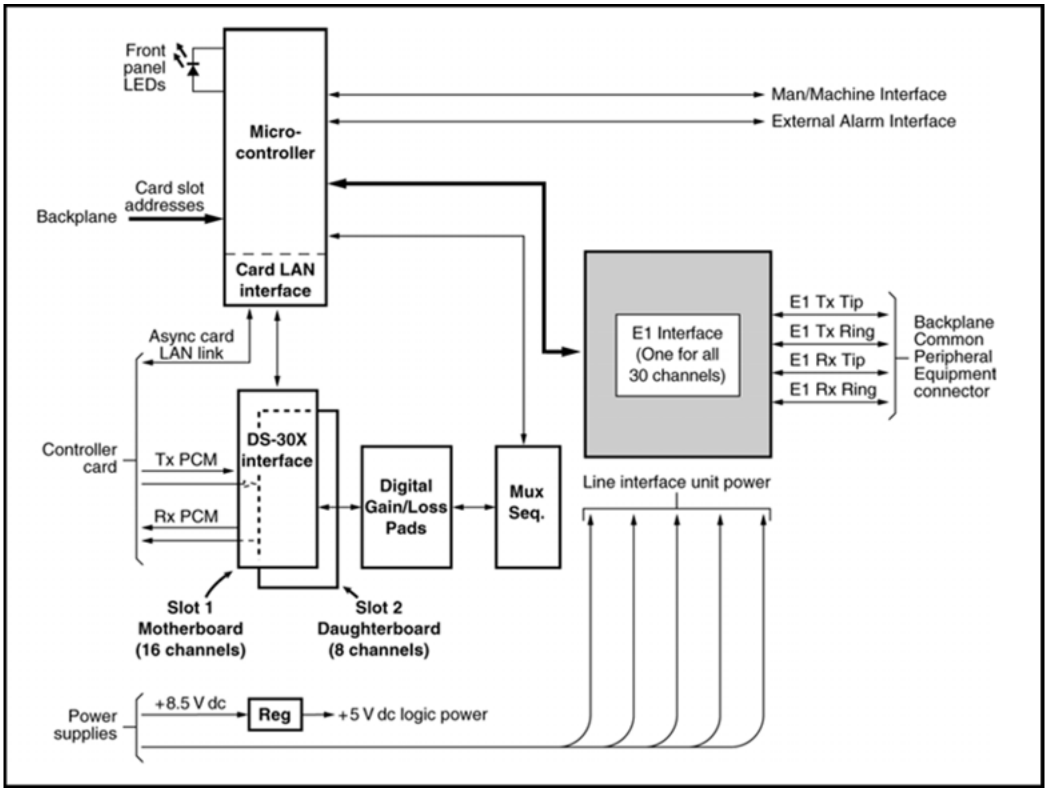


Figure 46: LEI card - block diagram

Overview

The LEI card is an IPE line card that provides a cost-effective, all-digital connection between E1-compatible terminal equipment (such as voice mail systems, voice response units, trading turrets, etc.) and the system. In this application, the terminal equipment can be assured access to analog (500/2500-type) telephone line functionality such as hook flash, SPRE codes and ringback tones. The LEI supports line supervision features such as loop and ground start protocols. It can also be used in an off-premise arrangement where analog (500/2500-type) telephones are extended over twisted-pair or coaxial E1 with the use of channel bank equipment.

The LEI offers significant improvement over the previous alternatives. For example, if a digital "trunk-side" connection were used, such as with the DTI/PRI interface card, "lineside" functionality would not be supported. Previously, the only way to achieve lineside functionality was to use analog ports and channel bank equipment. With the LEI, a direct connection is provided to the IPE. No channel bank equipment is required, resulting in a more robust and reliable connection.

When used for connecting to third-party applications equipment, the LEI offers a number of benefits. It is a more cost-effective alternative for connection because it eliminates the need for expensive channel bank equipment. The LEI card supports powerful E1 monitoring, and diagnostic capability. Overall costs for customer applications may also be reduced because the E1-compatible IPE is often more attractively priced than the analog-port alternatives.

The LEI is compatible with all IPE-based systems and with standard public or private CEPT-type carrier facilities. It supports CRC-4- or FAS only framing formats as well as AMI or HDB3 coding. Because it uses standard PCM in standard E1 timeslots, existing E1 test equipment remains compatible for diagnostic and fault isolation purposes. A/B Bit signaling may be customized according to the user's system, including the Australian P2 signaling scheme.

Card interfaces

The LEI passes voice and signaling data over DS-30X loops through the DS-30X Interface circuits and maintenance data over the card LAN link.

E1 interface circuit

The LEI contains one E1 line-interface circuit which provides 30 individually configurable voice interfaces to one E1 link in 30 different time slots. The circuit demultiplexes the 2.56 Mbps DS-30X transmit signaling bitstreams from the DS-30X network loop and converts it into 2.048 mHz E1 transmit signaling bitstreams onto the E1 link. It also does the opposite, receiving receive signaling bitstreams from the E1 link and transmitting receive signaling bitstreams onto the DS-30X network loop.

The E1 interface circuit provides the following:

- An industry standard CEPT (0 to 655 feet) interface
- DS-30X signaling protocol into FXO A- and B-channel-associated signaling protocol
- Switch-selectable transmission and reception of E1 signaling messages over an E1 link in either loop or ground start mode
- Switch-selectable call processing between the Australian P2, North American Standard, or other user-configurable schemes

Signaling and control

The LEI also contains signaling and control circuits that establish, supervise, and take down call connections. These circuits work with the system controller to operate the E1 line interface circuit during calls. The circuits receive outgoing call signaling messages from the controller and return incoming call status information to the controller over the DS-30X network loop.

Card control functions

Control functions are provided by a microcontroller and a card LAN link on the LEI. A sanity timer is provided to automatically reset the card if the microcontroller stops functioning for any reason.

Microcontrollers

The LEI contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the CE CP through the card LAN link
  - card identification (card type, vintage, serial number)
  - firmware version
  - self-test results
  - programmed unit parameter status
- receipt and implementation of card configuration
  - control of the E1 line interface
  - enabling/disabling of individual units or entire card
  - programming of loop interface control circuits for administration of channel operation
  - maintenance diagnostics
- interface with the line card circuit
  - converts on/off-hook, and ringer control messages from the DS-30X loop into A/B bit manipulations for each time slot in the E1 data stream, using channel associated signaling.
- the front panel LED when the card is enabled or disabled by instructions from the NT8D01 controller card.

Card LAN interface

Maintenance data is exchanged with the Common Equipment CPU over a dedicated asynchronous serial network called the Card LAN link. The Card LAN link is described in Card LAN link on page 40.

Sanity Timer

The LEI also contains a sanity timer that resets the microcontroller in the event of a loss of program control. If the timer is not properly serviced by the microcontroller, it times out and causes the microcontroller to be hardware-reset. If the microcontroller loses control and fails to service the sanity timer at least once per second, the sanity timer automatically resets the microcontroller restoring program control.

Man-Machine Interface

The LEI provides an optional Man-Machine Interface (MMI) that is primarily used for E1 link performance monitoring and problem diagnosis. The MMI provides alarm notification, E1 link performance reporting, and fault isolation testing. The interface is accessed through connections from the I/O panel to a terminal or modem. Multiple cards (up to 64) can be served through one MMI terminal or modem by linking the LEIs through a daisy chain.

The MMI is an optional feature, because all E1 configuration settings are performed through dip switch settings or preconfigured factory default settings. Available MMI commands, and their functionality, are discussed in-depth in Man-Machine E1 maintenance interface software on page 222.

ELEI additional functionality

As mentioned earlier, ELEI cards are enhanced to allow CAS+ compliance, as shown in Figure 47: CAS+ compliance on page 203. This enhancement provides several additional benefits for systems with ELEI cards installed.

Note:

MDECTS and ELEI (operating in enhanced mode) cannot be configured on the same system.

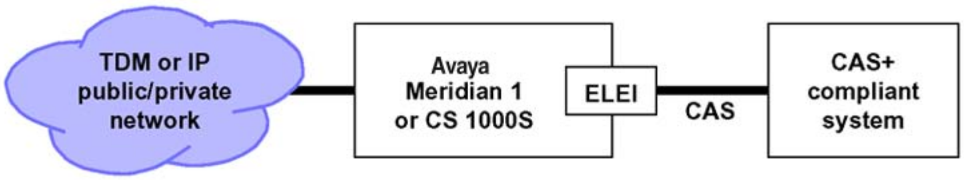


Figure 47: CAS+ compliance

Key Benefits of using CAS+ signaling (ELEI mode) over traditional A/B bit signaling (LEI mode) include:

1. Calling Line ID Presentation (CLIP)

   When an incoming call over the TDM/IP network or a CS 1000originated call is directed towards the CAS+ compliant system, Calling Line ID can be provided over the CAS+ interface. This is assuming that the incoming call has the CLID without any presentation restrictions.

2. Redirecting Line ID Presentation (RLIP)

   When an incoming call over the TDM/IP network or a CS 1000originated call which has undergone redirections is directed towards the CAS+ compliant system, Redirecting Line ID can be provided over the CAS+ interface. This is assuming that the incoming call has the Redirecting Line ID without any presentation restrictions.

3. Message waiting indication (MWI)

   Message waiting indication can be provided over the CAS+ interface.

Electrical specifications

Table 80: LEI card - line interface unit electrical characteristics on page 204 provides a technical summary of the E1 line interface. Table 81: LEI card - power required on page 204 lists the maximum power consumed by the card.

E1 channel specifications

Table 80: LEI card - line interface unit electrical characteristics on page 204 provides specifications for the 30 E1 channels. Each characteristic is set by a dip switch. Installation and Configuration on page 205 for a discussion of the corresponding dip switch settings.

Table 80: LEI card - line interface unit electrical characteristics

Characteristics	Description
Framing	CRC-4 or FAS, only
Coding	AMI or HDB3
Signaling	Loop or ground start A/B robbed-bit
Distance to LTU	0-199.6 meters (0-655 feet)

Power requirements

Table 81: LEI card - power required on page 204 shows the voltage and maximum current that the LEI requires from the backplane. One NT8D06 IPE Power Supply AC or NT6D40 IPE Supply DC can supply power to a maximum of eight LEIs.

Table 81: LEI card - power required

Voltage	Max. Current
5.0 V dc	1.6 Amp
+15.0 V dc	150 mA
-15.0 V dc	150 mA

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning strikes is not provided on the LEI. It does, however, protect against accidental shorts to –52 V dc analog lines.

When the card is used to service off-premise terminal equipment through the public telephone network, install a Line Termination Unit (LTU) as part of the terminal equipment to provide external line protection.

Environmental specifications

Table 82: LEI card - environmental specifications on page 204 shows the environmental specifications of the LEI.

Table 82: LEI card - environmental specifications

Parameter	Specifications
Operating temperature – normal	15° to +30° C (+59° to 86° F), ambient

Parameter	Specifications
Operating temperature – short term	10° to +45° C (+50 to 113° F), ambient
Operating humidity – normal	20% to 55% RH (non-condensing)
Operating humidity – short term	20% to 80% RH (non condensing)
Storage temperature	–50° to + 70° C (–58° to 158° F), ambient
Storage humidity	5% to 95% RH (non-condensing)

Installation and Configuration

Installation and configuration of the LEI consists of six basic steps:

1. Configure the dip switches on the LEI for the call environment.
2. Install the LEI into the selected card slots.
3. Cable from the I/O panel to the LTU, MMI terminal or modem (optional), external alarm (optional), and other LEIs for daisy chaining use of MMI terminal (optional).
4. Configure the MMI terminal.
5. Configure the LEI through the CS 1000 software and verify self-test results.
6. Verify initial E1 operation and configure MMI (optional).

   Steps 1-5 are explained in this section. Step 6 is covered in Man-Machine E1 maintenance interface software on page 222.

   Installation and configuration of the ELEI follows the same steps. If enhanced functionality is required, then one additional step is required:

7. The Meridian 1 line unit(s) associated with the lineside E1 must be programmed for wireless operation (set WTYP=DECT, and WRLS=Yes in LD 10) in non–concentrated mode. Refer to Avaya Software Input/Output Reference — Administration (NN43001-611) details on LD 10.

Dip switch settings

Begin the installation and configuration of the LEI by selecting the proper dip switch settings for the environment. The LEI contains two dip switches, each containing eight switch positions. They are located in the upper right corner of the motherboard circuit card as shown in Figure 48: LEI card - E1 protocol dip switch locations on page 207. The settings for these switches are shown in Table 83: LEI card - Switch 1 dip switch settings on page 208 through Table 86: LEI card - E1 Switch 2 (S2) dip switch settings on page 210.

When the LEI card is oriented as shown in Figure 48: LEI card - E1 protocol dip switch locations on page 207, the dip switches are ON when they are up, and OFF when they are down. The dip switch settings configure the card for the following parameters:

MMI port speed selection

This dip switch setting selects the appropriate baud rate for the terminal or modem (if any) that is connected to the MMI.

Line Supervisory Signaling protocol

The LEI is capable of supporting loop start or ground start call processing modes. Make the selection for this dip switch position based on what type of line signaling the Customer Premise Equipment (CPE) supports.

Address of LEI to the MMI

The address of the LEI to the MMI is made up of two components:

- the address of the card within the shelf
- the address of the shelf in which the card resides

These two addresses are combined to create a unique address for the card. The MMI reads the address of the card within the shelf from the card firmware; the address of the shelf must be set by this dip switch.

The shelf address dip switch can be from 0 to 15, 16 being the maximum number of lineside E1 IPE shelves (a maximum of 64 LEI cards) capable of daisy chaining to a single MMI terminal. For ease, it is recommended that this address be set the same as the address of the peripheral controller identifier in LD 97 for type: XPE. This is not possible because the dip switch is limited to 16; however, this is not mandatory.

E1 framing

The LEI is capable of interfacing with LTU equipment either in CRC-4 or FAS only framing mode. Make the selection for this dip switch position based on what type of framing the LTU equipment supports.

E1 Coding

The LEI is capable of interfacing with LTU equipment using either AMI or HDB3 coding. Make the selection for this dip switch position based on the type of coding the LTU equipment supports.

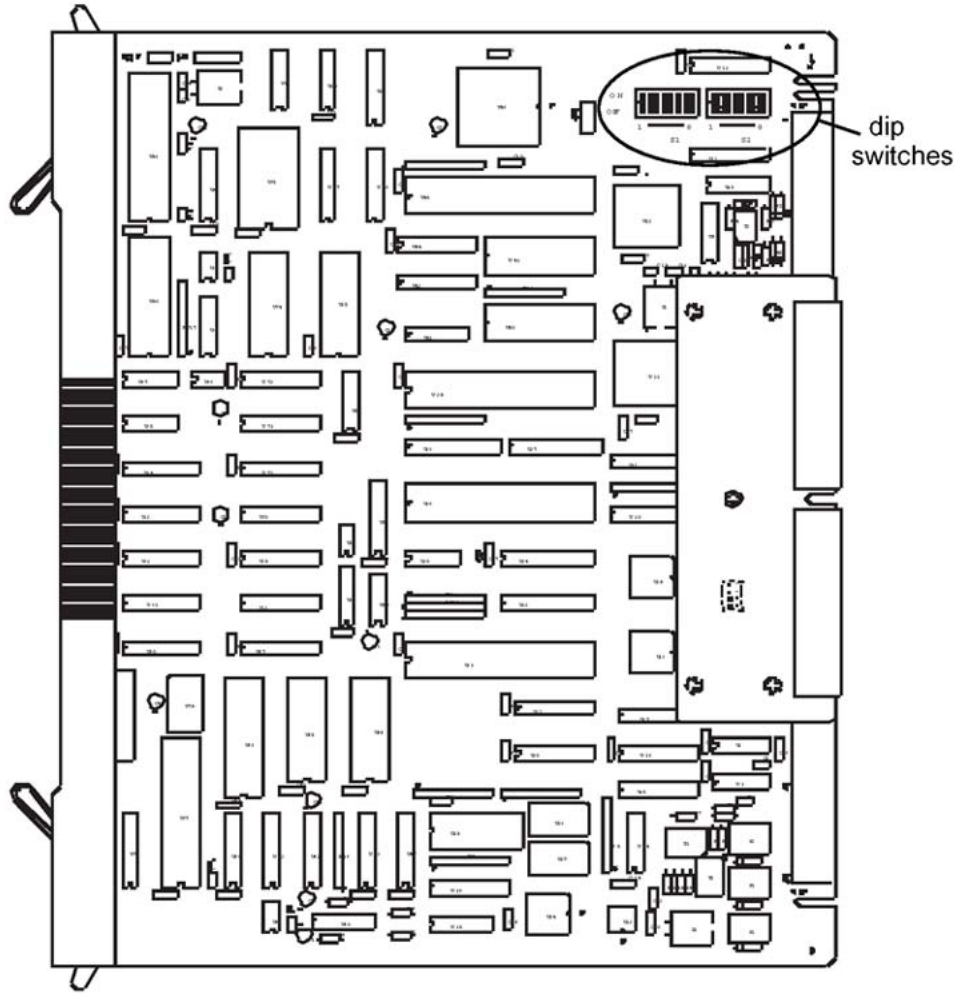


Figure 48: LEI card - E1 protocol dip switch locations

Line supervision on E1 failure

This setting determines in what state all 30 LEI ports appear to the CS 1000E, CS 1000M, and Meridian 1in case of E1 failure. Ports can appear as either in the "on-hook" or "off-hook" states on E1 failure.

Note:

All idle LEI lines go off-hook and seize a Digitone Receiver when the off-hook line processing is invoked on E1 failure. This may prevent DID trunks from receiving incoming calls until the LEI lines time-out and release the DTRs.

Daisy-Chaining to MMI

If two or more LEIs are installed and the MMI used, daisy-chain the cards together to use one MMI terminal or modem. Make the selection for this dip switch position based on how many LEIs are being installed.

MMI Master or Slave

This setting is used only if daisy-chaining the cards to the MMI terminal or modem. It determines whether this card is a master or a slave in the daisy chain. Select the master setting if there are no LEIs between this card and the MMI terminal or modem. Select the slave setting if there are other cards in the daisy chain between this card and the MMI.

Table 83: LEI card - Switch 1 dip switch settings on page 208 through Table 85: LEI card - XPEC address dip switch settings (Switch S1, positions 3-6) on page 209 show the dip switch settings for Switch 1. Table 86: LEI card - E1 Switch 2 (S2) dip switch settings on page 210 shows the dip switch settings for Switch 2.

Table 83: LEI card - Switch 1 dip switch settings

Characteristic	Selection	Switch Position	Switch Setting	Factory Default
MMI port speed selection	1200 baud 2400 baud	1 1	ON OFF	OFF
E1 signaling	Ground start Loop start	2 2	ON OFF	OFF
IPE Shelf address for LEI	Table 85: LEI card - XPEC address dip switch settings (Switch S1, positions 3-6) on page 209	3 4 5 6	Table 85: LEI card - XPEC address dip switch settings (Switch S1, positions 3-6) on page 209	OFF OFF OFF OFF
Card type for ringer allocation	XTI = 19 XMLC = 18	7 7	ON OFF	OFF
E1 signaling	See Table 84: LEI card - signaling-type dip switch settings on page 209	8	OFF	OFF

When dip switch #1, positions 2 and 8 are set to "Table," AB Bits are configured by the user through the Set Mode MMI command (see Set Mode on page 231). Otherwise, the signaling scheme selected by dip switch 1, positions 2 and 8 are used.

Table 84: LEI card - signaling-type dip switch settings

Switch #1			
Characteristic	**Selection**	**Position 2**	**Position 8**
Signaling Type	Loop start	OFF	OFF
	Ground start	ON	OFF
	Australian P2	OFF	ON
	Table	ON	ON

Table 85: LEI card - XPEC address dip switch settings (Switch S1, positions 3-6)

XPEC Address	S1 Switch Position 3	S1 Switch Position 4	S1 Switch Position 5	S1 Switch Position 6
00	OFF	OFF	OFF	OFF
01	ON	OFF	OFF	OFF
02	OFF	ON	OFF	OFF
03	ON	ON	OFF	OFF
04	OFF	OFF	ON	OFF
05	ON	OFF	ON	OFF
06	OFF	ON	ON	OFF
07	ON	ON	ON	OFF
08	OFF	OFF	OFF	ON
09	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

When setting E1 Switch 2 dip switch settings, there are differences between vintages. For NT5D33AB or NT5D34AB cards, use Table 86: LEI card - E1 Switch 2 (S2) dip switch settings on page 210. For NT5D33AC or NT5D34AC cards, use Table 86: LEI card - E1 Switch 2 (S2) dip switch settings on page 210.

Table 86: LEI card - E1 Switch 2 (S2) dip switch settings

Characteristic	Selection	Switch Position	Switch Setting	Factory Default
E1 framing	CRC-4 Disabled CRC-4 Enabled	1	ON OFF	OFF
E1 coding	AMI HDB3	2	ON OFF	OFF
NOT USED	leave ON	3	ON	ON
NOT USED	leave ON	4	OFF	OFF
NOT USED	leave ON	5	OFF	OFF
Line processing on E1 link failure	On-hook Off-hook	6	ON OFF	ON
Daisy-chaining to MMI	YES NO	7	ON OFF	OFF
MMI master or slave	Master Slave	8	ON OFF	ON

Table 87: ELEI card - E1 Switch 2 (S2) dip switch settings

Characteristic	Selection	Switch Position	Switch Setting	Factory Default
E1 framing	CRC-4 Disabled CRC-4 Enabled	1	ON OFF	ON
E1 coding	AMI HDB3	2	ON OFF	OFF
NOT USED	leave ON	3	ON	ON
NOT USED	leave ON	4	OFF	OFF
Mode	LEI Mode ELEI Mode	5	OFF ON	Off
Line processing on E1 link failure	On-hook Off-hook	6	ON OFF	OFF
Daisy-chaining to MMI	YES NO	7	ON OFF	OFF
MMI master or slave	Master Slave	8	ON OFF	ON

After the card is installed, display the dip switch settings using the MMI command Display Configuration (D C). See Man-Machine E1 maintenance interface software on page 222 for details on this and the rest of the available MMI commands.

Installation

Because of the wiring in some of the system modules and cabinets, the LEI only works in certain card slot pairs. These restrictions depend on the type of module or cabinet. In all other modules or cabinets where the conditions listed below do not exist, the LEI works in any two adjacent card slots:

- In the NT8D37 IPE module, if the 25-pair I/O connectors are partially split between adjacent IPE card slots, the LEI works only in card slots where Unit 0 of the motherboard card slot appear on the first pair of the 25-pair I/O connector.

If installing the LEI into the NT8D37 IPE module, determine the vintage level model. Certain vintage levels carry dedicated 25-pair I/O connectors only for card slots 0, 4, 8, and 12. These vintage levels are cabled with only 16 pairs of wires from each card slot to the I/O panel. Some of the 25-pair I/O connectors are split between adjacent card slots.

Other vintage levels cable each card slot to the I/O panel using a unique, 24-pair connector on the I/O panel. In these vintage levels, the LEI can be installed in any available pair of card slots. However, because of the lower number of wire pairs cabled to the I/O panel in the lower vintage level, only certain card slots are available to the LEI.

See Table 88: LEI card - NT8D37 IPE module vintage level port cabling on page 211 for the vintage level information for the NT8D37 IPE modules.

Table 88: LEI card - NT8D37 IPE module vintage level port cabling

Vintage Level	Number of ports cabled to I/O panel
NT8D37BA	30 ports
NT8D37DE	16 ports
NT8D37EC	30 ports

Available and restricted card slots in the NT8D37 IPE module

If installing the LEI into an NT8D37 IPE module, the card slots available depend on the vintage level module.

Vintage levels cabling 30 ports:

For modules with vintage levels that cabled 30 ports to the I/O panel, the LEI can be installed in any pair of card slots 0-15.

Vintage levels cabling 16 ports:

For modules with vintage levels that cable 16 ports to the I/O panel, the LEI can be installed into the card slot pairs shown in the following card slots:

Available: Motherboard/Daughterboard 0 and 1 1 and 2 4 and 5 5 and 6 8 and 9 9 and 10 12 and 13 13 and 14

LEIs must not be installed into the following card slot pairs:

Restricted: Motherboard/Daughterboard 2 and 3 3 and 4 6 and 7 10 and 11 11 and 12 14 and 15

If the LEI must be installed into one of the restricted card slot pairs, rewire the IPE module card slot to the I/O panel by installing an additional NT8D81 cable from the LEI motherboard slot to the I/O panel, and re-arranging the three backplane connectors for the affected card slots. This permits the connection of the NT5D35AA or NT5D36AA LEI card carrier and maintenance external I/O cable at the IPE and CE module I/O panel connector for card slots that are otherwise restricted.

Alternatively, all LEI connections can be made at the main distribution frame instead of connecting the NT5D35AA or NT5D36AA LEI card external I/O cable at the I/O panel. This eliminates these card slot restrictions.

Cabling the LEI card

After the dip switches are configured and the LEI installed into the selected card slots, the LEI can be cabled to the LTU equipment, the MMI terminal or modem (optional), an external alarm (optional), and other LEIs for daisy chaining use of the MMI terminal (optional).

The LEI is cabled from its backplane connector through connections from the motherboard circuit card only to the I/O panel on the rear of the IPE module. No cable connections are made from the daughterboard circuit card. The connections from the LEI to the I/O panel are made with the NT8D81AA Tip and Ring cables provided with the IPE module.

Cabling from the I/O panel with the NT5D35AA or NT5D36AA lineside E1 I/O cable

In a twisted-pair E1 installation, make the connection from the I/O panel to the E1 link and other external devices with the NT5D35AA lineside E1 I/O cable.

This cable consists of a 25-pair amphenol connector (P1) on one end which plugs into the I/O panel. The other end has four connectors:

1. a DB15 male connector (P2), which plugs into the E1 line
2. a DB9 male connector (P3), which plugs into an external alarm system
3. a second DB9 male connector (P5), which connects to an MMI terminal or modem
4. a DB9 female connector (P4), which connects to the next LEI's P4 connector for MMI daisy chaining

In a coaxial E1 installation, make the connection from the I/O panel to the E1 link and other external devices through the NT5D36AA lineside E1 I/O cable.

This cable consists of a 25-pair amphenol connector (P1) on one end which plugs into the I/O panel. The other end has 4 connectors:

1. a DB15 female connector (P2) with an adapter that breaks out Tx (transmit) and Rx (receive) connectors, which that plug into the E1 line
2. a DB9 male connector (P3), which plugs into an external alarm system
3. a second DB9 male connector (P5), which connects to an MMI terminal or modem
4. a DB9 female connector (P4), which connects to the next LEI's P4 connector for MMI daisy chaining. The Tx marking on the adapter at P2 is the LEI output. The E1 data stream coming from the network into the LEI connects at the Rx coaxial connector

Table 89: LEI card - LEI backplane and I/O panel pinouts on page 213 shows the pin assignments of the LEI backplane and I/O Panel.

Table 89: LEI card - LEI backplane and I/O panel pinouts

Backplane connector pin	I/O Panel connector pin	Signal
12A	1	E1 Tip, Receive data
12B	26	E1 Ring, Receive data
13A	2	E1 Tip, Transmit data
13B	27	E1 Ring, Transmit data
14A	3	Alarm out, normally open
14B	28	Alarm out, common
15A	4	Alarm out, normally closed
15B	29	No connection
16A	5	No connection
16B	30	Away from MMI terminal, receive data
17A	6	Away from MMI terminal, transmit data
17B	31	Toward MMI terminal, transmit data
18A	7	Toward MMI terminal, receive data
18B	32	Daisy chain control 2
19A	8	Daisy chain control 1
19B	33	Ground

Table 90: LEI card - lineside E1 I/O cable pinouts on page 214 shows the pin assignments from the I/O panel relating to the pin assignments of the lineside E1 I/O cable.

Table 90: LEI card - lineside E1 I/O cable pinouts

I/O Panel Connector Pin	Lead Designations	LEI Connector Pin	LEI Cable Connector to External Equipment
1	E1 Tip Receive data	11	DB15 male to E1 (P2). LEI is CPE transmit and receive to network
26	E1 Ring Receive data	3	
2	E1 Tip Transmit data	1	
27	E1 Ring Transmit data	9	
3	Alarm out, common	1	
28	Alarm out (normally open)	2	DB9 male to external alarm (P3)
4	Alarm out (normally closed)	3	
7	Toward MMI terminal, receive data	2	DB9 male toward MMI (P5). Wired as DCE. Data is transmitted on pin 2 (RXD) and received on pin 3 (TXD)
31	Toward MMI terminal, transmit data	3	
33	Ground	5	
8	Control 1	7	
32	Control 2	9	
33	Ground	5	DB9 female away from MMI terminal (P4)
8	Control 1	7	
32	Control 2	9	
30	Away from MMI terminal, transmit data	3	
6	Away from MMI terminal, receive data	2	

E1 Connections

For twisted-pair installations, E1 signaling for all 30 channels is transmitted over P2 connector pins 1, 3, 9, and 11, as shown in Table 90: LEI card - lineside E1 I/O cable pinouts on page 214.

Plug the DB 15 male connector labeled "P2" into the E1 link. E1 transmit and receive pairs must be turned over between the LEI and the CPE that is hardwired without carrier facilities.

If the LEI is connected through E1 carrier facilities, the transmit and receive pairs must be wired straight through to the RJ48 at the Telco demarc, the LTU, or other E1 carrier equipment. The E1 CPE at the far-end has transmit and receive wired straight from the RJ48 demarc at the far-end of the carrier facility.

For 75 ohm coaxial installations, E1 signaling for all 30 channels is transmitted over P2 connector pins 1, 3, 9, and 11 though an adapter and out two coaxial connectors Tx (transmit) and Rx (receive). Tx is the LEI output, and Rx is the LEI input from the E1 stream. E1 transmit and receive pairs must be turned over between the LEI and the CPE that is hardwired without carrier facilities. If the LEI is connected through E1 carrier facilities, the transmit and receive pairs must be wired straight through to the RJ48 at the Telco demarc, the LTU, or other E1 carrier equipment. The E1 CPE at the far end has Tx and Rx wired straight from the RJ48 demarc at the far end of the carrier facility.

External Alarm Connections

P3 connector pins 1, 2 and 3 can be plugged into any external alarm-sensing hardware. Plug the DB9 male connector labeled "P3" into an external alarm. These connections are optional, and the LEI functionality is not affected if they are not made.

The MMI monitors the E1 link for specified performance criteria and reports on problems detected. One of the ways it can report information is through this external alarm connection. If connected, the LEI's microprocessor activates the external alarm hardware if it detects certain E1 link problems it has classified as alarm levels 1 or 2. See Man-Machine E1 maintenance interface software on page 222 for a detailed description of alarm levels and configuration. If an alarm level 1 or 2 is detected by the MMI, the LEI closes the contact that is normally open, and opens the contact that is normally closed. The MMI command "Clear Alarm" returns the alarm contacts to their normal state.

MMI Connections

P5 connector pins 2, 3, 5, 7 and 9 are used to connect the LEI to the MMI terminal, connecting LEIs in a daisy chain for access to a shared MMI terminal. When logging into a LEI, "control 2" is asserted by that card, which informs all of the other cards not to talk on the bus, but rather to pass the data straight through. The pins labeled "control 1" are reserved for future use. As with the external alarm connections, MMI connections are optional. Up to 128 LEIs can be linked, located in up to 16 separate IPE shelves, to one MMI terminal using the daisy chain approach.

If only one LEI is installed, cable from the DB9 male connector labeled "P5" (toward MMI terminal) to one of the COM ports on the back of any TTY, a PC running a terminal emulation program, or a modem. For installations of only one card, no connection is made to the DB9 female connector labeled "P4" (away from MMI terminal).

If two or more LEIs are being installed into the system, the MMI port connections can be daisy-chained together so that only one MMI terminal is required for up to 128 LEIs. See Figure 49: LEI card - connecting two or more cards to the MMI on page 216. Cards can be located in up to 15 separate IPE shelves. Start with any card slot in the IPE shelf and connect to any other card slot. Connected card slots do not need to be consecutive.

Connecting two or more LEIs to the MMI terminal

Follow this procedure for connecting two or more LEIs to the MMI terminal:

1. Cable the DB9 male connector labeled "P5" (toward MMI terminal) to one of the COM ports on the back of any TTY, a PC running a terminal emulation program, or a modem.
2. Make the connection from the first card to the second card by plugging the DB9 female connector labeled "P4" (away from MMI terminal) from the first card into the DB9 male connector of the second card labeled "P5" (toward MMI terminal).
3. Repeat step 2 for the remaining cards.
4. At the last card of the daisy chain, make no connection from the DB9 female connector labeled "P4" (away from MMI terminal).
5. If two LEIs are too far apart to connect the "P4" and "P5" connectors connect them with an off-the-shelf DB9 female to DB9 male straight-through extension cable, available at any PC supply store.

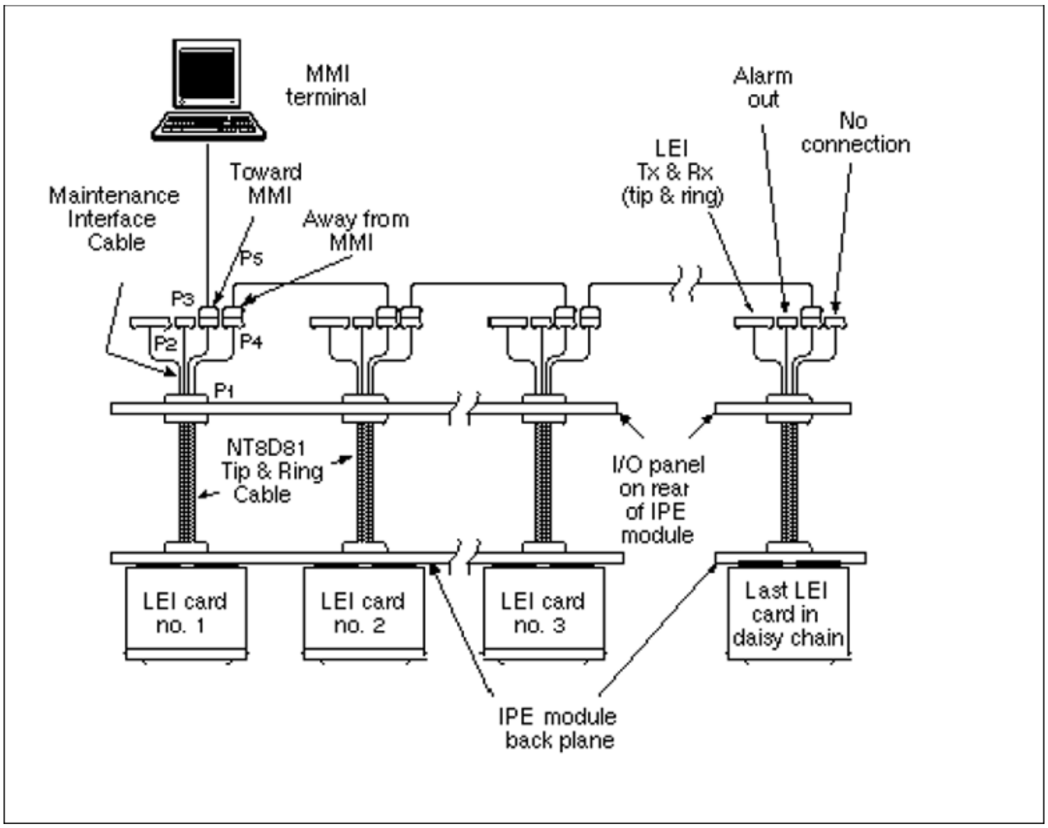


Figure 49: LEI card - connecting two or more cards to the MMI

Terminal configuration

For the MMI terminal to be able to communicate to the LEI, the interface characteristics must be set to:

- speed – 1200 or 2400 bps
- character width – 7 bits
- parity bit – mark
- stop bits – one
- software handshake (XON/XOFF) – off

Software Configuration

Although much of the architecture and many features of the LEI card are different from the analog line card, the LEI is designed to emulate an analog line card to the CS 1000 software. Because of this, the LEI software configuration is the same as for two adjacent analog line cards.

All 30 E1 channels carried by the LEI are individually configured using the analog (500/2500-type) Telephone Administration program LD 10. Use Table 91: Card unit number to E1 channel mapping on page 217 to determine the correct unit number, and refer to *Avaya Software Input/ Output Reference — Administration* (NN43001-611) for LD 10 service-change instructions.

LEI circuitry routes 16 units (0 – 15) on the motherboard and 14 (0 – 13) units on the daughterboard to 30 E1 channels. The motherboard circuit card is located in the left card slot, and the daughterboard circuit card is located in right card slot. For example, if installing the LEI into card slots 0 and 1, the motherboard would reside in card slot 0 and the daughterboard in card slot 1. To configure the terminal equipment through the switch software, the E1 channel number must be cross-referenced to the corresponding card unit number. This mapping is shown in Table 91: Card unit number to E1 channel mapping on page 217.

Table 91: Card unit number to E1 channel mapping

Item	TN	E1 Channel Number
Motherboard	0	1
Motherboard	1	2
Motherboard	2	3
Motherboard	3	4
Motherboard	4	5
Motherboard	5	6
Motherboard	6	7

Item	TN	E1 Channel Number
Motherboard	7	8
Motherboard	8	9
Motherboard	9	10
Motherboard	10	11
Motherboard	11	12
Motherboard	12	13
Motherboard	13	14
Motherboard	14	15
Motherboard	15	17
Daughterboard	0	18
Daughterboard	1	19
Daughterboard	2	20
Daughterboard	3	21
Daughterboard	4	22
Daughterboard	5	23
Daughterboard	6	24
Daughterboard	7	25
Daughterboard	8	26
Daughterboard	9	27
Daughterboard	10	28
Daughterboard	11	29
Daughterboard	12	30
Daughterboard	13	31

Disconnect supervision

The LEI supports far-end disconnect supervision by opening the tip side toward the terminal equipment upon the system's detecting a disconnect signal from the far-end on an established call. The Supervised Analog Line feature (SAL) must be configured in LD 10 for each LEI port. At the prompt FTR respond:

```
OSP <CR>
```

Against FTR respond:

ISP <CR>

The LEI treats OSP and ISP for both originating and terminating calls as hook flash disconnect supervision, also known as cut-off disconnect. Originating calls are outgoing from the terminal equipment. Terminating calls are incoming to the terminal equipment. The LEI does not support battery reversal answer and disconnect supervision on originating calls.

After the software is configured, power-up the card and verify the self-test results. The STATUS LED on the faceplate indicates whether or not the LEI has successfully passed its self test, and is, therefore, functional. When the card is installed, this LED remains lit for two to five seconds as the self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit. When the card is configured and enabled in software, the LED goes out. The LED goes out if either the motherboard or daughterboard is enabled by the software. If the LED continually flashes or remains weakly lit, replace the card.

Clocking Requirement

The clocking for NT5D34 Lineside E1 Interface card in CS 1000 system is as follows:

- Lineside E1 cards are clock master of their E1 link, which has a clock accuracy requirement of +/-50ppm
- MGC does not provide a backplane clock with +/-50ppm accuracy at freerun
- An accurate clock source is needed for Lineside E1 application

The following are the two methods to bring an accurate clock source to MCG:

- Configure a digital trunk card with Clock Controller within the same cabinet/chassis as Lineside E1 cards.

  With Clock Controller enabled, in both freerun or locked state, an accurate clock will be provided to MGC.
- Use an MGC DECT Clock Reference Cable (NTDW67AAE5) to bring a clock source from other Communication Server 1000 cabinet/chassis that has a Central Office Link.

  With accurate clock source available, MGC locks to the reference and provide an backplane clock as accurate as the clock source.

Connecting MGC DECT Clock Reference Cable

The following sections elaborate on how to connect an MGC DECT Clock Reference Cable.

Pre requisites

The pre requisites for connecting an MGC DECT Clock Reference Cable are the following:

- **MGC DECT Clock Reference Cable ---** NTDW67AAE5.

  Figure 50: MGC DECT Clock Reference Cable on page 220 shows the MGC DECT Clock Reference Cable. It is used to provide clock reference between Media Gateway Cabinet/ chassis.

Figure 50: MGC DECT Clock Reference Cable

Connecting MGC DECT Clock Reference Cable

1. Connect the MGC DECT Clock Reference Cable to the AUI port of the back of the MG1000 chassis. Figure 51: MG1000 chassis on page 221 shows the AUI port of the MG1000 chassis.

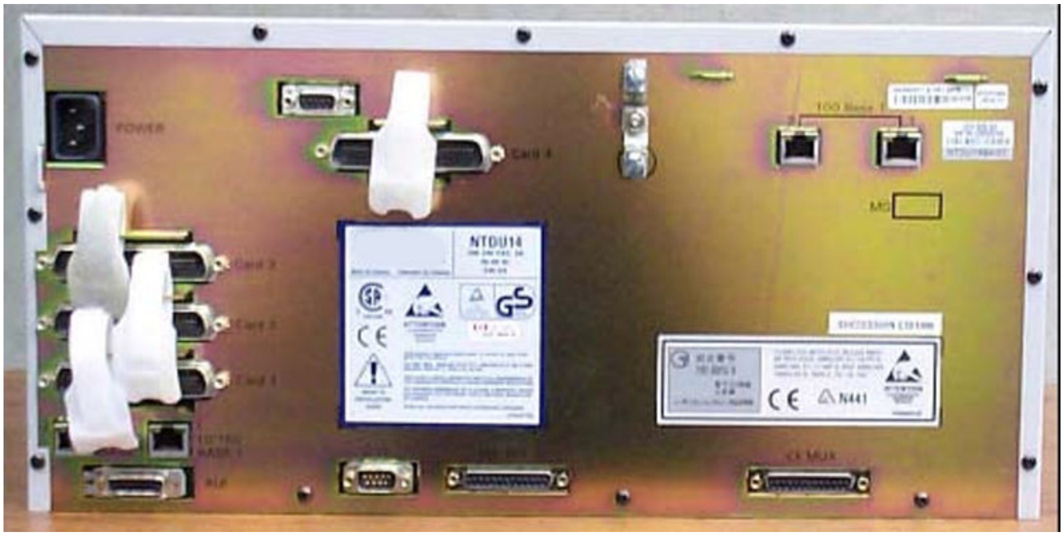


Figure 51: MG1000 chassis

2. In the chassis, connect to 15-pin DSUB connector on the back panel formerly used for the 10Base-T AUI connection. Figure 52: Chassis on page 221 shows the 10Base-T AUI connection of the chassis.

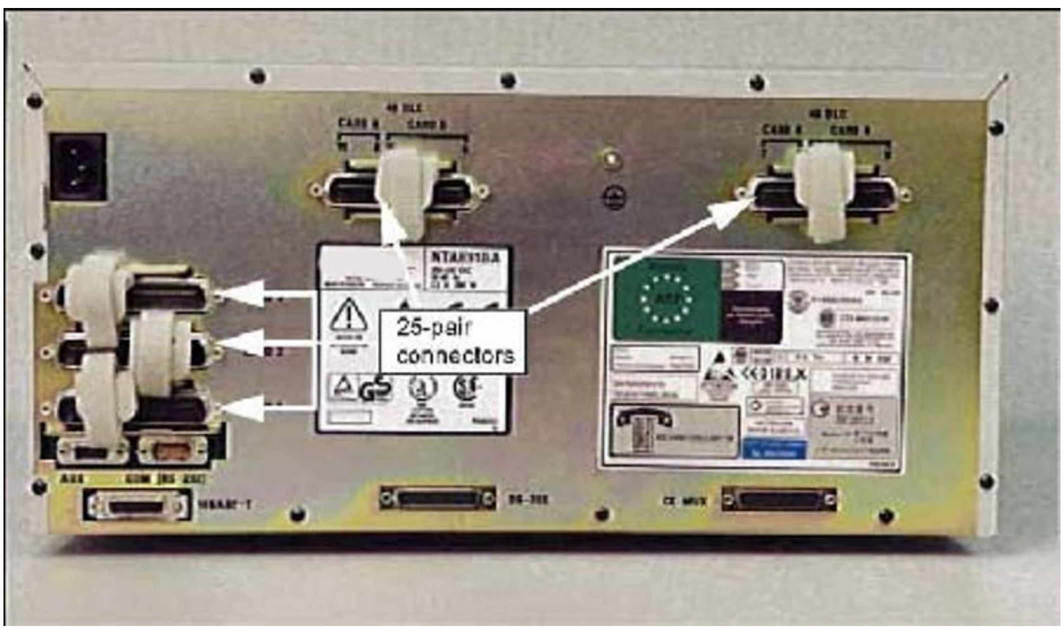


Figure 52: Chassis

3. Use an MGC Breakout Adapter for card.

   - Connect the adapter to 25 pairs MDF connector at Slot 0
   - Connect the MGC DECT Clock Reference Cable (NTDW67AAE5) to 15-pin DSUB connector on the Breakout Adapter. Figure 53: Cabinet on page 222 shows the cabinet.

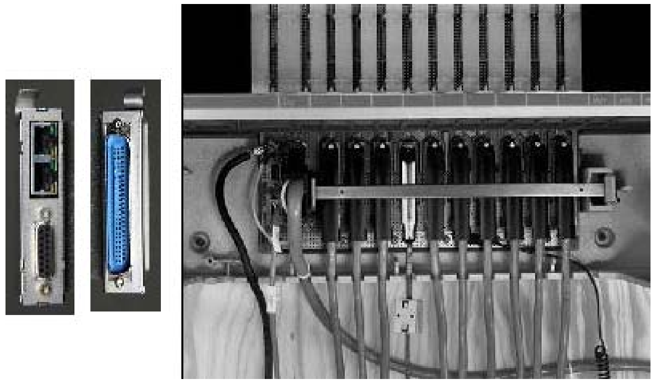


Figure 53: Cabinet

Man-Machine E1 maintenance interface software

Description

The Man-Machine Interface (MMI) provides E1-link diagnostics and historical information for the LEI system. See Installation and Configuration on page 205 for instructions on how to install the cabling and configure the terminal for the MMI. The following sections describe the options available through the LEI's MMI terminal and explain how to set up, configure, and use the MMI.

The MMI provides the following maintenance features:

- configurable alarm parameters
- E1-link problem indicator
- current and historical E1-link performance reports
- E1 verification and fault isolation testing
- configuration of A\B bits (North American Standard, Australian P2, or customized settings are available)

Alarms

The MMI may be used to activate alarms for the following E1-link conditions:

- excessive bit-error rate,
- frame-slip errors,
- out-of-frame,

- loss-of-signal, and
- blue alarm.

Preset thresholds and error durations trip LEI alarm notifications. For descriptions of each of these E1-link alarm conditions, see Performance counters and reporting on page 237. For instructions on how to set alarm parameters, see Set Alarm on page 227. For information about accessing alarm reporting, see Display Alarms on page 236, Display Status on page 237 and Display Performance on page 238.

Two levels of alarm severity exist for bit errors. Different threshold and duration settings must be established for each level.

When the first level of severity is reached (alarm level 1), the MMI causes the following:

- the external alarm hardware activates
- the RED ALARM LED on the faceplate is lit
- an alarm message is displayed on the MMI terminal
- an entry is created in the alarm log and printed to the MMI port

When the second level of severity is reached (alarm level 2), the MMI performs all functions at alarm level 1. In addition, the LEI enters line-conditioning mode. In this mode, the LEI sends either "on-hook" or "off-hook" signals for all 30 ports to the CS 1000E, CS 1000M, and Meridian 1, depending on how the dip switch for line processing is set (dip switch 2, position 6). See Table 86: LEI card - E1 Switch 2 (S2) dip switch settings on page 210.

If the MMI detects E1-link failures for any of the other conditions monitored (out-of-frame, excess frame slips, loss-of-signal, and blue alarm condition), the LEI automatically performs all alarm level 2 functions. The MMI also sends a yellow alarm to the far-end LTU. Alarms may be configured to self-clear when the alarm condition is no longer detected. See Set Clearing on page 230.

All alarms activated produce a record in the alarm log. The alarm log maintains records for the most recent 100 alarms, and can be displayed, printed, and cleared. The alarm log displays or prints the alarms in descending chronological order, beginning with the most recent alarm. Notifications in the alarm log include the date and time of the alarm's occurrence.

E1 Performance Counters and Reports

The MMI maintains performance error counters for the following E1 conditions:

- errored seconds
- bursty seconds
- unavailable seconds
- framer-slip seconds
- loss-of-frame seconds

The MMI retains E1 performance statistics for the current hour, and for each hour for the previous 24. For descriptions of these performance error counters and instructions on how to create a report on them and clear them, see Performance counters and reporting on page 237.

E1 Verification and Fault Isolation Testing

The MMI enables various tests to be performed that either verify that the E1 is working adequately, or help to isolate a problem to the LEI, the E1 link, or the CPE. For descriptions of all of these tests and instructions on how to run them, see Testing on page 239.

Login and Password

The MMI can be accessed through any TTY, PC running a terminal emulation program, or modem. After installing the MMI terminal and card cables, the MMI can be configured.

For single-card installations, it is accessed by entering **`L<CR>`** to login.

For multiple-card installations connected in a daisy chain, it is accessed by entering **`L <address>`**, where the four-digit address is a combination of the two-digit address of the IPE shelf as set by dip switch positions on the card Switch 1, positions 3-6, plus the address of the card slot the motherboard occupies. See Table 88: LEI card - NT8D37 IPE module vintage level port cabling on page 211.

For example, to login to a card located in shelf 13, card slot 4, type:

```
L 13 4 <CR>
```

Spaces are inserted between the login command (L), the shelf address, and the card slot address.

The MMI prompts for a password. The password is **"LEILINK,"** and it must be typed in all capital letters.

After logging in, the prompt looks like this:

`LEI:: >` (for single-card installations)

`LEI::ss cc>` (for multi-card installations, where ss represents the shelf address and cc represents the card slot address.)

Basic commands

MMI commands can now be executed. The seven basic commands are:

- Help
- Alarm

- Clear
- Display
- Set
- Test
- Quit

Type **? <CR>** to list these commands, along with an explanation of their usage. A screen similar to Figure 54: HELP (H, ?) screen on page 225 appears. The help screen also appears by typing **H<CR>**, or **HELP<CR>**.

```
ALARM   USAGE: Alarm [Enable | Disable]
CLEAR   USAGE: Clear [Alarm] | [Error counter] [Log]
DISPLAY USAGE: Display [Alarm | Status | Perform | History] [Pause]
HELP    USAGE: Help | ?
SET     USAGE: Set[Time | Date | Alarm | Clearing | Name Memory | Mode | Simple
TEST    USAGE: Test [Carrier All]
QUIT    USAGE: Quit

Notation Used:
CAPS - Required Letters       [ ] - Optional | - Either/Or
```

Figure 54: HELP (H, ?) screen

Each of these commands can be executed by entering the first letter of the command or by entering the entire command. Commands with more than one word are entered by entering the first letter of the first word, a space, and the first letter of the second word or by entering the entire command. Table 92: MMI commands and command sets on page 225 shows all possible MMI commands in alphabetical order. These commands are also described later in this section.

Table 92: MMI commands and command sets

Command	Description
A D	**Alarm Disable.** Disables all alarms.
A E	**Alarm Enable.** Enables all alarms.
C A	**Clear Alarm.** Clears all alarms, terminates time processing, and resets the E1 bit error rate and frame slip counters.
C A L	**Clear Alarm Log.** Clears alarmlog.
C E	**Clear Error.** Clears the E1 error counter.
D A(P)	**Display Alarms.** Displays the alarm log, which is a list of the 100 most recent alarms with time and date stamps. (Momentarily stop the scrolling display by typing P. Continue scrolling by typing any other key.)

Command	Description
D C(P)	**Display Configuration.** Displays the configuration settings for the LEI(s), single- or multiple-card system. Display includes each card's serial number, MMI firmware version, date and time, alarm disable/enable setting, self-clearing disable/enable setting, values entered through the Set Configuration command, and dip switch settings. (Momentarily stop the scrolling display by typing P. Continue scrolling by typing any other key.)
D H(P)	**Display History.** Displays performance counters for the past 24 hours. (Momentarily stop the scrolling display by typing P. Continue scrolling by typing any other key.)
D P	**Display Performance.** Displays performance counters for the current hour.
D S(P)	Display Status. Displays carrier status, including alarm state and, if active, alarm level. (Momentarily stop the scrolling display by typing P. Continue scrolling by typing any other key.)
H or ?	**Help.** Displays the Help screen.
L	**Login.** Logs into the MMI terminal in a single-LEI system.
Lxx	**Login.** Logs into the MMI terminal in a daisy-chained system, where xx represents the address of the card to be configured.
Q	**Quit.** Logs out of the MMI terminal. **Note:** If it is a daisy-chained system, be certain to log out when finished with configuration. In a daisy-chained system, only one card can occupy the bus at a given time and all other LEIs cannot notify the MMI of alarms unless logged-out of configuration mode.
S A	**Set Alarm.** Sets alarm parameters, such as the allowable bit-errors per second, threshold, and alarm duration.
S C	**Set Clearing.** Sets the alarm self-clearing function, "enable" or "disable."
S D	**Set Date.** Sets the date or verifies the current date.
S M	**Set Mode.** Sets the A/B Bits mode.
S S	**Set Simple.** Sets whether or not the LEI waits for the terminal equipment to return an idle-state message before returning the channel to idle at call disconnect from the far-end.
S T	**Set Time.** Sets the time or verifies current time.
T	**Test.** Initiates the E1 carrier test function. To terminate a test in-process, enter the STOP TEST command at any time.

Configuring parameters

The MMI is designed with default settings so that no configuration is necessary. However, it can be configured based on the call environment.

Set Time

Before beginning to configure the MMI, login to the system and verify the current time. Do this by entering the **`Set Time (S T)`** command. The MMI displays the time it has registered. Enter a new time or hit **`Enter`** to leave it unchanged. The time is entered in the "hh:mm:ss," the 24-hour, or military, format.

Set Date

Verify the current date. Do this by entering the **`Set Date (S D)`** command. The MMI then displays the date it has registered. Enter a new date or hit **`Enter`** to leave it unchanged. The date is entered in the "mm/dd/yy" format.

Set Alarm

The **`Set Alarm (S A)`** command sets the parameters by which an alarm is activated and the duration of the alarm after it is activated. There are three alarm levels as described below:

- **Alarm Level 0 (AL0)** consists of activity with an error threshold below the AL1 setting, which is a satisfactory condition and no alarm is activated.
- **Alarm Level 1 (AL1)** consists of activity with an error threshold above the AL1 setting, but below the AL2 setting that is deemed to be of minor importance. In this situation, the external alarm hardware is activated by closing the normally open contact, the RED ALARM LED on the faceplate lights, and an alarm message is created in the alarm log and the MMI terminal.
- **Alarm Level 2 (AL2)** consists of activity with an error threshold above the AL2 setting which is deemed to be of major importance. In this situation, the following happens:
  - the external alarm hardware is activated by closing the normally open contact
  - the RED ALARM LED on the faceplate lights
  - an alarm message is created in the alarm log and the MMI terminal
  - the LEI card enters line-conditioning mode
  - a yellow alarm message is sent to the CPE/LTU

Line processing sends the CS 1000E, CS 1000M, and Meridian 1either all "on-hook" or all "off-hook" signals, depending on the dip switch setting of the card. See Table 86: LEI card - E1 Switch 2 (S2) dip switch settings on page 210.

When the **`Set Alarm`** command is selected, the prompt appears for setting the threshold level and duration for alarm levels 1 and 2.

The E1 link processes at a rate of approximately 2.0 mb/s. The threshold value indicates the ratio of the total number of bits that must be detected as being in error per second before the LEI activates an alarm. It can be set between 3 and 9 and can be different for each alarm level. Any other value entered causes the MMI to display a `"Parameter Invalid"` message. The digit entered as the threshold value is a number representing a negative power of 10 as shown in Table 93: E1 bit error rate threshold settings on page 228.

Note:

The error-rate threshold for a level 2 alarm must be greater (a smaller power of 10) than for a level 1 alarm. Remember that the numbers being represented are negative numbers. because 3 represents –3, and 4 represents –4, 4 represents a smaller number than 3 does.

Table 93: E1 bit error rate threshold settings

Alarm threshold bit errors per second in power of 10	Threshold to set alarm	Allowable Duration Periods
10^{-3}	2,000/ second	1-21 seconds
10^{-4}	200/second	1-218 seconds
10^{-5}	20/second	1-2148 seconds
10^{-6}	2.0/second	1-3600 seconds
10^{-7}	2.0/10 seconds	10-3600 seconds
10^{-8}	2.0/100 seconds	100-3600 seconds
10^{-9}	2.0/1000 seconds	1000-3600 seconds

The duration value is set in seconds and can be set from 1 to 3,600 seconds (1 hour). This duration value indicates how long the alarm condition must last before an alarm is declared. Low bit-error rates (10^7 through 10^9) are restricted to longer durations because it takes more than one second to detect an alarm condition above10^6. Higher bit-error rates are restricted to shorter durations because the MMI error counter fills at 65,000 errors.

If the **`Set Clearing (S C)`** "Enable Self Clearing" option is set, the alarm indications (LEDs and external alarm contacts) is automatically cleared after the specified period, or duration, expires. Otherwise, the alarm continues until the command **`Clear Alarm (C A)`** is entered.

When an alarm is cleared, all activity caused by the alarm indications is cleared:

- the external alarm hardware is deactivated (the contact normally open is reopened)
- the LED goes out
- an entry is made in the alarm log of the date and time the alarm was cleared
- carrier-fail line supervision ceases (for alarm level 2 only)

If self-clearing alarm indications are disabled, carrier-fail line supervision terminates when the alarm condition has ceased, but the external alarm contact and faceplate LED remain active until the alarm is cleared.

A heavy bit-error rate can cause 200 bit errors to occur much more quickly than 100 seconds. This causes the alarm to be declared sooner.

An alarm condition is not automatically cleared until the system no longer detects the respective bit error threshold during the corresponding duration period.

For example, if AL1 threshold of 6 (representing 10-6) is specified, and a duration period of 100 seconds is specified, an alarm is activated if more than 200 bit errors occur in any 100 second period. As soon as the alarm is activated, the bit counter is reset to 0. If the next 100 seconds pass, and less than 200 bit errors are detected, then the alarm clears after the alarm's duration period. However, if more than 200 bit errors are detected in the next 100 seconds, the alarm condition continues for the designated time period.

The alarm finally clears when the alarm condition is no longer detected for the designated period, either by self-clearing (if this function is enabled), or when the **`Clear Alarm (C A)`** command is entered.

In addition to bit errors, the Set Alarm function sets parameters for detecting frame-slip errors by establishing a threshold necessary to activate an alarm. If the threshold value is exceeded, a level 2 alarm is activated. The frame slip threshold can be specified from 1 to 255 frame slips per time period. The duration time period can be specified from 1 to 24 hours.

When entering the **`Set Alarm (S A)`** command, the MMI scrolls through the previously described series of alarm options. These options are displayed along with their current value, at which point a new value can be entered or enter **<CR>** to retain the current value. Table 94: Set alarm options on page 229 outlines the options available in the **`Set Alarm (S A)`** function.

Table 94: Set alarm options

Option	Description
AL1 Threshold	Sets the allowable bit errors per second before alarm level 1 is activated. Factory default is 6.
AL1 Duration	Sets the duration in seconds (from 1 to 3,600 seconds) that alarm level 1 is activated. Factory default is 10 seconds.
AL2 Threshold	Sets the allowable bit errors per second (from 3 to 9) before alarm level 2 is activated. Factory default is 10^{-5}.

Option	Description
AL2 Duration	Sets the duration in seconds (from 1 to 3,600 seconds) that alarm level 2 is activated. Factory default is 10 seconds.
Frame Slip Threshold	Sets the allowable frame slips per time period (from 1 to 255) before alarm level 2 is activated. Factory default is 5.
Frame Slip Duration	Sets the duration in hours (from 1 to 24) that the frame slips are counted. After this time period, the counter is reset to 0. Factory default is 2 hours.

Note:

If the duration period set is too long, the LEI card is slow to return to service automatically even when the carrier is no longer experiencing errors. The **`CLEAR ALARM (C A)`** command has to be entered manually to restore service promptly. To avoid this, an alarm's duration period is normally set to 10 seconds.

Set Clearing

The **`SET CLEARING (S C)`** command allows self-clearing of alarms by responding to the question: Enable Self Clearing? (YES or NO). If YES is chosen (the factory default setting), the system automatically clears (resets) alarms after the alarm condition is no longer detected. Choosing the NO option causes the system to continue the alarm condition until the **`Clear Alarm (C A)`** command is entered. Line processing and yellow alarm indication to the CPE terminates as soon as the alarm condition clears, even if self-clearing is disabled.

Set Simple

The **`SET SIMPLE`** command controls call tear-down signaling when the far-end disconnects from a call.

When the far-end terminates a call, Release 1 of LEI's AB vintage sends a disconnect message to the terminal equipment and waits for the terminal equipment to go idle before going idle itself. A NO response to the **`S S`** command configures Release 2 (and later) boards to operate in this way. See Figure 55: Set Simple (S S) no screen on page 231.

Release 2 of AB vintage LEIs gives the administrator the option of using the signaling described above, or configuring the LEI to take its channel idle immediately after sending the call-disconnect message. A YES response to the **`S S`** command, the default configuration for Release 2 (and later) boards, configures the LEI to operate in this way. See Figure 56: Set Simple (S S) yes screen on page 231.

```
LEI::>S S
Enable Simplified Call Tear Down? (YES or NO)N
Simplified Call Tear Down Disabled.
LEI::>
```

Figure 55: Set Simple (S S) no screen

```
LEI::>S S
Enable Simplified Call Tear Down? (YES or NO)Y
Simplified Call Tear Down Enabled.
LEI::>
```

Figure 56: Set Simple (S S) yes screen

Set Mode

At the **`SET MODE (S M)`** command, the MMI prompts the user with the current signaling mode, either Default (Australian P2) or Table (of bit values.) Entering a **`<CR>`** accepts the current value, or the user can type in 1 to revert to the Default, or 2 to edit the table entries. See Figure 57: Set Mode screen on page 231. If the user selects default, then the A/B Bit values is reset to the Default values.

Responding to the MMI's **Set Mode** prompt with "**1**" also results in the line "**Signaling Bits set to Default,**" as in Figure 57: Set Mode screen on page 231.

```
LEI:>S M
1) Default
2) Table
Hit <CR> to accept current value or type in a new one.
Current Mode : 1              New Mode :
Signaling Bits set to Default.

LEI:>
```

Figure 57: Set Mode screen

However, responding to this prompt with **2** selects "Table" and allows the user to set the A/B Bit Mode to whatever configuration the user chooses.

If "Table" is selected, the individual table values are prompted for. See Figure 58: Set Mode (S M): Table screen on page 232 and Figure 59: Set Mode (S M): Table screen on page 233. After each value is displayed, enter **`<CR>`** to do the following:

- accept the current value
- enter just the AB bits (which is copied to the CD bits)
- enter a complete ABCD bit pattern
- in the case of optional states, a 'N' or 'n' can be entered to indicate that the state is not needed

Note that in D4 Framing for E1, there are no CD bits, so they are ignored.

The user is prompted for ABCD bit values for the following states when the table mode is selected.

Send and Receive refer to the LEI sending ABCD bits to the CPE (Customer Provided Equipment) or receiving ABCD bits from the CPE.

Incoming and Outgoing refer to E1 digital link from the CPE point of view. Incoming is an external call arriving over the digital link and accepted by the CPE. Outgoing is a call originated by the CPE over the digital link.

Configuring the A/B Bit Signaling table is illustrated in Figure 59: Set Mode (S M): Table screen on page 233.

```
Outgoing call SEIZE RECEIVE:  Current: 0001  New: 111
Error: Note enough values specified.  Enter either 2 or 4
values.
Outgoing call SEIZE RECEIVE:  Current: 0001  New: 11
Outgoing call SEIZE RECEIVE bits changed to: 1111

Outgoing call SEIZE ACK SEND enabled? (Y/N): N
Outgoing call SEIZE ACK SEND is disabled.

Outgoing call DIAL MAKE RECEIVE:  Current: 1111  New:
Outgoing call DIAL MAKE RECEIVE bits not changed.

Outgoing call DIAL BREAK RECEIVE:  Current: 1010  New:
Outgoing call DIAL BREAK RECEIVE bits not changed.

Outgoing call ANSWERED SEND:  Current: 0101  New:
Outgoing call ANSWERED SEND bits not changed.

Outgoing call (CPE) DISCONNECT RECEIVE:  Current: 0101  New:
Outgoing call (CPE) DISCONNECT RECEIVE bits not changed.

Outgoing call (Far End) DISCONNECT SEND:  Current: 1111  New:
Outgoing call (Far End) DISCONNECT SEND bits not changed.

Disconnect Time (0 to 4000 ms): 1000
Disconnect Time not changed.

Intercall Time (0 to 2000 ms): 800
Intercall Time not changed.

LEI:>
```

Figure 58: Set Mode (S M): Table screen

Idle SEND — This is the value that the LEI sends (acting as the CO or PSTN) when the circuit is in the idle state. This value is required.

Idle RECEIVE — This is the value that the LEI expects to see from the CPE when it is in the idle state. This value is required.

Blocking RECEIVE — This is the value that the LEI expects to see from the CPE when the customer equipment is in the blocking or fault state and is unable to accept new calls. Set this value to N if this state is not needed. If this value is not set to N, then dip switch #2 position 6 determines whether off-hook or on-hook is sent to the M1/SL100 when this state is entered. See Table 86: LEI card - E1 Switch 2 (S2) dip switch settings on page 210.

```
LEI:>S M
1) Default
2) Table
Hit <CR> to accept current value or type in a new one.
Current Mode : 1        New Mode : 2
Signaling Bits set to Table.

Incoming and outgoing calls are in reference to the CPE.
All ABCD bits are with respect to SENDing from LEI/M1 to CPE
or RECEIVing from CPE to LEI/M1.
Please enter new ABCD bits or hit <CR> to accept.  You may
enter 2 or 4 values.  If only 2 values are entered, the A and
B bits will be copied to the C and D bits.

IDLE SEND:  Current: 0000  New: 0101
IDLE SEND bits changed to: 0101

IDLE RECEIVE:  Current: 0101  New:
IDLE RECEIVE bits unchanged.

BLOCKING RECEIVE enabled? (Y/N): N
BLOCKING RECEIVE is disabled.

Incoming call RINGER-ON SEND:  Current: 0000  New:
Incoming call RINGER-ON SEND bits not changed.

Incoming call RINGER-OFF SEND:  Current: 0101  New: 0101
Incoming call RINGER-OFF SEND bits not changed.

Incoming call OFFHOOK RECEIVE:  Current: 1111  New: 11
Incoming call OFFHOOK RECEIVE bits not changed.

Incoming call CONNECTED SEND:  Current: 0101  New:
Incoming call CONNECTED SEND bits not changed.

Incoming call (Far End) DISCONNECT SEND:  Current: 1111  New:
Incoming call (Far End) DISCONNECT SEND bits not changed.

Incoming call (CPE) DISCONNECT RECEIVE:  Current: 0101  New:
Incoming call (CPE) DISCONNECT RECEIVE not changed.
```

Figure 59: Set Mode (S M): Table screen

Incoming call Ringer ON SEND – This is the value that the LEI sends to indicate that a call is incoming to the CPE and that ringing voltage should be applied at the CPE. This value is required.

Incoming call Ringer OFF SEND – This is the value that the LEI sends to indicate that a call is incoming to the CPE and that the ring cycle is in the off portion of the cadence. This value is required.

Incoming call Offhook RECEIVE – This is the value that the LEI expects to see from the CPE when the customer equipment has gone to an off hook state which indicates that the incoming call is answered. This value is required.

Incoming call CONNECTED SEND – This is the value that the LEI sends to the CPE to indicate that it has seen and recognized the off hook indication sent by the CPE. The call is considered fully connected at this point. This value is required.

Incoming call (Far-end) DISCONNECT SEND – This is the value that the LEI sends to indicate that the far-end has released the call. This value is required.

Incoming call (CPE) DISCONNECT RECEIVE – This is the value that the LEI expects to see from the CPE when the customer equipment wishes to end the call. This value is required.

Outgoing call SEIZE RECEIVE – This is the value that the LEI expects to see when the CPE goes to an off hook condition and wishes to initiate a call. This value is required.

Outgoing call SEIZE ACK SEND – This is the value that the LEI sends to indicate that the seized condition is noted and the M-1 is ready for dial digits. This value can be set to N if it is not required such as in a loop start case.

Outgoing call DIAL MAKE RECEIVE – This is the value that the LEI expects to see from the CPE during the make part of the digit. This value is required.

Outgoing call DIAL BREAK RECEIVE – This is the value that the LEI expects to see from the CPE during the break part of the digit. This value is required.

Outgoing call ANSWERED SEND – This is the value that the LEI sends to indicate that the far-end has answered the call. This value is required.

Outgoing call (CPE) DISCONNECT RECEIVE – This is the value that the LEI expects to see from the CPE when the customer equipment wishes to end the call. This value is required.

Outgoing call (Far-end) DISCONNECT SEND – This is the value that the LEI sends to indicate that the far-end has released the call. This value is required.

Disconnect Time – This is the number of milliseconds that the LEI sends the disconnect signal to the CPE before reverting to the idle state. If the CPE reverts to a connected state during this time, it is ignored. This value is only used when disconnect supervision is available and is needed for the signaling type in use. It is used when the far-end initiates the disconnect. For loop start cases, this value is not used.

Intercall (release guard) Time – This is the number of milliseconds that the LEI maintains the idle signal to the CPE before initiating a new call. The CPE should not initiate a new call during this time. If it does so, the off-hook indication is ignored until the release guard time has expired. This value defaults to 0 which relies on the M-1 to observe the proper guard time. If a non-zero value is entered, off-hook from the CPE and Ringer-On commands from the M1/SL100 is ignored until this timer has expired.

Display Configuration (D C)

The **`Display Configuration (D C)`** command displays the various configuration settings established for the LEI. Entering this command causes a screen similar to Figure 60: Display Configuration (D C) screen on page 235 to appear.

```
LEI  S/N 1103  Software Version 1.01    3/03/95  1:50
Alarms Enabled:  YES     Self Clearing Enabled:  YES
Alarm Level 1 threshold value:  E-7      Threshold duration (in
seconds):  10
Alarm Level 2 threshold value:  E-5      Threshold duration (in
seconds):  1
Frame slips alarm level threshold:  5    Threshold duration (in hours)
2
Current dip switch S1 settings (S1..S8)  On Off Off On Off Off Off On
Current dip switch S2 settings (S1..S8)  On Off On Off Off Off On Off
```

Figure 60: Display Configuration (D C) screen

Alarm operation and reporting

The MMI monitors the E1 link according to parameters established through the Set Alarm command for the following conditions:

- Excessive bit error rate
- Frame slip errors
- Out of frame condition
- Loss of signal condition
- Blue alarm (AIS) condition

Descriptions of the excessive bit error rate and frame slip errors conditions are found in Configuring parameters on page 227. Bit errors activate either a level 1 or level 2 alarm. The remaining conditions, when detected, always cause the system to activate a level 2 alarm.

An out-of-frame condition is declared if 3 consecutive frame bits are in error. If this condition occurs, the hardware immediately attempts to reframe. During the reframe time, the E1 link is declared out-of-frame, and silence is sent on all receive timeslots.

A loss of signal condition is declared if a full frame (255 bits) of consecutive zeros is detected at the receive inputs. If this condition occurs, the E1 link automatically attempts to resynchronize with the far-end. If this condition lasts for more than two seconds, a level 2 alarm is declared, and silence is sent on all receive timeslots. The alarm is cleared if, after two seconds, neither a loss of signal, out-of-frame condition, or blue alarm condition occurs.

If a repeating device loses signal, it immediately begins sending an unframed signal of all ones to the far-end to indicate an alarm condition. This condition is called a blue alarm, or an Alarm Indication Signal (AIS). If an AIS is detected for more than two seconds, a level 2 alarm is declared, and silence is sent on all receive timeslots. The alarm is cleared if, after two seconds, neither a loss of signal, out-of-frame condition, or blue alarm condition occurs.

Alarm Disable

The **`Alarm Disable (A D)`** command disables the external alarm contacts. When this command is typed, the MMI displays the message Alarms Disabled and the MAINT LED lights. In this mode, no yellow alarms are sent and the LEI does not enter line processing mode. Alarm messages are sent on the MMI terminal and the LED continues to indicate alarm conditions.

Alarm Enable

The **`Alarm Enable (A E)`** command does the reverse of the **`Alarm Disable (A D)`** command. It enables the external alarm contacts. When this command is typed in, the MMI displays the message Alarms Enabled. In this mode, yellow alarms can be sent and the LEI can enter line processing mode.

Clear Alarm

The **`Clear Alarm (C A)`** command clears all activity initiated by an alarm: the external alarm hardware is deactivated (the contact normally open is reopened), the LED goes out, an entry is made in the alarm log of the date and time the alarm was cleared, and line processing ceases (for alarm level 2 only). When this command is typed, MMI displays the message Alarm acknowledged. If the alarm condition still exists, an alarm is declared again.

Display Alarms

A detailed report of the most recent 100 alarms with time and date stamps can be displayed by entering the **`Display Alarms (D A)`** command into the MMI, which causes a screen similar to Figure 61: Display Alarm (D A) screen on page 236 to appear.

```
Alarm Log

 2/03/99  1:48  Yellow alarm on E1 carrier
 2/03/99  2:33  E1 carrier level 1 alarm
 2/03/99  3:47  E1 carrier level 2 alarm
 2/03/99  4:43  E1 carrier performance within thresholds
 2/03/99 15:01 Log Cleared
```

Figure 61: Display Alarm (D A) screen

The Pause command can be used to display a full screen at a time, by entering **`D A P`**. If there is more than one screen in the log, the MMI scrolls the log until the screen is full, then stops. When ready to see the next screen, press any key. The display shows another screen and stops again. This continues until the entire log is displayed.

Clear Alarm Log

Clear all entries in the alarm log by typing the **`Clear Alarm Log (C A L)`** command.

Display Status

The **`Display Status (D S)`** command displays the current alarm condition of the E1 link as well as the on-hook or off-hook status of each of the 30 ports of the LEI. Entering this command causes a screen similar to Figure 62: Display Status (D S) screen on page 237 to appear.

The Pause command can be used to display a full screen at a time, by entering **`D S P`**. If there is more than one screen, the MMI scrolls until the screen is full, then stops. When ready to see the next screen, press any key. The display shows one more screen, and stops again. This continues until the entire E1 link is reported on.

```
LEI  S/N   Software Version 1.01    3/03/95  1:50
In alarm state:  NO
E1 link at alarm level 0
Port 0 off hook, Port 1 on hook, Port 2 on hook, Port 3 on hook,
Port 4 on hook, Port 5 on hook, Port 6 off hook, Port 7 off hook,
Port 8 off hook, Port 9 on hook, Port 10 on hook, Port 11 on hook,
Port 12 off hook, Port 13 on hook, Port 14 on hook, Port 15 on hook,
Port 16 on hook, Port 17 on hook, Port 18 off hook, Port 19 off hook,
Port 20 off hook, Port 21 on hook, Port 22 on hook, Port 23 on hook
Port 21 off hook, Port 22 on hook, Port 23 on hook, Port 24 on hook,
Port 25 on hook, Port 26 on hook, Port 27 off hook, Port 28 off hook,
Port 29 off hook
```

Figure 62: Display Status (D S) screen

Performance counters and reporting

The MMI monitors the performance of the E1 link according to several performance criteria including errored, bursty, unavailable, loss-of-frame and frame-slip seconds. It registers the performance of these criteria by reading their status every second and counting their results. These counts are accumulated for an hour, then reset to 0. Previous hour count results are maintained for each of the previous 24 hours.

The LEI counts CRC-4 errors when CRC-4 is enabled and Bipolar Violations (BPV) when CRC-4 is disabled. The performance criteria for which these counts are maintained as follows:

- Errored seconds are seconds in which one or more CRC-4 / BPV errors, or one or more out-of-frame errors in one second.
- Bursty seconds are seconds in which more than one and less than 320 CRC-4 / BPV errors in a second.
- Severely errored seconds are seconds in which more than 320 CRC-4 / BPV errors, or one or more out-of-frames in a second.

- Unavailable seconds are seconds in which unavailable state starts with 10 consecutive severely errored seconds and ends with 10 consecutive non-severely errored seconds (excluding the final 10 non-severely errored seconds).
- Loss-of-frame seconds are seconds in which loss-of-frame or loss-of-signal conditions exist for three consecutive seconds.
- Frame slip seconds are seconds in which one or more frame slips occur.

The MMI also maintains an overall error counter which is the sum of all errors counted for the performance criteria listed above. The error counter can only be cleared by entering the **`Clear Error (C E)`** command. It stops counting at 65,000. The error counter provides an easy method to determine if an alarm condition is corrected. Clear the error counter, wait a few minutes, and display the performance to see if any errors occurred because the counter was cleared.

The MMI display reports on these performance counters through the **`Display Performance (D P)`** or the **`Display History (D H)`** commands.

Display Performance

Entering the **`Display Performance (D P)`** command displays performance counters for the past hour. A screen similar to Figure 63: Display Performance (D P) screen on page 238 appears.

LEI E1 Interface Performance Log
3/03/95 1:37 PM

Data for the past 37 Minutes

Errored Seconds	Bursty Seconds	Unavailable Seconds	Loss Frame Seconds	Frame Slip Seconds	Error Counter
2263	0	2263	2263	352	321

Figure 63: Display Performance (D P) screen

Each column, except the error counter, indicates the number of errors in the current hour and is reset to zero every hour on the hour. Just before the performance counters are reset to zero, the values are put into the history log.

The error counter indicates the number of errors because the error counter was cleared.

The Pause command can be used to display a full screen at a time, by entering **`D P P`**. If more than one screen is to be displayed, the MMI scrolls until the screen is full, then stops. When ready to see the next screen, press any key. The display shows one more screen, and stops again. This continues until the entire display is shown.

Display History

Entering the **`Display History (D H)`** command displays performance counters for each hour of the past 24 in reverse chronological order, beginning with the last full hour. A screen similar to Figure 64: Display History (D H) screen on page 239 appears.

The Pause command works the same for Display History as it does for the other display commands. Simply enter **`D H P`** to see a report on the performance counters, one screen at a time.

LEI E1 Interface History Performance Log
1/03/99 8:37 PM

Hour Ending	Errored Seconds	Bursty Seconds	Unavailable Seconds	Loss Frame Seconds	Frame Slip Seconds	Error Count
20:00	139	0	129	139	23	162
19:00	0	0	0	0	0	0
18:00	0	0	0	0	0	0
17:00	0	0	0	0	0	0
16:00	0	0	0	0	0	0

Figure 64: Display History (D H) screen

As with all **`Display`** commands, the Pause command can be used to display a full screen of the history report at a time, by entering **`D H P`**.

Clear Error

Reset the error counter to zero by entering the Clear Error (C E) command. The error counter provides a convenient way to determine if the E1 link is performing without errors because it can be cleared and examined at any time.

Testing

The **`Test Carrier (T)`** command allows tests to be run on the LEI, the E1 link, or the CPE device. The three tests are designed to provide the capability to isolate faulty conditions in any of these three sources. See Table 95: MMI Tests on page 240 for additional information about these three test types. Enter the **`T`** command, and at the prompt, enter which of these three tests is to be initiated. The prompt is similar to Figure 65: Test Carrier (T) screen on page 240.

```
Test 1:  Local Loopback Test
Test 2:  External Loopback Test
Test 3:  Network Loopback Test
(1,2,3 or S to cancel):
```

Figure 65: Test Carrier (T) screen

Tests can be performed once, for one through 98 minutes, or continuously (selected by entering 99 minutes), until a **`Stop Test`** command is entered. Tests continue for the duration specified even if a failure occurs, and terminate at the end of the time period or when a **`Stop Test`** command is issued. Only **`Stop Test`** stops a test with a duration selection of 99; however, the **`STOP`** command terminates a test set to any duration from one to 99. After entering the test number, a prompt similar to Figure 66: Test parameters screen on page 240 appears.

```
Enter Duration of Test (1-98 Mins, 0 = Once, 99 = Forever)
Test will interfere with traffic.  Hit Q to quit or any Key to Continue
```

Figure 66: Test parameters screen

Before a test is run, be sure to verify that the card is disabled, as the tests interfere with calls currently in process.

During a test, if an invalid word is received, this is recorded by a failure peg counter. The peg counter has a limit of 65,000. At the end of the test, the Test Results message indicates how many failures, if any, occurred during the test.

Table 95: MMI Tests on page 240 shows which test to run for the associated equipment.

Table 95: MMI Tests

Test number	Equipment Tested	Test Description
1	LEI	Local loopback
2	E1 link, LEI, and E1 network	External loopback
3	CPE device and E1 network	Network loopback

Test 1, local loopback, loops the E1 link signaling toward itself at the backplane connector. Test data is generated and received on all timeslots. If this test fails, it indicates that the LEI is defective. Figure 67: MMI Local loopback test on page 241 illustrates how the signaling is looped back toward itself.

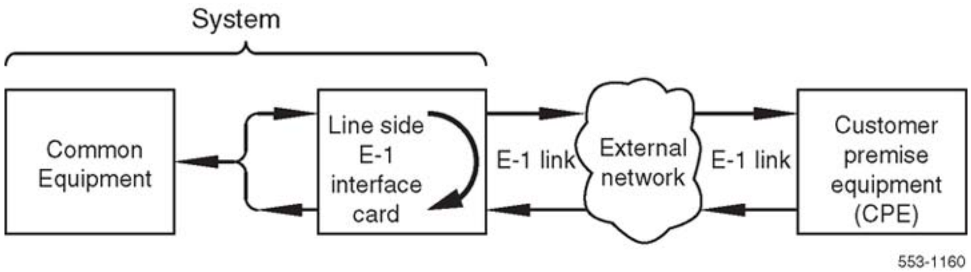


Figure 67: MMI Local loopback test

Test 2, external loopback, applies an external loopback to the E1 link. Test data is generated and received by the LEI on all timeslots. If test 1 passes but test 2 fails, it indicates that the E1 link is defective between the LEI and the external loopback location. If test 1 was not run and test 2 fails, the E1 link or the LEI could be defective. To isolate the failure to the E1 link, tests 1 and 2 must be run in tandem. Figure 68: MMI External loopback test on page 241 demonstrates how an external loopback is applied to the E1 link.

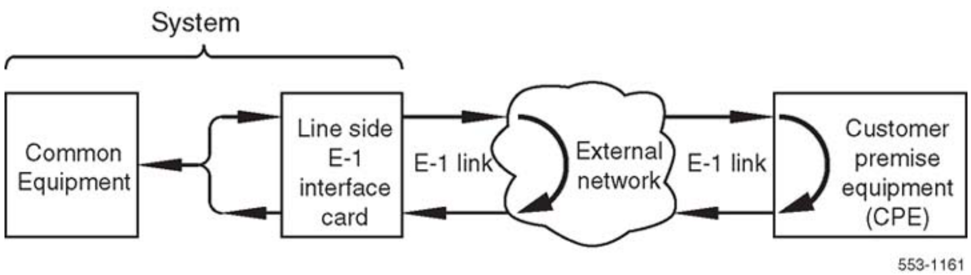


Figure 68: MMI External loopback test

Test 3, network loopback, loops the LEI's received E1 data back toward the CPE. No test data is generated or received by the LEI. If test 2 passes but test 3 fails, it indicates that the CPE device is defective. If test 2 was not run and test 3 fails, the E1 link or the CPE device could be defective. To isolate the failure to the CPE device, tests 2 and 3 must be run in tandem. Figure 69: MMI Network loopback test on page 241 illustrates how the signaling is looped back toward the CPE.

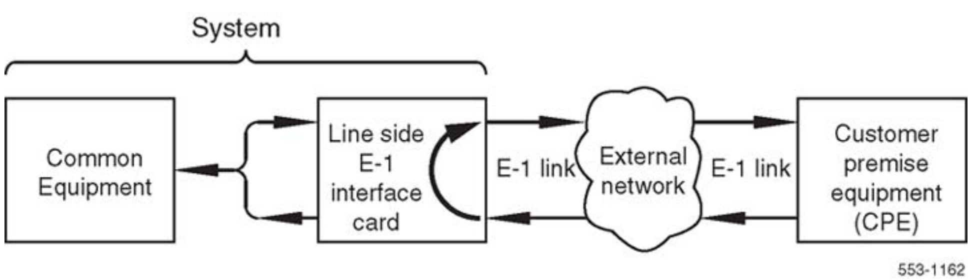


Figure 69: MMI Network loopback test

Applications

The LEI is an IPE line card that provides cost-effective connection between E1-compatible IPE and a CS 1000E, CS 1000M, and Meridian 1system or off-premise extensions over long distances.

Some examples of applications where an LEI can be interfaced to an E1 link are:

- E1-compatible VRU equipment
- E1-compatible turret systems
- E1-compatible wireless systems
- Remote analog (500/2500-type) telephones through E1 to channel bank
- Remote Norstar sites behind CS 1000E, CS 1000M, and Meridian 1over E1

The LEI is appropriate for any application where both E1 connectivity and "lineside" functionality are required. This includes connections to E1-compatible voice response units, voice messaging and trading turret (used in stock market applications) systems. See Figure 70: LEI connection to IPE on page 242.

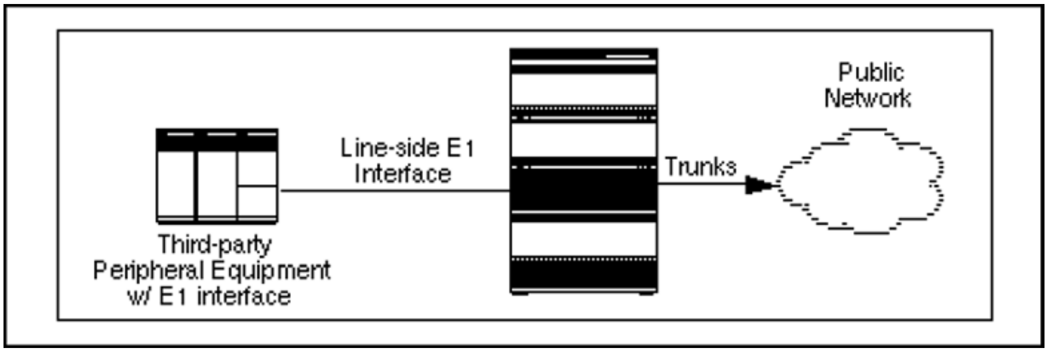


Figure 70: LEI connection to IPE

For example, the LEI can be used to connect the system to an E1-compatible Voice Response Unit (VRU). An example of this type of equipment is Avaya Open IVR system. In this way, the CS 1000E, CS 1000M, and Meridian 1can send a call to the VRU, and, because the LEI supports analog (500/2500-type) telephone functionality, the VRU can send the call back to the system for further handling.

The LEI can also be used to provide off-premise extensions to remote locations, up to 500 miles from the system. In this application, analog telephone functionality is extended over E1 facilities, providing a telephone at a remote site with access to analog (500/2500-type) telephone line functionality. See Figure 71: LEI in off-premise extension application on page 243. Audible Message Waiting Indicator can be provided as well.

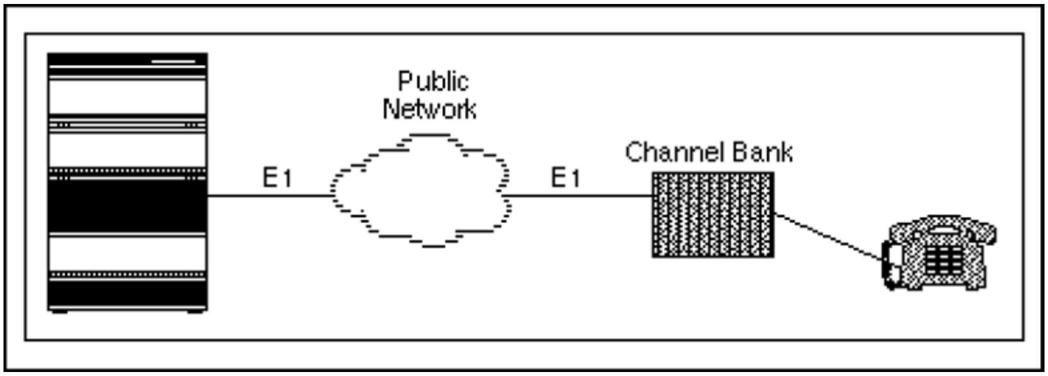


Figure 71: LEI in off-premise extension application

Similarly, use the LEI to provide a connection between the system and a remote Norstar system. See Figure 72: LEI connection to Norstar system on page 243. In this case, channel banks are not required if the Norstar system is equipped with an E1 interface.

Note:

Consider LEI audio levels when determining the appropriateness of an application.

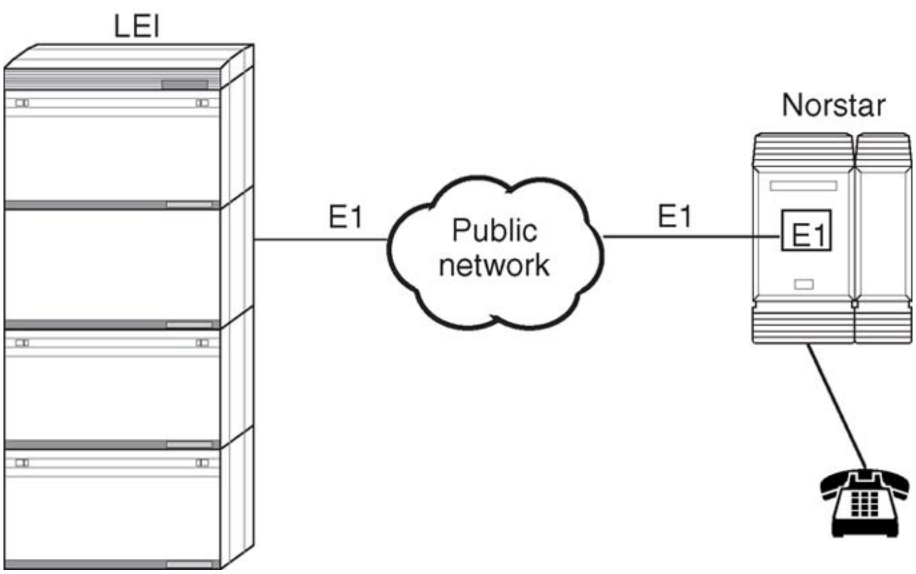


Figure 72: LEI connection to Norstar system

Chapter 12: NT5D60/80/81 CLASS Modem card (XCMC)

Contents

This section contains information on the following topics:

Introduction

The NT5D60/80/81 CLASS Modem card supports the Custom Local Area Signaling Services (CLASS) feature. The CLASS Modem card receives Calling Number and Calling Name Delivery (CND) data and time/date data from the Avaya Communication Server 1000E (Avaya CS 1000E), Avaya CS 1000M, and Meridian 1and transmits it to a line port, such as a port on an Analog Line card, which delivers the CND data to a CLASS telephone when presenting the telephone with a new call.

For information about the CLASS: Calling Number and Name Delivery feature, see *Avaya Features and Services* (NN43001-106-B). For administration and maintenance commands, see *Avaya Software Input/Output Reference — Administration* (NN43001-611) .The NT5D60AA CLASS Modem card supports the Custom Local Area Signaling Services (CLASS) feature. The CLASS Modem card receives Calling Number and Calling Name Delivery (CND) data and time/date data from the system and transmits it to a line port, such as a port on an Analog Line card, which delivers the CND data to a CLASS telephone when presenting the telephone with a new call.

For information about the CLASS: Calling Number and Name Delivery feature, see *Avaya Features and Services* (NN43001-106-B). For administration and maintenance commands, see *Avaya Software Input/Output Reference — Administration* (NN43001-611).

Physical description

CLASS Modem cards are housed in NT8D37 IPE modules.

The CLASS modem card circuitry is mounted on a 31.75 cm by 25.40 cm (12.5 in. by 10 in.) double-sided printed circuit board. The card connects to the backplane through a 160-pin edge connector.

The faceplate of the CLASS modem card is equipped with a red LED that lights when the card is disabled. When the card is installed, the LED remains lit for two to five seconds as a self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED continually flashes or remains weakly lit, replace the card.

CLASS Modem cards are housed in NT8D37 Intelligent Peripheral Equipment (IPE) Modules.

The CLASS modem card circuitry is mounted on a 31.75 cm by 25.40 cm (12.5 in. by 10 in.) double-sided printed circuit board. The card connects to the backplane through a 160-pin edge connector.

The faceplate of the CLASS modem card is equipped with a red LED that lights when the card is disabled. When the card is installed, the LED remains lit for two to five seconds as a self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED continually flashes or remains weakly lit, replace the card.

Functional description

The CLASS Modem card is designed to plug into any one of the peripheral card slots of the IPE module. The CLASS modem card supports up to 32 transmit-only modem resources, using a DS30X interface. Up to 255 modems can be configured per system.

The CND transmission process begins with the CS 1000 software sending an initiating message to the CLASS Modem card indicating the length of the CND information and the type of the CND information flow to be transmitted. In response, the CLASS Modem card assigns a message buffer to capture the CND information from the CS 1000 software.

System software then sends the CND information to the CLASS Modem card, one byte at a time, where it is stored in the message buffer. If the CLASS Modem card receives more bytes than were specified in the initiating message, then the additional bytes are discarded and not included in the CND memory buffer.

Once all of the CND information is stored in the memory buffer, the CLASS Modem card begins transmission when requested by the system software. Data is sent one ASCII character at a time. The CLASS Modem card inserts a start and stop bit to each ASCII character sent.

The transmission of the calling party name/number to the terminating telephone is accomplished through asynchronous FSK simplex-mode transmission at 1200 bits/second over a 2-wire loop, in accordance with the Bell 202 standard. The transmission is implemented by the appropriate PCM equivalent of 1200 or 2200 Hz.

Upon completion of transmitting the CND data, the CLASS Modem card sends a message to the system software to indicate successful transmission of the CND data.

Eight modems can be associated with each module. Table 96: Time slot mapping on page 247 shows time slot mapping for the CLASS modem card.

Table 96: Time slot mapping

XCMC mapping of TNs		
TNs	**DS30X timeslot**	**Modem units on the CLASS Modem card**
00 01 02 03	00 01 02 03	module 0, 00 01 02 03
04 05 06 07	04 05 06 07	04 05 06 07
08 09 10 11	08 09 10 11	module 1, 00 01 02 03
12 13 14 15	12 13 14 15	04 05 06 07
16 17 18 19	16 17 18 19	module 2, 00 01 02 03
20 21 22 23	20 21 22 23	04 05 06 07
24 25 26 27	24 25 26 27	module 3, 00 01 02 03

XCMC mapping of TNs		Modem units on the CLASS Modem card
TNs	DS30X timeslot	
28 29 30 31	28 29 30 31	04 05 06 07

The CLASS Modem card is designed to plug into any one of the peripheral card slots of the IPE module. The CLASS modem card supports up to 32 transmit-only modem resources, using a DS30X interface. Up to 255 modems can be configured per system.

The CND transmission process begins with the system software sending an initiating message to the CLASS Modem card indicating the length of the CND information and the type of the CND information flow to be transmitted. In response, the CLASS Modem card assigns a message buffer to capture the CND information from the system software.

System software then sends the CND information to the CLASS Modem card, one byte at a time, where it is stored in the message buffer. If the CLASS Modem card receives more bytes than were specified in the initiating message, then the additional bytes are discarded and not included in the CND memory buffer.

Once all of the CND information is stored in the memory buffer, the CLASS Modem card begins transmission when requested by the system software. Data is sent one ASCII character at a time. The CLASS Modem card inserts a start and stop bit to each ASCII character sent.

The transmission of the calling party name/number to the terminating telephone is accomplished through asynchronous FSK simplex-mode transmission at 1200 bits/second over a 2-wire loop, in accordance with the Bell 202 standard. The transmission is implemented by the appropriate PCM equivalent of 1200 or 2200 Hz.

Upon completion of transmitting the CND data, the CLASS Modem card sends a message to the system software to indicate successful transmission of the CND data.

Eight modems can be associated with each module. Table 97: Time slot mapping on page 248 shows time slot mapping for the CLASS modem card.

Table 97: Time slot mapping

XCMC mapping of TNs		Modem units on the CLASS Modem card
TNs	DS30X timeslot	
00 01 02 03	00 01 02 03	module 0, 00 01 02 03
04 05 06 07	04 05 06 07	04 05 06 07

XCMC mapping of TNs		Modem units on the CLASS Modem card
TNs	DS30X timeslot	
08 09 10 11	08 09 10 11	module 1, 00 01 02 03
12 13 14 15	12 13 14 15	04 05 06 07
16 17 18 19	16 17 18 19	module 2, 00 01 02 03
20 21 22 23	20 21 22 23	04 05 06 07
24 25 26 27	24 25 26 27	module 3, 00 01 02 03
28 29 30 31	28 29 30 31	04 05 06 07

Electrical specifications

This section lists the electrical characteristic of the CLASS modem card.

This section lists the electrical characteristic of the CLASS modem card.

Data transmission specifications

Table 98: CLASS modem card-data transmission electrical characteristics on page 250 provides specifications for the 32 transmit-only modem resources.

Table 98: CLASS modem card-data transmission electrical characteristics

Characteristics	Description
Units per card	32 transmit only modem resources
Transmission rate	1200 ± 12 baud

The CLASS modem card has no direct connection to the Public Network.

Table 99: CLASS modem card-data transmission electrical characteristics on page 250 provides specifications for the 32 transmit-only modem resources.

Table 99: CLASS modem card-data transmission electrical characteristics

Characteristics	Description
Units per card	32 transmit only modem resources
Transmission rate	1200 ± 12 baud

The CLASS modem card has no direct connection to the Public Network.

Power requirements

The CLASS modem card requires less than 1.0 Amps of +5 V dc ± 1% supply supplied by the power converter in the IPE shelf.

The CLASS modem card requires less than 1.0 Amps of +5 V dc ± 1% supply supplied by the power converter in the IPE shelf.

Environmental specifications

Table 100: CLASS modem card - environmental specifications on page 250 shows the environmental specifications of the card.

Table 100: CLASS modem card - environmental specifications

Parameter	Specifications
Operating temperature	0° C to +65° C (+32 ° F to +149 ° F)
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–50° C to +70° C (–58 ° F to +158 ° F)

Table 101: CLASS modem card - environmental specifications on page 251 shows the environmental specifications of the card.

Table 101: CLASS modem card - environmental specifications

Parameter	Specifications
Operating temperature	0° C to +65° C (+32 ° F to +149 ° F)
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–50° C to +70° C (–58 ° F to +158 ° F)

Configuration

The NT5D60/80/81 CLASS Modem card has no user-configurable jumpers or switches. The card derives its address from its position in the backplane and reports that information back to the CS 1000E, CS 1000M, and Meridian 1CPU through the Card LAN interface.

The NT5D60AA CLASS Modem card has no user-configurable jumpers or switches. The card derives its address from its position in the backplane and reports that information back to the Meridian 1 CPU through the Cardlan interface.

Software service changes

On systems equipped with either CNUMB (package 332) or CNAME (package 333), up to 255 CLASS Modem (CMOD) units can be configured in LD 13, and analog (500/2500-type) telephones can be assigned as CLASS telephones in LD 10 by assigning them CNUS, or CNUA and CNAA class of service. See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 10 and LD 13 service change instructions.

On systems which are equipped with either CNUMB (package 332) or CNAME (package 333), up to 255 CLASS Modem (CMOD) units can be configured in LD 13, and analog (500/2500-type) telephones can be assigned as CLASS telephones in LD 10 by assigning them CNUS, or CNUA and CNAA class of service. See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 10 and LD 13 service change instructions.

Chapter 13: NT5D97 Dual-port DTI2 PRI2 card

Contents

The following are the topics in this section:

Introduction

This section contains information required to install the NT5D97 Dual-port DTI2/PRI2 (DDP2) card.

