Critical Release Notice

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The content of this customer NTP supports the SN06 (DMS) software release.

Bookmarks used in this NTP highlight the changes between the LEC0015 baseline and the current release. The bookmarks provided are color-coded to identify release-specific content changes. NTP volumes that do not contain bookmarks indicate that the LEC0015 baseline remains unchanged and is valid for the current release.

Bookmark Color Legend

Black: Applies to new or modified content for LEC0015 that is valid through the current release.

Red: Applies to new or modified content for SN04 (DMS) that is valid through the current release.

Blue: Applies to new or modified content for SN05 (DMS) that is valid through the current release.

Green: Applies to new or modified content for SN06 (DMS) that is valid through the current release.

Attention!
Adobe® Acrobat® Reader™ 5.0 or higher is required to view bookmarks in color.

Publication History

June 2005

Standard release 11.03 for software release SN06 (DMS). Updates made for this release are shown below:

Volume 5

Added NTDX16AA (Q00946403)

March 2004

Standard release 11.02 for software release SN06 (DMS). Updates made for this release are shown below:

Volumes 1 – 3

No changes

Volume 4

Card NT9X30AB is Manufacture Discontinued and is replaced by new card NT9X30AC.

Volume 5

No changes

September 2003

Standard release 11.01 for software release SN06 (DMS). Updates made for this release are shown below:

Volumes 1 – 4

No changes

Volume 5

Updates were made to NT9X76AA according to CR Q00177945.

297-8991-805

DMS-100 Family

Hardware Description Manual

Volume 2 of 5

2001Q1 Standard 09.01 March 2001

How the world shares ideas.

DMS-100 Family

Hardware Description Manual

Volume 2 of 5

Publication number: 297-8991-805
Product release: 2001Q1
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Date: March 2001

Contents

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NT2X58AU through NT2X90AD (continued from Vol. 1)

NT2X58AU

Product Description

The NT2 NT2X58AU international maintenance trunk module (MTM) for the digital recorded announcement machine (DRAM) shelf has the circuit cards that store recorded phrases. The NT2X58AU for DRAM shelf and the digital multiplex system (DMS) control module (CM) route the circuit cards to speech channels. The NT2X58AU and DMS perform this action when necessary. This shelf is part of the NT0X46AB frame. This shelf houses digital recorded announcement circuit cards. The NT0X46AB frame can have a maximum of four NT2X58AU

The DRAM control section makes and maintains connections. The DRAM control section controls the module operation. The DRAM control section has the following cards:

- NT2X45BA trunk module (TM) interface card
- NT0X70BA international TM circuit card
- NT2X53AA TM control card
- NT2X59BA A-law coder-decoder (CODEC) and tones circuit cards

The DRAM unit has a speech processor, a microprocessor controller, and speech memory on circuit cards. The microprocessor controller and speech processor are on the NT1X75DA controller card for enhanced digital recorded announcement (DRA). You can use a group of any or all three different cards to provide the speech memory. The three different cards are the NT1X76AA PROM card, the NT1X77AA RAM card and the NT1X79AA EEPROM card. The unit must contain at least one PROM or RAM card. You can use any group from eight PROM, EEPROM, or RAM cards.

An NT2X58AU shelf at a specified customer site can have additional provisional cards. You can choose these additional cards from the following:

- test signal generators
- pulse code modulated (PCM) level meters
- line test cards
- minibar drivers
- looparound test line cards

Space for these additional cards is available when the shelf has less than eight speech memory cards.

Each NT2X58AU shelf has one of the following common circuit packs:

- NT2X58AY-replaces NT2X58AS
- NT2X58CL-replaces NT2X58CC
- NT2X58DB-replaces NT2X58DA

The NT2X58AU shelf must not have office alarm circuits.

Parts

The NT2X58AU has the following components:

- NT0X70BA-international trunk module card
- NT1X75DA-enhanced DRA controller card
- NT1X76AA-PROM cards
- NT1X77AA-RAM cards
- NT1X79AA-EEPROM cards
- NT2X09AA-multioutput power converter card
- NT2X45BA-trunk module interface card
- NT2X53AA-trunk module control card
- NT2X59BA-A-law CODEC and tones card

Design

The components of the NT2X58AU are described in the following table. The design of the NT2X58AU appears in the figure that follows the table.

NT2X58AU parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X70BA	2F	*International trunk module card* The NT2X58AU card performs or controls all the operations that the components of the MTM perform. The NT2X58AU contains a firmware-driven microprocessor and two RAMs. One RAM stores program information. The other RAM stores operational information. This information includes connection information for PCM channel-to-trunk assignments. The second RAM includes circuits that generate the clock signal, check parity, and perform synchronization.

NT2X58AU (continued)

NT2X58AU parts (Sheet 2 of 3)

PEC	Slot	Description
NT1X75DA, NT1X76AA, NT1X77AA, NT1X79AA	5F, 6-8F, 9-11F, 12-14F	*Enhanced DRA controller card,* *programmable read-only memory card,* *random-access memory card,* *electronically erasable read-only memory card* The DRAM unit contains an enhanced DRA controller card (NT1X75DA), and a number of PROM (NT1X76AA), EEPROM (NT1X79AA), and RAM (NT1X77AA) cards. The DRAM unit requires the enhanced DRA controller for advanced features. Two advanced features are the mechanized credit card system and the automatic intercept service. The DRAM unit must contain a minimum of one PROM or RAM card. You can use any group of PROM, RAM, and EEPROM cards. The unit can contain a maximum of eight PROM, RAM and EEPROM cards. The DRA controller controls the transmission and reception of messages between the DRAM unit and the DMS CM. Manual switches configure the DRA controller for 8-channel, 16-channel, 24-channel, or 30-channel operation. The DRA controller selects and retrieves recorded phrases from the PROM, EEPROM, or RAM cards, or a group of the cards. The DRA controller transmits the recorded phrases on selected speech link channels. The DRA controller controls the recording of new announcements. The DRA controller assigns the new announcements to an appropriate section of memory. Each memory card-PROM, EEPROM, or RAM-contains enough storage space for phrases a maximum of 31 s. When the enhanced DRA receives messages from the CM, the enhanced DRA transmits complete announcements. The enhanced DRA controller joins incomplete announcements to complete messages. For manual control during maintenance procedures and recording of new announcements, use the procedures in the DMS-100 *Commands Reference Manual*, 297-1001-820. Use these procedures at the MAP terminal. The RAM card (NT1X77AA) stores complete and incomplete announcements recorded on site. The complete and incomplete announcements are made over a PCM-channel network connection. The complete and incomplete announcements are lost if you remove the RAM card from the RAM card slot. The EEPROM card (NT1X79AA) stores messages recorded on site. The messages are not lost when you remove the EEPROM card from the EEPROM card slot. You can remove the messages if you use electronics to erase the memory.

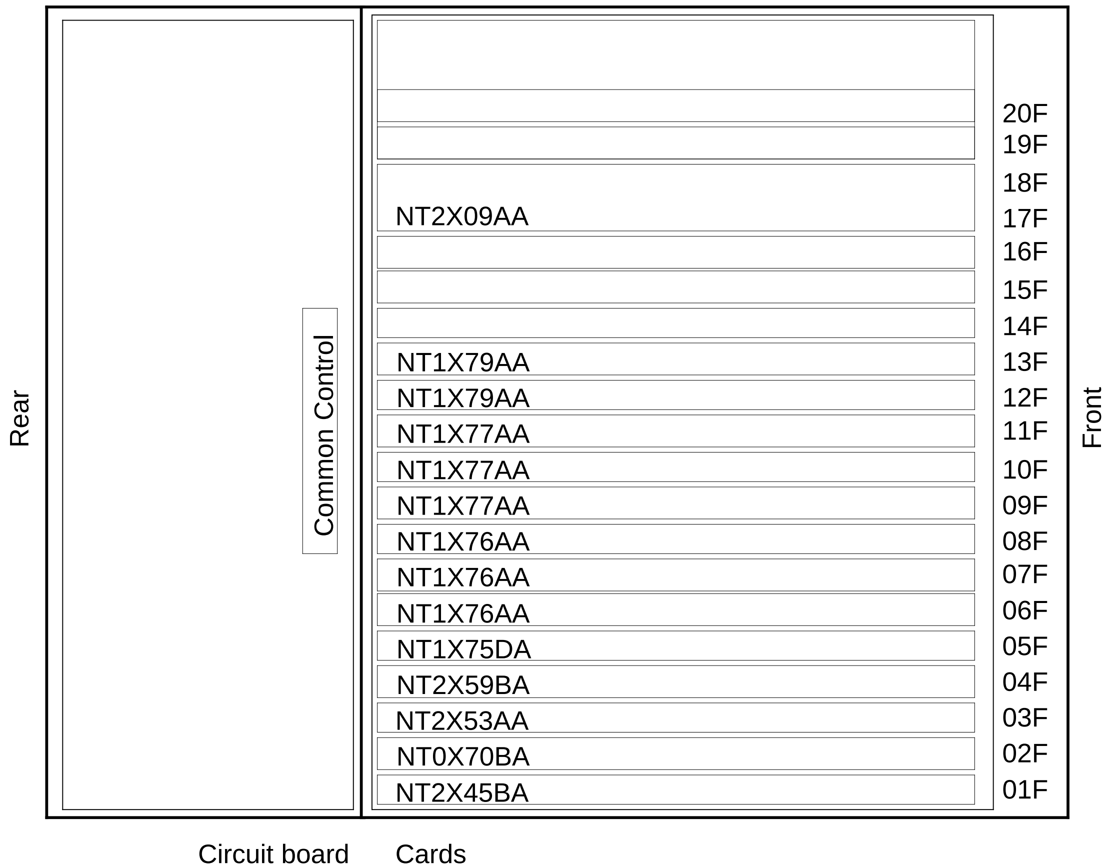
NT2X58AU (continued)

NT2X58AU parts (Sheet 3 of 3)

PEC	Slot	Description
NT2X09AA	17F	*Multioutput power converter card* The NT2X09AA power converter card converts dc voltages of -48 V to the lower voltages the circuit cards needs in the module. The NT2X09AA converter produces five outputs. These outputs need dc voltages of -5, -15, +5, +12, and +24 V. The NT2X09AA includes a low-voltage monitor circuit, overvoltage and overcurrent protection, faceplate test jacks, and a faceplate light-emitting diode (LED) status indicator.
NT2X45BA	1F	*Trunk module interface card* The TM interface card is the network interface for both planes of the network. The TM interface card provides two 2-way interfaces for the two transmission paths from both network planes. The TM interface card contains message registers, bit and channel timing circuits, circuits that check parity, and circuits that format data again.
NT2X53AA	3F	*Trunk module control card* The TM control card contains the circuit controllers that handle different messages. The TM control card exchanges information with the NT0X70BA over data and address buses. The TM control card produces enable signals for the circuits in the DRAM unit.
NT2X59BA	4F	*A-law CODEC and tones card* The CODEC and tones card creates PCM words from pulse amplitude modulated analog samples. The CODEC and tones card decodes PCM word streams in analog samples. The CODEC and tones card includes the ROM that contains the digital tones for dialing and signaling.

NT2X58AU (end)

NT2X58AU components



NT2X58CB

Product Description

The NT2X58CB maintenance trunk module (MTM) for digital recorded announcement (DRA) shelf is part of the NT0X46AB frame. The NT2X58CB houses digital recorded announcement circuit cards. These service cards have several uses. Residential services announcements and custom local area signaling service (CLASS) on the Meridian Digital Centrex system use these circuit cards. The NT2X58CB MTM for the digital recorded announcement machine (DRAM) shelf contains the circuit cards that store recorded phrases. This shelf and the control module (CM) for the digital multiplex system (DMS) control module (CM) route the circuit cards onto speech channels when needed.

The module is identical to the NT2X58AC MTM except that:

- the DRAM unit is a group of circuit cards.
- the intercard bus links the first 10 module slots. The MTM uses even/odd intercard connections.

The NT0X46AB frame can contain a maximum of four NT2X58CB shelves if you use the NT1X76AA circuit card. If all the PROM circuit cards are double density cards, the NT0X46AB frame can hold five NT2X58CB shelves.

The DRAM control section makes and maintains connections and controls the operation of the module. The DRAM control section contains the following cards:

- NT2X45AB trunk module (TM) interface card
- NT2X70AA TM processor card
- NT2X53AA TM control card
- NT2X59AA group coder-decoder (CODEC) and tone circuit cards

The DRAM unit contains a speech processor, a microprocessor controller, and speech memory on circuit cards. The microprocessor controller and speech processor are on the NT1X75BA computer card for enhanced digital recorded announcement (DRA). You can use three different cards to provide the speech memory. The three different cards are the NT1X76 PROM card, the NT1X77AA RAM card, and the NT1X79AA EEPROM card. The DRAM unit must contain a minimum of one PROM or RAM card. You can use any group of a maximum of eight PROM, EEPROM, or RAM cards.

The NT2X58CB uses the common circuit pack NT2X58AZ. The NT2X58AZ replaces the common circuit pack NT2X58AW. If the shelf is not equipped with an NT3X05AA/AC digital data line card, use the NT2X58AZ common

NT2X58CB (continued)

circuit pack. If the shelf is equipped with an NT3X05AA/AC digital data line card, use the NT2X58CP common circuit pack. The NT2X58CP common circuit pack replaces the NT2X58CK common circuit pack.

For DMS-250 applications, the NT2X58CB shelf uses the NT2X58AR or NT2X58CJ common circuit packs.

Parts

The NT2X58CB contains the following components:

- NT0X70AA-trunk module processor card
- NT1X75BA-DRA controller card
- NT1X76-PROM cards
- NT1X77AA-RAM cards
- NT1X79AA-EEPROM cards
- NT2X09AA-power converter
- NT2X45AB-trunk module interface card
- NT2X53AA-trunk module control card
- NT2X59AA-group CODEC and tone circuit card
- NT2X70AE-power converter

Design

A description of the components appear in the table. The design of the NT2X58CB appears in the figure.

NT2X58CB parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X70AA	2F	*Trunk module processor card* The TM processor card performs or controls all the operations that the components of the MTM perform. The TM processor card contains a firmware-driven microprocessor, and two RAMs. One RAM stores program information. The other RAM stores operational information. This information includes connection information for pulse code modulation (PCM) channel-to-trunk assignments. The second RAM includes circuits that generate the clock signal, check parity, and perform synchronization.

NT2X58CB (continued)

NT2X58CB parts (Sheet 2 of 3)

PEC	Slot	Description
NT1X75BA, NT1X76, NT1X77AA, NT1X79AA	5F, 6-8F, 9-11F, 12F, 13F	*Digital recorded announcement controller card,* *programmable read-only memory card,* *random-access memory card,* *electronically erasable read-only memory card* The DRAM unit contains a DRA controller card (NT1X75BA), and a number of PROM (NT1X76), EEPROM (NT1X79AA), and RAM (NT1X77AA) cards. The DRAM unit must contain a minimum of one PROM or RAM card. The DRAM unit can contain a maximum of eight cards. The DRA controller controls the transmission and reception of messages between the DRAM unit and the DMS CM. Manual switches configure the DRA controller for 8-channel, 16-channel, 24-channel, or 30-channel operation. The DRA controller selects and retrieves recorded phrases from the PROM, EEPROM, or RAM cards or a group of cards. The DRA controller transmits the recorded phrases on selected speech link channels. The DRA controller controls the recording of new announcements. The DRA controller assigns the new announcements to an appropriate section of memory. Each memory card-PROM, EEPROM, or RAM-contains enough storage space, a maximum of 31 s, for phrases. When the enhanced DRA-controlled card receives messages from the CM, the enhanced DRA transmits complete announcements. The enhanced DRA controller card joins incomplete announcements to complete messages. For manual control during maintenance procedures and the recording of new announcements, use the procedures in the DMS-100 *Commands Reference Manual*, 297-1001-820. Use these procedures at the MAP terminal. The RAM card (NT1X77AA) stores complete and partial announcements recorded on site. The complete and incomplete announcements are made over a PCM-channel network connection. The complete and incomplete announcements are lost if you remove the RAM card from the RAM card slot. The EEPROM card (NT1X79AA) stores messages recorded on site. The messages are not lost when you remove the EEPROM card from the EEPROM card slot. You can remove the messages if you use electronics to erase the memory.

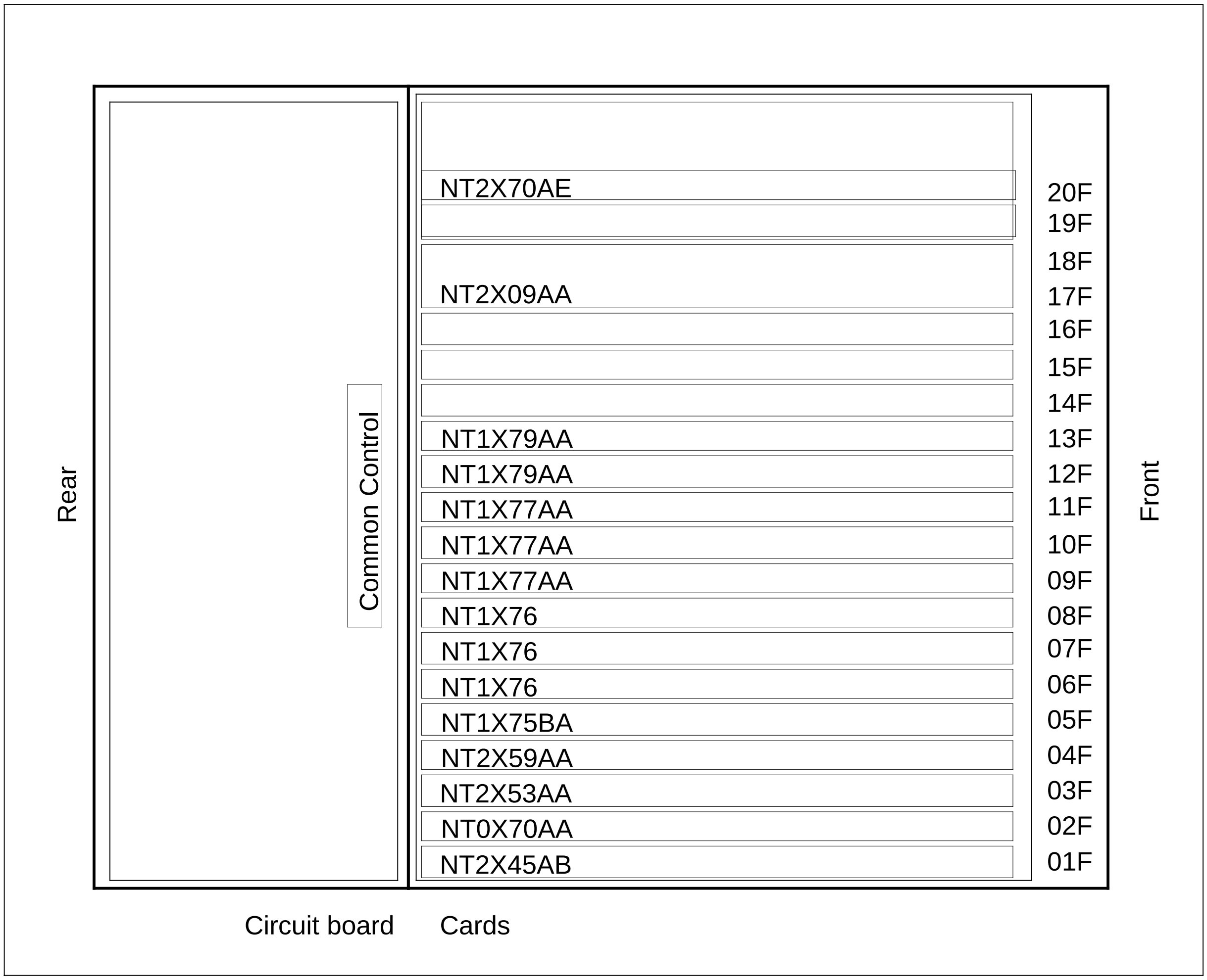
NT2X58CB (continued)

NT2X58CB parts (Sheet 3 of 3)

PEC	Slot	Description
NT2X09AA	17F	*Power converter card* The NT2X09AA power converter card converts dc voltages of -48 V to the lower voltages that the cards in the module need. The NT2X09AA converter produces five outputs. These outputs are dc voltages of -5, -15, +5, +12, and +24 V. The NT2X09AA includes a low-voltage monitor circuit, overvoltage and overcurrent protection, faceplate test jacks, and faceplate LED status indicator.
NT2X45AB	1F	*Trunk module interface card* The TM interface card is the network interface for both planes of the network. The TM interface provides two 2-way interfaces for the two transmission paths from both network planes. The TM interface contains message registers, bit and channel timing circuits, circuits that check parity, and circuits that format data again.
NT2X53AA	3F	*Trunk module control card* The TM control card contains the circuit controllers that handle different messages. The TM control card exchanges information with the processor circuit card over data and address buses. The TM control card produces enable signals for the circuits in the DRAM unit.
NT2X59AA	4F	*Group CODEC DMS-100/200 card* The group CODEC DMS100/200 card creates pulse code modulation (PCM) words from pulse amplitude modulated (PAM) analog samples. The CODEC DMS100/200 card decodes PCM word streams into analog samples. This circuit card includes the ROMs that contain the digital tones for dialing and signaling.
NT2X70AE	20F	*Power converter* The NT2X70AE is a dc-to-dc regulated power converter. The NT2X70AE works with a dc input of -48 V. The NT2X70AE supplies dc voltages of +5, -5, +12, and -12 V, with a common ground.

NT2X58CB (end)

NT2X58CB design



NT2X58CF

Product Description

The NT2X58CF remote service module shelf (RSM) houses office maintenance, alarm, and service circuits. Remote offices that use remote line modules (RLM) require these circuits.

You can mount the RSM in shelf positions 18, 32, 51, or 65 in the NT0X02AB frame.

Components

The NT2X58CF consists of the following components:

- NT0X50AC-Filler face plate 1.12
- NT2X58CM-RSM common circuit pack (CP)
  - — NT0X50AA-Filler face plate 0.875
  - — NT2X09AA-Multi-output power converter
  - — NT2X59AA-Trunk module (TM) group coder-decoder (CODEC) CP
  - — NT3X51AA-RLM service shelf interface CP
- NT2X70AE-Power converter±5V, 12 V

Design

Descriptions of the CPs that you can mount in the NT2X58CF appear in the following table.

NT2X58CF parts (Sheet 1 of 2)

PEC	Slot	Description
NT0X50AA	19F	*Filler face plate .875* Use the NT0X50AA filler face plate to fill card slot 19.
NT0X50AC	01F, 02F, and 05F-16F	*Filler face plate 1.12* Use the NT0X50AC filler face plate to fill card slots 1 and 2. Use the NT0X50AC filler face plate to fill card slots 05-16 when they are not used.
NT2X09AA	17F	*Multi-output power converter* The NT2X09AA multi-output power converter provides a regulated, common-ground dc power supply. This converter provides five different output voltages: +24 V, +12 V, +5 V, and -5 V.

NT2X58CF (continued)

NT2X58CF parts (Sheet 2 of 2)

PEC	Slot	Description
NT2X58CM	-	*Remote service module common circuit pack* The NT2X58CM RSM common CP fill contains the cards that have each NT2X58CF RSM: NT0X50AA-Filler face plate .875 NT2X09AA-Multi-output power converter NT2X59AA-TM group CODEC CP NT3X51AA-RLM service shelf interface CP
NT2X59AA	04F	*Trunk module group CODEC circuit pack* The NT2X59AA group CODEC DMS 100/200 card codes pulse amplitude modulation (PAM) signals to pulse code modulation (PCM) signals. The NT2X59AA decodes PCM signals into PAM signals. The NT2X59AA card produces PCM tones for signaling and supervision purposes.
NT2X70AE	20F	*Power converter,±5 V/12 V* The NT2X70AE power converter provides a regulated, common-ground dc power supply to the NT2X58CF shelf. This converter provides four different output voltages: +5 V, -5 V, +12 V, and -12 V.
NT3X51AA	03F	*RLM service shelf interface circuit pack* The NT3X51AA provides an interface between the NT2X58CF and the controlling remote line controller. This interface is normally in bay 0 of the RLM.

A list of the trunk cards that you can mount in the NT2X58CF shelf appears in the following table. Specified provisioning rules affect this list.

Provisionable TM cards (Sheet 1 of 7)

PEC	Slot	Description
NT0X10AA	05-16	Miscellaneous scanner
NT1X00AA	05-16	102 test trunk (milliwatt)
NT1X00AB	05-16	102 test trunk (milliwatt)
NT1X00AC	05-16	Receiver-off-hook (ROH) tone generator

NT2X58CF (continued)

Provisionable TM cards (Sheet 2 of 7)

PEC	Slot	Description
NT1X00AD	05-16	ROH tone generator
NT1X00AE	05-16	ROH tone international 102 test trunk
NT1X00AF	05-16	ROH tone 102/10-db test trunk
NT1X00AG	05-16	ROH tone 102/20-db test trunk
NT1X00AH	05-16	ROH tone 102/15-db test trunk
NT1X00KA	05-16	102 test trunk (China)
NT1X31AA	05-16	3-port conference circuit
NT1X75AA	05-16	Digital recorded announcement (DRA) processor
NT1X75BA	05-16	Enhanced DRA controller
NT1X75DA	05-16	A-law DRA processor
NT1X76AA	05-16	DRA standard announcement PROM-English
NT1X76AB	05-16	U.S. Bell standard announcement ROM card
NT1X76AE	05-16	Automatic coin toll service (ACTS) (American) DRA PROM announcements
NT1X76AF	05-16	Auxiliary operator services system (AOSS) voice recording unit (VRU) announcements-English (1)
NT1X76AG	05-16	AOSS VRU announcements-English (2)
NT1X76AH	05-16	Custom charge calling (CCC) announcements-English
NT1X76AJ	05-16	Custom local area signaling services (CLASS) phase 1-English, announcements 1 of 2
NT1X76AK	05-16	CLASS phase 1-English, announcements 2 of 2
NT1X76AM	05-16	Call forward remote activation (CFRA) phase 2-English
NT1X76AP	05-16	CLASS phase 2-English, announcements 1 of 8
NT1X76AQ	05-16	CLASS phase 2-English, announcements 2 of 8
NT1X76AR	05-16	CLASS phase 2-English, announcements 3 of 8
NT1X76AS	05-16	CLASS phase 2-English, announcements 4 of 8

NT2X58CF (continued)

Provisionable TM cards (Sheet 3 of 7)

PEC	Slot	Description
NT1X76AT	05-16	CLASS phase 2-English, announcements 5 of 8
NT1X76AU	05-16	CLASS phase 2-English, announcements 6 of 8
NT1X76AV	05-16	CLASS phase 2-English, announcements 7 of 8
NT1X76AW	05-16	CLASS phase 2-English, announcements 8 of 8
NT1X76BA	05-16	DRA PROM-French version
NT1X76BF	05-16	AOSS VRU announcements-French (1)
NT1X76BG	05-16	AOSS VRU announcements-French (2)
NT1X76BH	05-16	CCC standard announcements-French
NT1X76BJ	05-16	CLASS phase 1-French announcements 1 of 2
NT1X76BK	05-16	CLASS phase 1-French announcements 2 of 2
NT1X76BP	05-16	CLASS phase 2-French announcements 1 of 8
NT1X76BQ	05-16	CLASS phase 2-French announcements 2 of 8
NT1X76BR	05-16	CLASS phase 2-French announcements 3 of 8
NT1X76BS	05-16	CLASS phase 2-French announcements 4 of 8
NT1X76BT	05-16	CLASS phase 2-French announcements 5 of 8
NT1X76BU	05-16	CLASS phase 2-French announcements 6 of 8
NT1X76BV	05-16	CLASS phase 2-French announcements 7 of 8
NT1X76BW	05-16	CLASS phase 2-French announcements 8 of 8
NT1X76CA	05-16	DRA high-density PROM announcement card
NT1X76GA	05-16	CLASS phase 2-English announcements, list items 13-31: 1 of 3
NT1X76GB	05-16	CLASS phase 2-English announcements, list items 13-31: 2 of 3
NT1X76GC	05-16	CLASS phase 2-English announcements, list items 13-31: 3 of 3

NT2X58CF (continued)

Provisionable TM cards (Sheet 4 of 7)

PEC	Slot	Description
NT1X76GE	05-16	CLASS phase 2-U.S. custom feature names announcements-type I
NT1X76GF	05-16	CLASS phase 2-U.S. custom feature names announcements-type II
NT1X76GG	05-16	CLASS phase 2-U.S. custom feature names announcements-type III
NT1X76GH	05-16	CLASS phase 2-U.S. custom feature names announcements-type IV
NT1X76GJ	05-16	CLASS phase 2-U.S. custom feature names announcements-type V
NT1X76GK	05-16	CLASS phase 2-U.S. custom feature names announcements-type VI
NT1X76GL	05-16	CLASS phase 2-U.S. custom feature names announcements-type VII
NT1X76JA	05-16	CLASS phase 2-U.S. custom feature names announcements-type VIII
NT1X76JB	05-16	Automatic recall (AR) date/time, AOSS, SCA announcements
NT1X77AA	05-16	DRA RAM
NT1X79AA	05-16	DRA EEPROM
NT1X80AA	05-16	Enhanced DRA machine (E-DRAM)
NT1X90AA	05-16	Test signal generator 1
NT1X90BA	05-16	Test signal generator (A-law)
NT2X01AA	05-16	Automatic identification of outward dialing (AIOD) data recording C25
NT2X10AB	05-16	Line test unit, analog card
NT2X10AC	05-16	Line test unit, analog card
NT2X10BA	05-16	Multi-line test unit, analog card (North American)
NT2X11AA	05-16	Line test unit, digital card
NT2X11AC	05-16	Line test unit, digital card

NT2X58CF (continued)

Provisionable TM cards (Sheet 5 of 7)

PEC	Slot	Description
NT2X11AD	05-16	Line test unit, digital card with battery
NT2X11BA	05-16	Multi-line test unit control card (North American)
NT2X43AB	05-16	Office alarm circuit number 3
NT2X47AB	05-16	Controller for transmission test unit (TTU)
NT2X47AC	05-16	TTU controller
NT2X47AD	05-16	TTU controller
NT2X47BA	05-16	TTU controller (A-law)
NT2X48AA	05-16	Digital 4-channel multi-frequency (MF) receiver
NT2X48AB	05-16	Digital 4-channel receiver
NT2X48CA	05-16	A-law MF receiver (international-Turkey)
NT2X48CB	05-16	Dual-tone, multi-frequency (DTMF) receiver (for British Telecom)
NT2X48CC	05-16	A-law DTMF receiver (for U.K.)
NT2X50AB	05-16	Minibar driver
NT2X55AA	05-16	Signal distribution (SD) card II
NT2X56AA	05-16	Test TM (TTM) digital filter
NT2X56AB	05-16	TTM digital filter
NT2X56BA	05-16	Digital filter (A-law TTU)
NT2X57AA	05-16	SD card I
NT2X57AB	05-16	SD card with office alarm unit (OAU) monitor circuit
NT2X71AA	05-16	Transmission termination trunk
NT2X75AA	05-16	Loop around test line
NT2X96AA	05-16	PCM level meter
NT2X96BA	05-16	PCM lever meter (A-law)
NT3X02AA	05-16	TOPS control processor

NT2X58CF (continued)

Provisionable TM cards (Sheet 6 of 7)

PEC	Slot	Description
NT3X02BA	05-16	TOPS controller flash dial-up auto quote processor
NT3X03AA	05-16	TOPS digital signal processor
NT3X05AA	05-16	Digital data line card (DDLC)
NT3X05AB	05-16	Modified DDLC
NT3X05AC	05-16	DDLC
NT3X08AA	05-16	ACTS digitone receiver
NT3X08AB	05-16	ACTS coin detection circuit
NT3X09AA	05-16	Remote metallic test access CP
NT3X09BA	05-16	8 x 8 metallic test access CP
NT3X67AA	05-16	6-party conference circuit
NT3X67BA	05-16	6-party conference circuit (A-law)
NT3X67BB	05-16	6-party conference circuit with TBI tone (Turkey)
NT3X68AA	05-16	Pre-empted, permanent signal and conference tone generator
NT3X68AB	05-16	MF DT generator
NT3X68AC	05-16	Call waiting tone generator
NT3X68BA	05-16	Pre-empted, permanent signal and conference tone generator (U.K.)
NT3X68BB	05-16	MF TD generator (U.K.)
NT3X68BC	05-16	Call waiting tone generator (U.K.)
NT3X82AA	05-16	OAU dead system with unique audibles
NT3X82AB	05-16	OAU dead system with common audibles
NT3X83AA	05-16	OAU alarm transfer
NT3X84AA	05-16	OAU alarm sending
NT3X85AA	05-16	OAU alarm grouping
NT4X23AA	05-16	Digital test unit (DTU), bit error rate test (BERT) unit

NT2X58CF (continued)

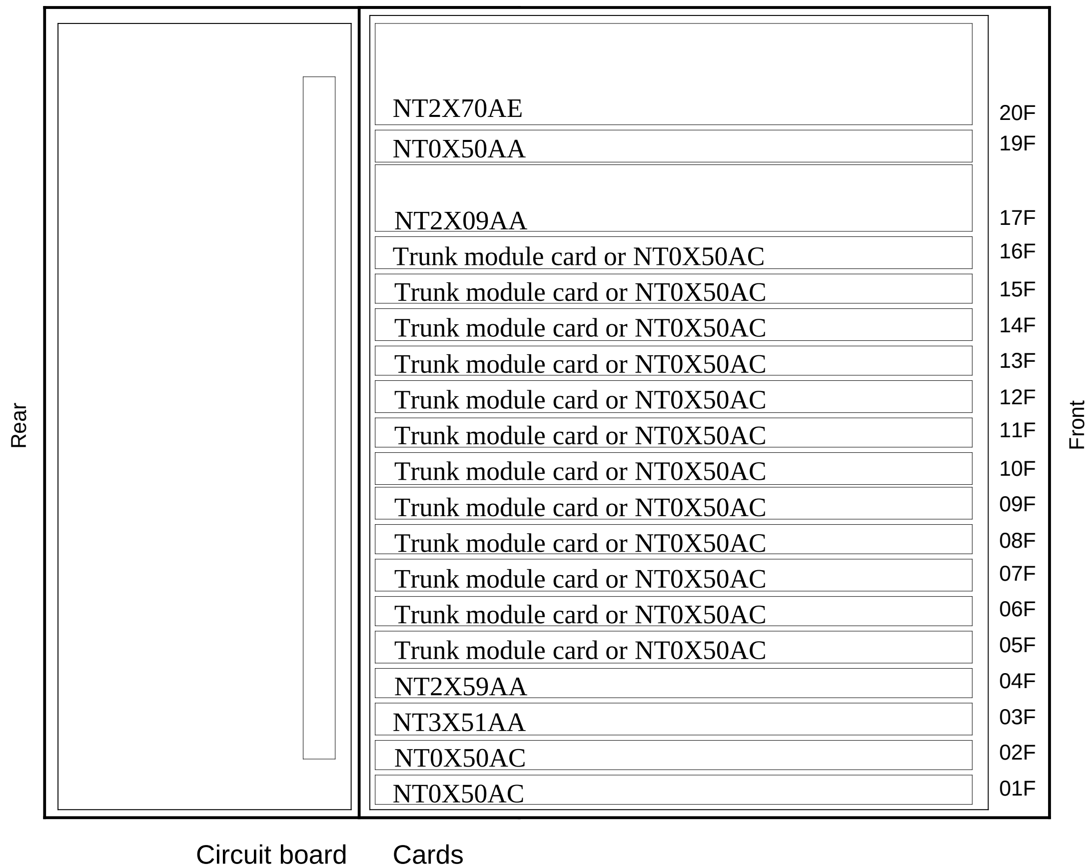
Provisionable TM cards (Sheet 7 of 7)

PEC	Slot	Description
NT4X97AA	05-16	Controller for the metallic test unit (MTU)
NT4X98BA	05-16	MTU analog 600µcard
NT4X98BB	05-16	*MTU analog card*
NT5X29AA	05-16	Continuity checker for the common channel interoffice signaling (CCIS)
NT5X29AC	05-16	Audio, answer, detect digitone MF circuit
NT5X29BA	05-16	Tone generator for the (A-law) audio tone detector (ATD)

The design of the NT2X58CF appears in the following figure.

NT2X58CF (end)

NT2X58CF design



NT2X59AA

Product description

The NT2X59AA group coder-decoder (CODEC) DMS-100/200 card codes pulse amplitude modulation (PAM) signals to pulse code modulation (PCM) signals. The NT2X59AA card decodes PCM signals to PAM signals. The NT2X59AA card produces PCM tones for signaling and supervision purposes.

Location

The NT2X59AA card occupies one card position in a DMS-100/200 peripheral module. Examples of a DMS-100/200 peripheral module include a maintenance trunk module (MTM), a remote service module (RSM), and a trunk module (TM).

Functional description

The NT2X59AA receives PCM signals from the C-bus. The NT2X59AA decodes the signals to PAM data. The NT2X59AA sends the PCM signals and receives the trunk circuits over the receive-PAM (RPAM) bus. The PAM signals from the trunk circuits over the transmit-PAM (XPAM) bus. card encodes the PAM signals into PCM. The card sends the PAM signals over the C-bus. The NT2X59AA card generates standard digital tones for supervision or signaling. The NT2X59AA card inserts the tones in an output channel. The operation of the card is synchronized with the system clock signal.

Functional blocks

NT2X59AA contains following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

NT2X59AA (continued)

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and the decoder.

16-channel encoders

The PAM samples from the PAM gate sends to the two 16-channel encoders. The 16-channel encoders convert the PAM samples to µ-law PCM samples. The PAM gate sends the samples to each alternate encoder. The combined encoder outputs produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals in a 32-channel signal. The digital MUX sends the 32-channel PCM signal over the C-bus.

32-channel decoder

The 32-channel decoder receives the PCM signals from the C-bus. The 32-channel decoder converts the PAM signals to µ-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the NT2X59AA card. Sequencer outputs control the timing of the PAM samples that the encoders receive. Sequencer outputs control the operation of the digital tone generator. The NT2X59AA card output remains synchronized with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit generated from each PAM sample. The sign bit delay circuit sends the PCM sign bit to the trunk circuit that transmits over the AUTONUL bus. The trunk circuit uses the AUTONUL signal to null dc offsets in the XPAM signals.

Digital tone generator

The digital tone generator produces signaling and supervisory tones. Signals from the TA bus operate the digital tone generator. You can insert the tones in the PAM or the PCM signals.

NT2X59AA (continued)

The tones that the digital tone generator produces appear in the following table.

NT2X59AA tone generator output

Frequency (Hz)	Level for each frequency (dBm)	Use
440 + 480	-19	Ringback
480 + 620	-24	Reorder (busy)
350 + 440	-13	Dial
480	17	High tone
2600	20	Single frequency (SF) low
2600	-8	SF high
0		Silence
700 + 900	-6	Multifrequency (MF) signaling
700 + 1100	-6	MF signaling
900 + 1100	-6	MF signaling
700 + 1300	-6	MF signaling
900 + 1300	-6	MF signaling
1100 + 1300	-6	MF signaling
700 + 1500	-6	MF signaling
900 + 1500	-6	MF signaling
1100 + 1500	-6	MF signaling
1300 + 1500	-6	MF signaling
700 + 1700	-6	MF signaling
900 + 1700	-6	MF signaling
1100 + 1700	-6	MF signaling
1300 + 1700	-6	MF signaling
1500 + 1700	-6	MF signaling

NT2X59AA (continued)

Measure the signal levels on the list at the output of the tone generator.

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. The regulated current source makes sure the operation of the encoders and the decoder is steady.

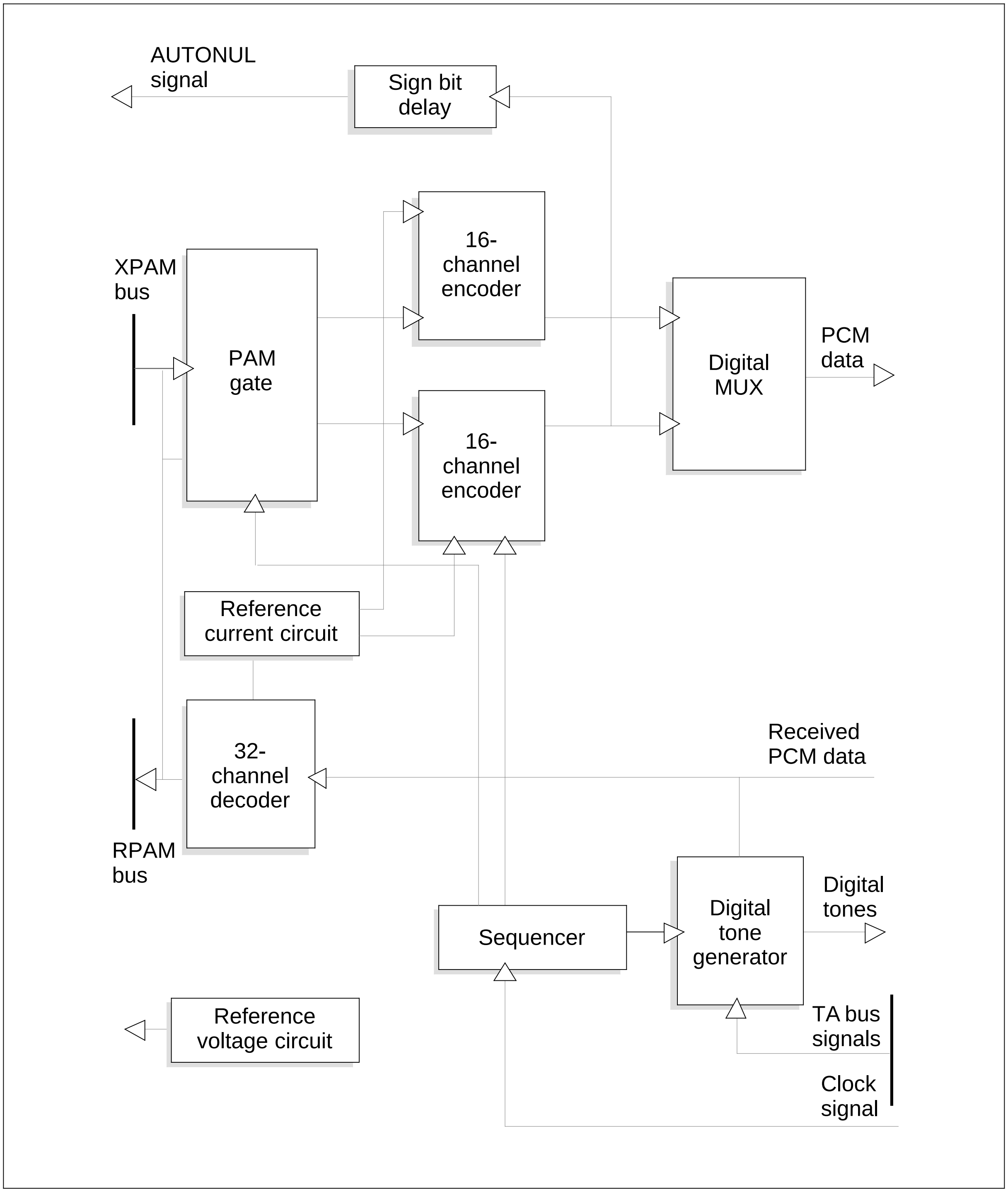
Reference voltage circuit

The reference voltage circuit produces a steady reference voltage. The reference voltage circuit sends the voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

The relationship between the functional blocks appears in the following figure.

NT2X59AA (continued)

NT2X59AA functional blocks



NT2X59AA (end)

Technical data

Dimensions

The NT2X59AA circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59AA appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59AB

Product description

The NT2X59AB group coder-decoder (CODEC) DMS-300 (Teleglobe) card codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). This card decodes PCM signals into PAM signals. This card produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-300 peripheral module. Examples of a PM include a maintenance trunk module (MTM), a remote service module (RSM) or a trunk module (TM).

Functional description

The NT2X59AB card receives PCM signals from the C-bus. The card decodes the signals into PAM data. The NT2X59AB card sends the decoded signals to the trunk circuits over the receive-PAM (RPAM) bus. The trunk circuits send the PAM signals over the transmit-PAM (XPAM) bus. The NT2X59AB encodes the PAM signals into PCM. The card sends the PAM signals over the C-bus. The card generates standard digital tones for supervision or signaling. This card inserts the tones into an output channel. The operation of the card is synchronized with the system clock signal.

Functional blocks

The NT2X59AB contains of the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

NT2X59AB (continued)

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and the decoder.

16-channel encoders

The PAM gate sends PAM samples to the two 16-channel encoders for conversion to μ-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs to produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals into a 32-channel signal. The Digital MUX sends this 32-channel PCM signal over the C-bus.

32-channel decoder

The digital MUX sends the PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals in to μ-law PAM signals. The 32-channel decoder sends PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders, and the operation of the tone generator. Sequencer control allows synchronization of the card output with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the AUTONUL signal to null dc offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59AB (continued)

The tones that the digital tone generator produces appear in the following table.

NT2X59AB tone generator output (Sheet 1 of 2)

Frequency(Hz)	Level per frequency (dBm)	Use
1100	-19	Ringback
480 + 620	-24	Low tone
350 + 440	-13	Dial
480	-17	High tone
2600	-20	Single frequency (SF) low
2600	-8	SF high
2400	-9	C5 signaling
2600	-9	C5 signaling
2400 + 2600	-9	C5 signaling
2000	-12	Reserved
0		Silence
700 + 900	-7	Multifrequency (MF) signaling
700 + 1100	-7	MF signaling
900 + 1100	-7	MF signaling
700 + 1300	-7	MF signaling
900 + 1300	-7	MF signaling
1100 + 1300	-7	MF signaling
700 + 1500	-7	MF signaling
900 + 1500	-7	MF signaling
1100 + 1500	-7	MF signaling
1300 + 1500	-7	MF signaling
700 + 1700	-7	MF signaling

NT2X59AB (continued)

NT2X59AB tone generator output (Sheet 2 of 2)

Frequency(Hz)	Level per frequency (dBm)	Use
900 + 1700	-7	MF signaling
1100 + 1700	-7	MF signaling
1300 + 1700	-7	MF signaling
1500 + 1700	-7	MF signaling

The listed signal levels are measured at the output of the tone generator.

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

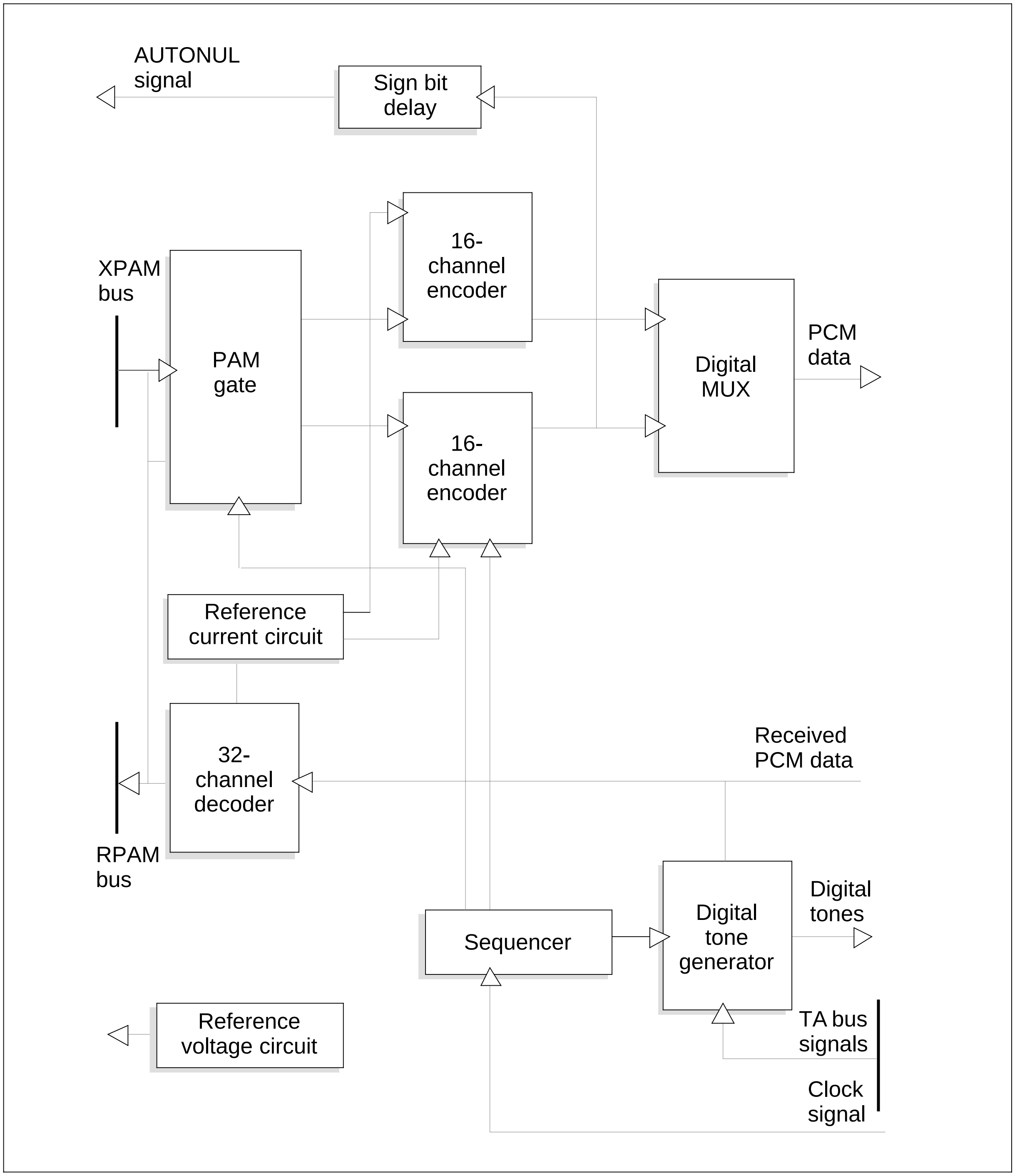
Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

The relationship between the functional blocks appears in the following figure.

NT2X59AB (continued)

NT2X59AB functional blocks



NT2X59AB (end)

Technical data

Dimensions

The NT2X59AB circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59AB appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59AC

Product description

The NT2X59AC codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). The NT2X59AC decodes PCM signals in to PAM signals. The NT2X59AC produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-100/200 peripheral module (PM). Examples of a PM include a maintenance trunk module (MTM), a remote service module (RSM) or a trunk module (TM).

Functional description

The NT2X59AC receives PCM signals from the C-bus. The NT2X59AC decodes the PCM signals into PAM data. The NT2X59AC sends the PAM data to the trunk circuits over the receive-PAM (RPAM) bus. The trunk circuits send the PAM signals over the transmit-PAM (XPAM) bus. The NT2X59AC encodes the PAM signals into PCM. The NT2X59AC sends the PCM over the C-bus. The card generates standard digital tones for supervision or signaling. The card inserts the tones in to an output channel. The operation of the card is synchronized with the system clock signal.

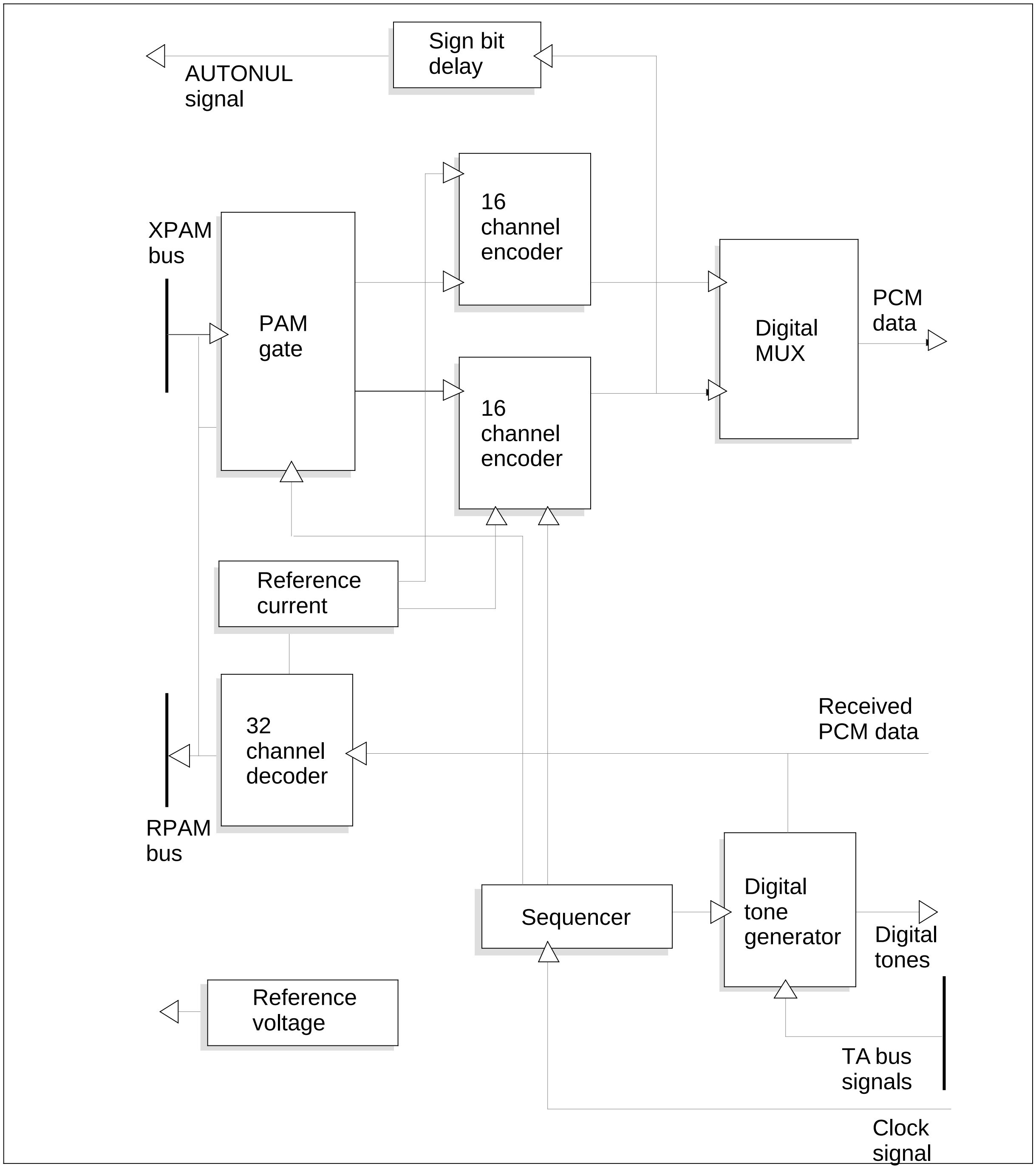
Functional blocks

The NT2X59AC contains the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

NT2X59AC (continued)

NT2X59AC functional blocks



PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and decoder.

16-channel encoder

PAM samples from the encoder are sent to the two 16-channel encoders for conversion to μ-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals into a 32-channel signal. The digital MUX sends the 32-channel PCM signal over the C-bus.

32-channel decoder

The digital MUX sends the PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals to μ-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders and the operation of the tone generator. The sequencer controls timing to allow synchronization of the card output remains synchronized with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the signal to null DC offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59AC (continued)

The tones that the tone generator produces appear in the following table.

NT2X59AC tone generator output

Frequency(Hz)	Level per frequency	Use
2600	-20 dBm	SF low
2600	-8 dBm	SF high
0		Silence
700 + 900	-6 dBm	Multifrequency (MF) signaling
700 + 1100	-6 dBm	MF signaling
900 + 1100	-6 dBm	MF signaling
700 + 1300	-6 dBm	MF signaling
900 + 1300	-6 dBm	MF signaling
1100 + 1300	-6 dBm	MF signaling
700 + 1500	-6 dBm	MF signaling
900 + 1500	-6 dBm	MF signaling
1100 + 1500	-6 dBm	MF signaling
1300 + 1500	-6 dBm	MF signaling
700 + 1700	-6 dBm	MF signaling
900 + 1700	-6 dBm	MF signaling
1100 + 1700	-6 dBm	MF signaling
1300 + 1700	-6 dBm	MF signaling
1500 + 1700	-6 dBm	MF signaling

The listed signal levels are measured at the output of the tone generator.

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

NT2X59AC (end)

Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

Technical data

Physical dimensions

The NT2X59AC circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

A list of the power requirements for the NT2X59AC appears in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59AD

Product description

The NT2X59AD codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). The NT2X59AD decodes PCM signals in to PAM signals. The card produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-100/200 peripheral module (PM). Examples of a PM are a maintenance trunk module (MTM), a remote service module (RSM) or a trunk module (TM).

Functional description

The NT2X59AD receives PCM signals from the C-bus and decodes the PCM signals into PAM data. The NT2X59AD sends the PAM data to the trunk circuits over the receive-PAM (RPAM) bus. The trunk circuits send the PAM signals over the transmit-PAM (XPAM) bus. The NT2X59AD encodes the PAM signals into PCM. The NT2X59AD sends the PCM over the C-bus. The card generates standard digital tones for supervision or signaling. The card inserts the tones in to an output channel. The operation of the card is synchronized with the system clock signal.

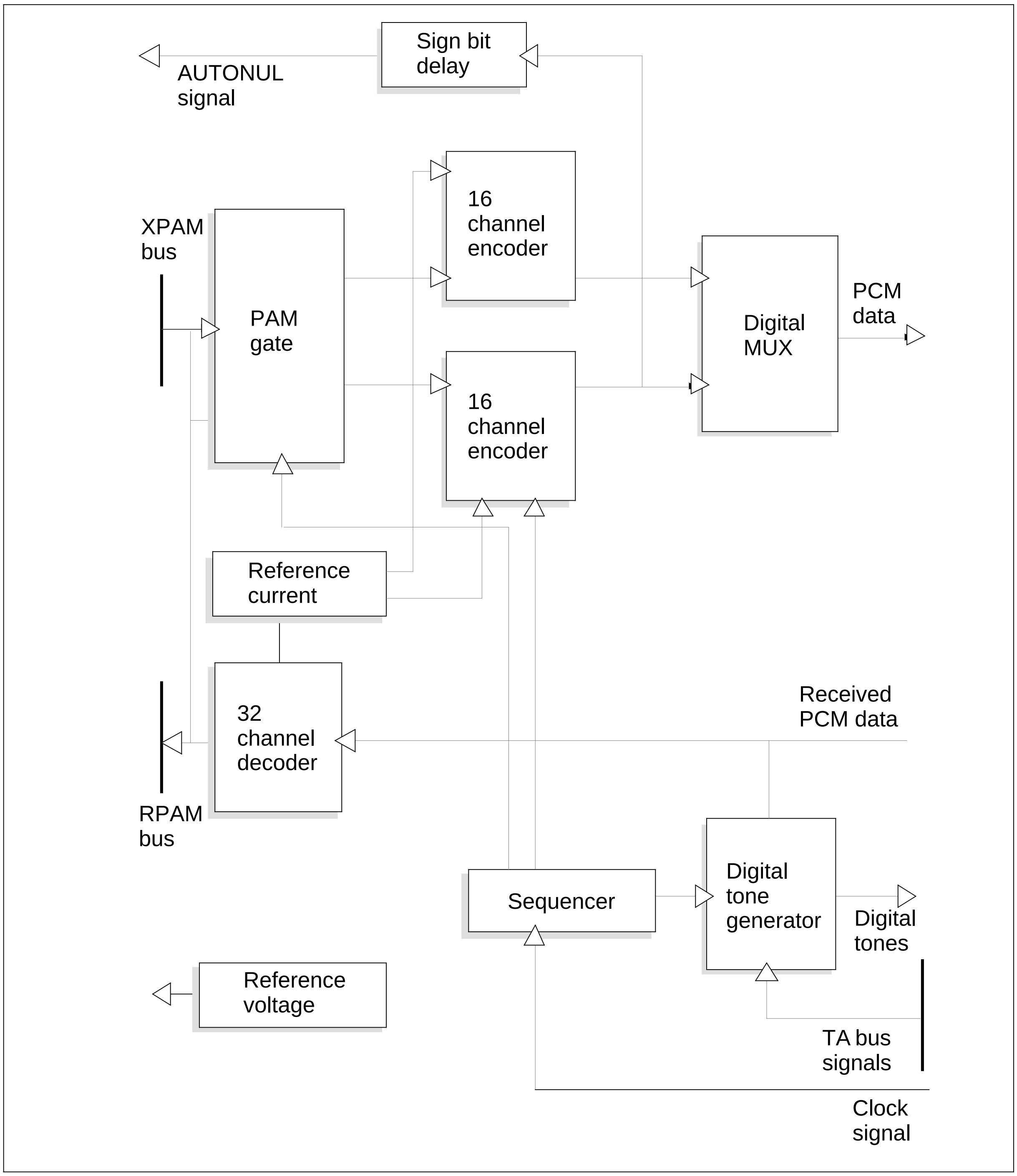
Functional blocks

The NT2X59AD contains the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

NT2X59AD (continued)

NT2X59AD functional blocks



NT2X59AD (continued)

PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder is able to receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and decoder.

16-channel encoder

The encoder sends the PAM samples to the two 16-channel encoders for conversion to μ-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders and combines the signals into a 32-channel signal. The digital MUX sends the 32-channel PCM signal over the C-bus.

32-channel decoder

The digital MUX sends the PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals to μ-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders, and the operation of the tone generator. The sequencer control allows synchronization of the card output with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the signal to null DC offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59AD (continued)

The tones that the tone generator produces appear in the following table.

NT2X59AD tone generator output

Frequency(Hz)	Level per frequency	Use
440 + 480	-19 dBm	Ringback
480 + 620	-24 dBm	Reorder (busy)
350 + 440	-13 dBm	Dial
480	-17 dBm	High tone
2600	-20 dBm	SF low
2600	-8 dBm	SF high
0		Silence
700 + 900	-6 dBm	Multifrequency (MF) signaling
700 + 1100	-6 dBm	MF signaling
900 + 1100	-6 dBm	MF signaling
700 + 1300	-6 dBm	MF signaling
900 + 1300	-6 dBm	MF signaling
1100 + 1300	-6 dBm	MF signaling
700 + 1500	-6 dBm	MF signaling
900 + 1500	-6 dBm	MF signaling
1100 + 1500	-6 dBm	MF signaling
1300 + 1500	-6 dBm	MF signaling
700 + 1700	-6 dBm	MF signaling
900 + 1700	-6 dBm	MF signaling
1100 + 1700	-6 dBm	MF signaling
1300 + 1700	-6 dBm	MF signaling
1500 + 1700	-6 dBm	MF signaling

The listed signal levels are measured at the output of the tone generator.

NT2X59AD (end)

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

Technical data

Dimensions

The NT2X59AD circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59AD appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59BA

Product description

The NT2X59BA codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). The NT2X59BA decodes PCM signals in to PAM signals. The card produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-100/200 peripheral module. An example of a PM is a maintenance trunk module (MTM), a remote service module (RSM) or a trunk module (TM).

Functional description

The NT2X59BA receives PCM signals from the C-bus. The NT2X59AB decodes the PCM signals into PAM data. The NT2X59BA sends the PAM data to the trunk circuits over the receive-PAM (RPAM) bus. The trunk circuits send the PAM signals over the transmit-PAM (XPAM) bus. The NT2X59BA encodes the PAM signals into PCM. The NT2X59AB sends the PCM over the C-bus. The card generates standard digital tones for supervision or signaling. The NT2X59AB inserts the tones into an output channel. The operation of the card is synchronized with the system clock signal.

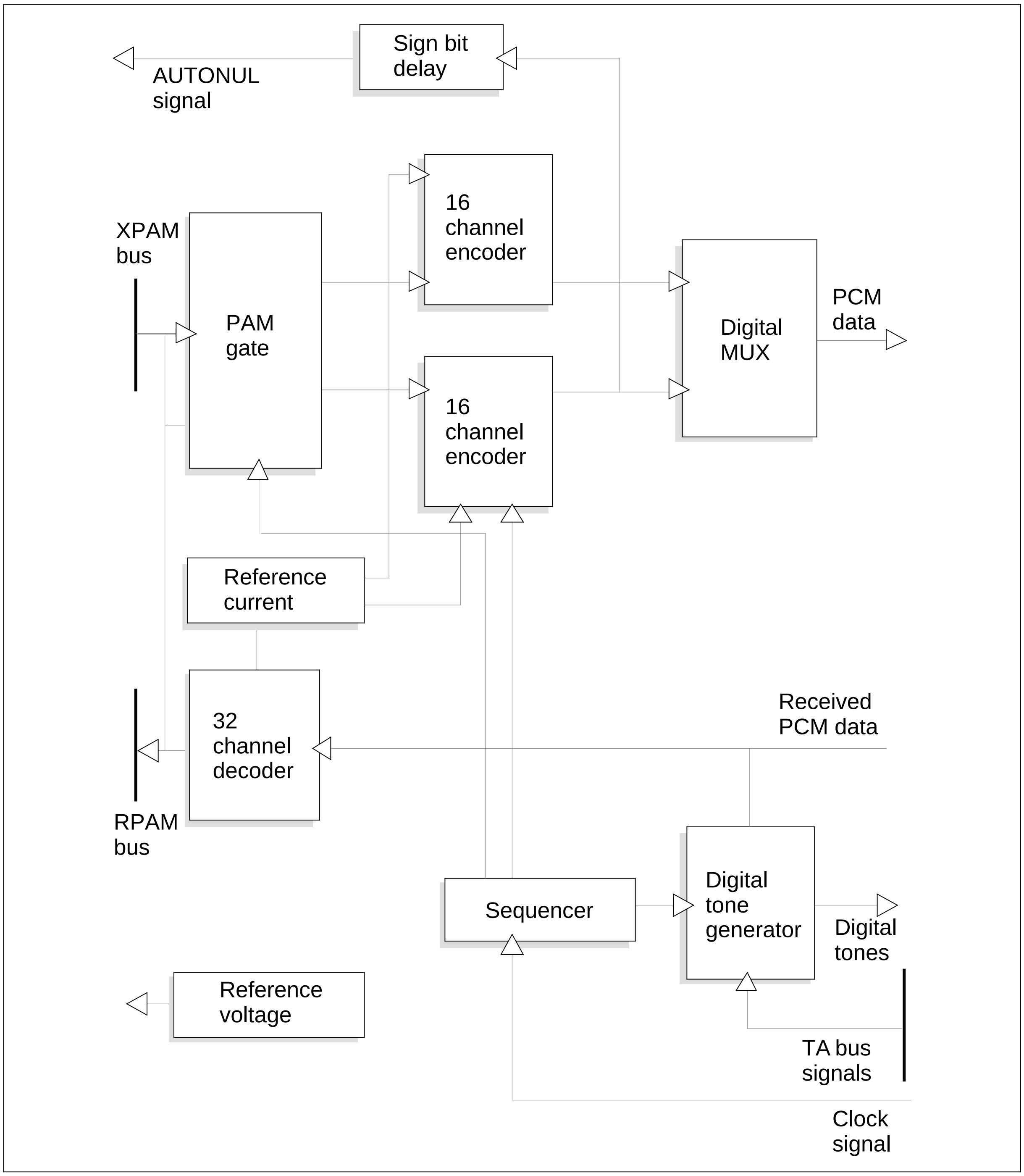
Functional blocks

The NT2X59BA contains the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

NT2X59BA (continued)

NT2X59BA functional blocks



NT2X59BA (continued)

PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and decoder.

16-channel encoder

The encoder sends the PAM samples to the two 16-channel encoders for conversion to A-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals into a 32-channel signal. The digital MUX sends the 32-channel PCM signal over the C-bus.

32-channel decoder

The digital MUX sends the PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals into A-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders and the operation of the tone generator. The sequencer controls the timing to synchronize the card output with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the signal to null DC offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59BA (continued)

The tones that tone generator produces appear in the following table.

NT2X59BA tone generator output (Sheet 1 of 2)

Frequency (Hz)	Level per frequency	Use
2600	-8 dBm	SF high
2600	-20 dBm	SF low
450	-10 dBm	Ringback
360 + 460	-13 dBm	Dial
360 + 460	-3 dBm	Dial
450	0 dBm	Reorder (busy)
450	0 dBm	Reorder (busy)
360 + 460	-13 dBm	
360 + 460	-3 dBm	
0		Silence
700 + 900	-6 dBm	Multifrequency (MF) signaling
700 + 1100	-6 dBm	MF signaling
900 + 1100	-6 dBm	MF signaling
700 + 1300	-6 dBm	MF signaling
900 + 1300	-6 dBm	MF signaling
1100 + 1300	-6 dBm	MF signaling
700 + 1500	-6 dBm	MF signaling
900 + 1500	-6 dBm	MF signaling
1100 + 1500	-6 dBm	MF signaling
1300 + 1500	-6 dBm	MF signaling
700 + 1700	-6 dBm	MF signaling
900 + 1700	-6 dBm	MF signaling
1100 + 1700	-6 dBm	MF signaling

NT2X59BA tone generator output (Sheet 2 of 2)

Frequency (Hz)	Level per frequency	Use
1300 + 1700	-6 dBm	MF signaling
1500 + 1700	-6 dBm	MF signaling

The listed signal levels are measured at the output of the tone generator.

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

Technical data

Dimensions

The NT2X59BA circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59BA appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59CA

Product description

The NT2X59CA codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). The NT2X59CA decodes PCM signals in to PAM signals. The card produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-100/200 peripheral module (PM). Examples of a PM include a maintenance trunk module (MTM), a remote service module (RSM) or a trunk module (TM).

Functional description

The NT2X59CA sends PCM signals over the C-bus. The NT2X59CA decodes the PCM signals into PAM data. The NT2X59CA sends the PAM data to the trunk circuits over the receive-PAM (RPAM) bus. The trunk circuits send the PAM signals over the transmit-PAM (XPAM) bus. The NT2X59CA encodes the PAM signals into PCM. The NT2X59CA sends the PAM signals over the C-bus. The card generates standard digital tones for supervision or signaling. The NT2X59CA inserts the tones into an output channel. The operation of the card is synchronized with the system clock signal.

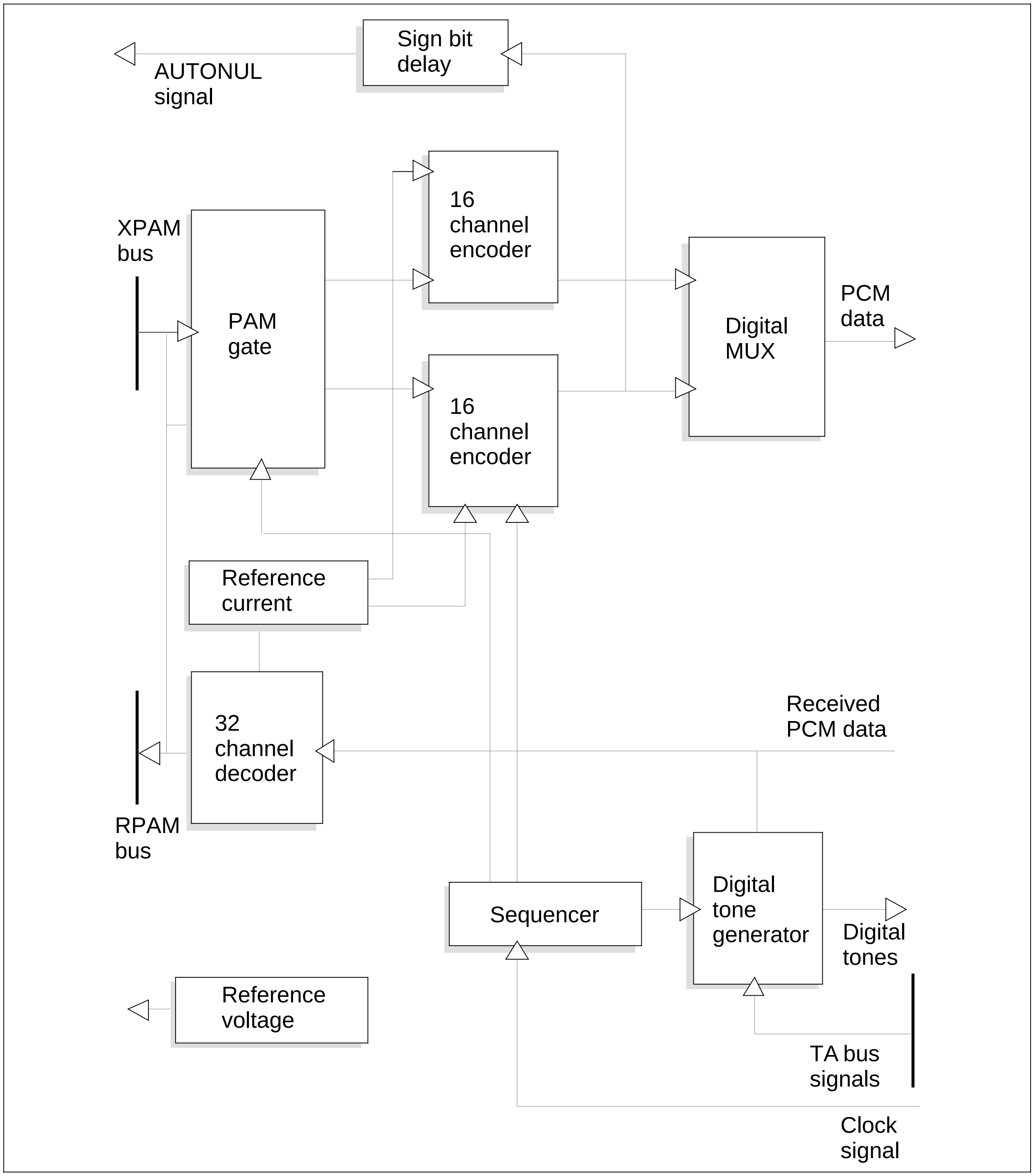
Functional blocks

The NT2X59CA contains the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

NT2X59CA (continued)

NT2X59CA functional blocks



NT2X59CA (continued)

PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and decoder.

16-channel encoder

The encoders sends the PAM samples to the two 16-channel encoders for conversion to A-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals into a 32-channel signal. The digital MUX sends the 32-channel PCM signal over the C-bus.

32-channel decoder

The digital MUX sends the PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals into A-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders and the operation of the tone generator. The sequencer controls timing to synchronize the card output with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the signal to null DC offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59CA (continued)

The tones that the tone generator produces appear in the following table.

NT2X59CA tone generator output

Frequency (Hz)	Level per frequency	Use
440 + 440	-21 dBm	Ringback
400	-19 dBm	Reorder (busy)
350 + 440	-21 dBm	Dial
400	-25 dBm	Reorder (busy)
2600	-20 dBm	SF low
2600	-8 dBm	SF high
0		Silence
700 + 900	-6 dBm	Multifrequency (MF) signaling
700 + 1100	-6 dBm	MF signaling
900 + 1100	-6 dBm	MF signaling
700 + 1300	-6 dBm	MF signaling
900 + 1300	-6 dBm	MF signaling
1100 + 1300	-6 dBm	MF signaling
700 + 1500	-6 dBm	MF signaling
900 + 1500	-6 dBm	MF signaling
1100 + 1500	-6 dBm	MF signaling
1300 + 1500	-6 dBm	MF signaling
700 + 1700	-6 dBm	MF signaling
900 + 1700	-6 dBm	MF signaling
1100 + 1700	-6 dBm	MF signaling
1300 + 1700	-6 dBm	MF signaling
1500 + 1700	-6 dBm	MF signaling

The listed signal levels are measured at the output of the tone generator.

NT2X59CA (end)

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

Technical data

Dimensions

The NT2X59CA circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59CA appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59CB

Product description

The NT2X59CB codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). The NT2X59CB decodes PCM signals in to PAM signals. The card produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-300 peripheral module. Examples of a peripheral module include a maintenance trunk module (MTM), a remote service module (RSM) or a trunk module (TM).

Functional description

The NT2X59CB receives PCM signals over the C-bus. The NT2X59CB decodes the PCM signals into PAM data. When this event occurs, the trunk circuits receive the PAM data over the receive-PAM (RPAM) bus. The trunk circuits send PAM signals over the transmit-PAM (XPAM) bus. The NT2X59CB encodes the PAM signals into PCM. The NT2X59CB sends the PCM signals over the C-bus. The card generates standard digital tones for supervision or signaling. The card inserts the tones into an output channel. The operation of the card is synchronized with the system clock signal.

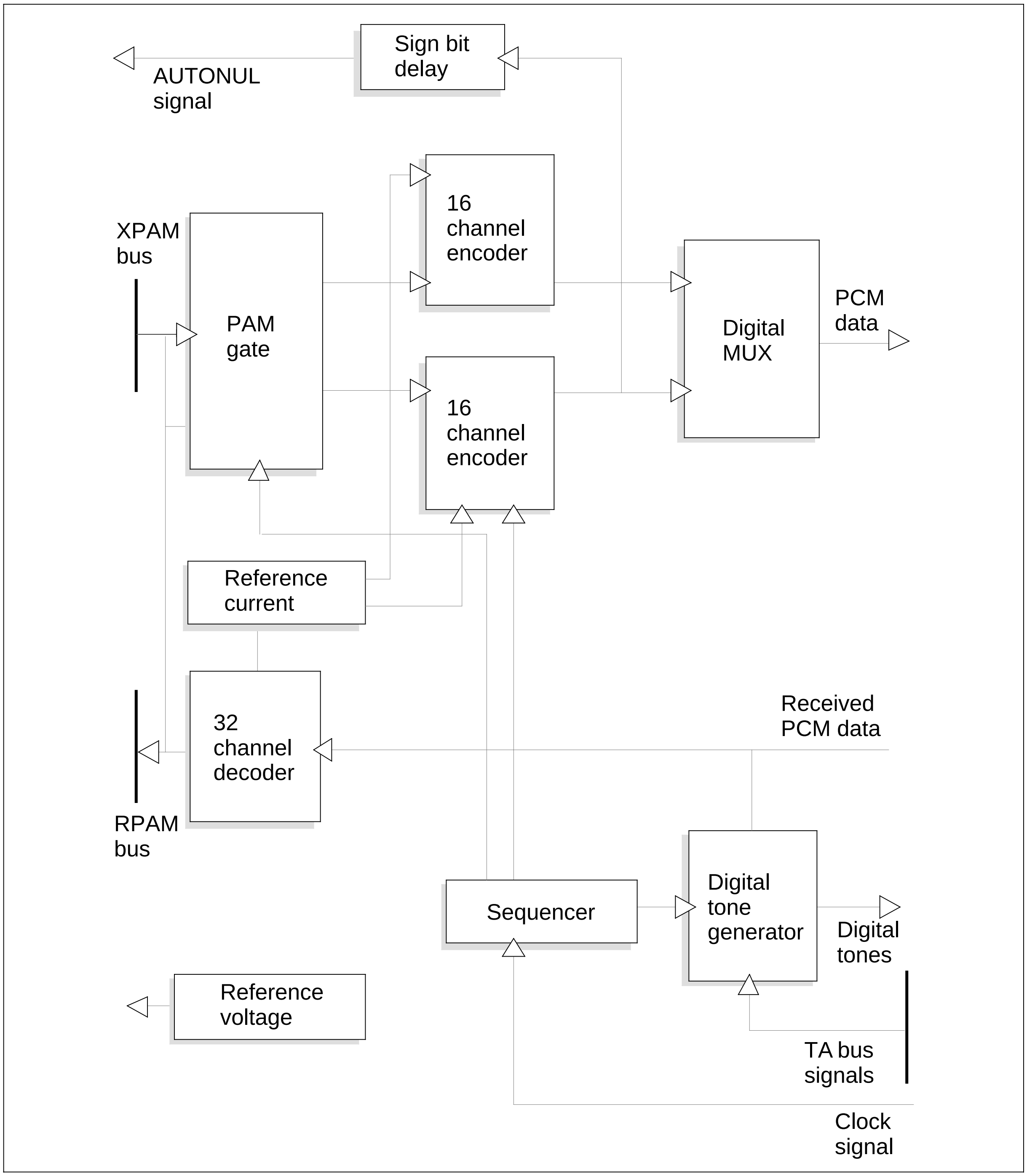
Functional blocks

The NT2X59CB contains the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

NT2X59CB (continued)

NT2X59CB functional blocks



PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and decoder.

16-channel encoder

The encoder sends the PAM samples to the two 16-channel encoders for conversion to A-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals into a 32-channel signal. The digital MUX sends the 32-channel PCM signal is over the C-bus.

32-channel decoder

The digital MUX sends PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals to A-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders and the operation of the tone generator. The sequencer controls timing to allow the synchronization of card output with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the signal to null DC offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59CB (continued)

The tones that the tone generator produces appear in the following table.

NT2X59CB tone generator output (Sheet 1 of 2)

Frequency (Hz)	Level per frequency	Use
1100	-19 dBm	Ringback
480 + 620	-24 dBm	Low tone
350 + 440	-13 dBm	Dial
480	-17 dBm	High tone
2600	-20 dBm	SF low
2600	-8 dBm	SF high
2400	-9 dBm	C5 signaling
2600	-9 dBm	C5 signaling
2400 + 2600	-9 dBm	C5 signaling
2000	-12 dBm	Reserved
0		Silence
700 + 900	-7 dBm	Multifrequency (MF) signaling
700 + 1100	-7 dBm	MF signaling
900 + 1100	-7 dBm	MF signaling
700 + 1300	-7 dBm	MF signaling
900 + 1300	-7 dBm	MF signaling
1100 + 1300	-7 dBm	MF signaling
700 + 1500	-7 dBm	MF signaling
900 + 1500	-7 dBm	MF signaling
1100 + 1500	-7 dBm	MF signaling
1300 + 1500	-7 dBm	MF signaling
700 + 1700	-7 dBm	MF signaling
900 + 1700	-7 dBm	MF signaling

NT2X59CB tone generator output (Sheet 2 of 2)

Frequency (Hz)	Level per frequency	Use
1100 + 1700	-7 dBm	MF signaling
1300 + 1700	-7 dBm	MF signaling
1500 + 1700	-7 dBm	MF signaling

The listed signal levels are measured at the output of the tone generator.

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

Technical data

Dimensions

The NT2X59CB circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59CB appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59DA

Product description

The NT2X59DA codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). The NT2X59DA decodes PCM signals in to PAM signals. The card produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-100/200 peripheral module (PM). An example of a PM includes a maintenance trunk module (MTM), a remote service module (RSM) or a trunk module (TM).

Functional description

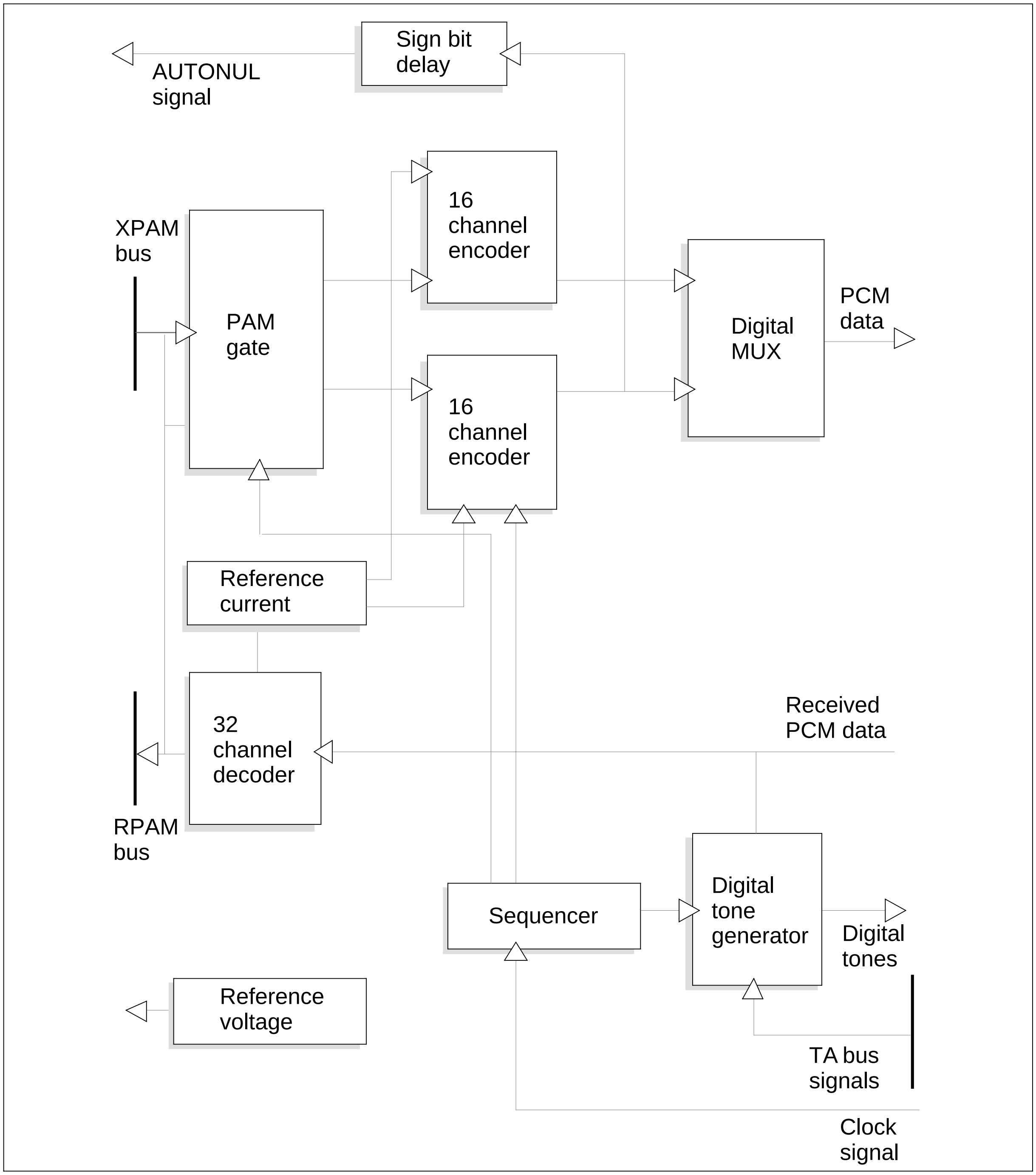
The NT2X59DA receives PCM signals from the C-bus. The NT2X59DA decodes the PCM signals into PAM data. The NT2X59DA sends the PAM data to the trunk circuits over the receive-PAM (RPAM) bus. The trunk units send PAM signals over the transmit-PAM (XPAM) bus. The NT2X59DA encodes the PAM signals to PCM. The NT2X59DA sends the PCM over the C-bus. The card generates standard digital tones for supervision or signaling. The card inserts the tones into an output channel. The operation of the card is synchronized with the system clock signal.

Functional blocks

The NT2X59DA contains the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

NT2X59DA functional blocks



PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM

NT2X59DA (continued)

data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and decoder.

16-channel encoder

The encoder sends PAM samples to the two 16-channel encoders for conversion to A-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals into a 32-channel signal. The digital MUX sends this 32-channel PCM signal over the C-bus.

32-channel decoder

The digital MUX sends the PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals to A-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders and the operation of the tone generator. The sequencer controls timing to synchronize card output remains synchronized with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the signal to null DC offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59DA (continued)

The tones that the tone generator produces appear in the following table.

NT2X59DA tone generator output

Frequency (Hz)	Level per frequency	Use
440 + 480	-10 dBm	Ringback
480 + 620	-10 dBm	Reorder (busy)
350 + 440	-10 dBm	Dial
440	-8 dBm	Toll break-in
0		Silence
700 + 900	-6 dBm	Multifrequency (MF) signaling
700 + 1100	-6 dBm	MF signaling
900 + 1100	-6 dBm	MF signaling
700 + 1300	-6 dBm	MF signaling
900 + 1300	-6 dBm	MF signaling
1100 + 1300	-6 dBm	MF signaling
700 + 1500	-6 dBm	MF signaling
900 + 1500	-6 dBm	MF signaling
1100 + 1500	-6 dBm	MF signaling
1300 + 1500	-6 dBm	MF signaling
700 + 1700	-6 dBm	MF signaling
900 + 1700	-6 dBm	MF signaling
1100 + 1700	-6 dBm	MF signaling
1300 + 1700	-6 dBm	MF signaling
1500 + 1700	-6 dBm	MF signaling

The listed signal levels are measured at the output of the tone generator.

NT2X59DA (end)

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

Technical data

Dimensions

The NT2X59DA circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59DA appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X59EA

Product description

The NT2X59EA codes pulse amplitude modulation (PAM) signals in to pulse code modulation (PCM). The NT2X59EA decodes PCM signals in to PAM signals. The card produces PCM tones for signaling and supervision purposes.

Location

The card occupies one card position in a DMS-100/200 peripheral module (PM). Examples of a PM include a maintenance trunk module (MTM), a remote service module (RSM), or a trunk module (TM).

Functional description

The NT2X59EA receives PCM signals from the C-bus. The NT2X59EA decodes the PCM signals into PAM data. The NT2X59EA sends the PAM data to the trunk circuits over the receive-PAM (RPAM) bus. The trunk circuits send the PAM signals over the transmit-PAM (XPAM) bus. The NT2X59EA encodes the PAM signals into PCM. The NT2X59EA sends the PCM over the C-bus. The card generates standard digital tones for supervision or signaling. The card inserts the tones into an output channel. The operation of the card is synchronized with the system clock signal.

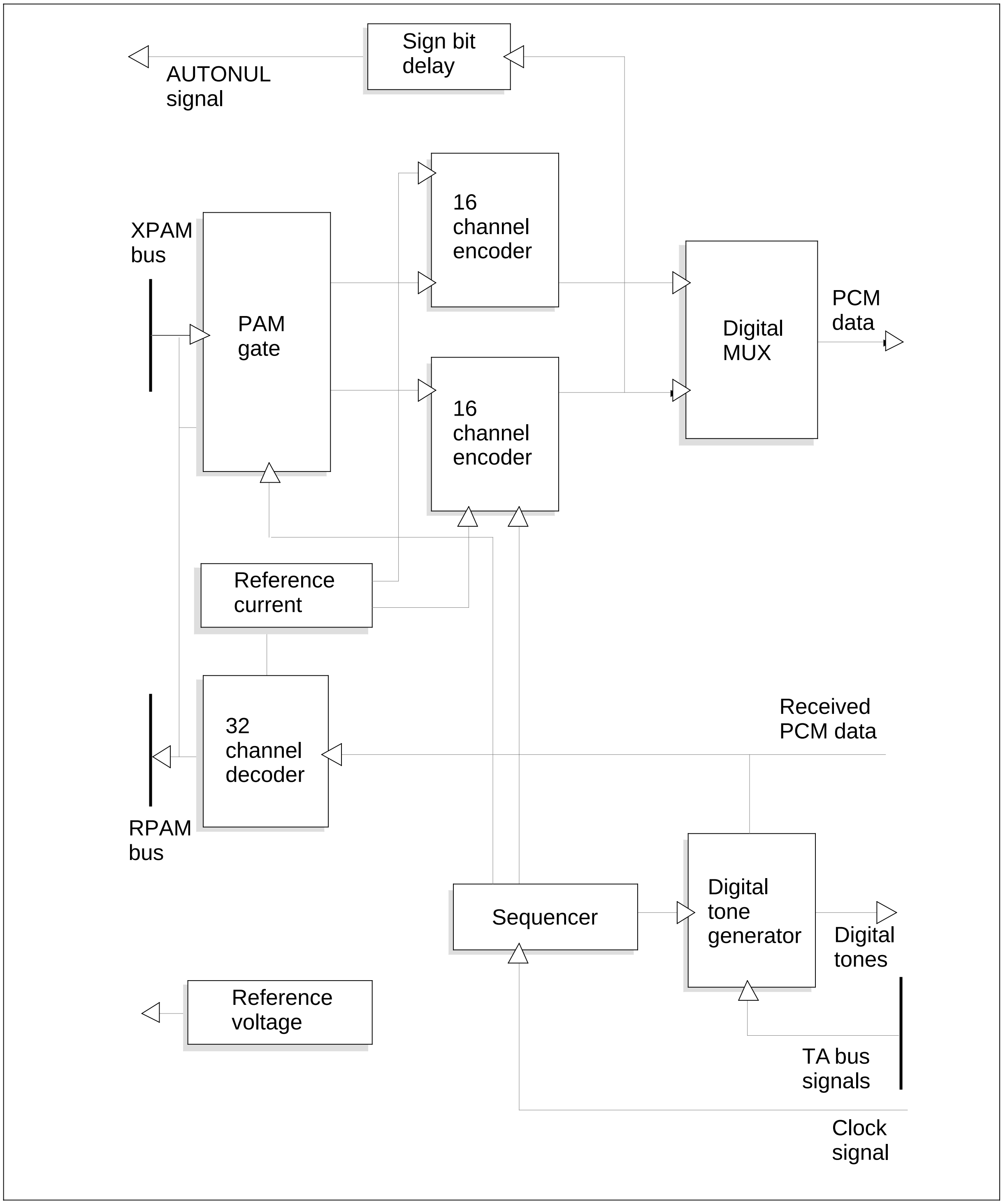
Functional blocks

The NT2X59EA contains the following functional blocks:

- PAM gate
- two 16-channel encoders
- digital multiplexer (MUX)
- 32-channel decoder
- sequencer
- sign bit delay
- digital tone generator
- reference current circuit
- reference voltage circuit

NT2X59EA (continued)

NT2X59EA functional blocks



PAM gate

The PAM gate receives the PAM samples from the trunk cards over the XPAM bus. The PAM gate holds the samples until the encoder can receive the PAM data. Signals from the sequencer control when the PAM gate sends the signals to the encoders.

The gate can connect the XPAM and the RPAM buses to test the operation of the encoders and decoder.

16-channel encoder

The encoder sends PAM samples to the two 16-channel encoders for conversion to A-law PCM samples. The PAM gate alternately sends the samples to each encoder. The combined encoder outputs, when combined, produce a composite 32-channel signal. Each encoder sends PCM signals to the digital MUX.

Digital MUX

The digital MUX receives the PCM samples from the 16-channel encoders. The digital MUX combines the signals into a 32-channel signal. The digital MUX sends the 32-channel PCM signal over the C-bus.

32-channel decoder

The digital MUX sends PCM signals over the C-bus to the 32-channel decoder. The 32-channel decoder converts the PCM signals to A-law PAM signals. The 32-channel decoder sends the PAM signals to the trunk circuits over the RPAM bus.

Sequencer

The sequencer uses a received clock signal to synchronize the operations of the card. Sequencer outputs control the timing of PAM samples sent to the encoders and the operation of the tone generator. The sequencer controls timing to synchronize the card output with the external PCM signals.

Sign bit delay

The sign bit delay circuit stores the PCM sign bit that each PAM sample generates. The sign bit delay sends the PCM sign bit to the transmitting trunk circuit over the AUTONUL bus. The trunk circuit uses the signal to null DC offsets in the XPAM signals.

Digital tone generator

Signals from the TA bus control the digital tone generator to produce signaling and supervisory tones. The card inserts the tones into the PAM or the PCM signals.

NT2X59EA (continued)

The tones that the tone generator produces appear in the following table.

NT2X59EA tone generator output

Frequency (Hz)	Level per frequency	Use
440 + 440	-13 dBm	Ringback
400	-10 dBm	Reorder (busy)
350 + 440	-13 dBm	Dial
400	-17 dBm	Reorder (busy)
2600	-20 dBm	SF low
2600	-8 dBm	SF high
0		Silence
700 + 900	-6 dBm	Multifrequency (MF) signaling
700 + 1100	-6 dBm	MF signaling
900 + 1100	-6 dBm	MF signaling
700 + 1300	-6 dBm	MF signaling
900 + 1300	-6 dBm	MF signaling
1100 + 1300	-6 dBm	MF signaling
700 + 1500	-6 dBm	MF signaling
900 + 1500	-6 dBm	MF signaling
1100 + 1500	-6 dBm	MF signaling
1300 + 1500	-6 dBm	MF signaling
700 + 1700	-6 dBm	MF signaling
900 + 1700	-6 dBm	MF signaling
1100 + 1700	-6 dBm	MF signaling
1300 + 1700	-6 dBm	MF signaling
1500 + 1700	-6 dBm	MF signaling

The listed signal levels are measured at the output of the tone generator.

NT2X59EA (end)

Reference current circuit

The reference current circuit provides a regulated current source for the two 16-channel encoders and the 32-channel decoder. This current source makes sure operation of the encoders and the decoder has stability.

Reference voltage circuit

The reference voltage circuit produces a stable reference voltage. The reference voltage circuit sends that voltage to the trunk circuits. The trunk circuits use the reference voltage for the trunk identification feature.

Technical data

Dimensions

The NT2X59EA circuit card has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10.0 in.)

Power requirements

The power requirements for the NT2X59EA appear in the following table.

Power requirements

Voltage	Current
+12 V	0.20 A
+5 V	1.40 A
-15 V	0.07 A

NT2X65AB

Product description

The NT2X65AB centralized automatic message accounting (CAMA) position signaling circuit card provides an interface between the trunk module (TM) and the common systems circuit. The common systems circuit serves as the position of a CAMA operator at a toll switchboard. The card provides an interface for two-way voice frequency (VF) and signaling information, and multi-frequency (MF) signals from the CAMA positions.

Location

The card occupies one card position in a TM.

Functional description

The NT2X65AB contains two main parts: the key circuit and the talk circuit. The key circuit receives MF pulses from the CAMA operator. The talk circuit provides a speech path for the CAMA operator. The talk circuit also provides supervision and signaling necessary for the operator number identification (ONI) and to handle failures in automatic number identification (ANI).

Functional blocks

The NT2X65AB contains the following functional blocks:

- two trunk logic circuits (TLC)
- dual sampling gate
- two analog/digital (A/D) low-pass filters (each key and talk circuit receives one filter)
- two digital/analog (D/A) low-pass filters (each key and talk circuit receives one filter)
- two receive level adjustment pads (each key and talk circuit receives one filter)
- fixed transmit level pad (key circuit)
- adjustable transmit level pad (talk circuit)
- three limiters (one for the key circuit, two for the talk circuit)
- two-wire to four-wire terminating set
- balance network
- loop detector
- resistive battery detector
- relays
- card-type identifier

TLC

Two TLCs are available. The TLC-0 for the key circuit and TLC-1 for the talk circuit. The two TLCs handle communication between the card and the TM. The TLCs serve as communication buffers between the TM and the card. The TLCs generate sampling pulses for the sampling gate, and control the test relays. The TLC-1 also generates the voltage for the card-type identification voltage.

Dual sampling gate

In the receive direction, the sampling gate converts analog VF signals to pulse amplitude modulation (PAM) signals. The sampling gate sends the signals over the transmit pulse amplitude modulation (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information, from the receive pulse amplitude modulation (RPAM) bus, back to VF signals. The gate sends the signals to the key or talk circuits. Use the transmit direction of the key circuit for tests.

The sampling gate performs the conversion functions separately for the key and the talk circuits. Signals from TLC-0 control the conversion for the key circuit. Signals from TLC-1 control the conversion for the talk circuit.

A/D low-pass filters

Each key and talk circuit contains an A/D low-pass filter. The filters accept VF signals from the receive level-adjustment pad and filter the signals to limit the bandwidth. The filters pass the signals to the sampling gate. The filters also amplify the signal.

D/A low-pass filters

Each key and talk circuit contains a D/A low-pass filter. The filters accept VF signals from the dual sampling gate and filter the signals to limit the bandwidth. The filters pass the signals to the transmit pads. The filters also amplify the signal.

Receive level adjustment pads

The receive level adjustment pads provide a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal. The receive level adjustment pads provide an adjustment before the card converts the VF signal to digital form and processes the VF signal. To make adjustments, set groups of miniature switches to the correct level.

NT2X65AB (continued)

The level adjustments for the talk circuit appear in the following table.

Talk circuit receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The level adjustments for the key circuit appear in the following table.

Key circuit receive level adjustments

Switch position	Adjustment (dB)
S5, position 3	8.00
S5, position 2	4.00
S5, position 1	2.00
S6, position 3	1.00
S6, position 2	0.50
S6, position 1	0.25

The receive level adjustment also contain a 60-Hz filter to remove line noise.

Fixed transmit level pad

The key circuit contains a fixed transmit level pad. The fixed transmit level pad provides a fixed level of adjustment for signals in the transmit direction. The transmit section of the key circuit is for tests. The transmit section does not require a range of level adjustment.

Adjustable transmit level pad

The adjustable transmit level pad provides a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal. The adjustable transmit level pad sends the adjustment over the trunk. To make adjustments, set groups of miniature switches to the correct level.

NT2X65AB (continued)

The talk circuit transmit level adjustments appear in the following table.

Talk circuit transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Three limiters are available. Each limiter prevents circuit overload. A received or transmitted signal can cause circuit overload. The first limiter is in the receive direction of the key circuit. The second limiter is in the transmit direction of the talk circuit. The third limiter is in the receive direction of the talk circuit.

Two-wire to four-wire terminating set

The two-wire to four-wire terminating set converts a two-wire circuit to the four-wire circuit that the CAMA equipment expects.

Balance network

A balance network connects with the two-wire to four-wire terminating set to match the card with a 600Ω nonloaded facility. The compromise network provides 600Ω of resistance and 2.15 µF of capacitance. This compromise network also provides network build-out capacitance (NBOC) and network build-out resistance (NBOR) circuits. The NBOC and the NBOR provide additional capacitance and resistance. You can switch the additional capacitance and resistance in or out of the circuit.

Loop detector

The loop detector checks the tip (T) and ring (R) leads for a high-resistance (onhook) loop or a low-resistance (offhook) loop. A low-resistance loop indicates to the operator that the T and R leads were seized. The CAMA operator uses a high-resistance loop to disconnect from an offhook condition. The CAMA operator activates the position disconnect (PD) key. The PD key causes the T and R leads to loop. When the CAMA operator leaves the CAMA

NT2X65AB (continued)

position, an alternating high-low loop is present on the T and R leads. This loop indicates that the CAMA operator is not available.

Resistive battery detector

The resistive battery detector monitors the P lead for an open or resistive battery condition. Resistive battery is present when the CAMA operator is ready to receive calls. The P lead is open if the CAMA operator leaves the CAMA position and indicates to the DMS that the operator is not available.

Relays

Six relays are available for supervisory and signaling purposes. The TLC-0 controls one relay that operates in the key circuit. The TLC-1 controls the other five relays that operate in the talk circuit. The designators and purpose for each relay appear in the following table.

Relay operation (Sheet 1 of 2)

Relay	Operated	Released	Controlled by
T0	Isolates leads KPT and KPR from the circuit. Allows internal tests on the key circuit.	Normal operation	TLC-0 (key circuit)
OI	The S and OI leads grounded. The CAMA supervision (CS) lamp glows, operator hears double-burst high tone. Operator challenges subscriber on calls that are not ANI and keys number of the subscriber.	Normal operation	TLC-1 (talk circuit)
IF	The OI relay operated, S and IF leads grounded. Operator hears long high tone, that indicates an ANI failure occurs. Operator challenges subscriber.	Normal operation	TLC-1 (talk circuit)

NT2X65AB (continued)

Relay operation (Sheet 2 of 2)

Relay	Operated	Released	Controlled by
RV	Steady battery reversal on T and R leads. The CS lamp flashes at 60 flashes each minute. The flashes indicate a keying error or an invalid calling number. Momentary battery reversal on T and R leads if relay operates for a moment before a release. The CS lamp flashes at 60 flashes each minute minute for 3 to 5 s. The flashes indicate the operator used the operator reset (RS) key. The operator user the key to erase a keying error during digit pulsing.	Removal of battery reversal on T and R leads. The CS lamp stops flashing. Indicates the system erased the digits in invalid number.	TLC-1 (talk circuit)
T1	Isolates the S and P leads and allows an internal test on part of the talk circuit. Relay T2 must be operated to loop the talk circuit.	Normal operation	TLC-1 (talk circuit)
T2	Isolates the T and R leads and allows an internal test on part of the talk circuit. Relay T1 must be operated to loop the talk circuit.	Normal operation	TLC-1 (talk circuit)

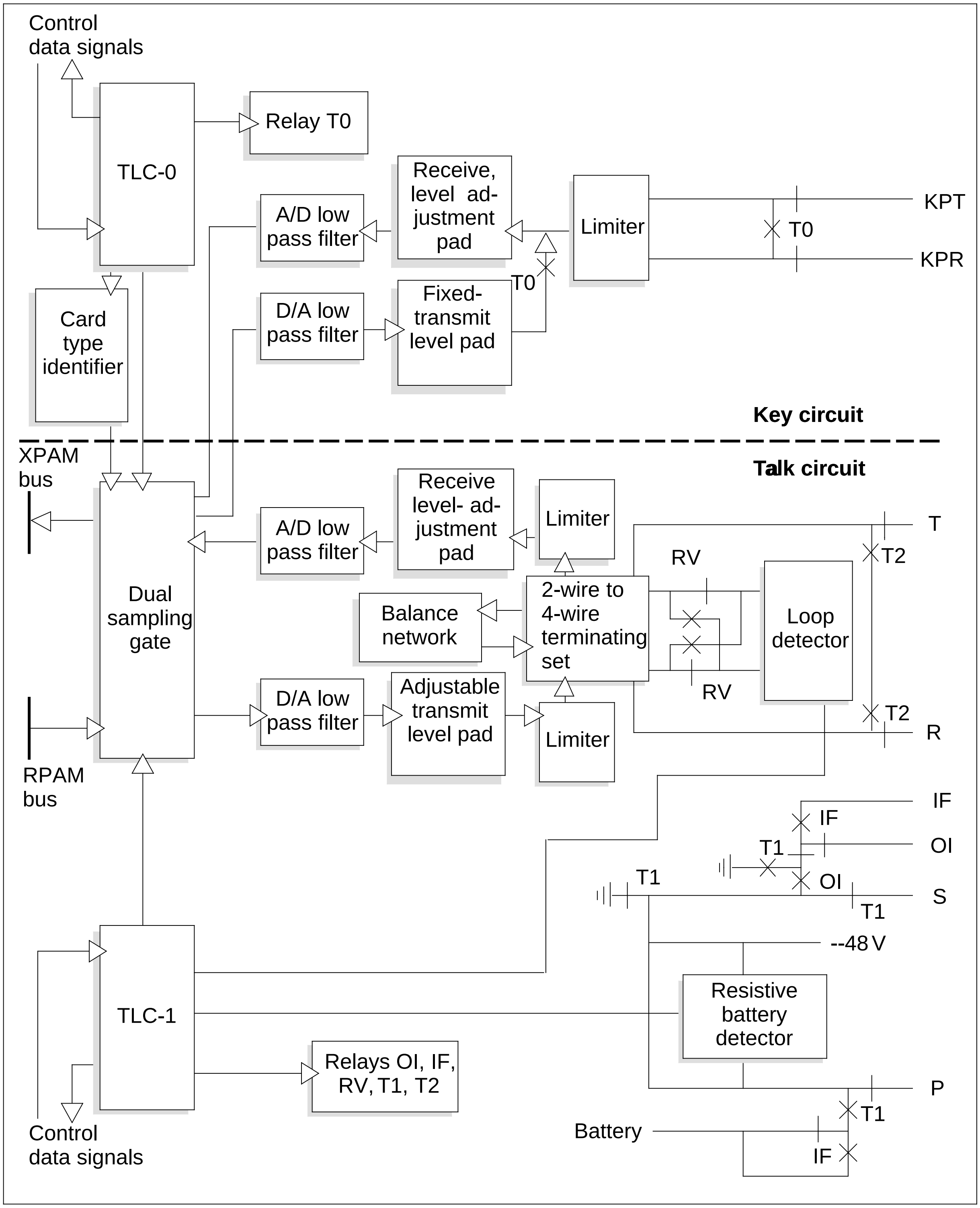
Card-type identifier

The card-type identifier provides the TM with an identification code for inventory purposes. The card-type identifier makes sure that the card is plugged in the TM card slot.

The relationship between the functional blocks appears in the following figure.

NT2X65AB (continued)

NT2X65AB functional blocks



NT2X65AB (end)

Technical data

Each talk circuit and key circuit provides impedance of 600Ω

The minimum receive level for the talk circuit is -9 dBm for digital test sequence (DTS) output. The level ranges for the talk and key circuits appear in the following table.

Talk and key circuit level ranges

Level	Range
Talk circuit, transmit level	+6 to -9 dBm for DTS input
Talk circuit, receive level	-9 to +6 dBm for DTS output
Key circuit	-3 to -18 dBm, single tone for DTS-6 output

Physical Dimensions

The dimensions for the NT2X65AB circuit card are:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)

Power requirements

The NT2X65AB normally uses 500 mW of power.

The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27.0 V (24.0 V nominal)

NT2X65AD

Product description

The NT2X65AD provides an interface between the trunk module (TM) and the common systems circuit. The common systems circuit serves as the position of a centralized automatic message accounting (CAMA) operator at a toll switchboard. The card provides an interface for two-way voice frequency (VF) and signaling information. The card provides an interface for multi-frequency (MF) signals that come from the CAMA positions.

Location

The card occupies one card position in a TM.

Functional description

The NT2X65AD contains two main parts: the key circuit and the talk circuit. The key circuit receives MF pulses from the CAMA operator. The talk circuit provides a speech path for the CAMA operator. The talk circuit also provides supervision and signaling necessary for the operator number identification (ONI), and to handle failures in automatic number identification (ANI).

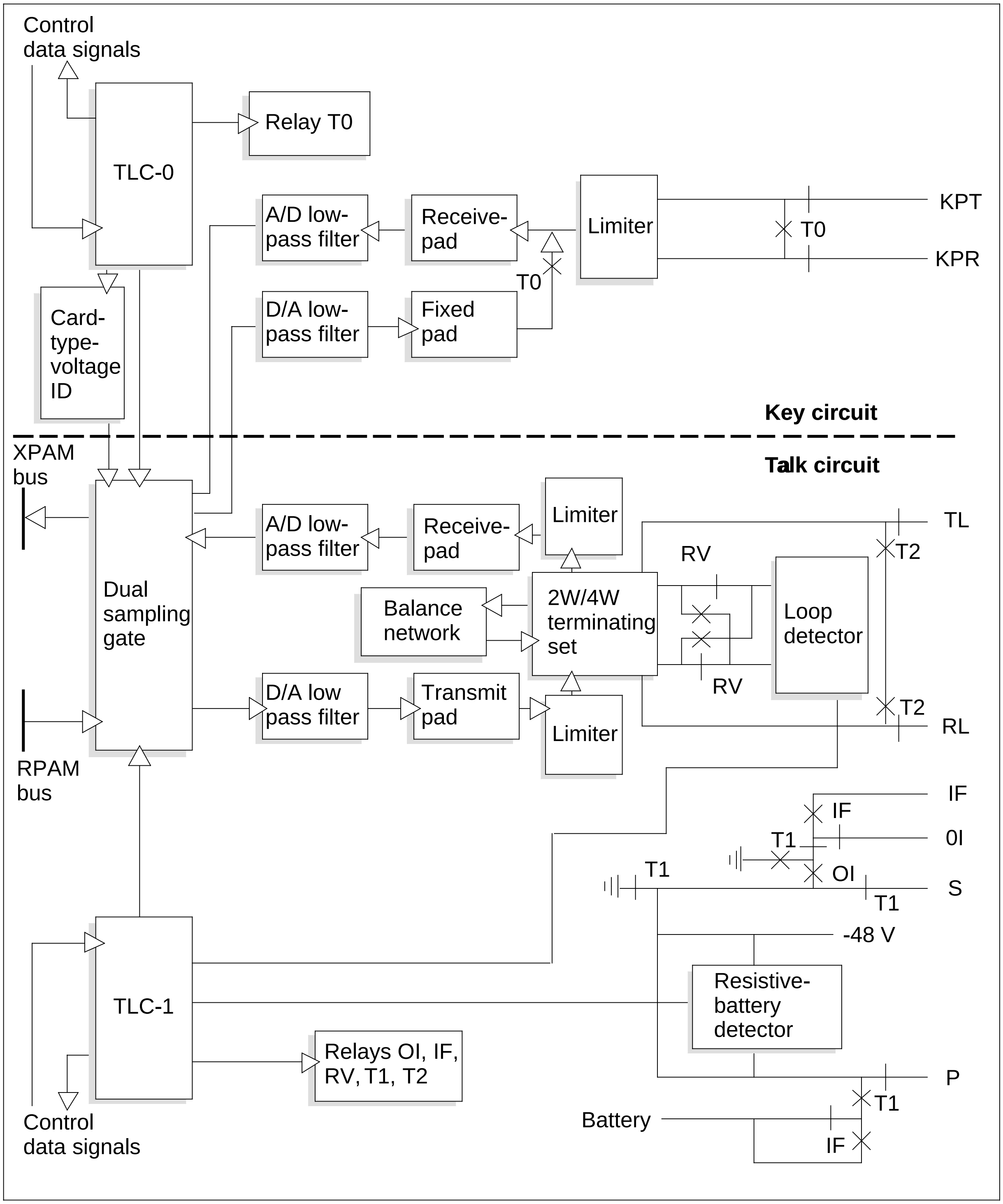
Functional blocks

The NT2X65AD contains the following functional blocks:

- two trunk logic circuits (TLC)
- dual sampling gate
- two analog/digital (A/D) low-pass filters (each key and talk circuit receives one filter)
- two digital/analog (D/A) low-pass filters (each key and talk circuit receives one filter)
- two receive level adjustment pads (each key and talk circuit receives one filter)
- fixed transmit level pad (key circuit)
- adjustable transmit level pad (talk circuit)
- three limiters (one for the key circuit, two for the talk circuit)
- two-wire/four-wire terminating set
- balance network
- loop detector
- resistive battery detector
- relays
- card type identifier

NT2X65AD (continued)

NT2X65AD functional blocks



NT2X65AD (continued)

TLC

Two TLCs are available: TLC-0 for the key circuit and TLC-1 for the talk circuit. The two TLCs handle communication between the card and the trunk module (TM). The TLCs serve as communication buffers between the TM and the card. The TLCs generate sampling pulses for the sampling gate, and control the test relays. The TLC-1 also generates the voltage for the card-type identification voltage.

Dual sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to pulse amplitude modulation (PAM) signals. The sampling gate sends the signals over the XPAM bus for further processing. In the transmit direction, the gate converts PAM information from the receive pulse amplitude modulation (RPAM) bus back to VF signals. The sampling gate sends the signals to the key or talk circuits. The transmit direction of the key is used for tests.

The sampling gate performs the conversion functions separate from the key and the talk circuits. Signals from TLC-0 control the conversion for the key circuit. Signals from TLC-1 control the conversion for the talk circuit.

A/D low-pass filters

The key and talk circuits each contain one A/D low-pass filter. The filters accept VF signals from the receive pads and filter the signal to limit the bandwidth. The filters pass the signal to the sampling gate. The filter also amplifies the signal.

D/A low-pass filters

The key and talk circuits each contain a D/A low-pass filter. The filters accept VF signals from the sampling gate and filter the signal to limit the bandwidth. The filters pass the signal to the transmit pads. The filter also amplifies the signal.

Receive level adjustment pads

The receive level pads provide a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal. The receive level adjustments pads provide an adjustment. The pads provide the adjustment before the card converts VF signals, converts to the digital form and processes the signal. To make adjustments, the user sets groups of small switches to achieve the correct level.

The level adjustments for the talk circuit appear in the following table.

Talk circuit receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The level adjustments for the key circuit appear in the following table.

Key circuit receive level adjustments

Switch position	Adjustment (dB)
S5, position 3	8.00
S5, position 2	4.00
S5, position 1	2.00
S6, position 3	1.00
S6, position 2	0.50
S6, position 1	0.25

The receive level pads also contain a 60-Hz filter to remove line noise.

Fixed transmit level pad

The key circuit contains a pad that provides a fixed level of adjustment for signals in the transmit direction. The transmit section of the key circuit is used for tests. The transmit section does not require a range of level adjustment.

Adjustable transmit level pad

The transmit level pads provide a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal. The adjustable transmit level pad sends the adjustment over the trunk. To make adjustments, the user sets groups of small switches to achieve the correct level.

NT2X65AD (continued)

The circuit transmit level adjustments appear in the following table.

Talk circuit transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Three limiters are available. Each limiter prevents a circuit overload. A received or transmitted signal can cause circuit overload. The first limiter is in the receive direction of the key circuit. The second limiter is in the transmit direction of the talk circuit. The third limiter is in the receive direction of the talk circuit.

Two-wire to four-wire terminating set

The terminating set converts a two-wire circuit to the four-wire circuit that the CAMA equipment expects.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600-Ω nonloaded facility. The compromise network provides 600 Ω of resistance and 2.15 µF of capacitance, and network build-out capacitance (NBOC) circuit. The NBOC provides additional capacitance that the user can switch in or out of the circuit.

Loop detector

The loop detector checks the tip (TL) and ring (RL) leads for a high-resistance (onhook) or low-resistance (offhook) loop. A low-resistance loop indicates to the operator that the system seizes TL and the RL leads. The CAMA operator uses a high-resistance loop to disconnect from an offhook condition. The CAMA operator activates the position disconnect (PD) key. The PD key causes the TL and the RL leads to loop. When the CAMA operator leaves the CAMA position, an alternating high-low loop is present on the TL and the RL leads. This loop indicates the CAMA operator is not available.

Resistive battery detector

The battery detector monitors the P lead for an open or resistive battery condition. Resistive battery is present if the CAMA operator is ready to receive calls. The P lead is open if the CAMA operator leaves the CAMA position and indicates to the DMS that the operator is not available.

Relays

Six relays are available for supervisory and signaling purposes. The TLC-0 controls one relay that operates in the key circuit. The TLC-1 controls the other five relays that operate in the talk circuit. The designator and purpose for each relay appear in the following table.

Relay operation (Sheet 1 of 2)

Relay	Operated	Released	Controlled by
T0	Isolates leads KPT and KPR from the circuit. The relay allows internal tests on the key circuit.	Normal operation	TLC-0 (key circuit)
OI	The S and OI leads grounded. CAMA Supervision (CS) lamp glows, operator hears double-burst high tone. Operator challenges subscriber on calls that are not ANI calls and keys the number of the subscriber.	Normal operation	TLC-1 (talk circuit)
IF	The OI relay is operated, S and IF leads grounded. Operator hears long high tone, which indicates that ANI failure occurs. Operator challenges subscriber.	Normal operation	TLC-1 (talk circuit)

NT2X65AD (continued)

Relay operation (Sheet 2 of 2)

Relay	Operated	Released	Controlled by
RV	Steady battery reversal on TL and RL leads. The CS lamp flashes at 60 flashes each minute which indicates a keying error or an invalid calling number. Momentary battery reversal on TL and RL leads if relay is momentarily operated and released. The CS lamp flashes at 60 flashes each minute for 3 to 5 s. The flashes indicate that the operator uses the operator reset (RS) key to erase a keying error during a digit pulse.	Removal of battery reversal on TL and RL leads. The CS lamp stops flashing. Indicates the system erases the digits in invalid number.	TLC-1 (talk circuit)
T1	Isolates the S and P leads and allows an internal test on part of the talk circuit. Relay T2 must be operated to loop the talk circuit.	Normal operation	TLC-1 (talk circuit)
T2	Isolates the TL and RL leads and allows an internal test on part of the talk circuit. Relay T1 must be operated to loop the talk circuit.	Normal operation	TLC-1 (talk circuit)

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card-type identifier checks that the card is plugged in the TM card slot.

Technical data

The talk circuit and the key circuit each provide an impedance of 600Ω The minimum receive level for the talk circuit is -9 dBm for digital test sequence

(DTS) output. The level ranges for the talk and key circuits appear in the following table.

Talk and key circuit level ranges

Level	Range
Talk circuit, transmit level	+6 to -9 dBm for DTS input
Talk circuit, receive level	-9 to + 6 dBm for DTS output
Key circuit	-3 to -18 dBm, single tone for DTS-6 output

Dimensions

Dimensions for the NT2X65AD circuit card are:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)

Power requirements

The NT2X65AD normally uses 500 mW of power.

The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V±0.5 V
- +22.8 V to +27.0 V (24.0 V nominal)

NT2X66AA

Product description

The NT2X66AA card performs two main functions. The call waiting circuit sends signals to the centralized automatic message accounting (CAMA) call waiting lamp circuits that indicate the level of calls waiting. The CAMA suspension circuit processes CAMA abandon switchboard (AS) signals and suspends CAMA operator functions. The card can appear as two E channels.

The card provides an interface between a trunk module (TM) and common systems SD95868-01 and SD95872-01 trunk circuits.

Location

The card occupies one card position in a TM shelf.

Functional description

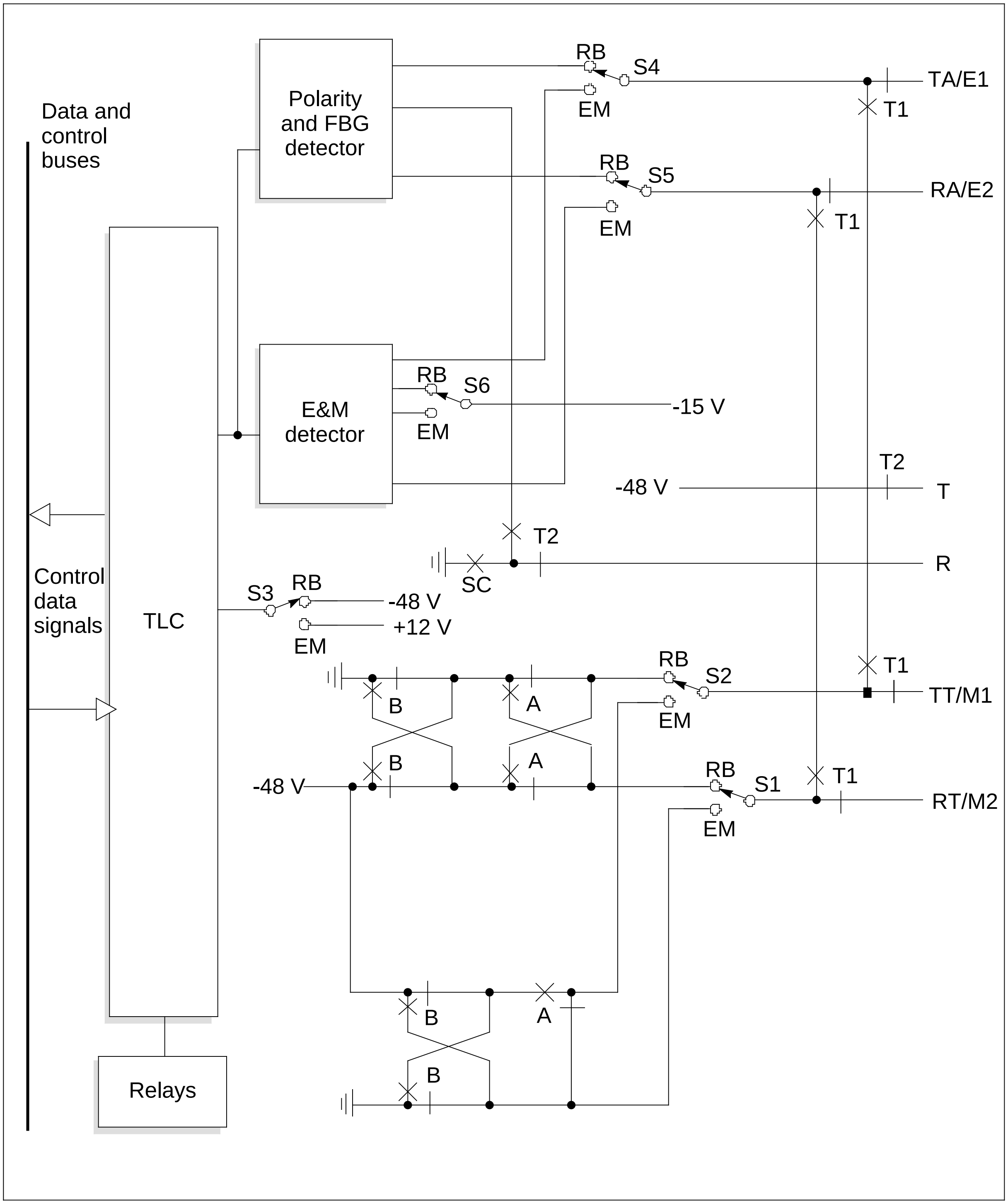
The card receives instructions from the TM to operate CAMA call waiting lamps and to control the CAMA suspension circuit. Based on these instructions, the card operates or releases relays to control the signals that the card transmits. If the distance between CAMA position and TM is longer than the reverse battery (RB) range, switches S1 through S6 are set. The switches are set to E&M operation. If the card must function as an E circuit, switches S1 through S6 are set to E & Moperation.

Functional blocks

The NT2X66AA contains the following functional blocks:

- trunk logic circuit (TLC)
- polarity and foreign battery or ground (FBG) detector
- E & M detector
- relays
- RB/EM switches

NT2X66AA functional blocks



NT2X66AA (continued)

TLC

The TLC receives control signals from the TM over the data and control buses. The TLC uses these signals to control the rest of the circuits. The TLC receives signals from the other components on the card. The TLC passes the information back to the TM over the control and data buses.

Polarity and FBG detector

The polarity and FBG detector checks for a reverse battery voltage on the TA and the RA leads. The polarity and FBG detector transmits this information to the TM through the TLC. The detector checks for a foreign battery voltage or a ground on the TA or on the RA leads. The detector sends a signal to the TM through the TLC. The detector checks for open TA and RA leads and reports the condition to the TM.

E & M detector

The abandon switchboard (AS) key operated at the CAMA position activates the two E & M channels. The E & M detector senses when the AS key activates two E & M channels. One E & M channel can activate without the other channel. When this event occurs, the E & M detector reports a fault condition to the TM through the TLC.

Relays

The TLC controls relays SC, A, B, T1 and T2 to perform several functions. Relay SC controls the response of the card to the operation of the CAMA abandon switchboard key. Relays A and B operate as a pair to control the response to different CAMA call waiting states. Relays T1 and T2 isolate the card for test or cutover. The functions of each relay appear in the following table.