The NT5D97 is a dual-port 2.0 Mb DTI2/PRI2 card (the DDP2 firmware functions in DTI2 or PRI2 mode, depending on DIP switch settings) that integrates the functionality of two NT8D72BA PRI2 cards, and one QPC414 ENET card into a single CE card. The NT5D97 occupies a single slot in the Network shelf and provides two DTI2/PRI2 network connections: the NT6D80 Multi-purpose Serial Data Link card, and an optional plug-on NTBK51AA/NTBK51CA Downloadable D-Channel daughterboard (DDCH) with two DCH interface ports.

The NT5D97 DDP2 card can be mixed in the same machine with PRI2 NT8D72BA cards.

The NT5D97 DDP2 card hardware design uses a B57 ASIC framer. The carrier specifications comply with the ANSI TI.403 specification. The NT5D97 provides an interface to the 2.048 Mbps external digital line either directly or through an office repeater, Network Channel Terminating Equipment (NCTE), or Line Terminating Unit (LTU).

Danger:

DANGER OF ELECTRIC SHOCK

The NT5D97 DDP2 card is not designed to be connected directly to the Public Switched Network, or other exposed plant networks. Such a connection should only be done using an isolating-type networking terminating device that provides voltage surge protection, such as a Line Terminating Unit (LTU), Network Channel Terminating Equipment (NCTE), or Network Termination 1 (NT1), as certified by your local, regional, or national safety agency and telecommunication authority.

Physical description

External D-Channel Interface DCH or MSDL

The connection between the DDP2 card and the external DCH or MSDL is through a 26-pin female D type connector. The data signals conform to the electrical characteristics of the EIA standard RS-422.

Two control signals are used to communicate the D-channel link status to the DCH or MSDL. These are:

- Receiver Ready (RR), originating at the DDP2 card, to indicate to the DCH or MSDL that the D-channel link is operational.
- Transmitter Ready (TR), originating at the DCH or MSDL, to indicate to the DDP2 card that the DCH are ready to use the D-channel link.

Table 102: DCH/MSDL Receiver Ready control signals on page 254 indicates how the RR control signal operates with regard to the DDP2 status.

Table 102: DCH/MSDL Receiver Ready control signals

RR State	Condition
ON	• D-Channel data rate selected at 64 Kbps. • PRI2 loop is enabled. • PRI2 link is not in OOS or Local Alarm mode state. • PRI2 link is not transmitting a Remote Alarm pattern. • PRI2 link is not receiving a Remote Alarm Indication from a remote facility.
OFF	All other conditions

NT5D97 faceplate

Figure 73: NT5D97 faceplate on page 256 illustrates the faceplate layout for the NT5D97 DDP card. The faceplate contains an enable/disable switch; a DDCH status LED; 6 x 2 trunk port status LEDs; and six external connectors. Table 103: External connectors and LEDs on page 256 shows the name of each connector, its designation with respect to the faceplate and the name and description of the card it is connected to. Also shown are the names of the LEDs.

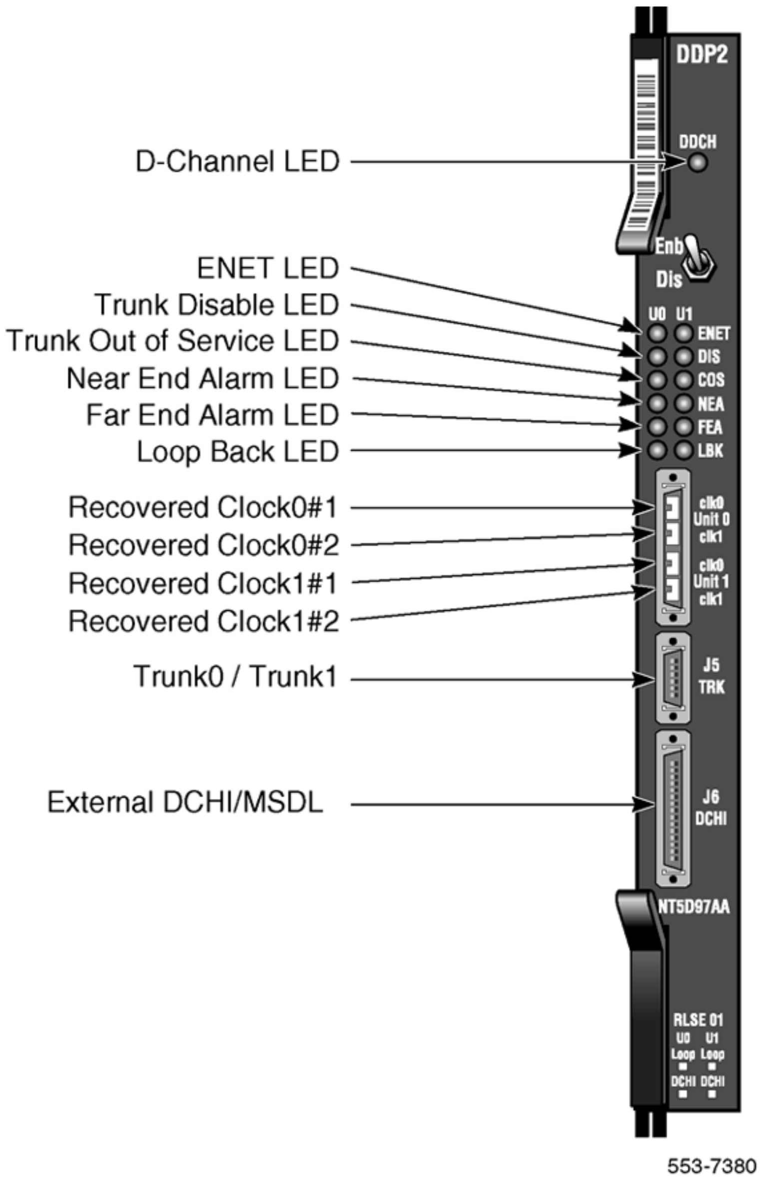


Figure 73: NT5D97 faceplate

Table 103: External connectors and LEDs

Function	Faceplate Designator	Type	Description
Switch	ENB/DIS	Plastic, ESD protected	Card Enable/disable switch
Connector s	Unit 0 Clock 0	RJ11 Connector	Connects reference clock 0 to Clock Controller card 0
	Unit 0 Clock 1	RJ11 Connector	Connects reference clock 0 to Clock Controller card 1

Function	Faceplate Designator	Type	Description
	Unit 1 Clock 0	RJ11 Connector	Connects reference clock 1 to Clock Controller card 0
	Unit 1 Clock 1	RJ11 Connector	Connects reference clock 1 to Clock Controller card 1
	J5 TRK	9 Pin Female D Connector	Two external E1 Trunk 0 and Trunk 1
	J6 DCH	26 Pin Female D Connector	Connects to external DCH or MSDL
LEDs	ENET	2 Red LEDs	ENET 0 or ENET 1 is disabled
	DIS	2 Red LEDs	Trunk 0 or Trunk 1 is disabled
	OOS	2 Yellow LEDs	Trunk is out of service
	NEA	2 Yellow LEDs	Local (Near End) Alarm
	FEA	2 Yellow LEDs	Far End Alarm
	LBK	2 Yellow LEDs	Loop Back test being performed on Trunk 0 or Trunk 1
	DCH	Bicolor Red/ Green LED	NTBK51AA/NTBK51CA status

The following sections provide a brief description of each element on the faceplate.

Enable/Disable Switch

This switch is used to disable the card prior to insertion or removal from the network shelf. While this switch is in disable position, the card does not respond to the system CPU.

ENET LEDs

Two red LEDs indicate if the "ENET0" and "ENET1" portions of the card are disabled. These LEDs are lit in the following cases:

- When the enable/disable switch is in disabled state (lit by hardware).
- After power-up, before the card is enabled.
- When the ENET port on the card is disabled by software.

Trunk Disable (DIS) LEDs

Two red LEDs indicate if the "trunk port 0" or "trunk port 1" portions of the card are disabled. These LEDs are lit in the following cases:

- Upon reception of the "disable loop" message from the software.
- After power-up.

OOS LEDs

Two yellow LEDs indicate if the "trunk port 0" and "trunk port 1" portions of the card are out of service.

NEA LEDs

Two yellow LEDs indicate if the near end detects absence of incoming signal or loss of synchronization in "trunk port 0" or "trunk port 1" respectively. The near-end alarm causes a far-end alarm signal to be transmitted to the far end.

FEA LEDs

Two yellow LEDs indicate if a far-end alarm is reported by the far end (usually in response to a near-end alarm condition at the far end) on "trunk port 0" or "trunk port 1".

LBK LEDs

Two yellow LEDs indicate if a remote loopback test is being performed on trunk port 0 or trunk port 1. The loopback indication is active when the digital trunk is in remote loopback mode. Normal call processing is inhibited during the remote loopback test.

DCH LED

When the dual colored LED is red, it indicates the on-board DDCH is present but disabled. When the dual colored LED is green, it indicates the on-board DDCH is present and enabled. If a DDCH is not configured on the DDP2 card, this lamp is not lit.

Unit 0 Clk Connectors

Two RJ11 connectors for connecting:

- Digital trunk unit 0 recovered clock to primary or secondary reference source on clock controller card 0.
- Digital trunk unit 0 recovered clock to primary or secondary reference source on clock controller card 1.

Unit 1 Clk Connectors

Two RJ11 connectors for connecting:

- Digital trunk unit 1 recovered clock to primary or secondary reference source on clock controller card 0.
- Digital trunk unit 1 recovered clock to primary or secondary reference source on clock controller card 1.

Connector J5 (TRK)

A 9 pin D-Type connector used to connect:

- Digital trunk unit 0 receive and transmit Tip / Ring pairs.
- Digital trunk unit 1 receive and transmit Tip / Ring pairs.

Connector J6 (DCH)

A 26 pin D-type connector is used to connect the DDP2 card to the external MSDL or D-channel handler.

Port definitions

The NT5D97 card is dual-card, it equips two ports; these ports can be defined in the following combinations:

Table 104: NT5D97AA/AB loops configuration

		Loop 0		
		not configured	DTI2	PRI2
Loop 1	not configured	V	V	V

		Loop 0		
	DTI2	V	V	V
	PRI2	V	V	V

Table 105: NT5D97AD loops configuration

		Loop 0			
		not configured	DTI2	PRI2	DDCS
Loop 1	not configured	V	V	V	V
	DTI2	V	V	V	V
	PRI2	V	V	V	X
	DDCS	V	V	X	V

Note:

Each loop DPNSS can be defined in Normal or Extended addressing mode.

System capacity and performance

Physical capacity

Each NT5D97 DDP2 card occupies one slot on the network shelf. Each card supports two digital trunk circuits and two network loops. The total number of DDP2 cards per system is limited by the number of network loops, physical capacity of the shelf, number of DTI2/PRI2 interfaces allowed by the software and the range of DCH addresses.

D-Channel capacity

The software configuration for the NTBK51AA/NTBK51CA DDCH is similar to the MSDL and only supports D-channel functionality.

The system has a total capacity of 16 addresses (Device Addresses or DNUM) that can be reserved for DCH card, MSDL card or DDCH card. One exception is DNUM 0 which is commonly assigned to the TTY terminal.

No two different D-Channel providers can share the same DNUM. Hence, the combined maximum number of DCH, MSDL and DDCH cards in the system is 16.

The DCH has one D-Channel unit, the DDCH has two D-Channel units, and the MSDL has a maximum of four units. Therefore, the total number of D-Channel is derived by the following formula:

Total_Num_DCH-Units = Num_DCHx1 + Num_DDCHx2 + Num_MSDLx4

Therefore, Total_Num_DCH-Units in any given system is between 0-63.

CPU capacity

Using a NT5D97 DDP2 card instead of DTI2/PRI2 cards does not increase the load on the CPU. The DDP2 replaces an ENET card and two DTI2/PRI2 cards. Emulating the ENET card and the overall CPU capacity is not impacted by using a DDP2 card instead of a DTI2/PRI2 card.

Power requirements

Table 106: NT5D97 DDP2 power requirements on page 261 lists the power requirements for the NT5D97 DDP2 card.

Table 106: NT5D97 DDP2 power requirements

Voltage	Source	Current	
		DDP2 (without NTBK51AA/NTBK51CA)	DDP2 (with NTBK51AA/ NTBK51CA)
+5 V	Backplane	3A	3.8A
+12 V	Backplane	25mA	75mA
-12 V	Backplane	25mA	75mA
Total Power (Maximum)		15.6W	20.8W

Cable requirements

This section lists the types of cable used and the lengths required for internal and external NT5D97 DDP2 connections.

Note:

No additional cabling is required for nB+D configurations. Multiple DDP2 cards and the D-channel are associated through software in LD 17.

DDP2 cable assemblies include:

- E1 carrier cables
  - NTCK45AA (A0407956)
  - NT8D7217 (A0617192)
  - NTCK78AA (A0618294)

- NTCK79AA (A0618296)

- DDP2 to DCH cables
  - NTCK46AA
  - NTCK46AB
  - NTCK46AC
  - NTCK46AD
- DDP2 to MSDL cables
  - NTCK80AA
  - NTCK80AB
  - NTCK80AC
  - NTCK80AD

A description of each type of DDP2 cable follows.

E1 carrier cables

NTCK45AA (A0407956)

The NTCK45AA (8 ft.) is an 120W cable for systems equipped with an I/O filter panel, connecting the TRK port (P1, D-type 9 pin male) on the DDP2 faceplate to the I/O filter (P2, P3 D-type 9 pin males).

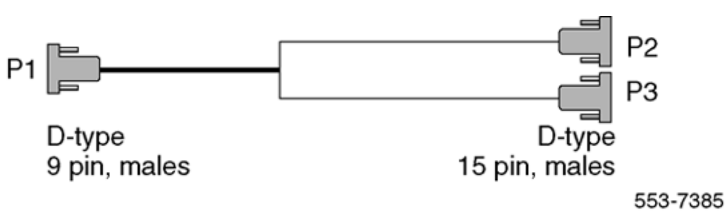


Figure 74: NTCK45AA

Table 107: NTCK45AA cable pins on page 262 which follows lists the pin attributes for the NTCK45AA cable.

Table 107: NTCK45AA cable pins

Cable	Name	Description	Color	DDP2 pins	I/O Pane pins
0	T-PRI0TX	Trunk 0 Transmit Tip	Black	P1-1	P2-6
0	R-PRI0TX	Trunk 0 Transmit Ring	Red	P2-2	P2-7
0	T-PRI0RX	Trunk 0 Receive Tip	Black	P1-3	P2-2
0	R-PRI0RX	Trunk 0 Receive Ring	White	P1-4	P2-3
0		GND Shield Wire	Bare	N/C	Case P2

Cable	Name	Description	Color	DDP2 pins	I/O Pane pins
0		GND Shield Wire	Bare	N/C	Case P2
0		Standard Wire (3")	Bare	Case P2	P2-5
0		Standard Wire (3")	Bare	Case P2	P2-9
1	T-PRI1TX	Trunk 1 Transmit Tip	Black	P1-5	P3-6
1	R-PRI1TX	Trunk 1 Transmit Ring	Red	P1-6	P3-7
1	T-PRI1RX	Trunk 1 Receive Tip	Black	P1-7	P3-2
1	R-PRI1RX	Trunk 1 Receive Ring	White	P1-8	P3-3
1		GND Shield Wire	Bare	N/C	Case P3
1		GND Shield Wire	Bare	N/C	Case P3
1		Standard Wire (3")	Bare	Case P3	P3-5
1		Standard Wire (3")	Bare	Case P3	P3-9

NT8D7217 (A0617192)

The NT8D7217 (50 ft.) is an 120W cable for systems equipped with an I/O filter panel, connecting the 9 pin I/O filter connector to the 9 pin NCTE connector.

Figure 75: NT8D7217

Table 108: NT8D7217 cable pins on page 263 which follows lists the pin attributes for the NT8D7217 cable.

Table 108: NT8D7217 cable pins

Cable	Name	Description	Color	DDP2 pins	I/O Panel pins
0	T-PRI0TX	Trunk 0 Transmit Tip	Black	P1-6	P2-6
0	R-PRI0TX	Trunk 0 Transmit Ring	White	P1-7	P2-7
0	T-PRI0RX	Trunk 0 Receive Tip	Black	P1-2	P2-2

Cable	Name	Description	Color	DDP2 pins	I/O Panel pins
0	R-PRI0RX	Trunk 0 Receive Ring	Red	P1-3	P2-3
0		GND Shield Wire	Bare	P1-5	N/C
0		GND Shield Wire	Bare	P1-9	N/C
1	T-PRI1TX	Trunk 1 Transmit Tip	Black	P1-6	P2-6
1	R-PRI1TX	Trunk 1 Transmit Ring	White	P1-7	P2-7
1	T-PRI1RX	Trunk 1 Receive Tip	Black	P1-2	P2-2
1	R-PRI1RX	Trunk 1 Receive Ring	Red	P1-3	P2-3
1		GND Shield Wire	Bare	P1-5	N/C
1		GND Shield Wire	Bare	P1-9	N/C

NTCK78AA (A0618294)

The NTCK78AA (50 ft.) is an 120W cable for connecting the TRK port on the DDP2 faceplate (P1, D-type 9 pin male) to the Main Distribution Frame (MDF) (P2, P3 D-type 15 pin males). The NTCK78AA is used for systems not equipped with an I/O filter panel.

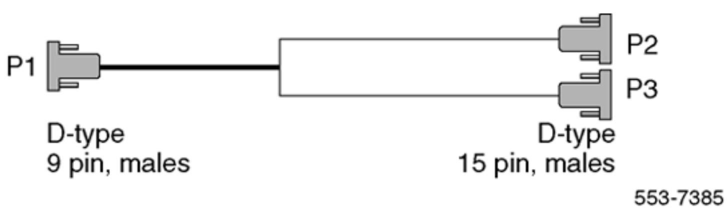


Figure 76: NTCK78AA

Table 109: NTCK78AA cable pins on page 264 lists the pin attributes for the NTCK78AA cable.

Table 109: NTCK78AA cable pins

Cable	Name	Description	Color	DDP2 pins	NCTE pins
0	T-PRI0TX	Trunk 0 Transmit Tip	Black	P1-1	P2-1
0	R-PRI0TX	Trunk 0 Transmit Ring	Red	P1-2	P2-9
0	T-PRI0RX	Trunk 0 Receive Tip	Black	P1-3	P2-3
0	R-PRI0RX	Trunk 0 Receive Ring	White	P1-4	P2-11
0		GND Shield Wire	Bare	P1 Case	P2-2

Cable	Name	Description	Color	DDP2 pins	NCTE pins
0		GND Shield Wire	Bare	P1 Case	P2-4
1	T-PRI1TX	Trunk 1 Transmit Tip	Black	P1-5	P3-1
1	R-PRI1TX	Trunk 1 Transmit Ring	Red	P1-6	P3-9
1	T-PRI1RX	Trunk 1 Receive Tip	Black	P1-7	P3-3
1	R-PRI1RX	Trunk 1 Receive Ring	White	P1-8	P3-11
1		GND Shield Wire	Bare	P1 Case	P3-2
1		GND Shield Wire	Bare	P1 Case	P3-4

NTCK79AA (A0618296)

The NTCK79AA (40 ft) is a 75W coaxial cable for connecting the TRK port on the DDP2 faceplate (P1, D-type 9 pin male) to the Line Terminating Unit (LTU) (P2, P3, P4, P5 BNC males).

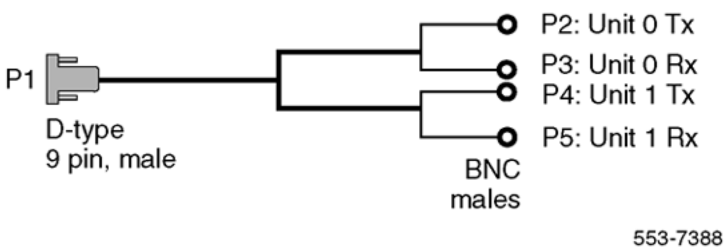


Figure 77: NTCK79AA

Table 110: NTCK79AA cable pins on page 265 lists the pin attributes for the NTCK79AA cable.

Table 110: NTCK79AA cable pins

Cable	Name	Description	Color	DDP2 pins	NCTE pins
0	T-PRI0TX	Trunk 0 Transmit Tip	Red	P1-1	P2 inner conductor
0	R-PRI0TX	Trunk 0 Transmit Ring	Red	P1-2	P2 shield
0	T-PRI0RX	Trunk 0 Receive Tip	Green	P1-3	P3 inner conductor
0	R-PRI0RX	Trunk 0 Receive Ring	Green	P1-4	P3 shield
1	T-PRI1TX	Trunk 1 Transmit Tip	Red	P1-5	P4 inner conductor

Cable	Name	Description	Color	DDP2 pins	NCTE pins
1	R-PRI1TX	Trunk 1 Transmit Ring	Red	P1-6	P4 shield
1	T-PRI1RX	Trunk 1 Transmit Tip	Green	P1-7	P5 inner conductor
1	R-PRI1RX	Trunk 1 Receive Ring	Green	P1-8	P5 shield
1		Outer metallized PVC shield	Bare	N/C	P1 Case
1		3 stranded wire	Bare	N/C	P1 Case

Reference clock cables

The NTCG03AA (14 ft), NTCG03AB (2.8 ft), NTCG03AC (4.0 ft), or NTCG03AD (7 ft), is a DDP2 card to Clock Controller cable, connecting each of the CLK0 or CLK1 ports on the DDP2 faceplate to the primary or secondary source ports on Clock Controller card 0 or 1.

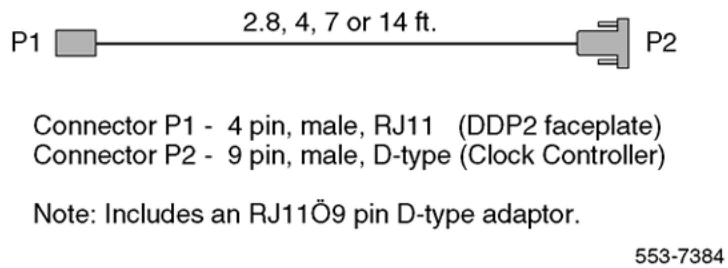


Figure 78: NTCG03AA/AB/AC/AD

MSDL/DCH cables

External DCH cable

The NTCK46 cable connects the DDP2 card to the NT5K75AA D-Channel Handler card. The cable is available in four different sizes:

- NTCK46AA (6 ft.) - DDP2 to DCH cable
- NTCK46AB (18 ft.) - DDP2 to DCH cable
- NTCK46AC (35 ft.) - DDP2 to DCH cable
- NTCK46AD (50 ft.) - DDP2 to DCH cable

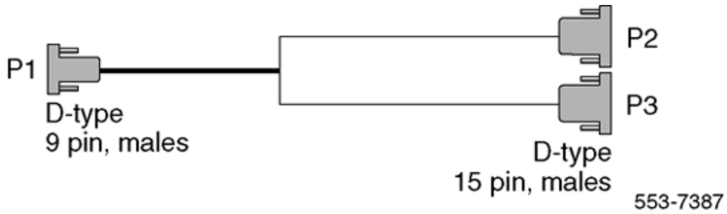


Figure 79: NTCK46AA/AB/AC/AD

External MSDL cable

The NTCK80 cable connects the DDP2 card to the NT6D80 MSDL card. The cable is available in four different sizes:

- NTCK80AA (6 ft) - DDP2 to MSDL cable
- NTCK80AB (18 ft) - DDP2 to MSDL cable
- NTCK80AC (35 ft) - DDP2 to MSDL cable
- NTCK80AD (50 ft) - DDP2 to MSDL cable

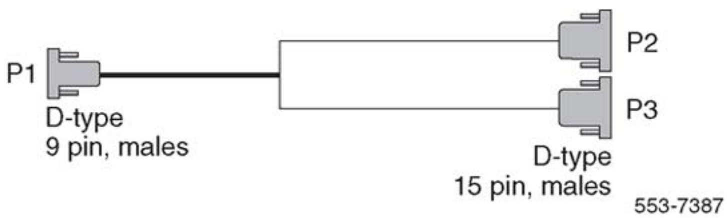


Figure 80: NTCK80AA/AB/AC/AD

Cable diagrams

Figure 81: DDP2 cable for systems with an I/O panel on page 268 and Figure 82: DDP2 cable for systems without an I/O panel on page 269 provide examples of typical cabling configurations for the DDP2.

Figure 81: DDP2 cable for systems with an I/O panel on page 268 shows a typical DDP2 cabling for a system with an I/O panel, with the connection between the I/O panel and a Network Channel Terminating Equipment (NCTE).

Figure 82: DDP2 cable for systems without an I/O panel on page 269 shows cabling for a system without an I/O panel. Here, the DDP2 faceplate is cabled directly to the NCTE.

Note:

Because of several clock cabling options exists, none is represented in the diagrams. Refer to Clock configurations on page 282 for a description on each available option.

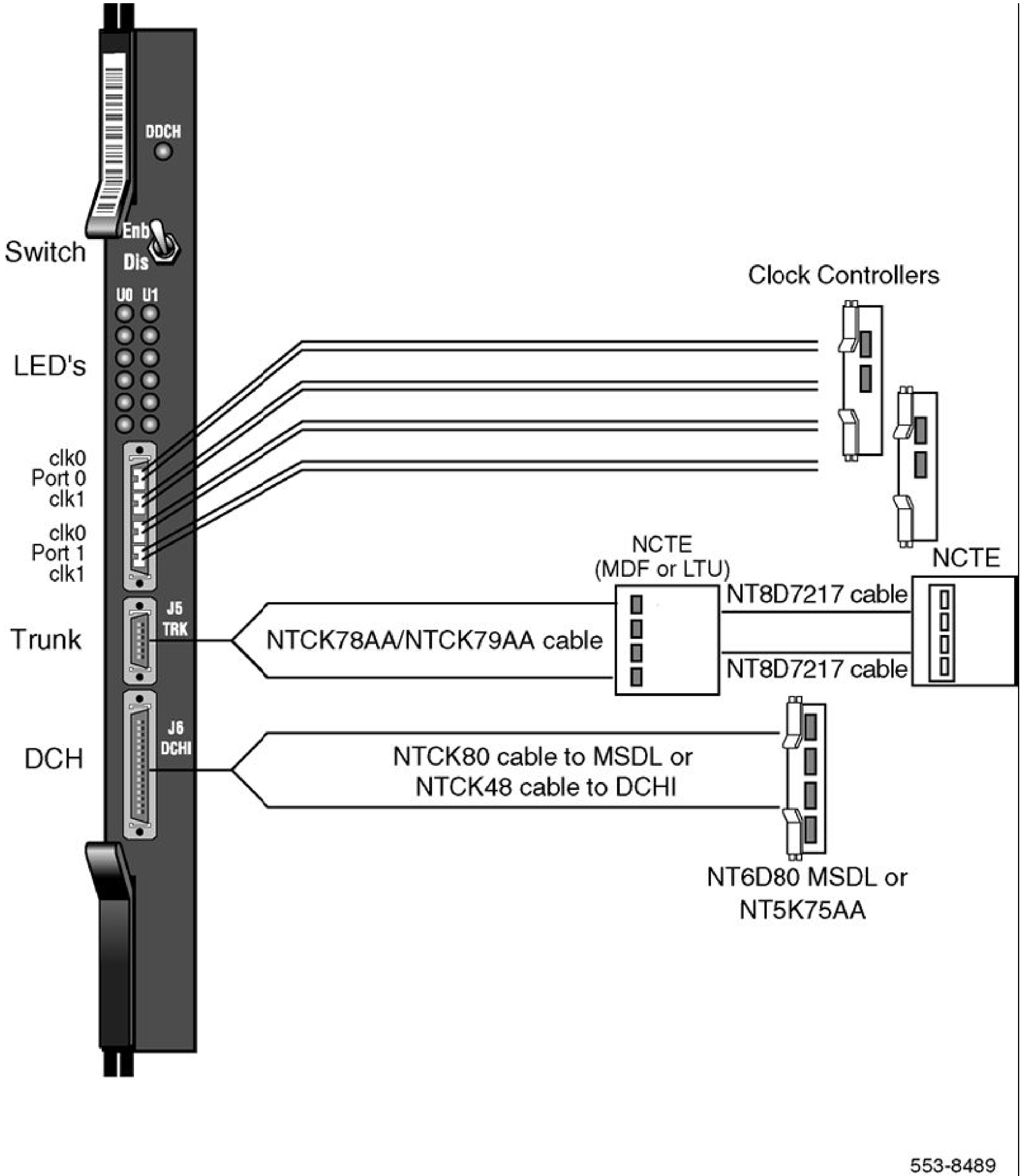


Figure 81: DDP2 cable for systems with an I/O panel

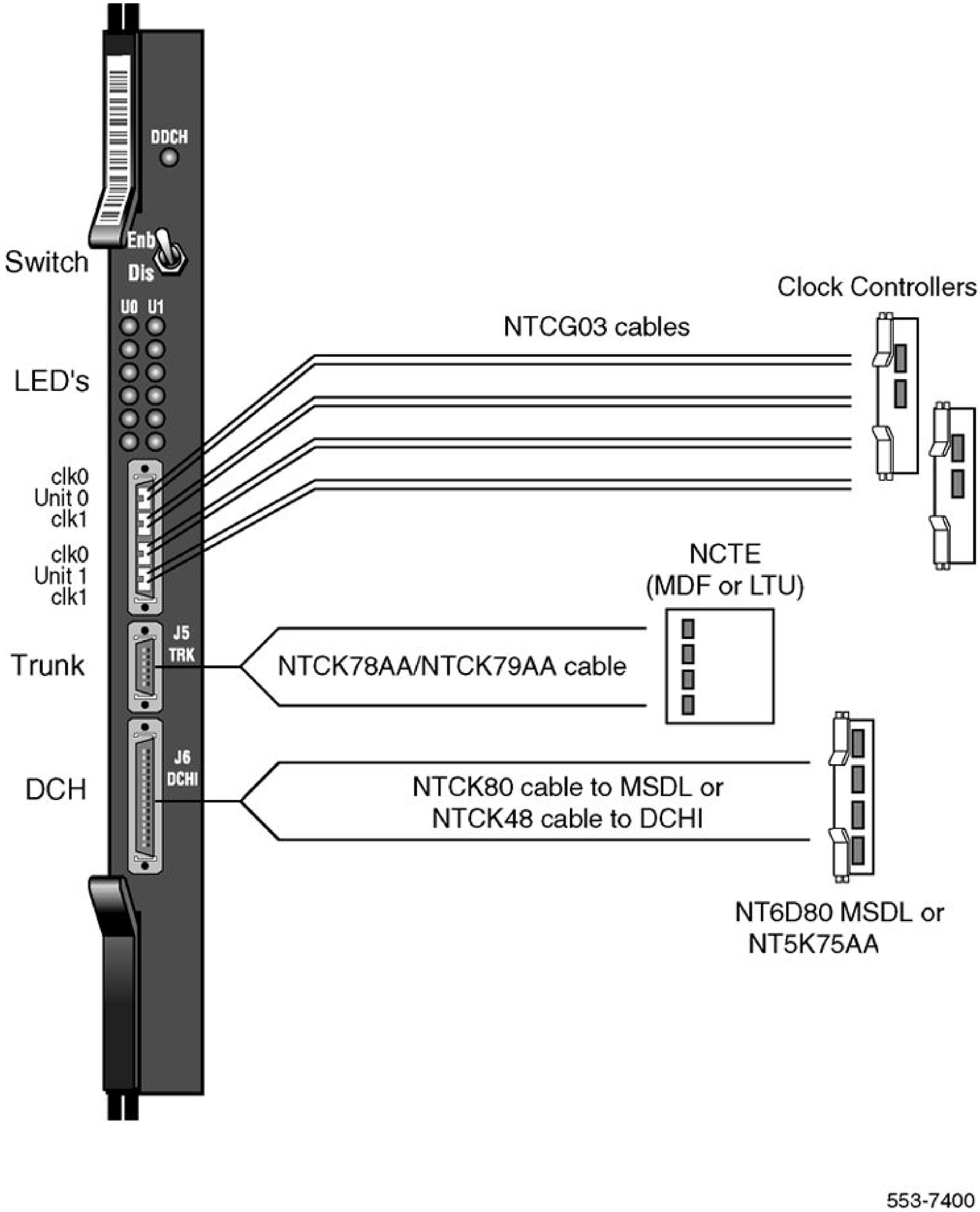


Figure 82: DDP2 cable for systems without an I/O panel

Functional description

NT5D97 circuit card locations

Each NT5D97 card requires one slot on a shelf. NT5D97 cards can be placed in any card slot in the network bus.

Note in all cases - If an NT8D72BA card is being replaced by a DDP2 card, the D-channel Handler can be reconnected to the DDP2 card, or removed if an onboard NTBK51DDCH card is used. Also, DIP Switches in the NT5D97 must be set properly before insertion. Refer to NT5D97AA/AB DIP switch settings on page 270 for DIP switch setting).

NT5D97AA/AB DIP switch settings

The NT5D97 DDP2 card is equipped with 6x2 sets of DIP switches for trunk parameters settings for port0 and port1 respectively. Additionally, the DDP2 card is equipped with one set of four DIP switches for the Ring Ground setting. The NT5D97AA/AB has one set of eight DIP switches and NT5D97AD has two sets of ten DIP switches for the D-channel Handler parameters setting.

The DIP switches are used for the setting of default values of certain parameters. Firmware reads the general purpose switches, which sets the default values accordingly.

Table 111: DIP switch settings for NT5D97AA/AB

	Card	Trunks 0 and 1	Port 0	Port 1	Trunk 0	Trunk 1
ENB/DSB mounted on the face plate	S1					
Ring Ground		S2				
MSDL			S3			
TX Mode					S4	S10
LBO Setting					S5	S11
					S6	S12
					S7	S13
Receiver Interface					S8	S14
General Purpose					S9	S15

The following parameters are set by DIP switches. The boldface font shows the factory set-up.

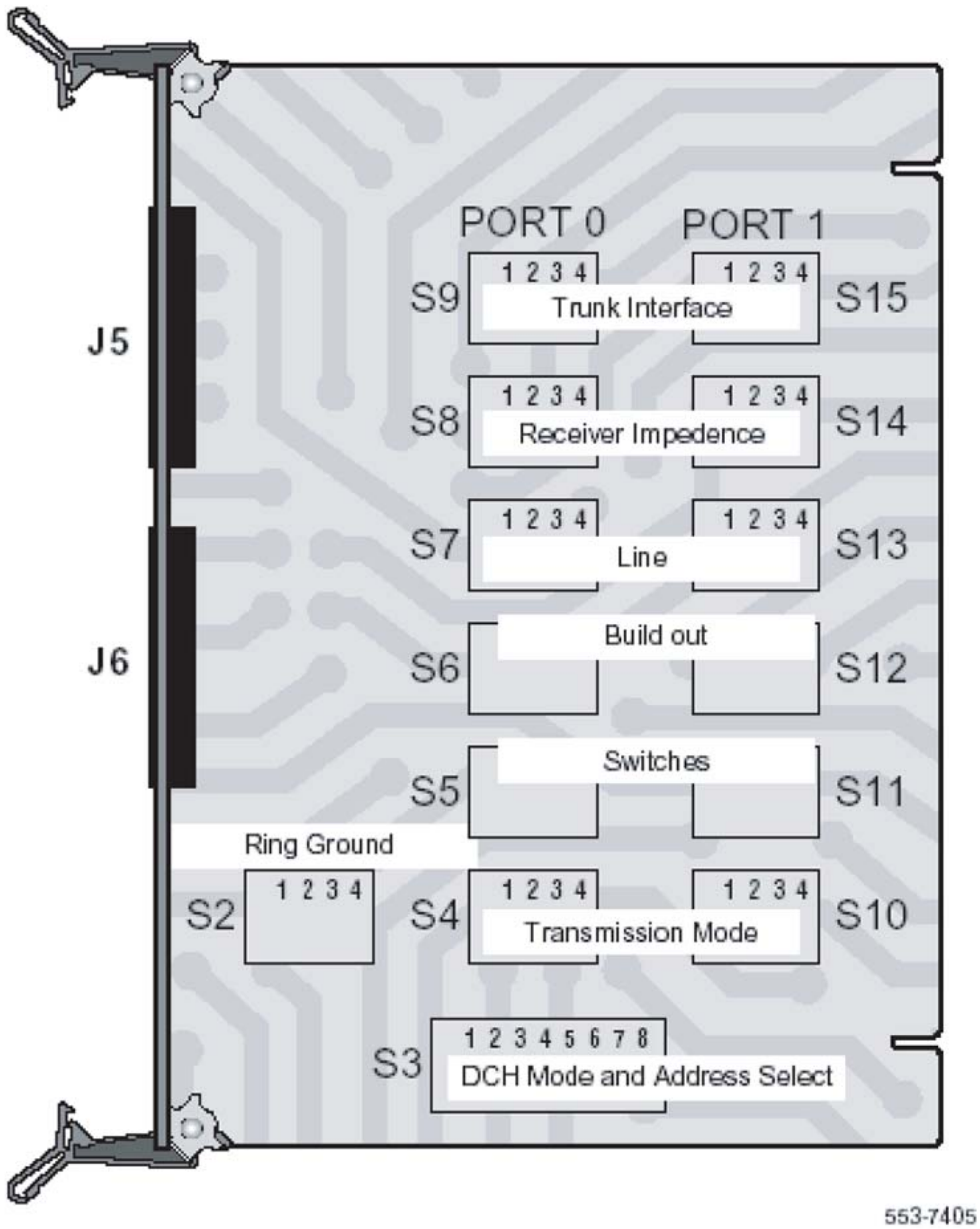


Figure 83: Dip switches for NT5D97AA/AB

Trunk interface switches for NT5D97AA/AB

Impedance level and unit mode

The S9/S15 switch selects the impedance level and loop operation mode on DEI2 OR PRI2. Refer to Table 112: Impedance level and loop mode switch settings on page 272.

Table 112: Impedance level and loop mode switch settings

Switch	Description	S9/S15 Switch Setting
1	Impedance level	OFF - 120 ohm ON - 75 ohm
2	Spare	X
3	Spare	X
4	Unit mode	OFF - Loop operates in the DTI2 mode ON - Loop operates in the PRI2 mode

Transmission mode

A per-trunk switch (S4/S10) provides selection of the digital trunk interface type. Refer to Table 113: Impedance level and loop mode switch settings on page 272.

Table 113: Impedance level and loop mode switch settings

Description	S4/S10 switch settings
E1	OFF
Not used	

Line build out

A per-trunk set of three switches (S5/S11, S6/S12 and S7/S13) provides the dB value for the line build out. Refer to Table 114: Trunk interface line build out switch settings on page 273.

Note:

Do not change this setup.

Table 114: Trunk interface line build out switch settings

	Switch setting		
Description	S5/S11	S6/S12	S7/S13
0dB	OFF	OFF	OFF

Receiver impedance

A per-trunk set of four DIP switches (S8/S14 provides selection between 75 or 120 ohm values. Refer to Table 115: Trunk interface impedance switch settings on page 273.

Table 115: Trunk interface impedance switch settings

Description	S8/S14 switch setting			
75 ohm	OFF	OFF	ON	OFF
120 ohm	OFF	OFF	OFF	ON

Ring ground switches for NT5D97AA/AB

A set of four Dip switches (S2) selects which Ring lines are connected to ground. Refer to Table 116: Ring ground switch settings on page 273.

Table 116: Ring ground switch settings

Switch	Description	S2 switch settingS
1	Trunk 0 Transit	OFF-Ring line is not grounded ON- Ring line is grounded
2	Trunk 0 Receive	OFF-Ring line is not grounded ON- Ring line is grounded
3	Trunk 1 Transmit	OFF-Ring line is not grounded ON- Ring line is grounded
4	Trunk 1 Receive	OFF-Ring line is not grounded ON- Ring line is grounded

DCH Address select switch for NTBK51AA/NTBK51CA daughterboard for NT5D97AA/AB

In case of an on-board NTBK51AA/NTBK51CA D-channel daughterboard, set of four switches (S3) provide the daughterboard address. Refer to Table 124: Trunk 1 switches on page 277.

Note:

Switch 8 of S3 (S3-8) does not require a switch setting to select between the on-board NTBK51AA/NTBK51CA D-channel daughterboard and an external DCHI/MSDL. The NT5D97 detects when the on-board NTBK51AA/NTBK51CA D-channel daughterboard is used.

Table 117: DCH mode and address switch settings

Switch	Description	S3 switch setting
1-4	D-channel daughterboard address	See Table 118: NTBK51AA/NTBK51CA daughterboard address select switch settings on page 274
5-8	For future use	OFF

Table 118: NTBK51AA/NTBK51CA daughterboard address select switch settings on page 274 shows the possible selection of the NTBK51AA/NTBK51CA D-channel.

Table 118: NTBK51AA/NTBK51CA daughterboard address select switch settings

Device Address	Switch Setting			
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Device Address	Switch Setting
Note: The system contains a maximum number of 16 DCHI, MSDL, and DDCH devices. The Device Addresses are equivalent to the MSDL DNUM designations. **Note:** Device address 0 is commonly assigned to the System TTYD Monitor.	

NT5D97AD DIP switch settings

The NT5D97 DDP2 card is equipped with 6x2 sets of DIP switches for trunk parameters settings for port0 and port1 respectively. Additionally, the DDP2 card is equipped with one set of four DIP switches for the Ring Ground setting. The NT5D97AA/AB has one set of eight DIP switches and NT5D97AD has two sets of ten DIP switches for the D-channel Handler parameters setting.

The DIP switches are used for the setting of default values of certain parameters. Firmware reads the general purpose switches, which sets the default values accordingly.

Table 119: DIP switch settings for NT5D97AD

	Card	Trunks 0 and 1	Port 0	Port 1	Trunk 0	Trunk 1
ENB/DSB mounted on the face plate	S1					
Ring Ground		S16				
DPNSS			S8	S9		
MSDL			S9			
TX Mode					S2	S10
LBO Setting					S3	S13
					S4	S14
					S5	S15
Receiver Interface					S6	S11
General Purpose					S12	S7

Refer to DIP switch locations in Figure 84: Dip switches locations for NT5D97AD on page 276.

The following parameters are set by DIP switches. The boldface font shows the factory set-up.

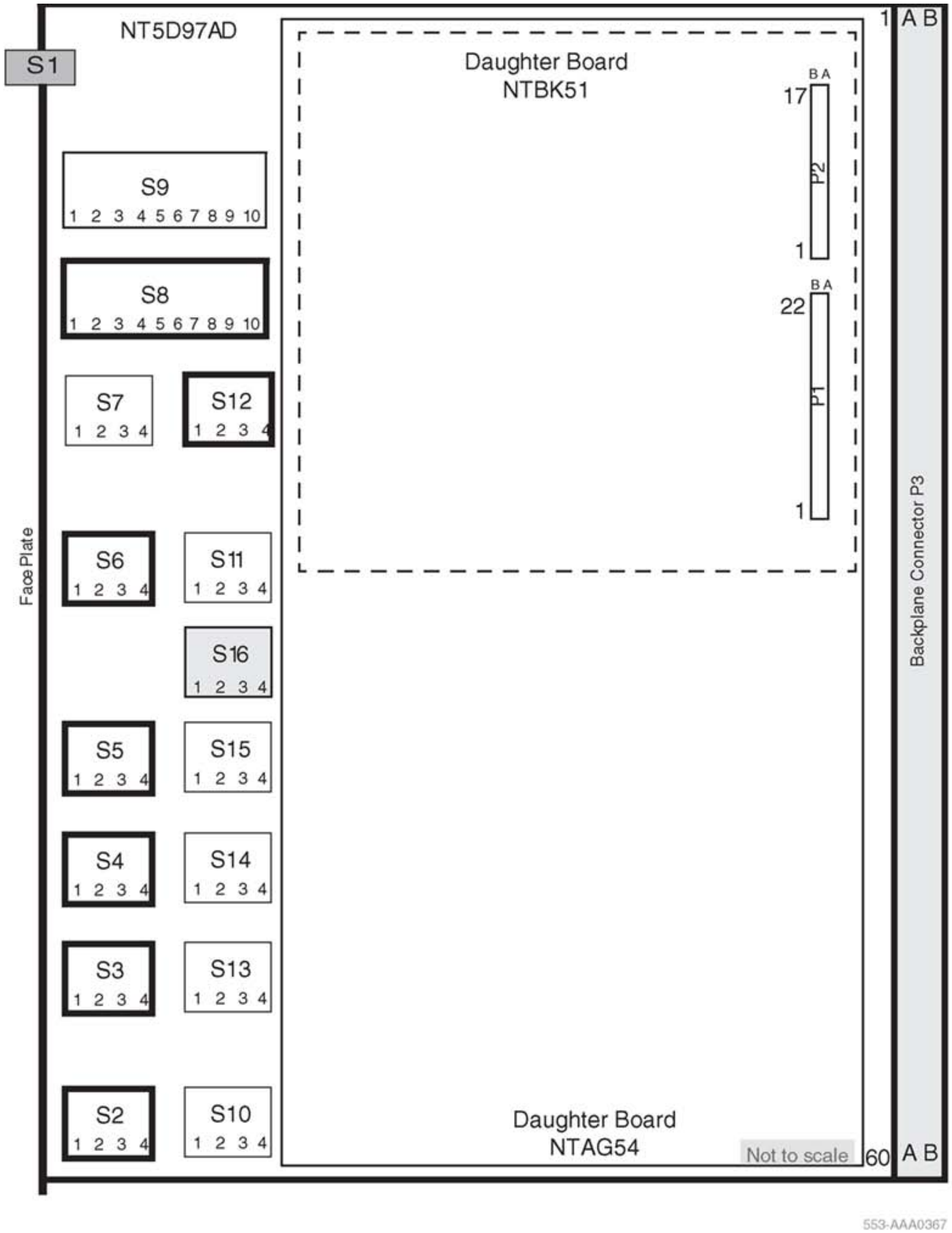


Figure 84: Dip switches locations for NT5D97AD

Trunk interface switches for NT5D97AD

Trunk 0 switches

Switch S12 gives the MPU information about its environment.

Table 120: General purpose switches for NT5D97AD

Switch	Description	S9/S15 Switch Setting
S12_1	Impedance level	OFF - 120 ohm ON - 75 ohm
S12_2	Spare	X
S12_3	Spare	X
S12_4	Unit mode	OFF - Unit operates in the DTI2 mode ON - Unit operates in the PRI2 mode

Switch S2 selects the Transmission mode.

Table 121: TX mode switches for NT5D97AD

TX mode	S2
E1	OFF
Not used	ON

Switch S3, S4, and S5 select LBO function.

Table 122: LBO switches for NT5D97AD

LBO setting	S3	S4	S5
0dB	OFF	OFF	OFF
7.5dB	ON	ON	OFF
15dB	ON	OFF	ON

Switch S6 selects the Receiver interface.

Table 123: Receiver interface switches for NT5D97AD

Impedance	S6-1	S6-2	S6-3	S6-4
75 ohm	OFF	OFF	ON	OFF
120 ohm	OFF	OFF	OFF	ON

Trunk 1 switches for NT5D97AD

Table 124: Trunk 1 switches

Switch	Function
S7	General Purpose...See Table 120: General purpose switches for NT5D97AD on page 277

Switch	Function
S10	TX Mode...See Table 121: TX mode switches for NT5D97AD on page 277
S13, S14 & S15	LBO...See Table 122: LBO switches for NT5D97AD on page 277
S11	RX Impedance...See Table 123: Receiver interface switches for NT5D97AD on page 277

Ring ground switches for NT5D97AD

Switch S16 selects which ring lines connect to ground. When set to ON, the ring line is grounded.

Table 125: Ring ground switch for NT5D97AD

Switch	Line
S16_1	Trunk 0 Transmit
S16_2	Trunk 0 Receive
S16_3	Trunk 1 Transmit
S16_4	Trunk 1 Receive

DCH Address select switch for NTBK51AA/NTBK51CA daughterboard for NT5D97AD

Switch S9 selects the NTBK51AA/NTBK51CA DCH daughter card address.

Switch S8 is not used when the NTBK51AA/NTBK51CA daughter card is used. S8_1-10 can be set to OFF position.

Table 126: NTBK51AA/NTBK51CA DCH switches for NT5D97AD

Switch number	Function
S9_1-4	DCH daughter card address
S9_5-8	Set to OFF
S9_9	Set to ON (NTBK51AA/NTBK51CA Mode)
S9_10	Set to ON (NTBK51AA/NTBK51CA Mode)

MSDL external card

Table 127: Switch settings for MSDL external card

Switch number	Function
S9_1-10	X
S8_1-10	X

Use Table 128: Switch setting for MSDL external card on page 279 to set the card address.

Table 128: Switch setting for MSDL external card

	Switch Setting			
DNUM (LD 17)	1	2	3	4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	ON	ON	ON	ON

Architecture

Clock operation

There are two types of clock operation - tracking mode and free-run mode.

Tracking mode

In tracking mode, the DDP2 loop supplies an external clock reference to a clock controller. Two DDP2 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 85: Clock Controller primary and secondary tracking on page 281, a system with dual CPUs can use two clock controllers (CC-0 and CC-1). One clock controller acts as a backup to the other. The clock controllers should be completely locked to the reference clock.

Free run (non-tracking) mode

The clock synchronization of the can operate in free-run mode if:

- no loop is defined as the primary or secondary clock reference,
- the primary and secondary references are disabled, or
- the primary and secondary references are in local (near end) alarm

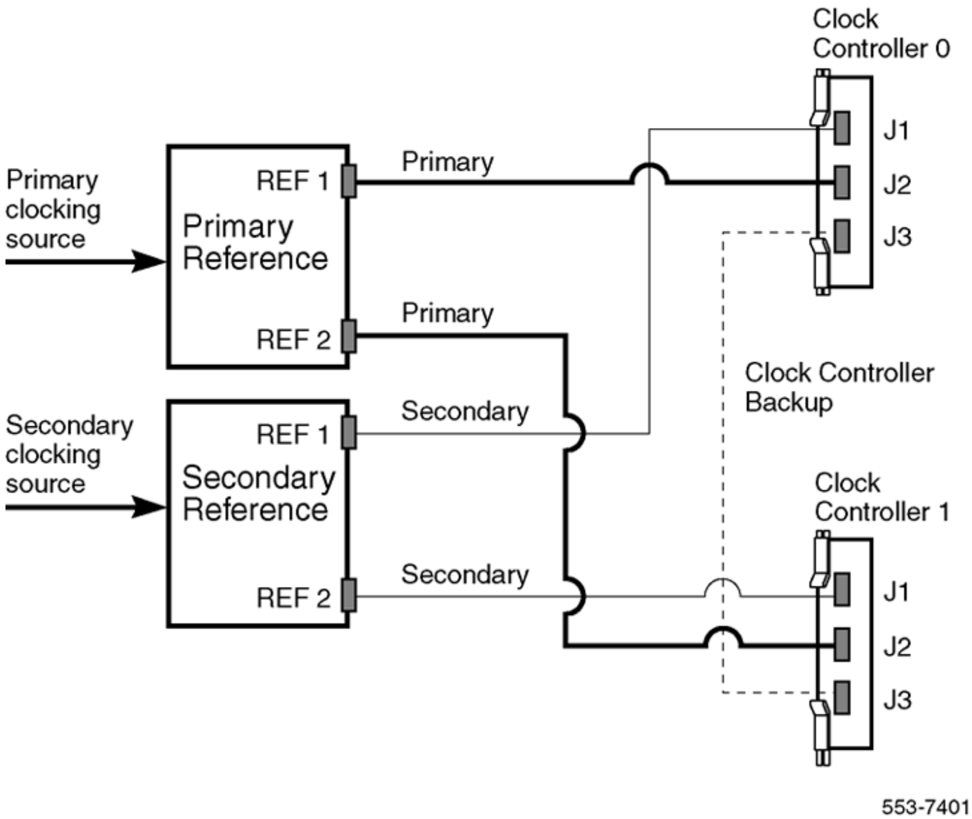


Figure 85: Clock Controller primary and secondary tracking

Reference clock errors

Avaya Communication Server 1000 software checks at intervals of 1 to 15 minutes to see if a clock controller or reference-clock error has occurred. (The interval of this check can be configured in LD 73).

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 clock at the far end. If the clock controller detects a reference-clock error, the reference clocks are switched.

Automatic clock recovery

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

A DDP2 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:

- 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.
- 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 clock check indicates the switch is in free-run mode:
  - Tracking is restored to the primary reference clock if defined.
  - If the primary reference is disabled or in local alarm, tracking is restored to the secondary reference clock if defined.

Note:

If the system is put into free-run mode by the craftsperson, it resumes tracking on a reference clock unless the clock-switching option is disabled (LD 60, command MREF), or the reference clock is "undefined" in the database.

Automatic clock switching

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

- If software is unable to track on the assigned primary reference clock, it switches to the secondary reference clock and sends appropriate DTC maintenance messages.
- If software is unable to track on the assigned secondary reference clock, it switches to free run.

Clock configurations

Clock Controllers can be used in a single or a dual CPU system.

A single CPU system has one Clock Controller card. This card can receive reference clocks from two sources referred to as the primary and secondary sources. These two sources can originate from a PRI2, DTI2, etc. PRI2 cards such as the NT8D72BA are capable of supplying two references of the same clock source. These are known as Ref1 (available at J1) and Ref2 (available at J2) on the NT8D72BA.

The NT5D97 card is capable of supplying two references from each clock source, for example, four references in total. NT5D97 can supply Clk0 and Clk1 from Unit 0 and Clk0 and Clk1 from Unit 1. Either Unit 0 or Unit 1 can originate primary source, as shown in Figure 86: Clock

Controller - Option 1 on page 284 through Figure 89: Clock Controller - Option 4 on page 287.

There is one Clock Controller cable required for the DDP2 card, which is available in four sizes; this is the NTCG03AA/AB/AC/AD. Refer to Reference clock cables on page 266 for more information.

Table 129: Clock Controller options - summary on page 283 summarizes the clocking options. Table 130: Clock Controller options - description on page 283 explains the options in more detail.

Table 129: Clock Controller options - summary

CC Option	CPU Type	Notes
Option 1	Single	Ref from P0 on Clk0 Ref from P1 on Clk0
Option 2	Dual	Ref from P0 on Clk0 Ref from P0 on Clk1
Option 3	Dual	Ref from P1 on Clk0 Ref from P1 on Clk1
Option 4	Dual	Ref from P0 on Clk0 Ref from P0 on Clk1 Ref from P1 on Clk0 Ref from P1 on Clk1

Table 130: Clock Controller options - description

Clock Option	Notes
Option 1	This option provides a single CPU system with 2 clock sources derived from the 2 ports of the DDP2. Connector Clk0 provides a clock source from Unit 0. Connector Clk0 provides a clock source from Unit 1. Refer to Figure 86: Clock Controller - Option 1 on page 284.
Option 2	This option provides a Dual CPU system with 2 references of a clock source derived from port 0 of the DDP2. Connector Clk0 provides a Ref 1 clock source from Unit 0. Connector Clk1 provides a Ref 2 clock source from Unit 0. Refer to Figure 87: Clock Controller - Option 2 on page 285.
Option 3	This option provides a Dual CPU system with 2 references of a clock source derived from port 1 of the DDP2. Connector Clk0 provides a Ref 1 clock source from Unit 1. Connector Clk1 provides a Ref 2 clock source from Unit 1. Refer to Figure 88: Clock Controller - Option 3 on page 286.
Option 4	This option provides a Dual CPU system with 2 references from each clock source derived from the DDP2.

Clock Option	Notes
	Connector Clk0 provides a Ref 1 clock source from Unit 0. Connector Clk1 provides a Ref 2 clock source from Unit 0. Connector Clk0 provides a Ref 1 clock source from Unit 1. Connector Clk1 provides a Ref 2 clock source from Unit 1. Refer to Figure 89: Clock Controller - Option 4 on page 287.

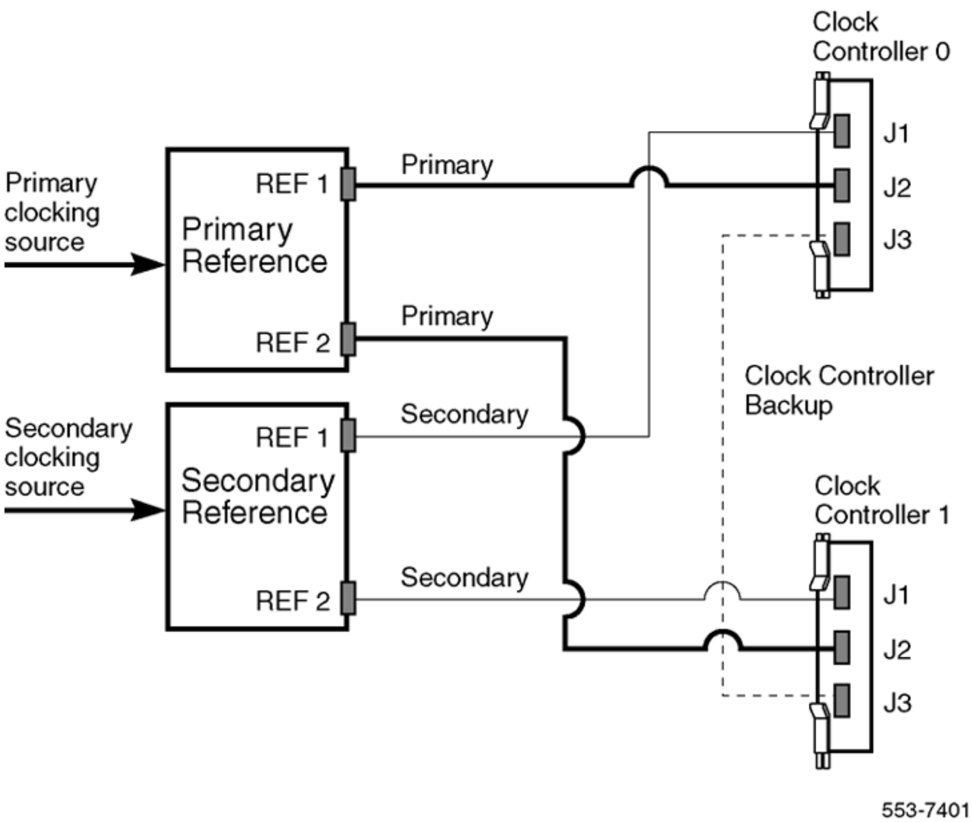


Figure 86: Clock Controller - Option 1

Operation

The following discussion describes possible scenarios when replacing a digital trunk NT8D72BA PRI2 card or QPC536E DTI2 card configuration with a NT5D97 DDP2 card configuration.

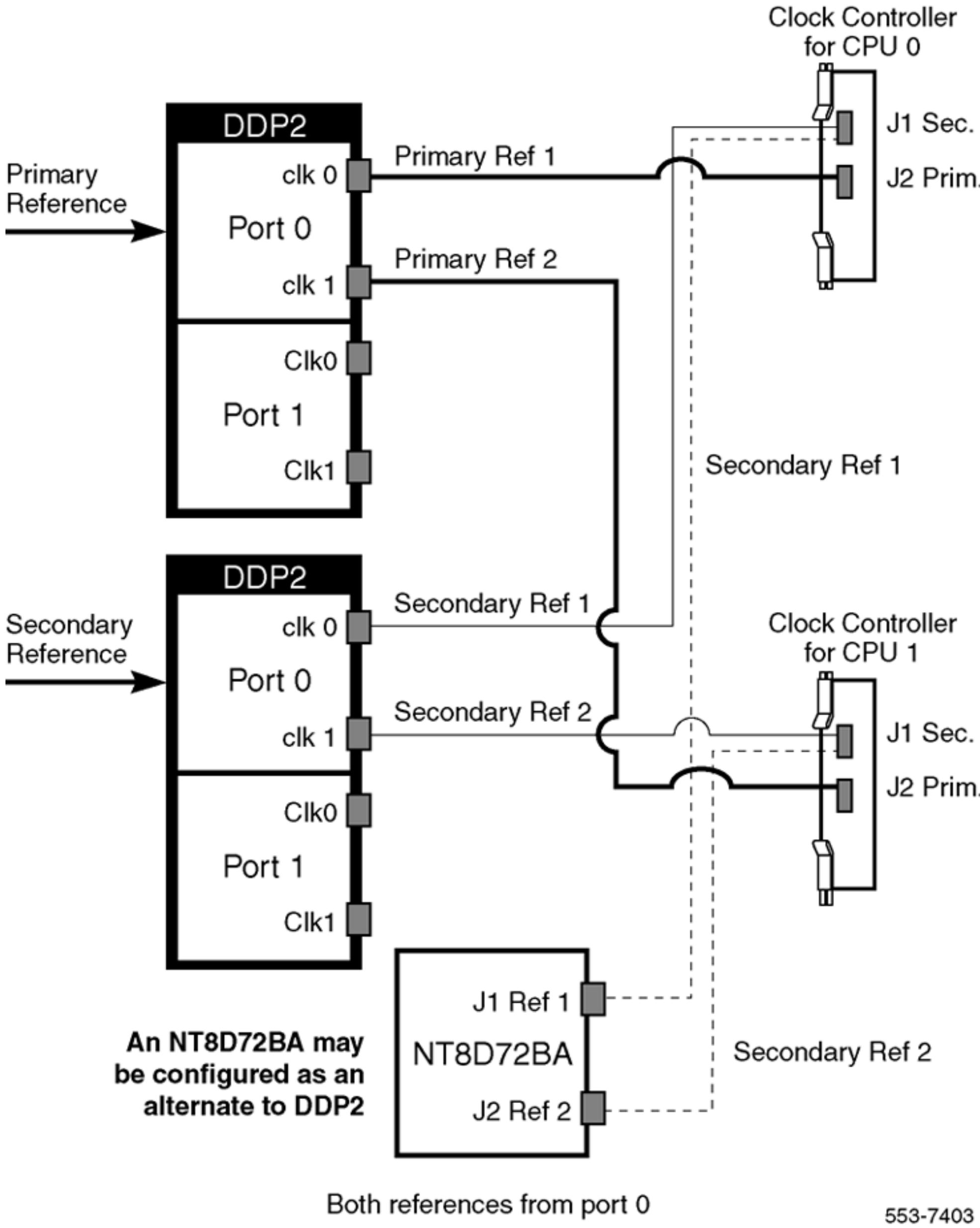


Figure 87: Clock Controller - Option 2

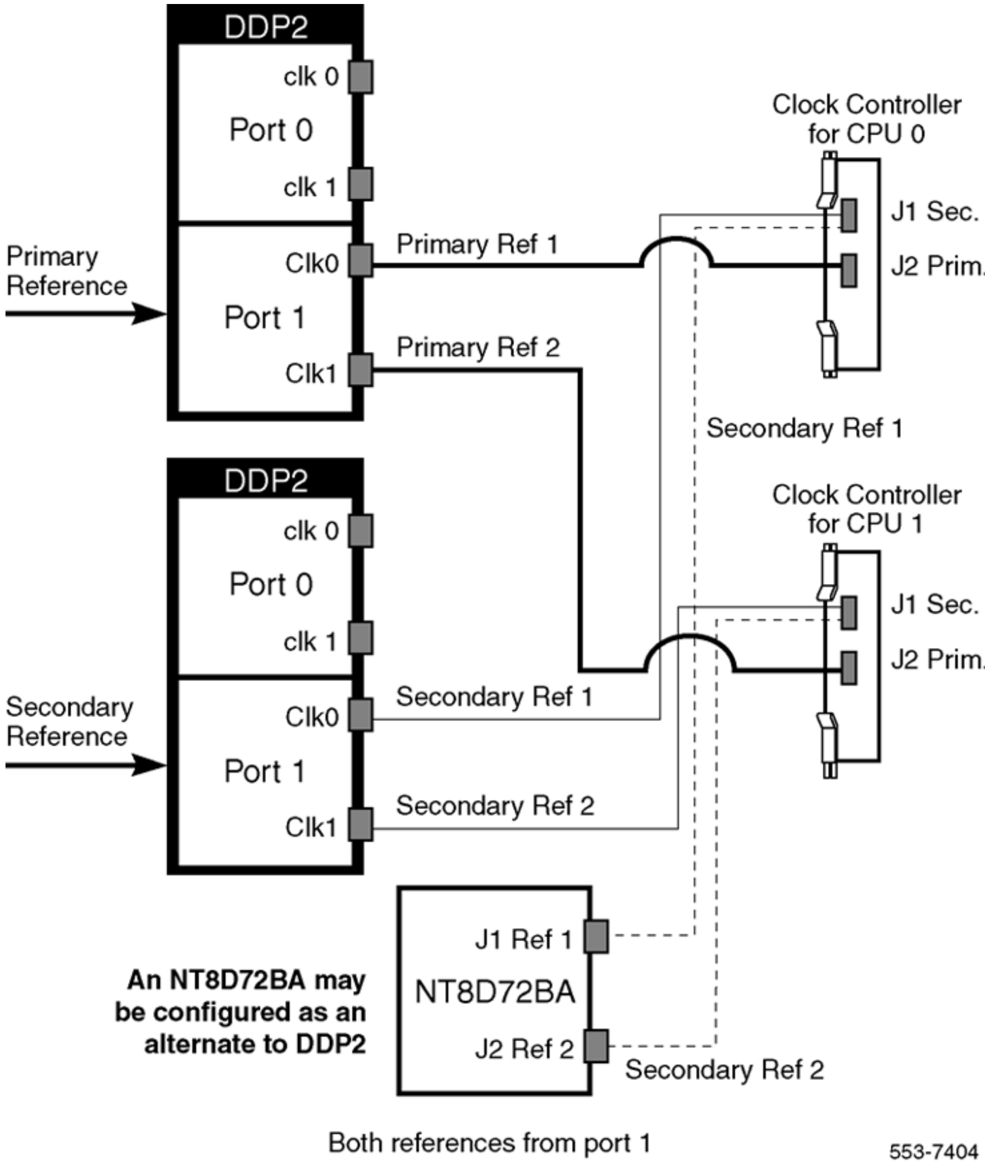


Figure 88: Clock Controller - Option 3

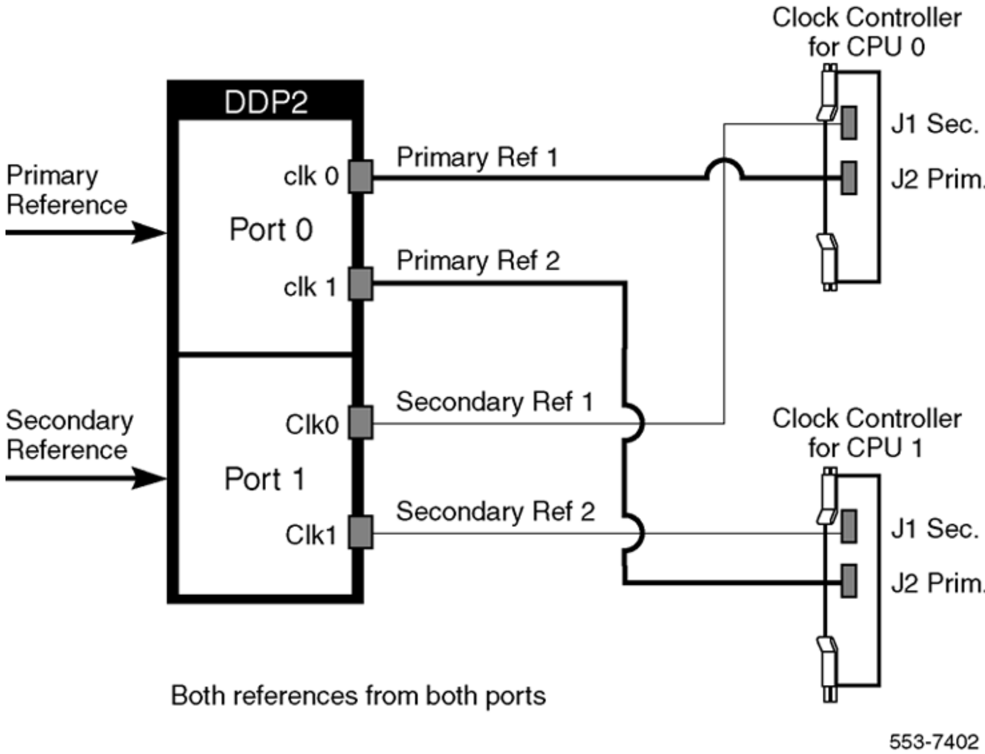


Figure 89: Clock Controller - Option 4

Case 1 — The two ports of a QPC414 network card are connected to two digital trunks.

In this case, the QPC414 and the two digital trunks are replaced by a single DDP2 card, which is plugged into the network shelf in the QPC414 slot.

Case 2 — One port of the QPC414 card is connected to a digital trunk, and the second is connected to a peripheral buffer. Both cards are in network loop location.

In this case, the QPC414 should not be removed. The digital trunk is removed and the DDP2 card is plugged into one of the two empty slots.

Case 3 — The network shelf is full, one port of a QPC414 network card is connected to a digital trunk, and the second is connected to a peripheral buffer. This arrangement is repeated for another QPC414. The digital trunks are located in a shelf that provides only power.

In this case, the peripheral buffers must be reassigned, so that each pair of buffers uses both ports of the same QPC414 card. The other QPC414 card can then be replaced by the NT5D97 DDP2.

⚠ Caution:

The static discharge bracelet located inside the cabinet must be worn before handling circuit cards. Failure to wear the bracelet can result in damage to the circuit cards.

Installing the NT5D97

1. Determine the cabinet and shelf location where the NT5D97 is to be installed. The NT5D97 can be installed in any card slot in the Network bus.
2. Unpack and inspect the NT5D97 and cables.
3. If a DDCH is installed, refer to the section Removing the NT5D97 on page 288.
4. Set the option switches on the NT5D97 card before installation. Refer to NT5D97AA/AB DIP switch settings on page 270.

   The ENB/DIS (enable/disable faceplate switch) must be OFF (DIS) when installing the NT5D97, otherwise a system initialize can occur. The ENB/DIS on the NT5D97 corresponds to the faceplate switch on the QPC414 Network card.
5. Install NT5D97 card in the assigned shelf and slot.
6. Set the ENB/DIS faceplate switch to ON.

   If the DDCH is installed, the DDCH LED should flash three times.
7. If required, install the I/O adapters in the I/O panel.
8. Run and connect the NT5D97 cables

   Caution:

   Clock Controller cables connecting the Clock Controller and NT5D97 card must NOT be routed through the center of the cabinet past the power harness. Instead they should be routed around the outside of the equipment shelves.
9. If required, install connecting blocks at the MDF or wall mounted cross-connect terminal.
10. If required, designate connecting blocks at the MDF or wall mounted cross-connect terminal.
11. If required, install a Network Channel Terminating Equipment (NCTE). or Line Terminating Unit (LTU).
12. Add related office data into switch memory.
13. Enable faceplate switch S1. This is the "Loop Enable" switch.

    The faceplate LEDs should go on for 4 seconds then go off and the OOS, DIS and ACT LEDs should go on again and stay on.

    IF DDCH is installed, the DCH LED should flash 3 times.
14. Run the PRI/DTI Verification Test.
15. Run the PRI status check.

Removing the NT5D97

1. Determine the cabinet and shelf location of the NT5D97 card to be removed.
2. Disable Network Loop using LD 60. The command is DISL "loop number."

The associated DCHI might need to be disabled first. The faceplate switch ENB/DIS should not be disabled until both PRI2/DTI2 loops are disabled first.

3. If the NT5D97 card is being completely removed, not replaced, remove data from memory.
4. Remove cross connections at MDF to wall-mounted cross-connect terminal.
5. Tag and disconnect cables from card.
6. Rearrange Clock Controller cables if required.

Caution:

Clock Controller cables connecting the Clock Controller and DDP2 card must NOT be routed through the center of the cabinet past the power harness. Instead, they should be routed around the outside of the equipment shelves.

7. Remove the DDP2 card only if both loops are disabled. If the other circuit of a DDP2 card is in use, **DO NOT** remove the card. The faceplate switch ENB/DIS must be in the OFF (DIS) position before the card is removed, otherwise the system initializes.
8. Pack and store the NT5D97 card and circuit card.

Configuring the NT5D97

After the NT5D97 DDP2 is installed, configure the system using the same procedures as the standard NT8D72BA PRI2.

Consider the following when configuring the NT5D97 DDP2 card:

- The Avaya CS 1000 software allows four ports to be defined for the NT6D80 MSDL. The DDCH (NTBK51AA/NTBK51CA) card has only two ports, 0 and 1; therefore, ports 2 and 3 must not be defined when using the NTBK51AA/NTBK51CA.
- Port 0 of the NTBK51AA/NTBK51CA can only be defined to work with Loop 0 of the NT5D97 DDP2 card, and Port 1 of the NTBK51AA/NTBK51CA can only be defined to work with Loop 1 of the NT5D97. This relationship must be reflected when configuring a new DCH in LD 17 (in response to the DCHL prompt, enter either 0 or 1 when specifying the loop number used by the DCH).
- You cannot define one of the DDP2 loops for the NTBK51AA/NTBK51CA DDCH, and the NT6D80 MSDL.
- When configuring the NT5D97 DDP2 in DTI2 outgoing dial pulse mode, a Digit Outpulsing patch is required.

Testability and diagnostics

The DDP2 card supports testing and maintenance functions through the following procedures:

- Self-test upon power up or reset
- Signalling test performed in the LD 30
- Loopback tests, self tests, and continuity tests performed by LD 60 and LD 45
- The D-Channel (DCH, MSDL, DDCH) maintenance is supported by LD 96.

Note:

The MSDL self-test is not applicable to the NTBK51AA/NTBK51CA D-Channel daughterboard.

Chapter 14: NT5K02 Flexible Analog Line card

Contents

This section contains information on the following topics:

Introduction

The NT5K02 Flexible Analog Line card provides an interface for up to 16 analog (500/2500-type) telephones equipped with either ground button recall switches, high-voltage Message Waiting lamps, or low-voltage Message Waiting LEDs.

You can install this card in any IPE slot.

Note:

Up to four NT5K02 Flexible Analog Line card are supported in each Media Gateway and Media Gateway Expansion.

The NT5K02 Flexible Analog Line card performs several functions, including:

- flexible transmission
- ground button operation
- low-voltage Message Waiting option
- card self-ID for auto-configuration

Applications

The NT5K02 Flexible Analog Line card can be used for the following applications:

- NT5K02AA high-voltage Message Waiting analog line card typically used in Australia
- NT5K02DA ground button, low-voltage Message Waiting, analog line card typically used in France
- NT5K02EA ground button, low-voltage Message Waiting, analog line card typically used in Germany
- NT5K02FA ground button, low-voltage Message Waiting, analog line card with 600½ termination (A/D –4 dB, D/A–1 dB)
- NT5K02GA same as NT5K02FA with a different loss plan (A/D –4 dB, D/A –3 dB)
- NT5K02HA ground button, low-voltage Message Waiting, analog line card typically used in Belgium
- NT5K02JA low-voltage Message Waiting, analog line card typically used in Denmark
- NT5K02KA ground button, low-voltage Message Waiting, analog line card typically used in Netherlands
- NT5K02LA and NT5K02LB analog line card typically used in New Zealand
- NT5K02MA ground button, low-voltage Message Waiting, analog line card typically used in Norway
- NT5K02NA ground button, low-voltage message Waiting, analog line card typically used in Sweden
- NT5K02PA ground button, low-voltage Message Waiting, analog line card typically used in Switzerland
- NT5K02QA ground button, low-voltage Message Waiting, analog line card typically used in the United Kingdom

Chapter 15: NT5K21 XMFC/MFE card

Contents

This section contains information on the following topics:

Introduction

The XMFC/MFE (Extended Multi-frequency Compelled/Multi-frequency sender-receiver) card is used to set up calls between two trunks. Connections may be between a PBX and a Central Office or between two PBXs. When connection is established, the XMFC/MFE card sends and receives pairs of frequencies and then drops out of the call.

The XMFC/MFE card can operate in systems using either A-law or µ-law companding by changing the setting in software.

You can install this card in any IPE slot.

MFC signaling

The MFC feature allows the system to use the CCITT MFC R2 or L1 signaling protocols.

Signaling levels

MFC signaling uses pairs of frequencies to represent digits, and is divided into two levels:

- Level 1: used when a call is first established and may be used to send the dialed digits.
- Level 2: used after Level 1 signaling is completed and may contain such information as the status, capabilities, or classifications of both calling parties.

Forward and backward signals

When one NT5K21 XMFC/MFE card sends a pair of frequencies to a receiving XMFC/MFE card (forward signaling), the receiving XMFC/MFE card must respond by sending a different set of frequencies back to the originating XMFC/MFE card (backward signaling). In other words, the receiving card is always "compelled" to respond to the originating card.

In summary, the signaling works as follows:

- The first XMFC/MFE card sends a forward signal to the second card.
- The second card hears the forward signal and replies with a backward signal.
- The first card hears the backward signal and "turns off" its forward signal.
- The second card hears the forward signal being removed and removes its backward signal.
- The first XMFC/MFE can either send a second signal or drop out of the call.

MFC signaling involves two or more levels of forward signals and two or more levels of backward signals. Separate sets of frequencies are used for forward and backward signals:

- Forward signals. Level I forward signals are dialed address digits that identify the called party. Subsequent levels of forward signals describe the category (Class of Service) of the calling party, and may include the calling party status and identity.
- Backward signals. Level I backward signals (designated "A") respond to Level I forward signals. Subsequent levels of backward signals (B, C, and so on) describe the status of the called party.

Table 131: MFC Frequency values on page 294 lists the frequency values used for forward and backward signals.

Table 131: MFC Frequency values

Digit	Forward direction DOD-Tx, DID-Rx	backward direction DOD-Rx, DID-Tx
1	1380 Hz + 1500 Hz	1140 Hz + 1020 Hz
2	1380 Hz + 1620 Hz	1140 Hz + 900 Hz

Digit	Forward direction DOD-Tx, DID-Rx	backward direction DOD-Rx, DID-Tx
3	1500 Hz + 1620 Hz	1020 Hz + 900 Hz
4	1380 Hz + 1740 Hz	1140 Hz + 780 Hz
5	1500 Hz + 1740 Hz	1020 Hz + 780 Hz
6	1620 Hz + 1740 Hz	900 Hz + 780 Hz
7	1380 Hz + 1860 Hz	1140 Hz + 660 Hz
8	1500 Hz + 1860 Hz	1020 Hz + 660 Hz
9	1620 Hz + 1860 Hz	900 Hz + 660 Hz
10	1740 Hz + 1860 Hz	780 Hz + 660 Hz
11	1380 Hz + 1980 Hz	1140 Hz + 540 Hz
12	1500 Hz + 1980 Hz	1020 Hz + 540 Hz
13	1620 Hz + 1980 Hz	900 Hz + 540 Hz
14	1740 Hz + 1980 Hz	780 Hz + 540 Hz
15	1860 Hz + 1980 Hz	660 Hz + 540 Hz

The exact meaning of each MFC signal number (1-15) within each level can be programmed separately for each trunk route using MFC. This programming can be done by the customer and allows users to suit the needs of each MFC-equipped trunk route.

Each MFC-equipped trunk route is associated with a data block that contains the MFC signal functions supported for that route.

MFE signaling

The NT5K21 XMFC/MFE card can be programmed for MFE signaling which is used mainly in France. MFE is much the same as MFC except it has its own set of forward and backward signals.

Table 132: MFE Frequency values on page 295 lists the forward and backward frequencies for MFE. The one backward signal for MFE is referred to as the "control" frequency.

Table 132: MFE Frequency values

Digit	Forward direction OG-Tx, IC-Rx	Backward direction
1	700 Hz + 900 Hz	1900 Hz (Control Frequency)
2	700 Hz + 1100 Hz	—
3	900 Hz + 1100 Hz	—

Digit	Forward direction OG-Tx, IC-Rx	Backward direction
4	700 Hz + 1300 Hz	—
5	900 Hz + 1300 Hz	—
6	1100 Hz + 1300 Hz	—
7	700 Hz + 1500 Hz	—
8	900 Hz + 1500 Hz	—
9	1100 Hz + 1500 Hz	—
10	1300 Hz + 1500 Hz	—

Sender and receiver mode

The XMFC/MFE circuit card provides the interface between the system's CPU and the trunk circuit which uses MFC or MFE signaling.

The XMFC/MFE circuit card transmits and receives forward and backward signals simultaneously on two channels. Each channel is programmed like a peripheral circuit card unit, with its own sending and receiving timeslots in the network.

Receive mode

When in receive mode, the XMFC/MFE card is linked to the trunk card by a PCM speech path over the network cards. MFC signals coming in over the trunks are relayed to the XMFC/MFE card as though they were speech. The XMFC/MFC card interprets each tone pair and sends the information to the CPU through the CPU bus.

Send mode

When in send mode, the CPU sends data to the XMFC/MFE card through the CPU bus. The CPU tells the XMFC/MFE card which tone pairs to send and the XMFC/MFE card generates the required tones and sends them to the trunk over the PCM network speech path. The trunk transmits the tones to the far end.

XMFC sender and receiver specifications

Table 133: XMFC sender specifications on page 297 and Table 134: XMFC receiver specifications on page 297 provide the operating requirements for the NT5K21 XMFC/MFE

card. These specifications conform to CCITT R2 recommendations: Q.441, Q.442, Q.451, Q.454, and Q.455.

Table 133: XMFC sender specifications

Forward frequencies in DOD mode:	1380, 1500, 1620, 1740, 1860, 1980 Hz
Backward frequencies in DOD mode:	1140, 1020, 900, 780, 660, 540 Hz
Frequency tolerance:	+/- 0.5 Hz from nominal
Power level at each frequency:	Selectable: 1 of 16 levels
Level difference between frequencies:	< 0.5 dB
Harmonic Distortion and Intermodulation	37 dB below level of 1 signaling frequency
Time interval between start of 2 tones:	125 usec.
Time interval between stop of 2 tones:	125 usec.

Table 134: XMFC receiver specifications

Input sensitivity:	
accepted: rejected:	-5 to -31.5 dBmONew CCITT spec. -38.5 dBmOBlue Book
Bandwidth twist:	
accepted: rejected:	fc +/- 10 Hz fc +/- 60 Hz
Amplitude twist:	
accepted:	difference of 5 dB between adjacent frequencies difference of 7 dB between non-adjacent frequencies
Norwegian requirement rejected:	difference of 12 dB (for unloaded CO trunks) difference of 20 dB between any two frequencies
Operating time:	< 32 msec.
Release time:	< 32 msec.
Tone Interrupt no release:	< 8 msec. Receiver on, while tone missing
Longest Input tone ignored:	< 8 msec. Combination of valid frequencies
Noise rejection:	S/N > 18 dB No degradation, in band white noise S/N > 13 dB Out-of-band disturbances for CCITT

XMFE sender and receiver specifications

Table 135: XMFE sender specifications on page 298 and Table 136: XMFE receiver specifications on page 298 provide the operating requirements for the XMFC/MFE card when

it is configured as an XMFE card. These requirements conform to French Socotel specifications ST/PAA/CLC/CER/692.

Table 135: XMFE sender specifications

Forward frequencies in OG mode:	700, 900, 1100, 1300, 1500 Hz
Forward frequencies in IC mode:	1900 Hz
Frequency tolerance:	+/- 0.25% from nominal
Power level at each frequency:	Selectable: 1 of 16 levels
Level tolerance:	+/- 1.0 dB
Harmonic Distortion and Intermodulation:	35 dB below level of 1 signaling frequency
Time interval between start of 2 tones:	125 usec.
Time interval between stop of 2 tones:	125 usec.

Table 136: XMFE receiver specifications

Input sensitivity: accepted: rejected: rejected: rejected:	-4 dBm to -35 dBm +/- 10 Hz of nominal -42 dBm signals -4 dBm outside 500-1900 Hz -40 dBm single/multiple sine wave in 500-1900 Hz
Bandwidth: accepted:	fc +/- 20 Hz
Amplitude twist: accepted:	difference of 9 dB between frequency pair
Operating time:	< 64 msec.
Release time:	< 64 msec.
Tone Interrupt causing no release:	< 8 msec. Receiver on, tone missing
Longest Input tone ignored:	< 8 msec. Combination of valid frequencies
Longest control tone ignored:	< 15 msec. Control Frequency only
Noise rejection:	S/N > 18 dB No degradation in-band white noise

Physical specifications

Table 137: Physical specifications on page 298 outlines the physical specifications of the NT5K21 XMFC/MFE circuit card.

Table 137: Physical specifications

Dimensions	Height: 12.5 in. (320 mm)

	Depth: 10.0 in. (255 mm) Thickness: 7/8 in. (22.25 mm)
Faceplate LED	Lit when the circuit card is disabled
Cabinet Location	Must be placed in the main cabinet (Slots 1-10)
Power requirements	1.1 Amps typical
Environmental considerations	Meets the environment of the system

Chapter 16: NT6D70 SILC Line card

Contents

This section contains information on the following topics:

Introduction

The S/T Interface Line card (SILC) (NT6D70AA –48V North America, NT6D70 BA –40 V International) provides eight S/T four-wire full-duplex interfaces to connect ISDN BRI-compatible terminals over Digital Subscriber Loops (DSLs) to the System. A description of the ISDN BRI feature is contained in *Avaya ISDN Basic Rate Interface: Installation and Configuration* (NN43001-318).

You can install this card in any IPE slot.

Note:

A maximum of four NT6D70 SILC cards are supported in a Media Gateway and Media Gateway Expansion.

The S/T Interface Line cards (SILC) (NT6D70AA-48V North America, NT6D70 BA -40 V International) provide eight S/T four-wire full duplex interfaces that are used to connect ISDN BRI compatible terminals over DSLs to the Meridian 1 system. A description of the ISDN BRI feature is contained in *Avaya ISDN Basic Rate Interface: Maintenance* (NN43001-718).

The S/T Interface Line card (SILC) (NT6D70AA –48V North America, NT6D70 BA –40 V International) provides eight S/T four-wire full-duplex interfaces to connect ISDN BRI-compatible terminals over Digital Subscriber Loops (DSLs) to the Avaya Communication Server 1000 system.

An NT6D70 SILC card can reside in a Media Gateway or Media Gateway Expansion. A maximum of four NT6D70 SILC cards are supported in a Media Gateway and Media Gateway Expansion.

ISDN BRI

ISDN BRI consists of two 64Kb/s Bearer (B) channels and one 16Kb/s Data (D) channel. The BRI interface is referred to as a 2B+D connection as well as a Digital Subscriber Loop (DSL).

B-channels transmit user voice and data information at high speeds, while D-channels are packet-switched links that carry call set-up, signaling and other user data across the network.

One single DSL can carry two simultaneous voice or data conversations to the same or to different locations. In either case, the D-channel can also be used for packet communication to a third location simultaneously. The two B-channels can also be combined to transmit data at uncompressed speeds of up to 128 Kbps.

A wide range of devices and telephone numbers can be associated with a single DSL to offer equipment flexibility and reduce line, wiring, and installation costs.

Avaya Communication Server (Avaya CS) 1000 Release 1.1 and later supports ISDN Basic Rate Interface (BRI).

ISDN BRI consists of two 64Kb/s Bearer (B) channels and one 16Kb/s Data (D) channel. The BRI interface is referred to as a 2B+D connection as well as a Digital Subscriber Loop (DSL).

B-channels transmit user voice and data information at high speeds, while D-channels are packet-switched links that carry call set-up, signaling and other user data across the network.

One single DSL can carry two simultaneous voice or data conversations to the same or to different locations. In either case, the D-channel can also be used for packet communications to a third location simultaneously. The two B-channels can also be combined to transmit data at uncompressed speeds of up to 128 Kb/s.

A wide range of devices and telephone numbers can be associated with a single DSL to offer equipment flexibility and reduce line, wiring, and installation costs.

Physical description

The NT6D70 SILC card is a standard-size circuit card. Its faceplate is equipped with an LED to indicate its status.

The NT6D70 SILC is a standard size circuit card designed to be inserted in peripheral equipment slots in the Meridian 1. Its faceplate is equipped with an LED to indicate its status.

The NT6D70 SILC Card is a standard-size circuit card designed to be inserted in slots in the Media Gateway and Media Gateway Expansion. Its faceplate is equipped with an LED to indicate its status.

Power consumption

Power consumption is +5 V at 800 mA and –48 V at 480 mA.

Power consumption is +5 V at 800 mA and -48V at 480 mA.

Power consumption is +5 V at 800 mA and –48 V at 480 mA.

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the SILC card. When the SILC card is used in TIE trunk applications in which the cabling is exposed to outside plant conditions, an NT1 module certified for such applications must be used. Check local regulations before providing such service.

In-circuit protection against power line crosses or lightning is not provided on the SILC card. When the SILC card is used in TIE trunk applications in which the cabling is exposed to outside plant conditions, an NT1 module certified for such applications must be used. Check local regulations before providing such service.

In-circuit protection against power line crosses or lightning is not provided on the SILC card. When the SILC card is used in TIE trunk applications in which the cabling is exposed to outside plant conditions, an NT1 module certified for such applications must be used. Check local regulations before providing such service.

Functional description

The NT6D70 SILC card provides eight S/T four-wire full-duplex polarity-sensitive interfaces to connect ISDN BRI-compatible terminals over Digital Subscriber Loops (DSL) to the system. Each S/T interface provides two B-channels and one D-channel and supports a maximum of eight physical connections that can link up to 20 logical terminals on one DSL.

A logical terminal is any terminal that can communicate with the system over a DSL. It can be directly connected to the DSL through its own physical termination or be indirectly connected through a common physical termination.

The length of a DSL depends on the specific terminal configuration and the DSL wire gauge; however, it should not exceed 1 km (3,280 ft).

The SILC interface uses a four-conductor cable that provides a differential Transmit and Receive pair for each DSL. The SILC has options to provide a total of two watts of power on the Transmit or Receive leads, or no power at all. When this power is supplied from the S/T interface, the terminal devices must not draw more than the two watts of power. Any power requirements beyond this limit must be locally powered.

Other functions of the SILC are:

- support point-to-point and multi-point DSL terminal connections
- execute instructions received from the MISP to configure and control the S/T interfaces
- provide channel mapping between ISDN BRI format (2B+D) and system bus format
- multiplex 4 D-channels onto one timeslot
- perform activation and deactivation of DSLs
- provide loopback control of DSLs
- provide a reference clock to the clock controller

The SILC provides eight S/T four wire full duplex polarity sensitive interfaces that are used to connect ISDN BRI compatible terminals over Digital Subscriber Loops (DSL) to the Meridian 1. Each S/T interface provides two B-channels and one D-channel and supports a maximum of eight physical connections that can link up to 20 logical terminals on one DSL.

A logical terminal is any terminal that can communicate with the Meridian 1 over a DSL. It may be directly connected to the DSL through its own physical termination or be indirectly connected through a common physical termination.

The length of a DSL depends on the specific terminal configuration and the DSL wire gauge, however, it should not exceed 1 km (3,280 ft).

The SILC interface uses a 4 conductor cable that provides a differential Transmit and Receive pair for each DSL. The SILC has options to provide a total of 2 Watts of power on the Transmit or Receive leads, or no power at all. When this power is supplied from the S/T interface, the terminal devices must not draw more than the 2 Watts of power. Any power requirements beyond this limit must be locally powered.

Other functions of the SILC are:

- support point-to-point and multi-point DSL terminal connections
- execute instructions received from the MISP to configure and control the S/T interfaces
- provide channel mapping between ISDN BRI format (2B+D) and Meridian 1 system bus format
- multiplexes 4 D-channels onto one timeslot
- perform activation and deactivation of DSLs
- provide loopback control of DSLs
- provide a reference clock to the clock controller

The NT6D70 SILC Card provides eight S/T four-wire full-duplex polarity-sensitive interfaces to connect ISDN BRI-compatible terminals over DSL to the CS 1000. Each S/T interface provides two B-channels and one D-channel and supports a maximum of eight physical connections that can link up to 20 logical terminals on one DSL.

A logical terminal is any terminal that can communicate with the CS 1000over a DSL. It can be directly connected to the DSL through its own physical termination or be indirectly connected through a common physical termination.

The length of a DSL depends on the specific terminal configuration and the DSL wire gauge; however, it should not exceed 1 km (3,280 ft).

The SILC interface uses a four-conductor cable that provides a differential Transmit and Receive pair for each DSL. The SILC has options to provide a total of two watts of power on the Transmit or Receive leads, or no power at all. When this power is supplied from the S/T interface, the terminal devices must not draw more than the two watts of power. Any power requirements beyond this limit must be locally powered.

Other functions of the SILC include the following:

- support point-to-point and multi-point DSL terminal connections
- execute instructions received from the MISP to configure and control the S/T interfaces
- provide channel mapping between ISDN BRI format (2B+D) and CS 1000 system bus format
- multiplex 4 D-channels onto one timeslot
- perform activation and deactivation of DSLs
- provide loopback control of DSLs
- provide a reference clock to the clock controller

Micro Controller Unit (MCU)

The Micro Controller Unit (MCU) coordinates and controls the operation of the SILC. It has internal memory, a reset and sanity timer, and a serial control interface.

The memory consists of 32 K of EPROM which contains the SILC operating program and 8 K of RAM used to store interface selection and other functions connected with call activities.

The reset and sanity timer logic resets the MCU.

The serial control interface is an IPE bus used by the MPU to communicate with the S/T transceivers.

The MCU coordinates and controls the operation of the SILC. It has internal memory, a reset and sanity timer, and a serial control interface.

The memory consists of 32 K of EPROM which contains the SILC operating program and 8 K of RAM used to store interface selection and other functions connected with call activities.

The reset and sanity timer logic resets the MCU.

The serial control interface is an IPE bus used by the MPU to communicate with the S/T transceivers.

The Micro Controller Unit (MCU) coordinates and controls the operation of the SILC. It has internal memory, a reset and sanity timer, and a serial control interface.

The memory consists of 32 K of EPROM which contains the SILC operating program and 8 K of RAM used to store interface selection and other functions connected with call activities.

The reset and sanity timer logic resets the MCU.

The serial control interface is an Peripheral Equipment (PE) bus used by the MPU to communicate with the S/T transceivers.

IPE interface logic

The IPE interface logic consists of a Card-LAN interface, an IPE bus interface, a maintenance signaling channel interface, a digital pad, and a clock controller and converter.

The Card-LAN interface is used for routine card maintenance, which includes polling the line cards to find the card slot where the SILC is installed. It also queries the status and identification of the card and reports the configuration data and firmware version of the card.

The IPE bus interface connects an IPE bus loop that has 32 channels operating at 64 kbps and one additional validation and signaling bit.

The Maintenance Signaling Channel (MSC) interface communicates signaling and card identification information from the system CPU to the SILC MCU. The signaling information also contains maintenance instructions.

The digital pad provides gain or attenuation values to condition the level of the digitized transmission signal according to the network loss plan. This sets transmission levels for the B-channel voice calls.

The clock recovery circuit recovers the clock from the local exchange.

The clock converter converts the 5.12-MHz clock from the IPE backplane into a 2.56 MHz clock to time the IPE bus channels and an 8 kHz clock to provide PCM framing bits.

The IPE interface logic consists of a Card-LAN interface, an IPE bus interface, a maintenance signaling channel interface, a digital pad, and a clock controller and converter.

The Card-LAN interface is used for routine card maintenance, which includes polling the line cards to find in which card slot the SILC is installed. It also queries the status and identification of the card, and reports the configuration data and firmware version of the card.

The IPE bus interface connects one IPE bus loop that has 32 channels operating at 64 kbps and one additional validation and signaling bit.

The maintenance signaling channel (MSC) interface is used to communicate signaling and card identification information from the Meridian 1 CPU to the SILC MCU. The signaling information also contains maintenance instructions.

The digital pad provides gain or attenuation values to condition the level of the digitized transmission signal according to the network loss plan. This sets transmission levels for the B-channel circuit-switched voice calls.

The clock recovery circuit recovers the clock from the local exchange.

The clock converter converts the 5.12 MHz clock from the IPE backplane into a 2.56 MHz clock to time the IPE bus channels and an 8 kHz clock to provide PCM framing bits.

The PE interface logic consists of a Card-LAN interface, a PE bus interface, a maintenance signaling channel interface, a digital pad, and a clock controller and converter.

The Card-LAN interface is used for routine card maintenance, which includes polling the line cards to find the card slot where the SILC is installed. It also queries the status and identification of the card and reports the configuration data and firmware version of the card.

The PE bus interface connects one PE bus loop that has 32 channels operating at 64 kbps and one additional validation and signaling bit.

The Maintenance Signaling Channel (MSC) interface communicates signaling and card identification information from the CS 1000CPU to the SILC MCU. The signaling information also contains maintenance instructions.

The digital pad provides gain or attenuation values to condition the level of the digitized transmission signal according to the network loss plan. This sets transmission levels for the B-channel voice calls.

The clock recovery circuit recovers the clock from the local exchange.

The clock converter converts the 5.12-MHz clock from the PE backplane into a 2.56-MHz clock to time the PE bus channels and an 8-kHz clock to provide PCM framing bits.

S/T interface logic

The S/T interface logic consists of a transceiver circuit and the DSL power source. This interface supports DSLs of different distances and different numbers and types of terminal.

The transceiver circuits provide four-wire full-duplex S/T bus interface. This bus supports multiple physical terminations on one DSL where each physical termination supports multiple logical B-channel and D-channel ISDN BRI terminals. Idle circuit-switched B-channels can be allocated for voice or data transmission to terminals making calls on a DSL. When those terminals become idle, the channels are automatically made available to other terminals making calls on the same DSL.

The power on the DSL comes from the SILC, which accepts –48 V from the IPE backplane and provides two watts of power to physical terminations on each DSL. It provides -48 V for ANSI-compliant ISDN BRI terminals and –40 V for CCITT (such as ETSI NET-3, INS NET-64) compliant terminals. The total power used by the terminals on each DSL must not exceed two watts.The S/T interface logic consists of a transceiver circuit and the DSL power source. This interface supports DSLs of different distances and different number and types of terminals.

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The power on the DSL comes from the SILC, which accepts -48 V from the IPE backplane and provides 2 watts of power to physical terminations on each DSL. It provides -48 V for ANSI compliant ISDN BRI terminals and -40 V for CCITT (such as ETSI NET-3, INS NET-64) compliant terminals. The total power used by the terminals on each DSL must not exceed 2 watts.

The S/T interface logic consists of a transceiver circuit and the DSL power source. This interface supports DSLs of different distances and different numbers and types of terminal.

The transceiver circuits provide four-wire full-duplex S/T bus interface. This bus supports multiple physical terminations on one DSL where each physical termination supports multiple logical B-channel and D-channel ISDN BRI terminals. Idle circuit-switched B-channels can be allocated for voice or data transmission to terminals making calls on a DSL. When those terminals become idle, the channels are automatically made available to other terminals making calls on the same DSL.

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Chapter 17: NT6D71 UILC line card

Contents

This section contains information on the following topics:

Introduction

The NT6D71 U Interface Line card (UILC) supports the OSI physical layer (Layer 1) protocol. The UILC is an ANSI-defined standard interface. The UILC provides eight two-wire full-duplex (not polarity sensitive) U interfaces to connect ISDN BRI-compatible terminals over Digital Subscriber Loops (DSL) to the Avaya Communication Server 1000E (Avaya CS 1000E), Avaya CS 1000M, and Meridian 1. A description of the ISDN BRI feature is contained in *Avaya ISDN Basic Rate Interface: Installation and Configuration* (NN43001-318).

You can install this card in any IPE slot.

Note:

A maximum of four UILCs are supported in an Media Gateway and Media Gateway Expansion.

The NT6D71 U Interface Line Card (UILC) supports the OSI physical layer (Layer 1) protocol. The UILC is an ANSI defined standard interface. The UILC provides eight two-wire full duplex (not polarity sensitive) U interfaces that are used to connect ISDN BRI compatible terminals over DSLs to the Meridian 1. A description of the ISDN BRI feature is contained in *Avaya ISDN Basic Rate Interface: Maintenance* (NN43001-718).