Relay operation (Sheet 1 of 3)

Relay	Operated	Released
SC	SC operated at 30 cycles/minute	Normal operation
	Indicates the CAMA Abandon Switchboard (AS) key is operated	AS lamp is off
	CAMA AS lamp is on	48 V on T lead, open on R lead
	-48 V on T lead, ground on R lead	Negative on TA lead, positive on TR lead (from 48 V floating source)

NT2X66AA (continued)

Relay operation (Sheet 2 of 3)

Relay	Operated	Released
	Negative current on TR lead, positive current on TA lead (voltage from 48 V floating source)	
A, B	A operated, B released	A released, B released
	Indicates X calls waiting (o<X<Xmax)	Indicates normal operation or removal of CAMA suspension
	Green CAMA call waiting lamp ON	CAMA call waiting lamps all OFF
	For RB option, high resistance battery on TT lead, high resistance ground on RT lead	For RB option, high resistance ground on TT lead, high resistance battery on RT lead
	For E & M option, low resistance battery on M1 lead, ground on M2 lead	For E & M option, ground on M1 and M2 leads
	A and B operated	
	Indicates Y calls waiting (Xmax<Y<Ymax)	
	Green and white CAMA call waiting lamps ON	
	For RB option, ground on TT lead, low resistance battery on RT lead	
	For E & M option, ground on M1 lead, low resistance battery on M2 lead	

NT2X66AA (continued)

Relay operation (Sheet 3 of 3)

Relay	Operated	Released
A, B (continued)	A released, B operated	
	Indicates Z calls waiting or CAMA suspension (Z>Ymax)	
	Green, white and red CAMA call waiting lamps ON	
	For RB option, low resistance battery on TT lead, ground on RT lead	
	For E & M option, low resistance battery on M1 lead, low resistance battery on M2 lead	
	A released, B operated at 30 cycles for each minute	
	Indicates CAMA suspension	
	Green, white and red CAMA call waiting lamps flash at 30 cycles for each minute	
	Low resistance battery on M1 and M2 leads	
T1, T2	T1 and T2 operated	T1 and T2 released
	Test or cutover operation	Normal operation
	All card circuits isolated from the CAMA switchboard	
	Relay T2 loops R lead into the FBG and polarity detector to check the state of relays A, B and SC	
	During cutover operation, card circuits isolated from CAMA switchboard. New external leads connected to the card. Relays T1 and T2 released to permit communication between the card and the new equipment.	

RB/EM switches

The six RB/EM switches determine if the card is in reverse battery (RB) or E mode. Set all six switches to the same position, RB or EM. The selection of RB or E operation affects how the card responds to the pressed CAMA AS key.

When the card is in RB mode, press the AS key to reverse the battery signal on TA and RA leads. The polarity detector senses the battery reversal and sends a signal to the TM. The TM returns a signal to the TLC. The signal causes the SC relay to cycle at a rate of 30 cycles for each minute. The relay operation causes the AS lamp at the CAMA position to flash at 30 cycles for each minute.

When the card is in EM mode, press the AS key to activate both E channels. The E detector senses the condition and sends a signal to the TM. The TM returns a signal to the TLC. The TLC operates the B relay at a rate of 30 cycles for each minute. The relay operation sends an alternate battery and ground over the M1 and M2 leads. This action causes the green, white and red CAMA call waiting lamps to flash at 30 cycles per minute.

Technical data

The electrical characteristics of the card, measured at the tip and ring of the CAMA trunk facilities, are as follows:

- maximum insulation resistance: 30 KΩ
- maximum ground potential difference: ±10 V

Dimensions

The dimensions of the NT2X66AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

The card requires a battery voltage of between -42.7 V and -55.8 V.

Normal power use is 500 mW.

NT2X70AA

Product description

The NT2X70AA power converter card is a dc-to-dc regulated converter. This card works from a -48 V dc input and supplies voltages of +5 V, -5 V, +12 V, and -12 V, each with a common ground.

The NT2X70AA contains fixed current limiting, overvoltage shutdown, undervoltage shutdown and dc isolation between input and output.

An on/off/reset switch converter fail light emitting diode (LED) operates with a frame supervisory panel (FSP) power control and alarm circuit.

Functional description

This section contains the functional description of the NT2X70AA.

Functional blocks

The NT2X70AA consists of eight functional blocks:

- input filter
- auxiliary power supply
- pulse width modulation (PWM) module and power train
- current limit
- monitor module
- alarms
- power on/off/reset switch
- test connector

Input filter

The input filter reduces noise fed back to the battery.

Auxiliary power supply

The auxiliary power module converts a -48 V battery to approximately +14 V to power the control circuitry of the NT2X70AA circuitry.

PWM module and power train

The PWM module and the power train convert the input voltage of -48 V to the output voltages of -12 V, +12 V, +5 V, and -5 V.

Current limit

The current limit reduces the pulse width if the current achieves a specified threshold. The current limit lowers the output voltage and limits the output current.

Monitor module

The monitor module monitors the output voltages. If a fault condition occurs, all outputs fail and the system removes the ground signal on the RESET lead to the FSP. The FSP removes main input power and the drive signal.

Alarms

Output failure causes the faceplate DS1 LED to glow. The FSP controls the DS1 LED and activates the remote alarms and alarm circuit.

Power on/off/reset switch

The faceplate mounted power on/off/reset switch S1 provides continuity in the position marked OFF.

Test connector

The test connector provides access to internal points in the circuit for test purposes.

Technical data

This section contains the technical data for the NT2X70AA circuit card.

Power requirements

The input power requirements for the NT2X70AA circuit are:

- voltage: -48 V (nominal), -42 V (minimum), -56V(maximum)
- input voltage step: +5V, -5 V
- maximum current drain: no load 0.5 A, full load 8 A
- efficiency: 70% (from 25% to 100% of rated load)

NT2X70AA (end)

The output power requirements for the NT2X70AE appear in the following table.

Output power requirements

Nominal (V)	Regulation (V)	High (V) shut-down	Low (V) shut-down	Ripple (mV RMS)	Maximum (A)	Current limit (A)
5	5.05 τo 5.25	6.3	4	50	40	44
-5.0	–4.8 τo –5.2	-6.5	-4	75	0.5	4.5
12.0	11.64 τo 12.36	14	11	75	2	4.5
-12.0	–11.64 τo –12.36	-14	-11	75	0.5	2

NT2X70AE

Product description

The NT2X70AE power converter card is a dc-to-dc regulated converter. This card works from a -48 V dc input and supplies voltages of +5 V, -5 V, +12 V, and -12 V, each with a common ground.

The NT2X70AE contains current limiting, overvoltage/undervoltage shutdown, an interlock and dc isolation between input and output. The interlock makes sure -5 V is present before +12 V.

An on/off/reset switch converter fail light emitting diode (LED) operates with a frame supervisory panel (FSP) power control and alarm circuit. The NT6X26DA is an example of an FSP that these functions can use.

Functional description

Functional blocks

The NT2X70AE consists of eight functional blocks:

- input filter
- auxiliary power supply
- pulse width modulation (PWM) module and power train
- current limit
- monitor module
- alarms
- power on/off/reset switch
- test connector

Input filter

The input filter reduces noise fed back to the battery.

Auxiliary power supply

The auxiliary power module converts a -48 V battery to approximately +14 V to power the control circuitry of the NT2X70AE circuitry.

PWM module and power train

The PWM module and the power train convert the input voltage of -48 V to the output voltages of -12 V, +12 V, +5 V, and -5 V.

NT2X70AE (continued)

Current limit

The current limit reduces the pulse width if the current achieves a specified threshold. The current limit lowers the output voltage and limits the output current.

Monitor module

The monitor module monitors the output voltages. If a fault condition occurs, all outputs fail and the system removes the ground signal on the RESET lead to the FSP. The FSP removes main input power and the drive signal.

Alarms

Output failure causes the faceplate DS1 LED to glow. The FSP controls the DS1 LED and activates the remote alarms and alarm circuit.

Power on/off/reset switch

The faceplate mounted power on/off/reset switch S1 provides continuity in the position marked OFF.

Test connector

The test connector provides access to internal points in the circuit for test purposes.

Technical data

Power requirements

The input power requirements for the NT2X70AE appear in the following list:

- voltage: -48 V (nominal), -42 V (minimum), -56V(maximum)
- current: 10 A
- efficiency: 75% (from 50% to 100% load)
- noise from battery: 56 dBrnc
- isolation: UL 300 µA at 720 V dc, ISG 100 µA at 500 V dc

NT2X70AE (end)

The output power requirements for the NT2X70AE appear in the following table.

Output power requirements

Nominal (V)	Regu-lation (V)	High (V) shut-down	Low (V) shut-down	Ripple (mV RMS)	Maxi-mum (A)	Mini-mum load (A)	Current limit (A)
5.15	±0.1	6.5 ± .5	4.3 ± .3	50	50	50	64 ± 13
-5.0	±0.2	-6.5 ± .5	-4.3 ± .3	75	2	0	4.5 + 1.5
12.0	±0.36	14 ± 1	11 ± .6	75	2	0	4.5 ± 1.5
-12.0	±0.36	-14 ± 3	-11±.6	75	0.5	0	3.5 ± 2.5

NT2X70AF

Product description

The NT2X70AF power converter card is a dc-to-dc regulated converter. This card operates from a -48V dc input. This card supplies voltages of +5 V, -5 V, +12 V, and -12 V, each with a common ground.

The NT2X70AF contains fixed current limiting, overvoltage/undervoltage shutdown, an interlock, and dc isolation between input and output. The interlock makes sure that -5 V is present before +12 V.

An on-off reset switch converter fail light emitting diode (LED) operates with a frame supervisory panel (FSP) power control and alarm circuit.

Functional description

Functional blocks

The NT2X70AF consists of eight functional blocks:

- input filter
- auxiliary power supply
- pulse width modulation (PWM) module and power train
- current limit
- monitor module
- alarms
- power on-off reset switch
- test connector

Input filter

The input filter reduces noise fed back to the battery.

Auxiliary power supply

The auxiliary power module converts a -48V battery to approximately +14 V to power the control circuitry of the NT2X70AF circuitry.

PWM module and power train

The PWM module and the power train convert the input voltage of -48 V to the output voltages of -12 V, +12 V, +5 V, and -5 V.

Current limit

The current limit reduces the pulse width if the current achieves a specified threshold. The reduction in pulse width lowers the output voltage and limits the output current.

NT2X70AF (continued)

Monitor module

The monitor module monitors the output voltages. Under a fault condition, all outputs fail and the system removes the ground signal on the RESET lead to the FSP. The FSP removes main input power and the drive signal.

Alarms

Output failure causes the faceplate DS1 LED to glow. The FSP controls the DS1 LED and activates the remote alarms and alarm circuit.

Power on-off reset switch

The faceplate mounted power on-off reset switch S1 provides continuity in the position marked OFF.

Test connector

The test connector provides access to internal points in the circuit for test purposes.

Technical data

Power requirements

The input power requirements for the NT2X70AF are:

- voltage: -48 V (nominal), -39.5 V (minimum), -56V(maximum)
- current: 10 A
- efficiency: 75% (from 50% to 100% load)
- noise from battery: 56 dBrnc
- isolation: UL 300 µA at 720 V dc, ISG 250 µA at 500 V dc

NT2X70AF (end)

The output power requirements for the NT2X70AF appear in the following table:

Output power requirements

Nominal (V)	Regula-tion (V)	High (V) shut-down	Low (V) shut-down	Ripple (mV RMS)	Maxi-mum current (A)	Maxi-mum current (A)(see note)	Mini-mum load (A)	Current limit (A)
5.15	±0.1	6.5 ± .5	4.3 ± .3	50	50	55	50	66 ± 10
-5.0	±0.2	-6.5 ± .5	-4.3 ± .3	75	2	2	0	4.5 ± 1.5
12.0	±0.36	14 ± 1	11 ± .6	75	2	2	0	4.5 ± 1.5
-12.0	±0.36	-14 ± 1	-11±.6	75	0.5	0.5	0	3.5 ± 2.5

Note: Application for +5V exceeding 50A is permitted for a maximum of 8 hours continuously and when V in is greater that 42V. Application example such as power sharing mode in XPM-based peripheral modules (XPM).

NT2X70KA

Product description

The NT2X70KA power converter card is a dc to dc regulated converter. The NT2x70KA works from a -60V dc input and supplies voltages of +5 V, -5 V, +12 V and -12 V. Each voltages has a common ground. This card is the -60V version of the NT2X70AE.

The NT2X70KA has fixed current limiting, overvoltage/undervoltage shutdown. The NT2X70KA has an interlock to make sure that -5 V is present before +12 V. The NT2X70KA has dc isolation between input and output.

Functional description

Functional blocks

The NT2X70KA contains the following eight functional blocks:

- input filter
- auxiliary power supply module
- pulse width modulation (PWM) module and power train
- current limit
- monitor module
- alarms
- power ON/OFF/RESET switch
- test connector

Input filter

The input filter reduces noise fed back to the battery.

Auxiliary power supply module

The auxiliary power module converts a -60 V battery to approximately +14 V to power the control circuitry of the NT2X70KA.

PWM module and power train

The PWM module and the power train convert the input voltage of -60 V to the following output voltages:

- -12 V
- +12 V
- +5 V
- -5 V

NT2X70KA (continued)

A dc isolation is provided between the -60 V input and the outputs.

Current limit

The current limit reduces the pulse width if the current reaches a set threshold. The reduced pulse width lowers the output voltage and limits the output current.

Monitor module

The monitor module monitors the output voltages. When a fault condition occurs, all outputs fail and the module removes ground signal on the RESET lead to the FSP. The FSP removes main input power and the drive signal.

Alarms

Output failure causes the faceplate DS1 LED to glow. The FSP controls this function. The FSP also enables the remote alarms and alarm circuit. The NT6X26DA is one FSP to use for these functions.

Power ON/OFF/RESET switch

The faceplate mounted power ON/OFF/RESET switch S1 provides continuity in the position marked OFF.

Test connector

The test connector provides access to internal points in the circuit for test purposes.

Technical data

Power requirements

The input power requirements for the NT2X70KA appear in the following list:

- voltage: -60 V (nominal), -52 V (minimum), -72 V(maximum)
- current: 10 A
- efficiency: 75% (from 50% to 100% load)
- noise from battery: 56 dBrnc
- isolation:
  - — UL 300 µA at 720 V dc
  - — ISG 100 µA at 500 V dc

NT2X70KA (end)

The output power requirements for the NT2X70KA appear in the following table.

Output power requirements

Nominal (V)	Regula-tion (V)	High (V) shut-down	Low (V) shut-down	Ripple (mV RMS)	Maxi-mum (A)	Mini-mum load (A)	Current limit (A)
5.15	±0.1	6.5 ± .5	4.3 ± .3	50	50	50	64 ± 13
-5.0	±0.2	-6.5 ± .5	-4.3 ± .3	75	2	0	4.5 ± 1.5
12.0	±0.36	14 ± 1	11 ± .6	75	2	0	4.5 ± 1.5
-12.0	±0.36	-14 ± 1	-11±.6	75	0.5	0	3.5 ± 2.5

NT2X71AA

Product description

The NT2X71AA transmission termination trunk tests DMS-100 and DMS-200 offices with open-circuit and short-circuit terminations. The termination trunk provides a balanced test termination for a DMS-100 office.

Location

The card occupies one position in two-wire, four-wire, or eight-wire trunk modules (TM).

Functional description

The NT2X71AA receives and transmits voice frequency (VF) and pulse amplitude modulation (PAM) signals between the transmission facility and the TM. The card uses relays to provide testing and level adjustment functions.

Functional blocks

The NT2X71AA has the following functional blocks:

- two-wire to four-wire terminating set
- fixed compromise network
- receive level adjustment pad and filter
- analog-to-digital (A/D) low-pass filter
- sampling gate
- card type ID circuit
- digital-to-analog (D/A) low-pass filter
- transmit level adjustment pad
- P-pad selector
- trunk logic circuit (TLC)
- relays

Two-wire to four-wire terminating set

In the receive direction, the two-wire to four-wire terminating set receives a VF signal from the tip (T) and ring (R) leads. The terminating set functions as an interface between the two-wire facility and the four-wire trunk circuit. In the transmit direction, the terminating set connects the signal to the two-wire path.

Fixed compromise network

The fixed compromise network provides the two-wire to four-wire terminating set with a 909Ω, 2.15 µF input impedance.

Receive level adjustment pad and filter

The receive level adjustment pad and filter have small switches. The switches obtain the required amount of loss in the receive direction. The pad and filter use a filter to block 60 Hz signal components. The switch settings appear in the following table.

Switch settings

Switch	Setment	Nominal dB
S1	3	8.00
	2	4.00
	1	2.00
S2	3	1.00
	2	0.50
	1	0.25

A/D low-pass filter

In the receive direction, the A/D low-pass filter receives a VF signal from the receive level adjustment pad and filter. The low-pass filter limits the signal bandwidth and amplifies the signal.

Sampling gate

The sampling gate uses an 8 kHz sampling rate to produce PAM samples for transmission to the TM with a transmit PAM (XPAM) bus. The gate receives PAM samples of the signal from the TM through the receive PAM (RPAM) bus. The gate constructs the signal again to an analog format.

Card type ID circuit

The card type ID circuit uses a voltage signal the TLC sends to identify the card type. The card type ID circuit transmits this information to the TM.

D/A low-pass filter

In the transmit direction, the D/A low-pass filter receives a VF signal from the sampling gate. The low-pass filter limits the signal bandwidth and amplifies the signal.

NT2X71AA (continued)

Transmit level adjustment pad

The transmit level adjustment pad has small switches to obtain the required amount of loss in the transmit direction. The switch settings appear in the following table.

Switch settings

Switch	Setment	Nominal dB
S3	3	8.00
	2	4.00
	1	2.00
S4	3	1.00
	2	0.50
	1	0.25

P-pad selector

The P-pad selector functions in the transmit direction to compensate for different level points and connecting circuits. The circuit provides a maximum adjustment of 7 dB in 1 dB increments. The adjustments are as follows:

Relay	Adjustment
K1	4 dB
K2	2 dB
K3	1 dB

TLC

The TLC is a communications buffer between the VF signaling and testing relays and the TM. The TLC generates sampling pulses for the sampling gate. The TLC controls the voltage that identifies the type of card to the TM.

Relays

Five relay circuits receive signals from the TLC. The circuits provide testing and level adjustment functions. The relays and the operated and released functions of the relays appear in the following table.

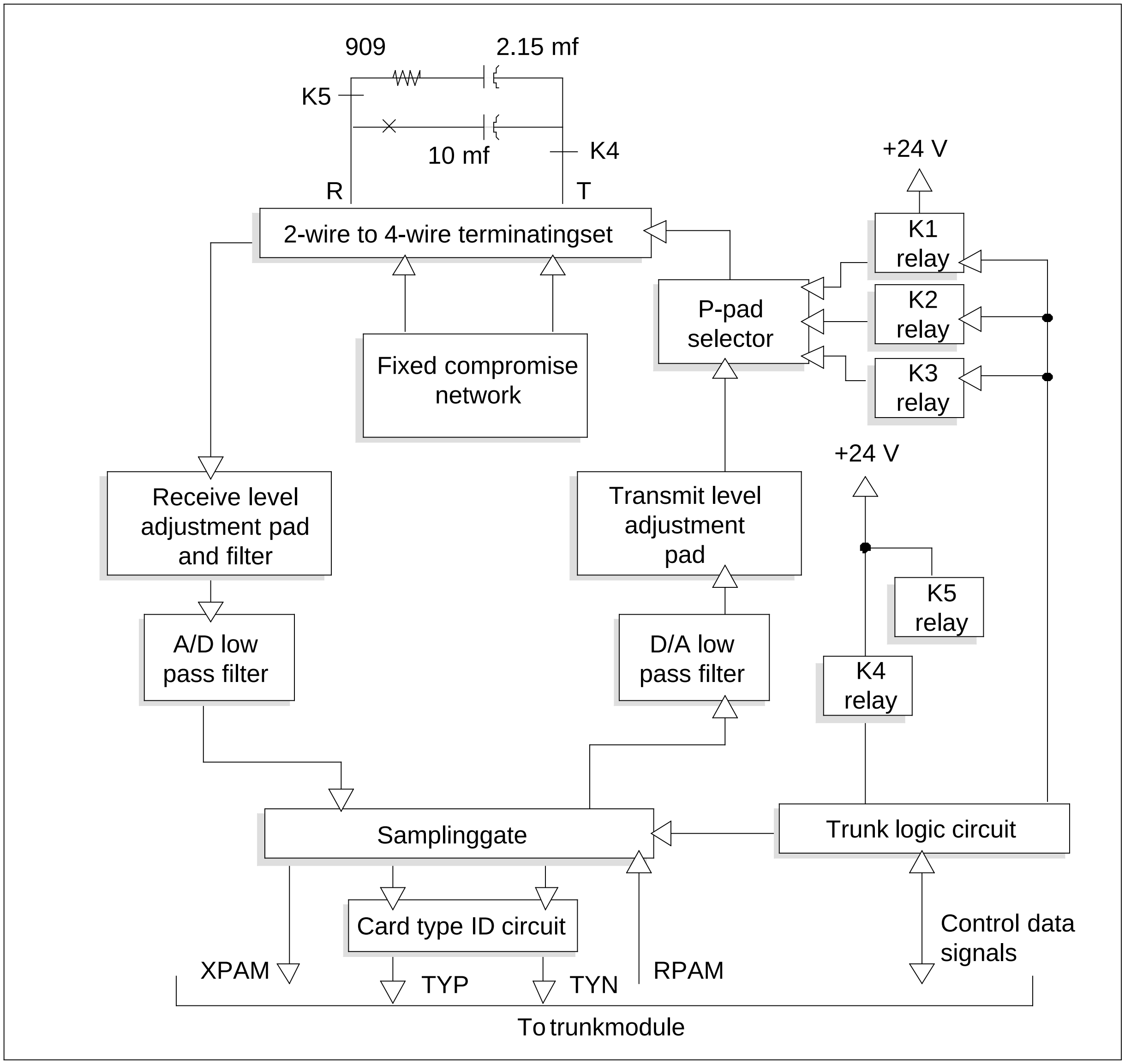
Relay operation

Relay	Operated	Released
K1	Introduces a 4 dB pad to compensate for different level points and connecting circuits	Pad removed
K2	Introduces a 2 dB pad to compensate for different level points and connecting circuits	Pad removed
K3	Introduces a 1 dB pad to compensate for different level points and connecting circuits	Pad removed
K4	Opens the circuit in an open-circuit termination to test the stability of trunks that have negative-impedance repeaters	Normal operation
K5	Provides the ac short-circuit termination through a 10 μF capacitor to test the stability of trunks that have negative-impedance repeaters	Normal operation

The relationship between the functional blocks appears in the following diagram.

NT2X71AA (continued)

NT2X71AA functional blocks



Technical data

The trunk circuit transmission characteristics appear in the following table.

Trunk circuit transmission characteristics

Characteristic	Value
Input impedance	Open circuit, or ac short circuit, or 909Ω2.15 μF
P-pads	1 dB, 2 dB, 4 dB, nominal
P-pad range	0 dB to 7 dB in 1 dB increments
Nominal transmit level	0 dBm
Nominal receive level	0 dBm

The connecting circuit expected measured loss (EML) appears in the following table.

Connecting circuit EML

Characteristic	value (dB)
Local to direct trunk	3
Tandem trunk to analog switch	3
Tandem trunk to digital switch	6
Toll connecting to analog class 4	5
Toll connecting to digital class 4	6
Local to collocated step-by-step	1

The P-pad applications appear in the following table.

P-pad applications (Sheet 1 of 2)

P-pad value (dB)	Trunk output (dBm)
-7	-6
-6	-5
Note: The output is the EML. The output takes into account the 6 dB gain of the D/A direction with the manual pads set to 6 dB.	

NT2X71AA (continued)

P-pad applications (Sheet 2 of 2)

P-pad value (dB)	Trunk output (dBm)
-5	-4
-4	-3
-3	-2
-2	-1
-1	0
0	+1
Note: The output is the EML. The output takes into account the 6 dB gain of the D/A direction with the manual pads set to 6 dB.	

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery	-42.50 V to -55.80 V
Normal range (float charge)	-49.00 V to -53.50 V
Maximum talk battery discharge (no charge)	-42.75 V
Maximum talk battery charge (equalizing)	-55.80 V
Insulation resistance	30 kΩminimum

Dimensions

The dimensions for the NT2X71AA are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X71AA (end)

Power requirements

The card consumes 500 mW of power. The card converts +12 V ±0.3 V, -15 V ±0.5 V, and +22.8 V ±27.0 V. The circuit power requirements appear in the following table.

Power requirements

Circuit	Idle/PCP	Busy/PCP
Trunk signaling	2 W	14 W
Data receiver	5 W	5 W

NT2X72AA

Product description

The NT2X72AA provides an incoming, outgoing, or two-way voice and signaling interface. The NT2X72AA provides the interface between a trunk module (TM) and a four-wire intertoll, tandem, or toll-connecting trunk. The card uses type D1 E&M supervision and accepts dial pulsing or multifrequency (MF) signaling.

Each card contains two trunk circuits and uses cable facilities.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X72AA exchanges control messages with the TM. The NT2X72AA transmits near-end signaling to the far end. The NT2X72AA receives far-end signaling and processes voice frequency (VF) information. The NT2X72AA receives the VF information over the tip (T) and ring (R) leads. The VF information is converted to pulse amplitude modulation (PAM) signals. The NT2X72AA sends the VF information to the TM for further processing. The PAM signals are received from the TM. The signals are converted into VF signals and sent over the T1 and R1 leads.

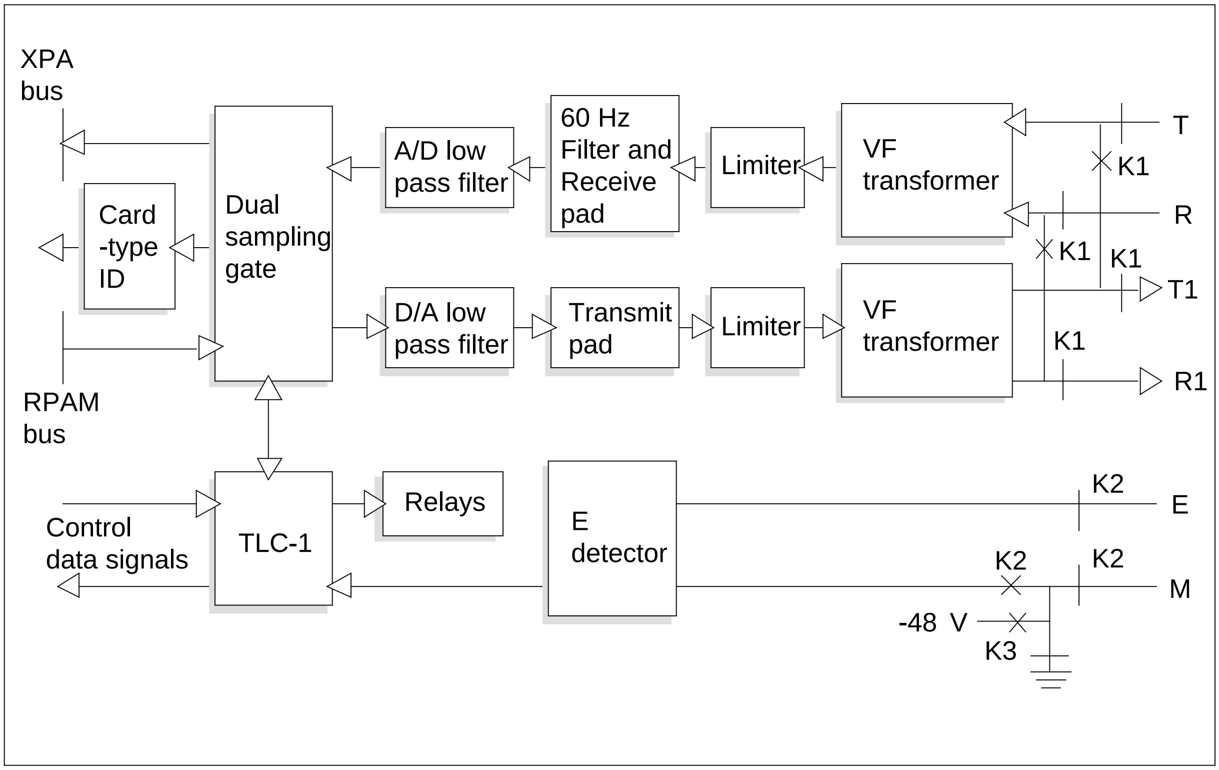
Functional blocks

Each circuit in the NT2X72AA contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- VF transformers (two)
- E detector
- relays (three)
- card type identifier

The functional blocks in trunk circuit 1 appear in the following figure. Trunk circuit 0 operation is identical.

NT2X72AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit has a separate TLC.

Dual sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to pulse amplitude modulation (PAM) signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive PAM (RPAM) bus into VF signals. The gate sends the signals over the T1 and R1 leads.

The card contains a single sampling gate that both trunk circuits use.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The filter passes the signal to the sampling gate. The filter amplifies the signal.

NT2X72AA (continued)

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth and passes the signal to the transmit pads. The filter amplifies the signal.

Receive level adjustment pad

The receive level pad has a maximum of 15.75 dB of adjustment to the VF signal level before the system converts the signal to digital form. When the card converts the signal to digital form, the card processes the signal. The adjustment of the signal occurs in 0.25 dB increments. To make the adjustments, set the combinations of the small switches to achieve the correct level.

The following table shows the receive level adjustments.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pads contain a 50 Hz filter to remove line noise.

Transmit level adjustment pad

The transmit level pad has a maximum of 15.75 dB of adjustment (in 0.25 dB increments) to the level of the VF signal sent over the trunk. To make the adjustments, set the combinations of the small switches to achieve the correct level.

NT2X72AA (continued)

The transmit level adjustments appear in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters prevent an overload of the circuit caused by a received or transmitted signal. One limiter is in the receive direction. One limiter is in the transmit direction.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal. The receive circuit processes the signal. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

E detector

The E detector detects the conditions present on the E lead and transmits the information through the TLC to the TM. The E lead conditions represent far-end signaling.

NT2X72AA (continued)

Relays

Three relays test and M-lead (near-end) signal. The designator and purpose for each relay appears in the following table.

Relay operation

Relay	Operated	Released
K1, K2	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These events allow the system to test the circuit internally	Normal operation
K3	-48 V placed on M lead	M lead grounded

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card connects into the TM card slot.

Signaling

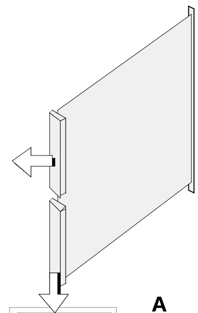
Pin numbers

The following figure illustrates the pin outs for the NT2X72AA.

NT2X72AA (continued)

NT2X72AA pin numbers

	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B		
7A 7B	M.0	
8A 8B	ESC.0	
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B	ESC.1	
29A 29B	M.1	
30A 30B		
31A 31B	R1.1	
32A 32B	T1.1	
33A 33B	R1.0	
34A 34B	T1.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

NT2X72AA (continued)

Technical data

Each circuit on the card has an impedance of 600 Ω.

The minimum receive level for the circuits is -12 dBm for digital test sequence (DTS) output. The range is -12 dBm to +3 dBm. The maximum transmit level is +9 dBm for DTS output. The range is +9 dBm to -6 dBm.

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V
Maximum external E-lead resistance	1000 Ω
Minimum external M-lead resistance	350 Ω
Minimum M-lead DP outpulsing resistance	2000 Ω
M-lead MF pulsing range	Limited by voice band transmission characteristics

Dimensions

The dimensions for the NT2X72AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X72AA (end)

Power requirements

> **DANGER**
> **Damage to equipment or loss of service**
> For use only on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to be used in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±3 V
- -15 V ± 5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 500 mW for each idle trunk circuit.

NT2X72AB

Product description

The NT2X72AB provides an incoming, outgoing, or two-way voice and signaling interface. The interface is between a trunk module (TM) and a four-wire intertoll, tandem, or toll-connecting trunk. The card uses type D1 E & M supervision and accepts dial pulsing or multifrequency (MF) signaling. The card also contains a relay. The relay functions as an echo suppressor control for connection to an external analog echo suppressor circuit. The relay controls if the external echo suppressor is connected to the circuit.

Each card contains two trunk circuits and uses cable facilities.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X72AB exchanges control messages with the TM. The NT2X72AB transmits near-end signaling to the far end. The NT2X72AB receives far-end signaling and processes voice frequency (VF) information. The NT2X72AB receives the VF information over the tip (T) and ring (R) leads. The NT2X72AB converts VF information to pulse amplitude modulation (PAM) signals. The NT2X72AB sends the VF information to the TM for further processing. The PAM signals are received from the TM, converted into VF signals, and sent over the T1 and R1 leads.

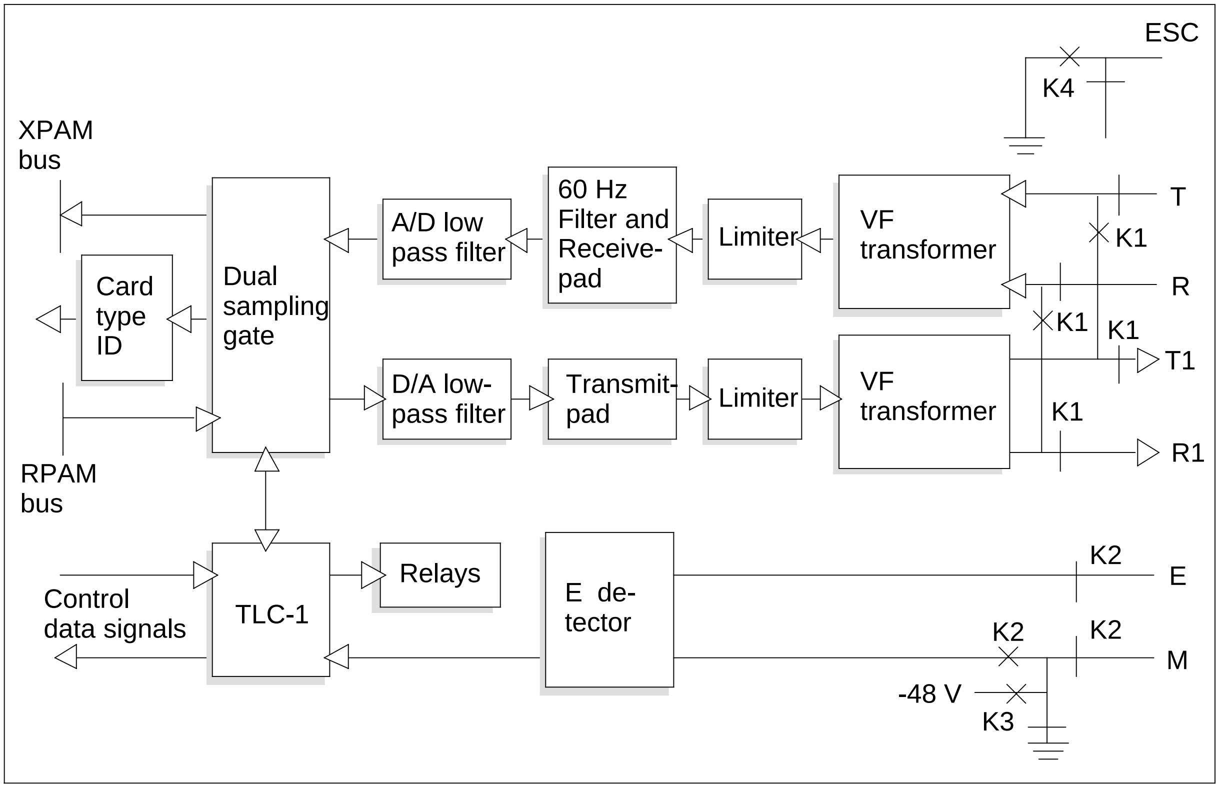
Functional blocks

Each circuit in the NT2X72AB contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- VF transformers (two)
- E detector
- relays (four)
- card type identifier

The relationship between functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is identical.

NT2X72AB functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit has a separate TLC.

Dual sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive PAM (RPAM) bus into VF signals. The gate sends the signals over the T1 and R1 leads.

The card has a single sampling gate that both trunk circuits use.

NT2X72AB (continued)

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The filter sends the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The filter sends the signal to the transmit pads. The filter also amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment in increments of 0.25-dB to the VF signal level. The card converts the signal to digital form and processes the signal. To make adjustments to the signal, set the combinations of the small switches to achieve the correct level.

The following table shows the receive level adjustments.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pads also contain a 50 Hz filter to remove line noise.

Transmit level adjustment pad

The transmit level pad has a maximum of 15.75 dB of adjustment in increments of 0.25 dB to the VF signal level sent over the trunk. To make adjustments to the signal, set the combinations of the small switches to achieve the correct level.

The following table shows the transmit level adjustments.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are provided so that a received or transmitted signal does not overload the circuit. One limiter is in the receive direction. One limiter is in the transmit direction.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal. The receive circuit processes the single signal. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

E detector

The E detector detects the conditions present on the E lead and transmits the information through the TLC to the TM. The E lead conditions represent far-end signaling.

NT2X72AB (continued)

Relays

Four relays on the NT2X72AB test, M-lead (near-end) signal, and control the echo suppressor. The designator and purpose for each relay appear in the following table.

Relay operation

Relay	Operated	Released
K1, K2	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These actions allow the system to test the circuit internally.	Normal operation
K3	-48 V placed on M lead	M lead ground
K4	ESC lead ground, external echo suppressor disabled	External echo suppressor in operation

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card connects into the TM card slot.

Signaling

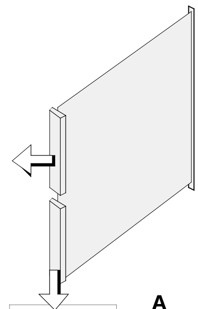
Pin numbers

The pin numbers for the NT2X72AB appear in the following figure.

NT2X72AB (continued)

NT2X72AB pin numbers

		A	B
1A	1B	GND	
2A	2B	T.0	
3A	3B	R.0	
4A	4B	T.1	
5A	5B	R.1	
6A	6B		
7A	7B	M.0	
8A	8B	ESC.0	
9A	9B		
10A	10B		
11A	11B		
12A	12B		
13A	13B		
14A	14B		
15A	15B		
16A	16B		
17A	17B		
18A	18B		
19A	19B		
20A	20B		
21A	21B		
22A	22B		
23A	23B		
24A	24B		
25A	25B		
26A	26B		
27A	27B		
28A	28B	ESC.1	
29A	29B	M.1	
30A	30B		
31A	31B	R1.1	
32A	32B	T1.1	
33A	33B	R1.0	
34A	34B	T1.0	
35A	35B	+24 V	+24 V
36A	36B	+24 V	+24 V
37A	37B	FLT-GND	FLT-GND
38A	38B	FLT-GND	FLT-GND
39A	39B	-48 V FLT	-48 V FLT
40A	40B	-48 V FLT	-48 V FLT



		A	B
41A	41B	GND	GND
42A	42B	GND	GND
43A	43B	GND	GND
44A	44B	RPAM-P	
45A	45B	RPAM-N	
46A	46B	GND	GND
47A	47B		
48A	48B	XPAM-N	
49A	49B	XPAM-P	
50A	50B	GNDGND	
51A	51B		
52A	52B		
53A	53B		
54A	54B		
55A	55B		
56A	56B		
57A	57B		
58A	58B		
59A	59B		
60A	60B		
61A	61B		
62A	62B		
63A	63B		
64A	64B		
65A	65B		
66A	66B	TE.0	TE.1
67A	67B	TYP	TYN
68A	68B	RDAT	
69A	69B	BUS/CLK	
70A	70B		ANUL
71A	71B	XDAT	
72A	72B		
73A	73B		
74A	74B	-15 V	-15 V
75A	75B		
76A	76B	+12 V	+12 V
77A	77B		
78A	78B		
79A	79B		
80A	80B	GND	GND

NT2X72AB (continued)

Technical data

Each circuit on the card provides an impedance of 600 Ω.

The minimum receive level for the circuits is -12 dBm for digital test sequence (DTS) output. The minimum receive range is -12 dBm to +3 dBm. The maximum transmit level is +9 dBm for DTS output. The maximum transmit range is +9 dBm to -6 dBm.

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V
Maximum external E-lead resistance	1000 Ω
Minimum external M-lead resistance	350 Ω
Minimum M-lead DP outpulsing resistance	2000 Ω
M-lead MF pulsing range	Voice band transmission characteristics limit this range.

Dimensions

The dimensions for the NT2X72AB circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

DANGER
Damage to equipment or loss of service
For use only on telephone wiring that a Nortel Networks protector protects in combination with a 26-AWG copper wire with thermoplastic insulation. The catalog number of the protector is 303M-12AIKE. The maximum fusing wire in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±3 V
- -15 V ±5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 500 mW for each idle trunk circuit.

NT2X72AC

Product description

The NT2X72AC has an incoming, outgoing, or two-way voice and signaling interface. The interface is between a trunk module (TM) and a four-wire intertoll, tandem, or toll-connecting trunk. The card uses type D1 E & M supervision and accepts dial pulsing or multifrequency (MF) signaling. The card contains a relay that functions as an echo suppressor control for connection to an external analog echo suppressor circuit. The relay controls if the external echo suppressor is connected to the circuit.

Each card has two trunk circuits and uses cable facilities.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X72AC exchanges control messages with the TM. The NT2X72AC transmits near-end signaling to the far end. The NT2X72AC receives far-end signaling and processes voice frequency (VF) information. The NT2X72AC receives the VF information over the tip (T) and ring (R) leads. The NT2X72AC converts the information to pulse amplitude modulation (PAM) signals and sends the information to the TM to process. The PAM signals are received from the TM, converted into VF signals, and sent over the T1 and R1 leads.

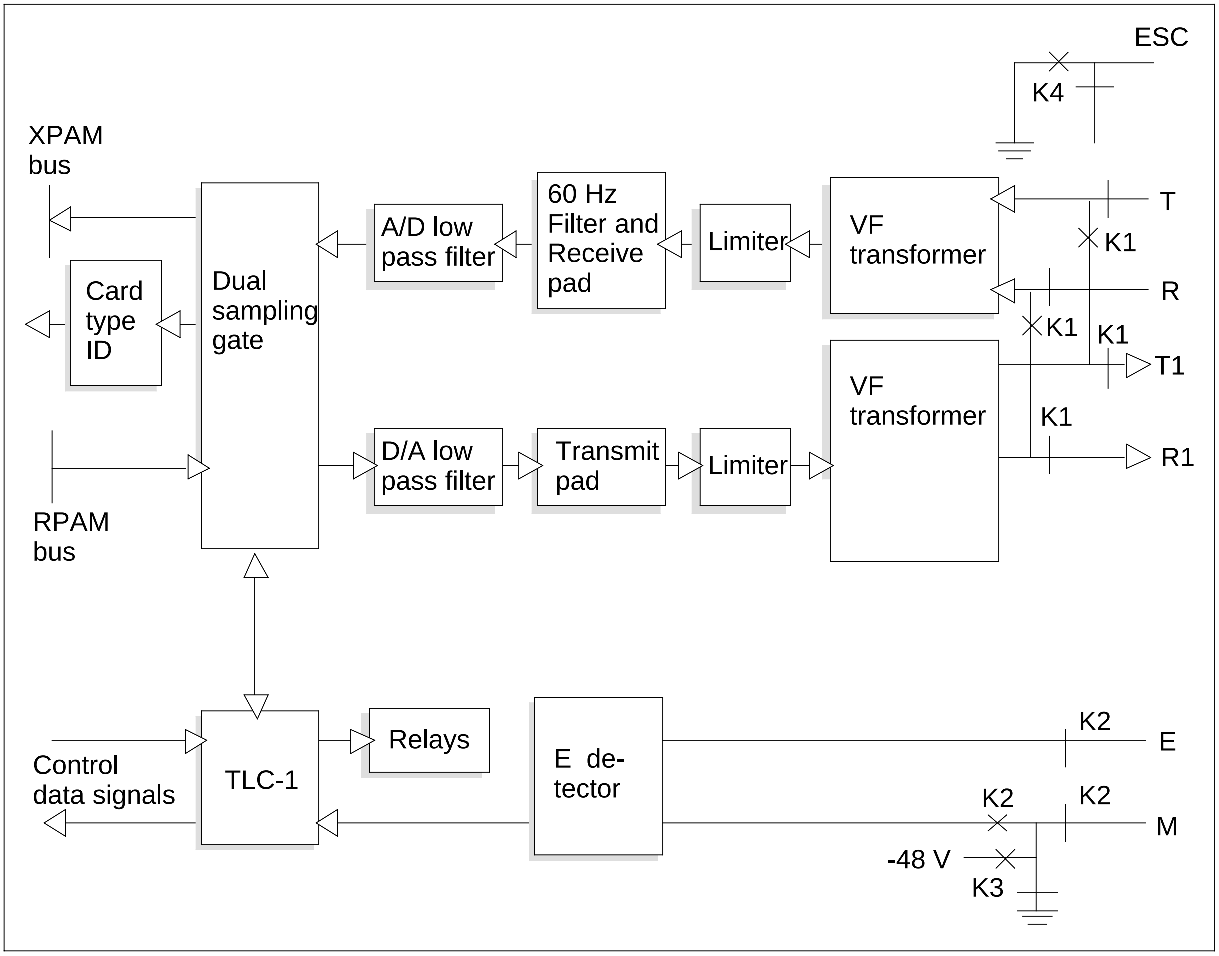
Functional blocks

Each circuit in the NT2X72AC contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- VF transformers (two)
- E detector
- relays (four)
- card type identifier

The relationship between functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 is identical.

NT2X72AC functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit contains a separate TLC.

Dual sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive PAM (RPAM) bus into VF signals. The gate sends the signals over the T1 and R1 leads.

NT2X72AC (continued)

The card contains a single sampling gate that both trunk circuits use.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The filter sends the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The filter passes the signal to the transmit pads. The filter amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment to the VF signal level before the card converts the signal to digital form. When the card converts the signal to digital form, the card processes the signal. The adjustments to the signal occur in 0.25 dB increments. To make the adjustments, set the combinations of the small switches to achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pad has a 50 Hz filter to remove line noise.

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment to the VF signal level sent over the trunk. The adjustment of the signal occurs in 0.25 dB increments. To make the adjustments, set the combinations of the small switches to achieve the correct level.

NT2X72AC (continued)

The transmit level adjustments appear in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are provided so that a received or transmitted signal does not overload the circuit. One limiter is in the receive direction. One limiter is in the transmit direction.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal. The receive circuit processes the single signal. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

E detector

The E detector senses the conditions present on the E lead and transmits the information through the TLC to the TM. The E-lead conditions represent far-end signaling.

NT2X72AC (continued)

Relays

Four relays on the NT2X72AC test, M-lead (near-end) signal and control the echo suppressor. The designator and purpose for each relay appear in the following table.

Relay operation

Relay	Operated	Released
K1, K2	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These actions allow the system to test the circuit internally.	Normal operation
K3	-48 V placed on M lead	M lead ground
K4	ESC lead ground, external echo suppressor disabled	External echo suppressor in operation

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card connects into the TM card slot.

Signaling

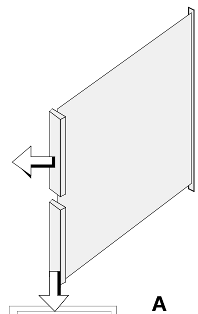
Pin numbers

The pin numbers for the NT2X72AC appear in the following figure.

NT2X72AC (continued)

NT2X72AC pin numbers

	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B		
7A 7B	M.0	
8A 8B	ESC.0	
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B	ESC.1	
29A 29B	M.1	
30A 30B		
31A 31B	R1.1	
32A 32B	T1.1	
33A 33B	R1.0	
34A 34B	T1.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

NT2X72AC (continued)

Technical data

Each circuit on the card provides an impedance of 600Ω.

The minimum receive level for the circuits is -2 dBm for digital test sequence (DTS) output. The minimum receive range is -2 dBm to +13 dBm. The nominal carrier receive level is +7 dBm. The maximum transmit level is -3 dBm for DTS output. The maximum transmit range is -3 dBm to -18 dBm. The nominal carrier transmit level is -16 dBm.

The signaling characteristics of the card are listed in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49.0 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 kΩ
Ground potential	±10 V
Maximum external E-lead resistance	1000Ω
Minimum external M-lead resistance	350Ω
Minimum M-lead DP outpulsing resistance	2000Ω
M-lead MF pulsing range	Voice band transmission characteristics limit this range.

Dimensions

The dimensions for the NT2X72AC circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X72AC (end)

Power requirements

DANGER
Damage to equipment or loss of service
For use only on telephone wiring a Northern Telecom protector protects, in combination with a 26-AWG copper wire with thermoplastic insulation. The catalog number for this protector is 303M-12AIKE. The maximum fusing wire used in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V±3 V
- -15 V±5 V
- +22.8 V to ±27 V (24 V nominal)

Power use is normally 500 mW for each idle trunk circuit.

Nortel NetworksNT2X72BA

Product description

The NT2X72BA four-wire trunk 600 Ω DC5A (UK) card provides an incoming, outgoing, or two-way voice and signaling interface. The interfaces are between a trunk module (TM) and a four-wire intertoll, tandem, or toll-connecting trunk. The card uses type D1 E & M supervision. The card accepts dial pulse or multifrequency (MF) signaling. Each card contains two trunk circuits. Use each card with cable facilities.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X72BA performs the following functions:

- exchanges control messages with the TM
- transmits near-end signaling to the far end
- receives far-end signaling
- processes voice frequency (VF) information

The NT2X72BA receive VF information over the T and R leads. The NT2X72BA converts VF information to pulse amplitude modulation (PAM) signals. The NT2X72BA sends the VF information to the TM for additional processing. The TM sends PAM signals. The TM converts PAM signals into VF signals. These signals are sent over the T1 and R1 leads.

Functional blocks

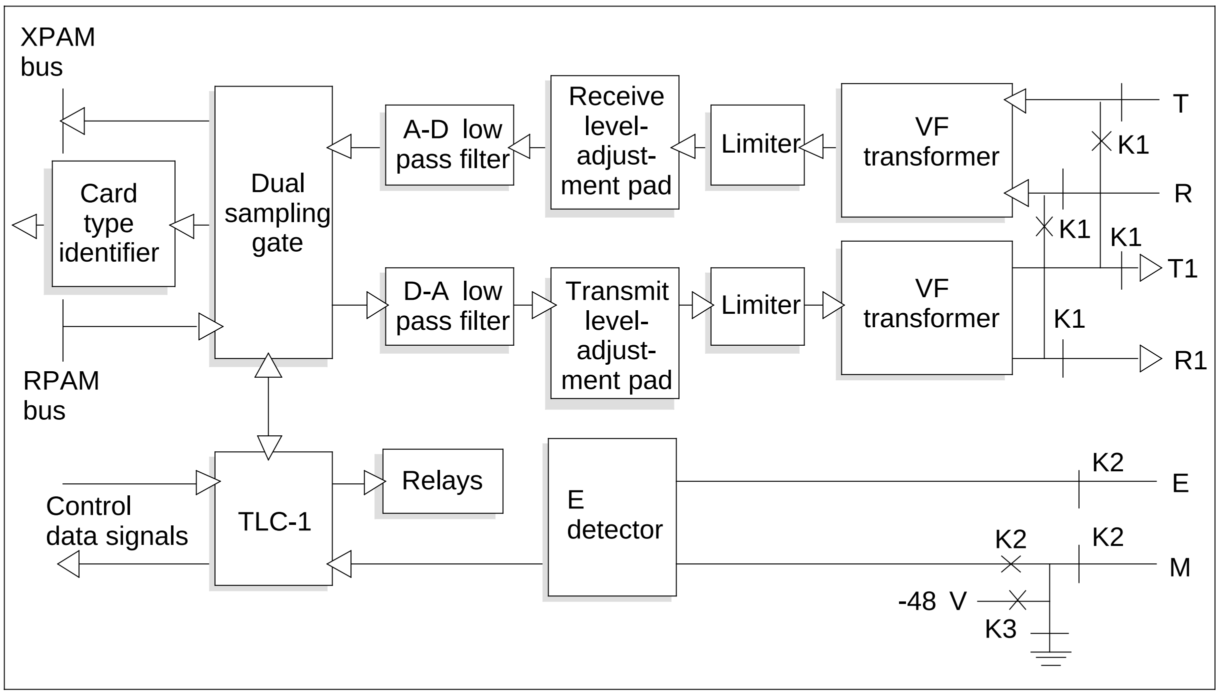
Each circuit in the NT2X72BA contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog-digital (A-D) low-pass filter
- digital-analog (D-A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- two limiters
- two VF transformers
- E detector

- three relays
- card-type identifier

The relationship between the functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is identical.

NT2X72BA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit contains a different TLC.

Dual sampling gate

In the receive direction, the dual sampling gate converts analog VF signals to PAM signals. The sampling gate sends the signals over the transmit-PAM (XPAM) bus for additional processing. In the transmit direction, the gate converts PAM information in to VF signals. The gate receives these VF signals from the receive-PAM (RPAM) bus. The gate sends the signals over the T1 and R1 leads.

The card contains a single sampling gate that both trunk circuits use.

Nortel NetworksNT2X72BA (continued)

A-D low-pass filter

The A-D low-pass filter accepts VF signals from the receive level-adjustment pad. The filter filters the signals to limit the bandwidth. The filter passes the signals to the dual sampling gate. The filter amplifies the signal.

D-A low-pass filter

The D-A low-pass filter accepts VF signals from the dual sampling gate. The filter filters the signals to limit the bandwidth. The filter passes the signals to the transmit level-adjustment pad. The filter amplifies the signal.

Receive level adjustment pad

The receive level adjustment pad provides a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal. Adjust the level of the VF signal before the signal is converted to digital form. The card processes the VF signal when the VF signal is in digital form. To make adjustments, set groups of miniature switches to achieve the correct level. The receive level adjustment pad contains a 50-Hz filter to remove line noise.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

Transmit level adjustment pad

The transmit level adjustment pad provides a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal sent over the trunk. To make adjustments, set combinations of miniature switches to achieve the correct level.

The transmit level adjustments appear in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are available. The two limiters do not allow a received or transmitted signal to overload the circuit. The receive direction receives one limiter. The transmit direction receives one limiter.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. The transformer converts the signals on the T and R leads to one signal. The receive circuit process this signal. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

E detector

The E detector senses the conditions present on the E lead (far end). The E detector transmits the information through the TLC to the TM. The E-lead conditions represent far-end signaling.

Nortel NetworksNT2X72BA (continued)

Relays

Three relays are available for testing and M-lead (near-end) signaling. The designator and purpose for each relay appears in the following table.

Relay operation

Relay	Operated	Released
K1, K2	Isolates the trunk circuit from the external transmission facilities. Loops the transmission and signaling paths to allow an internal circuit test.	Normal operation
K3	-48 V placed on M lead	M lead grounded

Card-type identifier

The card-type identifier provides the TM with an identification code for inventory purposes. The identifier makes sure that the card plugs in to the TM card slot.

Signaling

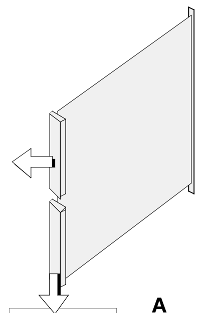
Pin numbers

The pin numbers for the appear in the following figure.

Nortel NetworksNT2X72BA (continued)

NT2X72BA pin numbers

	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B		
7A 7B	M.0	
8A 8B	ESC.0	
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B	ESC.1	
29A 29B	M.1	
30A 30B		
31A 31B	R1.1	
32A 32B	T1.1	
33A 33B	R1.0	
34A 34B	T1.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

Nortel NetworksNT2X72BA (continued)

Technical data

Each circuit on the card provides an impedance of 600 Ω.

The minimum receive level for the circuits is -12 dBm for digital test sequence (DTS) output. The receive level range is -12 to +3 dBm. The maximum transmit level is +9 dBm for DTS output. The transmit level range is +9 to -6 dBm.

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V
Maximum external E-lead resistance	1000 Ω
Minimum external M-lead resistance	350 Ω
Minimum M-lead dial pulse (DP) outpulsing resistance	2000 Ω
M-lead MF pulsing range	Voice band transmission characteristics limit the value

Physical dimensions

The NT2X72BA circuit card has the following dimensions:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

DANGER
Damage to equipment or loss of service
For use only on telephone wiring that a Nortel Networks protector, catalog number 303M-12AIKE protects. Use with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±3 V
- -15 V ±5 V
- +22.8 V to ±27 V (24 V nominal)

Power use is normally 500 mW for each idle trunk circuit.

NT2X72BB

Product description

The NT2X72BB CA1A trunk four-wire 600 Ω (Spain project) card provides an incoming, outgoing, or two-way voice and signaling interface. This interface is between a trunk module (TM) and a four-wire intertoll, tandem, or toll-connecting trunk. The card uses type D1 E & M supervision. The card accepts dial pulse or multifrequency (MF) signaling.

Each card contains two trunk circuits. Use these trunk circuits with cable facilities.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X72BB exchanges control messages with the TM. The NT2X72BB transmits near-end signaling to the far end. The NT2X72BB receives far-end signaling. The NT2X72BB processes voice frequency (VF) information. The NT2X72BB receives the VF information over the T and R leads. The NT2X72BB converts the VF information to pulse amplitude modulation (PAM) signals. The NT2X72BB sends the PAM signals to the TM for additional processing. The TM converts the PAM signals are in to VF signal. The TM sends the VF signals over the T1 and R1 leads.

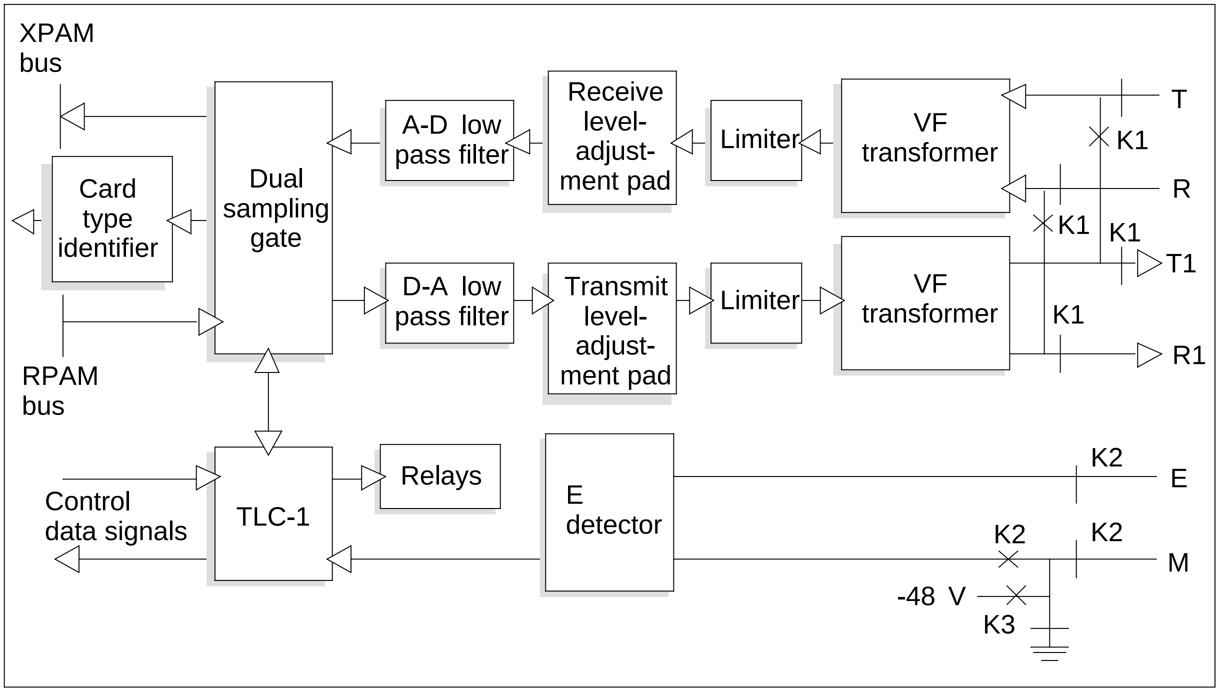
Functional blocks

Each circuit in the NT2X72BB contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog-digital (A-D) low-pass filter
- digital-analog (D-A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- two limiters
- two VF transformers
- E detector
- three relays
- card-type identifier

The relationship between the functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is identical.

NT2X72BB functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit contains a separate TLC.

Dual sampling gate

In the receive direction, the dual sampling gate converts analog VF signals to PAM signals. The sampling gate sends the signals over the transmit-PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive-PAM (RPAM) bus in to VF signals. The gate sends the signals over the T1 and R1 leads.

The card contains a single sampling gate that both trunk circuits use.

A-D low-pass filter

The A-D low-pass filter accepts VF signals from the receive level-adjustment pads. The filter filters the signals to limit the bandwidth. The filter passes the signals to the dual sampling gate. The filter amplifies the signal.

NT2X72BB (continued)

D-A low-pass filter

The D-A low-pass filter accepts VF signals from the dual sampling gate. The filter filters the signals to limit the bandwidth. The filter passes the signals to the transmit level-adjustment pad. The filter amplifies the signal.

Receive level adjustment pad

The receive level adjustment pad provides a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal. Adjust the VF signal before the VF signal is converted to digital form. The card processes the signal when the signal is in digital form. To make adjustments, set groups of miniature switches to achieve the correct level. The receive level adjustment pad contains a 50-Hz filter to remove line noise.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

Transmit level adjustment pad

The transmit level adjustment pad provides a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal sent over the trunk. To make the adjustments, set groups of miniature switches to achieve the correct level.

The transmit level adjustments appear in the following table.

Transmit level adjustments (Sheet 1 of 2)

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00

Transmit level adjustments (Sheet 2 of 2)

Switch position	Adjustment (dB)
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are available. These limiters do not allow a received or transmitted signal to overload the circuit. The receive direction has one limiter. The transmit direction has one limiter.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to one signal. The receive circuit processes this signal. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

E detector

The E detector senses the conditions present on the E lead (far end). The E detector transmits the information through the TLC to the TM. The E-lead conditions represent far-end signaling.

Relays

Three relays are available for testing and M-lead (near-end) signaling. The designator and purpose for each relay appears in the following table.

Relay operations

Relay	Operated	Released
K1, K2	Isolates the trunk circuit from the external transmission facilities. Loops the transmission and signaling paths, to allow the internal circuit test	Normal operation
K3	-48 V placed on M lead	M lead grounded

Card-type identifier

The card-type identifier provides the TM with an identification code for inventory purposes. The identifier makes sure that the card plugs in to the TM card slot.

NT2X72BB (continued)

Signaling

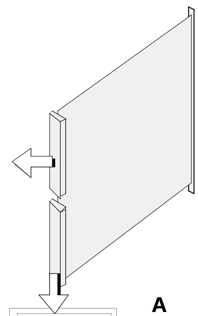
Pin numbers

The pin numbers for the NT2X72BB appear in the following figure.

NT2X72BB (continued)

NT2X72BB pin numbers

	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B		
7A 7B	M.0	
8A 8B	ESC.0	
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B	ESC.1	
29A 29B	M.1	
30A 30B		
31A 31B	R1.1	
32A 32B	T1.1	
33A 33B	R1.0	
34A 34B	T1.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

NT2X72BB (continued)

Technical data

Each circuit on the card provides an impedance of 600 Ω.

The minimum receive level for the circuits is -12 dBm for digital test sequence (DTS) output. The receive level has a range of -12 to +3 dBm. The maximum transmit level is +9 dBm for DTS output. The transmit level has a range of +9 to -6 dBm.

The signaling characteristics of the card appear in the following table.

Signaling characteristic

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V
Maximum external E-lead resistance	1000 Ω
Minimum external M-lead resistance	350 Ω
Minimum M-lead DP outpulsing resistance	2000 Ω
M-lead MF pulsing range	Characteristics of the voice band transmission limit the value

Physical dimensions

The NT2X72BB circuit card has the following dimensions:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X72BB (end)

Power requirements

DANGER
Damage to equipment or loss of service
For use only on telephone wiring that a Nortel Networks protector, catalog number 303M-12AIKE, protects. Use with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±3 V
- -15 V ±5 V
- +22.8 V to +27 V (24 V nominal)

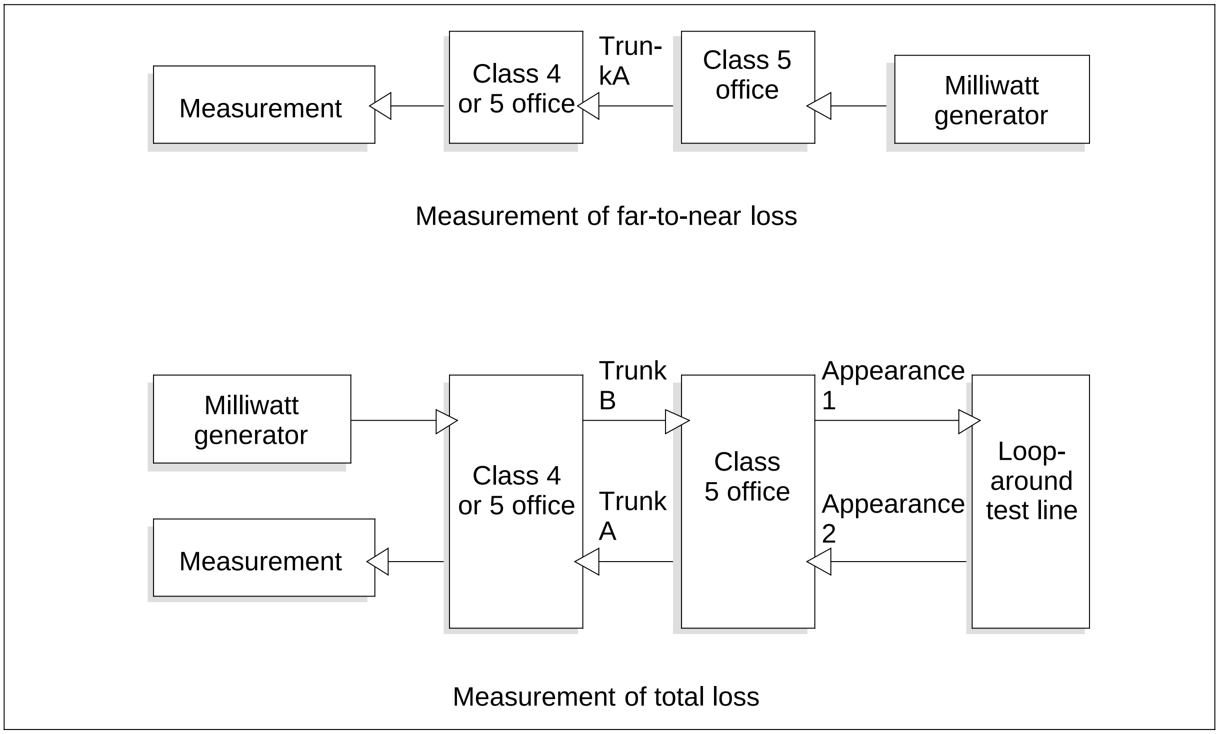
Power use is normally 500 mW for each idle trunk circuit.

NT2X75AA

Product description

The NT2X75AA looparound test line card allows the measurement of near-to-far trunk losses. The near-to-far trunk losses are from class 4 or 5 offices in a DMS-100 switching network. The following figure and explanation describe the procedure for measuring trunk losses.

NT2X75AA loss measurement



The looparound testing method requires that two trunks connect at a distant office. This condition is necessary so that you can take a measurement at the originating office. The following steps describe the looparound loss measurement method:

1. Establish the far-to-near trunk loss to use as a reference.
2. To determine the total loss, connect the reference trunk and the trunk to be measured to loop-around test lines. The loop-around test lines are at the terminating class-5 office.
3. To determine the near-to-far loss of the measured trunk, subtract the loss of the reference trunk from the measurement of the loss.

Location

The NT2X75AA card occupies one card position in a maintenance trunk module (MTM). The card requires two trunk appearances.

Functional description

The NT2X75AA card performs the trunk loss measurement test through the use of a looparound process. Use the following method to perform the looparound process. Transfer data associated with one channel time slot to the next channel time slot. Receive new data in the previous channel time slot under control of enable lines. The system receives pulse code modulation (PCM) data from the receive data (RDAT) bus. The system sends the data through bandpass filters and adjustable pads to the transmit data (XDAT) bus. Bandpass filters make sure that the system transmits milliwatt test tones.

Functional blocks

The NT2X75AA consists of the following functional blocks:

- input buffer
- two trunk logic circuits (TLC)
- two TLC buffers
- buffer gate
- adjustable pads
- two bandpass filters
- output buffer
- output gate

Input buffer

The input buffer receives PCM data in 8-bit samples from the RDAT bus and sends the data to the adjustable pads and bandpass filters.

TLC

The TLCs control PCM data attenuation according to the adjustable pad settings. The TLC-0 controls the PCM data associated with the channel assigned to TLC-1. The TLC-1 controls the PCM data associated with the channel assigned to TLC-0. Enable lines regulate the transfer of control signals from the TLCs to the buffers.

TLC buffers

The TLC buffers receive control signals from the previous channel. The TLC buffers transmit these samples to the XDAT bus in the time slot for the next channel. For example, the TLC buffers send the first sample to the XDAT bus

NT2X75AA (continued)

in the time slot for the second channel. The buffer in the second channel time slot accepts a new sample from the RDAT bus. The TLC buffer transmits a new sample to the XDAT bus in the time slot for the first channel.

Buffer gate

The buffer gate receives control signals from the TLC buffers. The buffer gate releases the information to the adjustable pads in channel sequence under control of enable lines.

Adjustable pads

The adjustable pads determine the output level for the PCM data. The settings range from 0 through 7 dB in 1-dB increments.

Bandpass filters

Two bandpass filters does not allow the XDAT bus to receive data other than a milliwatt test tone. Each filter measures the frequency of the incoming PCM data. If the data represents a frequency from 960 through 1200 Hz (which indicates the presence of the test tone), the output gate the filter controls opens to allow data to pass through.

Output buffer

The output buffer receives the attenuated data from the adjustable pads and sends the data to the output gate.

Output gate

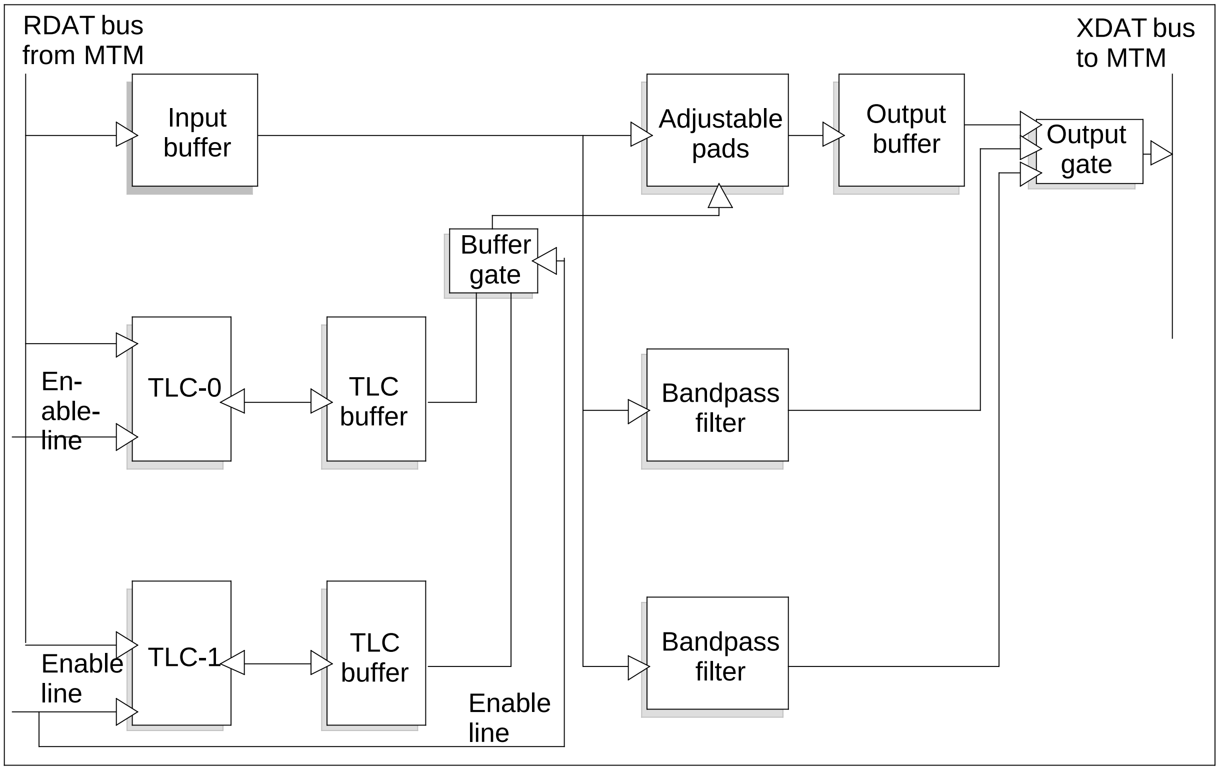
The output gate receives data from the output buffer and the bandpass filters and transmits the data to the XDAT bus. If the signal from the bandpass filter indicates the presence of a milliwatt test tone, the output gate releases the data.

The milliwatt test tone must be present in a single cycle for the looparound test line to transmit the PCM data. If the milliwatt test tone is not present for three consecutive cycles, the channel data returns to a quiet termination state.

The following figure displays the relationship between the functional blocks.

NT2X75AA (continued)

NT2X75AA functional blocks



Technical data

The input signal level is from +6 to -30 dBm. The bandpass filters have a bandwidth of 240 Hz from 960 through 1200 Hz with an accuracy of ±16 Hz. The adjustable pads have an adjustment range from 0 through 7 dB in 1-dB increments.

Physical dimensions

The physical dimensions for the NT2X75AA circuit card are:

- height: 353 mm (13.9 in.)
- depth: 277 mm (10.9 in.)
- width 28 mm (1.1 in.)

NT2X75AA (end)

Power requirements

The following table lists the power requirements for the NT2X75AA.

Power requirements

Voltage	Current
+5 V	780 mA
+12 V	7 mA
-15 V	3 mA

The power dissipation is 4.1 W.

NT2X77AA

Product description

The NT2X77AA compromise balance network (CBN) balances two–wire nonloaded cable facilities. The cable facilities connect to a two–wire to four–wire terminating set in a trunk circuit. The card permits compliance with any requirements to meet regulations. The NT2X77AA has a network build–out capacitance (NBOC) circuit. The NT2X77AA has a network build–out resistance (NBOR) circuit.

Location

The NT2X77AA connects to the DMS–100 two–wire trunk circuit card.

Functional description

The CBN sets switch assemblies in the on or off position to perform the balancing procedure. The CBN sets the switch assemblies for selected resistance and capacitance values. Cable facilities that the resistance and capacitance values balance can have a maximum length of 2743 m (9000 ft).

Functional blocks

The NT2X77AA contains the following functional blocks:

- NBOR circuit
- NBOC circuit
- switches

NBOR circuit

The CBN contains an NBOR switch assembly to select resistance values. The NBOR switch assembly has five sections. This switch assembly sets 32 resistance values in 20 Ω increments, to a maximum of 620 Ω. These resistance values add series.

NBOC circuit

The NBOC selects capacitance values. The NBOC has seven sections. The switch assembly sets 128 capacitance values, to a maximum of 0.1421 μF. The capacitance values add parallels.

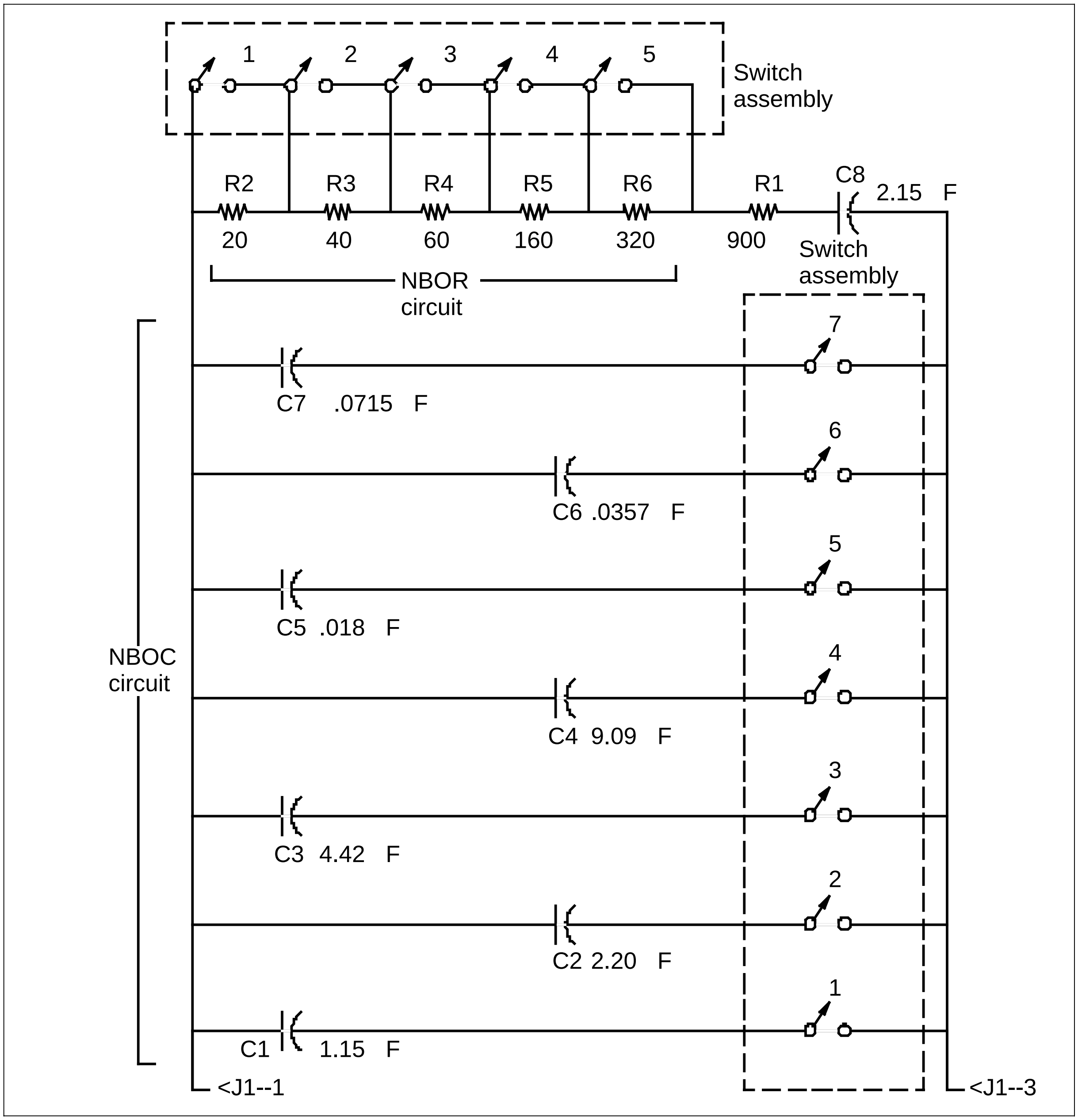
Switches

The switches select a network to provide compatibility with 19–, 22–, 24–, and 26–gauge nonloaded cables.

The relationship between the functional blocks appears in the following figure.

NT2X77AA (continued)

NT2X77AA functional blocks



Technical data

The NT2X77AA circuit is compatible with 19–, 22–, 24–, or 26–gauge nonloaded cables. The circuit has an impedance of 900 Ω plus the value of NBOR and NBOC. The circuit has a maximum cable length of 2743 m (9000 ft).

Physical dimensions

The NT2X77AA has the following dimensions:

- height: 65 mm (2.62 in.)
- depth: 70 mm (2.75 in.)

NT2X77AB

Product description

The NT2X77AB compromise balance network (CBN) balances two–wire nonloaded cable facilities. The cable facilities connect to a two–wire to four–wire terminating set in a trunk circuit. The card permits compliance with any requirements to meet local regulations. The NT2X77AB has a network build–out capacitor (NBOC) circuit. The NT2X77AB has a network build–out resistor (NBOR) circuit.

Location

The NT2X77AB connects to the DMS–100 two–wire trunk circuit card.

Functional description

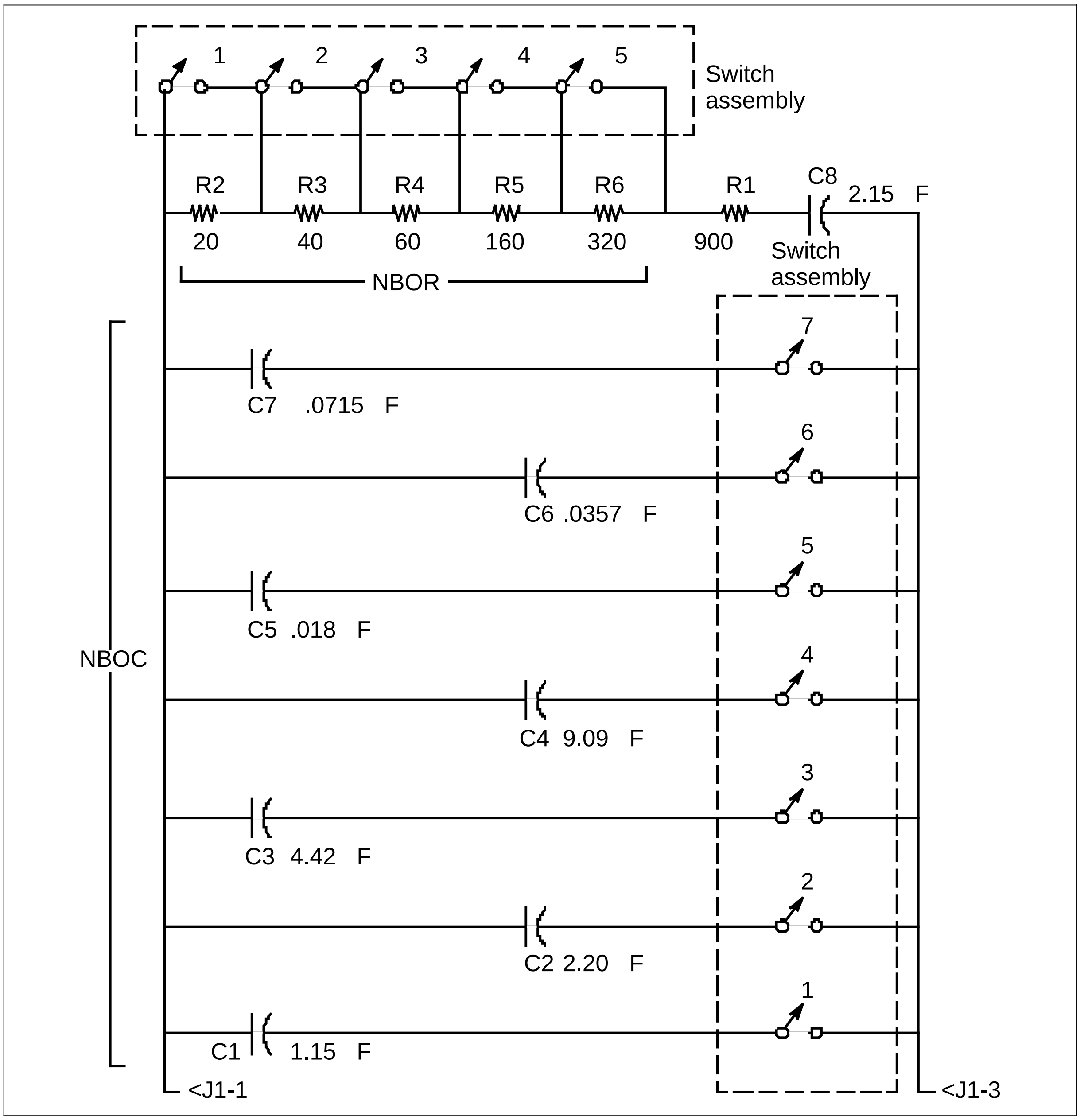
The CBN sets switch assemblies in the ON or OFF position to perform the balancing procedure. The CBN sets the switch assemblies for selected resistance and capacitance values. Cable facilities that the resistance and capacitance values balance can have a maximum length of 2743 m (9000 ft) in length.

Functional blocks

The NT2X77AB contains the following functional blocks:

- NBOR circuit
- NBOC circuit
- switches

NT2X77AB functional blocks



NT2X77AB (end)

NBOR circuit

The CBN contains an NBOR switch assembly to select resistance values. The NBOR switch has five sections. This switch assembly sets 32 resistance values in 20–Ω increments, to a maximum of 620 Ω. These resistance values add series.

NBOC circuit

The NBOC is a switch assembly that selects capacitance values. This switch assembly has seven sections. The switch assembly sets 128 capacitance values, to a maximum of 0.1421 μF. The capacitance values add parallels.

Switches

The switches select a network to provide compatibility with 19–, 22–, 24–, and 26–gauge nonloaded cables.

Technical data

The NT2X77AB circuit is compatible with 19–, 22–, 24–, or 26–gauge nonloaded cables. The circuit has an impedance of 600 Ω plus the value of NBOR and NBOC. The circuit has a maximum cable length of 2743 m (9000 ft).

Physical dimensions

The NT2X77AB has the following dimensions:

- height: 65 mm (2.62 in.)
- depth: 70 mm (2.75 in.)

NT2X77AC

Product description

The NT2X77AC compromise balance network (CBN) balances two-wire nonloaded cable facilities. These facilities connect to a two-wire to four-wire terminating set in a trunk circuit. The card allows compliance with local regulatory requirements. The circuit contains a network build-out capacitor (NBOC) circuit.

Location

The NT2X77AC connects to the DMS-100 two-wire trunk circuit card.

Functional description

The CBN performs the balancing procedure. The CBN sets switch assemblies in the ON or OFF position for selected resistance and capacitance values. Cable facilities can be a maximum of 229 m (750 ft) in length. The resistance and capacitance values balance the cable facilities.

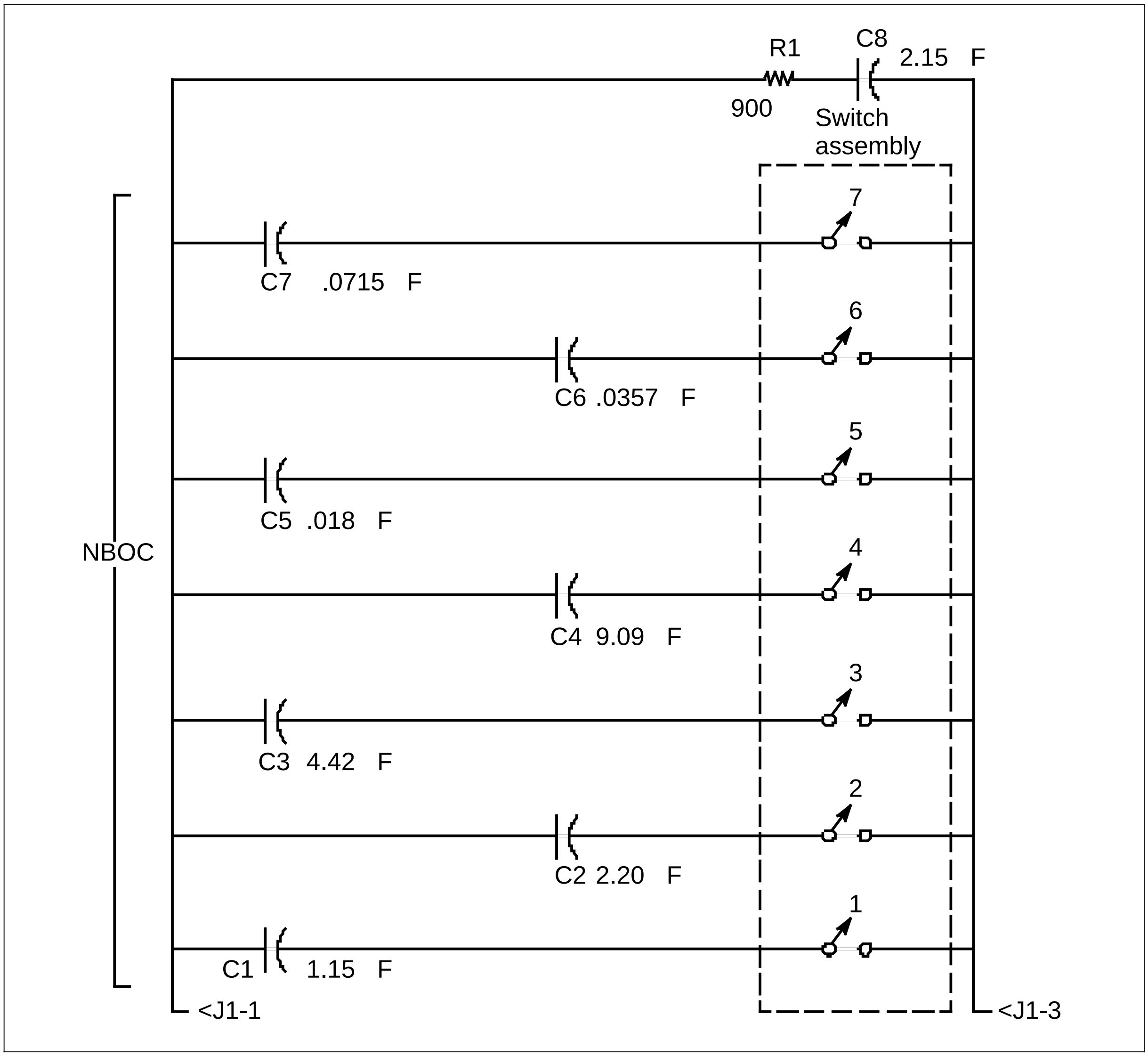
NT2X77AC (continued)

Functional blocks

The NT2X77AC contains the following functional blocks:

- resistor
- NBOC circuit
- switches

NT2X77AC functional blocks



Resistor

The CBN contains a resistor to match a 900-Ω cable load.

NBOC circuit

The NBOC is a seven-section switch assembly that selects capacitance values. The switch assembly sets 128 parallel-adding capacitance values, to a maximum of 0.1421 μF.

Switches

The switches select a network to provide compatibility with 19-, 22-, 24-, and 26-gauge nonloaded cables.

Technical data

The NT2X77AC circuit is compatible with 19-, 22-, 24-, or 26-gauge nonloaded cables. The circuit has an impedance of 900 Ω and the value of NBOC. The circuit has a maximum cable length of 229 m (750 ft).

Physical dimensions

The physical dimensions of the NT2X77AC are as follows:

- overall height: 65 mm (2.62 in.)
- overall depth: 70 mm (2.75 in.)

NT2X77AD

Product description

The NT2X77AD compromise balance network (CBN) balances two-wire nonloaded cable facilities. These facilities connect to a two-wire to four-wire terminating set in a trunk circuit. The card allows compliance with local regulatory requirements. The circuit contains a network build-out capacitor (NBOC) circuit.

Location

The NT2X77AD connects to the DMS-100 two-wire trunk circuit card.

Functional description

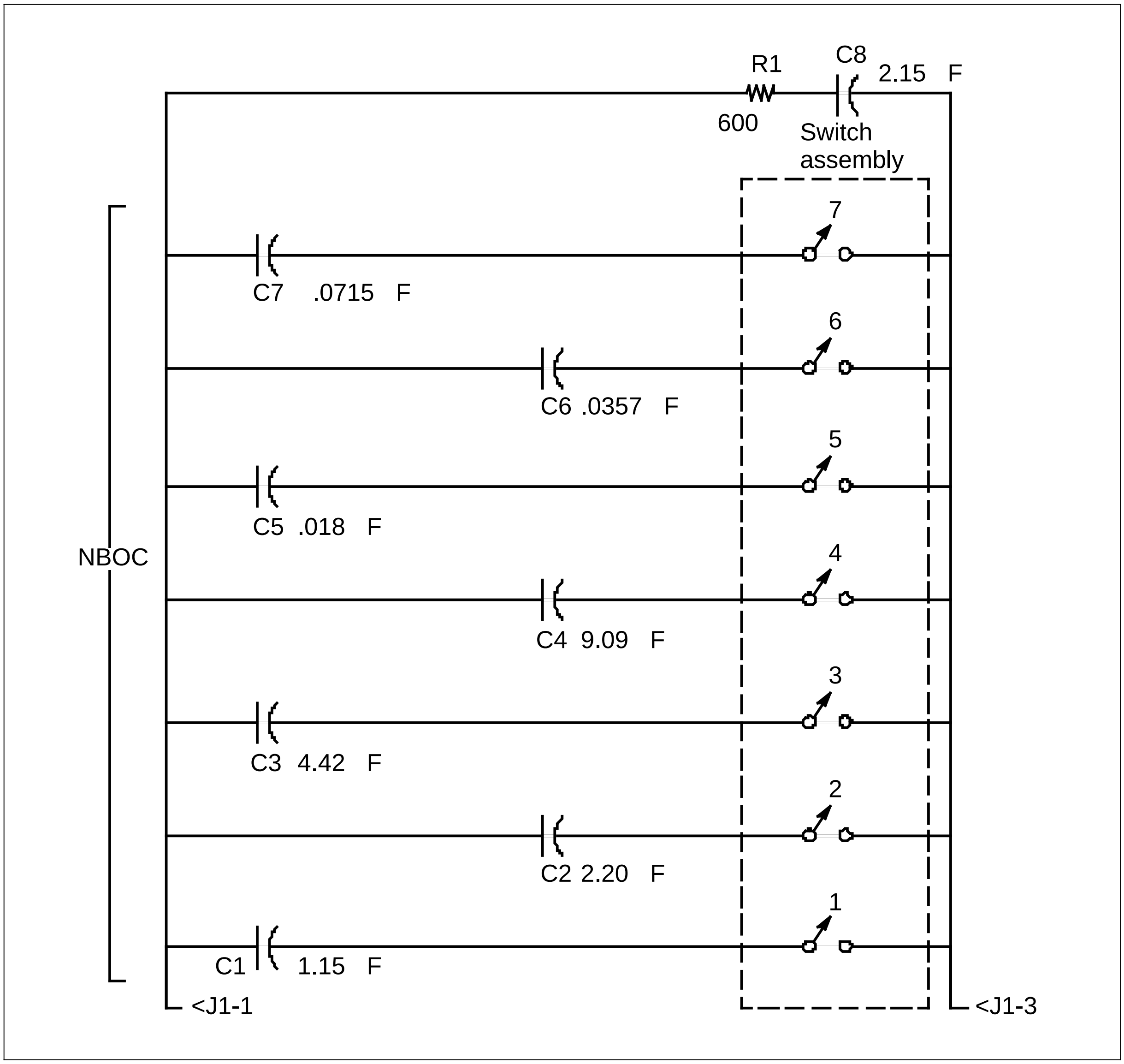
The CBN performs the balancing procedure. The CBN sets switch assemblies in the ON or OFF position for selected resistance and capacitance values. Cable facilities that the resistance and capacitance values balance, can be a maximum of 229 m (750 ft) in length.

Functional blocks

The NT2X77AD contains the following functional blocks:

- resistor
- NBOC circuit
- switches

NT2X77AD functional blocks



Resistor

The CBN contains a resistor to match a 600Ω cable load.

NT2X77AD (end)

NBOC circuit

The NBOC is a seven-section switch assembly that selects capacitance values. The switch assembly sets 128 parallel-adding capacitance values, to a maximum of 0.1421 µF.

Switches

The switches select a network to provide compatibility with 19-, 22-, 24-, and 26-gauge nonloaded cables.

Technical data

The NT2X77AD circuit is compatible with 19-, 22-, 24-, or 26-gauge nonloaded cables. The circuit has an impedance of 600 Ω and the value of NBOC. The circuit has a maximum cable length of 229 m (750 ft).

Physical dimensions

The physical dimensions of the NT2X77AD are as follows:

- overall height: 65 mm (2.62 in.)
- overall depth: 70 mm (2.75 in.)

NT2X77BA

Product description

The NT2X77BA compromise balance network (CBN) balances two–wire nonloaded cable facilities. These facilities connect to a two–wire to four–wire terminating set in a trunk circuit. The card allows compliance with local regulatory requirements.

Location

The NT2X77BA connects to the DMS–100 two–wire trunk circuit card.

Functional description

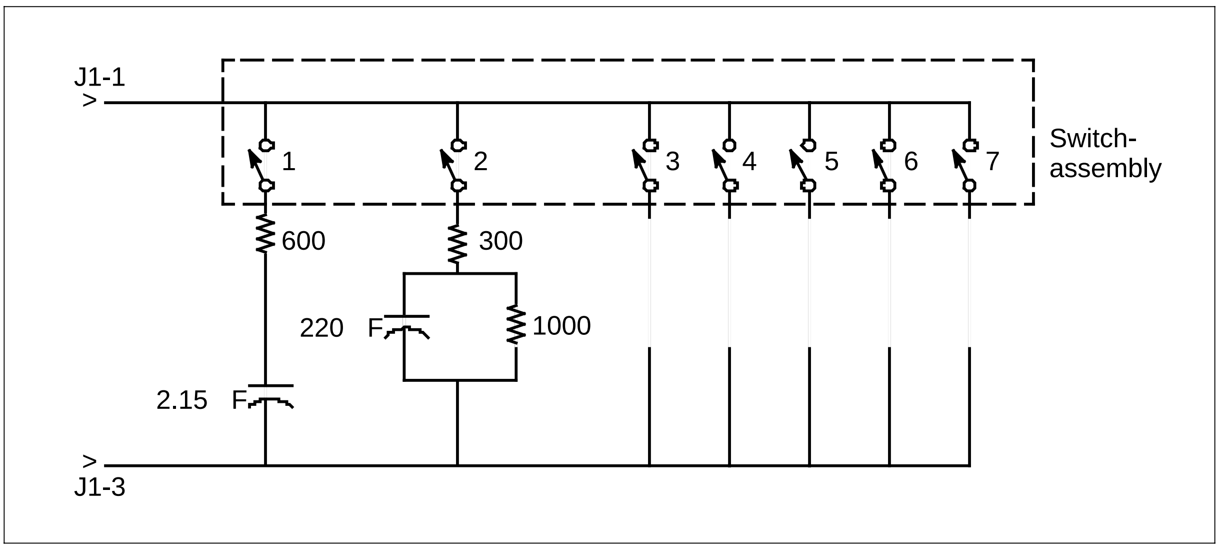
The CBN performs the balancing procedure. The CBN sets switch assemblies in the ON or OFF position for selected resistance and capacitance values.

Functional blocks

The NT2X77BA contains the following functional blocks:

- switch assembly
- switches

NT2X77BA functional blocks



Switch assembly

The seven–section switch assembly contains two main sections and five minor sections. If the first section is in the ON position, a resistive and capacitive series balance network is connected. A complex balance network is connected when the second section is in the ON position. One of these sections must be in the ON position.

NT2X77BA (end)

The five minor sections of the switch assembly, switches 3 through 7, do not connect to a network. These sections can be set to ON or OFF.

Switches

The switches select a network to provide compatibility with 19–, 22–, 24–, and 26–gauge nonloaded cables.

Technical data

The NT2X77BA circuit is compatible with 19–, 22–, 24–, or 26–gauge nonloaded cables. This section has an impedance of 600 Ω complex A.

Physical dimensions

The physical dimensions of the NT2X77BA are as follows:

- overall height: 65 mm (2.62 in.)
- overall depth: 70 mm (2.75 in.)

NT2X78AA

Product description

The NT2X78AA provides two incoming, outgoing, or two-way voice and signaling interfaces between a trunk module (TM). This card also provides a four-wire intertoll or toll-connecting trunk. The card uses single-frequency (SF) signaling. The signaling eliminates the need for a separate SF card.

Each card contains two trunk circuits.

Location

The card is in one card position in a four-wire or an eight-wire TM.

Functional description

The NT2X78AA exchanges control messages with the TM, and transmits near-end SF signaling to the far-end. This card receives far-end SF signaling, and processes voice frequency (VF) information. The card receives VF information over the T and R leads. The card converts the information to pulse amplitude modulation (PAM) signals, and sends the information to the TM for additional processing. The card receives PAM signals from the TM. The card converts the information to VF signals, and sends the information over the T1 and R1 leads.

Functional blocks

Each of the two circuits in the NT2X78AA contains the following functional blocks:

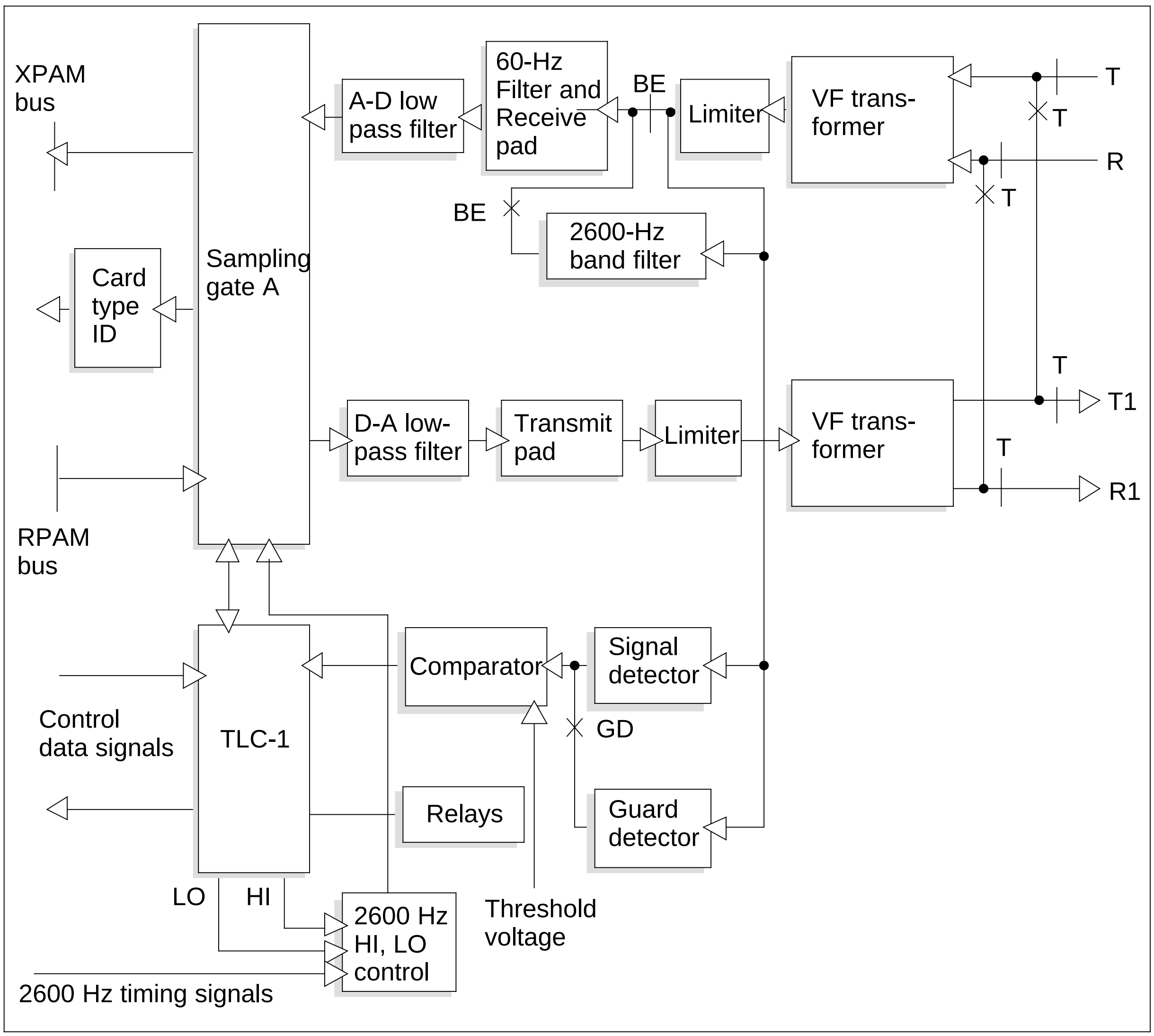
- trunk logic circuit (TLC)
- sampling gate
- analog-digital (A-D) low-pass filter
- digital-analog (D-A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- VF transformers (two)
- 2600-Hz band elimination filter
- signal detector
- guard detector
- comparator
- 2600-Hz HI, LO control

NT2X78AA (continued)

- relays (three)
- card type identifier

The relationship between functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is identical.

NT2X78AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog VF signals to PAM signals. The sampling gate sends the signals over the transmit-PAM (XPAM) bus for additional processing. In the transmit direction, the gate converts PAM information from the receive-PAM (RPAM) bus to VF signals. The sampling gate sends the signals over the T1 and R1 leads.

A-D low-pass filter

The A-D filter accepts VF signals from the receive pads and filters the signal to limit the bandwidth. The A-D filter passes the signal to the sampling gate. The filter also amplifies the signal.

D-A low-pass filter

The D-A filter accepts VF signals from the sampling gate and filters the signal to limit the bandwidth. The D-A filter passes the signal to the transmit pads. The filter also amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment to the level of the VF signal. The adjustment is in increases of 0.25-dB. The pad provides the adjustment before the card converts the pad to digital form and processes the pad. The adjustments occur when combinations of miniature switches are set to achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pads also contain a 50-Hz filter to remove line noise.

NT2X78AA (continued)

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment to the level of the VF signal sent over the trunk. The adjustment is in increases of 0.25-dB. The adjustments occur when combinations of miniature switches are set at the correct level.

The transmit level adjustments appear in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are available. These limiters do not allow a received or transmitted signal to overload the circuit. One limiter each is available in the receive direction and the transmit direction.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal. The receive circuit processes the signal. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

2600-Hz band elimination filter

The 2600-Hz filter makes sure that SF tones do not reach the calling customer. When an SF tone is present, the filter is inserted in the circuit. The received signal, with 2600-Hz tones, is sent to the filter and the SF processing circuits. The SF processing circuits are the signal detector and guard detector. The SF processing circuits are responsible for the signaling tones. The tones do not need to remain in the received VF signal. The filter removes the 2600-Hz tones from the signal and sends the filtered signal back to the receive path for additional processing.

Signal detector

The signal detector accepts the VF information from the receive path. The detector filters out all the parts of the signal, except a band of frequencies between 1700 and 3500 Hz. If SF tones are not present, the output voltage from the signal detector combines with the output from the guard detector. The output voltage is sent to the comparator. If SF tones are present, the signal detector output is sent to the comparator.

Guard detector

The guard detector accepts received VF information at the same time with the signal detector. The guard detector filters out a band of frequencies between 2550 and 2650 Hz. If SF tones are not present, the DMS software operates relay GD. The relay GD causes the output signal to combine with the output of the signal detector. The output of the signal detector is 10 dB lower. The relay GD also causes the output signal to be sent to the comparator. If SF tones are not present, the guard detector output is not used.

Filtered and combined signals do not allow the SF circuit from to respond to speech or noise signals.

Comparator

If SF tones are not present, the comparator receives the output from the signal detector. The guard detector compares the combined signal with a threshold voltage. If the detector outputs are lower than the threshold voltage, the comparator sends a signal through the TLC to the TM. This signal indicates that tones are not present.

If SF tones are present, the TM operates relay GD to remove the guard detector from the circuit. The comparator compares the output of the signal detector with the threshold voltage. If the detector output is higher than the threshold voltage, the comparator sends the TM a signal. This signal indicates that SF tones are present.

2600-Hz HI LO control

The 2600-Hz HI LO control regulates the 2600-Hz high-level (offhook) or low-level (onhook) tones that the transmit circuit sends. The tones are stored in digital form in the TM. The HI LO control controls the tones sent through the normal transmit path.

NT2X78AA (continued)

Relays

Three relays are available for testing and near-end signaling. The designator and purpose for each relay appears in the following table.

Relay operation

Relay	Operated	Released
T	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These actions allow the circuit to be tested internally.	Normal operation
BE	Operates when SF tones are present. Inserts the 2600-Hz filter in the receive circuit.	Released when SF tones are not present. Removes the 2600-Hz filter from the receive circuit.
GD	Operates when SF tones are not present. Inserts the guard detector in the SF processing circuit. Sends the detector output to the comparator.	Released when SF tones are present. Removes the guard detector from the SF processing circuit. Does not allow the detector output to reach the comparator.

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier also checks that the card that plugs into the TM card slot.

Technical data

Each circuit on the card provides an impedance of 600 Ω.

The minimum receive level for the circuits is -2 dBm for digital test sequence (DTS) output, with a range of -2 to +13 dBm. The maximum transmit level is -3 dBm for DTS output, with a range of -3 to -18 dBm.

The receive level switches must be set to 9 dB for a nominal carrier receive level of +7 dBm. The transmit level switches must be set to 13 dB for a nominal carrier transmit level of -16 dBm.

NT2X78AA (continued)

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω

The SF tone source (through the RPAM bus) has the following characteristics:

- frequency: 2600 Hz
- HI level amplitude: -8 dBm0
- LO level amplitude: -20 dBm0

The characteristics of the SF receiver appear in the following table.

SF receiver characteristics

Characteristic	Value
Center frequency	2600 Hz ± 0.3%
Broad detection bandwidth (signal detector only)	1800 Hz
Narrow detection bandwidth (guard and signal detectors)	100 Hz at -10 dBm input signal
Minimum sensitivity	-26 dBm ± 2 dBm
Maximum sensitivity	+7 dBm ± 1 dBm
DP pulsing	7.5 to 12.5 pulses per second
Signal-to-guard ratio	10 dB

NT2X78AA (end)

The characteristics of the 2600-Hz band elimination filter appear in the following table displays .

2600-Hz band elimination filter characteristics

Frequency	Loss
250 to 2200 Hz	0.5 dB
2600 Hz	45 dB minimum
3000 to 3400 Hz	0.5 dB

Physical dimensions

The dimensions for the NT2X78AA circuit card are as follows:

- overall height: 353 mm (13.9 in.)
- overall depth: 267 mm (10.5 in.)
- overall width: 29 mm (1.125 in.)

Power requirements

CAUTION
Damage to equipment or loss of service
Only for use on telephone wiring that a Nortel Networks protector protects, catalog number 303M-12AIKE. For use in combination with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire for use in series with the protector is 26-AWG.

The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

Power consumption is normally 600 mW for each idle trunk circuit

NT2X80AA

Product description

The NT2X80AA precision balance network card balances a two-wire to four-wire terminating set. The card balances the set when the two-wire consists of H88 loaded cable facilities of a maximum of 1828.8 m (6000 ft.).

Location

The NT2X80AA card mounts on the trunk circuit card directly.

Functional description

The NT2X80AA uses two, reduced in size, switch assemblies to adjust resistance and capacity elements. The NT2X80AA provides an adjustable impedance across terminals. The adjusted hybrid balance can produce a higher loss in the transmission path from between four-wire legs. These adjustments reduce the possibility of singing or oscillations in the four-wire loop.

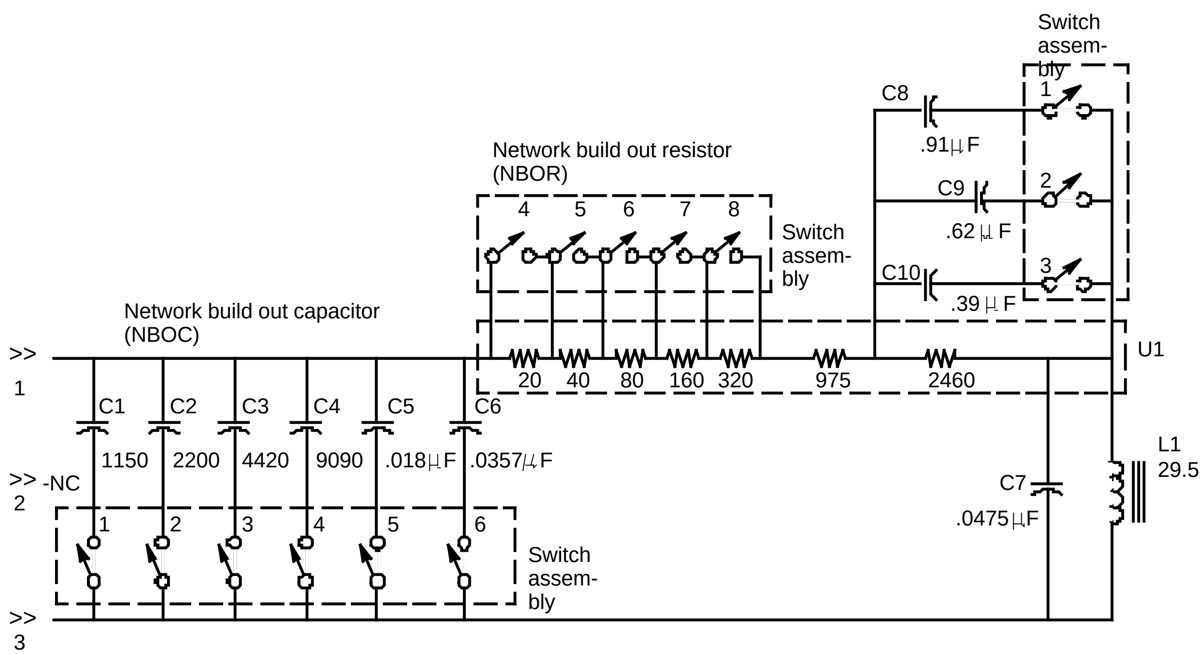
NT2X80AA (continued)

Functional blocks

The NT2X80AA has the following functional blocks:

- switches
- network resistor
- network capacitor

NT2X80AA functional blocks



Notes: 1) Capacity is in picofarads unless stated differently.
2) Resistance is in ohms.
3) Inductance is in millihenrys

Switches

The switch assembly contains switches 1 through 3. The switch assembly selects a network to provide compatibility with 19, 22, 24, and 26 gauge H88 loaded cables.

Network resistor

The switch assembly has switches 4 to 8. The switch assembly affects the resistance section of the balancing procedure. Switches 4 to 8 add series. The switches provide 32 resistance by values of 20 Ω, to a maximum of 620 Ω.

NT2X80AA (end)

Network capacitor

The switch assembly has switches 1 to 6. The switch assembly affects the capacity section of the balancing procedure. Switches 1 through 6 perform parallel addition. The switches provide 62 different capacitance values.

Technical data

The NT2X80AA is compatible with 19, 22, 24, or 26 gauge H88 loaded cables.

Dimensions

The dimensions for the NT2X80AA card are as follows:

- height: 65 mm (2.62 in.)
- depth: 70 mm (2.75 in.)

NT2X81AA

Product description

The NT2X81AA provides a incoming, outgoing, or two-way voice and signaling interface. The NT2X81AA provides interfaces between a trunk module (TM) and a two-wire interoffice, tandem, toll-connecting, or secondary intertoll trunk. The card uses type D1 E&M supervision. The card accepts dial pulsing or multifrequency (MF) signaling.

Each card has two trunk circuits.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X81AA communicates control messages with the TM. The NT2X81AA transmits near-end signaling to the far-end and receives far-end signaling. The NT2X81AA processes voice frequency (VF) information. The VF information is received, converted to pulse amplitude modulation (PAM) signals, and sent to the TM for further processing. The PAM signals are received from the TM. The PAM signals are converted to CF signals, and sent over the tip (T) and ring (R) leads.

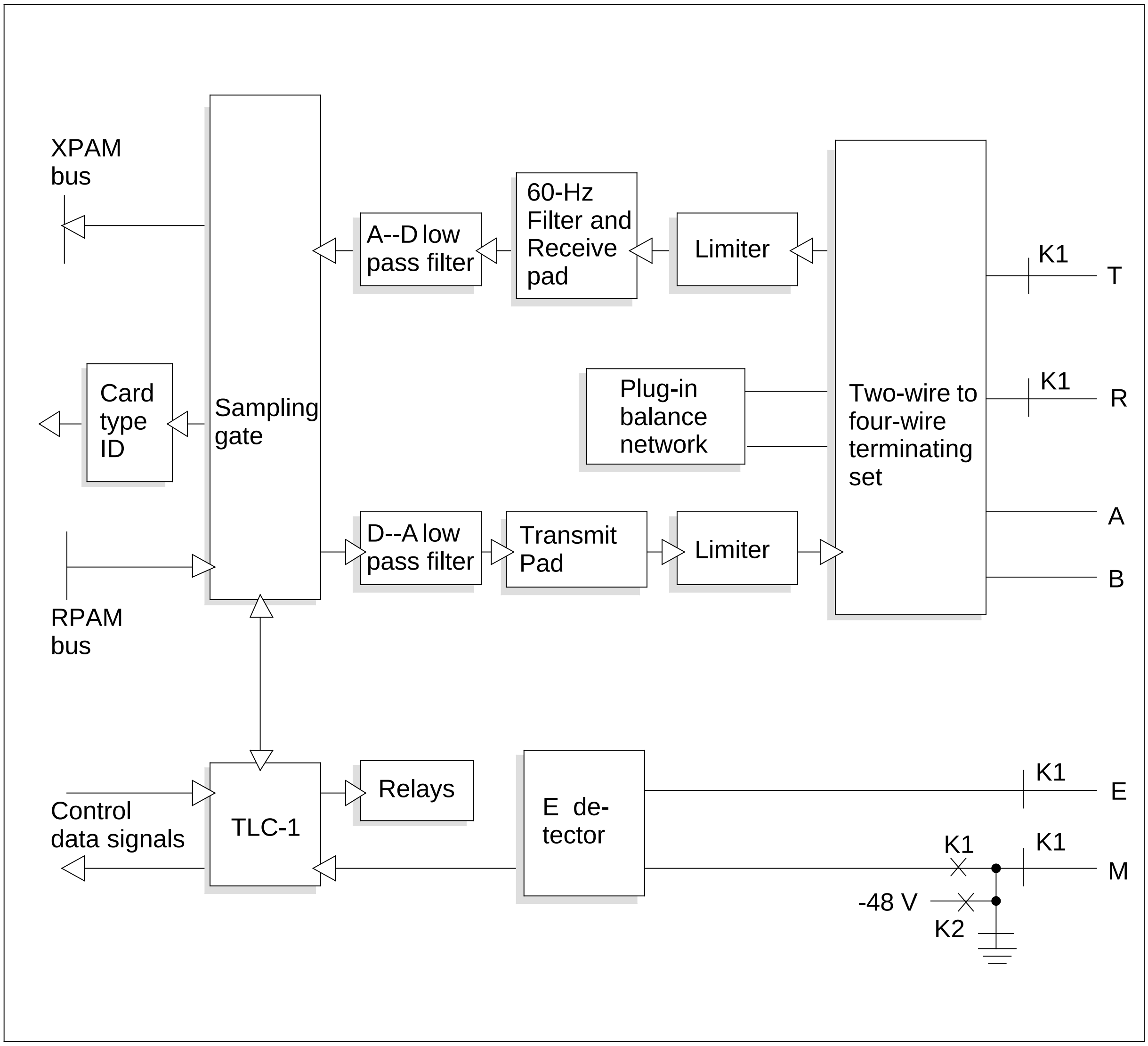
Functional blocks

Each circuit in the NT2X81AA has the following functional blocks:

- trunk logic circuit (TLC)
- sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- 60-Hz high-pass filter
- fixed receive level pad
- fixed transmit level pad
- two-wire to four-wire terminating set
- balance network
- E detector
- relays (two)
- card type identifier

The following figure shows the relationship between functional blocks in trunk circuit 1. Trunk circuit 0 operation is identical.

NT2X81AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the XPAM bus for further processing. In the transmit direction, the gate converts

NT2X81AA (continued)

PAM information received from the receive pulse amplitude modulation (RPAM) bus into VF signals. The gate sends the signals over the T and R leads.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The filter passes the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The filter passes the signal to the transmit pads. The filter amplifies the signal.

60-Hz high-pass filter

The 60 Hz filter removes all sections of the signal below 60 Hz to prevent line noise from entering the receive path.

Fixed receive level pad

The receive level pad provides a fixed 0 dBm level of adjustment to the level of the VF signal. The card converts the receive level pad to digital form and processes the the receive level pad.

Fixed transmit level pad

The transmit level pad provides a fixed 3 dBm level of adjustment. The transmit level pad provides this adjustment to the level of the VF signal sent over the trunk.

Two-wire to four-wire terminating set

The terminating set converts the internal four-wire circuit into a two-wire circuit for connection to a two-wire analog transmission facility.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600 Ω non-loaded facility. The compromise network provides 600W of resistance and 2.15 µF of capacitance.

NT2X81AA (continued)

The balance network plug-in options for applications are in the following table.

Balance network options

Application	Balance network product code	Maximum cable length
H88 loaded cable	NT2X80AA	
Non-loaded cable, 900 Ω	NT2X77AA	2743 m (9000 ft)
Non-loaded cable, 600 Ω	NT2X77AB	2743 m (9000 ft)
Non-loaded cable, 900 Ω	NT2X77AC	229 m (750 ft)
Non-loaded cable, 600 Ω	NT2X77AD	229 m (750 ft)
Non-loaded cable, 600 Ω (complex A)	NT2X77BA	
Non-loaded cable, 600 Ω (complex B)	NT2X77BB	

E detector

The E detector senses the conditions present on the E lead. The E detector transmits the information through the TLC to the TM. The E lead conditions represent far-end signaling.

Relays

There are two relays specified tests and M-lead (near-end) signaling. The following table shows the name and purpose for each relay.

Relay operation

Relay	Operated	Released
K1	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These events allow an internal test of the circuit.	Normal operation
K2	-48 V placed on M lead	M lead ground

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the TM card slot has the card connected to it.

NT2X81AA (continued)

Signaling

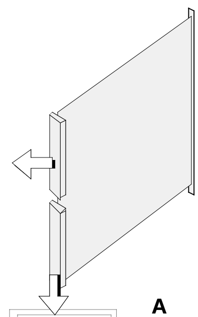
Pin numbers

The following figure describes the pin numbers for the NT2X81AA.

NT2X81AA (continued)

NT2X81AA pin numbers

	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B		
7A 7B	M.0	
8A 8B		
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B		
29A 29B	M.1	
30A 30B	E.1	
31A 31B	B.1	
32A 32B	A.1	
33A 33B	B.0	
34A 34B	A.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

NT2X81AA (continued)

Technical data

Each circuit on the card provides an impedance of 900 Ω.

The receive level and transmit level for the circuits are 0 dBm for digital test sequence (DTS) output.

The signaling characteristics of the card are in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±5 V
Maximum external E-lead resistance	1000 Ω
Minimum external M-lead resistance	350 Ω
Minimum M-lead DP outpulsing resistance	2000 Ω
M-lead MF pulsing range	Limited by voice band transmission characteristics

Dimensions

The dimensions for the NT2X81AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X81AA (end)

Power requirements

> **CAUTION**
> **Damage to equipment or loss of service**
> Use on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE only. Use with a 26 AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 500 mW.

NT2X81AB

Product description

The NT2X81AB provides an incoming, outgoing, or two-way voice and signaling interface. The interfaces are between a trunk module (TM) and a two-wire interoffice, tandem, toll-connecting, or secondary intertoll trunk. The card uses type D1 E&M supervision. The card accepts dial pulsing or multifrequency (MF) signaling.

Each card has two trunk circuits.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X81AB communicates control messages with the TM. The NT2X81AB transmits near-end signaling to the far-end and receives far-end signaling. The NT2X81AB processes voice frequency (VF) information. The VF information is received, converted to pulse amplitude modulation (PAM) signals, and sent to the TM for further processing. PAM signals are received from the TM, converted into VF signals, and sent over the tip (T) and ring (R) leads.

Functional blocks

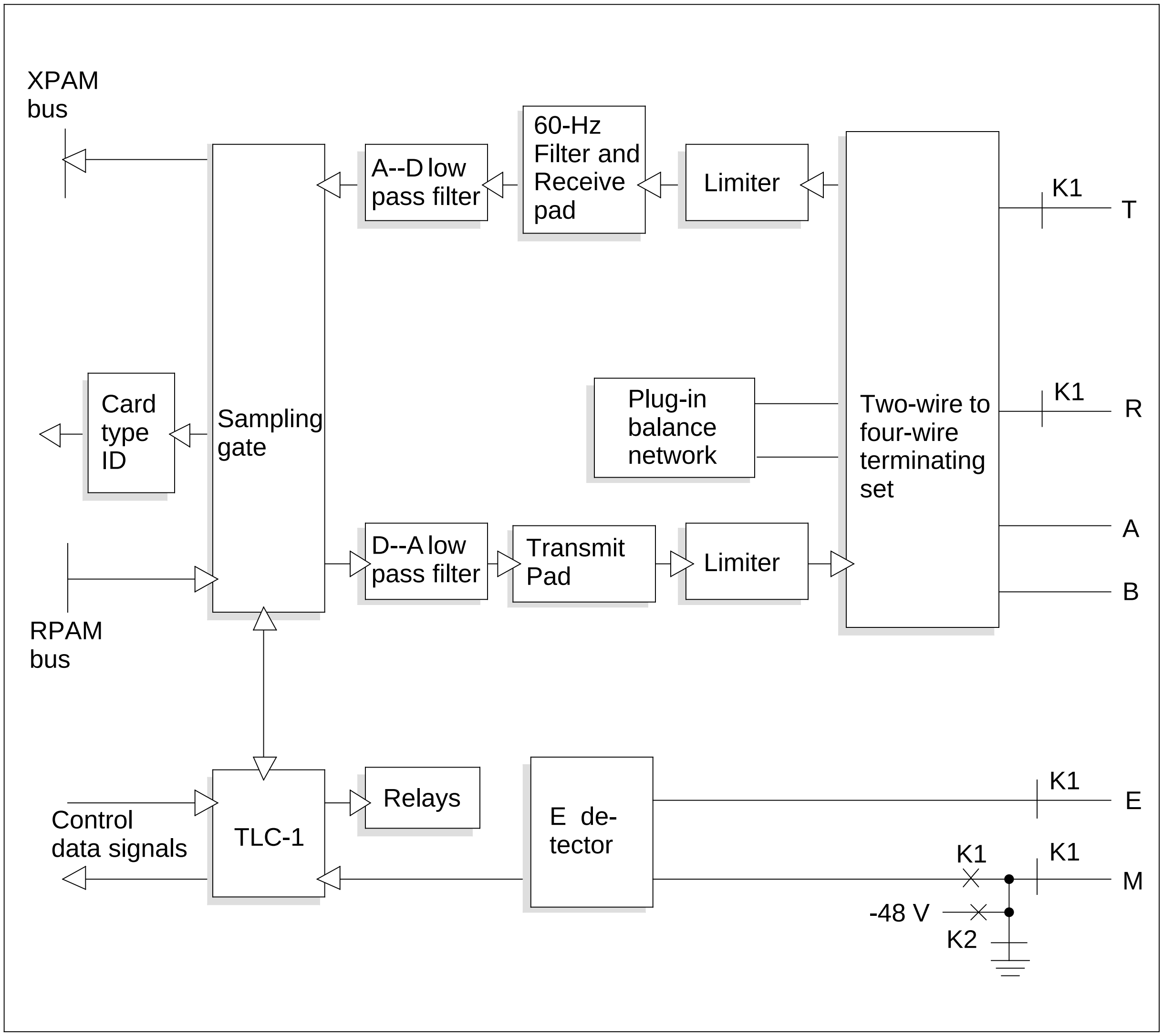
Each circuit in the NT2X81AB has the following functional blocks:

- trunk logic circuit (TLC)
- sampling gate
- analog-to-digital (A/D) low-pass filter
- analog-to-digital (D/A) low-pass filter
- 60 Hz high-pass filter
- fixed receive level pad
- fixed transmit level pad
- two-wire to four-wire terminating set
- balance network
- E detector
- relays (two)
- card type identifier

The following figure shows the relationship between functional blocks in trunk circuit 1. Trunk circuit 0 operation is identical.