The NT6D71 U Interface Line Card (UILC) supports the OSI physical layer (Layer 1) protocol. The UILC is an ANSI-defined standard interface. The UILC provides eight two-wire full-duplex (not polarity sensitive) U interfaces to connect ISDN BRI-compatible terminals over Digital Subscriber Loops (DSL) to the CS 1000. For more information about ISDN BRI, see ISDN BRI on page 302.

A UILC can reside in a Media Gateway or Media Gateway Expansion. A maximum of four UILCs are supported in a Media Gateway and Media Gateway Expansion.

Physical description

The NT6D71 UILC is a standard-size circuit card. Its faceplate is equipped with an LED to indicate its status.

The NT6D71 UILC is a standard size circuit card designed to be inserted in peripheral equipment slots in the Meridian 1. Its faceplate is equipped with an LED to indicate its status.

The NT6D71 UILC is a standard-size circuit card that inserts in slots in the Media Gateway and Media Gateway Expansion. The NT6D71 UILC can be installed in slots 1, 2, 3, and 4 of the Media Gateway and slots 7, 8, 9, and 10 of the Media Gateway Expansion.

The faceplate is equipped with an LED to indicate its status.

Power consumption

Power consumption is +5 V at 1900 mA.

Power consumption is +5 V at 1900 mA.

Power consumption is +5 V at 1900 mA.

Functional description

Each U interface provides two B-channels and one D-channel and supports one physical termination. This termination can be to a Network Termination (NT1) or directly to a single U interface terminal. Usually, this physical termination is to an NT1, which provides an S/T interface that supports up to eight physical terminal connections. The length of a DSL depends on the specific terminal configuration and the DSL wire gauge; however, it should not exceed 5.5 km (3.3 mi).

The main functions of the UILC are as follows:

- provide eight ISDN U interfaces conforming to ANSI standards
- support point-to-point DSL terminal connections
- provide channel mapping between ISDN BRI format (2B+D) and system bus format
- multiplex four D-channels onto one timeslot

- perform activation and deactivation of DSLs
- provide loopback control of DSLs

Each U interface provides two B-channels and one D-Channel and supports one physical termination. This termination may be to a Network Termination (NT1) or directly to a single U interface terminal. Normally this physical termination is to an NT1, which provides an S/T interface that allows up to 8 physical terminals to be connected. The length of a DSL depends on the specific terminal configuration and the DSL wire gauge, however, it should not exceed 5.5 km (3.3 mi).

The main functions of the UILC are:

- provide eight ISDN U interfaces conforming to ANSI standards
- support point-to-point DSL terminal connections
- provide channel mapping between ISDN BRI format (2B+D) and Meridian 1 bus format
- multiplex 4 D-channels onto one timeslot
- perform activation and deactivation of DSLs
- provide loopback control of DSLs

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The main functions of the UILC are as follows:

- provide eight ISDN U interfaces conforming to ANSI standards
- support point-to-point DSL terminal connections
- provide channel mapping between ISDN BRI format (2B+D) and CS 1000 bus format
- multiplex four D-channels onto one timeslot
- perform activation and deactivation of DSLs
- provide loopback control of DSLs

Micro Controller Unit (MCU)

The Micro Controller Unit (MCU) coordinates and controls the operation of the UILC. It has internal memory, a reset and sanity timer, a serial control interface, a maintenance signaling channel, and a digital pad.

The memory consists of 32 K of EPROM that contains the UILC operating program and 8 K of RAM that stores interface selection and other functions connected with call activities.

The reset and sanity timer logic resets the MCU.

The serial control interface is an IPE bus that communicates with the U transceivers.

The MCU coordinates and controls the operation of the UILC. It has internal memory, a reset and sanity timer, a serial control interface, a maintenance signaling channel, and a digital pad.

The memory consists of 32 K of EPROM that contains the UILC operating program and 8 K of RAM used to store interface selection and other functions connected with call activities.

The reset and sanity timer logic resets the MCU.

The serial control interface is an IPE bus used to communicate with the U transceivers.

The Micro Controller Unit (MCU) coordinates and controls the operation of the UILC. It has internal memory, a reset and sanity timer, a serial control interface, a maintenance signaling channel, and a digital pad.

The memory consists of 32 K of EPROM that contains the UILC operating program and 8 K of RAM that stores interface selection and other functions connected with call activities.

The reset and sanity timer logic resets the MCU.

The serial control interface is a PE bus that communicates with U transceivers.

IPE interface logic

The IPE interface logic consists of a Card-LAN interface, a IPE bus interface, a maintenance signaling channel interface, a digital pad, and a clock converter.

The Card-LAN interface is used for routine card maintenance, which includes polling the line cards to find in which card slot the UILC is installed. It also queries the status and identification of the card and reports the configuration data and firmware version of the card.

The IPE bus interface connects one IPE bus loop that has 32 channels operating at 64 kbps and one additional validation and signaling bit.

The Maintenance Signaling Channel (MSC) interface communicates signaling and card identification information from the system CPU to the UILC MCU. The signaling information also contains maintenance instructions.

The digital pad provides gain or attenuation values to condition the level of the digitized transmission signal according to the network loss plan. This sets transmission levels for B-channel voice calls.

The clock converter converts the 5.12 MHz clock from the IPE backplane into a 2.56 MHz clock to time the IPE bus channels and an 8-kHz clock to provide PCM framing bits.

The IPE interface logic consists of a Card-LAN interface, an IPE bus interface, a maintenance signaling channel interface, a digital pad, and a clock converter.

The CardLAN interface is used for routine card maintenance, which includes polling the line cards to find in which card slot the UILC is installed. It also queries the status and identification of the card, and reports the configuration data and firmware version of the card.

The IPE bus interface connects one IPE bus loop that has 32 channels operating at 64 kbps and one additional validation and signaling bit.

The Maintenance Signaling Channel (MSC) interface is used to communicate signaling and card identification information from the Meridian 1 CPU to the UILC MCU. The signaling information also contains maintenance instructions.

The digital pad provides gain or attenuation values to condition the level of the digitized transmission signal according to the network loss plan. This sets transmission levels for the B-channel circuit-switched voice calls.

The clock converter converts the 5.12 MHz clock from the IPE backplane into a 2.56 MHz clock to time the IPE bus channels and an 8 kHz clock to provide PCM framing bits.

The PE interface logic consists of a Card-LAN interface, a PE bus interface, a maintenance signaling channel interface, a digital pad, and a clock converter.

The Card-LAN interface is used for routine card maintenance, which includes polling the line cards to find in which card slot the UILC is installed. It also queries the status and identification of the card and reports the configuration data and firmware version of the card.

The PE bus interface connects one PE bus loop that has 32 channels operating at 64 kbps and one additional validation and signaling bit.

The Maintenance Signaling Channel (MSC) interface communicates signaling and card identification information from the CS 1000CPU to the UILC MCU. The signaling information also contains maintenance instructions.

The digital pad provides gain or attenuation values to condition the level of the digitized transmission signal according to the network loss plan. This sets transmission levels for B-channel voice calls.

The clock converter converts the 5.12-MHz clock from the PE backplane into a 2.56-MHz clock to time the PE bus channels and an 8-kHz clock to provide PCM framing bits.

U interface logic

The U interface logic consists of a transceiver circuit. It provides loop termination and high-voltage protection to eliminate the external hazards on the DSL. The U interface supports voice and data terminals, D-channel packet data terminals, and NT1s. A UILC has eight transceivers to support eight DSLs for point-to-point operation.The U interface logic consists of a transceiver circuit. It provides loop termination and high voltage protection to eliminate the external hazards on the DSL. The U interface supports circuit-switched voice and data terminals, D-channel packet data terminals, and NT1s. A UILC has eight transceivers to support eight DSLs for point-to-point operation.

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Chapter 18: NT6D80 MSDL card

Contents

This section contains information on the following topics:

Introduction

This document describes the Multi-purpose Serial Data Link (MSDL) card. This card provides multiple interface types with four full-duplex serial I/O ports that can be independently configured for various operations. Peripheral software downloaded to the MSDL controls functionality for each port. Synchronous operation is permitted on all MSDL ports. Port 0 can be configured as an asynchronous Serial Data Interface (SDI).

An MSDL card occupies one network card slot in Large SystemNetworks, or Core Network modules and communicates with the CPU over the CPU bus and with I/O equipment over its serial ports. It can coexist with other cards that support the same functions. For example, cards supported with the MSDL (NT6D80) are QPC757 (DCHI), QPC841 (SDI), and NTSD12 (DDP).

Though the MSDL is designed to coexist with other cards, the number of ports supported by a system equipped with MSDL cards is potentially four times greater than when using other cards. Because of each MSDL has four ports, representing a single device, a system can support as many as 16 MSDL cards with a maximum of 64 ports.

Physical description

The MSDL card is a standard size circuit card that occupies one network card slot and plugs into the module's backplane connector to interface with the CPU bus and to connect to the module's power supply. On the faceplate, the MSDL provides five connectors, four to connect to I/O operations and one to connect to a monitor device that monitors MSDL functions. Figure 90: MSDL component layout on page 316 illustrates major MSDL components and their locations on the printed circuit card.

Note:

Switches S9 and S10 are configured to reflect the device number set in LD 17 (DNUM). S10 designates tens, and S9 designates ones. For example, set device number 14 with S10 at 1 and S9 at 4.

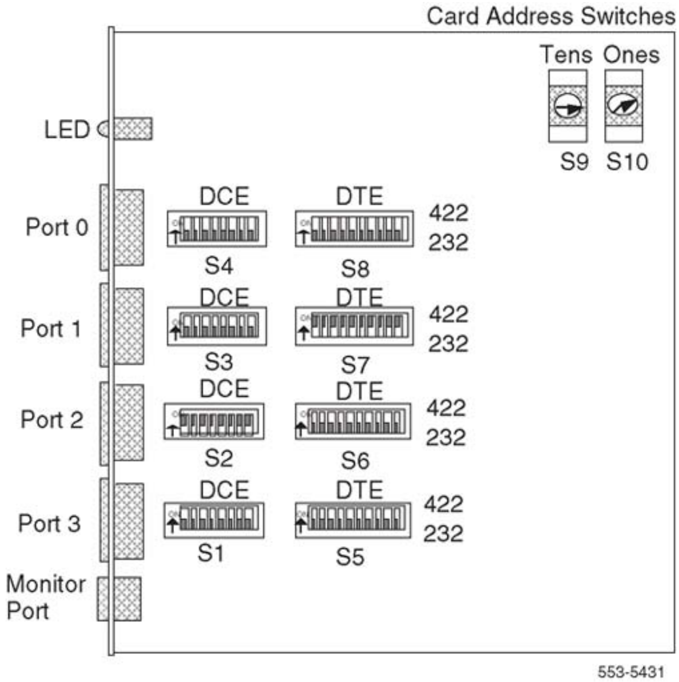


Figure 90: MSDL component layout

Functional description

Figure 91: MSDL block diagram on page 318 illustrates the MSDL functional block diagram. The MSDL card is divided into four major functional blocks:

- CPU bus interface
- Micro Processing Unit (MPU)
- Memory
- Serial interface

Two processing units serve as the foundation for the MSDL operation: the Central Processing Unit (CPU) and the MSDL Micro Processing Unit (MPU). Avaya Communication Server 1000 software, MSDL firmware, and peripheral software control MSDL parameters. Peripheral software downloaded to the MSDL controls MSDL operations.

The MSDL card's firmware and software do the following:

- communicate with the CPU to report operation status
- receive downloaded peripheral software and configuration parameters
- coordinate data flow in conjunction with the CPU
- manage data link layer and network layer signaling that controls operations connection and disconnection
- control operation initialization and addressing
- send control messages to the operations

CPU bus interface

The CPU bus transmits packetized information between the CPU and the MSDL MPU. This interface has a 16-bit data bus, an 18-bit address bus, and interrupt and read/write control lines.

Shared Random Access Memory (RAM) between the CPU and the MSDL MPU provides an exchange medium. Both the CPU and the MSDL MPU can access this memory.

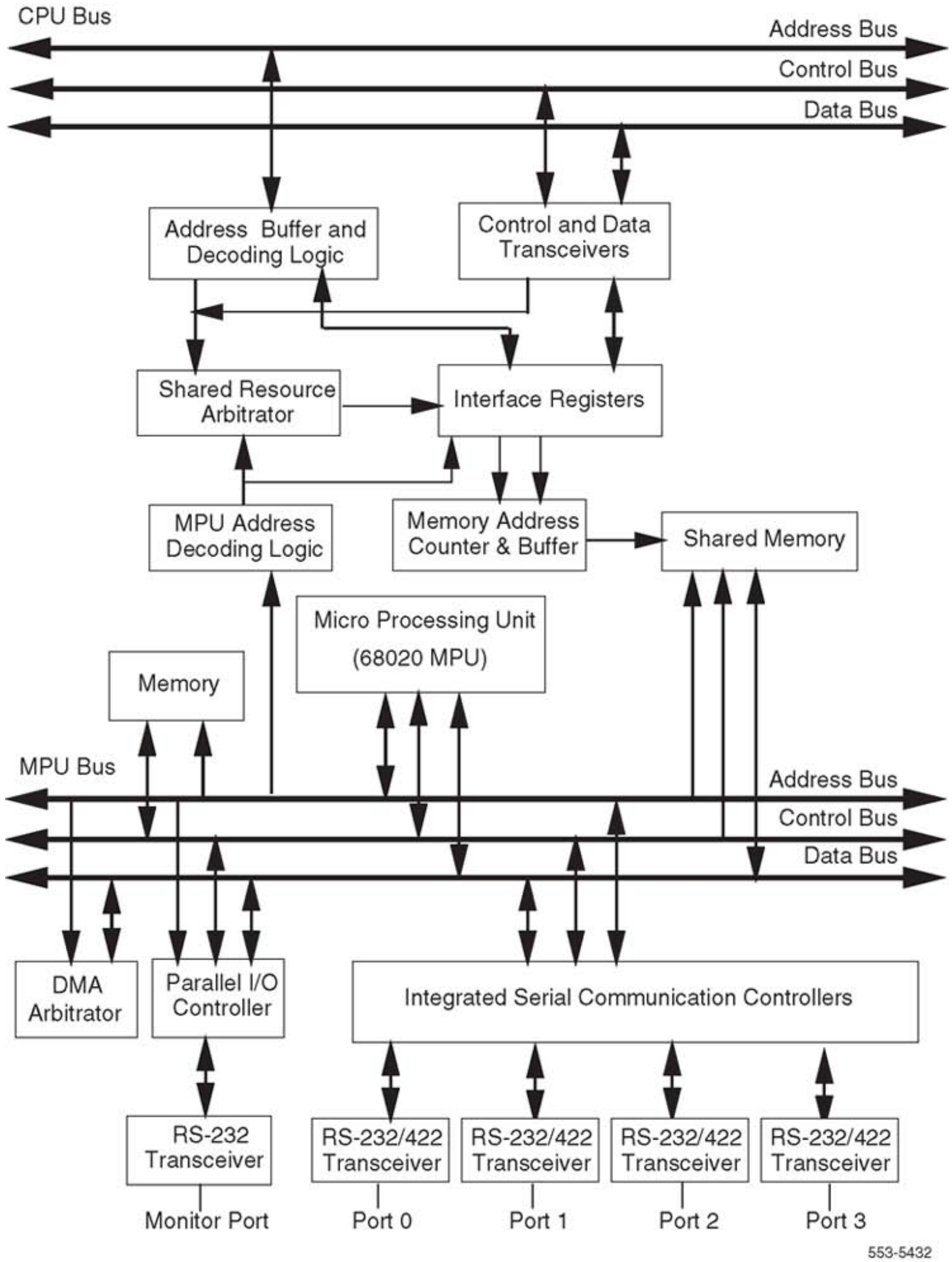


Figure 91: MSDL block diagram

Micro Processing Unit (MPU)

The MPU, which is based on a Motorola 68020 processor, coordinates and controls data transfer and port addressing, communicating via the CPU bus with the system. Prioritized interrupts tell the MPU which tasks to perform.

Memory

The MSDL card contains two megabytes of Random Access Memory (RAM) for storing downloaded peripheral software that controls MSDL port operations. The MSDL card includes the shared RAM that is used as a communication interface buffer between the CPU and the MPU.

The MSDL Flash Erasable Programmable Read Only Memory (Flash EPROM) also includes the peripheral software to protect it against a power failure or reset. MSDL can copy peripheral software directly from the Flash EPROM after power up or reset instead of requesting that the system CPU download it.

The MSDL card also contains Programmable Read Only Memory (PROM) for firmware that includes the bootstrap code.

Serial interface

The MSDL card provides one monitor port and four programmable serial ports that can be configured for the following various interfaces and combinations of interfaces:

- synchronous ports 0–3
- asynchronous port 0
- DCE or DTE equipment emulation mode
- RS-232 or RS-422 interface

Transmission mode – All four ports of the MSDL can be configured for synchronous data transmission by software. Port 0 can be configured for asynchronous data transmission for CRT, TTY, and printer applications only.

Equipment emulation mode – Configure an MSDL port to emulate DCE or DTE by setting switches on the card and downloading LD 17 interface parameters.

I/O port electrical interface – Each MSDL port can be configured as an RS-232 or RS-422 interface by setting the switches on the MSDL card. MSDL ports use Small Computer Systems Interface (SCSI) II 26-pin female connectors.

Figure 92: MSDL functional block diagram on page 321 shows the system architecture using the MSDL as an operational platform. It illustrates operation routing from the CPU, through the MSDL, to the I/O equipment. It also shows an example in which DCH operation peripheral software in the MSDL controls functions on ports 2 and 3.

MSDL operations

The system automatically performs self-test and data flow activities. Unless a permanent problem exists and the system cannot recover, there is no visual indication that these operations are taking place.

The system controls the MSDL card with software that it has downloaded. The MSDL and the system enable the MSDL by following these steps:

1. When the MSDL card is placed in the system, the card starts a self-test.
2. When the MSDL passes the test, it indicates its state and L/W version to the system. The CPU checks to see if downloading is required.
3. After downloading the peripheral software, the system enables the MSDL.
4. MSDL applications (DCH, AML, SDI) may be brought up if appropriately configured.

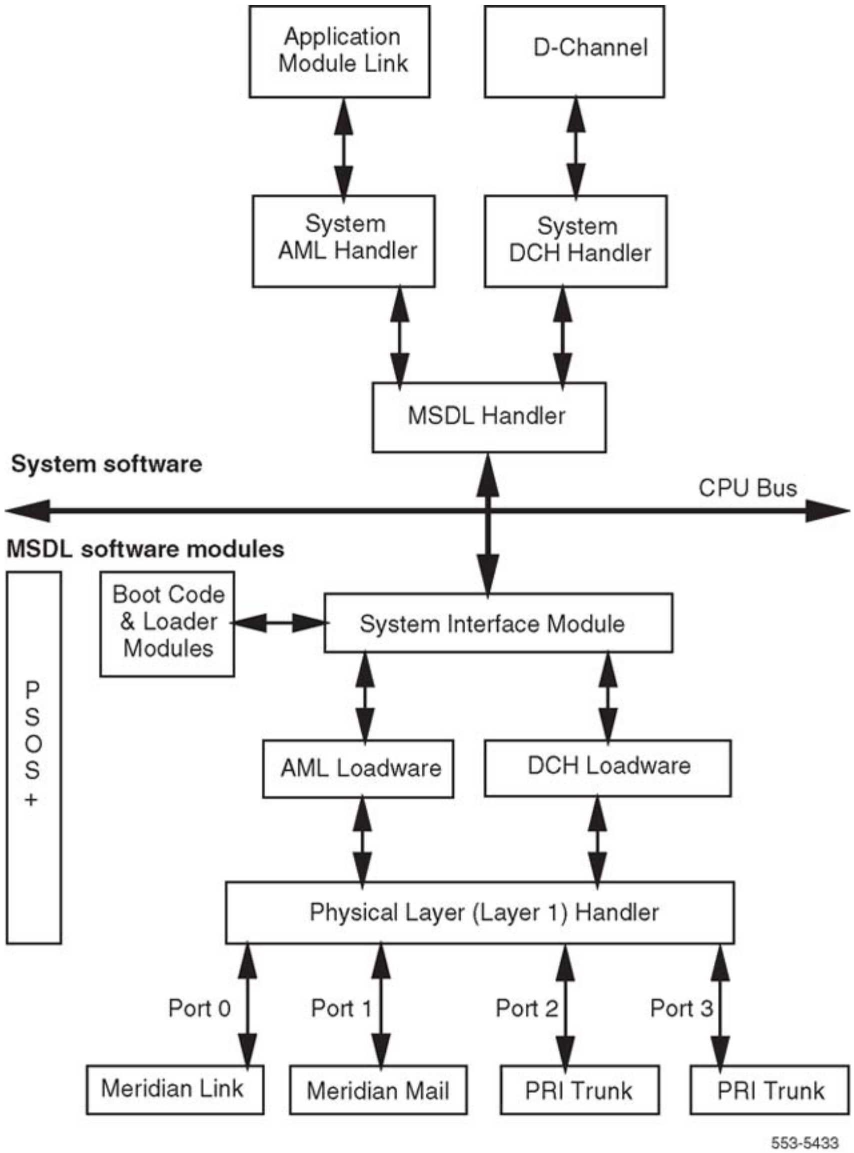


Figure 92: MSDL functional block diagram

Data flow

The MSDL transmit interface, managed by the MSDL handler, sends data from the system to the MSDL. This interface receives packetized data from the system and stores it in the transmit buffer on the MSDL. The transmit buffer transports these messages to the appropriate buffers, from which the messages travel over the MSDL port to the I/O equipment.

The MSDL uses the MSDL receive interface to communicate with the system. The MSDL card receives packetized data from the I/O equipment over the MSDL ports. This data is processed by the MSDL handler and sent to the appropriate function.

The flow control mechanism provides an orderly exchange of transmit and receive messages for each operation. Each operation has a number of outstanding messages stored in buffers waiting to be sent to their destinations. As long as the number of messages does not exceed the threshold specified, the messages queue in the buffer in a first-in-first-out process.

If the outstanding number of messages for an operation reaches the threshold, the flow control mechanism informs the sender to wait until the number of messages is below the threshold before sending the next message.

If buffer space is not available, the request to send a message to the buffer is rejected and a NO BUFFER fault indication is sent.

Engineering guidelines

Available network card slots

The number of available network slots depends on the system option, the system size, and the number of available network slots in each module for the selected system option.

Some of these network card slots are normally occupied by Network cards, Superloop Network cards, Conference/TDS, and others, leaving a limited number of unused slots for MSDL and other cards.

Card mix

A system that exclusively uses MSDL cards can support up to 16 such cards, providing 64 ports. These ports can be used to run various synchronous and asynchronous operations simultaneously.

The system also supports a mix of interface cards (MSDL, DCHI, and ESDI for example). However, using multiple card types reduce the number of cards and ports available.

Address decoding

The MSDL card decodes the full address information received from the system. This provides 128 unique addresses. Because of MSDL ports communicate with the CPU using a single card address, the system can support 16 MSDL cards providing 64 ports.

The MSDL card addresses are set using decimal switches located on the card. These switches can select 100 unique card addresses from 0 to 99.

An address conflict may occur between the MSDL and other cards because of truncated address decoding by the other cards. For example, if a DCHI port is set to address 5, it's companion port is set to address 4, which means that none of the MSDL cards can have hexadecimal address numbers 05H, 15H, É75H, nor addresses 04H, 14H, É74H. To avoid this conflicts system software limits the MSDL card addresses from 0 to 15.

Port specifications

The MSDL card provides four programmable serial ports configured with software as well as with switches for the following modes of operation:

Transmission mode:

Configure an MSDL port for synchronous or asynchronous data transmission using LD 17.

Synchronous transmission uses an external clock signal fed into the MSDL.

Table 138: Synchronous interface specifications on page 323 lists the synchronous interface specifications and the means of configuring the interface parameters.

Table 138: Synchronous interface specifications

Parameter	Specification	Configured
Data bits	In packets-Transparent	N/A
Data rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 48, 56, and 64 kbps	Software
Transmission	Full Duplex	N/A
Clock	Internal/External	Software
Interface	RS-232	Software
	RS-422	Switches
Mode	DTE or DCE	Switches

Asynchronous transmission uses an internal clock to generate the appropriate baud rate for serial controllers.

Table 139: Asynchronous interface specifications on page 323 lists asynchronous interface specifications and the means of configuring interface parameters.

Table 139: Asynchronous interface specifications

Parameter	Specification	Configured
Data bit, parity	7 bits even, odd or no parity, or 8 bits no parity	Software

Parameter	Specification	Configured
Data rate	0.3, 0.6, (1.2), 2.4, 4.8, 9.6, 19.2, and 38.4 kbps	Software
Stop bits	1 (default), 1.5, 2	Software
Transmission	Full Duplex	N/A
Interface	RS-232	Software
	RS-422	Switches
Mode	DTE or DCE	Switches

Emulation mode:

Each port can be configured to emulate a DCE port or a DTE port by setting the appropriate switches on the MSDL. For details on how to set the switches, refer to Installation on page 327 of this document.

DCE is a master or controlling device that is usually the source of information to the DTE and may provide the clock in a synchronous transmission linking a DCE to a DTE.

DTE is a peripheral or terminal device that can transmit and receive information to and from a DCE and normally provides a user interface to the system or to a DCE device.

Interface:

Each MSDL port can be configured as an RS-232 or an RS-422 interface by setting the appropriate switches on the card.

Table 140: RS-232 interface pin assignments on page 324 lists the RS-232 interface specifications for EIA and CCITT standard circuits. It shows the connector pin number, the associated signal name, and the supported circuit type. It also indicates whether the signal originates at the DTE or the DCE device.

This interface uses a 26-pin (SCSI II) female connector for both RS-232 and RS-422 circuits.

Table 140: RS-232 interface pin assignments

Pin	Signal name	EIA circuit	CCITT circuit	DTE	DCE
1	Frame Ground (FG)	AA	102	—	—
2	Transmit Data (TX)	BA	103	X	
3	Receive Data (RX)	BB	104		X
4	Request to Send (RTS)	CA	105	X	
5	Clear to Send (CTS)	CB	106		X
6	Data Set Ready (DSR)	CC	107		X

Pin	Signal name	EIA circuit	CCITT circuit	DTE	DCE
7	Signal Ground (SG)	AB	102	—	—
8	Carrier Detect (CD)	CF	109		X
15	Serial Clock Transmit (SCT)	DB	114		X
17	Serial Clock Receive (SCR)	DD	115		X
18	Local Loopback (LL)	LL	141	X	
20	Data Terminal Ready (DTR)	CD	108.2	X	
21	Remote Loopback (RL)	RL	140	X	
23	Data Rate Selector (DRS)	CH/CI	111/112	X	
24	External Transmit Clock (ETC)	DA	113	X	
25	Test Mode (TM)	TM	142		X

Table 141: RS-422 interface pin assignments on page 325 lists RS-422 interface specifications for EIA circuits. It shows the connector pin number, the associated signal name, and the supported circuit type. It also indicates whether the signal originates at the DTE or DCE device.

Table 141: RS-422 interface pin assignments

Pin	Signal Name	EIA Circuit	DTE	DCE
1	Frame Ground (FG)	AA	—	—
2	Transmit Data (TXa)	BAa	X	
3	Receive Data (RXa)	BBa		X
4	Request to Send (RTS)	CA	X	
5	Clear to Send (CTS)	CB		X
7	Signal Ground (SG)	AB	—	—
8	Receive Ready (RR)	CF		X
12	Receive Signal Timing (RST)	DDb		X
13	Transmit Data (TXb)	BAb		X
14	Transmit Signal Timing (TSTb)	DBb		X
15	Transmit Signal Timing (TSTa)	DBa		X
16	Receive Data (RXb)	BBb		X
17	Receive Signal Timing (RSTa)	DDa		X
20	Data Terminal Ready (DTR)	CD	X	
23	Terminal Timing (TTa)	DAb	X	

Pin	Signal Name	EIA Circuit	DTE	DCE
24	Terminal Timing (TTb)	DAa	X	

Implementation guidelines

The following are guidelines for engineering and managing MSDL cards:

- An MSDL can be installed in any empty network card slot.
- A maximum of eight MSDL cards can be installed in a fully occupied module because of the module's power supply limitations.
- The Clock Controller card should not be installed in a module if more than 10 MSDL ports are configured as active RS-232 (rather than RS-422) ports in that module because of the module's power supply limitations.
- The MSDL address must not overlap other card addresses.
- Before downloading a peripheral software module for an MSDL, disable all MSDL ports on cards running the same type of operation.

Environmental and power requirements

The MSDL card conforms to the same requirements as other interface cards. The temperature, humidity, and altitude for system equipment, including the MSDL, should not exceed the specifications shown in Table 142: Environmental requirements on page 326.

Table 142: Environmental requirements

Condition	Environmental specifications
Operating	
Temperature Relative Humidity Altitude	0° to 50° C (32° to 122° F) 5% to 95% non-condensing 3,048 meters (10,000 feet) maximum
Storage	
Temperature Relative Humidity	–50° to 70° C (–58° to 158° F) 5% to 95% non-condensing

A stable ambient operating temperature of approximately 22°C (72°F) is recommended. The temperature differential in the room should not exceed ±3°C (±5°F).

The internal power supply in each module provides DC power for the MSDL and other cards. Power consumption and heat dissipation for the MSDL is listed in Table 143: MSDL power consumption on page 327.

Table 143: MSDL power consumption

Voltage (VAC)	Current (Amps)	Power (Watts)	Heat (BTUs)
+5	3.20	16.00	55.36
+12	0.10	1.20	4.15
–12	0.10	1.20	4.15

Installation

Device number

Before installing MSDL cards, determine which of the devices in the system are available. If all 16 devices are assigned, remove one or more installed cards to replace them with MSDL cards.

Make sure that the device number assigned to the MSDL card is not used by an installed card, even if one is not configured. Use the MSDL planning form, at the end of this section, to assist in configuring MSDL cards.

MSDL interfaces

Before installing the cards, select the switch settings that apply to your system, the interfaces, and card addresses.

Table 144: MSDL interface switch settings on page 327 shows the switch positions for the DCE and the DTE interface configurations on the MSDL card. Figure 93: MSDL switch setting example on page 328 shows the MSDL and the location of configuration switches on the MSDL. The switch settings shown in this figure are an example of the different types of interfaces available. Your system settings may differ.

Table 144: MSDL interface switch settings

DCE switch	DTE switch	Interface	Comment
OFF	OFF	RS-232	DTE/DCE is software configured
OFF	ON	RS-422 DTE	All switches configured
ON	OFF	RS-422 DCE	All switches configured
ON	ON	N/A	Not allowed

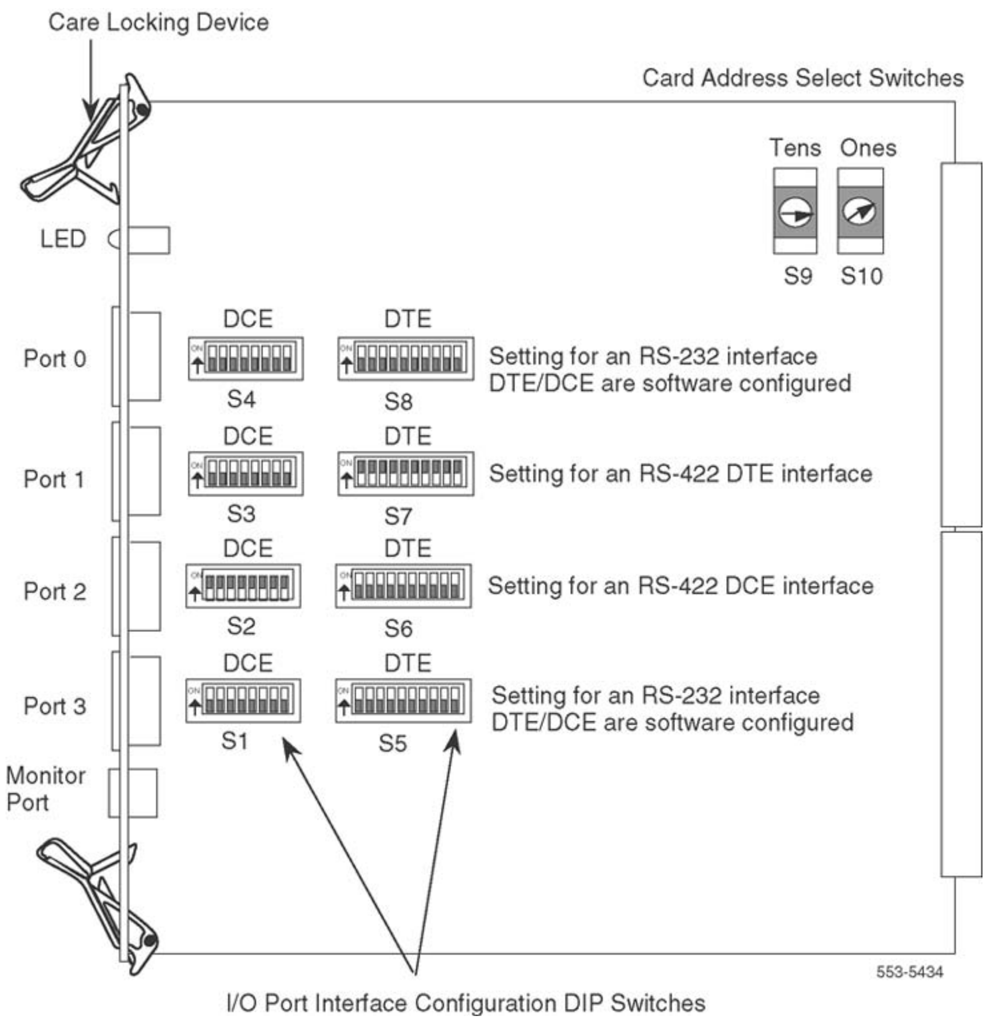


Figure 93: MSDL switch setting example

Installing the MSDL card

Installing the MSDL card

To install an MSDL card follow these steps:

1. Set Device Number S10 and S9.
2. Hold the MSDL by its card-locking devices. Squeeze the tabs to unlatch the card locking devices and lift the locking device out and away from the card. Be careful not to touch connector pins, conductor traces, or integrated circuits. Static discharge may damage integrated circuits.
3. Insert the MSDL card into the selected card slot of the module following the card guides in the module.
4. Slide the MSDL into the module until it engages the backplane connector.

5. Push the MSDL firmly into the connector using the locking devices as levers by pushing them toward the card's front panel.
6. Push the card-locking devices firmly against the front panel of the card so they latch to the front lip in the module and to the post on the card.
7. Observe the red LED on the MSDL faceplate. If it turns on, flashes three times, and stays on continuously, the MSDL is operating correctly but is not yet enabled. Go to step 7.
8. If the LED turns on and stays on continuously without flashing three times, the card may be defective. Go to steps 8 and 9.
9. Connect the cables. The installation is complete.
10. Unplug the MSDL card and reinsert it. If the red LED still does not flash three times, leave the card installed for approximately 10 minutes to allow the card to be initialized.
11. After 10 minutes unplug the card and reinsert it. If the card still does not flash three times, the card is defective and must be replaced.

Cable requirements

The MSDL card includes four high-density 26-pin (SCSI II) female connectors for ports and one 8-pin miniature DIN connector for the monitor port. See Figure 94: MSDL cabling on page 330 for a diagram of the MSDL cabling configuration.

A D-Channel on the MSDL requires a connection from the appropriate MSDL port connector to the DCH connector located on the ISDN PRI trunk faceplate.

Other operations on the MSDL are connected to external devices such as terminals and modems. To complete one of these connections, connect the appropriate I/O connector on the MSDL to a connector on the I/O panel at the back of the module where the MSDL is installed. If a terminal is connected to the regular SDI port, use 8 bit, VT100 terminal emulation. If the terminal is connected to the SDI/STA port with line mode editing, use 8 bit, VT220 terminal emulation.

To determine the type and number of cables required to connect to MSDL cards, you must determine the type of operation you wish to run and select the appropriate cable to connect the operation to the MSDL port. Different types of cables, as described in Table 145: Cable types on page 330, connect the MSDL port to a device:

- NTND26, used to connect the MSDL port to the ISDN PRI trunk connector J5, for DCH
- QCAD328, when cabling between two different columns, that is, I/O to I/O
- NTND98AA
- NTND27, used to connect the MSDL port to the I/O panel at the rear of the module, for other interface functions

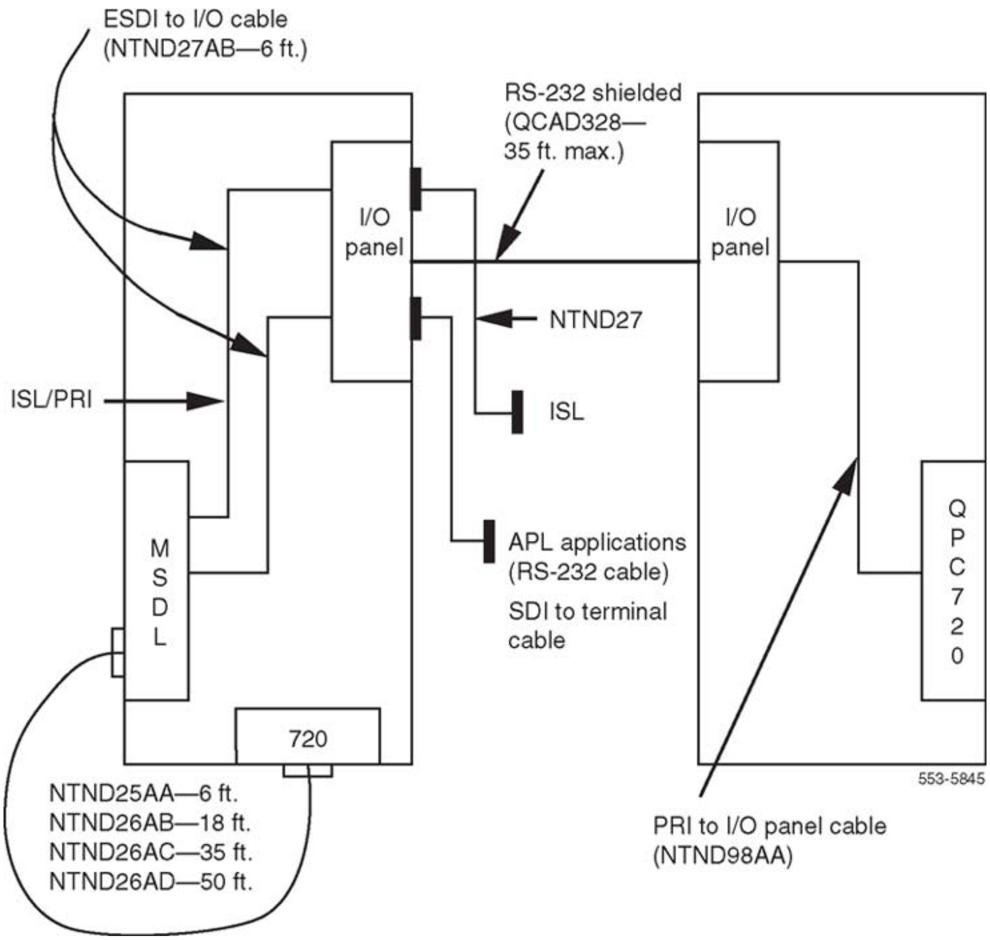


Figure 94: MSDL cabling

Note:

The choices of cable to use with an MSDL card depend on what type of modem is connected. For example, the NTND27 cable is used when the modem has a DB25 connection. If the modem is v.35, a customized or external vendor cable is required.

Table 145: Cable types

Function	Cable type	Cable length
DCH	NTND26AA NTND26AB NTND26AC NTND26AD	6 feet 18 feet 35 feet 50 feet
AML, ISL, SDI	NTND27AB	6 feet

Cable installation

When the MSDL card is installed, connect the cables to the equipment required for the selected operation.

PRI trunk connections

D-channel operations require connections between the MSDL and a PRI trunk card. Refer to *Avaya ISDN Primary Rate Interface: Features* (NN43001-569) for a complete discussion of PRI and D-channels.

Cabling the MSDL card to the PRI card

The following steps explain the procedure for cable connection:

1. Identify the MSDL and the PRI cards to be linked.
2. Select the appropriate length cable for the distance between the MSDL and the PRI card.
3. Plug the 26-pin SCSI II male connector end of a cable into the appropriate MSDL port.
4. Route the cable through cable troughs, if necessary, to the appropriate PRI card.
5. Plug the DB15 male connector end of the cable into the J5 DB15 female connector on the PRI card.
6. Secure the connections in place with their fasteners.
7. Repeat steps 1 through 6 for each connection.

I/O panel connections

Operations aside from PRI require cable connections to the I/O panel.

Cabling the MSDL card to the I/O panel

The following steps explain the procedure for cable connection:

1. Identify the MSDL card and the I/O panel connector to be linked.
2. Using the NTND27AB cable, plug the 26-pin SCSI II male connector end of a cable into the appropriate MSDL port.
3. Route the cable to the rear of the module next to the I/O panel.
4. Plug the DB25 male connector end of a cable into a DB25 female connector at the back of the I/O panel.
5. Secure cable connectors in place with their fasteners.
6. Repeat steps 1 through 5 for each connection.

MSDL planning form

Use the following planning form to help sort and store information concerning the MSDL cards in your system as shown in the sample. Record switch settings for unequipped ports as well as for equipped ports.

MSDL data form					
	Device no.	Shelf	Slot	Card ID	Boot Code version
	Date installed	Last update			
Ports	Operation	Logical no.	Switch setting	Cable no.	Operation information
0					
1					
2					
3					

Sample					
	Device no. 13	Shelf 3	Slot 5	Card ID NT6D80AA-110046	Boot Code version 004
	Date installed 2/1/93	Last update 5/5/93			
Ports	Operation	Logical no.	Switch setting	Cable no.	Operation information
0	TTY	13	RS-232 DCE	NTND27A B	maint TTY 9600 baud
1	DCH	25	RS-422 DTE	NTND26A B	PRI 27 to hdqtrs
2	AML	3	RS-232 DCE	NTND27A B	
3	Spare		RS-232		

Maintenance

Routine maintenance consists of enabling and disabling MSDL cards and downloading new versions of peripheral software. These activities are performed by an authorized person such as a system administrator.

Troubleshooting the MSDL consists of determining problem types, isolating problem sources, and solving the problem. A craftsperson normally performs these activities.

Avaya CS 1000E, CS 1000M, and Meridian 1 systems have self-diagnostic indicators as well as software and hardware tools. These diagnostic facilities simplify MSDL troubleshooting and reduce mean-time-to-repair (MTTR). For complete information concerning system maintenance, refer to *Avaya Communication Server 1000M and Meridian 1 Large System Maintenance* (NN43021-700).

For complete information regarding software maintenance programs, refer to *Avaya Software Input/Output Reference — Administration* (NN43001-611).

MSDL states

MSDL states are controlled manually by maintenance programs or automatically by the system. Figure 95: MSDL states on page 334 shows MSDL states and the transitions among them. These are the three states the MSDL may be in:

- Manually disabled
- Enabled
- System disabled

The following sections describe the relationships between these states.

Manually disabled

In this state, the MSDL is not active. The system does not attempt to communicate or attempt any automatic maintenance on the MSDL.

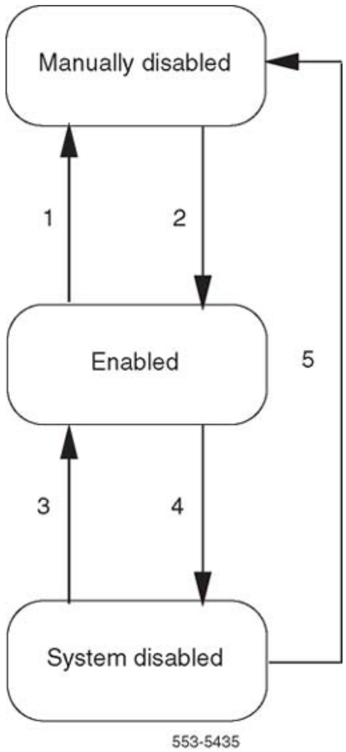


Figure 95: MSDL states

A newly configured MSDL automatically enters the manually disabled state. An operating MSDL can be manually disabled by issuing the **DIS MSDL x** command in LD 37 (step 1 in Figure 95: MSDL states on page 334).

Entering the **DIS MSDL x** command in LD 37 moves the card to manually disabled status and stops all system communication with the card (step 5 in Figure 95: MSDL states on page 334).

Manually enabled

When the card is manually disabled, re-enable it with the **ENL MSDL x** command in LD 37 (step 2 in Figure 95: MSDL states on page 334).

System disabled

When the system disables the MSDL card (step 4 in Figure 95: MSDL states on page 334), it continues to communicate and attempt maintenance procedures on the card. To stop all system communication with the card, enter **DIS MSDL x** to disable it (step 5 in Figure 95: MSDL states on page 334). Otherwise, the system periodically tries to enable the card, attempting recovery during the midnight routines (step 3 in Figure 95: MSDL states on page 334).

The system disables the MSDL if the card:

- exhibits an overload condition
- does not respond to system messages
- is removed
- resets itself
- encounters a fatal error
- is frequently system disabled and recovered

When an MSDL is system disabled, a substate indicates why the MSDL is disabled. The substates are:

- **Not Responding** The system cannot communicate with the MSDL.
- **Self-Testing** The MSDL card is performing self-tests.
- **Self-tests Passed** The MSDL card successfully completed self-tests and the system is determining if download is required or the software downloading is complete.
- **Self-tests Failed** The MSDL card self-tests failed.
- **Shared RAM Tests Failed** The system failed to read/write to the MSDL shared RAM.
- **Overload** The system received an excessive number of messages within a specified time period.
- **Reset Threshold** The system detected more than four resets within 10 minutes.
- **Fatal Error** The MSDL card encountered a fatal condition from which it cannot recover.
- **Recovery Threshold** The MSDL card was successfully enabled by the MSDL autorecovery function five times within 30 minutes. Each time it was system disabled because of a problem encountered during operation.
- **Bootloading** The MSDL base software is in the process of being downloaded to the MSDL.

Detailed information about system disabled substates and the action required for each substate appears in Symptoms and actions on page 339.

Maintaining the MSDL

The system controls automatic MSDL maintenance functions. A craftsperson or system administrator performs manual maintenance by changing the card status, downloading new versions of peripheral software, or invoking self-tests.

System controlled maintenance

Built-in diagnostic functions constantly monitor and analyze the system and individual card, performing the following operations:

- using autorecovery to automatically correct a temporarily faulty condition and maintain the system and its components
- printing information and error messages to indicate abnormal conditions that caused a temporary or an unrecoverable error

During system initialization, the system examines the MSDL base code. If the base code needs to be downloaded, the CPU resets the MSDL card and starts downloading immediately following initialization. At the same time, all other MSDL peripheral software programs are checked and, if they do not correspond to the system disk versions, the correct ones are downloaded to the card.

If manual intervention is required during initialization or operation, information and error messages appear on the console or the system TTY to suggest the appropriate action. For a complete discussion of the information and error messages, refer to *Avaya Software Input/ Output Reference — Administration* (NN43001-611). Detailed information of system disabled substates and the action required for each substate is found at the end of this document.

Manually controlled maintenance

Use manual maintenance commands found in the following programs to enable, disable, reset, get the status of, and perform self-tests on the MSDL card:

- Input/Output Diagnostic Program LD 37
- Link Diagnostic Program LD 48
- PRI D-channel Diagnostic Program LD 96

For a complete discussion of these programs, refer to *Avaya Software Input/Output Reference — Administration* (NN43001-611).

Note:

Enter commands after the dot (.) prompt.

Note:

The "**x**" in the commands below represents the DNUM value of the card number.

Enabling the MSDL

Enter **`ENL MSDL x`** to enable the MSDL manually. If the MSDL base code has not been previously downloaded or if the card version is different from the one on the system disk, the software is downloaded and the card is enabled.

To force software download and enable the card, enter **`ENL MSDL x FDL`**. This command forces the download of the MSDL base code and the configured peripheral software even if it is already resident on the card. The card is then enabled.

To enable a disabled MSDL and its ports, enter **`ENL MSDL x ALL`**. This command downloads all peripheral software (if required) and enables any configured ports on the card. This command can be issued to enable some manually disabled ports on an already enabled MSDL.

Disabling the MSDL

To disable an MSDL card, enter **`DIS MSDL x`**.

To disable the MSDL and all its ports, enter **`DIS MSDL x ALL`**.

Resetting the MSDL

To reset an MSDL and initiate a limited self-test, the MSDL must be in a manually disabled state. To perform the reset, enter **`RST MSDL x`**.

Displaying MSDL status

To display the status of all MSDL cards, enter **`STAT MSDL`**.

To display the status of a specific MSDL, enter **`STAT MSDL x`**. The status of the MSDL, its ports, and the operation of each port appears.

The command **`STAT MSDL x FULL`** displays all information about an MSDL (card ID, bootload firmware version, base code version, base code state, operation state, date of base code activation) as well as the version, state, and activation date for each card operation.

Self-testing the MSDL

To perform extensive self-testing of an MSDL, enter **`SLFT MSDL x`**. This test can be activated if the card is in the manually disabled state. If the test passes, the system outputs the card ID and a pass message. If it fails, the system displays a message indicating which test failed.

Manually isolating and correcting faults

Problems are due to configuration errors that occur during installation or hardware faults resulting from component failure during operation. See Symptoms and actions on page 339 for more information about problem symptoms and required responses.

Isolate MSDL faults using the diagnostic tools described below:

1. Observe and list the problem symptoms; for example, a typical symptom is a permanently lit LED.
2. If the LED flashes three times but the card does not enable, verify that the card is installed in a proper slot.
3. Check that the address is unique; no other card in the system can be physically set to the same device number as the MSDL.
4. If installation is correct and no address conflict exists, refer to Newly installed MSDL cards on page 338 or Previously operating MSDL cards on page 338.
5. If the MSDL still does not operate correctly, contact your Avaya representative.

Newly installed MSDL cards

Problems that occur during MSDL card installation usually result from improperly installed, incorrectly addressed, or faulty cards.

If the LED on a newly installed MSDL does not flash three times after insertion, wait 5 minutes, then remove and reinsert. If the LED still does not flash three times, the card is faulty.

Previously operating MSDL cards

Problems that occur during normal operation usually result from faulty cards. Follow these steps to evaluate the situation:

1. Use the **`STAT MSDL x`** command to check MSDL card status. See Displaying MSDL status on page 337.
2. If the card is manually disabled, try to enable it using **`ENL MSDL x`**. Enabling the MSDL on page 337 If this fails, perform self-testing as described in step 4.
3. If the card is disabled by the system, disable it manually with **`DIS MSDL x`**. See Disabling the MSDL on page 337
4. Invoke self-testing with the **`SLFT MSDL x`** command. Self-testing the MSDL on page 337 If self-tests fail, replace the card. If self-tests pass, try to enable the card again, as in step 2. If the card does not enable, note the message output to the TTY and follow the recommended action.

Replacing MSDL cards

After completing MSDL troubleshooting you may determine that one or more MSDL cards are defective. Remove the defective cards and replace them with new ones.

Replacing an MSDL card

An MSDL card can be removed from and inserted into a system module without turning off the power to the module. Follow these steps:

1. Log in on the maintenance terminal.
2. At the > prompt, type **`LD 37`** (you can also use LD 48 or LD 96) and press Enter.
3. Type **`DIS MSDL x ALL`** and press Enter to disable the MSDL and any active operations running on one or more of its ports. The MSDL card is now disabled.
4. Disconnect the cables from the MSDL faceplate connectors.
5. Unlatch the card-locking devices, and remove the card from the module.
6. Set the switches on the replacement card to match those on the defective card.
7. Insert the replacement card into the same card slot.
8. Observe the red LED on the front panel during self-test. If it flashes three times and stays on, it has passed the test. Go to step 8.
9. If it does not flash three times and then stay on, it has failed the test. Pull the MSDL partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the MSDL.
10. Connect the cables to the MSDL faceplate connectors.
11. At the . prompt in the LD 37 program, type **`ENL MSDL x ALL`** and press Enter to enable the MSDL and its operations. If the red LED on the MSDL turns off, the MSDL is functioning correctly. Because of self-tests were not invoked, no result message appears.
12. Tag the defective card(s) with a description of the problem and return them to your Avaya representative.

Symptoms and actions

Explained here are some of the symptoms, diagnoses, and actions required to resolve MSDL card problems. Contact your Avaya representative for further assistance.

These explain the causes of problems and the actions needed to return the card to an enabled state following installation or operational problems.

Symptom:	The LED on the MSDL card is steadily lit.
Diagnosis:	The MSDL card is disabled or faulty.
Action:	Refer to Trunk cards on page 59.
OR	
Diagnosis:	Peripheral software download failed because of MSDL card or system disk failure.
Action:	If only one MSDL card has its LED lit, replace it.

Symptom:	Autorecovery is activated every 30 seconds to enable the MSDL. MSDL300 messages appear on the console or TTY.
Diagnosis:	The MSDL card is system disabled because of an incorrect address.
Action:	Verify the switch settings.
OR	
Diagnosis:	The MSDL card is system disabled because of peripheral software or configuration errors.
Action:	Refer to System disabled actions on page 340.

System disabled actions

These explain the causes of problems and the actions needed to return the card to an enabled state following system disabling.

SYSTEM DISABLED—NOT RESPONDING:

Table 146:

Cause:
The MSDL card is not installed or is unable to respond to the messages from the system.

Action:

Check the MSDL messages on the console and take the action recommended. Refer to *Avaya Software Input/Output Reference — Administration* (NN43001-611).

Verify that the address switches on the MSDL are set correctly.

Verify that the card is properly installed in the shelf for at least 5 minutes.

If the problem persists, manually disable the card by entering the **DIS MSDL x**. Follow the steps described in Previously operating MSDL cards on page 338.

SYSTEM DISABLED—SELF-TESTING:

Table 147:

Cause:
The MSDL card has reset itself or the system has reset the card to perform self-tests. Self-tests are in progress.

Action:

Wait until self-tests are completed. Under some circumstances, the self-tests may take up to 6 minutes to complete.

Take the action described in the appropriate section below ("SYSTEM DISABLED—SELF-TESTS PASSED" or "SYSTEM DISABLED—SELF-TESTS FAILED").

SYSTEM DISABLED—SELF-TESTS PASSED

Table 148:

Cause:
The MSDL card passed self-tests. The system automatically downloads the MSDL base code, if needed, and attempts to enable the card using autorecovery. If a diagnostic program (overlay) is active, the downloading of the MSDL base code occurs later.

Action:

Wait to see if the system enables the card immediately. If the MSDL is enabled, no further action is necessary.

If the MSDL base code download fails five times, autorecovery stops. The following appears in response to the **STAT MSDL x** command;

```
MSDL 10: SYS DSBL—SELFTEST PASSED
NO RECOVERY UNTIL MIDNIGHT: FAILED BASE DNLD 5 TIMES
SDI  10  DIS  PORT 0
AML  11  DIS  PORT 1
DCH  12  DIS  PORT 2
AML  13  DIS  PORT 3
```

Error messages usually indicate the problem in this case. See Maintaining the MSDL on page 335.

SYSTEM DISABLED—SELF-TESTS FAILED:

Cause:
The card did not pass self-tests. These tests repeat five times. If unsuccessful, autorecovery stops until midnight unless you take action.

Action:

Allow the system to repeat the self-tests.

If self-tests fail repeatedly, disable the card using the **`DIS MSDL x`** command and replace the card.

SYSTEM DISABLED—SRAM TESTS FAILED:

Table 149:

Cause:
After self-tests pass, the system attempts to perform read/write tests on the shared RAM on the MSDL and detects a fault. The shared RAM test repeats five times, and, if unsuccessful, autorecovery does not resume until midnight unless you take action.

Action:

Allow the system to repeat the self-tests.

If self-tests fail repeatedly, disable the card using the **`DIS MSDL x`** command and replace the card.

SYSTEM DISABLED—OVERLOAD:

Table 150:

Cause:
The system received an excessive number of messages from the MSDL card in a certain time. If the card invokes overload four times in 30 minutes, it exceeds the recovery threshold as described in "SYSTEM DISABLED—RECOVERY THRESHOLD." The system resets the card, invokes self-tests, and attempts to enable the card. The problem may be due to excessive traffic on one or more MSDL ports. Traffic load redistribution may resolve this condition.

Action:

Check the traffic report, which may indicate that one or more MSDL ports are handling excessive traffic.

By disabling each port, identify the port with too much traffic and allow the remaining ports to operate normally. Refer to Maintaining the MSDL on page 335. If the problem persists, place the card in the manually disabled state by the **`DIS MSDL x`** command and follow the steps in Previously operating MSDL cards on page 338.

SYSTEM DISABLED—RESET THRESHOLD:

Table 151:

Cause:
The system detected more than four MSDL card resets within 10 minutes. The system attempts to enable the card again at midnight unless you intervene.

Action:

Place the card in the manually disabled state with the **`DIS MSDL x`** command and follow the steps in Previously operating MSDL cards on page 338.

SYSTEM DISABLED—FATAL ERROR:

Cause:
The MSDL card encountered a fatal error and cannot recover. The exact reason for the fatal error is shown in the MSDL300 error message output to the console of TTY when the error occurred.

Action:

Check the MSDL300 message to find out the reason.

Alternatively, display the status of the MSDL, which also indicates the cause of the problem, with the **`STAT MSDL x`** command and check the information to find the cause of the fatal error.

Allow the system to attempt recovery. If this fails, either by reaching a threshold or detecting self-test failure, place the MSDL in the manually disabled state with the **`DIS MSDL x`** command and follow the steps in Previously operating MSDL cards on page 338.

SYSTEM DISABLED—RECOVERY THRESHOLD:

Table 152:

Cause:
The system attempted autorecovery of the MSDL card more than five times within 30 minutes and each time the card was disabled again. The system attempts to enable the card again at midnight unless you intervene.

Action:

Place the MSDL card in a manually disabled state with the **`DIS MSDL x`** command and follow the steps in Previously operating MSDL cards on page 338.

Chapter 19: NT7K20 Global Analog Line Card

Contents

This section contains information on the following topics:

Introduction

The NT7K20 Global Analog Line Card (GALC) is an IPE line card that can be installed in any IPE slot of a Media Gateway chassis, cabinet, MG 1010 or IPE shelf on a Large System. The NT7K20AAE6 only replaces the NT8D09 series of line cards. The NT7K20ABE6 replaces all analog line cards.

The NT7K20 GALC provides talk battery and signaling for up to 16 regular 2-wire common battery analog (500/2500-type) telephones and key telephone equipment, with the Message Waiting lamp feature. NT7K20 is an analog line card for global market. You can configure this for use in different country and region by setting on-board DIP Switch S1 and S2. Following table shows definition of NT7K20 DIP Switch setting. The Message Waiting disable switch S2-4 turns the Message Waiting feature OFF when the switch is set to ON position. For North America, China, New Zealand, and Australia a High Voltage 1 Hz Message Waiting Signal is provided. All other countries provide a Low Voltage 1 Hz Message Waiting Signal.

Table 153: NT7K20ABE6 On-Board DIP Switch settings for Country and Region

Country Region	Transmission Parameters		Switch S1				Switch S2				Legacy Card Mapping Latest example	
	A-D Loss (db)	D-A Loss (db)	1 CLASS MW Enl	2	3	4	1	2 Ring Freq	3 Ring Freq	4 MW Disable		Ring Freq
Austria	0	7	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	NT5K02EBE5	50 Hz
Belgium	0	7	OFF	ON	ON	ON	ON	ON	OFF	OFF	NT5K02HAE5	25 Hz
China	0	3.5	OFF	ON	ON	ON	OFF	OFF	OFF	OFF	NTRA04BB	20 Hz
Denmark	4	1	OFF	ON	OFF	OFF	ON	ON	OFF	OFF	NT5K02JCE5	25 Hz
Denmark (ETSI)	1	1	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	NT5K02JCE5	25 Hz
Finland	0	7	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	NT5K02EBE5	25 Hz
France	-2	9	OFF	ON	ON	OFF	ON	OFF	ON	OFF	NT5K02DBE5	50 Hz
Germany	0	7	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	NT5K02EBE5	25 Hz
Greece	0	7	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	NT5K02EBE5	20 Hz
Holland	0	7	OFF	OFF	ON	ON	ON	ON	OFF	OFF	NT5K02KBE5	25 Hz
India	0	7	OFF	OFF	ON	ON	ON	ON	OFF	OFF	NT5K02KBE5	25 Hz
Ireland	0	7	OFF	OFF	ON	ON	ON	ON	OFF	OFF	NT5K02KBE5	25 Hz
Italy	0	7	OFF	OFF	ON	ON	OFF	ON	OFF	OFF	NT5K02TBE5	25 Hz
New Zealand	3.0	8.5	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	NT5K02LEE5	25 Hz

Country Region	Transmission Parameters		Switch S1				Switch S2				Legacy Card Mapping Latest example	
	A-D Loss (db)	D-A Loss (db)	1 CLASS MW Enl	2	3	4	1	2 Ring Freq	3 Ring Freq	4 MW Disable		Ring Freq
North America	3.5	0.5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	NT8D09CAE5	20 Hz
Norway	2	5	OFF	ON	OFF	ON	OFF	ON	OFF	OFF	NT5K02MCE5	25 Hz
Portugal	0	7	OFF	OFF	ON	ON	ON	ON	OFF	OFF	NT5K02KBE5	25 Hz
Spain	0	7	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF	NT5K02SAE5	25 Hz
Sweden	5	0	OFF	OFF	ON	OFF	ON	ON	OFF	OFF	NT5K02NCE5	25 Hz
Switzerland	0	6.5	OFF	ON	OFF	ON	ON	ON	OFF	OFF	NT5K02PCE5	25 Hz
UK	3	4	OFF	OFF	OFF	ON	ON	ON	OFF	OFF	NT5K02QCE5	25 Hz

Note:

- S2-4 Message Waiting Disable turns the feature OFF when the switch is set to ON position. For North America, China, and New Zealand a flashing **High Voltage** 1 Hz Message Waiting Signal is provided. All other countries provide a flashing **Low Voltage** 1 Hz Message Waiting Signal.
- S1-1 Class Message Waiting is used to turn on support for SL100 attendant consoles as well as enable the support for class message waiting. Do not use this feature unless you have a requirement to support these functions.
- S2-2 & S2-3 must be set to match the system ringing frequency used on the system ringing power supply. If the system ringing frequency differs from the one listed in the table please use the following to match what is set on the system ringing power supply. 20Hz = S2-2-OFF S2-3-OFF 25Hz = S2-2-ON S2-3-OFF 50Hz = S2-2-OFF S2-3-ON

The NT7K20ABE6 is functionally identical to the NT8D09 and NT5K02 series of packs.

NT7K20 support µ-Law and A-Law companding. System SSD message configures the companding law setting.

The NT7K20 supports 56K modem operation.

⚠ **Caution:**

Damage to Equipment

If a modem is connected to a port on the message waiting line card, do not define that port in software (LD 10) as having message waiting capabilities. Otherwise, the modem gets damaged.

The NT7K20 interfaces to and is compatible with the equipment listed in the following table:

Equipment	Specifications
500-type dial pulse sets (or equivalent):	
dial speed	8.0 to 12.5 pps **Note:** To achieve a 60 % break ratio when using a phone with a dial speed of 8 pps, increase the Flash Min timer in OVL 97 to be greater than 80 ms.
percent break	40 to 60%
interdigit time	150 ms **Note:** You can configure Interdigit time LD 97 in the system parameters under the item TID.
2500-type Digitone sets (or equivalent):	
frequency accuracy	± 1.5%
pulse duration	40 ms
interdigit time	40 ms
speed	12.5 digits/s

Physical description

The circuitry is mounted on a 31.75 cm. by 25.40 cm (12.5 in. by 10 in.) printed circuit board.

The NT7K20 circuits connects to the backplane through a 160-pin connector. The backplane is cabled to a connector in the bottom of the cabinet which is cabled to the cross-connect terminal (Main Distribution Frame) through 25-pair cables. Station apparatus then connects to the card at the cross-connect terminal.

The faceplate of the NT7K20 is equipped with a red LED which lights when the card is disabled (see Figure 96: Analog message waiting line card - faceplate on page 349. At power-up, the LED flashes as the analog line card runs a self-test. If the test completes successfully, the card is automatically enabled (if it is configured in software) and the LED goes out.

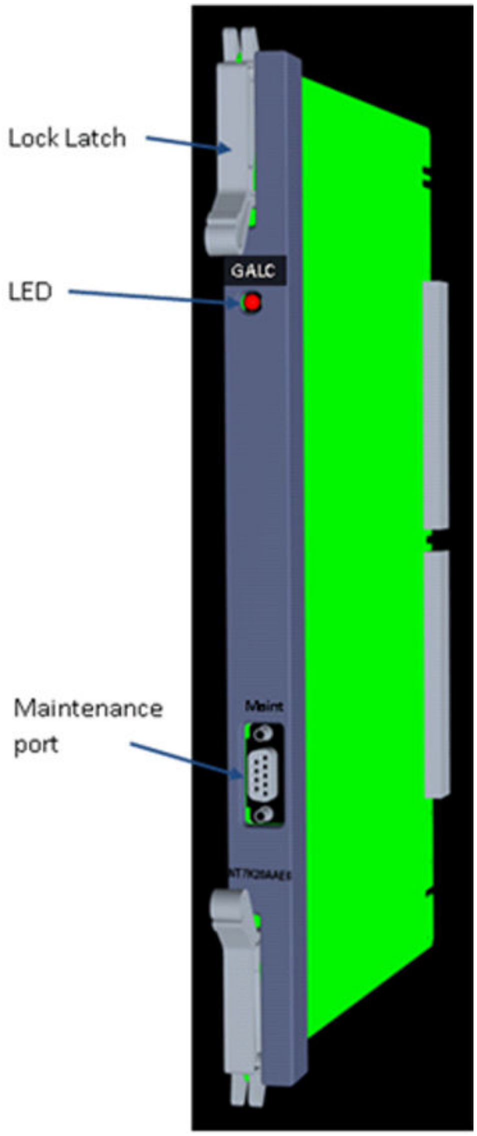


Figure 96: Analog message waiting line card - faceplate

Functional description

The NT7K20 GALC contains a microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- full set of Line Test features
- maintenance diagnostics

The NT7K20 also provides:

- configurable line terminating impedance, selected by on-board DIP Switches setting
- analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio phone lines
- transmission and reception of Scan and Signaling Device (SSD) signaling messages over a DS-30X signaling channel in A10 format
- on-hook/off-hook status and switchhook flash detection as low as 65 ms on the NT7K20ABE6
- ringing signal connection and automatic disconnection when the station goes off-hook
- synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage
- loopback of SSD messages and Pulse Code Modulation (PCM) signals for diagnostic purposes
- correct initialization of all features at power-up
- direct reporting of digit dialed (500-type telephones) by collecting dial pulses
- connection of –150 V DC to activate message waiting lamps be able to constantly light up message waiting lamp, or flash the lamp at 1Hz
- Low voltage message waiting is supported on the NT7K20ABE6
- Ground button is supported on the NT7K20ABE6
- lamp status detection
- disabling and enabling of selected units for maintenance

Figure 97: NT7K20- block diagram on page 351 shows a block diagram of the major functions contained on the analog message waiting line card. Each of these functions are described in the following sections.

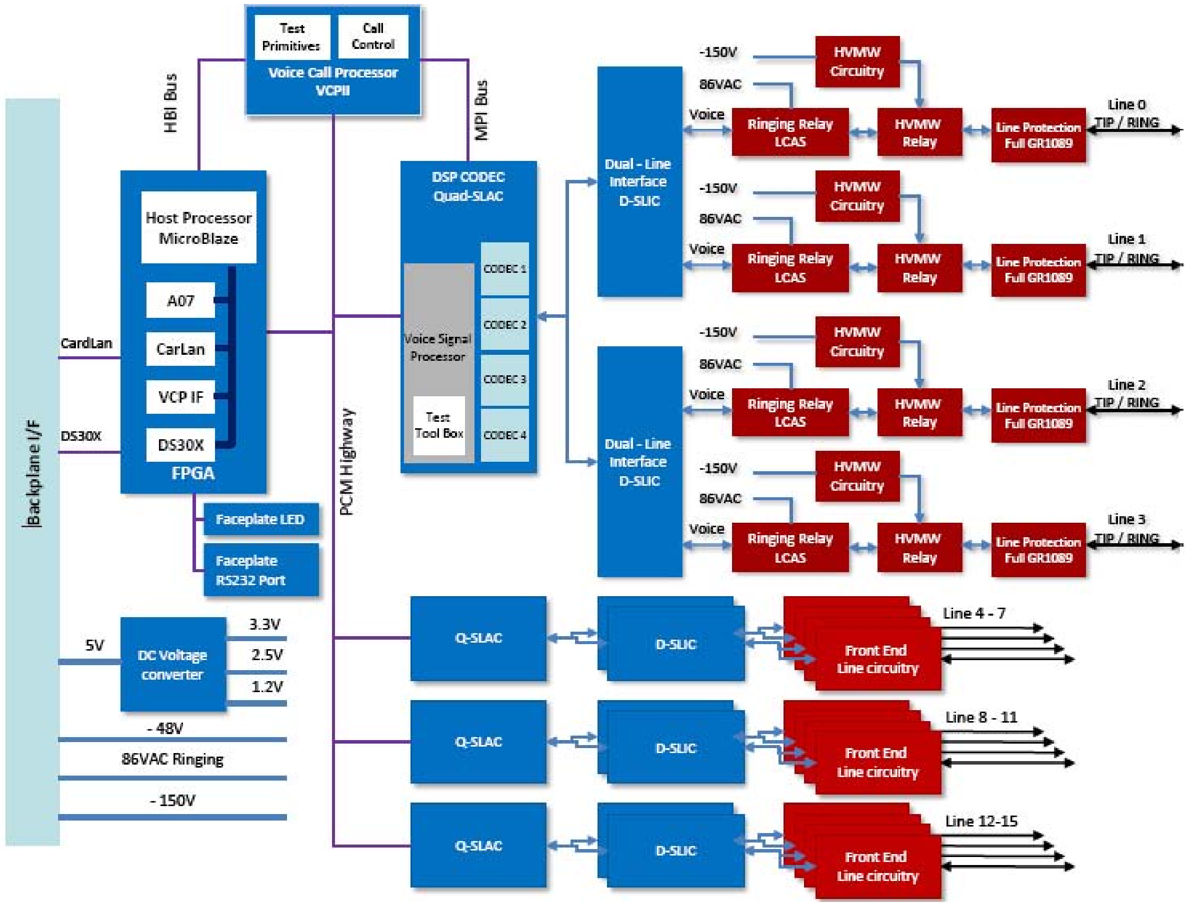


Figure 97: NT7K20- block diagram

System Interfaces

The analog message waiting line card passes voice and signaling data over DS-30X loops and maintenance data over the card LAN link. These interfaces are discussed in Intelligent Peripheral Equipment on page 37.

The following features are common to all units on the card:

- Transmission and reception of Scan and Signaling Device (SSD) signaling messages over a DS30X signaling channel in A10 format. Direct reporting of digits dialed (500 telephones) by collecting dial pulses.
- Loopback of SSD messages for diagnostic purposes. Connection of –150 V DC at 1 Hz to activate message waiting lamps in two telephones in parallel. The two telephones must be the same type or the neon series resistor in each telephone must be 54 K ohms or greater.
- Correct initialization of all features, as configured in software, at power-up.

Line interface units

The analog message waiting line card contains 16 identical and independently configurable line interface units (also referred to as circuits). Each unit provides configurable line impedance and transmission parameters. Each line interface circuit is made up with SLAC - SLIC - LCAS - Protection, and HVMW.

SLIC devices provide current-drive control to lines, and is responsible for detecting line state change.

SLAC devices provide DSP CODEC function, perform A/D, D/A conversion, control transmission parameter, and control line impedance.

Each line also has a solid state relay - LCAS that replaces mechanical relay on old line cards. LCAS switches ringing voltage on or off (analog line) with little EMI noise, and offer some over-voltage protection before the main line protection device kick in. Main Line Protection circuit is made up with in-line thermistors and shunt thyristor on both Tip or Ring lead. This combination provides a well-rounded protection for lighting, power-cross or other fault condition, and meets Full GR1089 requirement. Each line also have a High Voltage Message Waiting circuit that utilizes the HVMW voltage provided by system power supply and provides it to line with 1mA current limit.

The following features are common to all units on the card:

- Lamp status detection (does not detect a failure of either lamp when operating in parallel).
- Disabling and enabling of selected units for maintenance.
- 27 mA to telephones with short circuit protection.

Note:

GALC provides 27mA loop current for line with loop resistance (include set resistance) below 1K ohm. Beyond this, the loop current starts decreasing.

Card control functions

Card Control functions are provided by FPGA (U1) and VCP (U2). VCP handles real-time processing of line events, and reports to Micro-Processor in FPGA. It also executes commands from FPGA and control line circuits as requested. FPGA has the following logic units:

- a microcontroller
- a card LAN interface
- SSD Signalling interface - A07
- DS30X and PCM data interface

Microcontroller

The FPGA device (U1) on GALC contains a soft microprocessor, Xilinx MicroBlaze processor, which runs embedded firmware application and controls major functions of GALC. The MicroBlaze processor provides the following functions:

- reporting to the CE CP through the card LAN link:
  - card identification (card type, vintage, and serial number)
  - firmware version
  - self-test status
  - programmed configuration status
- Line Control:
  - process SSD message from Call Server and send command to VCP to control line circuity
  - process events from VCP and pass information through SSD interface to Call Server
- receipt and implementation of card configuration:
  - configure line circuit with desired line impedance, transmission parameters, according to on-board DIP Switch setting
  - enabling/disabling of individual units or entire card
  - enabling/disabling of an interrupted dial tone to indicate call waiting
  - provide a maintenance menu through faceplate RS232 port for line test and diagnosis
  - program card ID, serial number, release number through faceplate RS232 port maintenance menu
  - perform production test to all 16 lines or selected line through faceplate RS232 port maintenance menu
  - transmission loss levels

Signaling and control

SSD Signaling interface - A07

A07 equivalent circuit is implemented in FPGA. It is responsible of passing SSD signal between MicroBlaze processor and Call Server using backplane DS30X link.

DS30X and PCM data interface

This interface is implemented in FPGA, and is responsible of processing PCM data between backplane DS30X link and PCM highway on VCP/SLAC side.

Circuit power

The backplane +5.0 V supply is used for digital circuits only. It is regulated to +3.3 V, +2.5 V, +1.2 V and +1.8 V to meet the requirements of different digital devices.

The -48 V supply is only used to power analog line circuits. The amount of current consumed is directly related to number of units Off-hook. When all units are ON-hook, GALC consume around 15 mA of -48 V supply. Each unit Off-hook will add 27 mA.

Ringing voltage is provided by system power supply. It can be 86 Vrms, 75 Vrms, 70 Vrms, or 65 Vrms, depends on system setting. It is a AC voltage on top of -48 V DC voltage. This type of ringing voltage is referred to as Battery-backed Ringing. The ringing voltage is switched on to line by LCAS at zero current cross-over point.

High Voltage Message Waiting (HVMW) supply is provided by either the peripheral equipment power supply or the ringing generator. It can be -150 V or -120 V. HVMW circuit on GALC provide a current limiting function for each line, so that only 1mA of -150 V/-120 V can be provided to each line.

Technical summary or electrical specifications

Analog line interface

The NT7K20AAE6 Global Analog Line Card (GALC) meets the EIA/TA464 standard for ONS Type II line cards. Table 154: NT7K20 Global Analog Line Card - technical summary on page 354 shows a summary of the analog line interface unit electrical characteristics.

Table 154: NT7K20 Global Analog Line Card - technical summary

Characteristics	Description — North American Setting
Impedance	600 ohms
Loop limit (excluding telephone)	1000 ohms at nominal –48 V (excluding telephone)
Leakage resistance	30,000 ohms
Ring trip	During silent or ringing intervals
Ringing voltage	86 V ac
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (approximately -42 V on ring and -1.2 V on tip at nominal –48 V battery)

Characteristics	Description — North American Setting
Power input from backplane	–48 (can be as low as –42 for DC-powered systems), +5V, –150 V and ringing voltage
Insertion loss	4 dB +/–0.3 at 1020 Hz 3.5 dB loss for analog to PCM 0.5 dB loss for PCM to analog

Input impedance

The impedance at tip and ring is 600 ohms with a return loss of:

- 20 dB for 200-500 Hz
- 26 dB for 500-3400 Hz

Insertion loss

For North American setting, a station line-to-line connection, the total insertion loss at 1 kHz is 4 dB +0.5 dB. This is arranged as 3.5 dB loss for analog to PCM, and 2.5 dB loss for PCM to analog.

Frequency response

The loss values in Table 155: Analog message waiting line card - frequency response on page 355 are measured relative to the loss at 1 kHz.

Table 155: Analog message waiting line card - frequency response

Frequency (Hz)	Minimum (dB)	Maximum (dB)
60	20.0	-
200	0.0	5.0
300	–0.5	1.0
3000	–0.5	1.0
3200	–0.5	1.5
3400	0.0	3.0

Message channel noise

The message channel noise C-weighted (dBrnC) on 95 percent of the connections (line to line) with both ends terminated in 600 ohms does not exceed 20 dBrnC.

Power requirements

Table 156: Power requirements on page 356 provides the power requirements for the NT7K20 GALC.

Table 156: Power requirements

Voltage (+/-)	Tolerance	Idle current	Active current	Max
+5.0 V DC	0.5V DC	450 mA	10 mA/Line	610 mA
–48.0 V DC	2.00 V DC	16 mA	27 mA/Line	448 mA
86.0 V AC	5.00 V AC	0 mA	10 mA (Note 2)	160 mA
–150.0 V DC	3.00 V DC	0 mA	1 mA	16 mA
Note: Reflects the current for ringing a single station set (or DN telephone). There may be as many as five ringers on each line.				

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is provided on the each line on NT7K20 Global Analog Line Card.

Overload level

Signal levels exceeding +7 dBm applied to the tip and ring cause distortion in speech transmission.

Environmental specifications

Table 157: NT7K20 environmental specifications on page 356 lists the environmental specifications for the analog message waiting line card.

Table 157: NT7K20 environmental specifications

Parameter	Specifications
Operating temperature	0° to +60° C (+32 to +140° F), ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–40° to +70° C (–40° to +158° F)

Connector pin assignments

The NT7K20 brings the 16 phone lines to the IPE backplane through a 160-pin connector shroud. The backplane is cabled to the I/O panel on the rear of the module, which is then connected to the MDF by 25-pair cables.

Telephone lines from station equipment cross connect to the analog message waiting line card at the MDF using a wiring plan similar to that used for trunk cards. A typical connection example is shown in Figure 98: Analog message waiting line card - typical cross connection example on page 358 and Table 158: Analog message waiting line card - backplane pinouts on page 357 shows the I/O pin designations at the backplane connector. This connector is arranged as an 80-row by 2-column array of pins. Normally, these pin positions are cabled to 50-pin connectors at the I/O panel in the rear of each module for connection with 25-pair cables to the cross-connect terminal.

The information in Table 158: Analog message waiting line card - backplane pinouts on page 357 is provided as a reference and diagnostic aid at the backplane, because the cabling arrangement may vary at the I/O panel. See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for cable pinout information at the I/O panel.

Table 158: Analog message waiting line card - backplane pinouts

Backplane pinout*	Lead designations	Backplane pinout*	Lead designations
12A	Line 0, Ring	12B	Line 0, Tip
13A	Line 1, Ring	13B	Line 1, Tip
14A	Line 2, Ring	14B	Line 2, Tip
15A	Line 3, Ring	15B	Line 3, Tip
16A	Line 4, Ring	16B	Line 4, Tip
17A	Line 5, Ring	17B	Line 5, Tip
18A	Line 6, Ring	18B	Line 6, Tip
19A	Line 7, Ring	18B	Line 7, Tip
62A	Line 8, Ring	62B	Line 8, Tip
63A	Line 9, Ring	63B	Line 9, Tip
64A	Line 10, Ring	64B	Line 10, Tip
65A	Line 11, Ring	65B	Line 11, Tip
66A	Line 12, Ring	66B	Line 12, Tip
67A	Line 13, Ring	67B	Line 13, Tip

Backplane pinout*	Lead designations	Backplane pinout*	Lead designations
68A	Line 14, Ring	68B	Line 14, Tip
69A	Line 15, Ring	69B	Line 15, Tip

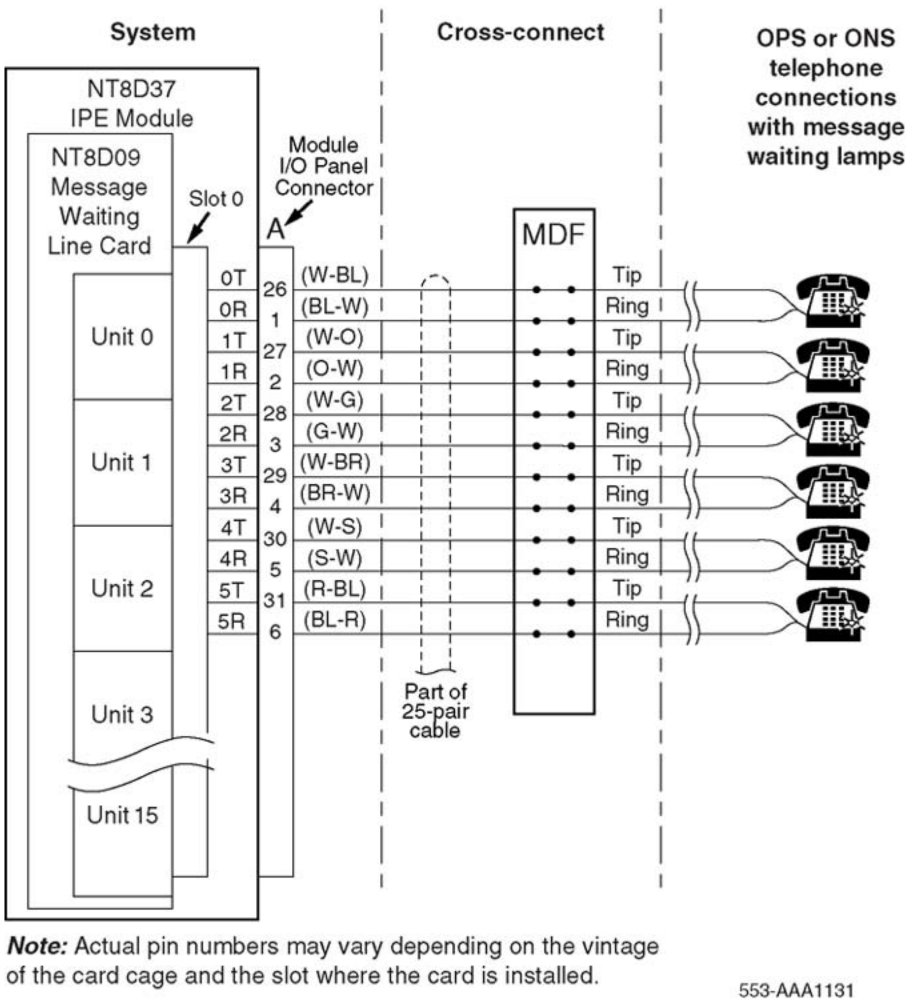


Figure 98: Analog message waiting line card - typical cross connection example

Configuration

This section outlines the procedures for configuring the switches on the NT7K20 GALC card and configuring the system software to properly recognize the card. Software service changes on page 359 shows where the switches are located on this board.

Switch settings

The NT7K20 has two user-configurable DIP switch on-board, S1 and S2. The location is shown in the following figure. The card derives its address from its position in the backplane and reports that information back to the CPU through the LAN Link interface.

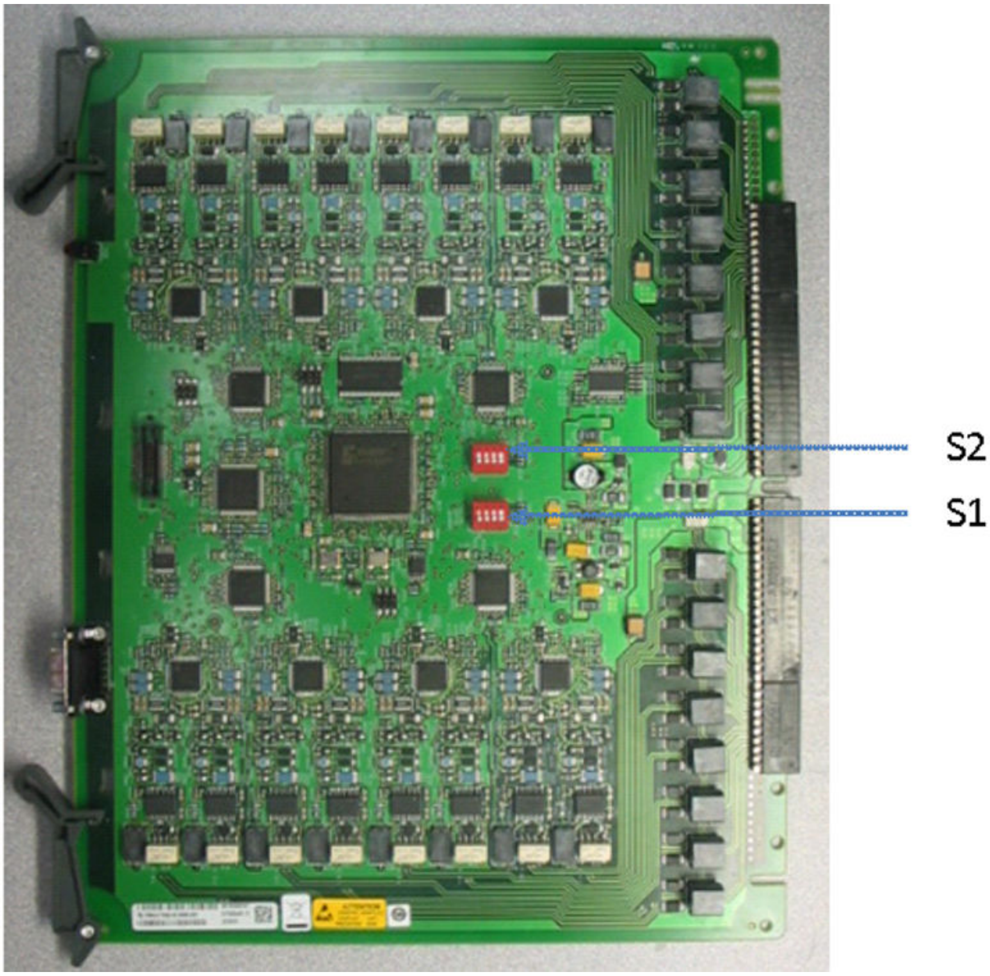


Figure 99: Analog message waiting line card - switch locations

Software service changes

NT7K20 requires no software change to accommodate it. It appears exactly the same as a NT8D09 (MWLC) card to the system. Individual line interface units on the NT8D09 Analog Message Waiting Line card are configured using the Analog (500/2500-type) Telephone Administration program LD 10.

The message waiting feature is enabled by entering data into the customer data block using LD 15. See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 10 and LD 15 service change instructions.

Line diagnosis and card test

In NT7K20 Global Analog Line Card, the faceplate maintenance port allows operator to perform line diagnosis and card test. The faceplate is a DB9 female connector configured as RS232 DCE port with signals defined in the following table:

Table 159: Signal definition — NT7K20 faceplate maintenance port

DB9 pin	Signal	DB9 pin	Signal	DB9 pin	Signal
1	Not connected	5	GND (Signal Ground)	9	Not connected
2	TX (Transmit Data)	6	asserted		
3	RX (Receive Data)	7	Not connected		
4	Not connected	8	asserted		

Port Configuration:

Baud Rate: 115,200

Data bits: 8

Parity: none

stop bits: 1

Flow control: None

Once you have connected NT7K20 faceplate maintenance port, SYSTEM TEST MENU is shown:

SYSTEM TEST MENU

Enter 'p' for Production menu

or 't' for Troubleshoot menu

or 'f' for Firmware Upgrade menu

or 'i' to Print Card Information

Return key for exit

Enter selection:

Use can choose options 'i' or 't' to get the card information.

If you enter 'i', following is the system menu.

Enter selection: I

****

Card Product Code: NT7K20AAE6

Card Serial Number: NNTMG900FCHF

Card Release: 03

FPGA version: GAB2

Card Firmware version: 14

Firmware Image version : AA03

****

If you enter 't' following is the system menu.

Enter selection: t

testTroubleshoot MENU

----

0 - Print FPGA and Firmware Version

1 - Print LineCard Status

2 - Print Channel Status

3 - Read LoopCondition on individual channel

4 - Turn ON message waiting lamp on individual channel

5 - Turn OFF message waiting lamp on individual channel

6 - Start Test individual Line

7 - Start Test All Lines

8 - Dump SLAC registers

9 - Turn ON/OFF A07/VCP debug A - Reboot card

Options for field diagnosis

Following are options for field diagnosis:

- Non service disruption options
- Service disruption options

Non service disruption options

Option 1 is used to check current status of NT7K20 GALC.

Option 2 is used to check current status of each individual line.

Service disruption options

Note:

Service is disrupted when the user performs the following tests. It is suggested to disable and again enable NT7K20 line card in OverLay 32 after the user performs these tests.

Option 6 is used to perform line tests on individual line.

These tests are performed on each line,

Line Ringing Test

Line High Voltage Message Waiting (HVMW) Test

VPTL_TID_DRAW_BREAK_DIALTONE

VPTL_TID_DC_FEED_SELF_TEST

VPTL_TID_RINGING_SELF_TEST

VPTL_TID_NOISE

VPTL_TID_ON_OFF_HOOK_SELF_TEST

VPTL_TID_TRANSMISSION_SELF_TEST

VPTL_TID_3ELE_RES

VPTL_TID_3ELE_CAP

VPTL_TID_3ELE_CAP and VPTL_TID_3ELE_RES test provides measured resistance or capacitance across TIPor RING, TIPor GND, RING or GND. They are useful in line diagnosis.

\---

Starting a new test: Test ID = VPTL_TID_3ELE_RES

\---

Using default inputs for high Three-Element Resistance Test Three-Element Resistance Results

RTG=OPEN

RRG=OPEN

RTR=OPEN

vTip=0.000000 V

vRing=0.000000 V

iTip=-0.000050 A

iRing=-0.000031 A

Starting a new test: Test ID = VPTL_TID_3ELE_CAP

Using default inputs for Three-Element Capacitance Test Three-Element Capacitance Results

Degraded accuracy=No

VtgAC=0.000000 Volts

VrgAC=0.956088 Volts

CTG=3.280578 nF

CRG=2.658815 nF

CTR=108.819176 nF

Line Ringing Test and Line High Voltage Message Waiting (HVMW) test checks NT7K20 line card's ability to apply ringing and HVMW to subscrible line. A working analog phone should be connected to the line under test to verify the result.

VPTL_TID_DRAW_BREAK_DIALTONE, VPTL_TID_RINGING_SELF_TEST,

VPTL_TID_DC_FEED_SELF_TEST, VPTL_TID_NOISE

VPTL_TID_ON_OFF_HOOK_SELF_TEST, and

VPTL_TID_TRANSMISSION_SELF_TEST performs test on various aspects of NT7K20 functionality, and is used to diagnosis card issue.

Option 7 is used to perform line tests on all 16 lines. These are the same tests that are performed Option 6.

Chapter 20: NT8D02 and NTDK16 Digital Line cards

Contents

This section contains information on the following topics:

Introduction

Important:

The NT8D02 Digital Line card is supported in Avaya Communication Server 1000E (Avaya CS 1000E), Avaya CS 1000M, and Meridian 1.

The NTDK16 digital line card is supported ONLY in the Chassis system.

The Digital Line card is a voice and data communication link between the system and Digital Telephones. It supports voice only or simultaneous voice and data service over a single twisted pair of standard telephone wiring.

When a digital telephone is equipped with the data option, an asynchronous or synchronous terminal or personal computer can be connected to the system through the digital telephone.

The Digital Line card provides 16 voice and 16 data communication links.

NT8D02 Digital Line card

The 32 port NT8D02 Digital Line card is supported in the Media Gateway and Media Gateway Expansion.

You can install this card in any IPE slot.

NTDK16 Digital Line card

The NTDK16 is a 48 port card supported only in the Chassis system. It is based on the NT8D02 Digital Line card and is functionally equivalent to three NT8D02s, and configured as cards 4, 5, and 6 in the main chassis. It uses A94 Digital Line Interface chips (DLIC) to provide the interface between the Digital sets and the system.

The NTDK16 Digital Line card can only be installed in slot 4 of the main chassis which is slotted to prevent accidental insertion of other cards.The Digital Line Card is a voice and data communication link between the system and Meridian Digital Telephones. It supports voice only or simultaneous voice and data service over a single twisted pair of standard telephone wiring.

When a digital telephone is equipped with the data option, an asynchronous or synchronous terminal or personal computer can be connected to the system through the digital telephone.

Physical description

The Digital Line card circuitry is mounted on a 31.75 cm by 25.40 cm (12.5 in. by 10 in.) printed circuit board. The NT8D02 is a double-sided PCB, whereas the NTDK16 is 4 layers, but standard thickness. Both cards connect to the backplane through a 120-pin or 160-pin edge connector.

The faceplate of the NT8D02 Digital Line card is equipped with a red LED that lights when the card is disabled. See Figure 100: Digital line card - faceplate on page 367. When the card is installed, the LED remains lit for two to five seconds as a self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED continually flashes or remains weakly lit, replace the card.

Note:

The NTDK16AA has one LED. This LED shows the status of Card 4.

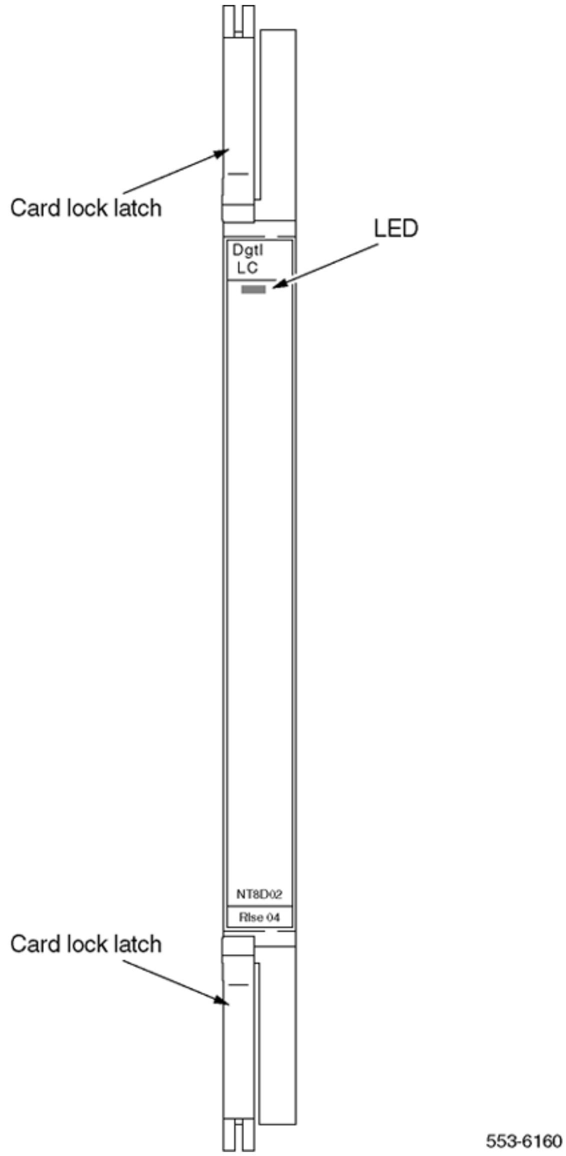


Figure 100: Digital line card - faceplate

Functional description

NT8D02 Digital Line card

The NT8D02 Digital Line card is equipped with 16 identical units. Each unit provides a multiplexed voice, data, and signaling path to and from digital apparatus over a 2-wire full duplex 512 kHz time compression multiplexed (TCM) digital link. Each digital telephone and associated data terminal is assigned a separate terminal number (TN) in the system database, for a total of 32 addressable ports per card.

The digital line card contains a microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- maintenance diagnostics

Figure 101: Digital line card - block diagram on page 369 shows a block diagram of the major functions contained on the NT8D02 Digital Line card. Each of these functions is described on the following pages.

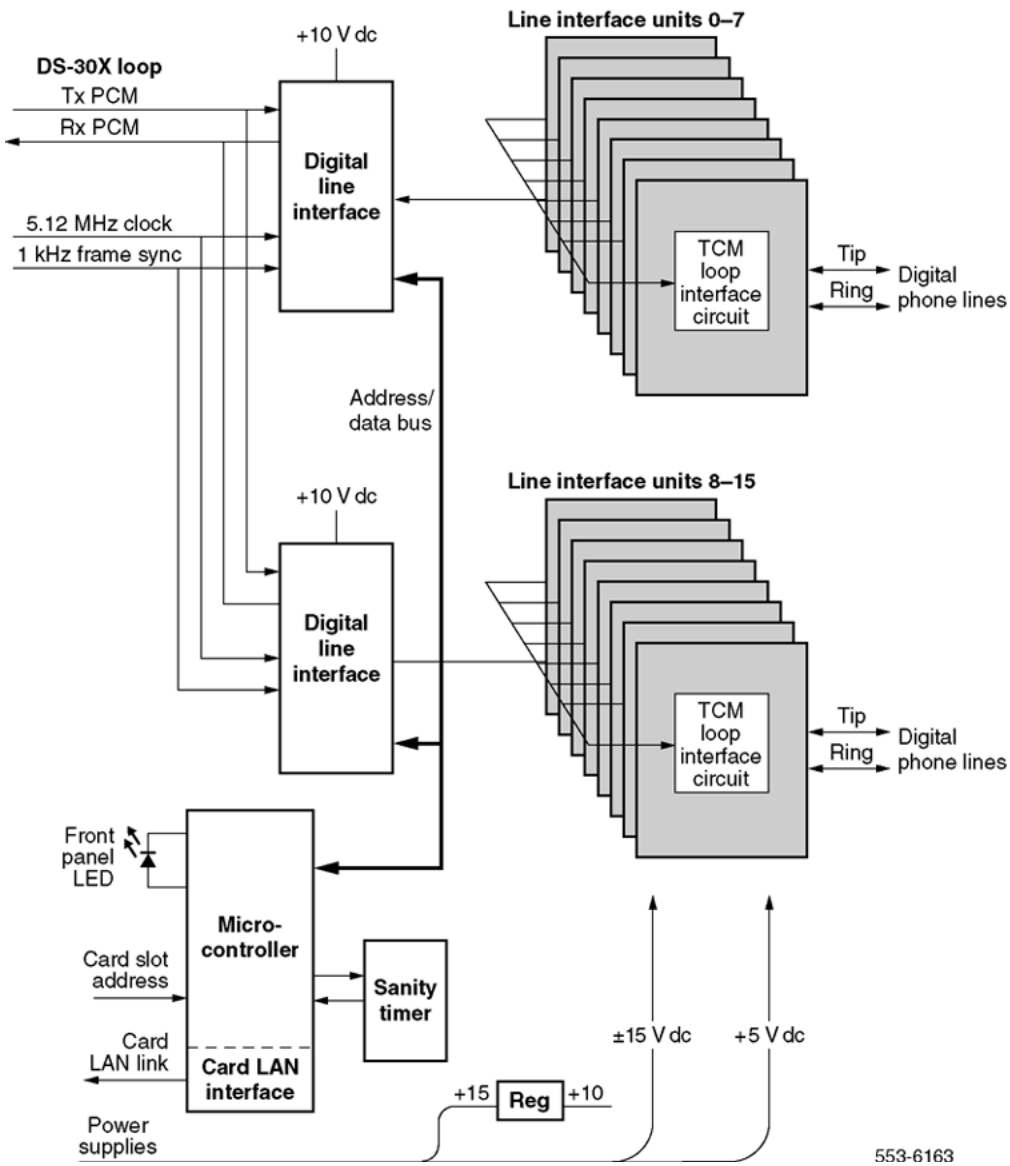


Figure 101: Digital line card - block diagram

NTDK16 Digital Line card

The NTDK16 digital line card is equipped with 48 identical units. Each unit provides a multiplexed voice, data, and signaling path to and from digital apparatus over a 2-wire full duplex 512 kHz time compression multiplexed (TCM) digital link. Each digital telephone and associated data terminal is assigned a separate terminal number (TN) in the system database, for a total of 96 addressable ports per card. Refer to Figure 102: NTDK16 DLC on page 371.

The NTDK16 digital line card contains a microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- maintenance diagnostics

The card also provides:

- Ability to support Digital sets and the Digital Console M2250
- Provides a serial link (Card LAN) for status report and maintenance.
- Supports loop lengths up to 3500 ft. (1.0 km) using 24 AWG wire.
- Interface between three DS30X loops and 48 TCM lines.

Figure 103: Digital line card - block diagram on page 372 shows a block diagram of the major functions contained on the digital line card. Each of these functions are described on the following pages.

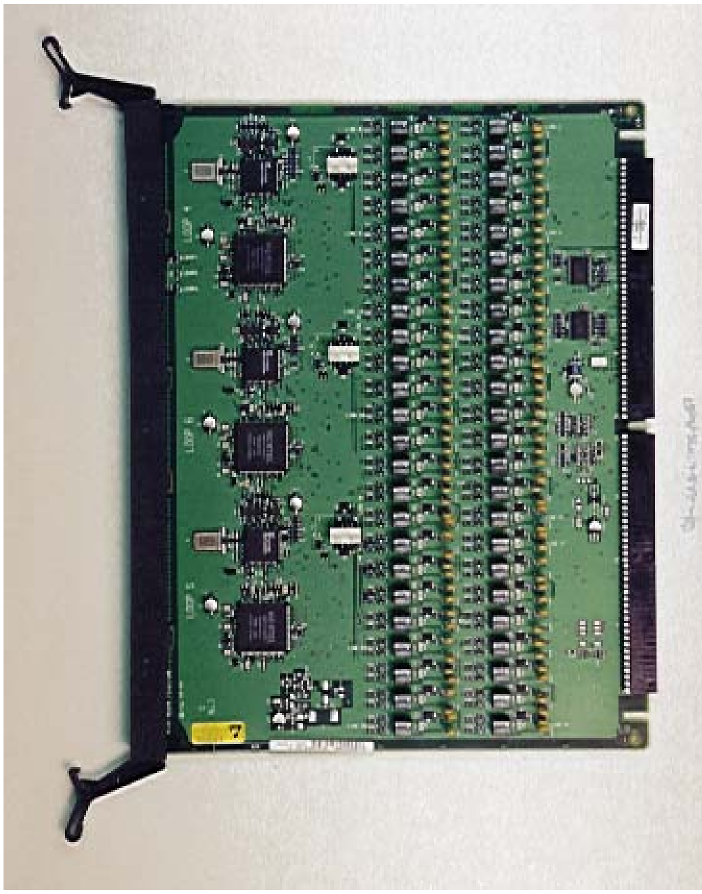


Figure 102: NTDK16 DLC

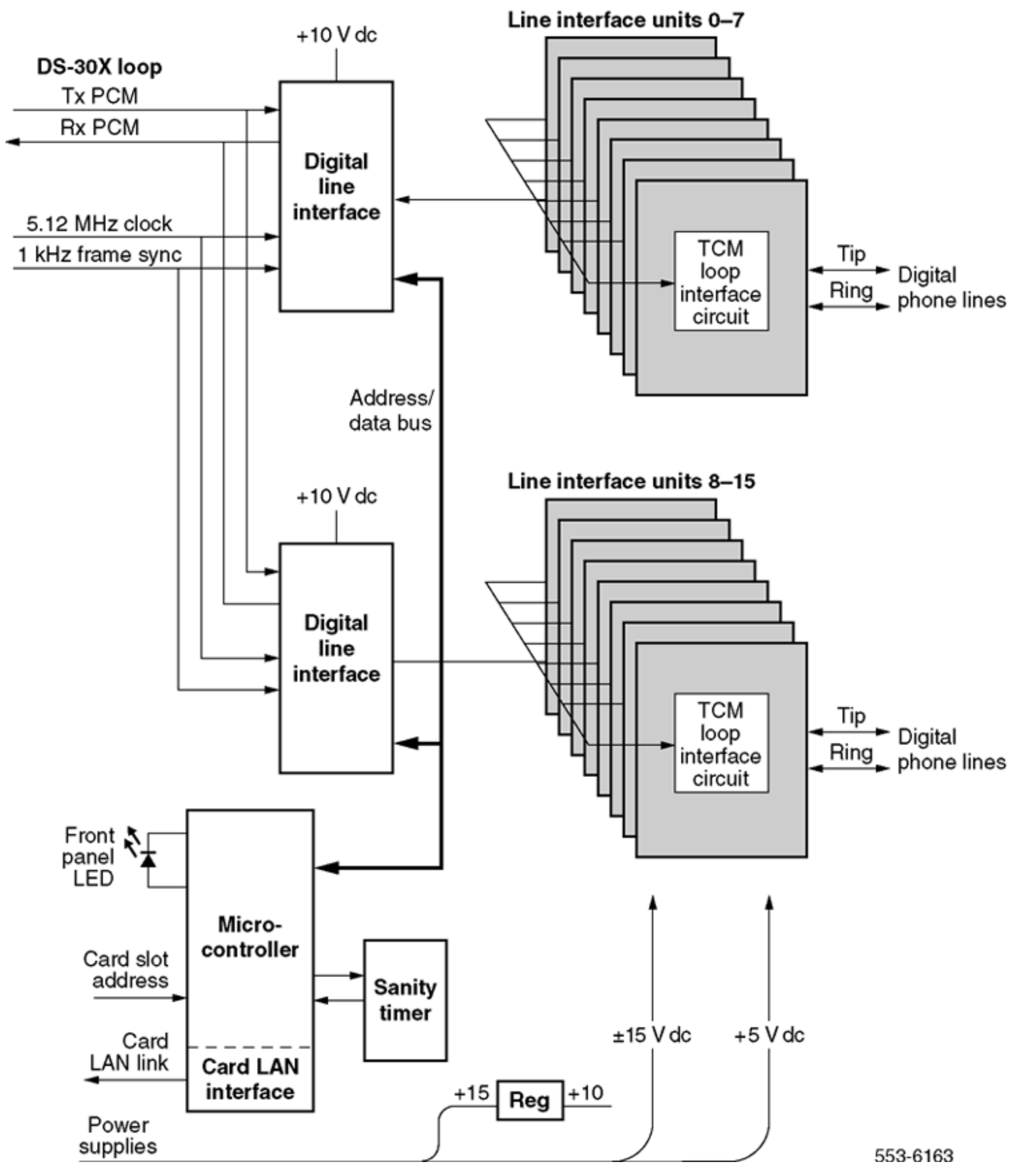


Figure 103: Digital line card - block diagram

Card interfaces

The digital line card passes voice, data, and signaling over DS-30X loops and maintenance data over the card LAN link. These interfaces are discussed in detail in the section Intelligent Peripheral Equipment on page 37.

Digital line interfaces

The digital line interface contains two Digital Line Interface Circuits (DLIC). Each digital line interface circuit provides eight identical, individually configurable voice and data interfaces to eight digital telephone lines. These lines carry multiplexed PCM voice, data, and signaling information as TCM loops.

The purpose of each digital line interface circuit is to de-multiplex data from the DS-30X Tx channel into eight integrated voice and data bitstreams. The circuits then transmit those bitstreams as Bi-Polar Return to Zero, Alternate Mark Inversion (BPRZ-AMI) data to the eight TCM loops. They also perform the opposite action: they receive eight BPRZ-AMI bitstreams from the TCM loops and multiplex them onto the DS-30X Rx channel. The two digital line interface circuits perform the multiplexing and de-multiplexing functions for the 16 digital telephone lines.

The digital line interface circuits also contain signaling and control circuits that establish, supervise, and take down call connections. These circuits work with the on-card microcontroller to operate the digital line interface circuits during calls. The circuits receive outgoing call signaling messages from the Call Server and return incoming call status information to the Call Server over the DS-30X network loop.

TCM loop interface circuit

Each digital telephone line terminates on the NT8D02 Digital Line card at a TCM loop interface circuit. The circuit provides transformer coupling and foreign voltage protection between the TCM loop and the digital line interface circuit. It also provides battery voltage for the digital telephone.

To prevent undesirable side effects from occurring when the TCM loop interface cannot provide the proper signals on the digital phone line, the card microcontroller can remove the ±15 V dc power supply from the TCM loop interfaces. This happens when either the microcontroller gets a command from the NT8D01 controller card to shut down the channel, or the digital line card detects a loss of the 1 KHz frame synchronization signal. The ±15 V dc power supply signal is removed from all 16 TCM loop interface units at the same time.

Each TCM loop interface circuit can service loops up to 3500 ft. in length when using 24-gauge wire. They support a maximum ac signal loss of 15.5 dB at 256 KHz and a maximum dc loop resistance of 210 ohms.

Card control functions

Control functions are provided by a microcontroller and a Card LAN link on the digital line card. A sanity timer is provided to automatically reset the card if the microcontroller stops functioning for any reason.

Microcontroller

The NT8D02 Digital Line card contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the Call Server through the card LAN link:
  - card identification (card type, vintage, and serial number)
  - firmware version
  - self-test status
  - programmed configuration status
- receipt and implementation of card configuration:
  - programming of the digital line interfaces
  - enabling/disabling of individual units or entire card
  - programming of loop interface control circuits for administration of line interface unit operation
  - maintenance diagnostics

The microcontroller also controls the front panel LED when the card is enabled or disabled by instructions from the NT8D01 controller card.

Card LAN interface

Maintenance data is exchanged with the common equipment Call Server over a dedicated asynchronous serial network called the Card LAN link.

Sanity timer

The NT8D02 Digital Line card also contains a sanity timer that resets the microcontroller if program control is lost. The microcontroller must service the sanity timer every 1.2 seconds. If the timer is not properly serviced, it times out and causes the microcontroller to be hardware reset.

Circuit power

The +15 V DC input is regulated down to +10 V DC for use by the digital line interface circuits. The ±15.0 V DC inputs to the card are used to power the loop interface circuits.

Electrical specifications

This section lists the electrical characteristics of the NT8D02 and NTDK16 digital line cards.

Digital line interface specifications

Table 160: NT8D02/NTDK16 Digital Line card technical summary on page 375 provides a technical summary of the digital line cards.

Table 160: NT8D02/NTDK16 Digital Line card technical summary

Characteristics	NT8D02 DLC description	NTDK16BA DLC description	NTDK16AA DLC description
Units per card	16 voice, 16 data	48 voice, 48 data	48 voice, 48 data
Impedance	100 Ohm j/b ohm	100 Ohm j/b ohm	100 Ohm j/b ohm
Loop limits	30 m (100 ft) to 915 m (3000 ft) with 24 AWG PVC cable (+15 V DC at 80 mA)	30 m (100 ft) to 915 m (3000 ft) with 24 AWG PVC cable (±15 V DC at 80 mA)	30 m (100 ft) to 915 m (3000 ft) with 24 AWG PVC cable (±15 V DC at 80 mA)
	0 to 1070 m (3500 ft) with 24 AWG PVC cable (±15 V DC at 80 mA)	0 to 1070 m (3500 ft) with 24 AWG PVC cable (±15 V DC at 80 mA)	0 to 1070 m (3500 ft) with 24 AWG PVC cable (±15 V DC at 80 mA)
Line rate	512 kbps ± 100 ppm	512 kbps ± 100 ppm	512 kbps ± 100 ppm
Power supply	+ 5 V DC ±15 V DC +10 V DC	+ 5 V DC ±15 V DC	+ 5 V DC ±15 V DC +8 V DC
Transmitter output voltage:			
• successive "1" bits	+1.5 ± 0.15 V and -1.5 ± 0.15 V		
• "0" bits	0 ± 50 mV		
Additional circuitry	Not applicable	Not applicable	Power Failure Transfer Control Ring Sync.

Power requirements

The digital line card needs +15 V DC over each loop at a maximum current of 80 mA. It requires +15 V, -15 V, and +5 V from the backplane. The line feed interface can supply power to one loop of varying length up to 1070 m (3500 ft) using 24 AWG wire with a maximum allowable AC signal loss of 15.5 dB at 256 kHz, and a maximum DC loop resistance of 210 ohms; 26 AWG wire is limited to 745 m (2450 ft).

Table 161: Digital line card-power required

Voltage	Current (max.)
±5.0 V dc	150 mA
+15.0 V dc	1.6 Amp
–15.0 V dc	1.3 Amp

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the NT8D02 Digital Line card. The NT8D02 Digital Line card does, however, have protection against accidental shorts to –52 V DC analog lines.

When the card is used to service off-premise telephones, primary and secondary Main Distribution Frame (MDF) protection must be installed.

Off-premise telephones served by cable pairs routed through the central office, or crossing a public right-of-way, can be subject to a requirement for on-card protection, and MDF protectors may not be acceptable. Check local regulations before providing such service.

Environmental specifications

Table 162: Digital line card - environmental specifications on page 376 shows the environmental specifications of the card.

Table 162: Digital line card - environmental specifications

Parameter	Specifications
Operating temperature	0° to +60°C (+32 to +140°F), ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–40° to +70° C (–40° to +158° F)

Connector pin assignments

Table 163: NT8D02 Digital Line card - backplane pinouts on page 377 shows the I/O pin designations at the backplane connector, which is arranged as an 80-row by 2-column array

of pins. Normally, these pin positions are cabled to 50-pin connectors at the I/O panel in the rear of each module for connection with 25-pair cables to the MDF.

The information in Table 163: NT8D02 Digital Line card - backplane pinouts on page 377 is provided as a reference and diagnostic aid at the backplane, because the cabling arrangement can vary at the I/O panel. See Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration (NN43021-310) for cable pinout information for the I/O panel.

Table 163: NT8D02 Digital Line card - backplane pinouts

Backplane Pinout*	Lead Designations	Backplane Pinout*	Lead Designations
12A	Line 0, Ring	12B	Line 0, Tip
13A	Line 1, Ring	13B	Line 1, Tip
14A	Line 2, Ring	14B	Line 2, Tip
15A	Line 3, Ring	15B	Line 3, Tip
16A	Line 4, Ring	16B	Line 4, Tip
17A	Line 5, Ring	17B	Line 5, Tip
18A	Line 6, Ring	18B	Line 6, Tip
19A	Line 7, Ring	19B	Line 7, Tip
62A	Line 8, Ring	62B	Line 8, Tip
63A	Line 9, Ring	63B	Line 9, Tip
64A	Line 10, Ring	64B	Line 10, Tip
65A	Line 11, Ring	65B	Line 11, Tip
66A	Line 12, Ring	66B	Line 12, Tip
67A	Line 13, Ring	67B	Line 13, Tip
68A	Line 14, Ring	68B	Line 14, Tip
69A	Line 15, Ring	69B	Line 15, Tip
*These pinouts apply to NT8D37 backplane.			

Configuration

This section outlines the procedures for configuring the switches and jumpers on the NT8D02 Digital Line card and configuring the system software to properly recognize the card. Figure 104: Digital line card - jumper block and switch locations on page 379 shows where the switches and jumper blocks are located on this board.

Jumper and switch settings

The NT8D02GA, NT8D02HA, and NT8D02HAE5 Digital Line Cards are based on a different architecture than previous releases and have a jumper (J1) to activate/deactivate the unterminated line detection (ULD) feature.

This feature is intended for debugging and should not be enabled except under the direction of Avaya Technical Support. It is recommended to leave the jumper in the default factory installed state.

Software service changes

Voice and data ports are configured using LD 11. See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 11 service change instructions. Voice and data ports are configured using the Meridian Digital Telephone Administration program LD 11. See *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 11 service change instructions.

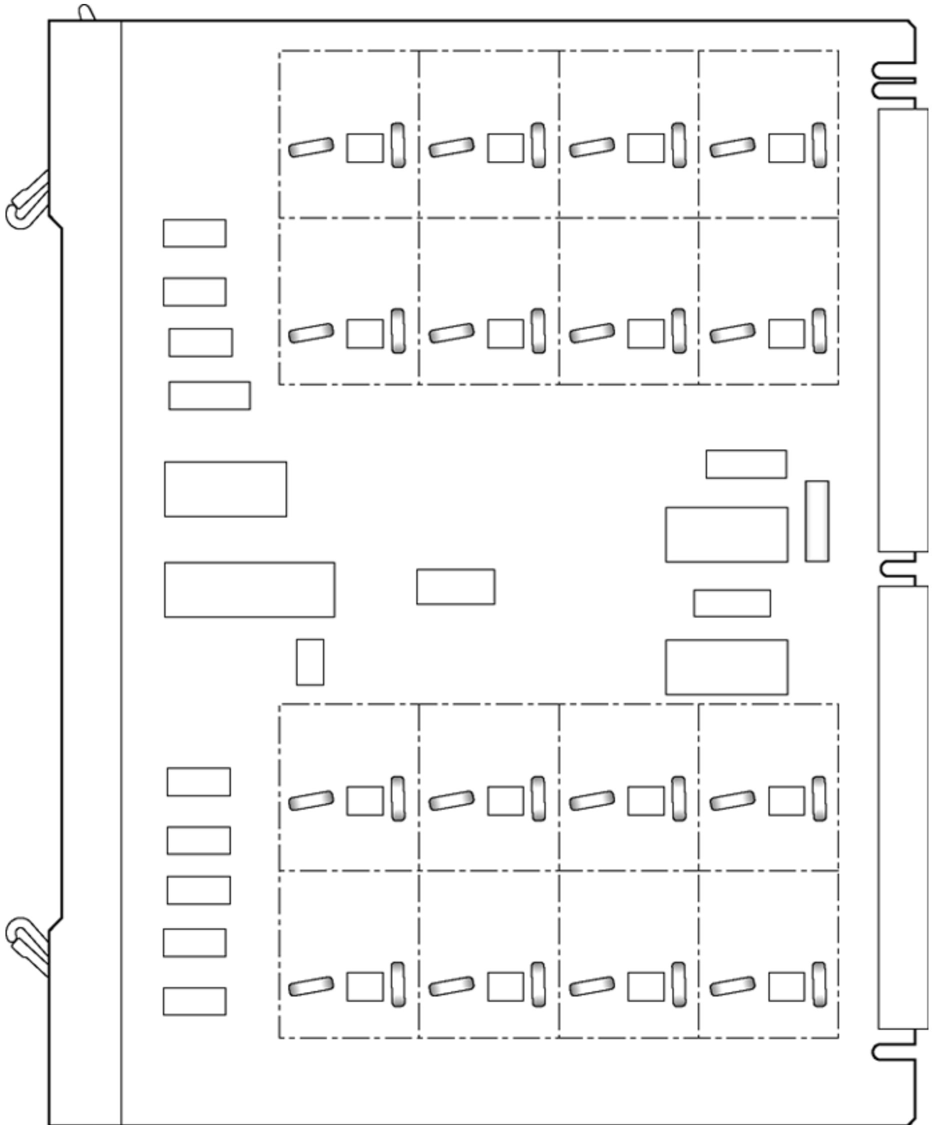


Figure 104: Digital line card - jumper block and switch locations

Chapter 21: NT8D09 Analog Message Waiting Line card

Contents

This section contains information on the following topics:

Introduction

The NT8D09 Analog Message Waiting Line card is an IPE line card that can be installed in the NT8D37 IPE module.

The NT8D09 Analog Message Waiting Line card (μ-Law) provides talk battery and signaling for up to 16 regular 2-wire common battery analog (500/2500-type) telephones and key telephone equipment, with the Message Waiting lamp feature.

The NT8D09 Analog Message Waiting Line card is functionally identical to the NT8D03 Analog Line card, except it can also connect a high-voltage, low-current feed to each line to light the message waiting lamp on telephones equipped with the Message Waiting feature.

The analog message waiting line card mounts in any IPE slot.

Note:

A maximum of four NT8D09 Analog Message Waiting Line cards for each Media Gateway and Media Gateway Expansion are supported. The NT8D09 Analog Message Waiting Line Card can be installed in slots 1, 2, 3, and 4 of the Media Gateway and slots 7, 8, 9 and 10 of the Media Gateway Expansion.

Cards later than vintage NT8D09AK support µ-Law and A-Law companding, and provide a 2 dB transmission profile change. The transmission change improves performance on long lines, particularly for lines used outside of a single-building environment.

The NT8D09 Analog Message Waiting Line card supports 56K modem operation.

Caution:

Damage to Equipment

If a modem is connected to a port on the message waiting line card, do not define that port in software (LD 10) as having message waiting capabilities. Otherwise, the modem gets damaged.

The NT8D09 Analog Message Waiting Line card interfaces to and is compatible with the equipment listed in Table 164: NT8D09 Analog Message Waiting Line card application and compatibility on page 382.

Table 164: NT8D09 Analog Message Waiting Line card application and compatibility

Equipment	Specifications
500-type rotary dial sets (or equivalent):	
dial speed	8.0 to 12.5 pps
percent break	58 to 70%
interdigital time	150 ms
2500-type Digitone sets (or equivalent):	
frequency accuracy	± 1.5%
pulse duration	40 ms
interdigital time	40 ms
speed	12.5 digits/s

Physical description

The circuitry is mounted on a 31.75 cm. by 25.40 cm (12.5 in. by 10 in.) printed circuit board.

The NT8D09 Analog Message Waiting Line card circuits connects to the backplane through a 160-pin connector. The backplane is cabled to a connector in the bottom of the cabinet which is cabled to the cross-connect terminal (Main Distribution Frame) through 25-pair cables. Station apparatus then connects to the card at the cross-connect terminal.

The faceplate of the NT8D09 Analog Message Waiting Line card is equipped with a red LED which lights when the card is disabled (see Figure 105: Analog message waiting line card - faceplate on page 383. At power-up, the LED flashes as the analog line card runs a self-test.

If the test completes successfully, the card is automatically enabled (if it is configured in software) and the LED goes out.

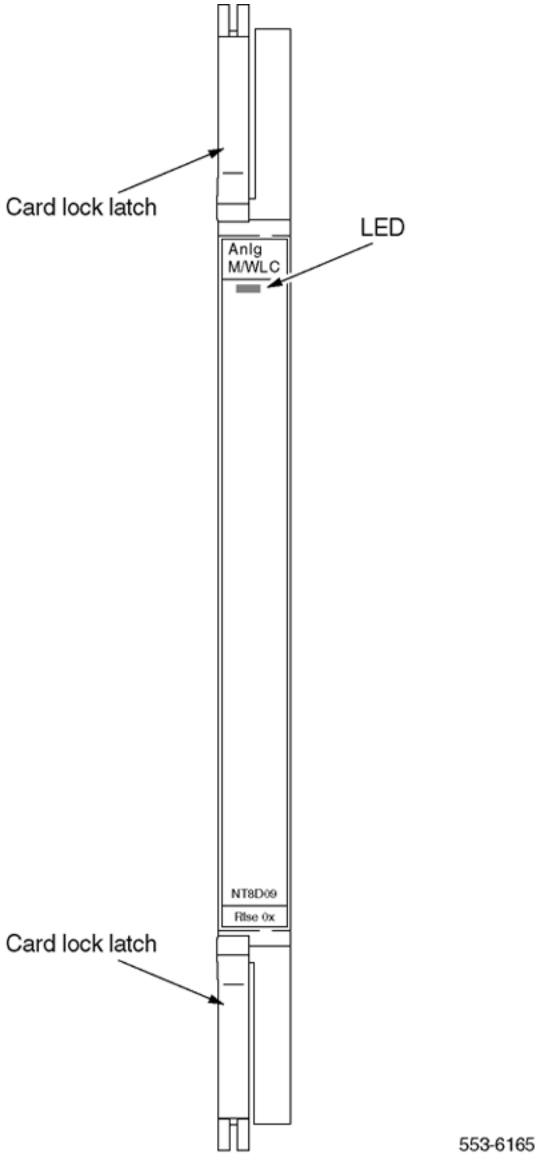


Figure 105: Analog message waiting line card - faceplate

Functional description

The **NT8D09** Analog Message Waiting Line card contains a microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- maintenance diagnostics

The NT8D09 Analog Message Waiting Line card also provides:

- 600 ohms balanced terminating impedance
- analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio phone lines
- transmission and reception of Scan and Signaling Device (SSD) signaling messages over a DS-30X signaling channel in A10 format
- on-hook/off-hook status and switchhook flash detection
- 20 Hz ringing signal connection and automatic disconnection when the station goes off-hook
- synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage
- loopback of SSD messages and Pulse Code Modulation (PCM) signals for diagnostic purposes
- correct initialization of all features at power-up
- direct reporting of digit dialed (500-type telephones) by collecting dial pulses
- connection of –150 V DC at 1 Hz to activate message waiting lamps
- lamp status detection
- disabling and enabling of selected units for maintenance

Figure 106: Analog message waiting line card - block diagram on page 385 shows a block diagram of the major functions contained on the analog message waiting line card. Each of these functions are described in the following sections.

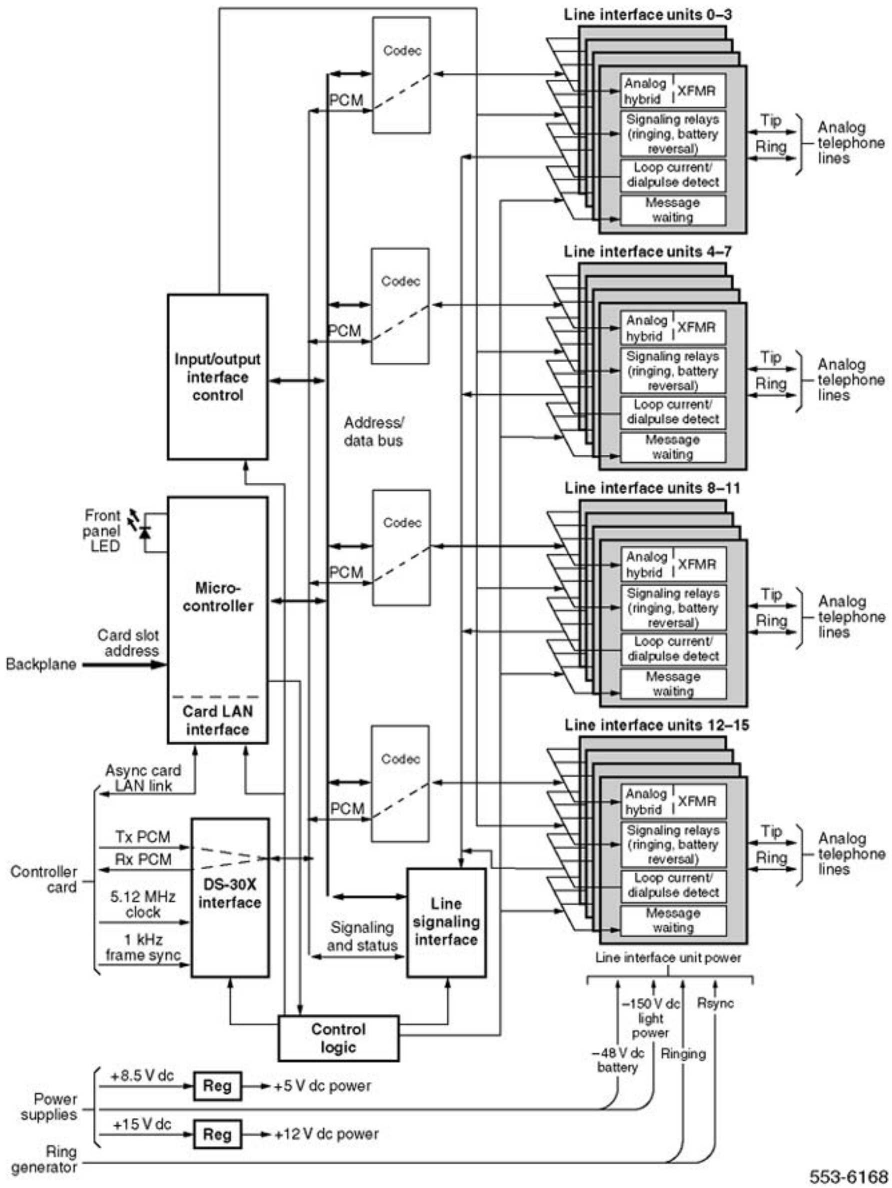


Figure 106: Analog message waiting line card - block diagram

Card interfaces

The analog message waiting line card passes voice and signaling data over DS-30X loops and maintenance data over the card LAN link. These interfaces are discussed in Intelligent Peripheral Equipment on page 37.

Line interface units

The analog message waiting line card contains 16 identical and independently configurable line interface units (also referred to as circuits). Each unit provides 600-ohm impedance matching and a balance network in a signal transformer/analog hybrid circuit. Circuits are also provided in each unit to apply the ringing voltage onto the line synchronized to the ringing current zero crossing. Signal detection circuits monitor on-hook/off-hook status and switchhook flash detection. Four codecs are provided to perform A/D and D/A conversion of line analog voiceband signals to digital PCM signals. Each codec supports four line interface units. The following features are common to all units on the card:

- Transmission and reception of Scan and Signaling Device (SSD) signaling messages over a DS30X signaling channel in A10 format.
- Loopback of SSD messages and pulse code modulation (PCM) signals for diagnostic purposes.
- Correct initialization of all features, as configured in software, at power-up.
- Direct reporting of digits dialed (500 telephones) by collecting dial pulses.
- Connection of –150 V DC at 1 Hz to activate message waiting lamps in two telephones in parallel. The two telephones must be the same type or the neon series resistor in each telephone must be 54 K ohms or greater.
- Lamp status detection (does not detect a failure of either lamp when operating in parallel).
- Disabling and enabling of selected units for maintenance.
- 40 mA to telephones with short circuit protection.

Card control functions

Control functions are provided by the following:

- a microcontroller
- a card LAN interface
- signaling and control circuits on the analog message waiting line card

Microcontroller

The analog message waiting line card contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the CE CP through the card LAN link:
  - card identification (card type, vintage, and serial number)
  - firmware version
  - self-test status
  - programmed configuration status
- receipt and implementation of card configuration:
  - programming of the codecs
  - enabling/disabling of individual units or entire card
  - programming of input/output interface control circuits for administration of line interface unit operation
  - enabling/disabling of an interrupted dial tone to indicate call waiting
  - maintenance diagnostics
  - transmission loss levels

Signaling and control

The signaling and control portion of the card provides circuits that establish, supervise, and take down call connections. These circuits work with the system CP to operate the line interface circuits during calls. The circuits receive outgoing call signaling messages from the CP and return incoming call status information over the DS-30X network loop.

Circuit power

The +8.5 V DC input is regulated down to +5 V DC for use by the digital logic circuits. All other power to the card is used by the line interface circuits. The +15.0 V DC input is regulated down to +12 V DC to power the analog circuits. The –48.0 V DC input is for the telephone battery.

Ringing power for telephones is 86 Vrms ac at 20 Hz on –48 V DC. The Rsync signal is used to switch 20 Hz ringing on and off at the zero current cross-over point to lengthen the life of the switching circuits.

Power for lighting the message waiting lights is provided by either the peripheral equipment power supply or the ringing generator. Logic on the message waiting line card interrupts the –150 V DC signal at 1 Hz intervals to provide a flashing message waiting light.

Technical summary or electrical specifications

Analog line interface

The NT8D09 Analog Message Waiting Line Card meets the EIA/TA464 standard for ONS Type II line cards. Table 165: Analog message waiting line card - line interface unit electrical characteristics on page 388 shows a summary of the analog line interface unit electrical characteristics.

Table 165: Analog message waiting line card - line interface unit electrical characteristics

Characteristics	Description
Impedance	600 ohms
Loop limit (excluding telephone)	1000 ohms at nominal –48 V (excluding telephone)
Leakage resistance	30,000 ohms
Ring trip	During silent or ringing intervals
Ringing voltage	86 V ac
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (approximately –44.5 V on ring and –2.5 V on tip at nominal –48 V battery)
Power input from backplane	–48 (can be as low as –42 for DC-powered systems), +15, +8.5, –150 V and ringing voltage
Insertion loss	4 dB ±1 dB at 1020 Hz 3.5 dB loss for analog to PCM 0.5 dB loss for PCM to analog

Input impedance

The impedance at tip and ring is 600 ohms with a return loss of:

- 20 dB for 200-500 Hz
- 26 dB for 500-3400 Hz

Insertion loss

On a station line-to-line connection, the total insertion loss at 1 kHz is 6 dB + 1 dB. This is arranged as 3.5 dB loss for analog to PCM, and 2.5 dB loss for PCM to analog.

Frequency response

The loss values in Table 166: Analog message waiting line card - frequency response on page 389 are measured relative to the loss at 1 kHz.

Table 166: Analog message waiting line card - frequency response

Frequency (Hz)	Minimum (dB)	Maximum (dB)
60	20.0	-
200	0.0	5.0
300	–0.5	1.0
3000	–0.5	1.0
3200	–0.5	1.5
3400	0.0	3.0

Message channel noise

The message channel noise C-weighted (dBrnC) on 95 percent of the connections (line to line) with both ends terminated in 600 ohms does not exceed 20 dBrnC.

Table 167: NT8D09 Analog Message Waiting Line card technical summary on page 389 provides a technical summary of the analog message waiting line card.

Table 167: NT8D09 Analog Message Waiting Line card technical summary

Impedance	600 ohms
Loop limit (excluding telephone)	1000 ohms at nominal -48 V (excluding telephone)
Leakage resistance	30,000 ohms
Ring trip	During silent or ringing intervals
Ringing voltage	86 V AC
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (approximately -44.5 V on ring and -2.5 V on tip at nominal -48 V battery)
Power input from backplane	-48 (can be as low as -42 for DC-powered systems), +15, -15, +8.5 V and ringing voltage; also -150 V on analog message waiting line card.
Insertion loss	6 dB + 1 dB at 1020 Hz 3.5 dB loss for analog to PCM

	2.5 dB loss for PCM to analog

Power requirements

Table 168: Power requirements on page 390 provides the power requirements for the NT8D09 Analog Message Waiting Line card.

Table 168: Power requirements

Voltage (+/-)	Tolerance	Idle current	Active current	Max
+ 12.0 V DC	0.36 V DC	48 mA	0 mA	48 mA
+ 8.0 V DC	0.40 V DC	150 mA	8 mA	280 mA
–48.0 V DC	2.00 V DC	48 mA	40 mA	688 mA
–48.0 V DC	5.00 V DC	0 mA	10 mA (Note 1)	320 mA
86.0 V AC	5.00 V AC	0 mA	10 mA (Note 2)	160 mA
–150.0 V DC	3.00 V DC	0 mA	2 mA	32 mA

Note:

1. Each active ringing relay requires 10 mA of battery voltage.

Note:

2. Reflects the current for ringing a single station set (or DN telephone). There may be as many as five ringers on each line.

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the Analog Message Waiting line card. When the Analog line card is used to service off-premise telephones, the NTAK92 Off-premise protection module must be used. Check local regulations before providing such service.

Overload level

Signal levels exceeding +7 dBm applied to the tip and ring cause distortion in speech transmission.

Environmental specifications

Table 169: Analog message waiting line card - environmental specifications on page 391 lists the environmental specifications for the analog message waiting line card.

Table 169: Analog message waiting line card - environmental specifications

Parameter	Specifications
Operating temperature	0° to +60° C (+32 to +140° F), ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–40° to +70° C (–40° to +158° F)

Connector pin assignments

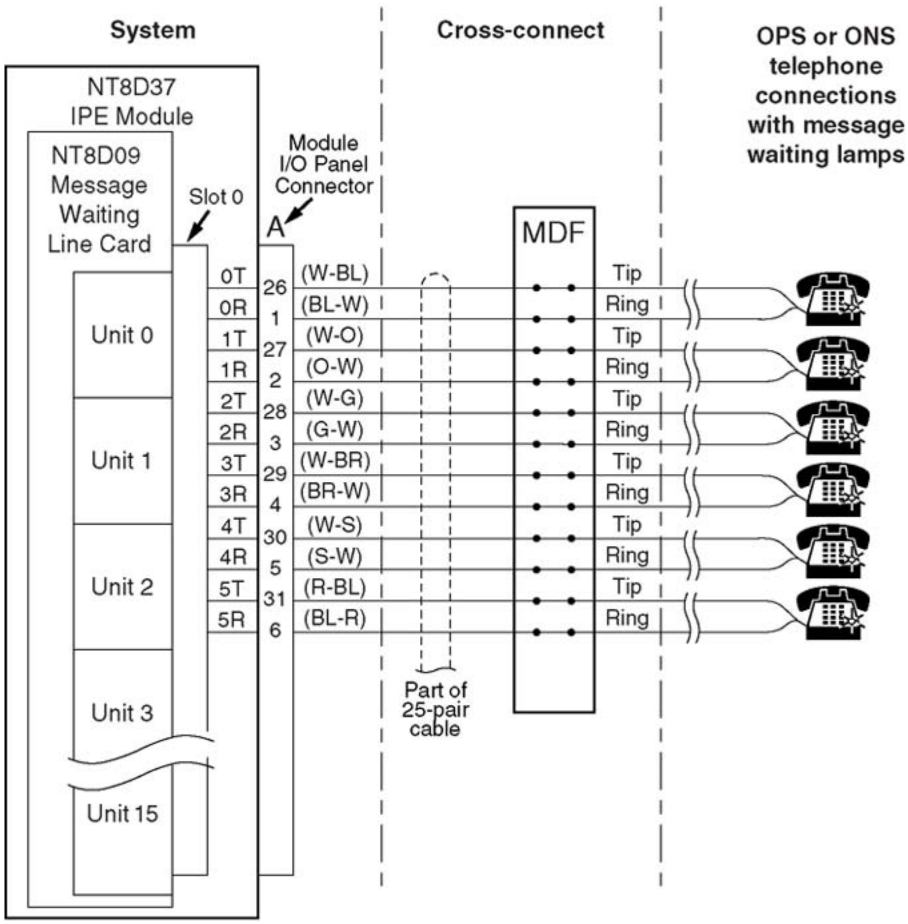
The analog message waiting line card brings the 16 phone lines to the IPE backplane through a 160-pin connector shroud. The backplane is cabled to the I/O panel on the rear of the module, which is then connected to the MDF by 25-pair cables.

Telephone lines from station equipment cross connect to the analog message waiting line card at the MDF using a wiring plan similar to that used for trunk cards. A typical connection example is shown in Figure 107: Analog message waiting line card - typical cross connection example on page 393 and Table 170: Analog message waiting line card - backplane pinouts on page 392shows the I/O pin designations at the backplane connector. This connector is arranged as an 80-row by 2-column array of pins. Normally, these pin positions are cabled to 50-pin connectors at the I/O panel in the rear of each module for connection with 25-pair cables to the cross-connect terminal.

The information in Table 170: Analog message waiting line card - backplane pinouts on page 392is provided as a reference and diagnostic aid at the backplane, because the cabling arrangement may vary at the I/O panel. See *Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for cable pinout information at the I/O panel.

Table 170: Analog message waiting line card - backplane pinouts

Backplane pinout*	Lead designations	Backplane pinout*	Lead designations
12A	Line 0, Ring	12B	Line 0, Tip
13A	Line 1, Ring	13B	Line 1, Tip
14A	Line 2, Ring	14B	Line 2, Tip
15A	Line 3, Ring	15B	Line 3, Tip
16A	Line 4, Ring	16B	Line 4, Tip
17A	Line 5, Ring	17B	Line 5, Tip
18A	Line 6, Ring	18B	Line 6, Tip
19A	Line 7, Ring	18B	Line 7, Tip
62A	Line 8, Ring	62B	Line 8, Tip
63A	Line 9, Ring	63B	Line 9, Tip
64A	Line 10, Ring	64B	Line 10, Tip
65A	Line 11, Ring	65B	Line 11, Tip
66A	Line 12, Ring	66B	Line 12, Tip
67A	Line 13, Ring	67B	Line 13, Tip
68A	Line 14, Ring	68B	Line 14, Tip
69A	Line 15, Ring	69B	Line 15, Tip
* These pinouts apply to NT8D37 backplane.			



Note: Actual pin numbers may vary depending on the vintage of the card cage and the slot where the card is installed.

Figure 107: Analog message waiting line card - typical cross connection example

Configuration

This section outlines the procedures for configuring the switches and jumpers on the NT8D09 Analog Message Waiting Line card and configuring the system software to properly recognize the card. Figure 108: Analog message waiting line card - jumper block and switch locations on page 395 shows where the switches and jumper blocks are located on this board.

Jumper and switch settings

The NT8D09 Analog Message Waiting Line card has no user-configurable jumpers or switches. The card derives its address from its position in the backplane and reports that information back to the CPU through the LAN Link interface.

Software service changes

Individual line interface units on the NT8D09 Analog Message Waiting Line card are configured using the Analog (500/2500-type) Telephone Administration program LD 10.

The message waiting feature is enabled by entering data into the customer data block using LD 15. See *Software Input/Output Reference — Administration* (NN43001-611) for LD 10 and LD 15 service change instructions.

Analog message waiting line cards with a vintage later than NT8D09AK provide a fixed +2 dB transmission profile change in the gain of the D/A convertor. See Table 171: Transmission Profile Changes on page 394.

This transmission profile change is used for control of end-to-end connection loss. Control of such loss is a major element in controlling transmission parameters such as received volume, echo, noise, and crosstalk. The loss plan for the analog message waiting line card determines port-to-port loss between an analog line card unit (port) and other IPE ports. LD 97 is used to configure the system for port-to-port loss. See *Software Input/Output Reference — Administration* (NN43001-611) for LD 97 service change instructions.

Table 171: Transmission Profile Changes

Vintage	A/D convertor gain	D/A convertor gain
Previous to AK	–3.5 dB	–2.5 dB
AK and later	–3.5 dB	–0.5 dB

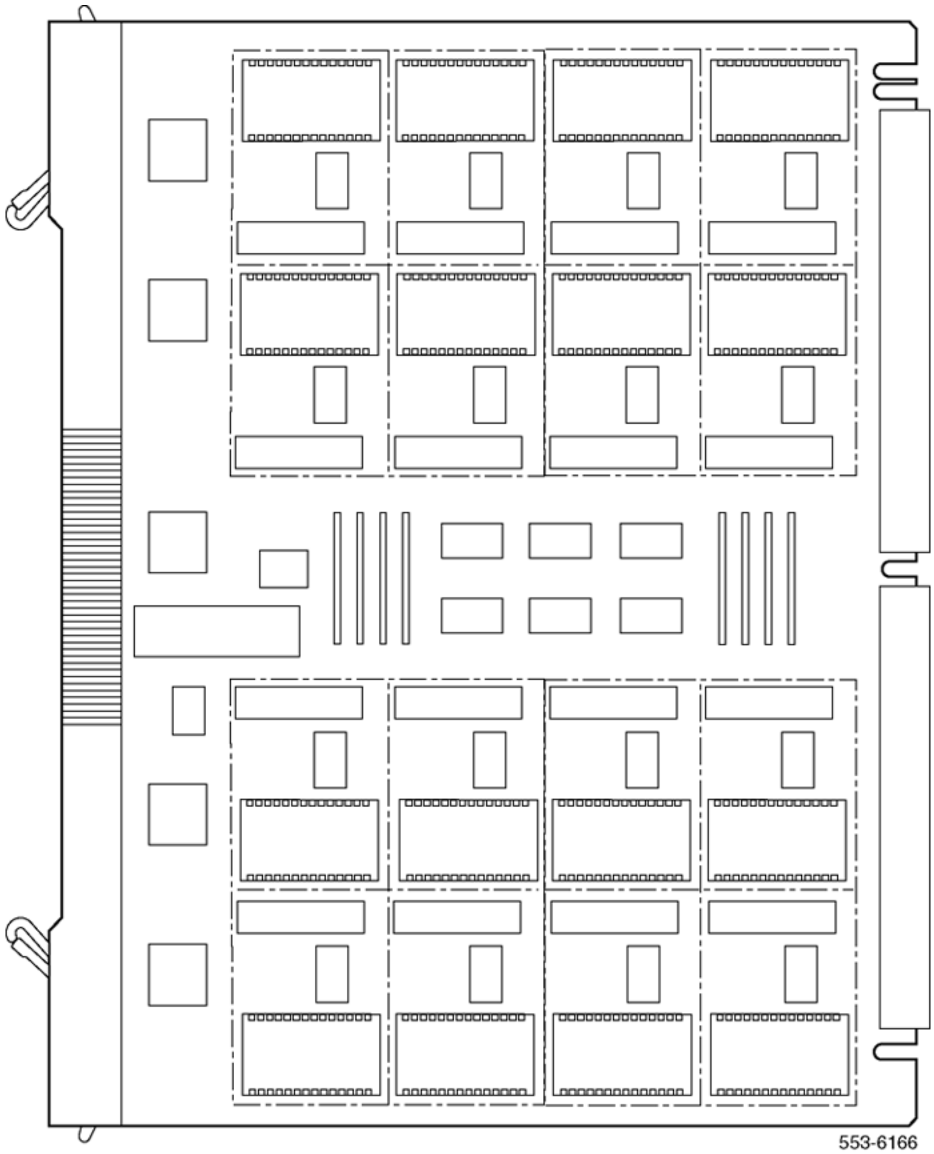


Figure 108: Analog message waiting line card - jumper block and switch locations

Chapter 22: NT8D14 Universal Trunk card

Contents

This section contains information on the following topics:

Introduction

Avaya is pleased to introduce the NT8D14CA Universal Trunk (XUT) card as a replacement for the NT8D14BB card. The NT8D14CA is modified to add a longer loop capability for CAMA trunk applications.

The NT8D14CA comes equipped with a set of 2 jumpers for each hybrid that should be set to the longer loop length (LL) when the trunk is used in a CAMA application. The jumpers are numbered P35 to P50 and are set to the shorter loop length (SL) position when it comes from the factory. For each hybrid, both jumpers should be changed to the LL position only if used as a CAMA trunk. Otherwise the jumpers should be left to the SL position.

The NT8D14 Universal Trunk card interfaces eight analog trunk lines to the system. Each trunk interface is independently configured by software control using the Trunk Administration program LD 14.

You can install this card in any IPE slot.

Note:

Each Media Gateway and Media Gateway Expansion can contain up to four analog trunk cards.

The NT8D14 Universal Trunk card supports the following trunk types:

- Centralized Automatic Message Accounting (CAMA) trunks
- Central Office (CO), Foreign Exchange (FEX), and Wide Area Telephone Service (WATS) trunks
- Direct Inward Dial (DID) trunks
- Tie trunks: two-way Loop Dial Repeating (LDR) and two-way loop Outgoing Automatic Incoming Dial (OAID)
- Recorded Announcement (RAN) trunks
- Paging trunks

The NT8D14 Universal Trunk card also supports Music, Automatic Wake Up, and Direct Inward System Access (DISA) features.

Table 172: Trunk and signaling matrix on page 398 lists the signaling and trunk types supported by the NT8D14 Universal Trunk card.

Table 172: Trunk and signaling matrix

Signaling type	Trunk types					
	CO/FX/ WATS	DID	Tie	RAN	Paging	CAMA
Loop start	Yes	No (see note)	No	N/A	N/A	Yes
Ground start	Yes	No	No	N/A	N/A	No
Loop DR	No	Yes	Yes	N/A	N/A	No
Loop OAID	No	No	Yes	N/A	N/A	No
Continuous operation mode	No	No	No	Yes	N/A	No
Start modes (pulse and level)	No	No	No	Yes	N/A	No

Note:

For incoming and outgoing service, DID trunks must be programmed as loop dial repeating.

Physical description

The trunk and common multiplexing circuitry is mounted on a 31.75 cm by 25.40 cm (12.5 in. by 10 in.) printed circuit board.

The NT8D14 Universal Trunk card connects to the backplane through a 160-pin connector shroud. The backplane is cabled to the I/O panel, which is cabled to the Main Distribution Frame (MDF) by 25-pair cables. External equipment, such as recorded announcement machines, paging equipment, and Central Office facilities, connect to the card at the MDF.

See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for termination and cross-connect information.

The faceplate of the card is equipped with a red Light Emitting Diode (LED). When an NT8D14 Universal Trunk card is installed, the LED remains lit for two to five seconds while the self-test runs. If the self-test is successful, the LED flashes three times and remains lit. When the card is configured and enabled in software, then the LED goes out. If the LED flashes continuously or remains weakly lit, replace the card.

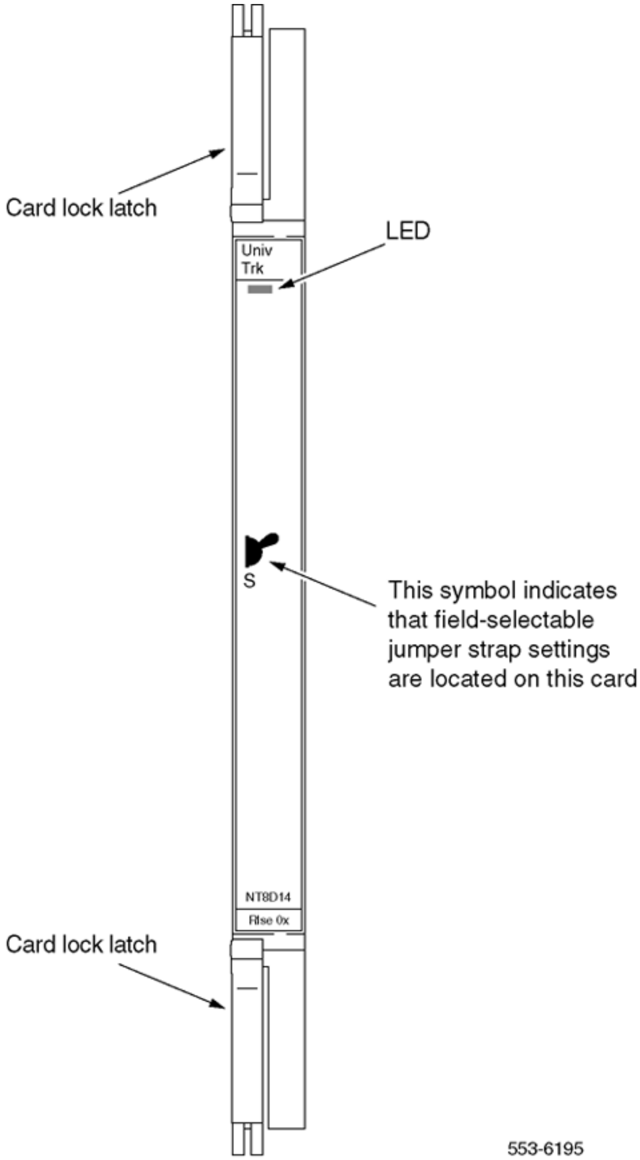


Figure 109: Universal trunk card - faceplate

Functional description

[Figure 110: NT8D14 Universal trunk card - block diagram](#) on page 401 shows a block diagram of the major functions contained on the NT8D14 Universal Trunk card. Each of these functions is described on the following pages.

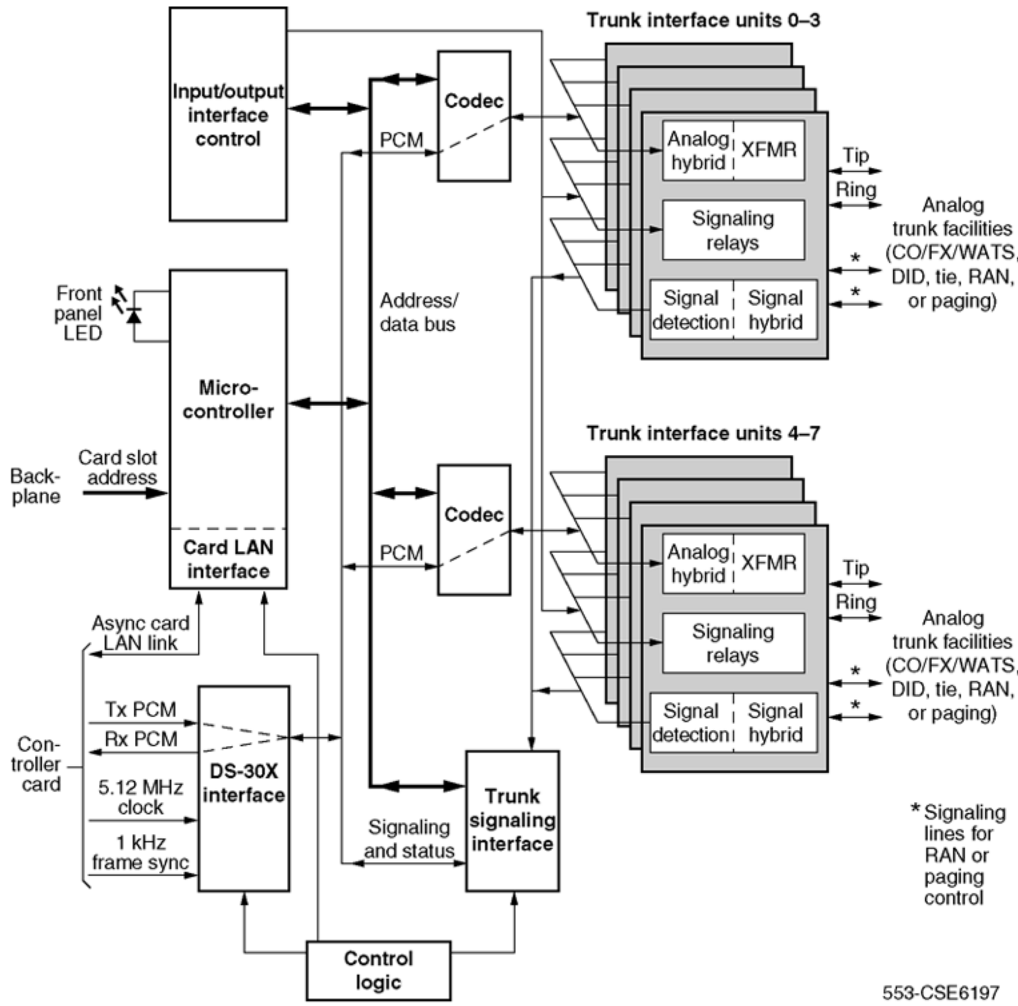


Figure 110: NT8D14 Universal trunk card - block diagram

Card interfaces

The NT8D14 Universal Trunk card passes voice and signaling data over DS-30X loops, and maintenance data over the card LAN link.

Trunk interface units

The NT8D14 Universal Trunk card contains eight identical and independently configurable trunk interface units (also referred to as circuits). Each unit provides impedance matching and a balanced network in a signal transformer/analog hybrid circuit.

Also provided are relays for placing outgoing call signaling onto the trunk. Signal detection circuits monitor incoming call signaling. Two codecs are provided for performing A/D and D/A conversion of trunk analog voiceband signals to digital PCM signals. Each codec supports four trunk interface units. The following features are common to all units on the card:

- trunk type configurable on a per unit basis
- terminating impedance (600 or 900 ohms) selectable on a per-unit basis (minimum vintage BA)
- balance impedance (600 or 900 ohms or complex impedance network) selectable on a per-unit basis (minimum vintage BA)
- control signals provided for RAN and paging equipment
- loopback of PCM signals received from trunk facility over DS-30X network loop for diagnostic purposes
- switchable pads for transmission loss control

Card control functions

Control functions are provided by a microcontroller, a card LAN interface, and signaling and control circuits on the NT8D14 Universal Trunk card.

Microcontroller

The NT8D14 Universal Trunk card contains a microcontroller that controls the internal operation of the card and the serial card LAN link to the controller card. The microcontroller controls the following:

- reporting to the CE CPU through the card LAN link:
    - card identification (card type, vintage, and serial number)
    - firmware version
    - self-test status
    - programmed configuration status
- receipt and implementation of card configuration through the card LAN link:
    - programming of the codecs
    - enabling/disabling of individual units or entire card
    - programming of input/output interface control circuits for administration of trunk interface unit operation
    - maintenance diagnostics
    - transmission pad settings

Card LAN interface

Maintenance data is exchanged with the common equipment CPU over a dedicated asynchronous serial network called the Card LAN link.

Signaling and control

The signaling and control portion of the Universal Trunk card works with the CPU to operate the card hardware. The card receives messages from the CPU over a signaling channel in the DS-30X loop and returns status information to the CPU over the same channel. The signaling and control portion of the card provides the means for analog loop terminations to establish, supervise, and take down call connections.

Signaling interface

All trunk signaling messages are three bytes long. The messages are transmitted in channel zero of the DS-30X in A10 format.

Configuration information for the Universal Trunk card is downloaded from the CPU at power-up or by command from maintenance programs. Eleven configuration messages are sent. Three messages are sent to the card to configure the make/break ratio and A-Law or µ-Law operation. One message is sent to each unit to configure the trunk characteristics.

Operation

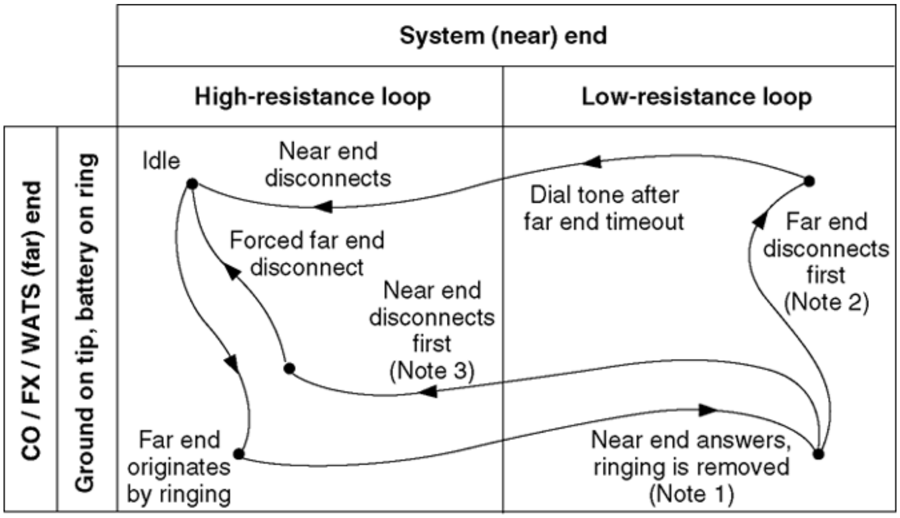
Administrators can assign optional applications, features, and signaling arrangements for each unit on the NT8D14 Universal Trunk card through the Trunk Administration LD 14 and Trunk Route Administration LD 16 programs or jumper strap settings on the card.

Loop start operation

Loop start operation is configured in software and implemented in the card through software download messages. When the card is idle, it provides a high impedance toward the CO for isolation and AC (ringing) detection.

Incoming calls

The alerting signal into the System is 20 Hz (nominal) ringing sent by the CO. When an incoming call is answered, ringing is tripped when the System places a low-resistance dc loop across the tip and ring leads toward the CO. See Figure 111: Loop start call states - incoming call from CO/FX/WATS on page 404 and Figure 112: Loop start call connection sequence - incoming call from CO/FX/WATS on page 405.



Note 1: The originating office may reverse battery and ground when attendant answer is received.

Note 2: No disconnection signal is passed to trunk.

Note 3: The near end provides a high-impedance (>150k ohms) disconnect signal of at least 50 ms before reconnecting the ground detector.

553-AAA1133

Figure 111: Loop start call states - incoming call from CO/FX/WATS

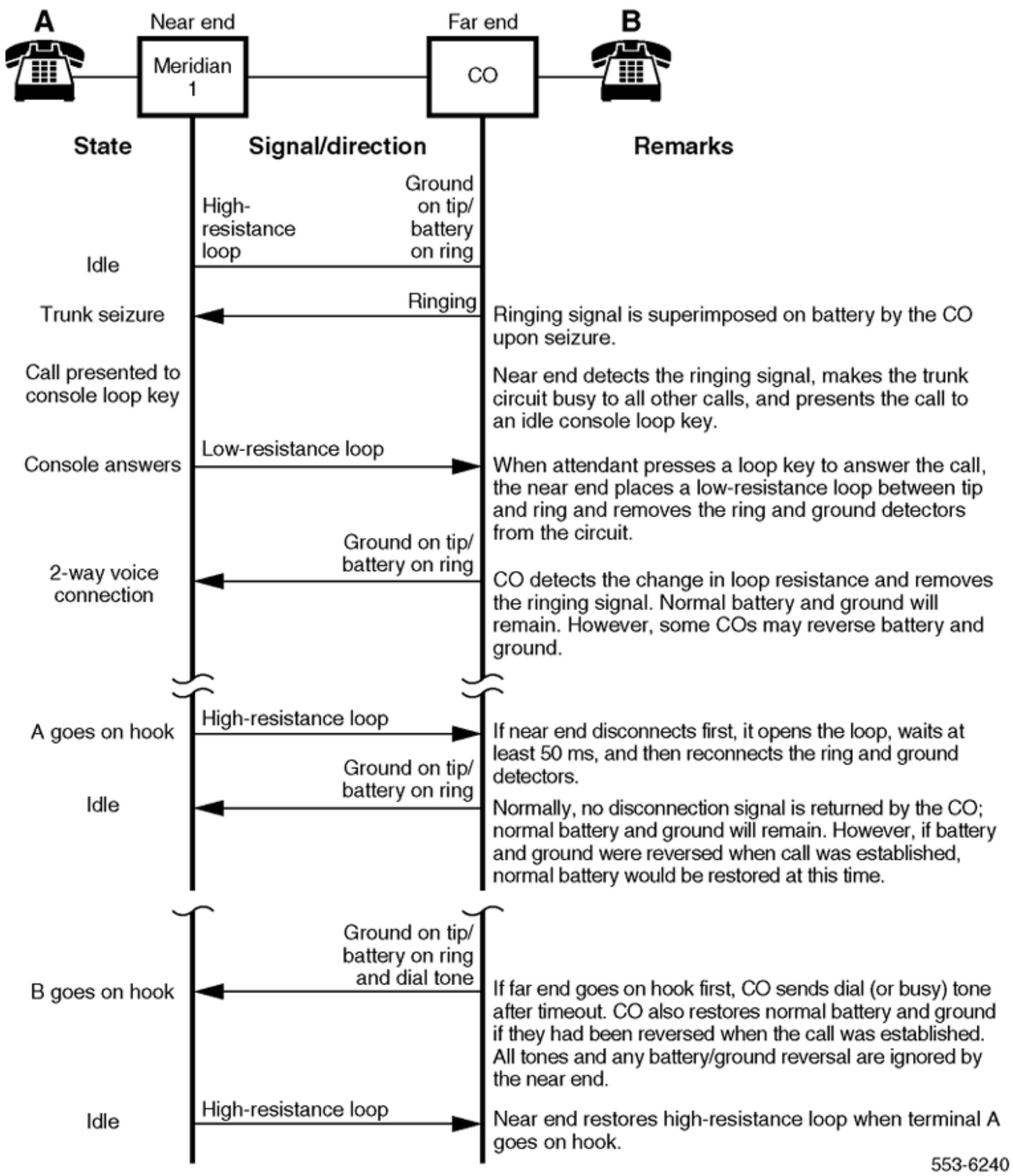
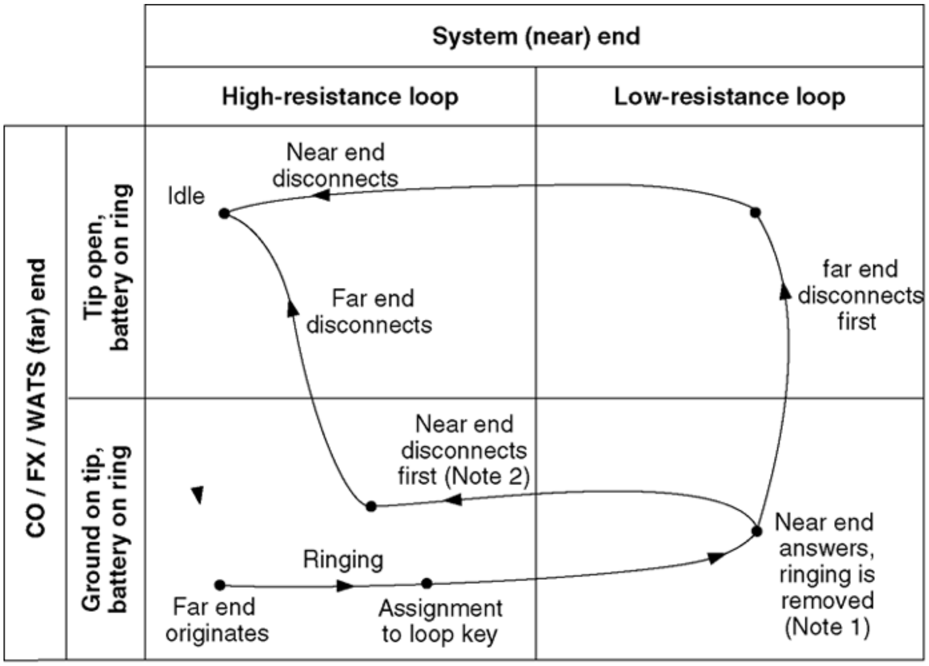


Figure 112: Loop start call connection sequence - incoming call from CO/FX/WATS

Outgoing calls

For outgoing calls, the software sends an outgoing seizure message to place a low-resistance loop across the tip and ring leads toward the CO. See Figure 113: Ground start call states - incoming call from CO/FX/WATS on page 406 and Figure 114: Ground start call connection sequence - incoming call from CO/FX/WATS on page 407. When the CO detects the low-resistance loop, it prepares to receive digits. When the CO is ready to receive digits, it returns a dial tone. Outward address signaling is then applied from the system in the form of loop (interrupting) dial pulses or DTMF tones.



Note 1: The far end may reverse battery and ground upon receipt of attendant answer.

Note 2: The near end provides a high-impedance (>150k ohms) disconnect signal of at least 50 ms before reconnecting the ground detector.

Figure 113: Ground start call states - incoming call from CO/FX/WATS

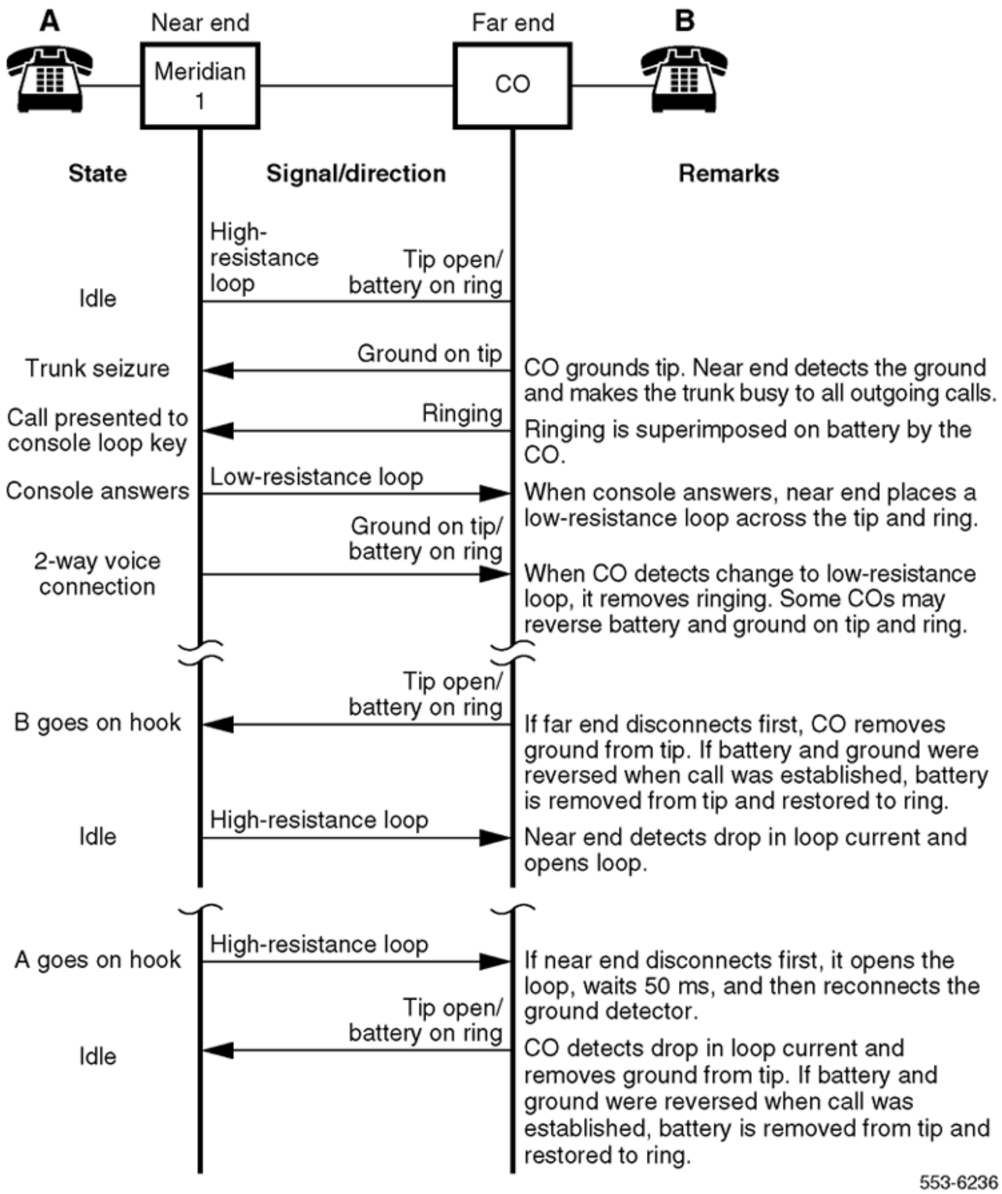


Figure 114: Ground start call connection sequence - incoming call from CO/FX/WATS

Polarity-sensitive/-insensitive packs feature

The Avaya Communication Server 1000 (Avaya CS1000) software provides the polarity-sensitive/polarity-insensitive (PSP and PIP) packs feature for the accurate recording of outgoing call duration for loop start and ground start operation.

On trunks equipped with far-end answer supervision, the PSP class of service is enabled in software and causes call-duration recording in CDR records to begin only upon receipt of answer supervision from the far-end.

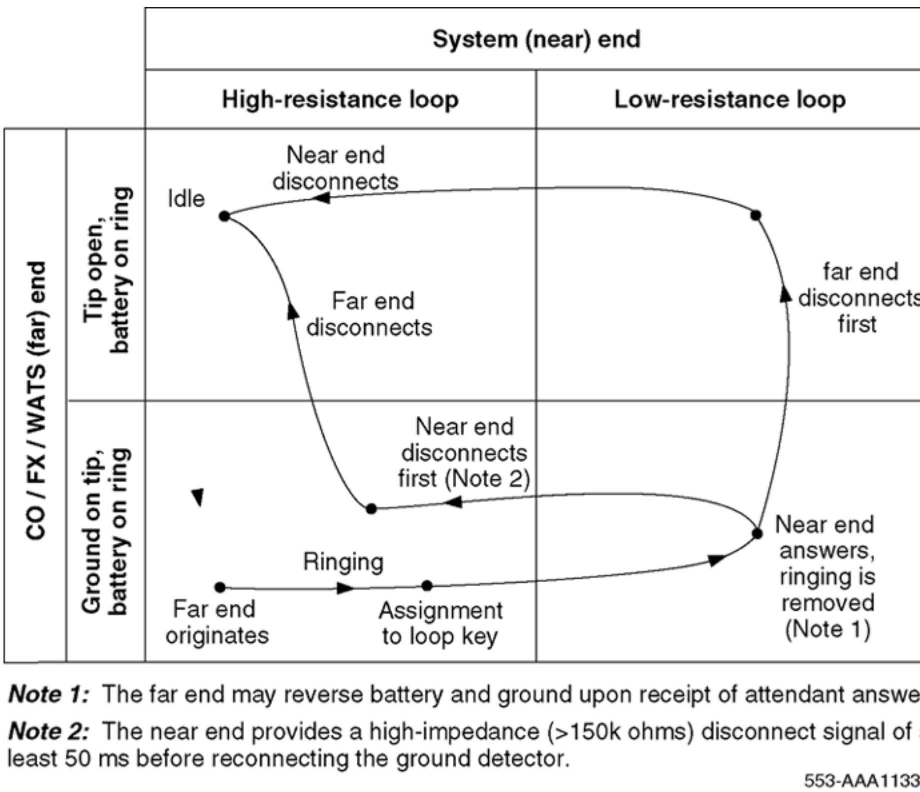
For trunks not equipped with answer supervision, the PIP class of service is enabled and call-duration recording begins immediately upon near-end trunk seizure. The PSP and PIP classes of service are enabled in the Trunk Administration program LD 14.

Ground start operation

Ground start operation is configured in software and implemented through software download messages. In the idle state, the tip conductor from the CO is open and a high-resistance negative battery is present on the ring lead.

Incoming calls

In an incoming call, after ground is detected on the tip, the universal trunk card scans for a ringing detection signal before presenting the call to an attendant and tripping the ringing. When the attendant answers, a low resistance is placed across the tip and ring conductors, which trips CO ringing and establishes a speech path. See Figure 115: Ground start call states - incoming call from CO/FX/WATS on page 408 and Figure 116: Ground start call connection sequence - incoming call from CO/FX/WATS on page 409.



Note 1: The far end may reverse battery and ground upon receipt of attendant answer.

Note 2: The near end provides a high-impedance (>150k ohms) disconnect signal of at least 50 ms before reconnecting the ground detector.

Figure 115: Ground start call states - incoming call from CO/FX/WATS

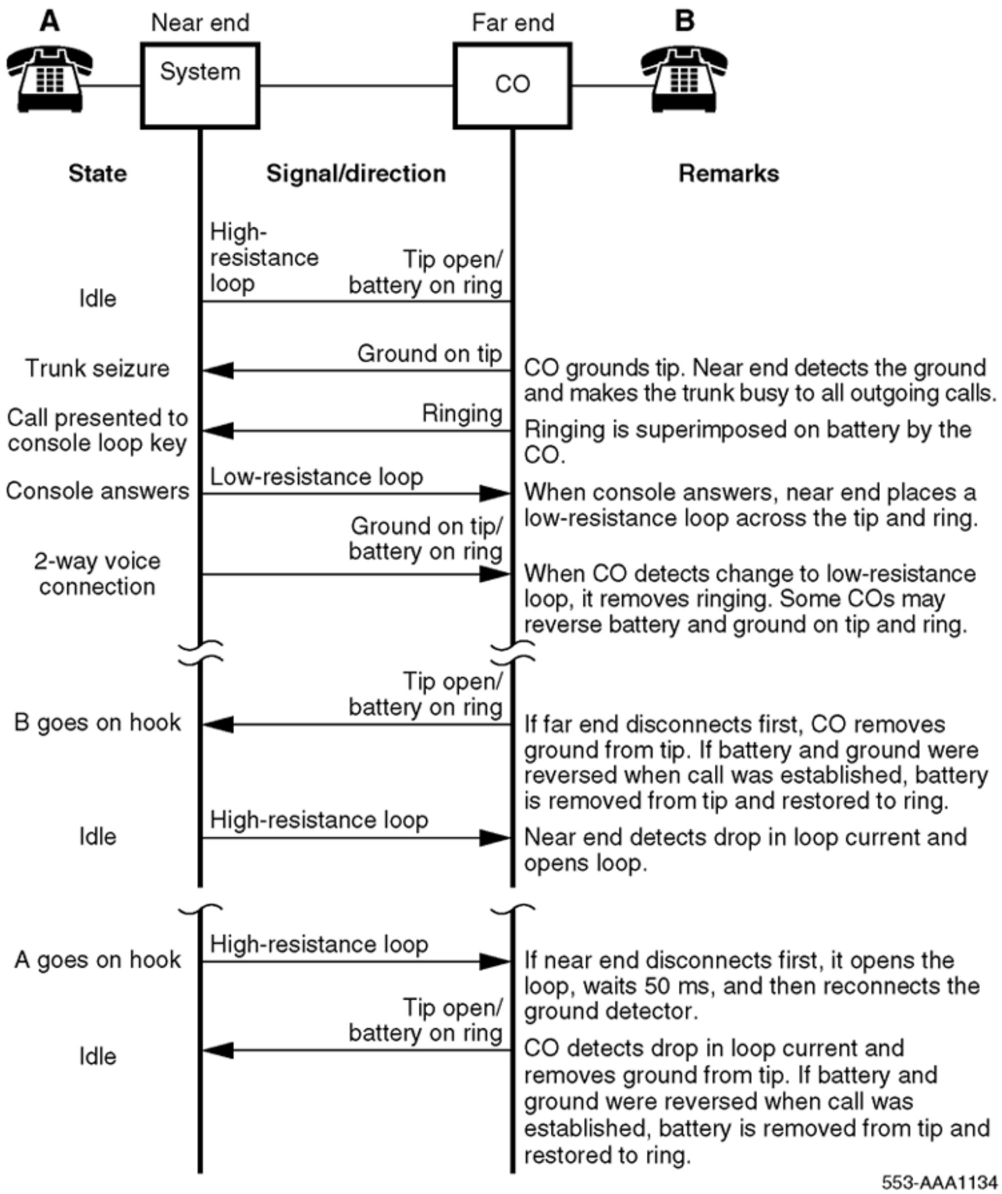


Figure 116: Ground start call connection sequence - incoming call from CO/FX/WATS

Reverse-wiring compensation

The Avaya CS 1000 software includes a feature for detecting reverse wiring (connection of the near-end tip and ring leads to the far-end ring and tip leads) on ground start trunks with far-end answer supervision.

Ordinarily, an incoming call on a reverse-wired trunk without reverse-wiring compensation presents ringing on the tip lead rather than on the ring lead. Because of the software expects to see a ground on the tip lead, it interprets the end of the first ringing signal as a switchhook flash. As the interval between ringing signals exceeds the switchhook flash time of 512 milliseconds, the software assumes a far-end disconnect. This causes the call to be presented to a console loop key and then immediately removed.

The reverse-wiring compensation feature operates as follows. If an apparent disconnect takes place immediately after the first ringing signal, the software time stamps the event and temporarily remove the call from the console loop key.

If another such ringing/disconnect event occurs during the No Ringing Detector (NRD) time, the trunk is considered "possibly reverse-wired" and a threshold counter starts. Calls on trunks identified as possibly reverse-wired are presented to the attendant during the initial ring, removed, and then continuously presented after the second ring. If a call on a possibly reverse-wired trunk is abandoned before the attendant answers, it is disconnected after the NRD timer expires.

A trunk identified as possibly reverse-wired is switched by the software to loop start processing after the second ring. This switching takes place on a call-by-call basis. So if a previously correctly wired trunk becomes reverse-wired, the next incoming call is marked as possibly reverse-wired and the threshold count begins.

If the threshold count exceeds its limit, an error message is printed and the trunk is registered as "positively reverse wired." Once identified as positively reverse wired, the call is presented continuously from the first ring. When a reverse-wired trunk becomes correctly wired, the first subsequent call clears the threshold counter and normal ground start processing is implemented.

Note:

The far-end can reverse battery and ground upon receipt of attendant answer.

Note:

The near-end provides a high-impedance (>150k ohms) disconnect signal of at least 50 ms before reconnecting the ground detector.

Outgoing calls

For outgoing calls, the trunk provides a ground to the ring lead. The CO responds by grounding the tip and returning dial tone. After the tip ground is detected by the card, a low-resistance path is placed between the tip and ring leads and the ground is removed from the ring. Addressing is then applied from the system in the form of loop (interrupting) dial pulses or DTMF tones. See Figure 117: Ground start call states - outgoing call to CO/FX/WATS on page 411 and Figure 118: Ground start call connection sequence - outgoing call to CO/FX/WATS on page 412.

The Polarity-Sensitive/Polarity-Insensitive Packs (PSP and PIP) feature must be set to provide for proper outgoing call-duration recording with ground start operation. Refer to the description of loop start operation in this section for a more complete discussion of PSP and PIP.

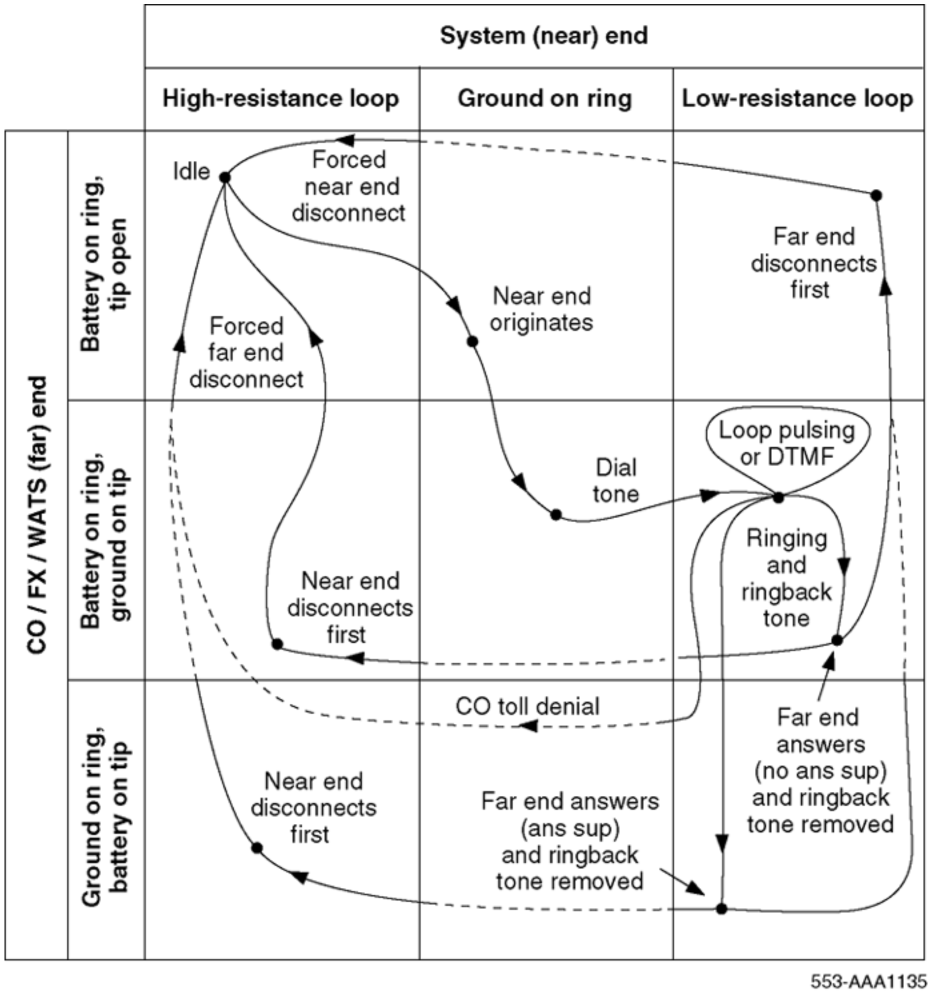


Figure 117: Ground start call states - outgoing call to CO/FX/WATS

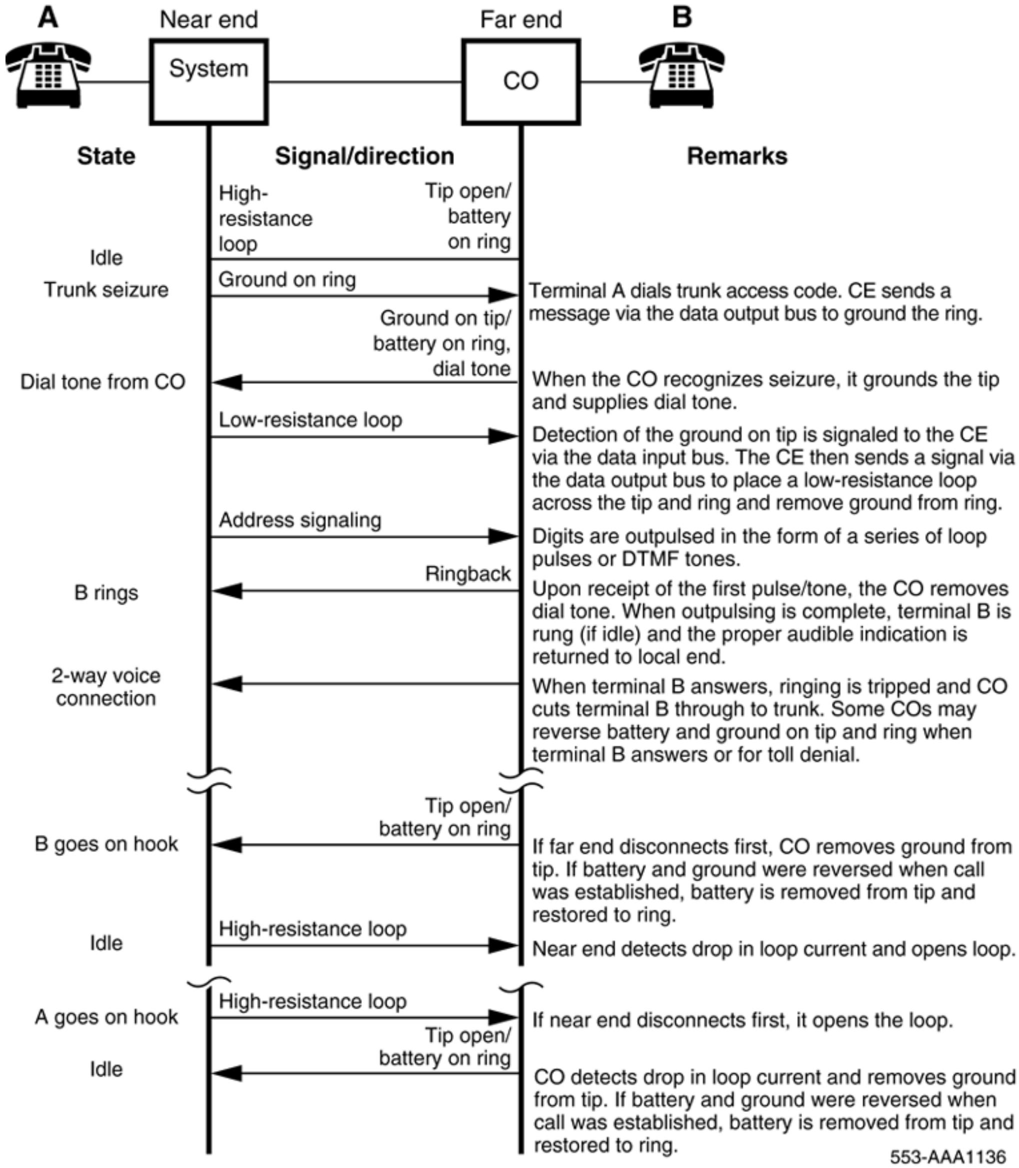


Figure 118: Ground start call connection sequence - outgoing call to CO/FX/WATS

Direct inward dial operation

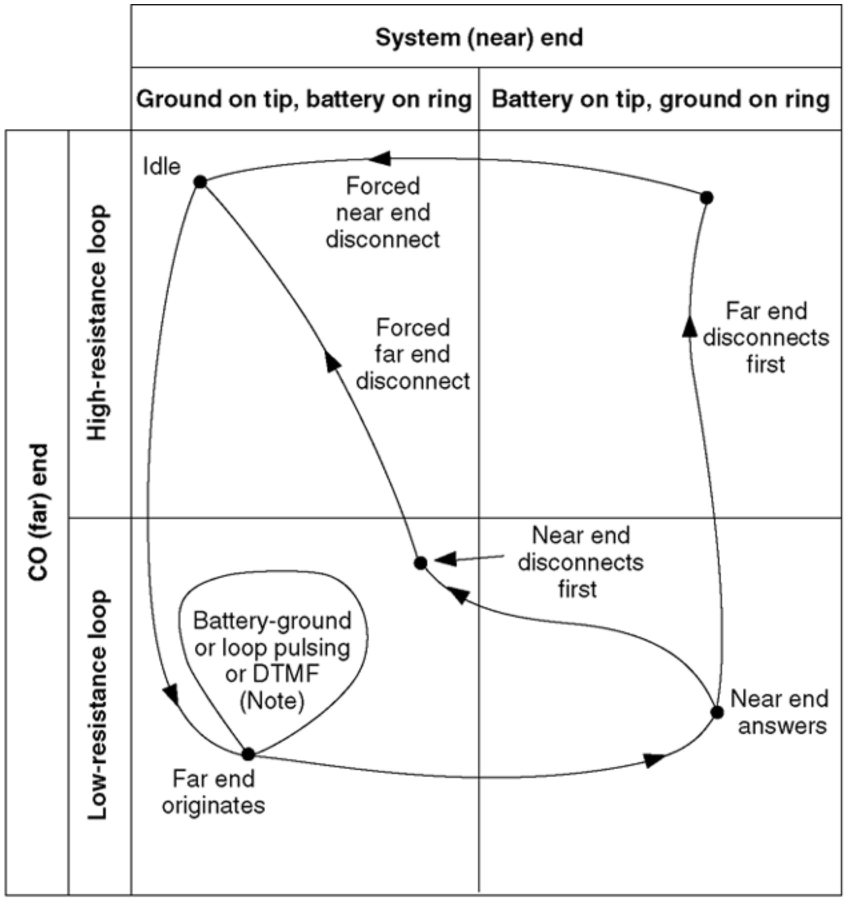
Incoming calls

An incoming call from the CO places a low-resistance loop across the tip and ring leads. See Figure 119: DID trunk, loop DR call states - incoming call from CO on page 414 and Figure 120: DID trunk, loop DR call connection sequence - incoming call from CO on page 415.

Dial pulses or DTMF tones are then presented from the CO. When the called party answers, the universal trunk card reverses battery and ground on the tip and ring leads to the CO. The trunk is arranged for first party release. The CO releases the trunk by removing the low-resistance loop, at which time normal battery and ground are restored at the near-end. This also applies to incoming tie trunk calls from a far-end PBX.

Note:

The near-end can be configured for immediate start, delay dial, or wink start.



Note: The near end may be configured for immediate start, delay dial, or wink start.

553-AAA1137

Figure 119: DID trunk, loop DR call states - incoming call from CO

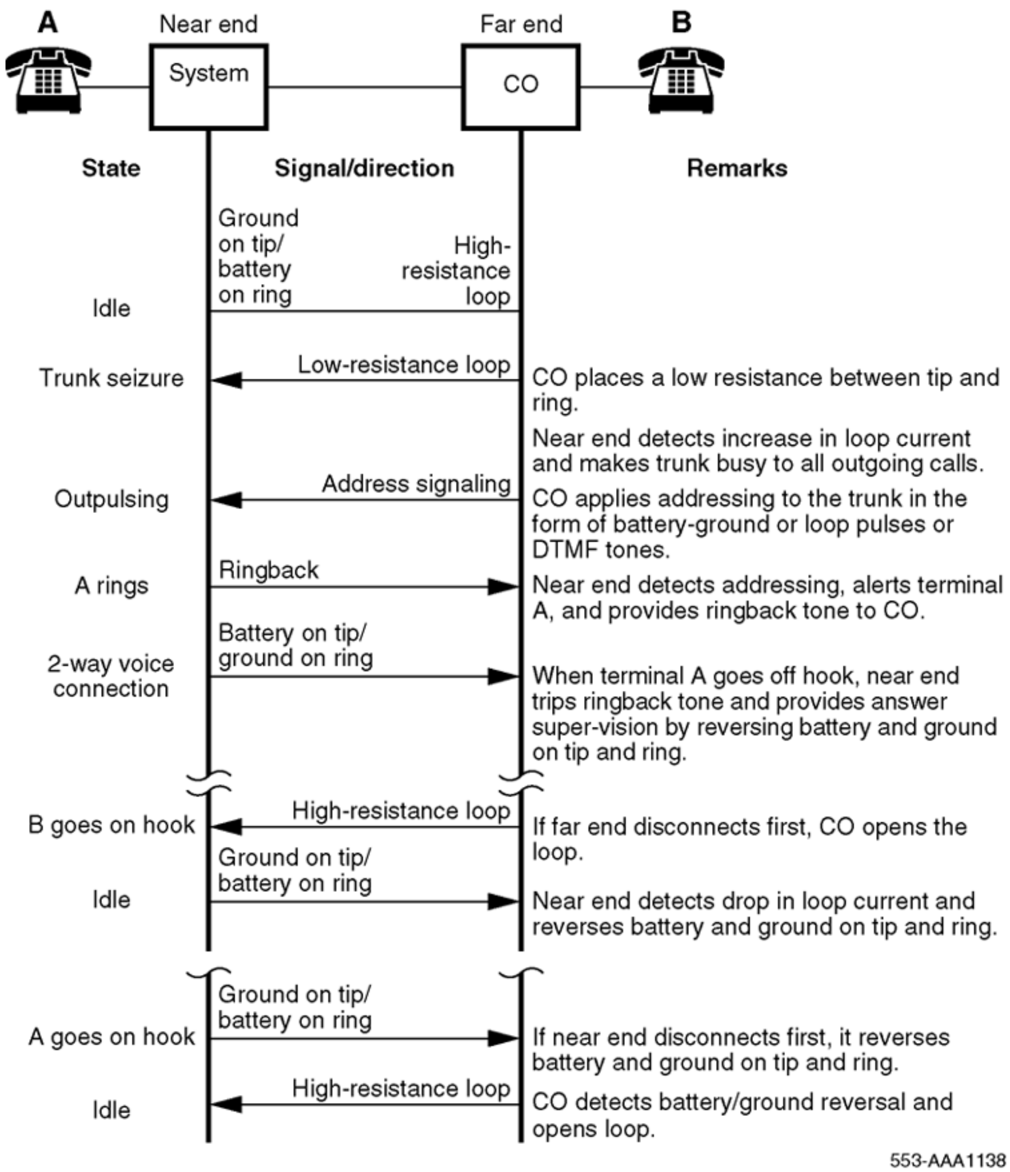


Figure 120: DID trunk, loop DR call connection sequence - incoming call from CO

Two-way, loop dial repeating, TIE trunk operation

Incoming calls

In an incoming call configuration, the far-end initiates a call by placing a low-resistance loop across the tip and ring leads. See Figure 121: Two-way, loop DR, TIE trunk call states - incoming call from far-end PBX on page 416 and Figure 122: Two-way, loop DR, TIE trunk call connection sequence - incoming call from far-end PBX on page 417.

This causes a current to flow through the battery feed resistors in the trunk circuit. Address signaling is then applied by the far-end in the form of DTMF tones or dial pulses. When the called party answers, an answer supervision signal is sent by the software, causing the System to reverse battery and ground on the tip and ringleads to the far-end. Far-end disconnect is initiated by opening the loop while the near-end disconnect is initiated by restoring normal battery and ground. The operation represented in Figure 121: Two-way, loop DR, TIE trunk call states - incoming call from far-end PBX on page 416 and Figure 122: Two-way, loop DR, TIE trunk call connection sequence - incoming call from far-end PBX on page 417 also applies to incoming DID trunk calls from a CO.

Note:

Where no near-end answer supervision is provided, the party at the far-end hangs up after recognizing near-end call termination.

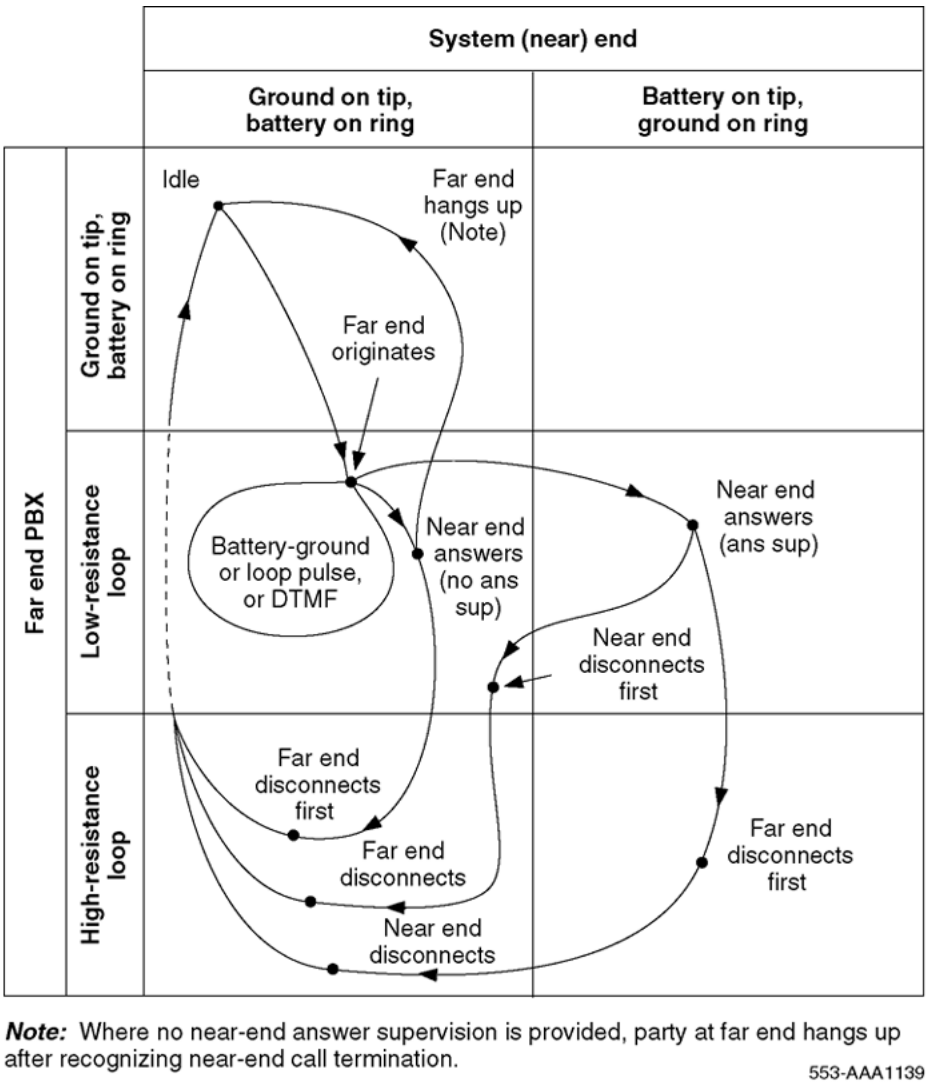


Figure 121: Two-way, loop DR, TIE trunk call states - incoming call from far-end PBX

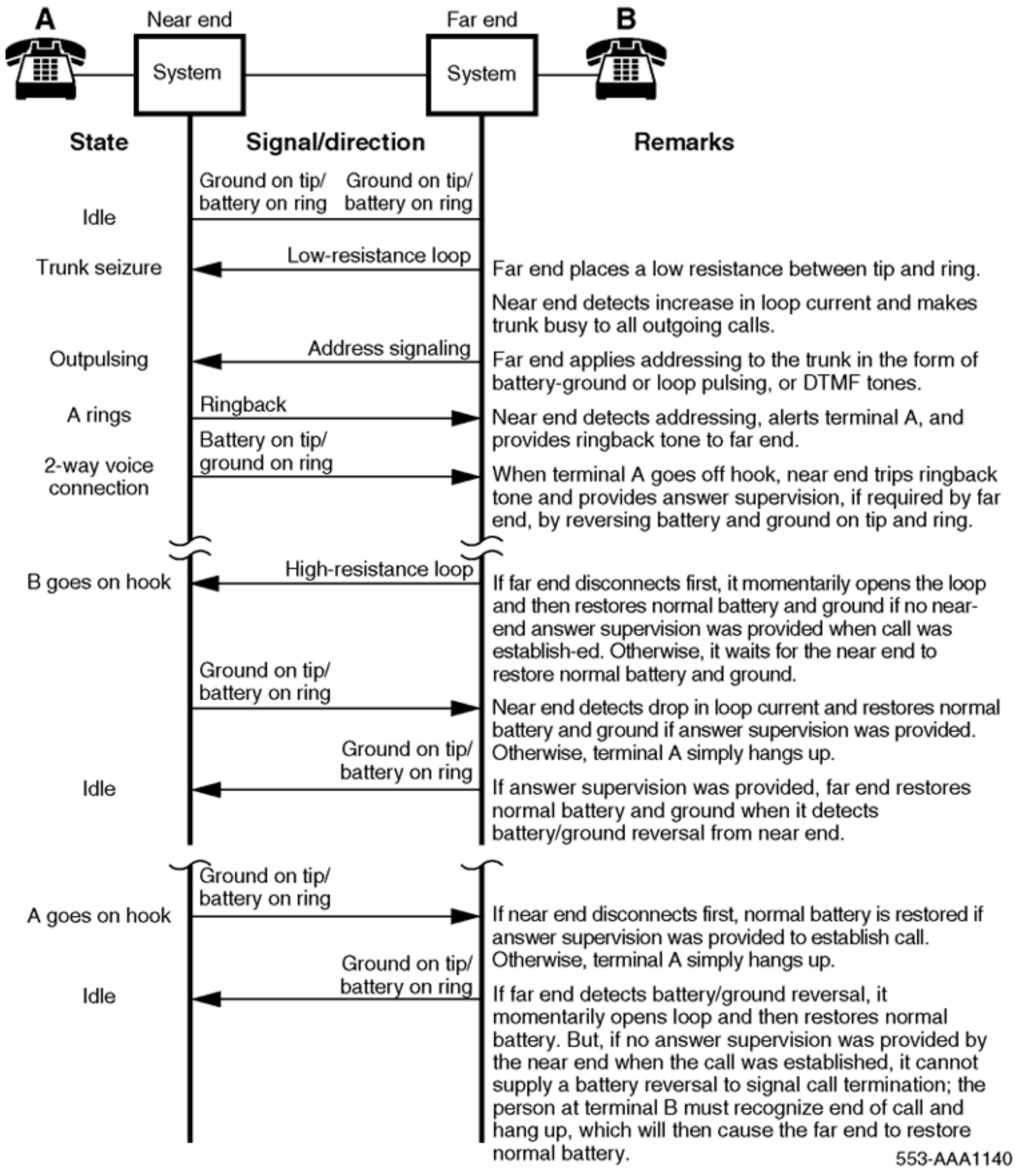


Figure 122: Two-way, loop DR, TIE trunk call connection sequence - incoming call from far-end PBX

Note:

Where no near-end answer supervision is provided, the party at the far-end hangs up after recognizing near-end call termination.