NT2X81AB (continued)

NT2X81AB functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC card generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive PAM (RPAM) bus back into VF signals. The gate sends the signals over the T and R leads.

NT2X81AB (continued)

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The filter passes the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The filter passes the signal to the transmit pads. The filter amplifies the signal.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600 Ω non-loaded facility. The compromise network provides 600 Ω of resistance and 2.15 μF of capacitance.

The balance network plug-in options for various applications are listed in the following table.

Balance network options

Application	Balance network product code	Maximum cable length
H88 loaded cable	NT2X80AA	
Non-loaded cable, 900 Ω	NT2X77AA	2743 m (9000 ft)
Non-loaded cable, 600 Ω	NT2X77AB	2743 m (9000 ft)
Non-loaded cable, 900 Ω	NT2X77AC	229 m (750 ft)
Non-loaded cable, 600 Ω	NT2X77AD	229 m (750 ft)
Non-loaded cable, 600 Ω (complex A)	NT2X77BA	
Non-loaded cable, 600 Ω (complex B)	NT2X77BB	

60 Hz high-pass filter

The 60 Hz filter removes all sections of the signal below 60 Hz to prevent line noise from entering the receive path.

Fixed receive level pad

The receive level pad provides a fixed 0 dBm level of adjustment to the level of the VF signal. The card converts the receive level to digital form and processes the receive level.

Fixed transmit level pad

The transmit level pad provides a fixed 3 dBm level of adjustment to the level of the VF signal. The trunk carries the VF signal.

Two-wire to four-wire terminating set

The terminating set converts the internal four-wire circuit into a two-wire circuit for connection to a two-wire analog transmission facility.

E detector

The E detector senses the conditions present on the E lead. The E detector transmits the information through the TLC to the TM. The E-lead conditions represent far-end signaling.

Relays

Two relays test and M-lead (near-end) signal. The following table shows the name and purpose for each relay.

Relay operation

Relay	Heading	Heading
K1	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths These events allow the internal test of the circuit	Normal operation
K2	-48 V placed on M lead	M lead ground

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the TM card slot has the card connected.

Signaling

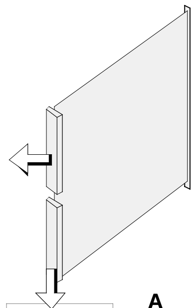
Pin numbers

The following figure illustrates the pin numbers for the .

NT2X81AB (continued)

NT2X81AB pin numbers

		A	B
1A	1B	GND	
2A	2B	T.0	
3A	3B	R.0	
4A	4B	T.1	
5A	5B	R.1	
6A	6B		
7A	7B	M.0	
8A	8B		
9A	9B		
10A	10B		
11A	11B		
12A	12B		
13A	13B		
14A	14B		
15A	15B		
16A	16B		
17A	17B		
18A	18B		
19A	19B		
20A	20B		
21A	21B		
22A	22B		
23A	23B		
24A	24B		
25A	25B		
26A	26B		
27A	27B		
28A	28B		
29A	29B	M.1	
30A	30B	E.1	
31A	31B	B.1	
32A	32B	A.1	
33A	33B	B.0	
34A	34B	A.0	
35A	35B	+24 V	+24 V
36A	36B	+24 V	+24 V
37A	37B	FLT-GND	FLT-GND
38A	38B	FLT-GND	FLT-GND
39A	39B	-48 V FLT	-48 V FLT
40A	40B	-48 V FLT	-48 V FLT



		A	B
41A	41B	GND	GND
42A	42B	GND	GND
43A	43B	GND	GND
44A	44B	RPAM-P	
45A	45B	RPAM-N	
46A	46B	GND	GND
47A	47B		
48A	48B	XPAM-N	
49A	49B	XPAM-P	
50A	50B	GND	GND
51A	51B		
52A	52B		
53A	53B		
54A	54B		
55A	55B		
56A	56B		
57A	57B		
58A	58B		
59A	59B		
60A	60B		
61A	61B		
62A	62B		
63A	63B		
64A	64B		
65A	65B		
66A	66B	TE.0	TE.1
67A	67B	TYP	TYN
68A	68B	RDAT	
69A	69B	BUS/CLK	
70A	70B		ANUL
71A	71B	XDAT	
72A	72B		
73A	73B		
74A	74B	-15 V	-15 V
75A	75B		
76A	76B	+12 V	+12 V
77A	77B		
78A	78B		
79A	79B		
80A	80B	GND	GND

NT2X81AB (continued)

Technical data

Each circuit on the card has an impedance of 600 Ω . The receive level and transmit level for the circuits is -3 dBm for digital test sequence (DTS) output.

The signaling characteristics of the card are in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.80 V
Normal talk battery range (float charge)	-49.00 V to -53.50 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.80 V
Minimum insulation resistance	30 k Ω
Ground potential	±5 V
Maximum external E-lead resistance	1000 Ω
Minimum external M-lead resistance	350 Ω
Minimum M-lead DP outpulsing resistance	2000 Ω
M-lead MF pulsing range	Limited by voice band transmission characteristics

Dimensions

The dimensions for the NT2X81AB circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X81AB (end)

Power requirements

DANGER
Damage to equipment or loss of service
For Use only on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26 AWG copper wire with thermoplastic insulation. The maximum fusing wire to be used in series with the protector is 26 AWG.

The card has the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 500 mW.

NT2X81AC

Product description

The NT2X81AC provides an incoming, outgoing, or two-way voice and signaling interface. The interfaces are between a trunk module (TM) and a two-wire interoffice, tandem, toll-connecting, or secondary intertoll trunk. The card uses SSDC5AA type supervision. The card accepts dial pulsing or multifrequency (MF) signaling.

Each card has two trunk circuits.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X81AC communicates control messages with the TM. The NT2X81AC transmits near-end signaling to the far-end and receives far-end signaling. The NT2X81AC processes voice frequency (VF) information. The VF information is received, converted to pulse amplitude modulation (PAM) signals, and sent to the TM for further processing. The PAM signals are received from the TM, converted into VF signals, and sent over the tip (T) and ring (R) leads.

Functional blocks

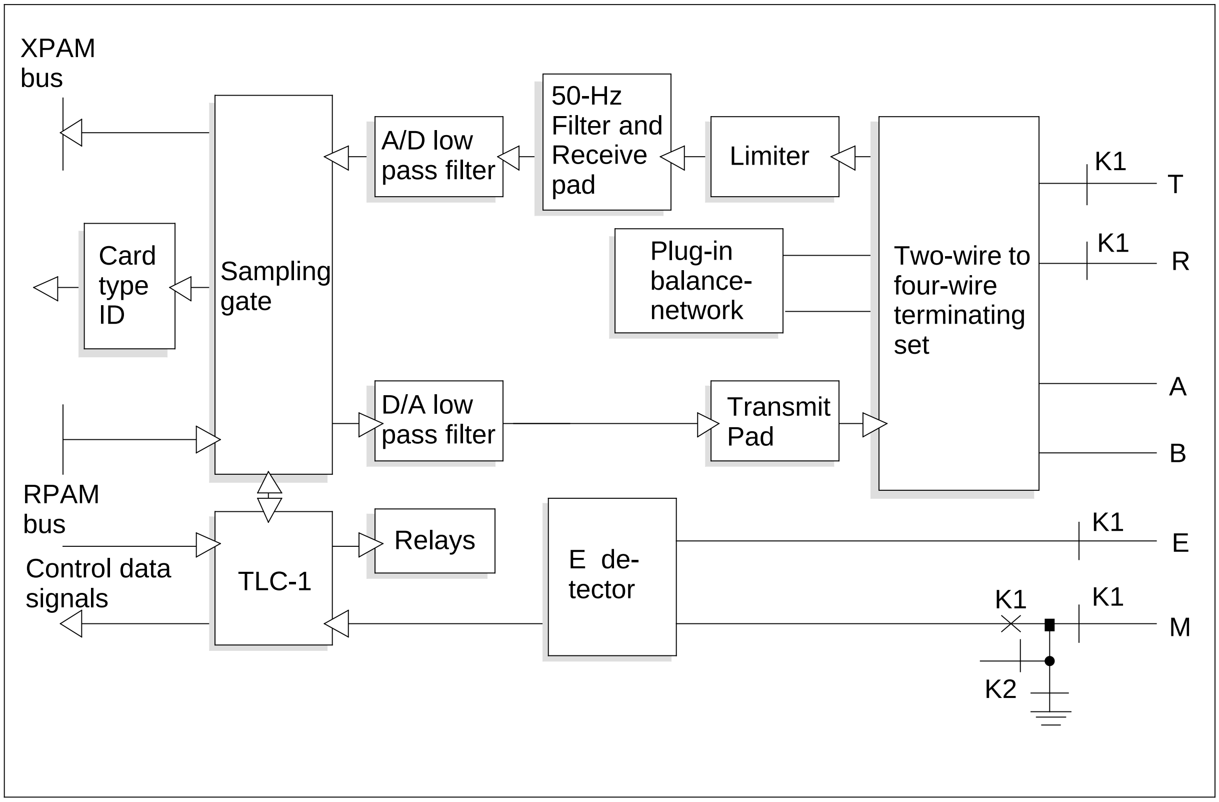
Each circuit in the NT2X81AC contains the following functional blocks:

- trunk logic circuit (TLC)
- sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- 50 Hz high-pass filter
- fixed receive level pad
- fixed transmit level pad
- two-wire to four-wire terminating set
- balance network
- E detector
- relays (two)
- card type identifier

The following figure shows the relationship between functional blocks in trunk circuit 1. Trunk circuit 0 operation is identical.

NT2X81AC (continued)

NT2X81AC functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive PAM (RPAM) bus into VF signals. The gate sends the signals over the T and R leads.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The filter passes the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The filter passes the signal to the transmit pads. The filter amplifies the signal.

50 Hz high-pass filter

The 50 Hz filter removes all sections of the signal below 50 Hz to prevent line noise from entering the receive path.

Fixed receive level pad

The receive level pad provides a fixed 0 dBm level of adjustment to the level of the VF signal. The card converts the receive level pad to digital form and processes the receive level path.

Fixed transmit level pad

The transmit level pad provides a fixed 3 dBm level of adjustment to the level of the VF signal. The trunk carries the VF signal.

Two-wire to four-wire terminating set

The terminating set converts the internal four-wire circuit into a two-wire circuit for connection to a two-wire analog transmission facility.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600 Ω non-loaded facility. The compromise network provides 600 Ω of resistance and 2.15 µF of capacitance.

The balance network plug-in options for applications are listed in the following table.

Balance network options (Sheet 1 of 2)

Application	Balance network product code	Maximum cable length
H88 loaded cable	NT2X80AA	
Non-loaded cable, 900 Ω	NT2X77AA	2743 m (9000 ft)
Non-loaded cable, 600 Ω	NT2X77AB	2743 m (9000 ft)
Non-loaded cable, 900 Ω	NT2X77AC	229 m (750 ft)
Non-loaded cable, 600 Ω	NT2X77AD	229 m (750 ft)

NT2X81AC (continued)

Balance network options (Sheet 2 of 2)

Application	Balance network product code	Maximum cable length
Non-loaded cable, 600 Ω (difficult A)	NT2X77BA	
Non-loaded cable, 600 Ω (difficult B)	NT2X77BB	

E detector

The E detector senses the conditions present on the E lead. The E detector transmits the information through the TLC to the TM. The E lead conditions represent far-end signaling.

Relays

Two relays test and M lead (near-end) signal. The following table shows the name and purpose for each relay.

Relay operation

Relay	Operated	Released
K1	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These event allow the internal test of the circuit	Normal operation
K2	M lead ground	M lead open

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the TM card slot has the card connected.

Signaling

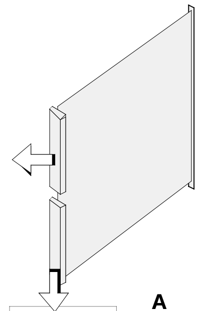
Pin numbers

The following figure illustrates the pin numbers for the NT2X81AC.

NT2X81AC (continued)

NT2X81AC pin numbers

	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B		
7A 7B	M.0	
8A 8B		
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B		
29A 29B	M.1	
30A 30B	E.1	
31A 31B	B.1	
32A 32B	A.1	
33A 33B	B.0	
34A 34B	A.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

NT2X81AC (continued)

Technical data

Both circuits on the card have an impedance of 900 Ω.

The receive level for the circuits is 0 dBm for digital test sequence (DTS) output. The transmit level is -1 dBm for DTS output.

The signaling characteristics of the card are in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.80 V
Normal talk battery range (float charge)	-49.00 V to -53.50 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.80 V
Minimum insulation resistance	30 k Ω
Ground potential	±5 V
Maximum external E lead resistance	1000 Ω
Minimum external M lead resistance	350 Ω
Minimum M lead DP outpulsing resistance	2000 Ω
M lead MF pulsing range	Limited by voice band transmission characteristics

The E lead (receiving) detects ground on as off-hook and ground off as on-hook. The M lead (transmitting) detects ground on as off-hook and an open circuit as on-hook.

Dimensions

The dimensions for the NT2X81AC circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X81AC (end)

Power requirements

The card has the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27.0 V (24.0 V nominal)

Power use is normally 500 mW.

NT2X81BA

Product description

The NT2X81BA circuit card provides an incoming, outgoing, or two-way voice and signaling interface. The interfaces are between a trunk module (TM) and a 2-wire interoffice, tandem, toll-connecting, or secondary intertoll trunk. The NT2X81BA circuit card usessignalling system DC5A (SSDC5AA). The NT2X81BA circuit card accepts dial pulsing or multifrequency (MF) signaling.

This circuit card accommodates two trunk circuits.

Location

The card occupies one card position in a 8-wire TM.

Functional description

The NT2X81BA communicates control messages with the TM. The NT2X81BA circuit card transmits near-end signaling to the far-end and receives far-end signaling. The NT2X81BA circuit card communicates control messages with the TM and processes voice frequency (VF) information. The VF information is received, converted to pulse amplitude modulation (PAM) signals, and sent to the TM for further processing. The PAM signals are received from the TM, converted into VF signals, and sent over the tip (T) and ring (R) leads.

Functional blocks

This section describes the functional blocks and provides a diagram that displays the major functional blocks of the NT2X81BA circuit card.

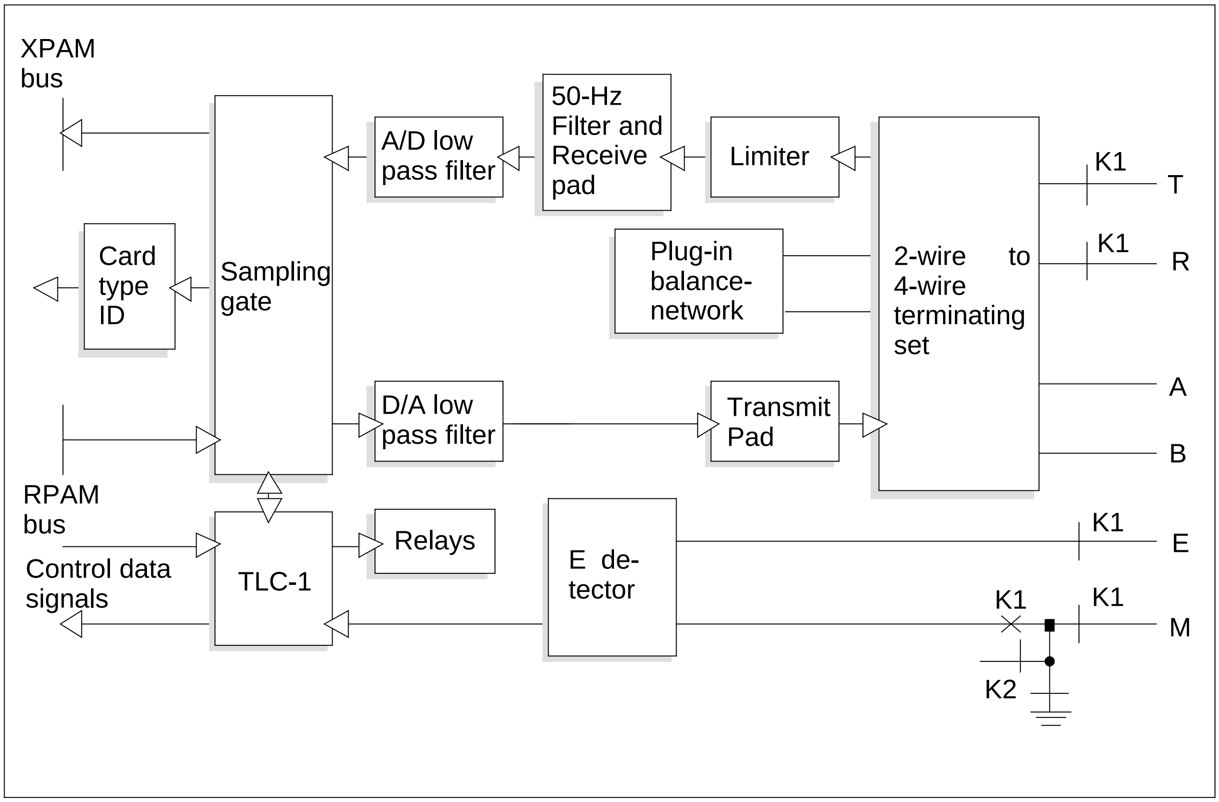
The functional blocks of the NT2X81BA circuit card are:

- trunk logic circuit (TLC)
- sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- 50 Hz high-pass filter
- fixed receive level pad
- fixed transmit level pad
- 2-wire to 4-wire terminating set
- balance network
- E detector

- relays (two)
- card type identifier

The next figure shows the relationship between functional blocks in trunk circuit 1. Trunk circuit 0 operation is identical.

NT2X81BA functional blocks



Trunk logic circuit

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the trunk circuit. The circuit card type identification voltage is made available to the TM under the control of the TLC.

Sampling gate

In the receive direction, the sampling gate converts analog VF signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction, the signaling gate converts PAM information received from the receive PAM (RPAM) bus into VF signals. The signaling gate sends the signals over the T and R leads.

NT2X81BA (continued)

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter limits the bandwidth and amplifies the signal. The signal is forwarded to the sampling gate.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The D/A filter limits the bandwidth and amplifies the signal. The signal is forwarded to the transmit pads.

50 Hz high-pass filter

The 50 Hz filter removes all sections of the signal below 50 Hz to prevent line noise from entering the receive path.

Fixed receive level pad

The receive level pad provides a fixed 0 dBm level of adjustment to the level of the VF signal. The NT2X81BA circuit card converts the receive level pad to digital form and processes the receive level path.

Fixed transmit level pad

The transmit level pad provides a fixed 3 dBm level of adjustment to the level of the VF signal. The trunk carries the VF signal.

2-wire to 4-wire terminating set

The terminating set converts the internal 4-wire circuit into a 2-wire circuit for connection to a 2-wire analog transmission facility.

Balance network

A balance network connects to the terminating set to match the card with a 600 Ω non-loaded facility. The network provides 600 Ω of resistance and 2.15 μF of capacitance.

The balance network plug-in options are listed in the next table.

Balance network options

Application	Balance network product code
Non-loaded cable, 600 Ω (difficult A)	NT2X77BA
Non-loaded cable, 600 Ω (difficult B)	NT2X77BB

E detector

The E detector senses the conditions present on the E lead. The E detector transmits the information through the TLC to the TM. The E lead conditions represent far-end signaling.

Relays

The next table shows the name and purpose of each relay.

Relay operation

Relay	Operated	Released
K1	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths.	Normal operation
K2	M lead ground	M lead open

Card type identifier

The circuit card type identifier provides the TM with an identification code for inventory purposes. The circuit card type identifier ensures the TM circuit card slot has the circuit card connected.

Signaling

This section contains the backplane pin numbers for the NT2X81BA circuit card.

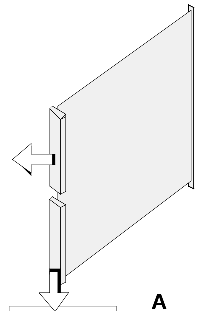
Pin numbers

The next figure illustrates the pin numbers for the NT2X81AC circuit card.

NT2X81BA (continued)

NT2X81BA pin numbers

Pins	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B		
7A 7B	M.0	
8A 8B		
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B		
29A 29B	M.1	
30A 30B	E.1	
31A 31B	B.1	
32A 32B	A.1	
33A 33B	B.0	
34A 34B	A.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



Pins	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

Technical data

The NT2X81BA circuit card has an input impedance of 600 Ω.

The receive level for the circuits is 0 dBm for digital test sequence (DTS) output. The transmit level is -1 dBm for DTS output.

The signaling characteristics of the NT2X81BA circuit card are in the next table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.80 V
Normal talk battery range (float charge)	-49.00 V to -53.50 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.80 V
Minimum insulation resistance	30 k Ω
Ground potential	±5 V

The E lead (receiving) detects ground on as off-hook and ground-off as on-hook. The M lead (transmitting) detects ground on as off-hook and an open circuit as on-hook.

Dimensions

The dimensions for the NT2X81AC circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

The card has the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27.0 V (24.0 V nominal)

Power use is normally 500 mW.

NT2X82AA

Product description

The NT2X82AA provides an incoming, outgoing, or two-way voice and signaling interface. The interfaces are between a trunk module (TM) and a two-wire interoffice, tandem, or toll-connecting trunk. Normal connecting circuits include SXS, NE-5 crossbar, and two-wire SP-1. The card accepts dial pulsing or multifrequency (MF) signaling.

Each card has two trunk circuits.

Location

The card occupies one card position in a two-wire, four-wire, or an eight-wire TM.

Functional description

The NT2X82AA communicates control messages with the TM. The NT2X82AA transmits near-end signaling to the far-end and receives far-end signaling. The NT2X82AA processes voice frequency (VF) information. The VF information is received, converted to pulse amplitude modulation (PAM) signals, and sent to the TM for further processing. The PAM signals are received from the TM, converted into VF signals, and sent over the tip (T) and ring (R) leads.

Functional blocks

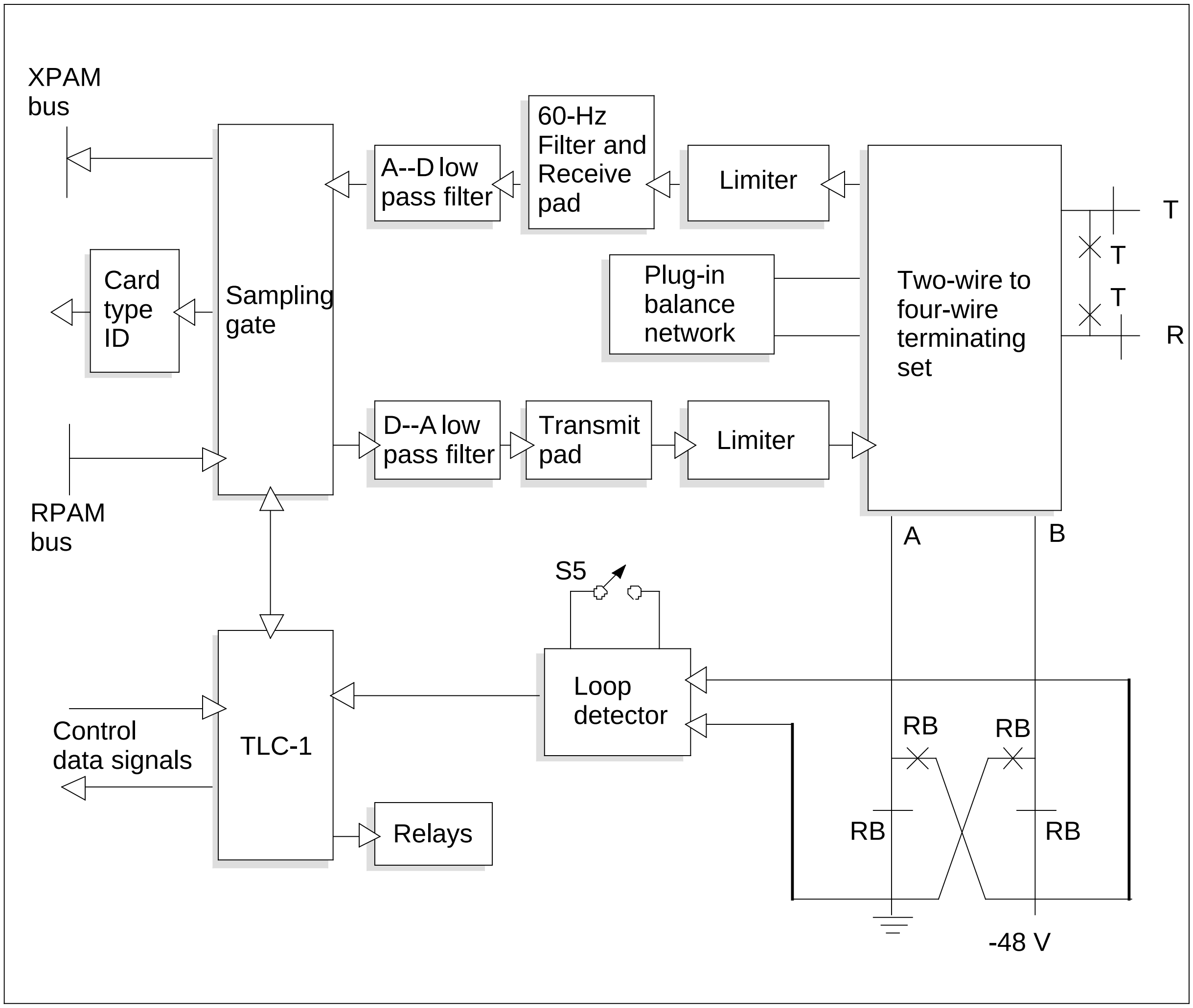
Each circuit in the NT2X82AA contains the following functional blocks:

- trunk logic circuit (TLC)
- sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- two-wire to four-wire terminating set
- balance network
- loop detector
- relays (two)
- card type identifier

NT2X82AA (continued)

The following figure shows the relationship between blocks in trunk circuit 1. Trunk circuit 0 operation is identical.

NT2X82AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction,

NT2X82AA (continued)

the gate converts PAM information received from the receive PAM (RPAM) bus back into VF signals. The gate sends the signals over the T and R leads.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The filter passes the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The filter passes the signal to the transmit pads. The filter amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment, in 0.25 dB steps, to the VF signal level. The card processes the signal and converts the signal to digital form. To make adjustments, set groups of miniature switches to achieve the correct level.

The following table shows the receive level adjustments.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment, in 0.25 dB steps, to the VF signal level sent over the trunk. To make adjustments to the signal level, set groups of miniature switches to achieve the correct level.

The following table shows the transmit level adjustments.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters prevent a received or transmitted signal from causing the circuit to overload. One limiter is in the receive direction. The other limiter is in the transmit direction.

Two-wire to four-wire terminating set

The terminating set converts the internal four-wire circuit into a two-wire circuit for connection to a two-wire analog transmission facility.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600 Ω non-loaded facility. The compromise network has 600 Ω of resistance and 2.15 µF of capacitance.

The balance network plug-in options include NT2X80AA (H88 loaded cable). The plug-in options include NT2X77AA (compromise network, network build-out capacitance, and network build-out resistance). The plug-in options also include NT2X77AC (compromise network and network build-out capacitance). The loaded and non-loaded cables can be 19, 22, 24, or 26 gauge. The non-loaded cable can be up to 2700 m (9000 ft) in length.

Loop detector

The loop detector senses the far-end signaling on the A and B leads. The loop detector transmits the signaling state to the TLC. Switch S5 selects if the detector detects short-loop signaling (S5 ON), or long-loop signaling (S5 OFF).

NT2X82AA (continued)

Relays

Two relays test and near-end signal. The following table shows the name and purpose for each relay.

Relay operation

Relay	Operated	Released
T	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These events allow the system to test the circuit internally.	Normal operation
RB	A and B leads reversed, reverse battery applied to transmission facilities	Normal operation

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that TM card slot has the card connected.

Technical data

Each circuit on the card has an impedance of 900 Ω.

The minimum receive level for the circuits is -9 dBm for digital test sequence (DTS) output. The range is -9 to +6 dBm. The maximum transmit level is +6 dBm for DTS output. The range is +6 to -9 dBm.

The signaling characteristics of the card are in the following table.

Signaling characteristics (Sheet 1 of 2)

Characteristic	Value
Talk battery voltage	-42.50 V to -55.80 V
Normal talk battery range (float charge)	-49.00 V to -53.50 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.80 V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V

NT2X82AA (end)

Signaling characteristics (Sheet 2 of 2)

Characteristic	Value
Supervision range	4500 Ω
DP pulsing range, short loop option	0-2000 Ω
DP pulsing range, long loop option	2000-4500 Ω
M lead MF pulsing range	Limited by voice band transmission characteristics

Dimensions

The dimensions for the NT2X82AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

DANGER
Damage to equipment or loss of service
For use only on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26 AWG copper wire with thermoplastic insulation. The maximum fusing wire to be used in series with the protector is 26 AWG.

The card has the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 500 mW.

NT2X83AA

Product description

The NT2X83AA circuit card provides a voice and signaling interface. This signaling interface is between a trunk module (TM) in Digital Multiplex System (DMS) and two-wire interoffice, tandem, or toll-connecting trunks.

Features of the NT2X83AA circuit card are

- 900 Ω =2.15 µF impedance
- 2-wire to 4-wire terminating set
- outpulse dial pulse (DP) or multifrequency (MF)
- card type identification to the TM
- looparound test circuits
- selection of two battery and ground feed resistance options
- polarity detector
- switch selected level adjustment
- optional plug-in circuit for balancing the terminating set

Connecting circuits are:

- SXS outgoing (OG) trunk circuit
- NE-5 crossbar
- No. 1 ESS OG trunk circuit
- SP-1 two-wire incoming (IC) trunk circuit

Each card can accommodate two trunk circuits.

Location

The NT2X83AA circuit card occupies one position in two-wire, four-wire, or eight-wire TMs.

Functional description

The NT2X83AA circuit card transmits and receives voice frequency (VF) and pulse amplitude modulation (PAM) signals between the transmission facility and the TM. The NT2X83AA circuit card uses relays to provide test and signal functions.

Functional blocks

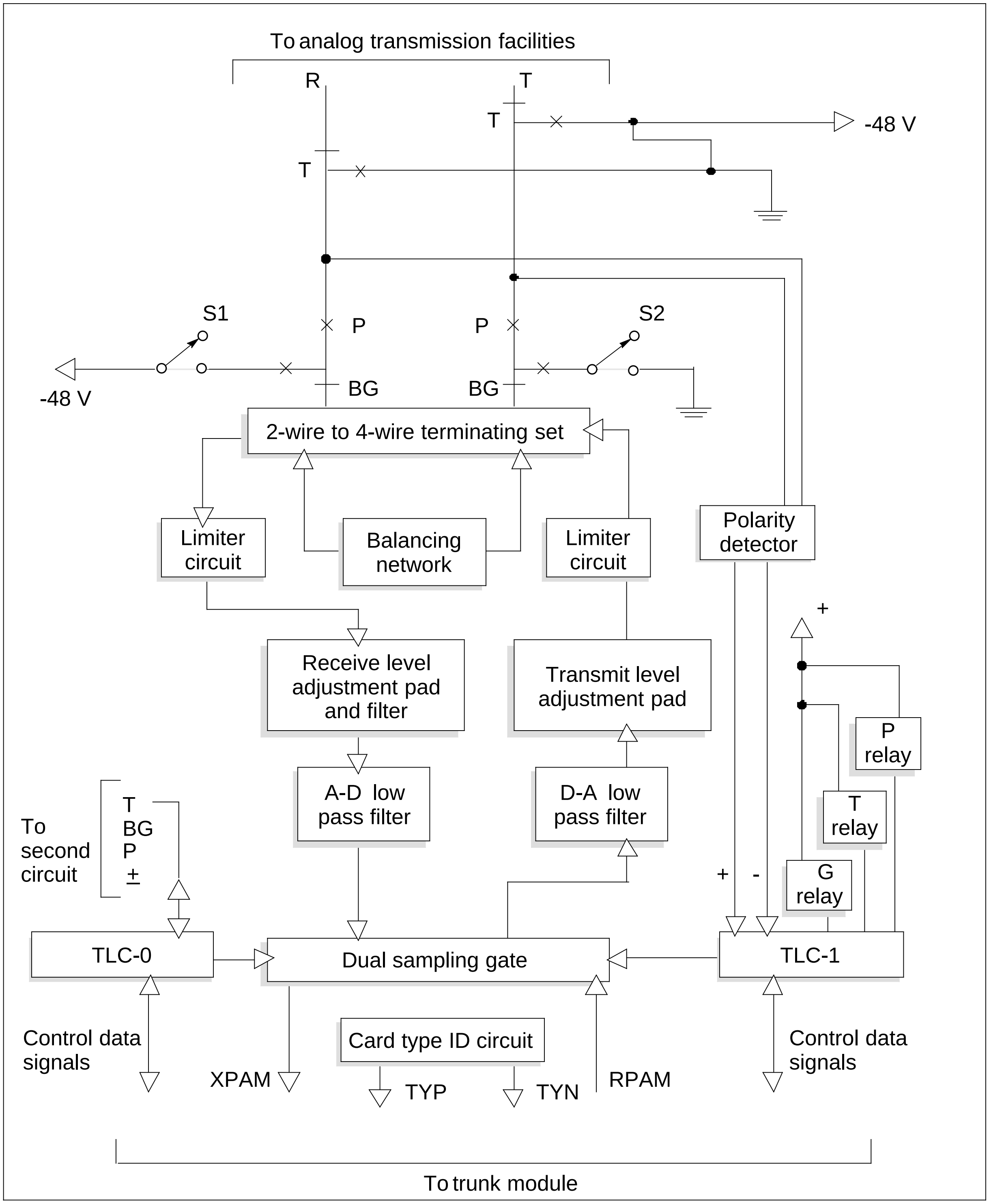
Functional blocks of the NT2X83AA circuit card are:

- two trunk logic circuits (TLC)
- dual sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad and filter
- transmit level adjustment pad
- two limiter circuits
- two-wire to four-wire terminating set
- balancing network
- polarity detector
- relays
- card type ID circuit

The next figure shows the relationship between the functional blocks.

NT2X83AA (continued)

NT2X83AA functional blocks



Trunk logic circuit

The TLCs function as communication buffers between the VF signaling and testing relays and the TM. The TLCs generate sampling pulses for the dual sampling gate. The TLCs control the voltage that identifies the type of card to the TM.

Dual sampling gate

The dual sampling gate uses an 8 kHz sampling rate to produce PAM samples for transmission to the TM. The dual sampling gate uses a transmit PAM (XPAM) bus. The gate receives PAM samples of the signal from the TM through the receive PAM (RPAM) bus. The gate constructs the signal again to an analog format.

Analog to digital low-pass filter

In the receive direction, the A/D low-pass filter receives a VF signal from the receive level adjustment pad and filter. The low-pass filter limits the signal bandwidth and amplifies the signal.

Digital to analog low-pass filter

In the transmit direction, the D/A low-pass filter receives a VF signal from the sampling gate. The low-pass filter limits the signal bandwidth and amplifies the signal.

Receive level adjustment pad and filter

The receive level adjustment pad and filter has miniature switches to obtain the required amount of loss in the receive direction. The adjustment pad and filter use a filter to block 60 Hz signal components.

The next table shows the receive switch positions and level adjustments.

Receive switch positions

Switch positions	Adjustment (dB)
S5, position 3	8.00
S5, position 2	4.00
S5, position 1	2.00
S6, position 3	1.00
S6, position 2	0.50
S6, position 1	0.25

NT2X83AA (continued)

Transmit level adjustment pad

The transmit level adjustment pad has miniature switches to obtain the required amount of loss in the transmit direction.

The next table shows the transmit switch positions and level adjustments.

Transmit switch positions

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiter circuits

Two limiter circuits restrict the signal voltage on the VF signals received and transmitted.

Two-wire to four-wire terminating set

In the receive direction, the two-wire to four-wire terminating set receives a VF signal from the tip (T) and ring (R) leads. The terminating set functions as an interface between the two-wire facility and the trunk circuit. In the transmit direction, the terminating set connects the signal to the two-wire path.

Balancing network

The balancing network balances the terminating set for the two-wire facility connected to the four-wire trunk.

Polarity detector

The polarity detector detects far-end signaling, on-hook and off-hook supervision signals, remote-make-busy signals, and loop integrity conditions.

Relays

Three relay circuits receive signals from the TLC. The relay circuits provide testing and signaling functions. The next table has the relays and the operated and released functions of the relays.

Relay operation

Relay	Operated	Released
T	Allows the system to perform internal tests on the card. These tests are possible through the addition of loop-around connections between the receive and transmit paths	Normal operation
BG	Conditions the trunk circuit for battery and ground signaling outpulsing	Normal operation
P	Transmits near-end signaling with miniature switches for outpulsing to short or long loops	Normal operation

Card type ID circuit

The card type ID circuit uses a voltage signal sent by the TLC to identify the card type. The card type ID circuit transmits this information to the TM.

Technical data

The balance network plug-in options include the NT2X80AA H88 loaded cable. The options include the NT2X77AA compromise network, network build-out capacitance (NBOC) and network build-out resistance (NBOR). The options also include the NT2X77AC compromise network and the NBOC.

The signaling characteristics of the NT2X83AA card are in the next table.

Signaling characteristics (Sheet 1 of 2)

Characteristic	Value
Talk battery voltage	-42.5 V to -55.8 V
Normal talk battery range (float charge)	-49.0 V to -53.5 V
Maximum talk battery discharge (no charge)	-42.7 V
Maximum talk battery charge (equalizing)	-55.8 V

NT2X83AA (continued)

Signaling characteristics (Sheet 2 of 2)

Characteristic	Value
Minimum insulation resistance	30 kΩ
Ground potential	±10.0 V
Supervision and pulsing	4500 Ω external resistance

The next table lists the pulsing options.

Pulsing options

Circuit requirements	External circuit loop resistance	Battery ground feed resistance	Switch position S1 and S2
SXS systems:			
Loop pulsing	0-1200	653/653	OFF
BG pulsing	1201-2000	200/200	ON
Common control systems:			
Loop pulsing	0-2000	653/653	OFF
BG pulsing	2001-4500	200/200	ON

Transmission specifications

The NT2X83AA circuit card uses 19, 22, 24, or 26 gauge H88 loaded and non-loaded cables. The cables can be a maximum of 2743 m (9000 ft) long. The next table lists the transmission characteristics of the NT2X83AA circuit card.

Transmission characteristics (Sheet 1 of 2)

Characteristic	Value
Impedance	900 Ω +2.15 µF
Minimum receive level with level adjustment switches set to OUT	-9 dBm nominal for digital test sequence (DTS) input at T and R leads of circuit card

NT2X83AA (end)

Transmission characteristics (Sheet 2 of 2)

Characteristic	Value
Maximum transmit level with level adjustment switches set to OUT	+6 dBm nominal for DTS output at T and R leads of circuit card
Receive level range	+6 dBm to -9 dBm for DTS input based on the return loss achieved on a particular transmission facility
Transmit level range	-9 dBm to +6 dBm for DTS output based on the return loss achieved on a particular transmission facility

Dimensions

The dimensions of the NT2X83AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

CAUTION
Damage to equipment or loss of service
For use only on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26 AWG copper wire with thermoplastic insulation. The maximum fusing wire to be used in series with the protector is 26 AWG.

The NT2X83AA circuit card uses 500 mW of power.

The NT2X83AA circuit card converts the following voltages:

- +12 V ±0.3V
- -15 V ±0.5V
- +24 V nominal (+22.8 to +27)

NT2X84BA

Product description

The NT2X84BA trunk 2-way BT public switched telephone network (PSTN) earth calling (EC) card exchanges information. The NT2X84BA card exchanges information between a private branch exchange (PBX) extension and the BT PSTN in a DMS-100 PBX switch.

Location

The card occupies one position in a trunk module (TM).

Functional description

The NT2X84BA receives and transmits voice frequency (VF) signals between the PSTN and the TM. The card filters the signals to limit the bandwidths. The card uses relays to provide testing and supervisory functions.

Functional blocks

The digital section of the card consists of the following functional blocks:

- two-wire to four-wire terminating set
- analog-to-digital (A-D) gain adjust circuit
- 50-Hz filter
- A-D filter
- sampling gate
- card type ID circuit
- digital-to-analog (D-A) filter
- D-A gain adjust circuit
- complex balance network
- two trunk logic circuits (TLC)
- relays

Two-wire to four-wire terminating set

In the transmit direction, the two-wire to four-wire terminating set receives a VF signal from the PSTN. The set converts the signal from the two-wire mode to the four-wire mode. In the receive direction, the terminating set connects the signal to the two-wire path.

A-D gain adjust circuit

In the transmit direction, the A-D gain adjust circuit receives the direction signal from the two-wire to four-wire terminating set. The circuit uses miniature switches to adjust the signal level.

50-Hz filter

The 50-Hz filter works in the transmit direction to attenuate 50-Hz main S frequency interference.

A-D filter

In the transmit direction, the A-D filter receives a VF signal from the 50-Hz filter. The A-D filter limits the signal bandwidth to a 300-Hz to 3400-Hz range, and amplifies the signal.

Sampling gate

The sampling gate uses an 8-kHz sampling rate to produce PAM samples for transmission to the TM with a transmit PAM (XPAM) bus. The gate receives PAM samples of the signal from the TM through the receive PAM (RPAM) bus. The gate reconstructs the signal to an analog format.

Card type ID circuit

The card type ID circuit uses a voltage signal that the TLC sends to identify the card type. The circuit transmits this information to the TM.

D-A filter

In the receive direction, the D-A filter receives a VF signal from the sampling gate. The D-A filter blocks frequencies above 3400 Hz, and amplifies the signal.

D-A gain adjust circuit

In the receive direction, the D-A gain adjust circuit receives the signal from the D-A filter. The circuit uses miniature switches to adjust the level.

Complex balance network

The complex balance network provides balance impedance to match the BT-specified cable impedance.

TLC

The two TLCs function as communication buffers between the VF signaling and supervisory circuits and the TM. The TLCs generate sampling pulses for the sampling gate and control the voltage that identifies the type of card to the TM.

The TLC-0 receives signals from the detector circuits in the analog section of the card. The TLC-0 transmits the data to the TM. The TLC-0 controls the scan points A0 to A7. The TLC-1 controls the signal distribution points A0 to A7.

NT2X84BA (continued)

Relays

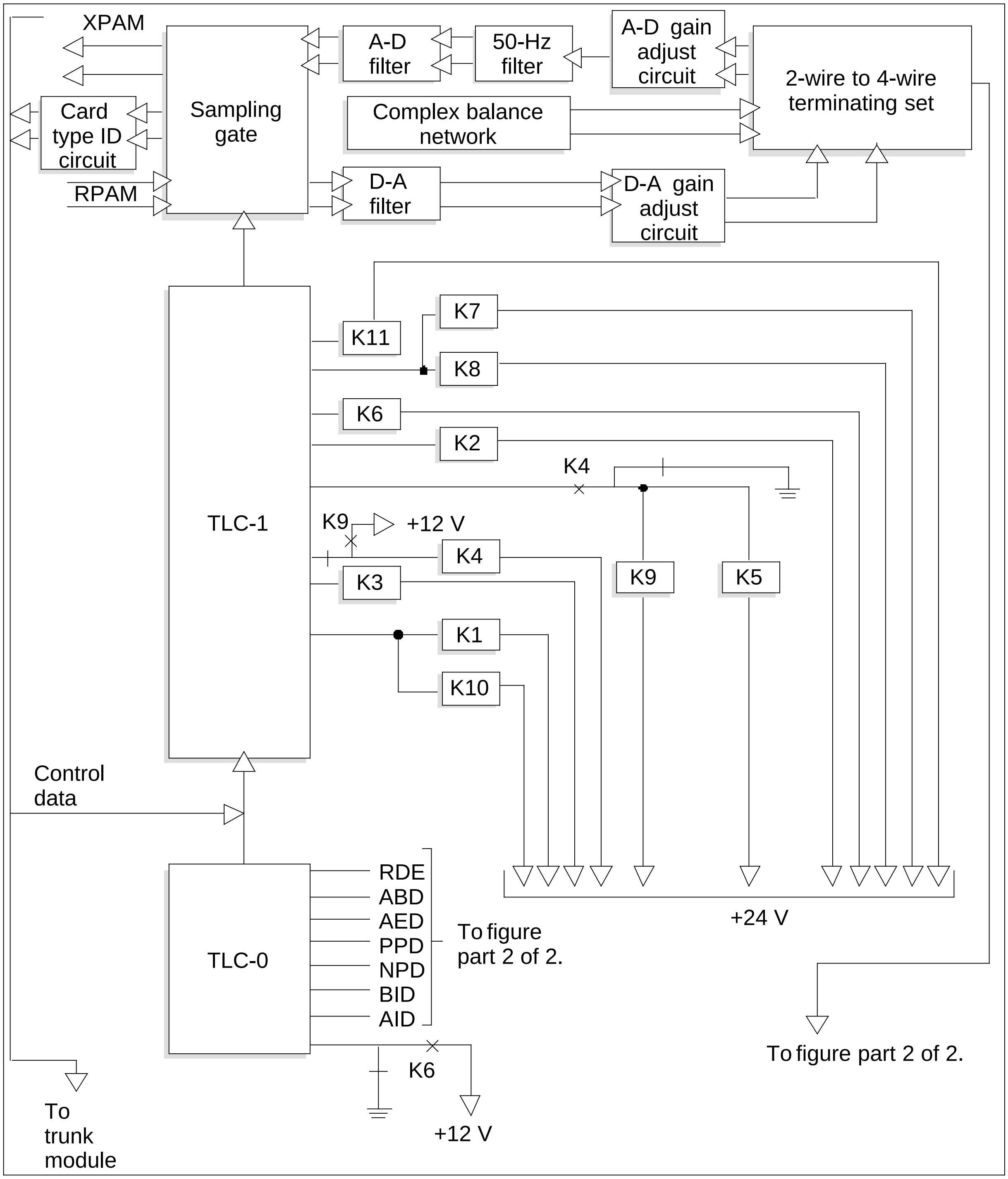
Eleven relays perform testing and supervisory functions. The following table lists the relays and operated and released functions.

Relay operation

Relay	Operated	Released
K1	Disconnects outside cable facility and connects self-test loop	Normal operation
K2	Establishes a trunk is ready for incoming or outgoing calls	Normal operation
K3	Disconnects hold loop and polarity detector	Hold loop and polarity detector connect
K4	Establishes a pulsing loop toward PSTN and operates before relays K5 and K9. Does not release until the relays release	Normal operation
K5	Establishes a holding circuit during pulsing	Normal operation
K6	Outpulses digits dialed toward the accessed PBX lines	Normal operation
K7	Reverses trunk A-wire and B-wire to verify that the polarity detector functions correctly	Normal operation
K8	Isolates ringing generator from transmission path. Establishes test operate conditions	Normal operation
K9	Establishes a holding circuit during pulsing	Normal operation
K10	Disconnects resistors R10 and R12 during the self-test	Resistors connect
K11	Detects PSTN idle conditions on the trunk A-wire and B-wire	Normal operation

The following figure displays the relationship between the functional blocks.

NT2X84BA digital section functional blocks (part 1 of 2)



NT2X84BA (continued)

The analog section of the card consists of the following functional blocks:

- A-idle detector
- polarity detector
- A-leg earth detector
- B-idle detector
- self-test loop
- ringing generator
- A-leg battery detector

A-idle detector

The A-idle detector monitors the trunk A wire to detect an idle condition at the PSTN end of the trunk.

Polarity detector

The polarity detector monitors the trunk A wire and B wire to detect battery reversal when the detector establishes an incoming call.

A-leg earth detector

The A-leg earth detector monitors the trunk A wire for an earth connection that the PSTN sends. The PSTN indicates a valid acknowledgment of a seizure by a call that originates from the PBX.

B-idle detector

The B-idle detector monitors the trunk B wire to detect an idle condition at the PSTN end of the trunk.

Self-test loop

The self-test loop checks the signaling, supervisory, and voice circuits in the trunk.

Ringing generator

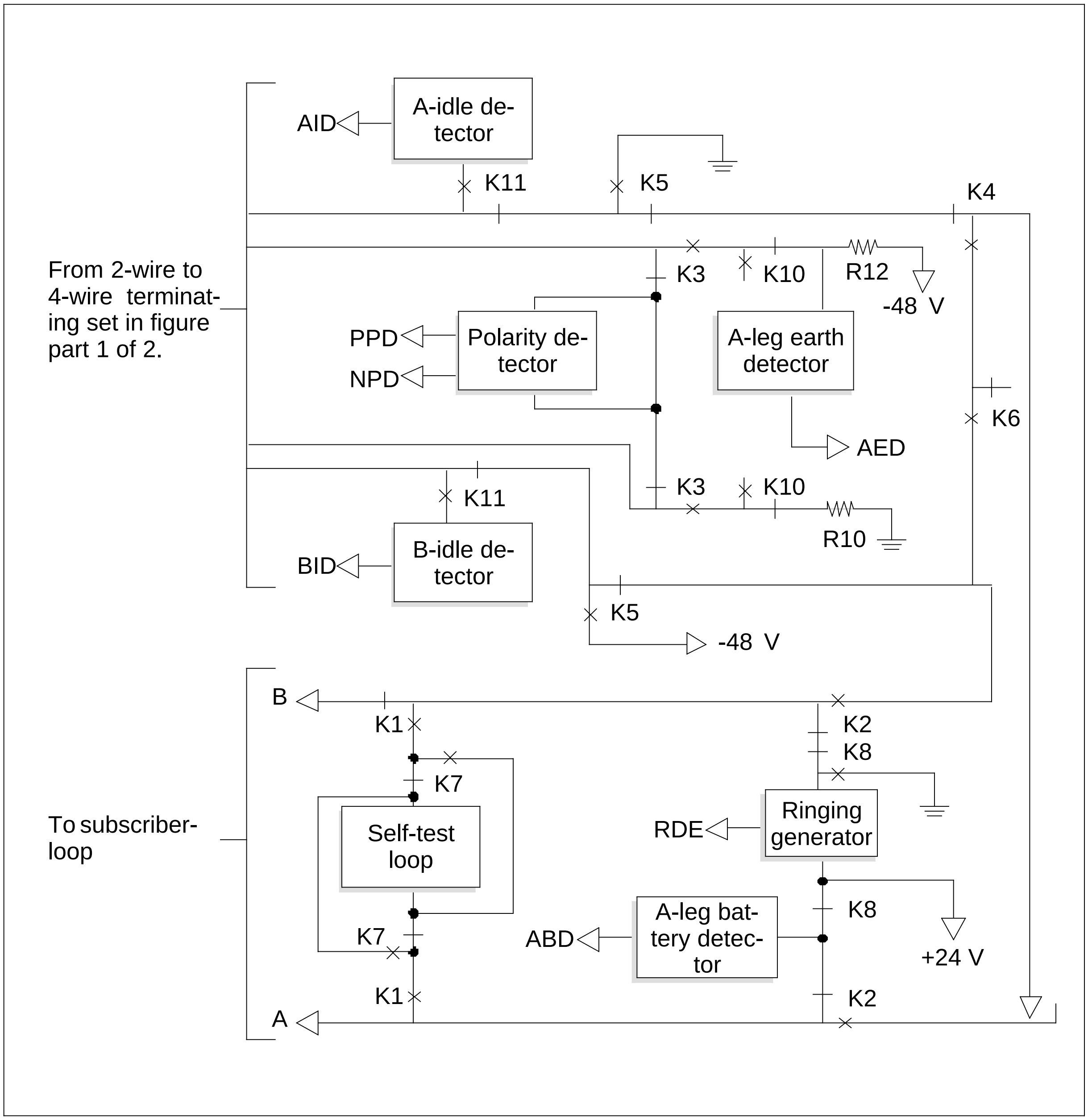
The ringing generator monitors the trunk B wire to detect a ringing signal of an incoming call from the PSTN.

A-leg battery detector

The A-leg battery detector prevents a seizure of the trunk by an outgoing call from the PBX to happen at the same time. The detector monitors the trunk A wire to detect a battery condition that the PSTN applies during ringing.

The following figure displays the relationship between the functional blocks.

NT2X84BA analog section functional blocks (part 2 of 2)



NT2X84BA (continued)

Technical data

The following table lists the signaling characteristics of the card.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.5 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge (no charge)	-42.7 V
Maximum talk battery charge (equalizing)	-55.9 V
Minimum insulation resistance	50 k Ω
Ground potential	±10.V
Supervision and pulsing	1500 Ω external looped resistance

Transmission specifications

The following table lists the transmission characteristics of the card.

Transmission characteristics (Sheet 1 of 2)

Characteristic	Value
Impedance	600 Ω
Minimum receive level with level adjustment switches set to OUT	-9 dBm nominal for digital test sequence (DTS) input at A and B wires of the circuit card
Maximum transmit level with level adjustment switches set to OUT	+6 dBm nominal for DTS output at A and B wires of the circuit card

NT2X84BA (end)

Transmission characteristics (Sheet 2 of 2)

Characteristic	Value
Receive level range	+6 to -9 dBm for DTS input depending on the return loss achieved on a particular transmission facility Adjustments are switch-selected in 0.25 dB increments
Transmit level range	-9 to +6 dBm for DTS output depending on the return loss achieved on a particular transmission facility Adjustments are switch-selected in 0.25 dB increments

Physical dimensions

The physical dimensions of the NT2X84BA are:

- height: 353 mm (13.9 in.)
- depth: 280 mm (10.9 in.)
- width: 28 mm (1.1 in.)

Power requirements

DANGER
Damage to equipment or loss of service
For use on telephone wiring that a Nortel Networks protector, catalog number 303M-12AIKE protects, with a 26 AWG copper wire with thermoplastic insulation. The maximum fusing wire for use in series with the protector is 26 AWG.

The NT2X84BA consumes 700 mW of power and converts voltages of +12 V ±0.3 V, -15 V ±5 V, and +24 V nominal (+22.8 to +27).

NT2X85AA

Product description

The NT2X85AA provides an incoming, outgoing, or two-way voice and signaling interface. The NT2X85AA provides this interface between a trunk module (TM) and a type-3 switchboard in a remote building. The card makes the switchboard operator able to control subscriber recall and release sequences and to perform coin control operations.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X85AA exchanges control messages with the TM, and transmits near-end signaling to the far-end. The card receives far-end signaling, and processes voice frequency (VF) information. The card receives the VF information, and converts the information to pulse amplitude modulation (PAM) signals. The card sends the information to the TM for additional processing. The card receives the PAM signals from the TM, and converts the PAM signals to VF signals. The card sends the signals over the T and R leads.

Functional blocks

The NT2X85AA contains the following functional blocks:

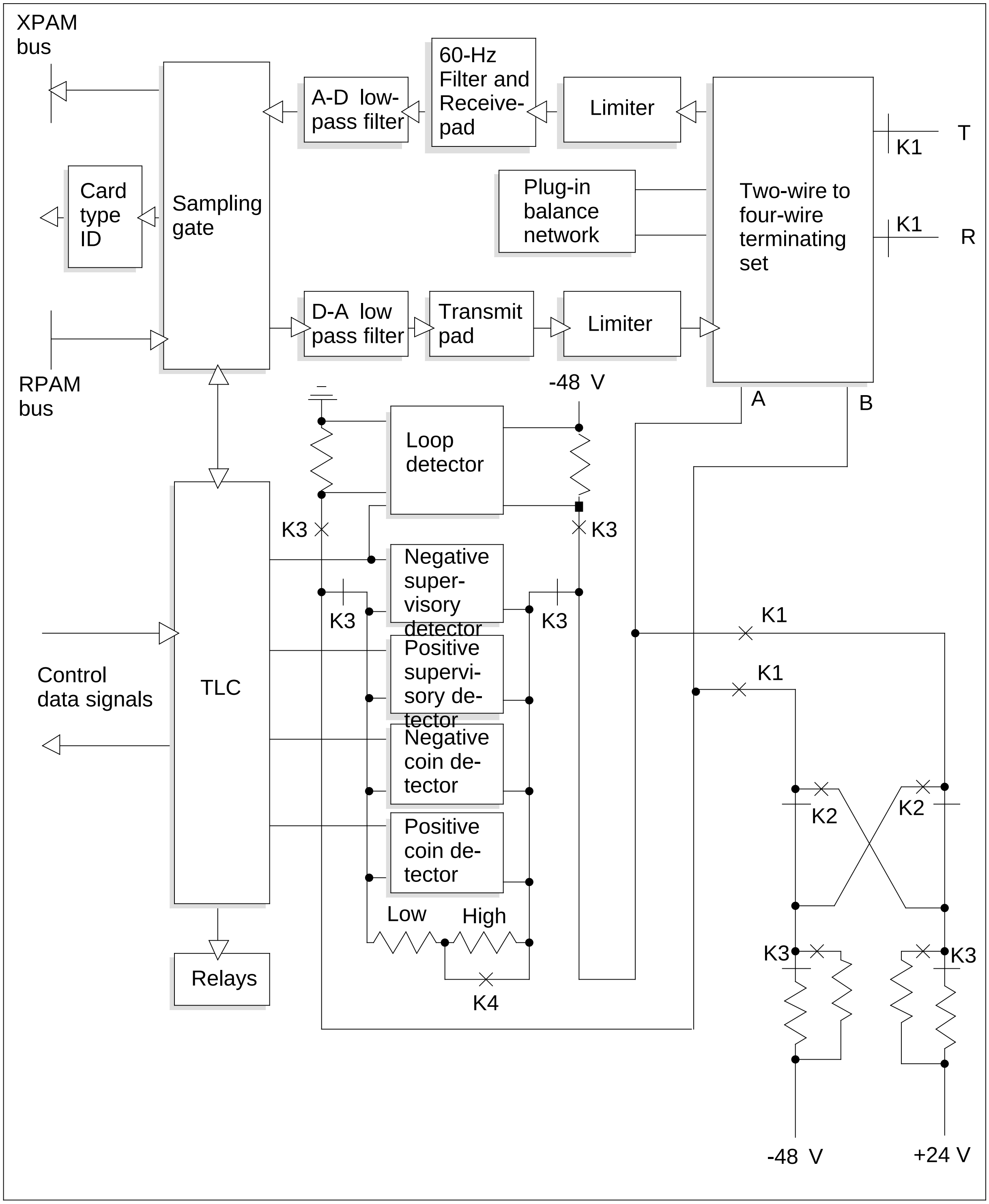
- trunk logic circuit (TLC)
- sampling gate
- analog-digital (A-D) low-pass filter
- digital-analog (D-A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- two-wire to four-wire terminating set
- balance network
- loop detector
- negative supervision detector
- positive supervision detector
- positive coin detector
- negative coin detector

NT2X85AA (continued)

- relays (four)
- card type identifier

NT2X85AA (continued)

NT2X85AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC is a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The gate sends the signals over the transmit-PAM (XPAM) bus for additional processing. In the transmit direction, the gate converts PAM information received from the receive-PAM (RPAM) bus back to VF signals. The gate sends the signals over the T and R leads.

A-D low pass filter

The A-D filter accepts VF signals from the receive pads, and filters the signal to limit the bandwidth. The filter passes the signal to the sampling gate. The filter amplifies the signal.

D-A low pass filter

The D-A filter accepts VF signals from the sampling gate and filters the signal to limit the bandwidth. The filter passes the signal to the transmit pads. The filter amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment in 0.25 dB increments to the level of the VF signal. The pad provides the adjustment before the adjustment converts to digital form and the card processes the adjustment. The adjustments occur when combinations of miniature switches are set at the correct level.

The following table displays the receive level adjustments.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

NT2X85AA (continued)

Transmit level adjustment pad

The transmit level pad provides a maximum 15.75 dB of adjustment in 0.25-dB increments to the level of the VF signal sent over the trunk. The adjustments occur when combinations of miniature switches are set at the correct level.

The following table displays the transmit level adjustments.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are provided to prevent a received or transmitted signal from overloading the circuit. One limiter each is provided in the receive direction and the transmit direction.

Two-wire to four-wire terminating set

The terminating set converts the internal four-wire circuit to a two-wire circuit for connection to a two-wire analog transmission facility.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600-Ω nonloaded facility. The compromise network provides 600 Ω of resistance and 2.15 μF of capacitance.

The balance network plug-in options include NT2X80AA, NT2X77AA, and NT2X77AC. The NT2X80AA option is for H88 loaded cable. The NT2X77AA is for compromise network, network build-out capacitance, and network build-out resistance. The NT2X77AA is for compromise network and network build-out capacitance. The loaded and nonloaded cables can be 19, 22, 24, or 26 gauge. The nonloaded cable can be a maximum of 2700 m (9000 ft) in length.

Relays

Four relays are provided for testing and near-end signaling. The following table displays the designator and purpose for each relay.

Relay operation

Relay	Operated	Released
K1	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. These actions allow the circuit to be tested internally	Normal operation
K2, K3	Indicates to the far end that the trunk circuit is seized. Reverse battery applied to T and R leads, operates trunk lamp on distant switchboard. The K3 connects loop detector to circuit. When relay K1 operated, simulates seizing of the trunk circuit	Signals far end that the near-end trunk is not seized
K4	Applies low resistance to T and R leads. indicates to far end that near-end subscriber is offhook When relay K1 operates, simulates subscriber offhook condition	Applies high resistance to T and R leads, which indicates to far end that near-end subscriber is onhook When relay K1 operates, simulates subscriber onhook condition

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The identifier checks that the card is plugged into the TM card slot.

Loop detector

When the near-end subscriber seizes the trunk circuit, the loop detector connects to the signaling path by relay K3. The detector connects to the signaling path to detect an answer by the far-end operator. When the loop detector senses the completion of the loop (operator answer), relay K3 releases. The loop detector is removed from the circuit. When the loop detector is removed, the negative and positive supervision detectors and the negative and positive coin detectors connect.

NT2X85AA (continued)

Negative supervision detector

The negative supervision detector monitors the signaling path after the loop detector is switched out of the circuit. The detector senses the presence of the far-end operator answer signal and passes the information to the TM through the TLC.

Positive supervision detector

The positive supervision detector monitors the signaling path for the presence of a far-end operator recall (re-ring) signal. The detector passes the information to the TM through the TLC.

Positive coin detector

The negative coin detector monitors the signaling path for the presence of a coin collect (CC) signal. The detector passes the information to the TM through the TLC.

Negative coin detector

The negative coin detector monitors the signaling path for the presence of a coin return (CR) signal. The detector passes the information to the TM through the TLC.

Technical data

The card provides an impedance of 900 Ω.

The minimum receive level for the circuit is -9 dBm for digital test sequence (DTS) output, with a range of -9 to +6 dBm. The maximum transmit level is +6 dBm for DTS output, with a range of +6 dBm to -9 dBm.

The signaling characteristics of the card appear in the following table.

Signaling characteristics (Sheet 1 of 2)

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V

Signaling characteristics (Sheet 2 of 2)

Characteristic	Value
Supervision range	4500 Ω
Coin control range	3500 Ω

Physical dimensions

The dimensions for the NT2X85AA circuit card are:

- height: 353 mm (13.9 in.)
- depth: 254 mm (10 in.)
- width: 29 mm (1.125 in.)

Power requirements

DANGER
Damage to equipment or loss of service
For use on telephone wiring that a Nortel Networks protector, catalog number 303M-12AIKE, protects, with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire for use in series with the protector is 26 AWG.

Power use is normally 500 mW. The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

NT2X86AA

Product description

The NT2X86AA provides an incoming, outgoing, or two-way voice and signaling interface. The interface is between a trunk module (TM) and a type-3 switchboard in a distant building. The card can process incoming calls from the distant switchboard operator. The card can process these calls with or without start dial indications, subscriber recall and release functions, and coin control operations.

Location

The card occupies one card position in a four-wire or an eight-wire trunk module (TM).

Functional description

The NT2X86AA exchanges control messages with the TM, transmits near-end signaling to the far end, and receives far-end signaling. The card also processes voice frequency (VF) information. The NT2X86AA receives VF information, and converts the information to pulse amplitude modulation (PAM) signals. This card sends the information to the TM for additional processing. The card receives the PAM signals from the TM. These signals convert to VF signals and the card sends the signals over the T and R leads.

Functional blocks

The NT2X86AA contains the following functional blocks:

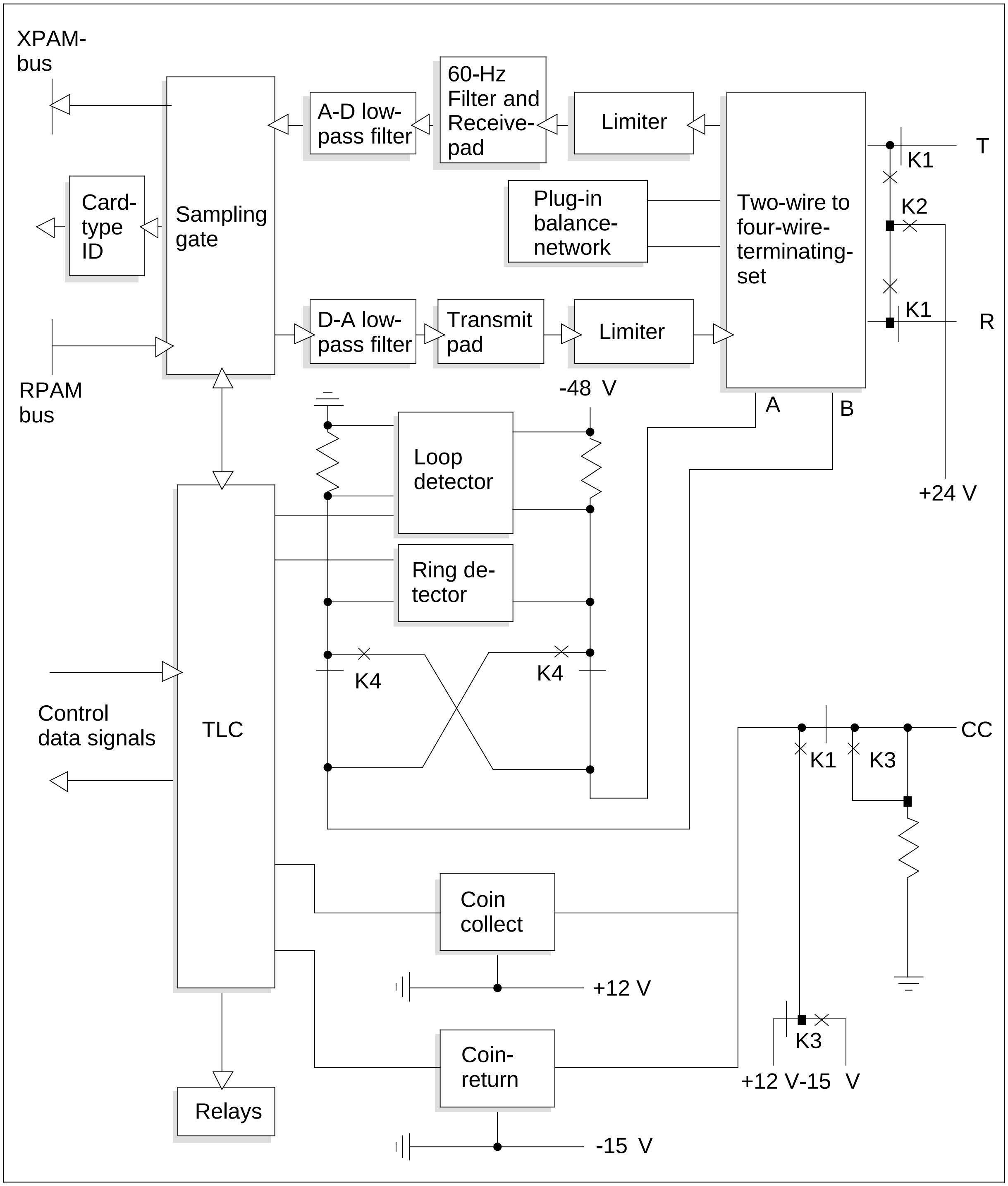
- trunk logic circuit (TLC)
- sampling gate
- analog-digital (A-D) low-pass filter
- digital-analog (D-A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- two-wire to four-wire terminating set
- balance network
- loop detector
- ring detector
- coin collect detector
- coin return detector

NT2X86AA (continued)

- relays (four)
- card type identifier

NT2X86AA (continued)

NT2X86AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the transmit-PAM (XPAM) bus for additional processing. In the transmit direction, the gate converts PAM information from the receive-PAM (RPAM) bus back to VF signals. The gate sends the signals over the T and R leads.

A-D low-pass filter

The A-D filter accepts VF signals from the receive pads, and filters the signal to limit the bandwidth. The A-D filter passes the signal to the sampling gate. The filter also amplifies the signal.

D-A low-pass filter

The D-A filter accepts VF signals from the sampling gate, and filters the signal to limit the bandwidth. The D-A filter passes the signal to the transmit pads. The filter also amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment in 0.25-dB increments to the level of the VF signal. The receive level pad provides this adjustment before the signal converts to digital form and the card processes the signal. The adjustments occur when groups of small switches are set at the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments (Sheet 1 of 2)

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50

NT2X86AA (continued)

Receive level adjustments (Sheet 2 of 2)

Switch position	Adjustment (dB)
S2, position 1	0.25

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment (in 0.25-dB increments) to the level of the VF signal sent over the trunk. The adjustments occur when groups of small switches are set at the correct level.

The transmit level adjustments appear in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are available. These limiters do not allow a received or transmitted signal to overload the circuit. One limiter is provided in the receive direction. Another limiter is provided in the transmit direction.

Two-wire to four-wire terminating set

The terminating set converts the internal four-wire circuit to a two-wire circuit for connection to a two-wire analog transmission facility.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600 Ω nonloaded facility. The compromise network provides 600 Ω of resistance and 2.15 µF of capacitance.

The balance network plug-in options include NT2X80AA, NT2X77AA, and NT2X77AC. The NT2X80AA is for H88 loaded cable. The NT2X77AA is for change network, network build-out capacitance, and network build-out resistance. The NT2X80AA is for compromise network and network build-out capacitance. The loaded and nonloaded cables can be 19, 22, 24, or 26 gauge. The nonloaded cable can be a maximum of 2700m (9000 ft.) in length.

Loop detector

The loop detector senses far-end loop seizure (distant operator that plugs into the switchboard) and dial pulsing over the T and R leads. The card passes the information from the detector to the TM through the TLC. The TM sends a signal to operate relay K4, which sends a reverse battery signal to the switchboard. The reverse battery lights the supervisory lamp of the operator as a start dial signal.

When the subscriber answers, the TM releases K4. This action sends an offhook signal to the switchboard and extinguishes the supervisory lamp. When the line of the subscriber returns to an onhook state, the TM operates K4 again. This action lights the supervisory lamp as a disconnect signal. When the operator unplugs, the loop detector senses the absence of a loop. The TM releases K4.

Ring detector

The ring detector senses far-end operator simplex (SX) ringing over the T and R leads. Place +130 V on the T and R leads to signal far-end SX ringing. The card passes information from the detector to the TM through the TLC.

Coin collect detector

The coin collect detector senses far-end coin collect (CC) signals over the CC lead. The card passes information from the detector to the TM through the TLC.

Coin return detector

The coin return detector senses far-end coin return (CR) signals over the CC lead. The card passes information from the detector to the TM through the TLC.

NT2X86AA (continued)

Relays

Four relays are available for testing and near-end signaling. The designator and purpose for each relay appear in the following table.

Relay operation

Relay	Operated	Released
K1	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. This action allows the system to test the circuit internally	Normal operation
K2	Applies +24 V to the T and R leads. Used during testing with relay K1 operated.	Normal operation
K3	Connects low resistance path to CC lead for near-end coin signaling	Connects high resistance path to CC for near-end coin signaling
K4	Connects reverse battery to T and R leads for near-end signaling. Lights distant switchboard supervisory lamp, to indicate dial start (first operation) or disconnect (second operation).	Removes reverse battery from T and R leads. Distant switchboard recognizes removal of reverse battery as offhook signal and extinguishes supervisory lamp.

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card is connected into the TM card slot.

Technical data

The card provides an impedance of 900 Ω.

The minimum receive level for the circuit is -9 dBm for digital test sequence (DTS) output, with a range of -9 to +6 dBm. The maximum transmit level is +6 dBm for DTS output, with a range of +6 to -9 dBm.

NT2X86AA (continued)

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.50 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 kΩ
Ground potential	±10 V
Supervision range	4500 Ω
Coin control range	3500 Ω

Physical dimensions

The dimensions for the NT2X86AA circuit card are:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X86AA (end)

Power requirements

> **DANGER**
> **Damage to equipment or loss of service**
> For use on telephone wiring that a Nortel Networks protector protects, catalog number 303M-12AIKE, along with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire for use in series with the protector is 26 AWG.

Power use is normally 500 mW. The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

NT2X88AA

Product description

The NT2X88AA provides an incoming, outgoing, or two-way voice and signaling interface. The interface is between a trunk module (TM) and a four-wire interoffice, tandem, toll-connecting, or secondary intertoll trunk.

Each card contains two trunk circuits.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT2X88AA exchanges control messages with the TM, transmits near-end signaling to the far-end, and receives far-end signaling. The card processes voice frequency (VF) information. The card receives VF information, and converts the information to pulse amplitude modulation (PAM) signals. The card sends the information to the TM for additional processing. The card receives the PAM signals from the TM. These signals convert to VF signals. The card sends these signals over the T and R leads.

Functional blocks

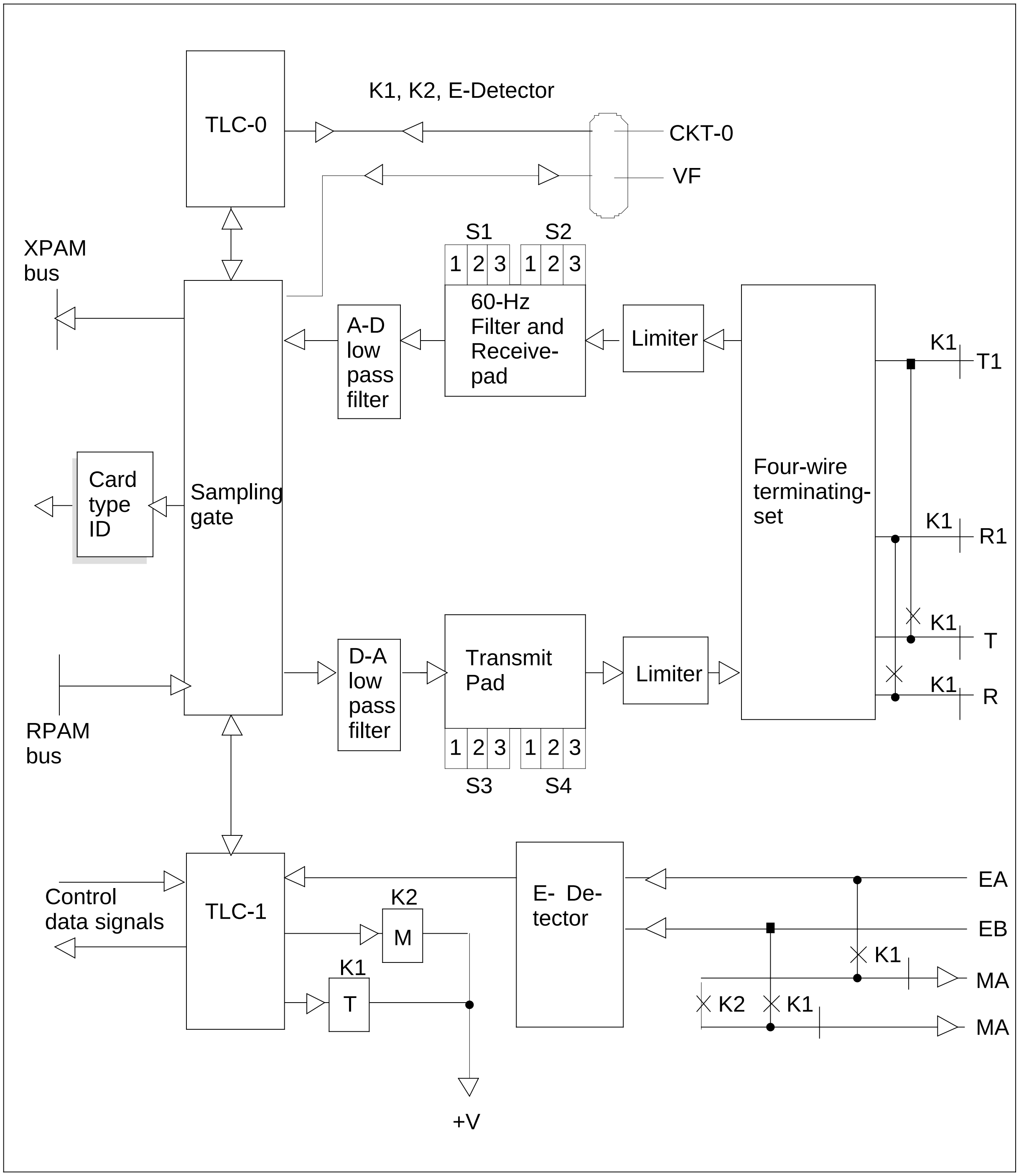
Each circuit in the NT2X88AA contains the following functional blocks:

- trunk logic circuit (TLC)
- sampling gate
- analog-digital (A-D) low-pass filter
- digital-analog (D-A) low-pass filter
- 60-Hz high-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- E detector
- relays (two)
- card type identifier

The following figure describes the relationship between functional blocks in trunk circuit 1. Trunk circuit 0 operation is the same.

NT2X88AA (continued)

NT2X88AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card, and generates sampling pulses for the sampling gate.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the signals over the transmit-PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information from the receive-PAM (RPAM) bus back to VF signals. The gate sends the signals over the T and R leads.

A-D low-pass filter

The A-D filter accepts VF signals from the receive pads, and filters the signal to limit the bandwidth. The A-D filter passes the signal to the sampling gate. The filter also amplifies the signal.

D-A low-pass filter

The D-A filter accepts VF signals from the sampling gate, and filters the signal to limit the bandwidth. The D-A filter passes the signal to the transmit pads. The filter also amplifies the signal.

60-Hz high-pass filter

The 60-Hz filter removes every part of the signal below 60 Hz. This action does not allow line noise to enter the receive path.

Receive level adjustment pad

The receive level adjustment pad provides adjustments in 0.25 dB steps. The adjustments consist of fixed pads which connect in groups by small switches. The pads connect in this method to obtain the required amount of gain or loss.

NT2X88AA (continued)

The switch settings for desired levels of adjustment appear in the following table.

Direction	CKT	Switch	Degment	dB (Nominal)
Receive	0/1	S1.0/1	3	8
			2	4
			1	2
		S2.0/1	3	1
			2	0.5
			1	0.25

Transmit level adjustment pad

The transmit level adjustment pad provides adjustments in 0.25 dB steps. The adjustments consist of fixed pads which connect in groups by small switches. The pads connect in this method to obtain the required amount of gain or loss. The switch settings for desired levels of adjustment appear in the following table.

Direction	CKT	Switch	Segment	db (Nominal)
Transmit	0/1	S3.0/1	3	8
			2	4
			1	2
		S4.0/1	3	1
			2	0.5
			1	0.25

E detector

The E detector senses the conditions present on the E lead. The E detector transmits the information through the TLC to the TM. The E-lead conditions represent far-end signaling.

Four-wire terminating set

The four-wire terminating circuit provides an interface. The interface is between the 600 ohms transmission and signaling facility and the internal 400 ohms trunk circuit components.

Relays

Two relays are provided for testing and M-lead (near-end) signaling. The following table describes the designator and purpose for each relay.

Relay operation

Relay	Operated	Released
K1	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. This action allows the system to test the circuit internally	Normal operation
K2	-48 V placed on M lead	M lead grounded

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card is connected in to the TM card slot.

Signaling

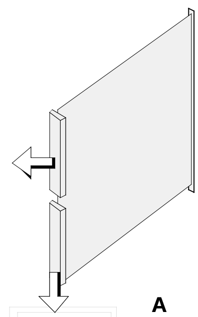
Pin numbers

The pin numbers for the NT2X88AA appear in the following figure.

NT2X88AA (continued)

NT2X88AA pin numbers

	A	B
1A 1B	GND	
2A 2B	T.0	
3A 3B	R.0	
4A 4B	T.1	
5A 5B	R.1	
6A 6B	EA	
7A 7B	EB	
8A 8B	MA	
9A 9B	MB	
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B	MB	
28A 28B	MA	
29A 29B	EB	
30A 30B	EA	
31A 31B	R.1	
32A 32B	T.1	
33A 33B	R.0	
34A 34B	T.0	
35A 35B	+24 V	+24 V
36A 36B	+24 V	+24 V
37A 37B	FLT-GND	FLT-GND
38A 38B	FLT-GND	FLT-GND
39A 39B	-48 V FLT	-48 V FLT
40A 40B	-48 V FLT	-48 V FLT



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B	RPAM-P	
45A 45B	RPAM-N	
46A 46B	GND	GND
47A 47B		
48A 48B	XPAM-N	
49A 49B	XPAM-P	
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B	TE.0	TE.1
67A 67B	TYP	TYN
68A 68B	RDAT	
69A 69B	BUS/CLK	
70A 70B		ANUL
71A 71B	XDAT	
72A 72B		
73A 73B		
74A 74B	-15 V	-15 V
75A 75B		
76A 76B	+12 V	+12 V
77A 77B		
78A 78B		
79A 79B		
80A 80B	GND	GND

Technical data

Each circuit on the card provides an impedance of 600 Ω. The receive level and transmit level for the circuits is -3 dBm for digital test sequence (DTS) output.

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.80 V
Normal talk battery range (float charge)	-49.00 V to -53.50 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.80 V
Minimum insulation resistance	30 k Ω
Ground potential	±10V
Maximum external E-lead resistance	500 Ω
Minimum external M-lead resistance	Limited by the connecting circuit.
Minimum M-lead DP transmission resistance	Limited by supervision range.
M-lead MF pulsing range	Limited by voice band transmission characteristics

Physical dimensions

The dimensions for the NT2X88AA circuit card are:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT2X88AA (end)

Power requirements

> **DANGER**
> **Damage to equipment or loss of service**
> For use only on telephone wiring that a Nortel Networks protector protects, catalog number 303M-12AIKE, along with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire for use in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 500 mW.

NT2X90

Product description

The incoming/outgoing (IC/OG) test trunk circuit card provides an interface. The interface is between a trunk module (TM) or remote maintenance module (RMM) of the DMS-100 Family of digital switching systems and many types of test facilities. These facilities include 14 local test desks (LTD), 3 local test cabinets (LTC), Centralized Automated Loop Reporting System (CALRS) test desk, and mechanized loop tester (MLT).

This card enables maintenance personnel to access subscriber lines at host or remote sites through the metallic test access (MTA) network. The test trunk card is also used to process incoming operator verification calls.

The NT2X90 is available in three versions. Alphabetic suffixes to the product engineering code (PEC) of the card distinguish these versions. The three versions are NT2X90AB, NT2X90AC, and NT2X90AD. The NT2X90AD version includes the NT2X90AC capabilities. These capabilities can be used to test remote carrier lines that are part of the DMS-100.

The primary features of the NT2X90 card are:

- 900-ohm impedance
- built-in, 2-wire-to-4-wire terminating set
- loop supervision
- sleeve lead supervision
- high-impedance monitor amplifier
- reverse battery seizure signaling
- receives dial pulse (DP) or multifrequency (MF)
- outpulses DP
- card-type identification to trunk module (TM)
- line identification (tip or ring party)
- dual-tone multifrequency (DTMF) testing
- manual setting for transmit and receive pad range from 0.0 dB to 15.75 dB selected in 0.25 dB steps
- manual selection of loop detector sensitivity
- talk with or without battery
- balance network plug-in option
- on-hook dc signature (NT2X90AD version only)

NT2X90 (continued)

- bypass initiate signal detector (NT2X90AD version only)
- ring ground signal detector (NT2X90AD version only)

Location

Each test trunk card accommodates one trunk circuit and can connect to an 8-wire TM or RMM.

Functional description

The following section describes the NT2X90 in terms of VF signal paths as well as signaling and supervisory circuits.

VF signal paths

The circuit incorporates a 2-wire to 4-wire terminating set. This set provides an interface between the 2-wire facility and the 4-wire trunk circuits.

The NT2X90 card passes incoming VF signal on the tip/ring (T/R) leads through the 2-wire to 4-wire terminating set. Terminating set balancing is available as a plug-in option. The card routes the signal through the limiter to the receive level adjustment pad. The card also routes the signal to the analog/digital (A/D) low pass filter. This filter limits the bandwidth and amplifies the signal. The sampling gate samples the signal at an 8-kHz rate. The pulse amplitude modulated (PAM) bus samples that result are applied to a common transmit PAM (XPAM) bus. The samples are applied to the XPAM bus for the encoder in the TM or RMM to process.

In the transmit direction of the 4-wire circuit, PAM samples from the decoder in the TM or RMM are applied to a common receive PAM (RPAM) bus. The PAM samples are applied to an RPAM bus. The digital-to-analog (D/A) low-pass filter samples and reconstructs the original VF signal. This filter also provides signal amplification. The card passes the VF signal to the T/R leads through the transmit level adjustment pad, limiter, and 4- to 2-wire terminating set.

Level adjustments are available in the two directions in 0.25 dB steps. The adjustments consist of fixed pads. These pads connect in groups of small multisection switches (S1, S2, S3, and S4) to obtain the required amount of loss. Refer to the table on page 7 for level adjustment switch settings.

Signaling and supervisory circuits

The trunk logic circuit establishes communications between the TM or RMM and VF, signaling, and supervisory circuits. The TLC serves as a communication buffer between the TM or RMM and the trunk circuit. The TLC also generates the sampling pulses for the sampling gate. Control of the TLC provides card-type identification voltage to the TM or RMM.

The loop detector detects far-end signaling and sends a signal to the TLC. Small switch (S5) selects the loop detector sensitivity for short-loop (S5 on S/LP) or long loop (S5 on L/LP) operation. System software responds through the TM or RMM and TLC, operates sleeve (S) relay (K8). The K8 connects four current detectors to the sleeve lead.

The sleeve lead detectors provide four different states to the TLC. These states include negative high current (NHC), negative low current (NLC), positive high current (PHC), and positive low current (PLC).

The current detector circuits on the sleeve lead are used in different groups to sense signaling information through the S lead. This information includes dial and key pulse completion and line identification. The current detector outputs appear at the TLC. The TLC forwards the results to the TM or RMM.

Activate relays (K1-K12) in the correct group and sequence to establish near-end signaling. This action allows the tester to perform routine or maintenance test procedures, or routine and maintenance test procedures.

A high impedance amplifier circuit connects across TT and TR leads when monitor relay (K4) operates for monitor applications, like DTMF testing.

A test circuit designed to check the signaling, supervisory and VF circuits is provided. The test relays (K9 and K10) operates through TLC to isolate the trunk circuit from the external transmission facility. The test relays also provide looparound connections between the receive and transmit paths. These connections allow the system to test the card internally. Activate relays (K1-K12) in the correct group and sequence to allow the system to test the card internally.

Test trunk card relays, SD points, and SC points

This section describes the function of the 12 relays, and the signal distribution (SD) points that activate these relays. This section also describes the the five scan (SC) points used in the NT2X90AD test trunk card.

NT2X90 (continued)

NT2X90AD test trunk card relays

A description of each of the 12 relays (K1-K12) appears in the following table.

Test trunk card relay descriptions (Sheet 1 of 2)

Relay	Description
K1	If switches SW8 and SW9 of the test trunk are set to ON, this relay enables the on-hook dc signature (5.2 k delta that connects between the tip/ring of the test trunk). This signature indicates that the subscriber line to be tested is on an integrated carrier system. If switches SW8 and SW9 are set to OFF, relay K1 provides the intercept identification sequence used for CALRS. If switch SW8 is set to ON and switch SW9 to OFF, 402 ohms are applied between T/R of the test trunk. The ohms are applied as required for line test position (LTP) testing.
K2	This relay opens the tip of the test trunk. With relays K3 and K12 in operation, pulsing relay K2 provides ground at intervals on the tip. This pulsing that is not continuous is used when the MTA is not available.
K3	This relay opens the ring of the test trunk. With relay K2 operated, pulsing relay K3 provides ground that is not continuous on the ring. This relay is used during busy and monitor sequences.
K4	This relay connects an amplifier circuit across the TT and TR leads. This circuit is used for monitor applications, like DTMF testing.
K5	This relay provides ground to external wire D. The position of a ground on wire indicates an external receiver to prepare to receive digits. An external receiver replaces the monitor amplifier for DTMF testing.
K6	This relay connects the T/R of the test trunk to the TT and TR leads in that order. This condition provides part of the metallic test path from test equipment to a subscriber loop. The test equipment includes a test desk or MLT.
K7	This relay connects the TT and TR leads to the metallic test pair. This condition provides part of the metallic test path from test equipment to a subscriber loop. The test equipment includes a test desk or MLT.
K8	This relay provides a sleeve-to-ground connection that indicates that the test trunk was seized.

Test trunk card relay descriptions (Sheet 2 of 2)

Relay	Description
K9, K10	Relays K9 and K10 isolate the test trunk card from external connections. These relays provide loop-around connections between the receive and transmit paths in the card. This condition allows the system to test internal signaling, supervisory, and VF circuits in the card.
K11	This relay provides a 35.7 k intercept delta between the T/R of the test trunk. This delta indicates that the line is not available for testing.
K12	This relay provides a reverse battery signal on the T/R loop that indicates the DMS switch is ready to receive digits. Relay K12, in operation with relay K3, puts ground on the tip and does not put the battery on the ring. Ground on the tip indicates to the test facility that the metallic path for testing is set up. The tip and ring of the subscriber connects to the metallic test pair. Before ground is placed on tip, the test facility removes a 116 V potential from the tip. The test facility uses the 116 V potential (the bypass initiate signal) to request a metallic test path to the subscriber loop. Battery detector 2 senses this voltage. Relays 2 and 3 are activated to remove this signal. Battery detector 2 detects this removal, which allows the test sequence to proceed.

NT2X90AD SD points

The association between SD points in the test trunk and the relays the points operate appears in the following table.

Test trunk SD point-relay associations (Sheet 1 of 2)

SD point	Relay activated
A0 (TLC 1)	K9 and K10
A1 (TLC 1)	K8
A2 (TLC 1)	K7
A3 (TLC 1)	K4
A4 (TLC 1)	K11
A5 (TLC 1)	K6
A6 (TLC 1)	K5

NT2X90 (continued)

Test trunk SD point-relay associations (Sheet 2 of 2)

SD point	Relay activated
A7 (TLC 1)	K1
A0 (TLC 2)	K12
A1 (TLC 2)	K3
A3 (TLC 2)	K2

NT2X90AD SC points

A description of the five SC points for the NT2X90AD appears in the following table.

Test trunk card scan points

Scan points	Description
A2	This scan point detects the ring ground detector. This detector is used during the bypass initiate signal setup. This detector is used to determine if the subscriber line to be tested is a coin line (ring-grounded) or a line like a ring-open line.
A4	This scan point detects NLC on the sleeve lead. The NLC is present when the metallic test path is set up from the test facility to the subscriber loop after the subscriber dials the digits.
A5	This scan point detects PHC or PLC on the sleeve lead. The NHC signals the test trunk to disconnect the test setup. The PHC signals the test trunk to enter the DTMF testing sequence.
A6	This scan point detects PLC on the sleeve lead. This scan point is not used with the NT2X90AD test trunk card.
A7	This scan point detects current on the T/R of the test trunk. Scan point 7 connects to the loop detector. Current flows in the T/R loop when the test facility seizes the test trunk. Scan point 7 also connects to battery detectors 1 and 2. These detectors detect the on-hook dc signature of the 116 V potential on the tip. When the on-hook dc signature is removed, battery detector 1 is disconnected.

NT2X90 (continued)

Switches

A description of switches S1-S10 appears in the following table.

Switches SW1-SW10 (Sheet 1 of 2)

Switch	Description
SW1-SW4	These switches connect attenuation pads in groups to obtain desired amounts of loss for certain signals. These signals go through the test trunk toward test facilities in one direction and toward the MTA network. The subscriber line is in the other direction. The switches are set according to the distance between the test facility and the test trunk card.
SW5	Switch SW5 selects loop detector sensitivity. The loop detector detects far-end signaling and signals the TLC in the test trunk. Short loop (S/LP) or long loop (L/LP) options are available. The option that you choose depends on the distance between the test facility and the test trunk card. This switch normally is set to S/LP, carrier systems that use the NT2X90AD test trunk use the L/LP option.
SW6	Switch SW6 selects an internal (INT) and external (EXT) ground for the sleeve lead. This switch allows the 2X90 to be referenced to the internal DMS system ground or to an external test equipment ground point. The INT (internal) ground. In this configuration, the NT2X90AD provides the ground reference. This is the recommendation option of Nortel Networks. Use this option for carrier systems that use the 2X90 Test Trunk. The EXT (external) ground. In this configuration, the NT2X90AD requires that an external ground reference connects to the Test Trunk. This connection requires a ground conductor to be wired between the test equipment (MLT2) ground reference and the NT2X90AD Test Trunk module.
SW7	Switch SW7 selects if the T/R that connects to the 2W/4W terminating set attaches normally or is reversed. Switch SW7 selects so that the tip attaches to where the ring normally attaches and the opposite. The setting depends on the application. For a carrier system that uses the NT2X90AD test trunk, the setting must be NORMAL.
Note: The TR-TSI-000536 specifies that the Maximum Sleeve/Ground Loop resistance is 1500 ohms.	

NT2X90 (continued)

Switches SW1-SW10 (Sheet 2 of 2)

Switch	Description
SW8-SW9	Switches SW8 and SW9 select the impedance between T/R according to card application. If switch SW8 is set to Y (ON), operation of relay K1 causes 30 kohms between T/R required for CALRS line identification. The switch SW9 setting is not used for CALRS and can be set to LTP or I/C. If switch SW8 is set to N (OFF) and switch SW9 is set to LTP, 402 ohms are applied between the T/R as required for LTP testing. If switch SW8 is set to N (OFF) and switch SW9 is set to I/C, a delta of 56.2 ohms is applied. A delta of 56.2 ohms is applied between the T/R to test lines of an integrated carrier system.
SW10	Switch SW10 selects the Sleeve/Ground Loop Detection sensitivity. The switch allows the 2X90 to compensate for the distances between the test equipment and the Test Trunk. The S/LP (short loop). In this configuration, the NT2X90AD provides a series 1000-ohm resistor on the Test Trunk Sleeve Lead. This resistor limits the power that the system dissipates on the Trunk Module, test equipment, or the Trunk Module and the test equipment. When you select the short loop option, the maximum Sleeve/Ground Loop resistance is 500 ohms or 250 ohms each lead. The S/LP requires that the EXT (external) ground conductor resistance between the test equipment and the Test Trunk Sleeve Lead is not greater than 250 ohms. The L/LP (long loop). In this configuration, the NT2X90AD operates in the maximum Sleeve/Ground Loop resistance of 1500 ohms or 750 ohms for each lead.
Note: The TR-TSI-000536 specifies that the Maximum Sleeve/Ground Loop resistance is 1500 ohms.	

The options for switch selection appear in the following table.

Switches S1-S4 level adjustments

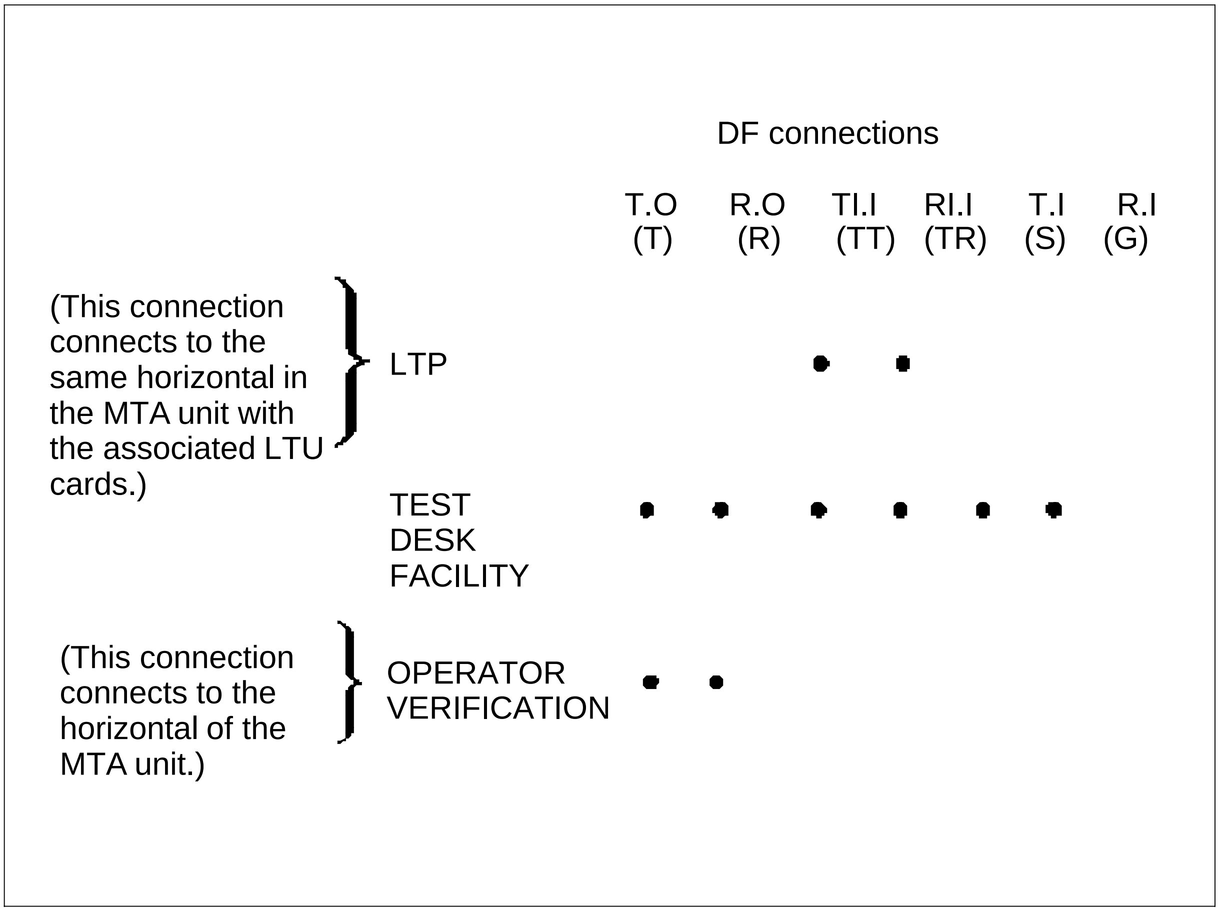
Direction	Switch	Segment	dB (normal)
Receive	S1	3	8
		2	4
		1	2
A/D	S2	3	1
		2	0.5
		1	0.25
Transmit	S3	3	8
		2	4
		1	2
D/A	S4	3	1
		2	0.5
		1	0.25

Application connections

The application connections appear in the following figure.

NT2X90 (continued)

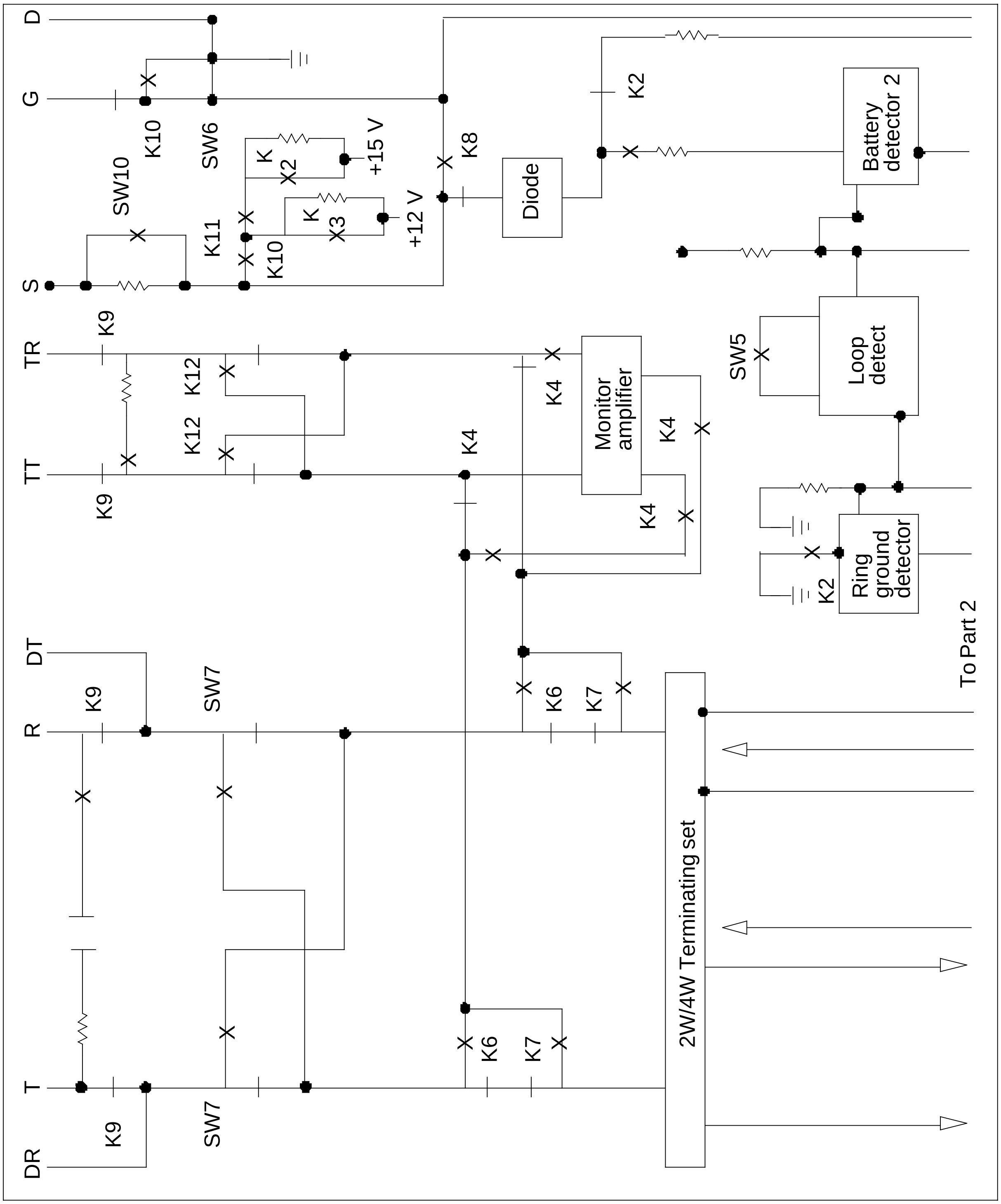
NT2X90 Application connections



The functional blocks of the NT2X90 trunk test card appear in the following figure.

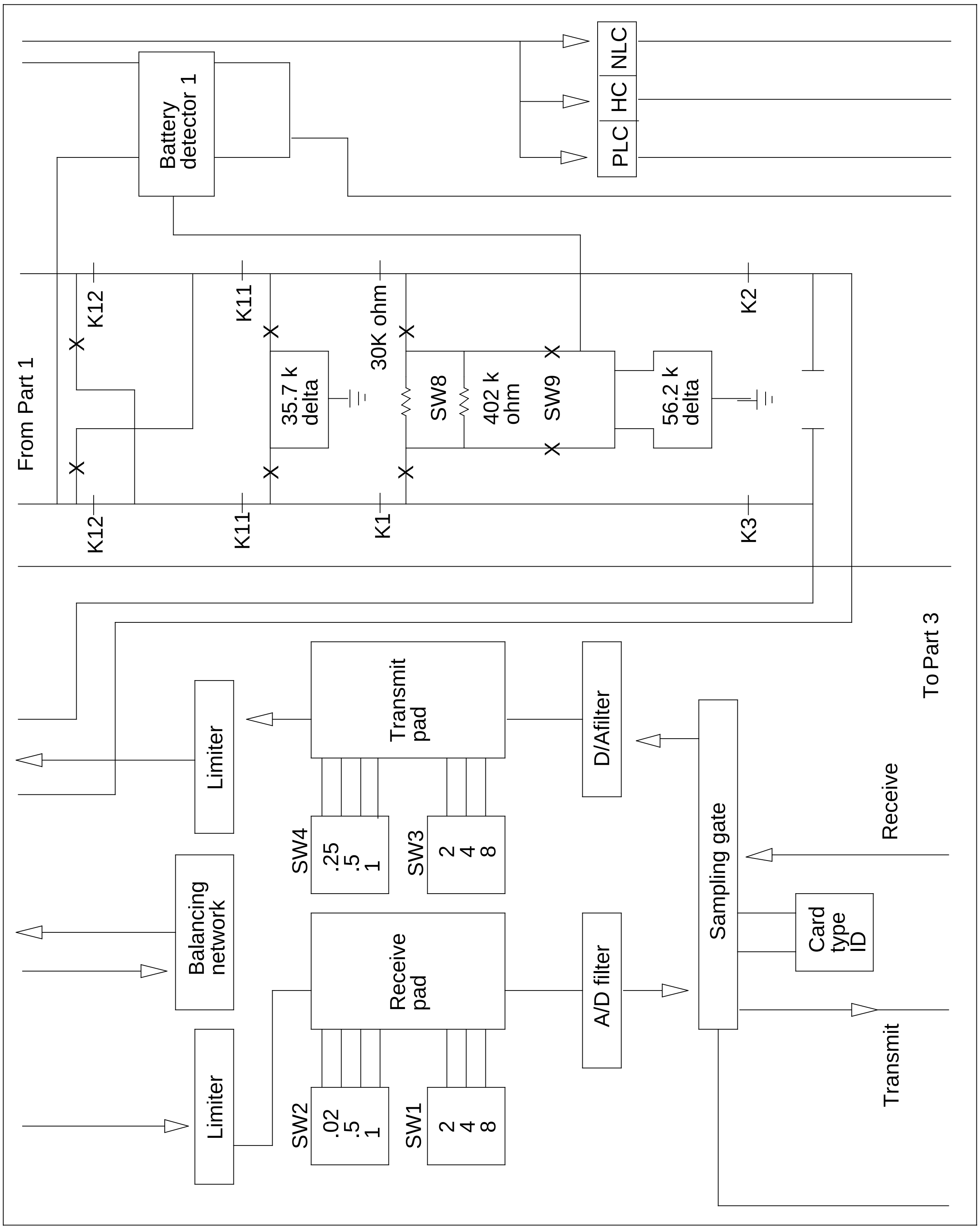
NT2X90 (continued)

NT2X90 Test trunk card (Part 1 of 3)



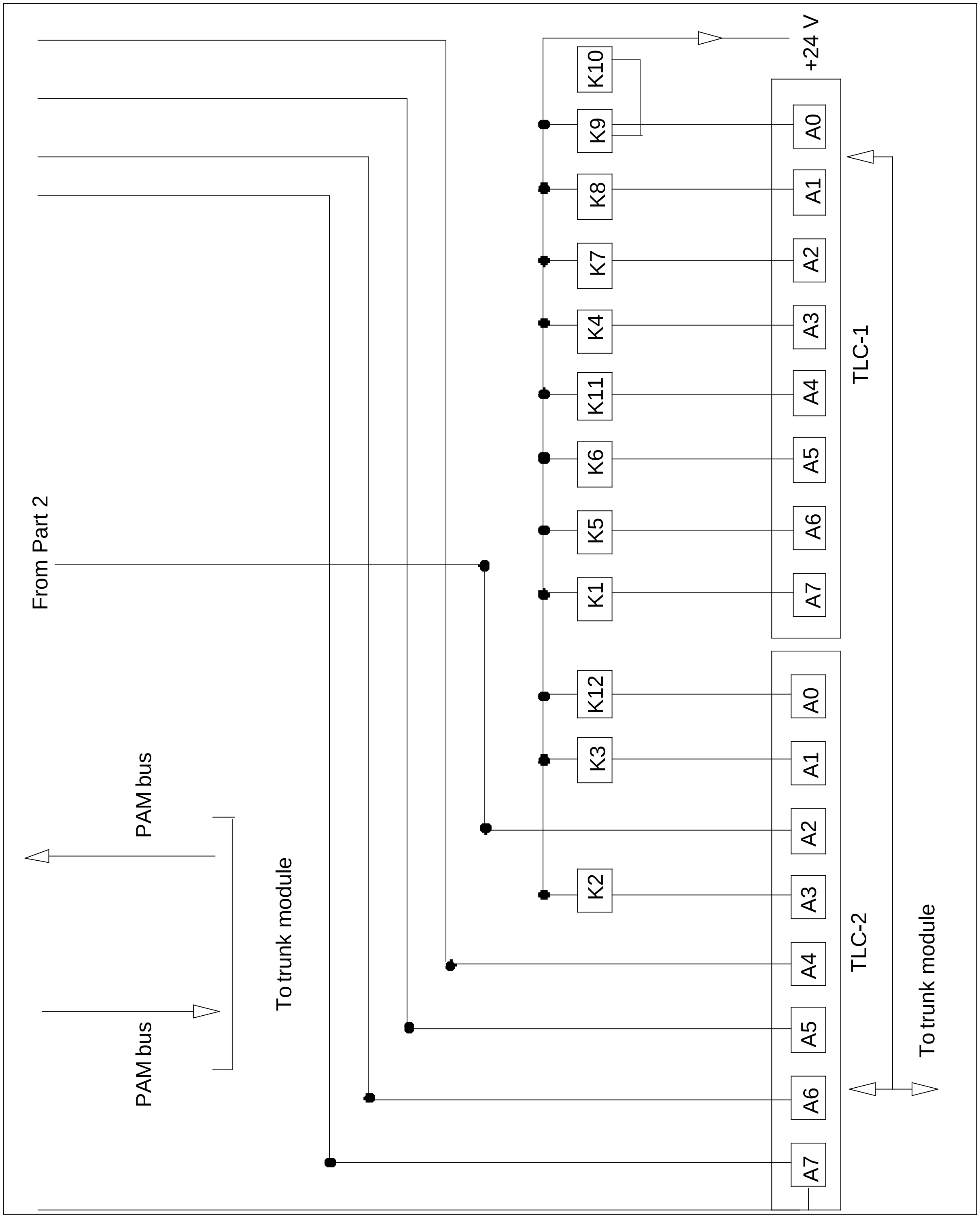
NT2X90 (continued)

NT2X90 Test trunk card (Part 2 of 3)



NT2X90 (continued)

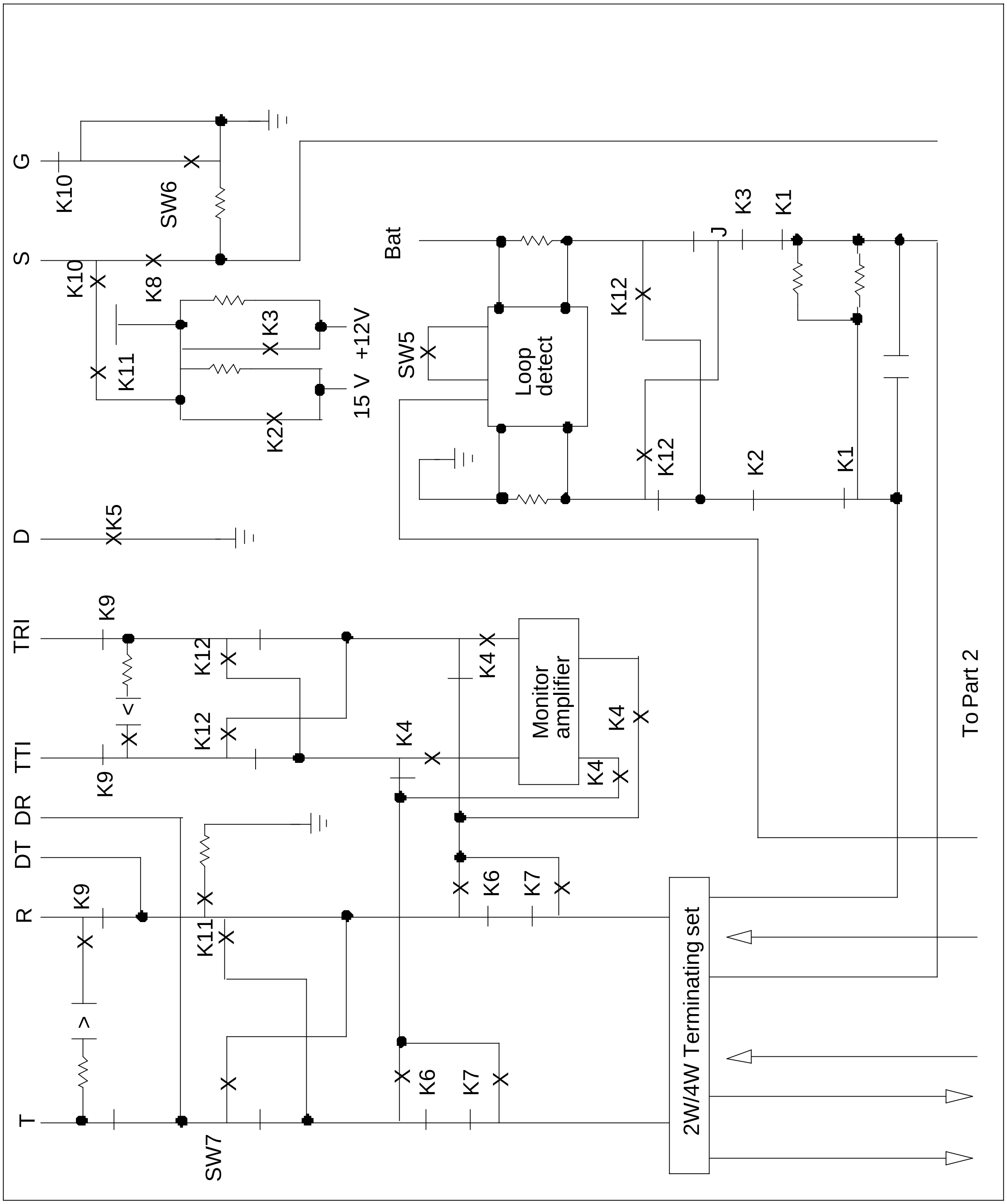
NT2X90 Test trunk card (Part 3 of 3)



NT2X90 (continued)

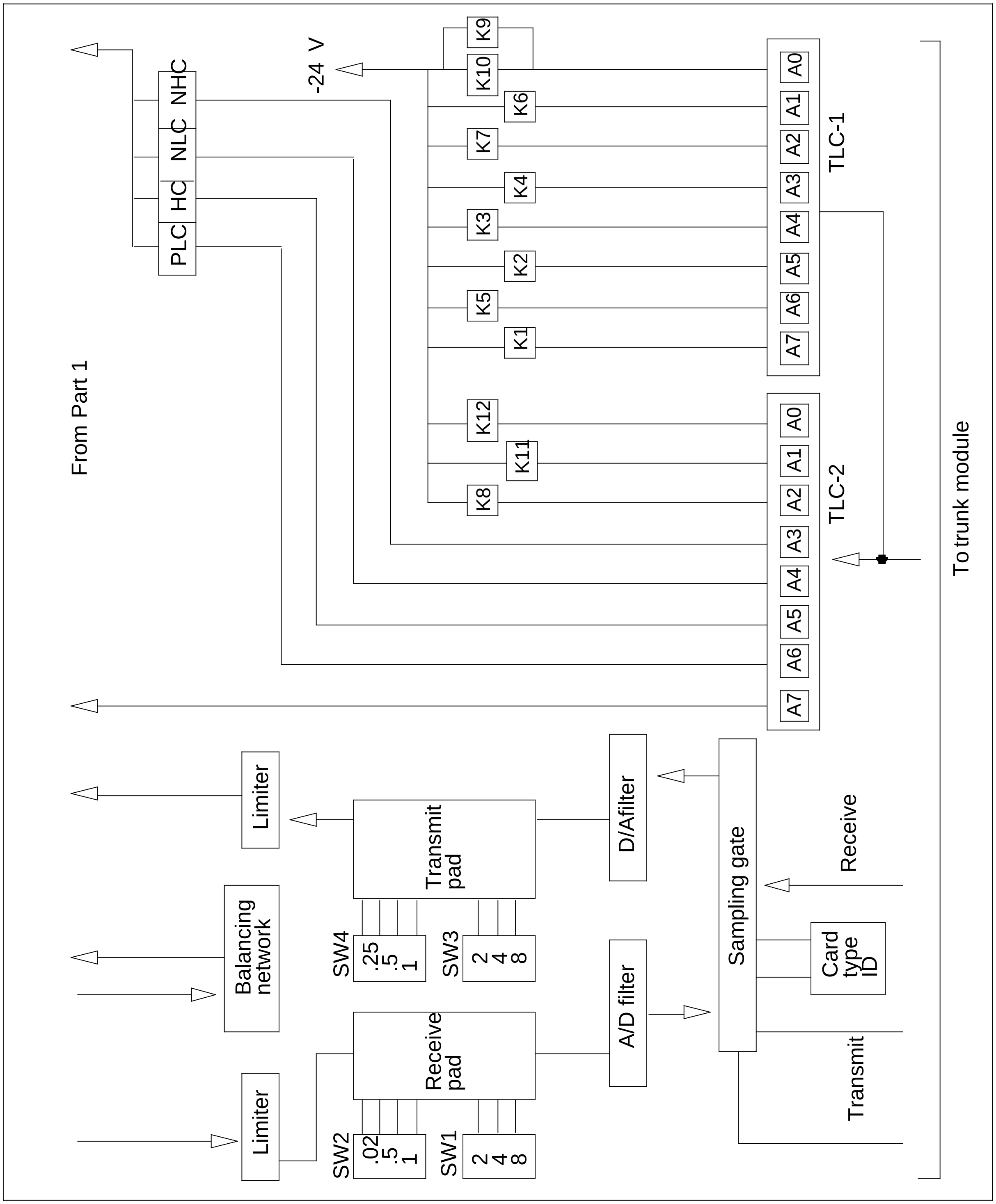
The IC/OG test trunk appears in the following figure.

NT2X90 IC/OG test trunk (Part 1 of 2)



NT2X90 (continued)

NT2X90 IC/OG test trunk (Part 2 of 2)



NT2X90 (continued)

Technical data

The technical data section provides specifications for

- the NT2X90 power requirements
- signaling characteristics
- equipment dimensions
- facility cable characteristics
- transmission specifications
- pulsing range
- environmental conditions

Power requirements

The NT2X90 power requirements appear in the following table.

Power requirements

Requirements	Value
Power use (for each idle trunk circuit)	500 mW (normal)
Converted voltages	+12 ±0.3 V -15 ±0.5 V +22.8 to 27.0 (24.0 V nominal)

Signaling characteristics

The NT2X90 signaling characteristics appear in the following table.

Signaling characteristics (Sheet 1 of 2)

Characteristics	Value
Talk battery	-42.75 V to -55.8 V
Normal range (float charge)	-49.0 V to -53.5 V
Maximum discharge (no charge)	-42.75 V
Maximum charge (equalizing)	-55.8 V
Insulation resistance (T and R)	30 ohm (minimum)
Insulation resistance (sleeve lead)	60 ohm (maximum)

Signaling characteristics (Sheet 2 of 2)

Characteristics	Value
Ground potential (sleeve lead)	±3 V
Ground potential (reverse battery)	±10 V
60-Hz longitudinal induction	40.0 mA
Supervision range	0 to 4500 ohms (maximum external loop resistance)

Equipment dimensions

The NT2X90 dimensions are 353 mm (9 inches) in height, 29 mm (1.125 inches) in width, and 267 mm (10.5 inches) in depth. The approximate weight of the NT2X90 is 1.36 kg (3 lb).

Facility cable characteristics

The facility cable characteristics for non-loaded cable are a maximum of 22.87 m (900 feet) for 19, 22, 24, or 26 ga NL.

Transmission specifications

The NT2X90 transmission specifications appear in the following table.

Transmission specifications (Sheet 1 of 2)

Characteristics	Value
Input impedance	900 ohm + 2.15 uF
Maximum transmit level with switches S3 and S4 set to OUT	+6 dBm nominal for digital test sequence (DTS) output. Refer to Note 1
Maximum receive level with switches S1 and S2 set to OUT	-9 dBm nominal for DTS input. Refer to Note 1
Receive level range	+6 dBm to -9 dBm for DTS output. Refer to Note 2
Transmit level range	-9 dBm to +6 dBm for DTS output (See Note 2)
Balance network plug-in options	
Note 1: The levels refer to the levels at the T/R of the circuit card.	
Note 2: The amount of usable gain depends on the return loss that can be achieved in a specified transmission facility.	

NT2X90 (continued)

Transmission specifications (Sheet 2 of 2)

Characteristics	Value
H88 loaded cable	NT2X80AA
Compromise Network + NBOC + NBOR	NT2X77AA
Compromise Network + NBOC	NT2X77AC

Note 1: The levels refer to the levels at the T/R of the circuit card.

Note 2: The amount of usable gain depends on the return loss that can be achieved in a specified transmission facility.

Pulsing range

The NT2X90 pulsing range characteristics appear in the following table.

Pulsing range

Characteristic	Value
Dial pulsing (DP) short-loop options	0 to 2000 ohms (maximum external loop resistance)
DP long loop option	2000 to 4500 ohms (maximum external loop resistance)
Short loop options (S5) to S/LP	
Maximum nonoperate current	7.0 mA
Minimum nonoperate current	13.0 mA
Short loop options (S5) to S/LP	
Maximum nonoperate current	2.6 mA
Minimum nonoperate current	7.8 mA

NT2X90 (end)

Environmental conditions

The NT2X90 performs under limited environmental restrictions. A description of these restrictions appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10°C to 30°C (50°F to 86°F)	5°C to 49°C (41°F to 120.2°F)
Relative humidity	20% to 55%	20% to 80%

Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the expected relative humidity is 30% maximum.

NT2X90AB

Product description

The incoming/outgoing test trunk circuit card (NT2X90AB) provides an interface between a trunk module (TM) or remote maintenance module (RMM) and many types of test facilities. The test facilities include 14 local test desks (LTD), 3 local test cabinets (LTC), Centralized Automated Loop Reporting System (CALRS) test desk, and mechanized loop tester (MLT).

The NT2X90AB circuit card enables maintenance personnel to access subscriber lines through the metallic test access (MTA) network. The NT2X90AB circuit card is used to process incoming operator verification calls.

The primary features of the NT2X90AB card are:

- 900 Ω impedance
- built-in, 2-wire-to-4-wire terminating set
- loop supervision
- sleeve lead supervision
- high-impedance monitor amplifier
- reverse battery seizure signaling
- receives dial pulse (DP) or multifrequency (MF)
- outpulses DP
- card-type identification to TM
- line identification (tip or ring party)
- dual-tone multifrequency (DTMF) testing
- manual setting for transmit and receive pad range from 0.0 dB to 15.75 dB selected in 0.25 dB steps
- manual selection of loop detector sensitivity
- talk with or without battery
- balance network plug-in option

Location

Each test trunk card accommodates one trunk circuit and can connect to an 8-wire TM or RMM.

Functional description

This section contains the functional description of the NT2X90AB circuit card.

VF signal paths

The NT2X90AB circuit card incorporates a 2- to 4-wire terminating set. This terminating set provides an interface between the 2-wire facility and the 4-wire trunk circuit.

In the receive direction, the NT2X90AB circuit card passes incoming VF signals on the tip and ring leads through the 2- to 4-wire terminating set. Terminating set balancing is available as a plug-in option. The NT2X90AC circuit card routes the signal through the limiter to the receive level adjustment pad and to the analog/digital (A/D) low pass filter. This A/D filter limits the bandwidth and amplifies the signal. The sampling gate samples the signal at an 8-kHz rate. The resultant pulse amplitude modulated (PAM) bus samples are applied to a common transmit PAM (XPAM) bus for the encoder in the TM or RMM to process.

In the transmit direction of the 4-wire circuit, PAM samples from the decoder in the TM or RMM are applied to a common receive PAM (RPAM) bus. The PAM samples are reconstructed to the original VF signal through the digital-to-analog (D/A) low-pass filter. This D/A filter also provides signal amplification. The VF signal is passed to the tip and ring leads through the transmit level adjustment pad, limiter and 4-wire to 2-wire terminating set.

Level adjustments are available in the two directions in 0.25 dB steps. The adjustments consist of fixed pads. These pads connect in groups of small multi-section switches; S1, S2, S3 and S4 to obtain the required amount of loss.

Signaling and supervisory circuits

The trunk logic circuit (TLC) establishes communications between the TM or RMM and VF signaling and supervisory circuits.The TLC serves as a communication buffer between the TM or RMM and the trunk circuit. The TLC generates the sampling pulses for the sampling gate. The TLC provides card-type identification voltage to the TM or RMM.

Far end signaling is detected by the loop detector which sends a signal to the TLC. The loop detector sensitivity is selected by a miniature switch (S5). This miniature switch selects the loop detector sensitivity for short-loop (S5 on S/LP) or long-loop (S5 on L/LP) operation. System software responds through the TM or RMM and the TLC, and operates sleeve relay K8. The K8 relay

NT2X90AB (continued)

connects four current detectors to the sleeve lead. The sleeve lead detectors provide four different states to the TLC.

The four states are:

- negative high current (NHC)
- negative low current (NLC)
- positive high current (PHC)
- positive low current (PLC)

The current detector circuits on the sleeve lead are used in different groups to detects signaling information through the sleeve lead. This information includes dial pulse completion, key pulse completion and line identification. The current detector outputs appear at the TLC. The TLC forwards the results to the TM or RMM.

Near-end signaling is established by activating relays K1-K12 in the correct group and sequence. This action allows operating company personnel to perform routine or maintenance test procedures.

A high-impedance amplifier circuit connects across tip to tip and tip to ring leads when relay K4 operates for monitor applications, such as DTMF testing.

A test circuit designed to check the signaling, supervisory and VF circuits is provided. Test relays K9 and K10 operate through the TLC to isolate the trunk circuit from the external transmission facility. Relays K9 and K10 also provide looparound connections between the receive and transmit paths. These connections allow the Digital Multiplex System (DMS) to test the circuit card internally, by activating relays K1-K12 in the correct group and sequence.