Outgoing calls

In an outgoing call configuration, the NT8D14 Universal Trunk card is connected to an existing PBX by a tie trunk. See Figure 123: Two-way, loop DR, TIE trunk call states - outgoing call to

far-end PBX on page 418 and Figure 124: Two-way, loop DR, TIE trunk call connection sequence - outgoing call to far-end PBX on page 419.

An outgoing call from the near-end seizes the trunk facility by placing a low-resistance loop across the tip and ring leads. Outward addressing is then applied from the System in the form of DTMF tones or dial pulses. If answer supervision is provided by the far-end, reverse battery and ground on the tip and ring leads are returned. The operation represented in Figure 125: Two-way, loop DR, TIE trunk call states - outgoing call to far-end PBX on page 420 and Figure 126: Two-way, loop DR, TIE trunk call connection sequence - outgoing call to far-end PBX on page 421 also applies to outgoing calls on a DID trunk.

Note:

Where no far-end answer supervision is provided, the party at the near-end hangs up, after recognizing far-end call termination.

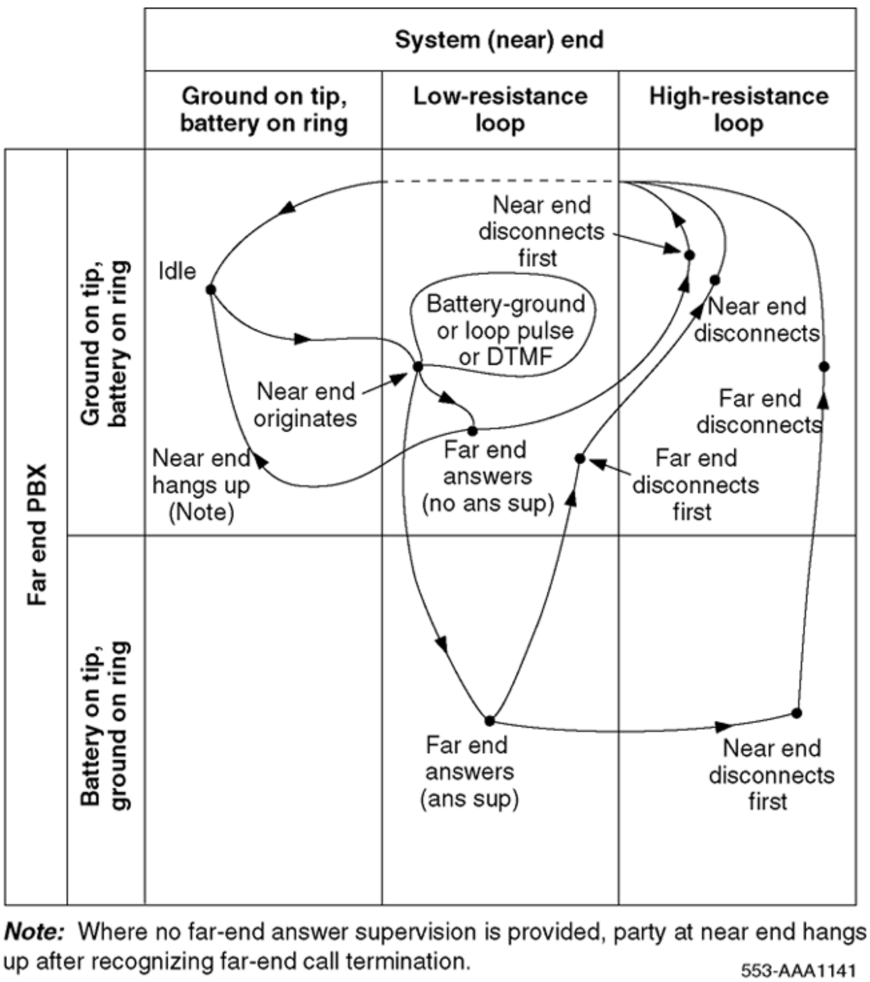


Figure 123: Two-way, loop DR, TIE trunk call states - outgoing call to far-end PBX

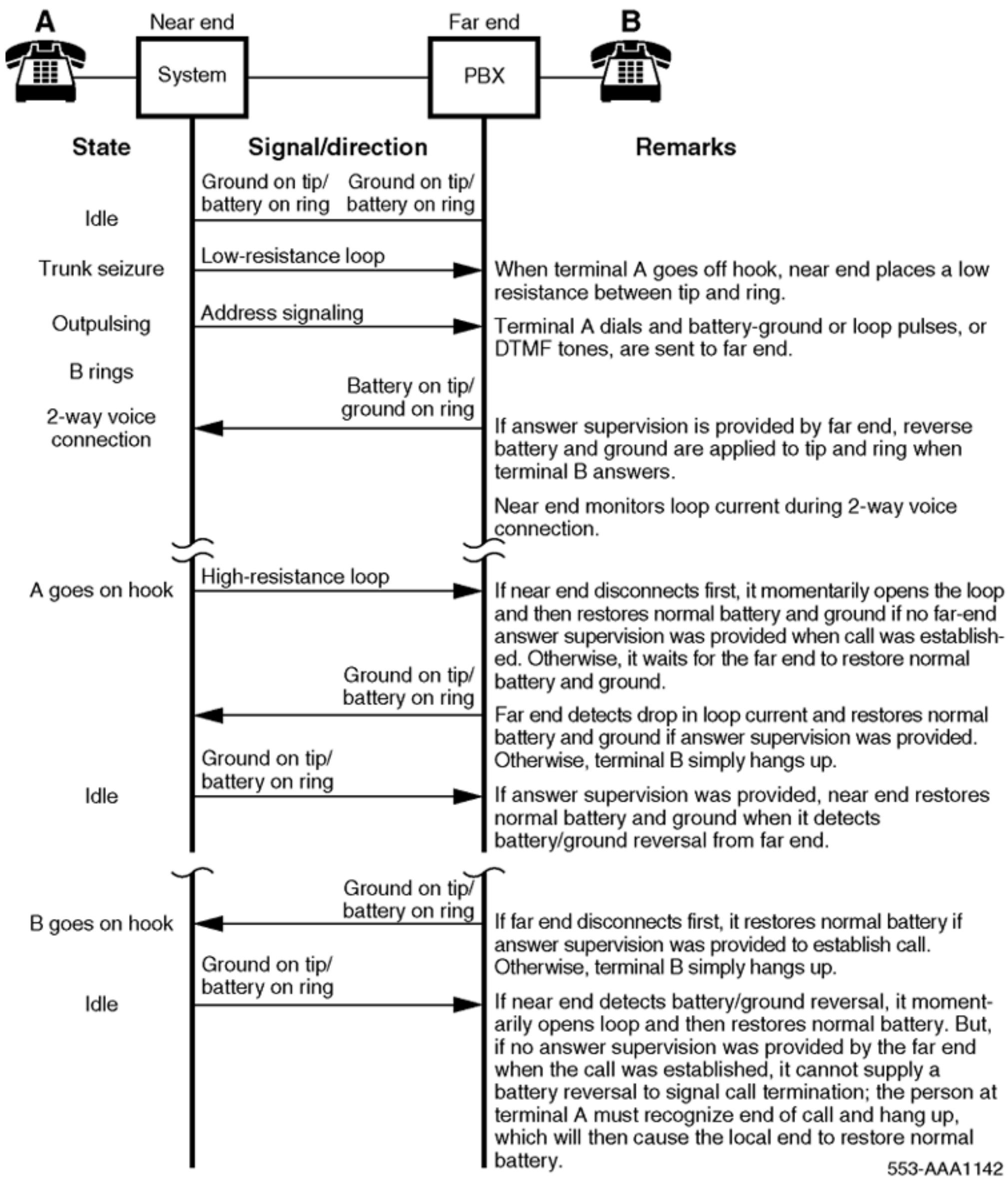


Figure 124: Two-way, loop DR, TIE trunk call connection sequence - outgoing call to far-end PBX

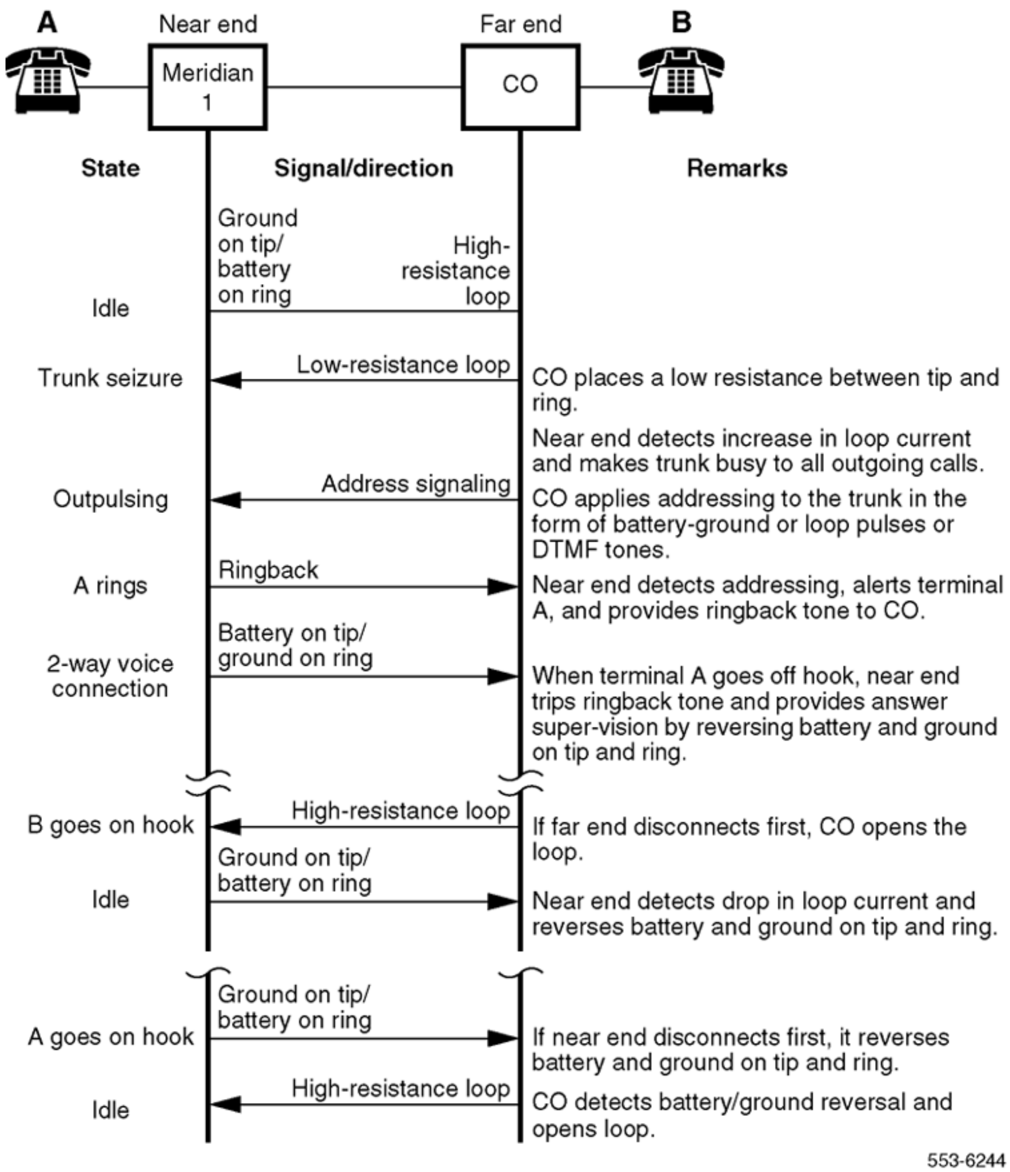


Figure 125: Two-way, loop DR, TIE trunk call states - outgoing call to far-end PBX

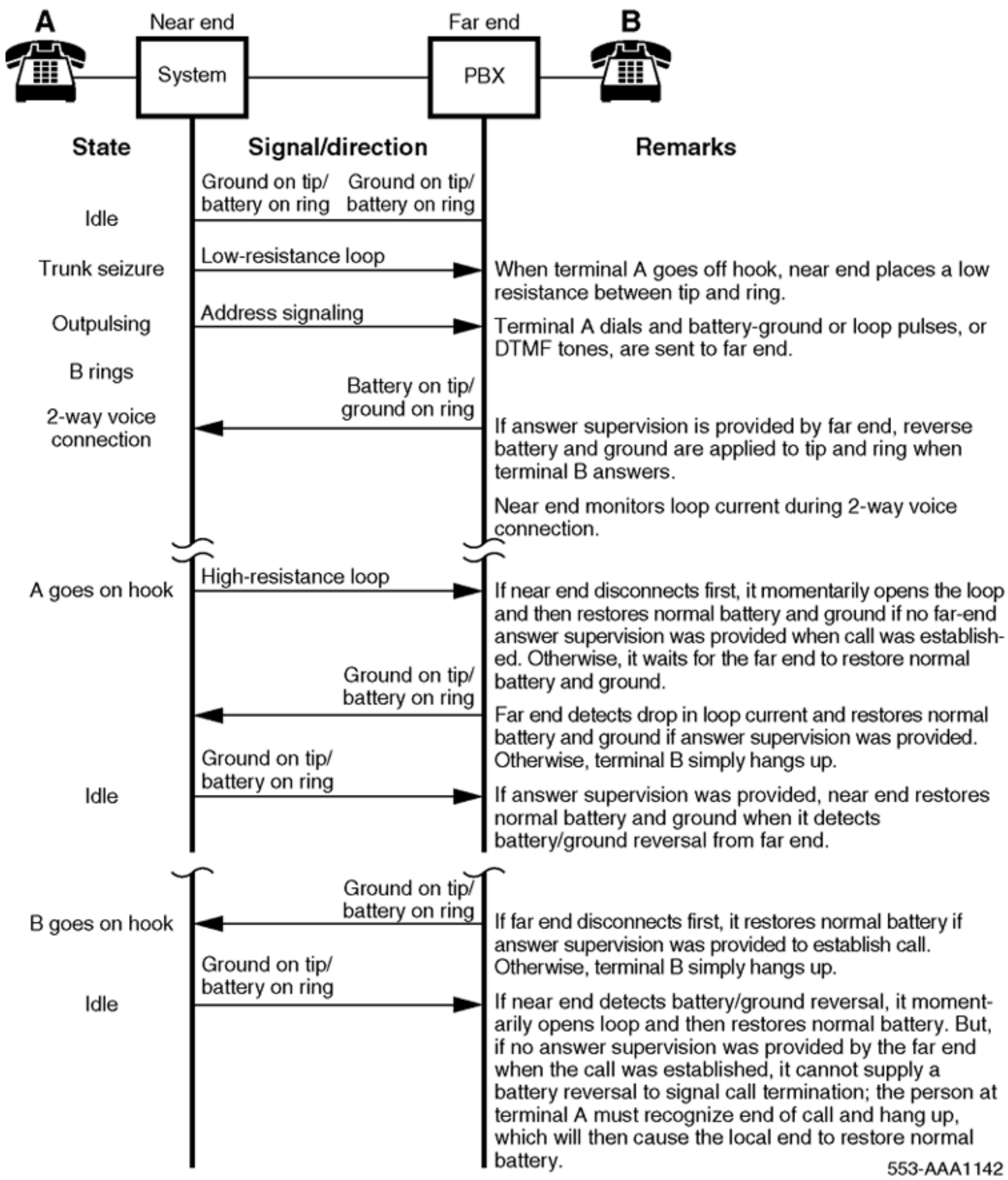


Figure 126: Two-way, loop DR, TIE trunk call connection sequence - outgoing call to far-end PBX

Senderized operation for DID and two-way loop DR trunks

Incoming calls

If the far-end is senderized, the near-end can operate in any mode: Immediate Start (IMM), Delay Dial (DDL) or Wink (WNK) start, as assigned at the STRI prompt in the Trunk Administration program LD 14. See Figure 127: Two-way, loop DR, TIE trunk call states - incoming call through senderized, tandem PBX from a CO/FX/WATS trunk on page 423.

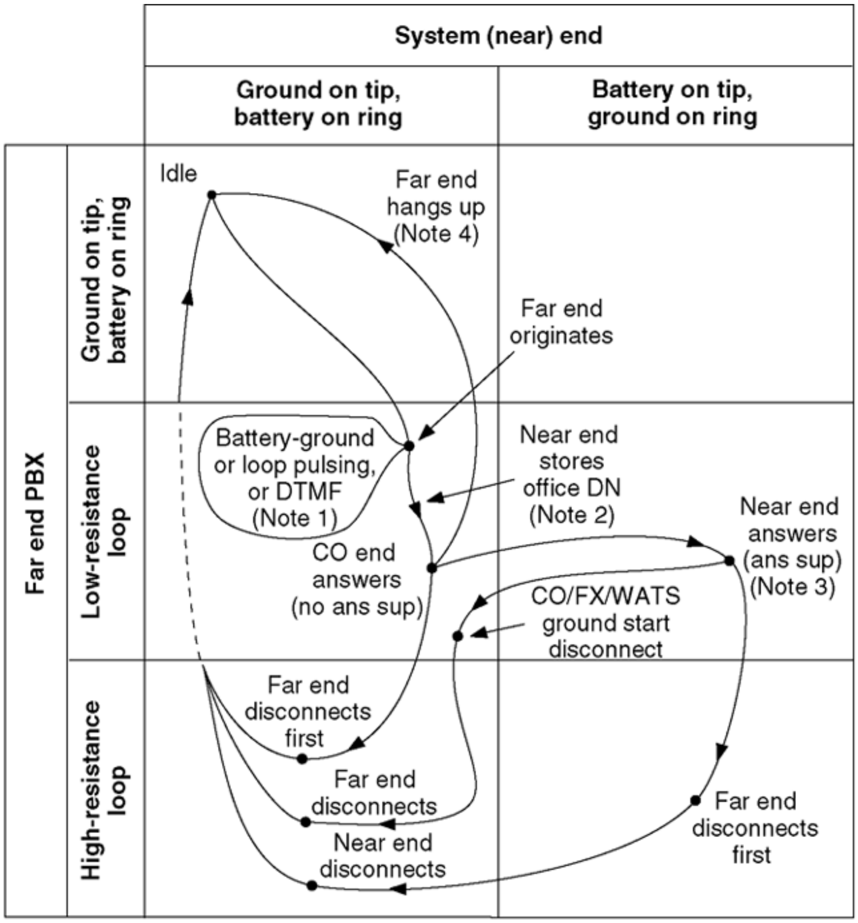
Note:

If a ground start trunk, the outpulse towards office occurs after ground detection. If a loop start trunk, the outpulse towards office occurs one second later.

For immediate start, following the seizure signal, the far-end starts pulsing after the standard delay (normally 65 ms, minimum).

For delay dial or wink start modes, stop/go signaling (off hook/on hook or battery/ground reversal) is returned by the System after receipt of the seizure signal. The delay dial (stop) signal begins immediately upon seizure and ends (go signal) 384 ms later. The wink start (stop) signal begins 384 ms after seizure and ends (go signal) 256 ms later. The far-end detecting the go signal starts pulsing after the standard delay (normally 55 ms, minimum). Stop/go signaling, in addition to the signaling function, serves as an integrity check to help identify a malfunctioning trunk.

If required, the near-end can be configured to provide pseudo-answer supervision at the expiration of the end-of-dial timer. End-of-dial timer settings are made at the EOD (non-DTMF) or ODT (DTMF) prompts in the Trunk Route Administration program LD 16.



Note 1: Dial CO/FX/WATS and office DN.
Note 2: If ground start trunk, outpulse toward office after ground detection. If loop start trunk, outpulse toward office 1 second later.
Note 3: Pseudo-answer supervision is provided by near end at expiration of end-of-dial timer.
Note 4: Where no far-end answer supervision is provided, party at far end hangs up after recognizing near-end call termination.

553-AAA1143

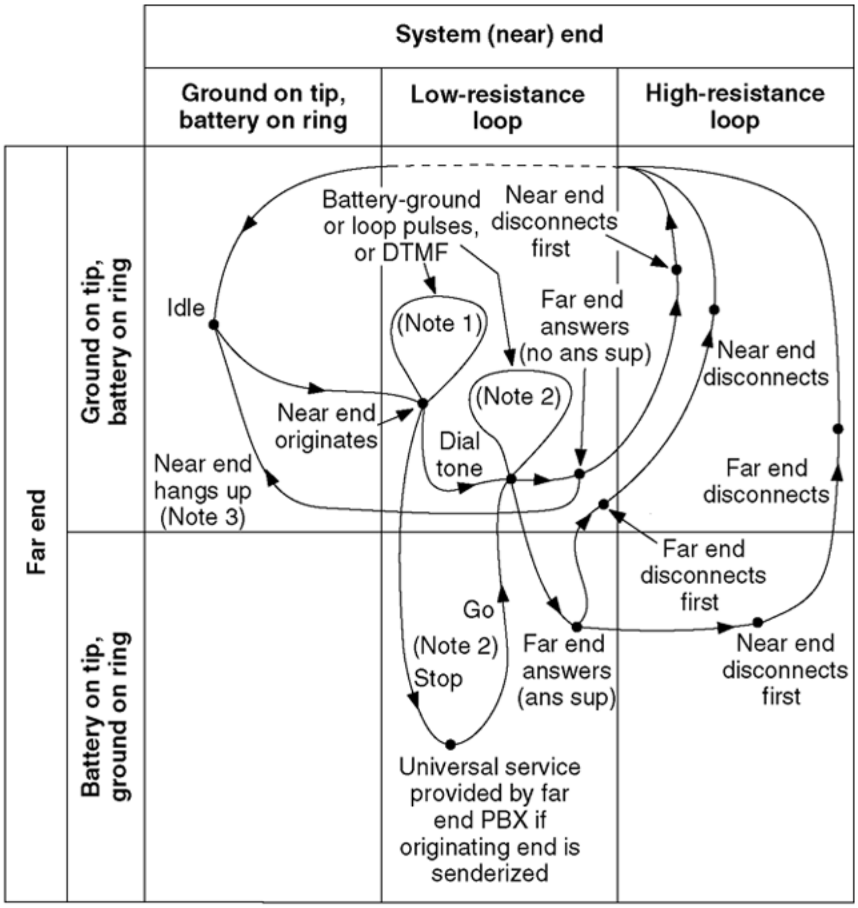
Figure 127: Two-way, loop DR, TIE trunk call states - incoming call through senderized, tandem PBX from a CO/FX/WATS trunk

Outgoing calls

When DDL or WNK mode is used, outgoing calls require a stop/go signal from the far-end so that the near-end cannot outpulse until the far-end is ready to receive digits. See Figure 128: Two-way, loop DR, TIE trunk call states - outgoing call through far-end PBX to CO/FX/WATS on page 424.

Note:

Pseudo-answer supervision is provided by near-end at expiration of end-of-dial timer. Where no far-end answer supervision is provided, the party at the far-end hangs up after recognizing near-end call termination.



Note 1: Immediate-start outpulsing.

Note 2: Delay-dial or wink-start outpulsing after go signal.

Note 3: Where no far-end answer supervision is provided, party at near end hangs up after recognizing far-end call termination.

553-1144

Figure 128: Two-way, loop DR, TIE trunk call states - outgoing call through far-end PBX to CO/FX/WATS

Outgoing automatic, incoming dial operation

Incoming calls

When the NT8D14 Universal Trunk card is seized by the far-end on an incoming call, a low-resistance loop is placed across the tip and ring leads. Addressing is then sent by the far-end in the form of battery-ground or loop pulses, or DTMF tones. The trunk is released at the far-end when the loop is opened. When the near-end detects an open loop, it returns to a normal state.

See Figure 129: Two-way, loop OAID, TIE trunk call states - incoming call from far-end PBX on page 425 and Figure 130: Two-way, loop OAID, TIE trunk call connection sequence - incoming call from far-end PBX on page 426.

Outgoing calls

When seized as a dial-selected outgoing trunk, the near-end places the battery on the tip and ground on the ring. This alerts the far-end of the seizure. The far-end responds with a low resistance across the tip and ring leads.

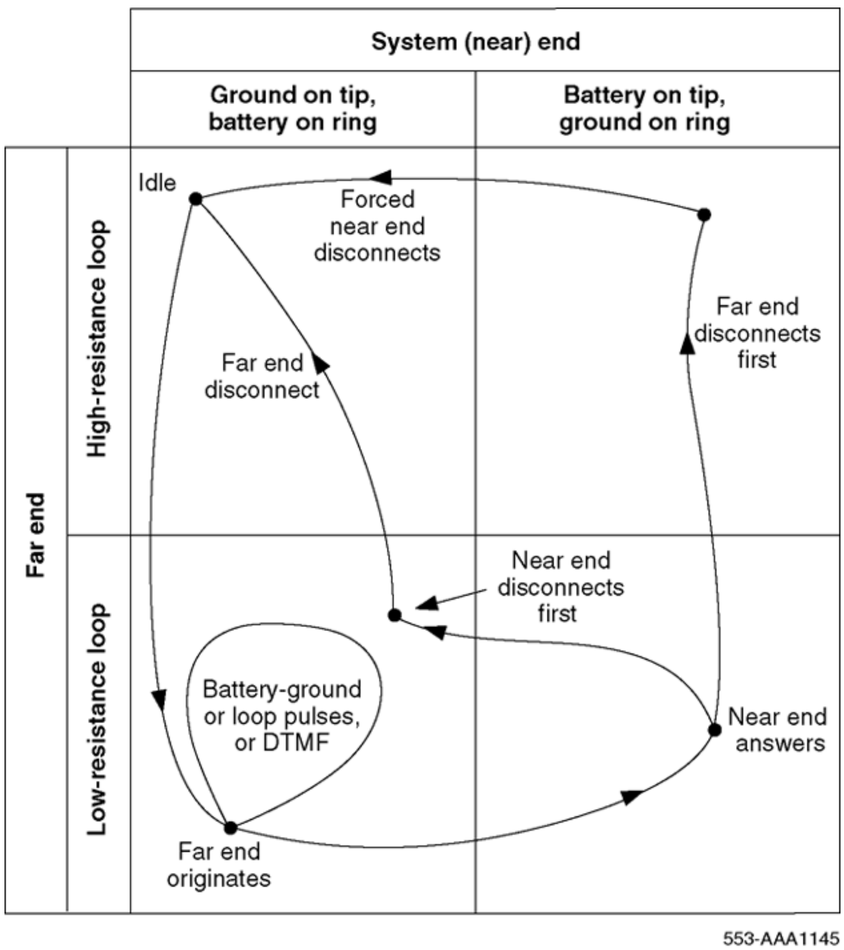


Figure 129: Two-way, loop OAID, TIE trunk call states - incoming call from far-end PBX

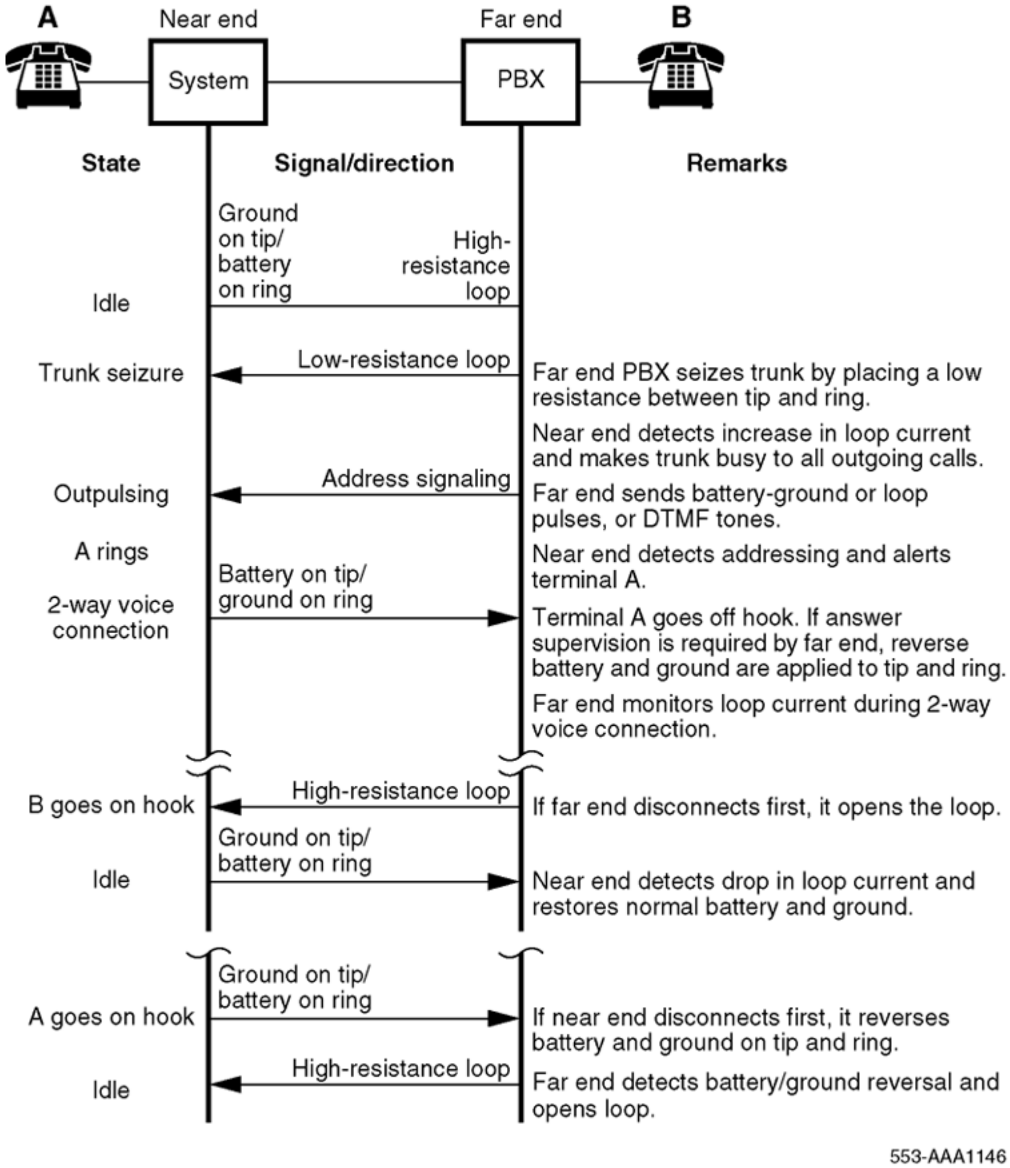


Figure 130: Two-way, loop OAID, TIE trunk call connection sequence - incoming call from far-end PBX

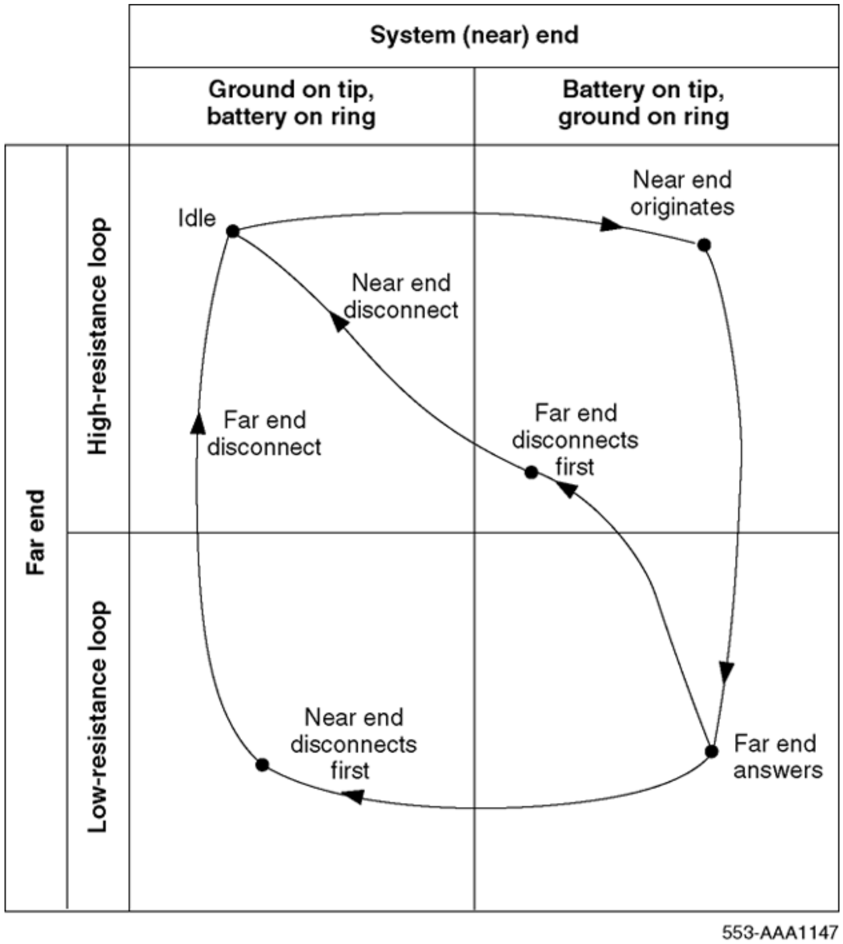


Figure 131: Two-way, loop OAID, TIE trunk call states - outgoing call to far-end PBX

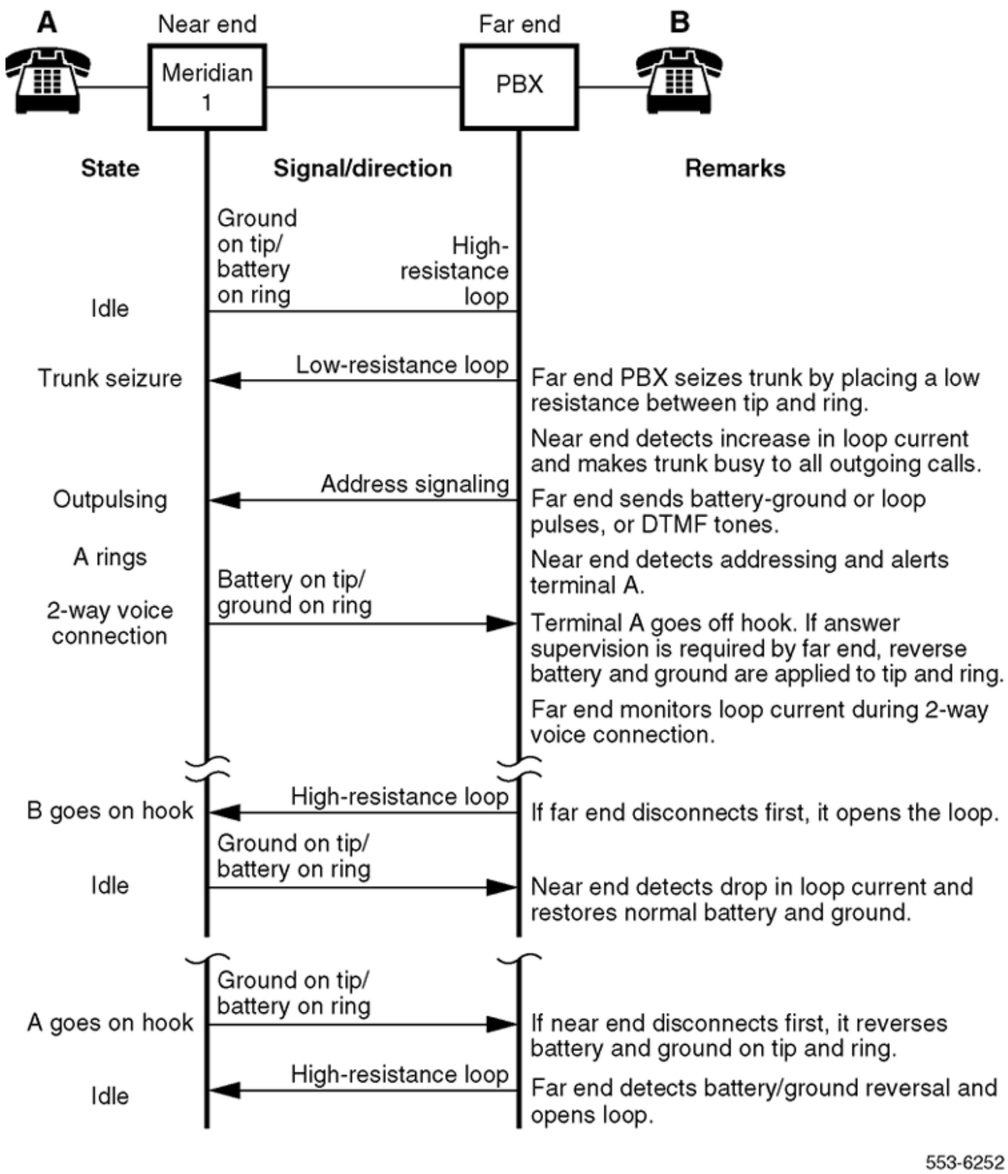


Figure 132: Two-way, loop OAID, TIE trunk call connection sequence - incoming call from far-end PBX

Recorded announcement trunk operation

Note:

Refer to Multi-Channel RAN modes on page 431 for information about Multi-Channel RAN modes, which are not linked to a RAN machine or a given trunk.

When configured for Recorded Announcement (RAN) operation, a trunk unit is connected to a customer-provided recorded announcement machine. Announcement machines must be compatible with RAN trunks. Use the manufacturer's instructions to set up the Announcement machines.

Each trunk unit provides the following for operation with RAN equipment:

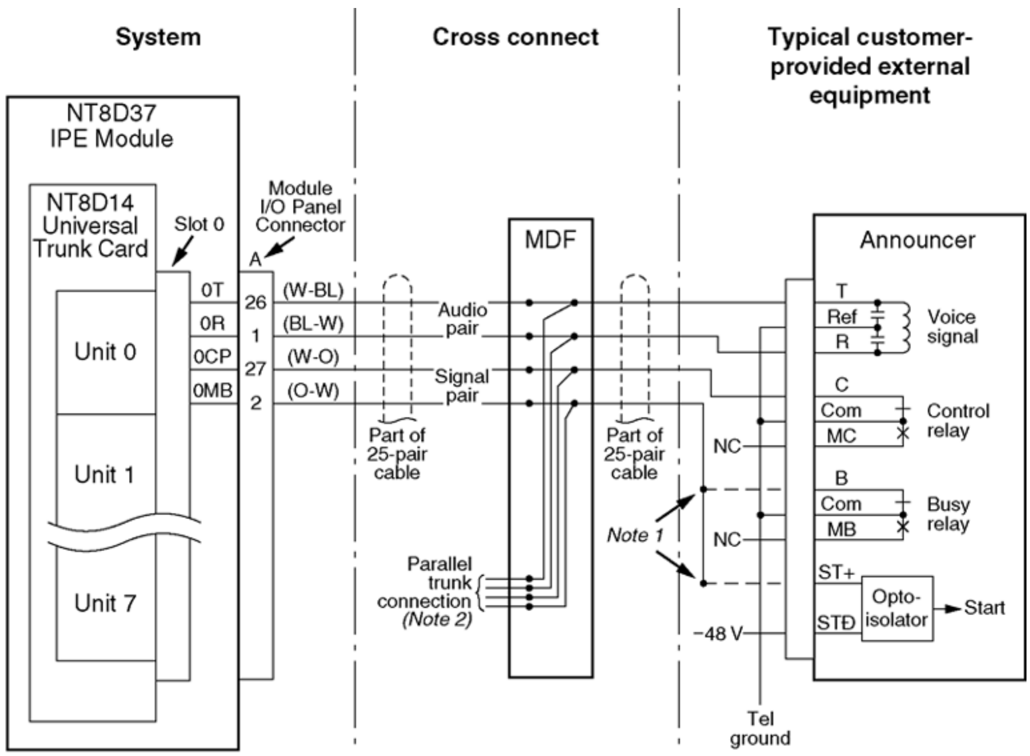
- pulse start, level start, or continuous operation modes
- selectable termination of tip and ring leads into 600 or 900 ohms for interface with a low-impedance (2 or 4 ohms) source
- connection of up to 24 trunk units to a single announcement machine channel

Recorded announcement machines

Recorded announcement machines store prerecorded voice messages that are played back to the trunk units to which they are connected. Most commercially available announcement machines store recordings digitally, although some drum and tape units are still in service.

An announcement machine can provide one or more channels and each channel may be prerecorded with a different message. Some announcement machines also provide a Special Information Tone (SIT) capability. These tones are inserted at the beginning of intercept messages such as "Your call cannot be completed as dialed. Please check the number and try again."

Figure 133: Connecting RAN equipment to the NT8D14 Universal Trunk Card (typical) on page 430 shows a typical connection from a single announcement machine channel to unit 0 on a universal trunk card.



Note 1: For continuous operation mode, connect the trunk unit MB line to the announcer B line only and ground the announcer ST+ line. For pulse start or level start modes, connect the trunk unit MB line to the announcer ST+ line only and leave the announcer B line unconnected.

Note 2: A maximum of 24 universal trunk card units can be paralleled to a single announcer channel.

553-AAA1149

Figure 133: Connecting RAN equipment to the NT8D14 Universal Trunk Card (typical)

RAN modes of operation

Figure 134: RAN control signals (Control GRD = IDLE) on page 431 shows the relationship of control signals to message playback for the operating modes available in announcement machines. The signal names shown in Figure 134: RAN control signals (Control GRD = IDLE) on page 431 are typical.

Note:

For continuous operation mode, connect the trunk unit MB line to the announcer B line only, and ground the announcer ST+ line. For pulse start or level start modes, connect the trunk unit MB line to the announcer ST+ line only, and leave the announcer B line unconnected.

Note:

A maximum of 24 universal trunk card units can be paralleled to a single announcer channel.

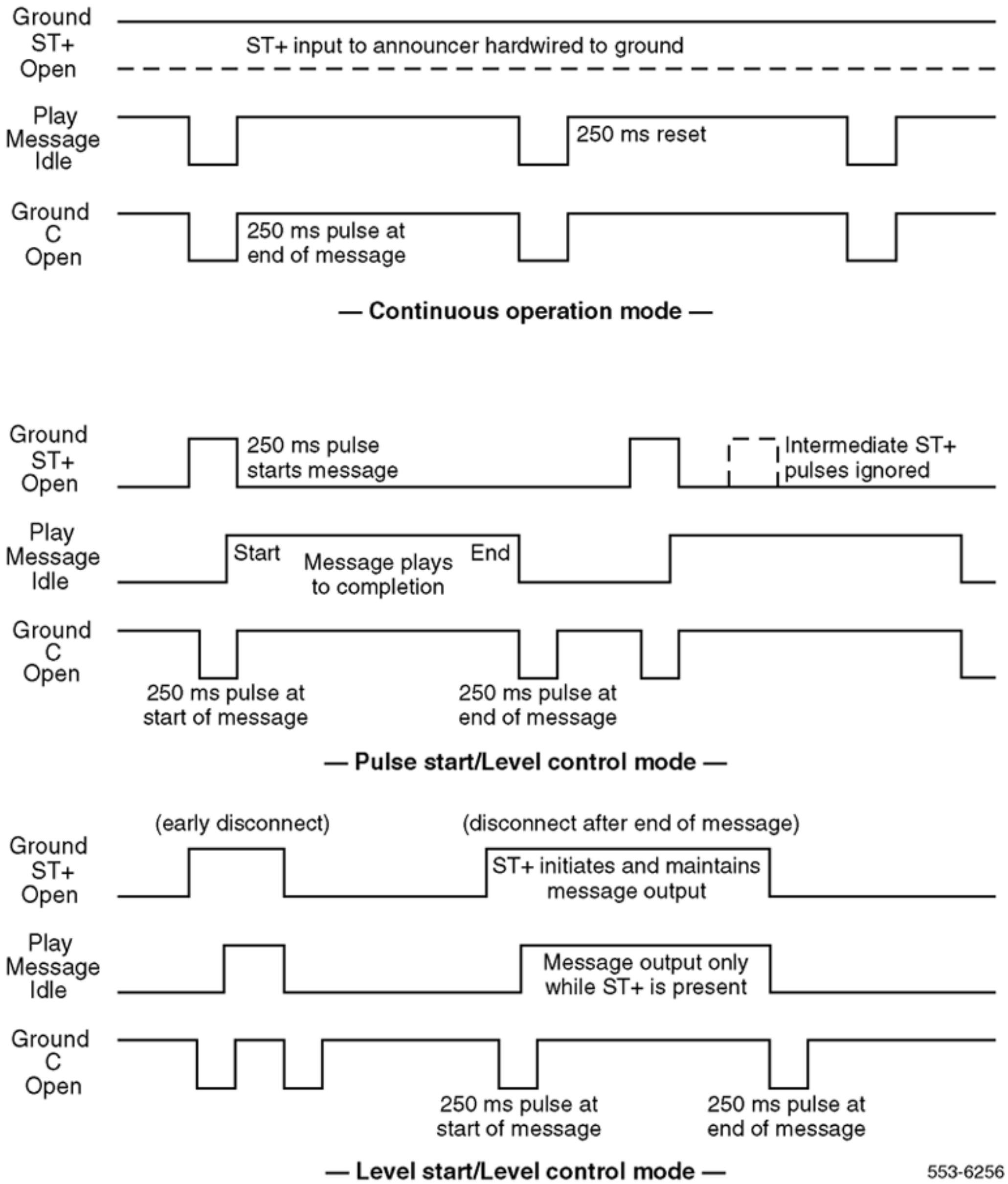


Figure 134: RAN control signals (Control GRD = IDLE)

Multi-Channel RAN modes

In Multi-Channel RAN, multiple RAN channels can be configured within one RAN trunk route. In a Multi-Channel RAN route, each trunk has its own dedicated RAN channel on a physical

RAN machine. Multi-Channel RAN routes do not support the cross connecting (daisy chains) of multiple trunk ports together so that several callers hear the same RAN message.

Multi-channel machine types - Continuous Mode Multi-Channel (MCON), Pulse Start/Stop Multi-Channel (MPUL) and Level Start/Stop Multi-Channel (MLVL) – are not linked to a RAN machine or a given trunk. All trunks belonging to the RAN route are considered independent. RAN trunks and RAN machine channels are connected one-to-one. If one RAN trunk is detected as faulty, then all other trunks are not impacted.

For the RAN machine types, the maximum length of the recorded announcement is two hours. The meaning of a ground signal received from the RAN machine (play or idle) is configured in LD 16.

Multi-Channel Level Start/Control Mode (minimum vintage BA)

A RAN mode of operation is available called "Multi-Channel Level Start/Control Mode." This mode enables provisioning of multiple RAN channels for a RAN route (playing the same message independently on demand) cross-connected one-to-one to each RAN trunk in a multi-channel level start RAN route. Do not bridge RAN trunks in a multi-channel RAN route.

The Route Data Block LD 16 is used to configure a RAN route in Multi-Channel Level Start/ Control mode, using the following response:

```
RTYP = MLSS
```

Trunk members are provisioned in the Trunk Data Block LD 14.

Refer to Programming RAN trunks on page 433 and to *Avaya Software Input/Output Reference — Administration* (NN43001-611) for instructions on service change programs.

Continuous operation mode

In the continuous operation mode (sometimes called the Audichron mode), a message is constantly played, over and over again. Callers "barge in" on a playing message or receive a ringback tone until the message plays again. The start line (ST+) is hardwired as always active. See Figure 134: RAN control signals (Control GRD = IDLE) on page 431. At the end of each message, a pulse is issued on the "C" line that is used by the trunk unit to cut through to the waiting call.

> **Note:**
>
> The "B" (busy) signal line indicates availability of an announcement machine message to the trunk unit when configured for the continuous operation mode. This signal is made active (ground) by the announcement machine if the channel contains a recorded message and is in an online condition. The "B" line is not connected to a trunk unit when configured for start mode operation.

Start modes (minimum vintage BA)

In a start mode (sometimes called the Code-a-Phone or start-stop mode), playback of a message does not begin until a start pulse is received by the announcement machine. Two subcategories of the start mode exist: pulse start and level start.

In the pulse start mode, a start pulse activates playback of a message that continues until completion. The announcement machine ignores all other start pulses that might occur until the message is complete.

In the level start mode, the start signal is a "level" rather than a pulse. The leading edge of the start signal initiates message playback that continues until either the trailing edge of the start signal occurs or the end of the message is reached. A message that is terminated by the trailing edge of a level start signal is immediately reset and ready for playback again.

Call routing to RAN trunks

The CS 1000 software controls recorded announcement machines. These programs detect the calls to be intercepted, determine the type of intercept treatment required (for example, overflow, attendant, announcement), queue the intercept, and provide ringback tone to the calling party. At the proper time, an intercepted call is connected to the appropriate RAN trunk.

Programming RAN trunks

The type of intercept and the RAN trunk parameters are defined in the Trunk Data Block LD 14, Customer Data Block LD 15, and Route Data Block LD 16 programs.

The Trunk Data Block and Route Data Block programs specify the following:

- the RAN trunk
- the type of announcement machine
- the number of repetitions of announcements before a forced disconnect (all calls) or an attendant intercept is initiated (CCSA/DID calls only)
- the point at which the trunk may be connected to the announcement

The Customer Data Block program defines the type of intercept and the trunk route to which the intercept is to be connected.

Refer to *Avaya Software Input/Output Reference — Administration* (NN43001-611) for instructions on service change programs.

Electrical specifications

Table 173: Universal trunk card - trunk interface electrical characteristics on page 434 gives the electrical characteristics of the NT8D14 Universal Trunk card.

Table 173: Universal trunk card - trunk interface electrical characteristics

	Trunk Types			
Characteristic	**CO / FX / WATS**	**DID / TIE**	**RAN**	**Paging**
Terminal impedance	600 or 900 ohms (Note 1)	600 or 900 ohms (Note 1)	600/900 ohms (Note 1)	600 ohms
Balance impedance	600 or 900 ohms (Note 1), 3COM, or 3CM2 (Note 2)	600 or 900 ohms (Note 1), 3COM, or 3CM2 (Note 2)	N/A	N/A
Supervision type	Ground or loop start (Note 3)	Loop start (with ans sup) (Note 3)	Continuous, level, or pulse	N/A
DC signaling loop length (max)	1700-ohm loop with near-end battery of –42.75 V	2450-ohm loop with near-end battery of –44 V	600/900-ohm loop	600 ohm loop
Far-end battery	–42 to –52.5 V (Note 4)	–42 to –52.5 V	–42 to –52 V	N/A
Minimum detected loop current	20 mA	10 mA	10 mA	N/A
Ground potential difference	±3 V	±3 V	±1 V	±1 V
Low DC loop resistance during outpulsing	<300 ohms	N/A	N/A	N/A
High DC loop resistance	Ground start Š 30k ohms; loop start Š 5M ohms	N/AŠ	N/A	N/A
Ring detection	17 to 33 Hz 40 to 120 V rms	N/A	N/A	N/A
Line leakage	Š 30k ohms, tip-to-ring, tip-to-ground, ring-to-ground	Š 30k ohms, tip-to-ring, tip-to-ground, ring-to-ground	N/A	N/A
AC induction rejection	10 V rms, tip-to-ring, tip-to-ground, ring-to-ground	10 V rms, tip-to-ring, tip-to-ground, ring-to-ground	N/A	N/A
Note: Selected in software.				

	Trunk Types			
Characteristic	**CO / FX / WATS**	**DID / TIE**	**RAN**	**Paging**
Note: Selected by jumper strap settings on card. Refer to Table 178: Jumper strap settings - factory standard (NT8D14BA, NT8D14BB) on page 438, Table 179: Jumper strap settings - extended range (NT8D14BA, NT8D14BB, NT8D14BB) on page 439, and Table 180: Trunk types - termination impedance and balance network (NT8D14BA, NT8D14BB) on page 440 for details. **Note:** For loop extender application, the maximum voltage applied between tip and ring is –105 V ±5%. The minimum dc loop resistance for this type of application is 1800 ohms.				

Power requirements

Power to the NT8D14 Universal Trunk card is provided by the module power supply (ac or dc).

Table 174: Power requirements for universal trunk card

Voltage	Tolerance	Current (max.)
+15.0 V dc	±5%	306 mA
–15.0 V dc	±5%	306 mA
+5.0 V dc	±5%	750 mA
+8.5 V dc	±2%	450 mA
–48.0 V dc	±5%	415 mA

Foreign and surge voltage protection

The NT8D14 Universal Trunk card meets UL-1489 and CS03 over-voltage (power cross) specifications and FCC Part 68 requirements.

Environmental specifications

Table 175: Environmental specifications for the NT8D14 Universal Trunk card on page 436 lists the environmental specifications for the NT8D14 Universal Trunk card.

Table 175: Environmental specifications for the NT8D14 Universal Trunk card

Parameter	Specifications
Operating temperature	0¡ to +60¡ C (+32 to +140¡ F), ambient 0 to 50 degrees C, ambient (CS 1000E)
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–40¡ to +70¡ C (–40¡ to +158¡ F)

Release control

Release control establishes which end of a call (near, far, either, joint, or originating) disconnects the call. Only incoming trunks in idle ground start configuration can provide disconnect supervision. You configure release control for each trunk independently in the Route Data Block (LD 16).

PAD switching

The transmission properties of each trunk are characterized by the class-of-service (COS) you assign in the Trunk Data Block (LD 14). Transmission properties may be via net loss (VNL) or non via net loss (non-VNL).

Non-VNL trunks are assigned either a Transmission Compensated (TRC) or Non-Transmission Compensated (NTC) class-of-service to ensure stability and minimize echo when connecting to long-haul trunks, such as Tie trunks. The class-of-service determines the operation of the switchable PADs contained in each unit. They are assigned as follows:

- Transmission Compensated
  - used for a two-wire non-VNL trunk facility with a loss of greater than 2 dB for which impedance compensation is provided
  - or used for a four-wire non-VNL facility
- Non-Transmission Compensated
  - used for a two-wire non-VNL trunk facility with a loss of less than 2 dB
  - or used when impedance compensation is not provided

The insertion loss from IPE ports to IPE ports is as follows:

Table 176: Insertion Loss from IPE Ports to IPE Ports (measured in dB)

	IPE Ports				
IPE Ports	500/2500 Line	Digital Line	2/4 Wire E&M Trunk	4 Wire (ESN) E&M Trunk	CO/FX /WATS Loop Tie Trunk
CO/FX/ WATSLoop Tie Trunk					
→	2.5	0	0.5	0	0.5
←	0	-3.5	0	-0.5	0.5

Connector pin assignments

The universal trunk card connects the eight analog trunks to the backplane through a 160-pin connector shroud. Telephone trunks connect to the universal trunk card at the back of the Media Gateway using a 25-pin connector.

A list of the connections to the universal trunk card is shown in Table 177: Universal trunk card - backplane pinouts on page 437. See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for I/O panel connector information and wire assignments for each tip/ring pair.

Table 177: Universal trunk card - backplane pinouts

Trunk Number	Back-plane Pin	Signal			Back-plane Pin	Signal		
		RAN mode	Paging mode	Other modes		RAN mode	Paging mode	Other modes
0	12A	Tip	Tip	Tip	12B	Ring	Ring	Ring
	13A	CP	A	N/A	13B	MB	RG	N/A
1	14A	Tip	Tip	Tip	14B	Ring	Ring	Ring
	15A	CP	A	N/A	15B	MB	RG	N/A
2	16A	Tip	Tip	Tip	16B	Ring	Ring	Ring
	17A	CP	A	N/A	17B	MB	RG	N/A

Trunk Number	Back-plane Pin	Signal			Back-plane Pin	Signal		
		RAN mode	Paging mode	Other modes		RAN mode	Paging mode	Other modes
3	18A	Tip	Tip	Tip	18B	Ring	Ring	Ring
	19A	CP	A	N/A	19B	MB	RG	N/A
4	62A	Tip	Tip	Tip	62B	Ring	Ring	Ring
	63A	CP	A	N/A	63B	MB	RG	N/A
5	64A	Tip	Tip	Tip	64B	Ring	Ring	Ring
	65A	CP	A	N/A	65B	MB	RG	N/A
6	66A	Tip	Tip	Tip	66B	Ring	Ring	Ring
	67A	CP	A	N/A	67B	MB	RG	N/A
7	68A	Tip	Tip	Tip	68B	Ring	Ring	Ring
	69A	CP	A	N/A	69B	MB	RG	N/A

Configuration

The trunk type for each unit on the card as well as its terminating impedance and balance network configuration is selected by software service change entries at the system terminal and by jumper strap settings on the card.

NT8D14 has a reduced jumper strap setting on the card. There are only three jumpers, J1.X, J2.X, and J3.X on each channel. Table 178: Jumper strap settings - factory standard (NT8D14BA, NT8D14BB) on page 438, Table 179: Jumper strap settings - extended range (NT8D14BA, NT8D14BB, NT8D14BB) on page 439, and Table 180: Trunk types - termination impedance and balance network (NT8D14BA, NT8D14BB) on page 440 show the functionality of these three jumpers.

Table 178: Jumper strap settings - factory standard (NT8D14BA, NT8D14BB)

Trunk types	Loop length	Jumper strap settings (Note 1)			
		J1.X	J2.X	J3.X	J4.X (Note 2)
CO/FX/WATS	0–1524 m (5000 ft.)	Off	Off	1–2	1–2
2-way TIE (LDR)					
2-way TIE (OAID)					
DID	0–600 ohms	Off	Off	1–2	1–2
RAN: continuous operation mode	Not applicable: RAN and paging trunks	Off	Off	1–2	1–2

Trunk types	Loop length	Jumper strap settings (Note 1)			
		J1.X	J2.X	J3.X	J4.X (Note 2)
Paging	should not leave the building.				

Note:

Jumper strap settings J1.X, J2.X, J3.X, and J4.X apply to all eight units; "X" indicates the unit number, 0–7. "Off" indicates that no jumper strap is installed on a jumper block. Store unused straps on the universal trunk card by installing them on a single jumper pin as shown below.

Note:

For the NT8D14BB card, J4.X is not provided on the card. The J4.X jumper setting specified in Table 178: Jumper strap settings - factory standard (NT8D14BA, NT8D14BB) on page 438 does not apply.

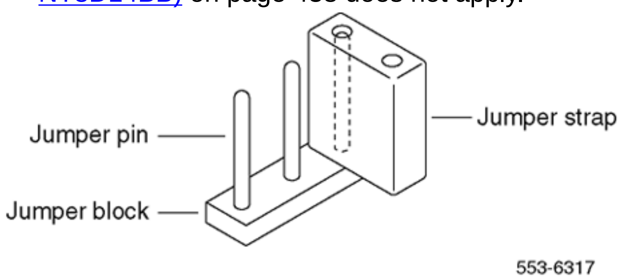


Table 179: Jumper strap settings - extended range (NT8D14BA, NT8D14BB, NT8D14BB)

Trunk types	Loop length	Jumper strap settings (Note 1)			
		J1.X	J2.X	J3.X	J4.X (Note 2)
CO/FX/WATS	> 1524 m (5000 ft.)	Off	Off	1–2	2–3
2-way TIE (LDR)					
2-way TIE (OAID)					
DID	> 600 ohms	On	On	1–2	2–3
RAN: pulse start or level start modes	Not applicable: RAN trunks should not leave the building.	Off	Off	2–3	1–2

Note:

Jumper strap settings J1.X, J2.X, J3.X, and J4.X apply to all eight units; "X" indicates the unit number, 0–7. "Off" indicates that no jumper strap is installed on a jumper block.

Trunk types	Loop length	Jumper strap settings (Note 1)			
		J1.X	J2.X	J3.X	J4.X (Note 2)

Note:

For the NT8D14BB card, J4.X is not provided on the board. The J4.X jumper setting specified in Table 179: Jumper strap settings - extended range (NT8D14BA, NT8D14BB, NT8D14BB) on page 439 does not apply.

Table 180: Trunk types - termination impedance and balance network (NT8D14BA, NT8D14BB)

Trunk types	Terminating impedance (Note 1)	Balance network for loop lengths (Note 2)		
		0–915 m (0–3000 ft)	915–1524 m (3000–5000 ft)	> 1524 m (> 5000 ft)
CO/FX/WATS	600 or 900 ohms	600 ohms	3COM	3CM2
2-way TIE (LDR)	600 or 900 ohms	600 ohms	3COM	3CM2
2-way TIE (OAID)	600 or 900 ohms	600 ohms	3COM	3CM2
DID (loop length < 600 ohms)	600 or 900 ohms	600 ohms	3COM	3CM2
DID (loop length Š 600 ohms)	600 or 900 ohms	600 ohms	N/A	3CM2
RAN: continuous operation mode	600 or 900 ohms	600 or 900 ohms	N/A	N/A
Paging	600 ohms	600 ohms	N/A	N/A

Note:

The terminating impedance of each trunk unit is software selectable in LD 14 and should match the nominal impedance of the connecting equipment.

Note:

The balance network of each trunk unit is software selectable between resistive 600 or 900 ohms or 3COM and jumper selectable between 3COM and 3CM2. Jumper selection for 3COM/3CM2 restriction does not apply to NT8D14BB.

Jumper strap settings

For most applications, the jumper strap settings remain set to the standard configuration as shipped from the factory. See Table 178: Jumper strap settings - factory standard (NT8D14BA, NT8D14BB) on page 438.

The jumper strap settings must be changed, as shown in Table 179: Jumper strap settings - extended range (NT8D14BA, NT8D14BB, NT8D14BB) on page 439, for the following:

- For CO/FX/WATS or TIE trunk loops exceeding 1524 meters (5000 ft.)
- DID trunks exceeding a loop resistance of 600 ohms
- RAN trunks operating in pulse start or level start modes

Figure 135: Universal trunk card - jumper locations for NT8D14BA and NT8D14BB Release 9 and below on page 442 shows jumper locations on the universal trunk card (vintage BA).

Note:

Refer to *Avaya Circuit Card Reference* (NN43001-311) for vintage AA jumper strap settings.

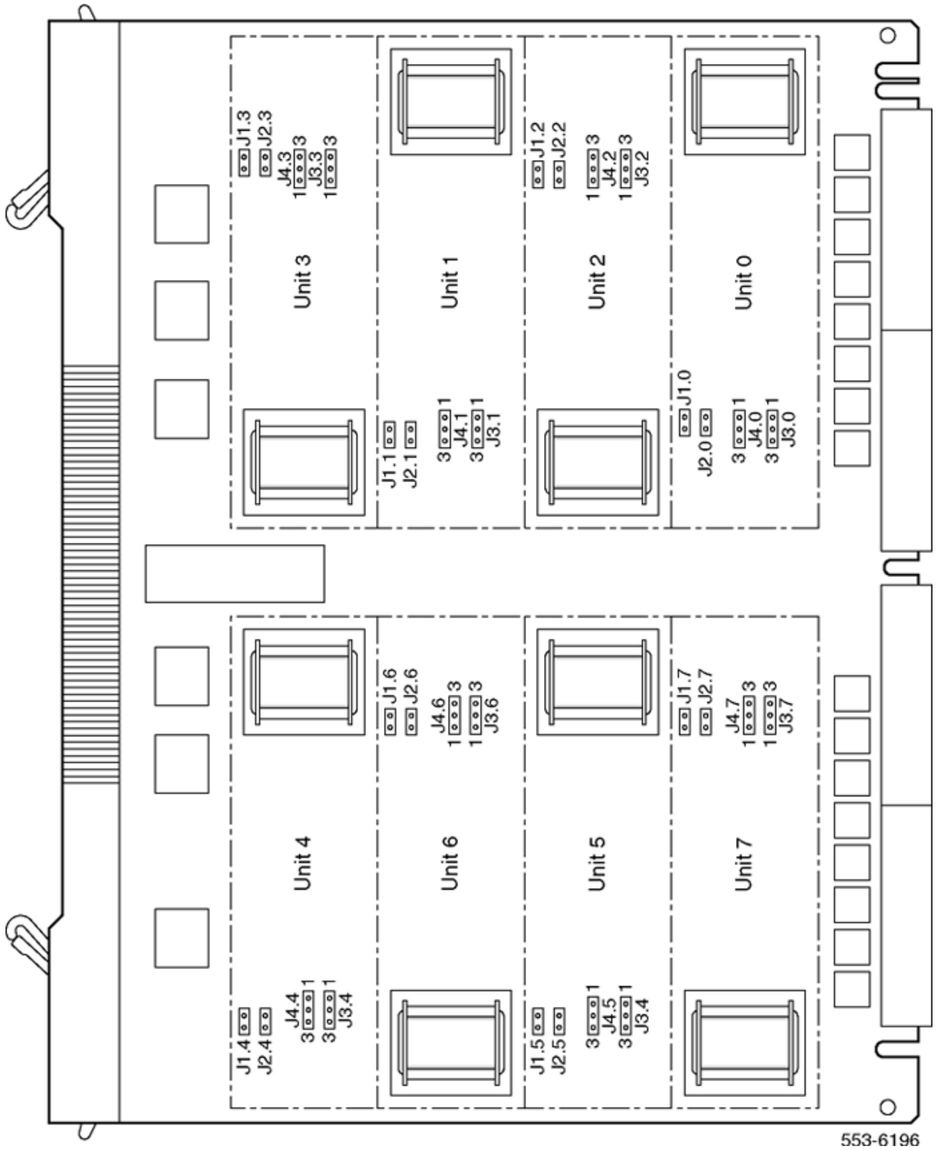


Figure 135: Universal trunk card - jumper locations for NT8D14BA and NT8D14BB Release 9 and below

Service change entries

The trunk type, terminating impedance, and balance network are selected by making service change entries in the Trunk Administration program LD 14.

See Table 181: Trunk types - termination impedance and balance network (NT8D14BA, NT8D14BB) on page 443 for the proper values for the trunk type and loop length. Refer to *Avaya Software Input/Output Reference — Administration* (NN43001-611) for LD 14 service change instructions.

Before the appropriate balance network can be selected, the loop length between the near-end and the far-end (a Central Office, for example) must be known. To assist in determining loop length, some typical resistance and loss values for the most common cable lengths are given in Table 182: Cable loop resistance and loss on page 443 for comparison with values obtained from actual measurements.

Table 181: Trunk types - termination impedance and balance network (NT8D14BA, NT8D14BB)

Trunk types	Terminating impedance (Note 1)	Balance network for loop lengths (Note 2)		
		0–915 m (0–3000 ft)	915–1524 m (3000–5000 ft)	> 1524 m (> 5000 ft)
CO/FX/WATS	600 or 900 ohms	600 ohms	3COM	3CM2
2-way TIE (LDR)	600 or 900 ohms	600 ohms	3COM	3CM2
2-way TIE (OAID)	600 or 900 ohms	600 ohms	3COM	3CM2
DID (loop length < 600 ohms)	600 or 900 ohms	600 ohms	3COM	3CM2
DID (loop length Š 600 ohms)	600 or 900 ohms	600 ohms	N/A	3CM2
RAN: continuous operation mode	600 or 900 hms	600 or 900 ohms	N/A	N/A
Paging	600 ohms	600 ohms	N/A	N/A

Note:

The terminating impedance of each trunk unit is software selectable in LD 14 and should match the nominal impedance of the connecting equipment.

Note:

The balance network of each trunk unit is software selectable between resistive 600 or 900 ohms or 3COM and jumper selectable between 3COM and 3CM2. Jumper selection for 3COM/3CM2 restriction does not apply to NT8D14BB.

Table 182: Cable loop resistance and loss

Cable length	Cable loop resistance (ohms)			Cable loop loss (dB) (nonloaded at 1kHz)		
	22 AWG	24 AWG	26 AWG	22 AWG	24 AWG	26 AWG
915 m (3000 ft.)	97	155	251	0.9	1.2	1.5
1524 m (5000 ft.)	162	260	417	1.6	2.0	2.5
2225 m (7300 ft.)	236	378	609	2.3	3.0	3.7
3566 m (11700 ft.)	379	607	977	3.7	4.8	6.0

Cable length	Cable loop resistance (ohms)			Cable loop loss (dB) (nonloaded at 1kHz)		
	22 AWG	24 AWG	26 AWG	22 AWG	24 AWG	26 AWG
5639 m (18500 ft.)	600	960	1544	5.9	7.6	9.4

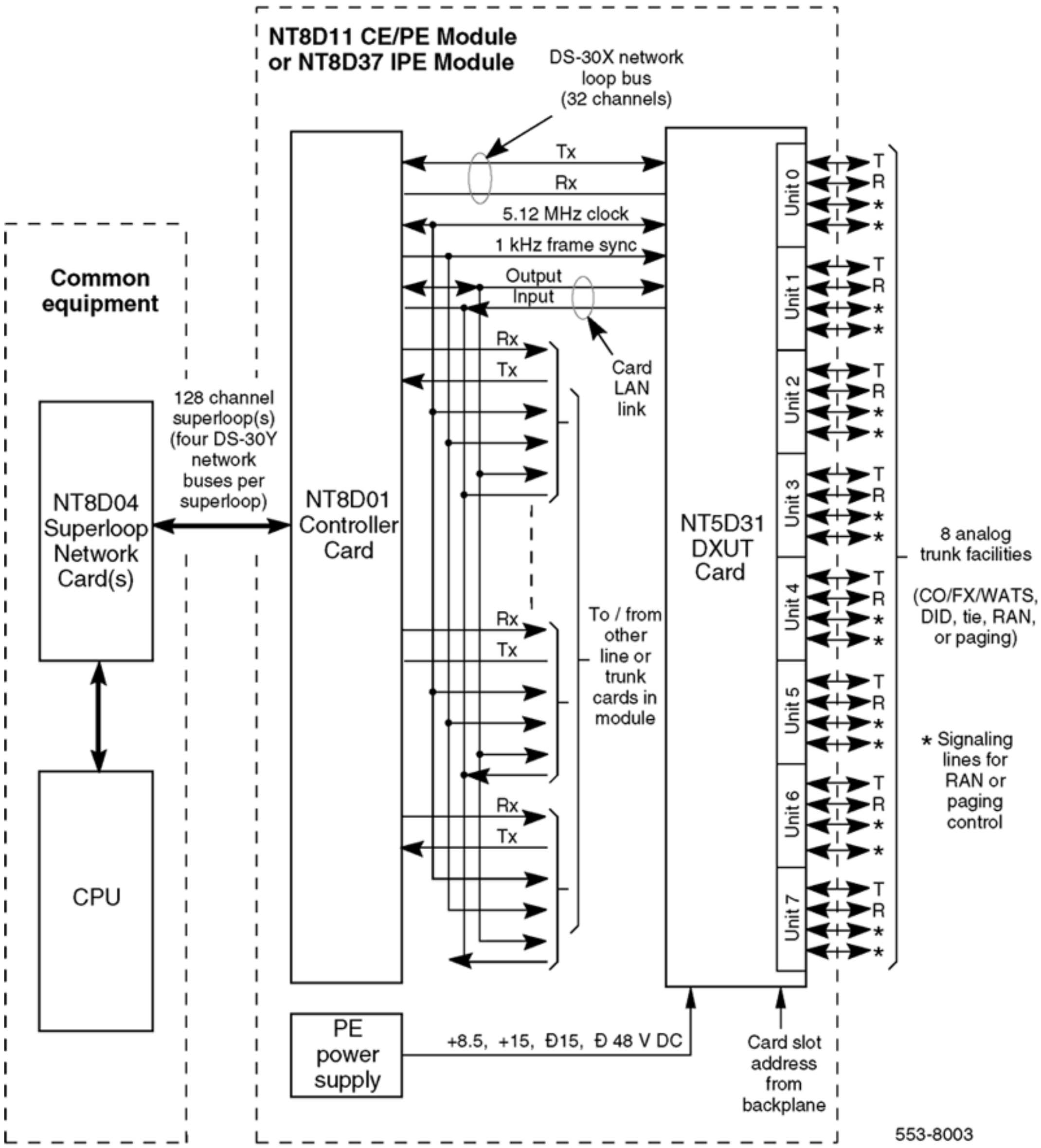


Figure 136: Universal trunk card - jumper locations for NT8D14BB Release 10 and higher

Port-to-port loss configuration

Loss parameters are selected on the NT8D14 Universal Trunk card by a switchable pad controlled by codec emulation software. For convenience, the pads settings are called "in" and "out." Pad settings are determined by the two factors listed below (the first is under direct user control; the second is controlled indirectly):

- Class of Service is assigned in LD 14 (under direct user control).
- Port-to-port connection loss is automatically set by software on the basis of the port type selected in LD 16; only the port type is set by the user (controlled indirectly).

The transmission properties of each trunk are characterized by the class of service assigned in LD 14. Transmission properties can be Via Net Loss (VNL) or non-Via Net Loss (non-VNL).

The VNL class of service is assigned at the prompt CLS with the response VNL. The non-VNL class of service is assigned at prompt CLS by selecting either the Transmission Compensated (TRC) or Non-Transmission Compensated (NTC) response.

Non-VNL trunks are assigned a TRC or NTC class of service to ensure stability and minimize echo when connecting to long-haul trunks, such as Tie trunks. The class of service determines the operation of the switchable pads contained in each unit. They are assigned as follows:

- TRC for a 2-wire non-VNL trunk facility with a loss of greater than 2 dB, or for which impedance compensation is provided, or for a 4-wire non-VNL facility.
- NTC for a 2-wire, non-VNL trunk facility with a loss of less than 2 dB, or when impedance compensation is not provided.

See Table 183: Pad switching algorithm on page 445 for the pad switching control for the various through connections and the actual port-to-port loss introduced for connections between the NT8D14 Universal Trunk card and any other port designated as Port B.

Table 183: Pad switching algorithm

Port B	Port B pads		Universal Trunk Pads		Port-to-port loss (dB)	
	Transmit D to A	Receive A to D	Transmit D to A	Receive A to D	Port B to Universal trunk card	Universal trunk card to Port B
IPE line	N/A	N/A	Out	Out	0.5	0.5
Universal trunk (TRC)	In	Out	In	Out	1	1
IPE TIE (VNL)	In	In	Out	Out	0	0

Note:

Transmit and receive designations are from and to the system. Transmit is from the system to the external facility (digital-to-analog direction in the Universal trunk card). Receive is to the system from the external facility (analog-to-digital direction in the Universal trunk card).

Port B	Port B pads		Universal Trunk Pads		Port-to-port loss (dB)	
	Transmit D to A	Receive A to D	Transmit D to A	Receive A to D	Port B to Universal trunk card	Universal trunk card to Port B
Note: When Port B is the call originating port. If the Universal trunk card is the originating port, the UTC pads are out, the Port B (PE CO/FX/WATS) pads are in.						

Applications

The optional applications, features, and signaling arrangements for each trunk are assigned through unique route and trunk data blocks.

Paging trunk operation

A universal trunk card unit can be configured as a paging trunk. Configure units as paging trunks in the Trunk Data Block program LD 14 and assign routes in the Route Data Block program LD 16.

Figure 137: Connecting paging equipment to the NT8D14 Universal Trunk card (typical) on page 447 shows a typical connection from customer-provided equipment to unit 0 on a universal trunk card that can be installed in slots 1, 2, and 3 in a Media Gateway and slots 7, 8, 9, and 10 in a Media Gateway Expansion. See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for trunk wiring information.

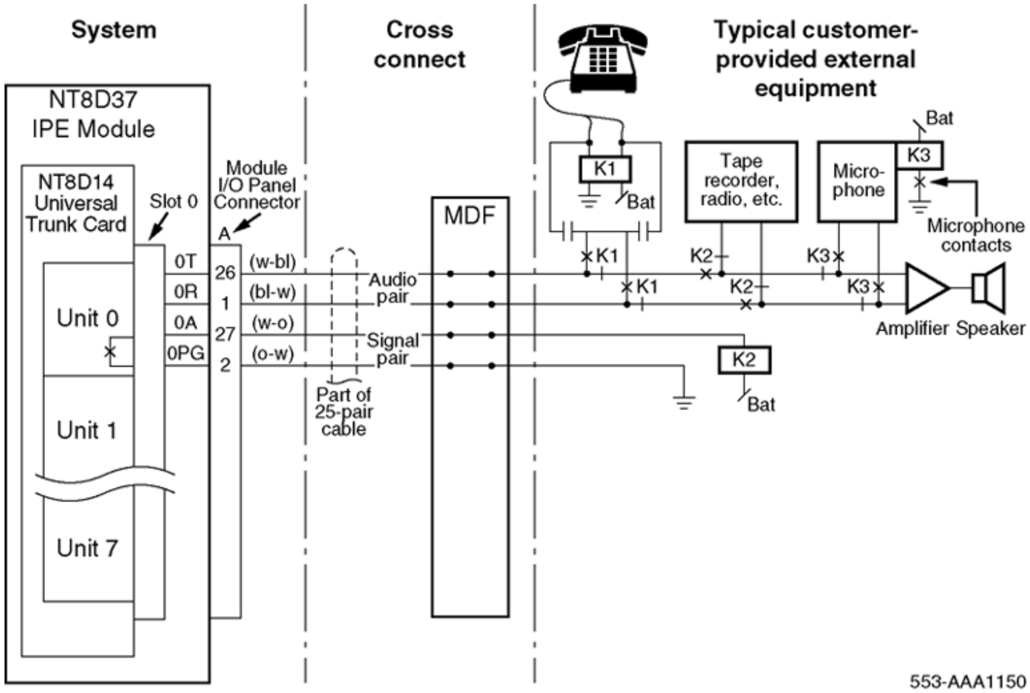


Figure 137: Connecting paging equipment to the NT8D14 Universal Trunk card (typical)

Music operation

A trunk unit can be connected to a music source. The audio source should provide an adjustable power output at 600 ohms.

Configure units for music at the MUS or AWR prompts in the Trunk Administration program LD 14 and assign routes at the MRT prompt in the Route Data Block program LD 16.

Music operation is similar to that of RAN in the continuous operation mode. Connect the unit tip and ring leads to the audio source and ground the CP line at the MDF.

If the music source is equipped with contacts that close when music is online, use these contacts to provide a ground to the MB line; otherwise, ground the MB line at the MDF.

Chapter 23: NT8D15 E and M Trunk card

Contents

This section contains information on the following topics:

Introduction

The NT8D15 E and M Trunk card interfaces four analog telephone trunks to the switch. Each trunk interface connects to a trunk facility using tip and ring leads that carry voice, ringing, and tone signaling, and to signaling interfaces by E and M leads. Each unit can be configured independently by software control in the Trunk Data Block (or Trunk Administration) program LD 14.

You can install this card in any IPE slot.

Note:

Up to four analog trunk cards are supported in each Media Gateway and Media Gateway Expansion.

The NT8D15 E and M Trunk card supports the following types of trunks:

- 2-wire E and M Type I signaling trunks
- two-wire dial repeating trunks

- two or four wire tie trunks
- 4-wire E and M Trunks:
    - Type I or Type II signaling
    - duplex (DX) signaling
- paging (PAG) trunks

Type I signaling uses two signaling wires plus ground. Type II and DX signaling uses two pairs of signaling wires. Most electronic switching systems use Type II signaling.

Table 184: Trunk and signaling matrix on page 450 lists the signaling and trunk types supported by the NT8D15 E and M Trunk card.

Table 184: Trunk and signaling matrix

Signaling	Trunk types			
	RLM/RLR	**TIE**	**PAG**	**CSA/CAA/CAM**
2-wire E and M	Yes	Yes	Yes	Yes
4-wire E and M	Yes	Yes	No	Yes
Legend: RLM Release Link Main RLR Release Link Remote CSA Common Control Switching Arrangement CAA Common Control Switching Arrangement with Automatic Number Identification (ANI) CAM Centralized Automatic Message Accounting (CAMA) trunk				

Physical description

The line interface and common multiplexing circuitry is mounted on a 31.75 cm by 25.40 cm (12.5 in. by 10 in.) printed circuit board.

The E and M Trunk card connects to the backplane through a 160-pin connector shroud. External equipment connects to the card at the back of the Media Gateway using a 25-pin connector. Telephone lines from station equipment cross connect to the OPS analog line card at the MDF using a wiring plan similar to that used for line cards. See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for termination and cross connect information.

Each card provides four circuits. Each circuit connects with the switching system and with the external apparatus by an 80-pin connector at the rear of the pack. Each trunk circuit on the card connects to trunk facilities by tip and ring leads which carry voice, ringing, tone signaling and battery. Trunk option selection is determined by software control in LD 14.

Figure 138: E and M Trunk card - faceplate on page 451 illustrates the faceplate of the E and M Trunk card. The words "Dict Trk" appear on the faceplate label because earlier versions of this card provided dictation trunk connections for third-party equipment.

The faceplate of the card is equipped with a red LED. When an E and M trunk card is installed, the LED remains lit for two to five seconds while the self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit. When the card is configured and enabled in software, then the LED goes out. If the LED continues to flash or remains weakly lit, replace the card.

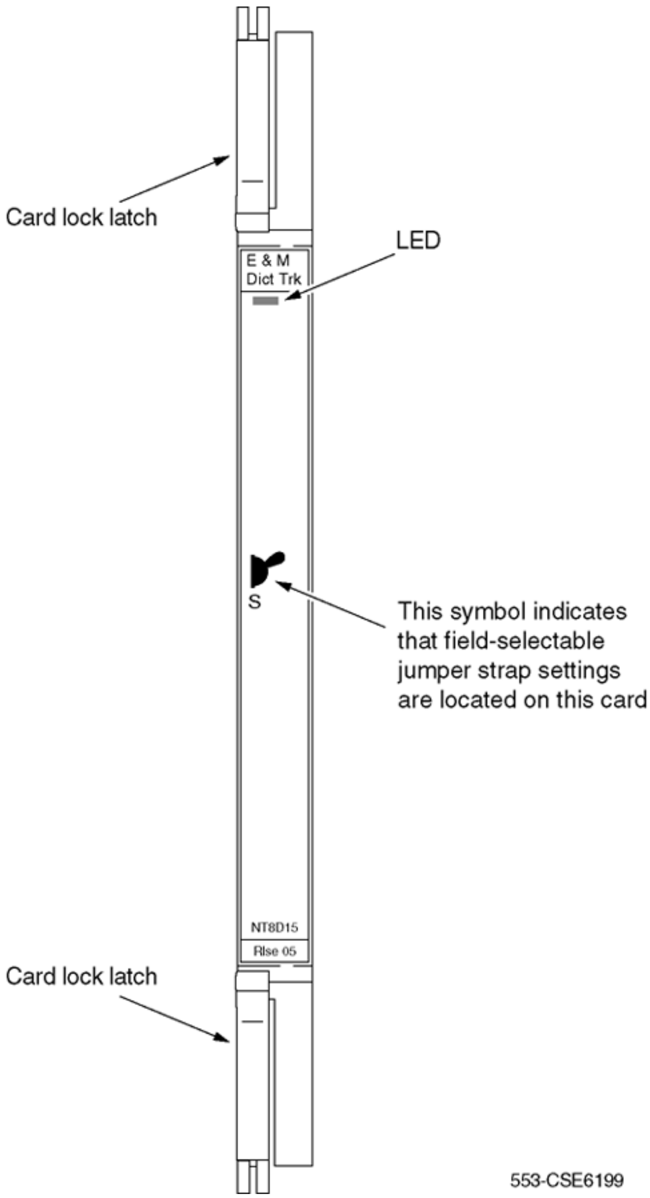


Figure 138: E and M Trunk card - faceplate

Functional description

The NT8D15 E and M Trunk card serves various transmission requirements. The trunk circuits on the card can operate in either A-Law or µ-Law companding modes. The mode of operation is set by service change entries.

Figure 139: E and M Trunk card - block diagram on page 452 shows a block diagram of the major functions contained on the E and M Trunk card. Each of these functions is discussed on the following pages.

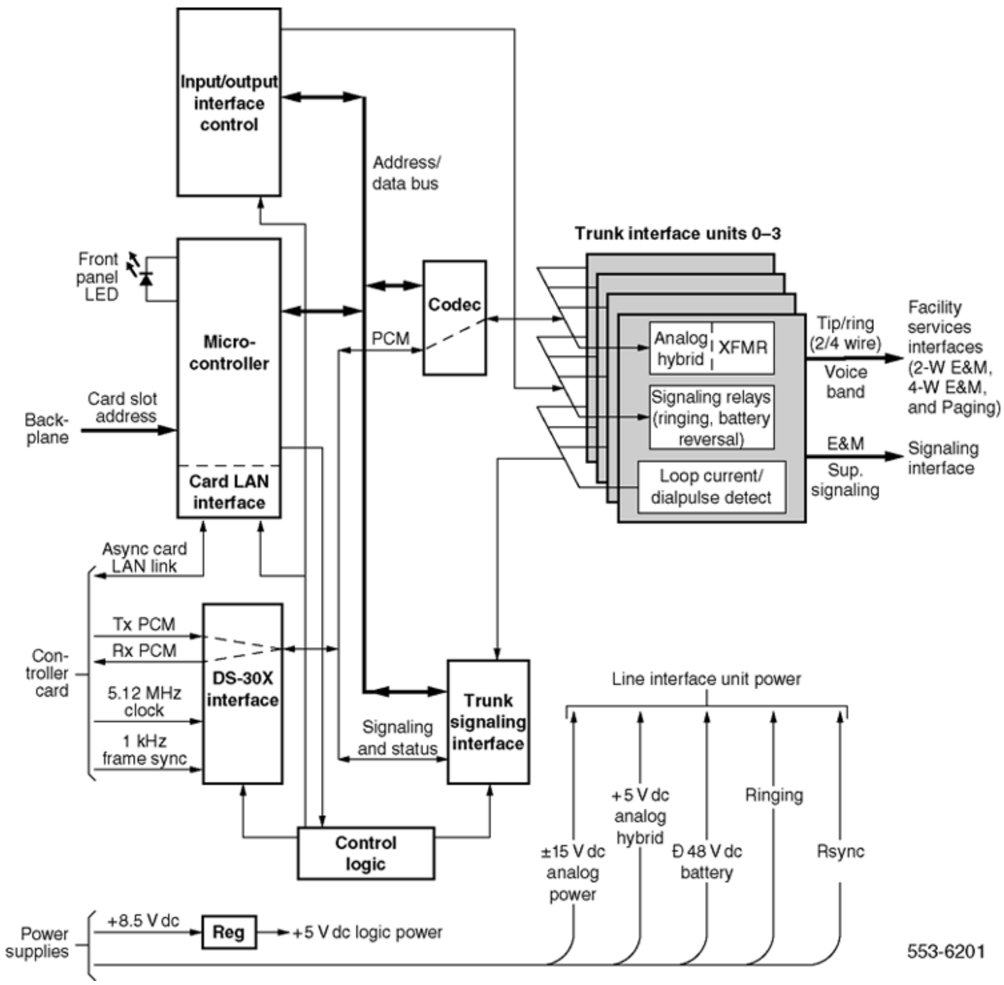


Figure 139: E and M Trunk card - block diagram

Common features

The following features are common to all circuits on the NT8D15 E and M Trunk card:

- Analog-to-digital and digital-to-analog conversion of transmission signals.
- Interfaces each of the four PCM signals to one DS30X timeslot in A10 format.
- Transmit and receive SSD signaling messages over a DS30X signaling channel in A10 format.
- Ability to enable and disable individual ports or the entire card under software control.
- Provides outpulsing on the card. Make break ratios are defined in software and down loaded at power up and by software commands.
- Provides indication of card status from self-test diagnostics on faceplate Light Emitting Diode (LED).
- Supports loopback of PCM signals to DS30X for diagnostic purposes.
- Card ID provided for auto configuration and determining serial number and firmware level of card.
- Software controlled terminating impedance (600, 900, or 1200 ohm) two and four-wire modes.
- Allows trunk type to be configured on a per port basis in software.
- Software controlled 600 ohm balance impedance is provided.
- Isolation of foreign potentials from transmission and signaling circuit.
- Software control of A/µ-Law mode.
- Software control of digit collection.

Card interfaces

The E and M Trunk card passes voice and signaling data over DS-30X loops and maintenance data over the card LAN link.

The E and M Trunk card contains four identical and independently configurable trunk interface units (also referred to as circuits). Each unit provides impedance matching and a balance network in a signal transformer/analog hybrid circuit. Also provided are relays for placing outgoing call signaling onto the trunk. Signal detection circuits monitor incoming call signaling. A CODEC performs A/D and D/A conversion of trunk analog voiceband signals to digital PCM signals.

The four units on the card can operate in the A-Law or the µ-Law companding mode. The mode is selected by making service change entries. Each unit can be independently configured for 2-wire E and M, 4-wire E and M, and paging trunk types. The trunk type is selected by service change entries and jumper strap settings. All units on the card can perform the following features:

- convert transmission signals from analog-to-digital and digital-to-analog
- provide outpulsing on the card: make/break ratios are defined in software and downloaded at power-up and by software command
- provide 600-ohms balance and termination impedance (2-wire configuration)
- provide 600-ohms termination impedance (4-wire configuration)
- provide pad control for 2-wire and 4-wire facility connections
- enable trunk type and function to be configured on a per-port basis in software
- provide isolation of foreign potentials from transmission and signaling circuit
- provide software control of A-Law and µ-Law modes
- support loopback of pulse code modulation (PCM) signals to DS-30X for diagnostic purposes

Trunk circuit features

Trunk unit functions

The functions provided by each unit on the E and M Trunk card include 2-wire signaling, 4-wire signaling, and paging operation as follows:

- 2-wire, E and M Type I signaling (see Figure 140: E and M Type I signaling on page 455) with:
  - near-end seizure and outpulsing with M lead
  - ground detection with E lead
  - voice transmission through tip and ring for transmit and receive
- 4-wire, E and M Type I and II signaling (see Figure 141: E and M Type II signaling on page 455), 2-way dial repeating with:
  - echo suppression for Type I signaling
  - switchable 7 dB and 16 dB pads for carrier interface
  - voice transmission and reception through two separate paths
  - Type I signaling through E and M leads
  - Type II signaling with near-end seizure by SB/M leads and far-end detection by E/SG lead

- 4-wire, DX signaling (see Figure 142: 4-wire DX signaling on page 456)
- paging trunk operation (see Figure 143: Paging trunk operation on page 457) with support access by low-resistance path at the PG/A1 leads

Note:

Paging end-to-end signaling is not supported.

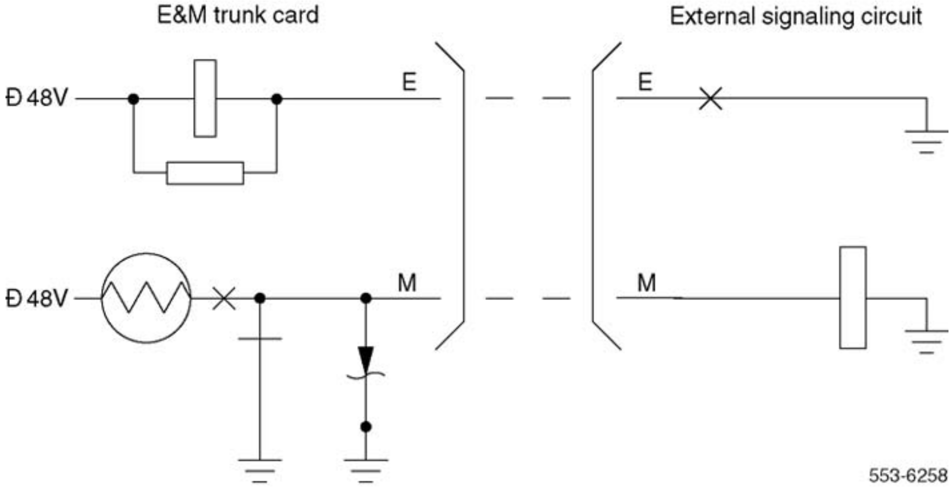


Figure 140: E and M Type I signaling

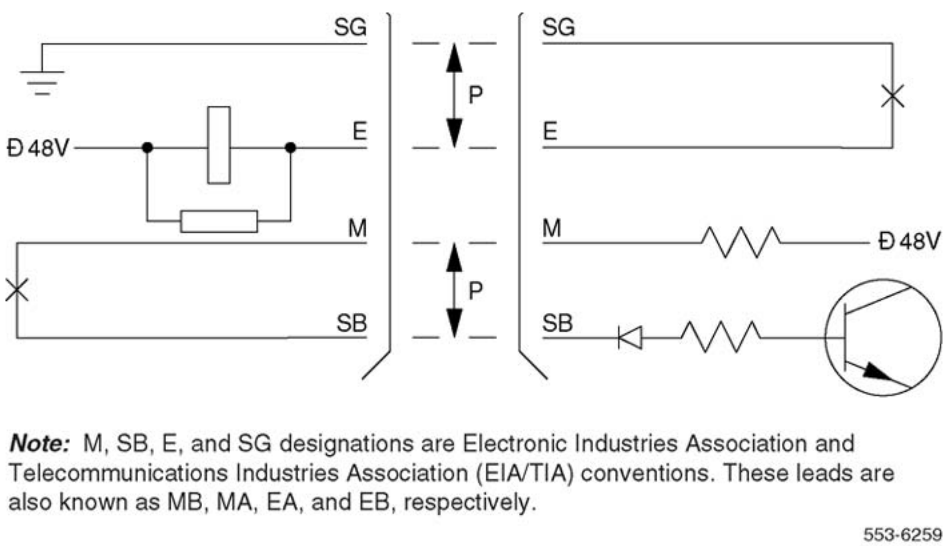
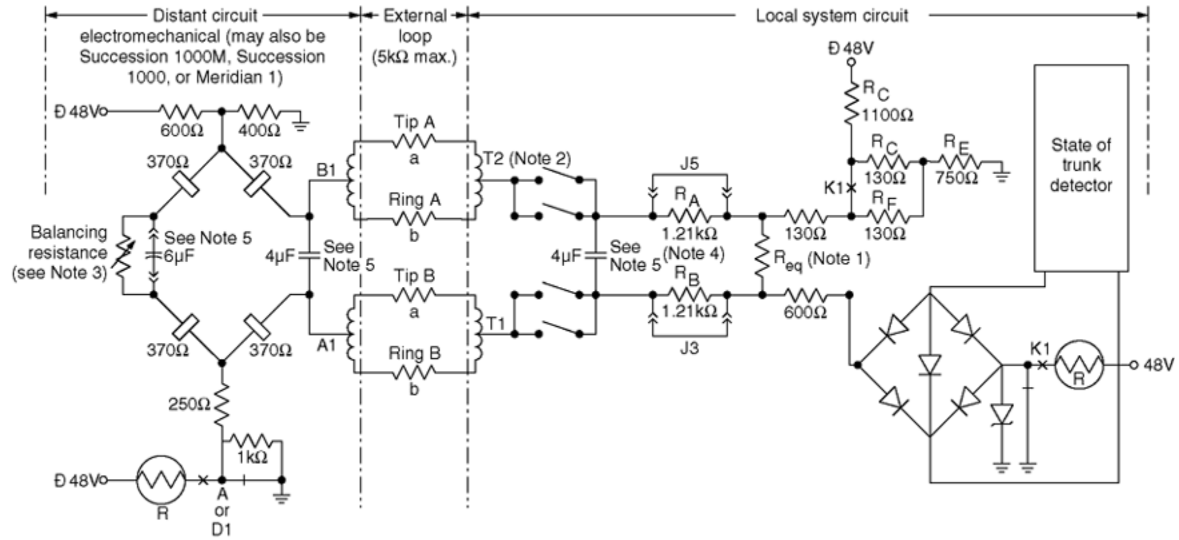


Figure 141: E and M Type II signaling



Note 1: The equivalent bridge circuit resistance as seen from distant trunk during the signaling is 1250 ±125 Ohms.

Note 2: T1 and T2 resistance is 47 Ohms for 600 Ohm termination option.

Note 3: Compute total balancing resistance as follows (note that in some new DX circuits, a 1260 Ohm resistor is permanently wired in series with the selectable resistance). Total balancing R = external loop resistance + 0.5 x T1 resistance + 0.5 x T2 resistance + [(R_A + R_D) if not shorted out] + R_{eq}. Resistance of transformers at electromechanical end is low and can be ignored. "External loop resistance" is defined as 1/2 the loop resistance of one cable pair.

Note 4: If the external loop is >2500 Ohms, the loop adjustment resistors R_A and R_B are shorted out. If the external loop is <2500 Ohms, R_A and R_B are in the circuit. When the system is connected to another Meridian 1 or pulse and external loop resistance is <2500 Ohms, the loop adjustment resistors must be shorted in one machine. If the external loop is >2500 Ohms, the loop adjustment resistors must be shorted out in both machines.

Note 5: When the system is connected to an electromechanical trunk using 4-wire operation, a 4µF capacitor must be connected from the A1 to B1 lead at each end of the trunk. (These may already be installed.) It is also recommended that a 6µF capacitor be connected in series with the balancing resistance.

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Figure 142: 4-wire DX signaling

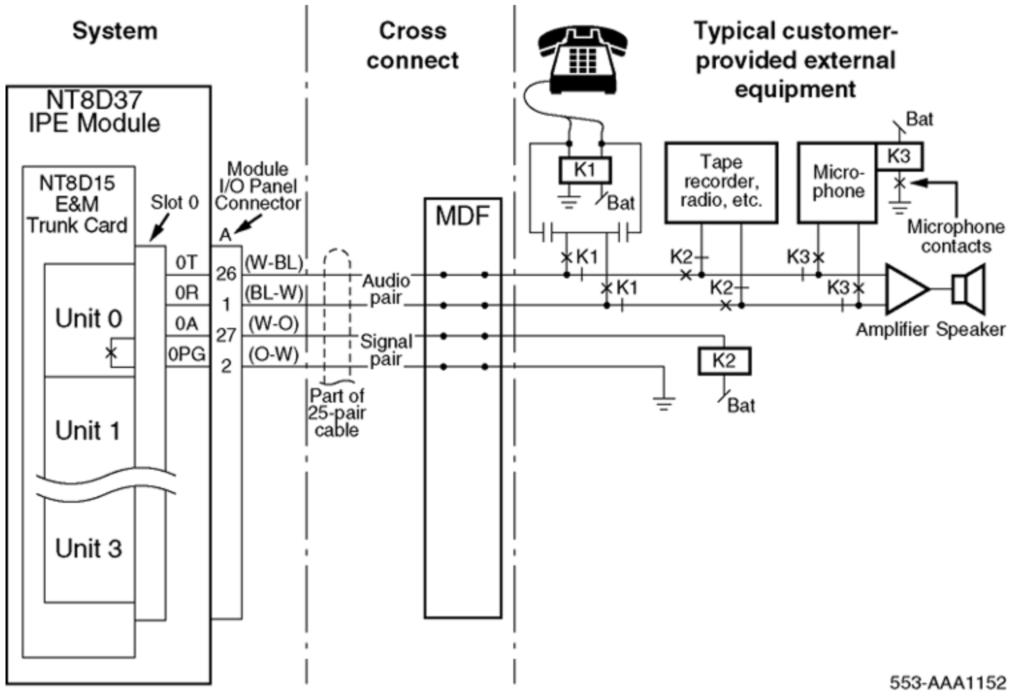


Figure 143: Paging trunk operation

Card control functions

Control functions are provided by a microcontroller, a card LAN, and signaling and control circuits on the E and M Trunk card.