NT2X90AB (continued)

Switches

The options for switch selection appear in the next table.

Switches S1-S4 level adjustments

Direction	Switch	Segment	dB (normal)
Receive	S1	3	8
		2	4
		1	2
A/D	S2	3	1
		2	0.5
		1	0.25
Transmit	S3	3	8
		2	4
		1	2
D/A	S4	3	1
		2	0.5
		1	0.25

Application connections

The NT2X90AB circuit card application connections appear in the next figure.

NT2X90AB (continued)

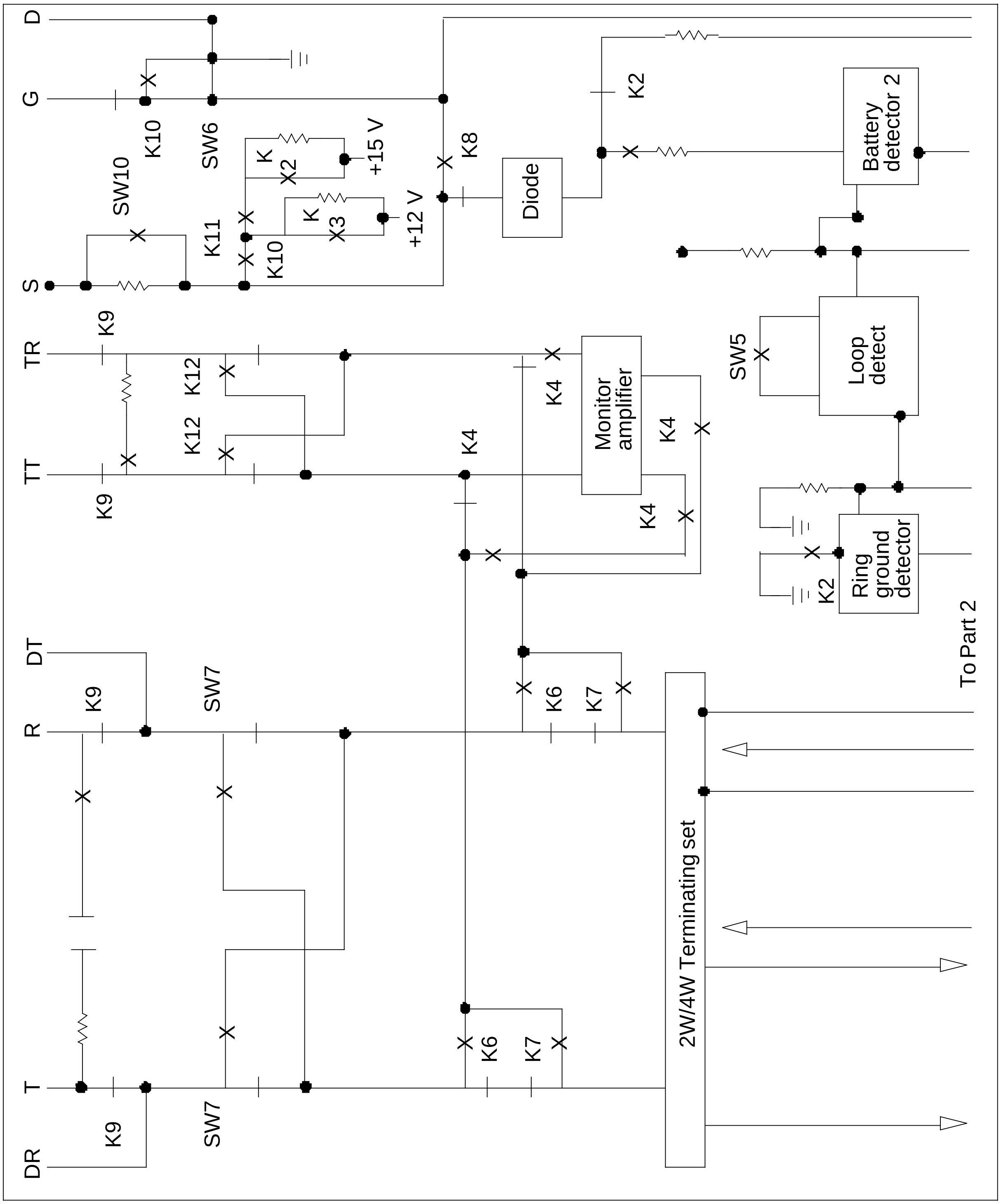
NT2X90AB circuit card application connections

		DF connections					
		T.O (T)	R.O (R)	TI.I (TT)	RI.I (TR)	T.I (S)	R.I (G)
(This connection connects to the same horizontal in the MTA unit with the associated LTU cards.)	LTP			●	●		
	TEST DESK FACILITY	●	●	●	●	●	●
(This connection connects to the horizontal of the MTA unit.)	OPERATOR VERIFICATION	●	●				

The functional blocks of the NT2X90AB trunk test card appear in the next figure.

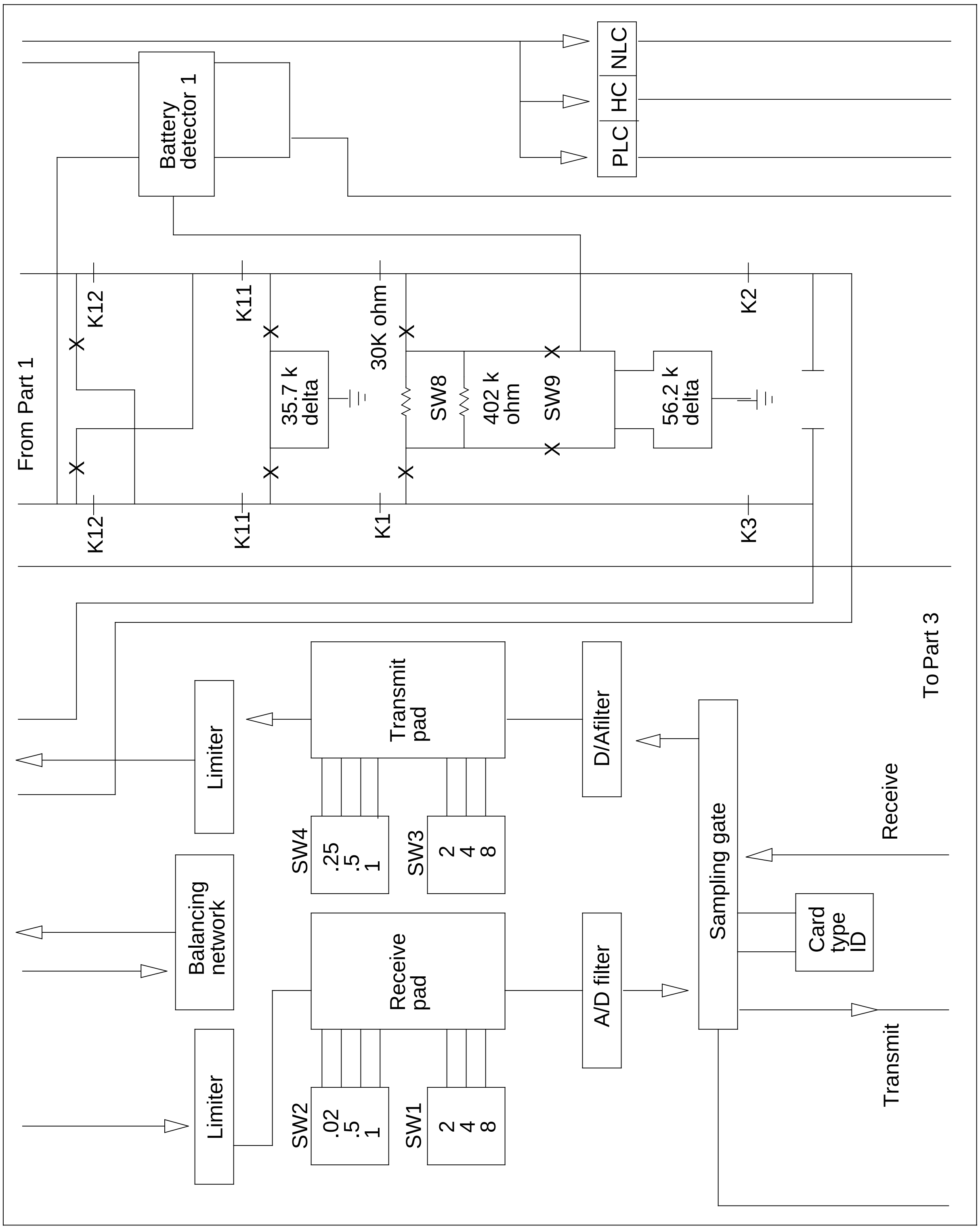
NT2X90AB (continued)

NT2X90AB functional blocks (Part 1 of 3)



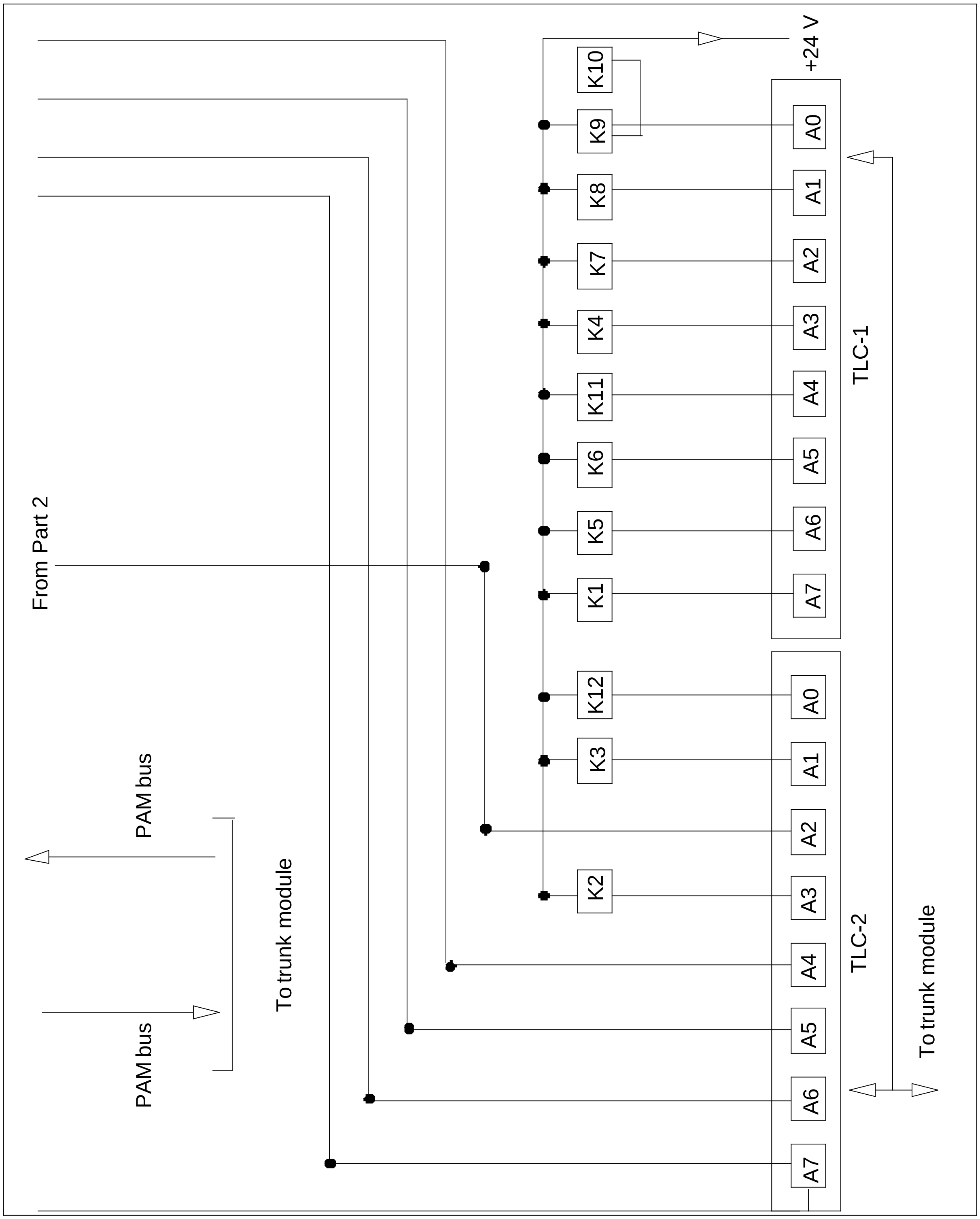
NT2X90AB (continued)

NT2X90AB functional blocks (Part 2 of 3)



NT2X90AB (continued)

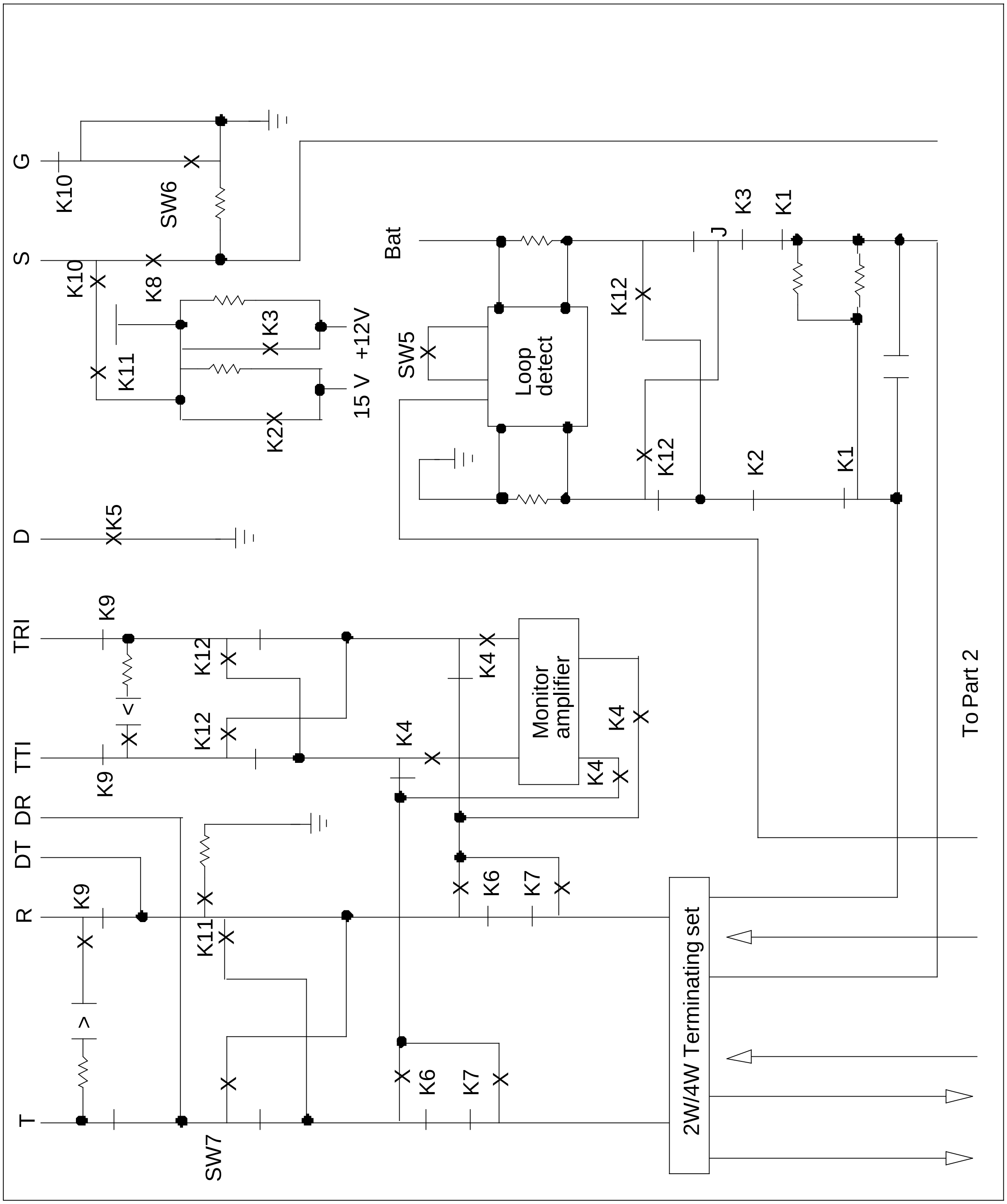
NT2X90AB functional blocks (Part 3 of 3)



NT2X90AB (continued)

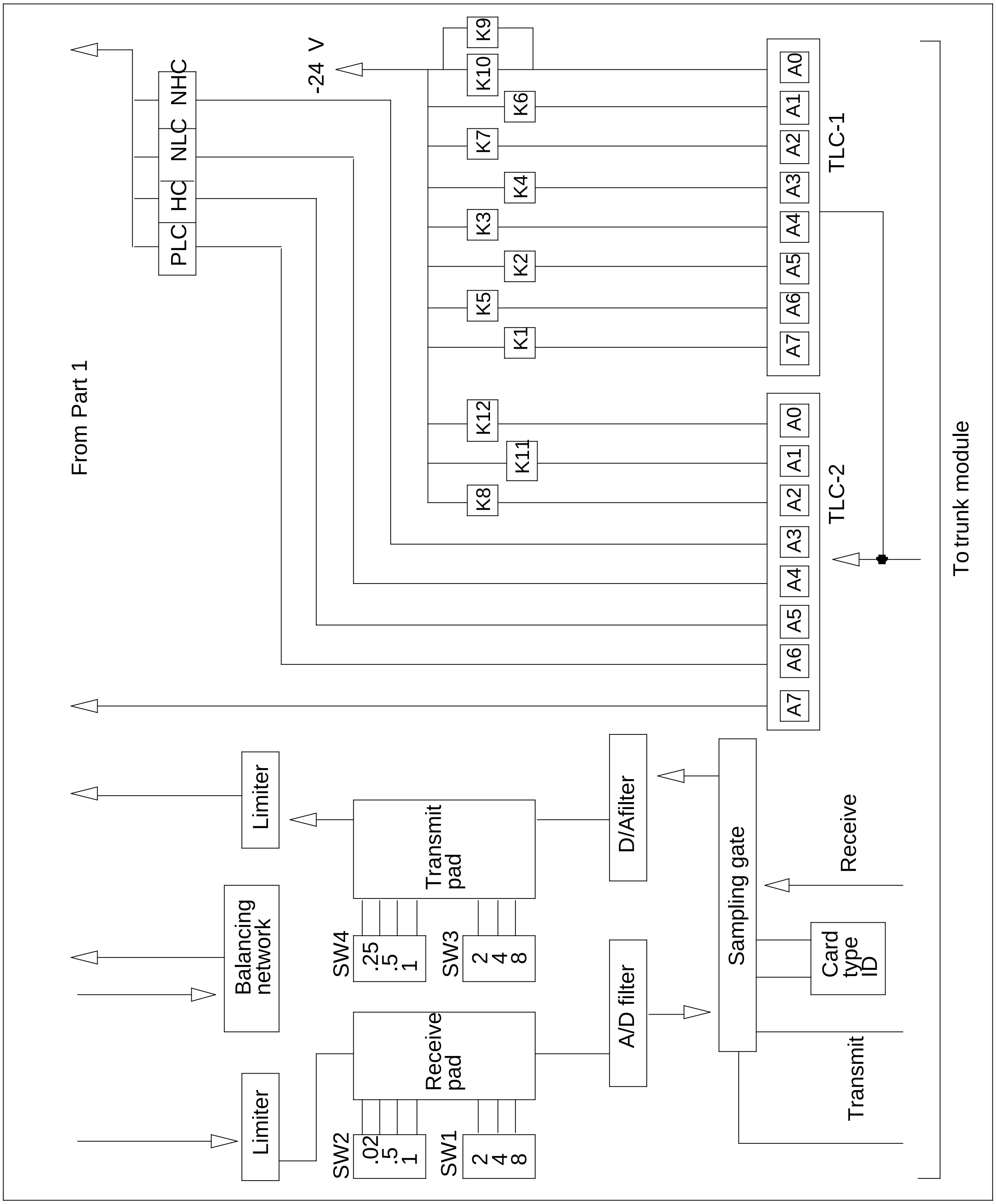
The incoming/outgoing (IC/OG) test trunk appears in the next figure.

NT2X90AB circuit card (Part 1 of 2)



NT2X90AB (continued)

NT2X90AB circuit card (Part 2 of 2)



NT2X90AB (continued)

Technical data

The technical data section provides specifications for

- power requirements
- signaling characteristics
- DP range characteristics
- loop option
- equipment dimensions
- facility cable characteristics
- transmission specifications
- balance plug-in network options
- environmental conditions

Power requirements

The NT2X90AB power requirements appear in the following table.

Power requirements

Requirements	Value
Power use (for each idle trunk circuit)	500 mW (normal)
Converted voltages	+12 ±0.3 V -15 ±0.5 V +22.8 to 27.0 (24.0 V nominal)

Signaling characteristics

The NT2X90AB signaling characteristics appear in the following table.

Signaling characteristics (Sheet 1 of 2)

Characteristics	Value
Talk battery	-42.75 V to -55.8 V
Normal range (float charge)	-49.0 V to -53.5 V
Maximum discharge (no charge)	-42.75 V
Maximum charge (equalizing)	-55.8 V

Signaling characteristics (Sheet 2 of 2)

Characteristics	Value
Insulation resistance (T and R)	30 k Ω (minimum)
Insulation resistance (sleeve lead)	60 kΩ (maximum)
Ground potential (sleeve lead)	±3 V
Ground potential (reverse battery)	±10 V
60-Hz longitudinal induction	40.0 mA
Supervision range	0 to 4.5 kΩ (maximum external loop resistance)

Dial pulse range and loop option

The NT2X90AB DP characteristics appear in the next table.

Dial pulse range

Characteristic	Value
DP short loop	0 to 2.0 kΩ (maximum external loop resistance)
DP long loop	2.0 kΩ to 4.5 kΩ (maximum external loop resistance)

The NT2X90AB short and long loop option information appear in the next table.

Short and long loop options

Characteristic	Value
Maximum non operate current (short loop option)	7.0 mA
Minimum non operate current (short loop option)	13.0 mA
Maximum non operate current (long loop option)	2.6 mA
Minimum non operate current (long loop option)	7.8 mA

Equipment dimensions

The NT2X90AB dimensions are 353 mm (9 inches) in height, 29 mm (1.125 inches) in width, and 267 mm (10.5 inches) in depth. The approximate weight of the NT2X90AB is 1.36 kg (3 lb).

NT2X90AB (continued)

Facility cable characteristics

The facility cable characteristics for non-loaded cable are a maximum of 22.87 m (900 feet) for 19, 22, 24, or 26 ga NL.

Transmission specifications

The NT2X90AB transmission specifications appear in the next table.

Transmission specifications

Characteristics	Value
Input impedance	900 Ω + 2.15 uF
Maximum transmit level with switches S3 and S4 set to OUT	+6 dBm nominal for digital test sequence (DTS) output. Refer to Note 1
Maximum receive level with switches S1 and S2 set to OUT	-9 dBm nominal for DTS input. Refer to Note 1
Receive level range	+6 dBm to -9 dBm for DTS output. Refer to Note 2
Transmit level range	-9 dBm to +6 dBm for DTS output (See Note 2)

Note 1: The levels refer to the levels at the T/R of the circuit card.

Note 2: The amount of usable gain depends on the return loss that can be achieved in a specified transmission facility.

Balance network

The NT2X90AB transmission specifications appear in the next table.

Balance network plug-in options

Characteristics	Value
H88 loaded cable	NT2X80AA
Compromise Network + network build-out capacitance (NBOC) + network build-out resistance (NBOR)	NT2X77AA
Compromise Network + NBOC	NT2X77AC

NT2X90AB (end)

Environmental conditions

The NT2X90AB performs under limited environmental restrictions. A description of these restrictions appear in the next table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10°C to 30°C (50°F to 86°F)	5°C to 49°C (41°F to 120.2°F)
Relative humidity	20% to 55%	20% to 80%

Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the expected relative humidity is 30% maximum.

NT2X90AC

Product description

The incoming/outgoing test trunk circuit card (NT2X90AC) provides an interface between a trunk module (TM) or remote maintenance module (RMM) and many types of test facilities. The test facilities include 14 local test desks (LTD), 3 local test cabinets (LTC), Centralized Automated Loop Reporting System (CALRS) test desk, and mechanized loop tester (MLT).

The NT2X90AC circuit card enables maintenance personnel to access subscriber lines through the metallic test access (MTA) network. The NT2X90AC circuit card is used to process incoming operator verification calls.

The NT2X90AC version includes the NT2X90AB circuit card capabilities.

The primary features of the NT2X90AC card are:

- 900 Ω impedance
- built-in, 2-wire-to-4-wire terminating set
- loop supervision
- sleeve lead supervision
- high-impedance monitor amplifier
- reverse battery seizure signaling
- receives dial pulse (DP) or multifrequency (MF)
- outpulses DP
- card-type identification to TM
- line identification (tip or ring party)
- dual-tone multifrequency (DTMF) testing
- manual setting for transmit and receive pad range from 0.0 dB to 15.75 dB selected in 0.25 dB steps
- manual selection of loop detector sensitivity
- talk with or without battery
- balance network plug-in option

Location

Each test trunk card accommodates one trunk circuit and can connect to an 8-wire TM or RMM.

Functional description

This section contains the functional description of the NT2X90AC circuit card.

VF signal paths

The NT2X90AC circuit card incorporates a 2- to 4-wire terminating set. This terminating set provides an interface between the 2-wire facility and the 4-wire trunk circuit.

In the receive direction, the NT2X90AC circuit card passes incoming VF signals on the tip and ring leads through the 2- to 4-wire terminating set. Terminating set balancing is available as a plug-in option. The NT2X90AC circuit card routes the signal through the limiter to the receive level adjustment pad and to the analog/digital (A/D) low pass filter. This A/D filter limits the bandwidth and amplifies the signal. The sampling gate samples the signal at an 8-kHz rate. The resultant pulse amplitude modulated (PAM) bus samples are applied to a common transmit PAM (XPAM) bus for the encoder in the TM or RMM to process.

In the transmit direction of the 4-wire circuit, PAM samples from the decoder in the TM or RMM are applied to a common receive PAM (RPAM) bus. The PAM samples are reconstructed to the original VF signal through the digital-to-analog (D/A) low-pass filter. This D/A filter also provides signal amplification. The VF signal is passed to the tip and ring leads through the transmit level adjustment pad, limiter and 4-wire to 2-wire terminating set.

Level adjustments are available in the two directions in 0.25 dB steps. The adjustments consist of fixed pads. These pads connect in groups of small multi-section switches; S1, S2, S3 and S4 to obtain the required amount of loss.

Signaling and supervisory circuits

The trunk logic circuit (TLC) establishes communications between the TM or RMM and VF signaling and supervisory circuits.The TLC serves as a communication buffer between the TM or RMM and the trunk circuit. The TLC generates the sampling pulses for the sampling gate. The TLC provides card-type identification voltage to the TM or RMM.

Far end signaling is detected by the loop detector which sends a signal to the TLC. The loop detector sensitivity is selected by a miniature switch (S5). This miniature switch selects the loop detector sensitivity for short-loop (S5 on S/LP) or long-loop (S5 on L/LP) operation. System software responds through the TM or RMM and the TLC, and operates sleeve relay K8. The K8 relay

NT2X90AC (continued)

connects four current detectors to the sleeve lead. The sleeve lead detectors provide four different states to the TLC.

The four states are:

- negative high current (NHC)
- negative low current (NLC)
- positive high current (PHC)
- positive low current (PLC)

The current detector circuits on the sleeve lead are used in different groups to detects signaling information through the sleeve lead. This information includes dial pulse completion, key pulse completion and line identification. The current detector outputs appear at the TLC. The TLC forwards the results to the TM or RMM.

Near-end signaling is established by activating relays K1-K12 in the correct group and sequence. This action allows operating company personnel to perform routine or maintenance test procedures.

A high-impedance amplifier circuit connects across tip to tip and tip to ring leads when relay K4 operates for monitor applications, such as DTMF testing.

A test circuit designed to check the signaling, supervisory and VF circuits is provided. Test relays K9 and K10 operate through the TLC to isolate the trunk circuit from the external transmission facility. Relays K9 and K10 also provide looparound connections between the receive and transmit paths. These connections allow the Digital Multiplex System (DMS) to test the circuit card internally, by activating relays K1-K12 in the correct group and sequence.

NT2X90AC (continued)

Switches

The options for switch selection appear in the next table.

Switches S1-S4 level adjustments

Direction	Switch	Segment	dB (normal)
Receive	S1	3	8
		2	4
		1	2
A/D	S2	3	1
		2	0.5
		1	0.25
Transmit	S3	3	8
		2	4
		1	2
D/A	S4	3	1
		2	0.5
		1	0.25

Application connections

The NT2X90AC circuit card application connections appear in the next figure.

NT2X90AC (continued)

NT2X90AC circuit card application connections

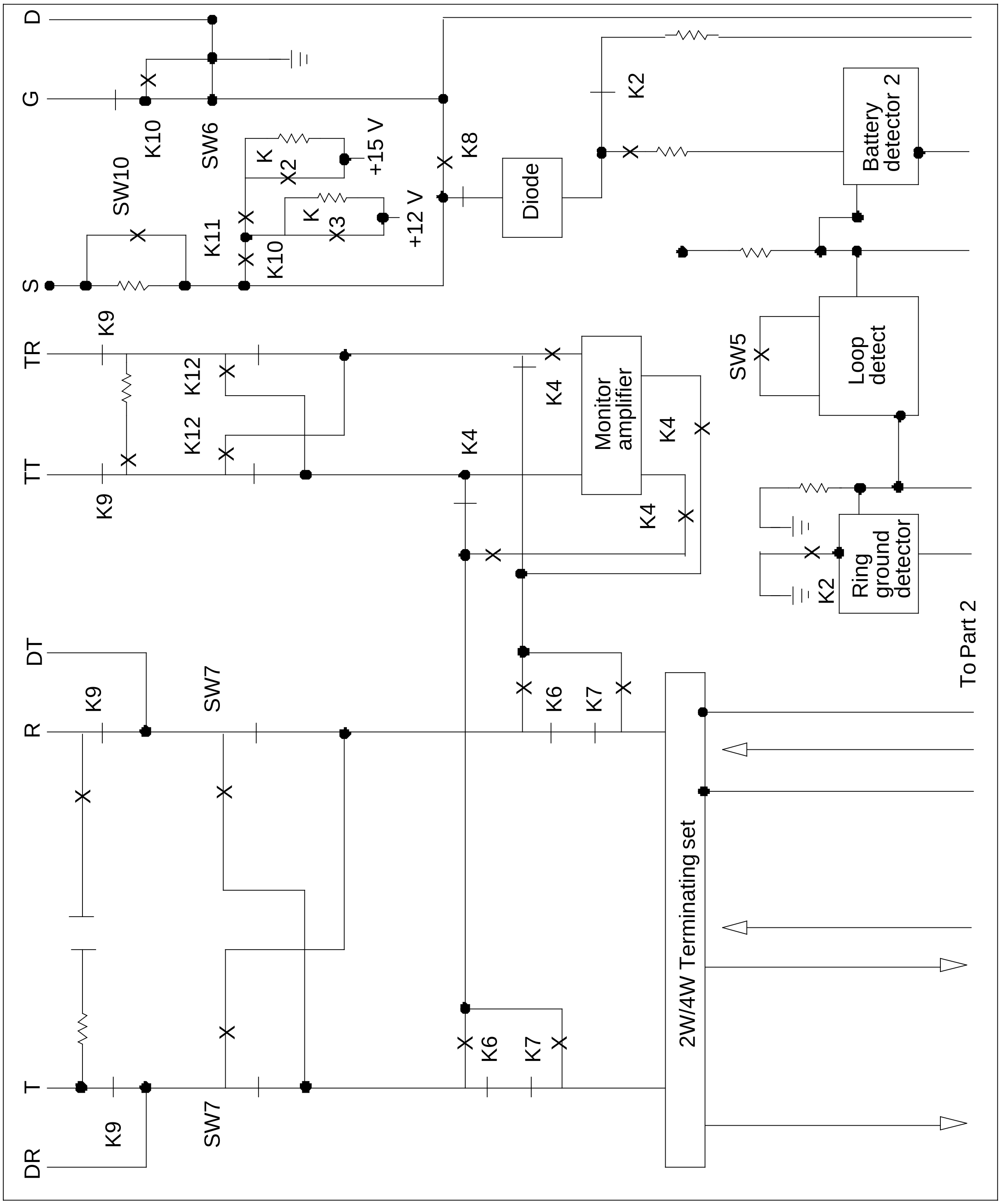
DF connections

		T.O (T)	R.O (R)	TI.I (TT)	RI.I (TR)	T.I (S)	R.I (G)
(This connection connects to the same horizontal in the MTA unit with the associated LTU cards.)	LTP			●	●		
	TEST DESK FACILITY	●	●	●	●	●	●
(This connection connects to the horizontal of the MTA unit.)	OPERATOR VERIFICATION	●	●				

The functional blocks of the NT2X90AC trunk test card appear in the next figure.

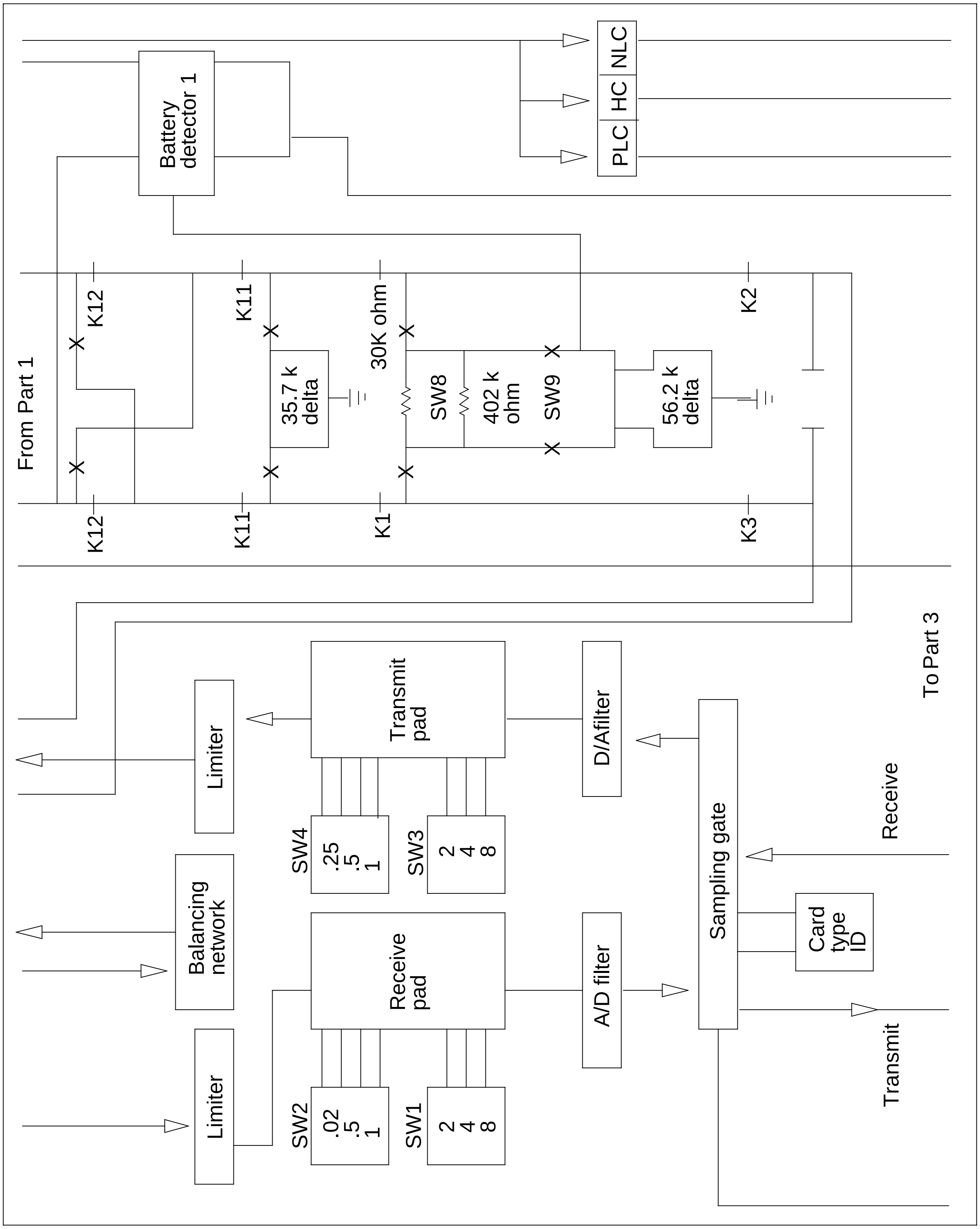
NT2X90AC (continued)

NT2X90AC functional blocks (Part 1 of 3)

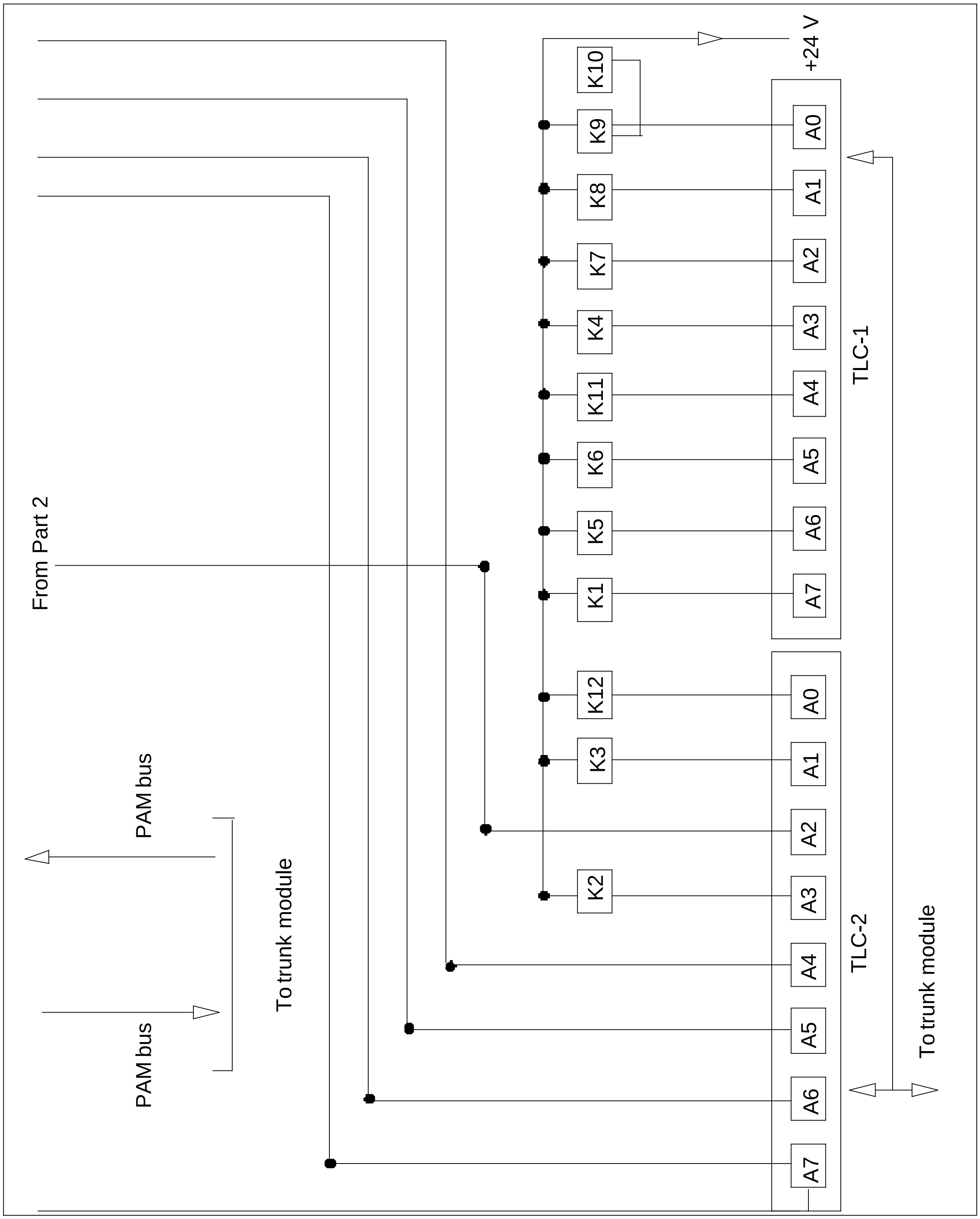


NT2X90AC (continued)

NT2X90AC functional blocks (Part 2 of 3)



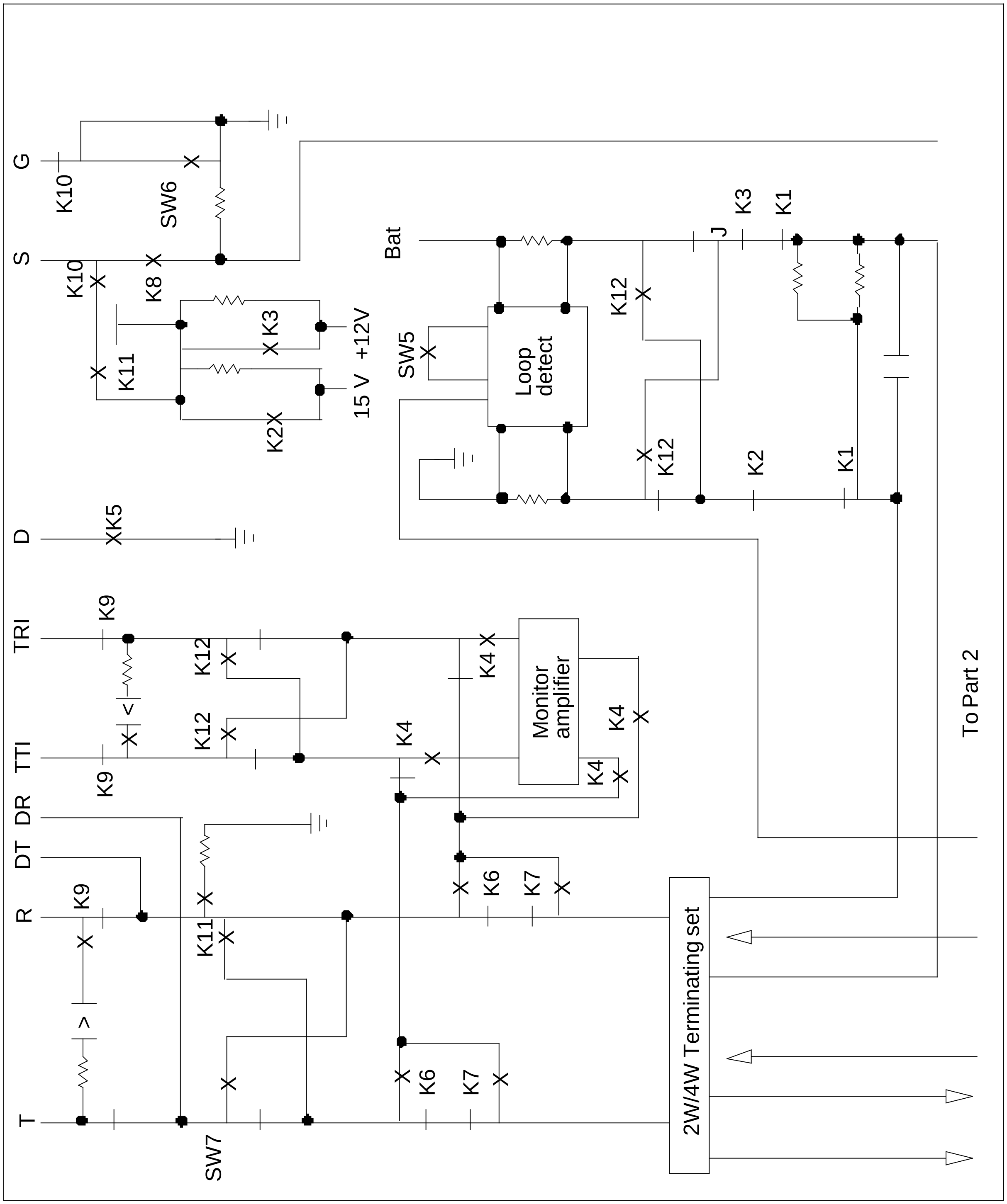
NT2X90AC functional blocks (Part 3 of 3)



NT2X90AC (continued)

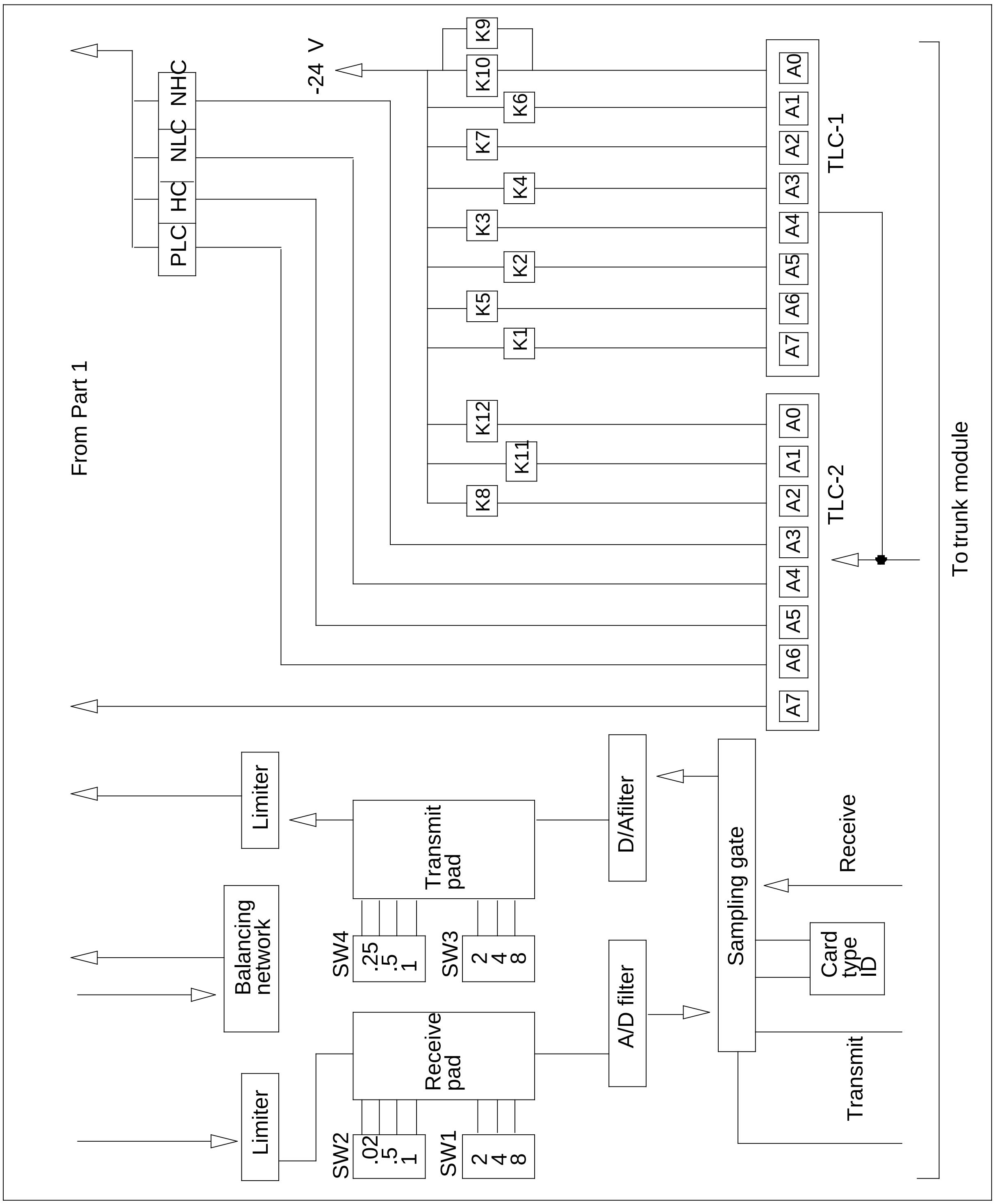
The incoming/outgoing (IC/OG) test trunk appears in the next figure.

NT2X90AC circuit card (Part 1 of 2)



NT2X90AC (continued)

NT2X90AC circuit card (Part 2 of 2)



NT2X90AC (continued)

Technical data

The technical data section provides specifications for

- power requirements
- signaling characteristics
- DP range characteristics
- loop option
- equipment dimensions
- facility cable characteristics
- transmission specifications
- balance plug-in network options
- environmental conditions

Power requirements

The NT2X90AC power requirements appear in the following table.

Power requirements

Requirements	Value
Power use (for each idle trunk circuit)	500 mW (normal)
Converted voltages	+12 ±0.3 V -15 ±0.5 V +22.8 to 27.0 (24.0 V nominal)

Signaling characteristics

The NT2X90AC signaling characteristics appear in the following table.

Signaling characteristics (Sheet 1 of 2)

Characteristics	Value
Talk battery	-42.75 V to -55.8 V
Normal range (float charge)	-49.0 V to -53.5 V
Maximum discharge (no charge)	-42.75 V
Maximum charge (equalizing)	-55.8 V

Signaling characteristics (Sheet 2 of 2)

Characteristics	Value
Insulation resistance (T and R)	30 k Ω (minimum)
Insulation resistance (sleeve lead)	60 kΩ (maximum)
Ground potential (sleeve lead)	±3 V
Ground potential (reverse battery)	±10 V
60-Hz longitudinal induction	40.0 mA
Supervision range	0 to 4.5 kΩ (maximum external loop resistance)

Dial pulse range and loop option

The NT2X90AC DP characteristics appear in the next table.

Dial pulse range

Characteristic	Value
DP short loop	0 to 2.0 kΩ (maximum external loop resistance)
DP long loop	2.0 kΩ to 4.5 kΩ (maximum external loop resistance)

The NT2X90AC short and long loop option information appear in the next table.

Short and long loop options

Characteristic	Value
Maximum non operate current (short loop option)	7.0 mA
Minimum non operate current (short loop option)	13.0 mA
Maximum non operate current (long loop option)	2.6 mA
Minimum non operate current (long loop option)	7.8 mA

Equipment dimensions

The NT2X90AC dimensions are 353 mm (9 inches) in height, 29 mm (1.125 inches) in width, and 267 mm (10.5 inches) in depth. The approximate weight of the NT2X90AC is 1.36 kg (3 lb).

NT2X90AC (continued)

Facility cable characteristics

The facility cable characteristics for non-loaded cable are a maximum of 22.87 m (900 feet) for 19, 22, 24, or 26 ga NL.

Transmission specifications

The NT2X90AC transmission specifications appear in the next table.

Transmission specifications

Characteristics	Value
Input impedance	900 Ω + 2.15 uF
Maximum transmit level with switches S3 and S4 set to OUT	+6 dBm nominal for digital test sequence (DTS) output. Refer to Note 1
Maximum receive level with switches S1 and S2 set to OUT	-9 dBm nominal for DTS input. Refer to Note 1
Receive level range	+6 dBm to -9 dBm for DTS output. Refer to Note 2
Transmit level range	-9 dBm to +6 dBm for DTS output (See Note 2)

Note 1: The levels refer to the levels at the T/R of the circuit card.

Note 2: The amount of usable gain depends on the return loss that can be achieved in a specified transmission facility.

Balance network

The NT2X90AC transmission specifications appear in the next table.

Balance network plug-in options

Characteristics	Value
H88 loaded cable	NT2X80AA
Compromise Network + network build-out capacitance (NBOC) + network build-out resistance (NBOR)	NT2X77AA
Compromise Network + NBOC	NT2X77AC

NT2X90AC (end)

Environmental conditions

The NT2X90AC performs under limited environmental restrictions. A description of these restrictions appear in the next table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10°C to 30°C (50°F to 86°F)	5°C to 49°C (41°F to 120.2°F)
Relative humidity	20% to 55%	20% to 80%

Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the expected relative humidity is 30% maximum.

NT2X90AD

Product description

The incoming/outgoing test trunk circuit card (NT2X90AD) provides an interface between a trunk module (TM) or remote maintenance module (RMM) and many types of test facilities. The test facilities include 14 local test desks (LTD), 3 local test cabinets (LTC), Centralized Automated Loop Reporting System (CALRS) test desk, and mechanized loop tester (MLT).

The NT2X90AD circuit card enables maintenance personnel to access subscriber lines at host or remote sites through the metallic test access (MTA) network. The NT2X90AD circuit card is used to process incoming operator verification calls

The NT2X90AD version includes the NT2X90AC capabilities. These capabilities can be used to test remote carrier lines that are part of the DMS-100.

The primary features of the NT2X90AD card are:

- 900 Ω impedance
- built-in, 2-wire-to-4-wire terminating set
- loop supervision
- sleeve lead supervision
- high-impedance monitor amplifier
- reverse battery seizure signaling
- receives dial pulse (DP) or multifrequency (MF)
- outpulses DP
- card-type identification to trunk module (TM)
- line identification (tip or ring party)
- dual-tone multifrequency (DTMF) testing
- manual setting for transmit and receive pad range from 0.0 dB to 15.75 dB selected in 0.25 dB steps
- manual selection of loop detector sensitivity
- talk with or without battery
- balance network plug-in option
- on-hook dc signature

- bypass initiate signal detector
- ring ground signal detector

Location

Each test trunk card accommodates one trunk circuit and can connect to an 8-wire TM or RMM.

Functional description

This section contains the functional description of the NT2X90AD circuit card.

VF signal paths

The NT2X90AD circuit card incorporates a 2- to 4-wire terminating set. This terminating set provides an interface between the 2-wire facility and the 4-wire trunk circuits.

In the receive direction, the NT2X90AD circuit card passes incoming VF signals on the tip and ring leads through the 2- to 4-wire terminating set. Terminating set balancing is available as a plug-in option. The NT2X90AD circuit card routes the signal through the limiter to the receive level adjustment pad and to the analog/digital (A/D) low pass filter. This A/D filter limits the bandwidth and amplifies the signal. The sampling gate samples the signal at an 8-kHz rate. The resultant pulse amplitude modulated (PAM) bus samples are applied to a common transmit PAM (XPAM) bus for the encoder in the TM or RMM to process.

In the transmit direction of the 4-wire circuit, PAM samples from the decoder in the TM or RMM are applied to a common receive PAM (RPAM) bus. The PAM samples are reconstructed to the original VF signal through the digital-to-analog (D/A) low33pass filter. This D/A filter also provides signal amplification. The VF signal is passed to the tip and ring leads through the transmit level adjustment pad, limiter and 4-wire to 2-wire terminating set.

Level adjustments are available in the two directions in 0.25 dB steps. The adjustments consist of fixed pads. These pads connect in groups of small multi-section switches; S1, S2, S3 and S4 to obtain the required amount of loss.

Signaling and supervisory circuits

The trunk logic circuit (TLC) establishes communication between the TM or RMM, and VF signaling and supervisory circuits. The TLC serves as a communication buffer between the TM or RMM and the trunk circuit. The TLC generates sampling pulses for the sampling gate. The TLC provides card-type identification voltage to the TM or RMM.

NT2X90AD (continued)

Far end signaling is detected by the loop detector which sends a signal to the TLC. The loop detector sensitivity is selected by a miniature switch (S5). This miniature switch selects the loop detector sensitivity for short-loop (S5 on S/LP) or long-loop (S5 on L/LP) operation. System software responds through the TM or RMM and the TLC, and operates sleeve relay K8. The K8 relay connects four current detectors to the sleeve lead. The sleeve lead detectors provide four different states to the TLC.

The four states are:

- negative high current (NHC)
- negative low current (NLC)
- positive high current (PHC)
- positive low current (PLC)

The current detector circuits on the sleeve lead are used in different groups to detects signaling information through the sleeve lead. This information includes dial pulse completion, key pulse completion and line identification. The current detector outputs appear at the TLC. The TLC forwards the results to the TM or RMM.

Near-end signaling is established by activating relays K1-K12 in the correct group and sequence. This action allows operating company personnel to perform routine or maintenance test procedures.

A high-impedance amplifier circuit connects across tip to tip and tip to ring leads when relay K4 operates for monitor applications, such as DTMF testing.

A test circuit designed to check the signaling, supervisory and VF circuits is provided. Test relays K9 and K10 operate through the TLC to isolate the trunk circuit from the external transmission facility. Relays K9 and K10 also provide looparound connections between the receive and transmit paths. These connections allow the Digital Multiplex System (DMS) to test the circuit card internally, by activating relays K1-K12 in the correct group and sequence.

NT2X90AD (continued)

Switch selection

The options for switch selection appear in the next table.

Switches S1-S4 level adjustments

Direction	Switch	Segment	dB (normal)
Receive	S1	3	8
		2	4
		1	2
A/D	S2	3	1
		2	0.5
		1	0.25
Transmit	S3	3	8
		2	4
		1	2
D/A	S4	3	1
		2	0.5
		1	0.25

NT2X90AD (continued)

A description of switches S1-S10 appears in the next table.

Switch selectors SW1-SW10 (Sheet 1 of 2)

Switch	Description
SW1-SW4	These switches connect attenuation pads in groups to obtain desired amounts of loss for certain signals. These signals go through the test trunk toward test facilities in one direction and toward the MTA network. The subscriber line is in the other direction. The switches are set according to the distance between the test facility and the test trunk card.
SW5	Switch SW5 selects loop detector sensitivity. The loop detector detects far-end signaling and signals the TLC in the test trunk. Short loop (S/LP) or long loop (L/LP) options are available. The option that you choose depends on the distance between the test facility and the test trunk card. This switch normally is set to S/LP, carrier systems that use the NT2X90AD test trunk use the L/LP option.
SW6	Switch SW6 selects an internal (INT) and external (EXT) ground for the sleeve lead. This switch allows the 2X90 to be referenced to the internal DMS system ground or to an external test equipment ground point. The INT (internal) ground. In this configuration, the NT2X90AD provides the ground reference. This is the recommendation option of Nortel Networks. Use this option for carrier systems that use the 2X90 Test Trunk. The EXT (external) ground. In this configuration, the NT2X90AD requires that an external ground reference connects to the Test Trunk. This connection requires a ground conductor to be wired between the test equipment (MLT2) ground reference and the NT2X90AD Test Trunk module.
SW7	Switch SW7 selects if the T/R that connects to the 2W/4W terminating set attaches normally or is reversed. Switch SW7 selects so that the tip attaches to where the ring normally attaches and the opposite. The setting depends on the application. For a carrier system that uses the NT2X90AD test trunk, the setting must be NORMAL.
Note: The TR-TSI-000536 specifies that the Maximum Sleeve/Ground Loop resistance is 1.5 kΩ.	

Switch selectors SW1-SW10 (Sheet 2 of 2)

Switch	Description
SW8-SW9	Switches SW8 and SW9 select the impedance between T/R according to card application. If switch SW8 is set to Y (ON), operation of relay K1 causes 30 kΩ between T/R required for CALRS line identification. The switch SW9 setting is not used for CALRS and can be set to LTP or I/C. If switch SW8 is set to N (OFF) and switch SW9 is set to LTP, 402 Ω are applied between the T/R as required for LTP testing. If switch SW8 is set to N (OFF) and switch SW9 is set to I/C, a delta of 56.2 Ω is applied. A delta of 56.2 Ω is applied between the T/R to test lines of an integrated carrier system.
SW10	Switch SW10 selects the Sleeve/Ground Loop Detection sensitivity. The switch allows the 2X90 to compensate for the distances between the test equipment and the Test Trunk. The S/LP (short loop). In this configuration, the NT2X90AD provides a series 1.0 kΩ resistor on the Test Trunk Sleeve Lead. This resistor limits the power that the system dissipates on the Trunk Module, test equipment, or the Trunk Module and the test equipment. When you select the short loop option, the maximum Sleeve/Ground Loop resistance is 500 Ω or 250 Ω each lead. The S/LP requires that the EXT (external) ground conductor resistance between the test equipment and the Test Trunk Sleeve Lead is not greater than 250 Ω. The L/LP (long loop). In this configuration, the NT2X90AD operates in the maximum Sleeve/Ground Loop resistance of 1.5 kΩ or 750 Ω for each lead.
Note: The TR-TSI-000536 specifies that the Maximum Sleeve/Ground Loop resistance is 1.5 kΩ.	

Test trunk card relays, signal distribution and scan points

This section describes the function of the 12 relays, and the signal distribution (SD) points that activate these relays. This section also describes the five scan (SC) points used in the NT2X90AD test trunk card.

NT2X90AD (continued)

NT2X90AD test trunk card relays

A description of K1-K12 appear in the next table.

Test trunk card relay descriptions (Sheet 1 of 2)

Relay	Description
K1	If switches SW8 and SW9 of the test trunk are set to ON, this relay enables the on-hook dc signature (5.2 k delta that connects between the tip/ring of the test trunk). This signature indicates that the subscriber line to be tested is on an integrated carrier system. If switches SW8 and SW9 are set to OFF, relay K1 provides the intercept identification sequence used for CALRS. If switch SW8 is set to ON and switch SW9 to OFF, 402 Ω are applied between T/R of the test trunk. The Ω are applied as required for line test position (LTP) testing.
K2	This relay opens the tip of the test trunk. With relays K3 and K12 in operation, pulsing relay K2 provides ground at intervals on the tip. This pulsing that is not continuous is used when the MTA is not available.
K3	This relay opens the ring of the test trunk. With relay K2 operated, pulsing relay K3 provides ground that is not continuous on the ring. This relay is used during busy and monitor sequences.
K4	This relay connects an amplifier circuit across the TT and TR leads. This circuit is used for monitor applications, like DTMF testing.
K5	This relay provides ground to external wire D. The position of a ground on wire indicates an external receiver to prepare to receive digits. An external receiver replaces the monitor amplifier for DTMF testing.
K6	This relay connects the T/R of the test trunk to the TT and TR leads in that order. This condition provides part of the metallic test path from test equipment to a subscriber loop. The test equipment includes a test desk or MLT.
K7	This relay connects the TT and TR leads to the metallic test pair. This condition provides part of the metallic test path from test equipment to a subscriber loop. The test equipment includes a test desk or MLT.
K8	This relay provides a sleeve-to-ground connection that indicates that the test trunk was seized.

Test trunk card relay descriptions (Sheet 2 of 2)

Relay	Description
K9, K10	Relays K9 and K10 isolate the test trunk card from external connections. These relays provide loop-around connections between the receive and transmit paths in the card. This condition allows the system to test internal signaling, supervisory, and VF circuits in the card.
K11	This relay provides a 35.7 k intercept delta between the T/R of the test trunk. This delta indicates that the line is not available for testing.
K12	This relay provides a reverse battery signal on the T/R loop that indicates the DMS switch is ready to receive digits. Relay K12, in operation with relay K3, puts ground on the tip and does not put the battery on the ring. Ground on the tip indicates to the test facility that the metallic path for testing is set up. The tip and ring of the subscriber connects to the metallic test pair.
	Before ground is placed on tip, the test facility removes a 116 V potential from the tip. The test facility uses the 116 V potential (the bypass initiate signal) to request a metallic test path to the subscriber loop. Battery detector 2 senses this voltage. Relays 2 and 3 are activated to remove this signal. Battery detector 2 detects this removal, which allows the test sequence to proceed.

NT2X90AD signal distribution points

The next table lists the SD points associated with the NT2X90AD circuit card and the relays operated by the SD points.

NT2X90AD circuit card SD point relay association (Sheet 1 of 2)

SD point	Relay
A0 (TLC 1)	K9 and K10
A1 (TLC 1)	K8
A2 (TLC 1)	K7
A3 (TLC 1)	K4
A4 (TLC 1)	K11
A5 (TLC 1)	K6
A6 (TLC 1)	K5

NT2X90AD (continued)

NT2X90AD circuit card SD point relay association (Sheet 2 of 2)

SD point	Relay
A7 (TLC 1)	K1
A0 (TLC 2)	K12
A1 (TLC 2)	K3
A3 (TLC 2)	K2

NT2X90AD circuit card scan points

A description of the five SC points for the NT2X90AD circuit card appear in the next table.

NT2X90AD circuit card scan points

Scan points	Description
A2	This scan point detects the ring ground detector. This detector is used during the bypass initiate signal setup. This detector is used to determine if the subscriber line to be tested is a coin line (ring-grounded) or a line like a ring-open line.
A4	This scan point detects NLC on the sleeve lead. The NLC is present when the metallic test path is set up from the test facility to the subscriber loop after the subscriber dials the digits.
A5	This scan point detects PHC or PLC on the sleeve lead. The NHC signals the test trunk to disconnect the test setup. The PHC signals the test trunk to enter the DTMF testing sequence.
A6	This scan point detects PLC on the sleeve lead. This scan point is not used with the NT2X90AD test trunk card.
A7	This scan point detects current on the T/R of the test trunk. Scan point 7 connects to the loop detector. Current flows in the T/R loop when the test facility seizes the test trunk. Scan point 7 also connects to battery detectors 1 and 2. These detectors detect the on-hook dc signature of the 116 V potential on the tip. When the on-hook dc signature is removed, battery detector 1 is disconnected.

Application connections

NT2X90AD circuit card application connections appear in the next figure.

NT2X90AD circuit card application connections

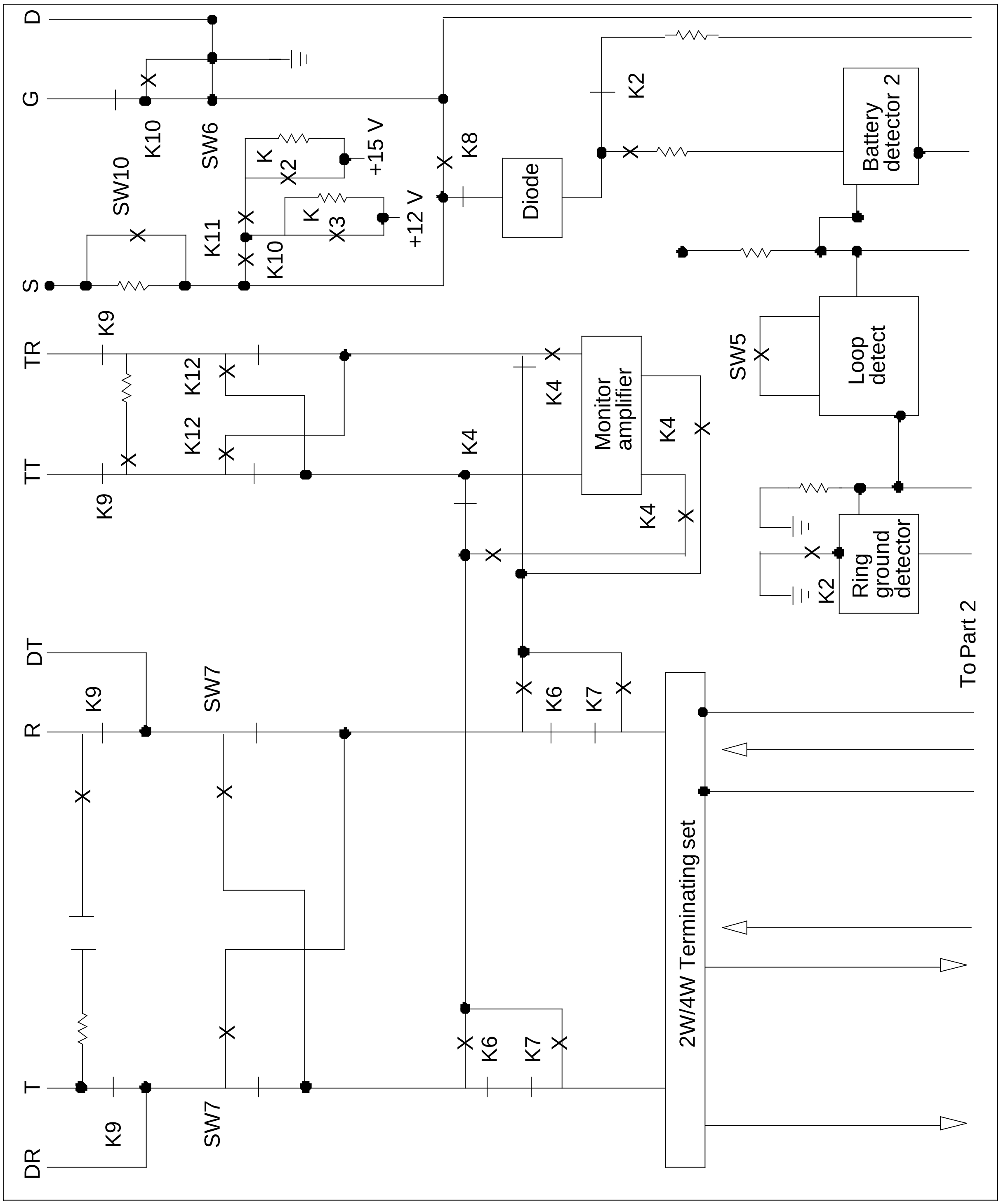
DF connections

		T.O (T)	R.O (R)	TI.I (TT)	RI.I (TR)	T.I (S)	R.I (G)
(This connection connects to the same horizontal in the MTA unit with the associated LTU cards.)	LTP			●	●		
	TEST DESK FACILITY	●	●	●	●	●	●
(This connection connects to the horizontal of the MTA unit.)	OPERATOR VERIFICATION	●	●				

The functional blocks of the NT2X90AD trunk test card appear in the next figure.

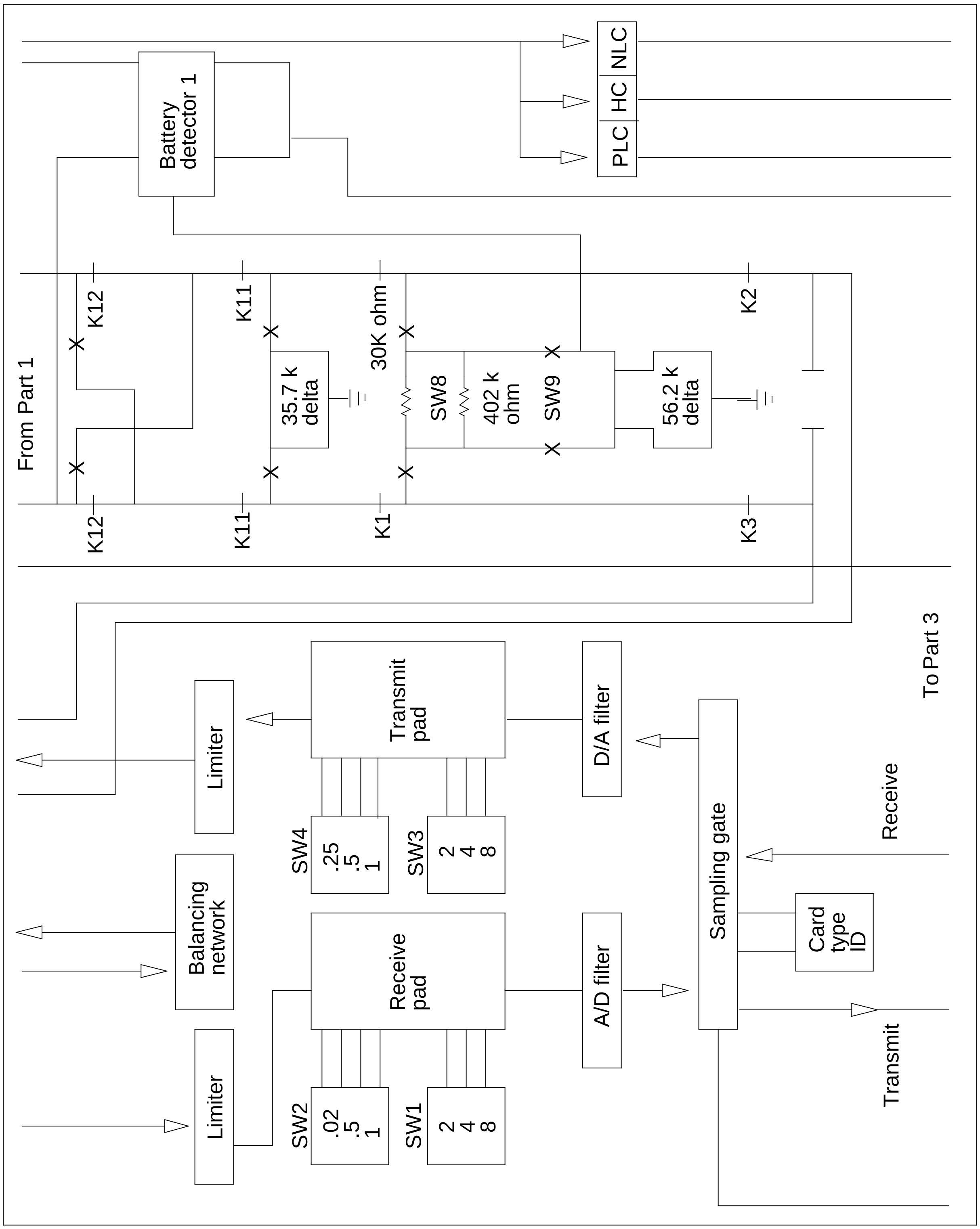
NT2X90AD (continued)

NT2X90AD functional blocks (Part 1 of 3)



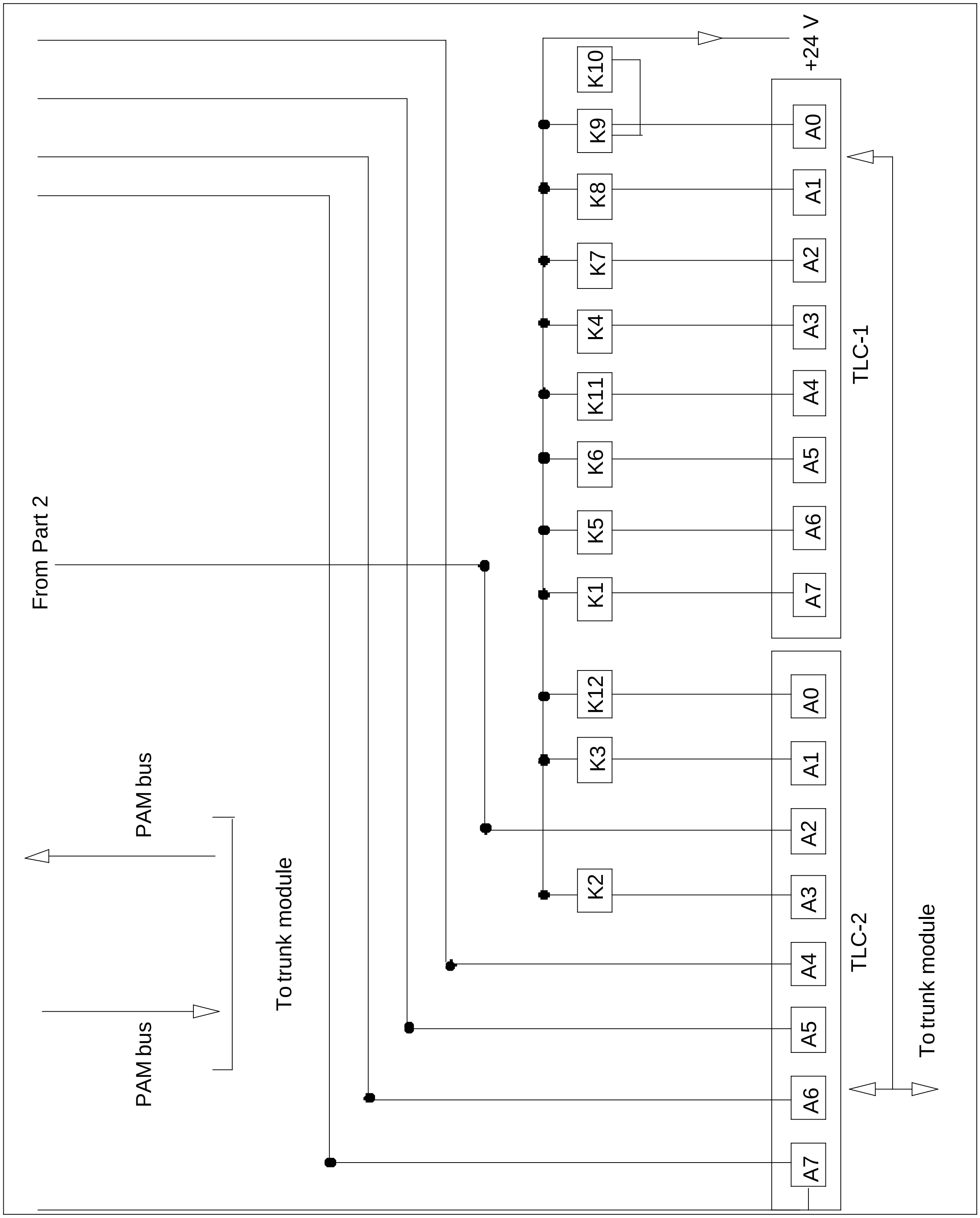
NT2X90AD (continued)

NT2X90AD functional blocks (Part 2 of 3)



NT2X90AD (continued)

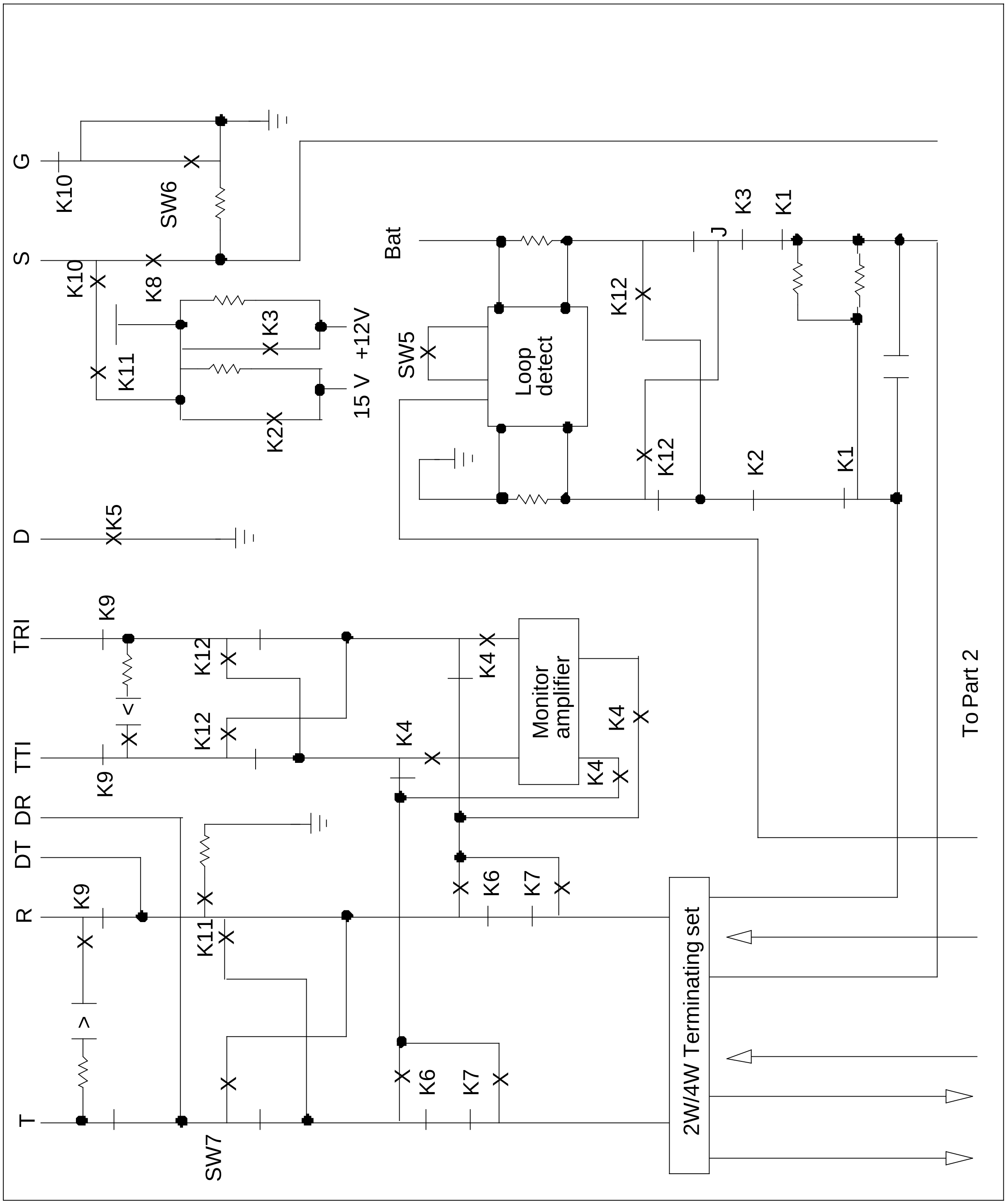
NT2X90AD functional blocks (Part 3 of 3)



NT2X90AD (continued)

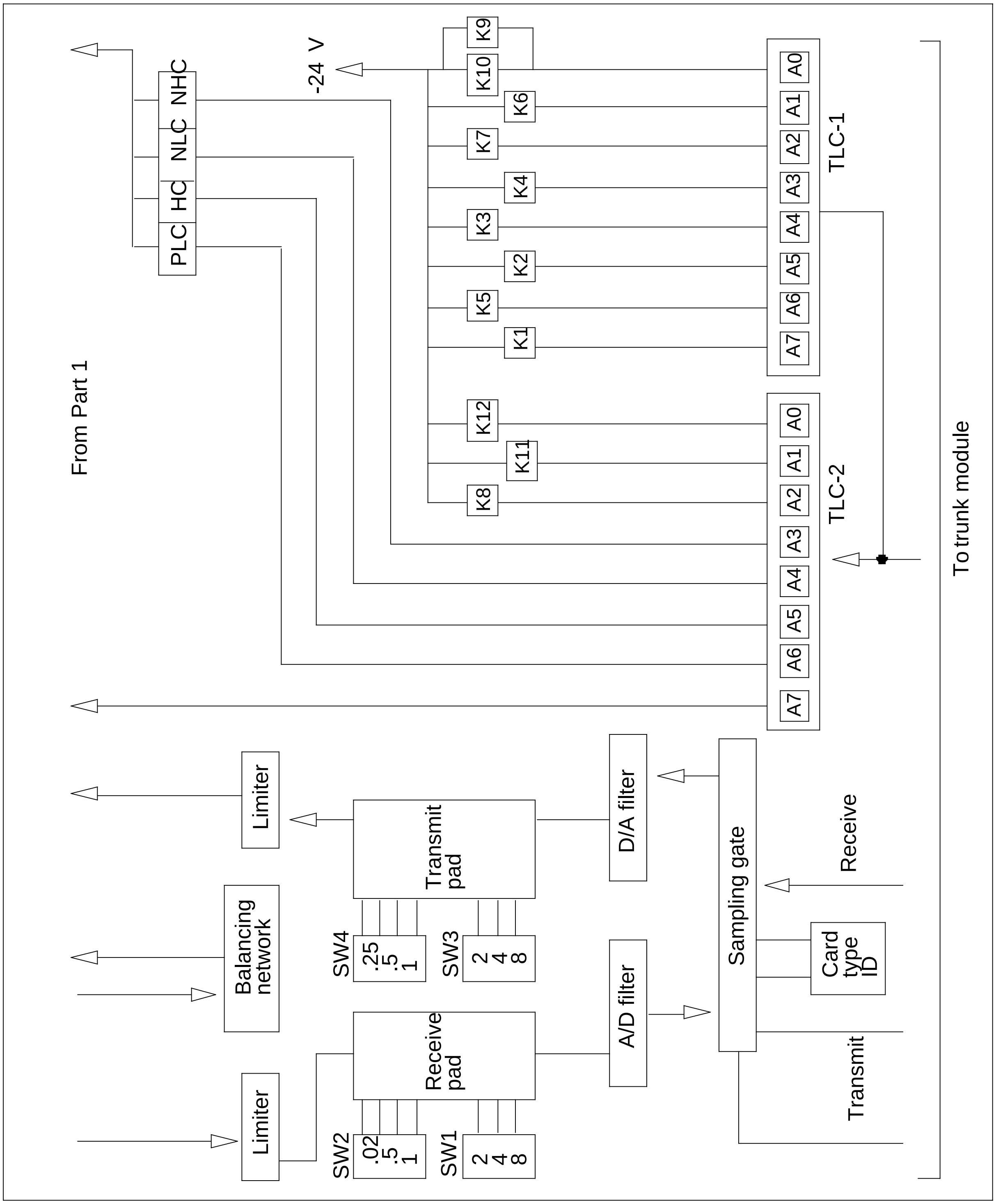
The NT2X90AD circuit card appears in the next figure.

NT2X90AD circuit card (Part 1 of 2)



NT2X90AD (continued)

NT2X90AD circuit card (Part 2 of 2)



Technical data

The technical data section provides specifications for

- power requirements
- signaling characteristics
- DP range characteristics
- loop option
- equipment dimensions
- facility cable characteristics
- transmission specifications
- balance plug-in network options
- environmental conditions

Power requirements

The NT2X90AD power requirements appear in the next table.

Power requirements

Requirements	Value
Power use (for each idle trunk circuit)	500 mW (normal)
Converted voltages	+12 ±0.3 V -15 ±0.5 V +22.8 to 27.0 (24.0 V nominal)

Signaling characteristics

The NT2X90AD signaling characteristics appear in the next table.

Signaling characteristics (Sheet 1 of 2)

Characteristics	Value
Talk battery	-42.75 V to -55.8 V
Normal range (float charge)	-49.0 V to -53.5 V
Maximum discharge (no charge)	-42.75 V
Maximum charge (equalizing)	-55.8 V

NT2X90AD (continued)

Signaling characteristics (Sheet 2 of 2)

Characteristics	Value
Insulation resistance (T and R)	30 Ω (minimum)
Insulation resistance (sleeve lead)	60 Ω (maximum)
Ground potential (sleeve lead)	±3 V
Ground potential (reverse battery)	±10 V
60-Hz longitudinal induction	40.0 mA
Supervision range	0 to 4.5 kΩ (maximum external loop resistance)

Dial pulse range and loop option

The NT2X90AD DP characteristics appear in the next table.

Dial pulse range

Characteristic	Value
DP short loop	0 to 2.0 kΩ (maximum external loop resistance)
DP long loop	2.0 kΩ to 4.5 kΩ (maximum external loop resistance)

The NT2X90AD short and long loop option information appear in the next table.

Short and long loop options

Characteristic	Value
Maximum non operate current (short loop option)	7.0 mA
Minimum non operate current (short loop option)	13.0 mA
Maximum non operate current (long loop option)	2.6 mA
Minimum non operate current (long loop option)	7.8 mA

Equipment dimensions

The NT2X90AD dimensions are 353 mm (9 inches) in height, 29 mm (1.125 inches) in width, and 267 mm (10.5 inches) in depth. The approximate weight of the NT2X90AD is 1.36 kg (3 lb).

Facility cable characteristics

The facility cable characteristics for non-loaded cable are a maximum of 22.87 m (900 feet) for 19, 22, 24, or 26 ga NL.

Transmission specifications

The NT2X90AD transmission specifications appear in the following table.

Transmission specifications

Characteristics	Value
Input impedance	900 Ω + 2.15 uF
Maximum transmit level with switches S3 and S4 set to OUT	+6 dBm nominal for digital test sequence (DTS) output. Refer to Note 1
Maximum receive level with switches S1 and S2 set to OUT	-9 dBm nominal for DTS input. Refer to Note 1
Receive level range	+6 dBm to -9 dBm for DTS output. Refer to Note 2
Transmit level range	-9 dBm to +6 dBm for DTS output (See Note 2)
Balance network plug-in options	
H88 loaded cable	NT2X80AA
Compromise Network + NBOC +	NT2X77AA
NBOR	
Compromise Network + NBOC	NT2X77AC

Note 1: The levels refer to the levels at the T/R of the circuit card.

Note 2: The amount of usable gain depends on the return loss that can be achieved in a specified transmission facility.

NT2X90AD (end)

Balance network

The NT2X90AD transmission specifications appear in the next table.

Balance network plug-in options

Characteristics	Value
H88 loaded cable	NT2X80AA
Compromise Network + network build-out capacitance (NBOC) + network build-out resistance (NBOR)	NT2X77AA
Compromise Network + NBOC	NT2X77AC

Environmental conditions

The NT2X90AD performs under limited environmental restrictions. A description of these restrictions appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10°C to 30°C (50°F to 86°F)	5°C to 49°C (41°F to 120.2°F)
Relative humidity	20% to 55%	20% to 80%

Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the expected relative humidity is 30% maximum.

NT2X96AA

Product description

The PCM (Pulse Code Modulation) Level Meter card (PLM) (NT2X96AA) contains circuits for measuring the level and frequency of PCM samples representing analog voice frequencies (VF) or tones. The PLM is used as part of the maintenance test facilities for the DMS-100 family of digital switching systems. The international version of NT2X96AA is NT2X96BA.

Location

The PLM card occupies one card position in the Maintenance Trunk Module (MTM) and connects to one trunk.

Functional description

The PLM card contains a level meter and a frequency meter which are activated by control signals from the MTM at the appropriate time for the channel under test. Communication between the MTM and the PLM card is accomplished via the receive data (RDAT), transmit data (XDAT) and maintenance (MAINT) busses. Control data on the RDAT bus is applied to the TLC which provides an interface between the MTM and the PLM card circuits. The TLC controls the card through eight signal distribution (SD) points, comprising an eight-bit code.

Results data from the test circuits are made available to the MTM during channel times 0 and 16, via the TLC and the XDAT bus. The availability of data is controlled by DMS software and through the SD points of the TLC.

VF signals are also present on the RDAT bus as Pulse Code Modulated (PCM) speech samples. Both control and PCM signals are in DMS format consisting of 32 channels per frame, with 10 bits per channel.

PLM test functions

The PLM test functions are grouped into two sections, a level meter section and a frequency meter section.

PCM speech samples which are applied to either of the test functions are selected from four busses: RDAT, MAINT BUS A, MAINT BUS B, and XDAT. For maintenance testing of the PLM itself, a constant input of +5 volts or ground can be selected. The results should be -88.8 dB and +6.0 dB respectively. Selection is performed by DMS software, acting via SD points of the TLC and a 8:1 multiplexor.

After selection, PCM samples in serial data form enter the serial to parallel converter and are applied as parallel data to the level and frequency meter sections of the PLM card.

NT2X96AA (continued)

Level Meter section

PCM samples in parallel data form address a ROM which gives an output consisting of a mantissa and an exponent representing the floating-point (FP) power equivilant of the PCM sample.

Frequency Meter section

The frequency circuit receives a PCM parallel data sample and compares it with a fixed theshold value. This has the effect of improving the noise immunity of the frequency meter. The PCM data from the threshold comparator, plus a signal from the sign comparator are applied to the frequency accumulator.

The results are stored in a buffer and made available to the MTM XDAT bus, via the TLC scan points, when the appropriate SD code is present. The integration time is controlled via delay and counter circuits by the hard-wired setting used for the level meter integration time.

Functional features

Functional features of the NT2X96AA PLM card are:

- receives VF signals in PCM format via the MTM
- level meter (+6 to -88.8 dBm)
- frequency meter (0 to 4 kHz)
- noise immunity circuits ensure low noise rejection on the frequency meter
- 104 test line function (in connection with the TSG)

Technical data

Electrical specifications

The power requirements of the NT2X96AA card are:

- Voltage +5V
- Current 1.2A

Level Meter specifications

The Level Meter specifications are:

(Sheet 1 of 2)

Specification	Value
Level measurement range	+6 to -88.8 dBm
Accuracy - better than	±0.1 dBm

NT2X96AA (end)

(Sheet 2 of 2)

Specification	Value
Frequency range	0 to 4 kHz
Integration time	64 ms

Frequency Meter specifications

The Frequency Meter specifications are:

Specification	Value
Frequency range	0 to 4 kHz
Integration time	62.5 ms
Accuracy (62.5 ms measurement)	±16 Hz
Threshold level	-30 dBm

Equipment Dimensions

The dimensions of the NT2X96AA card are:

Height	Depth	Weight
12.5 in.	10.0 in.	3.5 lb.
317.5 mm	254.0 mm	1.6 kg

Environmental conditions

The NT2X96AA card is designed for the following conditions:

	Temperature	Humidity
Operating range	10°C to 30°C	20 to 55%
Short-term range	5°C to 49°C	20 to 80%

NT2X96BA

Product description

NT2X96BA - refer to NT2X96AA.

2 NT3Xnnaa

NT3X02AA through NT3X95BB

NT3X02AA

Product description

The NT3X02AA Traffic Operator Position System (TOPS) control processor card is a four-port input/output (I/O) controller. The card handles duplex communication to four TOPS terminals at the same time.

The control processor of the card works with an NT3X03 digital signal processor to transfer data. You can use the control processor in a stand-alone mode. To use the stand-alone option, connect the RS-232-compatible modems or terminals to the NT3X02AA 4-channel RS-232 interface.

Location

The card plugs into one slot in a maintenance trunk module (MTM) beside the NT3X03.

Functional description

The NT3X02AA uses control and enable signals to transfer data. The signals transfer data between the DMS central control (CC) and any of the four TOPS terminals. Circuits provide trunk channel detection and generate receive and transmit baud rates.

Functional blocks

The NT3X02AA contains the following functional blocks:

- buffer
- microprocessor
- memory circuits
- memory mapper circuit
- control and timing circuit
- the MTM data interface circuit
- the RS-232 interface circuit
- the NT3X03 circuit card
- loopback and interface select circuit
- transmit baud rate select and universal asynchronous receiver/transmitter (UART) circuit

Buffer

The buffer receives a 2.56-MHz clock signal from the MTM for card timing. The buffer accepts the receive data (RDAT) signal and sends the signal to the following:

- the control and timing circuit
- the MTM data interface circuit
- the microprocessor

Microprocessor

The microprocessor controls the transfer of information between the CC and any of four peripherals. The microprocessor sends all outgoing addresses and data on buffered lines.

The microprocessor receives data change signals from the MTM data interface card. The microprocessor has 62.5 µs to read the channel 16 control data register of the trunk and save the contents before the system overwrites the register.

Memory circuits

The memory circuit contains an 8-kbyte erasable programmable read-only memory (EPROM) and a 4-kbyte random access memory (RAM). These memories hold the card commands and instructions. You can address the memory in absolute or relative terms with the use the memory mapper.

Memory mapper circuit

The memory mapper circuit sends possible addressing modes to the microprocessor. The circuit provides the microprocessor with three possible fixed addressing modes. The state of address bits 12 and 13 determines the addressing mode. The following table describes these modes.

Addressing modes

A13	A12	Addressing mode
0	0 or 1	absolute
1	0	peripheral relative
1	1	channel relative

Absolute addressing transfers microprocessor address bits 9 and 10. The microprocessor views memory, peripherals, and trunk channels as the microprocessor does in the absence of the mapper. Relative addressing allows

NT3X02AA (continued)

the microprocessor the ability to view the four peripheral ports and the four MTM trunk communication channels separately.

Control and timing circuit

The control and timing circuit uses the clock signal, the RDAT signal, and four enable signals to perform the following actions:

- detect trunk channel presence
- determine the address
- differentiate MTM control channels from the PCM channels

The circuit generates control signals for the transmission and reception of data to and from the MTM. The circuit also generates 300 baud and 1200 baud rate clocks for data transmission and reception.

The MTM data interface circuit

The MTM data interface circuit transmits data on the transmit data (XDAT) line and receives data from the RDAT bus. The circuit transmits data and receives data when the control and timing circuit determines. A four-word register file, which the microprocessor controls, stores the data for transmission to the MTM. Each word contains data different for each of the four trunk communication channels.

The RS-232 interface circuit

The RS-232 interface circuit allows modems or terminals to connect to the four independent I/O controller ports. The system selects this interface if the NT3X03 circuit card is not present.

The NT3X03 circuit card

The NT3X03 circuit card uses the PCM network to connect four I/O controller ports to RS-232-compatible terminals or modems.

Loopback and interface select circuit

The loopback and interface select circuit allows card diagnostics for each port. The circuit permits each UART output to loop back to the associates input.

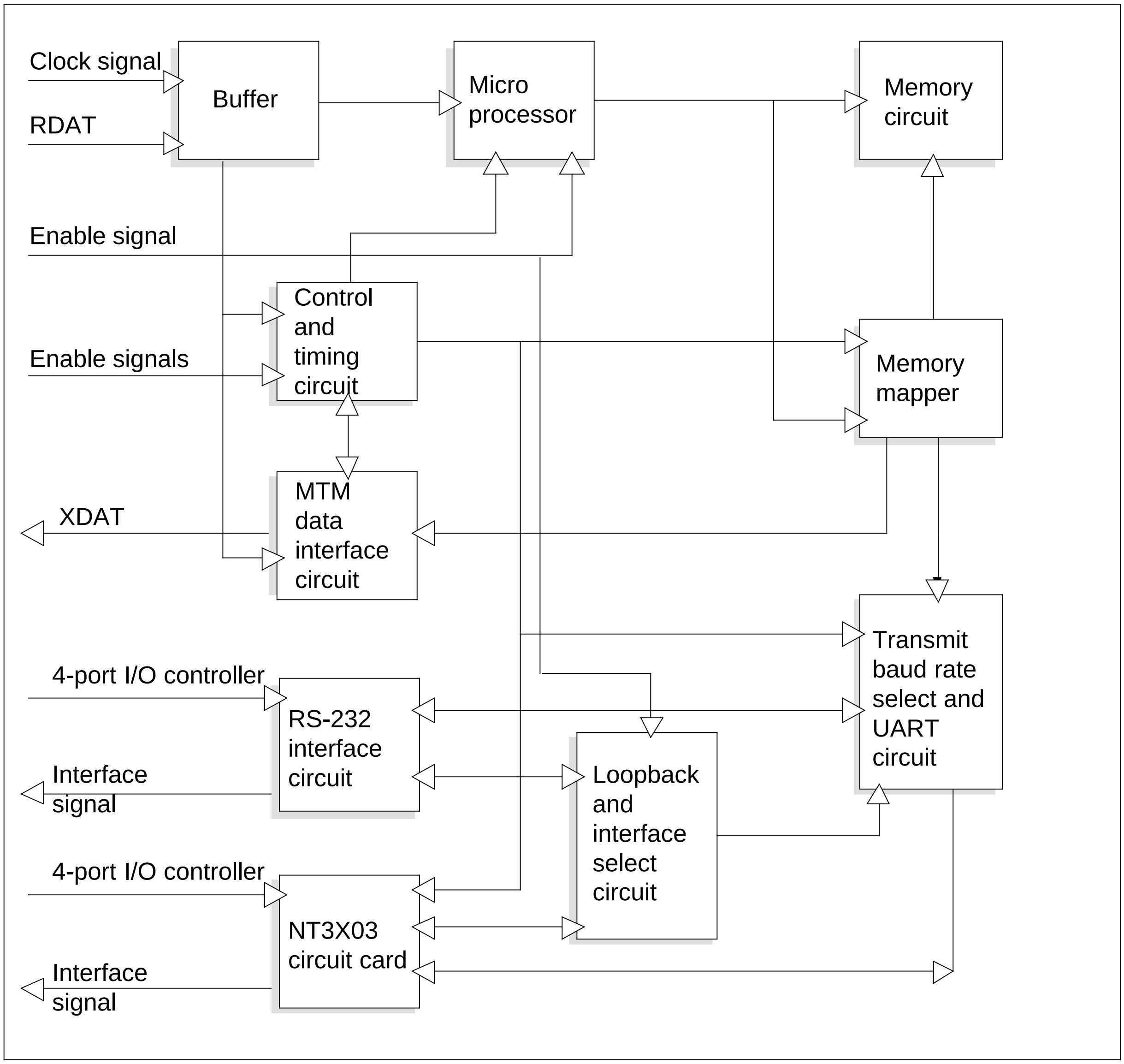
Transmit baud rate select and UART circuit

The transmit baud rate select and UART circuit synchronizes the UART output and the NT3X03 tone generator. Selection of transmit baud rates of 300 and 1200 can occur for each port. The receiver baud rate is constant at 300. To use a bit-rate multiplier, the 2.56-MHz MTM clock signal generates the baud rate clock.

The following diagram shows the relationship between the functional blocks.

NT3X02AA (continued)

NT3X02AA functional blocks



Technical data

The NT3X02AA has a receive baud rate of 300 and a transmit baud rate of 300 or 1200.

NT3X02AA (end)

Dimensions

The dimensions of the NT3X02AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 280 mm (11.0 in.)
- width: 28 mm (1.1 in.)

Power requirements

The power requirements for the NT3X02AA appear in the following table..

Power requirements

Voltage	Current
+5 V	1.5 A
+12 V	16.0 mA
-12 V	10.0 mA

NT3X03

Product description

The NT3X03 Traffic Operator Position System (TOPS) digital signal processor is a four-port digital interface. The interface allows the NT3X02AA TOPS control processor to handle duplex communications at the same time. The NT3X02AA handles communications to four remote TOPS terminals through the trunk module (TM) or digital carrier module (DCM) to digital channel bank trunks.

The primary use features for the NT3X03 are as follows:

- four channels incoming and four channels outgoing
- four receive configurations and four transmit configurations
- loopback for each port
- programmable frequency b/s configuration and loopback by the NT3X02 as the Digital Multiplex System (DMS) central control (CC) specifies.

Location

The NT3X03is in the maintenance trunk module (MTM).

Functional description

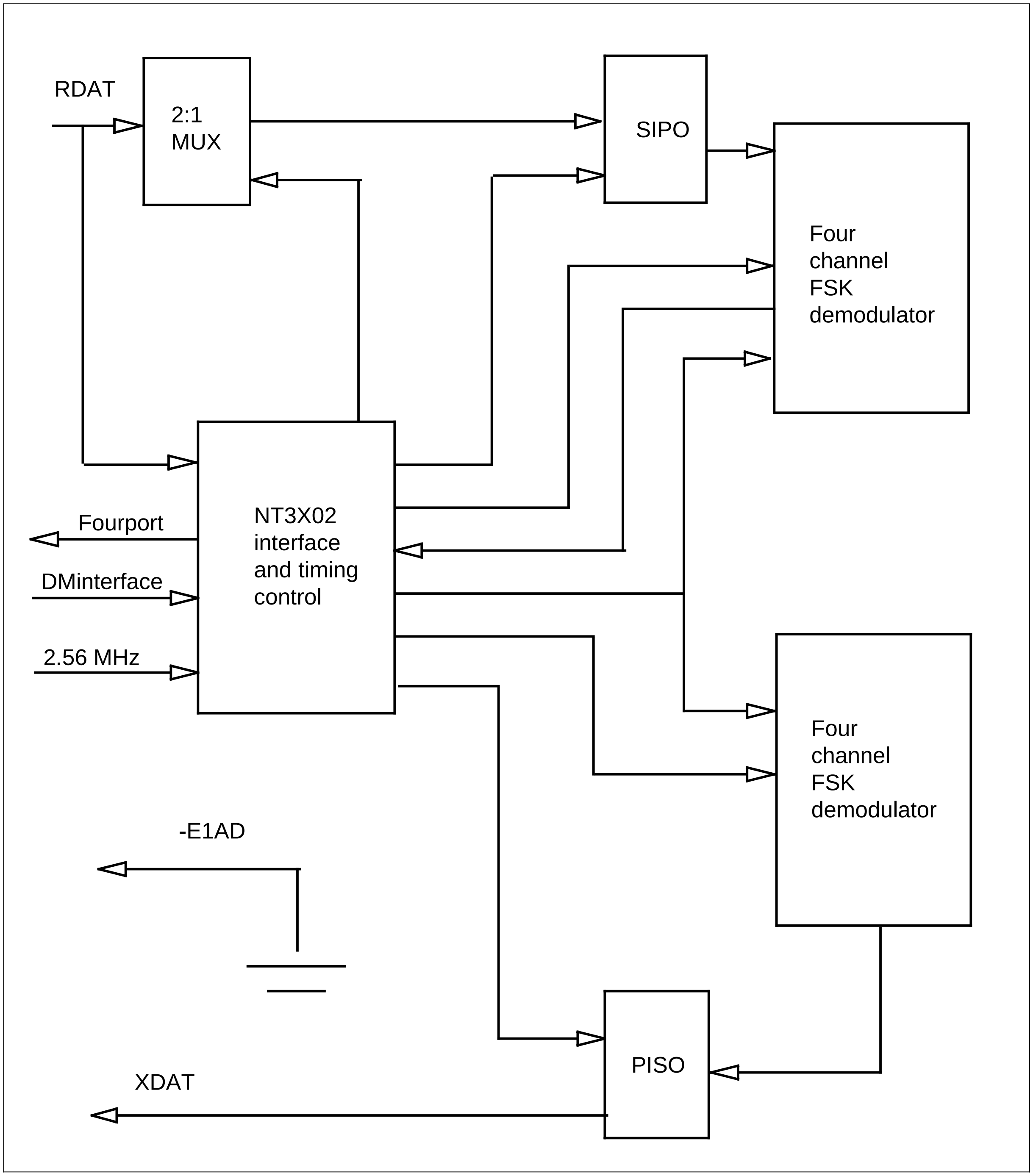
The digital modem (DM) and TOPS positions use a DMS digital network path for communications. The position can connect locally to TM trunks, or at a distance through the DCM to digital channel bank trunks. The DM communication ports can sectionalize to the different elements of the system because communication occurs through the digital network. Elements of the system include: the DM, MTM, and DCM.

Communications between the DM and the CC occurs over signaling changes zero and 16 for every input/output (I/O) port. The CC views each port as a separate I/O terminal. The only common feature in communications is the hardware reset. The hardware reset affects all channels. A hardware reset must occur when DM initialization is in progress or the DM stops communications with the CC.

The relationship between the functional blocks for the NT3X03 appears in the following diagram.

NT3X03 (continued)

NT3X03 functional blocks for digital signal processor



Technical data

This section provides technical specifications for the NT3X03. These specifications include:

- power requirements
- equipment dimensions
- environmental conditions
- transmit configuration specifications
- transmission rates
- receive frequency ranges
- carrier frequency ranges

Power requirements

The NT3X03 requirements appear in the following table.

Power requirements

Voltages required	+5 V
Current required	1 A

Equipment dimensions

The digital signal processor is 353 mm (13.9 in.) high, 28 mm (1.1 in.) wide, and 280 mm (11 in.) deep. The approximate weight is 0.59 kg (1.3 lb).

Environmental conditions

The following table details how environmental limits affect the NT3X03 performance.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10 °C to 30 °C (50 °F to 86 °F)	5 °C to 49 °C (41 °F to 120.2 °F)
Relative humidity	20% to 55%	20% to 80%
Note: A relative humidity of 80% is expected at a maximum ambient temperature of 21°C (69.8°F). A relative humidity of a maximum of 30% is expected at an ambient temperature of 49°C (120.2°F).		

NT3X03 (continued)

Transmit configuration specifications

The following table lists the specifications for the four NT3X03 transmit configurations.

Transmit configuration specifications>

Configuration	Specifications
1. 1070 Hz, 1270 Hz	loopback test at 300 b/s of 100 series modem-type receiver frequencies
2. 2025 Hz, 2225 Hz	normal TOPS terminal 300 b/s frequencies
3. 1200 Hz, 2200 Hz	normal TOPS teletypewriter (TTY) 1200 b/s frequencies
4. 1200 Hz, 2200 Hz	loopback test at 300 b/s of 202 series modem-type frequencies

Receive configuration specifications

The following table lists the specifications for the four NT3X03_ receive configurations.

Receive configuration specifications

Configuration	Specification
1. 1070 Hz, 1270 Hz	normal TOPS terminal 300 b/s frequencies
2. 2025 Hz, 2225 Hz	loopback tests at 300 b/s of 100 series modem-type transmitter frequencies
3. 1200 Hz, 2200 Hz	detection of carrier presence from TOPS TTY
4. 1200 Hz, 2200 Hz	loopback tests at 300 b/s of 202 series modem-type frequencies

Transmission rates

TheNT3X03 requirements for transmission rates are 300 b/s or 1200 b/s and the receive rates are 300 b/s.

Receive frequency ranges

The following table lists the receive frequency rates for the NT3X03.

Receive frequency ranges

Rate	Level (minimum)	Range (Hz)
300 b/s (low band)		
Valid 0 (space) 1070 Hz	-30 dBm	954 - 1144
Transitioning		1144 - 1177
Valid 1 (mark) 1270 Hz	-30 dBm	1177 - 3612
1200 b/s		
Valid 0 (space) 1200 Hz	-30 dBm	954 - 1642
Transitioning		1642 - 1734
Valid 1 (mark) 2200 Hz	-30 dBm	1734 - 3612
300 b/s (high band)		
Valid 0 (space) 2025 Hz	-20 dBm	954 - 2031
Transitioning		2031 - 2174
Valid 1 (mark) 2223 Hz	-25 dBm	2174 - 3612

Carrier frequency ranges

The following table lists the requirements for the NT3X03 carrier frequency.

Carrier frequency ranges

Carrier	Frequency (Hz)
Invalid	< 945
Transitional	945 - 954
Valid	954 - 3612
Transitional	3612 - 3618
Invalid	> 3618

NT3X04AA

Product description

The NT3X04AA incoming test trunk is for AECO local test board interfaces cards. This trunk is a bidirectional interface between an automatic electric (AE) 31-type test desk and DMS-100 subscriber lines.

Location

The card occupies two trunk circuits in a trunk module (TM).

Functional description

The NT3X04AA card uses a trunk logic circuit (TLC) and common buses to transmit control and data signals between the TM and the test desk. The test desk can seize the incoming test trunk and request a metal connection to a subscriber line with a bridge. The test desk also can out access when the desk applies dc conditions to the operate leads. A busy tone and dc conditions on the operate leads indicate that a connection cannot occur.

Signaling, supervisory and voice frequency circuit checks use TEST + and TEST - lead connections. If a test connection is available, the leads are connected to toll tandem (TT) and TR and to a metallic test access at the main distribution frame. When an idle state occurs, the switching network connects to the leads.

Transmission and signaling interfaces can test the trunk circuit separately.

Technical data

The NT3X04AA card has a transmit level adjustment range of 0 to 15.75 dB in 0.25-dB increments. The following manually set switches establish the transmission range.

Manually set switches

Switch	Segment	Designation (dB nominal value)
S1	A	0.25
	B	0.50
	C	1.00
S2	A	2.00
	B	4.00
	C	8.00

NT3X04AA (continued)

The following table lists the characteristics of the positive and negative test leads.

Positive and negative test lead characteristics

Characteristics	Value
Impedance	
ac (300 to 3400 Hz)	900 Ω+ 2 μF
dc	2 MΩminimum
Frequency response (relative to 1000 Hz)	
250 Hz	-1.0 to +2.0 dB
300 to 3000 Hz	-1.0 to +1.0 dB
3400 Hz	0.0 to +2.0 dB
Balance to ground (longitudinal balance)	
200 Hz	70 dB
1000 Hz	70 dB
3000 Hz	65 dB
C-message noise	20 dBrnC maximum
Echo return loss	25 dB minimum
Singing return loss	25 dB minimum
Maximum resistance of connection TEST + to TT, TEST - to TR	2Ω
Impedance between TEST + and TEST -, TEST + and ground, TEST - and ground when connected to TT, TR	2 MΩ minimum

The following table lists the characteristics of the positive and negative operating leads.

Positive and negative operating lead characteristics> (Sheet 1 of 2)

Characteristic	Value
Battery voltage	-42.5 to -55.8 V

NT3X04AA (end)

Positive and negative operating lead characteristics> (Sheet 2 of 2)

Characteristic	Value
External loop resistance	2800 Ω, maximum
Detector impedance	
+OPER to ground	200 Ω
-OPER to battery	200 Ω\

Dimensions

The dimensions of the NT3X04AA card are as follows:

- height: 353 mm (13.9 in.)
- depth: 280 mm (11.0 in.)
- width: 28 mm (1.1 in.)

Power requirements

DANGER
Damage to equipment or loss of service
Use telephone wiring that a Nortel Networks protector, catalog number 303M-12AIKE, protects. Use this protection with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in the series with the protector is 26 AWG.

The power requirements for the NT3X04AA appear in the following table.

Power requirements

Voltage	Current
-48 V	600 mA
+24 V	350 mA
-15 V	25 mA
+13 V	25 mA

NT3X05AA

Product description

The NT3X05AA digital data line card (DDLC) connects a four-wire facility, which is not conditioned, with a subscriber terminal or DATAROUTE facility. Use this card with a voice line card to provide the six-wire interface required by the circuit switched digital data service (CSDDS). The CSDDS is a data transmission system that operates with the DMS-100 digital voice network.

Location

The NT3X05AA card occupies one position in a maintenance trunk module (MTM) and requires one trunk appearance. One MTM can hold a maximum of 12 cards.

Functional description

The NT3X05AA receives data from the digital switching network and performs a looping process to provide the six-wire interface the CSDDS requires. The looping process uses a loop interface, interface control, and a network interface.

Functional blocks

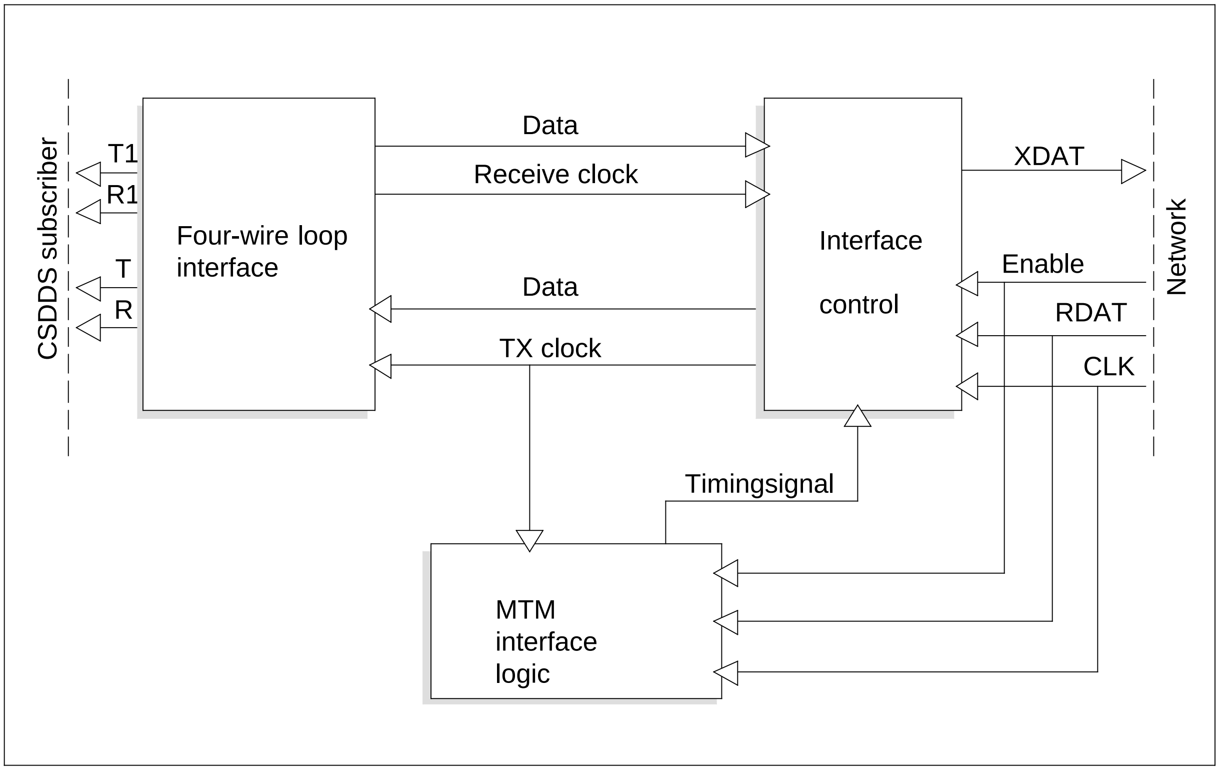
The NT3X05AA contains the following functional blocks:

- the MTM interface logic
- interface control

four-wire loop interface

NT3X05AA (continued)

NT3X05AA functional blocks



MTM interface logic

The MTM interface logic controls communication between the NT3X05AA and the MTM with four control lines:

- the receive data (RDAT) line
- the transmit data (XDAT) line
- one enable line
- one bus clock line.

Under control of the enable line, the RDAT line receives data from the MTM at a rate of 2.56 Mbps. The MTM interface logic examines this data to determine if the data is a control message or subscriber data signaling message. The XDAT line transfers the control message or subscriber data back to the MTM under control of the enable line. The bus clock line provides timing to make sure synchronization occurs between the DMS office and the subscriber facility.

Interface control

The interface control regulates the signaling and data transfer between the digital switching network and the DDLC. The interface control contains two main sections. The two main sections are a loop-to-network controller (LNC) and a network-to-loop controller (NLC).

The LNC receives data from the subscriber loop and checks the data for signaling or suppression code errors. If the LNC does not find any errors, the LNC processes the data and sends the data to the network. If the LNC detects errors, the LNC sends a command to the NLC. This command requests that the system send an update to the local subscriber terminal.

The NLC communicates with the central controller (CC) in the digital switch to receive subscriber and loop status and perform maintenance tests. The NLC monitors data from the network to determine if the information is data or signaling. The NLC transmits the result to the subscriber loop. The NLC polls the DDLC for the subscriber interface status and the loop state.

For maintenance, the NLC generates and sends a 511-bit word to the subscriber loop. If a loopback is already present, the same 511-bit word is returned to the NLC. The NLC compares the received data to the transmitted data. An error counter begins when the NLC detects an error.

Four-wire loop interface

The four-wire loop interface contains two main sections. These two main sections are the line receiver and the line driver. A transformer isolates these sections from the subscriber loop. The line receiver accepts data in bipolar signals from the subscriber loop. This receiver converts the signals to transistor-transistor logic-compatible (TTL) data pulses. The line driver performs conversion of TTL data pulses to bipolar signals and transmits them to the subscriber loop.

The line receiver contains a fixed equalizer circuit to provide a constant frequency response. This response compensates for distortion in maximum length transmission facilities. The line driver contains attenuator pads and a low-pass filter to make sure that bipolar signals conform to transmit-metallic specifications.

Technical data

The NT3X05AA provides duplex synchronous data transmission at 2.4, 4.8, and 9.6 kbps, and has an impedance of 135 Ω.

NT3X05AA (end)

Dimensions

The dimensions for the NT3X05AA circuit card are as follows:

- height: 31.75 cm (12.5 in.)
- depth: 25.4 cm (10 in.)

Power requirements

Connectors in the MTM satisfy the power requirements for the NT3X05AA. The following table lists the power requirements for the NT3X05AA.

Power requirement

Voltage	Current	Power
+5 V	1 A	5 W
- 5 V	10 mA	50 mW
+ 12 V	60 mA	.72 W
-15 V	60 mA	.9 W

NT3X06AA

Product description

The NT3X06AA provides an outgoing voice and signaling interface between a DMS-100 trunk module (TM) and an operator. The operator is at a Nortel Networks 3C, 3CL automatic electric (AE) 30 or 31 switchboard in the same building.

The card handles coin and flat-rate traffic.

Location

The card occupies one card position in a four-wire or an eight-wire TM.

Functional description

The NT3X06AA performs the following actions:

- exchange of control messages with the TM
- transmission of near-end signaling to the far end
- reception of far-end signaling
- processing of voice frequency (VF) information

The NT3X06AA receives the VF information, converts the information to pulse amplitude modulation (PAM) signals. The NT3X06AA sends the information to the TM for further processing. The NT3X06AA receives the PAM signals from the TM. The NT3X06AA converts the PAM signals to VF signals, and sends the signals over the tip (T) and ring (R) leads.

Functional blocks

The NT3X06AA contains the following functional blocks:

- trunk logic circuits (TLC)
- sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- two-wire to four-wire terminating set
- balance network
- build-out capacitors

NT3X06AA (continued)

- coin collect detector
- coin return detector
- re-ring detector
- ground detector
- sleeve detector
- AND gate
- relays (four)
- switches (three)
- card type identifier

TLC

Two TLCs, TLC-0 and TLC-1 handle communication between the card and the TM. The TLCs are communication buffers between the TM and the card and generate sampling pulses for the sampling gate. The TLC-1 also controls the P pad, the loop detector, the polarity detector, and the relays.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The gate sends the signals over the transmit-PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive PAM (RPAM) bus back into VF signals. The gate sends the signals over the T and R leads.

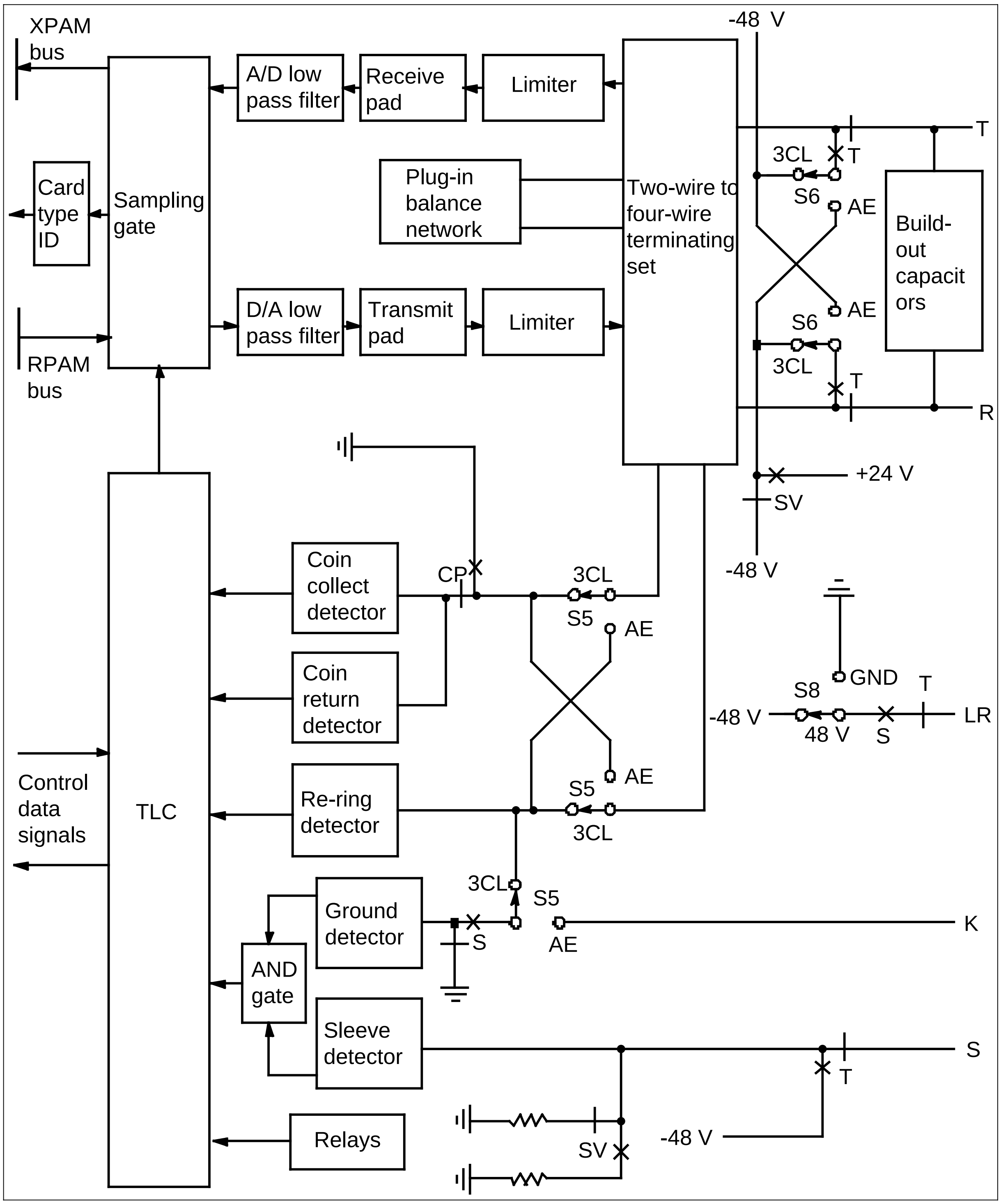
A/D low-pass filter

The A/D filter accepts VF signals from the receive pads and filters the signal to limit the bandwidth. The filter sends the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate and filters the signal to limit the bandwidth. The filter sends the signal to the transmit pads. The filter amplifies the signal.

NT3X06AA functional blocks



NT3X06AA (continued)

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment to the level of the VF signal. This adjustment occurs before the card converts the signal to digital form and processes the signal. These adjustments occur in 0.25-dB increments. Adjustments to different groups of miniature switches achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The circuit includes a 60-Hz high-pass filter to remove line noise.

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.7 dB of adjustment to the level of the VF signal sent over the trunk. These adjustments occur in 0.25-dB increments. Adjustments to different groups of miniature switches achieve the correct level.

The transmit level adjustments appear in the following table.

Transmit level adjustments (Sheet 1 of 2)

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00

Transmit level adjustments (Sheet 2 of 2)

Switch position	Adjustment (dB)
S4, position 2	0.50
S4, position 1	0.25

Limiters

A received or a transmitted signal can overload the circuit. Two limiters are available to prevent an overload. One limiter is for the receive direction and the second limiter is for the transmit direction.

Two-wire to four-wire terminating set

The terminating set converts the internal four-wire circuit into a two-wire circuit for connection to a two-wire analog transmission facility.

Balance network

A balance network connects to the two-wire to four-wire terminating set to match the card with a 600-Ω non-loaded facility. The compromise network provides 600 Ω of resistance and 2.15 μF of capacitance.

The balance network plug-in options include the following:

- the NT2X80AA (for H88 loaded cable)
- the NT2X77AA (compromise network, network build-out capacitance, and network build-out resistance)
- the NT2X77AC (compromise network and network build-out capacitance).

The loaded and non-loaded cables can be 19, 22, 24, or 26 gauge. The non-loaded cable can have a maximum length of 2700 m (9000 ft).

Build-out capacitors

The drop build-out capacitors provide additional capacitance to balance the circuit. Selection of each capacitor uses sections of miniature switch S7.

Coin collect detector

The coin collect detector senses coin collect signals present on the T or R lead. The 3CL switchboards send coin collect signals over the R lead. The AE switchboards send the signals over the T lead. The S5 switch provides control over the lead that the detector uses. The TM receives the detector output through the TLC.

NT3X06AA (continued)

Coin return detector

The coin return detector senses coin return signals present on the T or R lead. The 3CL switchboards send coin return signals over the R lead. The AE switchboards send the signals over the T lead. The S5 switch provides control over the lead that the detector uses. The TM receives the detector output through the TLC.

Re-ring detector

The re-ring detector detects re-ring signals to call the operator on the T or R lead. The 3CL switchboards send re-ring signals over the T lead. The AE switchboards send the signals over the R lead. The S5 switch provides control over the lead that the detector uses. The TM receives the detector output through the TLC.

Ground detector

The ground detector senses a ground. This condition indicates that the switchboard plug was seated on the T or K lead. The 3CL switchboards send coin collect signals over the T lead. The AE switchboards send the signals over the K lead. The S5 switch provides control over the lead that the detector uses. The detector makes sure that an operator answer is not provided until the operator receives a class-of-service tone. The detector output goes to the AND gate.

Sleeve detector

The sleeve detector senses far-end signaling on the sleeve (S) lead. The detector output goes to the AND gate.

AND gate

The AND gate accepts the output of the ground detector and the sleeve detector. If the signals are present, the data passes through the TLC to the TM. The gate makes sure that signals on the S lead are not processed if the far-end switchboard plug is not seated (T or K lead grounded).

Relays

Four relays are provided for tests and near-end signaling. The purpose for each relay appears in the following table.

Relay operation

Relay	Operated	Released
T	Isolates the trunk circuit from the external transmission facilities. Loops the transmission and signaling paths that allows the system to test the circuit internally	Normal operation
SV	Change resistance on S lead to send off-hook signal to far end.	Change resistance on S lead to send on-hook signal to far end
CP	Coin collect and coin return detectors removed from circuit. Operated when flat-rate traffic on trunk.	Coin collect and coin return detectors included in circuit. Released when flat rate or coin traffic present (normal operation).
S	Place -48 V or ground (switch S8 selection) on LR lead to send off-hook signal to far end. Signal turns on far-end switchboard trunk lamp.	Leave LR lead open to send on-hook signal to far end

Switches

Switches include the transmit and receive pad switches, build-out capacitor switches, and three additional switches. These switches change different

NT3X06AA (continued)

signaling properties. The purpose of each switch appears in the following table.

Switch functions

Switch	Normal position	Switched position
S5	Card set for connection to 3CL switchboard. Coin collect and coin return signals on R lead, re-ring signals and switchboard ground on T lead.	Card set for connection to AE switchboard. Coin collect and coin return signals on T lead, re-ring signals on R lead, switchboard ground on K lead.
S6	Card set for connection to 3CL switchboard. The T and R leads connect normally.	Card set for connection to AE switchboard. The -48 V connected to T and R leads when test relay (T) operated.
S8	The -48-V switchboard trunk lamp control selected	Ground switchboard trunk lamp control selected

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The identifier checks that the card plugs into the TM card slot.

Technical data

The card provides an impedance of 600 Ω

The minimum receive level for the circuits is -9 dBm for digital test sequence (DTS) output, with a range of -9 to +6 dBm. The maximum transmit level is +6 dBm for DTS output, with a range of +6 to -9 dBm.

The signaling characteristics of the card appear in the following table.

Signaling characteristics (Sheet 1 of 2)

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V

Signaling characteristics (Sheet 2 of 2)

Characteristic	Value
Minimum insulation resistance	30 k Ω
Ground potential	±3 V
Maximum supervision range (3C or 3CL switchboard, lead S)	25 Ω
Maximum supervision range (AE30 or AE31 switchboard, lead S)	25 Ω
Maximum supervision range (AE30 or AE31 switchboard, lead K)	25 Ω

Dimensions

The dimensions for the NT3X06AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

DANGER
Damage to equipment or loss of service
Use telephone wiring that a Nortel Networks protector, catalog number 303M-12AIKE protects. Use this protection with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±0.3 V
- -15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 700 mW for an idle trunk circuit.

NT3X07AA

Product description

The NT3X07AA provides an incoming voice and signaling interface. The interface is between a DMS–100 trunk module (TM) and an operator. The operator is at a Nortel Networks 3C, 3CL automatic electric (AE) 30 or 31 switchboard. The switchboard is in the same building. The card handles flat–rate traffic only.

Each card has two trunk circuits.

Location

The card occupies one card position in an eight–wire trunk module (TM).

Functional description

The NT3X07AA performs the following action:

- communicates control messages with the TM
- transmits near–end signaling to the far end
- receives far–end signaling
- processes voice frequency (VF) information

The NT3X07AA feature receives the VF information and converts the information to pulse amplitude modulation (PAM) signals. The NT3X07AA feature sends the information to the TM for further processing. The TM sends the PAM signals, converted into VF signals, over the tip (T) and ring (R) leads.

Functional blocks

Each circuit in the NT3X07AA has the following functional blocks:

- trunk logic circuits (TLC)
- sampling gate
- analog–to–digital (A/D) low–pass filter
- digital–to–analog (D/A) low–pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- two–wire to four–wire terminating set
- balance network
- build–out capacitors

- re–ring detector
- sleeve detector
- relays (three)
- switches (two)
- card type identifier

TLC

Two TLCs, TLC–0 and TLC–1, handle communication between the card and the TM. The TLCs are communication buffers between the TM and the card and generate sampling pulses for the sampling gate. The TLC–1 controls the P pad, the loop detector, the polarity detector, and the relays.

Sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The gate sends the signals over the transmit–PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive–PAM (RPAM) bus back into VF signals. The gate sends the signals over the T and R leads.

A/D low–pass filter

The A/D filter accepts VF signals from the receive pads, filters the signal to limit the bandwidth, and passes the signal to the sampling gate. The filter amplifies the signal.

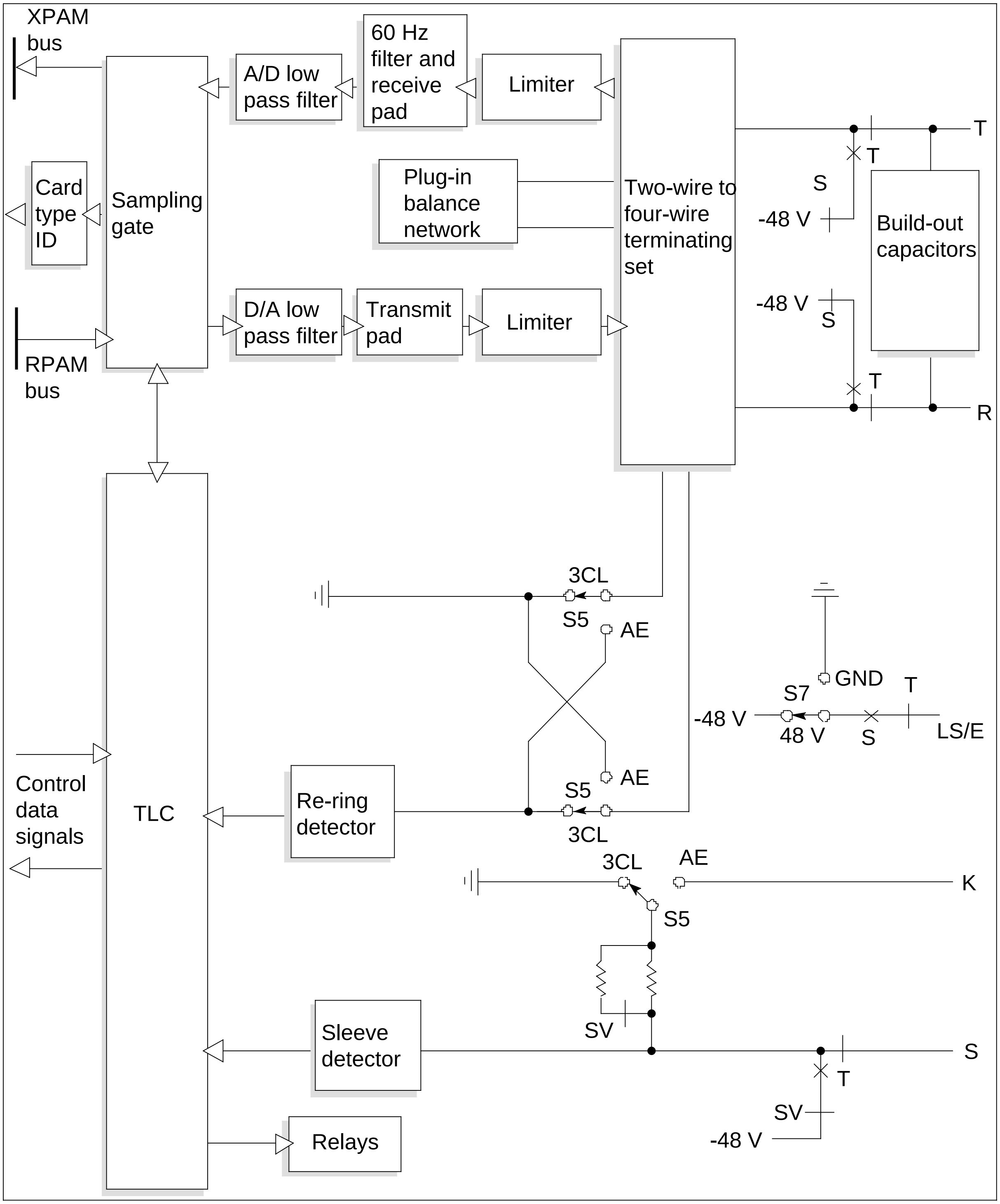
D/A low–pass filter

The D/A filter accepts VF signals from the sampling gate, filters the signal to limit the bandwidth, and passes the signal to the transmit pads. The filter amplifies the signal.

The relationship between the functional blocks appears in the following figure.

NT3X07AA (continued)

NT3X07AA functional blocks



Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment to the VF signal level before the card converts the signal to digital form. When the card converts the signal to digital form, the card processes the signal. The signal level adjustment occurs in .25 dB increments. To make the adjustments, set the groups of small switches to achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The circuit includes a 60 Hz high–pass filter to remove line noise.

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment to the level of the VF signal sent over the trunk. Adjustments occur in increments of 0.25 dB. To achieve the correct level, adjust the setting groups of miniature switches.

The transmit level adjustments appear in the following table.

Transmit level adjustments (Sheet 1 of 2)

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00

NT3X07AA (continued)

Transmit level adjustments (Sheet 2 of 2)

Switch position	Adjustment (dB)
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are available to prevent a received or a transmitted signal from causing the circuit to overload. One limiter each is available in the receive direction and the second limiter is available in the transmit direction.

Two–wire to four–wire terminating set

The terminating set converts the internal four–wire circuit to a two–wire circuit for connection to a two–wire analog transmission facility.

Balance network

A balance network connects to the two–wire to four–wire terminating set to match the card with a 600 Ω non–loaded facility. The compromise network provides 600 Ω of resistance and 2.15 µF of capacitance.

The balance network plug–in options include:

- NT2X77AA (for inter–office cable length of up to 2743 m, compromise network, network build–out capacitance, and network build–out resistance)
- NT2X77AD (for inter–office cable length of a maximum of 229 m, compromise network, and network build–out capacitance).

The non–loaded cables can be 19, 22, 24, or 26 gauge.

Build–out capacitors

The drop build–out capacitors provide additional capacitance to balance the circuit. Use sections of miniature switch S6 to select the separate capacitors.

Re–ring detector

The re–ring detector detects re–ring signals to recall the operator on the T or R lead. The 3CL switchboards send re–ring signals over the T lead. The AE switchboards send the signals over the R lead. The S5 switch provides control over the lead that the detector uses. The TM receives the detector output through the TLC.

Sleeve detector

The sleeve detector senses far–end signaling present on the sleeve (S) lead. The TM receives the detector output through the TLC.

Relays

Three relays are available for tests and near–end signaling. The name and purpose for each relay appear in the following table.

Relay operation

Relay	Operated	Released
T	Isolates the trunk circuit from the external transmission facilities. Loops the transmission and signaling paths. Allows the system to test the circuit internally	Normal operation
SV	Change resistance on S lead to send off–hook signal to far end	Change resistance on S lead to send on–hook signal to far end
S	off–hook signal sent to far end by placing –48 V or ground (switch S8 selection) on LS/E lead. Signal lights far–end switchboard trunk lamp.	Leave LS/E lead open to send on–hook signal

Switches

A number of switches change signaling properties. The properties include transmit and receive pad switches and the build–out capacitor switches. Two additional switches are available to change different signaling properties. The purpose of these two switches appear in the following table.

Switch functions

Switch	Normal position	Switched position
S5	Card set for connection to 3CL switchboard. Re–ring signals on T lead, K lead disconnected.	Card set for connection to AE switchboard. Re–ring signals on R lead, K lead connected.
S8	–48 V switchboard trunk lamp control selected	Ground switchboard trunk lamp control selected

NT3X07AA (continued)

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The identifier checks that the TM card slot has the card plugged in.

Technical data

The card provides an impedance of 600 Ω.

The minimum receive level for the circuits is –9 dBm for digital test sequence (DTS) output, with a range of –9 to +6 dBm. The maximum transmit level is +6 dBm for DTS output, with a range of +6 to –9 dBm.

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	–42.75 V to –55.8 V
Normal talk battery range (float charge)	–49 V to –53.5 V
Maximum talk battery discharge	–42.75 V
Maximum talk battery charge (equalizing)	–55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±3 V
Maximum supervision range (3C or 3CL switchboard, lead S)	25 Ω
Maximum supervision range (AE30 or AE31 switchboard, lead S)	25 Ω
Maximum supervision range (AE30 or AE31 switchboard, lead K)	25 Ω

Dimensions

The dimensions for the NT3X07AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT3X07AA (end)

Power requirements

> **DANGER**
> **Damage to equipment or loss of service**
> For use on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26–AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

> **CAUTION**
> **Damage to equipment or loss of service**
> For use on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26–AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12 V ±0.3 V
- –15 V ±0.5 V
- +22.8 V to +27 V (24 V nominal)

Power use is normally 700 mW for an idle trunk circuit.

NT3X08AA

Product description

The NT3X08AA digital tone transceiver card counts coin deposits from coin operated telephones (coin stations). The card reports the amount collected to the DMS–100 central control (CC).

The NT3X08AA operates as a component of the automatic coin toll system (ACTS). Each card supports eight ports.

Location

The card occupies one position in the maintenance trunk module (MTM). The MTM can support three NT3X08AA cards or 24 coin stations at the same time.

Functional description

The NT3X08AA identifies coin types through analysis of the on/off patterns of the coin–deposit tones. The NT3X08AA performs coin–collection calculations and sends the data to the CC.

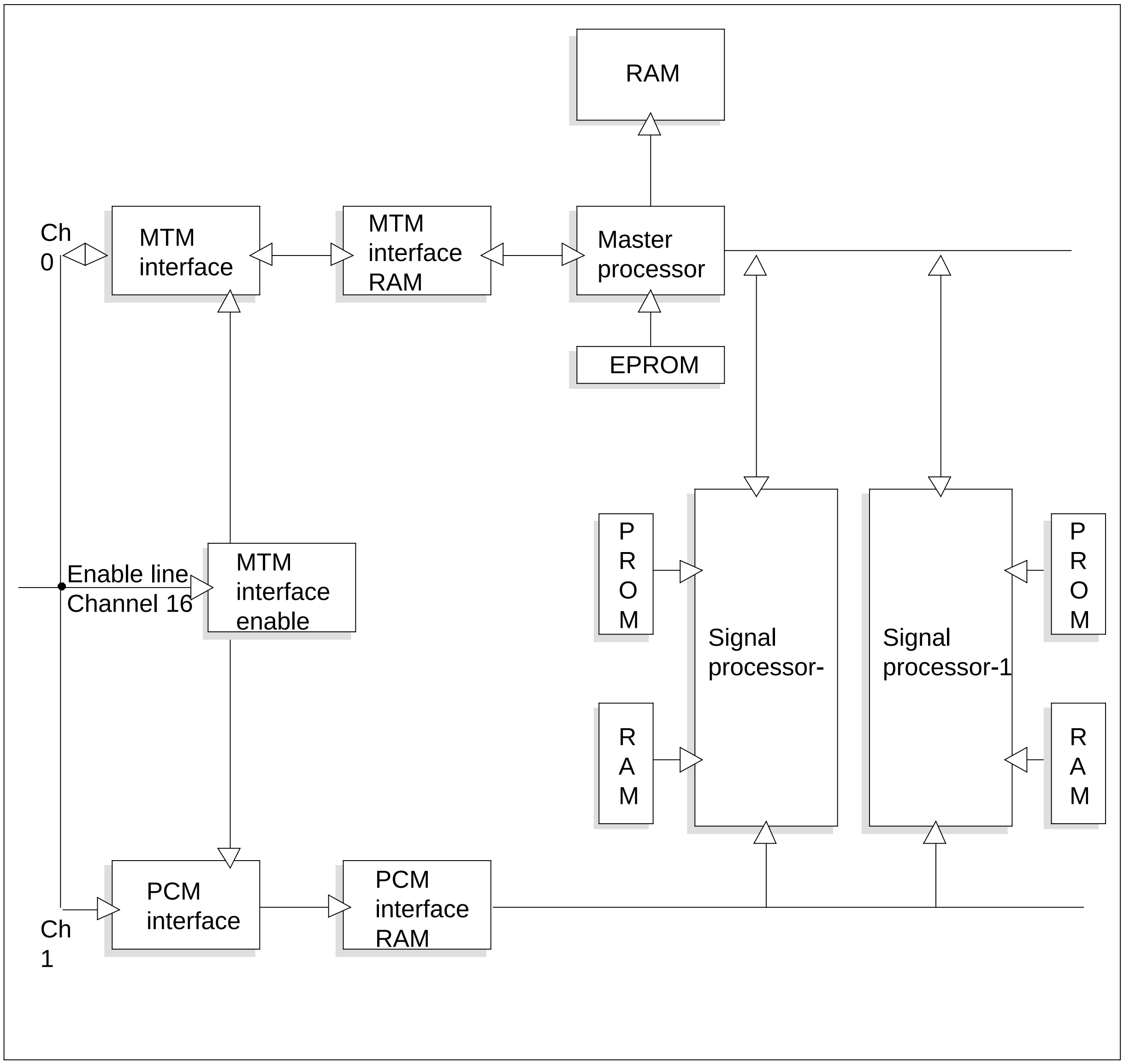
Functional blocks

The NT3X08AA consists of the following functional blocks:

- MTM interface enable
- MTM interface
- MTM interface RAM
- master processor
- pulse code modulation (PCM) interface
- the PCM interface random access memory (RAM)
- two signal processors
- erasable programmable read–only memory (EPROM) circuits
- two PROM circuits
- three RAM circuits

NT3X08AA (continued)

NT3X08AA functional blocks



MTM interface enable

The MTM interface enable activates the MTM interface or the PCM interface. A 4–µs enable pulse from channel 16 of a DS–30 frame regulates this decision. If an enable pulse is present, the MTM interface activates. If an enable pulse is not present, the PCM interface activates. This procedure allows the use of one serial data link for communication between the master processor and the CC. Communication occurs over channel 0 of a DS–30 frame. The signal processors can use the same serial link to receive PCM signals from coin stations. These signals transmit over the remaining channels.

NT3X08AA (continued)

MTM interface

The MTM interface enable activates the MTM interface. The MTM interface receives instructions for the master processor from the CC. The MTM interface sends messages from the master processor to the CC. The messages received are 10 bits long. The MTM interface converts these messages to an 8–bit word.

MTM interface RAM

The MTM interface RAM receives and sends the 8–bit message between the MTM interface and the master processor through a parallel bus.

Master processor

The master processor analyzes the on/off patterns of coin–deposit tones that the signal processors receive. The master processor determines the types of deposited coins. The master processor performs coin–collection calculations based on parameters that the CC specifies. The master processor receives instructions from the CC every 5 ms. The master processor sends the results back to the CC from the master processor.

The master processor responds to a RESET signal that the MTM interface sends. The master processor performs different communication tests, resets, and initializes the software for the signal processors.

PCM interface

When the MTM interface activates the PCM interface, the PCM interface receives PCM signals that represent coin–deposit tones. The PCM performs serial–to–parallel conversion on the data.

PCM interface RAM

The PCM interface RAM receives and stores the converted data from the PCM interface.

Signal processor

The signal processors distinguish between coin–deposit tones and non–coin–deposit tones. The signal processors inform the master processor if coin–deposit tones are present. A single processor can handle four calls at the same time.

EPROM circuits

The 16–kbyte EPROM that connects to the master processor contains the operating instructions for the master processor.

PROM circuits

The PROM contains the operating instructions for the signal processors.

RAM circuits

The RAM is temporary storage for the master processor and the signal processors.

Technical data

The NT3X08AA uses a dual–frequency tone in a predetermined on/off pattern to distinguish the coin–types. The two dual–frequency tones appear in the following table.

Dual-frequency tones

Frequency	Level (min)
1537 Hz + 2200 Hz $\pm$ 2.5%	- 28 dBm
1700 Hz + 2200 Hz $\pm$ 2.5%	- 28 dBm

The following table lists the predetermined on/off patterns for each coin type.

Coin type on/off patterns

Coin	Tone duration	Silent interval
Nickel	35–160 ms	> 160 ms
Dime	35–160 ms	25–160 ms
	35–160 ms	> 60 ms
Quarter	20–100 ms	20–110 ms
	20–60 ms	20–60 ms
	20–60 ms	20–60 ms
	20–60 ms	20–60 ms
	20–100 ms	> 60 ms
Dollar	600–700 ms	> 60 ms

Physical dimensions

The physical dimensions for the NT3X08AA card are:

- height: 317.5 mm (12.5 in.)
- width: 22.2 mm (0.875 in.)
- depth: 254.0 mm (10.0 in.)

NT3X08AA (end)

Power requirements

The power requirements for the NT3X08AA are a voltage of +5 V and current of 3 A.

NT3X08AB

Product description

The NT3X08AB coin detection card counts coin tones coin-operated telephones (coin stations) send. The card reports the amount collected to the DMS central control (CC). The NT3X08AB distinguishes coin-types based on the specified on-off pattern of a constant dual-frequency tone.

The NT3X08AB has the following features:

- simultaneous service to eight coin calls
- port diagnostic routines for off-line testing
- μ-law capability
- microprocessor controller
- digital filtering tone evaluation techniques
- logic cell array (LCA) control of the maintenance trunk module (MTM) interface that you can program

The NT3X08AB is backward compatible with the NT3X08AA. The NT3X08AA preceded the NT3X08AB.

Location

The NT3X08AB fits in the MTM shelf, in slots 05, 09, and 13. Three empty slots must be present after the card slot because the card occupies eight time slots.

Functional description

The NT3X08AB coin detection circuit functions in conjunction with automatic coin telephone service (ACTS), Traffic Operator Position System (TOPS) features, and enhanced coin services features (AF1400).

The digital signal processor detects coin-deposit tones the coin stations generate. The processor reports the tones to the microprocessor in real time. The microprocessor identifies the coin types deposited. The microprocessor determines if the deposit is the correct amount. The microprocessor reports the results to the CC.

The coin detection card has the following functions:

- detection of a dual-tone multifrequency (DTMF) that identifies a coin
- count of the amount of the coins collected
- report of the amount to the CC

NT3X08AB (continued)

The NT3X08AB allows separate maintenance for each port, and not on all eight ports at the same time.

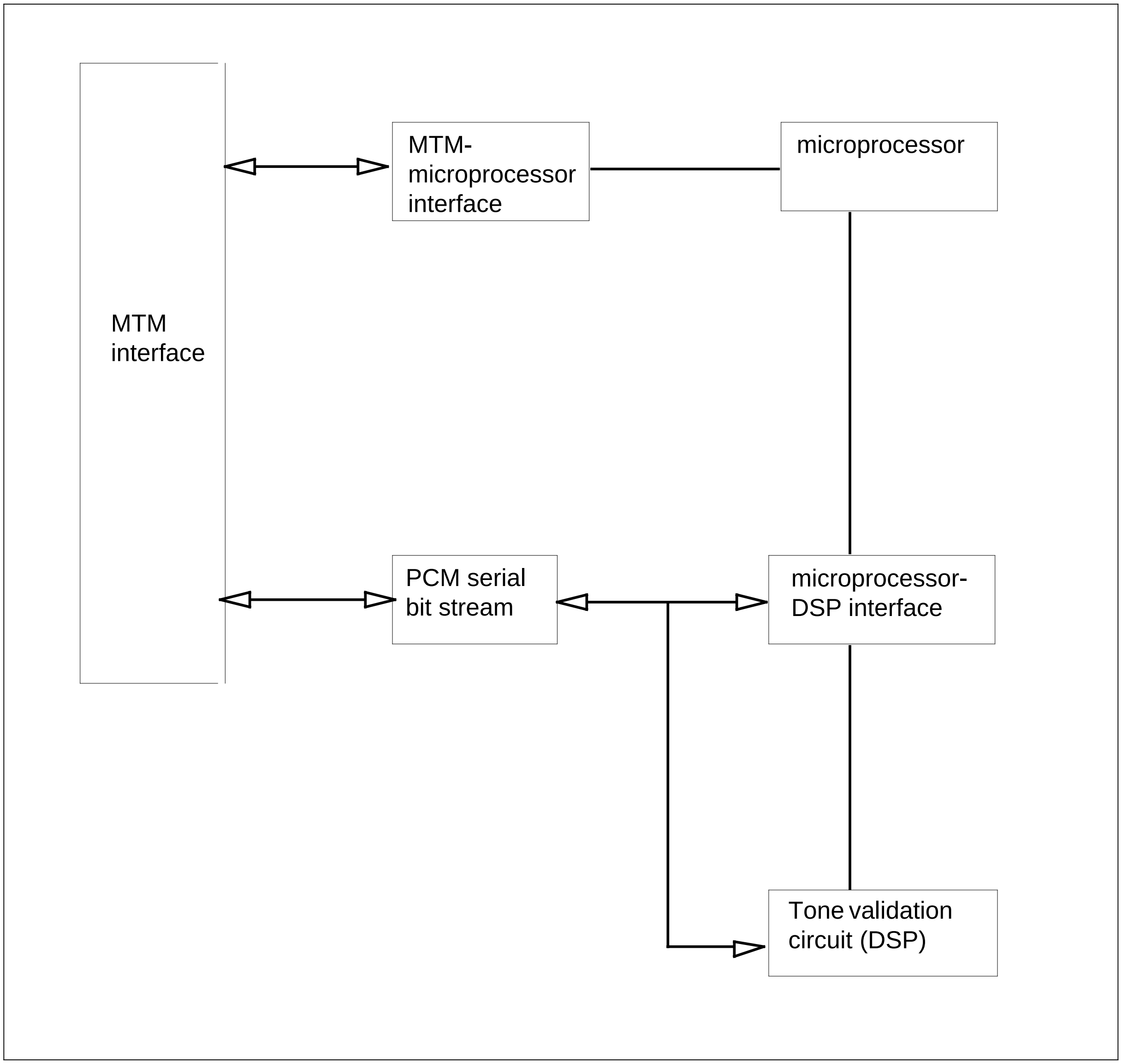
Functional blocks

The NT3X08AB has the following functional blocks:

- microprocessor
- maintenance trunk module (MTM) interface
- the MTM-microprocessor interface
- microprocessor-digital signal processor (DSP) interface
- pulse code modulation (PCM) serial bit stream
- tone validation circuit (DSP)

The following diagram shows the relationship between the functional blocks.

The NT3X08AB functional blocks



Microprocessor

The microprocessor block contains control circuits for bidirectional messages on the CC and the tone validation circuit. The microprocessor performs the following processes:

- a check with the MTM interface random access memory (RAM) for instructions from the CC
- analysis of the coin-deposit tones to identify the coin types deposited

NT3X08AB (continued)

- performance of coin collection calculations
- a response to self-test commands that the MTM interface issues

Maintenance trunk module-microprocessor interface

The MTM-microprocessor interface decodes the serial bit stream from the MTM interface. This action determines if the data must route to the microprocessor or the PCM bit stream.

Maintenance trunk module interface

The MTM interface handles bidirectional messages between the microprocessor and the CC. The interface has buffers that connect the microprocessor and PCM data to the system backplane.

Pulse code modulation serial bit stream

The PCM serial bit stream converts data from serial to parallel format. The tone validation circuit requires this conversion.

Microprocessor-digital signal processor interface

The microprocessor-DSP interface connects important sections of the NT3X08AB. These sections include the central processing unit (CPU), the DSP, and the microprocessor.

Tone validation circuit (DSP)

The tone validation circuit verifies that the PCM data represents a correct coin tone. The DSP differentiates between the coin-deposit tones and non-coin-deposit tones that coin stations generate. The DSP informs the microprocessor when real-time coin-deposit tones are present. The microprocessor analyzes the tone patterns to identify the types of coins deposited. The DSP can process activity on eight ports at the same time.

Signaling

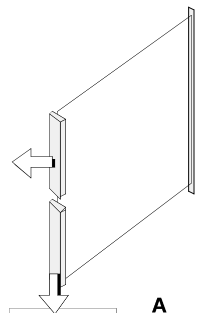
Pin numbers

The following diagram shows the pin numbers for the NT3X08AB.

NT3X08AB (continued)

The NT3X08AB pin numbers

	A	B
1A 1B	GND	GND
2A 2B		
3A 3B		
4A 4B		
5A 5B		
6A 6B		
7A 7B		
8A 8B		
9A 9B		
10A 10B		
11A 11B		
12A 12B		
13A 13B		
14A 14B		
15A 15B		
16A 16B		
17A 17B		
18A 18B		
19A 19B		
20A 20B		
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B		
29A 29B		
30A 30B		
31A 31B		
32A 32B		
33A 33B		
34A 34B		
35A 35B		
36A 36B		
37A 37B		
38A 38B		
39A 39B		
40A 40B		



	A	B
41A 41B	GND	GND
42A 42B	GND	GND
43A 43B	GND	GND
44A 44B		
45A 45B		
46A 46B	GND	GND
47A 47B		
48A 48B		
49A 49B		
50A 50B	GND	GND
51A 51B		
52A 52B		
53A 53B		
54A 54B		
55A 55B		
56A 56B		
57A 57B		
58A 58B		
59A 59B		
60A 60B		
61A 61B		
62A 62B	SPARE0	SPARE1
63A 63B	EN6	EN7
64A 64B	EN4	EN5
65A 65B	EN2	EN3
66A 66B	EN0	EN1
67A 67B		
68A 68B	RDATA	
69A 69B	CLK_IN	
70A 70B		
71A 71B	TDATA	
72A 72B		
73A 73B		
74A 74B		
75A 75B		
76A 76B		
77A 77B	+5IN	+5IN
78A 78B	+5IN	+5IN
79A 79B	+5IN	+5IN
80A 80B	GND	GND

NT3X08AB (end)

Technical data

Physical description

The NT3X08AB is a four-layer printed circuit board with power and ground that occupy the inner layers. The printed circuit board is a standard DMS-100 single-slot pack, with dimensions 342.9 mm (13.5 in) by 261.9 mm (10.312 in).

Technology

All components are defined as through-hole parts. The LCA and DSP are packaged in a 68-pin plastic leadless component carrier (PLCC) design. In this design a socket converts the PLCC package to through-hole configuration. The microprocessor is in a pin grid array (PGA) package design. All other components are packaged in a DIP design or an axis design.

Electrical specifications

For the purpose of a backplane load, the following table lists one Schottky or FAST load.

Current load for the NT3X08AB

Terms	Maximum
IIL (low-level input current)	-2 nA
IIH (high-level input current)	70 µA
Cin (input capacitance)	15 pF

Power requirements

DANGER
Damage to equipment or loss of service.
Use telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE. Use this protection with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

The uses the +5V power supply of the system, and draws a maximum current of 2 A.

NT3X09AA

Product description

The NT3X09AA remote metallic test access (MTA) card allows metal dc connections between test circuits and line circuits. This connection occurs in a remote line module (RLM) of DMS-100 equipment.

You can have four 2-wire paths at the same time.

Location

The card occupies one position in a maintenance trunk module (MTM) or a remote service module (RSM). One trunk appearance and 12 tip (T) and ring (R) appearances are required.

Functional description

The NT3X09AA interacts with the MTM or RSM and cross-connects the specified line circuits and test access points. The card establishes a metal connection between the T and R leads. This connection occurs from a specified horizontal element to a specified vertical element of a relay matrix.

Functional blocks

The NT3X09AA consists of the following functional blocks:

- trunk logic circuit (TLC)
- address decoder
- function code decoder circuit
- latch circuit
- relay drivers
- a 4 by 8 relay matrix
- readback circuit and 8-bit comparator
- power-up reset

TLC

The TLC is an interface between the card and the shelf controller. The circuit controls the relay matrix with one 8-bit signal distribution (SD) data word.

Address decoder

The address decoder reads the horizontal address to activate one of the four 8-bit latches in the latch circuit. The address decoder sends this information to the 4 by 8 relay matrix.

NT3X09AA (continued)

Function code decoder circuit

The function code decoder circuit decodes four basic function codes and three extended function codes. This action occurs on bits 6 and 7 of the 8-bit data word. The following table lists the basic function codes and their operations.

Basic function codes

Bit code	Function code	Operation
0 0	Clear	Activates extended function codes
0 1	Operate	If successful and no other relay on this horizontal is operated, scan bit = 0
1 0	Release	If successful and no other relay on this horizontal is operated, scan bit = 0
1 1	Read	If the relay indicated is the only operated relay, scan bit = 0 If the system releases the relay indicated and other relays in the same group are operated, scan bit = 1

The following table lists the extended function codes and their operation.

Extended function codes

Bit code	Function code	Operation
0 0	Clear all relays	Clears all relays; reads group 0. If system released the group, scan bit = 0
0 1	Clear group	Clears indicated group of eight relays. If system released the relays, scan bit =0
1 1	Read group	Reads indicated group of eight relays. If no relay operates, scan bit = 0. If any relay operates scan bit = 1

Latch circuit

The latch circuit uses transistors and one data bit from a decoded relay state to operate the crosspoint relays.

Relay drivers

The relay drivers receive the operated and released relay data from the latch circuit. The relay drivers send the information to the 4 by 8 relay matrix.

4 by 8 relay matrix

The 8-bit data word from the TLC controls the 4 by 8 relay matrix. The 4 by 8 relay matrix cross-connects the specified line circuits and test access points.

Readback circuit and 8-bit comparator

The readback circuit and 8-bit comparator receives the output from the latch circuit and generates an 8-bit data word. The 8-bit data word represents the status of the group of eight addressed relays. The circuit uses an 8-bit comparator to monitor the relays. If the relay that bits 1, 2, and 3 selected is operated, the scan bit is set to 0. A value of 0 indicates that the values in the readback circuit and the comparator are equal.

Power-up reset

The power-up reset releases all relays during power-up.

The following diagram shows the relationship between the functional blocks.

Technical data

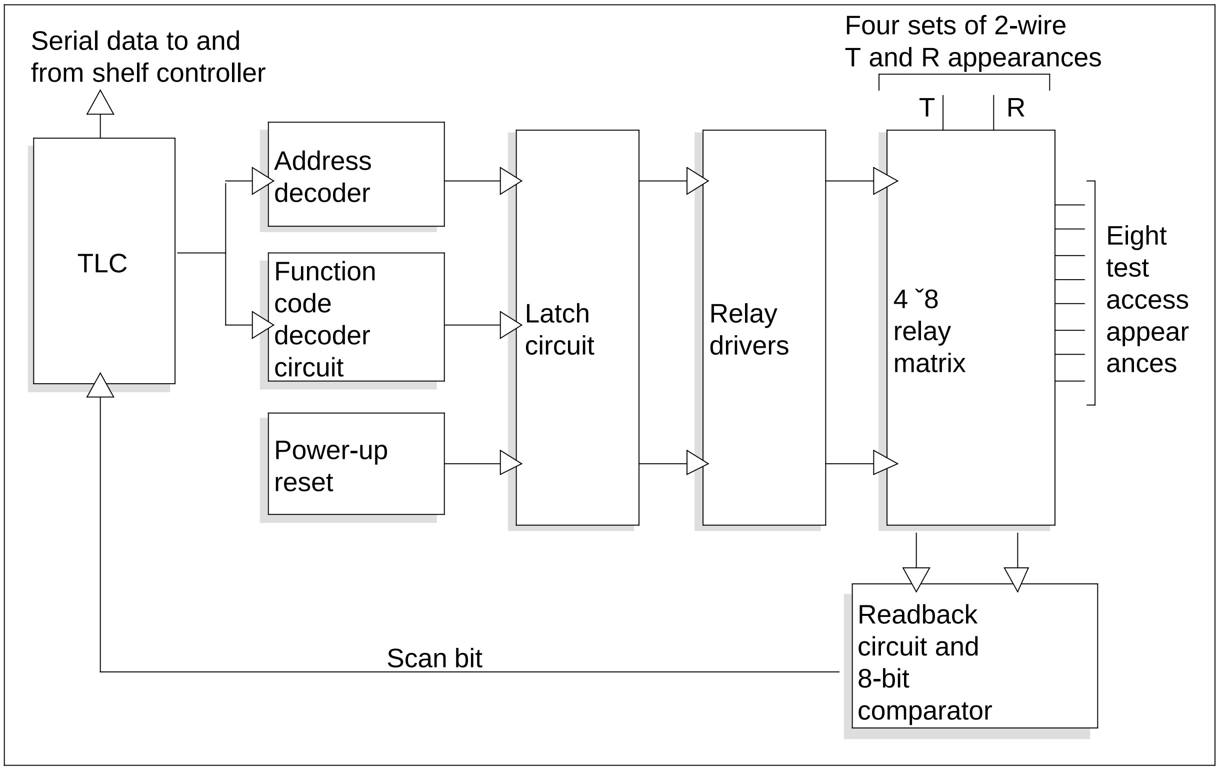
Dimensions

The dimensions of the NT3X09AA card are as follows:

- height: 353 mm (13.9 in.)
- depth: 280 mm (11.0 in.)
- width: 27 mm (1.07 in.)

NT3X09AA (end)

NT3X09AA functional blocks



Power requirements

The following table lists the power requirements for the card.

Power requirements

Voltage	Current
+5 V	1.00 A
+12 V	0.01 A
+24 V	0.20 A
-15 V	0.01 A

NT3X09BA

Product description

The NT3X09BA 8 by 8 metallic test access (MTA) card allows metal dc connections between test circuits and line circuits. This connection occurs in a remote line module (RLM) of DMS-100 equipment.

You can have eight 2-wire paths at the same time.

Location

The MTA card occupies one position in a maintenance trunk module (MTM) or a remote service module (RSM). One trunk appearance and 16 tip (T) and ring (R) appearances are required.

Functional description

The NT3X09BA interacts with the MTM or RSM and cross-connects the selected line circuits and test access points. The MTA card establishes a metal connection between the T and R leads. This metal connection occurs from a specified horizontal element to a specified vertical element of a relay matrix.

Functional blocks

The NT3X09BA consists of the following functional blocks:

- trunk logic circuit (TLC)
- address decoder
- function code decoder circuit
- latch circuit
- relay drivers
- an 8 by 8 relay matrix
- readback circuit and 8-bit comparator
- power-up reset

TLC

The TLC is an interface between the card and the shelf controller. The circuit controls the relay matrix with one or two 8-bit signal distribution (SD) data words.

Address decoder

The address decoder reads the horizontal address to activate one of the four 8-bit latches in the latch circuit. The address decoder sends this information to the 8 by 8 relay matrix.

NT3X09BA (continued)

Function code decoder circuit

The function code decoder circuit decodes four function codes on bits 6 and 7 of the 8-bit data word. The following table lists the function codes and operations.

Function codes

Bit code	Function code	Operation
0 0	Clear all and read	Releases all matrix crosspoints and returns a scan byte that represents the state of the eight crosspoints on the specified horizontal
0 1	Operate and read	Establishes a metal connection between the selected horizontal and vertical two-wire circuits. Returns a scan byte that represents the state of the eight crosspoints on the specified horizontal
1 0	Release and read	Releases all crosspoints on the specified horizontal. Returns a scan byte that represents the state of the eight crosspoints on the specified horizontal
1 1	Read	Returns a scan byte that represents the state of the eight crosspoints on the specified horizontal

Latch circuit

The latch circuit uses transistors and one data bit taken from a decoded relay state to operate the crosspoint relays.

Relay drivers

The relay drivers receive the operated and released relay data from the latch circuit. The relay drivers send the information to the 8 by 8 relay matrix.

8 by 8 relay matrix

The 8-bit data words from the TLC controls the 8 by 8 relay matrix. The address decoder addresses the 8 by 8 relay matrix. The 8 by 8 relay matrix cross-connects the specified line circuits and test access points.

Readback circuit and 8-bit comparator

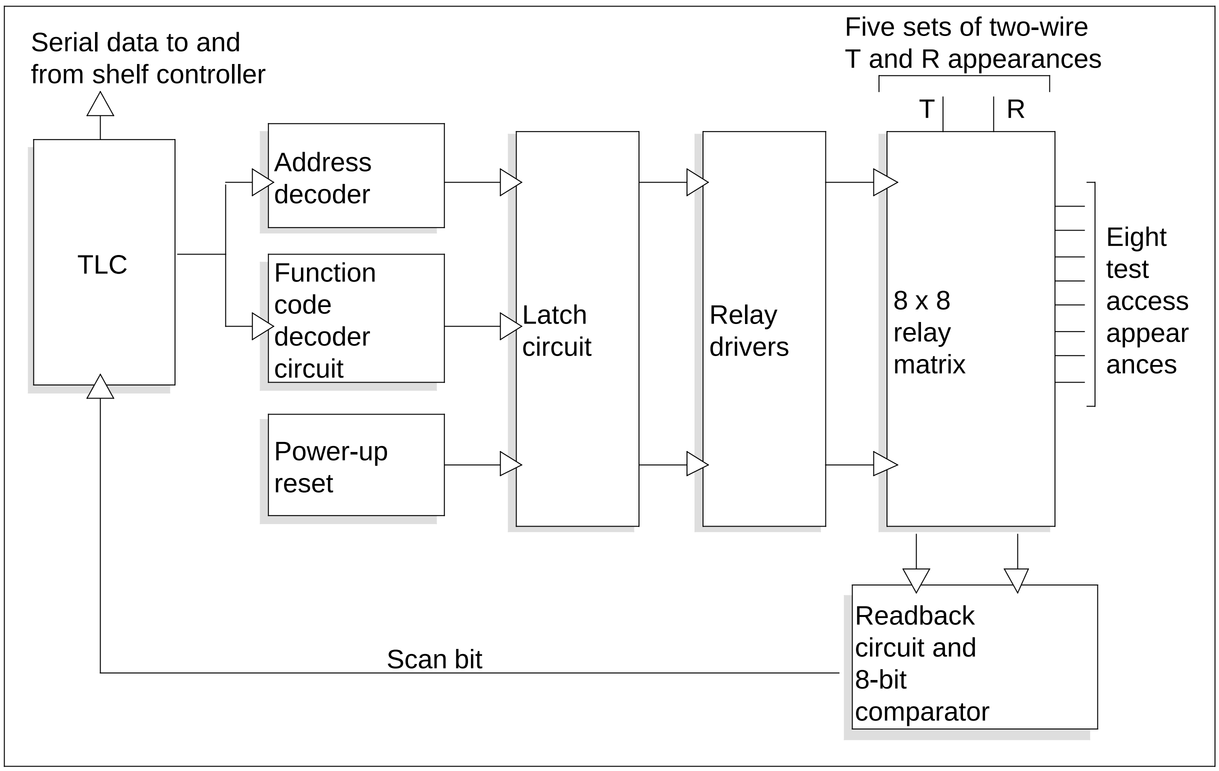
The readback circuit and 8-bit comparator receives the output from the latch circuit. The readback circuit and 8-bit comparator generate an 8-bit data word. This 8-bit data word represents the status of the eight addressed relays.

Power-up reset

The power-up reset releases all relays during power-up.

The following figure describes the relationship between functional blocks.

NT3X09BA functional blocks



Technical data

Dimensions

The dimensions of the NT3X09BA card are as follows:

- height: 353 mm (13.9 in.)
- depth: 280 mm (11.0 in.)
- width: 27 mm (1.07 in.)

NT3X09BA (end)

Power requirements

The following table lists the power requirements for the card.

Power requirements

Voltage	Current
+5 V	2.00 A
+12 V	0.01 A

NT3X13AA

Product description

The NT3X09BA master clock generator card generates clock and frame pulses for the central message controllers (CMC) and all office peripherals. The CMCs and office peripherals are in a DMS-100 office.

A switch uses two NT3X13AA cards. One card is active. One card is standby. If a failure occurs in the active NT3X13AA, the standby card becomes in service.

Location

The NT3X13AA is in a CMC shelf.

Functional description

The card uses transistor-transistor logic-compatible (TTL) waves to produce a time-of-day. The master oscillator and frame generator of the card are monitored to check for frequency differences or failures. The activity switcher receives detected error messages. If necessary, the activity switcher switches the standby NT3X13AA to service.

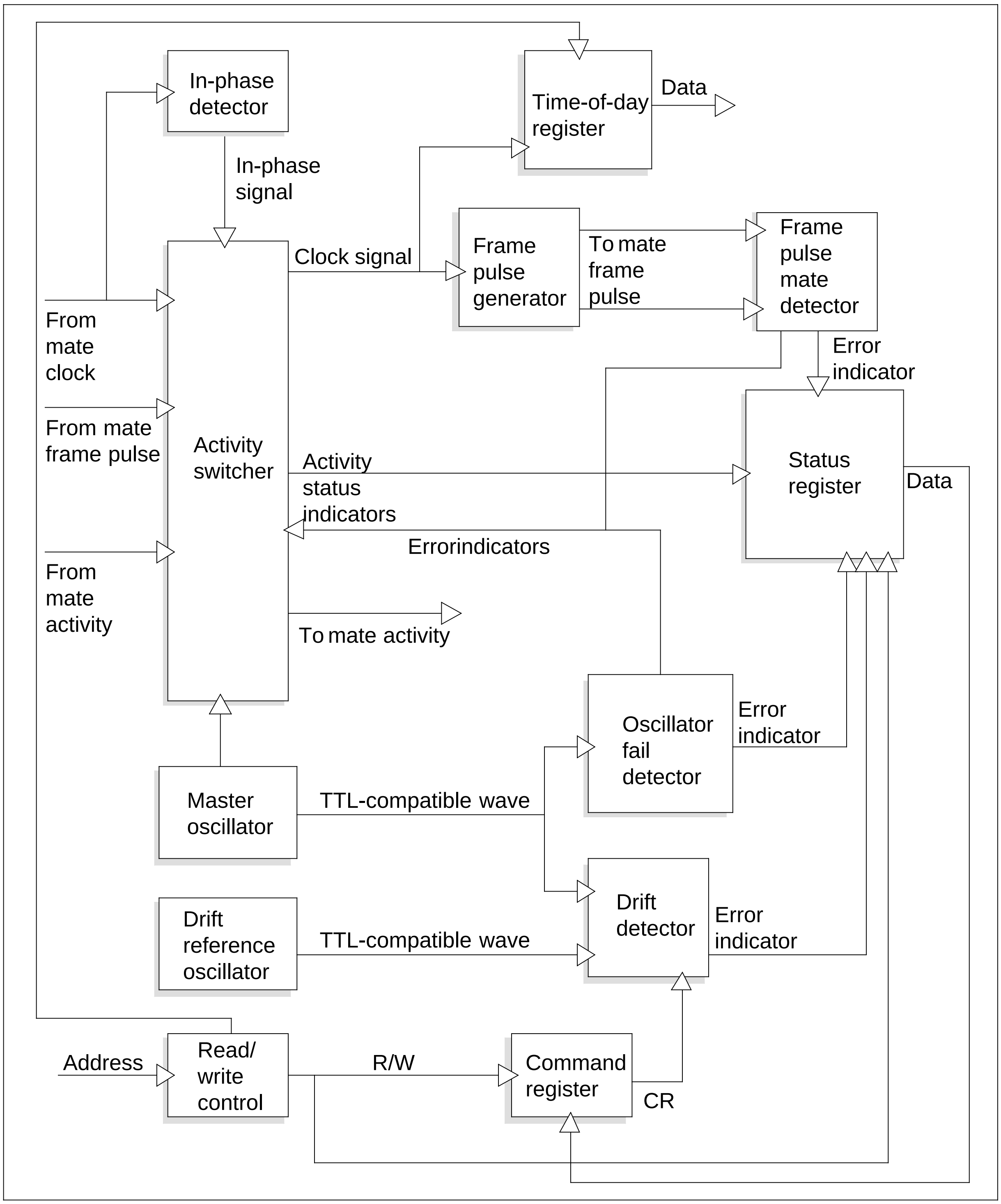
Functional blocks

The NT3X13AA contains the following functional blocks:

- master oscillator
- drift reference oscillator
- drift detector
- oscillator fail detector
- frame pulse generator
- frame pulse fail detector
- activity switcher
- in-phase detector
- time-of-day register
- read-write control
- command register
- status register

NT3X13AA (continued)

NT3X13AA functional blocks



Master oscillator

The master oscillator is a temperature-compensated crystal oscillator. The master oscillator generates a 10.24 Hz TTL-compatible wave that DMS-100 circuits use. The temperature stability of the oscillator is $\pm 1 \times 10^{-7}$ Hz from 0° to 50° C. The frequency adjusts to less than 1×10^{-7} Hz.

Drift reference oscillator

The drift reference oscillator generates a 10.24 Hz TTL-compatible wave. The drift reference oscillator has a temperature stability of $\pm 1 \times 10^{-7}$ Hz from 0° to 50° C. The drift reference oscillator is first set to the same frequency as the master oscillator. A drift between the two oscillators indicates that one oscillator is defective.

Drift detector

The drift detector monitors and compares the frequencies of the master oscillator and drift reference oscillator. The drift detector monitors these oscillators for differences in frequencies of more than 1.6×10^{-6} Hz. If the drift detector detects a difference, the detector sends an error indication to the status register. After the 1.6 s drift check, the counters reinitialize to zero. The drift checking starts again.

Oscillator fail detector

The oscillator fail detector detects an oscillator fail, or a gross frequency error. The time lapses between consecutive clock pulses from the master oscillator can be more than 275 ns. In this event, the oscillator fail detector sends a time-out signal as an error indicator. The status register and activity switcher receive this signal.

Frame pulse generator

The frame pulse generator uses the 10.24 MHz wave from the master clock oscillator. The generator uses this wave to provide the frame pulse the DMS-100 office uses. Every 125 µs, counters and decoding logic in the frame pulse generator generate a 97.6 ns pulse.

Frame pulse fail detector

If the lapses between consecutive pulse signals are more than 254 µs, the frame pulse fail detector produces a time-out signal. The status register and the activity switcher receive an error indicator when the time-out signal occurs.

Activity switcher

The activity switcher monitors the fault detection circuits in the NT3X13AA. If the fault detection circuits detect a fault, the activity switcher switches the NT3X13AA standby to service. The active NT3X13AA turns on an LED on the faceplate. The active NT3X13AA sets bit 8 in the status register.

NT3X13AA (continued)

In-phase detector

The in-phase detector searches between the master oscillators on the two NT3X13AA printed circuit boards. The in-phase detector detects an in-phase condition. If you remove one printed circuit board from the shelf, the in-phase detector on the other printed circuit board detects the condition. The in-phase detector prevents an activity switch. If two oscillators are in phase, an active low-going pulse passes to the activity switcher. This pulse has a minimum pulse width of 98 ns.

Time-of-day register

The time-of-day register uses the 10.24 MHz clock signal from the master oscillator to record a maximum of 48 h. The register records the time in increments of 195 ns. The clock contains the following three 16 bit segments:

- Least important. This 16 bit segment counts a maximum of 10 ms.
- Mid important. This 16 bit segment contains two 4-bit segments, which count to 100 ms and is one 8 bit segment. This segment contains one 8 bit segment which counts to 100 s.
- Most important. This 16 bit segment contains two sets of 8 bits. The first segment counts to 60 min. The second segment counts to 48 h in the sequence given.

Read-write control

The read-write control decodes CPU address bits 0, 1, 2, 7, 8, and 9. The read-write control performs this action to address the time-of-day, command, and status registers. You can read all the 16 bit segments for the time-of-day register. You can write only to the most important 16 bit segment. You can read all the 16 bit segments on the registers. You can write only to the least important 8 bits.

Command register

The CPU uses the command register. The command register is an 8 bit buffer. The command register applies the fault detection circuits on the master clock generator card. The command register can also:

- clear the status indicators
- inhibit the clock fault interrupts so that interrupts are not sent to the processor
- clear the drift detectors for maintenance purposes.

When the command register is addressed, the register latches the data on processor address lines six through zero. The data remains in these lines until another write operation replaces the data. Read the status register bits 0 through 6 to see this data.

State register

Different error indicators set the state register. This state register is a 16 bit buffer that the processor can read. The error indicators generate a processor interrupt to indicate a clock card failure. This processor interrupt continues until the command register issues a reset command, or a CPU issues a general data port reset. The status register allows the processor to read the command register.

Technical data

The NT3X13AA produces a 10.24 MHz TTL-compatible level clock signal. The NT3X13AA releases a 97.6 ns pulse to the office and to the standby every 125 ns.

Input signals into the NT3X13AA from the standby card include a 10.24 MHz TTL-compatible clock signal and a 97.6 ns pulse every 125 ns. The card receives a TTL-high activity state when the mate is active. The card receives a TTL-low activity state when the mate is not active.

Command register composition

The command register composition appears in the following table.

Command register composition

Bit number	Function
0	Permits switchover only when clocks in phase
1	Induces oscillator failure
2	Induces oscillator drift failure
3	Induces frame pulse failure
4	Resets status indicators
5	Clears oscillator drift detection counters
6	Inhibits clock failure interrupts
7	Not used

NT3X13AA (continued)

Status register composition

The status register composition appears in the following table.

Status register composition

Bit number	Function
0	Command register bit 0 state
1	Command register bit 1 state
2	Command register bit 2 state
3	Command register bit 3 state
4	Command register 4 bit state
5	Command register bit 5 state
6	Command register bit 6 state
7	Not used
8	Indicates present activity
9	Indicates oscillator failure
10	Indicates frame pulse failure
11	Indicates oscillator drift
12	Indicates activity dropped
13	Indicates interrupt posted
14	Not used
15	Not used

Physical dimensions

The NT3X13AA has the following dimensions:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 43 mm (1.7 in.)

Power requirements

The NT3X13AA requires a voltage of +5 Vdc, and current of 1.9 A.

NT3X13AA (end)

Power distribution is 9.5 W.

NT3X13BA

Product description

The NT3X13BA master clock generator card generates clock and frame pulses for the central message controllers (CMC) and all office peripherals. The CMCs and the office peripherals are in a DMS-100 office.

A switch uses NT3X13BA two cards. One NT3X13BA is active. One NT3X13BA is standby. If a failure occurs in the active NT3X13BA, the activity switcher puts the standby card in service.

Location

The NT3X13BA is in a CMC shelf.

Functional description

The card uses transistor-transistor logic-compatible (TTL) waves to produce a time-of-day clock. The master oscillator and frame generator of the NT3X13BA are monitored to check for frequency differences or failures. The activity switcher receives error messages. The activity switcher switches the standby NT3X13BA into service.

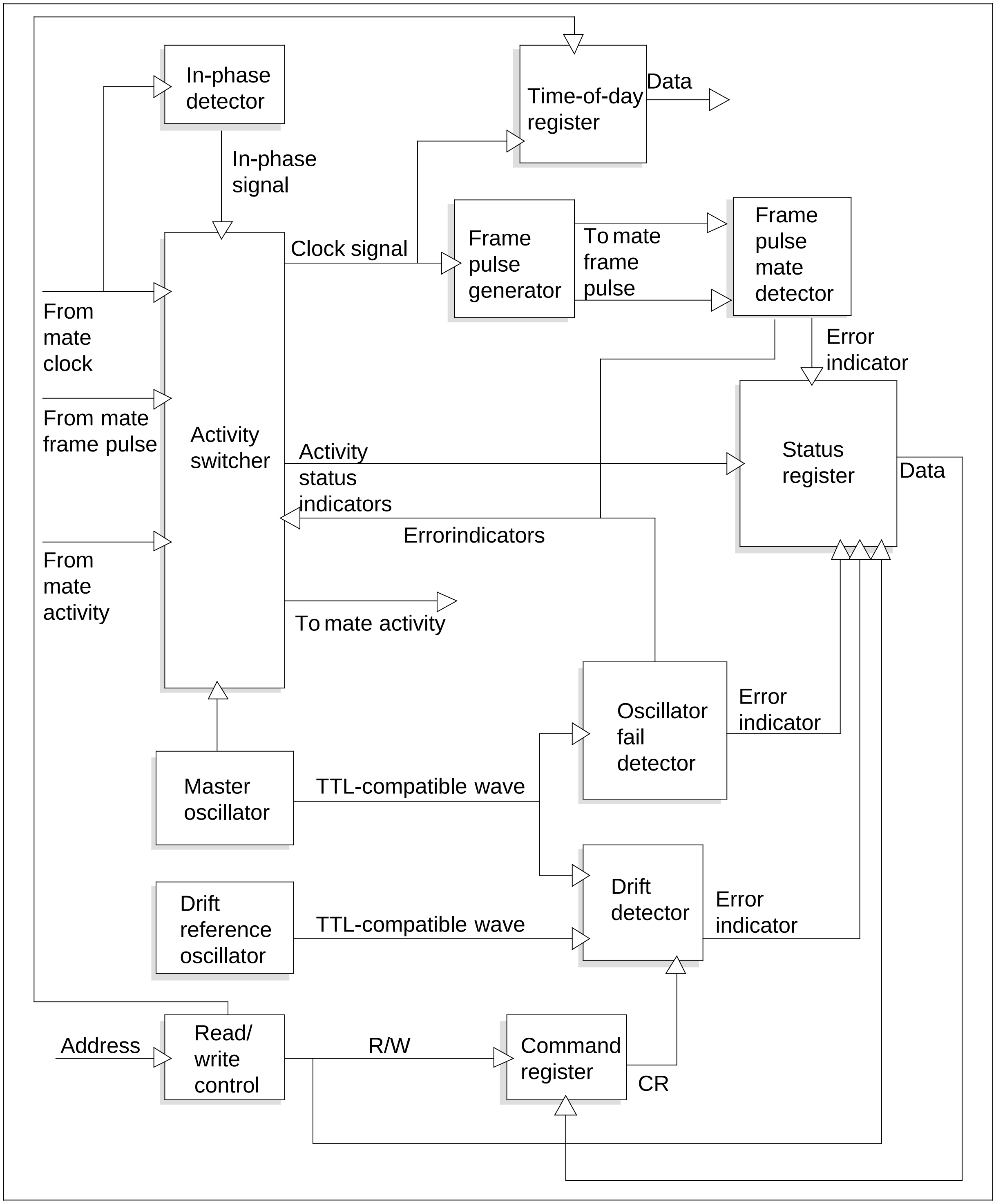
Functional blocks

The NT3X13BA contains the following functional blocks:

- master oscillator
- drift reference oscillator
- drift detector
- oscillator fail detector
- frame pulse generator
- frame pulse fail detector
- activity switcher
- in-phase detector
- time-of-day register
- read-write control
- command register
- status register

NT3X13BA (continued)

NT3X13BA functional blocks



NT3X13BA (continued)

Master oscillator

The master oscillator is a temperature-compensated crystal oscillator that generates a 10.24 Hz TTL-compatible wave. The DMS-100 circuits use this wave. The temperature stability of the oscillator is $\pm 1 \times 10^{-7}$ Hz from 0° to 50° C. You can adjust the frequency to less than 1×10^{-7} Hz.

Drift reference oscillator

The drift reference oscillator generates a 10.24 Hz TTL-compatible wave. The drift reference oscillator has a temperature stability of $\pm 1 \times 10^{-7}$ Hz from 0° to 50° C. The drift reference oscillator is first set to the same frequency as the master oscillator. A drift between the two oscillators indicates that one of the oscillators is defective.

Drift detector

The drift detector monitors and compares the frequencies of the master oscillator and drift reference oscillator for differences in frequencies. These frequency differences are greater than 1.6×10^{-6} Hz. When a difference occurs, the status register receives an error indication. After the 1.6 s drift check, the counters are reinitialized to zero. The drift checking begins again.

Oscillator fail detector

The oscillator fail detector detects an oscillator fail or a gross frequency error. The time lapse between consecutive clock pulses from the master oscillator must not be more than 275 ns. If the time lapse between the pulses is more than 275 ns, the system sends a time-out signal. The time-out signal is an error indicator. The status register and the activity switcher receive the time-out signal.

Frame pulse generator

The frame pulse generator uses the 10.24 MHz wave from the master clock oscillator to provide the frame pulse used in the DMS-100 office. Counters and decoding logic in the frame pulse generator produce a 97.6 ns pulse for every 125 µs.

Frame pulse fail detector

If the lapse between consecutive pulse signals is more than 254 µs, the frame pulse fail detector produces a time-out signal. When the time-out signal occurs, the status register and the activity switcher receive an error indicator.

Activity switcher

The activity switcher monitors the fault detection circuits in the NT3X13BA. When a fault occurs, the activity switch switches the standby NT3X13BA to service. The active NT3X13BA turns on an LED on the faceplate. The active NT3X13BA sets bit 8 in the status register.

In-phase detector

The in-phase detector searches between the master oscillators on the two NT3X13BA boards. The in-phase detector detects an in-phase condition. If you remove one board from the shelf, the in-phase detector on the other board detects the condition. This in-phase detector prevents an activity switch. When the two oscillators are in phase, the activity switcher receives an active low-going pulse. This pulse has a minimum pulse width of 98 ns.

Time-of-day register

The time-of-day register uses the 10.24 MHz clock signal from the master oscillator to record a maximum of 48 h. The register counts the time in increments of 195 ns. The clock contains the following three 16 bit segments:

- Least significant. This 16 bit segment counts a maximum of 10 ms.
- Mid significant. The next 16 bit contains of two 4 bit segments, and one 8 bit segment. The two 4 bit segments count to 100 ms and 1 s. The 8 bit segment counts to 60 s.
- Most significant. This 16 bit segment has 8 bits that count to 60 min. This segment has 8 bits that count to 48 h.

Read-write control

The read-write control decodes CPU address bits 0, 1, 2, 7, 8, and 9. The read-write control performs this action to address the time-of-day, command, and state registers. You can read all the 16 bit segments for the time-of-day register. You can write only to the most important 16 bit register. You can read all the 16 bit segments on the command and state register. You can write only to the least important 8 bits.

Command register

The CPU uses the command register to apply the fault detection circuits on the master clock generator card. The command register is an 8 bit buffer. The command register can also:

- clear the status indicators
- inhibit the clock fault interrupts so that interrupts are not sent to the processor
- clear the drift detectors for maintenance purposes.

When the command register is addressed, the register latches the data to processor address lines six through zero. The data remains in these lines until another write operation replaces the data. Read the status register bits 0 through 6 to see this data.

NT3X13BA (continued)

State register

Error indicators set the state register. The register is a 16 bit buffer that the processor can read. The error indicators generate a processor interrupt to indicate a clock card failure. This interrupt continues until the command register issues a reset command or until a CPU issues a general data port reset. The status register allows the processor to read the command register.

Technical data

The NT3X13BA produces a 10.24 MHz TTL-compatible level clock signal. The NT3X13BA releases a 97.6 ns pulse to the office and to the standby NT3X13BA every 125 ns.

The standby card sends input signals to the NT3X13BA. These input signals contain a 10.24 MHz TTL-compatible clock signal and a 97.6 ns pulse every 125 ns. The card receives a TTL-high activity state when the mate is active. The card receives a TTL-low activity state when the mate is not active.

Command register composition

The command register composition appears in the following table.

Command Register composition

Bit number	Function
0	Permits switchover only when clocks in phase
1	Induces oscillator fail
2	Induces oscillator drift fail
3	Induces frame pulse fail
4	Resets status indicators
5	Clears oscillator drift detection counters
6	Inhibits clock failure interrupts
7	Not used

Status register composition

The status register composition appears in the following table.

Status register composition

Bit number	Function
0	Command register bit 0 state
1	Command register bit 1 state
2	Command register bit 2 state
3	Command register bit 3 state
4	Command register 4 bit state
5	Command register bit 5 state
6	Command register bit 6 state
7	Not used
8	Indicates present activity
9	Indicates oscillator failure
10	Indicates frame pulse failure
11	Indicates oscillator drift
12	Indicates activity dropped
13	Indicates interrupt posted
14	Not used
15	Not used

Physical dimensions

The NT3X13BA has the following dimensions:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 43 mm (1.7 in.)

Power requirements

The NT3X13BA requires a voltage of +5 Vdc and current of 1.9 A.

NT3X13BA (end)

Power distribution is 9.5 W.

NT3X14AA

Product description

The NT3X14AA master clock controller card distributes and controls (in DMS-100 equipment) the 10.24 MHz clock signal. You can synchronize the clock controller card. An associated NT3X15 master clock oscillator or an NT3X16 Stratum 2 oscillator generates the 10.24 MHz clock signal. The board generates and distributes frame pulse signals to the central message controllers (CMC) and all office peripherals.

Location

The card is in a CMC shelf or a message and device controller (MDC) shelf. Normally, the pairs with an NT3X15. A second pair of cards in the second CMC or MDC provides standby facilities.

Functional description

The NT3X14AA uses transistor-transistor logic-compatible (TTL) waves to generate a time-of-day clock. The NT3X14AA monitors the frame pulse generator for failures. The NT3X14AA switches to the standby pair if required. The NT3X14AA provides an interface between the NT3X15 and the CPU.

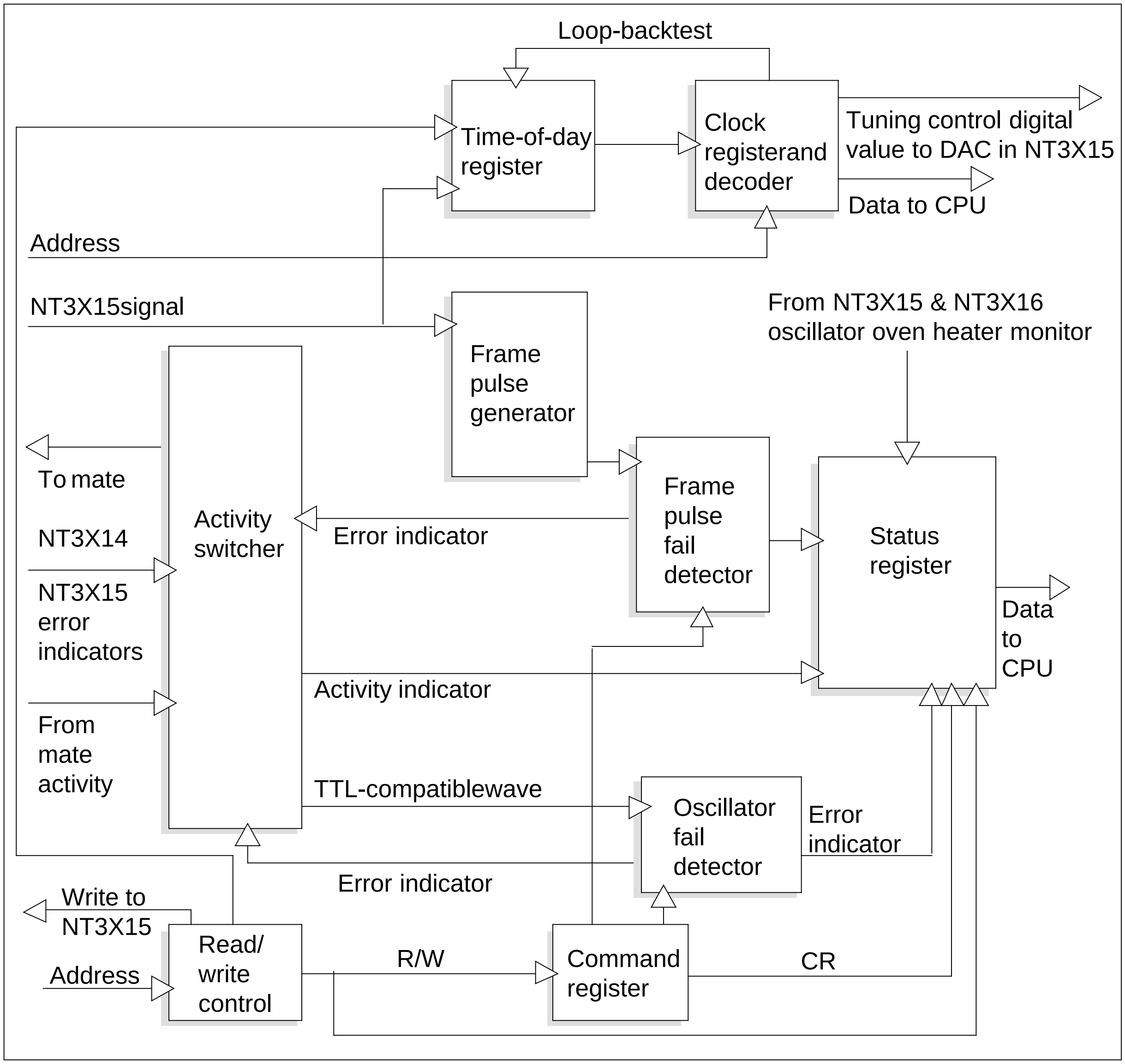
Functional blocks

The NT3X14AA contains the following functional blocks:

- activity switcher
- frame pulse generator
- frame pulse fail detector
- oscillator fail detector
- time-of-day register
- clock registers and decoder
- read-write control
- command register
- state register

NT3X14AA (continued)

NT3X14AA functional blocks



Activity switcher

The activity switcher monitors the frame pulse and oscillator fail detectors. If a problem occurs, the activity switcher switches the standby NT3X14AA to service. The active NT3X14AA sets bit 8 in the status register. An illuminated LED (STBY CLK) on the faceplate indicates an NT3X14AA in the standby mode.

Frame pulse generator

The frame pulse generator uses the 10.24 MHz wave from the active NT3X15. This wave provides the frame pulse for the DMS-100 office. Counters and decoding logic in the frame pulse generator produce a 97.6 ns pulse every 125 µs.

Frame pulse fail detector

If the lapse between consecutive pulse signals is greater than 634 µs, the frame pulse fail detector produces a time-out signal. The status register and the activity switcher receive an error indicator when a time-out signal occurs.

Oscillator fail detector

The oscillator fail detector detects oscillator failures and gross frequency errors. A lapse between consecutive clock pulses of more than 612 ns causes an error indicator. The system sends the error indicator to the status register and the activity switcher.

Time-of-day register

The time-of-day register uses the 10.24 MHz clock signal from the NT3X15 to record a maximum of 48 h. The register records the signal in increments of 195 ns. The clock contains three 16 bit segments:

- Least significant. This 16 bit segment counts a maximum of 10 ms.
- Mid significant. The next 16 bits have two 4 bit segments and one 8 bit segment. The two 4 bit segments count to 100 ms and 1 s. The 8 bit segment counts 60 s.
- Most significant. This 16 bit segment has two 8 bit segments. One segment counts to 60 min. The second segment counts to 48 h.

Clock register and decoder

The clock register and decoder have eight internal registers. You can read all registers. You can write to registers 2 through 7. To address the eight registers,

NT3X14AA (continued)

decode address bits 0, 9, 2, 7, 8, and 9. The following table lists the register assignments.

Register assignments

Read:	0 - Least significant time-of-day register
	1 - Mid significant time-of-day register
	2 - Most significant time-of-day register
	3 - Status and error register
	4 - Tuning control register for digital-to-analog converter (DAC) in NT3X15
	5 - Phase detector register
	6 - Spare
	7 - Loop back test register
Write:	2 - Most significant time-of-day register
	3 - Control register
	4 - Tuning control register for DAC in NT3X15
	5 - Clear errors register
	6 - DAC write project register
	7 - Loop back test register

Read-write control

The read-write control decodes CPU address bits to address the time-of-day, command, and status registers. You can read all the 16 bit segments for the time-of-day register. You can write only to the most important 16 bit segment. You can read all the segments in the command and state registers. You can write only to the least important 8 bits.

Command register

The CPU uses the command register to apply the fault detection circuits on the NT3X14AA. The command register can clear the state indicators and inhibit the sending of clock fault interrupts. The processor does not receive any interrupts from the clock.

State register

Error indicators set the state register. This status register is a 16 bit buffer that the processor can read. The error indicators generate a processor interrupt to indicate a clock failure. The interrupt continues until the command register issues a reset command, or the CPU reads the data. The status register allows the processor to read the command register.

Technical data

The NT3X14AA produces a 10.24 MHz ± 6 Hz TTL-compatible clock signal. The NT3X14AA releases a 97.6 ns pulse to the office and to the standby NT3X14AA every 125 µs.

Input signals into the NT3X14AA from the paired NT3X15 and the standby cards have 10.24 MHz ± 6 Hz TTL-compatible clock signals. The standby NT3X14AA card sends a 97.6 ns pulse every 125 µs. The card receives a TTL-high activity state when the mate is active. The card receives a TTL-low activity state when the mate is not active.

Physical dimensions

The NT3X14AA has the following dimensions:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 20 mm (0.8 in.)

Power requirements

The NT3X14AA requires a voltage of +5 V ± 5% and current of 2 A.

Power distribution is 10 W.

NT3X14BA

Product description

The NT3X14BA synchronizable master clock controller in DMS-100 equipment distributes and controls the 10.24 MHz clock signal. An associated NT3X15 synchronizable master clock oscillator or an NT3X16 Stratum 2 oscillator generates the clock signal. The NT3X14BA has an electrostatic-shield faceplate. The NT3X14BA generates and distributes frame pulse signals to the central message controllers (CMC) and all office peripherals.

Location

The card is in a CMC shelf or a message and device controller (MDC) shelf. The NT3X14BA is normally paired with an NT3X15. A second pair of cards in the second CMC or MDC provides standby facilities.

Functional description

The NT3X14BA performs the following functions:

- uses transistor-transistor logic-compatible (TTL) waves to generate a time-of-day clock
- monitors the frame pulse generator for failures. The controller switches to the standby pair if necessary.
- provides an interface between the NT3X15 and the CPU.

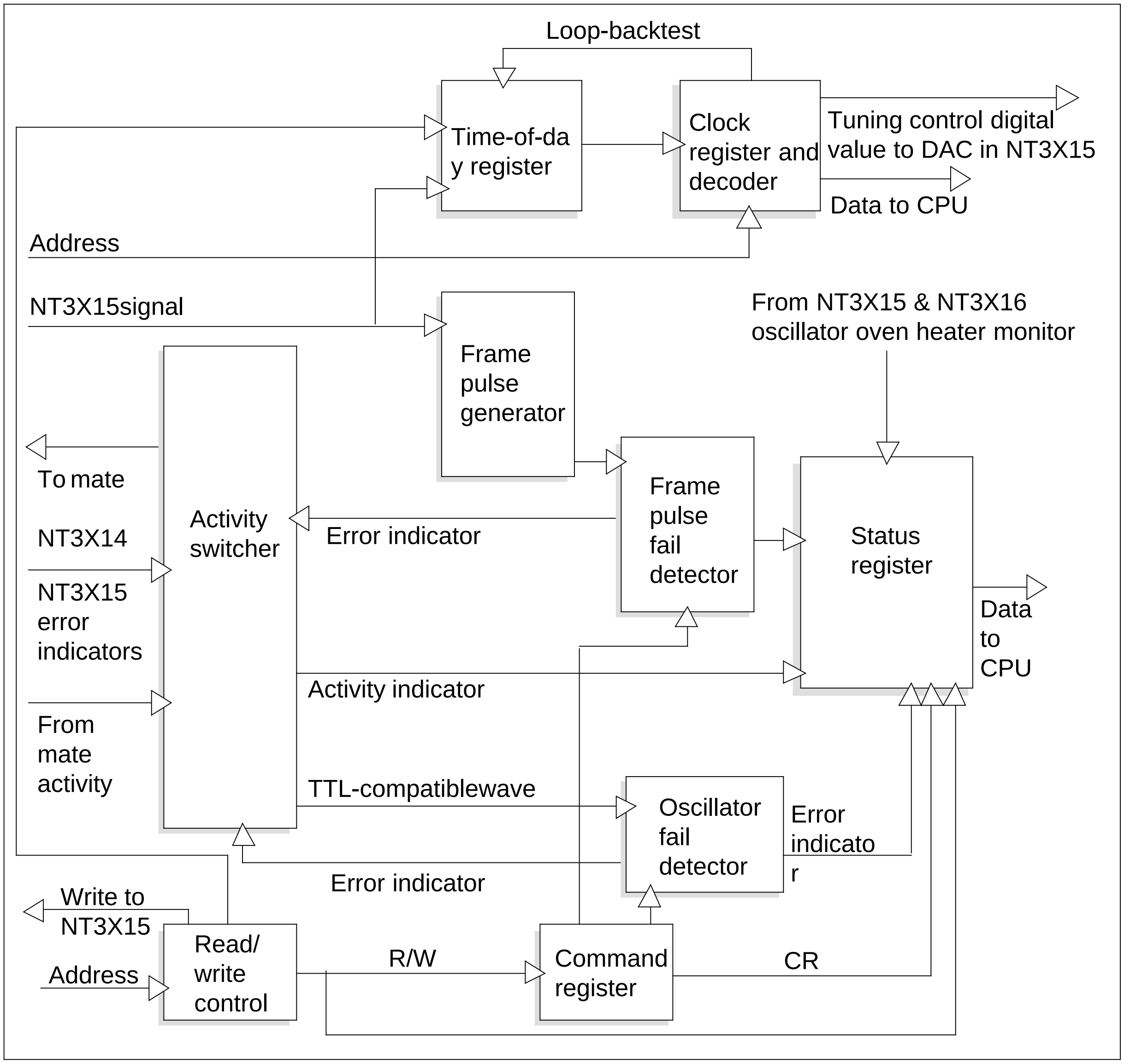
Functional blocks

The NT3X14BA consists of the following functional blocks:

- activity switcher
- frame pulse generator
- frame pulse fail detector
- oscillator fail detector
- time-of-day register
- clock registers and decoder
- read-write control
- command register
- status register

NT3X14BA (continued)

NT3X14BA functional blocks



Activity switcher

The activity switcher monitors the frame pulse and oscillator fail detectors. When the activity switcher detects a fault, the switcher switches the standby NT3X14BA to service. The active NT3X14BA sets bit 8 in the status register. An illuminated LED (STBY CLK) on the faceplate indicates an NT3X14BA in the standby mode.

NT3X14BA (continued)

Frame pulse generator

The frame pulse generator uses the 10.24 MHz wave from the active NT3X15 to provide the frame pulse in the DMS-100 office. At intervals of 125 µs, counters and decoding logic in the frame pulse generator produce a 97.6 ns pulse.

Frame pulse fail detector

If consecutive pulse signals are more than 634 µs apart, the frame pulse fail detector produces a time-out signal. The time-out signal sends an error indicator to the status register and the activity switcher.

Oscillator fail detector

The oscillator fail detector detects oscillator failures and gross frequency errors. When consecutive clock pulses are more than 612 ns apart, the frame pulse fail detector sends a time-out signal. The frame pulse fail detector sends the signal to the status register and the activity switcher as an error indicator.

Time-of-day register

The time-of-day register uses the 10.24 MHz clock signal from the NT3X15 to record a maximum of 48 h in increases of 195 ns. The clock contains three 16-bit segments. The least important 16 bits count to a maximum of 10 ms. The next 16 bits contain two 4 bit segments and one 8-bit segment. The 4 bit segments count to 100 ms and 1 s. The 8-bit segment counts 60 s. The most important 16-bit segment has 8 bits that count to 60 min. The most important 16-bit segment also has 8 bits that count to 48 h.

Clock register and decoder

The clock register and decoder contains eight internal registers. The system can read all registers. The system can write to registers 2 through 7. The decoding address bits 0, 9, 2, 7, 8, and 9, address the eight registers. The following table lists the register assignments

Register assignments

Read:	0 - Least important time-of-day register
	1 - Mid important time-of-day register
	2 - Most important time-of-day register
	3 - Status and error register
	4 - Tuning control register for digital-to-analog converter (DAC) in NT3X15
	5 - Phase detector register
	6 - Spare
	7 - Loop back test register
Write:	2 - Most important time-of-day register
	3 - Control register
	4 - Tuning control register for DAC in NT3X15
	5 - Clear errors register
	6 - DAC write project register
	7 - Loop back test register

Read-write control

The read-write control decodes CPU address bits to address the time-of-day, command, and status registers. The system can read all the 16-bit segments of the time-of-day register. The system can write to only the most important 16-bit register in the time-of-day register. The system can read all the 16-bit segments on the command and status registers. The system can write to only the least important 8-bit segment of the command and status registers.

Command register

The CPU uses the command register to apply the fault detection circuits on the NT3X14BA. The command register can clear the status indicators and inhibit the transmission of clock fault interrupts from the clock to the processor.

Status register

The status register is a 16-bit buffer that the processor can read. Different error indicators set the status register. The error indicators generate a processor interrupt to indicate a clock failure. The error indicators stay until the

NT3X14BA (end)

command register issues a reset command or until the CPU reads the data. The status register allows the processor to read back the command register.

Technical data

The NT3X14BA produces a 10.24 MHz ± 6 Hz TTL-compatible clock signal. The NT3X14BA releases a 97.6 ns pulse to the office and to the standby NT3X14BA every 125 µs.

Input signals to the NT3X14BA from the paired NT3X15 and the standby cards consist of 10.24 MHz ± 6 Hz TTL-compatible clock signals. The NT3X14BA receives a 97.6 ns pulse at intervals of 125 µs from the standby NT3X14BA card. The NT3X14BA receives a TTL-high activity state when the mate is active and a TTL-low activity state when the mate is not active.

Dimensions

The dimensions for the NT3X14BA are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 20 mm (0.8 in.)

Power requirements

The power requirements for the NT3X14BA are a voltage of +5 V ± 5% and current of 2 A.

Power distribution is 10 W.

NT3X14BB

Product description

The NT3X14BB synchronizable master clock controller in DMS-100 equipment distributes and controls the 10.24 MHz clock signal. An associated NT3X15 synchronizable master clock oscillator or an NT3X16 Stratum 2 oscillator generates the clock signal. The NT3X14BB has an electrostatic-shield faceplate. The NT3X14BB generates and distributes frame pulse signals to the central message controllers (CMC) and all office peripherals.

Location

The card is in a CMC shelf or a message and device controller (MDC) shelf. The NT3X14BB is normally paired with an NT3X15. A second pair of cards in the second CMC or MDC provides standby facilities.

Functional description

The NT3X14BB performs the following functions:

- uses transistor-transistor logic-compatible (TTL) waves to generate a time-of-day clock
- monitors the frame pulse generator for failures. The controller switches to the standby pair if necessary
- provides an interface between the NT3X15 and the CPU.

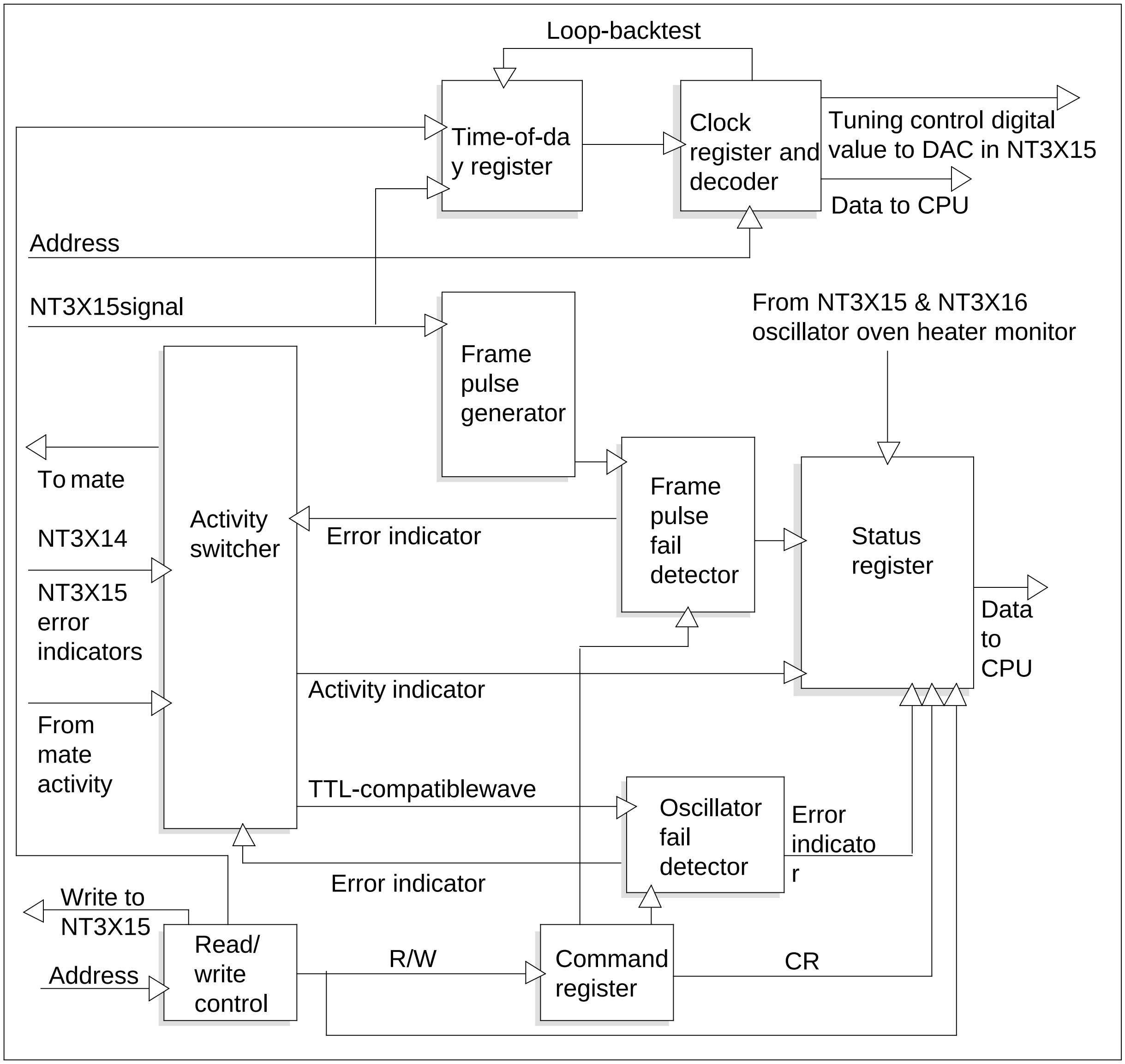
Functional blocks

The NT3X14BB contains the following functional blocks:

- activity switcher
- frame pulse generator
- frame pulse fail detector
- oscillator fail detector
- time-of-day register
- clock registers and decoder
- read-write control
- command register
- status register

NT3X14BB (continued)

NT3X14BB functional blocks



Activity switcher

The activity switcher monitors the frame pulse and oscillator fail detectors. When the activity switcher detects a fault, the switcher switches the standby NT3X14BB to service. The active NT3X14BB sets bit 8 in the status register. An illuminated LED (STBY CLK) on the faceplate indicates an NT3X14BB in the standby mode.

Frame pulse generator

The frame pulse generator uses the 10.24 MHz wave from the active NT3X15 to provide the frame pulse in the DMS-100 office. At intervals of 125 µs, counters and decoding logic in the frame pulse generator produce a 97.6 ns pulse.

Frame pulse fail detector

If consecutive pulse signals are more than 634 µs apart, the frame pulse fail detector produces a time-out signal. The time-out signal sends an error indicator to the status register and the activity switcher.

Oscillator fail detector

The oscillator fail detector detects oscillator failures and gross frequency errors. When consecutive clock pulses are more than 612 ns apart, the frame pulse fail detector sends a time-out signal. The frame pulse fail detector sends the signal to the status register and the activity switcher as an error indicator.

Time-of-day register

The time-of-day register uses the 10.24 MHz clock signal from the NT3X15 to record a maximum of 48 h in increases of 195 ns. The clock contains three 16-bit segments. The least important 16 bits count to a maximum of 10 ms. The next 16 bits contain two 4-bit segments and one 8-bit segment. The two 4-bit segments count to 100 ms and 1 s. The 8-bit segment counts 60 s. In the most important 16-bit segment, 8 bits count to 60 min and 8 bits count to 48 h.

Clock register and decoder

The clock register and decoder contain eight internal registers. The system can read all registers. The system can write to registers 2 through 7. The decoding

NT3X14BB (continued)

address bits 0, 9, 2, 7, 8, and 9, address the eight registers. The following table lists the register assignments.

Register assignments

Read:	0 - Least important time-of-day register
	1 - Mid important time-of-day register
	2 - Most important time-of-day register
	3 - Status and error register
	4 - Tuning control register for digital-to-analog converter (DAC) in NT3X15
	5 - Phase detector register
	6 - Spare
	7 - Loop back test register
Write:	2 - Most important time-of-day register
	3 - Control register
	4 - Tuning control register for DAC in NT3X15
	5 - Clear errors register
	6 - DAC write project register
	7 - Loop back test register

Read-write control

The read-write control decodes CPU address bits to address the time-of-day, command, and status registers. The system can read all the 16-bit segments of the time-of-day register. The system can only write to the most important 16-bit register of the time-of-day register. The system can read all the 16-bit segments on the command and status registers. The system can only write to the least important 8-bit segments on the command and status register.

Command register

The CPU uses the command register to exercise the fault detection circuits on the NT3X14BB. The command register can clear the status indicators and inhibit the transmission of clock fault interrupts from the clock to the processor.

Status register

The status register is a 16-bit buffer that the processor reads. Different error indicators set the status register. The error indicators generate a processor interrupt to indicate a clock failure. The error indicators stay until the command register issues a reset command or until the CPU reads the data. The status register allows the processor to read back the command register.

Technical data

The NT3X14BB produces a 10.24 MHz ± 6 Hz TTL-compatible clock signal. The NT3X14BB releases a 97.6 ns pulse to the office and to the standby NT3X14BB at intervals of 125 µs.

Input signals to the NT3X14BB from the paired NT3X15 and the standby cards consist of 10.24 MHz ± 6 Hz TTL-compatible clock signals. The NT3X14BB receives a 97.6 ns pulse at intervals of 125 µs from the standby NT3X14BB card. The NT3X14BB receives a TTL-high activity state when the mate is active and a TTL-low activity state when the mate is not active.

Dimensions

The dimensions for the NT3X14BB are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 20 mm (0.8 in.)

Power requirements

The power requirements for the NT3X14BB are a voltage of +5 V ± 5% and current of 2 A.

Power distribution is 10 W.

NT3X14BC

Product description

The NT3X14BC synchronizable master clock controller in DMS-100 equipment distributes and controls the 10.24 MHz clock signal. An associated NT3X15 synchronizable master clock oscillator or an NT3X16 Stratum 2 oscillator generates the clock signal. The NT3X14BC has an electrostatic-shield faceplate. The NT3X14BC generates and distributes frame pulse signals to the central message controllers (CMC) and all office peripherals.

Location

The card is in a CMC shelf or a message and device controller (MDC) shelf. The card is normally paired with an NT3X15. A second pair of cards in the second CMC or MDC provides standby facilities.

Functional description

The NT3X14BC performs the following functions:

- uses transistor-transistor logic-compatible (TTL) waves to generate a time-of-day clock
- monitors the frame pulse generator for failures. The controller switches to the standby pair if necessary
- provides an interface between the NT3X15 and the CPU.

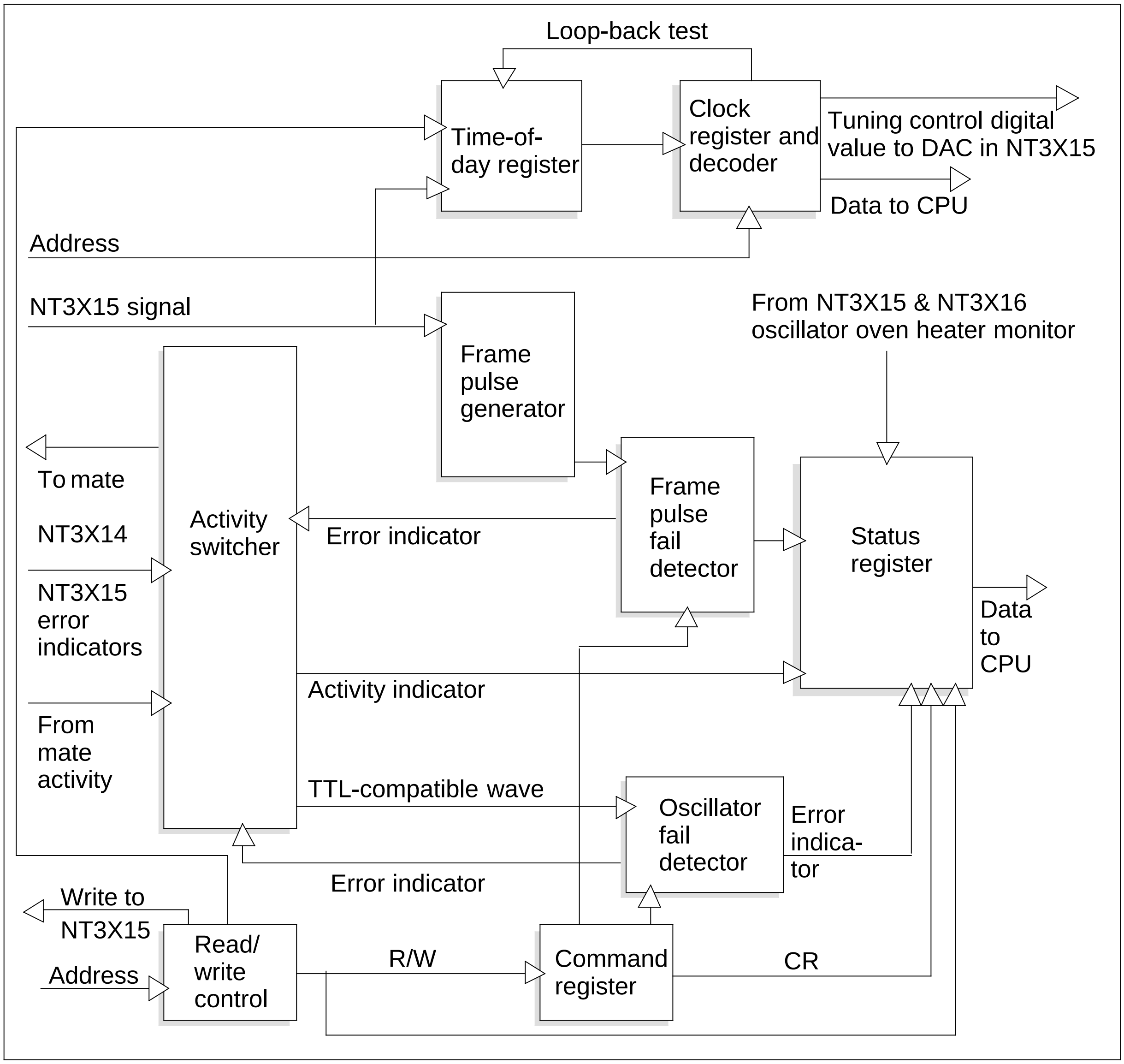
Functional blocks

The NT3X14BC consists of the following functional blocks:

- activity switcher
- frame pulse generator
- frame pulse fail detector
- oscillator fail detector
- time-of-day register
- clock registers and decoder
- read-write control

- command register
- status register

NT3X14BC functional blocks



Activity switcher

The activity switcher monitors the frame pulse and oscillator fail detectors. When the activity switcher detects a fault, the switcher switches the standby NT3X14BC to service. The active NT3X14BC sets bit 8 in the status register. An illuminated LED (STBY CLK) on the faceplate indicates an NT3X14BC in the standby mode.

NT3X14BC (continued)

Frame pulse generator

The frame pulse generator uses the 10.24 MHz wave from the active NT3X15 to provide the frame pulse in the DMS-100 office. At intervals of 125 µs, counters and decoding logic in the frame pulse generator produce a 97.6 ns pulse.

Frame pulse fail detector

If consecutive pulse signals are more than 634 µs apart, the frame pulse fail detector produces a time-out signal. The time-out signal sends an error indicator to the status register and the activity switcher.

Oscillator fail detector

The oscillator fail detector detects oscillator failures and gross frequency errors. When consecutive clock pulses are more than 612 ns apart, the frame pulse fail detector sends a time-out signal. The detector sends the time-out signal to the status register and the activity switcher. The time-out signal is an error indicator.

Time-of-day register

The time-of-day register uses the 10.24 MHz clock signal from the NT3X15 to record a maximum of 48 h in increases of 195 ns. The clock contains three 16-bit segments. The least important 16 bits count to a maximum of 10 ms. The next 16 bits contain two 4-bit segments and one 8-bit segment. The 4-bit segments count to 100 ms and 1 s. The 8-bit segments count 60 s. The most important 16-bit segment contains 8 bits that count to 60 min. The most important 16-bit segment also contains 8 bits that count to 48 h.

Clock register and decoder

The clock register and decoder contain eight internal registers. The system can read all registers. The system can write to registers 2 through 7. The decoding address bits 0, 9, 2, 7, 8 and 9 address the eight registers. The following table lists the register assignments

Register assignments

Read:	0 - Least important time-of-day register
	1 - Mid important time-of-day register
	2 - Most important time-of-day register
	3 - Status and error register
	4 - Tuning control register for digital-to-analog converter (DAC) in NT3X15
	5 - Phase detector register
	6 - Spare
	7 - Loop back test register
Write:	2 - Most important time-of-day register
	3 - Control register
	4 - Tuning control register for DAC in NT3X15
	5 - Clear errors register
	6 - DAC write project register
	7 - Loop back test register

Read-write control

The read-write control decodes CPU address bits to address the time-of-day, command, and status registers. The system can read all the 16-bit segments of the time-of-day register. The system can only write to the most important 16-bit register. The system can read all the 16-bit segments on the command and status registers. The system can only write to the least important 8 bits.

Command register

The CPU uses the command register to exercise the fault detection circuits on the NT3X14BC. The command register can clear the status indicators and inhibit the transmission of clock fault interrupts from the clock to the processor.

Status register

The status register is a 16-bit buffer that the processor can read. Different error indicators set the status register. The error indicators generate a processor interrupt to indicate a clock failure. The error indicators continue until the

NT3X14BC (end)

command register issues a reset command or until the CPU reads the data. The status register allows the processor to read back the command register.

Technical data

The NT3X14BC produces a 10.24 MHz ± 6 Hz TTL-compatible clock signal. The NT3X14BC releases a 97.6 ns pulse to the office and to the standby NT3X14BC at intervals of 125 µs.

Signals that transfer to the NT3X14BC from the paired NT3X15 and the standby cards contain 10.24 MHz ± 6 Hz TTL-compatible clock signals. The NT3X14BC receives a 97.6 ns pulse at intervals of 125 µs from the standby NT3X14BC card. The card receives a TTL-high activity state when the mate is active and a TTL-low activity state when the mate is not active.

Dimensions

The dimensions for the NT3X14BC are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 20 mm (0.8 in.)

Power requirements

The power requirements for the NT3X14BC are a voltage of +5 V ± 5% and current of 2 A.

Power distribution is 10 W.

NT3X15AA

Product description

The NT3X15AA synchronizable master clock oscillator generates a 10.40-MHz clock signal. The clock signal controls the timing circuits in the DMS-100 switching system.

The card operates with the NT3X14 synchronizable master clock controller. The card has two configurations. One configuration uses an internal crystal oscillator. The other configuration uses an external crystal oscillator.

Location

The card is in the central message controller (CMC) shelf or in the message and device controller (MDC) shelf. A second pair of NT3X15 - NT3X14 cards in the second CMC or the MDC provides standby facilities.

Functional description

The NT3X15AA uses waves compatible with transistor-transistor logic (TTL) to compare signal frequencies. The NT3X15AA sends an error signal if an output fails. The NT3X15AA uses the NT3X14 to communicate with the CMC. The NT3X14 provides an interface between the card and the CMC.

Functional blocks

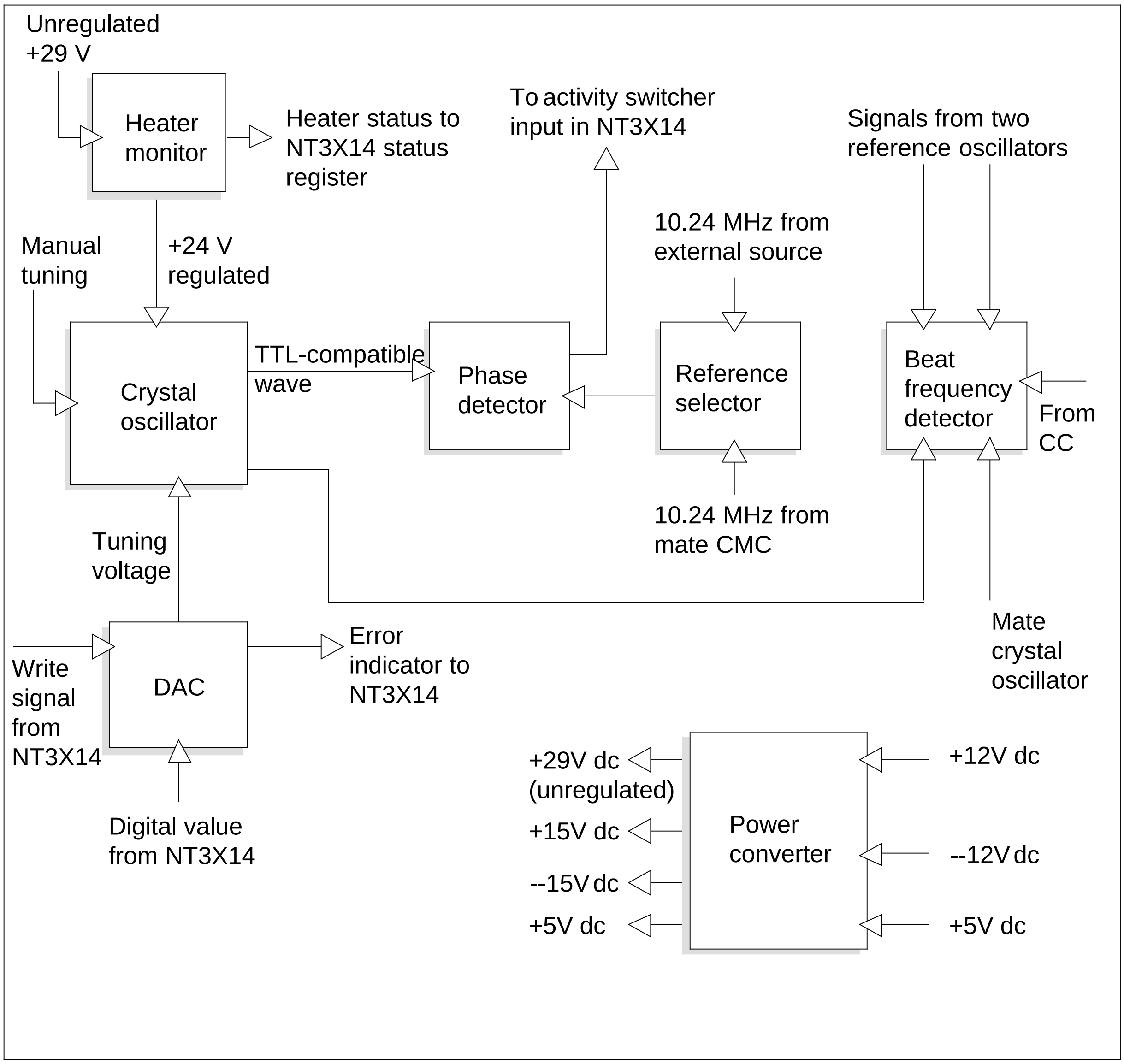
The NT3X15AA consists of the following functional blocks:

- crystal oscillator
- oscillator heater monitor circuit
- digital-to-analog converter (DAC)
- phase detector
- reference selector

NT3X15AA (continued)

- beat frequency detector
- power converter

NT3X15AA functional blocks



Crystal oscillator

The crystal oscillator generates a 10.24-MHz wave that is compatible with TTL. The oscillator sends the wave to the phase detector circuit. To tune the frequency of the oscillator electronically, you can use dc voltage. To tune the frequency manually, you can use a visual display unit (VDU) at the MAP display.

Oscillator heater monitor circuit

The oscillator heater monitor circuit converts the +29V unregulated power supply to the regulated +24 V that the crystal oscillator requires. The circuit sends the status of the heater to the NT3X14 card. The central control (CC) uses this status.

DAC

The 12-bit DAC supplies the tuning control voltage to the crystal oscillator. The DAC converts a digital value that the NT3X14 sends to the dc tuning voltage. A write signal from the NT3X14 controls the DAC loading. A write-protect function prevents incorrect tuning of the oscillator. The CC can read and verify the DAC contents through the NT3X14.

Phase detector

The phase detector has two counters that allow the phase detector to compare the frequency of the crystal oscillator with other sources. One counter accepts the 10.24-MHz signal from the crystal oscillator and one counter accepts the external source signal. Both counters divide the signals to 8 kHz for comparison and synchronization.

Reference selector

The reference selector makes sure that the crystal oscillator can synchronize to the mate CMC clock. The reference selector allows the external signal or the mate CMC clock signal to pass to the phase monitor circuits.

Beat frequency detector

The beat frequency detector monitors the difference in frequency between two signals provided to the NT3X15. In a slave system, the beat frequency detector monitors the difference between the two CMC oscillators. The CC times the detector state change to indicate correct operation of the reference oscillators in a master office configuration.

Power converter

The power converter accepts +12V dc and -12V dc from the CMC shelf supply circuit. The power converter converts the +12V dc and -12V dc to a +29V dc unregulated supply for the oscillator and temperature control oven. The power converter converts the ±12V dc power supply to +15V dc and -15V dc (regulated to ±0.1%) for the oscillator control circuits.

Circuits in the power converter protect the power converter against damage from large transient voltages. A monitor circuit checks the +15V output and sends an error signal to the NT3X14 if the output fails.

NT3X15AA (end)

Technical data

The NT3X15AA accepts a 10.24MHz ± 6Hz clock signal from the mate CMS and a 1-V rms signal from the external reference oscillator. The NT3X15AA sends a 10.24MHz ± 6Hz clock signal to the mate CMC.

The crystal oscillator has a center frequency of 10.24 MHz and a tuning voltage range of 0 to 5V dc. The crystal oscillator has a center frequency voltage of 2.5V dc, a frequency setting for tuning of ±20 Hz maximum and a stability setting of $\pm 2 \times 10^{-9}$ $\Delta f/F$ for each day.

Dimensions

The dimensions of the NT3X15AA card are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 66 mm (2.6 in.)

Power requirements

The power requirements for the NT3X15AA appear in the following table.

Power requirements

Voltage	Oven heater on	Oven heater off
-12V dc ±5%	400 mA	150 mA
+12V dc ±5%	475 mA	475 mA
+5V dc ±5%	1.6 A	

NT3X15AB

Product description

The NT3X15AB synchronizable master clock oscillator generates a 10.40-MHz clock signal. The clock signal controls the timing circuits in the DMS-100 switching system.

The card operates with the NT3X14 synchronizable master clock controller. The card has two configurations. One configuration uses an internal crystal oscillator. The other configuration uses an external crystal oscillator.

Location

The card is in the central message controller (CMC) shelf or in the message and device controller (MDC) shelf. A second pair of NT3X15 - NT3X14 cards in the second CMC or MDC provides standby facilities.

Functional description

The NT3X15AB uses waves compatible with transistor-transistor logic (TTL) to compare signal frequencies. The NT3X15AB sends an error signal if an output fails. The card uses the NT3X14 to communicate with the CMC. The NT3X14 provides an interface between the card and the CMC.

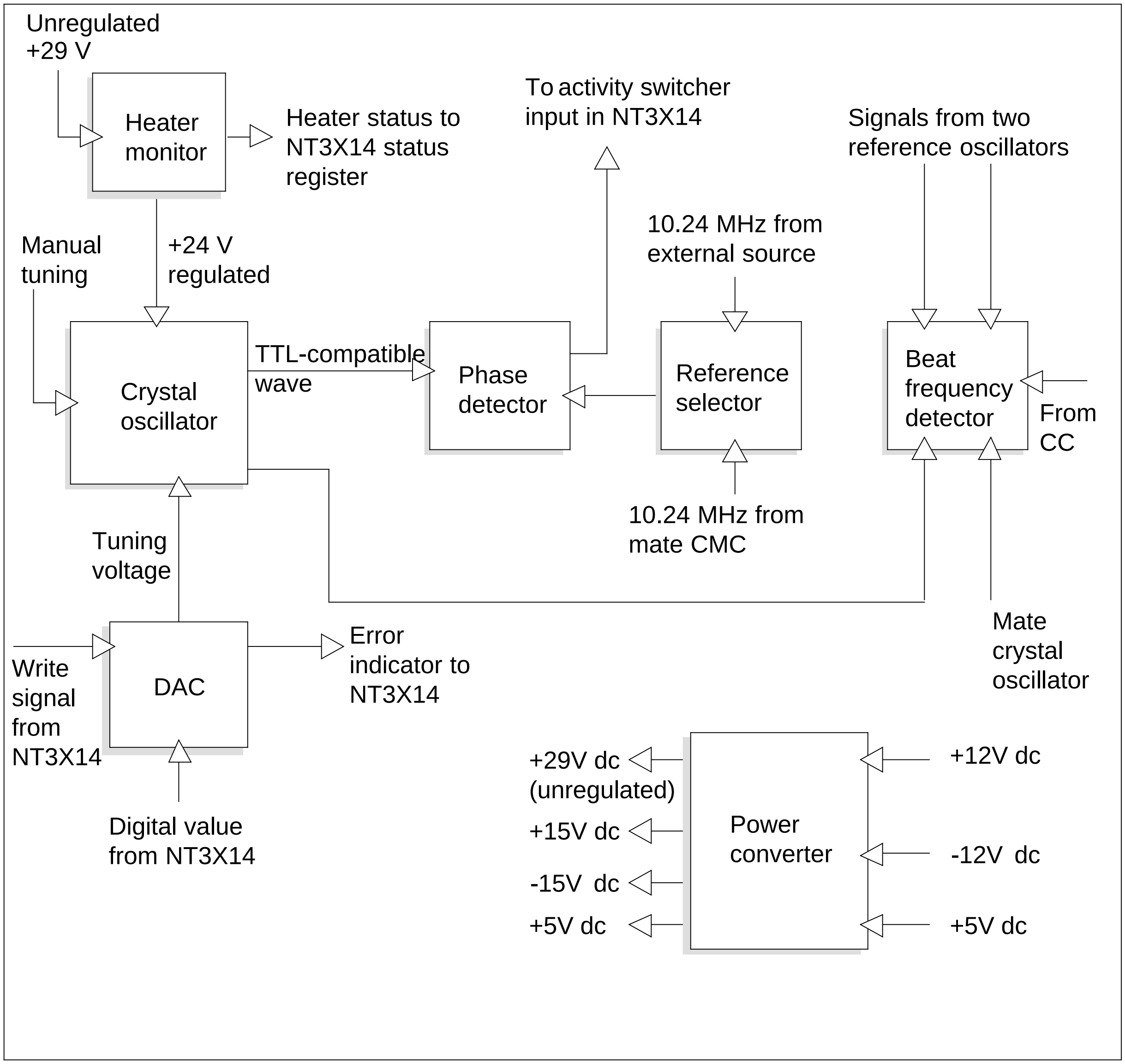
Functional blocks

The NT3X15AB consists of the following functional blocks:

- crystal oscillator
- oscillator heater monitor circuit
- digital-to-analog converter (DAC)
- phase detector
- reference selector
- -beat frequency detector
- power converter

NT3X15AB (continued)

NT3X15AB functional blocks



Crystal oscillator

The crystal oscillator generates a 10.24-MHz wave compatible with TTL that the oscillator sends to the phase detector circuit. To tune the frequency of the oscillator electronically, you can use dc voltage. To tune the frequency manually, you can use a visual display unit (VDU) at a MAP display.

Oscillator heater monitor circuit

The oscillator heater monitor circuit converts the +29V unregulated power supply to the regulated +24 V that the crystal oscillator requires. The circuit sends the status of the heater to the NT3X14 card. The central control (CC) uses this status.

DAC

The 12-bit DAC supplies the tuning control voltage to the crystal oscillator. The DAC converts a digital value that the NT3X14 sends to the dc tuning voltage. A write signal from the NT3X14 controls the DAC loading. A write-protect function prevents incorrect tuning of the oscillator. The CC can read and verify the DAC contents through the NT3X14.

Phase detector

The phase detector has two counters that allow the detector to compare the frequency of the crystal oscillator with other sources. One counter accepts the 10.24-MHz signal from the crystal oscillator. The other counter accepts the external source signal. Both counters divide the signals to 8 kHz for comparison and synchronization.

Reference selector

The reference selector makes sure the crystal oscillator can synchronize to the mate CMC clock. The reference selector allows the external signal or the mate CMC clock signal to pass to the phase monitor circuits.

Beat frequency detector

The beat frequency detector monitors the difference in frequency between two signals provided to the NT3X15. In a slave system, the beat frequency detector monitors the difference between the two CMC oscillators. The CC times the detector state change to indicate correct operation of the reference oscillators in a master office configuration.

Power converter

The power converter accepts +12V dc and -12V dc from the CMC shelf supply circuit. The power converter converts the +12V dc and -12V dc to a +29V dc unregulated supply for the oscillator and temperature control oven. The power converter converts the ±12V dc power supply to +15V dc and -15V dc regulated to ±0.1% for the oscillator control circuits.

Circuits in the power converter protect the power converter against damage from large transient voltages. A monitor circuit checks the +15V output and sends an error signal to the NT3X14 if the output fails.

Technical data

The NT3X15AB accepts a 10.24MHz ± 6Hz clock signal from the mate CMS and a 1-V rms signal from the external reference oscillator. The NT3X15AB sends a 10.24MHz ± 6Hz clock signal to the mate CMC.

NT3X15AB (end)

The crystal oscillator has a center frequency of 10.24 MHz and a tuning voltage range of 0 to 5V dc. The crystal oscillator has a center frequency voltage of 2.5V dc, a frequency setting for tuning of ±20 Hz maximum, and a stability setting of $\pm 2 \times 10^{-9}$ $\Delta f/F$ for each day.

Dimensions

The dimensions of the NT3X15AB card are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 66 mm (2.6 in.)

Power requirements

The power requirements for the NT3X15AB appear in the following table.

Power requirements

Voltage	Oven heater on	Oven heater off
-12V dc ±5%	400 mA	150 mA
+12V dc ±5%	475 mA	475 mA
+5V dc ±5%	1.6 A	

NT3X15BA

Product description

The NT3X15BA synchronizable master clock oscillator generates a 10.40-MHz clock signal. The clock signal controls the timing circuits in the DMS-100 switching system.

The card has a faceplate shielded electrostatically. The card operates with the NT3X14 synchronizable master clock controller. The card has two configurations. One configuration uses an internal crystal oscillator. The other configuration uses an external crystal oscillator.

Location

The card is in the central message controller (CMC) shelf or in the message and device controller (MDC) shelf. A second pair of NT3X15 - NT3X14 cards in the second CMC or MDC provides standby facilities.

Functional description

The NT3X15BA uses waves compatible with transistor-transistor logic (TTL) to compare signal frequencies. The NT3X15BA sends an error signal if an output fails. The card uses the NT3X14 to communicate with the CMC. The NT3X15BA provides an interface between the card and the CMC.

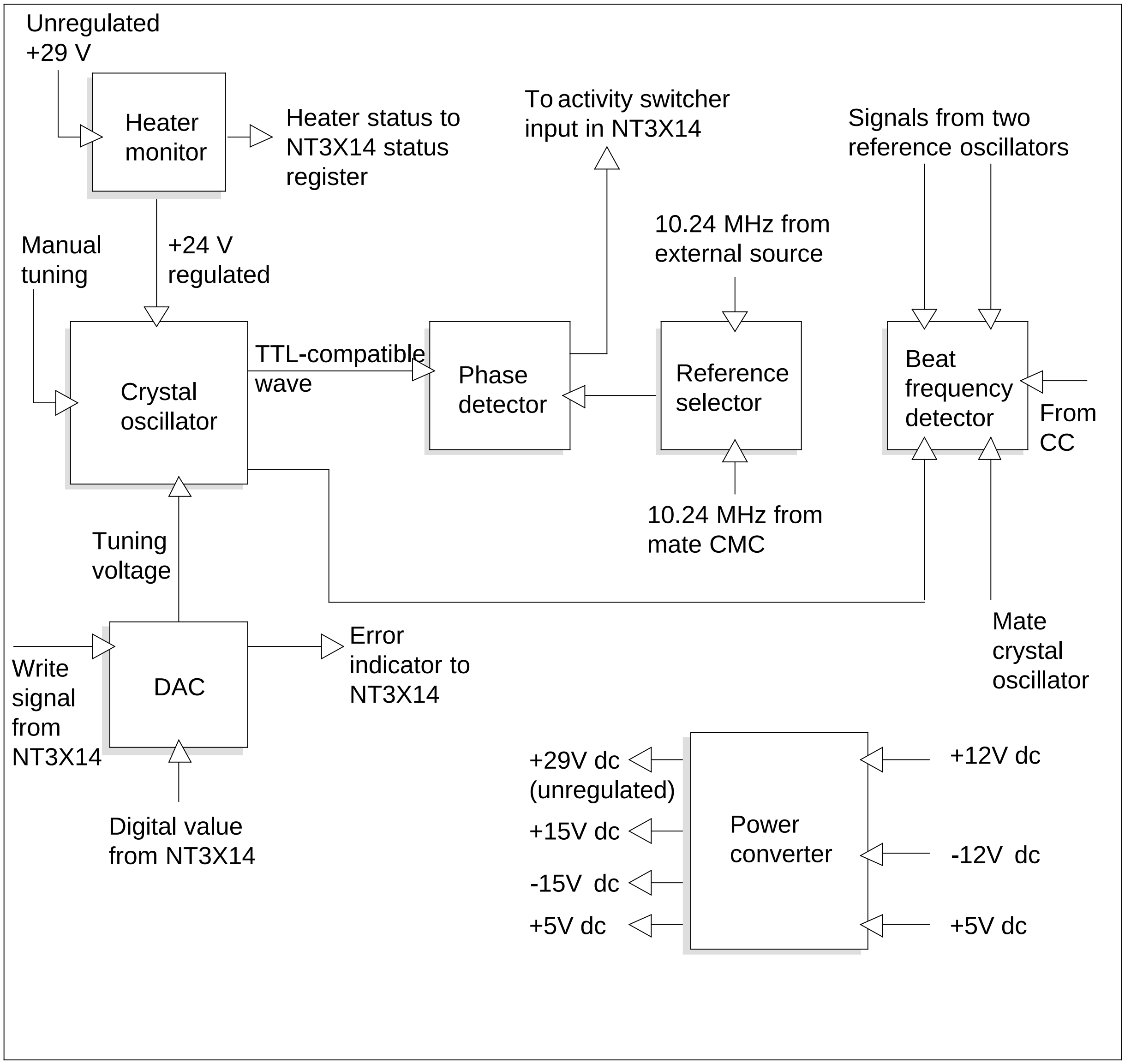
Functional blocks

The NT3X15BA consists of the following functional blocks:

- crystal oscillator
- oscillator heater monitor circuit
- digital-to-analog converter (DAC)
- phase detector
- reference selector
- beat frequency detector
- power converter

NT3X15BA (continued)

NT3X15BA functional blocks



Crystal oscillator

The crystal oscillator generates a 10.24-MHz wave compatible with TTL that the oscillator sends to the phase detector circuit. To tune the frequency of the oscillator electronically, you can use dc voltage. To tune the frequency manually, you can use a visual display unit (VDU) at a MAP display.

Oscillator heater monitor circuit

The oscillator heater monitor circuit converts the +29V unregulated power supply to the regulated +24 V that the crystal oscillator requires. The circuit sends the status of the heater to the NT3X14 card. The central control (CC) uses this status.

DAC

The 12-bit DAC supplies the tuning control voltage to the crystal oscillator. The DAC converts a digital value that the NT3X14 sends to the dc tuning voltage. A write signal from the NT3X14 controls the DAC loading. A write-protect function prevents incorrect tuning of the oscillator. The CC can read and verify the DAC contents through the NT3X14.

Phase detector

The phase detector comprises two counters that allow the detector to compare the frequency of the crystal oscillator with other sources. One counter accepts the 10.24-MHz signal from the crystal oscillator. The other counter accepts the external source signal. Both counters divide the signals to 8 kHz for comparison and synchronization.

Reference selector

The reference selector makes sure that the crystal oscillator can synchronize to the mate CMC clock. The reference selector allows the external signal or the mate CMC clock signal to pass to the phase monitor circuits.

Beat frequency detector

The beat frequency detector monitors the difference in frequency between two signals provided to the NT3X15. In a slave system, the beat frequency detector monitors the difference between the two CMC oscillators. The CC times the detector state change to indicate correct operation of the reference oscillators in a master office configuration.

Power converter

The power converter accepts +12V dc and -12V dc from the CMC shelf supply circuit. The power converter converts the +12V dc and -12V dc to a +29V dc unregulated supply for the oscillator and temperature control oven. The power converter converts the ±12V dc power supply to +15V dc and -15V dc regulated to ±0.1% for the oscillator control circuits.

Circuits in the power converter protect the power converter against damage from large transient voltages. A monitor circuit checks the +15V output. The monitor circuit sends an error signal to the NT3X14 if the output fails.

Technical data

The NT3X15BA accepts a 10.24MHz ± 6Hz clock signal from the mate CMS and a 1-V rms signal from the external reference oscillator. The NT3X15BA sends a 10.24MHz ± 6Hz clock signal to the mate CMC.

NT3X15BA (end)

The crystal oscillator has a center frequency of 10.24 MHz and a tuning voltage range of 0 to 5V dc. The crystal oscillator has a center frequency voltage of 2.5V dc, a frequency setting for tuning of ±20 Hz maximum, and a stability setting of $\pm 2 \times 10^{-9}$ $\Delta f/F$ for each day.

Dimensions

The dimensions of the NT3X15BA card are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 66 mm (2.6 in.)

Power requirements

The power requirements for the NT3X15BA appear in the following table.

Power requirements

Voltage	Oven heater on	Oven heater off
-12V dc ±5%	400 mA	150 mA
+12V dc ±5%	475 mA	475 mA
+5V dc ±5%	1.6 A	

NT3X15BB

Product description

The NT3X15BB synchronizable master clock oscillator generates a 10.40-MHz clock signal. The clock signal controls the timing circuits in the DMS-100 switching system.

The card has an electrostatically-shielded faceplate. The card operates with the NT3X14 synchronizable master clock controller. The card has two configurations. One configuration uses an internal crystal oscillator. The other configuration uses an external crystal oscillator.

Location

The card is in the central message controller (CMC) shelf or in the message and device controller (MDC) shelf. A second pair of NT3X15 - NT3X14 cards in the second CMC or in the MDC provides standby facilities.

Functional description

The NT3X15BB uses transistor-transistor logic-compatible (TTL) waves to compare signal frequencies. The NT3X15BB sends an error signal if an output fails. The card uses the NT3X14 to communicate with the CMC. The NT3X14 provides an interface between the card and the CMC.

Functional blocks

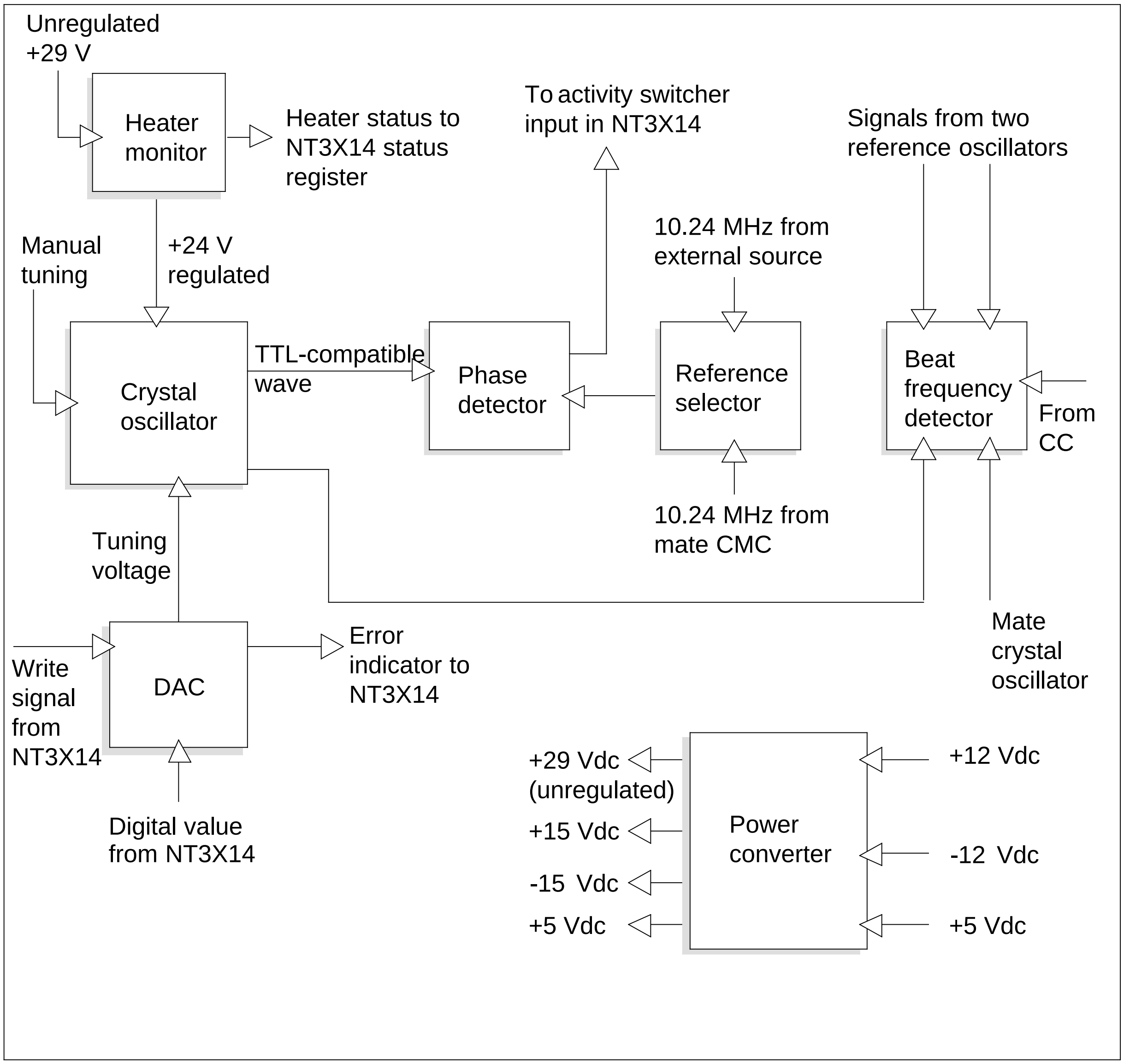
The NT3X15BB has the following functional blocks:

- crystal oscillator
- oscillator heater monitor circuit
- digital-to-analog converter (DAC)
- phase detector
- reference selector

NT3X15BB (continued)

- beat frequency detector
- power converter

NT3X15BB functional blocks



Crystal oscillator

The crystal oscillator generates a 10.24-MHz TTL-compatible wave. The oscillator sends the wave to the phase detector circuit. You can use the dc voltage to tune the frequency of the oscillator electronically. You can use a visual display unit (VDU) at a MAP terminal to tune the frequency of the oscillator manually.