Microcontroller

The E and M Trunk card contains a microcontroller that controls the internal operation of the card. The microcontroller provides the following functions:

- card-identification
- self-test
- control of card operation
- maintenance diagnostics

Card LAN

The card LAN provides a serial communication link for transferring maintenance data and control signals between the trunk card and the SSC card. The card LAN controls the microcontroller. The following functions are supported:

- providing card ID/RLS
- reporting self-test status
- polling from the controller card
- enabling/disabling of the DS-30X link

Signaling interface

All signaling messages for the trunk are three bytes long. The messages are transmitted in channel zero of the DS30X in A10 format.

Configuration information for the E and M trunk is downloaded from the CPU at power up and by command from maintenance programs. Seven configuration messages are sent. One message is sent to each unit (4) to configure trunk type, signaling type, balance impedance etc. Three messages are sent per card to configure the make/break ratio, A/µ-Law operation.

Signaling and control

The signaling and control portion of the E and M Trunk card works with the system CPU to operate the card hardware. The card receives messages from the CPU over a signaling channel in the DS-30X loop and returns status information to the CPU over the same channel. The signaling and control portion of the card provides analog loop terminations that establish, supervise, and take down call connections.

Configuration information for the E and M Trunk card is downloaded from the CPU at power-up and by command from maintenance programs. Configuration messages are sent. One message is sent to configure trunk and signaling type. The other messages are sent to each card to select the make/break ratio and the A-Law and µ-Law modes.

The signaling and control circuits on the card perform the following functions:

- provide an interface between the card and the system CPU
    - transmit PCM signals from each of the four units to one DS-30X timeslot in A10 format (ready to send/clear to send—flow control, handshake format)

- transmit and receive signaling messages over a DS-30X signaling channel in A10 format

- decode received messages to set configuration and activate/deactivate interface relays for PCM loopback diagnostic purposes
- decode outpulsing messages (one per digit) from the CPU to drive outpulsing relays at 20 pps, 10 pps1 (primary), or 10 pps2 (secondary)
- monitor signals from the trunk interface and generate a message when required for each state change
- control disabling and enabling of unit or card
- control A-Law and µ-Law operation modes
- control transmission pad settings

Maintenance features

The following features are provided for maintenance of the E and M trunk:

- indication of card status from self-test
- software enable and disable capability for individual units or entire card
- loopback of PCM signals to DS-30X for diagnostic purposes
- card ID for autoconfiguration and determination of serial number and firmware level

Operation

The optional applications, features, and signaling arrangements for each unit on the E and M Trunk card are assigned through the Trunk Administration LD 14 and Trunk Route LD 16 programs.

Signaling and call control

The information in this section describes the signaling and call control of E and M Type I and II trunks. The call is terminated and the trunk released by a disconnect message sent to the associated unit.

Figure 144: Signaling orientation for tandem connection between E and M and CO trunks on page 460 shows the trunk signaling orientation for a tandem connection between E and M and CO trunks.

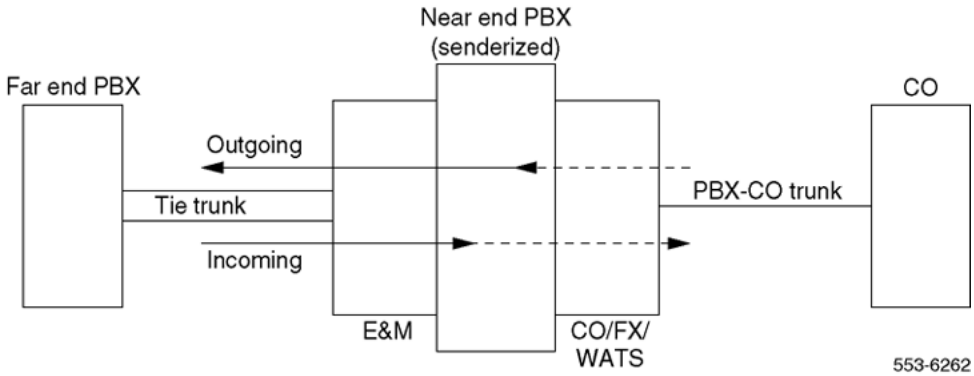


Figure 144: Signaling orientation for tandem connection between E and M and CO trunks

E and M Type I signaling

Figure 145: E and M Type I signaling patterns - originating party release on page 461 shows E and M Type I signaling patterns for incoming and outgoing calls. Figure 146: E and M Type I signaling patterns - originating party release on a tandem connection on page 462 shows Type I signaling patterns on a tandem connection where the originating end is senderized and the route is over a CO trunk (not applicable to CCSA).

Idle state

For E and M signaling, in the idle state the M lead is ground and the E lead is an open circuit.

Outgoing calls

Outgoing calls are processed as follows:

- The M lead changes from ground to battery.
  - If answer supervision is provided by the far end, there is a change from open to ground on the E lead (ground detection).

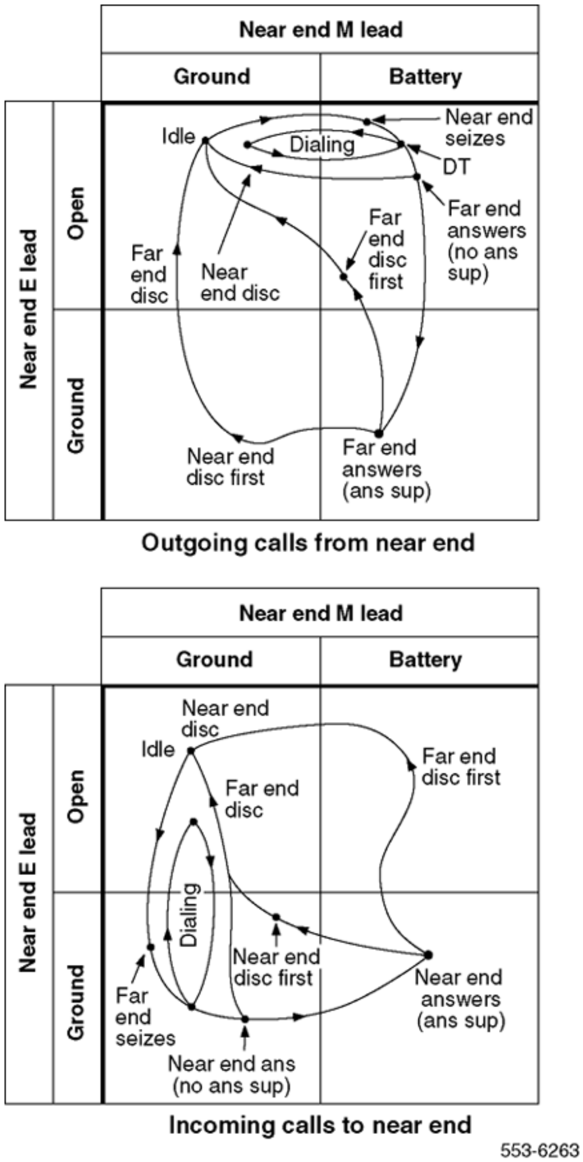


Figure 145: E and M Type I signaling patterns - originating party release

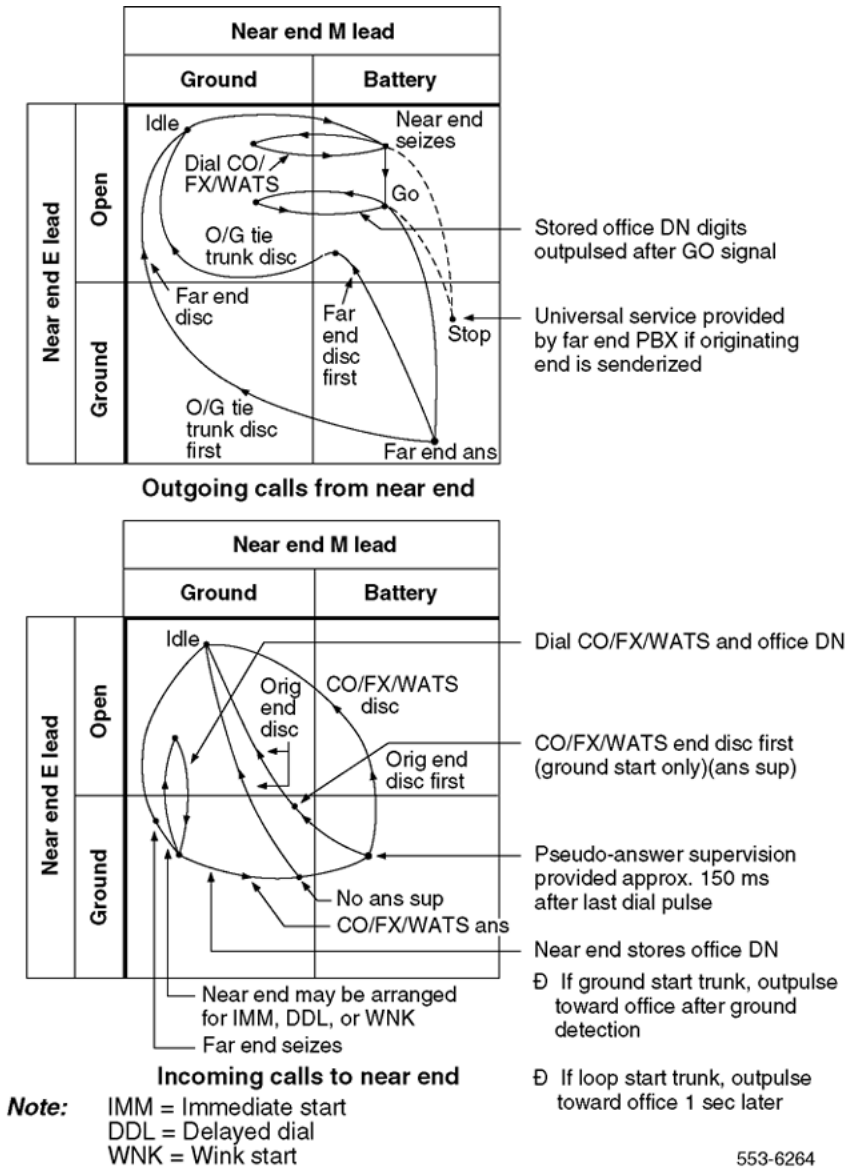


Figure 146: E and M Type I signaling patterns - originating party release on a tandem connection

Incoming calls

The far-end initiates calls as follows:

- The ground is placed on the E lead in E and M signaling.
- Dial pulses are subsequently applied from the far-end as ground open on the E lead.
- If the far-end is equipped for sending, the system can operate in any mode (immediate start, delay dial, or wink start), as assigned on a start arrangement basis. See Table 185: Operation Mode on page 463.
    - In immediate start mode, there is no start signal from the called office. The seizure signal (off hook supervisory state) from the far-end should be at least 150 ms. At the

end of the seizure signal, the far-end can start pulsing after the standard delay (normally 70 ms minimum).

- In delay dial mode, a 256-384 ms off hook/on hook signal is returned to the far-end immediately after receipt of the seizure signal. When the far-end detects the on hook signal (start signal), the far-end can start pulsing after the standard delay (normally 70 ms minimum).
- In wink start mode, within a 128–256 ms period after receipt of the seizure signal from the far-end, the called office transmits a 250 ms, wink start, off hook/on hook signal to the calling office.

Table 185: Operation Mode

Operation mode	Start arrangement
Immediate start	IMM
Delay dial	DDL
Wink start	WNK

E and M Type II signaling

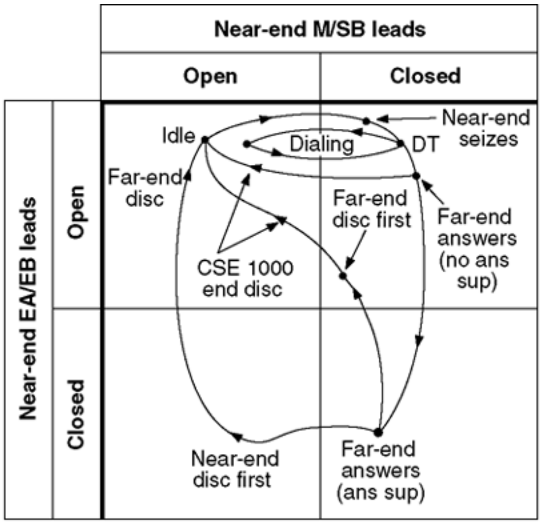
Figure 147: E and M Type II signaling patterns - originating party release on page 464 shows E and M Type II signaling patterns for incoming and outgoing calls.Figure 148: E and M Type II signaling patterns - originating party release on a tandem connection on page 465 shows Type II signaling patterns for a tandem connection where the originating end is senderized and the route is over a CO trunk (CCSA not applicable).

Type II signaling uses four leads: M, SB, E, and SG. Instead of changes of state between battery and ground (M signals) or open and ground (E signals), the trunk signals by closing the contacts between the lead pairs M and SB. Signals are received by detecting current flow between lead pairs E and SG.

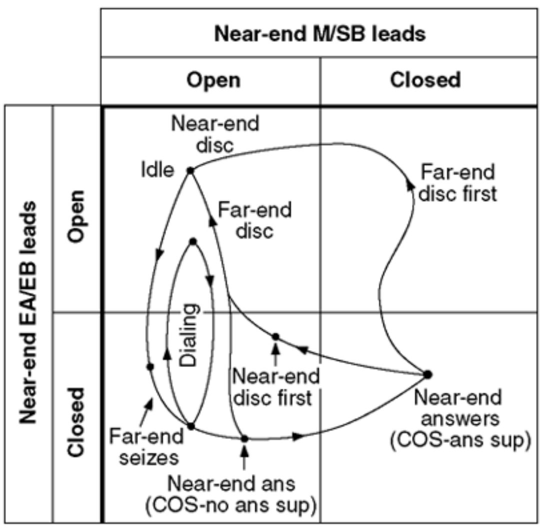
On incoming calls, the far end seizes the trunk by shorting the E and SG leads together. This transmits the ground from the SG lead to the E lead (in Type I signaling the ground to the E lead comes from the far-end). Dialing is done by opening and closing the E/SG contacts. Because of the SB and M leads are also used as the ESCG and ESC leads, respectively, for echo suppression, echo suppressor control cannot be used with Type II signaling.

Note:

M, SB, E, and SG designations are Electronic Industries Association and Telecommunications Industries Association (EIA/TIA) conventions. These leads are also known as MB, MA, EA, and EB, respectively.



Outgoing calls from Succession CSE 1000 (near-end)



Incoming calls to Succession CSE 1000 (near-end)

553-CSE6265

Figure 147: E and M Type II signaling patterns - originating party release

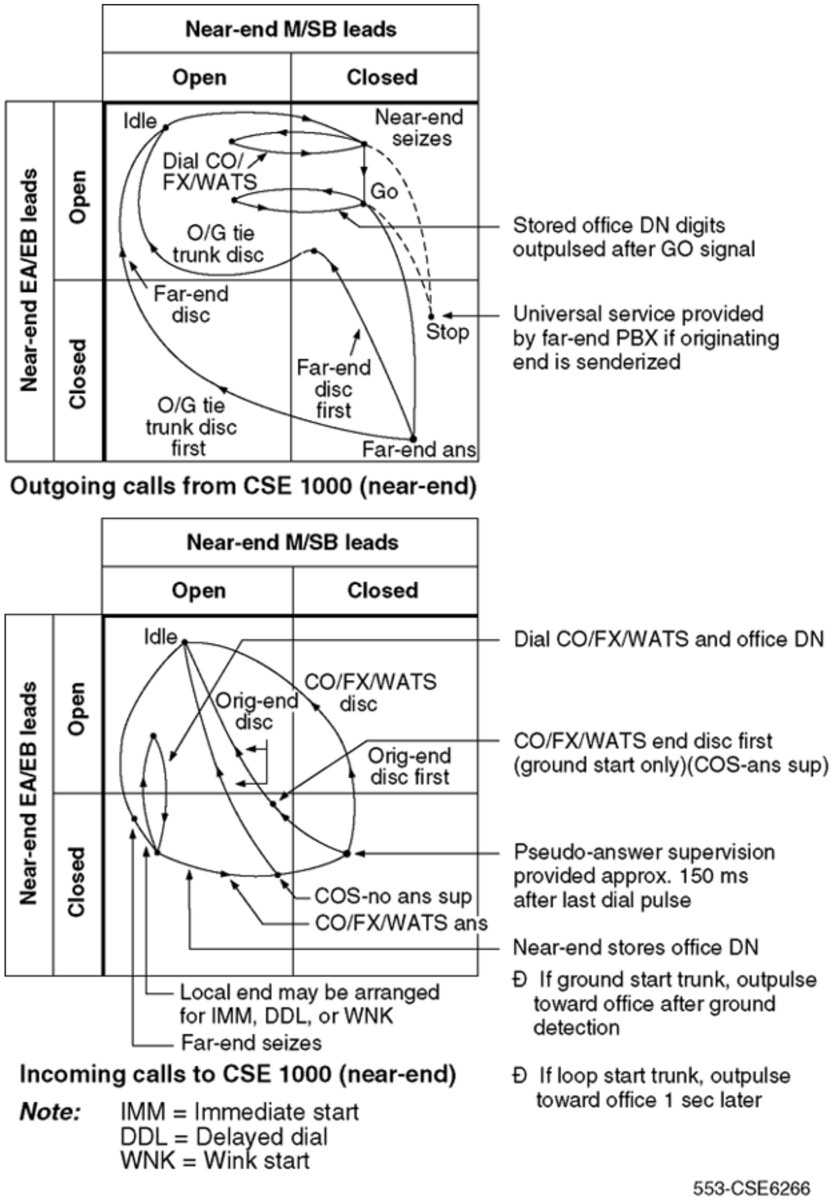


Figure 148: E and M Type II signaling patterns - originating party release on a tandem connection

Release control

Release control of a call made over a trunk is specified in LD 16. Disconnect supervision is specified for each trunk group independently. The two options available are EITHER or ORIGINATING party control. These can be specified for the end (near-end), or for the central office or other PBX end (far-end). Joint party control can also be specified for the far-end.

Duplex signaling

Duplex (DX) signaling makes use of the voice transmission leads for signaling as well as for voice transmission.

For descriptive purposes, the lead pair Tip B/Ring B is designated the signaling pair. The other pair Tip A/Ring A conducts current in the opposite direction to balance the overall current flow between the near and far ends. During signaling, current flows through both Tip B and Ring B leads in the same direction.

Table 186: DX signaling - outgoing calls with originating party release on page 466 and Table 187: DX signaling - incoming calls with originating party release on page 466 show call-connection and take-down sequencing for DX signaling. Table 188: DX signaling - outgoing calls with originating party release on tandem connections on page 467 and Table 189: DX signaling - incoming calls with originating party release on tandem connections on page 468 show sequencing where the E and M Trunk card is used in a tandem PBX.

Table 186: DX signaling - outgoing calls with originating party release

Condition	Current in signaling lead	State of trunk detector
Idle	No current flow	High
Seizure (dial tone from far-end: far-end ready for digits)	Current flow	High
Digits	Current flow interrupted for each pulse	High
Far-end answers	No current flow	Low
Far-end on hook first	Current flow	High
Network taken down and trunk idled when near-end goes on hook	No current flow	High
Near-end on hook first, network taken down	Current flow	Low
Far-end on hook, trunk idled	No current flow	High

Table 187: DX signaling - incoming calls with originating party release

Condition	Current in signaling lead	State of trunk detector
Idle	No current flow	High
Seizure (dial tone to far-end: near-end ready for digits)	Current flow	Low

Condition	Current in signaling lead	State of trunk detector
Digits	Current flow interrupted for each pulse	Low-high-low for each pulse
Near-end answers	No current flow	Low
Far-end on hook first	Current flow	High
Network taken down and trunk idled	No current flow	High
Near-end on hook first, network taken down	Current flow	Low
Far-end on hook, trunk idled	No current flow	High

Table 188: DX signaling - outgoing calls with originating party release on tandem connections

Condition	Current in signaling lead	State of trunk detector
Idle	No current flow	High
Seizure (far-end ready for digits)	Current flow	High
Dial CO/FX/WATS	Current flow interrupted for each pulse	High
Stop sender	No current flow	Low
Go sender (universal service provided by far-end PBX if originating end is senderized)	Current flow	High
CO/FX/WATS offices ready for digits		
Stored Office DN digits	Current flow interrupted for each pulse	High
Outpulsed	No current flow	Low
Far end answers	No current flow	Low
Far end on hook first	Current flow	High
Near end on hook, network taken down, trunk idled	No current flow	High
Near end on hook first, network taken down	Current flow	Low
Far end on hook, trunk idled	No current flow	High

Table 189: DX signaling - incoming calls with originating party release on tandem connections

Condition	Current in signaling lead	State of trunk detector
Idle	No current flow	High
Seizure (Can be arranged for IS, DD, or WS) (near-end ready for digits)	Current flow	Low
Dial CO/FX/WATS and office DN	Current flow interrupted for each pulse	Low-high-low for each pulse
Stored digits outpulsed on CO/FX/WATS trunk after ground detection if a ground start, but after 3 seconds if a loop start		
If answer supervision: pseudo-answer supervision is sent approximately 13 seconds after last dial pulse received	No current flow	Low
If no answer supervision: CO end disconnects (if a CO ground start – the trunk is idled and network taken down, but the incoming TIE trunk is held under control of the originating end)	Current flow	Low
Originating end disconnects – network taken down and trunk idled	No current flow	High

Note:

* – CO ground start: the trunk is idled and the network taken down, but the incoming tie trunk is controlled by the originating end.

Electrical specifications

Table 190: Electrical characteristics of E and M Trunk cards on page 468 lists the electrical characteristics of the trunk interface on the E and M Trunk card.

Table 190: Electrical characteristics of E and M Trunk cards

Characteristic	4-wire trunk	2-wire trunk
Signaling range	Type I 150 ohms Type II 300 ohms loop	Type I 150 ohms
Signaling type	Type I, Type II	Type I

Characteristic	4-wire trunk	2-wire trunk
Far-end battery	–42 to –52.5 V dc	–42 to –52.5 V dc
Near-end battery	–42.75 to –52.5 V dc	–42.75 to –52.5 V dc
Ground potential difference	±10 V dc	±10 V dc
Line leakage between E lead and ground	Š20K¾	Š20K¾
Effective loss	See pad table (Table 197: Pad switching algorithm on page 476)	See pad table (Table 197: Pad switching algorithm on page 476)
Terminating impedance	600 ohms	600 ohms
Balance impedance	N/A	600 ohms

Table 191: Electrical characteristics of trunk cards

Characteristic	DID Trunk	CO trunk
Nominal impedance	600 or 900 ohms, (selected by software)	600 or 900 ohms, (selected by software)
Signaling range	2450 ohms	1700 ohms
Signaling type	Loop	Ground or loop start
Far-end battery	-42 to -52.5 V	-42 to -52.5 V
Near-end battery	N/A	-42.75 to -52.5 V
Minimum loop current	N/A	20 mA
Ground potential difference	+ 10 V	+ 3 V
Low DC loop resistance during outpulsing	N/A	300 ohms
High DC loop resistance	N/A	Ground start equal to or greater than 30 kS. Loop start equal to or greater than 5 MS
Line leakage	Equal to or greater than 30 kS (Tip to Ring, Tip to GND, Ring to GND).	Equal to or greater than 30 kS (Tip to Ring, Tip to GND, Ring to GND)
Effective loss	See pad table	See pad table

Power requirements

Table 192: Power requirements on page 470 lists the power requirements for the E and M Trunk card.

Table 192: Power requirements

Voltage	Tolerance	Max current
+15.0 V dc	±5%	200 mA
–15.0 V dc	±5%	200 mA
+8.5 V dc	±2%	200 mA
–48.0 V dc	±5 %	415 mA

Environmental specifications

Table 193: Environmental specifications on page 470 provides the environmental specifications for the E and M Trunk card.

Table 193: Environmental specifications

Parameter	Specifications
Operating temperature	0 to +60 degrees C (32 to +140 degrees F), ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	–40 to +70 degrees C (–40 to +158 degrees F)

Foreign and surge voltage protection

The E and M Trunk card meets CS03 over-voltage (power cross) specifications and FCC Part 68 requirements.

Connector pin assignments

The E and M Trunk card brings the four analog trunks to the backplane through a 160-pin connector shroud. The backplane is cabled to the I/O panel on the rear of the module, which is then connected to the Main Distribution Frame (MDF) by 25-pair cables.

Telephone trunks connect to the E and M Trunk card at the MDF using a wiring plan similar to that used for line cards.

A typical connection example is shown in Figure 149: E and M Trunk card - typical cross connection example on page 472. A list of the connections to the E and M Trunk card in the various 2-wire modes is shown in Table 194: E and M Trunk card - backplane pinouts for 2-

wire modes on page 471. A list of the connections to the E and M Trunk card in the various 4-wire modes is shown in Table 195: E and M Trunk card - backplane pinouts for 4-wire modes on page 471.

See *Avaya Communication Server 1000M and Meridian 1 Large System Installation and Configuration* (NN43021-310) for complete I/O connector information and wire assignments for each tip/ring pair.

Table 194: E and M Trunk card - backplane pinouts for 2-wire modes

Trunk Number	2-wire Paging Mode				2-wire Type I Mode			
	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
0	12B	Tip	12A	Ring	12B	Tip	12A	Ring
	15B	A	15A	PG	14B	E	14A	M
1	16B	Tip	16A	Ring	16B	Tip	16A	Ring
	19B	A	19A	PG	18B	E	18A	M
2	62B	Tip	62A	Ring	62B	Tip	62A	Ring
	65B	A	65A	PG	64B	E	64A	M
3	66B	Tip	66A	Ring	66B	Tip	66A	Ring
	69B	A	69A	PG	48B	E	68A	M

Table 195: E and M Trunk card - backplane pinouts for 4-wire modes

Trunk Number	4-wire Type I Mode				4-wire Type II Mode			
	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
0	12B	TA	12A	TB	12B	TA	12A	TB
	13B	RA	13A	RB	13B	RA	13A	RB
	14B	E	14A	M	14B	EA	14A	EB
	15B	ECG	15A	ESCG	15B	MA	15A	MB
1	16B	TA	16A	TB	16B	TA	16A	TB
	17B	RA	17A	RB	17B	RA	17A	RB
	18B	E	18A	M	18B	EA	18A	EB
	19B	ECG	19A	ESCG	19B	MA	19A	MB
2	62B	TA	62A	TB	62B	TA	62A	TB
	63B	RA	63A	RB	63B	RA	63A	RB
	64B	E	64A	M	64B	EA	64A	EB
	65B	ECG	65A	ESCG	65B	MA	65A	MB

Trunk Number	4-wire Type I Mode				4-wire Type II Mode			
	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
3	66B	TA	66A	TB	66B	TA	66A	TB
	67B	RA	67A	RB	67B	RA	67A	RB
	68B	E	68A	M	68B	EA	68A	EB
	69B	ECG	69A	ESCG	69B	MA	69A	MB

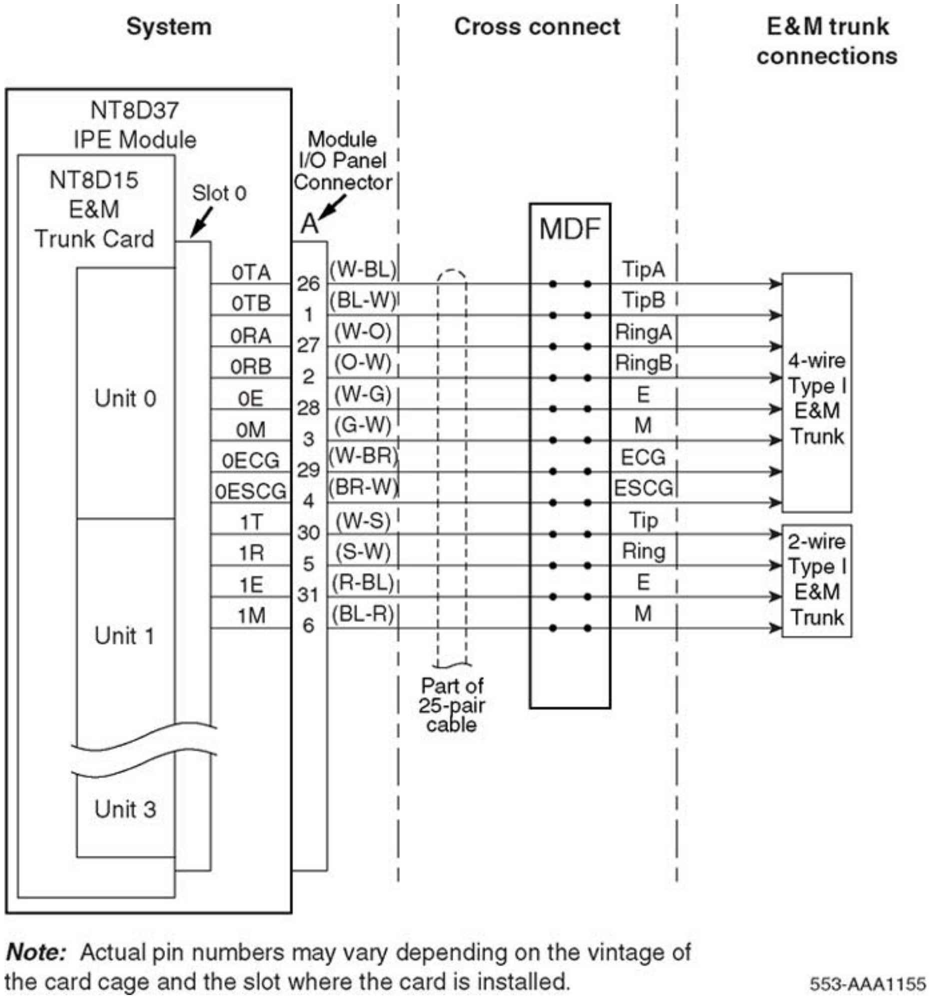


Figure 149: E and M Trunk card - typical cross connection example

Configuration

Each of the four trunk circuits on the E and M Trunk card can be individually configured for trunk type, companding mode, and port-to-port loss compensation. Configuring the card requires both jumper changes and configuration software service entries.

The locations of the jumpers are shown in Figure 150: E and M Trunk card - jumper locations on page 474.

Jumper settings

The NT8D15 E and M Trunk card serves various transmission requirements. The four units on the card can operate in A-Law or µ-Law companding modes, which are selected by service change entries. Each unit can be independently configured for 2-wire E and M, 4-wire E and M, and paging trunk types. The trunk type is selected by service change entries and jumper strap settings.

See Table 196: E and M Trunk card - jumper strap settings on page 474.

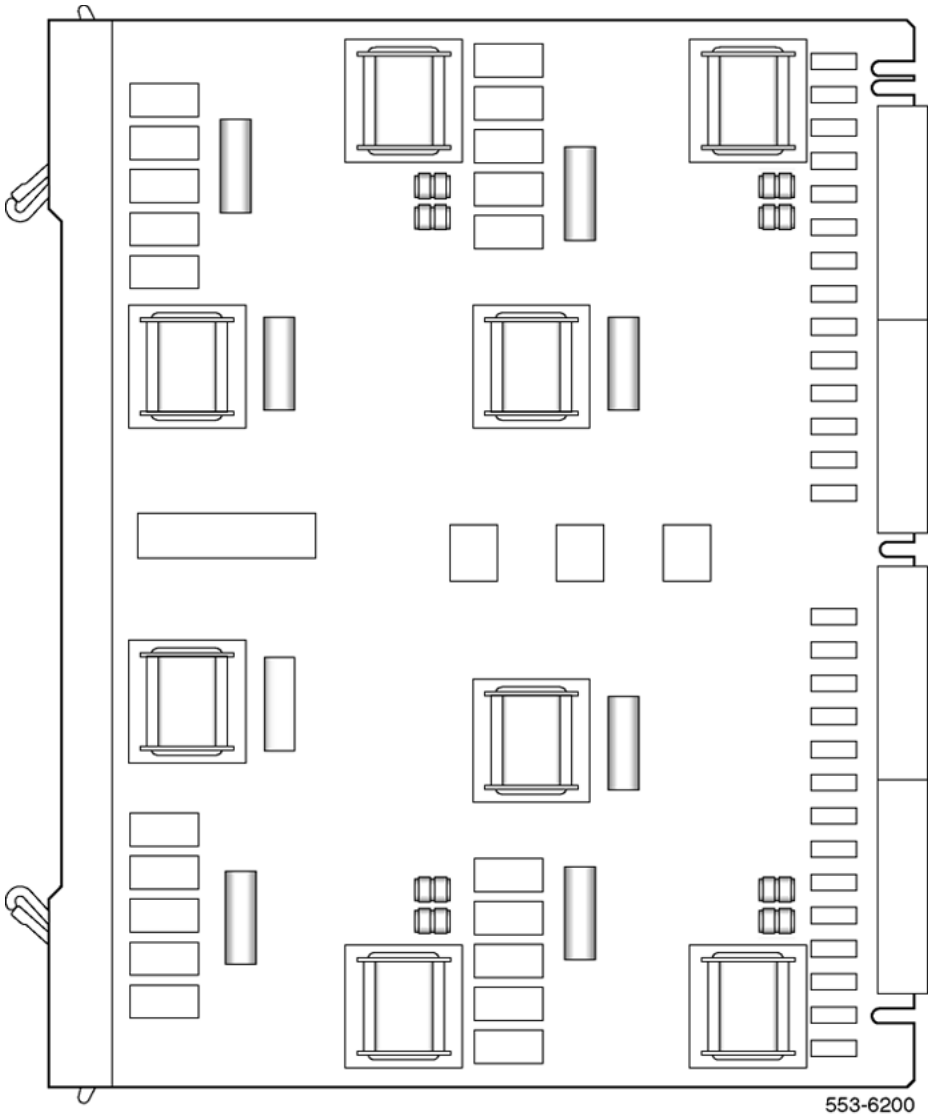


Figure 150: E and M Trunk card - jumper locations

Table 196: E and M Trunk card - jumper strap settings

Jumper (Note 1)	Mode of operation (Note 2)					
	2-wire trunk		4-wire trunk			
	Type I	Paging	Type I	Type II	DX tip & ring pair	
					M—rcv E —xmt	E—rcv M —xmt
J1.X	Off	Off	Off	Off	Pins 1–2	Pins 2–3
J2.X	On	On (Note 3)	On	On	Off	Off

Jumper (Note 1)	Mode of operation (Note 2)					
	2-wire trunk		4-wire trunk			
	Type I	Paging	Type I	Type II	DX tip & ring pair	
					M—rcv E —xmt	E—rcv M —xmt
J3.X	Off	Off	Off	Off	(Note 4)	(Note 4)
J4.X	Off	Off	Off	Off	Pins 2–3	Pins 1–2
J5.X	Off	Off	Off	Off	(Note 4)	(Note 4)
J6.X	Off	Off	Off	Off	On	On
J7.X	Off	Off	Off	Off	On	On
J8.X	Off	Off	Off	Off	On	On
J9.X	Pins 2–3	Pins 2–3	Pins 2–3	Pins 2–3	Pins 1–2	Pins 1–2
Note: Jumper strap settings J1.X through J9.X apply to all four units; "X" indicates the unit number, 0–3.						
Note: "Off" indicates that no jumper strap is installed on a jumper block.						
Note: Paging trunk mode is not zone selectable.						
Note: Jumper strap installed in this location only if external loop resistance is greater than 2500 ohms.						

Software service entries

The trunk type is selected by making service change entries in Route Data Block, Automatic Trunk Maintenance (LD 16). The companding mode is selected by making service change entries in Trunk Data Block (LD 14).

Refer toTable 196: E and M Trunk card - jumper strap settings on page 474 to select the proper values for the trunk type being employed.

Port-to-port loss configuration

Loss parameters are selected on the E and M Trunk card by a switchable pad controlled by CODEC emulation software. The pads settings are called "in" and "out." Pad settings are determined by the three factors listed below (the first two are under direct user control; the third is controlled indirectly):

- Class of Service is assigned in LD 14.
- Facility termination is selected (2-wire or 4-wire) in LD 14 (the 2-wire setting provides 0.5 dB more loss in each direction of transmission for echo control).

  Note:

  Facilities associated with the Avaya Electronic Switched Network (ESN) are recommended to be 4-wire for optimum transmission; so, the 4-wire setting is generally referred to as the ESN setting. However, the 4-wire setting is not restricted to networks using the ESN feature. Conversely, the 2-wire setting, often called non-ESN, can be used on certain trunks in an ESN environment.

- Port-to-port connection loss is automatically set by software on the basis of the port type selected in LD 16; only the port type is set by the user.

The transmission properties of each trunk are characterized by the class of service assigned in LD 14. Transmission properties can be Via Net Loss (VNL) or non-Via Net Loss (non-VNL).

The VNL class of service is assigned at the CLS prompt by typing VNL. The non-VNL class of service is assigned at the CLS prompt by typing TRC (Transmission Compensated) or NTC (Non-Transmission Compensated).

Non-VNL trunks are assigned a TRC or NTC class of service to ensure stability and minimize echo when connecting to long-haul trunks, such as tie trunks. The class of service determines the operation of the switchable pads contained in each unit. They are assigned as follows:

- TRC for a 2-wire non-VNL trunk facility with a loss of greater than 2 dB, or for which impedance compensation is provided, or for a 4-wire non-VNL facility.
- NTC for a 2-wire, non-VNL trunk facility with a loss of less than 2 dB, or when impedance compensation is not provided.

SeeTable 197: Pad switching algorithm on page 476 for the pad switching control for the various through connections and the actual port-to-port loss introduced for connections between the E and M Trunk card and any other IPE port designated as Port B.

Figure 151: Pad orientation on page 477 shows the pad switching orientation.

Table 197: Pad switching algorithm

Port B	Port B pads		E and M Trunk Pads		Port-to-port loss (dB)	
	Transmit D to A	Receive A to D	Transmit D to A	Receive A to D	Port B to E and M	E and M to Port B
IPE line	N/A	N/A	Out	In	2.5	3.5
Universal trunk (TRC)	Out	Out	In	In	0	0

Port B	Port B pads		E and M Trunk Pads		Port-to-port loss (dB)	
	Transmit D to A	Receive A to D	Transmit D to A	Receive A to D	Port B to E and M	E and M to Port B
IPE TIE (VNL)	In	Out	In	Out	0	0

Note:

Transmit and receive designations are from and to the system. Transmit is from the system to the external facility (digital-to-analog direction in the E and M Trunk card). Receive is to the system from the external facility (analog-to-digital direction in the E and M Trunk card).

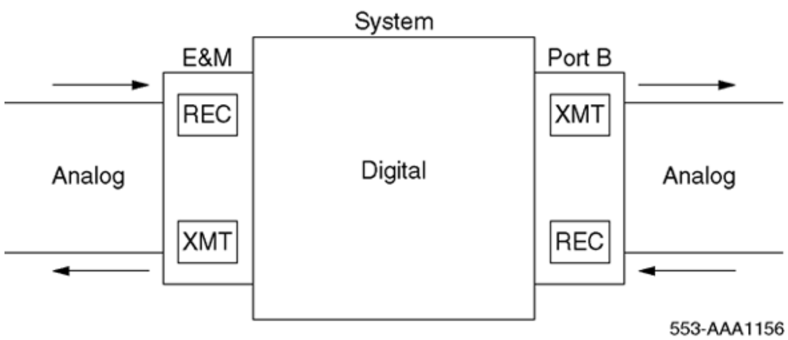


Figure 151: Pad orientation

Applications

The optional applications, features and signaling arrangements for each trunk are assigned through unique route and trunk data blocks. Refer to *Avaya Features and Services* (NN43001-106-B) for information about assigning features and services to trunks.

PAD switching

The transmission properties of each trunk are characterized by class-of-service (COS) assignments in the trunk data block (LD 14). The assignment may be non-Via Net Loss (non-VNL) or via Net Loss (VNL). To ensure stability and minimize echo when connecting to long-haul VNL (Tie) trunks, non-VNL trunks are assigned either Transmission Compensated (TRC) or Non-Transmission Compensated (NTC) class-of-service.

The TRC and NTC COS options determine the operation of the switchable pads contained in the trunk circuits. They are assigned as follows:

- TRC for a two-wire non-VNL trunk facility with a loss of greater than 2 dB or for which impedance compensation is provided, or for a four-wire non-VNL facility.
- NTC for a two-wire non-VNL trunk facility with a loss of less than 2 dB or when impedance compensation is not provided.

Table 198: Insertion Loss from IPE Ports to IPE Ports (measured in dB) on page 478 shows the insertion loss from IPE port to IPE port.

Table 198: Insertion Loss from IPE Ports to IPE Ports (measured in dB)

IPE Ports		500/2500 Line ↓ ↑	Digital Line ↓ ↑	2/4 Wire E&M Trunk ↓ ↑	4 Wire (ESN) E&M Trunk ↓ ↑	CO/FX /WATS Loop Tie Trunk ↓ ↑
2/4 Wire E&M Trunk	→	6	3.5	1		
	←	3	-0.5	1		
4 Wire (ESN) E&M Trunk	→	5.5	3	0.5	0	
	←	2.5	-1	0.5	0	

Paging trunk operation

When used in the paging mode, a trunk is connected to a customer-provided paging amplifier system (not zone selectable). When the trunk is accessed by dial-up or attendant-key operation, it provides a loop closure across control leads PG and A. See Figure 152: Paging trunk operation on page 479. In a typical application, this transfers the input of the paging amplifier system to the transmission path of the trunk.

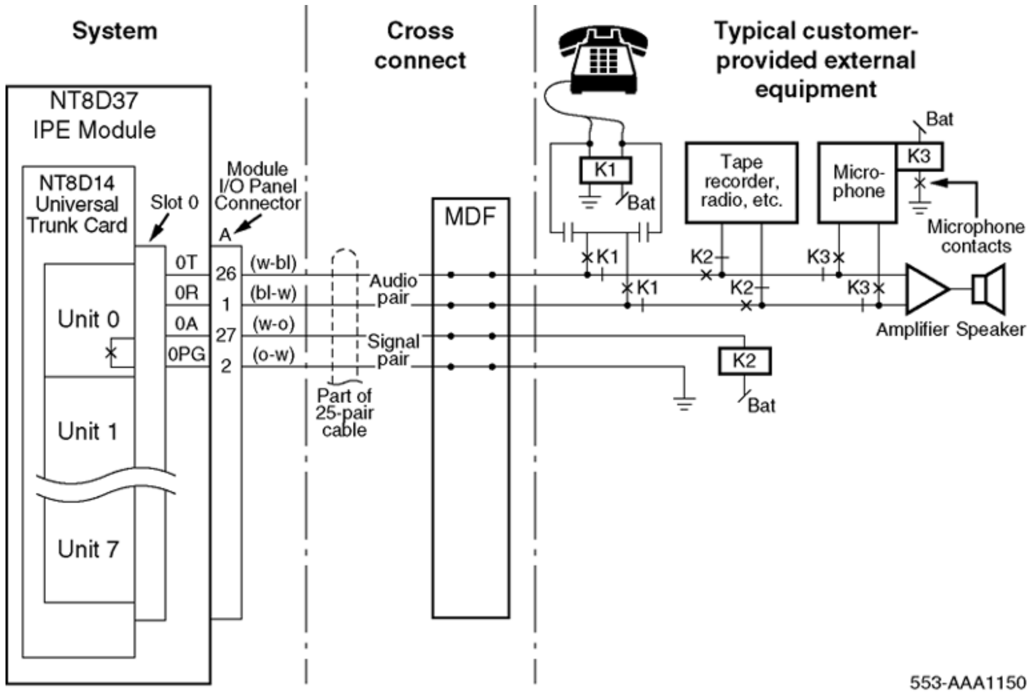


Figure 152: Paging trunk operation

Chapter 24: NTAG26 XMFR card

Contents

This section contains information on the following topics:

Introduction

The XMFR (Extended Multi-frequency receiver) card is used to receive MF digit information. Connections are made between a PBX and a central office. The XMFR card can only operate in systems using µ-law companding.

You can install this card in any IPE slot.

MF signaling

The MF feature allows the system to receive digits for 911 or feature group D applications.

Signaling levels

MF signaling uses pairs of frequencies to represent digits.

Table 199: MF frequency values on page 481 lists the frequency values used for received signals.

Table 199: MF frequency values

Digit	Backward direction DOD-Tx, DID-Rx
1	700 Hz + 900 Hz

Digit	Backward direction DOD-Tx, DID-Rx
2	700 HZ + 1100 Hz
3	900 Hz + 1100 Hz
4	700 Hz + 1300 Hz
5	900 Hz + 1300 Hz
6	1100 Hz + 1300 Hz
7	700 Hz + 1500 Hz
8	900 Hz +1500 Hz
9	1100 Hz + 1500 Hz
0	1300 Hz + 1500 Hz
KP	1100 Hz + 1700 Hz
ST	1500 Hz + 1700 Hz
STP(ST')	900 Hz + 1700 Hz
ST2P(ST")	1300 Hz + 1700 Hz
ST3P(ST")	700 Hz + 1700 Hz

XMFR receiver specifications

Table 200: XMFR receiver specifications on page 482 provides the operating requirements for the NTAG26 circuit card.

Table 200: XMFR receiver specifications

Coding:	Mu-Law
Input sensitivity:	must accept: 0 to -25 dBmO must reject: -35 to dBmO
Frequency sensitivity:	must accept: f +/- (1.5% + 5Hz)
Amplitude Twist:	must accept: difference of 6dB between frequencies
Signal Duration:	must accept: > 30 ms must reject: < 10 ms
KP Signal Duration:	must accept: > 55 ms may accept: > 30 ms must reject: < 10 ms
Signal Interruption Bridge:	must ignore: < 10 ms
Time Shift between 2 frequencies: (Envelop for start/stop)	must accept: < 4 ms
Coincidence between 2 frequencies:	must reject: < 10 ms

Intersignal Pause:	must accept: > 25 ms
Maximum Dialling Speed:	must accept: 10 signals per second
Noise Rejection: Error Rate in White Noise	Better than: < 1/2500 calls Test: 10 digit calls nominal frequency @ -23 dBmO ON/OFF = 50 ms/50ms KP duration 100 ms SNR = -20 dB all digits
Immunity to Impulse Noise	Better than: < 1/2500 calls Test: 10 digit calls nominal frequency @ -23 dBmO ON/OFF = 50ms/50ms KP duration 100 ms SNR = -12 dBs all digits ATT Digit Simulation Test, Tape #201 from PUB 56201
Error Rate from Power Lines	Better than: < 1/2500 calls Test: 10 digit calls nominal frequency @ -23 dBmO ON/OFF = 50 ms/50ms KP duration 100 ms 60 Hz signal @ 81 dBrnc0 (-9dBm) or 180 Hz signal @ 68 dBrnco (-22dBm) all digits
Tolerate Intermodulation:	Must tolerate @A-B and @B-A modulation products with a power sum 28 dB below each frequency component level of the signals.
KP: KP activation	The receiver must not respond to signals prior to KP. Remain unlocked until ST, STP, ST2P, or ST3P is received.
Multiple KP's	After the initial KP, subsequent KP's are ignored while in unlocked mode.
Excessive Components:	If more than two valid frequencies are detected, no digit is reported to the CPU.

The XMFR receiver specifications conform to the following:

- TR-NPL-000258, Compatibility Information for F.G.D. switched access service, Bell Communication Research Technical Reference, Issue 1.0, October 1985.
- TR-NPL-000275, Notes on the BOC Intra-LATA Networks, Bell Communication Research Technical Reference, Chapter 6, 1986.

Physical specifications

The physical specifications required by the NTAG26 XMFR circuit card are shown in the following table.

Table 201: Physical specifications

Dimensions	Height: 12.5 in. (320 mm) Depth: 10.0 in. (255 mm) Thickness: 7/8 in. (22.25 mm)
Faceplate LED	Lit when the circuit card is disabled
Power requirements	1.1 Amps typical

Environmental considerations	Meets the environment of Meridian 1 systems

Chapter 25: NTAK02 SDI/DCH card

Contents

This section contains information on the following topics:

Introduction

The NTAK02 Serial Data Interface/D-channel (SDI/DCH) digital trunk card is supported in the Media Gateway only for the ISDN Signaling Link (ISL) D-channel.

You can install this card in slots 1 through 4 in the Media Gateway. It is not supported in the Media Gateway Expansion. Up to four NTAK02 SDI/DCH cards are supported in a Media Gateway.

NTAK02 SDI/DCH card

The optional SDI/DCH card provides up to four serial I/O ports, which are grouped into two pairs:

- port 0 and port 1
- port 2 and port 3

Ports 1 and 3 are configured as DCH. Ports 0 and 2 are configured as SDI (not supported). See Table 202: Port configurations on page 485. Each pair is controlled by a switch, as shown in Table 203: Switch settings on page 486.

Table 202: Port configurations

Port 0	SDI (not supported)
Port 1	DCH

Port 2	SDI (not supported)
Port 3	DCH

Table 203: Switch settings

Port 0	Port 1	SW 1-1	SW 1-2
SDI (not supported)	DCH	OFF	OFF
SDI (not supported)	DCH	OFF	ON
—	ESDI	ON	ON

Port 2	Port 3	SW 1-3	SW 1-4
SDI (not supported)	DCH	OFF	OFF
SDI (not supported)	DCH	OFF	ON
—	ESDI	ON	ON

Note:

Digital Private Network Signaling System DPNSS can replace the DCH function in the U.K.

Two ports offer the option for DTE/DCE configuration. This option is selected from a jumper on the card. Table 204: Jumper settings on page 486 shows the jumper settings.

Table 204: Jumper settings

Port	Jumper location	Strap for DTE	Strap for DCE	Jumper location	RS422	RS232
0	J10	C - B	B - A			
1	J7J6	C - BC - B	B - AB - A	J9 J8	C - BC - B	B - AB - A
2	J5	C - B	B - A			
3	J4 J3	C - BC - B	B - AB - A	J2 J1	C - BC - B	B - AB - A

Connecting to the ports

External devices are connected to the SDI/DCH card by the following:

- the NTAK19FB four-port SDI cable. This cable does not have to be terminated at the cross connect terminal because it is equipped with connectors.
- the NE-A25-B cable. Terminate the NE-A25-B cable at the cross connect terminal. Tables Table 205: NTAK02 pinouts - Port 0 at the cross-connect terminal on page 487 through

Table 208: NTAK02 connections at the cross-connect terminal - Port 3 on page 488 give the pinouts for the SDI/DCH card.

Table 205: NTAK02 pinouts - Port 0 at the cross-connect terminal

		RS232			
Cable		Signal		Designations I=Input O=Output	
Pair	Color	DTE	DCE	DTE	DCE
1T1R	W-BLBL-W	0DTR	0DCD	—O	—I
2T2R	W-OO-W	DSRDCD	CH/CIDTR	II	OO
3T3R	W-GG-W	RTSCTS	CTSRTS	OI	IO
4T4R	W-BRBR-W	RXTX	TXRX	IO	OI
5T5R	W-SS-W	—SG	—SG	——	——

Table 206: NTAK02 connections at the cross-connect terminal - Port 1

		RS422				RS232			
Cable		Signal		Designations I=Input O=Output		Designations I=Input O=Output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
5T5R	W-SS-W	SCTEA—	SCTA—	O—	I—	O—	I—	SCT—	SCT—
6T6R	R-BLBL-R	SCTEB DTR	SCTBD CD	OO	II	——	——	CH/ CIDTR	—DCD
7T7R	R-OO-R	DSRDCD	CH/ CIDTR	II	OO	II	OO	DSRD CD	CH/ CIDTR
8T8R	R-GG-R	RTSCTS	CTSRTS	OI	IO	OI	IO	RTSC TS	CTSR TS
9T9R	R-BRBR-R	SCRAS CTA	SCTEA RXCA	II	OO	II	OO	SCRS CT	SCT—
10T10R	R-SS-R	SCRBS CTB	SCTEB RXCB	II	OO	——	——	——	——
11T11R	BK-BLBL-BK	RXDAT XDA	TXDAR XDA	IO	OI	IO	OI	RXDT XD	TXDR XD
12T12R	BK-OO-BK	RXDBT XDB	TXDBR XDB	IO	OI	——	——	——	——

Cable		RS422				RS232			
		Signal		Designations I=Input O=Output		Designations I=Input O=Output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
25T2 5R	V-SS-V	SG—	SG—	——	——	——	——	SG—	SG—

Table 207: NTAK02 connections at the cross-connect terminal - Port 2

Cable		RS422				RS232			
		Signal		Designations I=Input O=Output		Designations I=Input O=Output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
13T1 3R	BK-G G-BK			——	——	—O	—I	—DTR	—DCD
14T1 4R	BK-BRBR-BK			——	——	II	OO	DSRD CD	CH/ CIDTR
15T1 5R	BK-SS-BK			——	——	OI	IO	RTSC TS	CTSR TS
16T1 6R	Y-BLBL-Y			——	——	IO	OI	RXTX	TXDR XD
17T1 7R	Y-OO-Y			O—	I—	O—	I—	—SG	—SG

Table 208: NTAK02 connections at the cross-connect terminal - Port 3

Cable		RS422				RS232			
		Signal		Designations I=Input O=Output		Designations I=Input O=Output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
17T1 7R	Y-OO-Y	SCTE A—	SCTA—	O—	I—	O—	I—	SCT—	SCT—
18T1 8R	Y-GG-Y	SCTE BDTR	SCTBDC D	OO	II	——	——	CH/ CIDTR	—DCD
19T1 9R	Y-BRBR-Y	DSRD CD	CH/ CIDTR	II	OO	II	OO	DSRD CD	CH/ CIDTR
20T2 0R	Y-SS-Y	RTSC TS	CTSRTS	OI	IO	OI	IO	RTSC TS	CTSR TS

		RS422				RS232			
Cable		Signal		Designations I=Input O=Output		Designations I=Input O=Output		Signal	
Pair	Color	DTE	DCE	DTE	DCE	DTE	DCE	DTE	DCE
21T21R	V-BLBL-V	SCRA SCTA	SCTEAR XCA	II	OO	II	OO	SCRS CT	SCT—
22T22R	V-OO-V	SCRB SCTB	SCTEBR XCB	II	OO	——	——	——	——
23T23R	V-GG-V	RXDA TXDA	TXDARX DA	IO	OI	IO	OI	RXDT XD	TXDR XD
24T24R	V-BRBR-V	RXDB TXDB	TXDBRX DB	IO	OI	——	——	——	——
25T25R	V-SS-V	—SG	—SG	——	——	——	——	SG—	SG—

Characteristics of the low speed port

Ports 0 and 2 are asynchronous, low speed ports. They transfer data to and from the line one bit at a time.

The characteristics of the low speed port are as follows:

- Baud rate: 300; 600; 1200; 2400; 4800; 9600; 19,200 Default = 1200
- Parity: Odd, even, none Default = none
- Stop bits: 1, 1.5, 2 Default = 1
- Flow control: XON/XOFF, CTS, non. Default = none
- Duplex: Full
- Interface: RS-232-D
- Data bits: 5, 6, 7, 8 Default = 8

Characteristics of the high speed port

Ports 1 and 3 are synchronous, high speed ports with the following characteristics:

- Baud rate: 1200; 2400; 4800; 9600; 19,200; 56,000; 64,000
- Data bit: Transparent (1)
- Duplex: Full

- Clock: Internal or external
- Interface: RS-232-D, RS-422-A

Chapter 26: NTAK10 2.0 Mb DTI card

Contents

This section contains information on the following topics:

Introduction

The NTAK10 2.0 Mb DTI card is a digital trunk card that provides an IPE-compatible 2.0 Mb DTI interface. This circuit card includes an on-board clock controller that can be manually switched in or out of service.

You can install this card in slots 1 through 4 in the Media Gateway. The card is not supported in the Media Gateway Expansion. Up to four digital trunk cards are supported in each Media Gateway.

Important:

Each Media Gateway that has a digital trunk must have a clock controller clocked to an external reference clock.

Note:

Clocking slips can occur between systems that are clocked from different Central Offices (COs), if the COs are not synchronized. The slips can degrade voice quality.

Physical description

The 2 Mb DTI pack uses a standard 9.5" by 12.5", multi-layer printed circuit board. The faceplate is 7/8" wide and contains six LEDs.

The LEDs operate as follows:

- After the card is plugged in, the LEDs (a-e) are turned on by the power-up circuit. The clock controller LED is independently controlled by its own microprocessor.
- After initialization, the LEDs (a-e) flash three times (0.5 seconds on, 0.5 seconds off) and then individual LEDs go into appropriate states, as shown in Table 209: NTAK10 LED states on page 492.

Table 209: NTAK10 LED states

LED	State	Definition
DIS	On (Red)	The NTAK10 circuit card is disabled.
	Off	The NTAK10 is not in a disabled state.
OOS	On (Yellow)	The NTAK10 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 is detected.
	Off	No near end alarm.
FEA	On (Yellow)	A far end alarm state is detected.
	Off	No far end alarm.
LBK	On (Yellow)	NTAK10 is in loop-back mode.
	Off	NTAK10 is not in loop-back mode.
CC	On (Red)	The clock controller is switched on and disabled.
	On (Green)	The clock controller is switched on and is either locked to a reference or is in free-run mode.
	Flashing (Green)	The clock controller is switched on and locking onto the primary reference.
	Off	The clock controller is switched off. **Note:** See Clock controller interface on page 497 in this chapter for more on tracking and free-run operation.

Power requirements

The 2MB DTI obtains its power from the backplane. It draws less than 2 A on +5 V, 50 mA on +15 V and 50 mA on –15 V.

Environment

The NTAK10 card meets all applicable Avaya operating specifications.

Functional description

The NTAK10 provides the following features and functions:

- a clock controller that can be switched in as an option
- software-selectable A/µlaw operation
- software-selectable digital pads on a per channel basis
- frame alignment and multiframe alignment detection
- frame and multiframe pattern generation
- CRC-4 transmission and reception (software selectable)
- card status and alarm indication with faceplate-mounted LEDs
- Periodic Pulse Metering (PPM) counting
- outpulsing of digits on any of the ABCD bits
- Card-LAN for maintenance communication
- per-channel and all-channel loopback capabilities for near-end and far-end
- self-test
- download of incoming ABCD validation times from software
- warm SYSLOAD (TS16 AS16 transmitted)

Applicability to France

Features specific to DTI requirements for France are implemented in firmware, and are switch-accessed. These are:

- transmission and reception of alarm indication signaling (AIS) in TS16 such as card disabled and warm SYSLOAD
- France-specific PPM counting
- decadic dialing
- France-specific alarm report and error handling

Architecture

The main functional blocks of the NTAK10 card architecture include:

- DS-30X interface
- signaling interface
- three microprocessors
- digital pad
- Card-LAN interface
- carrier interface
- clock controller interface

DS-30X interface

The NTAK10 card interfaces to one DS-30X bus which contains 32 byte-interleaved timeslots operating at 2.56 Mb. Each timeslot contains 10 bits in a 10 message format; eight are assigned to voice/data (64 Kbps), one to signaling (8 Kbps), and one is a data valid bit (8 Kbps).

Transmit data

To transmit data on the carrier, the incoming serial bit stream from the NTAK02 circuit card is converted to 8-bit parallel bytes. The signaling bits are extracted by the signaling interface circuitry.

Digital Pad: The parallel data is presented to the pad PROM. The PROM contains pad values, idle code, and A/µ-law conversion. They can be set independently for incoming and outgoing voice on a per channel basis. Four conversion formats are provided: A-law to A-law, A-law to µ-law, µ-law to A-law, µ-law to µ-law.

Each of these four formats has up to 32 unique pad values. The NTAK10 card provides the pad values of -10, -9, -8, -7, -6,-5, -4, -3, -2, -1, 0, 0.6, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14 dB (also idle and unassigned code). A negative pad is a positive gain.

The pad PROM output is converted from parallel to serial format and passed on to a multiplexer, which passes PCM/data, TS0, and TS16 information. The FAS pattern is sent in even TS0s, while in odd TS0s alarm information is sent. The multiplexer output is fed to the carrier interface which can forward it to the carrier or perform per channel loopback.

Receive data

To receive data, PCM/Data from the carrier interface is converted from serial to parallel, is buffered, and is fed to the pad prom. It then sent onto the DS-30X interface, where signaling information from the signaling interface circuitry is multiplexed.

DS-30X microprocessor

The DS-30X is a utility processor, responsible for the following tasks:

- controlling the DS-30X interface
- receiving and decoding of messages and taking appropriate action
- transmitting TS16 messages to the TS16 microprocessor
- receiving TS16 messages from the TS16 microprocessor and passing these messages to the A07
- providing the 19.2 Kbps serial interface to the Card-LAN
- controlling LEDs
- downloading Local Calling Areas (LCAs)
- monitoring errors and alarms
- detecting the change of state in TS0, and outputting TS0 data
- counting bipolar violations, slips, PLL alarms, frame-alignment errors, and CRC-4 errors
- monitoring the status of frame alignment and multiframe alignment
- detecting and reporting of alarm indication signals (AIS)
- updating of per channel loopback registers
- controlling the far-end loopback and digroup loopback functions

Signaling interface

Interconnections

The external connection is through a 50-pin MDF connector.

CEPT interface

This is either an unbalanced 75 ohm or a balanced 120 ohm output which conforms to CCITT Recommendation G.703. The impedance is selected by a switch.

Table 210: 2 MB DTI switch options

Switch	Off (Switch Open)	On (Switch Closed)
S1-1	—	—
S1-2	CC Enabled	CC Disabled
S2-1	120 ohms	Not Applicable
S2-2	Not Applicable	120 ohms
S3-1	non-French Firmware	French Firmware
S3-2	—	—

Channel associated signaling

Channel associated signaling means that each traffic carrying channel has its own signaling channel permanently associated with it. Timeslot 16 is used to transmit two types of signaling: supervisory and address.

Incoming signal

Functions of the NTAK10 with regard to incoming signaling include:

- recognizing valid changes
- determining which channels made the changes
- collecting PPM
- reporting changes to software

Outgoing supervisory signals

The desired ABCD bit pattern for a channel is output by the NTAK10, under the control of the system controller card. The bit pattern to be transmitted is held on the line for a minimum period of time. This time is specified in the same message and ensures that the signal is detected correctly at the far end.

With the exception of the outpulsing signals and special signals, such as Denmark's Flash signal and Sweden's Parking signal, the minimum duration of any signal state is 100 ms. Some signal states can have a minimum duration time that is longer than 100 ms.

Periodic Pulse Metering (PPM)

Periodic Pulse Monitoring (PPM) is used to collect toll charges on outgoing CO trunk calls.

TS16 microprocessor

The functions of this microprocessor include:

- receiving signaling messages supplied by the DS-30X microprocessor, decoding these messages, and taking subsequent actions
- transmitting messages to the DS-30X microprocessor
- handling PPM
- updating the TS16 select RAM and TS16 data RAM
- providing outpulsing
- receive data from the change-of-state microprocessor
- transmitting AIS for CNET (France) application

Change-of-state microprocessor

The functions of this processor are:

- detecting valid change of state in TS16
- when a valid change is found, passing the new abcd bits to the TS16 microprocessor, along with five bits to indicate the associated channel

Clock controller interface

The recovered clock from the external digital facility is provided to the clock controller through the backplane-to-clock controller interface. Depending upon the state of the clock controller (switched on or off), the clock controller interface, in conjunction with software, enables or disables the appropriate reference clock source.

The clock-controller circuitry on NTAK10 is identical to that of the NTAK20. While several DTI/PRI packs can exist in one system, only one clock controller can be activated. All other DTI/PRI clock controllers must be switched off.

Important:

Each Media Gateway that has a digital trunk must have a clock controller clocked to an external reference clock.

Note:

Clocking slips can occur between systems that are clocked from different Central Offices (COs), if the COs are not synchronized. The slips can degrade voice quality.

Clocking modes

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

Tracking mode

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 are very near to being matched, the clock controller is locked 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 is locked onto the reference once again.

If the incoming reference is unstable, the internal clock controller remains continuously 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 is continually attempting to lock onto the signal. If slips are occurring, however, it means that 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 , Cabinet system are used as a master clock source for other systems in the network. Free-run mode is undesirable if the Avaya CS 1000E, Cabinet systemare 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 using software commands.

Clock controller functions and features

The NTAK10 2MB DTI clock controller functions and features include:

- phase-locking to a reference, generating the 10.24 Mhz system clock, and distributing it to the CPU through the backplane. Up to two references at a time can be accepted.
- providing primary to secondary switchover and auto-recovery
- preventing chatter
- providing error burst detection and correction, holdover, and free running capabilities
- complying with 2.0 Mb CCITT specifications
- communicating with software
- filtering jitter
- making use of an algorithm to aid in detecting crystal aging and to qualify clocking information

Reference switchover

Switchover may occur in the case of reference degradation or reference failure. When performance of the reference degrades to a point where the system clock is no longer allowed to follow the timing signal, then the reference is said to be out of specification. If the reference being used is out of specification and the other reference is still within specification, an automatic switchover is initiated without software intervention. If both references are out of specification, the clock controller provides holdover.

Autorecovery and chatter

If the software command "track to primary" is given, the clock controller tracks to the primary reference and continuously monitors the quality of both primary and secondary references. If the primary becomes out of specification, the clock controller automatically tracks to secondary provided that it is within specifications. On failure (both out of specification), the clock controller enters the HOLDOVER mode and continuously monitors both references. An automatic switchover is initiated to the reference that recovers first. If the secondary recovers first, then the clock controller tracks to the secondary, but switches over to the primary whenever the primary recovers. If the primary recovers first, then the clock controller tracks to the primary.

If the software command "track to secondary" is given, the clock controller tracks to the secondary reference and continuously monitors the quality of both primary and secondary references. If the secondary becomes out of specification, the clock controller automatically tracks to primary provided that it is within specifications. On failure (both out of specification), the clock controller enters the HOLDOVER mode and continuously monitors both references.

An automatic switchover is initiated to the reference that recovers first. If the primary recovers first, then the clock controller tracks to the primary, but switches over to the secondary whenever the secondary recovers. If the secondary recovers first, then the clock controller tracks to the secondary.

A time-out mechanism prevents chatter due to repeated automatic switching between primary and secondary reference sources.

Reference clock selection through software

The 2MB DTI card has the necessary hardware for routing its reference to the appropriate line on the backplane.

Software is responsible for the distribution of the secondary references and ensures that no contention is present on the REFCLK1 backplane line. Software designates the 2MB DTI card as a primary reference source to the clock controller. The secondary reference is obtained from another 2 Mbps DTI card, which is designated by a craft person. No other clocks originating from other 2MB DTI packs are used.

The clock controller provides an external timing interface and is capable of accepting two signals as timing references. In this case, an external reference refers to an auxiliary timing source which is bridged from a traffic carrying signal. This is not intended to be a dedicated non-traffic bearing timing signal. The clock controller uses either the two external/auxiliary references or the 2MB DTI references.

Reference clock interface

The recovered clock derived from the facility is available on the MDF connector. The signals at these connectors conform to the electrical characteristics of the EIA RS-422 standard.

Switch settings

Various 2MB DTI switch options exist on the NTAK10. These are shown in Table 211: 2 MB DTI switch options on page 500.

Table 211: 2 MB DTI switch options

Switch	Off (Switch Open)	On (Switch Closed)
S1-1	—	—
S1-2	CC Enabled	CC Disabled
S2-1	120 ohms	Not Applicable
S2-2	Not Applicable	120 ohms

Switch	Off (Switch Open)	On (Switch Closed)
S3-1	non-French Firmware	French Firmware
S3-2	—	—

Note:

The ON position for all the switches is toward the bottom of the card. This is indicated by a white dot printed on the board next to the bottom left corner of each individual switch.

Chapter 27: NTAK20 Clock Controller daughterboard

Contents

This section contains information on the following topics:

Introduction

Digital trunking requires synchronized clocking so that a shift in one clock source results in an equivalent shift in all parts of the network. Synchronization is accomplished with an NTAK20 clock controller daughterboard in each Media Gateway that contains a digital trunk card.

The NTAK20 clock controller daughterboard mounts directly on the following cards:

- NTAK09 1.5Mb DTI/PRI
- NTBK50 2.0 Mb PRI
- NTRB21 DTI/PRI/DCH TMDI
- NTBK22 MISP
- NT6D70 SILC
- NT6D71 UILC

Note:

The card is restricted to slots 1 through 3 in EMC- type cabinets (such as NAK11Dx cabinet). It does not work in slots 4 through 10 in these cabinets.

The NTAK20 clock controller card supports 1.5 Mb, 2.0 Mb, and 2.56 Mb clock recovery rates.

Important:

Each Media Gateway that has a digital trunk must have a clock controller clocked to an external reference clock.

If an IP Expansion multi-cabinet system is equipped with digital trunk cards, it is mandatory that at least one trunk card is placed in the Main cabinet.

Note:

Clocking slips can occur between systems that are clocked from different COs, if the COs are not synchronized. The slips can degrade voice quality.

The clock controller circuitry synchronizes the system to an external reference clock and generates and distributes the clock to the system. The system can function either as a slave to an external clock or as a clocking master. The NTAK20AD version of the clock controller meets the AT&T Stratum 3 and Bell Canada Node Category D specifications. The NTAK20BD version meets CCITT Stratum 4 specifications.

The NTAK20 card performs the following functions:

- phase lock to a reference, generation of the 10.24 Mhz system clock, and distribution of the clock to the CPU through the backplane
- accept one primary and one secondary reference
- primary-to-secondary switchover and auto-recovery
- chatter prevention due to repeated switching
- error-burst detection and correction, holdover, and free running capabilities
- communication with software
- jitter filtering
- use of an algorithm to detect crystal aging and qualify clocking information

Clocking modes

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

Tracking mode

In tracking mode, one or more DTI/PRI cards supply a clock reference to the NTAK20 clock controller daughterboard. When operating in tracking mode, one DTI/PRI card is defined as the Primary Reference Source (PREF) for clock synchronization. The other DTI/PRI card is defined as the Secondary Reference Source (SREF). PREF and SREF are defined in LD 73.

There are two stages to clock controller tracking:

- tracking a reference
- locking on to 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 are almost matched, the clock controller locks on to 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 on to it, and matches frequencies exactly. Occasionally, environmental circumstances cause the external or internal clocks to vary. When this happens, the internal clock controller briefly enters the tracking stage. The green LED flashes until the clock controller is locked on to the reference again.

If the incoming reference is unstable, the internal clock controller continuously tracks, and the LED continuously flashes green. This condition does not present a problem. It shows that the clock controller is continually attempting to lock onto the signal. If slips occur, 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 outside source. Instead, it provides its own internal clock to the system. This mode can be used when the system acts 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 to an external network clock. Free-run mode can occur when both the primary and secondary clock sources are lost due to hardware faults or invoked using software commands.

Physical description

Faceplate LEDs

Each motherboard has five DTI/PRI LEDs and one clock controller LED. The clock controller LED is dual-color (red and green). The clock controller LED states are described in Table 212: Faceplate LEDs on page 506.

Table 212: Faceplate LEDs

State	Definition
On (Red)	NTAK20 is equipped and disabled.
On (Green)	NTAK20 is equipped, enabled, and is either locked to a reference or is in free run mode.
Flashing (Green)	NTAK20 is equipped and is 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	NTAK20 is not equipped.

Functional description

The main functional blocks of the NTAK20 architecture include:

- phase difference detector circuit
- digital Phase Locked Loop (PLL)
- clock detection circuit
- digital-to-analog converter
- CPU MUX bus interface
- signal conditioning drivers and buffers
- sanity timer
- microprocessor
- CPU interface
- external timing interface

Phase difference detector circuit

This circuit, under firmware control, enables a phase difference measurement to be taken between the reference entering the PLL and the system clock.

The phase difference is used for making frequency measurements and evaluating input jitter and PLL performance.

Digital phase lock loops

The main digital PLL enables the clock controller to provide a system clock to the CPU. This clock is both phase and frequency locked to a known incoming reference.

The hardware has a locking range of + 4.6 ppm for Stratum 3 and + 50 ppm for Stratum 4 (CCITT).

A second PLL on the clock controller provides the means for monitoring another reference. Note that the error signal of this PLL is routed to the phase difference detector circuit so the microprocessor can process it.

System clock specification and characteristics

As the accuracy requirements for CCITT and EIA Stratum 3 are different, it is necessary to have two TCVCXOs which feature different values of frequency tuning sensitivity. See Table 213: System clock specification and characteristics on page 507.

Table 213: System clock specification and characteristics

Specifications	CCITT	EIA
Base Frequency	20.48 MHz	20.48 MHz
Accuracy	±3 ppm	±1 ppm
Operating Temperature	0 to 70 C ±1 ppm	0 to 70 C ±1 ppm
Drift Rate (Aging)	±1 ppm per year	±4 ppm in 20 years
Tuning Range (minimum)	±60 ppm min.	±10 ppm min.
	±90 ppm max.	±15 ppm max.
Input Voltage Range	0 to 10 volts, 5 V center	0 to 10 volts, 5 V center

EIA/CCITT compliance

The clock controller complies with 1.5 Mb EIA Stratum 3ND, 2.0 Mb CCITT or 2.56 Mb basic rate. The differences between these requirements mainly affect PLL pull in range. Stratum 4 conforms to international markets (2.0 Mb) while Stratum 3 conforms to North American markets (1.5 Mb).

Monitoring references

The primary and secondary synchronization references are continuously monitored to provide autorecovery.

Reference switchover

Switchover occurs in the case of reference degradation or loss of signal. When performance of the reference degrades to a point where the system clock is no longer allowed to follow the timing signal, then the reference is out of specification. If the reference is out of specification and the other reference is still within specification, an automatic switchover is initiated without software intervention. If both references are out of specification, the clock controller provides holdover.

Autorecovery and chatter

If the command "track to primary" is given, the clock controller tracks to the primary reference and continuously monitors the quality of both primary and secondary references. If the primary goes out of specification, the clock controller automatically tracks to secondary when the secondary is within specifications. On failure (both out of specification), the clock controller enters the HOLDOVER mode and continuously monitors both references. An automatic switchover is initiated to the reference that recovers first. If the secondary recovers first, then the clock controller tracks to the secondary, then switches over to the primary when the primary recovers. If the primary recovers first, the clock controller tracks to the primary and continues to do so even if the secondary recovers.

If the command "track to secondary" is given, the clock controller tracks to the secondary reference and continuously monitors the quality of both primary and secondary references. If the secondary goes out of specification, the clock controller automatically tracks to primary provided that is within specifications. On failure (both out of specification), the clock controller enters the HOLDOVER mode and continuously monitors both references. An automatic switchover is initiated to the reference that recovers first. If the primary recovers first, the clock controller tracks to the primary, but switches over to the secondary when the secondary recovers. If the secondary recovers first, the clock controller tracks to the secondary even if the primary recovers.

To prevent chatter due to repeated automatic switching between primary and secondary reference sources, a time-out mechanism of at least 10 seconds is implemented.

Digital to analog converter

The Digital to Analog Converter (DAC) enables the microprocessor to track, hold, and modify the error signal generated in the digital PLL.

The firmware uses the available memory on the clock controller to provide error-burst detection and correction. Temporary holdover occurs in the momentary absence of the reference clock.

Holdover and free-run

In the temporary absence of a synchronization reference signal, or when sudden changes occur on the incoming reference due to error bursts, the clock controller provides a stable holdover. Free-run mode is initiated when the clock controller has no record of the quality of the incoming reference clock.

If the command "free run" is given, the clock controller enters the free-run mode and remains there until a new command is received. Free-run automatically initiates after the clock controller is enabled.

CPU-MUX bus interface

A parallel I/O port on the clock controller provides a communication channel between the clock controller and the CPU.

Signal conditioning

Drivers and buffers are provided for all outgoing and incoming lines.

Sanity timer

The sanity timer resets the microprocessor in the event of system hang-up.

Microprocessor

The microprocessor does the following:

- communicates with software
- monitors two references
- provides a self-test during initialization
- minimizes the propagation of impairments on the system clock due to errors on the primary or secondary reference clocks

Reference Clock Selection

The DTI/PRI card routes its reference to the appropriate line on the backplane. The clock controller distributes the primary and secondary references and ensures that no contention is present on the REFCLK1 backplane line. It designates the DTI/PRI motherboard as a primary reference source. The secondary reference is obtained from another DTI/PRI card, which is designated by a technician. No other clock sources are used.

External timing interface

The clock controller provides an external timing interface and accepts two signals as timing references. An external reference is an auxiliary timing clock which is bridged from a traffic carrying signal and is not intended to be a dedicated non-traffic-bearing timing signal. The clock controller uses either the external/auxiliary references or the DTI/PRI references.

Hardware integrity and regulatory environment

The clock controller complies with the following hardware integrity and regulatory specifications:

Item	Specification
EMI	FCC part 15 sub- part J CSA C108.8 CISPR publication 22
ESD	IEC 801-2
Temperature	IEC 68-2-1 IEC 68-2-2 IEC 68-2-14
Humidity	IEC 68-2-3
Vibration/Shock	IEC 68-2-6 IEC 68-2-7 IEC 68-2-29 IEC 68-2-31 IEC 68-2-32

Chapter 28: NTAK79 2.0 Mb PRI card

Contents

This section contains information on the following topics:

Introduction

The NTAK79 2.0 Mb Primary Rate Interface (PRI) card provides a 2.0 Mb interface and an onboard D-channel handler (DCH). The NTAK79 card also includes an onboard clock controller (equivalent to the NTAK20 Clock Controller) that can be manually switched into or out of service.

The NTAK79 card does not support the NTBK51 downloadable D-channel handler daughterboard.

You can install this card in slots 1 through 4 in the Media Gateway. The card is not supported in the Media Gateway Expansion.

Note:

Up to three four trunk cards are supported in each Media Gateway.

Important:

Each Media Gateway that has a digital trunk must have a clock controller clocked to an external reference clock.

Note:

Clocking slips can occur between systems that are clocked from different Central Offices (COs), if the COs are not synchronized. The slips can degrade voice quality.

Physical description

The NTAK79 uses a standard 9.5" by 12.5" multi-layer printed circuit board. The faceplate is 7/8" wide. 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). The LEDs are described in Table 214: NTAK79 LEDs on page 512.

Table 214: NTAK79 LEDs

LED	State	Definition
OOS	On (Red)	The NTAK79 2 MB PRI circuit card is disabled or out-of-service.
	Off	The NTAK79 2 MB PRI is not in a disabled state.
ACT	On (Green)	The NTAK79 2 MB PRI circuit card is in an active state.
	Off	The NTAK79 2 MB PRI is in a disabled state. The OOS LED turns red.
RED	On (Red)	A red alarm state is 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 is detected. This represents a remote alarm indication from the far end. The alarm can be either Alarm Indication (AIS) or Remote Alarm (RAI).
	Off	No yellow (remote) alarm.
LBK	On (Green)	2 MB PRI is in loop-back mode.
	Off	2 MB PRI is not in loop-back mode.
CC	On (Red)	The clock controller is switched on and is disabled by the software.
	On (Green)	The clock controller is switched on and is either locked to a reference or in free run mode.
	Flashing (Green)	The clock controller is switched on and attempting to lock on to a reference (tracking mode). If the LED

LED	State	Definition
		flashes continuously over an extended period of time, check the CC STAT in LD 60. If the CC is tracking this can 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.
DCH	On (Red)	DCH is switched on and disabled.
	On (Green)	DCH is switched on and enabled, but not necessarily established.
	Off	DCH is switched off.

NTAK79 switches

The NTAK79 card incorporates four on-board dip switches. The tables that follow provide information about the various settings and related functions of these switches.

Note:

The ON position for all the switches is towards the bottom of the card. This is indicated by a white dot printed on the board adjacent to the bottom left corner of each individual switch.

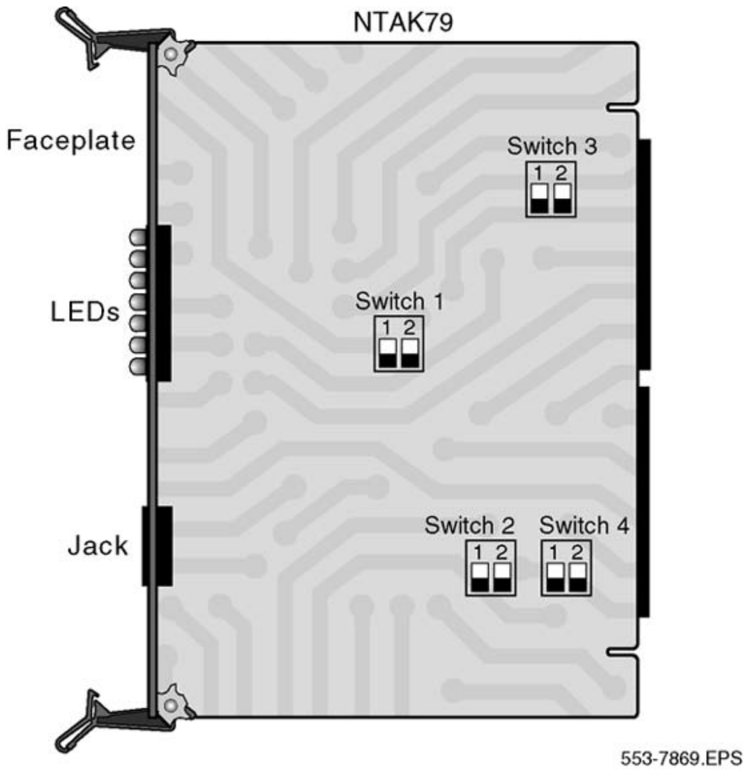


Figure 153: NTAK79 card with switch locations

Switch SW1 - DCHI Configuration

This switch enables/disables the on-board DCHI and sets the operating mode of the DCHI. DPNSS1 mode is supported on an NTAK79BC. For all other countries that do not use DPNSS, use Q.931 mode.

Table 215: Switch SW1

Switch	Down (On)	Up (Off)
SW 1-1	enable DCHI	disable DCHI
SW 1-2	DPNSS1/DASS2	Q.931

Switch SW2 - Carrier Impedance Configuration

This switch sets the carrier impedance to either 120 ohms. Twisted pair cable is usually associated with 120 ohms.

Table 216: Switch SW2

Cable Type	SW 2-1	SW 2-2
120 ohms	Down (On)	Up (Off)

Switch SW3 - Clock Controller Configuration

This switch enables/disables (H/W) the on-board Clock Controller. Disable the SW 3-2 if the on-board clock controller is not in use.

Table 217: Switch SW3

Switch	Down (On)	Up (Off)	Note
SW 3-1	—	—	Spare
SW 3-2	Disabled	Enabled	

Switch SW4 - Carrier Shield Grounding

This switch enables for the selective grounding of the Tx / Rx pairs of the carrier cable. The switch should be kept off (up).

Table 218: Switch SW4

Switch	Up (Off)
SW 4-1	Rx – OPEN
SW 4-2	Tx – OPEN

The usual method is to ground the outer conductor of the receive coaxial signal.

Power requirements

The NTAK79 obtains its power from the backplane, drawing maximums of 2 A on +5 V, 50 mA on +12 V and 50 mA on –12 V.

Environment

The NTAK79 meets all applicable Avaya's operating specifications.

Functional description

The NTAK79 card provides the following features and functions:

- recovery of the 2.048 kbps data by the CEPT receiver, at signal levels which are attenuated by up 10 dB
- control of CEPT line density using HDB3 which provides 64 kbps clear channel
- performance monitoring of the receive carrier by means of Bipolar Violations (BPV), Slips, CRC-4 (CRC), and Frame Bit Errors (FBER)
- monitoring of receive carrier alarms including AIS, LOS, and RAI
- transmission of remote alarm when instructed
- slip-buffering receive messages
- supporting National and International bits in time slot 0
- on-board clock controller
- onboard D-channel interface
- 32 software-selectable Tx & Rx Pad values
- conversion of PCM commanding Laws (A-A, u-u, A-u, u-A)
- Card-LAN for maintenance communication

Architecture

The main functional blocks of the NTAK79 architecture include:

- DS-30X interface
- A07 signaling interface
- digital pad
- carrier interface
- CEPT transceiver
- SLIP control
- D-channel support interface
- 8031 microcontroller
- Card-LAN / echo / test port interface

DS-30X interface

The NTAK79 interfaces to one DS-30X bus which contains 32 byte-interleaved timeslots operating at 2.56 Mb. Each timeslot contains 10 bits in A10 message format; eight are assigned to voice/data (64 kbps), one to signaling (8 kbps), and one is a data valid bit (8 kbps).

The incoming serial bit stream is converted to 8-bit parallel bytes to be directed to padding control.

The signaling bits are extracted and inserted by the A07 signaling interface circuitry. The DS-30X timeslot number is mapped to the PCM-30 channel number. Timeslots 0 and 16 are currently unused for PCM.

Digital PAD

Software selects A-Law or Mu-Law and one of 32 possible PAD values for each channel. These values are provided in a PROM through which the data is routed. The idle code for A-Law is 54H and for Mu-Law is 7FH. The unequipped code is FFH for both A-Law and Mu-Law. As the idle code and unequipped code can be country dependent, the software instructs the NTAK79 to use different codes for each direction. The 32 digital pads available are listed in Table 219: Digital pad values and offset allocations on page 517. The values shown are attenuation levels; 1.0 dB is 1 dB of loss and –1.0 dB is 1 dB of gain.

Table 219: Digital pad values and offset allocations

PAD SET 0		PAD SET 1	
Offset	PAD	Offset	PAD
0	0.6 dB	0	0.0 dB
1	1.0 dB	1	–1.0 dB
2	2.0 dB	2	–2.0 dB
3	3.0 dB	3	–3.0 dB
4	4.0 dB	4	–4.0 dB
5	5.0 dB	5	–5.0 dB
6	6.1 dB	6	–6.0 dB
7	7.0 dB	7	–7.0 dB
8	8.0 dB	8	–8.0 dB
9	9.0 dB	9	–9.0 dB
10	10.0 dB	10	–10.0 dB
11	11.0 dB	11	spare

PAD SET 0		PAD SET 1	
Offset	PAD	Offset	PAD
12	12.0 dB	12	spare
13	13.0 dB	13	spare
14	14.0 dB	14	Idle Code
15	spare	15	Unassigned Code

Signaling interface

The signaling interface consists of the A07 DS-30X signaling controller. This interface provides an 8 Kbps signaling link through the DS-30X timeslot zero data bit zero. Messages are 3 bytes in length.

Carrier interface

The E1 interface connection to the external digital carrier is provided by the line interface chip. This chip provides accurate pulse shaping to meet the CCITT pulse mask requirements. It provides clock recovery functions on the receive side as well as tolerance to jitter and wander in the received bit stream.

Impedance matching

The line interface provides for the use of 120 ohms twisted pair cable. The impedance is selected by a switch, as shown in Table 220: Impedance matching switch selection on page 518.

Table 220: Impedance matching switch selection

Cable	On	Off
120 ohms	S1	S2

Note:

The ON position for all the switches is towards the bottom of the card. This is indicated by a white dot printed on the board next to the bottom left corner of each individual switch.

Carrier grounding

The NTAK79 card provides the capability of selectively grounding the shield of the Tx and/or Rx pairs of the carrier. Closing (down) the on-board switch applies FGND to the appropriate carrier cable shield. The switch settings are shown in Table 221: Carrier shield grounding switch settings on page 519. The switch should be kept ON position.

Table 221: Carrier shield grounding switch settings

Switch	Carrier Pair	On	Off
S4-1	Rx shield	Open	GND
S4-2	Tx shield	Open	GND

Receiver functions

The receiver extracts data and clock from an AMI (Alternate Mark Inversion) coded signal and outputs clock and synchronized data. The receiver is sensitive to signals over the entire range of cable lengths and requires no equalization. The clock and data recovery meets or exceeds the jitter specifications of the CCITT recommendation G.823, and the jitter attenuation requirements of the CCITT recommendation G.742. This provides jitter attenuation increasing from 0 dB to 60 dB over the frequency range from about 6 Hz to 6 KHz.

Transmitter functions

The transmitter takes the binary (dual unipolar) data from the PCM transceiver and produces bipolar pulses which conform to the CCITT recommendation G.703 pulse shape.

Loopbacks

The remote loopback function causes the device to transmit the same data that it receives, using the jitter attenuated receive clock. The data is also available at the receive data outputs. Local loopback causes the transmit data and clock to appear at the receive clock and data outputs. This data is also transmitted on the line unless transmit AIS is selected.

CEPT transceiver

The transmitter and receiver functions are used for synchronization, channel, and signal extraction. The functions meet applicable specifications of the CCITT recommendation G.703 and G.732.

The transceiver provides transmit framing based on the 2.048 MHz clock derived from the DS-30X system clock and 1 KHz framing pulse.

Slip control

Slip control provides organized recovery of PCM when the clock recovered from the external facility is at a different frequency than the local clock.

D-channel support interface

The D-channel support interface is a 64 Kbps, full-duplex serial bit stream configured as a DCE device. The data signals include:

- Receive data output
- transmit data input
- receive clock output
- transmit clock output

The receive and transmit clocks have slightly different bit rates from each other, as determined by the transmit and receive carrier clocks.

The NTAK79 has an onboard D-Channel Handler Interface (DCHI). It is the equivalent to a single port of an NTAK02 SDI/DCH pack. This enables for a completely operational ISDN PRA link with clock synchronization and D-channel on a single circuit card.

The onboard D-channel has one status LED on the NTAK79 faceplate to indicate enabled/ disabled states. See Table 214: NTAK79 LEDs on page 512.

The on-board DCHI can be operated in two separate modes as defined by an on-board dip switch. It can operate in a standard DCHI mode common to most ISDN standard countries. The U.K. specific mode that uses the DPNSS format is not supported at this time.

Table 222: Settings for the DCHI dip switch (SW1)

Switch	Function	On	Off
S1-1	En/Dis	Enabled	Disabled
S1-2	F/W Mode	DPNSS (not supported at this time)	DCHI

DCHI special applications connection

The connection between the PRI2 and the on-board D-channel Handler Interface card is also available at the MDF connector. Connections are made to these pins for normal on-board DCHI operation. They can also be used for future or special applications.

The signals conform to the EIA RS-422 standard.

Card-LAN interface

A Dual Port UART handles the functions of the serial ports for the Card-LAN serial link and the echo canceller/test port interface. The echo/test interface is an asynchronous 4800 bps 8-bit connected to port A of the UART. The Card-LAN interface is an asynchronous 19.2 kbps 9 bit start/stop connected to port B of the UART.

The connection to the echo canceler/test port is available at the backplane/MDF connector. The signals at this port conform to the EIA RS-232C standard.

Clock controller interface

The clock controller circuitry on the NTAK79 is identical to that of the NTAK20 clock controller.

Though several DTI/PRI packs can exist in one system, only one clock controller may be activated. All other DTI/PRI clock controllers must be switched off.

Clocking modes

The clock controller can operate in one of two modes:

- tracking
- non-tracking (also known as free-run)

Tracking mode

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 are very near to being matched, the clock controller is locked 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 is locked onto the reference once again.

If the incoming reference is unstable, the internal clock controller remains continuously 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 is continually attempting to lock onto the signal. If slips are occurring, however, it means that 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 CS 1000E, CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinetare used as a master clock source for other systems in the network. Free-run mode is undesirable if the CS 1000E, CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinetare 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 using software commands.

Clock controller functions and features

The NTAK79 clock controller functions and features include:

- phase lock to a reference, generate the 10.24 MHz system clock, and distribute it to the CPU through the backplane. Up to two references at a time are accepted
- primary to secondary switchover (auto-recovery is provided)
- prevent chatter
- error burst detection and correction, holdover, and free running capabilities
- compliance with 2.0Mb CCITT specifications
- software communication
- jitter filtering
- use of an algorithm to detect crystal aging and to qualify clocking information

Reference switchover

Switchover may occur in the case of reference degradation or reference failure. When performance of the reference degrades to a point where the system clock is no longer allowed to follow the timing signal, then the reference is said to be out of specification. If the reference being used is out of specification and the other reference is still within specification, an automatic switchover is initiated without software intervention. If both references are out of specification, the clock controller provides holdover.

Autorecovery and chatter

If the software command "track to primary" is given, the clock controller tracks to the primary reference and continuously monitors the quality of both primary and secondary references. If the primary becomes out of specification, the clock controller automatically tracks to secondary provided that it is within specifications. On failure (both out of specification), the clock controller enters the HOLDOVER mode and continuously monitors both references. An automatic switchover is initiated to the reference that recovers first. If the secondary recovers first, then the clock controller tracks to the secondary, but switches over to the primary when the primary recovers. If the primary recovers first, the clock controller tracks to the primary.

If the software command "track to secondary" is given, the clock controller tracks to the secondary reference and continuously monitors the quality of both primary and secondary references. If the secondary becomes out of specification, the clock controller automatically tracks to primary provided that it is within specifications. On failure (both out of spec.), the clock controller enters the HOLDOVER mode and continuously monitors both references. An automatic switchover is initiated to the reference that recovers first. If the primary recovers first, then the clock controller tracks to the primary, but switches over to the secondary whenever the secondary recovers. If the secondary recovers first, then the clock controller tracks to the secondary.

A time-out mechanism prevents chatter due to repeated automatic switching between primary and secondary reference sources.

Holdover and free-run

In the temporary absence of a synchronization reference signal, or when sudden changes occur on the incoming reference due to error bursts, the clock controller provides a stable holdover. The free-run mode is initiated when the clock controller has no record of the quality of the incoming reference clock.

If the software command "free run" is given, the clock controller enters the free-run mode and remains there until a new command is received. Note that the free-run mode of operation is automatically initiated after the clock controller is enabled.

Reference clock selection through software

The NTAK79 has the necessary hardware for routing its reference to the appropriate line on the backplane.

The software is responsible for the distribution of the secondary references and ensures that no contention is present on the REFCLK1 backplane line. The software designates the NTAK79 as the primary reference source to the clock controller. The secondary reference is obtained from another NTAK79 card, which is designated by a technician. No other clocks originating from other NTAK79 circuit cards are used.

The clock controller provides an external timing interface and is capable of accepting two signals as timing references. In this case, an external reference refers to an auxiliary timing source which is bridged from a traffic carrying signal. This is not intended to be a dedicated non-traffic bearing timing signal. The clock controller uses either the two external/auxiliary references or the NTAK79 references.

Chapter 29: NTDW79AAE5 Universal Digital Trunk card

Contents

This section contains information on the following topics:

Introduction

The NTDW79AAE5 Universal Digital Trunk (UDT) card is a single slot size TDM card. The NTDW12AAE5 Universal Clock Controller (UDT CC) daughter board may be mounted on the UDT card.

The UDT card and daughterboard replace NTAK79, NTAK10, NTBK50, NTRB21, NTAK20, NTAK93, NTAK09 and include onboard DDCH/DCHI functionality.

You can use the UDT card in Avaya Communication Server 1000 (Avaya CS 1000) systems, positioned on CE-MUX slots.

Figure 154: UDT card positioning in Avaya CS 1000M Cabinet/ Meridian 1 PBX 11C Cabinet on page 526 shows UDT card positioning in the Communication Server 1000M cabinet / Meridian1 PBX 11C cabinet.

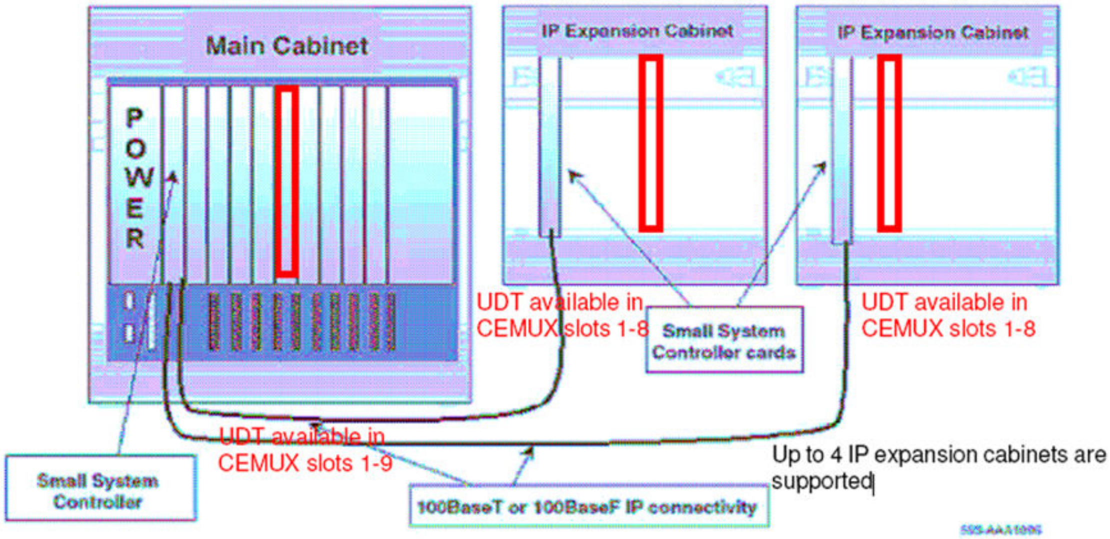


Figure 154: UDT card positioning in Avaya CS 1000M Cabinet/ Meridian 1 PBX 11C Cabinet

Figure 155: UDT card positioning in CS 1000M Chassis/ Meridian 1 PBX 11C Chassis on page 527 shows the UDT card positioning in the CS 1000M chassis / Meridian1 PBX 11C chassis.

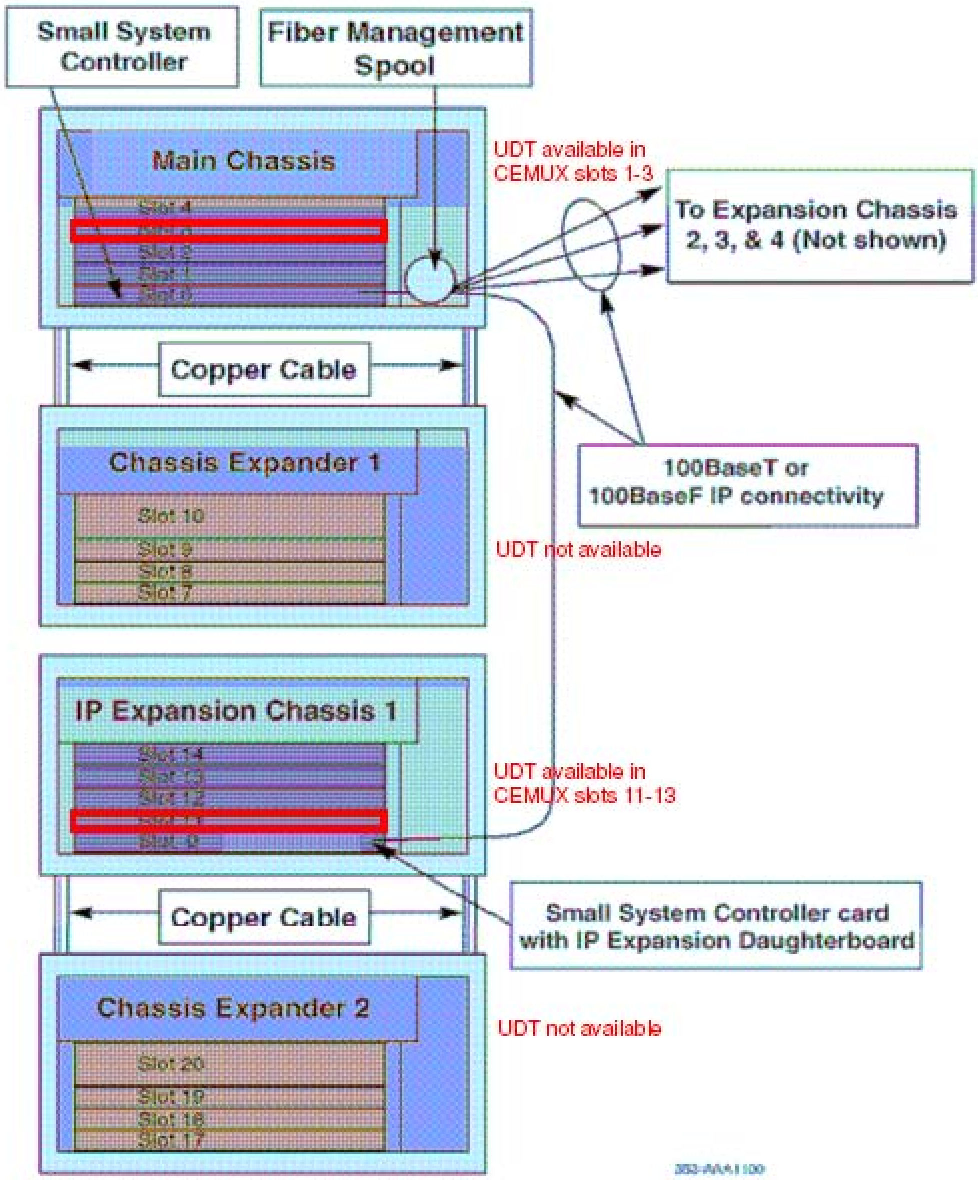


Figure 155: UDT card positioning in CS 1000M Chassis/ Meridian 1 PBX 11C Chassis

Figure 156: UDT card positioning in a CS 1000E system on page 528 shows the UDT card positioning in a CS 1000E system.