Oscillator heater monitor circuit

The oscillator heater monitor circuit converts the +29V unregulated power supply to the regulated +24 V that the crystal oscillator requires. The circuit sends the status of the heater to the NT3X14 card the central control (CC) to use.

DAC

The 12-bit DAC supplies the tuning control voltage to the crystal oscillator. The DAC converts a digital value that the NT3X14sends to the dc tuning voltage. A write signal from the NT3X14 controls the DAC loading. A write-protect function is set to prevent mistuning the oscillator. The CC can use the NT3X14 to read and verify the DAC contents.

Phase detector

The phase detector has two counters that allow a comparison of the frequency of the crystal oscillator with other sources. One counter accepts the 10.24-MHz signal from the crystal oscillator. The other counter accepts the external source signal. The two counters divide the signals down to 8 kHz for comparison and synchronization.

Reference selector

The reference selector makes sure synchronization occurs between the crystal oscillator and the mate CMC clock. The reference selector allows the external signal or the mate CMC clock signal to pass to the phase monitor circuits.

Beat frequency detector

The beat frequency detector monitors the difference in frequency between two signals provided to the NT3X15. In a slave system, the beat frequency detector monitors the difference between the two CMC oscillators. The CC uses the timing of the beat frequency detector change of state as an indicator. The timing indicates the correct operation of the reference oscillators in a master office configuration.

Power converter

The power converter accepts +12 Vdc and -12 Vdc from the CMC shelf supply circuit. The power converter converts the +12 Vdc and -12 Vdc to a +29Vdc unregulated supply for the oscillator and temperature control oven. The power converter converts the ± 12 Vdc power supply to +15 Vdc and -15 Vdc regulated to ± 0.1%. The +15 Vdc and -15 Vdc are for the oscillator control circuits.

Circuits in the power converter protect against damage from large transient voltages. A monitor circuit checks the +15V output. The monitor circuit sends an error signal to the NT3X14 if the output fails.

NT3X15BB (end)

Technical data

The NT3X15BB accepts a 10.24 MHz ± 6 Hz clock signal from the mate CMS. The NT3X15BB accepts a 1-V rms signal from the external reference oscillator. A 10.24 MHz ± 6 Hz clock signal is sent to the mate CMC.

The crystal oscillator has a center frequency of 10.24 MHz and a tuning voltage range of 0 to 5 Vdc. The crystal oscillator has a center frequency voltage of 2.5 Vdc. The crystal oscillator has a tunable frequency setting of ± 20 Hz maximum. The crystal oscillator has a stability setting of $\pm 2 \times 10^{-9}$ $\Delta f/F$ per day.

Dimensions

The dimensions of the NT3X15BB card are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 66 mm (2.6 in.)

Power requirements

The following table lists the power requirements for the NT3X15BB.

Power requirements

Voltage	Oven heater on	Oven heater off
-12 Vdc ±5%	400 mA	150 mA
+12 Vdc ±5%	475 mA	475 mA
+5 Vdc ±5%	1.6 A	

NT3X15CA

Product description

The NT3X15CA Stratum 3 synchronizable master clock oscillator generates a 10.40-MHz clock signal. This signal controls the timing circuits in the DMS-100 switching system. The card complies with the requirements for use in a Stratum 3 office.

The card has an electrostatically-shielded faceplate. The card operates with the NT3X14 synchronizable master clock controller. The card has two configurations. One configuration uses an internal crystal oscillator. The other configuration uses an external crystal oscillator.

Location

The card is in the central message controller (CMC) shelf or in the message and device controller (MDC) shelf. A second pair of NT3X15 - NT3X14 cards in the second CMC or in the MDC provides standby facilities.

Functional description

The NT3X15CA uses transistor-transistor logic-compatible (TTL) waves to compare signal frequencies. The NT3X15CA sends an error signal if an output fails. The card uses NT3X14 to communicate with the CMC. The NT3X14 has an interface between the card and the CMC.

Functional blocks

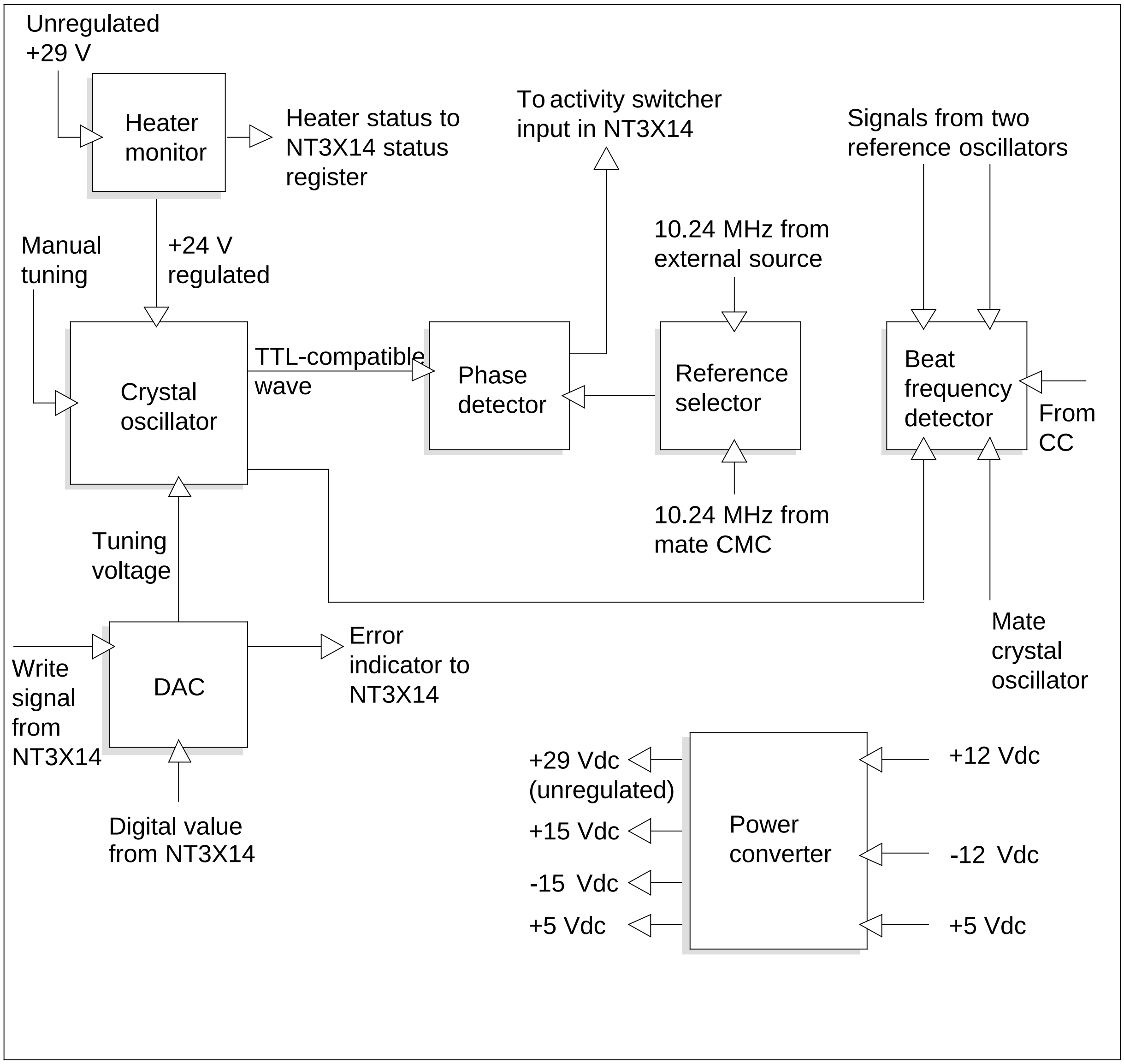
The NT3X15CA has the following functional blocks:

- crystal oscillator
- oscillator heater monitor circuit
- digital-to-analog converter (DAC)
- phase detector
- reference selector

NT3X15CA (continued)

- beat frequency detector
- power converter

NT3X15CA functional blocks



Crystal oscillator

The crystal oscillator generates a 10.24-MHz TTL-compatible wave. The oscillator sends the wave to the phase detector circuit. The dc voltage can tune the frequency of the oscillator electronically. You can use a visual display unit (VDU) at a MAP terminal to tune the frequency manually.

Oscillator heater monitor circuit

The oscillator heater monitor circuit converts the +29V unregulated power supply to the regulated +24 V that the crystal oscillator requires. The circuit sends the status of the heater to the NT3X14 card for the central control (CC) to use.

DAC

The 12-bit DAC supplies the tuning control voltage to the crystal oscillator. The DAC converts a digital value that the NT3X14 sends to the dc tuning voltage. A write signal from the NT3X14 controls the DAC loading. A write-protect function is set to prevent mistuning of the oscillator. The CC can use the NT3X14 to read and verify the DAC contents.

Phase detector

The phase detector has two counters that allow a comparison of the frequency of the crystal oscillator with other sources. One counter accepts the 10.24-MHz signal from the crystal oscillator. The other counter accepts the external source signal. The two counters divide the signals down to 8 kHz for comparison and synchronization.

Reference selector

The reference selector makes sure synchronization can occur between the crystal oscillator and the mate CMC clock. The reference selector allows the external signal or the mate CMC clock signal to pass to the phase monitor circuits.

Beat frequency detector

The beat frequency detector monitors the difference in frequency between two signals provided to the NT3X15. In a slave system, the beat frequency detector monitors the difference between the two CMC oscillators. The timing of the beat frequency detector change of state of the CC indicates the correct operation of the reference oscillators in a master office configuration.

Power converter

The power converter accepts +12 Vdc and -12 Vdc from the CMC shelf supply circuit. The power converter converts the +12 Vdc and -12 Vdc to a +29Vdc unregulated supply for the oscillator and temperature control oven. The power converter converts the ±12 Vdc power supply to +15 Vdc and -15 Vdc regulated to ± 0.1% for the oscillator control circuits.

Power converters have circuits to protect against damage from large transient voltages. A monitor circuit checks the +15V output and sends an error signal to the NT3X14 if the output fails.

NT3X15CA (end)

Technical data

The NT3X15CA accepts a 10.24 MHz ± 6 Hz clock signal from the mate CMS. The NT3X15CA accepts a 1-V rms signal from the external reference oscillator. The oscillator sends a 10.24 MHz ± 6 Hz clock signal to the mate CMC.

The crystal oscillator has a center frequency of 10.24 MHz and a tuning voltage range of 0 to 10 Vdc. The crystal oscillator has a center frequency voltage of 5 Vdc and a tunable frequency setting of ± 156 Hz maximum. The crystal oscillator has a stability setting of $\pm 3 \times 10^{-7}$ $\Delta f/F$ for each day.

Dimensions

The dimensions of the NT3X15CA card are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 66 mm (2.6 in.)

Power requirements

The power requirements for the NT3X15CA appear in the following table.

Power requirements

Voltage	Oven heater on	Oven heater off
-12 Vdc ±5%	400 mA	150 mA
+12 Vdc ±5%	475 mA	475 mA
+5 Vdc ±5%	1.6 A	

NT3X15DA

Product description

The NT3X15DA Stratum 2 synchronizable master clock generates a 10.40-MHz clock signal. This signal controls the timing circuits in the DMS-100 switching system. The card complies with the requirements for use in a Stratum 2 office.

The card has an electrostatically-shielded faceplate. The card operates with the NT3X14 synchronizable master clock controller. The card has two configurations. One configuration uses an internal crystal oscillator. The other configuration uses an external crystal oscillator.

Location

The card is in the central message controller (CMC) shelf or in the message and device controller (MDC) shelf. A second pair of NT3X15 - NT3X14 cards in the second CMC or MDC provides standby facilities.

Functional description

The NT3X15DA uses power received from the CMC shelf. The NT3X15DA sets the tuning voltage for the remote oscillator on the NT3X16 Stratum 2 oscillator card. The NT3X15DA uses signals received from the CMC shelf to compare the signals of the oscillator with external reference signals.

Functional blocks

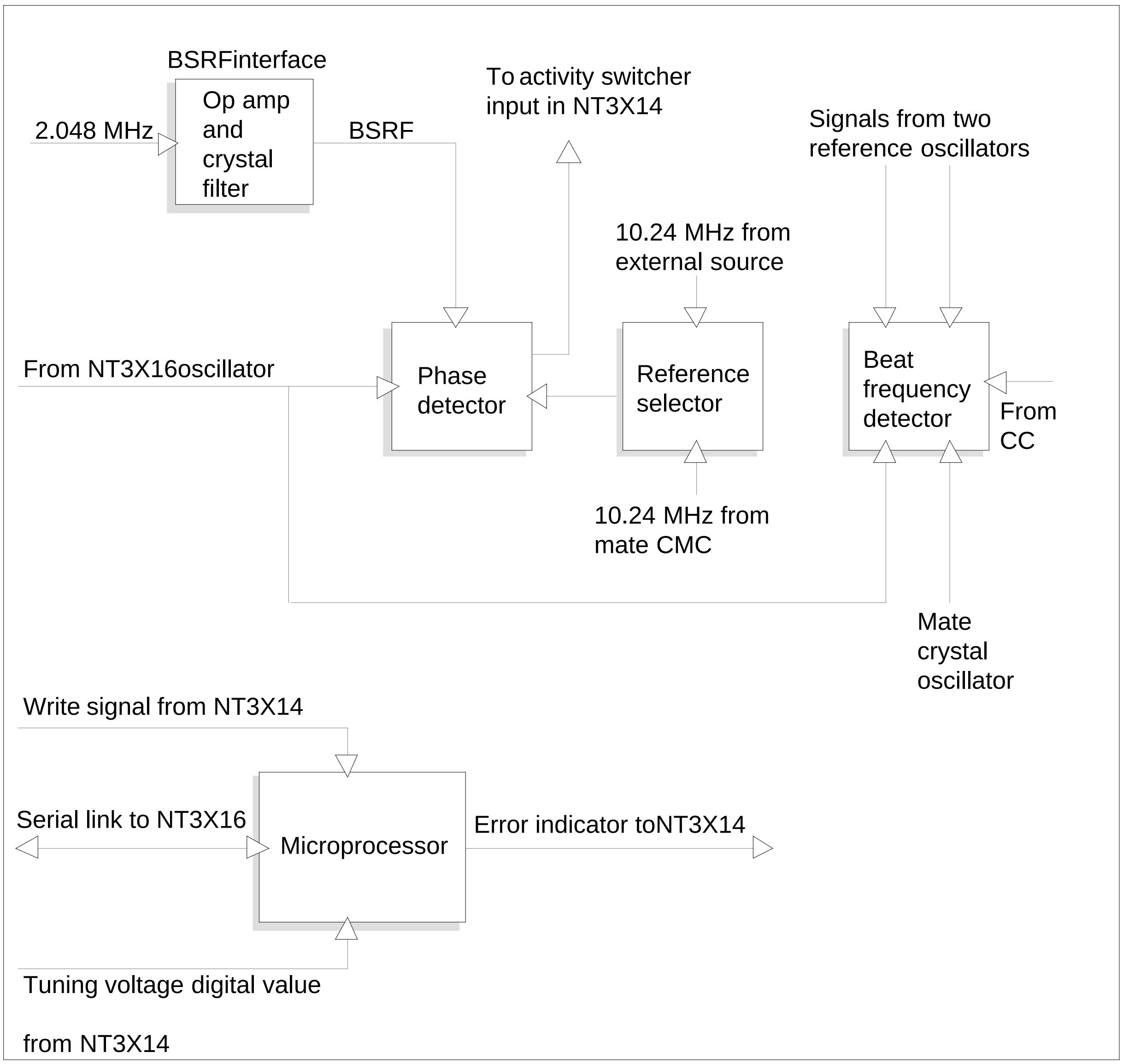
The NT3X15DA consists of the following functional blocks:

- microprocessor
- Bell system reference frequency (BSRF) interface
- phase detector

NT3X15DA (continued)

- reference selector
- beat frequency detector

NT3X15DA functional blocks



Microprocessor

The microprocessor operates as an interface and as a controller. The microprocessor transmits data and reception between the card and the NT3X16 oscillator. The microprocessor receives a digital value. This value represents the desired oscillator frequency from the NT3X14. The microprocessor formats the value again to allow transmission of the value to the NT3X16. The card decodes the digital value and converts the value to the tuning voltage for the remote oscillator.

To verify messages, the microprocessor checks the number of messages received from the NT3X16. The microprocessor compares this number with the number of messages sent from the NT3X15. The microprocessor handles test instructions and commands for the NT3X16. The microprocessor acknowledges error reports and alarms from the NT3X16.

BSRF interface

The BSRF interface receives a 2.048-MHz sine-wave signal from the CMC shelf. An operational amplifier has this signal applied. The operational amplifier filters the signal. The amplifier sends the signal to the phase detector as a reference input.

Phase detector

The phase detector allows the comparison of the signal frequency from the remote oscillator with 10.24-MHz reference signals. The reference signals are from the mate CMC oscillator or from an external frequency standard. The BSRF signal can perform a comparison function.

Reference selector

The reference selector allows passage of the external reference signal or the signal from the mate CMC clock to the phase monitor circuits.

Beat frequency detector

The beat frequency detector monitors the difference in frequency between two signals provided to the NT3X15. In a slave system, the beat frequency detector monitors the difference between the two CMC oscillators. The central control (CC) uses the timing of the beat frequency detector change of state as an indicator. The timing indicates the correct operation of the reference oscillators in a master office configuration.

Technical data

The NT3X15DA accepts a 10.24 MHz ± 6 Hz clock signal from the mate CMS. The NT3X15DA accepts a 1-V rms signal from the external reference oscillator. The oscillator sends a 10.24 MHz ± 6 Hz clock signal to the mate CMC.

The BSRF has a frequency setting of 2.048 MHz, with a level of - 20 dBm. The impedance of the BSRF is 75 Ω. The maximum input level of the BSRF is 2 V peak-to-peak.

NT3X15DA (end)

Dimensions

The dimensions of the NT3X15DA card are:

- height: 353 mm (13.9 in.)
- depth: 279 mm (11.0 in.)
- width: 66 mm (2.6 in.)

NT3X16AA

Product description

The NT3X16AA oscillator and interface card allows the synchronization of the DMS-100 switch frequency with the digital network frequency. The card allows the synchronization of the DMS-100 switch frequency with Stratum II accuracy. This card operates in applications that do not have intersystem-ground (ISG).

The NT3X16AA oscillator frequency is adjustable under central control to synchronize the DMS switch frequency with the digital network frequency. The NT3X16AA clock signal has stability to dF/f of $\pm 1 \times 10^{-10}$ and is tuneable over a range of ±0.75 Hz maximum. The includes monitor circuits that detect power supply failures.

Location

The NT3X16AA functions in an NT3X95AA remote oscillator shelf. The dual backplane of the NT3X95AA has provision for an active clock and an inactive clock. The backplane has provision for two NT1X78AA power converters and two hot standby spares. Operating company personal place these spares in service. In SuperNode applications the NT3X16AA card communicates with the NT9X53 through an interface card (NT9X54). In NT40 applications the NT3X16AA communicates directly with the NT3X15 card.

Functional description

Adjustments to the NT3X16AA oscillator frequency occur under the central control complex. The adjustment allows the synchronization of the DMS switch frequency with the office clock reference. This adjustment allows the use of the DMS switch frequency as a stand-alone master clock reference.

Functional blocks

The NT3X16AA consists of the following functional blocks:

- crystal oscillator
- oscillator circuit and monitors
- oscillator tuning control
- power converters
- microprocessor and serial link

Crystal oscillator

The crystal oscillator on the NT3X16AA provides a 10.24 MHz clock sine wave signal to the NT3X15DA or the NT9X53. The signal passes through a coaxial cable interconnection between the NT3X95AA and the NT3X15DA or NT9X53. The crystal oscillator requires a maximum of 500 mA during

NT3X16AA (continued)

warmup and 100 mA after warmup at 25°C. A fine tune of the oscillator occurs with a tuning voltage in the range of 0 to 10 V. The lowest frequency is 0 V. The center frequency is 10.24 MHz at 5 V. A voltage change of 0.1 V results in a frequency shift of 0.015 Hz. A mechanical adjustment provides a timing range of ±3 Hz.

Oscillator circuit and monitors

The oscillator has two outputs. The first output monitors the oscillator frequency when adjustment occurs (pin 59A). The second output transmits to the NT3X15DA or NT9X53. A dc-to-dc converter regulates the oscillator supply voltage. The NT1X78AA power converter supplies the dc-to-dc converter. A transistor detects +24V failure. The system flags the +24V failure as a heater alarm. Another transistor monitors the digital-to-analog converter (DAC) supply voltage. If a failure of the +15V supply is detected, the system transmits a power (PWR) alarm message to the NT3X15DA or NT9X53.

Power converters

A dc-to-dc converter from the +5V logic supply supplies the ±15 V (0.02) for the DAC. The voltage is monitored. A failure of the ±15 V results in a power alarm being reported to the NT3X53/54 through the serial link. A dc-dc converter provides the +24 V. The converter is regulated to 1%. A current monitor on the supply input for the dc-to-dc converter detects failure of the dc-to-dc converter or the crystal oven. The system reports this failure as a heater alarm to the NT3X53/54.

Oscillator tuning control

A 16-bit DAC supplies the oscillator tuning control voltage. Only the lower 14 bits are used on this DAC. The ±15V dc-to-dc converter and the +5V logic supply power the DAC. Latches hold the digital value of the DAC setting. The DAC reads the digital value through multiplexers. The multiplexers select the DAC value that the NT3X15DA, NT9X53, or hot standby mode sends. The ground of signal SPARE (26A) can enable hot standby mode. When the signal SPARE (26A) is ground, the value 8000 H loads into the DAC. This value is the center frequency of the oscillator. The microprocessor can read the current DAC setting on the multiplexers.

Microprocessor and serial link

The microprocessor used on the NT3X16AA is an Intel 8751 microcontroller. The microprocessor receives the DAC value serially from the NT3X15DA or the NT9X53. The microprocessor decodes the DAC value and writes the most important byte in a latch. The microprocessor writes the lower byte of the DAC setting in a second latch. At the same time, the upper byte is transferred from the first latch to a third latch. The transfer of the upper byte causes a 14-bit

DAC value. The microprocessor reads the DAC setting on the multiplexers and sends a confirmation message to the NT3X15DA or NT9X53.

The microprocessor is reset through the serial link. The latches that hold the DAC value are disabled. If the system generates a power or heater alarm, an interrupt occurs. The microprocessor sends a correct message to the NT3X15DA or NT9X53.

Signaling

Pin numbers

The following figure shows the pin outs for the NT3X16AA.

Technical data

Power requirements

The NT3X16AA has the following power requirements:

- +5 V ±15%
- +24 V ±4%

NT3X16AA (continued)

Power converter outputs

The NT3X16AA has the following onboard power converter outputs:

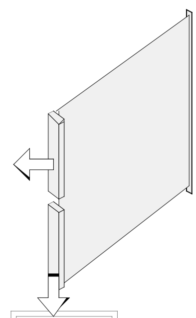
- ±15 V ±0.02%
- +24 V ±1%

> ***Note:*** The +24 V must not change more than 10 mV under changing load.

NT3X16AA (end)

NT3X16AA pin numbers

Pins		A	B
1A	1B	GND	GND
2A	2B	GND	GND
3A	3B		
4A	4B		
5A	5B		
6A	6B		
7A	7B		
8A	8B		
9A	9B		
10A	10B	GND	GND
11A	11B	GND	GND
12A	12B		
13A	13B		
14A	14B		
15A	15B	24 V	24 V
16A	16B	24 V	24 V
17A	17B	24 V	24 V
18A	18B	24 V	24 V
19A	19B	24 V	24 V
20A	20B		
21A	21B	GND	GND
22A	22B	Bact-	
23A	23B		
24A	24B		
25A	25B		
26A	26B	Spare	
27A	27B	Rdx+	Rdx-
28A	28B	GND	GND
29A	29B	Tdx+	Tdx-
30A	30B		
31A	31B	GND	GND
32A	32B		
33A	33B		
34A	34B		
35A	35B	GND	GND
36A	36B		
37A	37B		
38A	38B		
39A	39B	Reset+	Reset-
40A	40B	GND	GND



41A	41B
42A	42B
43A	43B
44A	44B
45A	45B
46A	46B
47A	47B
48A	48B
49A	49B
50A	50B
51A	51B
52A	52B
53A	53B
54A	54B
55A	55B
56A	56B
57A	57B
58A	58B
59A	59B
60A	60B
61A	61B
62A	62B
63A	63B
64A	64B
65A	65B
66A	66B
67A	67B
68A	68B
69A	69B
70A	70B
71A	71B
72A	72B
73A	73B
74A	74B
75A	75B
76A	76B
77A	77B
78A	78B
79A	79B
80A	80B

NT3X16AB

Product description

The NT3X16AB oscillator (DMS-core) and interface card allows the DMS-100 switch frequency to be synchronized to the digital network frequency. The isolation of the clock output is the only difference between NT3X16AB and an earlier version, NT3X16AA.

The NT3X16AB oscillator frequency is adjustable under central control to synchronize the DMS switch frequency with the digital network frequency. The NT3X16AB clock signal has stability to dF/f of $\pm 1\times 10^{10}$ and is tuneable over a range of ±0.75 Hz maximum. The NT3X16AB includes monitor circuits that detect power supply failures.

Location

The NT3X16AB is for use in a NT3X95AA/AB remote oscillator shelf. The NT3X95AA/AB has provision for an active clock and an inactive clock. The NT3X95AA/AB also has provision for two NT1X78AA power converters and two hot standby spares. The placement of two hot standby spares in service occurs manually. In SuperNode applications the NT3X16AB card communicates with the NT9X53 through an interface card (NT9X54). In NT40 applications the NT3X16AB talks directly to the NT3X15 card.

Functional description

The NT3X16AB card allows provisioning of the NT3X95 remote oscillator shelf packfill. The NT3X16AB card provides normal NT40 outputs. The card brings out a transformer-coupled intersystem ground (ISG) compliant to a new set of backplane pins for SuperNode applications.

Functional blocks

The NT3X16AB consists of the following functional blocks:

- crystal oscillator
- oscillator circuit and monitors
- oscillator tuning control
- power converters
- microprocessor and serial link

Crystal oscillator

The crystal oscillator used on the NT3X16AB provides a 10.240000 MHz sine wave signal to the NT3X15DA or NT9X53. The signal passes through a coaxial cable interconnection between the NT3X95AA and the NT3X15DA or NT9X53. The crystal oscillator requires a maximum of 500 mA during warmup and 100 mA after warmup at 25°C. A fine tune of the oscillator occurs through a tuning voltage in the range of 0 to 10 V. The lowest frequency is 0 V. The center frequency is 10.240000 MHz at 5 V. A voltage change of 0.1 V results in a frequency shift of 0.015 Hz. A mechanical adjustment provides a timing range of ±3 Hz.

Oscillator circuit and monitors

The oscillator has two outputs. The first output monitors the oscillator frequency when mechanical adjustments occur (pin 59A). The second output transmits to the NT3X15DA or NT9X53. A dc-to-dc converter regulates the oscillator supply voltage. The NT1Z78AA power converter supplies the oscillator supply voltage. A transistor detects +24V failure. The system flags the +24V failure as a heater alarm. Another transistor monitors the digital-to-analog converter (DAC) supply voltage. If a failure of the +15V supply is detected, the system transmits a power (PWR) alarm message to the NT3X15DA or NT9X53.

Power converters

A dc-to-dc converter supplies the ±15 V (0.02) for the DAC from the +5V logic supply. The voltage is monitored. A failure of the ±15 V results in a power alarm report to the NT3X53AA/54AA through the serial link. A dc-to-dc converter provides the +24 V. The converter is regulated to 1%. A current monitor is on the supply input for the dc-to-dc converter. The current monitor detects failure of the dc-to-dc converter or the crystal oven. The system reports this failure as a heater alarm to the NT3X53AA/54AA.

Oscillator tuning control

A 16-bit DAC supplies the oscillator tuning control voltage. Only the lower 14 bits are used on this DAC. The ±15 V dc-to-dc converter and the +5V logic supply powers the DAC. Latches hold the digital value of the DAC setting. The DAC reads the value through multiplexers. The multiplexers select the DAC value the NT3X15DA or NT9X53 or hot standby mode sent. Grounding signal SPARE (26A), which loads 8000 H in the DAC can enable hot standby mode. This value is the center frequency of the oscillator. The microprocessor can read the current DAC setting on the multiplexers.

Microprocessor and serial link

The microprocessor used on the NT3X16AB is an Intel 8751 microcontroller. The microprocessor receives the DAC value serially from the NT9X53. The microprocessor decodes the DAC value and writes the most significant byte in a latch. The microprocessor writes the lower byte of the DAC setting in a second latch. At the same time, the upper byte transfers from the first latch to a third latch. The transfer causes a 14-bit DAC value. The microprocessor reads the DAC setting on the multiplexers and sends a confirmation message to the NT3X15DA or NT9X53. The microprocessor is reset through the serial

NT3X16AB (continued)

link. When the reset of the microprocessor occurs, the latches that hold the DAC value are disabled. If the system generates a power or heater alarm, an interrupt occurs. The microprocessor sends a correct message to the NT3X15DA or NT9X53.

Signaling

Pin numbers

The following figure shows the pin outs for the NT3X16AB.

Technical data

Power requirements

NT3X16AB has the following power requirements:

- +5 V (±15%)
- +24 V (±4%)

> ***Note:*** The +24 V must not change more than 10 mV under changing load.

Power converter outputs

NT3X16AB has the following onboard power converter outputs:

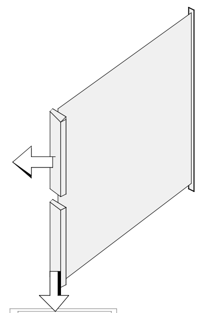
- +15 V (±0.02%)
- +24 V (±1%)

> ***Note:*** The +24 V must not change more than 10 mV under changing load.

NT3X16AB (end)

NT3X16AB pin numbers

Pins		A	B
1A	1B	Gnd	Gnd
2A	2B	Gnd	Gnd
3A	3B		
4A	4B		
5A	5B		
6A	6B		
7A	7B		
8A	8B		
9A	9B		
10A	10B	Gnd	Gnd
11A	11B	Gnd	Gnd
12A	12B		
13A	13B		
14A	14B		
15A	15B	24 V	24 V
16A	16B	24 V	24 V
17A	17B	24 V	24 V
18A	18B	24 V	24 V
19A	19B	24 V	24 V
20A	20B		
21A	21B	Gnd	Gnd
22A	22B	Bact-	
23A	23B		
24A	24B		
25A	25B		
26A	26B	Spare	
27A	27B	Rdx+	Rdx-
28A	28B	Gnd	Gnd
29A	29B	Tdx+	Tdx-
30A	30B		
31A	31B	Gnd	Gnd
32A	32B		
33A	33B		
34A	34B		
35A	35B	Gnd	Gnd
36A	36B		
37A	37B		
38A	38B		
39A	39B	Reset+	Reset-
40A	40B	Gnd	Gnd



41A	41B
42A	42B
43A	43B
44A	44B
45A	45B
46A	46B
47A	47B
48A	48B
49A	49B
50A	50B
51A	51B
52A	52B
53A	53B
54A	54B
55A	55B
56A	56B
57A	57B
58A	58B
59A	59B
60A	60B
61A	61B
62A	62B
63A	63B
64A	64B
65A	65B
66A	66B
67A	67B
68A	68B
69A	69B
70A	70B
71A	71B
72A	72B
73A	73B
74A	74B
75A	75B
76A	76B
77A	77B
78A	78B
79A	79B
80A	80B

NT3X16BA

Product description

The NT3X16BA oscillator (DMS-core) and interface card provides a 10.240000-MHz signal. The signal is for use as the clock frequency for the DMS-100 peripherals, network, and interfaces.

Location

The NT3X16BA card is for use in the NT3X95BA remote oscillator shelf. The remote oscillator shelf has provisions for an active clock and an inactive clock. The shelf has provisions for two NT1X78AA power converters, and two hot standby spares. The NT3X16BA card communicates to the NT3X53AA/54AA card through a serial link.-

Functional description

The master clock oscillator frequency is adjustable under the central control to synchronize the DMS switch frequency with the digital network frequency. The adjustable frequency allows the synchronization of the oscillator frequency with the digital network.

Functional blocks

The NT3X16BA has the following functional blocks:

- crystal oscillator
- oscillator circuit and monitors
- oscillator tuning control
- power converters
- microprocessor and serial link

Crystal oscillator

The crystal oscillator on the NT3X16BA provides a 10.24-MHz sine wave signal to the NT3X53AA/54AA. The signal passes through a coaxial cable interconnection between the NT3X95BA and the NT3X53AA/54AA. The crystal oscillator on the NT3X16BA requires a maximum of 277 mA during warmup and 100 mA after warmup at 27°C. A fine tune of the oscillator occurs through the application of a tuning voltage in the range of 0 to 5 volts. The highest frequency is 0 V. The center frequency is 10. 24 MHz at 2.5 V.

Oscillator circuit and monitors

The oscillator has two outputs. The first output monitors the oscillator frequency when mechanical adjustment occurs (pin 59A). The second output transmits to the NT3X53AA/54AA. A dc-to-dc converter regulates the oscillator supply voltage. The NT1X78AA power converter supplies the voltage. A transistor detects +24V failure. The failure is flagged as a heater

NT3X16BA (continued)

alarm. The system sends the appropriate message to the NT3X53AA/54AA to flag the failure as a heater alarm. Another transistor monitors the DAC supply voltage. If the transistor detects a failure of the +15V supply, the system sends a power alarm message to the NT3X53AA/54AA to generate a PNR alarm.

Oscillator tuning control

A 16-bit digital-to-analog converter (DAC) supplies the oscillator tuning control voltage. The DAC uses only the lower 14 bits. The ±15 V dc-to-dc converter and the +5V logic supply power the DAC. Latches hold the digital value of the DAC setting. The DAC reads the digital value through multiplexers. The multiplexers select the DAC value that.the NT3X53AA/54AA on hot standby mode sends. The ground of the signal SPARE frequency of the oscillator can enable hot standby mode. The microprocessor can read the current DAC setting on the multiplexers.

Power converters

A dc-to-dc converter from the +5V logic supply supplies the ±15 V (0.02) for the DAC. The voltage is monitored. A failure of the ±15 V causes a report of a power alarm to the NT3X53AA/54AA through the serial link. A dc-to-dc converter provides the +24 V. The converter is regulated to 1%. A current monitor on the supply input for the dc-to-dc converter detects failure of the converter or the crystal oven. The system reports this failure as a heater alarm to the NT3X53AA/54AA.

Microprocessor and serial link

The microprocessor used on the NT3X16BA is an Intel 8751 microcontroller. The microprocessor receives the DAC value serially from the NT3X53AA/54AA. The microprocessor decodes the DAC value and writes the most significant byte in a latch. The microprocessor writes the lower byte of the DAC setting in a second latch. At the same time, the upper byte transfers from the first latch to a third latch. The transfer results in a 14-bit DAC value. The microprocessor reads the DAC setting on the multiplexers and sends a confirmation message to the NT3X53AA/54AA. The microprocessor is reset through the serial link. The reset disables the latches that hold the DAC value. If the system generates a power or heater alarm, an interrupt occurs. The microprocessor sends a correct message to the NT3X53AA/54AA.

Signaling

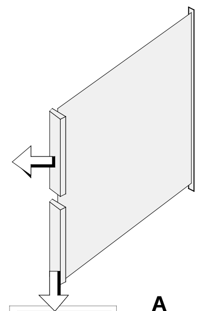
Pin numbers

The following figure shows the pin numbers for the NT3X16BA.

NT3X16BA (continued)

NT3X16BA pin numbers

		A	B
1A	1B	Gnd	Gnd
2A	2B	Gnd	Gnd
3A	3B		
4A	4B		
5A	5B		
6A	6B		
7A	7B		
8A	8B		
9A	9B		
10A	10B	Gnd	Gnd
11A	11B	Gnd	Gnd
12A	12B		
13A	13B		
14A	14B		
15A	15B	24V	24V
16A	16B	24V	24V
17A	17B	24V	24V
18A	18B	24V	24V
19A	19B	24V	24V
20A	20B		
21A	21B	Gnd	Gnd
22A	22B	BACT-	
23A	23B		
24A	24B		
25A	25B		
26A	26B	SPARE	
27A	27B	RDX+	RDX-
28A	28B	Gnd Gnd	
29A	29B	TDX+	TDX-
30A	30B		
31A	31B	Gnd	Gnd
32A	32B		
33A	33B		
34A	34B		
35A	35B	Gnd	Gnd
36A	36B		
37A	37B		
38A	38B		
39A	39B	RESET+	RESET-
40A	40B	Gnd	Gnd



		A	B
41A	41B		
42A	42B		
43A	43B		
44A	44B		
45A	45B	5 V	5 V
46A	46B	5 V	5 V
47A	47B	5 V	5 V
48A	48B	5 V	5 V
49A	49B	5 V	5 V
50A	50B		
51A	51B		
52A	52B		
53A	53B		
54A	54B		
55A	55B	OSC1	
56A	56B	Gnd	Gnd
57A	57B		
58A	58B		
59A	59B	OSC2	
60A	60B	Gnd	Gnd
61A	61B		
62A	62B		
63A	63B		
64A	64B		
65A	65B		
66A	66B		
67A	67B		
68A	68B		
69A	69B		
70A	70B		
71A	71B		
72A	72B		
73A	73B		
74A	74B		
75A	75B		
76A	76B		
77A	77B		
78A	78B	Gnd	Gnd
79A	79B	Gnd	Gnd
80A	80B	Gnd	Gnd

NT3X16BA (end)

Technical data

For the NT3X16BA the clock signal has stability to dF/f of $\pm 1 \times 10^{-9}$ and is tunable over a range of ±10.24 Hz (minimum) to ±20.48 Hz (maximum).

Power requirements

NT3X16BA has the following power requirements:

- +5 V (±5%)
- +24 V (±4%)

Power converter outputs

NT3X16BA has the following onboard power converter outputs:

- +15 V (±0.02%)
- -15 V (±0.02%)
- +24 V (±1%)

Note: The +24 V must not change more than 10 mV under changing load.

NT3X16BB

Product description

The master clock oscillator circuit card provides a 10.24-MHz signal for use as the clock frequency for the DMS-100 peripherals, network, and interfaces. The clock is stratum 2.5 accuracy. The clock outputs are intersystem-ground (ISG) compliant. This card is for use with the SuperNode only.

Location

The NT3X16BB card is for use in the NT3X95BB remote oscillator shelf. The remote oscillator shelf has provisions for an active clock and an inactive clock. The shelf has provisions provisions for two NT1X78AA power converters and two hot standby spares. The NT3X16BB communicates to the NT9X53/54 card through a serial link.

Functional description

The master clock oscillator frequency is adjustable under the central control to synchronize the DMS switch frequency with the digital network frequency. This capability allows the oscillator frequency to be synchronized with the digital network.

Functional blocks

The NT3X16BB has the following functional blocks:

- crystal oscillator
- oscillator circuit and monitors
- oscillator tuning control
- power converters
- microprocessor and serial link

Crystal oscillator

The crystal oscillator used on the NT3X16BB has a 10.24-MHz sine wave signal to the NT3X53/54. The system sends the signal through a coaxial cable interconnection between the NT3X95BB and the NT3X53/54. The crystal oscillator on the NT3X16BB requires a maximum of 277 mA during warmup and 100 mA after warmup at 27°C. A fine tune of the oscillator occurs through the application of a tuning voltage in the range of 0 to 5 V. The highest frequency is 0 V. The center frequency is 10.24 MHz at 2.5 V.

Oscillator circuit and monitors

The oscillator output is for transmission to the NT3X53/54. A dc-to-dc converter regulates the oscillator supply voltage. The NT1X78AA power converter supplies the voltage. A transistor detects +24V failure. The system sends the appropriate message to the NT3X53/54 to flag the failure as a heater

NT3X16BB (continued)

alarm. Another transistor monitors the DAC supply voltage. If the transistor detects a failure of the +15V supply, the system sends a power alarm message to the NT3X53/54 to generate PWR alarm.

Oscillator tuning control

A 16-bit digital-to-analog converter (DAC) supplies the oscillator tuning control voltage. The DAC uses only the lower 14 bits. The ±15V dc-to-dc converter and the +5V logic supply power the DAC. Latches hold the digital value of the DAC setting. The DAC reads the value through multiplexers. The multiplexers select the DAC value the NT3X53/54 sends. The ground of the signal SPARE can enable hot standby mode. The grounding enables the microprocessor to read 7FFFH to center the DAC.

Power converters

A dc-to-dc converter from the +5V logic supply supplies the ±15 V (0.02) for the DAC. The voltage is monitored. A failure of the ±15 V causes a power alarm report to the NT3X53/54 through the serial link. A dc-to-dc converter provides the +24 V. The converter is regulated to 1%. A current monitor on the supply input for the dc-to-dc converter detects failure of the converter or the crystal oven. The system reports this failure as a heater alarm to the NT3X53/54.

Microprocessor and serial link

The microprocessor used on the NT3X16BB is an Intel 8751 microcontroller. The microprocessor receives the DAC value serially from the NT3X53/54. The microprocessor decodes the DAC value and writes the most significant byte in a latch. The microprocessor writes the lower byte of the DAC setting in a second latch. At the same time, the upper byte transfers from the first latch to a third latch. The transfer causes a 14-bit DAC value. The microprocessor reads the DAC setting on the multiplexers. The microprocessor sends a confirmation message to the NT3X53/54. The microprocessor is reset through the serial link. The reset disables the latches that hold the DAC value. If the system generates a power or heater alarm, an interrupt occurs. The microprocessor sends a correct message to the NT3X53/54.

Signaling

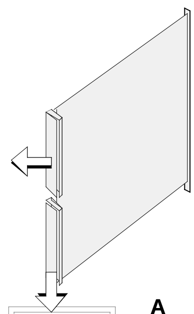
Pin numbers

The following figure shows the pin numbers for the NT3X16BB.

NT3X16BB (continued)

NT3X16BB pin numbers

	A	B
1A 1B	GND	GND
2A 2B	GND	GND
3A 3B		
4A 4B		
5A 5B		
6A 6B		
7A 7B		
8A 8B		
9A 9B		
10A 10B	GND	GND
11A 11B	GND	GND
12A 12B		
13A 13B		
14A 14B		
15A 15B	24 V	24 V
16A 16B	24 V	24 V
17A 17B	24 V	24 V
18A 18B	24 V	24 V
19A 19B	24 V	24 V
20A 20B		
21A 21B	GND	GND
22A 22B	BACT-	
23A 23B		
24A 24B		
25A 25B		
26A 26B	SPARE	
27A 27B	RDX+	RDX-
28A 28B	GND	GND
29A 29B	TDX+	TDX-
30A 30B		
31A 31B	GND	GND
32A 32B		
33A 33B		
34A 34B		
35A 35B	GND	GND
36A 36B		
37A 37B		
38A 38B		
39A 39B	RESET+	RESET-
40A 40B	GND	GND



	A	B
41A 41B		
42A 42B		
43A 43B		
44A 44B		
45A 45B	5 V	5 V
46A 46B	5 V	5 V
47A 47B	5 V	5 V
48A 48B	5 V	5 V
49A 49B	5 V	5 V
50A 50B		
51A 51B		
52A 52B		
53A 53B	ISG2	
54A 54B		
55A 55B		
56A 56B	GND	GND
57A 57B		ISG1
58A 58B		
59A 59B		
60A 60B	GND	GND
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B		
67A 67B		
68A 68B		
69A 69B		
70A 70B		
71A 71B		
72A 72B		
73A 73B		
74A 74B		
75A 75B		
76A 76B		
77A 77B		
78A 78B	GND	GND
79A 79B	GND	GND
80A 80B	GND	GND

NT3X16BB (end)

Technical data

For the NT3X16BB the clock signal has stability to dF/f of $\pm 1 \times 10^{-9}$. The clock signal is tunable over a range of ±10.24 Hz (minimum) to ±20.48 Hz (maximum).

Power requirements

NT3X16BB has the following power requirements:

- +5 V ±5%
- +24 V ±4%

Power converter outputs

NT3X16BB has the following onboard power converter outputs:

- +15 V ±0.02%
- -15 V ±0.02%
- +24 V ±1%

Note: The +24 V must not change more than 10 mV under changing load.

NT3X22AB

Product description

The NT3X22AB network module interface card provides communication between NT0X48AA network modules (NM) and the central message controller (CMC) or the message switch (MS).

Functional description

The NT3X22AB performs two main functions:

- provides a bidirectional communication interface between the network module (NM) and the DS30 links of the central message controller (CMC) or the message switch (MS)
- extracts clock and frame pulse (FP) signals from the DS30 links and distributes the signals in the NM.

Functional blocks

The NT3X22AB consists of the following functional blocks:

- DS30 interface
- clock and FP removal and distribution
- clock status register
- clock test control

DS30 interface

The NT3X22AB has identical but independent DS30 interfaces. The CMC and the MS link have an interface.

Clock and frame pulse extraction and distribution

The NT3X22AB extracts frequency-divided received clock and latched frame pulse (NFPM) from each DS30 link. Both received clocks come from the same source and have the same frequency.

The NT3X22AB can select either link as the source of the clock and frame pulse. If clock integrity on the selected link becomes suspect, the NT3X22AB can switch the clock port to the other link.

Clock status register

The clock status register maintains a record of the NT3X22AB status and other parameters. The clock status register stores the following information:

- current CMC or MS message port
- previous clock port switchovers

NT3X22AB (end)

- clock switchover ride state
- NM size code (backplane strapped)

Clock test control

The clock test (CLK TEST) control register performs clock circuit tests. To apply the clock integrity checking hardware, you can suppress the correct NFPM signals from the CMC or the MS link. You can suppress clock port switchovers.

Technical data

Power requirements

NT3X22AB has the following power requirements:

- voltage: +5 V
- current: 1.5 A

NT3X25BA

Product description

The system uses the NT3X25BA terminal block assembly shelf to perform a local cross–connect of equipment mounted in an NT0X02AB miscellaneous equipment (MIS) frame. An example of equipment to mount includes a bank of modems.

The system requires a mounted NT3X25BA in the MIS frame that has modems to cross–connect. The connection occurs between the NT3X02BA TOPS controller flash dial up auto quote processor circuit packs (CP) and the 62245004 224A UDS modems.

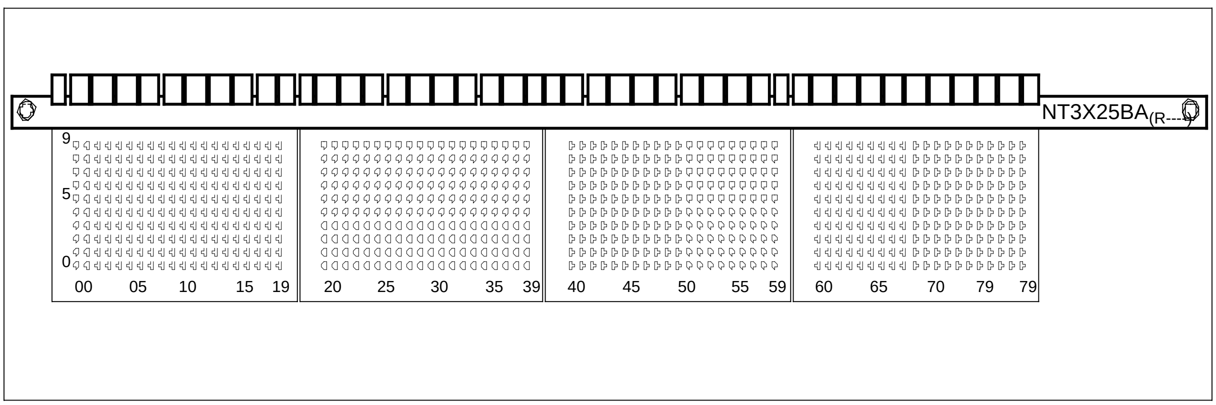
Parts

The NT3X25BA shelf is a mounting board for the cross connections.

Design

The design of the NT3X25BA appears in the following figure.

NT3X25BA layout



Note: This diagram is not drawn to scale.

NT3X25BB

Product description

The NT3X25BB terminal block assembly shelf is used to locally cross-connect equipment mounted in an NT0X02AB miscellaneous equipment (MIS) frame. An example of this equipment is a bank of modems.

For example, mount the NT3X25BB in the MIS frame for DMS-250 systems in place of a distribution frame (DF). In this example, the NT3X25BB cross-connects equipment in the MIS frame locally. The NT3X25BB cross-connects equipment remotely in the DF.

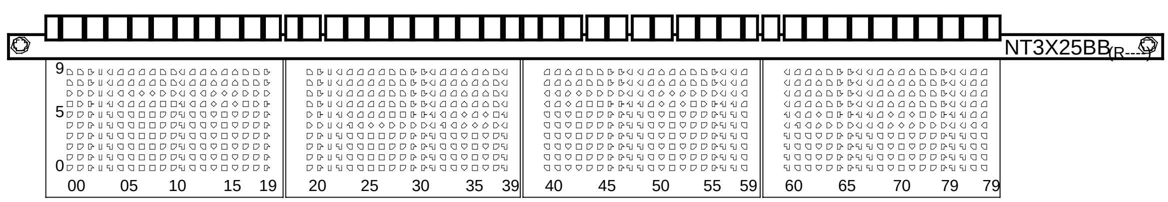
Parts

The NT3X25BB shelf is a mounting board for the cross connections.

Design

The following figure displays the design of the NT3X25BB.

NT3X25BB components



Note: This figure is not drawn to scale.

NT3X40AA

Product description

The NT3X40AA 64 Kword metallic oxide semiconductor (MOS) memory card provides data storage for the memory modules in the DMS-100 switching system.

The card can expand with each card that receives the same bus signals at the same time. The card cannot expand for a board enable signal that is different.

Location

The card is in DMS-100 memory shelves NT3X31AD, NT3X31AE, and NT3X31AF. The memory controller card selects the card.

Functional description

The NT3X40AA uses seventy-two 16 Kword MOS memory chips organized into four memory blocks of 18 chips. The memory blocks provide storage for 65,536 words that are a maximum of 18 bits wide. The memory blocks use chips numbered 17 through 00. The chips correspond to the arithmetical meaning of the bits in the data word.

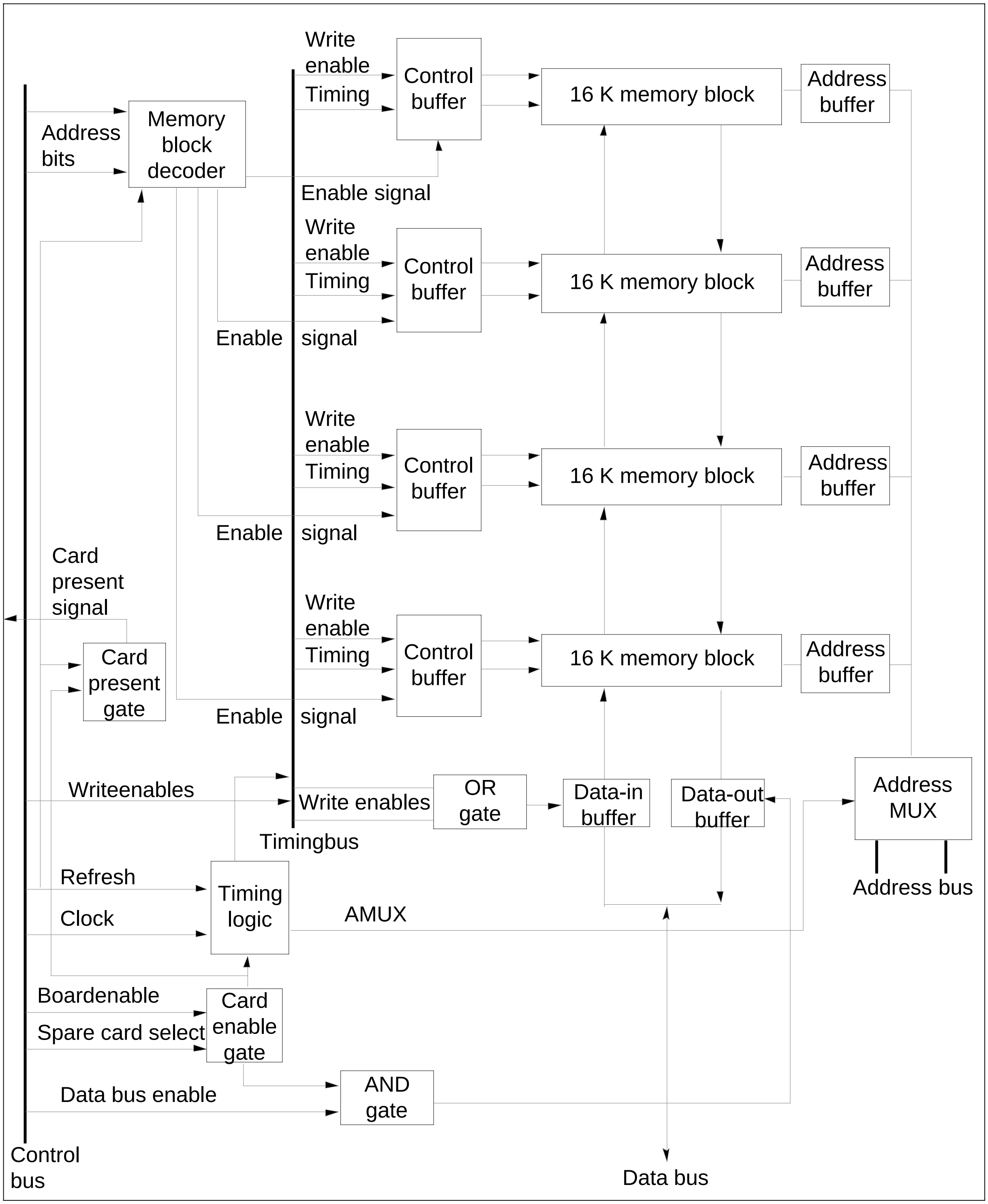
Functional blocks

The NT3X40AA consists of the following functional blocks:

- memory block decoder
- card present gate
- timing logic circuit
- card enable gate
- AND gate
- OR gate
- data-in buffer
- data-out buffer
- control buffer (four)
- 16 Kword memory block (four)
- address multiplexer (MUX)
- address buffer (four)

NT3X40AA (continued)

NT3X40AA functional blocks



Memory block decoder

The memory block decoder selects the two most significant address bits and decodes the bits for memory block selection. The decoder uses the refresh signal to make sure that all four memory blocks are enabled during a refresh cycle. The decoder generates enable signals to the control buffers to allow block access to other signals.

Card present gate

The card present gate is an open collector gate that receives the refresh and the card enable signals. If the card is enabled and the refresh signal is high, the gate sends a low signal (MCP signal). The gate sends the low signal to the memory module. A low signal indicates that the card is present and received the board enable signal.

Timing logic circuit

The timing logic circuit uses the memory controller clock signal to generate timing signals for the control buffers and the address MUX. The refresh signal, enables the generated signals. The refresh signal suppresses the circuit to make sure that memory blocks cannot enable data outputs.

Card enable gate

The card enable gate receives low board-enable and spare-card-select signals to enable the memory card. The gate sends signals to the AND gate, the timing logic circuit, and the card present gate.

AND gate

The AND gate receives data bus enable and card enable gate signals. The AND gate sends an output data buffer enable signal to the data-out buffer when both signals are present.

OR gate

The OR gate receives write enable signals. The OR gate sends an input data buffer enable signal to the data-in buffer. The OR gate sends the signal, when a write enable signal is present.

Data-in buffer

The data-in buffer uses a 47-Ω damping resistor and an input data buffer enable signal to send information to the memory blocks. When the data-in buffer is enabled, the system performs a write operation. The data-in buffer or the data-out buffer can be enabled. Only one of the buffers can be enabled at a time.

NT3X40AA (continued)

Data-out buffer

The data-out buffer receives information from the enabled memory block. The data-out buffer requires an output data buffer enable signal to send the information to the memory module. The data-out buffer sends information on the data bus. When the data-out buffer is enabled, the system performs a read operation. Only one of the buffers can be enabled at a time.

Control buffer

The control buffer receives write enable, timing, and enable signals. The memory blocks are addressed because of the signals that the buffer receives.

16-Kword memory block

The 16-Kword memory block receives data and timing signals under control of enable lines. The memory block stores the information or sends the information to the memory module. The word block divides into two 9-bit bytes. The division allows two 8-bit data bytes independent write enables. Each memory block can hold 16,384 word blocks.

Address MUX

The address MUX receives data on 14 low-order address lines and transmits the data on to seven lines at the same time. The seven lines provide row and column addresses. The memory blocks require the row and column addresses. The MUX uses the timing signal that the timing logic circuit sends to change the row address bits in to column address bits. During the refresh mode, these same address bits function as the refresh address.

Address buffer

The address buffer receives the address bits from the address MUX. The address buffer sends the address line to the specified memory chip in the memory block.

Signaling

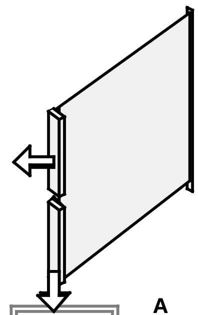
Pin numbers

The pin number diagram for the NT3X40AA appears in the following table.

NT3X40AA (continued)

NT3X40AA pin numbers

Pins	A	B
1A 1B	GRD	GRD
2A 2B	+5 V	+5 V
3A 3B	+5 V	+5 V
4A 4B	GRD	GRD
5A 5B	-5 V	-5 V
6A 6B	-5 V	-5 V
7A 7B	GRD	GRD
8A 8B	IMAD08-	IMAD09-
9A 9B	IMAD10-	IMAD11-
10A 10B	IMAD12-	IMAD13-
11A 11B	IMAD14-	IMAD15-
12A 12B	IMDT00-	IMDT01-
13A 13B	IMDT02-	IMDT03-
14A 14B	IMDT04-	IMDT05-
15A 15B	IMDT06-	IMDT07-
16A 16B		
17A 17B	GRD	GRD
18A 18B		
19A 19B	+12 V	+12 V
20A 20B	+12 V	+12 V
21A 21B		
22A 22B		
23A 23B		
24A 24B		
25A 25B		
26A 26B		
27A 27B		
28A 28B		
29A 29B		
30A 30B		
31A 31B		GRD
32A 32B	REFRESH	GRD
33A 33B		GRD
34A 34B	MCP-	GRD
35A 35B	CLK-	GRD
36A 36B	WEL-	GRD
37A 37B	WEH-	GRD
38A 38B	DBEN-	GRD
39A 39B		GRD
40A 40B	GRD	GRD



Pins	A	B
41A 41B		
42A 42B		
43A 43B		
44A 44B		
45A 45B		
46A 46B		
47A 47B		
48A 48B		
49A 49B		
50A 50B		
51A 51B		GRD
52A 52B	IMDT16-	GRD
53A 53B	IMDT17-	GRD
54A 54B	SPSLT-	GRD
55A 55B	BE-	GRD
56A 56B		GRD
57A 57B		GRD
58A 58B		GRD
59A 59B		GRD
60A 60B		GRD
61A 61B		
62A 62B		
63A 63B		
64A 64B		
65A 65B		
66A 66B		
67A 67B		
68A 68B		
69A 69B		
70A 70B		
71A 71B	IMDT08-	IMDT09-
72A 72B	IMDT10-	IMDT11-
73A 73B	IMDT12-	IMDT13-
74A 74B	IMDT14-	IMDT15-
75A 75B	IMAD00-	IMAD01-
76A 76B	IMAD02-	IMAD03-
77A 77B	IMAD04-	IMAD05-
78A 78B	IMAD06 V-	IMAD07-
79A 79B	+5 V	+5 V
80A 80B	GRD	GRD

NT3X40AA (continued)

Technical data

The access time of the NT3X40AA from the memory controller clock is 175 ns and 200 ns from the address. The access time has a cycle time of 375 ns and a 128-cycle refresh cycle at intervals of 2 ms.

The negative logic input signal of the card is a true signal that disables the data drivers. The system disables the data drivers when the signal is low.

The card uses data bit numbers to correspond to the arithmetical meaning of the bits in the data word. The data bit numbers and the meaning of the numbers appear in the following table.

Data bit numbers

Data bit no.	Meaning
17	9th bit associated with high byte
16	9th bit associated with low byte
15 - 08	High byte
07 - 00	Low byte

Dimensions

The dimensions for the NT3X40AA are:

- height: 317 mm (12.5 in)
- width: 254 mm (10 in.)

Power requirements

The NT3X40AA receives power from the memory module power converters. The power requirements for the appear in the following table.

Power requirements

Voltage	Current
+ 12 V ±10%	1.0 A (400 nanosecond cycle) 0.1 A (standby - refresh only)
+ 5 V ±5%	1.5 A
- 5 V ±5%	1.0 mA

NT3X40AA (end)

Note: The + 12 V ± 10% voltage requires low inductance supply leads. The low inductance supply leads minimize the effects of current spikes at the beginning of each cycle.

NT3X45EW

Product description

The NT3X45EW double bay central control complex (CCC) frame replaces the NT3X45DA double bay frame. The replacement occurs because of an upgrade to the cooling unit.

A CCC double bay frame consists of two identical single-bay frames, like NT0X41AC, welded together. The attachment makes sure that the two CCC frames are located immediately next to each other. The attachment fosters the one-unit, dual-system concept.

The NT3X45EW frame does not have an association with memory extension (MEX) frames.

Parts

The central control frame, double bay consists of the following components:

- NT0X28AF—Frame supervisory panel (FSP)
- NT0X84AA—Filler panel
- NT2X7606—Message and device controller shelf
- NT3X3209—Data store shelf
- NT3X4106—Central processor and memory shelf
- NT3X90AC—DC fan cooling unit

Frame supervisory panel

The NT0X28AF FSP contains power control and alarm circuits that provide interfaces between the PDC and the equipment frames of the digital switching system. Circuit packs contain the power control and alarm circuits. The circuit packs NT0X91AE (power control and alarm) and NT0X91AA (alarm and converter drive) contain the control and alarm circuits. The circuit packs NT0X91AD (converter drive and protection circuit), and NT0X91AE (converter drive and protection circuit) also contain the control and alarm circuits.

The NT0X28AF FSP uses four power feeds and uses fuses to protect both the power control and alarm circuits. Some NT0X28 models use circuit breakers to protect the power control, and some models require two or three power feeds.

Filler panel

The NT0X84AA filler panel covers shelves the CCC does not use. The filler panel allows the frame to cool correctly.

Message and device controller shelf

The message and device controller shelf (MDC) combines the central message controller (CMC) and input/output controller (IOC) on to the same equipment shelf.

The CMC provides an interface between the CPU and the network message controllers (NMC) of the switching network. The IOC controls the flow of data between the CPU and different input/output (I/O) devices. Some examples of these devices include magnetic tape units and disk drive units.

The double bay frame provides duplicated MDCs. The dupilcated MDCs can interface all CPU peripherals through the network frame/module and IOC as CMC0:00 and CMC1:00. The MDC can interface directly to a limited number of I/O devices while the MDC functions as an IOC.

The MDC module can function as a normal CMC and operate as an IOC. These functions overlap in card slot assignment. Each function can reduce the capacity of the other function.

To eliminate or reduce the need for separate IOC shelves, equip the IOC function on the MDC. Use separate CMC/IOC shelves when specific load limits are exceeded or the necessary equipment placement requirements are not met.

Data store shelf

Each NT3X3209 data store (DS) shelf provides 4 Mwords (4,096 Kwords) of 17-bit word DS RAM. The double bay CCC frame provides a duplicate DS. The duplicate DS can provide a maximum of 15.75 Mwords of memory.

This memory shelf contains memory cards, timing and control circuits. These features meet the standards of the handshake bus protocol, interface circuits, and optional bus termination circuits. These features are used with a local or remote CPU. A power converter provides multi-voltage power supplies for the shelf.

DS memory holds the transient or per call information and the customer or office parameters.

Central processor and memory shelf

The CPU and program store (PS) memory occupy one shelf in the CCC frame called the central processor and memory shelf (CPM). The CPM houses the DMS-100F NT40 CPU and PS (NT3X45EP and NT3X45EQ) circuit packs.

NT3X45EW (continued)

The double bay CCC frame provides duplicated CPMs. These CPMs accommodate a maximum of 7.75 Mwords of PS memory. Spare memory does not require a memory card because a spare row of memory devices on the controller serves as the hot spare.

PS memory serves as a repository for the programs required for call processing, administration, maintenance, and for the operating system.

DC fan cooling unit

The NT3X90AC cooling unit consists of five-fan assemblies that maintain a normal five-shelf cabinet. The fans are dc-powered at 48 V from two feeders in the PDC, fused at 5 A for each fan.

The use of two NT3X90AC units cools the NT3X45EW double bay frame. The frame cools at a thermal stress equivalent (TSE). The TSE is equal to the static bulk ambient temperature (50°C maximum) with a maximum heat distribution of 1200 W.

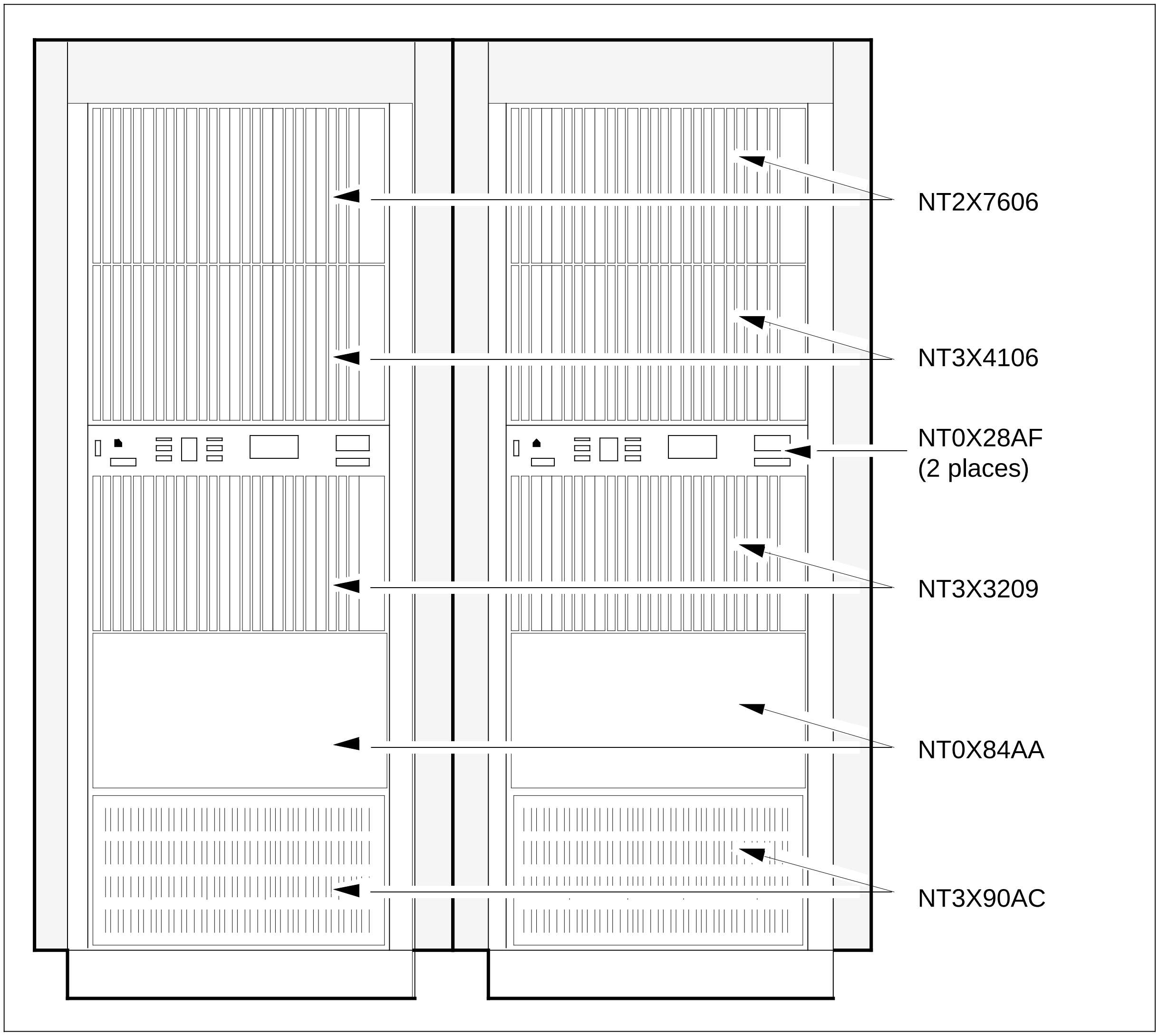
The NT3X90AC cooling unit also uses a single-fan failure detection and signaling system. Some redundancy is built into the multiple-fan design. This redundancy makes sure the failure of one fan does not cause a serious loss of cooling air.

Design

The design of the NT3X45EW appears in the following figure.

NT3X45EW (end)

NT3X45EW parts



Note: This diagram is not drawn to scale.

NT3X48AA

Product description

The NT3X48AA T1 interface card generates dual, two-way digital voice and signaling interfaces between 24-channel, 1.544-Mbps bit streams (DS-1), and the internal circuits of a remote line module (RLM).

Each card contains two 24/32-channel interface circuits. Each circuit in the card runs separately. Each card runs by the same method.

Location

The card plugs in to one of two assigned positions in the remote line controller (RLC). The RLC can hold two cards.

Functional description

The NT3X48AA uses receive and transmit paths between the DS-1 facilities and RLC shelf circuits. The NT3X48AA uses the paths to convert a bipolar bit stream to a transistor-transistor logic (TTL) bit stream. The NT3X48AA converts the TTL bit stream to a 24-channel bipolar data. The card uses internal and external loop-around procedures to check for errors.

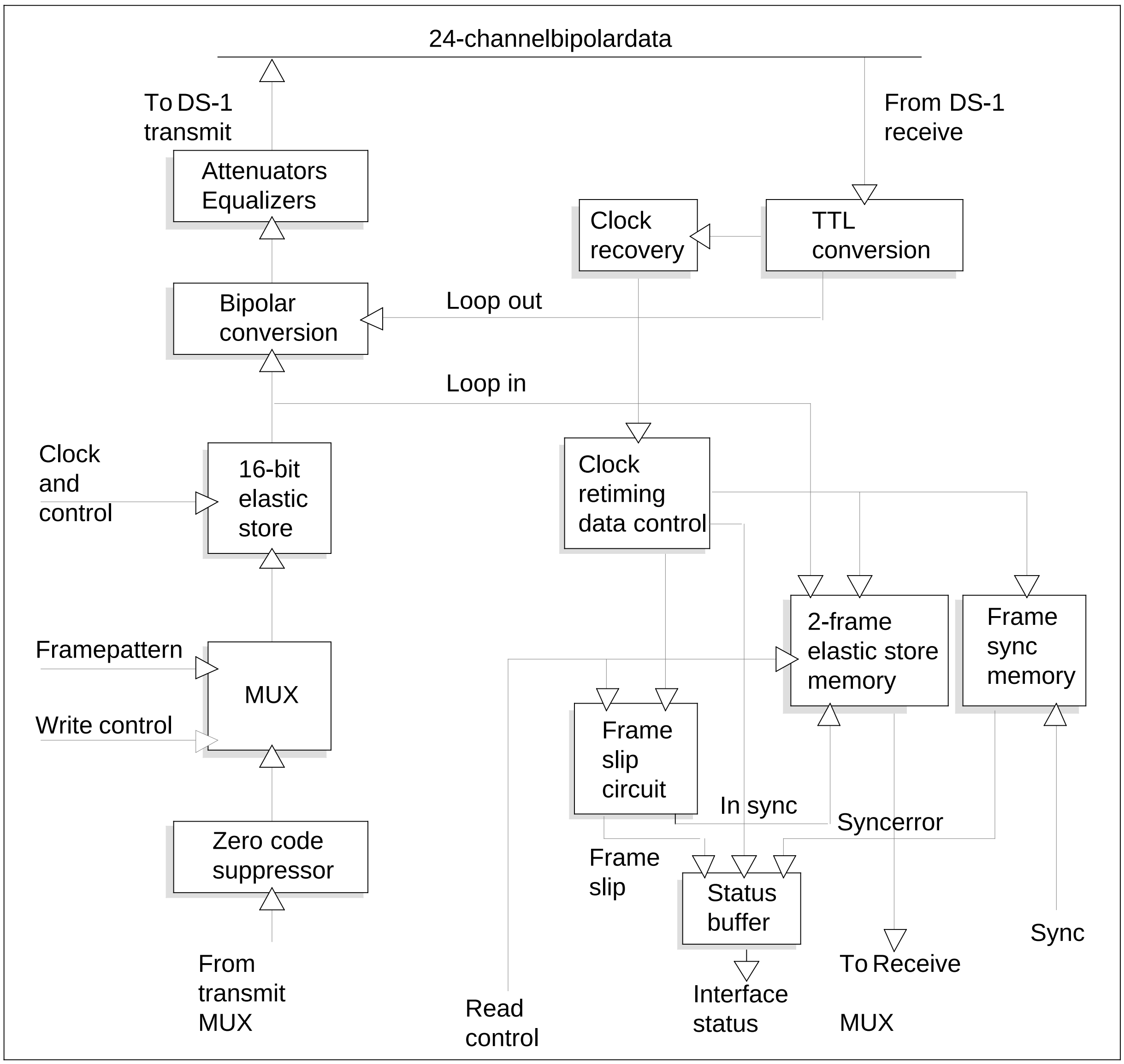
Functional blocks

Each circuit of the NT3X48AA card consists of the following functional blocks:

- TTL conversion circuit
- clock recovery circuit
- clock retiming data control circuit
- 2-frame elastic store memory circuit
- frame synchronization memory circuit
- frame slip circuit
- status buffer circuit
- zero code suppressor circuit
- multiplexer (MUX)
- 16-bit elastic store memory circuit

- bipolar conversion circuit
- attenuator and equalizer circuits

NT3X48AA functional blocks



TTL conversion circuit

The TTL conversion circuit monitors the bipolar data receive path and converts the 1.544-Mbps bipolar bit stream to 32-channel, 2.56-Mbps TTL signals. The conversion circuit combines the TTL data in to unipolar bit streams for transmission to the clock recovery circuit.

NT3X48AA (continued)

Clock recovery circuit

The clock recovery circuit receives TTL signals and outputs a 1.544-MHz clock pulse to the clock retiming data control.

Clock retiming data control circuit

The clock retiming data control circuit receives a 1.544-MHz clock signal from the clock recovery circuit. The clock retiming data control circuit times the signal again. This action allows the signal to synchronize with the 2.56-MHz RLC clock pulse. To time the incoming data again the system produces a new 1.544-MHz clock pulse. This pulse has the same high-to-low changes as the 2.56-MHz clock.

2-frame elastic store memory circuit

The 2-frame elastic store memory circuit provides a buffer between the incoming 24-channel PCM data and the 32-channel data output to the RLC. The memory circuit receives the retimed data from the clock retiming data control circuit. The memory circuit sends this information to the RLC receive MUX.

The circuit contains at least two 8-bit channels of data. The circuit can store one 24-channel frame and 22 channels of the next frame.

Frame synchronization memory circuit

The frame synchronization memory circuit reads the retimed data from the clock retiming data control circuit. The memory circuit reads the data to make sure that frame synchronization is correct. The memory circuit sends a synchronization error to the status buffer if the synchronization is not correct.

Frame slip circuit

The frame slip circuit compares the read address of the RLC and the address of the retimed data stored in the 2-frame elastic store memory circuit. If the addresses are in two channels, the frame slip circuit changes the read address to the retimed data address.

Status buffer circuit

The status buffer circuit receives and stores data on the state of the interface circuits. The status buffer circuit uses the interface status line to make the data available to the RLC message processor.

The status buffer circuit uses in-synchronization, synchronized error, and frame slip information. These features indicate correct framing patterns for eight consecutive frames. These features indicate the detection of the correct frame pulse. These features also indicate the switch from a 2-frame elastic store memory circuit read address to the retimed data address.

Zero code suppressor circuit

The zero code suppressor circuit receives the 32-channel PCM bit stream from the RLC transmit MUX. The circuit monitors the data for an 8-bit word that contains all logic ones. The circuit inserts a zero into bit 2 of any word that contains all ones.

MUX

The MUX inserts the frame pattern into the bit stream. Under the control of the write line, the MUX writes 24 selected 8-bit words. The MUX writes the words in to the 16-bit elastic store memory circuit at a rate of 2.56-MHz.

16-bit elastic store memory circuit

The 16-bit elastic store memory circuit receives 8-bit words from the MUX. Under control of clock and control lines, the MUX outputs the data at a rate of 1.544-MHz. The difference between the write and read rate allows the circuit to store more than eight bits. The circuit cannot store the eight bits permanently.

Bipolar conversion circuit

The bipolar conversion circuit changes TTL signals to bipolar signals for DS-1 transmission.

Attenuators and equalizers

The attenuator and the equalizer circuits compensate for different cable lengths. The cable lengths connect the transmit path of the interface card to the DS-1 transmission equipment. Use seven small switches in the circuit to manually select compensation.

The transmit path equalizer ranges for different cable lengths appears in the following table.

Equalizer switch positions

	Equalizer switch positions						
Length of cable	**A**	**B**	**C**	**D**	**E**	**F**	**G**
0 - 91 m (0 to 300 ft)	OFF	ON	ON	ON	ON	ON	ON
91 - 137 m (300 to 450 ft)	ON	ON	OFF	OFF	OFF	ON	ON
137 - 200 m (450 to 656 ft)	ON	OFF	ON	ON	ON	OFF	OFF

NT3X48AA (end)

Technical data

Dimensions

The dimensions of the NT3X48AA card are:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 25.4 mm (1.0 in.)

Power requirements

The NT3X48AA power converter card in the RLC shelf supplies the power requirements of +5 V and +12 V.

NT3X65AA

Product description

The NT3X65AA echo suppression card provides time-shared hardware and firmware control functions. The card provides these functions for a maximum of eight echo suppressor channels in DMS-100/200 equipment.

Location

The card occupies one position in the digital echo suppressor (DES) module. and can connect a maximum of six cards to the module.

Functional description

The NT3X65AA receives 16 pulse code modulation (PCM) channels from the DES bus. The NT3X65AA analyzes the data to select the highest level of channel samples. The card computes the attenuation levels of the channels. The card disables attenuation if the card detects a disabling tone bit on the channels.

Functional blocks

The NT3X65AA consists of the following functional blocks:

- interface and control circuit
- level controller
- tone detector
- loss controller

Interface and control circuit

The interface and control circuit receives and transmits 16 PCM channels between the DES speech bus and the level controller. The circuit uses a frame pulse and a 10.24-MHz clock signal to control clock, bit, channel, and frame timing. The DES backplane sends the DES slot address to the circuit. The circuit uses the address data to assign port and channel numbers to each NT3X65AA.

Level controller

The level controller receives and stores the 16 receive PCM (RPCM) channels from the interface and control circuit. During a time frame of 1 ms, the controller scans an internal memory. The controller selects the highest level sample out of eight samples stored for each channel. The controller stores the selected sample in a delay memory. The sample in a delay memory scans for selection of the highest level sample. The controller sends the data selected from the scans to the tone detector and the loss controller.

NT3X65AA (continued)

Tone detector

The tone detector is a microprocessor that receives sign bytes and level bytes from the level controller. The tone detector analyzes the bytes to detect the small 2100-Hz disabling tones on any channel. If the tone detector detects a disabling tone, the tone detector transmits a tone bit to the loss controller.

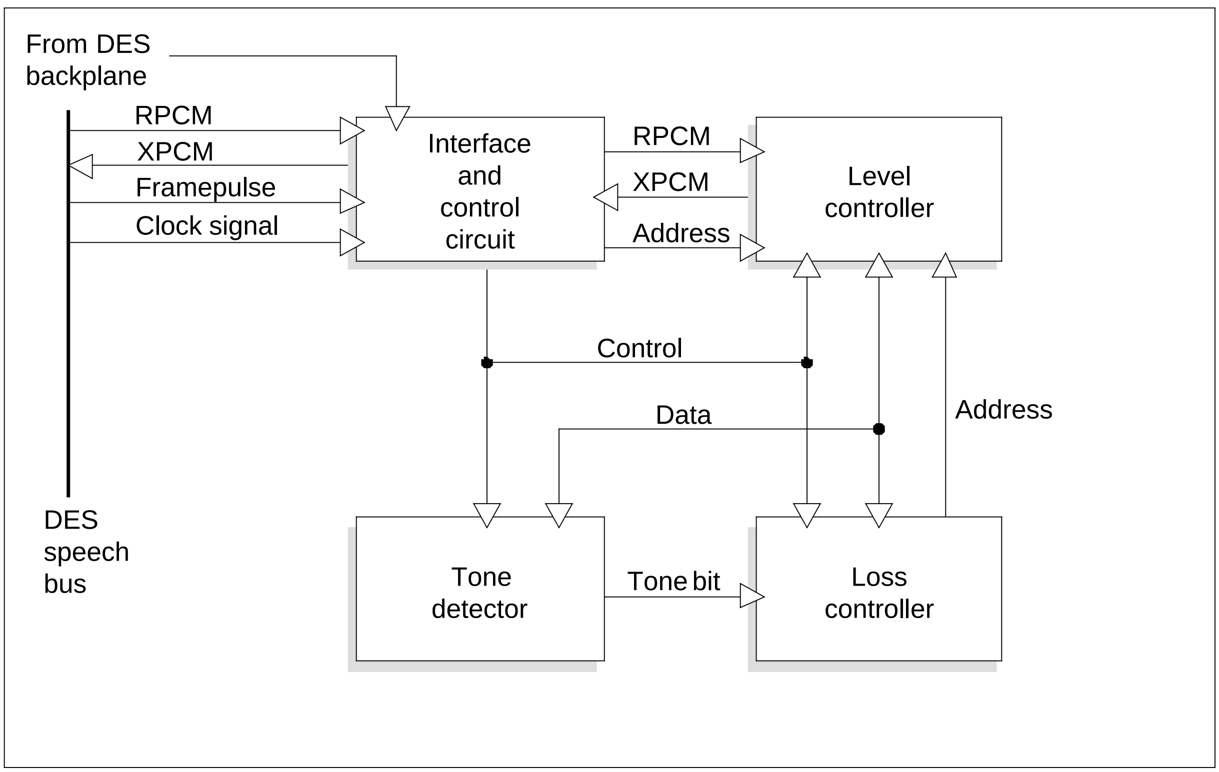
Loss controller

The loss controller is a microprocessor that receives data from the level controller. The loss controller computes the attenuation levels of the receive and send paths of all echo suppressor channels on a card. The controller sends the attenuation and noise values to the level controller for transmission to the channels that are processed.

If the controller receives a disabling tone bit from the tone detector, the controller disables any attenuation on the associated channel. Small switches in the controller select a duplex or half-duplex operation for each echo suppressor.

The relationship between the functional blocks appears in the following figure.

NT3X65AA functional blocks



Technical data

The operational states in a split (half-duplex) operation appear in the following table.

Operational states

State	Loss in send path (dB)	Loss in receive path (dB)
X idle	0	0
Y send only	0	0
Z suppression	≥50 (noise inserted)	
W break-in	0	6
V hysteresis	As W entered from W As Z entered from Z	

The characteristics of a split (half-duplex) operation appear in the following table.

Split operation characteristics (Sheet 1 of 2)

Characteristic	Value
Transition thresholds	
Txz	-31 ±2 dBm0
Tzx	Between Txz and Txz -3
Suppression operate time	<1 ms
Suppression hangover time	24 to 36 ms
Break-in operate time at constant send level	24 to 36 ms
Break-in operate time at constant receive level	
Partial break-in	≤2 ms
Full break-in	6 to 10 ms

NT3X65AA (continued)

Split operation characteristics (Sheet 2 of 2)

Characteristic	Value
Break-in hangover time at constant receive level	
Full break-in	≤26 ms
Full break-in	48 to 66 ms

The operational states in a full (duplex) operation appear in the following table.

Operational states

State	Loss in send path (dB)	Loss in receive path (dB)
X idle	0	0
Zs suppression	≥50 (noise inserted)	0
Zr suppression	0	≥50 (noise inserted)
W break-in	6	6

The characteristics of a full (duplex) operation appear in the following table.

Full operation characteristics (Sheet 1 of 2)

Characteristic	Value
Transition thresholds	
• Txzs (idle to suppression send)	• -31 ± dBm0
• Txzr (idle to suppression receive)	• -31 ± dBm0
• Tzsx (suppression-send to idle)	• Between Txzr and Txzr -3
• Tzrx (suppression-receive to idle)	• Between Txzs and Txzs -3
Suppression operate time (X to Zr; Z to Zs)	<1 ms
Suppression hangover time	
• Zs to X	• 24 to 36 ms
• Zr to X	• 75 to 100 ms

NT3X65AA (end)

Full operation characteristics (Sheet 2 of 2)

Characteristic	Value
Break-in operate time at constant send level (Zr to W) • Partial break-in • Full break-in	• ≤ 2ms • 6 to 10 ms
Break-in operate time at constant receive level (Zs to W) • Partial break-in • Full break-in	• ≤ 2ms • 6 to 10 ms
Break-in hangover time at constant send level (W to Zr) • Partial break-in • Full break-in	• ≤64 ms • ≤64 ms
Break-in hangover time at constant receive level (W to Zs) • Partial break-in • Full break-in	• ≤26 ms • 48 to 66 ms

Dimensions

The dimensions for the NT3X65AA card are as follows:

- height: 353 mm (13.9 in.)
- depth: 277 mm (10.9 in.)
- width: 22 mm (0.875 in.)

Power requirements

The power requirements for the NT3X65AA are a voltage of +5 V and current of 2.2 A.

NT3X67AA

Product description

The NT3X67AA six-conference circuit card provides conference facilities on single cards for use with the DMS-100. The card can accommodate a single six-party conference or two three-party conferences.

Location

The card occupies one position in a maintenance trunk module (MTM) or trunk module (TM). The card requires six four-wire pulse code modulation (PCM) trunk appearances.

Functional description

The NT3X67AA card receives 8-bit PCM samples from conferees and sends 8-bit PCM samples. The samples represent the line and compound total of the speech samples from two of the six speech signals.

Functional blocks

The NT3X67AA card consists of the following functional blocks:

- speech memory
- loudness evaluation circuit
- speaker identification logic
- speaker selection circuit
- sum and compound circuit

Speech memory

The speech memory receives 8-bit PCM samples from the receive data (RDAT) bus. The speech memory converts the samples to a parallel format, and stores the samples in a register file. The speech memory receives PCM samples in channel time slots that correspond to the conferees. In each time slot, two stored samples are transmitted under control of the speaker selection circuit.

Loudness evaluation circuit

The loudness evaluation circuit compares the stored loudness code with the amplitude of each 8-bit PCM sample received from the RDAT bus. The stored code decreases if the range of the sample is less than the code. The stored code increases if the range of the sample is greater than the code. The system transmits the loudness code to the speaker selection circuit and to the speaker identification logic.

Speaker identification logic

The speaker identification logic identifies the two loudest speakers for each port. The speaker identification logic sends a 3-bit code for each of the selected speakers to the speaker selection circuit.

Speaker selection circuit

The speaker selection circuit uses the 3-bit codes from the speaker identification logic. The speaker selection circuit reads the 8-bit PCM samples from the two loudest speakers. The speaker selection circuit reads the associated loudness codes. The codes control the inserted loss.

The speaker selection circuit determines the variable loss and linear capability of the samples. The circuit sends a 14-bit amplitude and sign sample. The sample represents the amplitude of the attenuated speech samples to the sum and compound circuit.

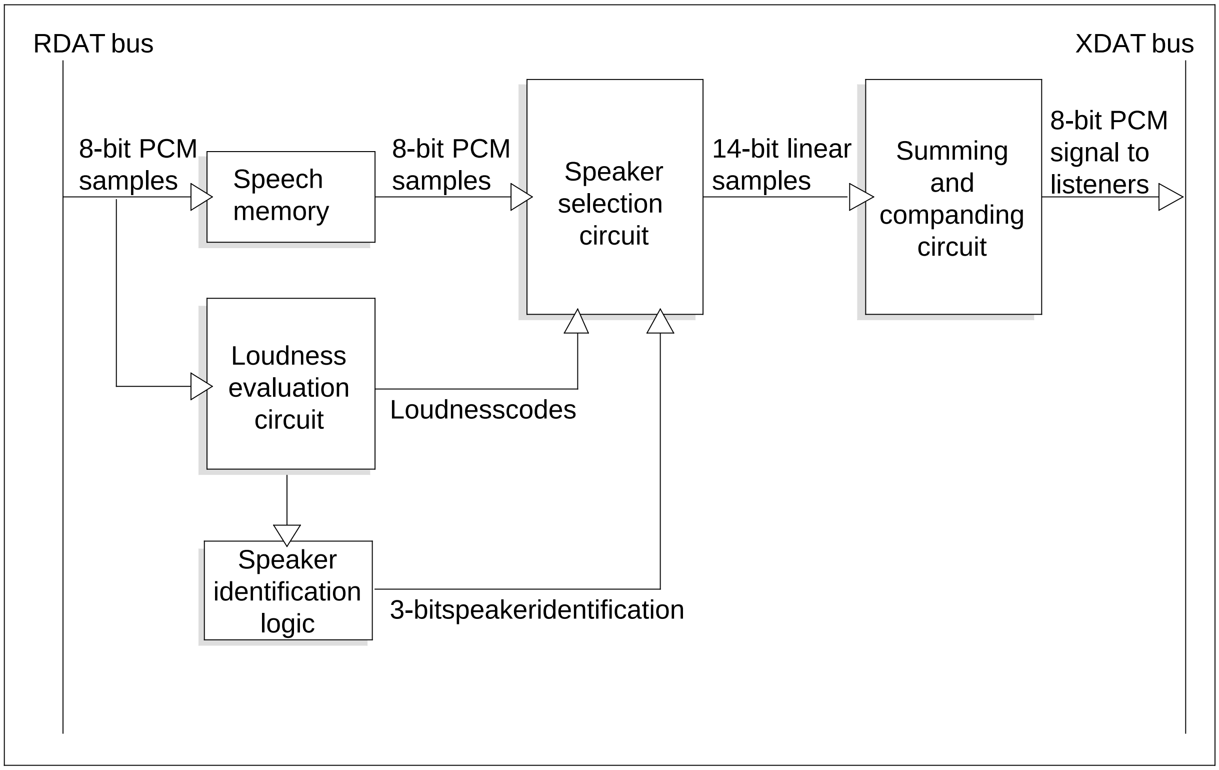
Sum and compand circuit

The sum and compand circuit receives the 14-bit amplitude and sign speech samples from the speaker selection circuit. The circuit converts these samples to 8-bit PCM data. The circuit receives two samples during each channel, and the circuit sends the output to the transmit data (XDAT) bus.

The relationship between the functional blocks appears in the following figure.

NT3X67AA (end)

NT3X67AA functional blocks



Technical data

Dimensions

The dimensions for the NT3X67AA card are as follows:

- height: 353 mm (13.9 in.)
- depth: 277 mm (10.9 in.)
- width: 28 mm (1.1 in.)

Power requirements

The power requirements for the NT3X67AA are a voltage of 5V and current of 1.5 V.

Power distribution is 7.5 W.

NT3X67BB

Product description

The NT3X67BB six-conference circuit card provides conference facilities on single cards for use with the DMS-100. The card can accommodate a single six-party conference or two three-party conferences.

The conference outputs total the amount of tones that the software selects. The name of the tone depends on the use of the tones. The name of the tone is Toll Break-In (TBI) or Intrusion tone. A six-party conference can select TBI tones. The use of the tones is limited during three-party conferences. When the tones are not required, the NT3X67BB functions like the NT3X67BA.

Location

The card occupies one position in a maintenance trunk module (MTM) or trunk module (TM). The card requires six four-wire pulse code modulation (PCM) trunk appearances.

Functional description

The NT3X67BB card receives 8-bit PCM samples from conferees and sends 8-bit PCM samples. The samples represent the linear and compound total of the speech samples from two of the six speech signals.

Select the Toll Break-In (TBI) or Intrusion tone for any conference configuration. The tone addresses are under software control and can change when the signal distribution points are accessed.

Functional blocks

The NT3X67BB card consists of the following functional blocks:

- speech memory
- loudness evaluation circuit
- speaker identification logic
- speaker selection circuit
- loss control and linearization
- sum and compound circuit

Speech memory

The speech memory receives 8-bit PCM samples from the receive data (RDAT) bus. The speech memory converts the samples to a parallel format and stores the samples in a register file. The PCM samples are received in channel time slots that correspond to the conferees. The speaker selection circuit controls the transmission of two stored samples in each time slot..

NT3X67BB (continued)

Loudness evaluation circuit

The loudness evaluation circuit compares the stored loudness code with the amplitude of each 8-bit PCM sample received from the RDAT bus. The stored code decreases if the range of the sample is less than the code. The stored code increases if the range of the sample exceeds the code. The system transmits the loudness code to the speaker selection circuit and to the speaker identification logic.

Speaker identification logic

The speaker identification logic identifies the two loudest speakers for each port. The speaker identification logic sends a 3-bit code for each of the selected speakers to the speaker selection circuit.

Speaker selection circuit

The speaker selection circuit uses the 3-bit codes from the speaker identification logic. The speaker uses the codes to read the 8-bit PCM samples from the two loudest speakers. The circuit can read the associated loudness codes. The codes are used to control the inserted loss.

Loss control and linearization

The loss control and linearization circuit determines the variable loss and linearization of the samples. The circuit sends a 14-bit amplitude and sign sample that represents the amplitude of the attenuated speech samples to the sum and compand circuit.

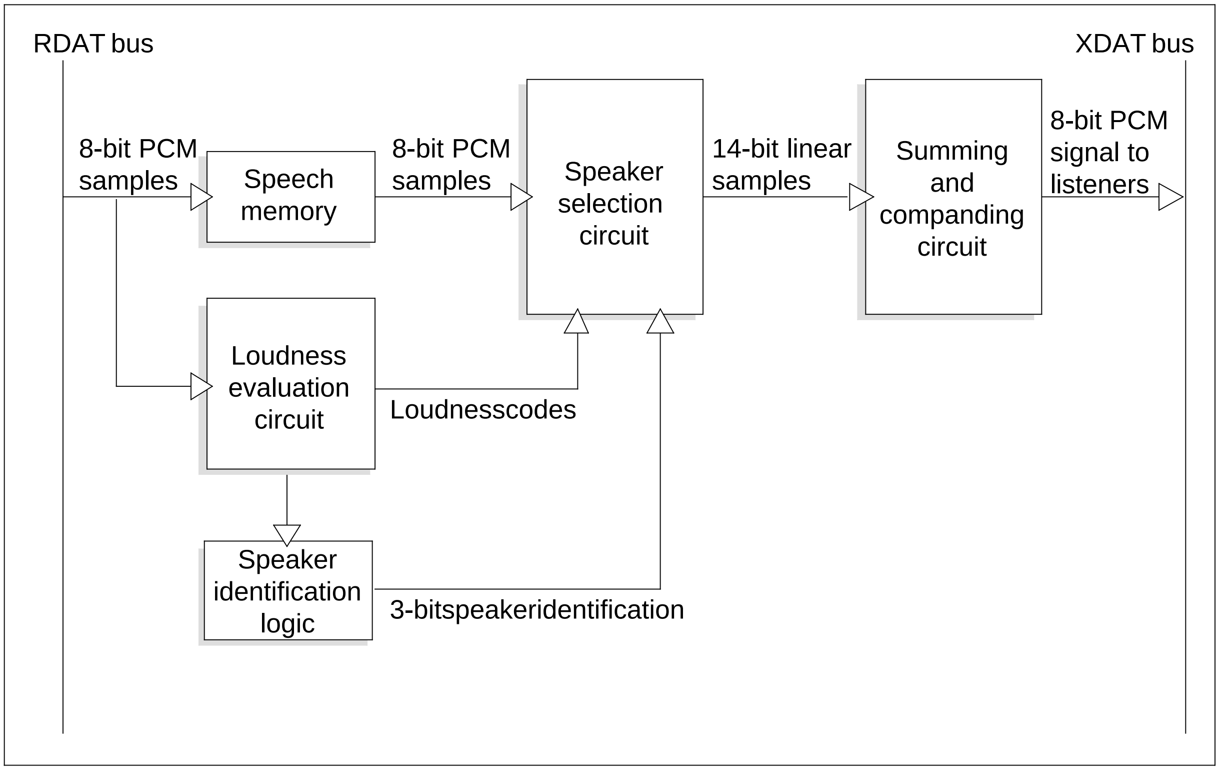
Sum and compand circuit

The sum and compand circuit receives the 14-bit amplitude and sign speech samples from the speaker selection circuit. The circuit converts the samples to 8-bit PCM data. The circuit receives two samples during each channel, and the circuit sends output to the transmit data (XDAT) bus.

The relationship between the functional blocks appears in the following figure.

NT3X67BB (end)

NT3X67BB functional blocks



Technical data

Dimensions

The dimensions for the NT3X67BB card are as follows:

- height: 353 mm (13.9 in.)
- depth: 277 mm (10.9 in.)
- width: 28 mm (1.1 in.)

Power requirements

The power requirements for the NT3X67BB are a voltage of 5V and current of 1.5 V.

Power distribution is 7.5 W.

NT3X68AA

Product description

The NT3X68AA pre-empt, permanent signal, and conference tone generator card generates tones for military use.

Location

You can find the card in a spare position of slots 05 through 19 in a maintenance trunk module (MTM).

Functional description

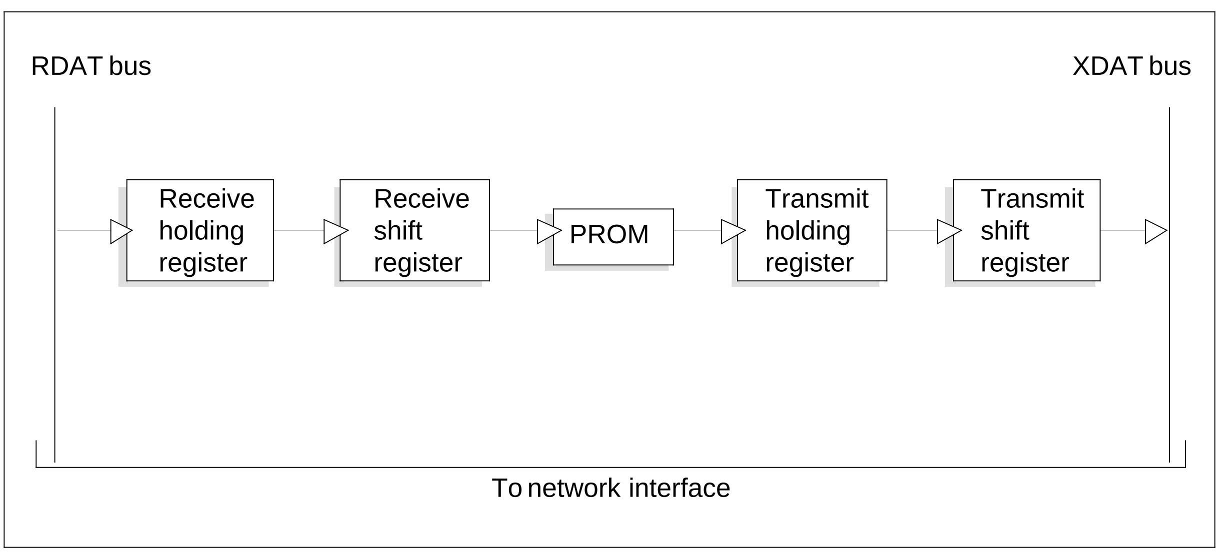
The NT3X68AA card has four ports and a maximum of eight 2-Kbyte PROM circuits. Each port allocates commands for tone selection and stores samples of all tones available in the card. Each port transmits selected tones to specified addresses.

Functional blocks

Each port on the NT3X68AA card consists of the following functional blocks:

- receive holding register
- receive shift register
- PROM circuit
- transmit holding register
- transmit shift register

NT3X68AA functional blocks



Receive holding register

The receive holding register receives tone selection and tone address commands. The register receives the commands from the receive data bus (RDAT) and transmits these commands to the receive shift register.

Receive shift register

Under control of the system clock, the shift register sends tone commands to a specified PROM address.

PROM circuit

The PROM, stores PCM samples of all tones available in the card and receives commands from the receive shift register. The PROM transmits a sample of the selected tone to the transmit holding register.

Transmit holding register

The transmit holding register receives a sample tone from the PROM and sends the tone to the transmit shift register. The PROM sends the tone for transmission to a specified port.

Transmit shift register

The transmit shift register receives a sample tone from the transmit holding register. The register uses the transmit data bus (XDAT) to send the sample to the port that ordered the tone.

Technical data

The NT3X68AA has an output frequency tolerance of ± 0.5% and uses μ-law coding. The tone frequencies for each type of call appear in the following table.

Tone characteristics

Tone	Frequency (Hz)	Total power level (dBM)
Permanent	350	- 13.0
	440	
Pre-empt	440	- 14.0
Conference (L)	850	- 23.0
Conference (H)	1340	- 23.0

NT3X68AA (end)

Dimensions

The dimensions of the NT3X68AA card are:

- height: 353 mm (13.9 in.)
- width: 29 mm (1.13 in.)

Power requirements

The power requirements for the NT3X68AA are a voltage of 5 V and current of 650 mA.

The NT3X6AA consumes 3.25 W of power.

NT3X68AB

Product description

The NT3X68AB dual-tone multifrequency (DTMF) generator circuit card generates DTMF general use tones.

Location

You can find the card in a spare position of slots 05 to 19 in a maintenance trunk module (MTM).

Functional description

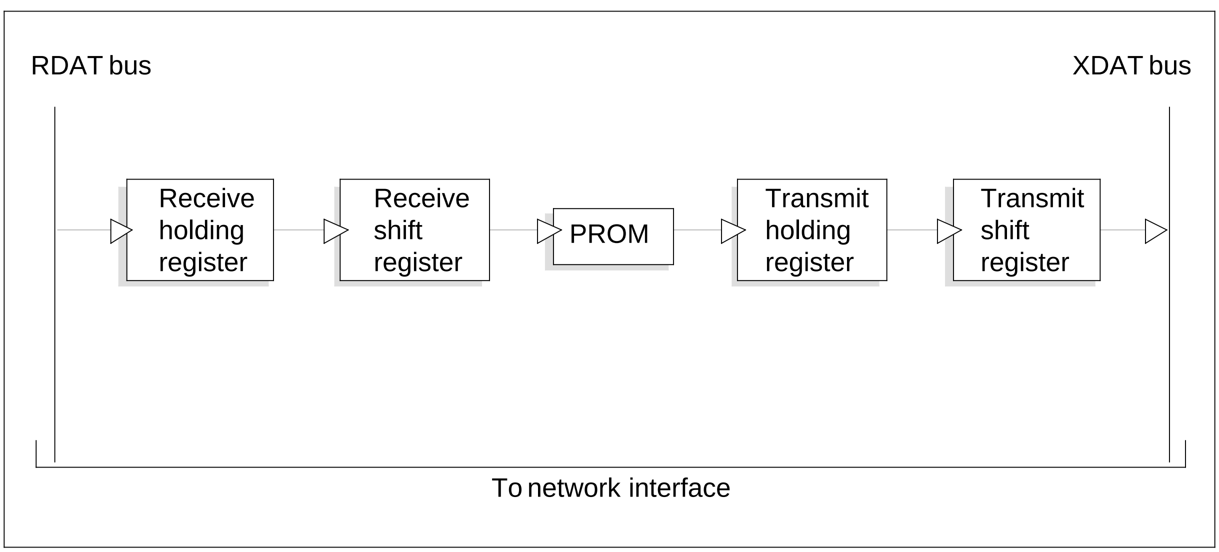
The NT3X68AB card has four ports and a maximum of eight 2-Kbyte PROM circuits. Each port allocates commands for tone selection and stores samples of all tones available in the card. Each port transmits selected tones to specified addresses.

Functional blocks

Each port on the NT3X68AB card consists of the following functional blocks:

- receive holding register
- receive shift register
- PROM circuit
- transmit holding register
- transmit shift register

NT3X68AB functional blocks



NT3X68AB (continued)

Receive holding register

The receive holding register receives tone selection and tone address commands. The register receives the commands from the receive data bus (RDAT) and transmits these commands to the receive shift register.

Receive shift register

Under control of the system clock, the shift register sends tone commands to a specified PROM address.

PROM circuit

The PROM, stores PCM samples of all tones available in the card and receives commands from the receive shift register. The PROM transmits a sample of the selected tone to the transmit holding register.

Transmit holding register

The transmit holding register receives a sample tone from the PROM and sends the tone to the transmit shift register. The register sends the tone for transmission to a specified port.

Transmit shift register

The transmit shift register receives a sample tone from the transmit holding register. The register uses the transmit data bus (XDAT) to send the sample to the port that ordered the tone.

Technical data

The NT3X68AB has an output frequency tolerance of ± 0.5%, a total power level of –2 dBm, and uses µ-law coding. The DTMF tones appear in the following table.

DTMF tones (Sheet 1 of 2)

Key	Frequency pair (Hz)
P	941 1633
1	697 1209
2	697 1336
3	697 1477
4	770 1209
5	770 1336
6	770 1477

NT3X68AB (end)

DTMF tones (Sheet 2 of 2)

Key	Frequency pair (Hz)
7	852 1209
8	852 1336
9	852 1477
0	941 1336
*	941 1209
#/A	941 1477
FO	697 1633
F	770 1633
I	852 1633

Dimensions

The dimensions of the NT3X68AB card are:

- height: 353 mm (13.9 in.)
- width: 29 mm (1.13 in.)

Power requirements

The power requirements for the NT3X68AB are a voltage 5 V and current of 650 mA.

The NT3X68AB consumes 3.25 W of power.

NT3X68AC

Product description

The NT3X68AC call waiting tone generator circuit card generates call waiting general use tones.

Location

You can find the card in a spare position of slots 05 through 19 in a maintenance trunk module (MTM).

Functional description

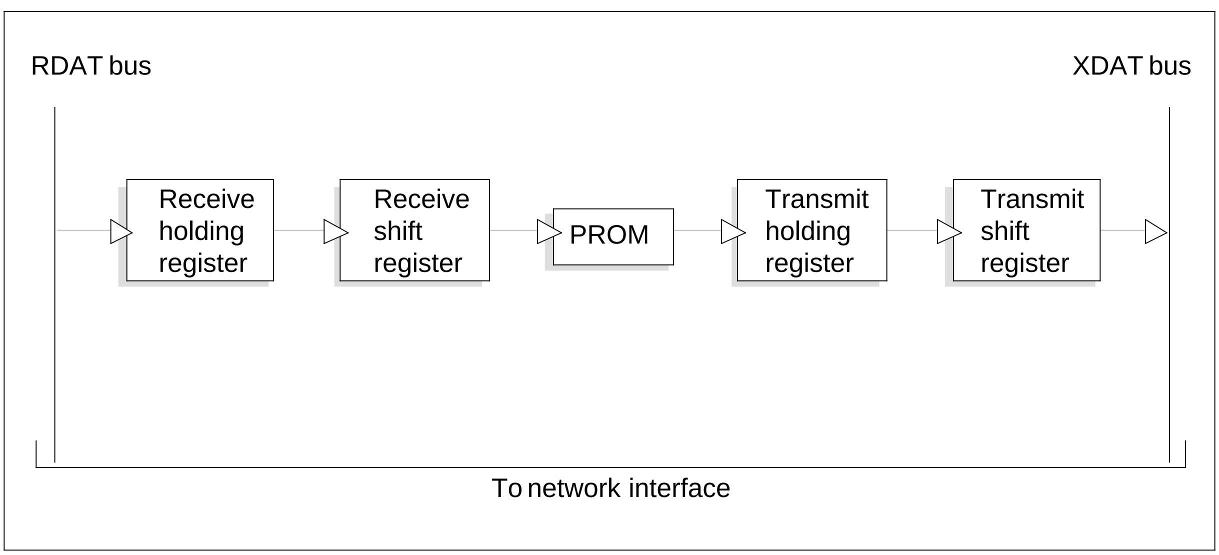
The NT3X68AC card has four ports and a maximum of eight 2-Kbyte PROM circuits. Each port allocates commands for tone selection and stores samples of all tones available in the card. Each port transmits selected tones to specified addresses.

Functional blocks

Each port on the NT3X68AC card consists of the following functional blocks:

- receive holding register
- receive shift register
- PROM circuit
- transmit holding register
- transmit shift register

NT3X68AC functional blocks



Receive holding register

The receive holding register receives tone selection and tone address commands. The register receives the commands from the receive data bus (RDAT) and transmits these commands to the receive shift register.

Receive shift register

Under control of the system clock, the shift register sends tone commands to a specified PROM address.

PROM circuit

The PROM stores PCM samples of all tones available in the card and receives commands from the receive shift register. The PROM transmits a sample of the selected tone to the transmit holding register.

Transmit holding register

The transmit holding register receives a sample tone from the PROM and sends the tone to the transmit shift register. The register sends the tone for transmission to a specified port.

Transmit shift register

The transmit shift register receives a sample tone from the transmit holding register. The register uses the transmit data bus (XDAT) to send the sample to the port that ordered the tone.

Technical data

The NT3X68AC has an output frequency tolerance of ± 0.5%, a tone frequency of 440 Hz with levels of -13 dBm and -17 dBm, and uses μ-law coding.

Dimensions

The dimensions of the NT3X68AC card are:

- height: 353 mm (13.9 in.)
- width: 29 mm (1.13 in.)

Power requirements

The power requirements for the NT3X68AC are a voltage 5 V and current of 650 mA.

The NT3X68AC consumes 3.25 W of power.

NT3X68BB

Product description

The NT3X68BB dual tone multifrequency (DTMF) generator circuit card generates DTMF general use tones.

The card is for A-law applications.

Location

The card is in a spare position of slots 05 through 19 in a maintenance trunk module (MTM).

Functional description

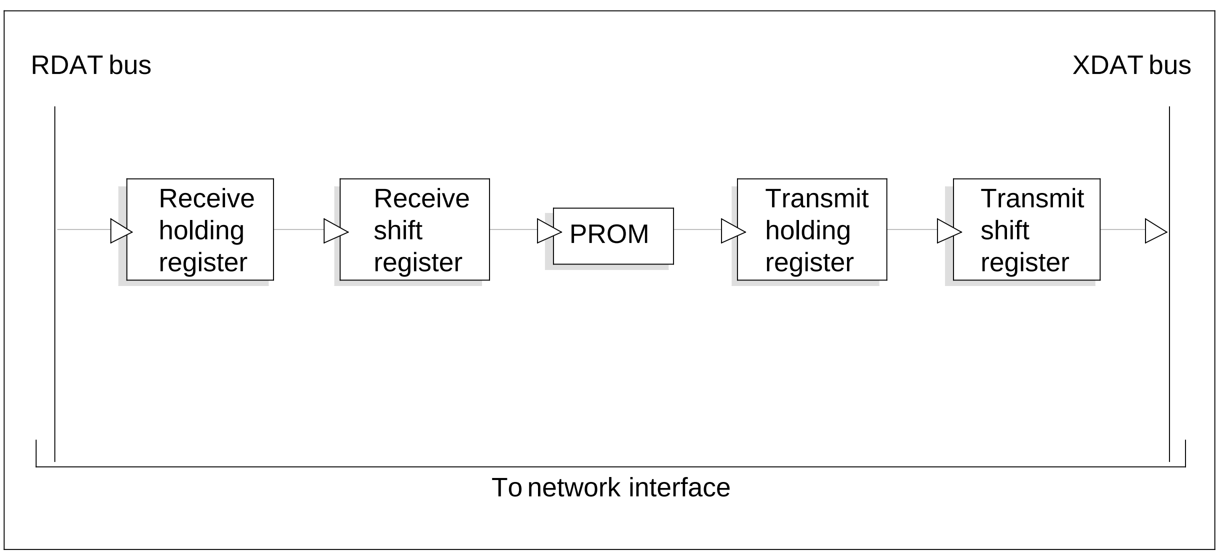
The NT3X68BB card has four ports and a maximum of eight 2-Kbyte PROM circuits. Each port allocates commands for tone selection and stores samples of all tones available in the card. Each port transmits selected tones to specified addresses.

Functional blocks

Each port on the NT3X68BB card consists of the following functional blocks:

- receive holding register
- receive shift register
- PROM circuit
- transmit holding register
- transmit shift register

NT3X68BB functional blocks



Receive holding register

The receive holding register receives tone selection and tone address commands. The register receives the commands from the receive data bus (RDAT) and transmits these commands to the receive shift register.

Receive shift register

Under control of the system clock, the shift register sends tone commands to a specified PROM address.

PROM circuit

The PROM stores PCM samples of all tones available in the card and receives commands from the receive shift register. The PROM transmits a sample of the selected tone to the transmit holding register.

Transmit holding register

The transmit holding register receives a sample tone from the PROM and sends the tone to the transmit shift register. The register sends the tone for transmission to a specified port.

Transmit shift register

The transmit shift register receives a sample tone from the transmit holding register. The register uses the transmit data bus (XDAT) to send the sample to the port that ordered the tone.

Technical data

The NT3X68BB has an output frequency tolerance of ± 0.5% and a tone frequency of -13 dBm for the low frequency group and -11 dBm for the high frequency group. The NT3X68BB has a total power output of -9 dBm. The PCM samples of the tones must be encoded in A-law PCM. The DTMF tones appear in the following table.

DTMF tones (Sheet 1 of 2)

Key	Frequency pair (Hz)	
P	941	1633
1	697	1209
2	697	1336
3	697	1477
4	770	1209
5	770	1336

NT3X68BB (end)

DTMF tones (Sheet 2 of 2)

Key	Frequency pair (Hz)	
6	770	1477
7	852	1209
8	852	1336
9	852	1477
0	941	1336
*	941	1209
A or #	941	1477
F0	697	1633
F	770	1633
I	852	1633

Dimensions

The dimensions of the NT3X68BB card are:

- height: 353 mm (13.9 in.)
- width: 29 mm (1.13 in.)

Power requirements

The power requirements for the NT3X68BB are a voltage 5 V and current of 650 mA.

The NT3X68BB consumes 3.25 W of power.

NT3X68BC

Product description

The NT3X68BC call waiting tone generator circuit card generates dual tone multifrequency (DTMF) call waiting tones.

The card is for A-law applications.

Location

The card is in a spare position of slots 05 through 19 in a maintenance trunk module (MTM).

Functional description

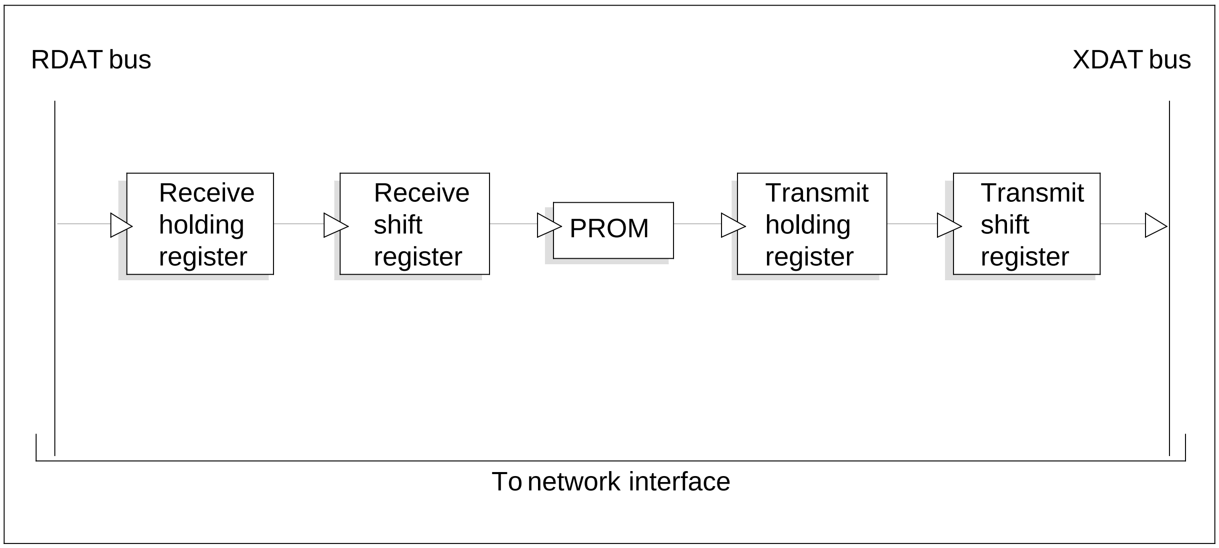
The NT3X68BC card has four ports and a maximum of eight 2-Kbyte PROM circuits. Each port allocates commands for tone selection and stores samples of all tones available in the card. Each port transmits selected tones to specified addresses.

Functional blocks

Each port on the NT3X68BC card consists of the following functional blocks:

- receive holding register
- receive shift register
- PROM circuit
- transmit holding register
- transmit shift register

NT3X68BC functional blocks



NT3X68BC (end)

Receive holding register

The receive holding register receives tone selection and tone address commands. The register receives the commands from the receive data bus (RDAT) and transmits these commands to the receive shift register.

Receive shift register

Under control of the system clock, the shift register sends tone commands to a specified PROM address.

PROM circuit

The PROM stores PCM samples of all tones available in the card and receives commands from the receive shift register. The PROM transmits a sample of the selected tone to the transmit holding register.

Transmit holding register

The transmit holding register receives a sample tone from the PROM and sends the tone to the transmit shift register. The register sends the tone for transmission to a specified port.

Transmit shift register

The transmit shift register receives a sample tone from the transmit holding register. The register uses the transmit data bus (XDAT) to send the sample to the port that ordered the tone.

Technical data

The NT3X68BC has an output frequency tolerance of ± 0.5% and a tone frequency of 400 Hz with levels of -18 dBm and -22 dBm. The PCM samples of the tones must be encoded in A-law PCM.

Dimensions

The dimensions of the NT3X68BC card are:

- height: 353 mm (13.9 in.)
- width: 29 mm (1.13 in.)

Power requirements

The power requirements for the NT3X68BC are a voltage 5 V and current of 650 mA.

The NT3X68BC consumes 3.25 W of power.

NT3X82AA

Product description

The NT3X82AA office alarm unit dead system with different audibles circuit card provides the following for use with alarm circuits in a DMS-100 office alarm system:

- control relays
- power distribution
- a ringing generator

The size of the office and the required alarm capabilities determine if one or two cards are necessary. Offices with different audible alarm signaling devices use this card. An example of a different audible alarm signaling is the critical alarm bell and the major alarm tone bar.

Location

The card occupies two card positions in a maintenance trunk module (MTM). If an office requires the use of two cards, mount the cards in different MTMs. The MTM that contains most of the office alarm system circuits is the office alarm unit (OAU).

Functional description

The NT3X82AA card uses relays and detectors to operate many alarms in a DMS-100 office. The card monitors the communications with the central control (CC) and sounds an alarm if communications fail. The card also monitors the activities of the card and operates alarms if these activities fail.

Functional blocks

The NT3X82AA card consists of the following functional blocks:

- software monitor circuit
- major audible interrupt circuit
- test relays
- 20 Hz ac ringing generator
- 20 Hz monitor circuit
- MTM fail detector
- audible reset detector
- diagnostic circuits
- scan points
- signal distribution (SD) points

NT3X82AA (continued)

- critical system lamp
- critical bell
- hybrid transformer

Software monitor circuit

The software monitor circuit monitors the communications between the card and the CC and initiates an alarm sequence if these communications fail. In normal operation, when communications are not broken, the software monitor holds relay OA in the operated state. Cycles scan point ABMTMFAIL (for the card in the OAU) or ABOAUFAIL (for the card in the MTM).

Communications can fail between the CC and the OAU card or the MTM card. In this event, the software monitor circuit in the affected card stops cycling the corresponding scan point. The monitor circuit releases the OA relay in that card. When communications fail between the CC and the card that remains, the software monitor circuit stops cycling the other scan point. The software monitor releases the OA relay that remains. With both OA relays released, relay DS is released. This action causes a dead system alarm.

Major audible interrupt circuit

When detection of a major alarm occurs, the alarm system software operates signal distribution point MJALMAUD. This process initiates the major audible alarm and activates the major audible interrupt circuit. The circuit operates relay MJ at a rate of 60 times every minute. Each relay operation completes a path between ground and the major tone bar. This path causes the alarm to sound at a rate of 60 times every minute.

NT3X82AA (continued)

Test relays

Ten relays control the alarm circuits. The following table lists the designator and the purpose of each relay.

Relay functions (Sheet 1 of 2)

Relay	Operated	Released
OA	Normal operation. Indicates inact communications between the card and the CC.	Released if communications fail between the card and the CC, causing MTM fail lamp to glow. If communications fail between the CC and the other card, the release of the other OA relay causes the DS relay to release.
PT	Normal operation in the OAU keeps the 20 Hz ringing generator connected to the circuit. In the MTM, connects the ringing generator to the circuit.	Normal operation in the MTM. In the OAU, disconnects the 20 Hz ringing generator from the circuit. In the MTM, keeps the ringing generator disconnected from the circuit.
CA	Activates DMS alarms in the distributing frame	There are no alarms.
MJ	Activated by major alarm. Operated at a rate of 60 cycles per minute to sound an alarm at the major tone bar at a 60 cycle-per-minute rate.	There is no major alarm.
AUD	Activates AB audible alarms	There is no alarm.
VIS	Activates AB visible alarms	There is no alarm.
20 Hz	Normal operation. Indicates 20 Hz ringing generator is operating correctly.	Released if 20 Hz monitor circuit detects a failure in the 20 Hz ringing generator. Causes the AB relay to release, which releases the PT relay and disconnects the 20 Hz ringing generator.
AB	Normal operation	Released when the release of relay 20 Hz or OA occurs. Activates MTM fail detector in matched NT3X82AA.

NT3X82AA (continued)

Relay functions (Sheet 2 of 2)

Relay	Operated	Released
DS	There is no alarm	Causes a dead system alarm. Released when both OA relays or both 20 Hz relays are released.
AR	Resets the critical system lamp and the critical bell and resets all alarms.	Returns critical system lamp and critical bell to the alert state.

20 Hz ac ringing generator

The 20 Hz ac ringing generator provides alternating current at a 20 Hz rate. This alternating current is superimposed on -48V direct current. The current operates the alarm battery subset, minor alarm subset, and the trunk test center (TTC) chime. The voltage is supplied to the circuits when relay PT is operated. The operating relay connects the 20 Hz alternating current in the OAU card and removes the current in the MTM card.

20 Hz monitor circuit

The 20 Hz monitor circuit monitors the 20 Hz ac voltage in the OAU card and holds relay 20 Hz open. This action only occurs as long as the voltage is present. If the 20 Hz supply fails, the detector senses the condition and releases relay 20 Hz. Release of the 20 Hz relay causes the AB relay to release. This process causes the PT relay in the OAU to release. Release of the PT relay disconnects the 20 Hz ac ringing generator from the circuit.

The ABOAUFAIL scan point in the OAU detects the alarm condition. This detection causes the MTMPWRXFR scan point in the MTM to operate. The MTMPWRXFR scan point operates the PT relay in the MTM. The MTMPWRXFR also connects the MTM 20 Hz ac ringing generator to the circuit. When the fault is corrected, all relays are operated again, and the cards return to their normal states.

MTM fail detector

The MTM fail detector senses the absence of ground the operation relay AB causes. This process allows the MTM to detect alarm activations in the matched NT3X82AA. The detector changes the state of scan point ABMTMFAIL to indicate the alarm status in the other alarm card.

Audible reset detector

The audible reset detector senses a change in the state of scan points AUDAROAU (in the OAU) or AUDARMTM (in the MTM). The changes indicate the alarm reset key was pressed. The detector operates relay DS, which in turn operates the AR relay, causing the critical bell and critical system lamp to reset.

Diagnostic circuits

The system software operates the diagnostic circuits to verify the correct operation of the relays and the detectors on the card.

Scan points

Each card provides three scan points, or logic bits that can be read, to indicate the status of different card conditions. The two cards have different functions. This condition means scan points at the same location on the OAU card and the MTM card can have different designators and purposes. The following table lists the designator and purpose of each scan point.

Scan point functions

Scan point	Purpose	Location
ABMTMFAIL	When ground is removed, initiates audible and visible alarms through signal distribution points.	Both
AUDAROAU	When grounded by pressing the audible alarm reset key, silences any current audible alarms.	OAU
AUDARMTM	When grounded by pressing the audible alarm reset key, silences any current audible alarms.	MTM
Diagnostics	Activates diagnostic circuits	Both

Signal distribution points

Each card provides seven signal distribution points, or logic bits that can be read. The points or logic bits indicate the state of different alarms and relays. The SD points at the same location on the OAU card and the MTM card can have different designators and purposes. This condition occurs because of differences in the function of the two cards. The following table lists the designator the purpose of each SD point.

Signal distribution point functions (Sheet 1 of 2)

SD point	Purpose	Location
ABMTMFAIL	Initiates audible alarms in the OAU. Activated on release of relay AB in the MTM.	OAU
ABOAUFAIL	Initiates audible alarms in the MTM. Activated on release of relay AB in the OAU.	MTM

NT3X82AA (continued)

Signal distribution point functions (Sheet 2 of 2)

SD point	Purpose	Location
OAUPNAXFR	In the OAU card, operates the relay PT, that connects the 20 Hz ac ringing generator in the OAU to the alarm circuits. If the generator fails, the following occurs: • SD point changes state • the release of relay PT occurs • the generator in the OAU is removed	OAU
MTMPWRXFR	In the MTM card, operates the PT relay, that connects the 20 Hz ac ringing generator in the MTM to the alarm circuits. The SD point changes state because of the removal of the OAU ringing generator.	MTM
COMAUD1	Operates relay CA in the OAU, which activates DMS alarms in the distributing frame	OAU
COMAUD2	Operates relay CA in the MTM, which activates DMS alarms in the distributing frame	MTM
MJALMAUD	Initiates major audible alarm	Both
ABMTMAUD	Operates relay AUD in the OAU that activates external AB audible alarms	OAU
ABOAUAUD	Operates relay AUD in the MTM that activates external AB audible alarms	MTM
ABMTMVIS	Operates relay VIS in the OAU that activates external AB visible alarms	OAU
ABOAUVIS	Operates relay VIS in the MTM that activates external AB visible alarms	MTM
TEST	Activates test relays	Both

Critical system lamp

Relays AR and DS control the critical system lamp to provide visual indication of an alarm that affects the OAU and MTM cards. The operation of relay 20 Hz or relay OA operates the DS relay. Relay 20 Hz indicates a 20 Hz ac failure. Relay OA indicates a loss of communications with the CC. Relay 20 Hz or relay OA can be operated on the OAU and MTM cards. In this event, both DS relays are operated and the critical system lamp glows.