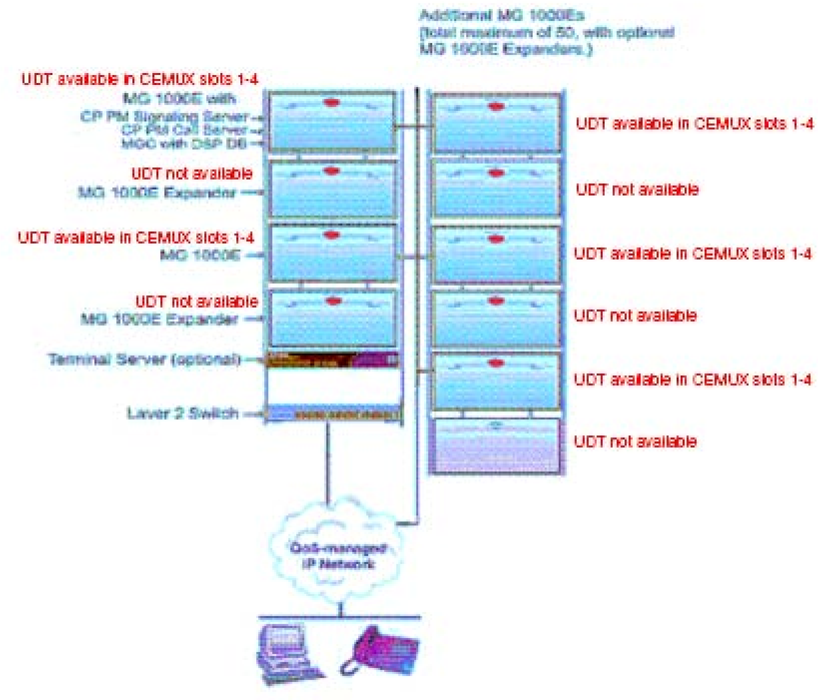


Figure 156: UDT card positioning in a CS 1000E system

Figure 157: UDT card positioning in a CS 1000B system on page 529 shows the UDT card positioning in a CS 1000B system.

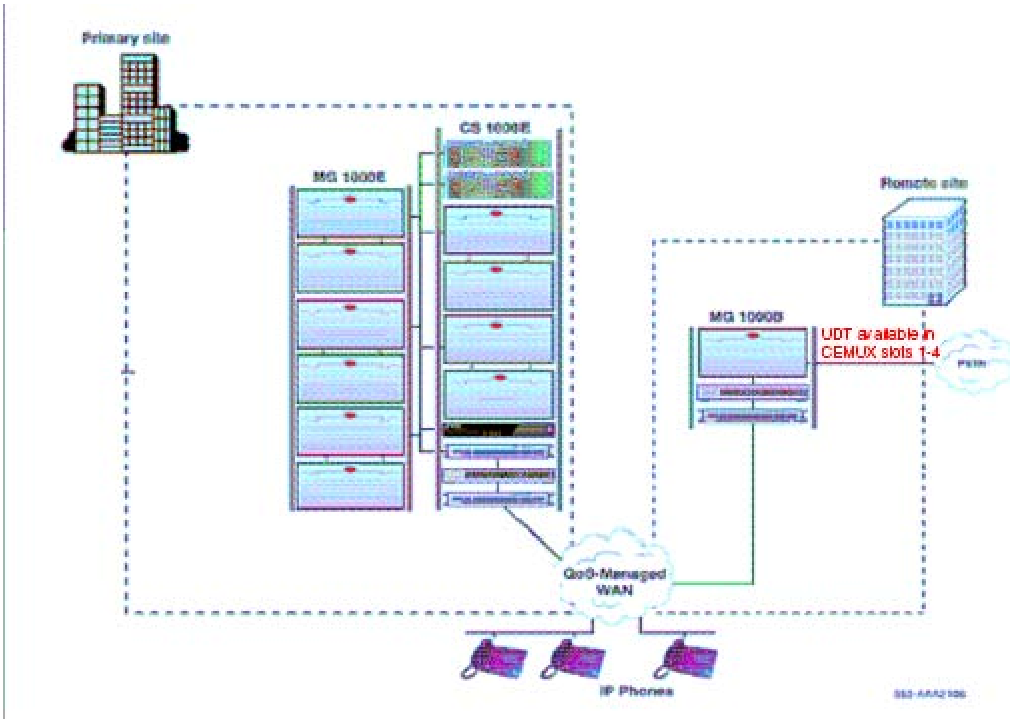


Figure 157: UDT card positioning in a CS 1000B system

The UDT card is based on the technology of the MG 1000E PRI Gateway, with the following main features:

- DTI, DTI2, PRI, PRI2, DPNSS, DASS2
- Optional UDT CC daughter board
- On board DDCH/DCHI functionality
- F/W download

Physical description

The UDT card consists of the following hardware features:

- A Motorola MPC880 PowerQUICC Main Processing Unit (MPU) . The MPU block includes a 32 Megabyte (MB) Flash memory device that stores and executes the Boot code, and a 32 MB SDRAM main memory. The MPU core operates internally at 100 Megahertz (MHz), but only operates externally at a capacity of 50 MHz.
- PCM interfaces based on Infineon FALC E1/T1 transceivers
- Digital PLL for synchronizing on external clock
- One DIP switch for E1/T1 mode setting
- One 10/100BaseT Ethernet port connected to the faceplate

- Seven LEDs on the faceplate for diagnostic information display
- An FPGA circuit

Power requirements

The current card consumption is 1 Amper (A) at 5 volts (V) and 0.1A at 15 V.

Connectors

The UDT card includes the following connectors:

- RJ45 Ethernet connector on the faceplate
- RS232 connector on the faceplate
- Bantam jacks
- E1/T1 trunk connector (the existing connector in CS 1000E cabinets)

LED indicators

Figure 158: UDT card faceplate LEDs on page 530 and Table 223: UDT card LED functionality on page 530 demonstrate the UDT card LEDs functionality.

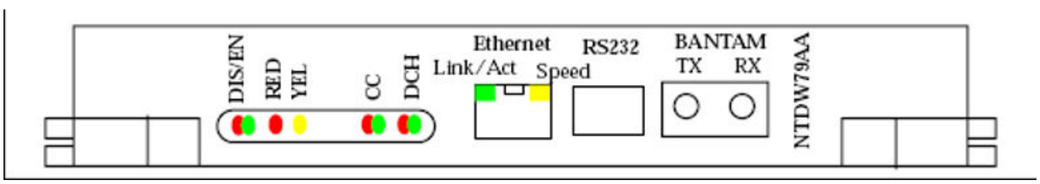


Figure 158: UDT card faceplate LEDs

Table 223: UDT card LED functionality

Group	LED name	Color	Functionality
E1/T1 span (3 LEDs)	EN/DIS	green	E1/T1 link is enabled
		red	E1/T1 link is disabled
	RED	off	No Alarm/Loop disabled
		red	E1/T1 Link has Near End Alarm
	YEL	off	No Alarm/Loop disabled
		yellow	E1/T1 Link has Far End Alarm

Group	LED name	Color	Functionality
D-Channel (1 LED)	DCH	off	DCH is not configured in UDT
		red	MSDL/DDSL is disabled
		green	MSDL/DDSL is enabled
Clock Sync (1 LED)	CC	off	UDT CC is not equipped
		red	Clock Controller disabled/not configured
		green	Enabled and locked to a reference or in free run mode
		green flashing	Tracking mode
Ethernet (2 LEDs)	LNK/ACT	green	Flashing when Ethernet Link is receiving data
	SPEED	off	Speed is 10Mbps
		yellow	Speed is 100Mbps

Functional description

The NTDW79AAE5 - UDT card provides the following features and functionality:

- DTI/DTI2, PRI/PRI2, DPNSS1/DASS2 and B-channels functionality
- Software transparency that allows you to use it in the installed base for repairs and upgrades
- Enhanced trouble shooting by way of a Command Line (CLI) interface
- On board DDCH/DCHI functionality
- Secure and simplified UDT card firmware upgrade process from Call Server (PSDL)
- Highly secured with no Telnet, HTTP and FTP servers
- Uses a universal CC DB (NTDW12AAE5)

UDT card alarms

The UDT card meets the standard alarms currently implemented by Avaya Enterprise trunk cards, receiving frame bit errors, loss of signal and more. The alarms status appears in LD 60, CLI status commands and on the product LEDs.

Clock reference

The UDT card must synchronize its E1/T1 TDM stream with the Central Office or another PBX clock.

The UDT card can work as a Master clock for other PBXs. The card uses an internal timing source and generates the timing signal on E1/T1. The Clock Controller functionality is X11/X21 Software transparent.

Feature interactions

- The UDT CC daughter board can only be mounted on the UDT card.
- The NTAK20 CC daughter board can not be mounted on the UDT card.
- 75ohm impedance can be used by converting the UDT card 120ohm impedance using a proper converter.
- The RS232 port is not to be used during normal operation and is for maintenance and configuration only.
- The UDT card does not simulate the TMDI card (NTRB21). Do not configure the UDT card as a TMDI card.
- The UDT card can be used starting with software release X21 Release 5.0 for CS 1000E systems.
- The UDT card can coexist with other digital trunk cards within the same CS 1000E cabinet.
- The UDT CC daughter board mounted on the UDT card can be used as the CC card serving other digital trunk cards within the same CS 1000E cabinet.
- The NTAK20 CC daughterboard mounted on another digital trunk card can be used as the CC card serving the UDT card within the same CS 1000E cabinet.
- The UDT card can be used as the Secondary clock reference for the NTAK20 CC daughter board.
- Other digital trunk cards can be used as the Secondary clock reference for the UDT CC daughter board.
- The UDT CC daughter board and the NTAK20 CC daughter board can be used in different cabinets within the same system.

Chapter 30: NTAK93 D-channel Handler Interface daughterboard

Contents

This section contains information about the following topics:

Introduction

The NTAK93 provides the D-channel handler interfaces required by the ISDN PRI trunk.

The DCHI performs D-channel Layer 2 message processing and transfers Layer 3 signaling information between two adjacent network switches. It is mounted on the NTAK09 1.5 Mb DTI/PRI card or the NTBK50 2.0 Mb PRI card (installed in the Media Gateway) using standoff reference pins and connectors. The NTAK93 daughterboard, when mounted on the NTBK50 PRI digital trunk card, is addressed in the same slot as the NTBK50. The NTAK93 daughterboard can use SDI I/O addresses 1 to 15 and port 1.

The NTAK93 provides the following features and functions:

- D-channel interface or DPNSS interface
- Special features included for LAPD implementation at DCH:
  - system parameters are service changeable (system parameters are downloaded from software)
  - incoming Layer 3 message validation procedures are implemented in the D-PORT firmware
  - supported message units and information elements can be service changed
  - translation of the CCITT message types information elements into a proprietary coding scheme for faster CPU operation

- convention of IA5-encoded digits to BCD-encoded digits for incoming Layer 3 messages for faster CPU operation
- self-test
- loopback

Physical description

The DCH function can be installed in the main and IP expansion cabinets. The DTI/PRI card which carries a DCH daughterboard resides in the main and IP expansion cabinets.

Faceplate LEDs

NTAK09 1.5 Mb PRI and NTBK50 2.0 MB PRI cards

LEDs are located on the faceplate of the NTAK09 and NTBK50 cards. The DCHI LED is dual-color (red and green). The LEDs are described in Table 224: Faceplate LEDs on page 534.

Table 224: Faceplate LEDs

State	Definition
On (Red)	NTAK93 is equipped and disabled.
On (Green)	NTAK93 is equipped and enabled, but not necessarily established.
Off	NTAK93 is not equipped.

Power consumption

Power consumption is +5 V at 750 mA; +12 V at 5 mA; and –12 V at 5 mA.

Functional description

The main functional blocks of the NTAK93 architecture include the following.

Microprocessors

One microprocessor does the following:

- handles data transfer between each pair of serial ports and software
- reports the status of each port
- takes commands from software to control the activities of the ports

The microprocessors also handle some D-channel data processing in DCHI mode.

DMA controller

A Z80A-DMA chip controls the data transfer between local RAM memory and communication ports. The DMA channels are only used in the receive direction, not in the transmit direction.

Random Access Memory (RAM)

A total of 32 KBytes of RAM space for each pair of ports is used as the communication buffer and for firmware data storage.

Read Only Memory (ROM)

A total of 32K bytes of ROM space for each pair of ports is reserved as a code section of the DCH-PORT firmware.

LAPD data link/asynchronous controller

One chip controls each pair of independent communication ports. It performs the functions of serial-to-parallel and parallel-to-serial conversions, error detection, and frame recognition (in HDLC). The parameters of these functions are supplied by the DCH-PORT firmware.

Counter/timer controller

Two chips are used as real-time timers and baud-rate generators for each pair of communication ports.

Software interface circuit

This portion of the circuit handles address/data bus multiplexing, the interchange of data, commands, and status between the on board processors and software. It includes transmit buffer, receive buffer, command register, and status register for each communication channel.

DPNSS/DCHI Port

The mode of operation of the DCH-PORT is controlled by a switch setting on the NTAK09/ NTBK50. For DPNSS the switch is ON; for DCHI it is OFF.

The port operates at:

Data Rate	56kbps, 64kbps
Duplex	Full
Clock	Internal / External
Interface	RS422

The address of ports is selected by hardwired backplane card address. Port characteristics and LAPD parameters are downloaded from software.

The address of a port is determined by the hardwired backplane card address. Port characteristics and LAPD parameters are downloaded from software.

D-Port - SDTI/PRI interface

Below is a brief description of signals. When connected to SDTI/PRI, DCHI-PORT is considered Data Terminal Equipment (DTE):

- SDA, SDB: Transmit Clock provided by SDTI/PRI
- RTA, RTB: Receive Clock provided by SDTI/PRI
- RR, CS: SPDC ready signal provided by DCHI-PORT
- TR: D-PORT ready signal provided by DCHI-PORT
- RDA, RDB: Incoming serial data bit stream, driven by SDTI/PRI
- SDA, SDB: Transmit serial data bit stream driven by DCHI-PORT

Chapter 31: NTBK22 MISP card

Contents

This section contains information on the following topics:

Introduction

The NTBK22 Multi-Purpose ISDN Signaling Processor (MISP) card is a microprocessor-controlled signaling processor that performs Data Link (Layer 2) and Network (Layer 3) processing associated with ISDN BRI and the OSI protocol.

Physical description

The MISP occupies one slot in the Media Gateway. It uses one of the network loops to interface with SILCs and UILCs and to provide 32 timeslots for D-channel signaling and packet data transmission. The other loop address is used to communicate with the Call Server.

You can install this card in slots 1 through 4 in the Media Gateway. The card is not supported in the Media Gateway Expansion.

Note:

When configuring BRI trunks, the MISP (NTBK22) card must be co-located in the same Media Gateway as the SILC (NT6D70) and UILC (NT6D71) cards the MISP is supporting.

Refer to Avaya ISDN Basic Rate Interface: Installation and Configuration (NN43001-318) and Avaya ISDN Basic Rate Interface: Features (NN43001-580) for additional information.

Functional description

Each MISP can support 4 line cards (UILC or SILC or any combination of the two). Each line card supports 8 DSLs, therefore each MISP supports 32 DSLs. As each DSL uses two B-channels and one D-channel the MISP supports 64 B-channels and 32 D-channels. If the MISP is carrying packet data, it must dedicate one of its D-channels to communicate with the external packet handler. In this case the MISP supports only 31 DSLs.

The main functions of the MISP are:

- communicate with the Call Server CPU to report ISDN BRI status and receive downloaded application software and configuration parameters
- manage Layer 2 and Layer 3 signaling that controls call connection and terminal identification
- control terminal initialization and addressing
- assign B-channels for switched voice and data transmission by communicating with the BRI terminal over the D-channel and allocating to it an idle B-channel with appropriate bearer capabilities
- separate D-channel data from signaling information and route the data to the packet handler
- send call control messages to ISDN BRI terminals over the D-channel

Micro Processing Unit (MPU)

The MPU coordinates and controls data transfer and addressing of the peripheral devices and communicates with the CPU using a message channel on the CPU bus. The tasks that the MPU performs depend on the interrupts it receives. The interrupts are prioritized by the importance of the tasks they control.

High-Level Data Link Controller (HDLC)

The HDLC is a format converter that supports up to 32 serial channels that communicate at speeds up to 64 kbps. The HDLC converts messages into the following two message formats:

- a serially transmitted, zero-inserted, CRC protected message that has a starting and an ending flag
- a data structure

CPU to MISP bus interface

Information exchange between the CPU and the MISP is performed with packetized messages transmitted over the CPU bus. This interface has a 16-bit data bus, an 18-bit address bus, and interrupt and read/write control lines.

This interface uses shared Static Random Access Memory (SRAM) as a communication exchange center between the CPU and the MPU. Both the CPU and the MPU can access this memory over the transmit and receive channels on the bus.

MISP network bus interface

The network bus interface:

- converts bit interleaved serial data received from the network bus into byte interleaved data for transmission over the 32 time slots used by the HDLC controller
- accepts byte interleaved data transmitted from the HDLC controller and converts it into a bit interleaved data stream for transmission over the network bus

Power consumption

Power consumption is +5 V at 2 A; +15 V at 50 mA; and -15 V at 50 mA.

Chapter 32: NTBK50 2.0 Mb PRI card

Contents

This section contains information on the following topics:

Introduction

The NTBK50 2.0 Mb PRI card provides a 2.0 Mb PRI interface. It supports the NTAK20 clock controller daughterboard and either the NTAK93 D-channel interface or the NTBK51 Downloadable D-channel handler. The NTAK93 DCHI daughterboard provides identical performance to the on-board NTAK79 DCHI. The NTBK51 DDCH daughterboard provides support for protocols based on the MSDL platform.

You can install this card in slots 1 through 4 in the Media Gateway. The card is not supported in the Media Gateway Expansion.

Important:

Each Media Gateway that has a digital trunk must clock the clock controller to an external reference clock.

Note:

Clocking slips can occur between systems that are clocked from different Central Offices (COs), if the COs are not synchronized. The slips can degrade voice quality.

Physical description

The NTBK50 uses a standard 9.5" by 12.5" multi-layer printed circuit board. The faceplate is 7/8" wide and contains seven LEDs. See Figure 159: NTBK50 2.0 Mb PRI card with daughterboards on page 542.

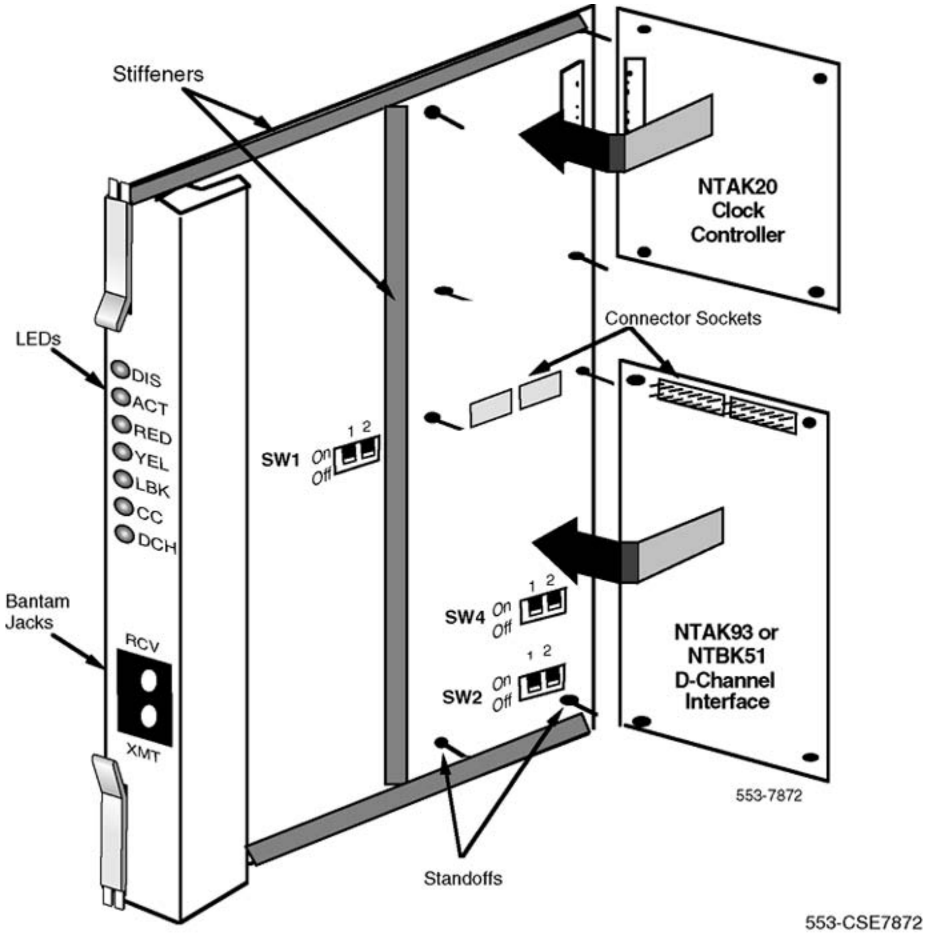


Figure 159: NTBK50 2.0 Mb PRI card with daughterboards

The LEDs are described in Table 225: NTBK50 faceplate LEDs on page 542.

Table 225: NTBK50 faceplate LEDs

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

LED	State	Definition
ACT	On (Green)	The NTBK50 2.0 Mb PRI circuit card is in an active state.
	Off	The NTBK50 2.0 Mb PRI is in a disabled state. The OOS LED is red.
RED	On (Red)	A red alarm state is 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 is 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)	2.0 Mb PRI is in loop-back mode.
	Off	2.0 Mb PRI is not in loop-back mode.
CC	On (Red)	The clock controller is software disabled.
	On (Green)	The clock controller is enabled and is either locked to a reference or is in free run mode.
	Flashing (Green)	NTAK20 is equipped and is 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 can 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.

Power requirements

The NTBK50 obtains its power from the backplane, drawing up to 2 A on +5 V, 35 mA on +15 V and 20 mA on –15 V.

Environment

The NTBK50 meets all applicable Avaya operating specifications.

Functional description

NTBK50 provides the following features and components:

- recovery of the 2.048 kbps data by the CEPT receiver, at signal levels which are attenuated by up to 10 dB
- control of CEPT line density using HDB3 which provides 64 kbps clear channel
- performance monitoring of the receive carrier by means of Bipolar Violations (BPV), Slips, CRC-4 (CRC), and Frame Bit Errors (FBER)
- monitoring of receive carrier alarms including AIS, LOS, and RAI
- transmission of remote alarm when instructed
- slip-buffering receive messages
- support of National and International bits in timeslot 0
- clock controller daughterboard
- D-channel interface daughterboard
- downloadable D-channel handler daughterboard
- 32 software-selectable Tx and Rx Pad values
- conversion of PCM commanding Laws (A-A, u-u, A-u, u-A)
- Card-LAN for maintenance communication

Architecture

The main functional blocks of the NTBK50 architecture are:

- DS-30X interface
- A07 signaling interface
- digital pad
- carrier interface
- CEPT transceiver
- SLIP control
- D-channel support interface
- clock controller interface

- Card-LAN / echo / test port interface
- 80C51FA Microcontroller

DS-30X interface

NTBK50 interfaces to one DS-30X bus which contains 32-byte interleaved timeslots operating at 2.56 Mb. Each timeslot contains 10 bits in A10 message format; eight are assigned to voice/ data (64 Kbps), one to signaling (8 Kbps), and one is a data valid bit (8 Kbps).

The incoming serial bit stream is converted to 8-bit parallel bytes to be directed to padding control. The signaling bits are extracted and inserted by the A07 signaling interface circuitry. Timeslots 0 and 16 are currently unused for PCM.

Digital PAD

The software selects A-Law or µ-Law and one of 32 possible PAD values for each channel. These values are provided in a PROM through which the data is routed. The idle code for A-Law is 54H and for µ-Law is 7FH. The unequipped code is FFH for both A-Law and µ-Law.

As the idle code and unequipped code can be country dependent, the software instructs the NTBK50 to use different codes for each direction. The 32 digital pads available are illustrated in Table 226: Digital Pad - values and offset allocations on page 545. The values shown are attenuation levels (1.0dB is 1 dB of loss and –1.0 dB is 1 dB of gain.

Table 226: Digital Pad - values and offset allocations

PAD SET 0		PAD SET 1	
Offset	PAD	Offset	PAD
0	0.6 dB	0	0.0 dB
1	1.0 dB	1	-1.0 dB
2	2.0 dB	2	-2.0 dB
3	3.0 dB	3	-3.0 dB
4	4.0 dB	4	-4.0 dB
5	5.0 dB	5	-5.0 dB
6	6.1 dB	6	-6.0 dB
7	7.0 dB	7	-7.0 dB
8	8.0 dB	8	-8.0 dB
9	9.0 dB	9	-9.0 dB
10	10.0 dB	10	-10.0 dB
11	11.0 dB	11	spare

PAD SET 0		PAD SET 1	
Offset	PAD	Offset	PAD
12	12.0 dB	12	spare
13	13.0 dB	13	spare
14	14.0 dB	14	Idle Code
15	spare	15	Unassigned Code

Signaling interface

The signaling interface consists of the A07 DS-30X signaling controller. This interface provides an 8 Kbps signaling link via the DS-30X timeslot zero data bit zero. Messages are 3 bytes in length.

Carrier interface

For the E1 interface, the connection to the external digital carrier is provided by the line interface chip. This device provides accurate pulse shaping to meet the CCITT pulse mask requirements. It provides clock recovery functions on the receive side, as well as tolerance to jitter and wander in the received bit stream.

Impedance matching (Switch SW2)

The line interface provides for the use of 120 ohms twisted pair cable. The impedance is selected by SW2, as shown in Table 227: Impedance matching switch settings on page 546.

Table 227: Impedance matching switch settings

Cable Type	SW 2-1
120 ohms	Up (Off)

Note:

The ON position for all the switches is toward the bottom of the card. This is indicated by a white dot printed on the board next to the bottom left corner of each individual switch.

Carrier grounding

NTBK50 enables the shield of the Tx and/or Rx pairs of the carrier to be selectively grounded. Closing (down position) the on-board switch applies FGND to the appropriate carrier cable shield. The switch settings are shown in Table 228: Carrier Shield grounding switch settings on page 547. The switch should be kept in Off (Up) position.

Table 228: Carrier Shield grounding switch settings

Switch	Down (On)	Up (Off)
SW 4 – 1	Rx – FGND	Rx – OPEN
SW 4 – 2	Tx – FGND	Tx – OPEN

Receiver functions

The receiver extracts data and clock from an AMI (Alternate Mark Inversion) coded signal and outputs clock and synchronized data. The receiver is sensitive to signals over the entire range of cable lengths and requires no equalization. The clock and data recovery meets or exceeds the jitter specifications of the CCITT recommendation G.823 and the jitter attenuation requirements of the CCITT recommendation G.742. This provides jitter attenuation increasing from 0 dB to 60 dB over the frequency range from about 6 Hz to 6 KHz.

Transmitter functions

The transmitter takes the binary (dual unipolar) data from the PCM transceiver and produces bipolar pulses. This conforms to CCITT recommendation G.703 pulse shape.

Loopbacks

The remote loopback function causes the far-end device to transmit the same data that it receives, using the jitter attenuated receive clock. The data is additionally available at the far-end receive data outputs. Local loopback causes the transmit data and clock to appear at the near-end clock and receive data outputs. This data is also transmitted on the line unless an Alarm Indication Signal (AIS) is transmitted instead.

CEPT transceiver

The transmitter and receiver functions are used for synchronization, channel, and signal extraction. The functions meet applicable specifications of the CCITT recommendation G.703 and G.732.

The transceiver provides transmit framing based on the 2.048 MHz clock derived from the DS-30X system clock and 1 KHz framing pulse.

Slip control

Slip control provides organized recovery of PCM when the clock recovered from the external facility is at a different frequency with respect to the local clock.

D-channel support interface

The D-channel support interface is a 64 Kbps, full-duplex serial bit stream configured as a DCE device. The data signals include:

- receive data output
- transmit data input
- receive clock output
- transmit clock output

The receive and transmit clocks can be of slightly different bit rates from each other as determined by the transmit and receive carrier clocks.

The NTBK50 supports a D-Channel Handler Interface (DCHI) daughterboard. It is equivalent to a single port of an NTAK02 SDI/DCH card. The NTBK50 also supports a Downloadable D-Channel Handler interface (DDCH) daughterboard. The DDCH brings MSDL D-channel capability to the system.

DCHI Configuration for NTAK93 only (SW1)

The NTAK93 DCHI daughterboard can be operated in two separate modes defined by an on-board dip switch. It can operate in a standard DCHI mode common to most ISDN standard countries. It can also operate in a DPNSS mode, which is not supported at this time. The DDCH supports only a single port which directly interfaces to the PRI motherboard. See Table 229: Settings for the DCHI dip switch (SW1) on page 548.

Table 229: Settings for the DCHI dip switch (SW1)

Switch	Function	On	Off
S1-1	—	—	—
S1-2	F/W Mode	DPNSS	DCHI

Card-LAN interface

A Dual Port UART handles the functions of the serial ports for the Card-LAN serial link test port interface. The test interface is an asynchronous 4800 bps 8 bit connected to port A of the

UART. The card-LAN interface is an asynchronous 19.2 kbps 9 bit start/stop connected to port B of the UART.

The connection to the test port is available at the backplane/MDF connector.

The signals at this port conform to the EIA RS-232C standard.

Chapter 33: NTBK51 Downloadable D-channel Handler daughterboard

Contents

This section contains information on the following topics:

Introduction

The NTBK51 daughterboard provides Downloadable D-channel Handler (DDCH) interfaces based on the Multipurpose Serial Data Link (MSDL). The DDCH provides a single purpose full-duplex serial port capable of downloading the D-channel application and base software into the card.

The NTBK51 provides the following features and functions:

- ISDN D-channel related protocol
- Selftest
- Loopback
- D-channel loadware including:
  - management and maintenance
  - LAPD- software for data link layer processing
  - DCH interface
  - Layer 3 preprocessor

- traffic reporting including link capacity

Physical description

The NTBK51 daughterboard interfaces with the system CPU and is mounted on either the NTAK09 1.5 DTI/PRI card or the NTBK50 2 Mb PRI digital trunk card.

You can install this card in:

- slots 1 through 9 in the main cabinet or slots 11-19, 21-29, 31-39, or 41-49 in the expansion cabinets
- slots 1 through 4 in the Media Gateway. The card is not supported in the Media Gateway Expansion.

The NTBK51 daughterboard, when installed on the NTAK09 digital trunk card, is addressed in the same slot as the NTAK09.

One NTBK51 daughterboard is required for each PRI link.

LEDs are located on the faceplate of the NTAK09/NTBK50 card. The DCHI LED is a dual-color (red/green). The LED is described in Table 230: Faceplate LED on page 552.

Table 230: Faceplate LED

State	Definition
On (Red)	NTBK51 is disabled.
On (Green)	NTBK51 is enabled, but not necessarily established.
Off	NTBK51 is not equipped.

Functional description

The main functional blocks of the NTBK51 architecture include the following:

- Microprocessors
- Main memory
- Shared memory
- EPROM memory
- Flash EPROM memory
- EEPROM memory
- Serial communication controller

- Sanity timer
- Bus timer

Microprocessors

One microprocessor handles data transfer between each serial interface and software, reports the status of each port and takes commands from the software to control the activities of the ports. A high performance MPU supports the D-channel from the PRI card and other software applications running simultaneously on other ports of the DDCH card.

The microprocessor performs the following functions:

- sanity check and self tests
- message handling between the CS 1000E, CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinetand the card
- four port serial communication controller handling with Direct Memory Access (DMA)
- program download from the system controller

Main memory

The main 68EC020 system memory is comprised of 1 Mbyte of SRAM and is accessible in 8 or 16 bits. The software, base code and application reside in main RAM and is downloaded from the software through the shared memory.

Shared memory

The shared memory is the interface between the CPU and the 68EC020 MPU. This memory is a 16 Kbyte RAM, expandable to 64 kbytes and accessible in 8 or 16 bits.

EPROM memory

The Bootstrap code resides in this 27C1000 EPROM and is executed on power up or reset.

Flash EPROM memory

Flash EPROM provides non-volatile storage for the DDCH loadware which minimizes the impact to sysload. The Flash EPROM provides an increase in system service with a reduced delay after a brown-out, and faster testing of a hardware pack after it is plugged in.

EEPROM memory

The DDCH uses a 1024 bit serial EEPROM for storing the Avaya product code and a revision level. This information can be queried by the software.

Serial communication controller

The serial controller is the Zilog Z16C35 and is referenced as the Integrated Controller (ISCC). The ISCC includes a flexible Bus Interface Unit (BIU) and four Direct Memory Access (DMA) channels, one for each receive and transmit. The DMA core of the ISCC controls the data transfer between local RAM and the communication ports.

Sanity timer

A sanity timer is incorporated on the DDCH to prevent the MPU from getting tied-up as the result of a hardware or software fault. If the MPU encounters a hardware or software fault and enters a continuous loop, the sanity timer enables the DDCH to reset itself.

Bus timer

The bus timer presents an error signal to the MPU if an attempt to access a device did not receive acknowledgment within the bus time-out period of 120 ms.

Download operation

Downloading is performed in either of two modes: background mode or maintenance mode. Before a download takes place, a D-channel link must be configured. The following situations lead to software downloading:

- during initialization when new software is installed
- when enabling the card or application
- during card reset (due to loss of software or corruption)
- during a background audit

System initialization

When new base or application software is installed on a CS 1000E, CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinet, the download decision is made during system initialization. The actual MSDL base software download is done in background mode and can take several minutes to complete, depending on switch traffic and the size of the MSDL base software.

Card enabling or application enabling

If a normal download enable command is executed, the MSDL base code and application is conditionally downloaded to the DDCH card. This conditional download depends on the result of the check made by the CPU on the MSDL base code and application software.

If a forced download enable command is executed in LD 96, the MSDL base code and application are forced down to the DDCH card, even if the base and application software is already resident on the DDCH card. To complete a forced download, the following conditions must be met:

- the DDCH card must be enabled
- the D-channel port must be disabled

Card reset

After a card reset, the MSDL base code and the D-channel application software are validated by the CPU. The software is stored in flash EPROM on the DDCH card and need not be downloaded. But if the software is missing due to new installation, corruption, or loadware version mismatch, the CPU automatically downloads the base/application into the DDCH card.

Background audit

If a background audit of the card and associated applications finds that a download is required, the card is queued in the PSDL tree. Downloading is performed in background mode based on the entries in the PSDL tree.

Chapter 34: NTCK16 Generic Central Office Trunk cards

Contents

This section contains information on the following topics:

Introduction

The NTCK16 generic Central Office trunk cards support up to eight analog Central Office trunks. They can be installed in any IPE slot.

The cards are available with or without the Periodic Pulse Metering (PPM) feature. The cards are also available in numerous countries. Country specific information is provided in this chapter.

The cards are identified by a two-letter suffix to the product code called the vintage. The card vintage is based on whether PPM is equipped or not, and the individual countries where the card is being installed.

The cards listed below are minimum vintage required to support the following countries:

- NTCK16AA generic Central Office trunk card with PPM
  - Ireland
- NTCK16BC generic Central Office trunk card without PPM.
  - Brazil
  - Ireland
  - Mexico
  - Tortolla
  - Singapore
- NTCK16AD generic Central Office trunk card with PPM
  - Turkey
- NTCK16BD generic Central Office trunk card without PPM.
  - Argentina
  - Turkey
  - Brazil
  - Chile
  - Indonesia
  - Korea
  - Venezuela

Throughout this chapter, cards with PPM are identified by the vintage AX. Cards without PPM are referenced by the vintage BX.

Physical description

The NTCK16AX and NTCK16BX generic Central Office trunk cards uses eight units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the I/O panel which is then cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by Tip and Ring leads.

Switch settings

There are no option switches on the NTCK16AX and NTCK16BX generic Central Office trunk cards. All settings are configured in software.

Self-test

When the NTCK16AX and NTCK16BX trunk cards are installed and power is applied to them, a self-test is performed on each card. The red LED on the faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED remains lit.

Functional description

The NTCK16AX and NTCK16BX generic Central Office trunk cards support up to eight analog Central Office trunks. They can be installed in any IPE slot.

Both cards are exactly the same except for the Periodic Pulse Metering (PPM) feature. The NTCK16AX card supports internal 12/16 kHz PPM but the NTCK16BX card does not.

Common features

The NTCK16AX and NTCK16BX generic Central Office trunk cards:

- support the North American loss plan
- support loop start signalling
- support busy tone detection and supervision on a per unit basis.
- support battery reversal detection
- provide 4 dB dynamic attenuation pads on a per call basis
- allow individual units or the entire board to be disabled by software
- provide software selectable A-law or µ-law companding
- indicate self-test status during an automatic or manual self-test
- provide card-identification for auto configuration, and for determining the serial number and firmware level of the card
- convert transmission signals from analog-to-digital and from digital-to-analog
- provide termination and trans-hybrid balance impedance to match 600 Ω.

Operation

Each NTCK16AX and NTCK16BX generic Central Office trunk card supports the following:

- Loop start operation
- Battery reversal detection
- Busy tone detection and supervision
- Loss Switching
- Trunk-to-Trunk connections
- Call Disconnect

In addition, the NTCK16AX circuit card supports internal 12/16 kHz PPM detection.

Loop start operation

Loop start operation is configured in software and is implemented in the card through software download messages.

Idle state

In the idle state, the ringing detector is connected across the tip and ring wires, providing a high impedance loop toward the Central Office.

Call placed by Central Office

The Central Office initiates a call by applying ringing between the tip and ring wires. If the call is answered, the ringing detector on the trunk card is switched out and a low resistance dc loop is placed between the tip and ring leads.

On trunks configured for battery supervision, the battery detector records the polarity of the tip and ring wires and sends an answer acknowledge signal to software.

Call placed by CS 1000E, CS 1000M, and Meridian 1

To initiate a call, the CS 1000E, CS 1000M, and Meridian 1switches out the ringing detector and places a low resistance loop across the tip and ring leads. On trunks configured for battery supervision, the trunk card sends a seize acknowledge signal to software.

The system sends digits in the form of Dual Tone Multifrequency (DTMF) tones or pulse digits. When the far-end answers, the Central Office reverses polarity. If the trunk is configured for battery supervision, it sends a polarity reversal message to software.

Central Office disconnect

There are two ways the Central Office can disconnect the call:

- by applying busy tone toward the CS 1000E, CS 1000M, and Meridian 1. If the trunk card is configured to detect busy tone, it sends a disconnect message to software.
- by reversing battery. If the trunk card is configured to detect battery reversal, it sends a disconnect message to software. When the unit on the trunk card is idled, the trunk card sends a release confirm message to software.

CS 1000E, CS 1000M, and Meridian 1disconnect

The CS 1000E, CS 1000M, and Meridian 1disconnects the call by removing the loop between the tip and ring leads and replacing the ringing detector. Trunks configured for battery supervision send a release confirm message to software.

Electrical specifications

Power requirements

Table 231: NTCK16 circuit card power requirements on page 561 shows the power requirements for the NTCK16AX and NTCK16BX generic Central Office trunk cards.

Table 231: NTCK16 circuit card power requirements

Voltage	Idle Current	Active current
+15.0 V dcFootnote. [1]	170 ma	330 ma
-15.0 V dcFootnote.	170 ma	249 ma
+8.5 V dc[2]	101 ma	100 ma
+5.0 V dc	160 ma	322 ma

[1] Analog circuitry is powered with +/-12 V generated from +/-15 V. The maximum current imbalance between the +/-15 V rails is 100 ma per circuit pack.

[2] 8.5 V is regulated to give 5 V.

Environmental specifications

Table 232: NTCK16 circuit card environmental specifications on page 562 lists the environmental specifications of the NTCK16AX and NTCK16BX generic Central Office trunk cards.

Table 232: NTCK16 circuit card environmental specifications

Parameter	Specifications
Operating temperature	10 to 45 degrees C
Operating humidity	20 to 80% RH (non-condensing)
Storage temperature	–20 to +60 degrees C
Storage humidity	5 to 95% Relative Humidity

Pad switching

The NTCK16AX and NTCK16BX generic Central Office trunk cards support the North American loss plan. Software configuration allows the selection of 4 dB loss pads on a per unit basis.

Table 233: NTCK16 pad switching

Loss	Analog-to-Digital	Digital-to-Analog
PAD out	0 dB	–3 dB
PAD in	+4 dB	+1 dB

Note:

The tolerance for the above nominal values is +0.3 dB, -0.7 dB.

Connector pin assignments

Cross connections

Figure 160: NTCK16 Central Office trunk connections for NT8D37 I/O panel connectors A, E, K, R on page 564, Figure 161: NTCK16 Central Office trunk connections for NT8D37 I/O panel connectors B, F, L, S on page 565, and Figure 162: NTCK16 Central Office trunk

connections for NT8D37 I/O panel connectors C, G, M, T on page 566 provide cross connect information for the NTCK16AX and NTCK16BX generic Central Office trunk cards.

Configuration

The trunk type for each unit on the card is selected by software service change entries at the system terminal.

Lead designations	Pins	Pair Color	I/O Panel Connector				Unit Number
COT			A	E	K	R	
T0 R0	26 1	W-BL BL-W					Unit 0
	27 2	W-O O-W					
T1 R1	28 3	W-G G-W					Unit 1
	29 4	W-BR BR-W					
T2 R2	30 5	W-S S-W	SLOT 0	SLOT 4	SLOT 8	SLOT 12	Unit 2
	31 6	R-BL BL-R					
T3 R3	32 7	R-O O-R					Unit 3
	33 8	R-G G-R					
T4 R4	34 9	R-BR BR-R					Unit 4
	35 10	R-S S-R					
T5 R5	36 11	BK-BL BL-BK					Unit 5
	37 12	BK-O O-BK					
T6 R6	38 13	BK-G G-BK					Unit 6
	39 14	BK-BR BR-BK					
T7 R7	40 15	BK-S S-BK					Unit 7
	41 16	Y-BL BL-Y					

Figure 160: NTCK16 Central Office trunk connections for NT8D37 I/O panel connectors A, E, K, R

Lead designations	Pins	Pair Color	I/O Panel Connector				Unit Number
COT			B	F	L	S	
T0 R0	26 1	W-BL BL-W					Unit 0
	27 2	W-O O-W					
T1 R1	28 3	W-G G-W					Unit 1
	29 4	W-BR BR-W					
T2 R2	30 5	W-S S-W	SLOT 1	SLOT 5	SLOT 9	SLOT 13	Unit 2
	31 6	R-BL BL-R					
T3 R3	32 7	R-O O-R					Unit 3
	33 8	R-G G-R					
T4 R4	34 9	R-BR BR-R					Unit 4
	35 10	R-S S-R					
T5 R5	36 11	BK-BL BL-BK					Unit 5
	37 12	BK-O O-BK					
T6 R6	38 13	BK-G G-BK					Unit 6
	39 14	BK-BR BR-BK					
T7 R7	40 15	BK-S S-BK					Unit 7
	41 16	Y-BL BL-Y					
T0 R0	42 17	Y-O O-Y					Unit 0
	43 18	Y-G G-Y					
T1 R1	44 19	Y-BR BR-Y	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 1
	45 20	Y-S S-Y					
T2 R2	46 21	V-BL BL-V					Unit 2
	47 22	V-O O-V					
T3 R3	48 23	V-G G-V					Unit 3
	49 24	V-BR BR-V					

Figure 161: NTCK16 Central Office trunk connections for NT8D37 I/O panel connectors B, F, L, S

Lead designations	Pins	Pair Color	I/O Panel Connector				Unit Number
COT			C	G	M	T	
T4 R4	26 1	W-BL BL-W	SLOT 2	SLOT 6	SLOT 10	SLOT 14	Unit 4
	27 2	W-O O-W					
T5 R5	28 3	W-G G-W					Unit 5
	29 4	W-BR BR-W					
T6 R6	30 5	W-S S-W					Unit 6
	31 6	R-BL BL-R					
T7 R7	32 7	R-O O-R					Unit 7
	33 8	R-G G-R					
T0 R0	34 9	R-BR BR-R	SLOT 3	SLOT 7	SLOT 11	SLOT 15	Unit 0
	35 10	R-S S-R					
T1 R1	36 11	BK-BL BL-BK					Unit 1
	37 12	BK-O O-BK					
T2 R2	38 13	BK-G G-BK					Unit 2
	39 14	BK-BR BR-BK					
T3 R3	40 15	BK-S S-BK					Unit 3
	41 16	Y-BL BL-Y					
T4 R4	42 17	Y-O O-Y					Unit 4
	43 18	Y-G G-Y					
T5 R5	44 19	Y-BR BR-Y					Unit 5
	45 20	Y-S S-Y					
T6 R6	46 21	V-BL BL-V					Unit 6
	47 22	V-O O-V					
T7 R7	48 23	V-G G-V					Unit 7
	49 24	V-BR BR-V					

Figure 162: NTCK16 Central Office trunk connections for NT8D37 I/O panel connectors C, G, M, T

NTCK16AX Central Office trunk card

Route Data Block

Respond to the prompts in LD 16 as shown.

Table 234: LD 16 - Route Data Block for NTCK16AX.

Prompt	Response	Description
REQ:	NEW	Define a new unit
TYPE:	COT	Define a new Route Data Block
CUST	xx	Customer number as defined in LD 15.
ROUT		Route number
	0-511	Range for Large System, Call Server 1000E, Media Gateway 1000B, and Media Gateway 1000E
TKTP	COT	Define trunk type as Central Office
ICOG	IAO	Incoming and Outgoing trunk
CNTL	YES	Change a trunk timer
TIMER	RGV 256	Set Ring Validation Timer to 128 ms.
MR	(NO) PPM XLD	PPM is off, buffered, or unbuffered on this route.

Trunk Data Block

Respond to the prompts in LD 14 as shown:

Table 235: LD 14 - Trunk Data Block for NTCK16AX.

Prompt	Response	Description
REQ:	NEW	Define a new trunk unit
TYPE:	COT	Central Office Trunk
TN		Terminal Number
	l s c u	Format for Large System, Call Server 1000E, and Media Gateway 1000E, where l = loop, s = shelf, c = card, u = unit
XTRK[3]	XCOT	Type is IPE COT
CDEN	(8D)	Card density is 8D (default)
SIGL	LOP	Loop start signaling
PPID[4]	Xx	04 Ireland/Turkey 12 KHz 03 Turkey 16 KHz

[3] These prompts are required only for the first unit defined on each NTCK16AX card.
[4] PPIDFreqMin pulse detection 0316Kz>70ms 0412Kz>70ms

Prompt	Response	Description
BTID[5]	Xx	Enter the country busy tone ID: Tortola, Brazil = 10 Mexico = 10 or 08 (depending on CO)Singapore = 11 Ireland = 3 or 9 (depending on CO)Chile, Venezuela, Thailand, Korea = 06Argentina = 12 or 07Turkey = 14
SUPN	(NO) YES	Supervision yes (no)
STYP	BTS	Busy tone supervision enabled
	BAT	Loop break supervision enabled
CLS	(LOL) SHL	Attenuation Pads In, (Out)
	DTN, (DIP)	Digitone signaling, (digipulse)
	P20, P12, (P10)	Make-break ratio for pulse dialing speed.

NTCK16BX Central Office trunk card

Route Data Block

Respond to the prompts in LD 16 as shown:

Table 236: LD 16 - Route Data Block for NTCK16BX.

Prompt	Response	Description
REQ:	NEW	Define a new unit
TYPE:	COT	Define a new Route Data Block
CUST	xx	Customer number as defined in LD 15.
ROUT		Route number
	0-511	Range for Large System, Call Server 1000E, Media Gateway 1000B, and Media Gateway 1000E
TKTP	COT	Define trunk type as Central Office

[5] CountryBTIDCadence Brazil, Tortola10250 ms +/- 50 ms on/off Mexico10250 ms +/- 50 ms on/off Mexico 8375 ms on/off Singapore11750 ms on/off Ireland 3500 +/- 50 ms on/off Ireland 9375 - 750 ms on/off Kuwait, Chile 6500 +/- 50 ms on/off Venezuela, Indonesia12300 ms on, 200 ms off Thailand, Korea12300 ms on, 200 ms off Argentina12300 ms on, 200 ms off Argentina07250 - 500 ms on/off Turkey1410 seconds of Tone 1: 200 ms off, 200 ms on; 200 ms off, 200 ms on; 200 ms off, 200 ms on; 200 ms off, 600 ms on; followed by Tone 2: 200 ms off, 200 ms on.

Prompt	Response	Description
ICOG	IAO	Incoming and Outgoing trunk
CNTL	YES	Change a trunk timer
TIMER	RGV 256	Set Ring Validation Timer to 128 ms.
MR	(NO)	PPM is off on this route.

Trunk Data Block

Respond to the prompts in LD 14.

Table 237: LD 14 - Trunk Data Block for NTCK16BX

Prompt	Response	Description
REQ:	NEW	Define a new trunk unit.
TYPE:	COT	Central Office Trunk
TN		Terminal Number
	l s c u	Format for Large System, Call Server 1000E, and Media Gateway 1000E, where l = loop, s = shelf, c = card, u = unit
XTRK[6]	XCOT	Type is IPE COT
CDEN	(8D)	Card density is 8D (default).
SIGL	LOP	Loop start signaling
BTID (See Periodic Pulse Metering on page 570.)	Xx	Enter the country busy tone ID: Tortola, Brazil = 10 Mexico = 10 or 08 (depending on CO) Singapore = 11 Ireland = 3 or 9 (depending on CO) Kuwait, Chile, Venezuela, Indonesia, Thailand,Korea = 06 Argentina = 12 or 07Turkey = 14
SUPN	(NO) YES	Supervision yes (no)
STYP	BTS	Busy tone supervision enabled
	BAT	Loop break supervision enabled
CLS	(LOL) SHL	Attenuation Pads In, (Out)
	(DIP) DTN	Digitone signaling, (digipulse)
	(P10) P12 P20	Make-break ratio for pulse dialing speed.

[6] These prompts are required only for the first unit defined on each NTCK16BX card.

BTID values by country

Country BTIDCadence Brazil Tortola 10250 ms +/- 50 ms on/off Mexico 10250 ms +/- 50 ms on/offMexico 8375 ms on/off Singapore11750 ms on/off Ireland 3500 +/- 50 ms on/off Ireland 9375 - 750 ms on/off Kuwait, Chile 6500 +/- 50 ms on/off Venezuela, Indonesia1 2300 ms on, 200 ms off Thailand, Korea1 2300 ms on, 200 ms off Argentina1 2300 ms on, 200 ms off Argentina 07250 - 500 ms on/off Turkey 1410 seconds of Tone 1: 200 ms off, 200 ms on; 200 ms off, 200 ms on; 200 ms off, 200 ms on; 200 ms off, 600 ms on; followed by Tone 2: 200 ms off, 200 ms on.

Applications

Periodic Pulse Metering

All trunk units on the NTCK16AX trunk card can be individually configured to support the Periodic Pulse Metering (PPM) feature.

Note:

PPM is available on the NTCK16AX trunk card. It is not supported on the NTCK16BX trunk card.

PPM allows the user of a telephone to keep an accurate record of Central Office calls for billing or administration purposes.

Detection limits

Pulses detected by the NTCK16AX circuit card must be within the following limits:

Frequency	11 880 to 12 120 Hz
Level	105 to 1100 mVrms **Note:** The pack should not be used to detect levels of 1100 mVrms or greater a Tip and Ring, as this may result in noise.
Pulse length	Dependent on PPID – see LD 14

Busy tone detect

Busy tone is sent by the Central Office to indicate the release of an established call.

Detection limits

The NTCK16AX and NTCK16BX generic Central Office trunk cards can detect busy tone within the following limits:

Frequency	400 to 620 Hz
Level	–30 to 0 dBm
Cadence	See on Trunk Data Block on page 567.

Loss switching

The Generic XFCOT is based on the XFCOT design, which is using a static pad download algorithm by default for its loss plan.

The generic XFCOT has to be set explicitly to a Dynamic Pad Switching mode to make it compliant with the standard North American Dynamic Pad Switching mode.

Therefore the following steps must be followed when the Generic XFCOT is installed:

1. Define Loss Switching mode. Respond to the prompts in LD 97 as shown.

Table 238: LD 97 - Defining Loss Switching mode.

Prompt	Response	Description
REQ:	CHG	
TYPE:	SYSP	IPE system parameters configuration
...		
NATP	YES	Select North American transmission plan. **Note:** The default to the NATP prompt is NO, and therefore this prompt must always be checked during installation.

2. Define Loss Switching Class Of Service. Respond to the prompts in LD 14 as shown.

Table 239: LD 14 - Defining Loss Switching Class Of Service.

Prompt	Response	Description
REQ:	CHG	
TYPE:	COT	
XTRK	XCOT	
SIGL	LOP	
...		
CLS	LOL	LOL= Long Line **Note:** The XFCOT uses the CLS Long Line (LOL) and Short Line (SHL) for Loss Switching purposes and that the card and trunk type is different from the XUT.

Equivalencies

The following equivalencies do apply:

- XFCOT COT SHL is equivalent with XUT COT TRC
- XFCOT COT LOL is equivalent with XUT COT NTC.

The entries TRC and NTC are no longer allowed for the Generic XFCOT.

Trunk to Trunk connection

When any disconnect supervision is configured (CLS = BAT, BTS), the Loop Start Trunk of the Generic XFCOT is marked as having disconnect supervision and therefore follows the same rules as a Ground Start Trunk.

There is no configuration involved for this operation.

Call disconnect

If any disconnect supervision is configured (CLS = BAT, BTS), the Loop Start Trunk is released when the disconnect signal is received. This applies also in call states such as ringing, camp-on, and DISA.

There is no configuration involved for this operation.

Chapter 35: NTDW12AAE5 Universal Clock Controller daughter board

Contents

This section contains information on the following topics:

Introduction

Digital trunking requires synchronized clocking so that a shift in one clock source results in an equivalent shift in all parts of the network. In an Avaya Communication Server 1000 (Avaya CS 1000) system synchronization is accomplished with a clock controller daughterboard in each Media Gateway that contains a digital trunk card.

The NTDW12AAE5 Universal clock controller card supports 1.5 Mb and 2.0 Mb clock recovery rates.

The NTDW12AAE5 Universal clock controller daughterboard mounts directly on the NTDW79AAE5 Universal Digital Trunk card. For more information about mounting the Universal clock controller daughterboard on the Universal Digital Trunk card, see *Avaya New in this Release* (NN43001-115).

Important:

Each Media Gateway that has a digital trunk must have a clock controller clocked to an external reference clock.

Note:

NTDW12AAE5 Universal Clock Controller daughter board can be mounted only on the NTDW79AAE5 UDT E1/T1 card. It cannot be mounted on any other Avaya digital trunk card, e.g. NTBK50, NTAK09.

Note:

NTDW12AAE5 Universal Clock Controller daughter board and the NTAK20 Clock Controller daughter board can be used in different cabinets within the same Avaya CS 1000E cabinet.

Note:

The NTDW12AAE5 Universal Clock Controller daughter board mounted on the NTDW79AAE5 UDT E1/T1 card can be used as the clock controller card serving other Avaya digital trunk cards (e.g. NTBK50, NTAK09) within the same CS 1000E cabinet.

Note:

Existing Avaya digital trunk cards (e.g. NTBK50, NTAK09) can be used as the Secondary clock reference for the NTDW12AAE5 Universal Clock Controller daughter board.

Note:

Clocking slips can occur between systems that are clocked from different COs, if the COs are not synchronized. The slips can degrade voice quality.

The clock controller circuitry synchronizes the CS 1000 system to an external reference clock and generates and distributes the clock to the system. The CS 1000 system can function either as a slave to an external clock or as a clocking master. The Universal clock controller meets the AT&T Stratum 3 and Bell Canada Node Category D specifications and CCITT Stratum 4 specifications.

The Universal clock controller performs the following functions:

- phase lock to a reference, generation of the 160 Khz system clock, and distribution of the clock to the CPU through the backplane
- accept one primary and one secondary reference
- primary-to-secondary switchover and auto-recovery
- chatter prevention due to repeated switching
- error-burst detection and correction, holdover, and free running capabilities
- communication with software
- jitter filtering
- use of an algorithm to detect crystal aging and qualify clocking information

Clocking modes

The CS 1000 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 more DTI/PRI cards supply a clock reference to the clock controller daughterboard. When operating in tracking mode, one DTI/PRI card is defined as the Primary Reference Source (PREF) for clock synchronization. The other DTI/PRI card is defined as the Secondary Reference Source (SREF). PREF and SREF are defined in LD 73.

There are two stages to clock controller tracking:

- tracking a reference
- locking on to 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 are almost matched, the clock controller locks on to 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 on to it, and matches frequencies exactly. Occasionally, environmental circumstances cause the external or internal clocks to vary. When this happens, the internal clock controller briefly enters the tracking stage. The green LED flashes until the clock controller is locked on to the reference again.

If the incoming reference is unstable, the internal clock controller continuously tracks, and the LED continuously flashes green. This condition does not present a problem. It shows that the clock controller is continually attempting to lock onto the signal. If slips occur, 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 outside source. Instead, it provides its own internal clock to the system. This mode can be used when the CS 1000 acts as a master clock source for other systems in the network. Free-run mode is undesirable if the CS 1000 is intended to be a slave to an external network clock. Free-run mode can occur when both the primary and secondary clock sources are lost due to hardware faults or invoked using software commands.

Physical description

Faceplate LEDs

Each motherboard (NTDW79AAE5 UDT E1/T1 card) has four DTI/PRI LEDs and one clock controller LED. The clock controller LED is dual-color (red and green). The clock controller LED states are described in Table 240: Faceplate LEDs on page 576.

Table 240: Faceplate LEDs

State	Definition
On (Red)	The clock controller is equipped and disabled/not configured.
On (Green)	The clock controller is equipped, enabled, and is either locked to a reference or is in free run mode.
Flashing (Green)	The clock controller is equipped and is 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.

Functional description

The main functional blocks of the Universal clock controller daughterboard include:

- phase difference detector circuit
- digital phase lock loops (PLL)
- digital-to-analog converter
- signal conditioning drivers and buffers

- sanity timer
- microprocessor
- CPU interface
- Oven Controlled Voltage Controlled Oscillator (OCVCXO)

Phase difference detector circuit

This circuit, under firmware control, enables a phase difference measurement to be taken between the reference entering the PLL and the system clock. The phase difference is used for making frequency measurements and evaluating input jitter and PLL performance.

Digital phase lock loops

The main digital PLL enables the clock controller to provide a system clock to the CPU. This clock is both phase and frequency locked to a known incoming reference.

The hardware has a locking range of + 4.6 ppm for Stratum 3 and + 50 ppm for Stratum 4 (CCITT).

A second PLL on the clock controller provides the means for monitoring another reference. Note that the error signal of this PLL is routed to the phase difference detector circuit so the microprocessor can process it.

System clock specification and characteristics

As the accuracy requirements for CCITT and EIA Stratum 3 are different, it is necessary to have two TCVCXOs which feature different values of frequency tuning sensitivity. See Table 241: System clock specification and characteristics on page 577.

Table 241: System clock specification and characteristics

Specifications	CCITT	EIA
Base Frequency	20.48 MHz	20.48 MHz
Accuracy	±3 ppm	±1 ppm
Operating Temperature	0 to 70 C ±1 ppm	0 to 70 C ±1 ppm
Drift Rate (Aging)	±1 ppm per year	±4 ppm in 20 years
Tuning Range (minimum)	±60 ppm min.	±10 ppm min.
	±90 ppm max.	±15 ppm max.
Input Voltage Range	0 to 10 volts, 5 V center	0 to 10 volts, 5 V center

EIA/CCITT compliance

The clock controller complies with 1.5 Mb EIA Stratum 3ND, 2.0 Mb CCITT or 2.56 Mb basic rate. The differences between these requirements mainly affect PLL pull in range. Stratum 4 conforms to international markets (2.0 Mb) while Stratum 3 conforms to North American markets (1.5 Mb).

Monitoring references

The primary and secondary synchronization references are continuously monitored to provide autorecovery.

Reference switchover

Switchover may occur in the case of reference degradation or loss of signal. When performance of the reference degrades to a point where the system clock is no longer allowed to follow the timing signal, then the reference is out of specification. If the reference being used is out of specification and the other reference is still within specification, an automatic switchover is initiated without software intervention. If both references are out of specification, the clock controller provides holdover.

Autorecovery and chatter

If the command "track to primary" is given, the clock controller tracks to the primary reference and continuously monitors the quality of both primary and secondary references. If the primary goes out of specification, the clock controller automatically tracks to secondary when the secondary is within specifications. On failure (both out of specification), the clock controller enters the HOLDOVER mode and continuously monitors both references. An automatic switchover is initiated to the reference that recovers first. If the secondary recovers first, then the clock controller tracks to the secondary, then switches over to the primary when the primary recovers. If the primary recovers first, the clock controller tracks to the primary and continues to do so even if the secondary recovers.

If the command "track to secondary" is given, the clock controller tracks to the secondary reference and continuously monitors the quality of both primary and secondary references. If the secondary goes out of specification, the clock controller automatically tracks to primary provided that is within specifications. On failure (both out of specification), the clock controller enters the HOLDOVER mode and continuously monitors both references. An automatic switchover is initiated to the reference that recovers first. If the primary recovers first, the clock controller tracks to the primary, but switches over to the secondary when the secondary recovers. If the secondary recovers first, the clock controller tracks to the secondary even if the primary recovers.

To prevent chatter due to repeated automatic switching between primary and secondary reference sources, a time-out mechanism of at least 10 seconds is implemented.

Digital to analog converter

The Digital to Analog Converter (DAC) enables the microprocessor to track, hold, and modify the error signal generated in the digital PLL.

The firmware uses the available memory on the clock controller to provide error-burst detection and correction. Temporary holdover occurs in the momentary absence of the reference clock.

Holdover and free-run

In the temporary absence of a synchronization reference signal, or when sudden changes occur on the incoming reference due to error bursts, the clock controller provides a stable holdover. Free-run mode is initiated when the clock controller has no record of the quality of the incoming reference clock.

If the command "free run" is given, the clock controller enters the free-run mode and remains there until a new command is received. Free-run automatically initiates after the clock controller is enabled.

Signal conditioning

Drivers and buffers are provided for all outgoing and incoming lines.

Sanity timer

The sanity timer resets the microprocessor in the event of system hang-up.

Microprocessor

The microprocessor does the following:

- communicates with software
- monitors two references
- provides a self-test during initialization
- minimizes the propagation of impairments on the system clock due to errors on the primary or secondary reference clocks

Reference Clock Selection

The DTI/PRI card routes its reference to the appropriate line on the backplane. The clock controller distributes the primary and secondary references and ensures that no contention is present on the REFCLK1 backplane line. It designates the DTI/PRI motherboard as a primary reference source. The secondary reference is obtained from another DTI/PRI card, which is designated by a technician. No other clock sources are used.

External timing interface

The clock controller provides an external timing interface and accepts two signals as timing references. An external reference is an auxiliary timing clock which is bridged from a traffic carrying signal and is not intended to be a dedicated non-traffic-bearing timing signal. The clock controller uses either the external/auxiliary references or the DTI/PRI references.

Hardware integrity and regulatory environment

The clock controller complies with the following hardware integrity and regulatory specifications:

Item	Specification
EMI	FCC part 15 sub- part J CSA C108.8 CISPR publication 22
ESD	IEC 801-2
Temperature	IEC 68-2-1 IEC 68-2-2 IEC 68-2-14
Humidity	IEC 68-2-3
Vibration/Shock	IEC 68-2-6 IEC 68-2-7 IEC 68-2-29 IEC 68-2-31 IEC 68-2-32

Chapter 36: NTDW60 Media Gateway Controller Card

Contents

This section contains information on the following topics:

Introduction

The NTDW60 Media Gateway Controller (MGC) card provides a gateway controller for MG 1000E IP Media Gateways in an Avaya Communication Server 1000E (Avaya CS 1000E) system. The MGC only functions as a gateway controller under control of an Avaya CS 1000E Call Server.

The NTDW98 MGC card is functionally identical to the NTDW60, but contains a metal faceplate for enhanced EMC containment. Avaya recommends you use a NTDW98 MGC card in the Media Gateway 1010 (MG 1010).

The MGC card has two expansion sites to accommodate Digital Signal Processor (DSP) daughterboards (DBs). The daughterboards are described in NTDW62, NTDW64, and NTDW78 Media Gateway Controller Daughterboards on page 631.

The MGC card occupies the system controller slot 0 in the Media Gateway chassis.

The MGC card, without expansion daughterboards, includes the following components and features:

- Arm processor.
- 128 MB RAM.
- 4MB boot flash.
- Internal CompactFlash (CF) card mounted on the card. It appears to the software as a standard ATA hard drive.
- Embedded Ethernet switch.
- Six 100 BaseT Ethernet ports for connection to external networking equipment.
- Four character LED display on the faceplate.
- Two PCI Telephony Mezzanine Card form factor sites for system expansion.
- Real time clock (RTC).
- Backplane interface.
- Three serial data interface ports.

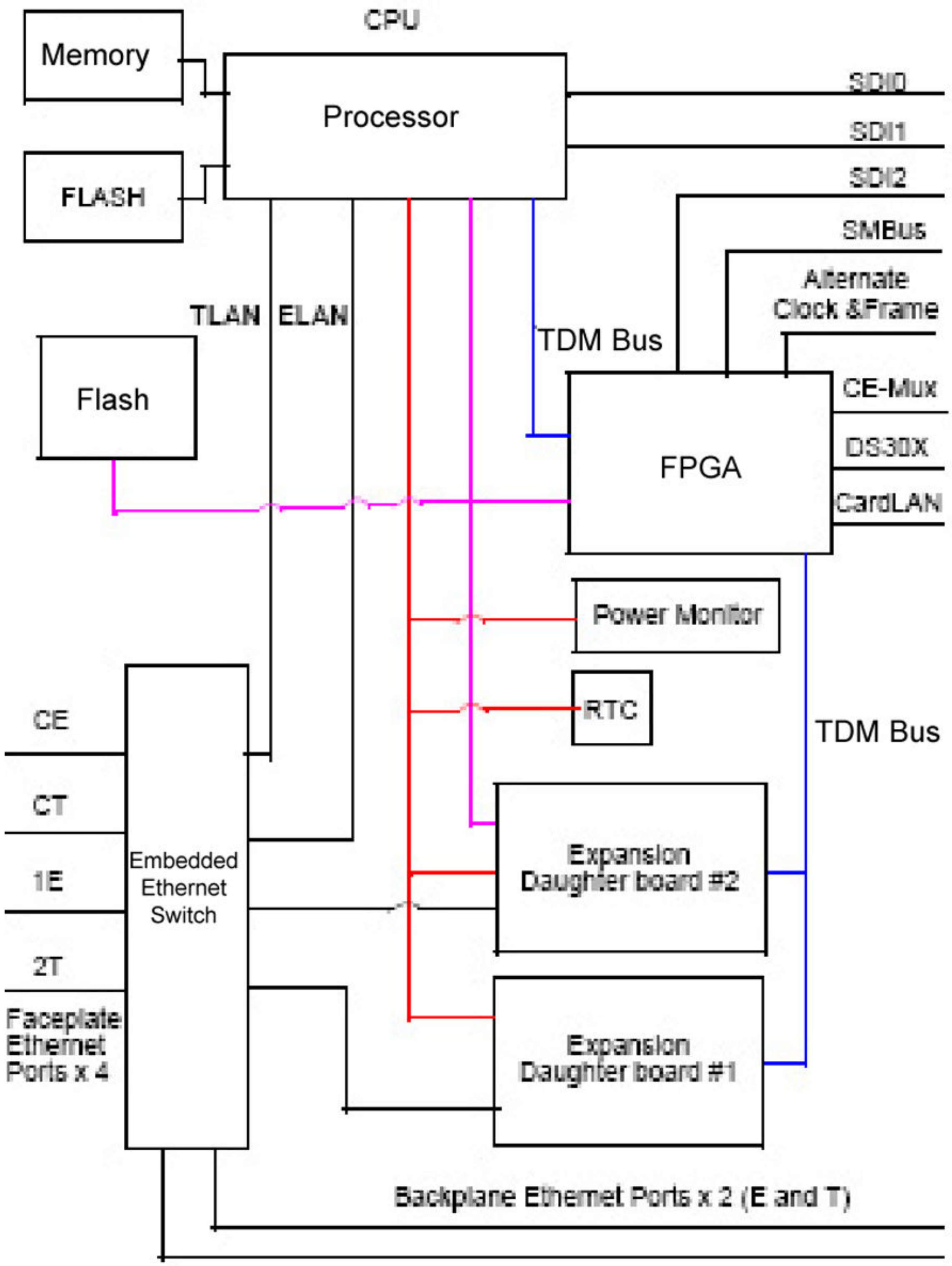


Figure 163: MGC block diagram

Processor

The processor combines RISC processors, DSP resources, SDRAM controller, and UARTs. The processor runs the application as well as providing tone and conference functions. It interfaces to the rest of the system using Ethernet.

Ethernet ports

External connections

Of the six external Ethernet ports, three are reserved for ELAN subnet connections and three for TLAN subnet connections. Two ELAN ports and two TLAN ports are accessed via RJ-45 connectors on the faceplate. The third ELAN and the third TLAN port are connected to the backplane.

The two ports connected to the backplane are available if a CS 1000M cabinet is used. This cabinet does not require a backplane adapter.

Internal connections

Four Ethernet ports provide internal connections: one to each of the expansion daughterboards, and a TLAN subnet and an ELAN subnet connection to the processor.

Expansion daughterboards

Both expansion sites use the same PMC form factor and pin-out. However, one site is intended for a VoIP daughterboard only and provides Ethernet and TDM connectivity. It is not accessible from the faceplate and a PCI bus is not available. The other site provides a full PCI bus and faceplate accessibility in addition to Ethernet and TDM.

Backplane interface

The FPGA features include:

- Serial data interface port
- Time slot interchanger (TSIC)
- SSD X12/A10 signaling interface
- CE-Mux bus interface
- CardLan interface
- DS30x interface
- TDM bus for tones and conference
- System clock generation and system clock reference

Serial data interface ports

The MGC has three serial data interface (SDI) ports. The ports can be used locally for debugging, or they can be configured in the CS 1000E Call Sever as system terminals. Only ports SDI 0 and SDI 1 can be used to access the installation menu during initial configuration of the MGC. SDI 2 is not available during bootup. Due to a limitation of the three port cable used, SDI 1 and SDI 2 do not use hardware flow control. Only SDI 0 has full modem support.

TTY default settings

The default tty settings for the SDI ports are:

- Baud rate: 9600.
- Data bit length: 8.
- Stop bit: 1.
- Parity: none.
- Flow control: none.

MGC serial port configuration change

If the serial ports are configured as SL1 terminals on the Call Server, the tty default settings can be changed in LD 17. Any values configured in LD 17 are downloaded to the MGC and override default values. The downloaded values persist over restarts and power outages. A system message is output when the serial port baud rate is changed.

Faceplate LED display

The faceplate on the MGC card has a four character LED display.

The diagnostic messages summarized in the following table are displayed on the faceplate.

Table 242: Faceplate display

Message	Description
BOOT	This is the first message displayed when the system becomes active.
POST	Power on self test. This message is displayed when the MGC is carrying out system tests during power up.
PASS	Power on self test pass.
EXXX	Error code. XXX is a numeric value. An error code is displayed if a serious system error is detected.
LOAD	Application software is loading.
LLL:S	IPMG super loop and MGC shelf number. LLL is the superloop number. S is the shelf number. For example, 032:0, 120:1

Faceplate LED display

In a normal boot process the diagnostic messages would be displayed in the following order:

1. BOOT
2. POST
3. PASS
4. LOAD

If there is a fatal self test error during bootup, an error code appears and the PASS and LOAD messages are not displayed.

During normal operations the LED displays the IP Media Gateway (IPMG) superloop and MGC shelf number. If an error occurs the display cycles between the shelf number and the error code. Each item is displayed for 20 seconds.

Chapter 37: NTDW20 Media Gateway Extended Peripheral Equipment Controller card

Contents

This section contains information on the following topics:

Introduction

The NTDW20 Media Gateway Extended Peripheral Equipment Controller (MG XPEC) is a dual card assembly based on Media Gateway Controller (MGC) hardware. It provides control over line cards in an IPE shelf. The MG XPEC consists of a mother board (MB) and a daughter board (DB), which operate independently of one another. Each board provides the same hardware functionality as that of an MGC.

Each card (MB/DB) of the dual-card assembly contains the following features:

- MindSpeed Chagall-2 Processor M82515 to run Avaya proprietary software
- Two on-board M82710 processors, as two High Density DSP DB (on-board), provide 192 DSP Channels with media security
- Ten port Embedded Fast Ethernet Switch
- Two faceplate 100 BaseT E-LAN ports

- Two faceplate 100 BaseT T-LAN ports
- SDRAM
- Local Flash Boot-ROM
- Compact Flash Card (ATA) Program Store and file system
- FPGA for Avaya proprietary connection for A31, TSIC, CardLan, UART
- Two Remote TTY ports
- Faceplate Four-Character Hex display
- RTC with charge capacitor hold-up
- In-rush power controller to support hot-plug

In addition to the previously listed features, the MB consists of the following:

- Clock circuitry of Stratum 4 quality; allow clock daisy chain to form among several MG XPEC shelves, see *Avaya Communication Server 1000E Installation and Commissioning* (NN43041-310)
- One Remote TTY for XSM
- MG XPEC MB also provides a relay to replace the PFTU relay in the XSM module loaded in the base of the column

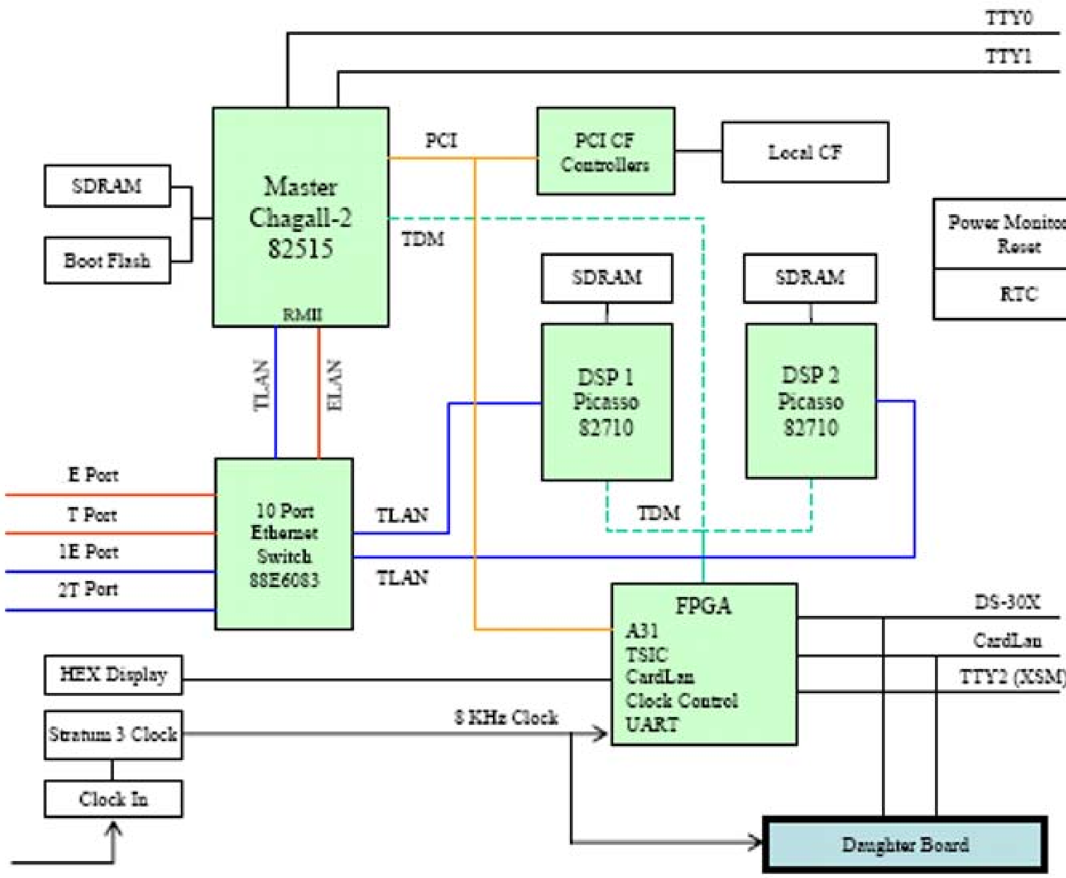


Figure 164: MG XPEC block diagram

The MGC and MG XPEC run the same MGC loadware. A run-time check exists to identify which hardware platform the MGC loadware is running on. Therefore, each half of the dual card assembly functions identically to the MGC, except for the following differences:

- Each board of the dual assembly controls 8 slots of the IPE shelf for a total of 16. The MGC controls 10 slots. The motherboard controls the 8 IPE slots to the left of the MG XPEC and the daughter board controls the 8 IPE slots to the right of the MG XPEC. Card slots are numbered from 0 to 7 for the mother board and 0 to 7 for the daughter board, whereas the MGC card slots are numbered from 1 to 10.
- IPE shelves do not support CEMUX cards. CEMUX cards are supported in a CS 1000E shelf populated with an MGC card.
- The mother board and daughter board share the Card LAN bus between each other.
- Boot messages only display on TTY port 0 (needed for PMS support).
- MG XPEC cards slots 8, 9 and 10 are dedicated for DSP resources.

- The MG XPEC registers to the call server as an IPMG type of MGX.
- Overlays accept, as input and print, an IPMG type of MGX for the MG XPEC in all instances where it uses an IPMG type of MGC for the MGC.

There are no removable DSP daughter boards on the MG XPEC. One-hundred and ninety-two DSP resources populate each board of the dual assembly. The software treats the DSP resources as MGC DSP daughter boards. Therefore, from a software perspective, each board of the dual assembly possesses two high density MGC DSP daughter boards.

When replacing the Extended Peripheral Equipment Controller (XPEC) card with the MG XPEC, all equipment in the common equipment and network shelves are not used. The MG XPEC communicates with the Call Server through the ELAN instead of the DS30Y TDM loops used by the previous XPEC card.

To the Call Server, the MG XPEC appears as two separate IPMG loops.

Important:

The IPMG package must be enabled so that the Call Server can accept the IP media gateway connections.

Processors

Chagall-2 Core

The MG XPEC utilizes a MindSpeed Chagall-2 Processor M82515 to execute Avaya software. The Chagall-2 processor combines an ARM9 RISC processor (CSP) for user applications, a second ARM9 RISC processor (MSP), and DSP resources for packet and media processing. The Chagall-2 processor also provides a shared memory interface, an SDRAM controller, UARTs and Ethernet interfaces.

DSP processors

Two on-board M82710 processors, as two High Density DSP DB (on-board), provide 192 DSP Channels with media security. The MindSpeed Picasso processor (M82710) voice solution is used.

Ethernet interfaces

The Chagall-2 processor contains two external Ethernet interfaces as well as internal virtual Ethernet ports.

The MSP controls both external Ethernet interfaces and the CSP accesses them through a virtual Ethernet port as part of the internal shared memory bus. One interface, the standard Chagall-2 Ethernet port, provides the media path and slave control interface (TLAN) and the other provides the ELAN interface. Another virtual Ethernet port provides the CSP to MSP communication path.

Backplane interface

The following interfaces are provided on Communication Server 1000 MG XPEC (IP XPEC) backplane connector for both MB and DB:

- DS-30X voice/signalling
- Card LAN
- TTY ports

DS-30X voice/signalling

The DS30X bus contains 32 timeslots for each IPE slot. Each timeslot consists of 8 bits of TDM data and 2 bits of signalling data. The FPGA performs the transformation between 10 bits DS30X timeslot and 8 bits TDM timeslot of the MindSpeed processors.

Card LAN

Like the MGC, the FPGA implements the local back plane 19200 baud CardLan UART functionality. The MB and DB must share control of the Card LAN bus through hardware negotiation. The hardware negotiation takes place in the FPGA of MB and DB.

TTY ports

Two TTY ports (TTY0, 1) from the Master Chagall-2 are routed to backplane for general usage.

The MB contains a third TTY port (TTY2), which is reserved for XSM connection. The DB TTY2 is not used.

LED indicators

The faceplate Ethernet port contains LED indicators incorporated into and RJ45 connector. The Embedded Ethernet Switch directly controls the faceplate Ethernet port.

The backplane TLAN/ELAN ports' RJ45 connectors are installed on Backplane . The LED indicators contain the same signal assignment as faceplate RJ45 connectors.

Table 243: Ethernet LED indicator functions on page 592 summarizes the Ethernet LED indicator functions.

Table 243: Ethernet LED indicator functions

TLAN/ELAN LED color	Function
yellow	speed
green	link/activity

When a link is establish, the green LED illuminates and flashes when activity exists on the link. When the link is established at a 100 BaseT speed, the yellow LED illuminates, otherwise it does not illuminate.

Network connections and dual homing

Each of the dual assembly boards of the MG XPEC contains 4 physical network connections. The MG XPEC contains no physical network back plane connection as does the MGC. The dual homing feature on the MGX works identically to the MGC, except all 4 network connection are on the faceplate. Faceplate connections must be routed to the rear I/O using the new NTDW25AAE6 cable kit. See Figure 165: MG XPEC faceplate on page 593 for the MG XPEC faceplate.

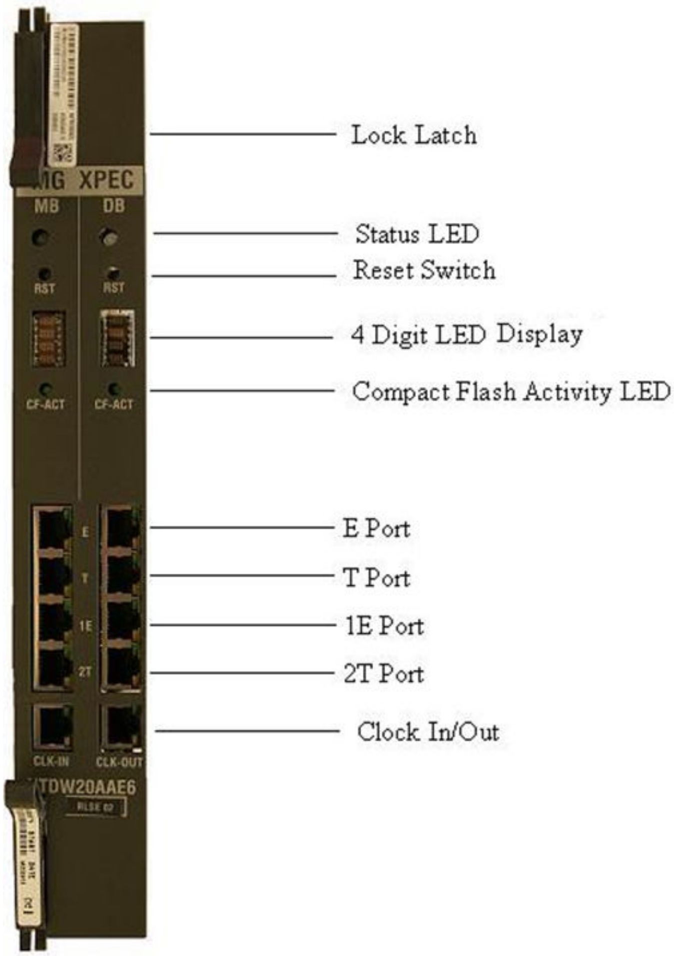


Figure 165: MG XPEC faceplate

Dual homing works independently for each half of the dual assembly board. Network traffic sent and received on one board is not seen by the other.

To connect an MG XPEC for dual homing, each half requires the following:

- 2 ELAN physical connections
- 2 TLAN physical connections
- 1 ELAN IP address
- 3 TLAN IP addresses

Therefore a total of following exists for each MG XPEC card:

- 4 ELAN physical connections
- 4 TLAN physical connections
- 2 ELAN IP address
- 6 TLAN IP addresses

If you do not require dual homing then only one physical ELAN connection and one physical TLAN connection is required for each board in the dual assembly.

You do not have to connect both halves of the board to get the other working, since each half of the dual assembly is stand alone.

Chapter 38: NTDW56 and NTDW59 Common Processor Media Gateway card

Contents

This section contains information on the following topics:

Introduction

The hardware for the Common Processor Media Gateway (CP MG) card consists of integrating a Common Processor, a Gateway Controller, and non-removable Digital Signal Processor (DSP) resources into a single card for use in an Avaya Communication Server 1000E (Avaya CS 1000E) system. The CP MG card design is based on the CP PM card and MGC card with DSP daughterboards. The CP MG card is available in two versions:

- NTDW56BAE6 - CP MG card with 32 DSP ports
- NTDW59BAE6 - CP MG card with 128 DSP ports

The CP MG card provides improvements in port density and cost reductions by functioning as a Co-resident Call Server and Signaling Server (Co-res CS and SS) and a Gateway Controller with DSP ports while only occupying slot 0 in a Media Gateway cabinet or chassis.

The CP MG card includes the following components and features:

- Intel EP80579 integrated processor, 1200 Mhz (Common Processor)
- 2 GB DDR2 RAM (expandable to 4 GB)
- 160 GB SATA hard drive
- USB to 1-wire bridge chip from Intel processor to security device
- One faceplate USB 2.0 port for software installations and upgrades
- Two faceplate Common Processor TTY serial ports
- Mindspeed Chagall-2 processor M82515 to run Avaya proprietary software (MGC, tone and conference)
- SPI flash for BIOS storage
- Compact Flash card (ATA) for Chagall-2 file system
- Onboard flash boot-ROM
- Three backplane TTY ports, two from Chagall-2, one from Intel Common Processor
- Mindspeed Picasso M82710 or Matisse M82910 for VoIP or DSP resources
- Ten port embedded fast Ethernet switch
- One faceplate 100 BaseT T-LAN port
- One faceplate 100 BaseT E-LAN port
- One backplane 100 BaseT T-LAN port
- One backplane 100 BaseT E-LAN port
- Faceplate status LED and card reset buttons
- In-rush power controller to support hot-plug

The CP MG hardware block diagram is a schematic of the CP MG hardware.

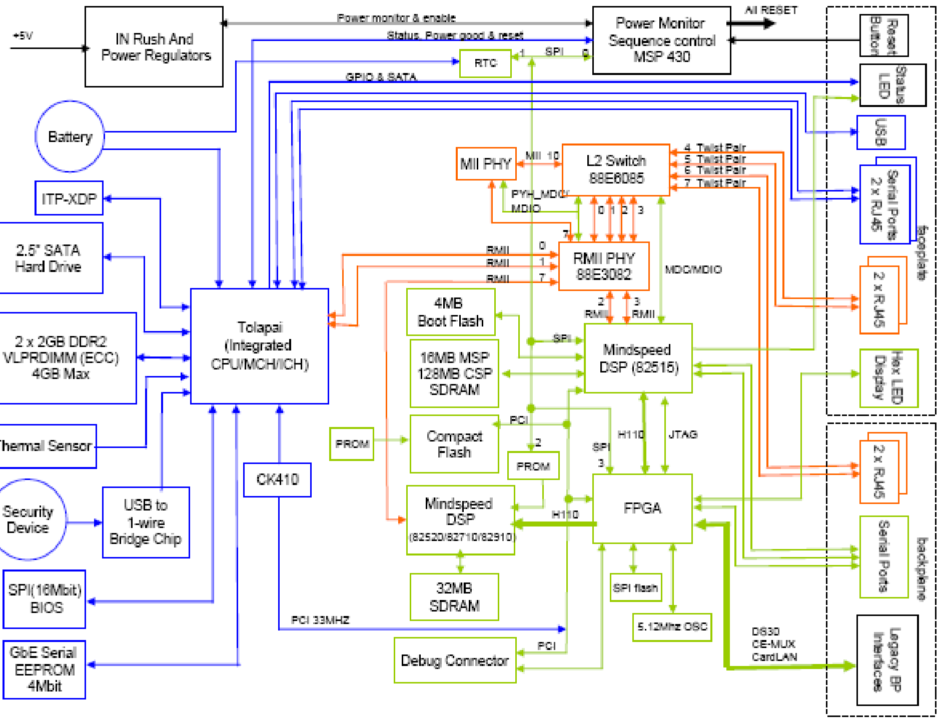


Figure 166: CP MG hardware block diagram

The Gateway Controller component of the CP MG card is based on the same architecture as the MGC card. For more information about the Gateway Controller architecture, see NTDW60 Media Gateway Controller Card on page 581. The Gateway Controller component of the CP MG card registers with the Call Server with an Internet Protocol Media Gateway (IPMG) type of MGS. The Avaya CS 1000E system uses a common Gateway Controller loadware for the MGC, MG XPEC, and MGS.

Important:

The IPMG package must be enabled so that the Call Server can accept the IP Media Gateway connections.

Cabinet and chassis support

The CP MG card is supported in the following Media Gateway chassis:

- MG 1000E main chassis
- MG 1000E expander chassis
- MG 1010 chassis

The CP MG card occupies the system controller slot 0 in a Media Gateway chassis.

Faceplate

The CP MG card faceplate provides reset buttons, status LEDs, a four character LED display, a USB 2.0 port, two serial connections, and two Ethernet connections. A labelled CP MG card faceplate is shown in Figure 167: CP MG faceplate on page 598.

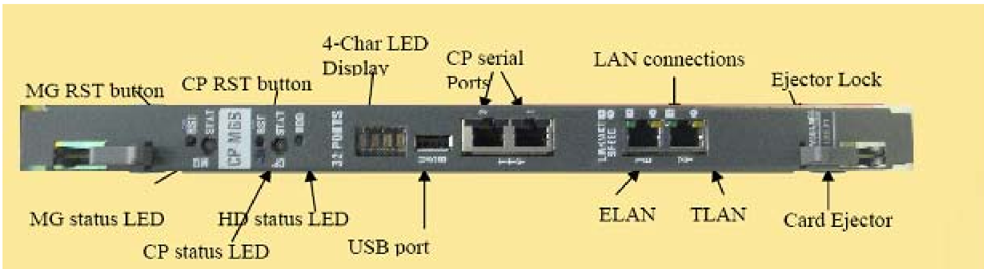


Figure 167: CP MG faceplate

The Common Processor (CP) and Gateway Controller (MGS) reset buttons provide a hardware reset for each component. The reset buttons are recessed to prevent accidental resets. You must use a small blunt object to press the reset buttons. You can perform a CP hardware reset with a press of the CP reset button. You can perform a MGS reset with a press of the MG reset button. You can also perform a MGS password reset, see Resetting the CP MG card MGS password on page 598.

Resetting the CP MG card MGS password

1. At the LDB shell login prompt, type resetPWD and follow the instructions.
2. Press the MG reset button on the CP MG faceplate.

The CP MG faceplate USB 2.0 port allows you to use a USB 2.0 storage device to install, upgrade, or patch the Linux base software on the CP MG card.

Status LED

The CP and MG status LEDs are tri-color status indicators for each component, see Table 244: CP MG faceplate LED status on page 598. The HD status LED flashes to indicate SATA hard drive activity.

Table 244: CP MG faceplate LED status

LED color	Common Processor status	Gateway Controller status
Green	All applications running	Not used

LED color	Common Processor status	Gateway Controller status
Orange	Linux running, applications booting	Self test error
Red	BIOS and Linux Base initializing	Booting
Flashing Red	Not used	Self test passed
Off	No power	Running, or no power

LED display

The four character LED display provides information on the CP MG card status during power-on self test and during boot. The four character LED display provides super-loop and shelf information when the Media Gateway registers with the Call Server. The four character LED display also provides the IP link status between the MGS and the Call Server.

The diagnostic messages display on the CP MG faceplate, see Table 245: CP MG LED display on page 599

Table 245: CP MG LED display

Message	Description
BOOT	This is the first message displayed when the system becomes active.
POST	Power on self test. This message is displayed when the MGS is carrying out system tests during power up.
PASS	Power on self test pass.
EXXX	Error code. XXX is a numeric value. An error code is displayed if a serious system error is detected.
LOAD	Application software is loading.
LLL:S	IPMG super loop and MGS shelf number. LLL is the superloop number. S is the shelf number. For example, 032:0, 120:1

In a normal boot process the diagnostic messages display in the following order:

1. BOOT
2. POST
3. PASS
4. LOAD

If a fatal self test error occurs during bootup, an error code appears and the PASS and LOAD messages do not display.

During normal operations the LED displays the IP Media Gateway (IPMG) superloop and MGS shelf number. If an error occurs the display cycles between the shelf number and the error code. Each item is displayed for 20 seconds.

Serial data interface ports

The two RJ45 serial ports (TTY1, TTY2) provide serial connections to the Common Processor. The CP MG card serial ports are factory configured to 9600 bps 8-N-1. You require an NTC325AAE6 CP MG serial port adapter kit, a customer provided straight through Cat-5 Ethernet cable, a 9 pin and a 25 pin serial cable, and a maintenance terminal to establish serial connections. The NTC325AAE6 CP MG serial port adapter kit includes a 9 pin and a 25 pin adapter. The 9 pin adapter provides TX, RX, and ground for null modem. The 25 pin adapter provides a full set of signals without null modem for DCE. The CP MG serial port adapter kit is required to connect to a 9 pin or 25 pin serial cable. The adapter kit pin mapping is shown in Table 246: CP MG serial port adapter kit pin mapping on page 600.

Table 246: CP MG serial port adapter kit pin mapping

RJ45	DB-9 pin	DB-25 pin	I/O	Description
1	6	6	I	DCE Data Set Ready (DSR)
2	1	8	I	Received Line Signal Detector (DCD)
3	4	20	O	DTE Data Terminal Ready (DTR)
4	5	7		Signal Ground (SG)
5	2	3	I	Received Data (RXD)
6	3	2	O	Transmitted Data (TXD)
7	8	5	I	Clear to Send (CTS)
8	7	1	O	Request to Send (RTS)

Ethernet connections

The CP MG card provides four external Ethernet LAN connections. Two connections are on the faceplate, and two connections are on the backplane. Dual homing is supported on each pair of LAN connections. The CP MG card does not support a High Speed Pipe (HSP) connection.

The two faceplate Ethernet ports (1E, 2T) provide TLAN and ELAN connections. The Ethernet ports contain integrated LEDs to provide link, activity, and speed indicators, see Table 247: CP MG faceplate TLAN and ELAN LED status on page 601.

Table 247: CP MG faceplate TLAN and ELAN LED status

Ethernet port LED color	Status	Description
Yellow	Speed	ON - 100 BaseT OFF - 10 BaseT
Green	Link and activity	ON - Link established OFF - No link Flashing - Activity on link

The Server and Gateway Controller components of the CP MG card are networked internally through the embedded Ethernet switch on the CP MG card. The Common Processor and Gateway Controller are co-located on the motherboard of the CP MG card, therefore the IP data links between the Server and Gateway Controller do not require external cabling.

You require an NTDW63BAE5 backplane adapter to provide DECT clock reference synchronization connections. The NTDW63BAE5 adapter is the same adapter you use with MGC cards.

Media storage

A Compact Flash card provides the Gateway Controller program and file system storage which is used to store downloaded program images and applications. The PCI to CF bridge device is TI PCI1510. The Compact Flash card presents a standard ATA (disk drive type) interface.

The CP MG card requires a SATA hard drive running the Linux Base Operating System. For new installations, you must install the 160 GB pre-loaded SATA hard drive onto the CP MG card. The 160 GB hard drive contains a pre-installed Linux Base Operating System.

If the hard drive fails, you can replace the hard drive by performing the following procedure.

You need a small Phillips screw driver to install the hard drive.

Replacing the CP MG hard drive

⚠ **Electrostatic alert:**

Observe proper ESD precautions while handling the hard drive and CP MG card.

To install a hard drive on a new CP MG card, perform steps 4 and 5 only.

1. Power off and remove the CP MG card from the Media Gateway cabinet or chassis.
2. Remove the four Phillips screws on the bottom of the CP MG card to unsecure the hard drive, see Figure 168: CP MG card hard drive screws on page 602.

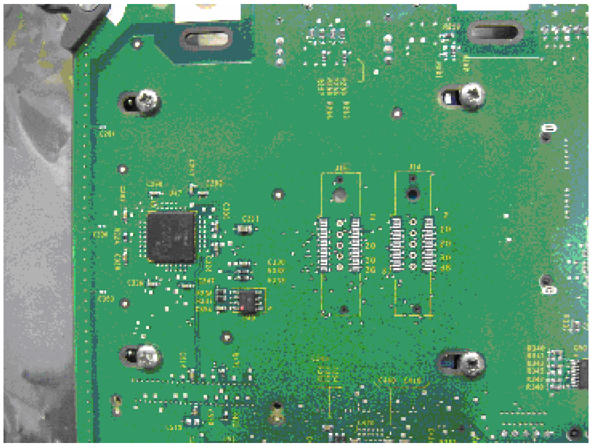


Figure 168: CP MG card hard drive screws

3. Slide the defective hard drive off the SATA connector J7. and remove the defective hard drive from the CP MG card.
4. Place the replacement hard drive on the CP MG card and slide the replacement hard drive into SATA connector J7. See Figure 169: CP MG card hard drive connector on page 602.

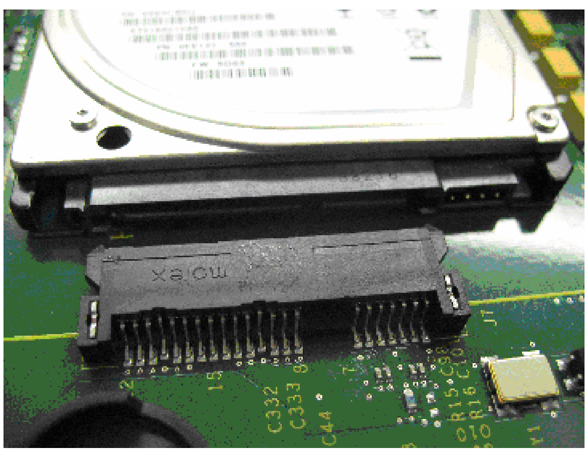


Figure 169: CP MG card hard drive connector

5. Secure the replacement hard drive from the bottom of the CP MG card with the four Phillips screws.

You can reinstall the CP MG card into the Media Gateway cabinet or chassis. If the replacement hard drive does not have Linux Base pre-installed, install the Linux Base software from a bootable USB 2.0 flash drive. For more information, see *Avaya Communication Server 1000 New in this Release, NN43001-115*.

Security Device (Dongle)

The installation of the CP MG Security Device is the same procedure as a CP PM card, however the device is in a different location on the CP MG. Figure 170: CP MG Security Device (Dongle) on page 603 shows the location of the dongle on the CP MG.

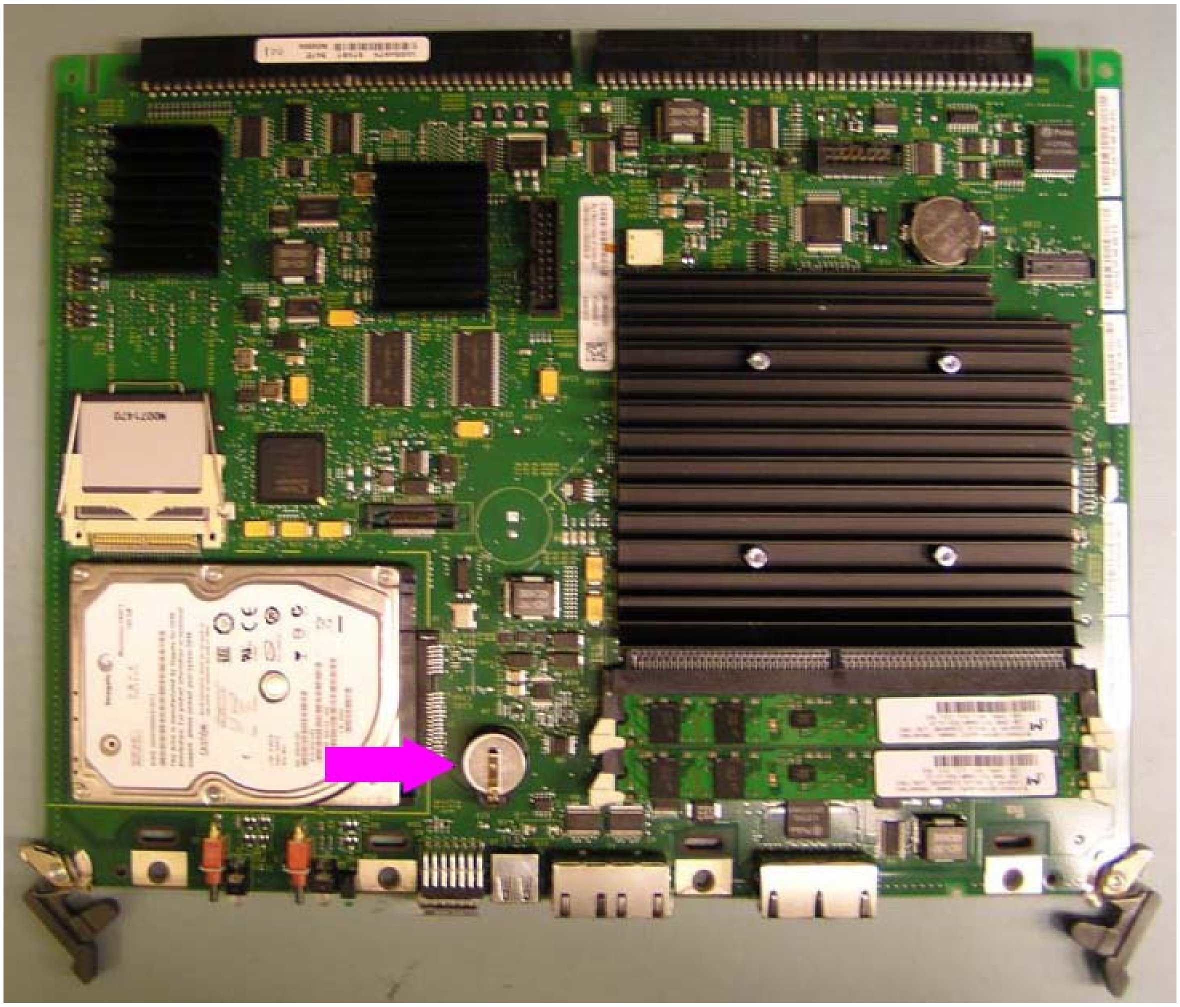


Figure 170: CP MG Security Device (Dongle)

Chapter 39: NTDW53 and NTDW54 Common Processor Dual Core card

Contents

This section contains information on the following topics:

Introduction

The Common Processor Dual Core (CP DC) card is a Server card for use in an Avaya Communication Server 1000E (Avaya CS 1000E) system. The CP DC card is designed to replace the Common Processor Pentium Mobile (CP PM) card. The CP DC card contains a dual core AMD processor and upgraded components which can provide improvements in processing power and speed over the CP PM card. The CP DC card requires the Linux Base Operating System, and supports Co-resident Call Server and Signaling Server, or stand-alone Signaling Server configurations. The CP DC card does not support the standard or high availability Call Server configuration.

The CP DC card is available in two versions:

- NTDW53AAE6 - single slot metal faceplate CP DC card.
- NTDW54AAE6 - double slot metal faceplate CP DC card.

The CP DC card provides performance improvements in MIPS, maximum memory capacity, and network transfer rate, and occupies only one IPE slot in a Media Gateway.

The CP DC card includes the following components and features:

- AMD Athlon 64 X2 1.8 Ghz dual core processor
- 2 GB DDR2 RAM
- 160 GB SATA hard drive
- Three faceplate USB 2.0 ports for software installations, upgrades, patching, and USB keyboard and mouse support
- One faceplate VGA port for monitor support
- Two faceplate Gigabit Ethernet ports
- Faceplate status LED and card reset buttons

You can use a USB 2.0 storage device to install or upgrade the Linux Base Operating System. The CP DC card does not support Compact Flash (CF) cards.

An NTDW5309E6 2 GB memory upgrade kit is available for Media Application Server (MAS) deployments. This upgrades a CP DC card to a total of 4 GB DDR2 RAM.

Important:

The IPMG package must be enabled so that the Call Server can accept IP Media Gateway connections.

Cabinet and chassis support

The NTDW53 single-slot CP DC card is supported in the following chassis:

- MG 1000E cabinet (except for slot 0).
- MG 1000E chassis (except for slot 0).
- MG 1000E expander chassis.
- MG 1010 chassis (except for slot 0).

The NTDW54 double-slot CP DC card is supported in the CS 1000M IPE Universal Equipment Module (UEM).

Slot 0 in a cabinet or chassis is reserved for the Gateway Controller.

Faceplate

The CP DC card is available in two sizes: NTDW53 single slot, and NTDW54 double slot. The CP DC card faceplate provides a reset button, status LEDs, three USB 2.0 ports, one VGA port, and two Gigabit Ethernet ports. The NTDW53 CP DC card faceplate is shown in Figure 171: NTDW53 CP DC faceplate on page 607.

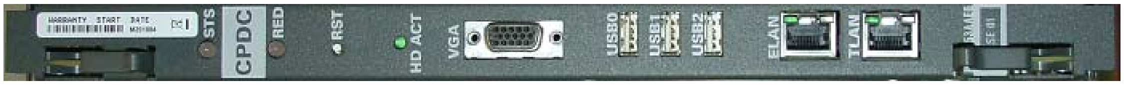


Figure 171: NTDW53 CP DC faceplate

The VGA port provides monitor support. The three USB 2.0 ports provide USB keyboard, USB mouse, and USB 2.0 storage device support. You can use the USB 2.0 ports for software installations, upgrades, and patches.

The reset button provides a CP DC hardware reset. The reset button is recessed to prevent accidental resets. You must use a small blunt object to access the reset button. During a reset the status LED will flash red until the reset is complete. The CP DC card does not provide a faceplate INI button. To re-initialize a CP DC card, use the Command Line Interface (CLI) appstart cs restart command.

Status LED

The CP DC faceplate STS LED is a tri-color system status indicator. To determine the CP DC system status, see Table 248: CP DC faceplate status LED on page 607.

Table 248: CP DC faceplate status LED

LED color	CP DC system status
Green	Link is up
Flashing Green	Link is down
Orange	Linux applications loading
Flashing Orange	Linux applications load successful
Red	BIOS self test
Flashing Red	Bootrom and Linux base loading
Off	No power

The CP DC faceplate RED LED is not active and is intended for future use The RED LED is a tri-color redundancy status indicator.

The HD ACT LED flashes during SATA hard drive activity.

Ethernet connections

The two RJ45 Ethernet ports provide TLAN and ELAN connections. The CP DC card does not contain a High Speed Pipe (HSP) port because Linux base Servers do not use the HSP mechanism. The CP DC Ethernet ports contain two integrated LEDs to provide link, activity, and speed indicators, see Figure 172: CP MG Ethernet port LED indicators on page 608.

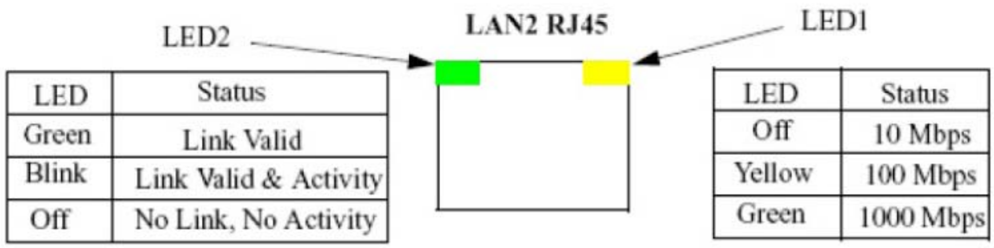


Figure 172: CP MG Ethernet port LED indicators

Important:

If your cabinet or chassis does not require specific Avaya supplied cables for CP DC cards, you must use shielded twisted pair Ethernet cables for CP DC faceplate ELAN and TLAN connections.

Serial data interface ports

The CP DC has two serial data interface (SDI) ports: Port 0 and Port 1. Both ports are standard RS232 DTE ports. They are routed through the backplane of the shelf to a 50-pin main distribution frame (MDF) connector on the back of the shelf. You require a NTAK19ECE6 cable to adapt the 50-pin MDF to a pair of 25-pin DB connectors. A 25-pin null modem is required to adapt an SDI port to a typical PC serial port. Port 0 is used for maintenance access. Port 1 is for an external modem connection.

You can change the baud rate of the CP DC card from the BIOS menu. The default serial connection baud rate of the CP DC card is 9600 bps, no parity, 1 stop bit.

The CP DC card serial port connection procedure remains the same as the CP PM card . For more information, see *Linux Platform Base and Applications installation and commissioning, NN43001-315* .

Media storage

The CP DC card contains a 160 GB SATA hard drive. The hard drive stores the Linux Base Operating System. If the hard drive fails, you can replace it by performing the following procedure.

You need a small Phillips screw driver to install the hard drive.

Replacing the CP DC hard drive

⚠ **Electrostatic alert:**

Observe proper ESD precautions while handling the hard drive and CP DC card.

To install a hard drive on a new CP DC card, perform steps 4 and 5 only.

1. Power off and remove the CP DC card from the Media Gateway cabinet or chassis.
2. Remove the four Phillips screws on the bottom of the CP DC card to unsecure the hard drive, see Figure 173: CP DC card hard drive screws on page 609.

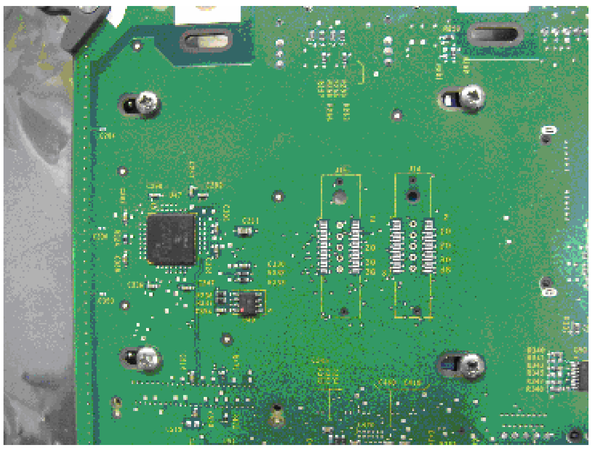


Figure 173: CP DC card hard drive screws

3. Slide the defective hard drive off the SATA connector J8. and remove the defective hard drive from the CP DC card.
4. Place the replacement hard drive on the CP DC card and slide the replacement hard drive into SATA connector J8.
5. Secure the replacement hard drive from the bottom of the CP DC card with the four Phillips screws.

You can reinstall the CP DC card into the Media Gateway cabinet or chassis. If the replacement hard drive does not have Linux Base pre-installed, install the Linux Base software from a bootable USB 2.0 flash drive. For more information, see *Avaya Communication Server 1000 New in this Release, NN43001-115*.

Security Device (Dongle)

The installation of the CP DC Security Device remains the same as the CP PM, however the device is in a different location on the board.Figure 174: CP DC security dongle on page 610 shows the location of the dongle on the CP DC card.

Figure 174: CP DC security dongle

Chapter 40: NTDW61 and NTDW66 Common Processor Pentium Mobile Card

Contents

This section contains information on the following topics:

Introduction

The system hardware for the Common Processor Pentium Mobile (CP PM) consists of one new pack design with multiple variants: CP PM NTDW61 (single slot), NTDW99 (metal faceplate single slot), and CP PM NTDW66 IPE (double slot).

The NTDW99 CP PM card is functionally identical to the NTDW61, but contains a metal faceplate for enhanced EMC containment. Avaya recommends you use a NTDW99 CP PM card in the Media Gateway 1010.

Note:

Limitations: In High Availability (HA) configurations, you must match HA pairs of call processors according to the following criteria:

- You must pair an NTDW99CAEx with another NTDW99CAEx
- You can pair any vintage of NTDW61 or NTDW99Ax with any other NTDW61 or NTDW99Ax; there are no vintage restrictions

The CP PM cards provide a platform for applications including Call Server and Signaling Server, storage of system and customer data and they provide various 10/100/1000 BaseT Ethernet network interfaces. Gateway functionality and shelf container functionality are delivered by the Media Gateway Controller (MGC) card and its Digital Signal Processor (DSP) daughterboard.

The CP PM hardware includes the following components and features:

- Intel Pentium processor.
- Integrated Intel 855GME GMCH/Intel ICH-4 controller chipset.
- Two CompactFlash sockets: (1) a fixed media disk (FMD) on the card and (2) a hot swappable removable media disk (RMD) accessible on the faceplate.
- DDR RAM expandable up to 2 GB.
- Three Ethernet ports.
- Two serial data interface ports.
- One USB port.
- Security device.

When populated with different memory and disk drive options, the CP PM hardware can be used for other purposes. For example, the CP PM hardware can be used as a Call Server or as a platform for the Avaya Communication Server 1000 (Avaya CS 1000) Signaling Server.

The CP PM high level hardware block diagram is a schematic of the CP PM hardware.

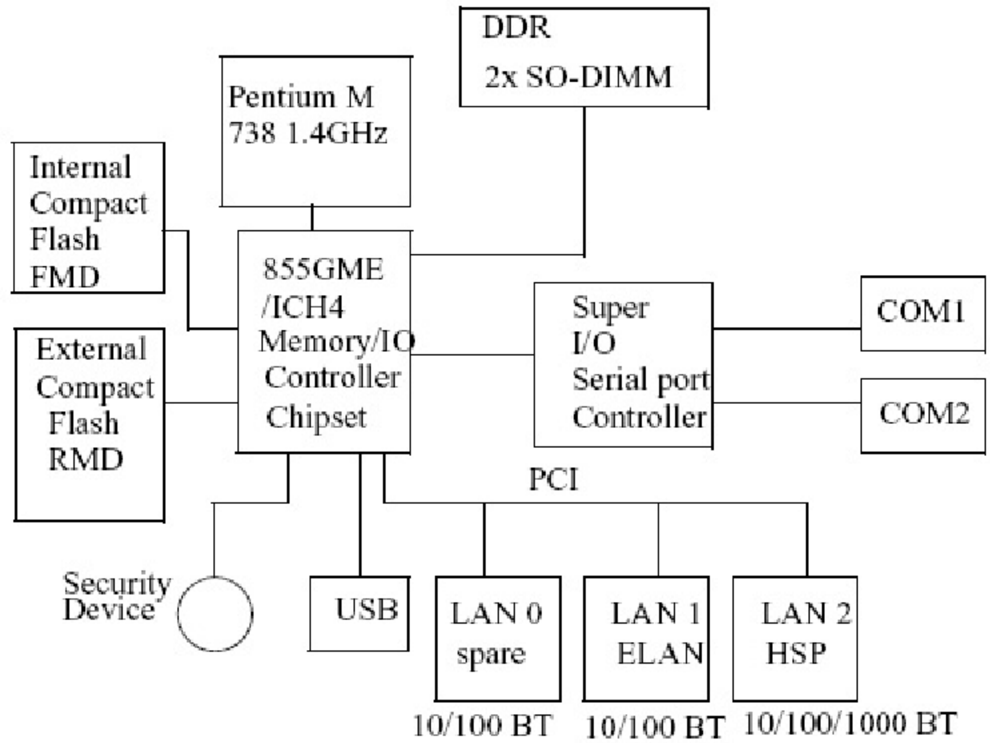


Figure 175: CP PM high level hardware block diagram

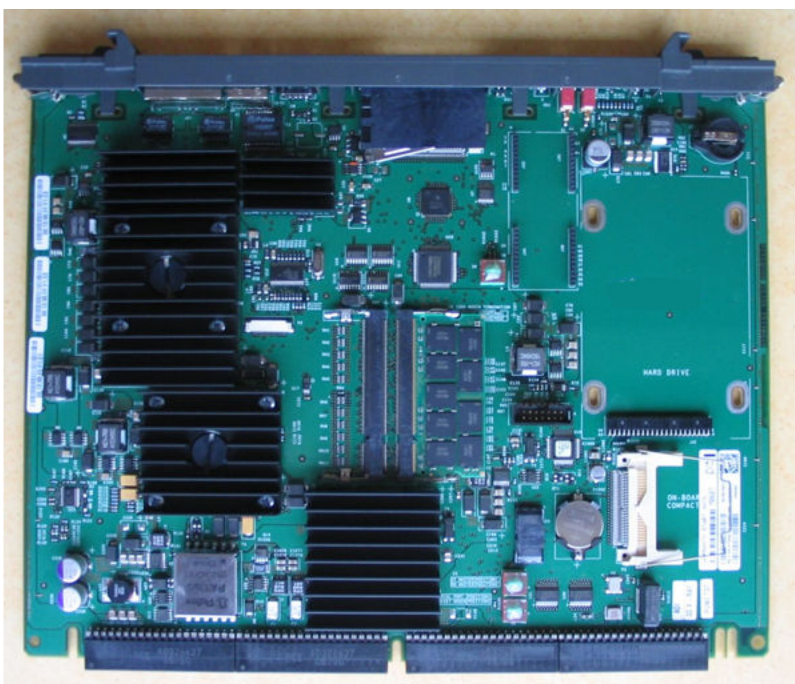


Figure 176: CP PM card

Cabinet/chassis support

The CP PM NTDW61 and NTDW99 single-slot card is supported in the following chassis:

- MG 1000E main chassis (except for slot 0).
- MG 1000E expander chassis.
- MG 1010 chassis (except for slot 0).

The CP PM NTDW66 double-slot card is supported in the CS 1000M IPE Universal Equipment Module (UEM).

Slot 0 in the MG 1000E main chassis are reserved for the MGC card.

Media storage

Fixed media drive

The fixed media drive (FMD) is a CompactFlash (CF) card that is internal to the CP PM card. It is accessible only when the CP PM card is removed from the system. The FMD serves as a hard drive. The Fixed Media Drive is used when CP PM is a Call Server. It is connected directly to the ATA controller in the chipset, which is also known as the hard drive controller.

Removable media drive

The removable media drive (RMD) is a hot swappable CF card accessible from the CP PM faceplate. The CS 1000 software is shipped on a CF card and is loaded onto the CP PM through the RMD. This drive is also used for data backups.

Hard disk drive

The CP PM hardware can be used as a platform for the CS 1000 Signaling Server. When deployed as a signaling server, the CP PM platform is equipped with a hard disk drive.

Note:

The hard drive must have its jumper set for CSEL operation before installation.

Install a hard drive on a CP PM Signaling Server

This section describes the procedure for installing a hard drive on both models of the CP PM Signaling Server (NTDW61BAE5 and NTDW66AAE5). A CP PM Signaling Server Hard Drive kit (NTDW6102E5) ships with the servers, and if required, can also be ordered from Avaya.

The hard drive kit contains a hard drive with a jumper, 4 screws, and installation instructions (document N0120776). You need only a small Phillips screw driver to install the hard drive.

Important:

IMPORTANT!

Observe proper ESD precautions while handling the hard drive and CP PM server.

Use the following procedure to replace the hard drive on a CP PM server.

Replacing the hard drive on a CP PM Signaling Server

1. Ensure jumper is located in the cable select (CS) position according to the labeling on the hard drive.

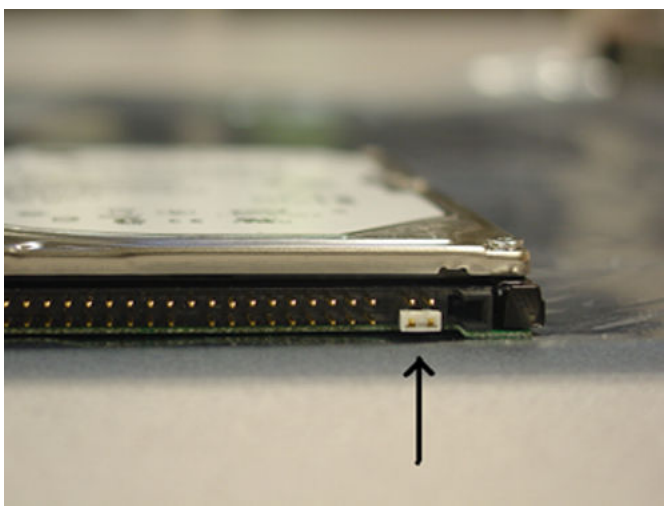


Figure 177: CP PM hard drive jumper

2. Place hard drive on printed circuit board and slide to mate with connector J32.

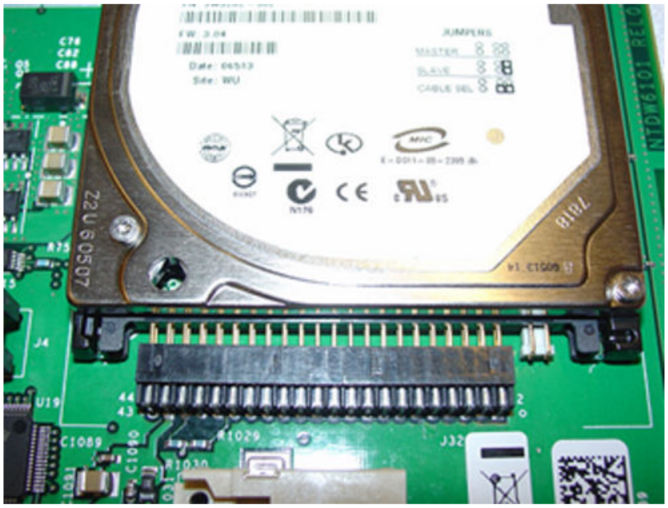


Figure 178: CP PM hard drive and connector J32

3. Secure hard drive from the bottom side with the included screws.

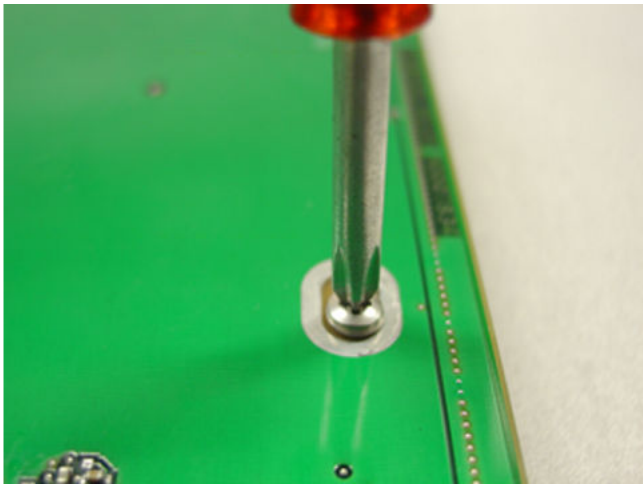


Figure 179: Securing CP PM hard drive to circuit board

4. Place Dip Switch S5 in position 2 to select HD Master option.

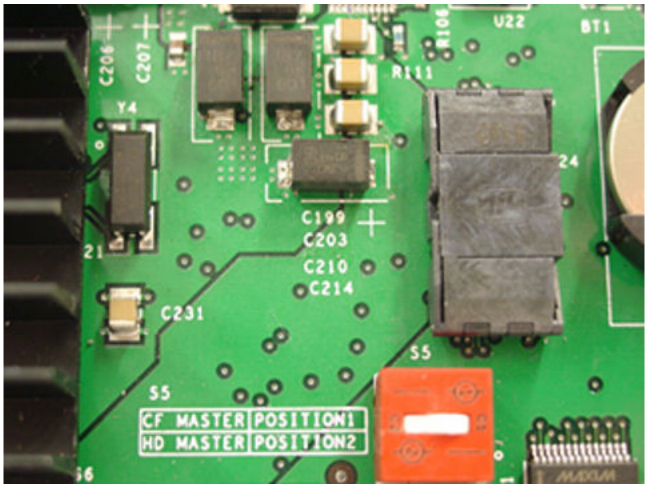


Figure 180: CP PM Signaling Server FMD dip switch

Important:

A CP PM circuit card has an on-board switch (S5) for designating the internal hard drive (HD) or internal Compact Flash (CF) drive as the Fixed Media Device (FMD) for the Signaling Server. You must configure the on-board FMD switch (S5) to position 2 to designate the HD as the FMD for the Signaling Server.

5. Remove on-board compact flash retainer clip if populated.

Figure 181: CP PM Signaling Server internal CF card retainer clip

Memory

The memory controller in the Intel 855 GME graphics memory controller hub (GMCH) supports one channel of DDR 200/266/333 (PC1600/2100/2700) with error correcting code (ECC). The maximum capacity of the controller is 2GB. The main memory is comprised of two 200-pin SO-DIMM modules. This facilitates future upgrades.

Memory upgrade

This section details the procedure to upgrade the CP PM memory.

Ensure that the memory upgrade kit contains a DDR memory module as seen in Figure 182: DDR memory module on page 618

Figure 182: DDR memory module

Upgrading the CP PM memory

1. Locate an empty memory slot on the CP PM card, as shown in Figure 183: CP PM card with empty memory slot on page 619

Figure 183: CP PM card with empty memory slot

2. Grip the memory module by its sides and insert it into the slot at an approximately 30 degree angle.

   Align the notch in the memory module with the protruding pin in the slot, as shown in Figure 184: Inserting a memory module in CP PM card on page 620.

Figure 184: Inserting a memory module in CP PM card

Ensure that you have pushed the module in as far as it can go.

3. While holding the memory module in place, push it down until the two clips on either side snap into place, as shown inFigure 185: Fastening memory module in CP PM card on page 621

Figure 185: Fastening memory module in CP PM card

Note:

If the memory module is not aligned properly, the clips will not snap in place, as shown in Figure 186: Incorrectly aligned memory module on page 622. Remove the memory module and align it correctly.

Figure 186: Incorrectly aligned memory module

4. Ensure that the pins of the memory module are just visible and parallel with the edge of the slot. The module pins must make proper contact with the slot pins, as shown in Figure 187: Correctly aligned memory module on page 623

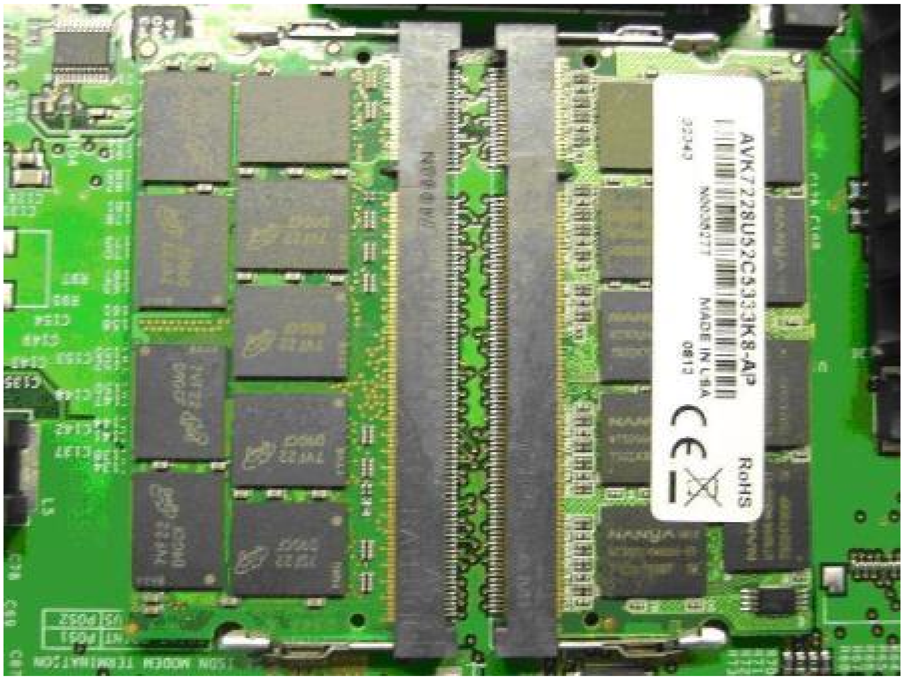


Figure 187: Correctly aligned memory module

> **Note:**
>
> If the module pins do not make proper contact with the slot pins, the system may not recognize the presence of the module.

Ethernet interfaces

There are three Ethernet network interfaces on a CP PM card: HSP, TLAN and ELAN. The network interfaces are application specific.

> **Important:**
>
> If your cabinet or chassis does not require specific Avaya supplied cables for CP PM cards, you must use shielded twisted pair Ethernet cables for CP PM faceplate ELAN and TLAN connections.

ELAN

The ELAN network interface is a 10/100 BaseT port. By default this port is set to autonegotiate. This network interface is used for both Call Server and Signaling Server applications.

HSP

The HSP is a 10/100/1000 BaseT network interface that provides standby Call Server redundancy. By default this network interface is set to autonegotiate.

TLAN

The TLAN network interface is a 10/100 BaseT port. By default this network interface is set to autonegotiate. This network interface is used for Signaling Server applications.

Serial data interface ports

The CP PM has two serial data interface (SDI) ports: Port 0 and Port 1. Both ports are standard RS232 DTE ports. They are routed through the backplane of the shelf to a 50-pin main distribution frame (MDF) connector on the back of the shelf. A cable (NTAK19ECE6) that adapts the 50-pin MDF to a pair of 25-pin DB connectors is shipped with the CP PM. A 25-pin null modem is required to adapt an SDI port to a typical PC serial port. Port 0 is used for maintenance access. Port 1 is for an external modem connection.

TTY parameters

The TTY parameters are configured through the BIOS features configuration menu. The BIOS can be accessed only through TTY Port 0. On the Call Server, TTY parameters can be modified using LD 17. On the Signaling Server, these parameters can be modified using the maintenance shell.

Supported parameters:

- Baud rate: 1200, 2400, 4800, 9600, and 19200.
- Data bit length: 5-8.
- Stp bit: 1, 1.5, and 2.
- Parity: odd, even, and none.

Default parameters for both ports:

- Baud rate: 9600.
- Data bit length: 8.
- Stop bit: 1.

- Parity: none.
- Flow control: none.

USB 2.0 port

The USB port is not currently used by the Call Server or Signaling Server applications.

Security device

The CS 1000 provides an on-board interface for the existing security device (dongle) using a Maxim/Dallas 1-wire to USB interface device. This is used for the Call Server application.

Faceplate

The CP PM faceplate is available in two sizes: NTDW61 single slot, and NTDW66 double slot. The NTDW99 is a single slot metal faceplate CP PM card. The CP PM card faceplate is equipped with Status, Active CPU, CF, and Ethernet LED indicators.

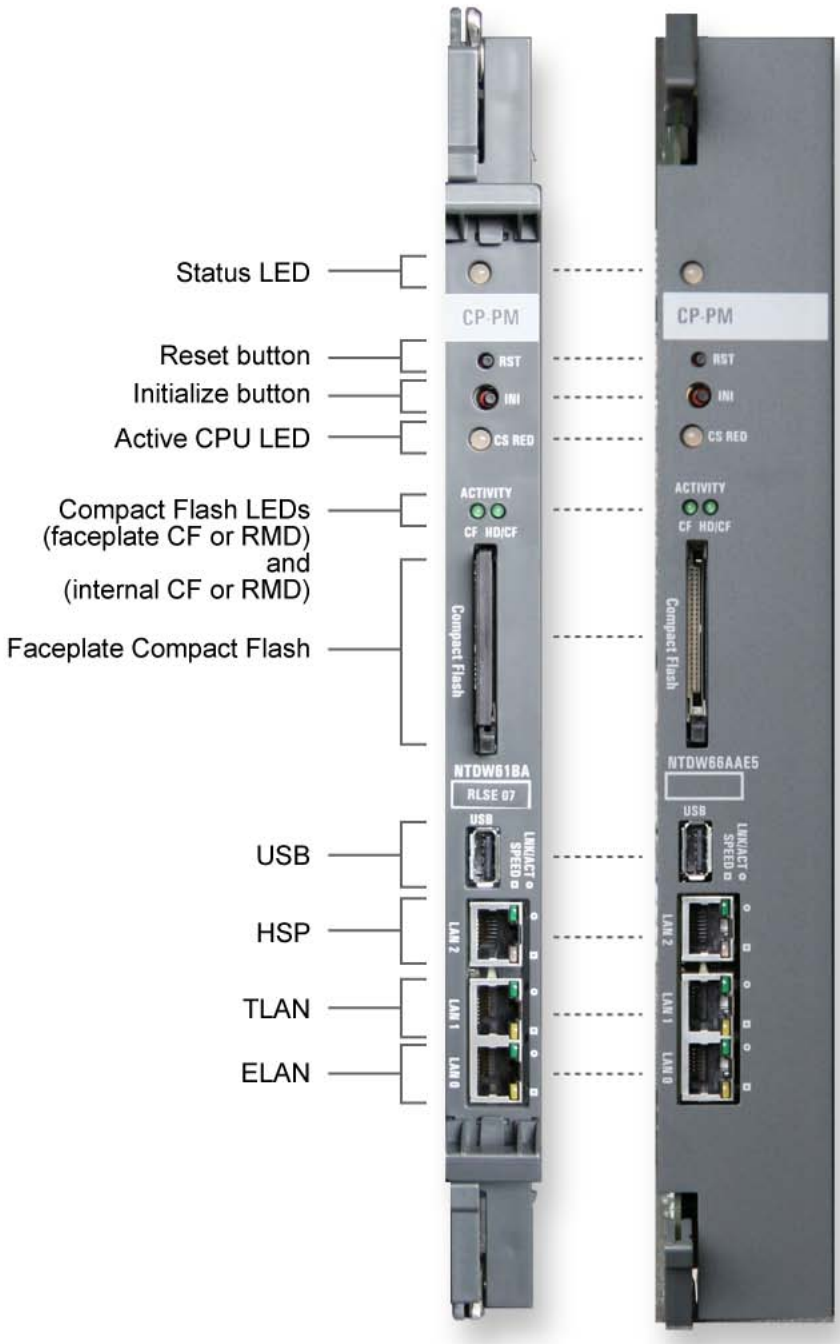


Figure 188: CP PM NTDW61 and NTDW66 faceplates

Faceplate buttons

Reset

Reset (RST) generates a hard reset of the card.

Init

Init (INI) generates a manual initialization of the software.

DIP switch

The DIP switch selects the media drive. CF MASTER/POSITION1 selects the Compact Flash (CF) FMD and HD MASTER/POSITION2 selects the Hard Drive FMD.

LED indicators

Status LED

The functionality of the Status LED is summarized in the following table.

Table 249: Status LED functionality

LED	Color	CP PM Status
Status	Green	After sysload
	Flashing Green	Not implemented
	Yellow	Not implemented
	Orange	Selftest error
	Red	During sysload phase 2
	Flashing Red	During sysload phase 1
	Off	No power

Active CPU LED

The CP PM can operate in single CPU mode or dual CPU mode. A tri-color LED indicates the Call Server redundancy status. This LED is not used by the Signaling Server and is OFF if it is a Signaling Server. The functionality of the active CPU LED is summarized in the following table.

Table 250: Call server redundancy status

LED	Color	Status
Call server redundancy	Green	Redundant mode, active
	Yellow	Redundant mode, standby
	Red	Redundant mode, fault (HSP down)
	Off	Standard mode

Ethernet LEDs

ELAN and TLAN LEDs

The functionality of the ELAN and TLAN network interface LED indicators is depicted in the following figure.

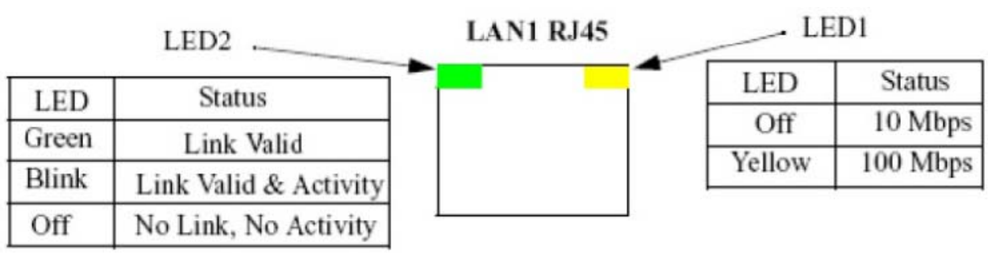


Figure 189: ELAN and TLAN port LED indicators

HSP LEDs

The functionality of the HSP port LED indicators is depicted in the following figure.

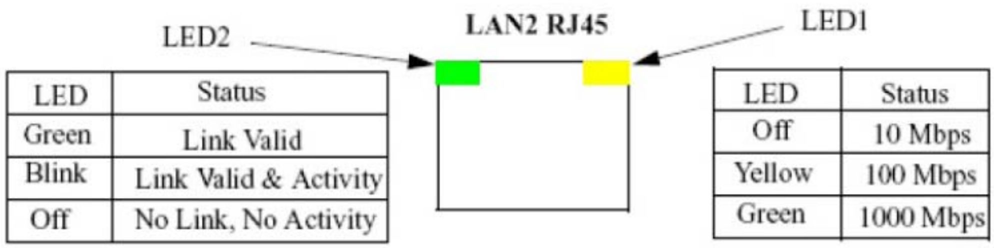


Figure 190: HSP port LED indicators

Removable and fixed media drive LEDs

LEDs are provided to indicate the access/activity of the removable and fixed media drives.

Chapter 41: NTDW62, NTDW64, and NTDW78 Media Gateway Controller Daughterboards

Contents

This section contains information on the following topics:

Introduction

The NTDW60 or NTDW98 Media Gateway Controller (MGC) card has two PCI Telephony Mezzanine Card form factor expansion sites. Daughterboards (DB) in the expansion sites provide Digital Signal Processor (DSP) resources for VoIP.

The DBs are slave devices controlled by the MGC processor.

Media Gateway Controller card

The MGC has two DB expansion sites. They are Expansion Daughterboard #1 and Expansion Daughterboard #2.

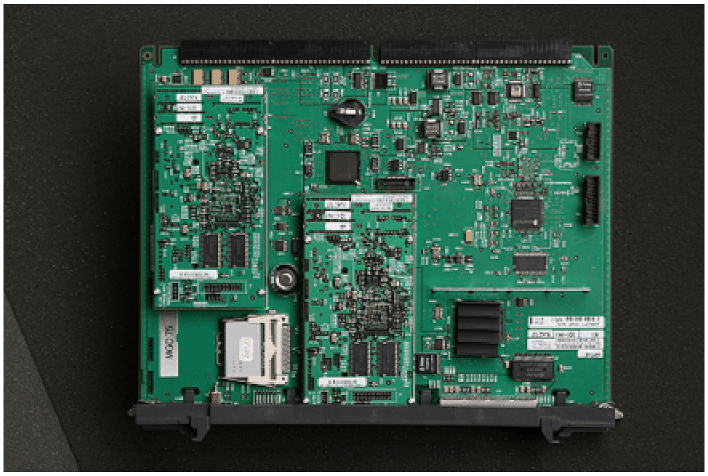


Figure 191: Media Gateway Controller with daughterboards

Figure 192: Daughterboard

Daughterboard configurations

The DBs are available in three sizes: An NTDW62 32-port daughterboard (DB-32), an NTDW64 96-port daughterboard (DB-96), and an NTDW78 128-port daughterboard (DB-128).

There are four possible Media Gateway configurations:

- A pure TDM single Media Gateway with no DSP daughterboards or Media Cards.
- A system with only Voice Gateway Media Cards.
- A system with only DSP daughterboards.
- A system with both DSP daughterboards and Media Cards.

The DB-32, DB-96, and DB-128 are supported in both expansion sites on the MGC card. The Avaya Communication Server 1000E (Avaya CS 1000E) Peripheral Rate Interface (PRI) Media Gateway is required to support an MGC card populated with greater than 192 DSP ports. The MGC card can support a maximum of 256 DSP ports.

The following table summarizes the supported placement of the DBs in the MGC expansion sites and the card slots represented by each DB.

Table 251: DSP daughterboard placement

DB size	DB expansion site	Card slot
DB-32	1	11
DB-32	2	0
DB-96	1	11,12,13
DB-96	2	0, 9, 10
DB-128	1	11,12,13,14
DB-128	2	0,9,10,15

Note:

The Extended Media Gateway PRI (MGP) package 418 is required to support MGC cards populated with two DB-96 or two DB-128.

Card slots are not dedicated. For example, you can configure card 9 and 10 for other card types when card 0 is configured as DB-128. Similarly, you can configure card 14 or card 15 for DTR/XTD when card 11,12, and 13 is configured as DB-128.

Chapter 42: NTDW65 Voice Gateway Media Card

Contents

This section contains information on the following topics:

Introduction

The NTDW65 MC32S Media Card provides 32 IP-TDM gateway ports between an IP device and a TDM device in an Avaya Communication Server 1000 (Avaya CS 1000) network. The MC32S replaces the previous media card or ITG card.

The Media Card comes in an IPE form factor. The card can be used in the MG 1000E, Avaya CS 1000E, and Avaya CS 1000M systems.

The card includes a processor and a DSP. Secure Real Time Protocol (SRTP) is used to secure the IP media path to and from the DSP channels on the card.

The Media Card includes the following components and features:

- Processor.
- DSP.
- Memory for processor and DSP.
- 4MB boot CompactFlash.
- CompactFlash firmware storage.

- Six-port Ethernet Layer 2 switch.
- 10/100 BaseT ELAN network interface for management and signalling messages.
- 10/100BaseT TLAN network interface for telephony voice traffic.
- FPGA for backplane interfaces.
- Two TTY ports on the processor for debugging.
- 100BaseT faceplate port for debugging.

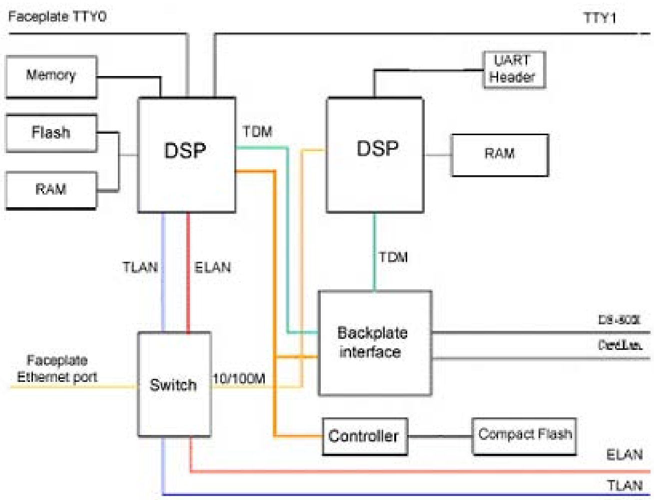


Figure 193: Voice Gateway Media card block diagram

Ethernet ports

External connections

There are TLAN and ELAN network interfaces for connection to external networks, and a faceplate debug port.

Internal connections

There is a TLAN connection to the DSP, and ELAN and TLAN connections to the processor.

Backplane interfaces

The FPGA features include:

- DS30X interfaces.
- A10 signalling.
- CardLan interface.
- Hardware watchdog.
- Time-switch for flexible TDM timeslot mapping.

Serial data interface ports

The Media Card has two serial data interface ports on the master MSP. The installation menu can by accessed through either port.

TTY settings

The default tty settings for both ports are:

- Baud rate: 9600.
- Data bit length: 8.
- Stop bit: 1.
- Parity: none.
- Flow control: none.

Faceplate LED display

The faceplate on the Media Card has a four character LED display. The diagnostic messages summarized in the following table are displayed on the faceplate during system bootup.

Table 252: Faceplate display

Message	Description

BOOT	This is the first message displayed when the system becomes active.
POST	Power on self test. This message is displayed when the Voice Gateway Media card is carrying out system tests during power up.
PASS	Power on self test pass.
EXXX	Error code. XXX is a numeric value. An error code is displayed if a serious system error is detected.
LOAD	Application software is loading.

In a normal boot process the diagnostic messages would be displayed in the following order:

1. BOOT
2. POST
3. PASS
4. LOAD

If there is a fatal self-test error during bootup, an error code appears and the PASS and LOAD message are not displayed.

During normal operation after bootup, the faceplate displays Leader (L) or Follower (F) and the number of registered sets. For example, 'L027' means Leader of 27 sets

Chapter 43: NTRB21 DTI/PRI/DCH TMDI card

Contents

This section contains information on the following topics:

Introduction

The NTRB21 (DTI/PRI/DCH) TMDI digital trunk card is a 1.5 Mb DTI or PRI interface to the Avaya Communication Sever 1000E (Avaya CS 1000E), Avaya CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinet. The NTRB21 card has a built-in downloadable D-channel.

The TMDI feature supports the software changes required for CS 1000E, CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinetto use the TDMI pack. The software includes:

- a prompt to replace a function that was handled by a dip switch on the NTAK09
- an extra loadware application to handle Layer 1
- a change to the existing loadware files into 32 bit format from the original 16 bit format

To provide CEMUX communication with the card, changes are also required to create an I/O entry for the card.

You can install this card in slots 1 through 4 in the Media Gateway. The card is not supported in the Media Gateway Expansion. Up to four digital trunks are supported in each Media Gateway.

Note:

For CISPR B group cabinets, the active Clock Controller (NTAK20) can only occupy slots 1-3. For FCC and/or CISPR A group cabinets, this limitation does not exist - the Clock Controller can occupy any available slot 1-9.

Note:

On non-ECM system cabinets, the NTAK20 can be placed in slots 1-9.

Important:

Each Media Gateway that has a digital trunk must use a clock controller clocked to an external reference clock.

Physical description

The NTRB21 card uses a standard 9.5" by 12.5" multi-layer printed circuit board with buried power and ground layers. The clock controller daughterboard is fastened by standoffs and connectors.

The NTRB21 card has seven faceplate LEDs. The first five LEDs are associated with the NTRB21 card. The remaining two LEDs are associated with the clock controller and DCHI daughterboards. See Figure 194: NTRB21 TMDI card with clock controller on page 641.

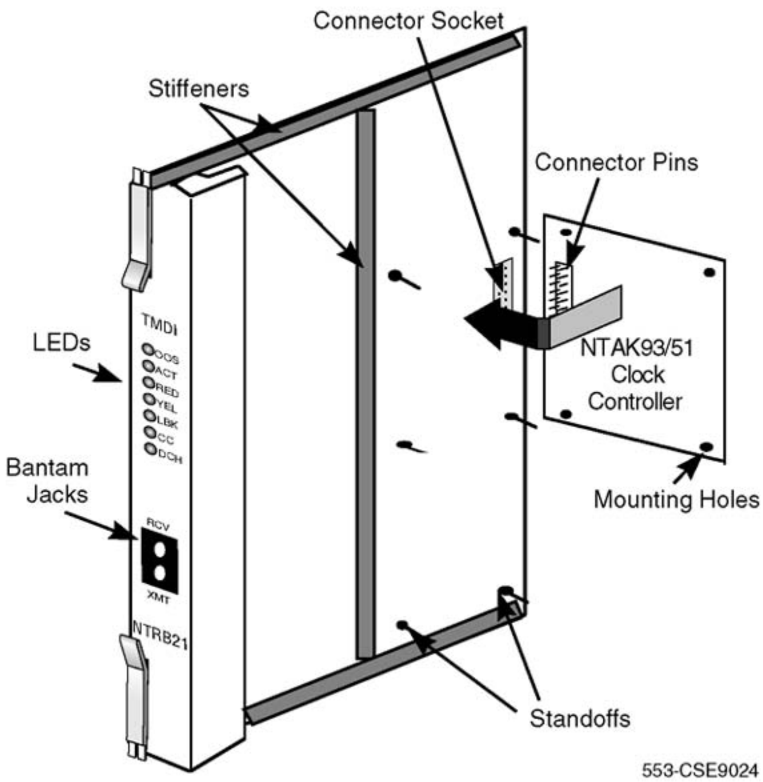


Figure 194: NTRB21 TMDI card with clock controller

In general, the first five LEDs operate as follows:

- During system power up, the LEDs are on.
- When the self-test is in progress, the LEDs flash on and off three times, then go into their appropriate states, as shown in Table 253: NTRB21 LED states on page 641.

Table 253: NTRB21 LED states

LED	State	Definition
DIS	On (Red)	The NTRB21 circuit card is disabled.
	Off	The NTRB21 is not in a disabled state.
ACT	On (Green)	The NTRB21 circuit card is in an active state. No alarm states exist, the card is not disabled, nor is it in a loopback state.
	Off	An alarm state or loopback state exists, or the card is disabled. See the other faceplate LEDs for more information.
RED	On (Red)	A red-alarm state is detected.
	Off	No red alarm.
YEL	On (Yellow)	A yellow alarm state is detected.

LED	State	Definition
	Off	No yellow alarm.
LBK	On (Green)	NTRB21 is in loop-back mode.
	Off	NTRB21 is not in loop-back mode.

Figure 195: NTRB21 TMDI card faceplate on page 642 shows the faceplate of the NTRB21 TMDI card.

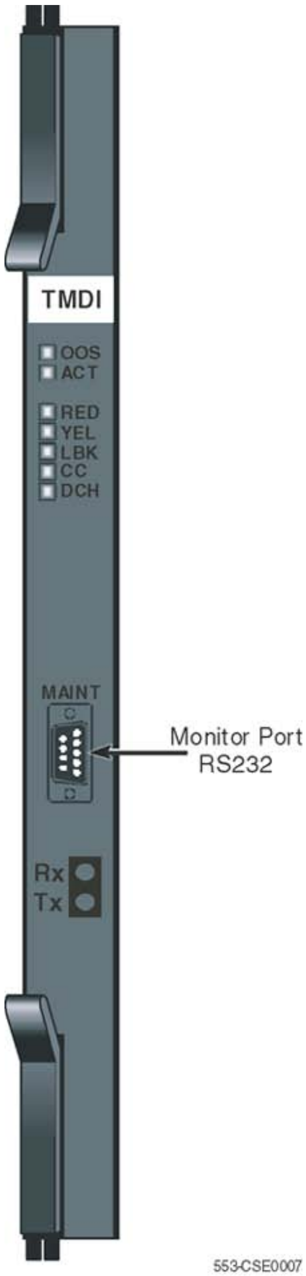


Figure 195: NTRB21 TMDI card faceplate

Power requirements

The DTI/PRI obtains its power from the backplane, and draws less than 2 amps on +5 V, 50 mA on +12 V, and 50 mA on –12 V.

Foreign and surge voltage protection

Lightning protectors must be installed between an external T1 carrier facility and the system. For public T1 facilities, this protection is provided by the local operating company. In a private T1 facility environment (a campus, for example), the NTAK92 protection assembly can be used.

The NTRB21 circuit card conforms to safety and performance standards for foreign and surge voltage protection in an internal environment.

Functional description

NTRB21 provides the following features and functions:

- configurable parameters, including A-Law and µ-Law operation, digital pads on a per channel basis, and Superframe or Extended Superframe formats
- AMI or B8ZS line coding
- 1.5 Mb Digital Trunk Interface and 1.5 Mb Primary Rate Interface
- 1.5 Mb Clock recovery and distribution of reference clocks
- DG2 or FDL yellow alarm methods
- card status and alarm indication with faceplate-mounted LED
- automatic alarm monitoring and handling
- Card-LAN for maintenance communication
- loopback capabilities for both near-end and far-end
- echo canceler interface
- integrated trunk access (both D-channel and in-band A/B signaling can be mixed on the same PRI)
- faceplate monitor jacks for T1 interface
- configurable D-channel data rate with 64 kbps, 56 kbps or 64 kbps inverted
- self-test

Software description

Changes from the NTAK09 are required for the new trunk card and License parameters are n service change and maintenance overlays. There is a change to CardLAN to introduce a new CardLAN ID. The download of PSDL data is also changed to handle a 32 bit download as well as existing 16 bit.

Hardware description

NTRB21 TMDI card

The NTRB21 TMDI card provides 1.5 MBits Digital Trunk Interface or Primary Rate Interface functionality. It also has a built-in downloadable D-channel.

The NTRB21 can be used with the NTAK09 DTI/PRI card (with the NTBK51 downloadable D-channel daughterboard).

Architecture

Signaling interface

The signaling interface performs an 8 Kbps signaling for all 24 channels and interfaces directly to the DS-30X link. Messages transmitted in both directions are three bytes long.

Interconnection

The interconnection to the carrier is by NTBK04, a 1.5 Mb 20 ft. carrier cable. The NT8D97AX, a fifty-foot extension cable, is also available.

Microprocessor

The NTRB21 is equipped with bit-slice microprocessors that handle the following major tasks:

- Task handler: also referred to as an executive. The task handler provides orderly per-channel task execution to maintain real-time task ordering constraints.
- Transmit voice: inserts digital pads, manipulates transmit AB bits for DS1, and provides graceful entry into T-Link data mode when the data module connected to the DTI/PRI trunk is answering the call.
- Receive voice: inserts digital pads and provides graceful entry into T-Link data mode when the data module connected to the DTI/PRI trunk is originating the call.
- T-Link data: a set of transmit and receive vectored subroutines which provides T-Link protocol conversion to and from the DM-DM protocol.
- Receive ABCD filtering: filters and debounces the receive ABCD bits and provides change of state information to the system.
- Diagnostics
- Self-test

Digital pad

The digital pad is an EPROM whose address-input to data-output transfer function meets the characteristics of a digital attenuator. The digital pad accommodates both µ255-Law and A-Law coding. There are 32 combinations each for µ255 to µ255, µ255 to A-Law, A-Law to µ255, and A-Law to A-Law. These values are selected to meet the EIA loss and level plan.

Table 254: Digital pad values and offset allocations

Offset	PAD set 0	PAD set 1
0	0dB	–7db
1	2dB	–8db
2	3dB	–9db
3	4dB	–10db
4	5dB	0.6db
5	6.1dB	7db
6	8dB	9db
7	–1dB	10db
8	–3dB	11db

Offset	PAD set 0	PAD set 1
9	–4dB	12db
A	idle code, 7F	3db
B	unassigned code, FF	14db
C	1dB	spare
D	–2dB	spare
E	–5db	spare
F	–6db	spare

D-channel interface

The D-channel interface is a 64 kbps, full-duplex, serial bit-stream configured as a Data Circuit-terminating Equipment (DCE) device. The data signals include:

- receive data output
- transmit data input
- receive clock output
- transmit clock output

The bit rate of the receive and transmit clocks can vary slightly from each other. This is determined by the transmit and receive carrier clocks.

Feature selection through software configuration for the D-channel includes:

- 56 kbps
- 64 kbps clear
- 64 kbps inverted (64 Kbps restricted)

DCHI can be enabled and disabled independent of the PRI card, as long as the PRI card is inserted in its cabinet slot. The D-channel data link cannot be established unless the PRI loop is enabled.

On the NTRB21 use switch 1, position 1 to select either the D-channel feature or the DPNSS feature, as follows:

OFF = D-channel

The ON setting for DPNSS (U.K.) is not supported at this time.

OFF = D-channel

ON = DPNSS (U.K.).

OFF = D-channel

The ON setting for DPNSS (U.K.) is not supported at this time.

DS-1 Carrier interface

Transmitter

The transmitter takes the binary data (dual unipolar) from the PCM transceiver and produces bipolar pulses for transmission to the external digital facility. The Digital Signal – Level 1 (DS-1) transmit equalizer enables the cabling distance to be extended from the card to the Digital Signal Cross-connect – Level 1 (DSX-1), or LD-1. Equalizers are switch selectable through dip-switches. The settings are shown in Table 255: NTRB21 switch settings on page 647.

Table 255: NTRB21 switch settings

Distance to Digital Cross-Connect	Switch Setting			
	1 DCH F/W	2 (LEN 0)	3 (LEN 1)	4 (LEN 2)
0 - 133 feet	Off	Off	Off	On
133 - 266 feet	Off	On	On	Off
266 - 399 feet	Off	Off	On	Off
399 - 533 feet	Off	On	Off	Off
533 - 655 feet	Off	Off	Off	Off

Receiver

The receiver extracts data and clock from an incoming data stream and outputs clock and synchronized data. At worst case DSX-1 signal levels, the line receiver operates correctly with up to 655 feet of ABAM cable between the card and the external DS-1 signal source.

Connector pinout

The connection to the external digital carrier is through a 15 position Male D-type connector.

Table 256: DS-1 line interface pinout for NTBK04 cable

From 50-pin MDF connector	To DB-15	Signal name	Description
pin 48	pin 1	T	transmit tip to network

From 50-pin MDF connector	To DB-15	Signal name	Description
pin 23	pin 9	R	transmit ring to network
pin 25	pin 2	FGND	frame ground
pin 49	pin 3	T1	receive tip from network
pin 24	pin 11	R1	receive ring from network

NTAK20 Clock Controller (CC) daughterboard

Digital Trunking requires synchronized clocking so that a shift in one clock source results in an equivalent shift of the same size and direction in all parts of the network.

The NTAK20 clock controller circuitry synchronizes the CS 1000E, CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinet to an external reference clock and generates and distributes the clock to the system. The CS 1000E, CS 1000M Cabinet, and Meridian 1 PBX 11C Cabinet can function either as a slave to an external clock or as a clocking master to the network.

The NTAK20AD and NTAK20AA versions of the clock controller meet AT&T Stratum 3 and Bell Canada Node Category D specifications. The NTAK20BD and NTAK20BA versions meet CCITT stratum 4 specifications. NTAK20 Clock Controller daughterboard on page 503

Important:

Each Media Gateway that has a digital trunk **must** use a clock controller clocked to an external reference clock.

If an IP Expansion multi-cabinet system is equipped with digital trunk cards, it is mandatory that at least one trunk card is placed in the cabinet. A cabinet that has a digital trunk must use a clock controller.

Note:

Clocking slips can occur between systems that are clocked from different COs, if the COs are not synchronized. The slips can degrade voice quality.

On CS 1000 systems, synchronization is accomplished with the NTAK20 clock controller circuit card. The clock controller circuitry synchronizes the CS 1000 to an external reference clock and generates and distributes the clock to the system. The CS 1000 can function either as a slave to an external clock or as a clocking master to the network.

Clock rate converter

The 1.5 Mb clock is generated by a Phase-Locked Loop (PLL). The PLL synchronizes the 1.5 Mb DS1 clock to the 2.56 Mb system clock through the common multiple of 8 kHz by using the main frame synchronization signal.

Chapter 44: NTVQ01xx Media Card

Contents

This section contains information on the following topics:

Physical description

The Media Card replaces the ITG Pentium card and is available as an 8-port or 32-port card.

You can install this card in slots 1 through 4 in the Media Gateway or slots 7 through 10 in the Media Gateway Expansion.

Note:

Up to four Media Cards can be installed in each Media Gateway and Media Gateway Expansion.

An NTVQ01xx Media Card is shown in Figure 196: NTVQ01xx Media Card on page 652.

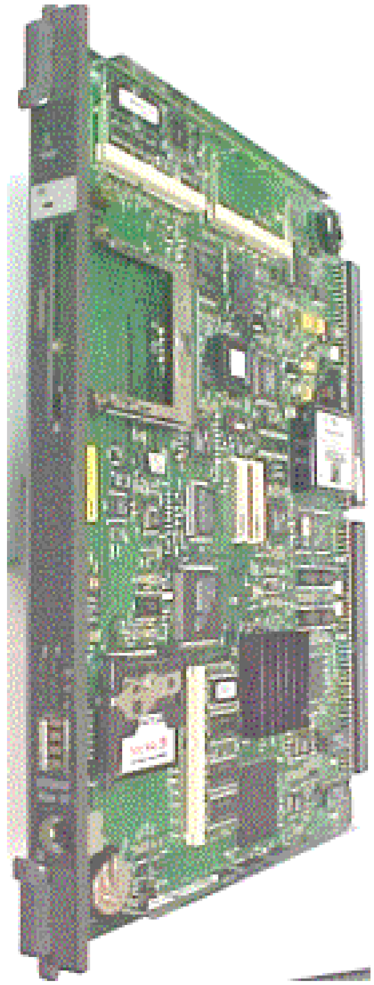


Figure 196: NTVQ01xx Media Card

The NTVQ01xx Media Card provides faceplate and backplane interfaces, which are used to connect external LANs. This section provides information about the faceplate connectors and indicators.

Hardware architecture

The Media Card comes in two versions: 8-port and 32-port.

Faceplate connectors and indicators

Figure 197: NTVQ01xx Media Card faceplate on page 654 shows the NTVQ01xx Media Card faceplate.

Reset switch

The reset switch on the faceplate manually resets the Media Card.

Status LED

The NTVQ01xx Media Card faceplate red LED indicates the following:

- the enabled/disabled status of the card
- the self-testing result during power up or card insertion into an operational system

PC card slot

This slot accepts standard PC card flash cards, including ATA Flash cards (3 Mbit/s to 170 Mbit/s). Avaya supply PCM card adaptors which enable CompactFlash cards to be used in this slot. This slot is used for NTVQ01xx Media Card software upgrades, backing up announcements, and additional storage.

Ethernet activity LEDs

The NTVQ01xx Media Card faceplate contains Ethernet activity LEDs for each network.

Maintenance hex display

This is a four-digit LED-based hexadecimal display that provides the status of the NTVQ01xx Media Card at all times. The hex display provides an indication of fault conditions and the progress of PC card-based software upgrades or backups. It also indicates the progress of the internal self-test in the form of T:xx.

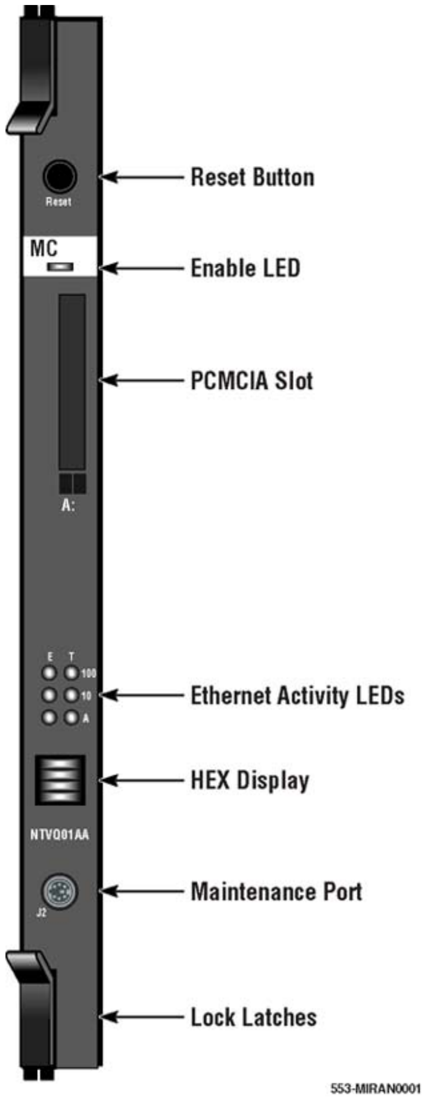


Figure 197: NTVQ01xx Media Card faceplate

RS-232 Asynchronous Maintenance Port

An 8-pin mini-DIN socket on the NTVQ01xx Media Card faceplate provides access to the RS-232 port. This faceplate port can provide access to the Media Card for OA&M purposes. The maintenance port is also available through a female DB9 connector on the 50-pin I/O Adaptor. This should be used to make a permanent terminal connection.

Functional description

Media Cards use different types of firmware pre-installed, depending on the application being supported. The Voice Gateway application enables Digital Signal Processors (DSPs) for either line or trunk applications. When the Voice Gateway application is installed on the Media Card, the card is called the Voice Gateway Media card. Other examples of applications on a Media Card include IP Line 3.0 and Integrated Recorded Announcer.

The NTVQ01xx Media Card connects an IP and circuit-switched device. The DSPs perform media transcoding between IP voice packets and circuit-switched devices. The Media Card also provides echo cancellation and compression/decompression of voice streams.

Chapter 45: NTC314AAE6 Media Gateway utility card

Contents

This section contains information on the following topics:

Physical description

The NTC314AAE6 MG1010 utility card is a standard card size with a two inch metal faceplate. The Utility card is inverted to accommodate power connections on the backplane. The components are placed to left instead of right.

Functional description

The MGU provides connectivity to the three serial ports of the MGC inserted in slot 0 and to the two serial ports of each call processor card inserted in slots 22 and 23.

The blower module assembly contains the blower control ICs but the Interface card contains the LED status. The utility card also contains the ring generator functions and the message waiting voltage supply. The PCB is located on the opposite side of the card, in respect to other cards, to prevent interference with the power supply connector on the backplane.

A temperature sensor located at the lower front of the card allows the SM bus to poll for ambient temperature of the air entering the chassis. Faceplate LEDs, for both power supplies, mirror the power supply LED giving the same display on both the front and rear of the chassis. A dip switch for setting ringing requirements, as well as message waiting, exists on the card with settings silk-screened on the PCB for all international settings. The card also contains power fail transfer circuitry and interfaces to the auxiliary connector located on the I/O panel at the rear.

Important:

Removing the utility card for maintenance and then re-inserting it could result in a PFTS for a period of milliseconds. You can remove the utility card without causing loss of service, however it can cause a loss of ringing and message waiting. Removing the utility card does not prevent an outgoing call, but prevents an incoming analog call.

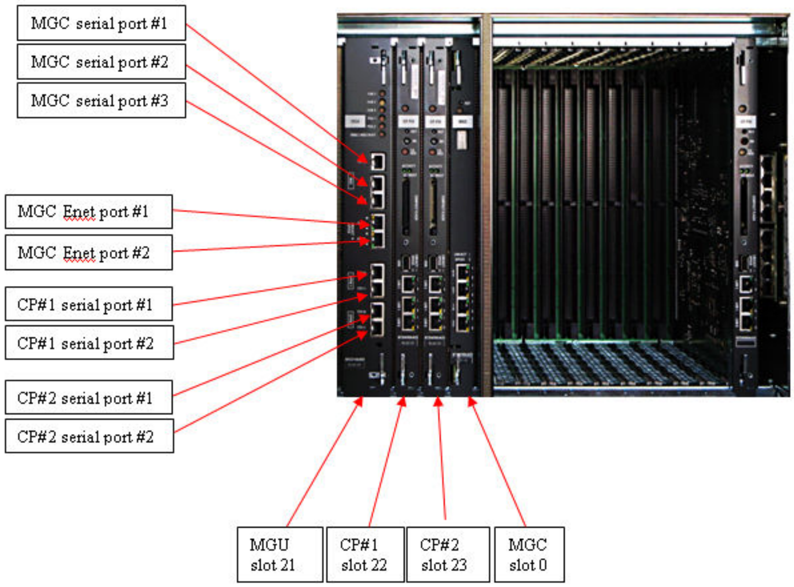


Figure 198: NTC314AAE6 utility card

The utility card supports all international requirements for message waiting voltages as well as ringing requirements. A dip switch is required on this card for various country requirements.

The utility card is also hot-pluggable, thus you can connect it with the system turned on.

There are five tri-colour LEDs on the faceplate. Three LEDs are for the blowers and indicate green as normal, orange as running at full speed, and red as a failure. The other two LEDs provide the status of the power supplies with green being normal and red or extinguished indicating a partial or full failure. The power supply LEDs are directly controlled by the power supplies while the blower LEDs are controlled by controller circuitry on the blower modules.

The following tables describe the LED states for the power supply, blowers, and ringing and message waiting.

Table 257: Power supply LED states

LED Color	Status
Green	Normal

LED Color	Status
Red	Partial Failure
Extinguished	Total failure
Yellow	Power supply is not installed

Table 258: Blower LED states

LED Color	Status
Green	Normal
Red	Failure

Table 259: Ringing and message waiting LED states

LED Color	Status
Green	Normal
Red	Failure

MGU dip switch settings

See the following tables to set the MGU DIP switch settings to set any one frequency, any one voltage level, and to enable the ring generator.

Table 260: Frequency

FREQUENCY	SWITCH S1	
	S1_3	S1_4
20Hz	ON	OFF
25Hz	OFF	ON
50Hz	OFF	OFF

Table 261: Voltage

VOLTAGE	SWITCH S1		
	S1_5	S1_6	S1_7
70V	OFF	OFF	OFF
75V	ON	OFF	OFF
80V	OFF	ON	OFF

VOLTAGE	SWITCH S1		
	S1_5	S1_6	S1_7
86V	OFF	OFF	ON

Table 262: Ringer enable

RINGER ENABLE	SWITCH S1
	S1_8
Ringer enable	ON
Ringer disable	OFF

Set the -150 switch to be -120 and -150 based on the following tables.

Table 263: S2_UV Protect

S2_UV PROTECT	
-120	OFF
-150	ON

Table 264: S4 OV_Protect

S4 OV_PROTECT	
-120	ON
-150	OFF

Table 265: S3 Volt_Sel

S3 VOLT_SEL	
-120	OFF
-150	ON

International power supply DIP switch settings:

See the following tables for international power supply DIP switch settings:

- Asia Pacific/CALA power supply DIP switch settings
- European power supply DIP switch settings
- North American power supply DIP switch settings

Table 266: Asia Pacific power supply DIP switch settings

Ring Frequency(Hz)		Ringing Amplitude(Vrms)		Message waiting Lamp(VDC)		
Switch Setting	20 25 50	Switch Setting	70 75 80 86	Switch Setting	-120	150
S1_3	off					
S1_4	on			S2		on
S1_8	on	S1_5	on	S3		on
		S1_6	off	S4		off
		S1_7	off			

Table 267: European power supply DIP switch settings

Ring Frequency(Hz)		Ringing Amplitude(Vrms)		Message waiting Lamp(VDC)		
Switch Setting	20 25 50	Switch Setting	70 75 80 86	Switch Setting	-120	150
S1_3	off					
S1_4	on			S2	off	
S1_8	on	S1_5	on	S3	off	
		S1_6	off	S4	on	
		S1_7	off			

Table 268: North American power supply DIP switch settings

Ring Frequency(Hz)		Ringing Amplitude(Vrms)		Message waiting Lamp(VDC)		
Switch Setting	20 25 50	Switch Setting	70 75 80 86	Switch Setting	-120	150
S1_3	on					
S1_4	off			S2	off	
S1_8	on	S1_5	off	S3	off	
		S1_6	off	S4	on	
		S1_7	on			

The following figure shows the dip switch settings on the board of the MGU.

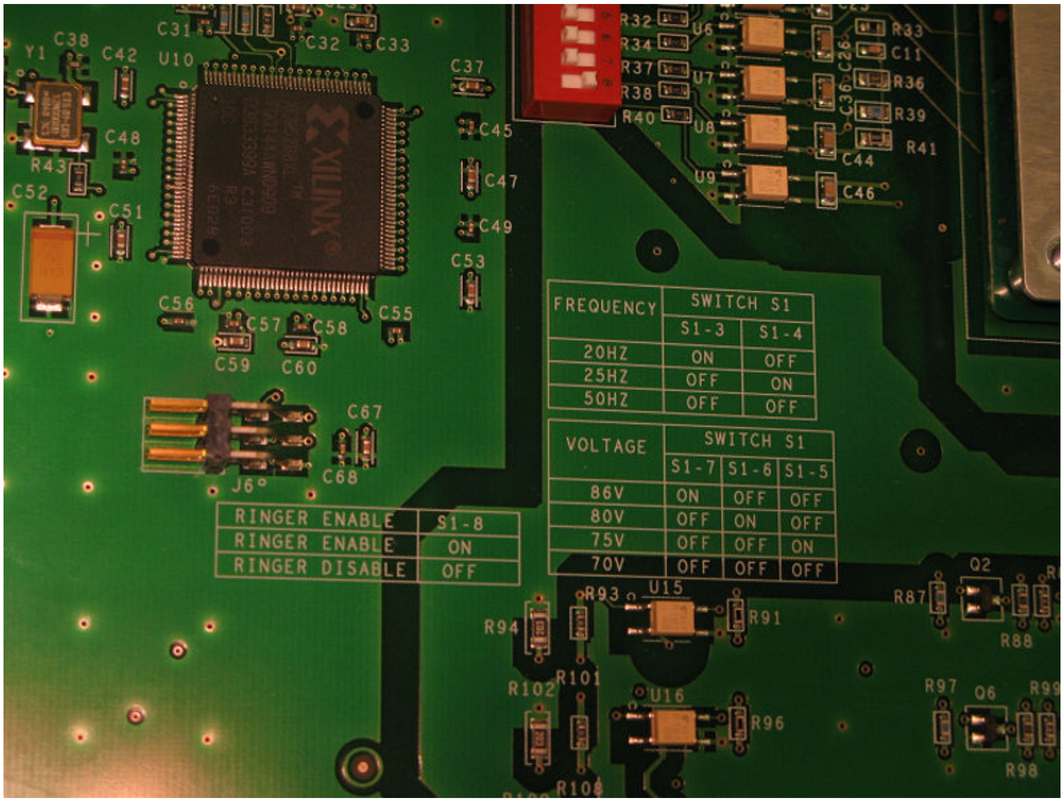


Figure 199: MGU dip switch settings

Rear components

The following figure shows the rear components of the MG 1010. Note the following:

- Hot swappable redundant power supplies
- Hot swappable fans in a redundant N + 1 configuration for chassis cooling
- One DECT connector
- One AUX connector
- Ten MDF connectors

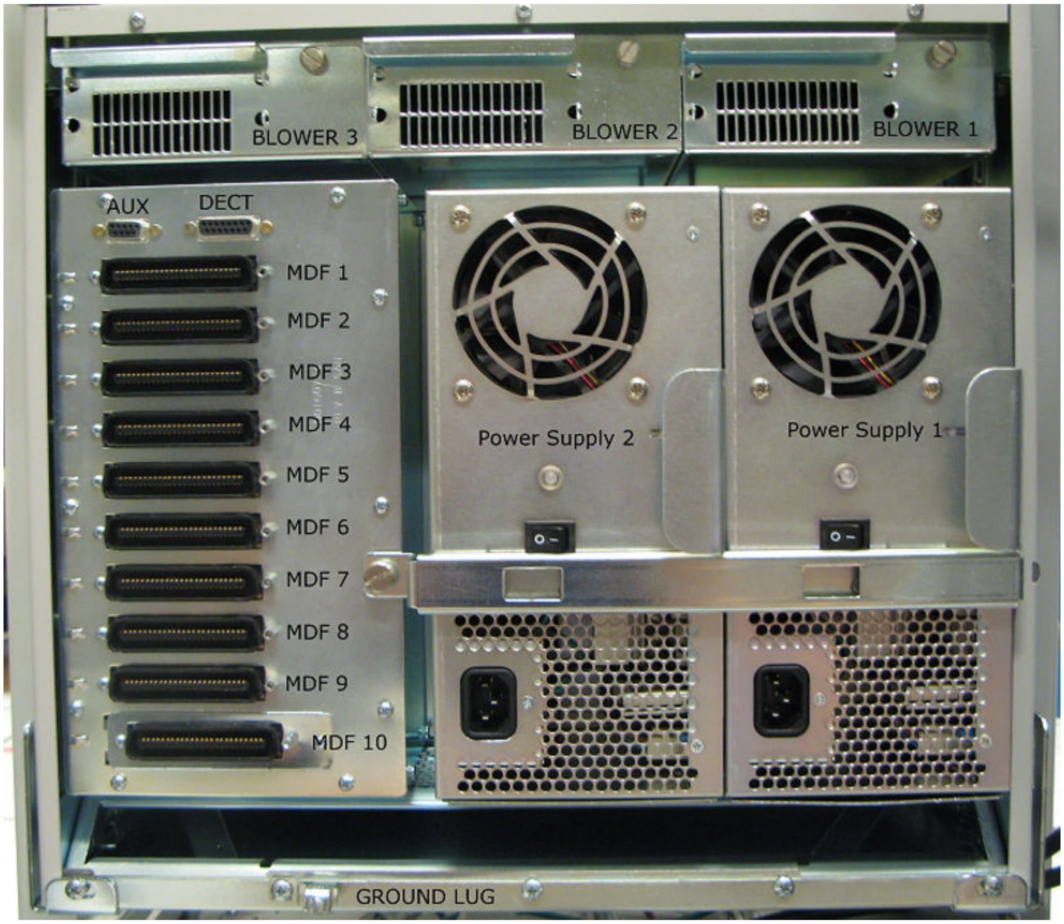


Figure 200: MG 1010 rear view

Important:

If your MG 1010 includes a cover over the Power Supply 2 connector, remove the cover by loosening the two Phillips screws and sliding the cover upwards. Once the cover is removed, tighten the two Phillips screws again.

Chapter 46: QPC841 Quad Serial Data Interface card

Contents

This section contains information on the following topics:

Introduction

The QPC841 Quad Serial Data Interface (QSDI) card provides four RS-232-C serial ports between the system and external devices. The QSDI card plugs into a slot in the common equipment area of any system.

The Quad Serial Data Interface card is normally used to connect the system to its administration and maintenance terminal. It is also used to connect the system to a background terminal (used in the Hotel/Motel environment), a modem, or the Automatic Call Distribution (ACD) and Call Detail Recording (CDR) features.

The QSDI card is compatible with all existing system software. It does not support 20 mA current loop interface.

QSDI cards are housed in the following module:

- NT8D35 Network module (slots 5 through 13)

Physical description

The QPC841 QSDI card is a printed circuit board measuring 31.75 cm by 25.4 cm (12.5 in. by 10 in.). The front panel is 2.54 cm (1 in.) thick. See Figure 201: QPC841 QSDI card front panel on page 667.

Up to four QSDI boards can be used in a system, allowing a total of sixteen asynchronous serial ports. The four serial ports on each card are addressed as two pairs of consecutive addresses (0 and 1, 2 and 3, and so on up to 14 and 15). The pairs need not be consecutive. For example: pairs 0 and 1, and 4 and 5 could be used.

The card front panel has two connectors, J1 and J2. Connector J1 is used for port 1 while connector J2 is used for ports 2, 3, and 4. It also has an Enable/Disable (ENB/DIS) switch and a red LED. The LED indicates that the card is disabled. It is lit when the following occurs:

- the ENB/DIS switch is set to DIS
- all of the ports on the card are disabled in software
- none of the card ports are configured in software

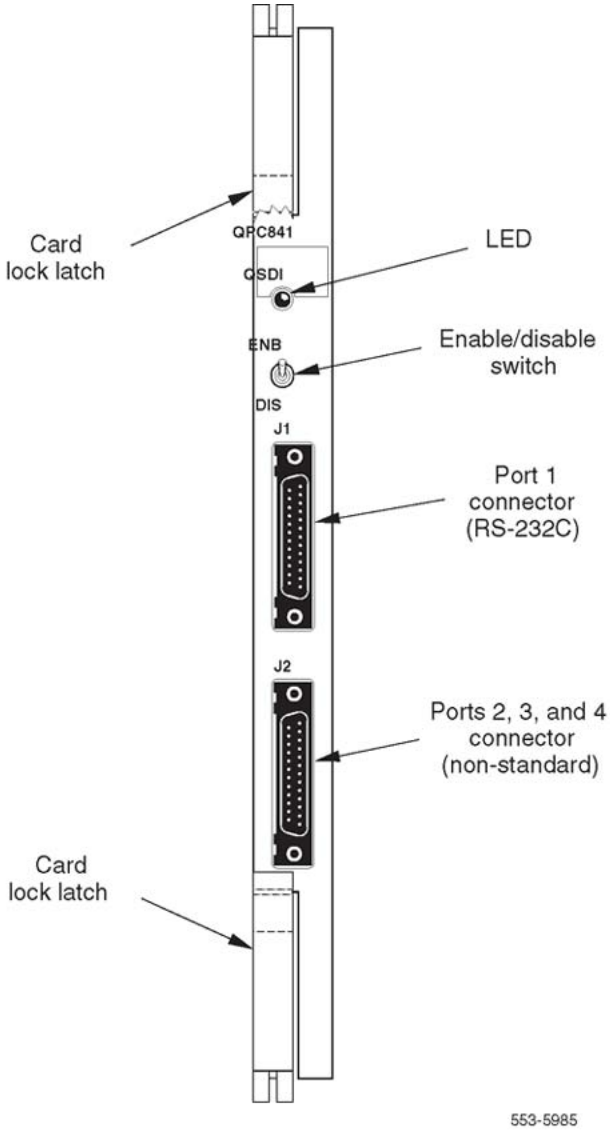


Figure 201: QPC841 QSDI card front panel

Functional description

The QPC841 Quad Serial Data Interface card contains all the logic for four asynchronous serial ports, including the baud rate generators. These serial ports are directly accessed by the system processor using memory reads and writes.

The QPC841 Quad Serial Data Interface card contains four universal asynchronous receiver/ transmitters (UARTs) and the logic necessary to connect the UARTs to the system processor bus. See Figure 202: QPC841 QSDI card block diagram on page 668. The other logic on the card consists of four baud rate generators, four RS-232-C driver/receiver pairs, and the jumpers and logic needed to configure the UARTs.

The address select switches and logic on the card always address the UARTs using two pairs of addresses: 0 and 1, and 2 and 3 through 15 and 16. The pairs do not need to be consecutive. Other switches on the board determine the baud rate for each individual port and whether the port is configured to talk to a terminal (DTE equipment) or a modem (DCE equipment). Instructions for setting the jumpers are given later in this section.

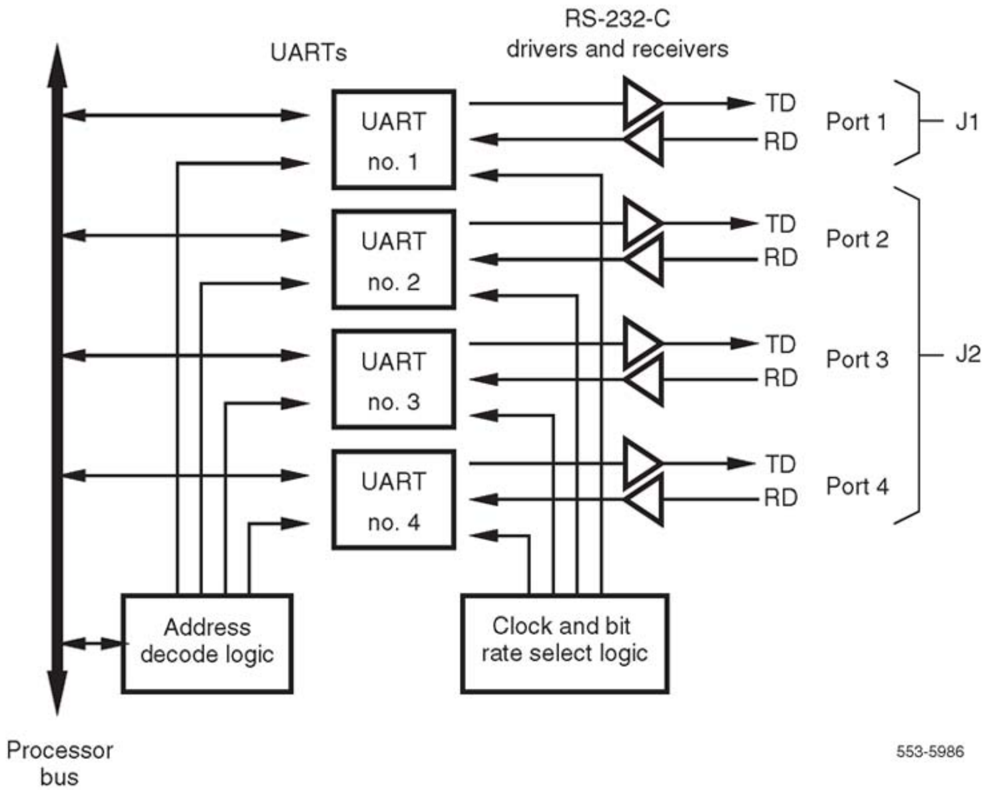


Figure 202: QPC841 QSDI card block diagram

Connector pin assignments

Connector J1 is connected to port one, and uses the RS-232-C standard DB-25-pinout. Connector J2 is connected to ports two, three, and four, and is a non-standard pinout that requires an adapter cable. An adapter cable (NT8D96) splits the J2 signals out to three standard RS-232-C connectors. Port 2 is connected to connector A, Port 3 is connected to connector B, and Port 4 is connected to connector C.

Table 269: Connector J1 pin assignments on page 669 shows the pinouts for connector J1, and Table 270: Connector J2 pin assignments on page 669 shows the pinouts for connector J2.

Table 269: Connector J1 pin assignments

Pin number	Signal	Purpose in DTE mode	Purpose in DCE mode
1	FGD	Frame ground	Frame ground
2	TD	Received data	Transmitted data
3	RD	Transmitted data	Received data
4	RTS	Request to send (not used)	Request to send (Note 2)
5	CTS	Clear to send (Note 1)	Clear to send
6	DSR	Data set ready (Note 1)	Data set ready
7	GND	Ground	Ground
8	CD	Carrier detect (Note 1)	Carrier detect (not used)
20	DTR	Data terminal ready	Data terminal ready (Note 2)

Note:

In DTE mode, the signals CD, DSR, and CTS are tied to +12 volts (through a resistor) to indicate that the QSDI port is always ready to transmit and receive data.

Note:

In DCE mode, the signals DTR, and RTS are tied to +12 volts (through a resistor) to indicate that the QSDI port is always ready to transmit and receive data.

Table 270: Connector J2 pin assignments

Pin Number	Port	Signal	Purpose in DTE mode	Purpose in DCE mode
1		FGD	Frame ground	Frame ground
2		TD	Transmitted data	Transmitted data
3		RD	Received data	Received data
4		RTS	Request to send (not used)	Request to send (Note 2)
5	2	CTS	Clear to send (Note 1)	Clear to send
6		DSR	Data set ready (Note 1)	Data set ready
7		GND	Ground	Ground
8		CD	Carrier detect (Note 1)	Carrier detect (not Used)
20		DTR	Data terminal ready	Data terminal ready (Note 2)
9		TD	Transmitted data	Transmitted data
10		RD	Received data	Received data

Pin Number	Port	Signal	Purpose in DTE mode	Purpose in DCE mode
11		RTS	Request to send (not used)	Request to send (Note 2)
12	3	CTS	Clear to send (Note 1)	Clear to send
13		DSR	Data set ready (Note 1)	Data set ready
25		GND	Ground	Ground
24		CD	Carrier detect (Note 1)	Carrier detect (not used)
23		DTR	Data terminal ready	Data terminal ready (Note 2)
14		TD	Transmitted data	Transmitted data
15		RD	Received data	Received data
16		RTS	Request to send (not used)	Request to send (Note 2)
17	4	CTS	Clear to send (Note 1)	Clear to send
18		DSR	Data set ready (Note 1)	Data set ready
19		GND	Ground	Ground
21		CD	Carrier detect (Note 1	Carrier detect (not used)
22		DTR	Data terminal ready	Data terminal ready (Note 2)

Note:

In DTE mode, the signals CD, DSR, and CTS are tied to +12 volts (through a resistor) to indicate that the QSDI port is always ready to transmit and receive data.

Note:

In DCE mode, the signals DTR and RTS are tied to +12 volts (through a resistor) to indicate that the QSDI port is always ready to transmit and receive data.

Configuring the QSDI card

Configuring the QSDI card consists of setting these option switches for each serial port:

- Port address
- Baud rate
- DTE/DCE mode

Figure 203: QSDI card option switch locations on page 673 shows the location of the option switches on the QSDI card. Instructions for setting these switches are in the section that follows.

Address switch settings

Table 271: QSDI card address switch settings on page 671 lists the address switch settings for the QPC841 Quad Serial Data Interface card. The address select jumpers and logic on the card address the UARTs using two pairs of addresses: 0 and 1, 2 and 3, through 15 and 16. The pairs do not need to be consecutive. Switch SW14 is used to select the addresses for ports 1 and 2. Switch SW15 is used to select the addresses for ports 3 and 4.

Table 271: QSDI card address switch settings

SW14	Port 1	Port 2	Switch settings							
SW15	**Port 3**	**Port 4**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Device pair addresses	0	1	off	off	off	off	off	on	on	on
	2	3	off	off	off	off	off	on	on	off
	4	5	off	off	off	off	off	on	off	on
	6	7	off	off	off	off	off	on	off	off
	8	9	off	off	off	off	off	off	on	on
	10	11	off	off	off	off	off	off	on	off
	12	13	off	off	off	off	off	off	off	on
	14	15	off	off	off	off	off	off	off	off

Note:

On SW16, positions 1, 2, 3, and 4 must be OFF.

Note:

To avoid address conflicts, SW14 and SW15 can never use identical settings.

Note:

To disable ports 1 and 2, set SW14 position 1 to ON. To disable ports 3 and 4, set SW15 position 1 to ON.

Baud rate switch settings

Table 272: QSDI card baud rate switch settings on page 672 lists the switch settings necessary to set the baud rate.

Table 272: QSDI card baud rate switch settings

Baud rate	Port 1 – SW10				Port 2 – SW11				Port 3 – SW12				Port 4 – SW13			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
150	off	off	on	on	off	off	on	on	off	off	on	on	off	off	on	on
300	off	on	off	on	off	on	off	on	off	on	off	on	off	on	off	on
600	off	off	off	on	off	off	off	on	off	off	off	on	off	off	off	on
1200	off	on	on	off	off	on	on	off	off	on	on	off	off	on	on	off
2400	off	off	on	off	off	off	on	off	off	off	on	off	off	off	on	off
4800	off	on	off	off	off	on	off	off	off	on	off	off	off	on	off	off
9600	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off	off

DTE/DCE mode switch settings

Table 273: QSDI card DTE/DCE mode switch settings on page 672 shows the DTE/DCE mode selection switches for the four serial ports.

Table 273: QSDI card DTE/DCE mode switch settings

	Port 1 – SW8						Port1 – SW9					
Mode	1	2	3	4	5	6	1	2	3	4	5	6
DTE (Terminal)	on	on	on	on	on	on	off	off	off	off	off	off
DCE (Modem)	off	off	off	off	off	off	on	on	on	on	on	on
	Port 2 – SW6						Port 2 – SW7					
Mode	1	2	3	4	5	6	1	2	3	4	5	6
DTE (Terminal)	on	on	on	on	on	on	off	off	off	off	off	off
DCE (Modem)	off	off	off	off	off	off	on	on	on	on	on	on
	Port 3 – SW4						Port 3 – SW5					
Mode	1	2	3	4	5	6	1	2	3	4	5	6
DTE (Terminal)	on	on	on	on	on	on	off	off	off	off	off	off
DCE (Modem)	off	off	off	off	off	off	on	on	on	on	on	on
	Port 4 – SW2						Port 4 – SW3					
Mode	1	2	3	4	5	6	1	2	3	4	5	6
DTE (Terminal)	on	on	on	on	on	on	off	off	off	off	off	off
DCE (Modem)	off	off	off	off	off	off	on	on	on	on	on	on

Test switch setting

Switch SW16 is only used for factory testing; all of its switches must be set to OFF for proper operation.

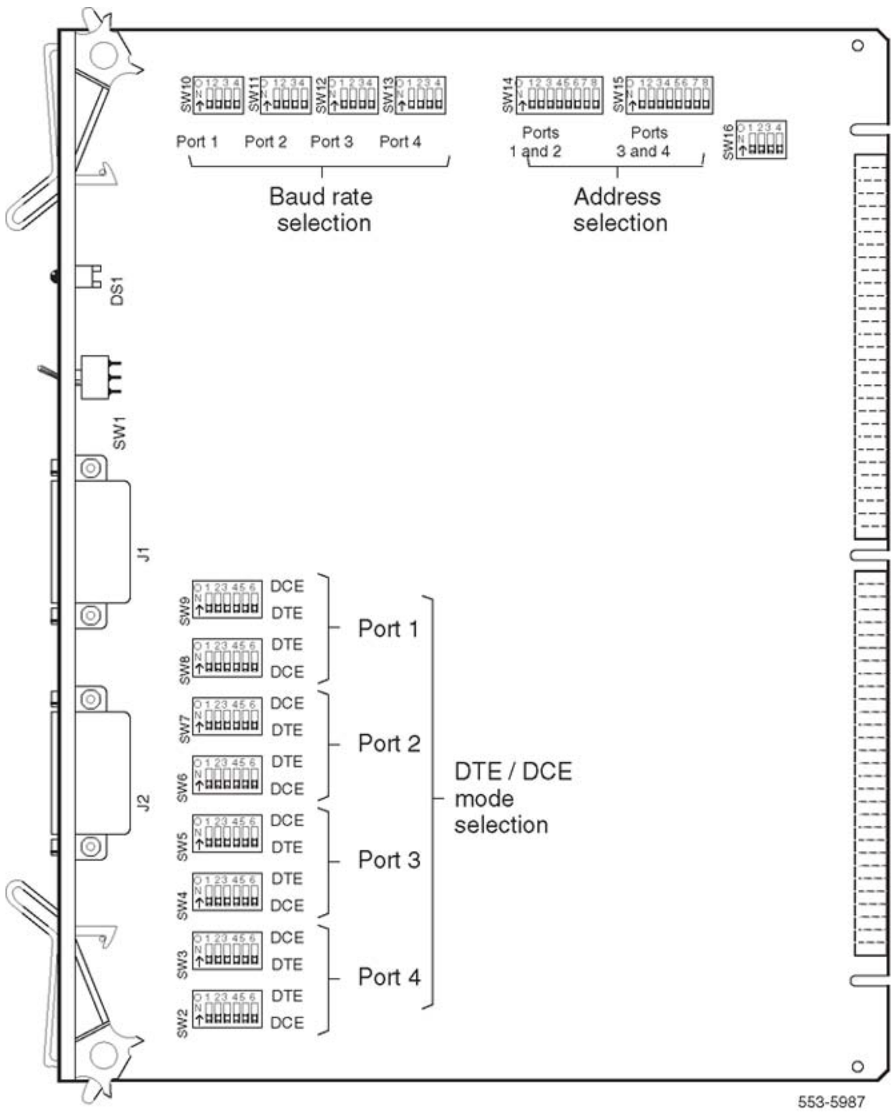


Figure 203: QSDI card option switch locations

Software service changes

Once the QPC841 QSDI card is installed in the system, the system software needs to be configured to recognize it. This is done using the Configuration Record program LD 17.

Instructions for running the Configuration Record program are found in Avaya Software Input/ Output Reference — Administration (NN43001-611).

Some of the prompts that are commonly used when running the Configuration Record program LD 17 are shown in Table 274: LD 17 - Serial port configuration parameters on page 674 These parameters must be configured for each port that is being used.

Table 274: LD 17 - Serial port configuration parameters

Prompt	Response	Description
REQ:	CHG	Change configuration.
TYPE:	CFN	Configuration type.
IOTB	YES	Change input/output devices.
ADAN	NEW TTY x NEW PRT x	Define a new system terminal (printer) port as device x, where x = 0 to 15.
CDNO	1-16	Use the QSDI card number to keep track of all ports.
DENS	DDEN	Double density SDI paddle board.
USER	xxx	Enter the user of port x. The values that can be entered depend on the software being used. See *Avaya Software Input/Output Reference — Administration(NN43001-611) for details.*
XSM	NO YES	Port is used for the system monitor.

Applications

The QPD841 Quad Serial Data Interface (QSDI) card is used to connect the switch to a variety of communication devices and peripherals. Any RS-232-C compatible device can be connected to any of the four serial ports.

The standard application for the QSDI card is to connect the switch to the system console. This can be either a direct connection if the console is located near the switch, or through a modem for remote maintenance.

Bell 103/212 compatible dumb modems are recommended to connect a remote data terminal. If a smart modem (such as a Hayes modem) is used, select the dumb mode of operation (Command Recognition OFF, Command Echo OFF) before connecting the modem to the asynchronous port.

Serial data interface connector J1 is a standard RS-232-C DB-25 connector that connects port 1 of the QSDI card to outside peripherals. Connector J2 is non-standard in that it contains the connections for the three remaining serial ports (ports 2, 3, and 4), on a single DB-25 connector.

An adapter cable must be used to connect to standard RS-232-C peripherals. Cables that are applicable to the QSDI card are:

- SDI male-to-female flat cables (internal module use only)
  - NT8D82
  - QCAD290

    Note:

    This cable is available in different lengths. Refer to Avaya Equipment Identification (NN43001-254) for more information
  - QCAD42
- SDI male-to-male round cables (external use only)
  - NT8D95
- SDI to I/O cables (system options use only)
  - NT8D82

Note:

This cable is available in different lengths. Refer to Avaya Equipment Identification (NN43001-254) for more information

- SDI multiple-port cable (internal system options use only)
  - NT8D90
- SDI I/O to DTE/DCE cables (system options use only)
  - NT8D95

Note:

This cable is available in different lengths. Refer to Avaya Equipment Identification (NN43001-254) for more information

- SID Multiple-port cable (system options use only)
  - NT8D96

Figure 204: QPC841 QSDI card cabling on page 676 shows the QPC841 card and the cables listed above in a standard configuration.

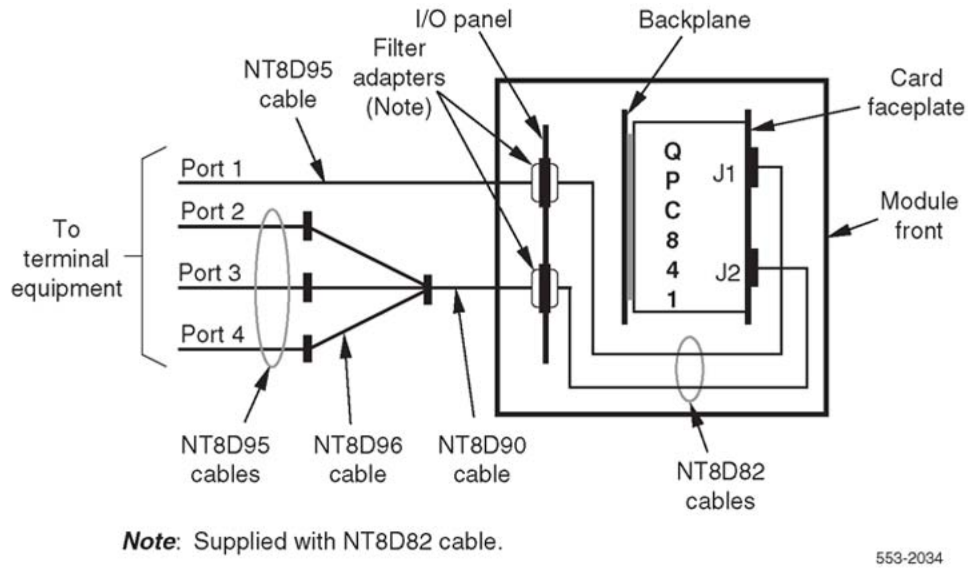


Figure 204: QPC841 QSDI card cabling

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