If communications between the CC and the MTM fail and a power failure follows in the OAU card, the critical system lamp glows.

Critical bell

Relays AR and DS control the critical bell to provide an audible indication of an alarm that affects the OAU and MTM cards. The operation of relay 20 Hz or relay OA operates the DS relay. Relay 20 Hz indicates a 20 Hz ac failure. Relay OA indicates a loss of communications. Relay 20 Hz or relay OA can be operated on the OAU and the MTM cards. In this event, relay DS is operated on both cards. The critical bell sounds.

If communications fail between the CC and the OAU and a power failure follows in the MTM card, the critical bell sounds.

Hybrid transformer

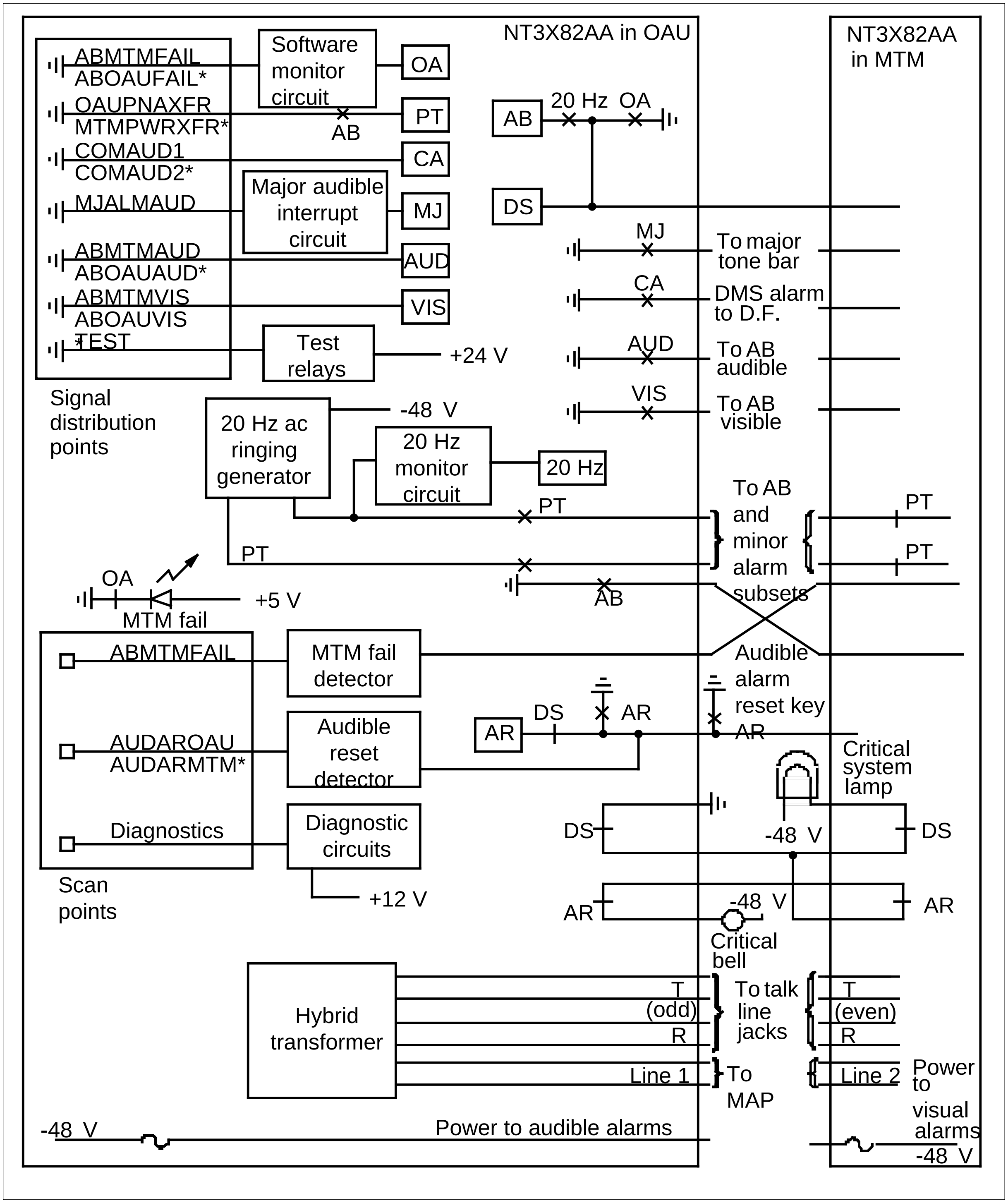
The hybrid transformer accepts one of two office telephone lines that terminate at the MAP in a DMS-100 office as input. The transformer divides one of the two lines into a separate transmit and receive path. This process means the line can be sent to talk line jacks in the even or odd aisles in an office. The card in the OAU connects to the odd aisle, and the card in the MTM, to the even aisle.

The following figure shows the relationship between the functional blocks.

Note: The SD points marked with an asterisk (*) are present in the MTM.

NT3X82AA (continued)

NT3X82AA functional blocks



NT3X82AA (end)

Technical data

The input voltage range for the card is from -42.75 V to -55.8 V.

The 20 Hz ac ringing generator requires an input voltage of -52 V. The generator produces an output voltage of +86 V rms at a maximum power of 5 W and frequency of 20 Hz (±1 percent).

Physical dimensions

The NT3X82AA has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 57 mm (2.25 in.)

Power requirements

The power requirements for the NT3X82AA appear in the following table.

Power requirements

Voltage	Current
-48 V	144 mA typical, 3 A maximum
-15 V	5 mA
+5 V	15 mA
+12 V	10 mA
+24 V	60 mA

Power distribution is normally 7 W, with a maximum of 54 W.

NT3X82AB

Product description

The NT3X82AB office alarm unit dead system with common audibles circuit card provides control relays and power distribution. Alarm circuits in a DMS-100 office alarm system use the control relays and power distribution. The size of the office and the required alarm capabilities determine if the office uses one or two cards. Offices with a common audible alarm signaling device use the card.

Location

The card occupies one card position in a maintenance trunk module (MTM). If an office requires the use of two cards, mount the cards in different MTMs. The office alarm unit (OAU) is the MTM that contains most of the office alarm system circuits.

Functional description

The NT3X82AB card uses relays and detectors to operate many alarms in a DMS-100 office. The card monitors the communications with the central control (CC) and sounds an alarm if these communications fail. The card also monitors the activities of the card and operates alarms if these activities fail.

Functional blocks

The NT3X82AB card consists of the functional blocks that follow:

- software monitor circuit
- major audible interrupt circuit
- test relays
- MTM fail detector
- audible reset detector
- scan points
- signal distribution (SD) points
- critical system lamp
- common audible alarm and display lamp

Software monitor circuit

The software monitor circuit monitors the communications between the card and the CC. The circuit initiates an alarm sequence if these communications fail. In normal operation, when communications are intact, the software monitor holds relay OA in the operated state and cycles scan point ABMTMFAIL or ABOAUFAIL. Scan point ABMTFAIL is for the card in the OAU. Scan point ABOAUFAIL is for the card in the MTM.

Communications can fail between the CC and the OAU card or the MTM card. In this event, the software monitor circuit in the affected card stops cycling the corresponding scan point. The software monitor circuit also releases the OA relay in that card. Communications can fail between the CC and the remaining card. In this event, the software monitor circuit stops cycling the other scan point and releases the remaining OA relay. With both OA relays released, relay DS is released, causing a dead system alarm.

Major audible interrupt circuit

When a major alarm is detected, the alarm system software operates signal distribution point MJALMAUD. Signal distribution point MJALMAUD initiates the major audible alarm and activates the major audible interrupt circuit. The circuit operates relay MJ at a rate of 60 times per minute. Each relay operation completes a path between ground and the major tone bar. This action causes the alarm to sound at a rate of 60 times every minute.

Test relays

Seven relays are provided to control the alarm circuits. The designator and the purpose of each relay appear in the following table.

Relay functions (Sheet 1 of 2)

Relay	Operated	Released
OA	Normal operation. Indicates inact communications between the card and the CC.	Released if communications fail between the card and the CC, causing MTM fail lamp to glow. If communications fail between the CC and the other card, the other OA relay is released. This action causes the DS relay to release.
PT	There is no function	There is no function
CA	Activates DMS alarms in the distributing frame and common alarms in the card.	There are no alarms
VIS	Activates AB visual alarms.	There is no alarm
AB	Normal operation	Released when relay OA is released. Activates MTM fail detector in matched NT3X82AB.

NT3X82AB (continued)

Relay functions (Sheet 2 of 2)

Relay	Operated	Released
DS	There is no alarm	Causes a dead system alarm. Released when both OA relays are released.
AR	Resets the critical system lamp, common audible alarm, and common audible display lamp and resets all alarms.	Returns critical system lamp, common audible alarm, and common audible display lamp to the alert state.

MTM fail detector

The MTM fail detector senses alarm activations in the matched NT3X82AB. This action occurs when the MTM senses the absence of ground caused by the operation of relay AB. The detector changes the state of scan point ABMTMFAIL to indicate the alarm status in the other alarm card.

Audible reset detector

The audible reset detector senses changes in the state of scan points AUDAROAU (in the OAU) or AUDARMTM (in the MTM). This action indicates that the alarm reset key was pressed. The detector operates relay DS, which in turn operates the AR relay and causes the critical system lamp, common audible alarm, and common audible display lamp to reset.

Scan points

Two scan points, or logic bits that can be read, are provided in each card to indicate the status of different card conditions. Scan points at the same location on the OAU card and on the MTM card can have different designators and purposes. This event occurs because of differences in the functions of the two cards. The designator and the purpose of each scan point appear in the following table.

Scan point functions

Scan point	Purpose	Location
ABMTMFAIL	When ground removed, initiates audible and visual alarms through signal distribution points.	Both
AUDAROAU	When grounded by pressing the audible alarm reset key, silences any current audible alarms.	OAU
AUDARMTM	When grounded by pressing the audible alarm reset key, silences any current audible alarms.	MTM

Signal distribution points

Five signal distribution points, or logic bits that can be written, are provided in each card to indicate the status of various alarms and relays. The SD points at the same location on the OAU card and the MTM card can have different designators and location purposes. This event occurs because of differences in the functions of the two cards. The designator and the purpose of each SD point appear in the following table.

Signal distribution point functions

SD point	Purpose	Location
ABMTMFAIL	Initiates audible alarms in the OAU. Activated when relay AB in the MTM is released.	OAU
ABOAUFAIL	Initiates audible alarms in the MTM. Activated when relay AB in the OAU is released.	MTM
OAUPNHXFR	There is no function	OAU
MTMPWRXFR	There is no function	MTM
COMAUD1	Operates relay CA in the OAU, which activates DMS alarms in the distributing frame and common alarms in the card.	OAU
COMAUD2	Operates relay CA in the MTM, which activates DMS alarms in the distributing frame and common alarms in the card	MTM
ABMTMVIS	Operates relay VIS in the OAU, which activates external AB visual alarms	OAU
ABOAUVIS	Operates relay VIS in the MTM, which activates external AB visual alarms	MTM
TEST	Activates test relays	Both

Critical system lamp

The critical system lamp operates under control of relays AR and DS. This action provides a visual indication of an alarm that affects both the OAU card and the MTM card. The operation of relay OA, which indicates a loss of communications with the CC operates the DS relay. Relay OA can be operated on both the OAU and the MTM cards. In this event, relay DS is operated on both cards, and the critical system lamp glows.

If communications fail between the CC and the MTM and a subsequent power failure in the OAU card occurs, the critical system lamp glows.

NT3X82AB (continued)

Common audible alarm and display lamp

When an alarm condition occurs in a DMS office, the CA relay operates. The relay communicates the alarm condition to the distributing frame and activates the common audible alarm and the display lamp.

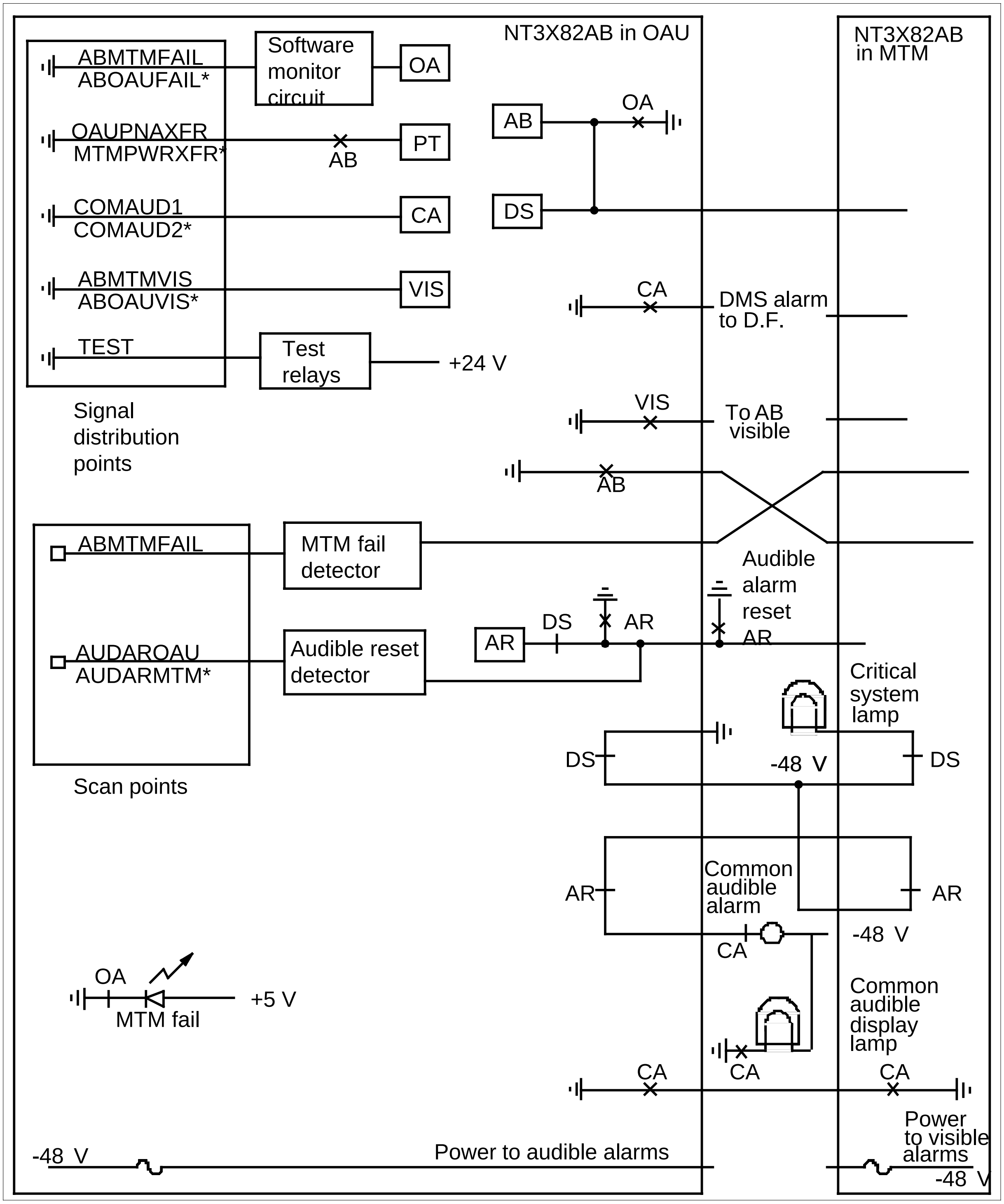
The alarms are reset when the alarm reset key is operated.

The following figure shows the relationship between the functional blocks.

> ***Note:*** The SD points marked with an asterisk (*) are present in the MTM.

NT3X82AB (continued)

NT3X82AB functional blocks



NT3X82AB (end)

Technical data

The input voltage range for the card is from -42.75 V to -55.8 V.

Physical dimensions

The NT3X82AB has the following dimensions:

- length: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 29 mm (1.125 in.)

Power requirements

The power requirements for the NT3X82AB appear in the following table.

Power requirements

Voltage	Current
-48 V	144 mA normal, 3A maximum
-15 V	5 mA
+5 V	15 mA
+12 V	10 mA
+24 V	60 mA

Power distribution is normally 7 W, with a maximum of 54 W.

NT3X82AC

Product description

The NT3X82AC office alarm unit dead system alarm with different audibles circuit card provides the following:

- control relays
- power distribution
- a ringing generator for use with alarm circuits in a DMS-100 office alarm system

The size of the office and the required alarm capabilities determine if the office uses one or two cards. Offices with different audible alarm signal devices, like the critical alarm bell and the major alarm tone bar, use the card.

Location

The card occupies two card positions in a maintenance trunk module (MTM). If an office requires the use of two cards, the cards must be mounted in different MTMs. The MTM referred to as the office alarm unit contains most of the office alarm system circuits.

Functional description

The NT3X82AC card uses relays and detectors to operate many different alarms in a DMS-100 office. The card monitors the communications with the central control (CC) and sounds an alarm if these communications fail. The card also monitors activities of the card and sounds or lights alarms if these activities fail.

Functional blocks

The NT3X82AC card consists of the functional blocks that follow:

- software monitor circuit
- major audible interrupt circuit
- test relays
- 20 Hz ac ringing generator
- 20 Hz monitor circuit
- MTM fail detector
- audible reset detector
- diagnostic circuits
- scan points
- signal distribution (SD) points

NT3X82AC (continued)

- critical system lamp
- critical bell
- hybrid transformer
- low battery voltage detector circuit
- A- and B-feed loss detector relays
- remote alarm contacts

Software monitor circuit

The software monitor circuit monitors communications between the card and the CC and initiates an alarm sequence if these communications fail. In normal operation, when communications are not broken, the software monitor holds relay OA in the operated state. The monitor cycles scan point ABMTMFAIL or ABOAUFAIL. Scan point ABMTMFAIL is for the card in the OAU and ABOAUFAIL is for the card in the MTM.

When communications fail between the CC and the OAU card or the MTM card, the following occurs:

- software monitor circuit in the affected card stops cycling the scan point that corresponds
- the monitor circuit releases the OA relay in the affected card

When communications fail between the CC and the card that remains the following occurs:

- the software monitor circuit stops cycling the other scan point
- the monitor circuit releases the OA relay that remains

With both OA relays released, relay DS is released, which causes a dead system alarm.

Major audible interrupt circuit

Detection of a major alarm causes the alarm system software to operate signal distribution point MJALMAUD. The signal distribution point initiates the major audible alarm and activates the major audible interrupt circuit. The circuit operates relay MJ at a rate of 60 times per min. Each relay operation completes a path between ground and the major tone bar. This process causes the alarm to sound at a rate of 60 times per min.

NT3X82AC (continued)

Test relays

Seventeen relays are provided to control the alarm circuits. The following table lists the designator and the purpose of each relay.

Relay functions

Relay	Operated	Released
OA	Normal operation. Indicates communications between the card and the CC are intact	Released if communications fail between the card and the CC, causing the MTM fail lamp to glow. If communications fail between the CC and the other card, the other OA relay is released. The release causes the DS relay to release.
PT	There is no function.	There is no function.
CA	Activates DMS alarms in the distributing frame and common alarms in the card	There are no alarms.
VIS	Causes AB visible alarms to glow	There is no alarm.
AB	Normal operation	Released when relay OA is released. Activates MTM fail detector in matched NT3X82AD
DS DSS DSSS	There is no alarm	Causes a dead system alarm. Released when both OA relays are released.
AR ARR	Turns off the critical system lamp, common audible alarm, and common audible display lamp; resets all alarms.	Returns the critical system lamp, common audible alarm, and common audible display lamp to the alert state
PWR1 PWR2 PWR3	Indicates an A- or B-feed loss at power distribution center (PDC) when -48 V arrive from PDC. Critical bell and critical power lamp turn on immediately.	Normal operation
CPWRL	Normal operation. Connects low battery scan point to low battery voltage detection circuit.	Released when a blown fuse causes complete loss of the -48V feed. Prevents low power alarm from ringing for fuse loss.

NT3X82AC (continued)

20 Hz ac ringing generator

The 20 Hz ac ringing generator provides alternating current at a 20 Hz rate. This alternating current is superimposed on -48V direct current and operates the following:

- the alarm battery subset
- the minor alarm subset
- the trunk test center (TTC) chime

The voltage is supplied to the circuits when relay PT is operated. The operating relay connects the 20 Hz alternating current in the OAU card and removes it in the MTM card.

20 Hz monitor circuit

The 20 Hz monitor circuit monitors the 20 Hz ac voltage in the OAU card. The monitor circuit holds relay 20 Hz open as long as the voltage remains. If the 20 Hz supply fails, the detector senses this condition and releases relay 20 Hz. Release of the 20 Hz relay causes the AB relay to release. This process causes the PT relay in the OAU to release. The release causes the PT relay to disconnect the 20 Hz ac ringing generator from the circuit.

The ABOAUFAIL scan point in the OAU detects the alarm condition. This detection causes the MTMPWRXFR scan point in the MTM to operate. The operating MTMPWRXFR scan point operates the PT relay in the MTM. The scan point also connects the MTM 20 Hz ac ringing generator to the circuit. Correction of the fault causes all relays to operate again and all cards return to normal states.

MTM fail detector

The MTM fail detector senses the absence of ground caused by operation of relay AB. This sense allows the fail detector to sense alarm activations in the matched NT3X82AC. The detector changes the state of scan point ABMTMFAIL to indicate the alarm status in the other alarm card.

Audible reset detector

The audible reset detector senses a change in the state of scan points AUDAROAU (in the OAU) or AUDARMTM (in the MTM). These changes indicate the alarm reset key was pressed. The detector operates the DS relay, which in turn operates the AR relay. This operation causes the critical bell and critical system lamp to reset.

Diagnostic circuits

The system software operates the diagnostic circuits to verify the correct operation of the relays and the detectors on the card.

Scan points

Each card provides eight scan points, or logic bits that can be read to indicate the status of different card conditions. Different functions of two cards can mean scan points at identical locations on the OAU and MTM cards have different designators and purposes. The following table lists the designator and the purpose of each scan point.

Scan point functions

Scan point	Purpose	Location
ABMTMFAIL	Initiates audible and visible alarms through signal distribution points, when ground removal occurs	Both
AUDAROAU	Silences any currently audible alarms (when grounded) by pressing the audible alarm reset key	OAU
AUDARMTM	Silences any currently audible alarms (when grounded) by pressing the audible alarm reset key	MTM
Diagnostics	Activate diagnostic circuits (three scan points)	Both
Low Battery	Initiates audible and visible alarms when office battery drops below threshold	Both
Feed Loss	Initiates audible and visible alarms when loss of A or B feed occurs at PDC	Both
Unused	One scan point that is not used exists	Both

Signal distribution points

Each card provides eight signal distribution points, or logic bits that can be written. The distribution points or logic bits indicate the status of different alarms and relays. Two cards with different functions can mean SD points at identical locations on the OAU and MTM card have different designators and purposes. The following table lists the designator and purpose of each SD point.

Signal distribution point functions (Sheet 1 of 2)

SD point	Purpose	Location
ABMTMFAIL	Sounds audible alarms in the OAU. Activated on release of relay AB in the MTM	OAU

NT3X82AC (continued)

Signal distribution point functions (Sheet 2 of 2)

SD point	Purpose	Location
ABOAUFAIL	Sounds audible alarms in the MTM. Activated on release of relay AB in the OAU	MTM
OAUPNHXFR	There is no function	OAU
MTMPWRXFR	There is no function	MTM
COMAUD1	Operates relay CA in the OAU, which activates DMS alarms in the distributing frame and common alarms in the card	OAU
COMAUD2	Operates relay CA in the MTM, which activates DMS alarms in the distributing frame and common alarms in the card	MTM
ABMTMVIS	Operates relay VIS in the OAU, which causes external AB visible alarms to glow	OAU
ABOAUVIS	Operates relay VIS in the MTM, which causes external AB visible alarms to glow	MTM
TEST	Operates test relays	Both

Critical system lamp

Relays AR and DS cause the critical system lamp to provide a visible indication of an alarm that affects the OAU and MTM cards. The operation of relay 20 Hz or relay OA operates the DS relay. Relay 20 Hx indicates a 20 Hz ac failure and relay OA indicates a loss of communications with the CC. Operation of relay 20 Hz or OA on OAU and MTM cards causes operation of both DS relays. The critical system lamp glows.

If communications fail between the CC and the MTM and a power failure follows in the OAU card, the critical system lamp glows.

Critical bell

Relays AR and DS cause the critical bell to provide an audible indication of an alarm that affects the OAU and MTM cards. The operation of relay 20 Hz or relay OA operates the DS relay. Relay 20 Hz indicates a 20 Hz ac failure and relay OA indicates a loss of communication with the CC.

If communications fail between the CC and the OAU and a power failure follows in the MTM card, the critical bell rings.

Hybrid transformer

The hybrid transformer accepts one of two office telephone lines that terminate at the MAP in a DMS-100 office as input. The transformer divides one of the two lines into a separate transmit and receive path. This division means the line can be sent to talk line jacks in the even or odd aisles in an office. The card in the OAU connects to the odd aisle, and the card in the MTM connects to the even aisle.

Low battery voltage detector circuit

The low battery voltage detector circuit monitors the -48V office battery. The detector circuit also initiates an alarm condition when the battery level drops below a selected level.

A- and B-feed loss detector relays

The A- and B-feed loss detector relays are normally not powered up. But the relays operate when loss of one or both of the A- or B-feeds occurs at the power distribution center (PDC). The operation of these relays also causes the critical bell to ring and the critical plant lamp to glow. These relays remain powered up until the feeds are restored in the PDC.

Remote alarm contacts

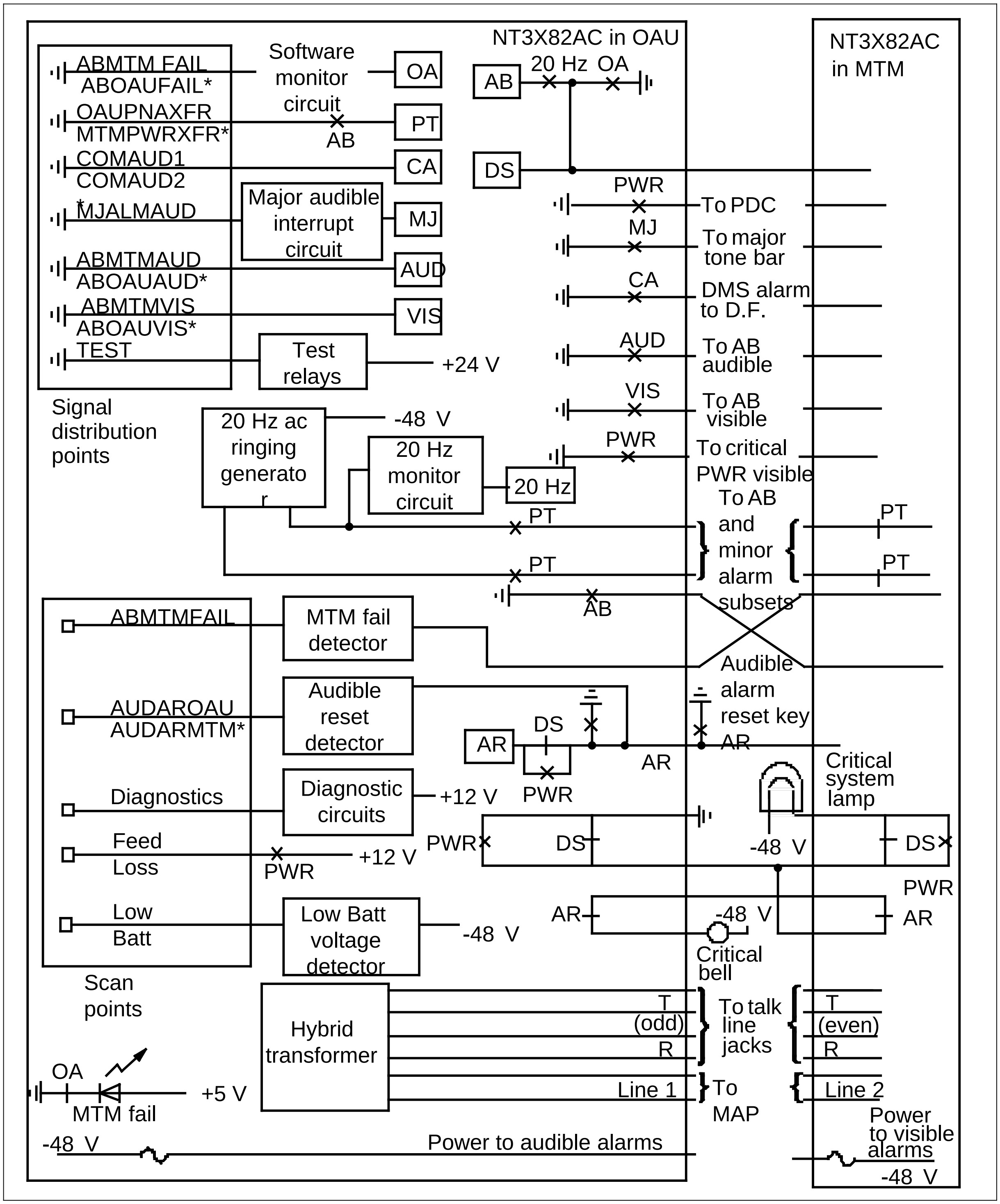
Three remote alarm contacts exist on the NT3X82AC and are connected through a common lead. The PWR2 relay drives one contact (feed loss contact). The contact establishes a make connection when loss of one or both of the A- or B-feeds occurs at the PDC. The dead system relay drives the other two contacts (dead system contacts). These are make and break connections.

The following figure shows the relationship between the functional blocks.

Note: SD points marked with an asterisk (*) are present in the MTM.

NT3X82AC (continued)

NT3X82AC functional diagram



NT3X82AC (end)

Technical data

The input voltage range for the card ranges from -42.75 V to -55.8 V.

The 20 Hz ac ringing generator requires an input voltage of -52 V. The generator produces an output voltage of +86 V rms at a maximum power of 5 W and a frequency of 20 Hz (±1 percent).

Physical dimensions

The NT3X82AC has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 57 mm (2.25 in.)

Power requirements

The power requirements for the NT3X82AC appear in the following table.

Power requirements

Voltage	Current
-48 V	144 mA normal, 3 A maximum
-15 V	5 mA
+5 V	15 mA
+12 V	10 mA
+24 V	60 mA

Power distribution is normally 7 W, with a maximum of 54 W.

NT3X82AD

Product description

The NT3X82AD office alarm unit dead system with common audibles circuit card provides control relays and power distribution. The NT3X82AD is used with alarm circuits in a DMS-100 office alarm system. The size of the office and the required alarm capabilities determine if one or two cards are used. Offices with a common audible alarm signaling device use the card.

Location

The card occupies one card position in a maintenance trunk module (MTM). If an office requires two cards, these cards must be mounted in different MTMs. The MTM referred to as the office alarm unit (OAU) contains most of the office alarm system circuits.

Functional description

The NT3X82AD card uses relays and detectors to operate many different alarms in a DMS-100 office. The card monitors communications with the central control (CC) and sounds an alarm if these communications fail. The card also monitors activities of the card and sounds or lights alarms if these activities fail.

Functional blocks

The NT3X82AD card consists of the following functional blocks:

- software monitor circuit
- major audible interrupt circuit
- test relays
- MTM fail detector
- audible reset detector
- scan points
- signal distribution (SD) points
- critical system lamp
- common audible alarm and display lamp
- low battery voltage detector circuit
- A- and B-feed loss detector relays
- remote alarm contacts

Software monitor circuit

The software monitor circuit monitors communications between the card and the CC. In normal operation the following conditions occur:

- communications are intact
- the software monitor holds relay OA in the operated state
- the software monitor cycles scan point ABMTMFAIL for the card in the OAU or ABOAUFAIL for the card in the MTM

The monitor circuit initiates an alarm sequence if these communications fail.

Communications between the CC and the OAU card or the MTM card can fail. When this event occurs, the software monitor circuit in the affected card stops cycling the corresponding scan point. The software monitor circuit releases the OA relay in this card.

Communications between the CC and the card that remains can fail. When this event occurs, the software monitor circuit stops cycling the other scan point. The software monitor circuit releases the OA relay that remains.

With both OA relays released, the release of the relay DS that follows causes a dead system alarm.

Major audible interrupt circuit

Detection of a major alarm causes the alarm system software to operate signal distribution point MJALMAUD. This signal distribution point initiates the major audible alarm and activates the major audible interrupt circuit. The circuit operates relay MJ at a rate of 60 times per min. Each relay operation completes a path between ground and the major tone bar. This path causes the alarm to sound at a rate of 60 times per min.

NT3X82AD (continued)

Test relays

Fourteen relays are provided to control the alarm circuits. The designator and purpose of each relay appear in the following table.

Relay functions (Sheet 1 of 2)

Relay	Operated	Released
OA	Normal operation. Indicates communications between the card and the CC are intact.	Released if communications between the card and the CC fail. This event causes the MTM fail lamp to glow. A communications failure between the CC and the other card, can occur. The other OA relay is released. This event causes the DS relay to release.
PT	There is no function	There is no function.
CA	Activates DMS alarms in the distributing frame and common alarms in the card	There are no alarms.
VIS	Causes AB visible alarms to glow	There is no alarm.
AB	Normal operation	Released when release of relay OA occurs. Activates MTM failure detector in matched NT3X82AD.
DS DSS DSSS	There is no alarm.	Causes a dead system alarm. Released when release of both OA relays occurs.
AR ARR	Turns off the critical system lamp, common audible alarm and common audible display lamp. Resets all alarms	Returns the critical system lamp, common audible alarm and common audible display lamp to the alert state.

Relay functions (Sheet 2 of 2)

Relay	Operated	Released
PWR1 PWR2 PWR3	Indicates an A- or B-feed loss at power distribution center (PDC) when -48 V arrived from PDC. Critical bell and critical power lamp turn on immediately	Normal operation.
CPWRL	Normal operation. Connects low battery scan point to low battery voltage detection circuit	Releases when a blown fuse causes complete loss of the -48V feed. Prevents low power alarm from ringing for fuse loss.

MTM fail detector

The MTM fail detector senses the absence of ground. The operation of relay AB causes this event to occur. This process allows the fail detector to sense alarm activations in the matched NT3X82AD. The detector changes the state of scan point ABMTMFAIL to indicate the alarm status in the other alarm card.

Audible reset detector

The audible reset detector senses a change in the state of scan points AUDAROAU in the OAU or AUDARMTM in the MTM. The change in state indicates that the alarm reset key is pressed. The detector operates the DS relay.

The relay operates the AR relay that resets the following:

- the critical system lamp
- the common audible alarm
- the common audible display lamp

Scan points

Each card provides eight scan points, or readable logic bits, to indicate the status of different card conditions. Scan points at the same location on the OAU card and the MTM card can have different designators and purposes. The designators and purposes are not the same because the two cards have different

NT3X82AD (continued)

functions. The designator and purpose of each scan point appears in the following table.

Scan point functions

Scan point	Purpose	Location
ABMTMFAIL	Initiates audible and visible alarms through signal distribution points when ground is removed.	Both
AUDAROAU	Silences any current audible alarms when grounded. The audible alarm reset key must be pressed for this action to occur.	OAU
AUDARMTM	Silences any current audible alarms when grounded. The audible alarm reset key must be pressed for this action to occur.	MTM
Diagnostics	Activate diagnostic circuits (three scan points).	Both
Low Battery	Initiates audible and visible alarms when office battery drops below threshold.	Both
Feed Loss	Initiates audible and visible alarms when A or B feed is lost at PDC.	Both
Unused	One scan point that is not used is present.	Both

Signal distribution points

Each card provides eight signal distribution points (SD), or writeable logic bits, to indicate alarm and relay status. The SD points at the same location on the OAU card and the MTM card can have different designators and location purposes. The designators and location purposes are not the same because the two cards have different functions. The designator and purpose of each SD point appear in the following table.

Signal distribution point functions (Sheet 1 of 2)

SD point	Purpose	Location
ABMTMFAIL	Sounds audible alarms in the OAU. Activated on release of relay AB in the MTM.	OAU
ABOAUFAIL	Sounds audible alarms in the MTM. Activated on release of relay AB in the OAU.	MTM
OAUPNHXF R	There is no function.	OAU

NT3X82AD (continued)

Signal distribution point functions (Sheet 2 of 2)

SD point	Purpose	Location
MTMPWRXFR	There is no function.	MTM
COMAUD1	Operates relay CA in the OAU, which activates DMS alarms in the distributing frame and common alarms in the card.	OAU
COMAUD2	Operates relay CA in the MTM, which activates DMS alarms in the distributing frame and common alarms in the card	MTM
ABMTMVIS	Operates relay VIS in the OAU, which causes external AB visible alarms to glow	OAU
ABOAUVIS	Operates relay VIS in the MTM, which causes external AB visible alarms to glow	MTM
TEST	Operates test relays	Both

Critical system lamp

The critical system lamp operates under control of relays AR and DS. The critical system lamp provides a visible indication of an alarm that affects OAU and MTM cards. The operation of relay OA operates the DS relay. Relay OA indicates a loss of communications with the CC. When relay OA operates on OAU and MTM cards, relay DS operates on both cards and the critical system lamp glows.

When a power failure in the OAU card follows a communication failure between the CC and MTM, the critical system lamp glows.

Common audible alarm and display lamp

The CA relay operates when an alarm condition occurs in a DMS office. The relay communicates the alarm condition to the distributing frame. The relay causes the common audible alarm to ring and the display lamp to glow.

The alarms are reset when the alarm reset key is operated.

Low battery voltage detector circuit

The low battery voltage detector circuit performs the following functions:

- monitors the -48V office battery
- initiates an alarm condition when the battery level drops below a specified level

NT3X82AD (continued)

A-feed and B-feed loss detector relays

The A-feed and B-feed loss detector relays are not normally powered up. The loss of one or both of the A-feed and B-feed at the power distribution center (PDC) causes the start of detector relays. The activation of these relays causes the common audible lamp and the critical lamp to glow. These relays remain powered up until the feeds are restored in the PDC.

Remote alarm contacts

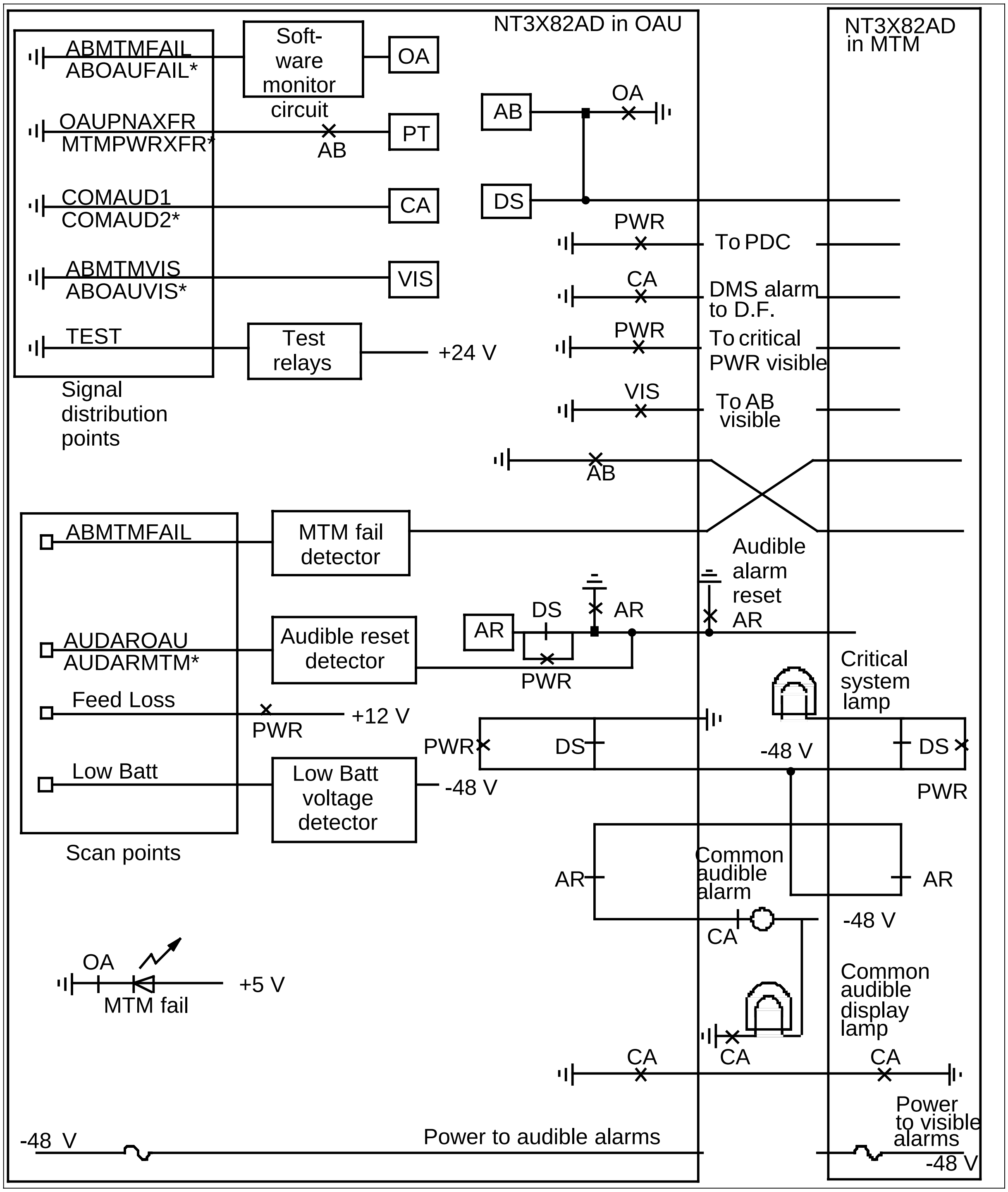
Three remote alarm contacts are present on the NT3X82AD. A common lead connects the remote alarm contacts. The PWR2 relay drives one contact (feed loss contact). The contact establishes a "make" connection when loss of one or both A- or B-feeds occurs at the PDC. The dead system relay drives the other two contacts (dead system contacts). These contacts are "make and break" connections.

The relationship between the functional blocks appears in the following figure.

> ***Note:*** SD points marked with an asterisk (*) are present in the MTM.

NT3X82AD (continued)

NT3X82AD functional diagram



NT3X82AD (end)

Technical data

The NT3X82AD input voltage ranges from -42.75 V to -55.8 V.

Dimensions

The NT3X82AD card has the following dimensions:

- length: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 29 mm (1.125 in.)

Power requirements

The power requirements for the NT3X82AD appear in the following figure.

Power requirements

Voltage	Current
-48 V	144 mA typical, 3A maximum
-15 V	5 mA
+5 V	15 mA
+12 V	10 mA
+24 V	60 mA

Power dissipation is normally 7 W, with a maximum of 54 W.

NT3X82AE

Product description

The NT3X82AE office alarm unit dead system with unique audibles circuit card provides the following:

- control relays
- power distribution
- a ringing generator for use with alarm circuits in a DMS-100 office alarm system

The size of the office and the required alarm capabilities determine if one or two cards are used. Offices with unique audible alarm signaling devices, like the critical alarm bell and the major alarm tone bar, use the card. This card is the 60-V version of the NT3X82AE

Location

The card occupies two card positions in a maintenance trunk module (MTM). If an office requires two cards, the cards must be mounted in different MTMs. The MTM that contains most of the office alarm system circuits is the office alarm unit (OAU).

Functional description

The NT3X82AE card uses relays and detectors to operate many different alarms in a DMS-100 office. The card monitors communications with the central control (CC) and sounds an alarm if these communications fail. The card also monitors the activities of the card and operates alarms if these activities fail.

Functional blocks

The NT3X82AE card contains the following functional blocks:

- software monitor circuit
- major audible interrupt circuit
- test relays
- 20 Hz ac ringing generator
- 20 Hz monitor circuit
- MTM fail detector
- audible reset detector
- diagnostic circuits
- scan points

NT3X82AE (continued)

- signal distribution (SD) points
- critical system lamp
- critical bell
- hybrid transformer

Software monitor circuit

The software monitor circuit monitors communications between the card and the CC and initiates an alarm sequence if these communications fail. In normal operation, when communications are intact, the following events occur:

- the software monitor holds relay OA in the operated state
- the software monitor cycles scan point ABMTMFAIL for the card in the OAU or ABOAUFAIL for the card in the MTM

Communications can fail between the CC and the OAU card or the MTM card. When communication fails, the software monitor circuit in the affected card performs the following functions:

- stops cycling the scan point that corresponds
- releases the OA relay in that card

When communications fail between the CC and the card that remains, the software monitor circuit performs the following functions:

- stops cycling the other scan point
- releases the OA relay that remains

With both OA relays released, the release of relay DS that follows causes a dead system alarm.

Major audible interrupt circuit

When detection of a major alarm occurs, the alarm system software operates signal distribution point MJALMAUD. The signal distribution point initiates the major audible alarm and activates the major audible interrupt circuit. The circuit operates relay MJ at a rate of 60 times per min. Each relay operation completes a path between ground and the major tone bar. This path causes the alarm to sound at a rate of 60 times per min.

Test relays

Ten relays are provided to control the alarm circuits. The designator and the purpose of each relay appear in the following table.

Relay functions (Sheet 1 of 2)

Relay	Operated	Released
OA	Normal operation. Indicates communications between the card and the CC are intact.	Released if communications fail between the card and the CC. This event causes the MTM fail lamp to glow. If communications fail between the CC and the other card, the other OA relay is released. This event causes the DS relay to release.
PT	Normal operation in the OAU. In the OAU, keeps the 20 Hz ringing generator connected to the circuit. In the MTM, connects the ringing generator to the circuit.	Normal operation in the MTM. In the OAU, disconnects the 20 Hz ringing generator from the circuit. In the MTM, keeps the ringing generator disconnected from the circuit.
CA	Activates DMS alarms in the distributing frame.	There is no major alarm.
MJ	A major alarm activates this relay. Operates at a rate of 60 cycles per min. Sounds an alarm at the major tone bar at a 60 cycle-per-min rate.	There is no major alarm.
AUD	Activates AB audible alarms.	There is no alarm.
VIS	Activates AB visible alarms.	There is no alarm.
20 Hz	Normal operation. Indicates 20 Hz ringing generator operates correctly.	Released if 20 Hz monitor circuit detects a failure in the 20 Hz ringing generator. Causes the AB relay to release, which releases the PT relay and disconnects the 20 Hz ringing generator.
AB	Normal operation.	Released when release of relay 20 Hz or OA occurs. Activates MTM fail detector in matched NT3X82AE.

NT3X82AE (continued)

Relay functions (Sheet 2 of 2)

Relay	Operated	Released
DS	There is no alarm.	Causes a dead system alarm. Released when release of both OA relays or both 20 Hz relays occurs.
AR	Resets the critical system lamp and the critical bell and resets all alarms.	Returns critical system lamp and critical bell to the alert state.

20 Hz ac ringing generator

The 20 Hz ac ringing generator provides an alternating current at a 20 Hz rate. This alternating current is superimposed on -60V direct current and operates the following:

- the alarm battery subset
- minor alarm subset
- the trunk test center (TTC) chime

The voltage is supplied to the circuits when relay PT is operated. The operating relay connects the 20 Hz alternating current in the OAU card and removes the current in the MTM card.

20 Hz monitor circuit

The 20 Hz monitor circuit monitors the 20 Hz ac voltage in the OAU card. The 20 Hz monitor circuit holds relay 20 Hz open as long as the voltage is present. If the 20 Hz supply fails, the detector senses the condition and releases relay 20 Hz. Release of the 20 Hz relay causes the AB relay to release. This event causes the PT relay in the OAU to release. Release of the PT relay disconnects the 20 Hz ac ringing generator from the circuit.

The ABOAUFAIL scan point in the OAU detects the alarm condition. This detection causes the MTMPWRXFR scan point in the MTM to operate. The operating MTMPWRXFR scan point operates the PT relay in the MTM. The MTMPWRXFR also connects the MTM 20 Hz ac ringing generator to the circuit. When the fault is corrected, all relays operate again and the cards return to their normal states.

MTM fail detector

The MTM fail detector senses the absence of ground caused by operation of relay AB. This event allows the MTM to sense alarm activations in the matched NT3X82AE. The detector changes the state of scan point ABMTMFAIL to indicate the alarm status in the other alarm card.

Audible reset detector

The audible reset detector senses a change in the state of scan points AUDAROAU in the OAU or AUDARMTM in the MTM. This change in state indicates the alarm reset key is pressed. The detector operates relay DS, which in turn operates the AR relay. This operation causes the critical bell and critical system lamp to reset.

Diagnostic circuits

The system software operates the diagnostic circuits to check the correct operation of the relays and the detectors on the card.

Scan points

Each card provides three scan points, or readable logic bits, to indicate the status of different card conditions. Scan points at the same location on the OAU card and the MTM card can have different designators and purposes. The designators and purposes are not the same because the two cards have different functions. The designator and purpose of each scan point appears in the following table.

Scan point functions

Scan point	Purpose	Location
ABMTMFAIL	Removal of the ground initiates audible and visible alarms through signal distribution points.	Both
AUDAROAU	Silences any current audible alarms. The audible alarm reset key must be pressed to ground this scan point for this event to occur.	OAU
AUDARMTM	Silences any current audible alarms. The audible alarm reset key must be pressed to ground this scan point for this event to occur.	MTM
Diagnostics	Activates diagnostic circuits.	Both

Signal distribution points

Each card provides seven signal distribution points or writeable logic bits. These signal distribution points or logic bits indicate the status of many different alarms and relays. The SD points at the same location on the OAU card and the MTM card can have different designators and purposes. The designators and purposes are not the same because the two cards have different

NT3X82AE (continued)

functions. The designator and the purpose of each SD point appear in the following table.

Signal distribution point functions

SD point	Purpose	Location
ABMTMFAIL	Initiates audible alarms in the OAU. Activated on release of the relay AB in the MTM.	OAU
ABOAUFAIL	Initiates audible alarms in the MTM. Activated on release of relay AB in the OAU.	MTM
OAUPNAXF R	In the OAU card, operates the relay PT, which connects the 20 Hz ac ringing generator in the OAU to the alarm circuits. If the generator fails, the SD point changes state. Release of the relay PT and removal of the generator in the OAU occur.	OAU
MTMPWRXF R	In the MTM card, operates the PT relay, which connects the 20 Hz ac ringing generator in the MTM to the alarm circuits. The SD point changes state because of the removal of the OAU ringing generator.	MTM
COMAUD1	Operates relay CA in the OAU, which activates DMS alarms in the distributing frame.	OAU
COMAUD2	Operates relay CA in the MTM, which activates DMS alarms in the distributing frame.	MTM
MJALMAUD	Initiates major audible alarm.	Both
ABMTMAUD	Operates relay AUD in the OAU, which activates external AB audible alarms.	OAU
ABOAUAUD	Operates relay AUD in the MTM, which activates external AB audible alarms.	MTM
ABMTMVIS	Operates relay VIS in the OAU, which activates external AB visible alarms.	OAU
ABOAUVIS	Operates relay VIS in the MTM, which activates external AB visible alarms.	MTM
TEST	Activates test relays.	Both

Critical system lamp

Relays AR and DS operate the critical system lamp. The critical system lamp provides visual indication of an alarm that affects the OAU and MTM cards.

The DS relay operates by the operation of relay 20 Hz or relay OA. The 20 Hz indicates a 20 Hz ac failure and relay OA indicates a loss of communications with the CC. Relay 20 Hz and relay OA can each operate on the OAU and MTM cards. When one relay operates on both cards, both DS relays operate and the critical system lamp glows.

A communication failure between the CC and the MTM can occur. If a power failure also occurs in the OAU card, the critical system lamp glows.

Critical bell

Relays AR and DS operate the critical bell and provide audible indication of an alarm that affects the OAU and MTM cards. The operation of relay 20 Hz or relay OA operates the DS relay. Relay 20 Hz indicates a 20 Hz ac failure and relay OA indicates a loss of communications with the CC. When relay 20 Hz or relay OA operates on the OAU and MTM cards, relay DS operates on both cards. The critical bell sounds when this condition occurs.

A communication failure between the CC and the OAU can occur. If a power failure follows in the MTM card, the critical bell sounds.

Hybrid transformer

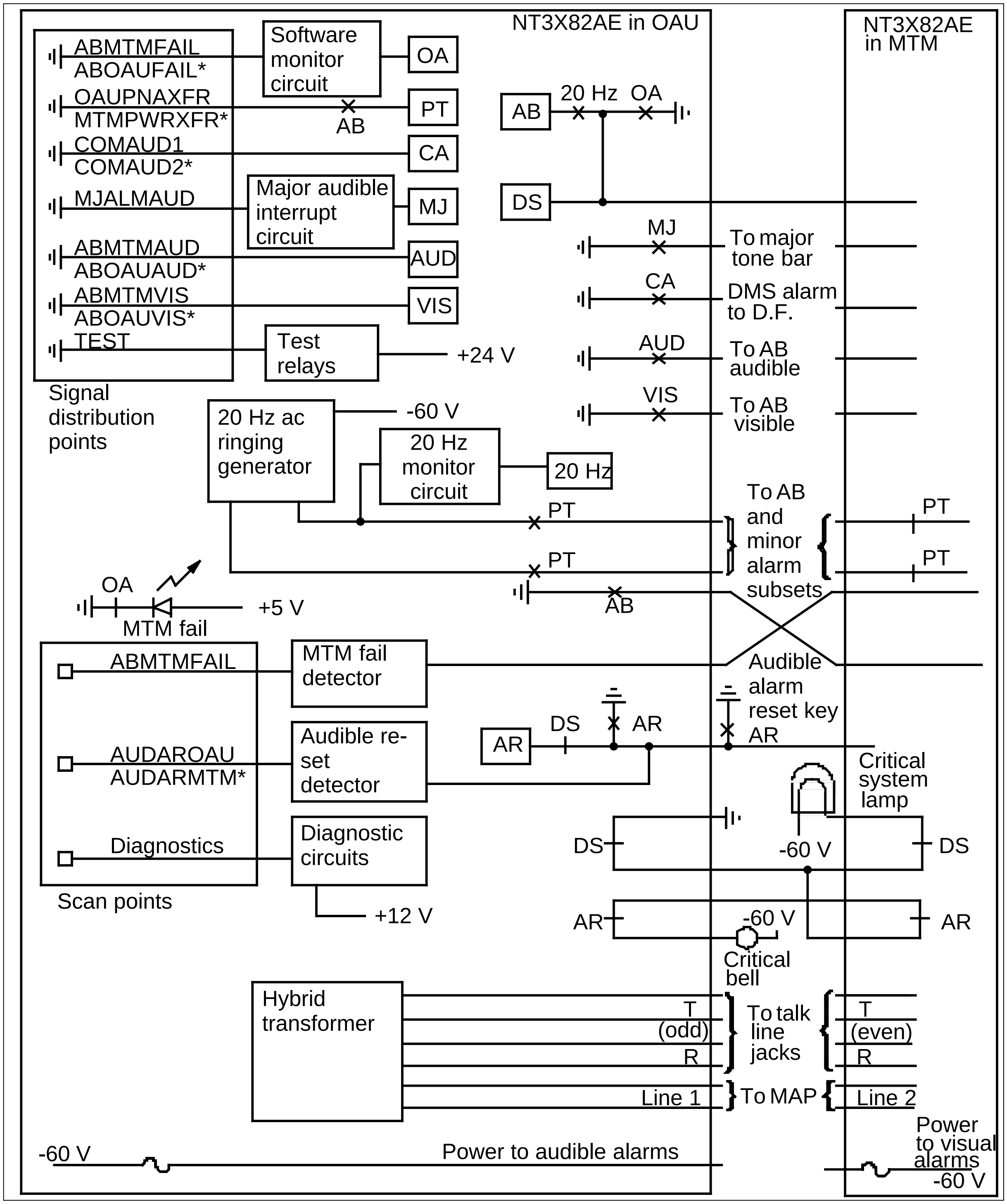
The hybrid transformer accepts one of two office telephone lines that terminate at the MAP in a DMS-100 office as input. The transformer divides one of the two lines into a separate transmit and receive path. This event allows the line to be sent to talk line jacks in the even or odd aisles in an office. The card in the OAU connects to the odd aisle. The card in the MTM connects to the even aisle.

The relationship between the functional blocks appears in the following figure.

> ***Note:*** SD points marked with an asterisk (*) are present in the MTM.

NT3X82AE (continued)

NT3X82AE functional blocks



NT3X82AE (end)

Technical data

The card input voltage ranges from -52 V to -72 V.

The 20 Hz ac ringing generator requires an input voltage of -52 V and produces an output voltage of +86 V rms at a maximum power of 5 W and a frequency of 20 Hz (±1 percent).

Dimensions

The NT3X82AE has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 57 mm (2.25 in.)

Power requirements

The power requirements for the NT3X82AE appear in the following table.

Power requirements

Voltage	Current
-60 V	144 mA typical, 3 A maximum
-15 V	5 mA
+5 V	15 mA
+12 V	10 mA
+24 V	60 mA

Power dissipation is normally 7 W, with a maximum of 54 W.

NT3X82BA

Product description

The NT3X82BA dead system with audibles card controls alarms hardware functions in DMS-100 Family offices. The NT3X82BA is the main controller in the office alarm unit (OAU) to route alarm hardware scan (SC) points to central control (CC) and signal distribution (SD) points to peripheral alarm devices. The NT3X82BA card is part of the Low Power Alarm (LPA) system.

The NT3X82BA card provides the following functions:

- control relays to activate visual and audible alarms for unique and common audibles (-48V and -60V applications)
- control relays to activate visual and audible alarms for office alarm unit (OAU), dead system, and DMS alarms
- inactive timing circuit (IATC) clock with dedicated battery
- routes duplicated and fused alarm battery supply (ABS) voltage through the alarm crossconnect unit (AXU) panel to peripheral devices
- 2:4-wire hybrid transformer circuit to provide power for the office talk loop
- SC and SD points to allow alarm system software to monitor and control DMS alarm functions
- self-diagnostic circuits that use alarm system software or a test switch on the alarm control and display (ACD) panel
- low voltage alarm for -48V and -60V applications
- major audible alarm interrupter circuit

The NT3X82BA replaces the NT3X82 card types used in the Version 2 and Version 2 Enhanced Alarm System (EAS) products, as a low power alternative.

If you provision the NT3X82BA, then you must do the following:

- remove existing paired NT3X82 and NT3X84 cards.
- replace existing NT3X83 cards with cards

The major audible interrupter circuit and the 20-Hz high voltage transformer and monitor circuit, present in previous versions of the NT3X82, is not in the NT3X82BA. If you provision the NT3X82BA, you do not require the IAST/IATC (NT5X69AA/AB).

Location

The NT3X82BA card occupies one slot in an integrated services module (ISM) shelf (NTFX4101). If you use two cards, you must mount the cards in separate ISMs. The OAU is the ISM shelf that contains most of the office alarm system circuits. The standby ISM is the ISM that contains the backup card.

Functional description

The NT3X82BA card uses relays and detectors to activate alarms in a DMS-100 office. The card also monitors communication with CC and activates an alarm if this communication fails.

NT3X82BA functional blocks

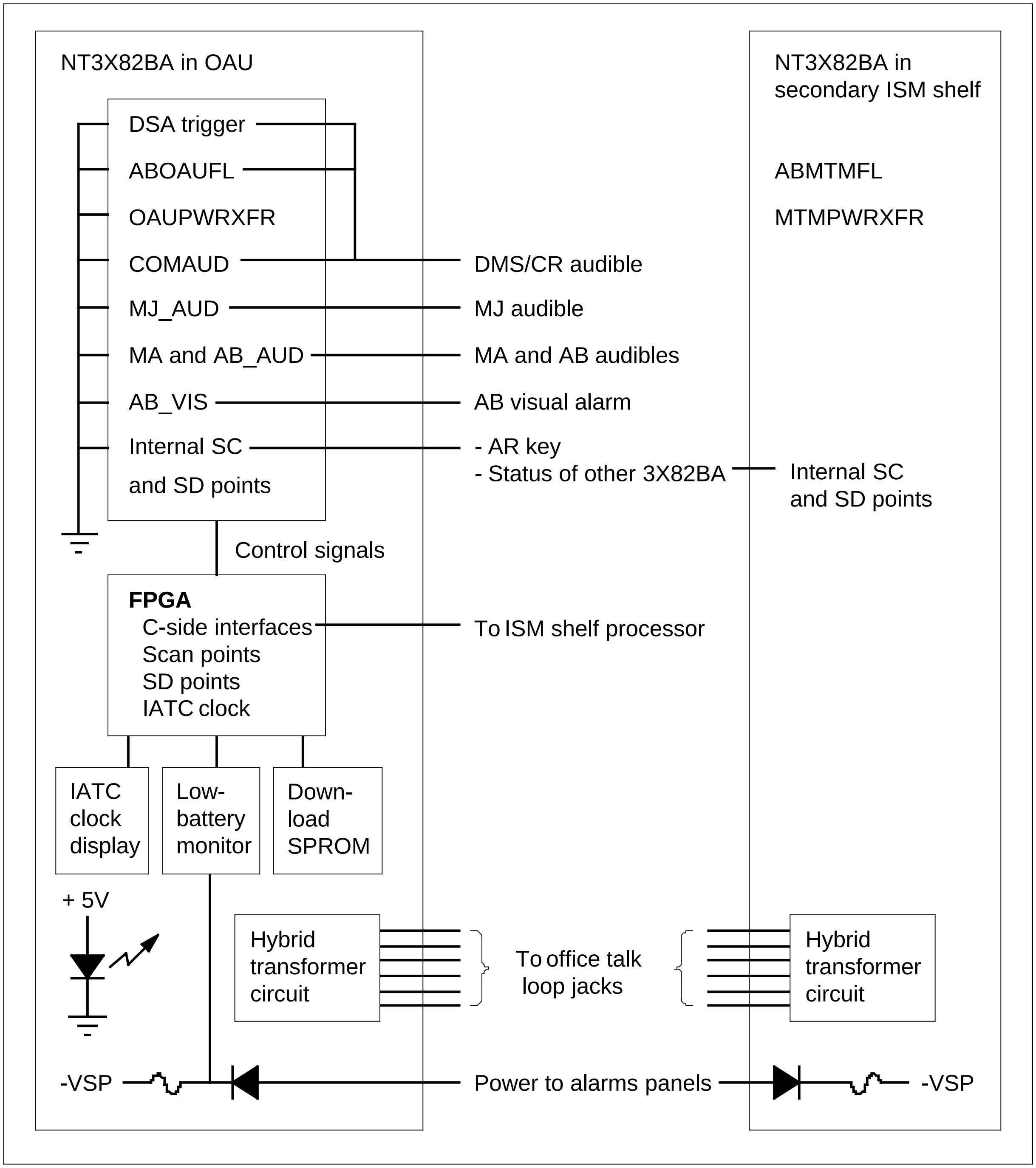
The NT3X82BA card contains the following functional blocks:

- ABS power distribution
- on-board power supplies
- field programmable gate array (FPGA)
- SD points and relay circuits
- SC points
- IATC
- low voltage detector switch
- office talk circuit
- OAU alarm circuits
- dead system alarm circuits
- critical system alarm circuits
- common audible alarm circuit
- major audible interrupt circuit
- test and diagnostic circuits

The following illustration shows the functional blocks in the NT3X82BA card.

NT3X82BA (continued)

NT3X82BA functional blocks



ABS power distribution

Each NT3X82BA card distributes the ABS voltage, at a maximum of 5 amperes, to the peripheral panels of the alarm system. The NT3X82BA cards provide the -48V (or -60V) power to the data link control card (NT3X8906, NT3X8907) on the NT3X89EA AXU panel. The NT3X82BA cards also distribute the -48V feed to the alarm control and display (ACD), alarm display (AD), and DMS exit alarm panels.

In an LPA system, using a NT3X89EA AXU panel with the J1 shorting strap applied, the maximum current to all panels and equipment aisle alarms is 10 amperes. In configurations other than LPA, that use another AXU or the NT3X89EA with the J1 shorting strap removed, the maximum currents are as follows:

- maximum current of 2.5 amperes from the OAU to the visual alarms
- maximum current of 2.5 amperes from the backup ISM to the audible alarms

In previous designs, the NT3X82 in the OAU powers the data link control card and the NT3X82 card in the standby MTM (or ISM) powers the peripheral alarm system panels.

On-board power supplies

The uses a +5V point-of-use power supply (PUPS) for normal powered operation, and rechargeable lithium batteries for the IATC function.

Since there is no office power when the IATC functions, a rechargeable lithium battery pack powers the FPGA during an outage. When a dead system alarm condition occurs, a relay circuit disconnects the battery charger to minimize the drain on the batteries. After you restore power, recharge starts if the battery voltage drops below 6.0 and stops if battery voltage rises to 6.4. This function prevents battery overheating caused by uninterrupted charging. You can disconnect the batteries and the IATC display with a manually-operated switch.

Field-programmable gate array

The FPGA contains all the control circuits to communicate with the following:

- ISM shelf processor
- liquid crystal display (LCD) drivers for the IATC clock display
- SC and SD points for alarm circuits
- peripheral alarm devices through individual solid state or plastic sealed relays

The FPGA firmware is stored in programmable read-only memory (PROM). The PROM uses an internal configuration clock signal to automatically download the firmware file to the FPGA at power up.

NT3X82BA (continued)

Trunk logic interface

The trunk logic interface (TLI) portion of the FPGA firmware replaces two LSI integrated circuits (IC) in earlier NT3X82 versions. The five control-side (C-side) CMOS (complementary metal-oxide semiconductor) interfaces to the ISM processor card are TE.0 (trunk enable signal for the SD points), TE.1 (trunk enable signal for the SC points), RDAT (receive data), XDAT (transmit data), and shelf BUS clock. The first three signals are active enabled 'low'.

Alarm circuits

The alarm circuits functional block uses logic-based netlists to replace the relays, ICs, operational amplifiers, and transistor circuits in earlier NT3X82 versions. The alarm circuits are backwards compatible with the DMS alarms reporting structure. The alarm circuits interface with older alarm system mechanical design external alarm panels.

Improvements to alarm circuit design provide the following:

- driver controls for the status LED
- reduced power drain on the since the NT3X82BA is powered directly from the ABS power
- single slot provisioning for unique audible applications
- low battery alarm circuit for -60V
- the NT3X82BA includes the IATC function
- modern solid state technology

Inactive timing circuit clock

You require this functional block only when there is an E1-type (critical) outage because of a loss of call processing capability in the office. The IATC functional block generates the hours, minutes, and seconds clock signals for an E1-type outage.

SD points and relay circuits

Each NT3X82BA card contains seven SD points or writeable logic bits. These SD points indicate the state of various alarms and relays. SD points at the same location on the OAU card and the standby ISM card have different designations and purposes because the two cards have different functions. The following table shows the designation and purpose of each SD point.

Signal distribution point functions

SD point	Purpose	Location
ABMTMFAIL	Initiates audible alarms in the OAU. Activated on release of the AB (alarm battery) relay in the ISM.	OAU
ABOAUFAIL	Initiates audible alarms in the ISM. Activated on release of the AB relay in the OAU.	standby ISM
COMAUD1	Operates the CA (common alarm) relay in the OAU, which activates DMS alarms in the distribution frame.	OAU
COMAUD2	Operates the CA relay in the standby ISM, which activates DMS alarms in the distribution frame.	standby ISM
MJALMAUD	Initiates major audible alarm indication.	OAU and standby ISM
ABAUD	Operates the AUD (audibles) relay in the OAU, which activates external AB (alarm battery) audible alarms.	OAU and standby ISM
ABMTMVIS	Operates the VIS (visual) relay in the OAU, which activates external AB visible alarms.	OAU and standby ISM

The SD points are ground paths via relays enabled directly from the FPGA, except for three circuits that use plastic-sealed relays to route alarm signals to customer-provisioned external equipment. The SD points and relay circuits provide the battery return and loop paths to route alarm signals to peripheral alarm panels and to connect/disconnect paths between the PUPS or rechargeable batteries.

NT3X82BA (continued)

Relay circuits

Ten alarm relays are provided. The following table shows the designation and the purpose of each relay.

Relay functions (Sheet 1 of 2)

Relay	Reason for operation	Reason for release
OA	Normal operation. Indicates normal communication between the card and CC.	Communication failure between the card and CC. This event causes the ISM fail lamp to light. If communication between CC and the card in the standby ISM fails, the OA (office alarm) relay in the standby ISM releases. This event causes the DS (dead system) relay to release.
CA	Activates DMS alarms in the distribution frame.	There is no major alarm.
MJ	A major alarm activates this relay. Operates at a rate of 60 cycles per min. Activates an alarm at the major tone bar at a 60 cycle-per-min rate.	There is no major alarm.
AUD	Activates AB audible alarms.	There is no alarm.
VIS	Activates AB visible alarms.	There is no alarm.
DS	There is no alarm.	Released both OA circuits fail. Causes a dead system alarm.
K1	Relay K8 alarm condition is met and the system creates a shelf power failure indication	Relay K8 alarm condition is not met, or the power failure condition does not exist (SD point 1)
K2/ K5	An alarm battery fault for DMS software datafill is reported.	No alarm battery faults are present.
K3/ K12	PDC failure or a dead system condition exists.	PDC A, B and ABS feeds are present and there is no dead system alarm condition.
K4	Relay K8 alarm condition is met.	Relay K8 for condition is not met.
K6/ K11	Dead system alarm condition is present.	Dead system alarm condition does not exist.

Relay functions (Sheet 2 of 2)

Relay	Reason for operation	Reason for release
K7	Dead system alarm is present.	Dead system condition does not exist, or the MAP command SIL is entered, or the ACD/AD panel AAR key is activated.
K8	Loss of communication with the core or a battery problem exists.	Communication with the core exists and the lithium batteries are charged.
K9	A major alarm is indicated in the DMS software tables datafill.	There are no major alarms present and the MAP command SIL is entered, or the ACD/AD panel AAR key is activated.
K10	A common audible alarm is indicated in the DMS software tables datafill.	The alarm datafill activation criteria is not met.

SC points

On-board SC points such as low voltage alarm route directly into the FPGA. External SC points route onto the board through optocouplers and then to the FPGA for processing.

Each card provides three scan points, or readable logic bits, to indicate various alarm conditions. SC points at the same location on the OAU card and the standby ISM card have different designations and purposes because the two cards have different functions. The following table shows the designation and purpose of each SC point.

Scan point functions (Sheet 1 of 2)

Scan point	Purpose	Location
ABMTMFAIL	Initiates audible and visible alarms through SD points for removal of the ground path.	standby ISM
ABOAUFAIL	Initiates audible and visible alarms through SD points for removal of the ground path.	OAU
AUDAROAU	Silences active audible alarms. For this event to occur, you must press the audible alarm reset key to ground this SC point.	OAU

NT3X82BA (continued)

Scan point functions (Sheet 2 of 2)

Scan point	Purpose	Location
AUDARMTM	Silences active audible alarms. For this event to occur, you must press the audible alarm reset key to ground this SC point.	standby ISM
Diagnostics	Activates diagnostic circuits.	OAU and standby ISM

Inactive timing circuit

The IATC clock displays the period of time an office is without power. The IATC clock is a seven-digit LCD to display hours, minutes, seconds, and tenths of seconds. The IATC clock increments from 00:00:00.0 to 59:59:59.9. The IATC clock operates until you restore power, at which time, the IATC clock stops operating. You can reset the IATC clock with the switch on the NT3X82BA faceplate. The IATC clock display is blank when the office has power.

The control circuits for the IATC clock are in the FPGA. Both NT3X82BA cards have IATC.

Low voltage detector switch

The low voltage detector switch, present in previous NT3X82 versions, is a seven-position dip switch that sets the range for monitored ABS voltage. If the ABS voltage drops below the alarm condition threshold, the alarm system generates an alarm. This feature is not ISG-compliant and is not available on earlier -60V versions of the NT3X82. The following table contains dip switch information.

Dip switch functions (Sheet 1 of 2)

Switch	Label	Application	Alarm generation thresholds
1	HIGH (domestic)	-48V	-49.5V to -50.5V
2	MED (domestic)	-48V	-47.5 V to -48.5V
3	LOW (domestic)	-48V	-45.5V to -46.5V
1	HIGH (international)	-60V	-64.5 to -65.5V

Dip switch functions (Sheet 2 of 2)

Switch	Label	Application	Alarm generation thresholds
2	MED (international)	-60V	-59.5V to -60.5V
3	LOW (international)	-60V	-57.5V to -58.5V

Office talk circuit

The office talk circuit uses a hybrid transformer circuit similar to the circuit used in previous versions. For use in -48V and -60V applications, resistor and capacitor values are different from previous NT3X82 versions. This transformer provides voltage and current to the talk loop jacks on the front of each FSP or MSP. At these jacks, you can connect a handset or headset and speak to other persons without the requirement for lines equipment.

Office alarm unit alarm

The alarm system generates the OAU alarm when a fault causes the release of the AB relay in the NT3X82BA card of the OAU or standby ISM.

Both the OAU and the standby ISM monitor the other unit's alarm circuits through SC points. The release of the AB relay in the OAU removes the ground from SC point ABOAUFAIL in the standby ISM, which contains the backup . Release of the AB relay in the standby ISM removes the ground from SC point ABMTMFAIL in the OAU. The alarm system activates audible and visual alarms with the related SD points. SD point ABMTMAUD or ABOAUAUD operate the AUD (audibles) relay. SD point ABMTMVIS or ABOAUVIS operate the VIS relay.

The following conditions cause the OAU alarm:

- loss of the -48V (or -60V) supply to the OAU or standby ISM shelf
- blown fuse on an NT3X82 card
- loss of communication between CC and the OAU or standby ISM, detected by the software monitor circuit

Dead system alarm

The alarm system hardware generates the dead system alarm when the office loses call processing capability.

The alarm system generates the dead system alarm when the DS relays on both NT3X82BA cards release. The DS relays connect to ground through contacts in the OA relays in the OAU and standby ISM. Software monitor circuits in the FPGA in the OAU and standby ISM keep the OA relays in the operated state.

NT3X82BA (continued)

The software monitor circuit in the OAU connects to SD point ABMTMFAIL. The software monitor circuit in the standby ISM connects to SD point ABOAUFAIL. When there is communication with CC, the peripheral processor cycles these SD points between their high and low states.

If a loss of communication between CC and either the OAU or standby ISM occurs, the cycling of the ABMTMFAIL or ABOAUFAIL SD points stops. The affected software monitor circuit detects this change and releases its OA relay. The DS relays stay connected to ground. If a loss of sanity in CC software or a loss of communication between CC and both the OAU and the standby ISM occurs, both OA relays release. Since no ground path exists, both DS relays release.

Critical system alarm indication

The critical system lamp on the ACD panel and the critical bell (unique) or common audible buzzer on the audible alarms panel connect to ground through the DS relays in the OAU and standby ISM. When both DS relays release, the alarm system generates an audible and visual critical system alarm indication.

A dead system alarm indication also occurs if there is a power failure on the OAU or standby ISM shelf while the other shelf cannot communicate with CC. If the power failure occurs in the OAU, only the critical system lamp lights to indicate the alarm. If the power failure occurs in the standby ISM, the alarm system generates the following:

- only audible alarm indication (critical bell or common audible alarm) in an office without the Version 2 Enhanced Alarm System (EAS)
- both visual and audible alarm indication in an office with the Version 2 Enhanced Alarm System (EAS)

Common audible alarms

Any alarm condition in an office operates the CA (common alarm) relay. The CA relay contacts connect to ground to indicate there is an alarm condition.

Audible alarm reset

When the system functions normally, operation of the audible alarm reset key on the ACD panel connects SC points AUDAROAU (OAU) and AUDARMTM (standby ISM) to ground. The alarm system monitors the state of these SC points and silences audible alarms if the state changes. The duplication of these SC points allows you to silence an audible alarm if either the OAU or standby ISM is out of service.

When a dead system alarm occurs, the software cannot silence audible alarms. In this case, the exit alarms and audible cutoff panel (NT0X63MA) allows you to silence the critical alarm bell or common audible alarm.

Release of the DS relays in the OAU and standby ISM closes the contacts that connect the audible alarm reset key to the winding of the AR relay in both the OAU and the standby ISM. When a dead system alarm occurs, operation of the audible alarm reset key operates both AR relays. Operation of the AR relays disconnects the critical bell or common audible alarm from ground, and silences the alarm. The AR relays lock and then release automatically when the DS relays operate again when the dead system alarm clears. Duplication of the AR relays allows you to silence the audible alarm if a power failure in the OAU or standby ISM occurs.

Test and diagnostic circuits

The NT3X82BA card contains test relays and self diagnostic circuits, operated by alarm system software, that verify the state and correct operation of the relays and dectectors (SC points, SD points, and operational amplifiers) on the card.

A three-color LED on the faceplate of the NT3X82BA indicates the state of the card. The following table lists the various LED indications and their meanings.

LED indications

Color	Audible alarm	Alarm condition
red	yes	OAU failure (MTBF condition on NT3X82BA card)
	no	OAU failure (no backup NT3X82)
yellow	yes	ABS/IATC battery alarm condition
green	no	card in service and operational
none	yes	dead system alarm
	no	card not in use

The relationship between the functional blocks appears in the following figure.

Software interface

The NT3X82BA card functions if datafilled as *3X82BA* in tables ALMSCGRP and ALMSDGRP.

Firmware interface

The direct firmware interface for the NT3X82BA is a downloadable file of alarms and IATC logic that resides on a serial PROM in the FPGA. At power

NT3X82BA (continued)

up, a reset circuit starts the file download. The reset circuit provides a 200 millisecond window for the download.

The DMS software load contains a firmware file that you must manually download to the ISM processor card. The NT3X82BA card requires this file to function properly.

Technical data

Dimensions

The NT3X82BA has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10..0 in.)
- width: 28.6 mm (1.13 in.)

Power dissipation

Power dissipation for the NT3X82BA is 0.5 Watts or 1.7 BTU (British Thermal Units).

Power requirements

The following table lists power requirements for the NT3X82BA card.

Power requirements

Supply	Min.	Nominal	Max.	Application
ABS battery feed	-42.75V	-48V	-55.8V	-48V offices (domestic)
ABS battery feed	-52V	-60V	-72V	-60V offices (international)
filtered battery	-42.75V	-48V	-55.8V	-48V offices
filtered battery	-52V	-60V	-72V	-60V offices
battery noise		200 mV		
battery current	90 mA	110 mA	120 mA	See Note
NTFX43 supply		12V		
NTFX43 supply		50 mA		

Note: The minimum value is for an NT3X82BA with no alarm conditions and no peripheral devices connected. The nominal value is for a standard configuration with peripheral devices and no alarm conditions. The maximum value is for a severely degraded system with multiple alarms.

Input/output characteristics

The following table contains the output characteristics for output or bi-directional pins. The data in the table is based on signals present on the ISM shelf and the characteristics of the immediate C-side interface TTL (totem pole logic) F-series devices.

Pin descriptions - shelf processor contacts

Parameter	Min.	Nominal	Max.	Comments
frequency		2.56-MHz		system clock
$V_{I/OL}$	-0.5V	0.0V	0.5V	
$V_{I/OH}$	4.5V	5.0V	5.5V	
I_{IL}			4 mA	
I_{IH}			0.2 mA	
I_{OL}			240 mA	
I_{OH}			26 mA	
I_{OS}	-30 mA		-130 mA	
$t_f(t_{PHL})$			50 nsec	propagation delay
$t_r(t_{PLH})$			50 nsec	propagation delay
$t_{SET\text{-}UP}$	50 nsec			

Pin descriptions

The following tables contains pin descriptions.

Pin descriptions - power contacts (Sheet 1 of 2)

Pin no.	Signal	Function	Description
66A	TE.0	BUS	trunk enable 0
66B	TE.1	BUS	trunk enable 1
68A	RDAT	-In	receive data via shelf bus to shelf processor
69A	BUS_CLK	-CLK	2.56-MHz system clock
71A	XDAT	-Out	transmit data via shelf bus to shelf processor

NT3X82BA (continued)

Pin descriptions - power contacts (Sheet 2 of 2)

Pin no.	Signal	Function	Description
1A/B	LG	GND	logic return (system ground)
8A to 11A	-VSP	Out	voltage source for alarms peripheral units
13 to 14B	SP1	PWR	ABS voltage SP1 battery feed
16A/B	SP1	GND	ABS voltage SP1 battery feed return
37 to 38A/B	FLT_L+	GND	filtered battery return
39 to 40A/B	FLT_L-	PWR	filtered battery (-48V/-60V)
41 to 43A/B	LG	GND	logic return (system ground)
46A/B	LG	GND	logic return (system ground)
50A/B	LG	GND	logic return (system ground)
51A/B	SP2	GND	-48V SP2 battery feed return
53A/B	SP2	PWR	-48V SP2 battery feed
76A/B	+12V	PWR	from shelf power converter
80A/B	LG	GND	logic return (system ground)

Pin descriptions - cabled signals (Sheet 1 of 3)

Pin no.	Signal	Function	Description
2A	TRM	Out	ring connection : path B (even rows) - OTL
2B	PDC-IN	In	A or B feed loss relay coils path
3A	TRA	Out	ring connection : path A (odd rows) - OTL

Note: Because of the 20-Hz ac signal in previous alarm system versions, the alarm system requires a separate ground contact. (pin 34A)

NT3X82BA (continued)

Pin descriptions - cabled signals (Sheet 2 of 3)

Pin no.	Signal	Function	Description
3B	RCOM	In	remote communication (feed loss contact)
4A	TTB	Out	tip connection : path B (even rows) - OTL
4B	CPWR-VIS	In	ground for critical power plant LED (ACD/AD panels)
5A	TTA	Out	tip connection : path A (odd rows) - OTL
6A	T2	Out	tip connection to MDF -OTL
7A	R2	Out	ring connection to MDF -OTL
17A	MTMFLSD	Out	signal distribution point to indicate the state of the NT3X82BA to the other (paired) NT3X82BA
18A	MTMFLSC	In	scan point to monitor the state of the paired NT3X82BA
19AD	S-SD	In	dead system signal distribution to dead system alarm relays
20A	DSDF1	Out	dead system alarm (DSA) ground monitor between NT3X82BA cards
21A	DSDF2	In	to IATC (NT5X69AA0 via MDF
22A	DS-VIS1	In	ground path for critical system LED on ACD and AD panels
23A	DS-VIS2	Out	DSA signal to other (paired) NT3X82BA
24A	DS-AUD1	Out	AAR loop between paired NT3X82BA cards
25A	DIS-AUD2	Out	loop to DIS-VIS2 on backup NT3X82BA card

Note: Because of the 20-Hz ac signal in previous alarm system versions, the alarm system requires a separate ground contact. (pin 34A)

NT3X82BA (continued)

Pin descriptions - cabled signals (Sheet 3 of 3)

Pin no.	Signal	Function	Description
26A	AR-KEY	In	audible alarms reset key switch from ACD panel
27A	COM-AUD	In	ground path for AAR circuit
28A	DMS LM	In	ground path for CA alarm via MDF
29A	AB-AUD	In	signal to drive MA, AB, and TTC audibles devices
30A	AB-VIS	In	OAU fail LED on ACD and AD panels
31A	MJ-AUD	In	major audible alarm ground path
32B	RDSYS1	Out	remote dead system alarm 1 (to remote alarm contacts)
33B	RDSYS2	Out	remote dead system alarm 1 (to remote alarm contacts)
34A	RING GND	GND	ground (See Note)
34B	RPWR	Out	remote power (to remote alarm contacts)

Note: Because of the 20-Hz ac signal in previous alarm system versions, the alarm system requires a separate ground contact. (pin 34A)

NT3X82BA backplane pinouts (Sheet 1 of 4)

Row	A	ISM connection	B	ISM connection
1	LoGic return		LoGic return	
2	TRB	A01	PDC-IN	A11
3	TRA	A02	RCOM	A12
4	TTB	A03	CPWR-VIS	A13
5	TTA	A04	Bus	
6	T2	A05	Bus	
7	R2	A06	Bus	

NT3X82BA (continued)

NT3X82BA backplane pinouts (Sheet 2 of 4)

Row	A	ISM connection	B	ISM connection
8	-48V	A07	Bus	
9	-48V	A08	Bus	
10	-48V	A09	Bus	
11	-48V	A10	Bus	
12	TA/T1	Tst.Acc.	NC	
13	TA/R1	Tst.Acc.	-48V_SP1	Battery feed
14	TA/T	Tst.Acc.	-48V_SP1	
15	TA/R	Tst.Acc.	NC	
16	SP1_GND		SP1_GND	
17	MTMFL/SD	B02	Bus	
18	MTMFL/SC	B03	Bus	
19	DS-SD	B04	Bus	
20	DSDF1	B05	Bus	
21	DSDF2	B06	Bus	
22	DS-VIS1	B07	Bus	
23	DS-VIS2	B08	Bus	
24	DS-AUD1	B09	Bus	
25	DS-AUD2	B10	Bus	
26	AR-KEY	B11	Bus	
27	COM-AUD	B12	Bus	
28	DMS-ALM	B13	Bus	
29	AB-AUD	B14	Bus	
30	AB-VIS	B15	Bus	
31	MJ-AUD	B16	Bus	

NT3X82BA (continued)

NT3X82BA backplane pinouts (Sheet 3 of 4)

Row	A	ISM connection	B	ISM connection
32	20 HZ	B17	RDSYS1	B37
33	20 HZ	B18	RDSYS2	B38
34	RING GND	B19	RPWR	B39
35	+24V		+24V	
36	NC		NC	
37	FLT_L+	filtered battery	FLT_L+	
38	FLT_L+	filtered battery	FLT_L+	
39	FLT_L-	filtered battery	FLT_L-	
40	FLT_L-	filtered battery	FLT_L-	
41	LoGic return		LoGic return	
42	LoGic return		LoGic return	
43	LoGic return		LoGic return	
44	RPAMP			
45	RPAMN			
46	LoGic return		LoGic return	
47				
48	XAMP			
49	XPAMN			
50	LoGic return		LoGic return	
51	SP2_GND		SP2_GND	
53	-48V_SP2		-48V_SP2	
66	TE.0		TE.1	

NT3X82BA (end)

NT3X82BA backplane pinouts (Sheet 4 of 4)

Row	A	ISM connection	B	ISM connection
67			TYN	
68	RDAT-			
69	BUS_CLK-			
70			ANUL	
71	XDAT-			
74	-15V		-15V	
76	+12V		+12V	
78	+5V		+5V	
80	LoGic return		LoGic return	

NT3X83AA

Product description

The NT3X83AA office alarm unit alarm transfer card provides facilities for transfer of the following:

- major and minor alarms
- dead system alarms
- 101 test line calls

Alarms transfer from the local DMS office or power plant to a remote circuit in a distant office that receives alarms. The local office does not need attendants because of the alarm transfer capability.

Location

The card occupies one card position in a maintenance trunk module (MTM).

Functional description

The NT3X83AA card uses scan points, signal distribution (SD) points and relays to transfer local alarms to a remote office. Operation of one of the following begins the alarm transfer function:

- the alarm transfer key on the alarm control and display (ACD) panel
- the alarm reset key in the remote alarm receiving circuit

Operation of either key a second time cancels the alarm transfer.

Alarms transferred include major alarms, minor alarms, dead system alarms, DMS office alarms and DMS power plant alarms. Calls on the 101 test lines are also transferred. These calls cause the trunk test center (TTC) chime to sound at the remote location. Operation of the night alarm transfer switch on the ACD or the exit alarm panel initiates night alarm transfer. The night alarm transfer allows the transfer of 101 test line calls. The sound of the TTC chimes is not heard when a night alarm transfer occurs.

Functional blocks

The NT3X83AA card contains the following functional blocks:

- 130 V generator
- alarm transfer detector
- signal distribution points
- scan points
- test relays

- positive/negative current detector
- remote alarm reset detector
- 101 detector
- night alarm transfer detector
- switches
- -130 V detector
- +130 V detector
- diagnostic circuit

130-V generator

The 130 V generator provides the following signaling voltages:

- +130 V on the tip (T) lead
- -130 V on the ring (R) lead to the remote alarm receiving circuit in the remote office

The voltage checks the integrity of the signaling path between the two offices. Changes in the supplied voltages are used to transfer major and minor alarm signals to the remote office.

Alarm transfer detector

The alarm transfer detector senses the presence of ground on scan point XFRALM. This presence indicates the remote alarm transfer key has is pressed. The detector operates SD point ALMXFR which operates relay AT. The relay reverses voltage on the T and R leads to inform the remote office of alarm transfer circuit activation.

NT3X83AA (continued)

Signal distribution points

Eight signal distribution points, or writeable logic bits, indicate the status of different alarms and relays. The designator and purpose of each SD point appear in the following table.

Signal distribution point functions

SD point	Purpose
ALMXFR	Operates when alarm transfer or alarm reset key is operated. Operates relay AT, which reverses the 130-V signal to the remote office and indicates activation of alarm transfer circuit.
MJXFR	Operates when detection of major alarm occurs in the DMS office. Operates relay MJX to send major alarm signal to remote office.
MNXFR	Operates when detection of minor alarm occurs in the DMS office. Operates relay MNX to send minor alarm signal to remote office.
LN101TST	Operates when detection of incoming call on 101 test lines occurs. Operates relay 101 to transfer call to remote office.
NTALMXFR	Operates when night alarm transfer switch in the ACD or the exit alarm panel is operated. Operates relay NAT to activate night alarm transfer.
EXPILPWR	Operates when detection of alarm condition in the DMS power plant occurs. Operates relay EP-PWR, which turns on the following: • the power plant lamp on all DMS exit alarm panels • the exit pilot lamps that represent the power plant on all non-DMS floors
EXPILDMS	Operates when detection of alarm condition in the DMS office occurs. Operates relay EP, which turns on the exit pilot lamp. The pilot lamp represents the DMS office on all DMS and non-DMS exit alarm panels.
TST3	Operates during testing.

Scan points

Eight scan points, or readable logic bits, are provided to indicate the status of different card conditions. The designator and purpose of each scan point appear in the following table.

Scan point functions

Scan point	Purpose
XFRALM	Grounded to initiate the alarm transfer function. Operation of the alarm transfer key on the ACD or the alarm reset key in the remote office places ground on the scan point. Operates SD point ALMXFR, which operates relay AT to complete the alarm transfer function.
REMOTEAR	Grounded when alarm transfer is initiated to enable remote alarm reset. Ground removed when the alarm transfer key on the ACD or the alarm reset key in the remote office is operated.
130MONITOR	Grounded in normal operation to indicate the 130-V generator operates correctly. Ground removed when the generator fails.
TTCNTXFR	Grounded when night alarm transfer is in effect. Operates SD point NTALMXFR, which operates relay NAT to activate the night alarm transfer.
TSTLN101	Grounded when detection of an incoming call on a 101 test line occurs. Operates SD point LN101TST, which operates relay 101 to transfer the call to the remote office. Ground removed when the call is answered at the remote office.
DIAG4	Used during diagnostic testing.
DIAG5	Grounded when -130 V are present on the T lead, which indicates transfer of alarms has not occurred. Ground removed when +130 V are present, which indicates alarm transfer occurred.
DIAG6	Grounded when +130 V are present on the R lead, which indicates transfer of alarms did not occur. Ground removed when -130 V are present, which indicates alarm transfer occurred.

NT3X83AA (continued)

Test relays

Eleven relays are provided for alarm transfers and test purposes. The designator and the purpose of each relay appear in the following table.

Relay functions (Sheet 1 of 2)

Relay	Operated	Released
AT	Operated when alarm transfer signal arrives. Reverses 130-V signaling voltage on T and R leads to notify remote office of alarm transfer. Maintains ground on scan point XFRALM to keep alarm transfer in operation.	Alarms not transferred.
MJX	Operated when detection of a critical or major alarm in the DMS office occurs. When relay AT is also operated, places -130 V on T and R leads to notify remote office of major alarm condition.	Normal operation.
MNX	Operated when detection of a minor alarm in the DMS office occurs. When relay AT is also operated, places +130 V on T and R leads to notify remote office of minor alarm condition.	Normal operation.
130	Normal operation. +130 V are present on T lead; -130 V are present on R lead.	Released when 130 V generator fails. Removes ground from scan point 130MONITOR.
DIS	Normal operation	Released when switch S2 is operated to prevent remote alarm transfer. Disconnects the -48 V supply from the 130 V generator to prevent operation of the generator. Also breaks the path to the remote ACD panel, to prevent operation of the alarm transfer key.

NT3X83AA (continued)

Relay functions (Sheet 2 of 2)

Relay	Operated	Released
101	Operated when an incoming call is received on the 101 test lines. Ringing ground from the NT3X82 card is applied to the TTC chime, which causes the TTC chime to operate.	Normal operation. Also released when incoming call on 101 test lines is answered. Ringing ground removed from the TTC chime.
NAT	Operated when the night alarm transfer switch is operated on the ACD panel or the exit alarm panel. When relay 101 is also operated, operates audible and visible minor system alarms and turns on TTC lamp. Relay 101 is operated during incoming calls on 101 test lines. Prevents operation of the TTC chime for 101 alarms.	Normal operation.
EP-P WR	Operated when detection of alarm condition in the DMS power plant occurs. Turns on the power plant lamp on all DMS exit alarm panels and the exit pilot lamps. The exit pilot lamps represent the power plant on all non-DMS floors.	There is no power plant alarm present.
EP	Operated when detection of an alarm condition in the DMS office occurs. Turns on the exit pilot lamp that represents the DMS office on all exit alarm panels.	There is no DMS office alarm present.
L	Normal operation.	Released on operation of alarm reset key in remote office. Places ground on scan point XFRALM to initiate alarm transfer.
AB	Normal operation.	Released when AB relay on the NT3X82 card is released, which indicates a dead system alarm. If alarm transfer is in effect, operates relay MJX to activate major alarm in the remote office.

NT3X83AA (continued)

Positive/negative current detector

The positive/negative current detector senses the polarity of the current on the T lead. This action allows the current detector to determine the state of the alarm transfer. If the T lead carries -130 V, the card does not transfer alarms. If the T lead carries +130 V, the card initiated the alarm transfer process. The detector releases relay L, which grounds scan point XFRALM to begin the alarm transfer.

The alarm transfer switch is operated again to cancel the alarm transfer. This process removes ground from the REMOTEAR scan point. The detector senses the change in state and releases SD point ALMXFR to cancel the alarm transfer.

Remote alarm reset detector

The remote alarm reset detector detects ground on the REMOTEAR scan point. Ground indicates that the remote alarm transfer key was operated. When the detector detects ground on the scan point, the detector operates SD point ALMXFR to initiate the alarm transfer process.

101 detector

The 101 detector detects an incoming call on the 101 test lines and grounds scan point TSTLN101. The alarm system software operates SD point LN101TST, which causes relay 101 to operate. Relay 101 connects ringing ground from the 20-Hz ac ringing generator on the NT3X83AA card to the TTC chime. This action causes the chime to sound.

Night alarm transfer detector

The night alarm transfer detector detects ground on scan point TTCNTXFR. Ground indicates operation of the night alarm transfer switch at the ACD panel or the exit alarm panel. The detector operates SD point NTALMXFR, which causes relay NAT to operate and initiates night alarm transfer.

When night alarm transfer is in effect, incoming calls on the 101 test lines cause audible and visible minor system alarm. The incoming call also turns on the TTC lamp. The TTC chime does not sound.

Switches

Two switches are provided to control card operations. The designator and purpose of the switches appear in the following table.

Switch functions

Switch	ON	OFF
S1	Sets maximum resistance of the alarm transfer loop to 9000 Ω.	Sets maximum resistance of the alarm transfer loop to 5000 Ω.
S2	Normal operation.	The -48 V supply disconnected from the 130 V generator to disable the remote alarm transfer function.

-130 V detector

The -130 V detector monitors the T lead for a -130 V signal, which indicates normal operation. If the voltage is present, the detector grounds scan point DIAG5. If the detector senses a polarity change to +130 V, the ground is removed. Scan point DIAG5 is part of the diagnostic circuitry.

+130 V detector

The +130 V detector monitors the R lead for the presence of a +130 V signal, which indicates normal operation. If the voltage is present, the detector grounds scan point DIAG6. If the detector senses a polarity change to -130 V, the ground is removed. Scan point DIAG6 is used as part of the diagnostic circuitry.

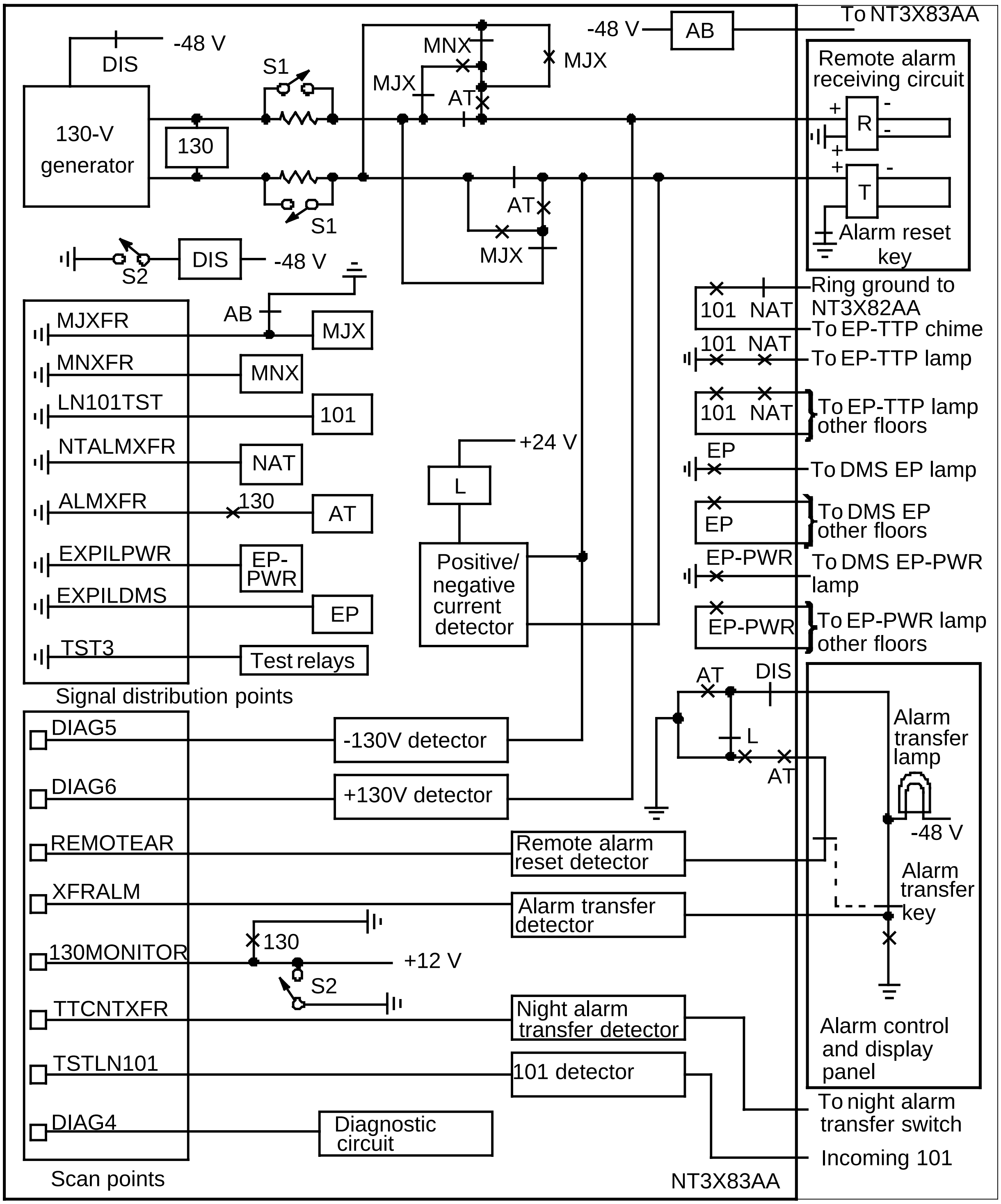
Diagnostic circuit

The system software operates the diagnostic circuit to check the correct operation of the relays and detectors on the card.

The relationship between the functional blocks appears in the following figure.

NT3X83AA (continued)

NT3X83AA functional blocks



Technical data

The 130 V generator on the card accepts a nominal input voltage of -52 V. The generator also produces a 130 V output at a maximum current of 35 mA. The oscillator frequency of the generator is 13 kHz.

Dimensions

The NT3X83AA has the following dimensions:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 29 mm (1.125 in.)

Power requirements

The card requires an input voltage between -42.75 V and -55.8 V. The power requirements for the appear in the following figure.

Power requirements

Voltage	Current
-48 V	100 mA typical, 200 mA maximum
+12 V	10 mA typical
+24 V	72 mA typical, 100 mA maximum

Normal power dissipation is normally 8 W, with a maximum of 14 W. Power dissipation with switch S2 off is normally 2 W. The remote transfer disables when switch S2 is off.

NT3X83AB

Product description

The NT3X83AB alarm transfer circuit card for the office alarm unit provides facilities to transfer the following:

- major alarms
- minor alarms
- dead system alarms
- 101 test line calls

The NT3X83AB allows the transfer of these items from the local DMS office or power plant to a remote circuit. This circuit receives alarms in a distant office. The alarm transfer ability allows the local office to remain unattended. This card is the 60 V version of the NT3X83AA.

Location

The card occupies one card position in a maintenance trunk module (MTM).

Functional description

The NT3X83AB functional blocks card uses scan points, signal distribution (SD) points and relays to transfer local alarms to a remote office. The alarm transfer key or the alarm reset key initiate the alarm transfer function. The alarm transfer key is on the alarm control and display (ACD) panel. The alarm reset key is in the remote alarm receiving circuit. To cancel the alarm transfer, operate one of the keys a second time.

Operation of the keys can transfer the following alarms:

- major alarms
- minor alarms
- dead system alarms
- DMS office alarms
- DMS power plant alarms

The NT3X83AB also transfers calls on the 101 test lines. The calls on the 101 test lines cause the trunk test center (TTC) chime to sound at the remote location. Operate the night alarm transfer switch on the ACD or on the exit alarm panel to initiate night alarm transfer. The night alarm transfer allows the transfer of 101 test line calls. The night alarm transfer does not sound the TTC chimes.

Functional blocks

The NT3X83AB card contains the following functional blocks:

- 130 V generator
- alarm transfer detector
- signal distribution points
- scan points
- test relays
- positive/negative current detector
- remote alarm reset detector
- 101 detector
- night alarm transfer detector
- switches
- -130 V detector
- +130 V detector
- diagnostic circuit

130 V generator

The 130 V generator provides signaling voltages to the circuit that receives remote alarm in the remote office. The 130 V generator provides signaling voltages of +130 V on the tip (T) lead and -130 V on the ring (R) lead. The presence of the voltage verifies the integrity of the signaling path between the two offices. The card uses changes in the supplied voltages to transfer major and minor alarm signals to the remote office.

Alarm transfer detector

The alarm transfer detector detects ground on scan point XFRALM. Ground on the XFRALM indicates that you pressed the remote alarm transfer key. The detector operates SD point ALMXFR. The SD point ALMXFR operates relay AT. The relay reverses the voltage on the T and R leads. The relay reverses the voltage on the leads to inform the remote office that you activated the alarm transfer circuit.

NT3X83AB (continued)

Signal distribution points

Eight signal distribution points, or writeable logic bits, indicate the status of different alarms and relays. The designator and the purpose of each SD point appear in the following table.

Signal distribution point function

SD Point	Purpose
ALMXFR	Operates when you operate the alarm transfer or alarm reset key. Operates relay AT. Relay AT reverses the 130 V signal to the remote office. Relay AT indicates that you activated the alarm transfer circuit.
MJXFR	Operates when the NT3X83AB detects a major alarm in the DMS office. Operates relay MJX to send major alarm signal to remote office.
MNXFR	Operates when the NT3X83AB detects a minor alarm in the DMS office. Operates relay MNX to send minor alarm signal to remote office.
LN101TST	Operates when the NT3X83AB detects an incoming call on 101 test lines. Operates relay 101 to transfer call to remote office.
NTALMXFR	Operates when you operate night alarm transfer switch in the ACD or the exit alarm panel. Operates relay NAT to activate night alarm transfer.
EXPILPWR	Operates when the NT3X83AB detects an alarm condition in the DMS power plant. Operates relay EP-PWR. The EP-PWR turns on the power plant lamp on all DMS exit alarm panels. The EP-PWR also turns on the exit pilot lamps that represent the power plant on all floors that are not DMS.
EXPILDMS	Operates when the alarm transfer detector detects an alarm condition in the DMS office. Operates relay EP. Relay EP turns on the exit pilot lamp. This lamp represents the DMS office on all DMS and exit alarm panels that are not DMS.
TST3	Operates during testing.

Scan points

Eight scan points, or readable logic bits, indicate the status of different card conditions. The designator and the purpose of each scan point appear in the following table.

Scan point function

Scan point	Purpose
XFRALM	Grounded to initiate the alarm transfer function. The operation of the alarm transfer key on the ACD places ground on the scan point. The alarm reset key in the remote office places ground on the scan point. Operates SD point ALMXFR. The SD point ALMXFR operates relay AT to complete the alarm transfer function.
REMOTEAR	Grounded when you initiate alarm transfer to enable remote alarm reset. Operation of the alarm transfer key on the ACD or the alarm reset key in the remote office removes ground.
130MONITOR	Grounded in normal operation to indicate that the 130 V generator operates correctly. Ground removed when the generator fails.
TTCNTXFR	Grounded when night alarm transfer is in effect. Operates SD point NTALMXFR. The SD point NTALMXFR operates relay NAT to activate the night alarm transfer.
TSTLN101	Grounded when the NT3X83AB detects an incoming call on a 101 test line. Operates SD point LN101TST, which operates relay 101 to transfer the call to the remote office. Ground removed when the call is answered at the remote office.
DIAG4	In use during diagnostic testing.
DIAG5	Grounded when -130 V are present on the T lead, which indicates that alarms are not transferred. Ground removed when +130 V are present, which indicates alarms are transferred.
DIAG6	Grounded when +130 V are present on the R lead, which indicates that alarms are not transferred. Ground removed when -130 V are present, which indicates that alarms are transferred.

NT3X83AB (continued)

Test relays

This feature provides eleven relays for alarm transfers and test purposes. The designator and the purpose of each relay appear in the following table.

Relay functions (Sheet 1 of 2)

Relay	Operation	Release
AT	Operates when the NT3X83AB receives an alarm transfer signal. Reverses 130-V signaling voltage on T and R leads to notify remote office of alarm transfer. Maintains ground on scan point XFRALM to keep alarm transfer in operation.	Alarms not transferred.
MJX	Operates when the NT3X83AB detects a critical or major alarm in the DMS office. When relay AT is also in operation, MJX places -130 V on T and R leads. This event notifies the remote office of major alarm condition.	Normal operation.
MNX	Operates when the NT3X83AB detects a minor alarm in the DMS office. When relay AT is also in operation, MNX places +130 V on T and R leads to notify remote office of minor alarm condition.	Normal operation.
130	A normal operation. +130 V are present on T lead; -130 V are present on R lead.	Released when 130 V generator fails. Removes ground from scan point 130MONITOR.
DIS	Normal operation	Released when switch S2 operates to prevent remote alarm transfer. Disconnects the -60 V supply from the 130 V generator to prevent generator operation. Breaks the path to the remote ACD panel, which prevents operation of the alarm transfer key.

NT3X83AB (continued)

Relay functions (Sheet 2 of 2)

Relay	Operation	Release
101	Operates when an incoming call is received on the 101 test lines. The 101 relay applies ringing ground from the NT3X82 and to the TTC chime, which causes the TTC chime to operate.	Normal operation. Released when an incoming call on 101 test lines is answered. Ringing ground removed from the TTC chime.
NAT	Operates when the night alarm transfer switch is in operation on the ACD panel or the exit alarm panel. When relay 101 is also in operation, operates audible and visible minor system alarms and turns on the TTC lamp. Relay 101 operates for incoming call on 101 test lines. Prevents operation of the TTC chime for 101 alarms.	Normal operation.
EP-PWR	Operates when detection of an alarm condition occurs in the DMS power plant. Turns on the power plant lamp on all DMS exit alarm panels and the exit pilot lamps. These lamps represent the power plant on all non-DMS floors.	No power plant alarm present.
EP	Operated when detection of alarm condition in the DMS office occurs. Turns on the exit pilot lamp that represents the DMS office on all exit alarm panels.	No DMS office alarm present.
L	Normal operation	Released when alarm reset key in remote office is in operation. Places ground on scan point XFRALM to initiate alarm transfer.
AB	Normal operation	Released when AB relay on the NT3X82 card is released, which indicates a dead system alarm. When alarm transfer is in effect, operates relay MJX to activate major alarm in the remote office.

NT3X83AB (continued)

Positive/negative current detector

The positive/negative current detector senses the polarity of the current on the T lead to determine the state of the alarm transfer. When the T lead carries -130 V, the card does not transfer alarms. When the T lead carries +130 V, the system initiates the alarm transfer process. The detector releases relay L, which grounds scan point XFRALM to begin the alarm transfer.

When you operate the alarm transfer switch again to cancel the alarm transfer, the detector removes ground from the REMOTEAR scan point. The detector senses the change in state and releases SD point ALMXFR to cancel the alarm transfer.

Remote alarm reset detector

The remote alarm reset detector senses ground on the REMOTEAR scan point. Ground on the REMOTEAR indicates that the remote alarm transfer key is in operation. When the detector senses ground on the scan point, the detector operates SD point ALMXFR. The SD point ALMXFR initiates the alarm transfer process.

101 detector

The 101 detector detects an incoming call on the 101 test lines and grounds scan point TSTLN101. The alarm system software operates SD point LN101TST. The SD point LN101TST causes relay 101 to operate. Relay 101 connects ringing ground from the 20 Hz ac ringing generator on the NT3X82 card to the TTC chime. The connection causes the chime to sound.

Night alarm transfer detector

The night alarm transfer detector detects ground on scan point TTCNTXFR. Ground on TTCNTXFR indicates that the night alarm transfer switch begins operation. The switch begins operation at the ACD panel or the exit alarm panel. The detector operates SD point NTALMXFR. The SD point NTALMXFR causes relay NAT to operate. The SD point NTALMXFR initiates night alarm transfer.

During night alarm transfer, an incoming call on the 101 test lines causes an audible and visible minor system alarm. The alarm turns on the TTC lamp and the TTC chime does not sound.

Switches

Two switches control card operations. The designator and the purpose of the switches appear in the following table.

Switch functions

Switch	ON	OFF
S1	Sets maximum resistance of the alarm transfer loop to 9000 Ω.	Sets maximum resistance of the alarm transfer loop to 5000 Ω..
S2	Normal operation.	The -60 V supply disconnects from the 130 V generator to disable the remote alarm transfer function.

-130 V detector

The -130 V detector monitors the T lead for a -130 V signal. A -130 V signal indicates normal operation. When the -130 V signal is present, the detector grounds scan point DIAG5. When the detector senses a polarity change to +130 V, the detector removes the ground. Scan point DIAG5 is part of the diagnostic circuitry.

+130 V detector

The +130 V detector monitors the R lead for a +130 V signal. A +130 V signal indicates normal operation. When the +130 V signal is present, the detector grounds scan point DIAG6. When the detector senses a polarity change to -130 V, the detector removes the ground. Scan point DIAG6 is part of the diagnostic circuitry.

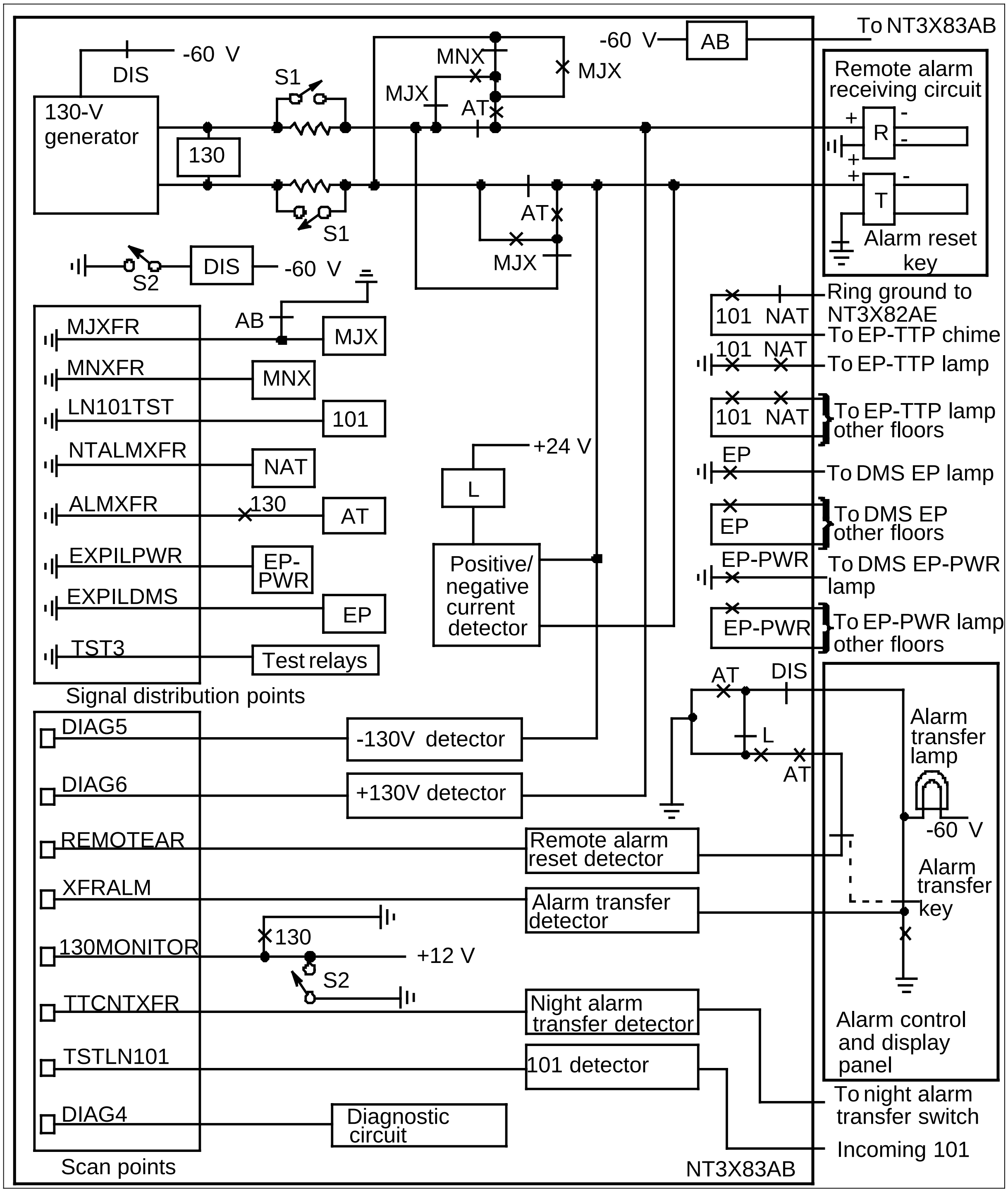
Diagnostic circuit

The system software operates the diagnostic circuit to verify the correct operation of the relays and the detectors on the card.

The relationship between the functional blocks appears in the following figure.

NT3X83AB (continued)

NT3XNT3X functional blocks



NT3X83AB (end)

Technical data

The 130-V generator on the card accepts a nominal input voltage of -52 V. The 130-V generator produces a 130-V output at a maximum current of 35 mA. The oscillator frequency of the generator is 13 kHz.

Dimensions

The dimensions of the NT3X83AB circuit card follow:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 29 mm (1.125 in.)

Power requirements

The card requires an input voltage between -52 V and -72 V. The power requirements for the NT3X83AB appear in the following table.

Power requirements

Voltage	Current
-60 V	100 mA standard, 200 mA maximum
+12 V	10 mA standard
+24 V	72 mA standard, 100 mA maximum

Power distribution is normally 8 W, with a maximum of 14 W. Power distribution with switch S2 in the OFF position (remote transfer disabled) is normally 2 W.

NT3X83BA

Product description

The NT3X83BA alarm transfer and sending card controls alarms hardware functions in DMS-100 Family offices. The NT3X83BA card is part of the Low Power Alarm (LPA) system.

The NT3X83BA card provides the following:

- control relays for the following circuits:
- trunk test center (TTC) night alam transfer circuit
- DMS exit pilot lamps
- power plant exit pilot lamps
- TTC exit pilot lamps
- TTC chime
- dead system (DS) alarm sending circuit. This circuit detects the DS signal from the NT3X82 card and activates a 480-Hz tone generator
- comunication with central control (CC) through signal distribution (SD) and scan (SC) points
- self diagnostic circuits

The NT3X83BA replaces all previous versions of the NT3X83 and NT3X84 cards, as a low power alternative. The NT3X83BA operates on -48V (domestic) or on -60V (international) battery feeds.

The NT3X83BA card uses surface mount technology. The field programmable gate array (FPGA) implements all logic. Where possible, the NT3X83BA uses +5V devices to simplify power distribution and signal level interfaces.

Location

The NT3X83BA card occupies one slot in an integrated services module (ISM) shelf (NTFX40). If you use two cards, you must mount the cards in separate ISMs. The OAU is the ISM shelf that contains most of the office alarm system circuits. The standby ISM is the ISM that contains the backup card.

Functional description

The NT3X83BA card provides the following functions:

- trunk enable (TE) decoding
- SD points to enable CC to control relays on the NT3X83BA
- SC points to detect inputs from various internal and external circuits

- tone generator to generate a pulsed 480-Hz tone
- an interface to the E & M trunk

Decode trunk enable circuits

All versions of the NT3X83 that the NT3X83BA replaces use two trunk logic circuit (TLC) chips. The FPGA on the NT3X83BA card provides the TLC functionality. The NT3X83BA does not use the pulse code modulation (PCM) channels assigned to the shelf slot that contains NT3X83BA, only the control channels in time slots 0 and 16. The following signals are used for decoding:

- RDAT: The NT3X83BA receives serial data from the ISM controller in time slot 0 and 16 during its control frame.
- XDAT: The NT3X83BA multiplexes data during its control frame to communicate with the controller. This data consists of SC point changes.
- BUSCLK is a 2.56-MHz clock signal from the backplane to clock serial data in/out on the RDAT and XDAT signals.
- TE.0 and TE.1 are trunk enable signals that validate incoming data.

Signal distribution points

Central control uses the SD points to communicate with the NT3X83BA through the trunk controller. The SD signals activate relays on the NT3X83BA. The controller receives the following SD signals:

- 101TSTL: The CC software activates this SC point to operate the TTC chime by closing a relay contact.
- NTALMXFR: The CC software activates this SC point to indicate that the TTC 101 test line alarms are transferred to the main office.
- EXPILDMS: This SD point connects DMS exit pilot lamps to ground to provide alarm indication. This SD point also closes a relay contact towards the DMS exit pilot (EP) to other floors.
- EXPILPWR: The CC software activates this SD point. This SD point connects power plant exit pilot lamps to ground to provide alarm indication. This SD point also closes a relay contact towards the DMS EP to other floors.
- TST4: The CC requests self-diagnostic information from the NT3X83BA.

NT3X83BA (continued)

Scan points

The NT3X83BA SC points detect when either an external device applies a battery ground signal to an input pin or the card's tone generator circuitry has failed. Signals from external devices include:

- a night alarm transfer (NAT) switch when set on an alarm panel
- a dead system signal from the NT3X82s
- a signal from 1A2 key equipment indicating an incoming 101 test line call
- and of the NAT trunks being polled by the busy card.

Tone generator

The NT3X83BA card generates a 480-Hz sine wave tone that is modulated by a 1-Hz, 50% duty cycle pulse.

Dead system alarm sending circuit

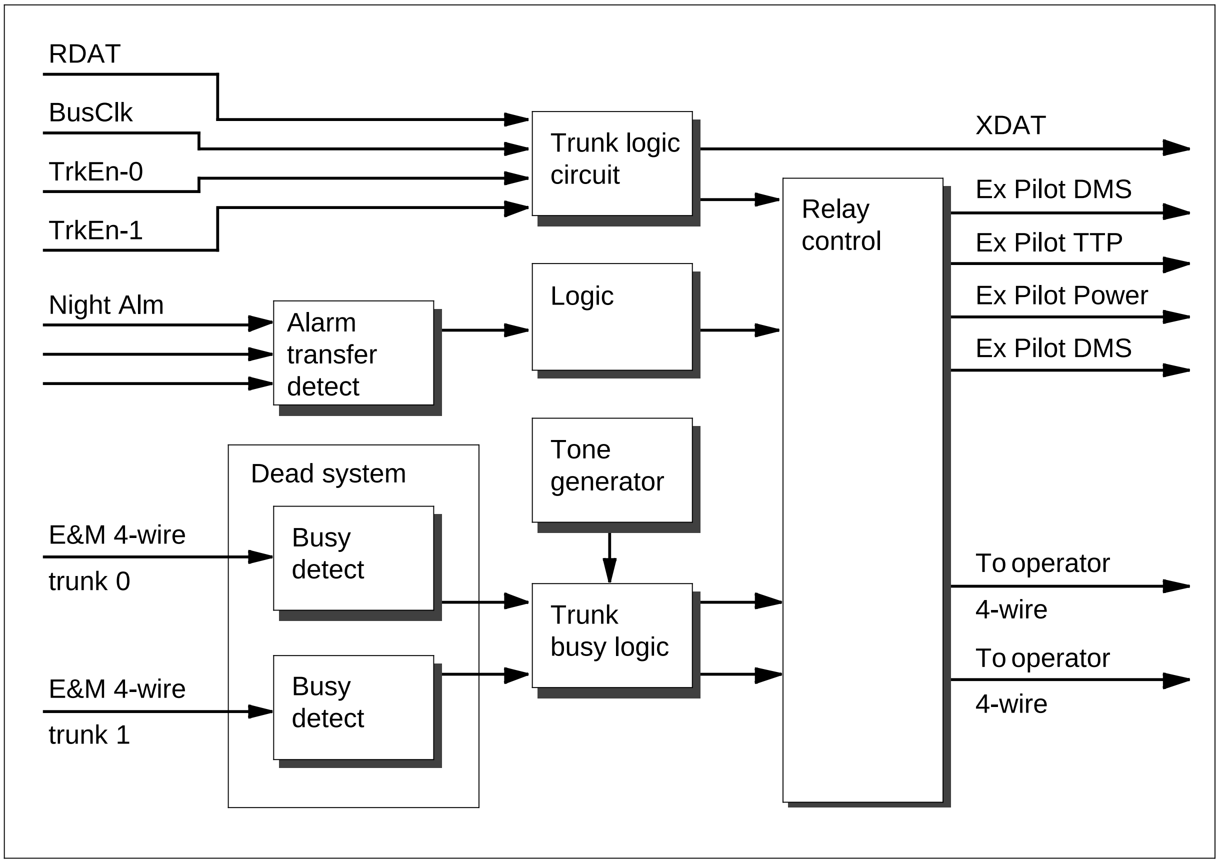
The NT3X83BA card uses two four-wire (E & M) trunks to send the dead system alarm indication to a remote operator position.

Functional blocks

The following illustration shows the functional blocks in the NT3X83BA card.

NT3X83BA (continued)

NT3X83BA functional blocks



Circuit descriptions

In the NT3X83BA, all high voltage circuits are removed and current requirements are reduced.

Trunk enable interface

The TE interface assigns PCM and control channels to trunk cards based on the trunk cards physical location (slot number).. The TE interface consists of the following signals:

- RDAT carries PCM and control data to trunks in 32 ten-bit time slots.
- XDAT carries PCM and control data from the trunk to the controller in 32 ten-bit time slots.
- BCLOCK is a 2.56-MHz signal the system uses to synchronize RDAT and XDAT bits.
- TE0 and TE1 mark the channels assigned to the card location in the shelf during PCM (once per frame) and control (once in 40 frames)

NT3X83BA (continued)

Detector circuits

The NT3X83BA card receives inputs from the following circuits:

- night alarm transfer circuit
- 101 test call detector circuit
- dead system alarm detector circuit
- trunk busy detector circuits

Field programmable gate array

The field programmable gate array (FPGA) implements all logic functions and most digital circuit functions. The FPGA provides the following:

- trunk logic circuit
- tone generator ROM
- tone address generator
- relay control
- tone generator
- dead system alarm sending circuit

Trunk logic circuit

The cards the replaces use two trunk logic circuit (TLC) devices. These devices decode the PCM channels assigned to the slot that contains the card and decode the control frames the system uses to send messages to and receive messsages from the NT3X83 or NT3X84. The does not use the PCM channel so there is no need to to use the PCM channel selection signals from TE. The NT3X83BA only decodes the control nmesages sent to and received from the controller.

Tone generator ROM

The FPGA memory generator program provides the read-only memory required to generate the dead system tone.

NT3X83BA (continued)

Relay control

The cards the NT3X83BA replaces use relay logic to generate the control signals required for night alarm transfer and dead system alarm. In the NT3X83BA, Boolean logic replaces this relay logic.

Relay control dependencies (Sheet 1 of 2)

Relay	Signal	Function	Activated by
K2	MA.1-OUT	E trunk 1 signaling pulsed by 60 IPM (impulses per minute)	
K3	RINGGND	Ring ground from NT3X82, operated when night alarm transfer is active and 101TSTL is not active	101TSTL & NTALMXFR
K4	EP-TTP	Exit pilot TTP trunks	101TSTL & NTALMXFR
K5	EP-PWR	Exit pilot power	Operated by SD1, asserted by CC
K6	EP-DMS	Exit pilot DMS	Operated by SD2, asserted by CC
K7 to 11, K14	DIAG	Diagnostic signal: separates internal analog circuit from outside pins	Operated by SD0, asserted by CC
K15	M/MB.0-IN	E& M trunk 0 in, operated when exit pilot power and diagnostic input is low. Normally closed contact is used.	EP-PWR or TST4
K1, K16	MA.0, T/RO-IN	Asserted if E & M trunk 0 is not busy and a dead system alarm is detected resulting in tone T/RO-OUT. Also signals to trunk 0.	TRK0BSY and DS
K12	M/MB.1-IN	E & M trunk 1 in, operated when exit pilot DMS and diagnostic input is low. Normally closed contact is used.	EP-PWR or TST4

NT3X83BA (continued)

Relay control dependencies (Sheet 2 of 2)

Relay	Signal	Function	Activated by
K13	T/RI-IN	Asserted if E & M trunk 0 is busy and a dead system alarm is detected resulting in tone T/RO-OUT	TRK0BSY and DS
K13	T/RI-IN	Asserted if E & M trunk 0 is busy (regardless of whether trunk 1 is busy) and a dead system alarm is detected resulting in tone T/R1-OUT	TRK0BSY and DS

Tone generator

To indicate a dead system condition (signalled by the NT3X82BA), the NT3X83BA sends a tone to an operator position. The base frequency of the tone is 480-MHz. The tone pulses at 60 IPM.

Dead system alarm sending circuit

The dead system alarm sending circuit provides the capability to send an indication of a dead system alarm condition in a DMS office through a type II E & M trunk to a distant operator.

Pin descriptions

The table that follows contains backplane pinout descriptions.

Backplane pinouts (Sheet 1 of 3)

Pin number	A	B	Pin number	A	B
1	GND		41	GND	GND
2			42	GND	GND
3			43	GND	GND
4	M/MBO-IN		44		
5			45		
6			46	GND	GND
7	M/MBO-OUT		47		
8			48		
9			49		

NT3X83BA (continued)

Backplane pinouts (Sheet 2 of 3)

Pin number	A	B	Pin number	A	B
10			50	GND	GND
11	M/MWB1-IN		51		
12			52		
13		-48SP	53		
14		-48SP	54		
15			55		
16	SPGND	SPGND	56		
17			57		
18			58		
19	M/MB1-OUT		59		
20			60		
21	DS-DF2		61		
22	NAT		62		
23	101TTC		63		
24	EP		64		
25	EPI		65		
26	EP2		66	TE0	TE1
27	EP-PWR		67		
28	EP-P2		68	RDAT	
29	EP-P1		69	BUSCLK	
30	EP-TTP		70		
31	EP-T1		71	XDAT	
32	EP-T2		72	-5V	
33	CHIME		73		

NT3X83BA (end)

Backplane pinouts (Sheet 3 of 3)

Pin number	A	B	Pin number	A	B
34	RINGGND		74		
35			75		
36			76		
37	FLTGND	FLTGND	77		
38	FLTGND	FLTGND	78	+5V	+5V
39	-48FLT	-48FLT	79		
40	-48FLT	-48FLT	80	GND	GND

Power requirements

The power requirements for the NT3X83BA appear in the following table.

Power requirements

Voltage	Current
+5 V	100 mA standard
-5 V	100 mA standard

NT3X84AA

Product description

The NT3X84AA office alarm unit alarm sending card transfers the following alarms to the main office alarm system:

- dead system alarms
- 101 test line alarms
- DMS office alarms
- DMS power plant alarms

The card generates a 480 Hz alarm tone. The card sends the tone to a remote operator in response to a dead system alarm.

Location

The card occupies one card position in a maintenance trunk module (MTM).

Functional description

The NT3X84AA alarm sending card uses the following to send alarms to a remote location:

- scan points
- signal distribution (SD) points
- relays
- detectors

The NT3X84AA receives dead system alarms from the NT3X82 dead system alarm circuit card. The NT3X84AA sends a 480 Hz alarm tone to a remote operator. The NT3X84AA sends the DMS alarms, DMS power plant alarms, and 101 test line alarms to the correct alarm circuits. The NT3X84AA permits night alarm transfer. During a night alarm transfer, transferred alarms do not sound an audible alarm.

Functional blocks

The NT3X84AA circuit card consists of the following functional blocks:

- dead system tone generator
- trunk selector logic circuit
- pulse circuit
- signal distribution points
- scan points
- test relays

NT3X84AA (continued)

- tone monitor circuit
- 101 detector
- NAT detector
- diagnostic circuits

Dead system tone generator

The dead system tone generator produces a 480 Hz tone in response to a dead system alarm from the NT3X82 card. When the NT3X82 card produces a dead system alarm, the NT3X82 releases the DS relay on the card. Release of the DS relay on the NT3X82 card causes the DS relay on the NT3X84AA to release. The release of the activates the dead system tone generator. The generator produces the dead system tone and sends the tone to the trunk selector logic circuit.

The tone has a frequency of 48 Hz modulated with 10 Hz. The tone level range is adjustable from 0 dB to -14 dB.

Trunk selector logic circuit

The trunk selector logic circuit receives the 480 Hz tone from the dead system tone generator. The trunk selector logic circuit places the tone on one of the two operator trunks (trunk 0 or trunk 1). The logic circuit places the tone on the trunk that is idle. The logic circuit seizes the idle trunk and connects the 480 Hz tone to the trunk. The logic circuit sends the tone to the operator position. When no trunk is idle, the logic circuit seizes trunk 1. The logic circuit connects the 480 Hz tone to trunk 1, and activates the pulse circuit.

You can set the switches in the trunk selector logic circuit to accommodate Type I or Type II E & M interfaces.

Pulse circuit

The NT3X84AA activates the pulse circuit when trunks 0 and 1 are busy. This event occurs when the logic circuit receives the 480 Hz dead system tone. The logic circuit seizes trunk 1 and connects the 480 Hz tone to trunk 1. The logic circuit activates the pulse circuit. The pulse circuit pulses the M (transmit) lead of trunk 1 at a rate of 60 pulses each minute. The pulse circuit sends the pulsed 480 Hz tone to the operator.

NT3X84AA (continued)

Signal distribution points

Five signal distribution points, or writeable logic bits, indicate the status of different alarms and relays. The designator and the purpose of each SD point appear in the following table.

Signal distribution point functions

SD point	Purpose
LN101TST	Operates after the detection of an incoming call on 101 test lines. Operates relay 101 to transfer call to remote office.
NTALMXFR	Operates when the night alarm transfer switch in the ACD or the exit alarm panel is in operation. Operates relay NAT to activate night alarm transfer.
EXPILPWR	Operates after the detection of an alarm condition in the DMS power plant. Operates relay EP-PWR, which turns on the power plant lamp on all DMS exit alarm panels. Relay EP-PWR also turns on the exit pilot lamps that represent the power plant on all non-DMS floors.
EXPILDMS	Operates after the detection of an alarm condition in the DMS office. Operates relay EP. Rlay EP turns on the exit pilot lamp. The exit pilot lamp represents the DMS office on all DMS and exit alarm panels that are not DMS.
TST4-	Operates during tests.

Scan points

Six scan points, or readable logic bits, indicate the status of different card conditions. The designator and the purpose of each scan point appear in the following table.

Scan point functions (Sheet 1 of 2)

Scan point	Purpose
TONEMONITOR	Grounded after the detection of a dead system tone generator. Ground removed when tone generator stops.
TTCNTXFR	Grounded when night alarm transfer is in effect. Operates SD point NTALMXFR. The SD point NTALMXFR operates relay NAT to complete the night alarm transfer.

NT3X84AA (continued)

Scan point functions (Sheet 2 of 2)

Scan point	Purpose
TSTLN101	Grounded after the detection of an incoming call on a 101 test line. Operates SD point LN101TST, which operates relay 101 to transfer the call to a remote office. Ground removed when the call is answered at the remote office.
DIAG7	Diagnostic tests use this scan point.
DIAG8	Diagnostic tests use this scan point.
DIAG9	Diagnostic tests use this scan point.

Test relays

Eleven relays are provided for alarm transfers and test purposes. The designator and the purpose of each relay appear in the following table.

Relay operation (Sheet 1 of 2)

Relay	Operation	Release
101	Operates when the 101 test lines receive an incoming call. This relay applies ringing ground from the NT3X82 card to the TTC chime, which causes the TTC chime to operate.	Normal operation. This release of this relay occurs when an incoming call on 101 test line is answered. Ringing ground removed from the TTC chime.
NAT	Operates when the night alarm transfer switch is in operation on the ACD panel or the exit alarm panel. When relay 101 is also in operation, NAT operates audible and visible minor system alarms and turns on the TTC lamp. Relay 101 operates for incoming call on 101 test lines. Prevents the operation of the TTC chime for 101 alarms.	Normal operation.

Relay operation (Sheet 2 of 2)

Relay	Operation	Release
EP-PWR	Operates when the NT3X84AA detects an alarm condition in the DMS power plant. Turns on the power plant lamp on all DMS exit alarm panels and the exit pilot lamps. These lamps represent the power plant on all floors that are not DMS.	A power plant alarm is not present.
EP	Operates after the detection of an alarm condition in the DMS office. Turns on the exit pilot lamp that represents the DMS office on all exit alarm panels.	A DMS office alarm is not present.
DS	Operates when the DS relay on NT3X82 card operates because of a dead system alarm. Activates the dead system tone generator.	A dead system alarm is not present. The tone generator is not active.

Tone monitor circuit

The tone monitor circuit receives the output of the dead system tone generator circuit in parallel with the trunk selector logic circuit. When the tone is present, the monitor places a ground on scan point TONEMONITOR. When the output of the tone generator stops, the monitor removes the ground from the scan point. When tone does not meet the necessary limits, the monitor removes the ground from the scan point.

101 detector

The 101 detector detects an incoming call on the 101 test lines. The 101 detector grounds scan point TSTLN101. The alarm system software operates SD point LN101TST. The SD point LN101TST causes relay 101 to operate. Relay 101 connects ringing ground from the 20 Hz ringing generator of the NT3X82 card to the TTC chime. The connection causes the chime to sound.

NAT detector

The NAT detector detects ground on scan point TTCNTXFR. Ground on TTCNTXFR indicates that the night alarm transfer switch begins operation. The night alarm transfer switch begins operation at the ACD panel or the exit alarm panel. The detector operates SD point NTALMXFR. The SD point NTALMXFR causes relay NAT to operate and initiates night alarm transfer.

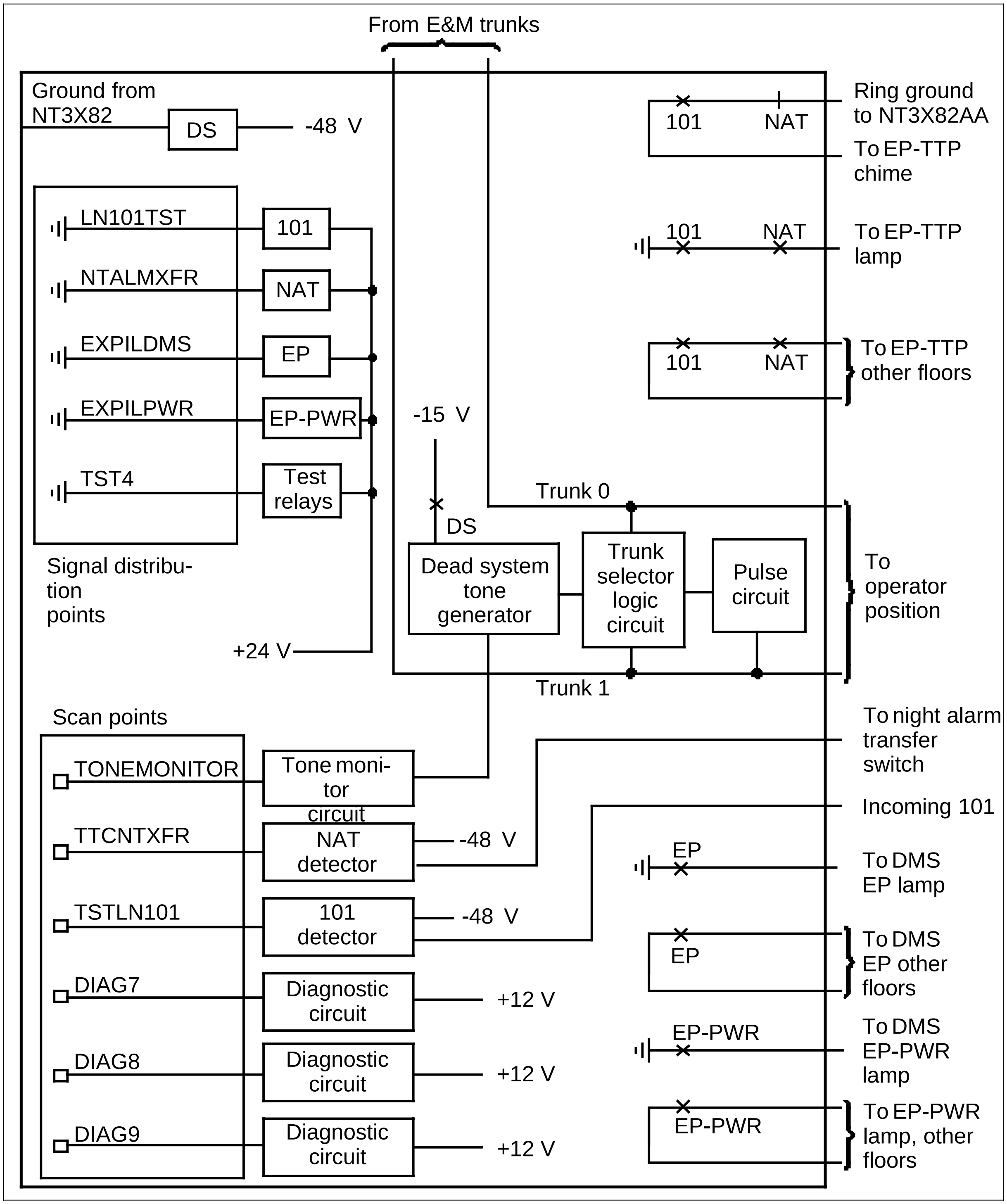
NT3X84AA (continued)

During night alarm transfer, an incoming call on the 101 test lines causes an audible and visible minor system alarm. The alarm turns on the TTC lamp but the TTC chime does not sound.

The relationship between the functional blocks appears in the following figure.

NT3X84AA (continued)

NT3X84AA functional blocks



NT3X84AA (end)

Diagnostic circuits

The system software operates the diagnostic circuits to verify the correct operation of the relays and the detectors on the card.

Technical data

Dimensions

The dimensions of the NT3X84AA circuit card follow:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 29 mm (1.125 in.)

Power requirements

The card requires an input voltage between -42.75 V and -55.8 V. The power requirements for the NT3X84AA appear in the following table.

Power requirements

Voltage	Current
-48 V	1 mA standard
-15 V	10 mA standard
+12 V	12 mA standard
+24 V	28 mA standard

Power distribution is normally 2 W, with a maximum of 10 W.

NT3X85AA

Product description

The NT3X85AA office alarm unit alarm group card. The NT3X85AA groups alarms that originate on preceding and following floors. The NT3X85AA lights the major other system and minor other system lamps on the alarm control and display (ACD) panel. The card sends alarm signals from the preceding floor to the following floor. The card sends alarms from the following floor to the preceding floor. The card routes DMS alarms to the preceding floors and the following floors.

Location

The card occupies one card position in a maintenance trunk module (MTM).

Functional description

Functional blocks

The NT3X85AA card consists of the following functional blocks:

- signal distribution (SD) points
- scan points
- test relays
- MNP detector
- MJP detector
- CRP detector
- CRS detector
- MJS detector
- MNS detector
- AG detector
- diagnostic circuit

NT3X85AA (continued)

Signal distribution points

Nine signal distribution points, or writeable logic bits, indicate the status of different alarms and relays. The designator and the purpose of each SD point appear in the following table.

Signal distribution point functions

SD point	Purpose
MJOTHVIS	Grounded when NT3X85AA receives a major alarm from other system. Operates relay MJOV. Relay MJOV turns on the major other system lamp on the ACD panel.
MNOTHVIS	Grounded when NT3X85AA receives a minor alarm from other system. Operates relay MNOV. Relay MNOV turns on the minor other system lamp on the ACD panel.
PREFLRMN	Grounded when NT3X85AA receives a minor alarm from following floor or from the DMS. Operates relay MNP. Relay MNP operates relay MN on the preceding floor.
PREFLRMJ	Grounded when NT3X85AA receives a major alarm from following floor or from the DMS. Operates relay MJP. Relay MJP operates relay MJ on the preceding floor.
PREFLRCR	Grounded when NT3X85AA receives a critical alarm from following floor or from the DMS. Operates relay CRP. Relay CRP operates relay CR on the preceding floor.
SUCFLRMN	Grounded when NT3X85AA receives a minor alarm from preceding floor or from the DMS. Operates relay MNS. Relay MNS operates relay MN on the following floor.
SUCFLRMJ	Grounded when NT3X85AA receives a major alarm from preceding floor or from the DMS. Operates relay MJS. Relay MJS operates relay MJ on the following floor.
SUCFLRCR	Grounded when NT3X85AA receives a critical alarm from preceding floor or from the DMS. Operates relay CRS. Relay CRS operates relay CR on the following floor.
TST5	Grounded during tests.

Scan points

Eight scan points, or readable logic bits, indicate the status of different card conditions. The designator and the purpose of each scan point appear in the following table.

Scan point functions

Scan point	Purpose
MNPREFLR	Operates when NT3X85AA receives a minor alarm on preceding floor. Grounds SD point SUCFLRMN to send the alarm to the following floor.
MJPREFLR	Operates when NT3X85AA receives a major alarm on preceding floor. Grounds SD point SUCFLRMJ to send the alarm to the following floor.
CRPREFLR	Operates when NT3X85AA receives a critical alarm on preceding floor. Grounds SD point SUCFLRCR to send the alarm to the following floor.
CRSUCFLR	Operates when NT3X85AA receives a critical alarm on following floor. Grounds SD point PREFLRCR to send the alarm to the preceding floor.
MJSUCFLR	Operates when NT3X85AA receives a major alarm following floor. Grounds SD point PREFLRMJ to send the alarm to the preceding floor.
MNSUCFLR	Operates when NT3X85AA receives a minor alarm following floor. Grounds SD point PREFLRMN to send the alarm to the preceding floor.
ALMGRP	Operates when you press the alarm grouping key. Activates alarm grouping circuits.
DIAG10	Diagnostic tests use this scanpoint.

NT3X85AA (continued)

Test relays

Eight relays group the received alarms. The relays also route the alarms to the correct floor. The designator and the purpose for each relay appear in the following table.

Relay operation

Relay	Operation	Release
MJOV	Operates when NT3X85AA receives a major alarm from another system. Turns on major other system lamp on the ACD panel.	There is no alarm.
MNOV	Operated when NT3X85AA receives a minor alarm from another system. Turns on minor other system lamp on the ACD panel.	There is no alarm.
MNP	Routes minor alarm to preceding floor. Operated when NT3X85AA receives a minor alarm from following floor or from the DMS system.	There is no alarm.
MJP	Routes major alarm to preceding floor. Operates when NT3X85AA receives a major alarm from following floor or from the DMS system.	There is no alarm.
CRP	Routes critical alarm to preceding floor. Operates when NT3X85AA receives a critical alarm from following floor or from the DMS system.	There is no alarm.
MNS	Routes minor alarm to preceding floor. Operates when NT3X85AA receives a minor alarm from following floor or from the DMS system.	There is no alarm.
MJS	Routes major alarm to preceding floor. Operates when NT3X85AA receives a major alarm from following floor or from the DMS system.	There is no alarm.
CRS	Routes critical alarm to preceding floor. Operates when NT3X85AA receives a critical alarm from following floor or from the DMS system.	There is no alarm.

MNP detector

The MNP detector detects ground on lead MNP. Ground on lead MNP indicates a minor alarm on the preceding floor. The detector operates scan point MNPREFLR. Scan point MNPREFLR grounds SD point SUCFLRMN. When MNPREFLR grounds the SD point, relay MNS operates. Relay MNS grounds lead MNS to operate the minor alarm (MN) relay on the following floor.

MJP detector

The MJP detector detects ground on lead MJP. Ground on MJP indicates a major alarm on the preceding floor. The detector operates scan point MJPREFLR. Scan point MJPREFLR grounds SD point SUCFLRMJ. Grounding the SD point operates relay MJS. Relay MJS grounds lead MJS to operate the major alarm (MJ) relay on the following floor.

CRP detector

The CRP detector detects ground on lead CRP. Ground on lead CRP indicates a critical alarm on the preceding floor. The detector operates scan point CRPREFLR. Scan point CRPREFLR grounds SD point SUCFLRCR. When CRPREFLR grounds the SD point, relay CRS operates. Relay CRS grounds lead CRS to operate the critical alarm (CR) relay on the following floor.

CRS detector

The CRS detector senses ground on lead CRS. Ground on lead CRS indicates a critical alarm on the following floor. The detector operates scan point CRSUCFLR. Scan point CRSUCFLR grounds SD point PREFLRCR. Grounding the SD point operates relay CRP. Relay CRP grounds lead CRP to operate the CR relay on the following floor.

MJS detector

The MJS detector senses ground on lead MJS. Ground on lead MJS indicates a major alarm on the following floor. The detector operates scan point MJSUCFLR. Scan point MJSUCFLR grounds SD point PREFLRMJ. When MJSUCLFR grounds the SD point, relay MJP operates. Relay MJP grounds lead MJP to operate the MJ relay on the following floor.

MNS detector

The MNS detector detects ground on lead MNS. Ground on lead MNS indicates a minor alarm on the following floor. The detector operates scan point MNSUCFLR. Scan point MNSUCFLR grounds SD point PREFLRMN. When the MNSUCFLR grounds the SD point relay, MNP operates. Relay MNP grounds lead MNP to operate the MN relay on the following floor.

AG detector

The AG detector senses ground from the operation of the alarm grouping key. When the detector detects the key operation, the detector operates scan point ALMGRP. Scan point ALMGRP activates the alarm grouping circuitry.

Diagnostic circuit

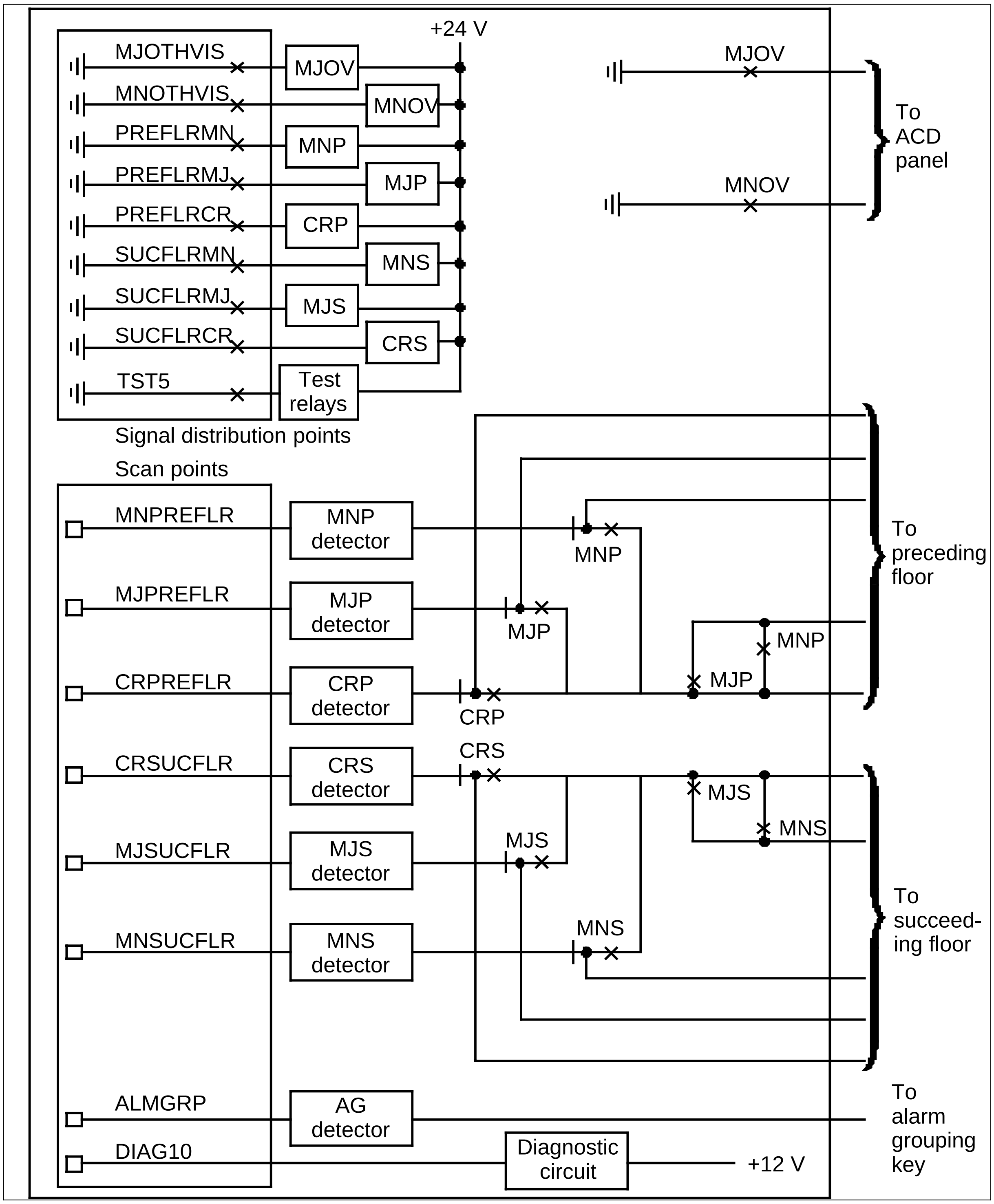
The system software operates the diagnostic circuit to verify the correct operation of the relays and the detectors on the card.

NT3X85AA (continued)

The relationships between the functional blocks appear in the following figure.

NT3X85AA (continued)

NT3X85AA functional blocks



NT3X85AA (end)

Technical data

Dimensions

The dimensions of the NT3X85AA card follow:

- height: 317 mm (12.5 in.)
- depth: 254 mm (10 in.)
- width: 28.6 mm (1.125 in.)

Power requirements

The card requires an input voltage of between –42.75 V and –55.8 V. The power requirements for the NT3X85AA appear in the following table.

Power requirements

Voltage	Current
–48 V	1 mA
–15 V	10 mA
+12 V	10 mA
+24 V	0 mA, 176 mA maximum

Power distribution is normally 1 W, with a maximum of 6.5 W.

NT3X89CA

Product description

The alarm cross–connect unit (AXU) shelf is part of an alarm system for a large office. Each office must have one AXU shelf. The AXU requires a primary alarm maintenance trunk module. This module can be NT2X58CA, NT2X58AL, or NT2X58AT. This trunk module is normally known as an office alarm unit (OAU). The OAU and the OAU backup MTM house the alarm control circuit cards. The AXU routes the alarm signals when any alarm signals are present. The AXU and the primary alarm maintenance trunk module is a functional pair. You must mount the AXU and the primary alarm maintenance trunk module together on the same frame.

Parts

The NT3X89CA AXU does not have flip plates, the 25 RS–232C connectors, or the 34– and 72–pin male and female connectors. The 2x16 and 2x20, and two 2x20 IDT AMP level 5 connectors replace these connectors. Use these connectors on a panel printed circuit board (PCB) with compliant pins. Use plastic brackets to support the AMP level 5 connectors.

On the NT3X89AB, four NT0X89AA data link control (DLC) cards were used. The NT3X8906 (–48 V) daughter card or the NT3X8907 (–60 V) daughter card replaces these cards for the NT3X8906. These cards contain the two diodes and the R–C network that was soldered earlier on to the NT3X89AA/AB pins.

The following lists the AMP level 5 cables for the NT3X89CA:

- NT0X96HN
- NT0X96HP
- NT0X96HQ
- NT0X96HR
- NT0X96HS
- NT0X96HT
- NT0X96HU
- NT0X96HV–bulkhead (for cabinetized CTME)
- NT0X96HW–bulkhead (for cabinetized CTME)
- NT0X96HX–bulkhead (for cabinetized CTME)
- NT0X96HY
- NT0X96JA–bulkhead (for cabinetized CTME)

NT3X89CA (end)

- NT0X96JB–bulkhead (for cabinetized CTME)
- NT0X96JC
- NT0X96HL–to IOC

NT3X89EA

Product description

The NT3X89EA alarm crossconnect unit - low power alarms panel is part of the Low Power Alarm (LPA) system for DMS-100 Family offices.

The NT3X89EA panel connects alarm circuits to the alarm scanners of the Office Alarm System (OAS). The panel replaces the NT3X89CA alarm crossconnect unit (AXU) shelf. The panel is for new LPA installations only.

The NT3X89EA panel contains six additional circuit paths to provide the following:

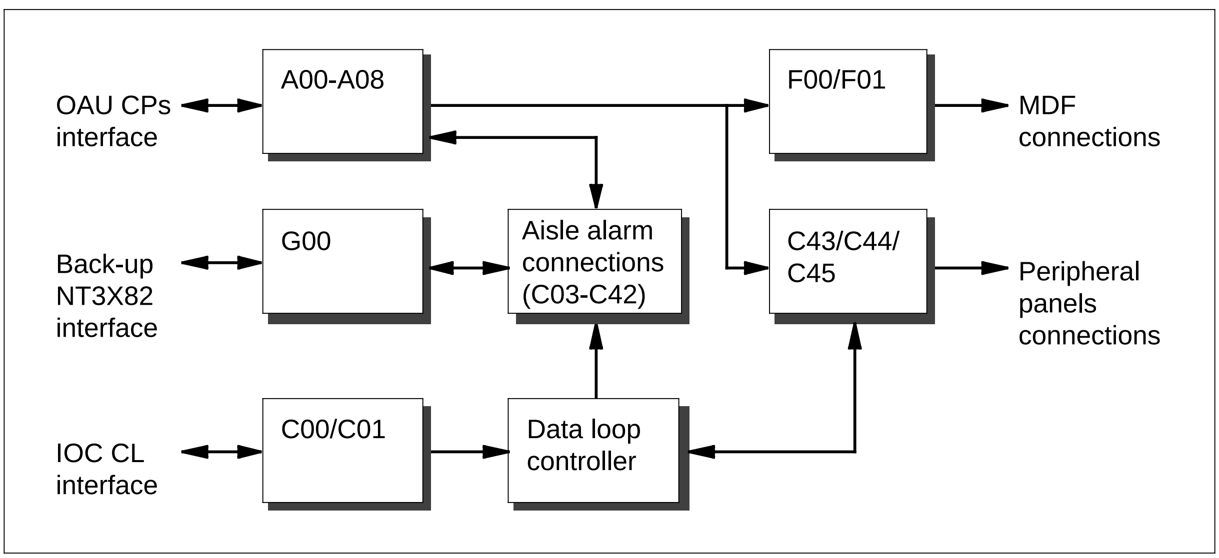
- data loop circuit and alarms panels that remain active if the OAU or backup integrated service module (ISM) fail
- duplicated power source
- frame ground signal for peripheral alarms panels

The NT3X89EA occupies shelf position 47 in a cabinetized integrated services module (CISM) frame or shelf position 53 in an ISM equipment (ISME) frame.

Functional blocks

This section provides an illustration and descriptions of the main functional blocks of the NT3X89EA alarm cross-connect unit.

NT3X89EA alarm crossconnect unit functional blocks



NT3X89EA (continued)

Parts

CAUTION
Service interruption
If you use the NT3X89EA in configurations with Version 2 or Version 2 EAS equipmment, disconnect the J1 shorting strap. Failure to disconnect the J1 strap could result in damage to equipment.

The NT3X89EA contains a J1 shorting strap which allows for supply voltage redundancy for the data loop circuit and peripheral panels. You must remove this shorting strap if you use the NT3X89EA in configurations with Version 2 or Version 2 EAS equipment

The NT3X89EA panel uses the NT3X8906 (-48V) or the NT3X8907 (-60V) paddle boards.

The NT3X89EA AXU uses AMP 5 level insulation displacement connector (IDC) cables. These cables interface with alarm controllers, DMS equipment aisles, MDF connections, data loop controller and visual alarms (ACD/AD) panels. Five 2X8 IDC connectors replace the terminal blocks and wrap posts found on the NT3X89CA AXU panel.

The AMP level 5 cables for the NT3X89EA are listed as follows:

- NTRX40DY/NA/NB- to EMI bulkhead in cabinetized applications
- NT0X96HN
- NT0X96HP
- NT0X96HQ
- NT0X96HR
- NT0X96HS
- NT0X96HT
- NT0X96HU
- NT0X96HV-bulkhead
- NT0X96HW-bulkhead
- NT0X96HX-bulkhead

NT3X89EA (end)

- NT0X96HY
- NT0X96JA-bulkhead
- NT0X96JB-bulkhead
- NT0X96JC
- NT0X96HL-to IOC

NT3X91AA

Product description

The NT3X91AA provides a voice and signaling interface between a trunk module (TM) and the test ports and 105 test lines of an automatic products company remote office test line (ROTL).

Each card contains two Type II E trunk circuits.

Location

The card occupies one card position in an eight-wire TM.

Functional description

The NT3X91AA performs the following tasks:

- exchanges control messages with the TM
- transmits near-end signaling to the far-end and receives far-end signaling
- processes voice frequency (VF) information

The NT3X91AA receives VF information over the T and R leads. The card converts VF information to pulse amplitude modulation (PAM) signals. The card sends the VF information to the TM for additional processing. The card receives PAM signals from the TM. The card converts PAM signals into VF signals and sends over the T1 and R1 leads.

Functional blocks

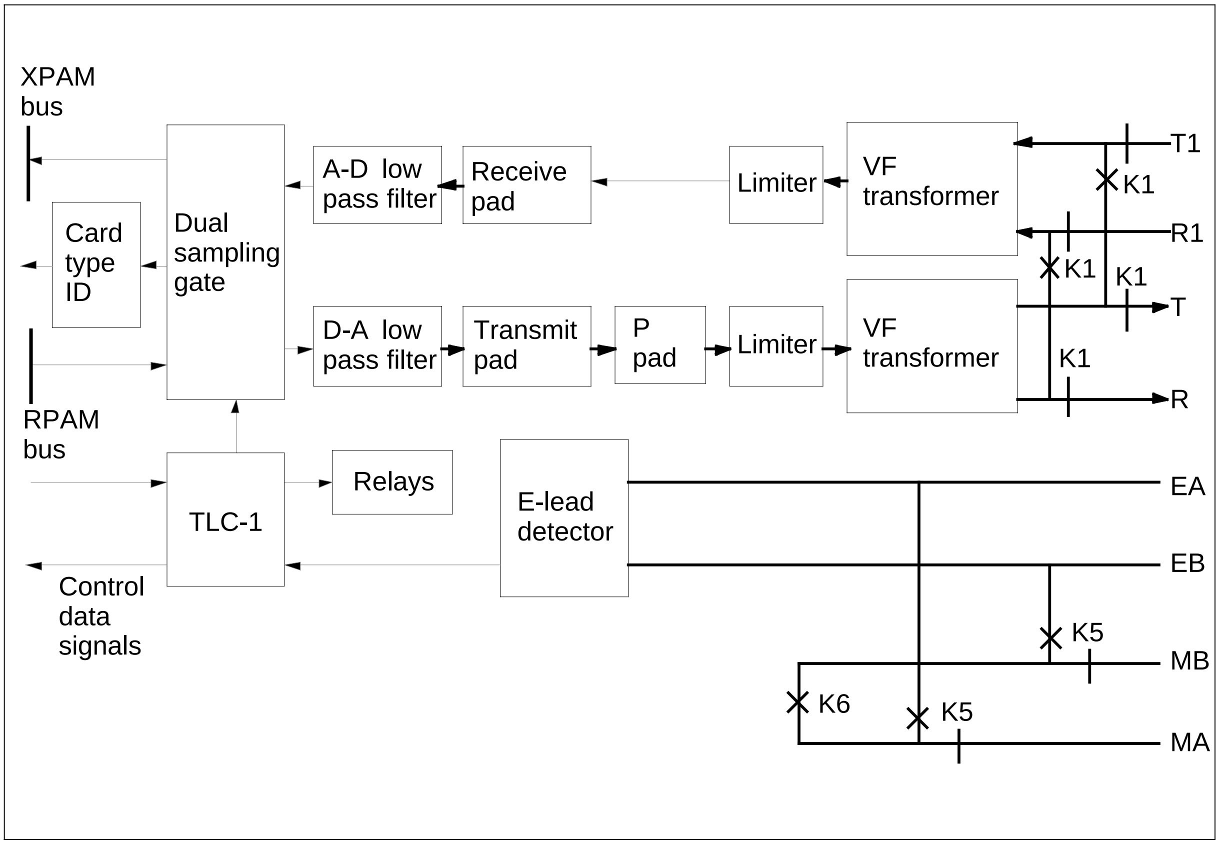
Each circuit in the NT3X91AA contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- P pad
- two limiters
- two VF transformers
- E detector
- six relays
- card type identifier

NT3X91AA (continued)

The relationship between functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is the same.

NT3X91AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC is a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit contains a separate TLC.

Dual sampling gate

In the receive direction, the sampling gate converts analog voice frequency (VF) signals to PAM signals. The sampling gate sends the VF signals over the transmit PAM (XPAM) bus for additional processing. In the transmit direction, the sampling gate converts PAM information received from the receive PAM (RPAM) bus back to VF signals. The sampling gate sends the VF signals over the T1 and R1 leads.

NT3X91AA (continued)

The card contains a single sampling gate. Both trunk circuits use the single sampling gate.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads. The A/D filter filters the signal to limit the bandwidth. The A/D filter passes the signal to the sampling gate. The filter also amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate. The D/A filter filters the signal to limit the bandwidth. The D/A filter passes the signal to the transmit pads. The filter also amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment in 0.25-dB increments to the level of the VF signal before the receive level pad converts to digital form for the card to process. To make the adjustments, the pad sets groups of small switches to achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pads contain a 50 Hz filter to remove line noise.

Transmit level adjustment pad

The transmit level pad provides up to 15.75 dB of adjustment in 0.25-dB increments to the level of the VF signal. The pad sends this signal over the trunk. To make the adjustments, the pad sets groups of small switches to achieve the correct level.

The transmit level adjustments appear in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

P pad

The P pad provides software-selectable level adjustments to the transmit signal. The pads compensate different level points and produce the actual measured loss (AML) for any trunk under test. The circuit contains 4-, 2-, and 1-dB adjustment pads. Relays K2, K3, and K4 select the adjustments pads.

Limiters

A received or transmitted signal provides two limiters to prevent the overload of a circuit. The receive direction and the transmit direction each have one limiter.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal the receive circuit processes. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

E detector

The E detector senses the conditions present on the E lead. The E detector transmits the information through the TLC to the TM. The E-lead conditions represent far-end signaling.

NT3X91AA (continued)

Relays

Six relays are available to provide testing and P-pad selection. The designator and purpose for each relay appear in the following table.

Relay operation

Relay	Operated	Released
K1, K5	Isolates the trunk circuit from the external transmission facilities. Loops the transmission and signaling paths. Allows the system to test the circuit internally. The following leads are connected: T and T1, R and R1, EA and MA, and EB and MB.	Normal operation
K2	Selects 4-dB P-pad segment	4-dB P-pad segment removed
K3	Selects 2-dB P-pad segment	2-dB P-pad segment removed
K4	Selects 1-dB P-pad segment	1-dB P-pad segment removed
K6	Loops the MA and MB leads	Normal operation

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card is connected in to the TM card slot.

Technical data

Both circuits on the card provide an impedance of 600 W. The minimum receive level for the circuits is -12 dBm for digital test sequence (DTS) output, with a range of -12 to +3 dBm. The maximum transmit level with the P pads set to 0 is +9 dBm for DTS output, with a range of +9 to -6 dBm.

For TP3 testing, the nominal receive level is 0 dBm and the nominal transmit level is -6 dBm. For TP0 testing, the nominal receive level is 0 dBm and the nominal transmit level is 0 dBm plus the P-pad settings. The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 kΩ

Dimensions

The dimensions for the NT3X91AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

DANGER
Damage to equipment or loss of service
Use the circuit card only on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE. Use the circuit card with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

Power use is normally 500 mW for each idle trunk circuit. The card provides the following converted voltages:

- +12 V ±0.3V
- -15 V ±0.5V
- +22.8 V to +27 V (24 V nominal)

NT3X93AA

Product description

The NT3X93AA 256 Kword metallic oxide semiconductor (MOS) Memory card provides data storage for the memory modules in the DMS-100 switching system.

The card is card expandable. Each card receives the same bus signals at the same time. Each card does not receive different board enable signals at the same time.

Location

The card is in DMS-100 memory shelves NT3X31AD, NT3X31AE, and NT3X31AF. The memory controller card selects the NT3X93AA card.

Functional description

The NT3X93AA uses seventy-two 64 Kword MOS memory chips organized in four memory blocks of 18 chips. The memory chips provide storage for 262,144 words that are a maximum of 18 bits wide. The blocks use chips numbered 17 through 00 to correspond to the arithmetical meaning of the bits in the data word.

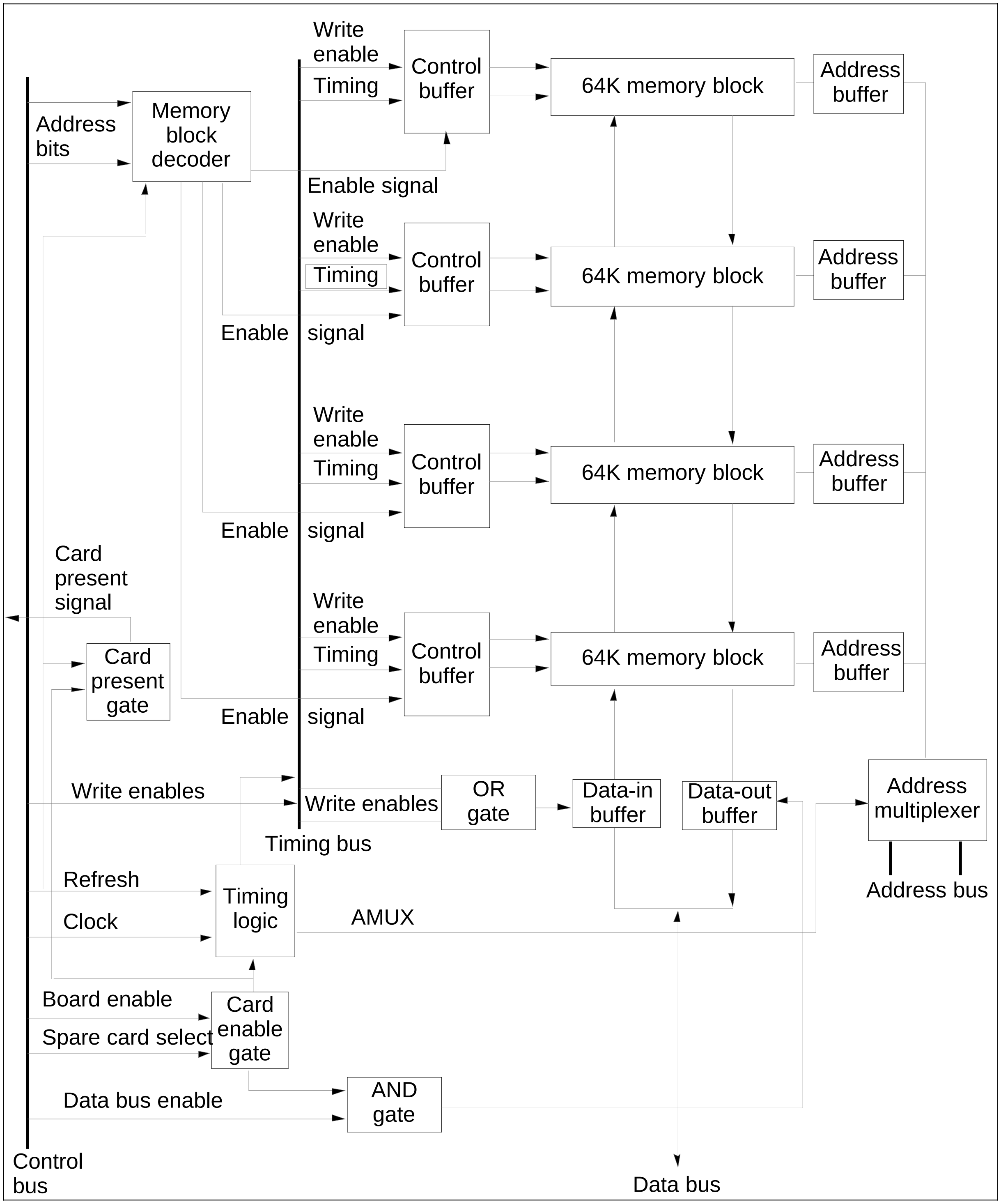
Functional blocks

The NT3X93AA consists of the following functional blocks:

- memory block decoder
- card present gate
- timing logic circuit
- card enable gate
- AND gate
- OR gate
- data-in buffer
- data-out buffer
- four control buffers
- four 64-Kword memory blocks
- address multiplexer (MUX)
- four address buffers

NT3X93AA (continued)

NT3X93AA functional blocks



NT3X93AA (continued)

Memory block decoder

The memory block decoder selects the two most significant address bits and decodes the address bits for memory block selection. The decoder uses the refresh signal to make sure all four memory blocks are enabled during a refresh cycle. The decoder generates enable signals to control buffers. These signals allow block access to other signals.

Card present gate

The card present gate is an open collector gate that receives the refresh and card enable signals. The card can be enabled and the refresh signal can be high. In this event, the card present gate sends a low signal (MCP signal) to the memory module. The low signal (MCP signal) indicates that the card is present and has received the board enable signal.

Timing logic circuit

The timing logic circuit uses the memory controller clock signal to generate timing signals for the control buffers and the address MUX. The refresh signal enables the generated signals. The refresh signal suppresses the timing logic circuit to make sure the memory blocks cannot enable the data outputs.

Card enable gate

The card enable gate receives low board-enable and spare-card-select signals to enable the memory card. The card enable gate sends signals to the AND gate, the timing logic circuit, and the card present gate.

AND gate

The AND gate receives data bus enable and card enable gate signals. The AND gates sends an output data buffer enable signal to the data-out buffer if both signals are present.

OR gate

The OR gate receives write enable signals. The OR gate sends an input data buffer enable signal to the data-in buffer if at least one write enable signal is present.

Data-in buffer

The data-in buffer uses a 47-Ω damping resistor and an input data buffer enable signal to send information to the memory blocks. When the data-in buffer is enabled, perform a write operation. The data-in buffer or the data-out buffer can be enabled. Both buffers cannot be enable at the same time.

Data-out buffer

The data-out buffer receives information from the enabled memory block. The data-out buffer requires an output data buffer enable signal. This signal allows the data-out buffer to use a data bus to send the information to the memory module. The data bus sends information by means of the data bus. When the data-out buffer is enabled, a read operation runs. The data-out buffer or the data-in buffer can be enabled. Both buffers cannot be enabled at the same time.

Control buffer

The control buffer receives write enable, timing, and enable signals that allow the memory blocks to be addressed.

64-Kword memory block

The 64-Kword memory block receives data and timing signals under control of enable lines. The 64-Kword stores the information or sends the information to the memory module. The word block divides in two 9-bit bytes to allow two 8-bit data bytes independent write enables. Each memory block can hold 65,536 word blocks.

Address MUX

The address MUX receives data on 14 low-order address lines. The address MUX transmits the data at the same time to eight lines that provide row and column addresses. Memory blocks require these addresses. The MUX uses a timing signal sent from the timing logic circuit to change the row address bits to column address bits. During the refresh mode, these address bits function as the refresh address.

Address buffer

The address buffer receives the address bits from the address MUX. The address buffer sends the address line to the specified memory chip in the memory block.

Signaling

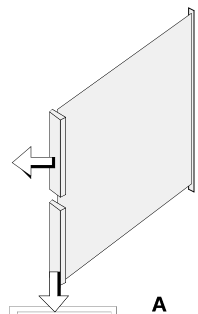
Pin numbers

The pin number diagram for the appears in the following figure.

NT3X93AA (continued)

NT3X93AA pin numbers

		A	B
1A	1B	GND	GND
2A	2B	+5V	+5V
3A	3B	+5V	+5V
4A	4B	GND	+5V
5A	5B		
6A	6B		
7A	7B	GND	GND
8A	8B	IMAD08-	IMAD09-
9A	9B	IMAD10-	IMAD11-
10A	10B	IMAD12-	IMAD13-
11A	11B	IMAD14-	IMAD15-
12A	12B	IMDT00-	IMDT01-
13A	13B	IMDT00-	IMDT03-
14A	14B	IMDT02-	IMDT05-
15A	15B	IMDT04-	IMDT07-
16A	16B		
17A	17B	GND	GND
18A	18B		
19A	19B		
20A	20B		
21A	21B		
22A	22B		
23A	23B		
24A	24B		
25A	25B		
26A	26B		
27A	27B		
28A	28B		
29A	29B		
30A	30B		
31A	31B		
32A	32B	REFRESH	
33A	33B	IMAD17-	
34A	34B	MCP-	
35A	35B	CLK-	
36A	36B	WEL-	
37A	37B	WEH-	
38A	38B	DBEN-	
39A	39B	GND	
40A	40B	GND	



		A	B
41A	41B		
42A	42B		
43A	43B		
44A	44B		
45A	45B		
46A	46B		
47A	47B		
48A	48B		
49A	49B		
50A	50B		
51A	51B	IMAD16	GRD
52A	52B	IMDT16-	GRD
53A	53B	IMDT17-	GRD
54A	54B	SPSLT-	GRD
55A	55B	BE-	GRD
56A	56B		GRD
57A	57B		GRD
58A	58B		GRD
59A	59B		GRD
60A	60B		GRD
61A	61B		
62A	62B		
63A	63B		
64A	64B		
65A	65B		
66A	66B		
67A	67B		
68A	68B		
69A	69B		
70A	70B		
71A	71B	IMDT08-	IMDT09-
72A	72B	IMDT10-	IMDT11-
73A	73B	IMDT12-	IMDT13-
74A	74B	IMDT14-	IMDT15-
75A	75B	IMAD00-	IMAD01-
76A	76B	IMAD02-	IMAD03-
77A	77B	IMAD04-	IMAD05-
78A	78B	IMAD06V-	IMAD07-
79A	79B	+5V	+5V
80A	80B	GRD	GRD

NT3X93AA (end)

Technical data

The NT3X93AA timing access time from the memory controller clock is 175 ns, and 200 ns from the address. The NT3X93AA has a cycle time of 300 ns and a 128 cycle refresh cycle at intervals of 2 ms.

The NT3X93AA negative logic input signal can be low. In this event, the negative logic input signal is a true signal that disables the data drivers.

The card uses data bit numbers to correspond to the arithmetical meaning of the bits in the data word. The data bit numbers and the meaning of the data bit numbers appear in the following table.

Data bit numbers

Data bit no.	Meaning
17	9th bit associated with high byte
16	9th bit associated with low byte
15 - 08	High byte
07 - 00	Low byte

Dimensions

The dimensions for the NT3X93AA are:

- height: 317 mm (12.5 in)
- width: 254 mm (10 in.)

Power requirements

The NT3X93AA receives power from the memory module power converters. The power requirements for the NT3X93AA are a voltage of +5 V ± 5% and current of 2.6 A.

NT3X95AA

Product description

The NT3X95AA Stratum II remote oscillator shelf has two NT3X16AA Stratum 2 oscillator and interface cards. The oscillator shelf has dedicated power converters. One NT3X16AA card is in active mode. The other card is inactive. The inactive card is available as a backup to the active card.

The function of the NT3X16AA oscillator and interface card defines the function of the NT3X95AA shelf. The following information describes the NT3X95AA shelf.

Parts

The NT3X95AA contains the following parts:

- NT0X50BA—Filler faceplate 0.875
- NT0X50BE—Filler faceplate 2.62
- NT0X50BF—Filler faceplate 1.72
- NT1X78AA—Power converter, 5 V/-12 V/+24 V
- NT3X16AA—Stratum 2 oscillator and interface card

Design

The NT3X95AA parts appear in the following table.

(Sheet 1 of 2)

Card PEC	Slot	Description
NT0X50BA	14F	*Filler faceplate .875* The NT0X50BA fills the empty slot 14.
NT0X50BE	9F, 23F	*Filler faceplate 2.62* The NT0X50BE fills the two empty slots 9F and 23F.
NT0X50BF	12F, 26F	*Filler faceplate 1.72* The NT0X50BF fills the two empty slots 12 F and 26F.

NT3X95AA (continued)

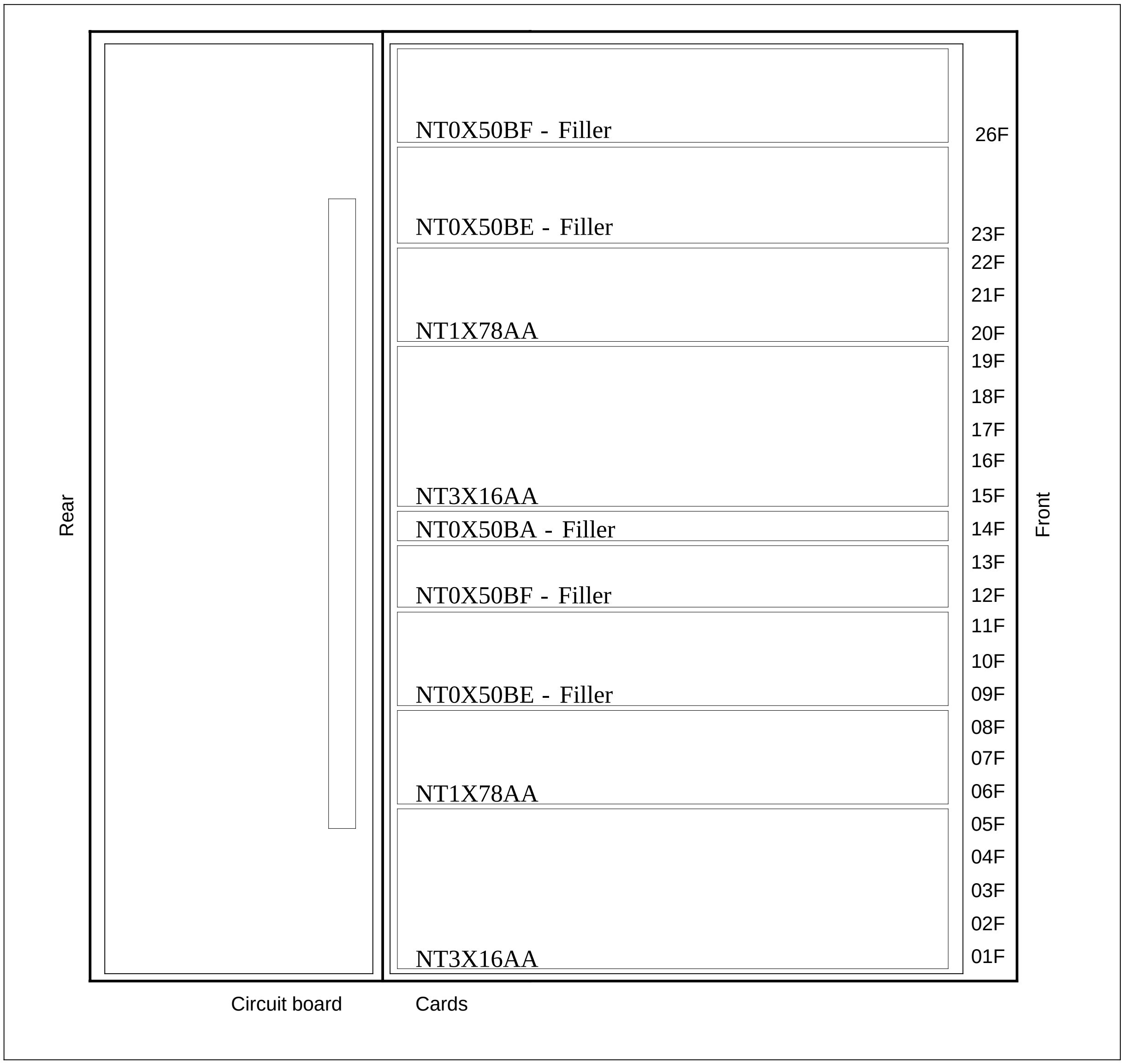
(Sheet 2 of 2)

Card PEC	**Slot**	**Description**
NT1X78AA	6F, 20F	*Power converter, 5 V/-12 V/+24 V* The NT1X78AA provides a regulated dc power supply with outputs of +5 V, +24 V, -5 V, and -12 V. The NT1X78AA provides the power supply to the circuit packs on the NT3X95AA remote oscillator shelf. IA nominal -48V dc office battery supplies input to the converter. The NT1X78AA operates in conjunction with the NT0X28AL frame supervisory panel.
NT3X16AA	1F, 15F	*Stratum 2 oscillator and interface card* The NT3X16AA provides a clock frequency signal. The signal controls circuit timing in the peripherals, networks, and interfaces of the DMS-100 Group of digital switches. The NT3X16AA is part of the master clock system that can be synchronized. The NT3X16AA operates in conjunction with the NT3X15DA Stratum 2 master clock card and the NT3X14 master clock system. The master clock card and the master clock system can be synchronized.

The design of the NT3X95AA appears in the following figure.

NT3X95AA (end)

NT3X95AA design



NT3X95AB

Product description

The NT3X95AB Stratum II remote oscillator shelf has two NT3X16AB Stratum 2 oscillator and interface cards. The oscillator shelf has dedicated power converters. One NT3X16AA card is in active mode. The other card is inactive. The inactive card is available as a backup to the active card.

The NT3X95AB shelf replaces the NT3X95AA shelf in isolated system ground (ISG) offices. The AB shelf is the ISG version of the AA card.

The function of the NT3X16AB oscillator and interface card defines the function of the NT3X95AB shelf. The following information describes the NT3X95AB shelf.

Parts

The NT3X95AB contains the following components:

- NT0X50BA—Filler faceplate 0.875
- NT0X50BE—Filler faceplate 2.62
- NT0X50BF—Filler faceplate 1.72
- NT1X78AA—Power converter, 5 V/-12 V/+24 V
- NT3X16AB—Stratum 2 oscillator and interface card

Design

The parts appear in the following table.

(Sheet 1 of 2)

Card PEC	Slot	Description
NT0X50BA	14F	*Filler faceplate .875* The NT0X50BA fills the empty slot 14.
NT0X50BE	9F, 23F	*Filler faceplate 2.62* The NT0X50BE fills the two empty slots 9F and 23F.
NT0X50BF	12F, 26F	*Filler faceplate 1.72* The NT0X50BF fills the two empty slots 12 F and 26F.

NT3X95AB (continued)

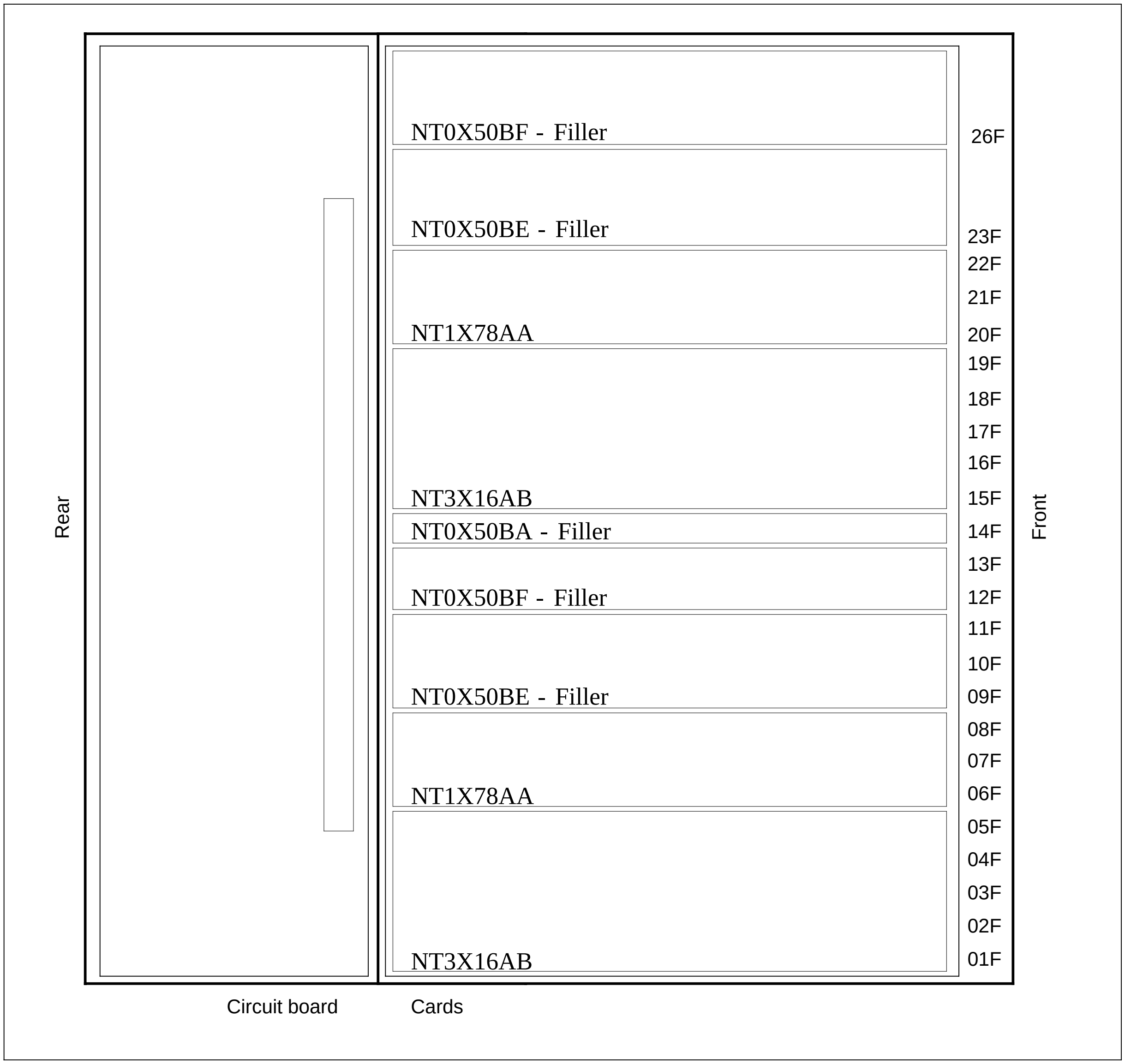
(Sheet 2 of 2)

Card PEC	Slot	Description
NT1X78AA	6F, 20F	*Power converter, 5 V/-12 V/+24 V* The NT1X78AA provides a regulated dc power supply with outputs of +5 V, +24 V, -5 V, and -12 V. The NT1X78AA provides the power supply to the circuit packs on NT3X95AA remote oscillator shelf. A nominal -48V dc office battery provides input to the converter. The NT1X78AA operates in conjunction with the NT0X28AL frame supervisory panel.
NT3X16AB	1F, 15F	*Stratum 2 oscillator and interface card* The NT3X16AB provides a clock frequency signal. The signal controls circuit timing in the peripherals, networks, and interfaces of the DMS-100 Group of digital switches. The NT3X16AB is part of the master clock system. The master clock system can be synchronized. The NT3X16AB operates in conjunction with the NT3X15DA Stratum 2 master clock card and the NT3X14 master clock system. The master clock card and the master clock system can be synchronized.

The design of the appears in the following figure.

NT3X95AB (end)

NT3X95AB design



NT3X95BA

Product description

The NT3X95BA Stratum 2.5 remote oscillator shelf has four NT3X16BA Stratum 2.5 oscillator and interface cards. The oscillator shelf has two dedicated power converters for the active and inactive cards. One NT3X16BA card is in active mode. The other card is in inactive mode. The two optional cards are in hot standby mode. The user must manually place the two optional cards in service when necessary. The inactive card automatically comes online when the active card has a problem.

The function of the NT3X16BA oscillator and interface card defines the function of the NT3X95BA shelf. The following information describes the NT3X95BA shelf.

Parts

The NT3X95BA contains the following parts:

- NT0X50BE—Filler faceplate 2.62
- NT0X50BF—Filler faceplate 1.72
- NT1X78AA—Power converter, 5 V/-12 V/+24 V
- NT3X16BA—Stratum 2.5 oscillator and interface card

Design

The NT3X95BA parts appear in the following table.

(Sheet 1 of 2)

Card PEC	Slot	Description
NT0X50BE	9F, 23F	*Filler faceplate 2.62* The NT0X50BE fills the two empty slots 9F and 23F.
NT0X50BF	12F, 26F	*Filler faceplate 1.72* The NT0X50BF fills the two empty slots 12F and 26F.

NT3X95BA (continued)

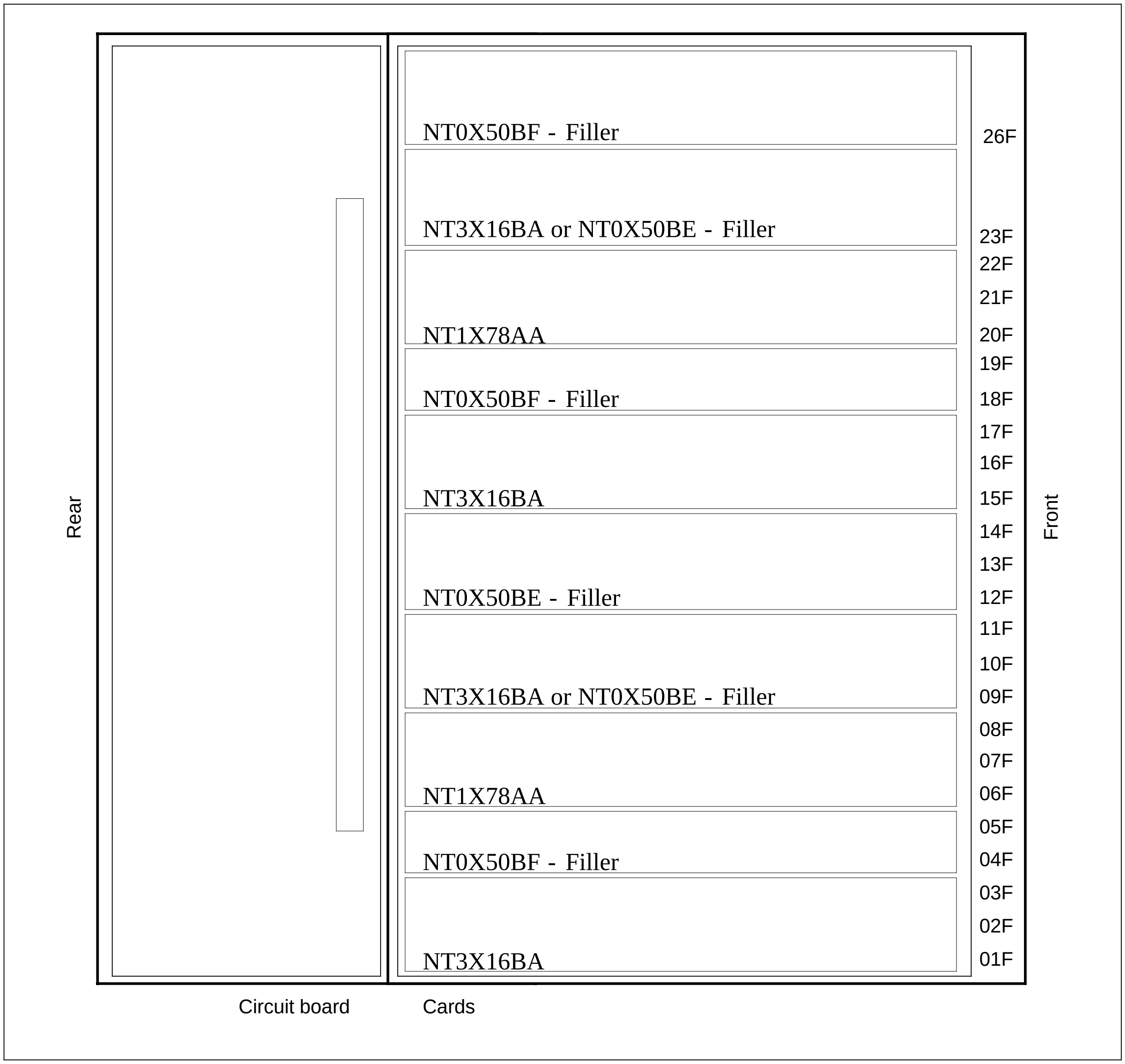
(Sheet 2 of 2)

Card PEC	Slot	Description
NT1X78AA	6F, 20F	*Power converter, 5 V/-12 V/+24 V* The NT1X78AA provides a regulated dc power supply with outputs of +5 V, +24 V, -5 V, and -12 V. The NT1X78AA provides the power supply to the circuit packs on the NT3X95AA remote oscillator shelf. A nominal -48V dc office battery provides input to the converter. The NT1X78AA operates in conjunction with the NT0X28AL frame supervisory panel (FSP).
NT3X16BA	1F, 15F	*Stratum 2.5 oscillator and interface card* The NT3X16BA provides a clock frequency signal. The signal controls circuit timing in the peripherals, networks, and interfaces of the DMS-100 Group of digital switches The NT3X16BA is part of the master clock system. The master clock system can be synchronized. The NT3X16BA operates in conjunction with the NT3X15DA Stratum 2 master clock card and the NT3X14 master clock system. The master clock card and the master clock system can be synchronized.

The design of the appears in the NT3X95BA following figure.

NT3X95BA (end)

NT3X95BA design



NT3X95BB

Product description

The NT3X95BB Stratum 2.5 remote oscillator shelf has four NT3X16BB Stratum 2.5 oscillator and interface cards. The remote oscillator shelf has two dedicated power converters for the active and inactive cards. One NT3X16BB card is in active mode. The other card is in inactive mode. Two optional cards are in hot standby mode. The user must manually place the two optional cards in service when necessary. The inactive card automatically comes online when the active card has a problem.

The NT3X95BB shelf replaces the NT3X95BA shelf in isolated system ground (ISG) offices. The BB shelf is the ISG version of the BA card.

The function of the NT3X16BB oscillator and interface card defines the function of the NT3X95BB shelf. The following information describes the NT3X95BB shelf.

Parts

The NT3X95BB contains the following parts:

- NT0X50BE—Filler faceplate 2.62
- NT0X50BF—Filler faceplate 1.72
- NT1X78AA—Power converter, 5V/-12 V/+24 V
- NT3X16BB—Stratum 2.5 oscillator and interface card

Design

The NT3X95BB parts appear in the following table.

(Sheet 1 of 2)

PEC	Slot	Description
NT0X50BE	9F, 23F	*Filler faceplate 2.62* The NT0X50BE fills the two empty slots 9F and 23F.
NT0X50BF	12F, 26F	*Filler faceplate 1.72* The NT0X50BF fills the two empty slots 12 F and 26F.

NT3X95BB (continued)

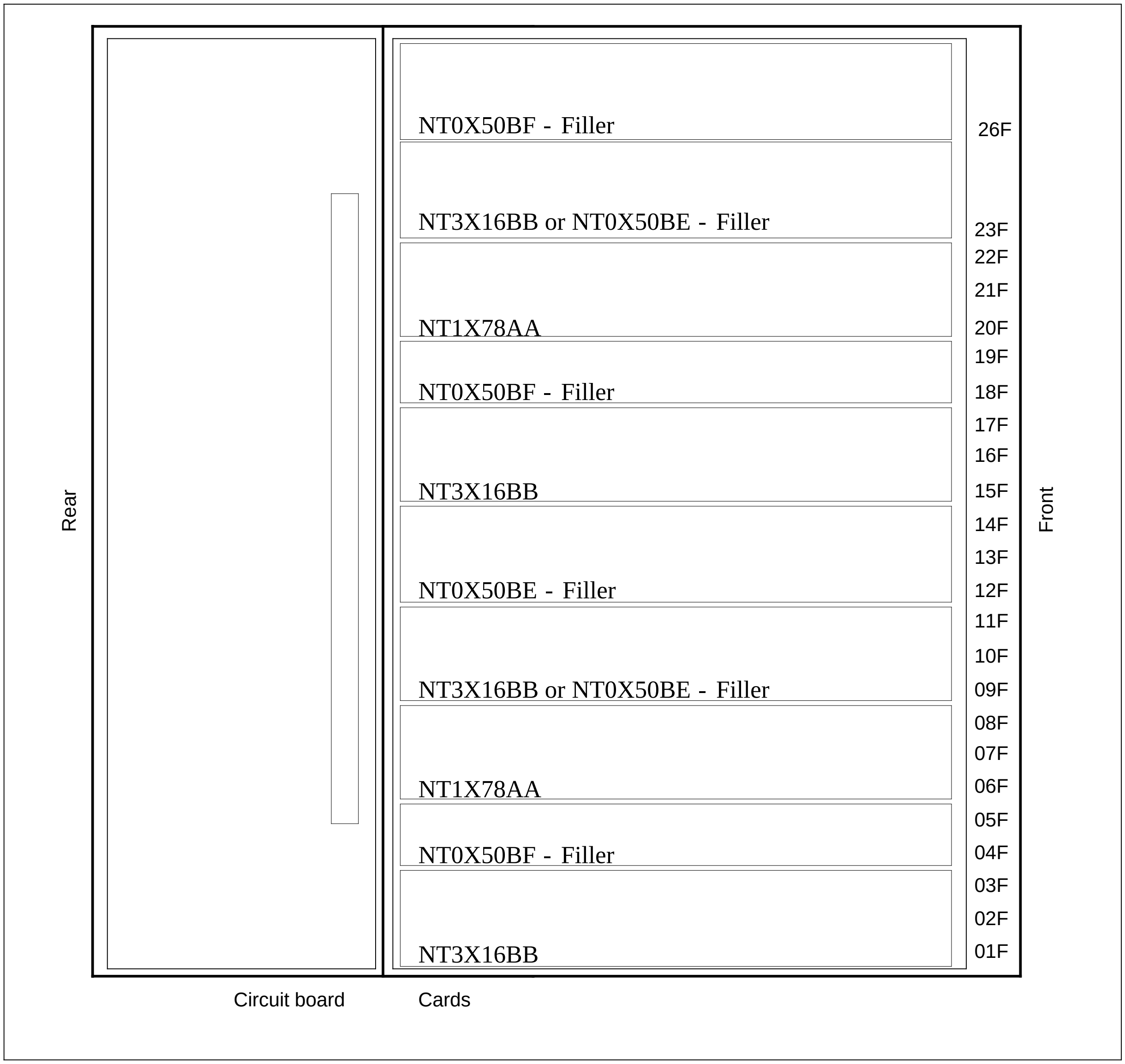
(Sheet 2 of 2)

PEC	Slot	Description
NT1X78AA	6F, 20F	*Power converter, 5 V/-12 V/+24 V* The NT1X78AA has a regulated dc power supply with outputs of +5 V, +24 V, -5 V, and -12 V. The NT1X78AA provides the power supply to the NT3X95AA remote oscillator shelf. A nominal -48V dc office battery provides input to the converter. The NT1X78AA operates in conjunction with the NT0X28AL frame supervisory panel.
NT3X16BB	1F, 15F	*Stratum 2.5 oscillator and interface card* The NT3X16BB provides a clock frequency signal. The signal controls circuit timing in the peripherals, networks, and interfaces of the DMS-100 Group of digital switches. The NT3X16BB is part of the master clock system. The master clock system can be synchronized. The NT3X16BB operates in conjunction with the NT3X15DA Stratum 2 master clock card and the NT3X14 master clock system. The master clock card and the master clock system can be synchronized.

The NT3X95BB parts appear in the following figure.

NT3X95BB (end)

NT3X95BB design



3 NT4Xnnaa

NT4X00AC through NT4X98AA

NT4X00AC

Product description

The NT4X00AC disk drive unit (DDU) fits in the DMS-100 Group input/output equipment frame (NT0X43AD). The NT4X00AC occupies shelf position 04 of the NT0X43AD. Shelf position 18 is empty. Shelf position 18 is empty to meet cooling requirements.

Nortel Networks recommends the use of a minimum of two DDUs for each DMS-100 system.

The following use disk drives:

- automatic message accounting system (AMA)
- operational measurements (OM)
- journal files storage
- office image storage
- bootstrapping

Parts

The NT4X00AC shelf contains a 8211D–19–063 8 in. (203 mm) or NT4X00AG 5.25 in. (133 mm) DDU disk drive and NT1X78AA power converter. The drive and power converter mount in an NT4X0013 DDU assembly.

Design

The main parts that the NT4X00AC can use or must use appear in the following table. The NT4X00AC appears in the following figure.

NT4X00AC parts (Sheet 1 of 2)

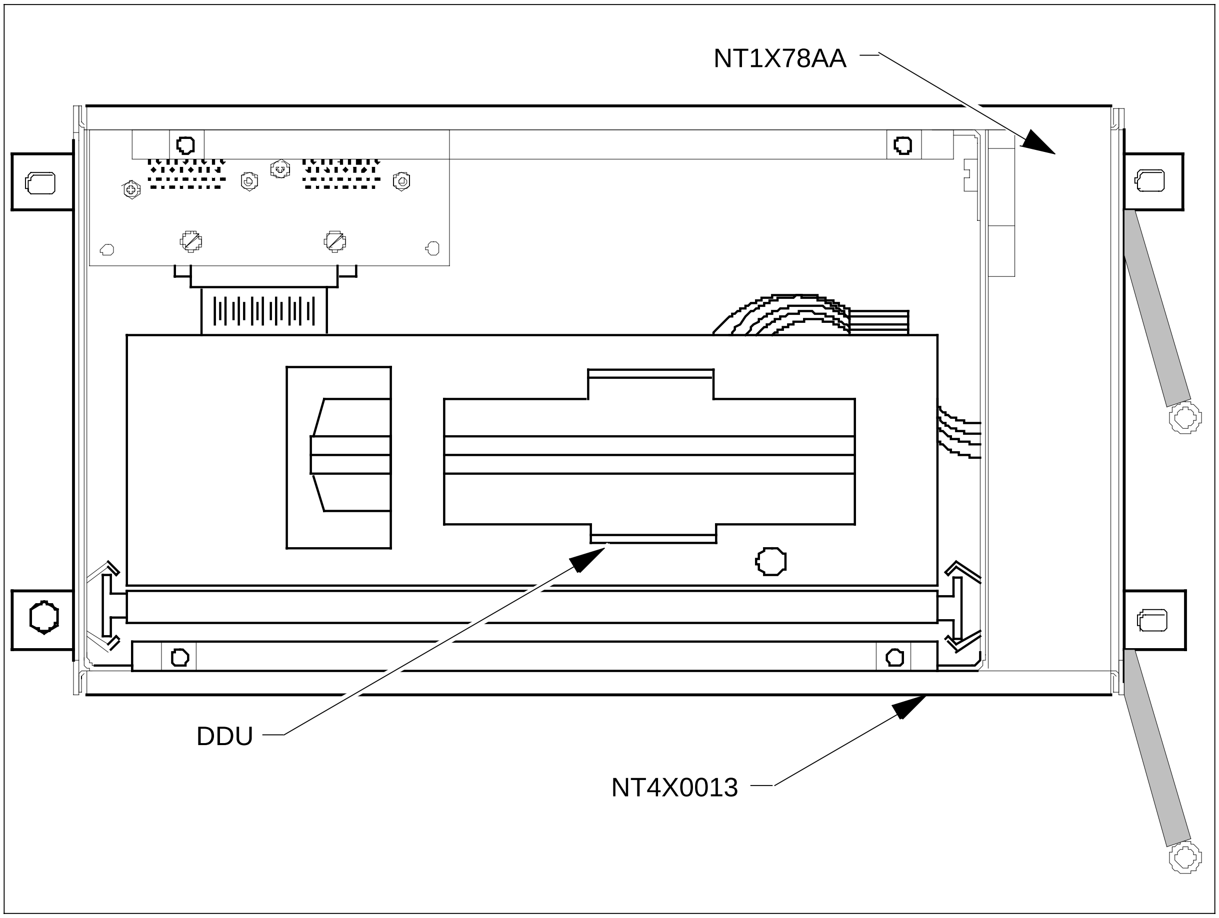
PEC	Slot	Description
NT1X78AA	-	*Power converter ± 5 V/+12 V/+24 V* The NT1X78AA provides a regulated dc power supply to the DDU. Input to the converter comes from a nominal -48 V dc office battery. The NT1X78AA operates in conjunction with the NT0X28AL frame supervisory panel.
Note: The 5.25 in. (133 mm) DDUs are available to replace 8 in. (203 mm) DDUs. The 8 in. (203 mm) DDUs replaced the older 14 in. (356 mm) DDUs.		

NT4X00AC (end)

NT4X00AC parts (Sheet 2 of 2)

PEC	Slot	Description
NT4X00AG	-	*5.25-in. disk drive unit* The NT4X00AG is a 5.25 in (133 mm) hard DDU. The NT4X00AG has a capacity of 228.7 Mbytes when formatted.
8211D–19–063	-	*MSD 8–in. disk drive unit* The 8211D-19-063 is an 8 in. (203 mm) hard DDU. The 8211D–19–063 has a capacity of 228.9 Mbytes when formatted. The NT4X00AG DDU must replace the 8211D-19-063 when you require replacement of the 8211D-19-063.
Note: The 5.25 in. (133 mm) DDUs are available to replace 8 in. (203 mm) DDUs. The 8 in. (203 mm) DDUs replaced the older 14 in. (356 mm) DDUs.		

NT4X00AC parts



Product description

The NT4X00AF dual disk drive unit (DDU) combines two disk drives on a single shelf. The NT4X00AF DDU functions as the office primary mass storage system.

Dual disks provide for a redundant storage method. The NT8X48AD uses distribute processing peripheral (DPP) to write identical copies of data to each of the two disks.

The DPP writes to the automatic message accounting system (AMA). The DPP writes AMA data that is not AMA data to the two disks. Log messages and MAP commands are examples of data that is not AMA data.

The NT4X00AC DDU fits in the DMS-100 Group NT0X43AD input/output equipment frame. You can mount the NT4X00AF only in shelf position 04 of the NT0X43AD. Shelf position 18 is empty. Shelf position 18 is empty to meet cooling requirements.

Parts

The NT4X00AF shelf has one or two NT4X00AG disk drives. The shelf has one NT1X78AA power converter for each disk drive.

Design

Tthe main parts of the NT4X00F appears in the following figure. The top view of a standard NT4X00F appears in the following table.

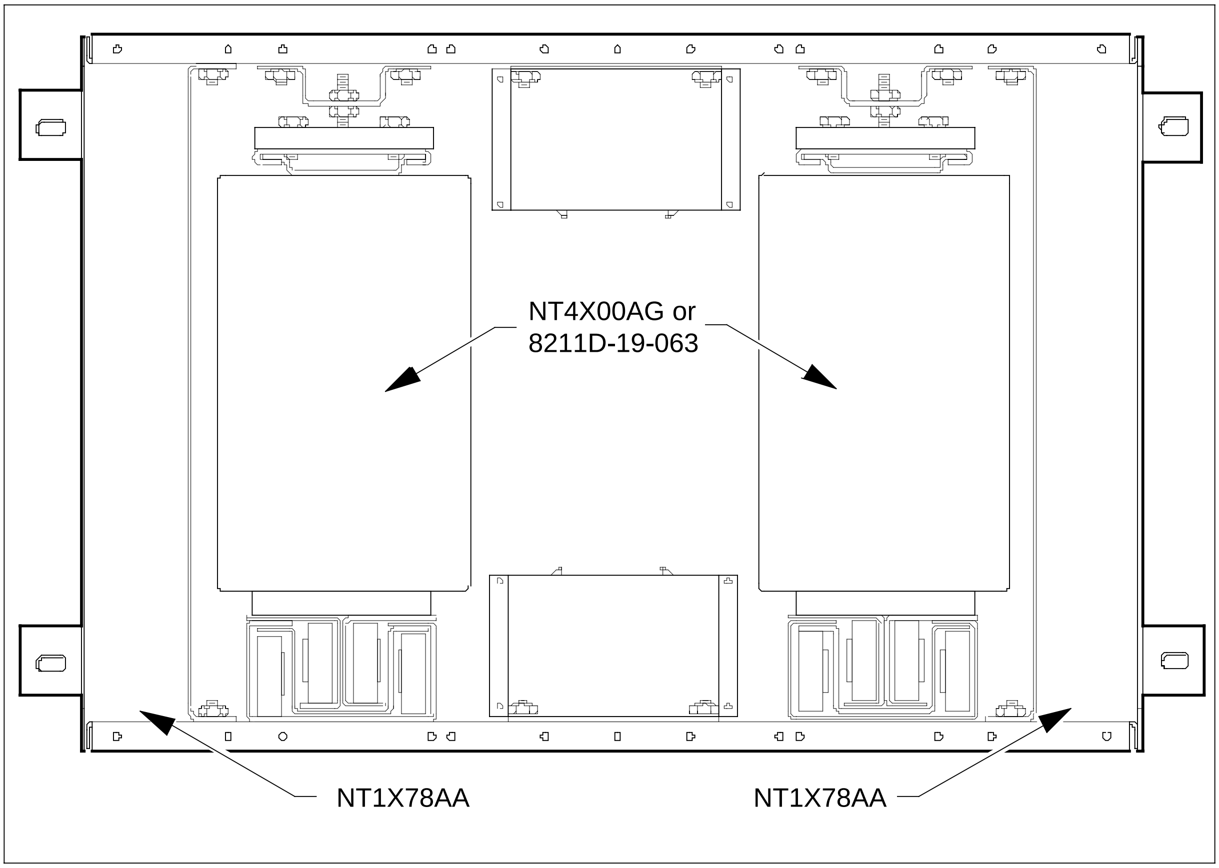
NT4X00AF parts (Sheet 1 of 2)

PEC	Slot	Description
NT0X50AE	2, 26	*Filler face plate* The NT0X50AE filler face plate fills slots 2 and 26 when the slots are empty.
Note: The 5.25 in. (133 mm) DDUs are available to replace 8 in. (203 mm) DDUs. The 8 in. (203 mm) DDUs replace the older 14 in. (356 mm) DDUs.		

NT4X00AF parts (Sheet 2 of 2)

PEC	Slot	Description
NT4X00AG	10, 18	*5.25 in disk drive unit* The NT4X00AG is a 5.25 in. (133 mm) hard disk drive unit. The disk drive unit has a capacity of 228.7 Mbytes when formatted.
NT1X78AA	2, 26	*Power converter, ±5 V/+12 V/+24 V* Each NT1X78AA provides a regulated dc power supply to a single disk drive. Input to the converter comes from a nominal –48 V dc office battery. The NT1X78AA operates with the NT0X28AL frame supervisory panel (FSP).
8211D–19–063	10,18	*MSD 8 in disk drive unit* The 8211D–19–063 is an 8 in. (203 mm) hard disk drive unit. The disk drive unit has a capacity of 228.9 Mbytes when formatted. The NT4X00AG DDU replaces the 8211D-19-063 when you require replacement of the 8211D-19-063.
Note: The 5.25 in. (133 mm) DDUs are available to replace 8 in. (203 mm) DDUs. The 8 in. (203 mm) DDUs replace the older 14 in. (356 mm) DDUs.		

NT4X00AF top view (normal)



NT4X00AG

Product description

The NT4X00AG disk drive unit (DDU) assembly fits the NT4X00AC (disk drive unit) or the NT4X00AF (dual disk drive unit).

Parts

The NT4X00AG is a 5.25 in. (133 mm) hard disk drive unit. The NT4X00AG has a capacity of 228.7 Mbytes when formatted.

Design

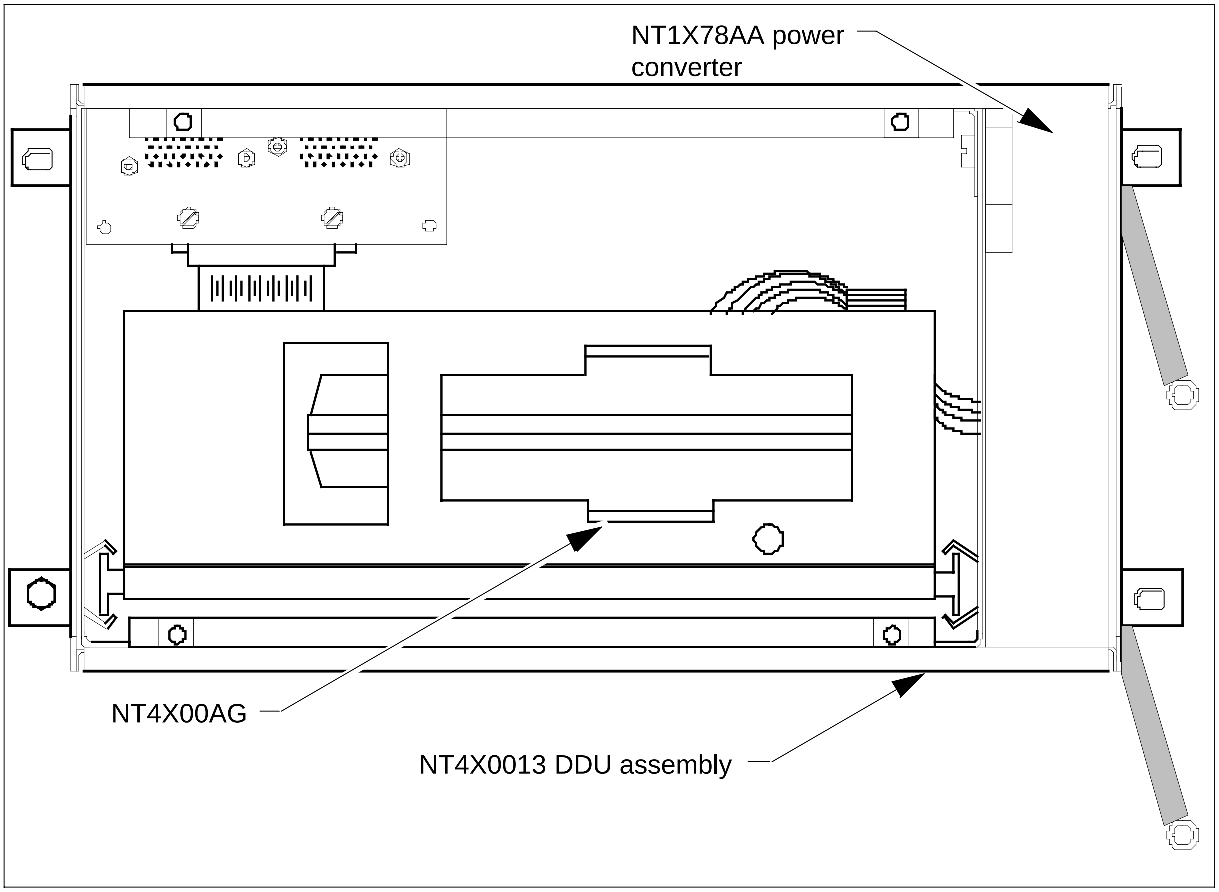
The main parts of the NT4X00AG appear in the following table. The NT4X00AG in the NT4X00AC and the NT4X00AG in the NT4X00AF appear in the following figures.

NT4X00AC parts

PEC	Slot	Description
NT4X00AG	-	*5.25 in disk drive unit* The NT4X00AG is a 5.25 in. (133 mm) hard DDU with a capacity of 228.7 Mbytes when formatted.
Note: The 5.25 in. (133 mm) DDUs are available to replace 8 in. (203 mm) DDUs. The 8 in. (203 mm) DDUs replaced the 14 in. (356 mm) DDUs.		

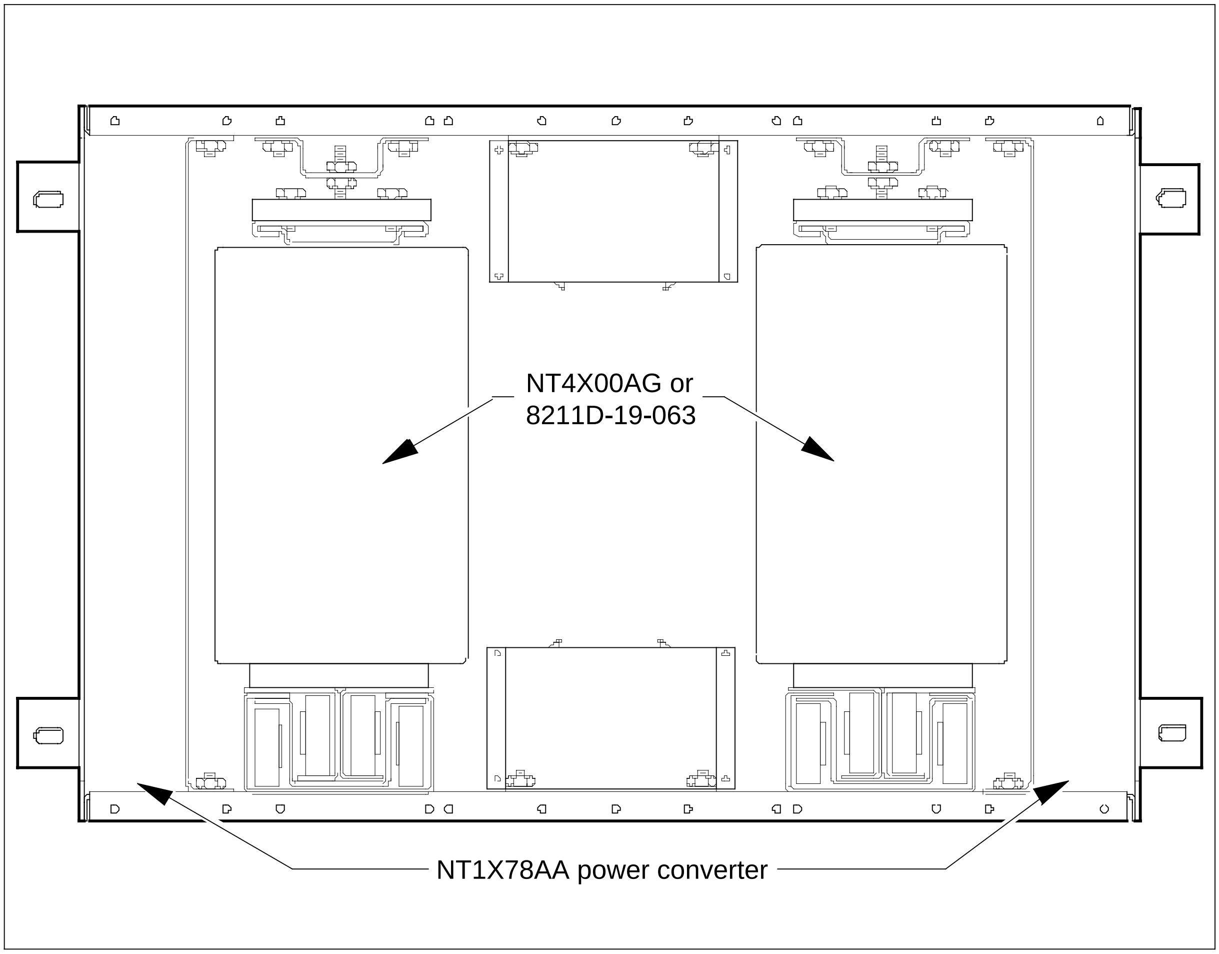
NT4X00AG (continued)

Example of NT4X00AG in NT4X00AC disk drive unit



NT4X00AG (end)

Example of NT4X00AG in NT4X00AF dual disk drive unit



NT4X09BB

Product description

The NT4X09BB Meridian services attendant console (MSAC), Phase 2, replaces the NT4X09AG Nortel Networks (NT) Integrated Business Network Services (IBNS) attendant console (Phase 1). The NT4X09BB improves the console to 15 kV sensitivity and performance levels.

The NT4X09BB provides the following improvements to the IBNS attendant console:

- electrostatic discharge
- static mat requirements
- double headset operation
- reset circuits
- IEC standard
- operational testing

The console modifications include plastic supports that replace the metal brackets inside the keyboard. Plastic replaces the metal in the headset jack assembly where appropriate. The main circuit was redesigned. The main circuit includes reset circuits, double headset operation circuit changes, and a multiple layer main process control block (PCB) board.

The IBNS Phase 1 console can operate next to the NT4X09BB console through use of the same peripheral. This console requires BCS26 or higher BCS release software. Software releases BCS23 to BCS25 require a patch to update the software to BCS26.

> ***Note:*** The IBNS attendant console that the NT4X09BB replaces is considered manufacture discontinued (MD).

Location

The location of the is an operator position.

Functional description

The NT4X09BB connects through the telephone network to the Enhanced Business Service (EBS). The NT4X09BB on Nortel Networks DMS-100, DMS-250, or Meridian SL-100 digital switching systems. The NT4X09BB provides the customer with service on premises. Attendants control this service. The NT4X09BB transmits data to the central office (CO) switch at 300 b/s and receives data at 1200 b/s.

NT4X09BB (continued)

The trunks and lines that normally provide voice communications and other services from the CO do not terminate at the console. These trunks and lines use a virtual loop method. The process involves an attendant only for the time necessary to handle the call.

A console can use a maximum of six loops. The loops allow the attendant to gain voice access to calls routed to the console. Only one new call connects to the console at time. When the attendant completes action on a call, the call can be released from the loop in use. The attendant can hold the call on the loop and make the console available to new calls. These events can occur when the console continues to receive call status information.

Parts

The NT4X09BB has the following parts:

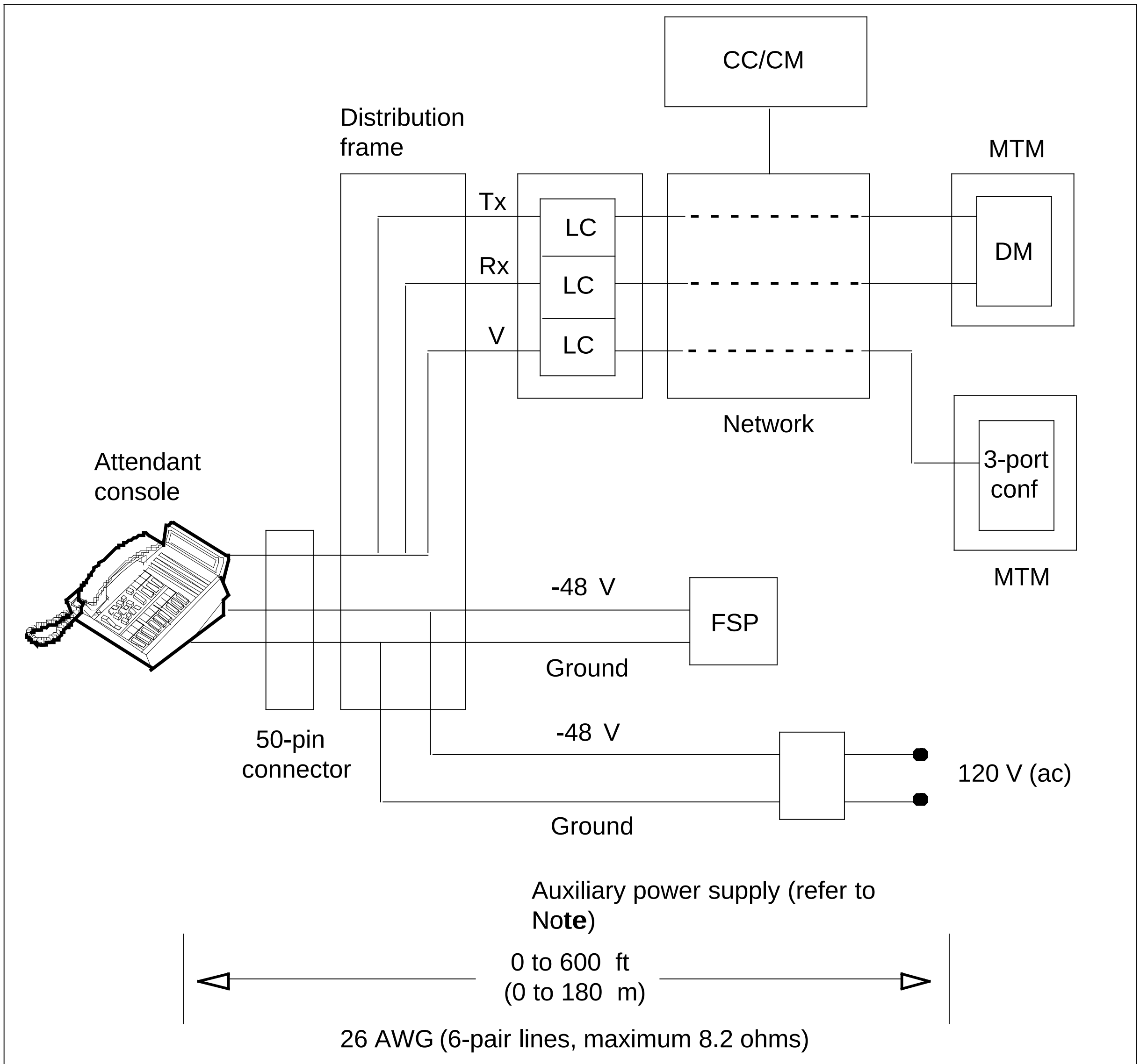
- 12-button dial pad
- 6 loop keys with associated indicator lamps
- 10 standard keys. 6 standard keys are associated with indicator lamps
- 42 assigned keys that are not required and indicator lamps
- 2 headset/handset jacks, 1 on each side of the console
- speaker
- 2 thumb wheel-type volume controls for audio adjustments of speakers and headsets
- 16-character, light-emitting diode (LED)-equipped alphanumeric display
- 50-pin Amphenol 57-10500-27 connector at the end of power and signal lead connecting cable

Note: This cable plugs into a circuit board connector. Manufacturing installs the cable before the connector is shipped.

A standard attendant console in the DMS configuration appears in the following figure. One pair of lines provides voice communication on a virtual loop. The other two pairs provide an asynchronous, full-duplex, frequency shift key (FSK). The other two lines also provide a four-wire data circuit to transfer signaling and supervision data between the console and the digital switching system.

NT4X09BB (continued)

NT4X09BB functional blocks



Legend:		
	Tx = transmit path	MTM = Maintenance Trunk Module
	Rx = receive path	DM = Digital modem
	V = voice path	FSP = Frame Supervisory Panel
	LC = line card	CC = Central Control
		CM = Computing module

Note: If the attendant console is farther than 180 m (600 ft) from the FSP, an auxiliary power supply powers the console.

NT4X09BB (continued)

Technical data

The technical data section has specifications for the NT4X09BB power requirements, environmental conditions, equipment dimensions, and signaling specifications.

Power requirements

The -48 V (dc nominal) CO battery powers the attendant console. Where consoles are at the same place as CO equipment, a miscellaneous (MIS) equipment frame FSP can provide power. When power source cables are farther than 180 m (600 ft) from the console, the NT4X09BB requires a separate power source. When the console is not found, the NT4X09BB requires a separate power source. A recommended commercial power supply is the PYLON KTS-3.

The console can use a PYLON NT-3 NEVAFAIL power system if the console requires a battery backup. The NT-3 power system has a KTS-3 power supply, an NF-3 power unit, and an LB-3 local battery supply. The NT-3 power system provides a continuous 48 V (dc) 1 A power supply during commercial power failures. The NT-3 power system provides this power supply for four hours. The two power supplies each require a 115 V (dc) 60 Hz outlet. The two power supplies have an output range of 52 V (dc) to 58 V (dc). Adjust power supplies to console powering requirements.

The NT4X09BB power requirements appear in the following table.

Power requirements

Voltage	Current	Power
-5 V (dc)	250 mA maximum	13.0 W maximum
	175 mA standard	9.1 W typical

Environmental conditions

The NT4X09BB performs under limited environmental conditions. These restrictions appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	4 °C to 38 °C (39.2 °F to 100.4 °F)	2 °C to 49 °C (35.6 °F to 120.2 °F)
Relative humidity	20% to 55%	20% to 80%

Note: At an ambient temperature of a maximum of 21 °C (69.8 °F). Relative humidity is 80%. At an ambient temperature of 49 °C (120.2 °F), the relative humidity is 30% maximum.

Equipment dimensions

The NT4X09BB dimensions are:

- height: 86 mm (3.4 in.)
- width: 335 mm (13.2 in.)
- depth: 305 mm (12 in.)
- weight: 28 kg (6.2 lb)

Signaling specifications

This section includes signaling specifications for the following:

- receive and transmit gain for an applied signal generator of 1000 Hz
- modem limits of the 1200 b/s console
- modem transmit circuit
- voice circuit limits
- frequency response
- return loss

1200 b/s console modem limits

The half-duplex BELL 202 modem parameters control the 1200 b/s console.

- The frequency range for receive carrier detect in which the modem detects a signal as a correct carrier is 600 Hz to 3200 Hz ± 200 Hz at -25 dBm.
- The frequency range for the bandwidth in which the modem accepts a signal as a valid mark (1200 Hz) is 650 Hz to 1680 Hz ± 20 Hz at -13 dBm.
- The frequency range for the bandwidth of detection in which a modem accepts a signal as a valid space (2200 Hz) is 1720 Hz to 3200 Hz ± 3200 Hz at -13 dBm.
- The echo return loss (ERL) is >20 dB and the singing return loss (SRL) is >14 dB. This condition occurs with the test set internal balance network set to 900 ohms +2.16 uF, and the transmit jacks terminated with 900 ohms.

Modem transmit circuit

When DT1/DR1 terminates with 9100 ohms, and the test set internal balance network is set to 900 ohms +2.16 uF, the return loss measured across DT/DR is >26 dB for the ERL, and >21 dB for the SRL.

NT4X09BB (continued)

Voice circuit limits

The following limits apply to voice circuit tests:

- Operate relay K2. Insert a headset plug into one of the console jacks causes K2 to operate the relay K2.
- The receive volume control must be set to maximum volume on all tests, unless a different value is available.
- The gain strap on P1 must be on pins 2 and 3.

1000 Hz gain

This section describes the receive gain and transmit gain when the NT4X09BB uses an applied signal generator of 1000 HZ.

The signal generator has a source impedance of 900 ohm. Apply a 1000 Hz sine wave at a level of -21 dB to the tip and ring (T/R) leads of the console. The output levels on the receive jacks (sleeve-to-sleeve) with 900 ohm termination and with the receive volume control set to the maximum are -29 ±1.0 dBm. With the receive volume control set to the minimum, the output levels are -40 ±1.0 dBm.

Apply a 1000-HZ sine wave at the level of -29.5 dB to the headset jacks (tip-to-tip). The signal generator has a source impedance of 900 ohms. The following table lists the measured output levels for the transmit gains on the T/R leads (900 ohm termination).

Transmit gains

Strap location	Output level
Pins 1 and 2	-27.0 dBm ±0.5 dBm 42.4 mV (rms)
Pins 2 and 3	-21.0 dBm ±0.5 dBm 84.5 mV (rms)
Pins 3 and 4	-15.0 dBm ±0.5 dBm 168.7 mV (rms)

Frequency response

The receive direction, transmit direction, and return loss with a signal generator indicate the frequency response.

The signal generator has a source impedance of 900 ohms. You applied a sine wave to the the T/R at -21 dBm. The frequencies of the sine wave appear in the following table. Output levels measured on the receive jacks 900 ohm termination appear in this table.

> ***Note:*** All measurements refer to 1000 Hz. Dips or rises do not occur between the frequencies that appear in this table.

Receive direction output levels

Frequency	Output level
60 Hz	<-3.0 dB
300 Hz	-1.5 dB, 0.0 dB
1500 Hz	-0.1 dB, +0.1 dB
3000 Hz	- 0.1 dB, +0.2 dB

Apply a sine wave to the transmit jack at -29.5 dBm. The signal generator has a source impedance of 900 ohms. Apply the sine wave at the frequencies that appear in the following table. The guidelines of the output levels as measured on the T/R leads with 900 ohm termination appear in the following table.

> ***Note:*** All measurements refer to 1000 Hz. Dips or rises do not occur between the frequencies that appear in the table.

Transmit direction output levels

Frequency	Output level
60 Hz	< -3.0 dB
300 Hz	-1.5 dB, 0.0 dB
1500 Hz	-0.1 dB, +0.1 dB
3000 Hz	-0.1 dB, +0.2 dB

The return losses are measured at the T/R input with a return loss test set internal balance network. The return loss test set internal balance network is set for 900 ohm +2.16 uF. The return losses are >22 dB for ERL, >22 dB for SRL high, and >17 dB for SRL low.

NT4X25DA

Product description

The NT4X25DA 3194 NSA coax eliminator control unit interface card connects IBM3194 and 3270 compatible control units and terminals. This connection is through the DMS-100 or the SL-100. A switched network with twisted pair wiring replaces the coaxial cable between the control unit and the table. The switched network uses the terminal interface card, NT4X25DB or NT4X24EB for the replacement.

Use the two switches on the faceplate of the NT4X25DA to configure the unit in back-to-back mode. Use the two switches to also select the 8031 processor option.

This feature provides two light-emitting diodes (LEDs). The upper LED, CONN, indicates the connect status of the device:

- If CONN is off, the card is idle.
- If CONN is on, the card is in use.
- If CONN flashes, the card has not gained time compressed multiplex (TCM) synchronization.
- If CONN flashes an error code, a diagnostic failure is present.

The lower LED, POLL, indicates the perceived status of the control unit:

- If POLL is off, a power interruption occurred.
- If POLL is on, the control unit connection is present and a session can be started from the NT4X25DA.
- If POLL flashes, the control unit is not running or is disconnected.

Functional description

The NT4X25DA converts the protocols associated with the control unit to the TCM link format and message set.

Functional blocks

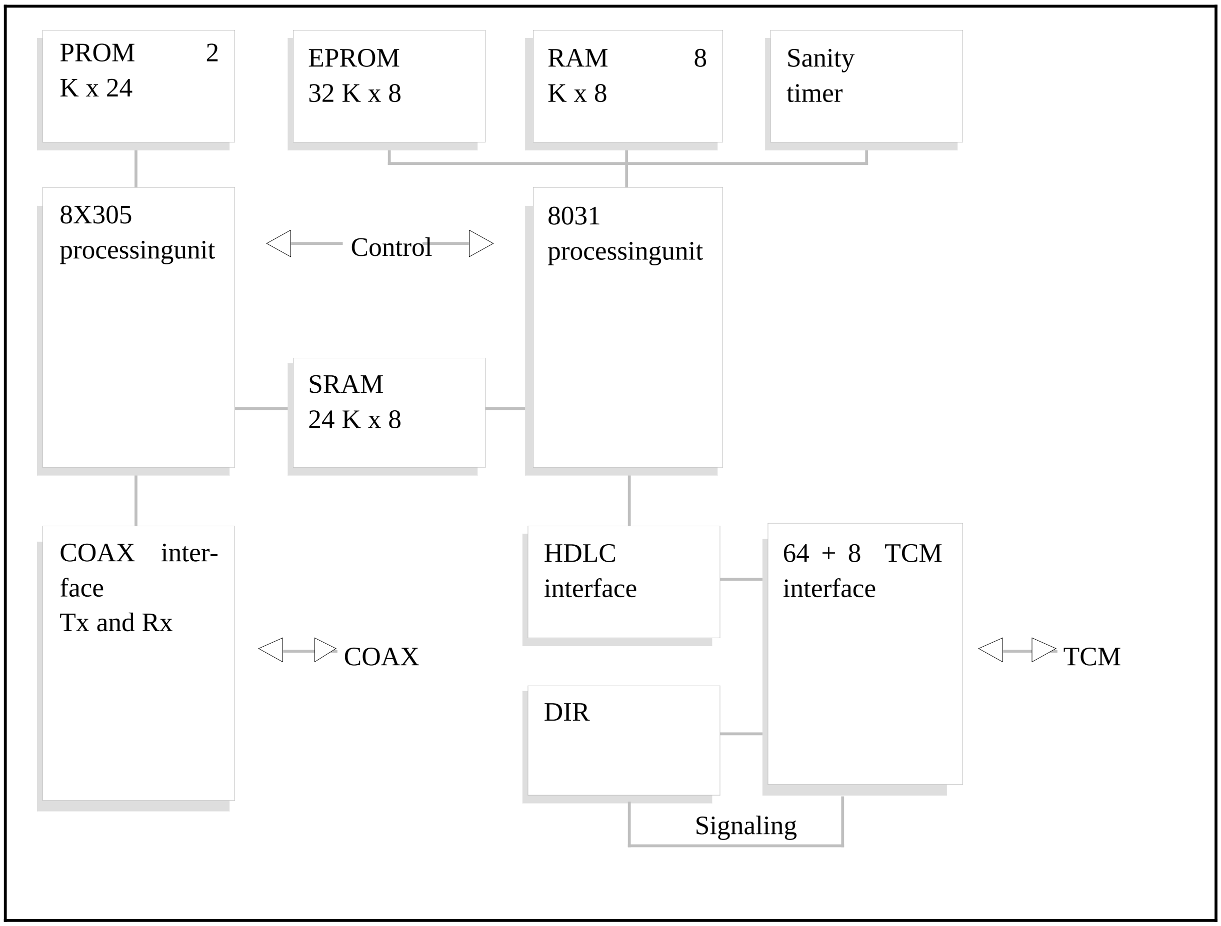
The NT4X25DA contains the following functional blocks:

- coax interface
- 8X305 processing unit
- interprocessor shared RAM (SRAM)
- 8031 processing unit
- TCM interface

- high-level data link control (HDLC) interface
- direct interface
- memory interface

The functional relationship of these parts appears in the following figure.

NT4X25DA functional blocks



Coax interface

A length of coaxial cable connects the to the control unit. Data transmission occurs through the cable at 2.3 Mbps with diphase formatting. This transmission meets IBM requirements.

8X305 processor

The 8X305 processor maintains the IBM side link. The maintenance includes support of the IBM protocol for the control unit and the terminal emulation.

NT4X25DA (end)

8031 processor

The 8031 processor maintains the loop side activity for the . The loop side activity includes the basic TCM interface functions and communication with the 8X305 through the SRAM.

Shared RAM

The SRAM performs three functions:

- acts as general purpose RAM to the 8X305
- contains the screen and attribute data for the terminal that the control unit sends
- provides a communication path between the two processors.

Time-compressed multiplex interface

The TCM interface contains:

- a parallel interface that communicates signaling and control information to the 8031
- a serial line in each direction to carry 64 Kbit data.

Technical data

Power requirements

NT4X25DA power requirements

Voltage	Current
+5 V	3 A
+12 V	0.3 A
-12 V	0.2 A

NT4X45AA

Product description

The Enhanced Digital Test Unit (EDTU) NT4X45AA card is a single circuit pack unit. The EDTU replaces the TTT (Transmission Test Trunk - 2 CP's), the TTU (Transmission Test Unit - 2 CP's) as well as their international equivalents and the DTU (Digital Test Unit - 1 CP).

The EDTU is a redesign of the Digital Test Unit (DTU) and incorporates four independent virtual test units (VTU) on one DMS MTM or ISM provision able circuit pack. By introducing 4-channel EDTU the following circuit pack codes are eliminated:

- domestic TTT (2 packs: NT1X90AA and NT2X96AA)
- international TTT (2 packs: NT1X90BA and NT2X96BA)
- domestic TTU (2 packs: NT2X47AD and NT2X56AB, or NT2X56AA)
- International TTU, ATME-2 version (2 packs: NT2X47AB and NT2X56BA)
- international TTU, non-ATME-2 version (2 packs: NT2X47BA and NT2X56BA)
- DTU (one pack: NT4X23AA)

Location

The EDTU occupies a card position in the Maintenance Trunk Module (MTM) and is connected by four PCM channels.

Functional description

The EDTU has 4 functional areas:

- Self-diagnostics
- TTT functionality (domestic and international)
- TTU functionality (domestic and international)
- DTU functionality

NT4X45AA (continued)

Self-diagnostics

The diagnostic functions of the EDTU are:

Test/Function Name	**Description**
Master Processor memory check	Sanity of the 256k memory
DSP Processor memory check	Sanity of the 64k memory
EDTU load check (check sum test)	Verification of the load checksum validity
Digital loop-back test (PCM test)	Verification of the EDTU RDAT and XDAT path sanity
Verify load name	Verification of the release of the EDTU load

TTT functionality

The TTT-based tests of the EDTU are:

Test/Function Name	**Description**
Tone Generator	Level 3.0 to -60.5 dBm; Frequency 4 to 3996 Hz
Tone Meter	Level 3.0 to -30.0 dBm; Frequency 16 to 4000 Hz ± 16 Hζ
C-Msg Weighing Filter	C-message filtered noise level measurement
C-Msg Weighing + Notch filter	C-message and 1010 Hz notch filtered noise level measurement

TTU functionality

The TTU-based tests of the EDTU are:

(Sheet 1 of 2)

Test/Function Name	Description
ATME-2	Simplified version of CCITT (REd Book) ATME No.2. THe Blue Book ATME No. 2 tests (modified Red Book tests + Bit Error-like tests) are required but not implemented to date in the DMS system.
Trans-Hybrid Loss	4 frequency test (304, 704, 1504, 3204 Hz @ 10.0 dBm)
Singing/Echo Return Loss	The DMS implementation of these tests needs to be re-evaluated and the tests need to be re-designed.
Off-Hook Return Loss	6-frequency (1004, 1504, 2004, 2504, 3004, 3204 Hz @ -10.0 dBm; return power measured over a period of 32 ms; power calculation delayed by 5 ms
High Tone	Tone of 480 Hz @ -17.0 dBm in 1 of 8 cadences (for LC testing)
MF Receive Test	Test for MF Receiver Diagnostics: TTU is used as a programmable MF Sender.
DT Receiver Test	Similar to MF Sender Test
Ring Waveform Test	Ring Waveform Analyzer performs: • detection of PCM > threshold (over a period of 7 sec.) • recording of minimum and maximum excursions over a period of 250 ms. ***Note:*** The application test incorporates the power measurement of the ringing signal
Weighted Noise Measurement	Similar to TTT but more accurate

NT4X45AA (continued)

(Sheet 2 of 2)

Test/Function Name	Description
Notch Noise Measurement	Similar to TTT but more accurate
Single Frequency Tone Sender	Similar to TTT but more accurate
Power Measurement	Broad-Band measurement based upon formula $\Sigma x2/\iota$
105 Test Line	There are 21 test sub-commands; TTU acts as director and responder (ROTL); the tests consist of los (404, 1004, 2804 Hz, SERL and noise (C-msg) measurements.
Tone Detector	The test detects the presence of a tone.
DTRCVR	Testing of DTRCVR

DTU functionality

The DTU-based tests of the EDTU are:

Test/Function Name	Description
BERT	IBERT (similar to NT6X99) tests on digital trunks and data lines
OHBT	Off-Hook BalNet (Balance Network) Test on lines

Technical data

Electrical specifications

The power consumption of each channel of the EDTU is 2.7 watts.

Equipment Dimensions

The dimensions of the NT4X45AA card are:

Height	Depth	Width
12.5 in.	10.4 in.	1.125 in.

NT4X45AA (end)

Environmental conditions

The NT4X45AA card is designed for the following conditions:

	Temperature	Humidity
Operating range	10°C to 30°C	20 to 55%
Short-term range	5°C to 49°C	20 to 80%

NT4X70

Product description

The NT4X70 Auxiliary operator services system (AOSS) is an interface between an operator and a DMS-200 or 250. The AOSS allows the operator to process directory assistance (DA) and operator intercept calls. The AOSS provides data communication between the operator and the DMS switch. The AOSS provides voice communication between the operator and a subscriber.

The primary NT4X70 features include two test modes. The features include a warm restart when the headset is reseated in the jack. The features include French or English language messaging and a training package.

Location

The NT4X70 is in the controller unit. The controller unit contains an audio/modem circuit card, a central processor unit (CPU) circuit card and a power supply.

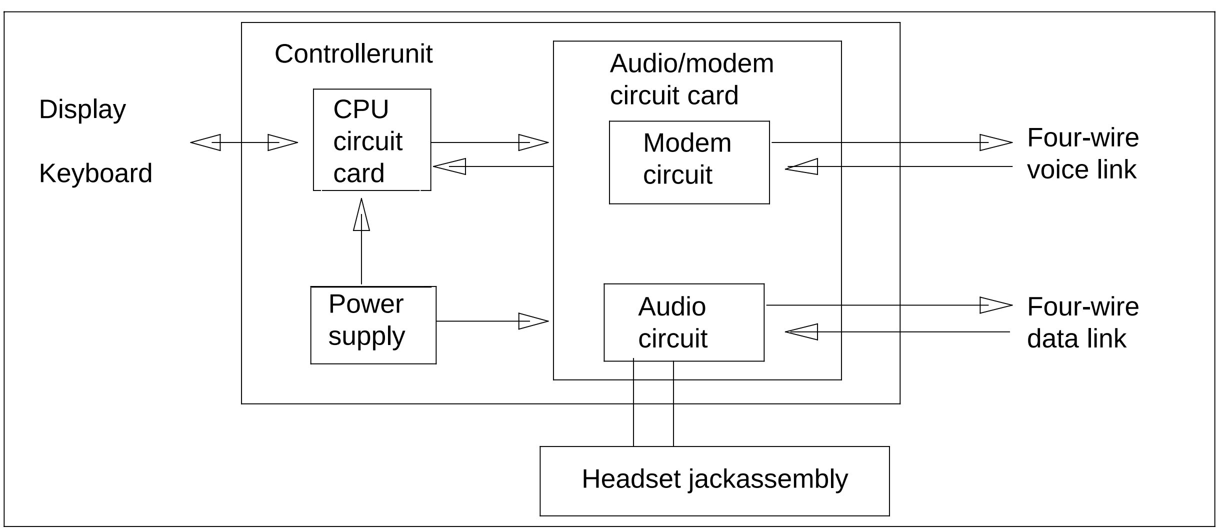
Functional description

The AOSS hardware contains the following:

- controller unit
- keyboard/display module
- headset jack assembly

The relationship of the NT4X70 functional blocks appears in the following figure.

NT4X70 functional blocks



Controller unit

The controller unit contains the audio/modem circuit card (NT4X61AA), central processor unit (CPU) circuit card (NT4X62AA) and power supply (NT4X60AB).

Audio/modem circuit card (NT4X61AA)

The audio/modem circuit card transmits and receives voice and data that travels to and from a DMS switch. The rate of transmission and reception is 300 b/s. The audio/modem circuit card contains modem circuits and audio circuits.

The modem circuits receives asynchronous serial data in frequency shift key (FSK) transmissions from the switching center. The modem circuits converts the data from FSK transmission to transistor-transistor (TTL) transmission. The modem circuit transmits the TTL signals to the CPU circuit card.

In the transmit direction, the modem circuits takes asynchronous serial TTL data from the CPU circuit card. The modem circuits converts the data to FSK signals for transmission to the switching center.

The modem circuits can activate the analog loop (ANALOOP) test. The ANALOOP test checks continuity in the keyboard/display module, the modem circuit and the CPU circuit card. Flip the ANALOOP/Normal toggle switch to the ANALOOP position to place the AOSS into the ANALOOP test mode. The toggle switch is mounted on the face plate of the controller unit. When in the ANALOOP mode, all data that the keyboard of the keyboard/display module generates is routed through the CPU. This data is routed to the display part of the keyboard/display module.

The audio circuits receives and transmits voice communication for the operator and the caller. The audio circuits appears in the figure on page 5. The audio circuits includes a two section dual inline package (DIP) switch. The switch sets the analog gain of side tone feedback to the headphones of the operator. This switch is S2. A list of the different settings for the S2 switch appears in the following table.

Dip switch S2 settings (Sheet 1 of 2)

S2 settings	Side tone level (600 ohms probe)	Side tone level (300 ohms probe)
00	No side tone	No side tone
01	-19 (±1.0) dBA	-16 (±1.0) dBA
Note: The zero in the settings column represents off and the one represents on.		

NT4X70 (continued)

Dip switch S2 settings (Sheet 2 of 2)

S2 settings	Side tone level (600 ohms probe)	Side tone level (300 ohms probe)
10	-15 (±1.0) dBA	-12 (±1.0) dBA
11	-11 (±1.0)dBA	-8 (±1.0) dBA
Note: The zero in the settings column represents off and the one represents on.		

The audio circuits includes a three-section DIP switch to set the amplitude limit for incoming voice signals. This switch is S3. A list of the different settings for the S3 switch appears in the following table.

Dip switch S3 settings

S3 settings	Limiting level (600 ohms probe)	Limiting level (300 ohms probe)
000	No limit	No limit
001	-25 (±1.0) dBA	-22 (±1.0) dBA
010	-28 (±1.0) dBA	-25 (±1.0) dBA
100	-34 (±1.0) dBA	-31 (±1.0) dBA
110	-37.5 (±1.0) dBA	-34.5 (±1.0) dBA
Note: The zero in the settings column represents off and the one represents on.		

Activation of a loopback test can test the voice and data trunk facilities that terminate on the audio/modem circuit card. A command from the DMS initiates the test. Operating company personnel invoke this command manually. This command activates a relay in the modem circuits. The command routes signals on incoming link signals to the outgoing link.

CPU circuit card (NT4X62AA)

The CPU circuit card (NT4X62AA) performs the following functions:

- transmits and receives asynchronous serial data to and from the audio/modem circuit card
- receives data from the keyboard/display module
- transmits messages to the display part of the keyboard/display module
- activates ANALOOP testing
- provides English or French language messaging

In addition, the CPU circuit card activates cold and warm restarts. When the AOSS is turned on (powered-up), the CPU circuit card performs a cold restart. A cold restart consists of the system self-testing the hardware and memory checks. A cold restart establishes communication with the DMS switch. A cold restart establishes communication between the controller unit and the keyboard/display module. The CPU circuit performs a warm restart when the headset of the operator is reseated in the headset jack. A warm restart includes a part of the hardware self-tests that the system performs during a cold restart.

Power supply (NT4X60AB)

The NT4X06AB power supply produces a set of DC voltages. The set of DC voltages is +5 V, +12 V, -12 V from a 115 V (ac) 50/60 Hz or a -48 V (dc).

Keyboard/display module

The keyboard part of the module has 27 Hall effect keyswitches. The keyswitches have 15 predefined function keys and a 12-key telephone dial pad. The display part of the module can display alphanumeric characters. The display part features a fluorescent plasma display panel of four lines with 16 characters for each line. The operator can adjust the brightness of the display.

The display unit provides information from the switch through the controller unit. The display unit echoes the information the operator enters at the keyboard during an ANALOOP test. The keyboard/display module works with the controller unit to run a menu of simulated calls to train operators. This event occurs when the keyboard/display module is in training mode. The trainee can respond to these calls in the normal method. The trainee can observe the responses that appear under operating conditions. The keyboard/display module does not provide audio simulations.

A single five-conductor, retractile cord allows the data and power connection between the keyboard/display module and the controller unit.

Headset jack assembly

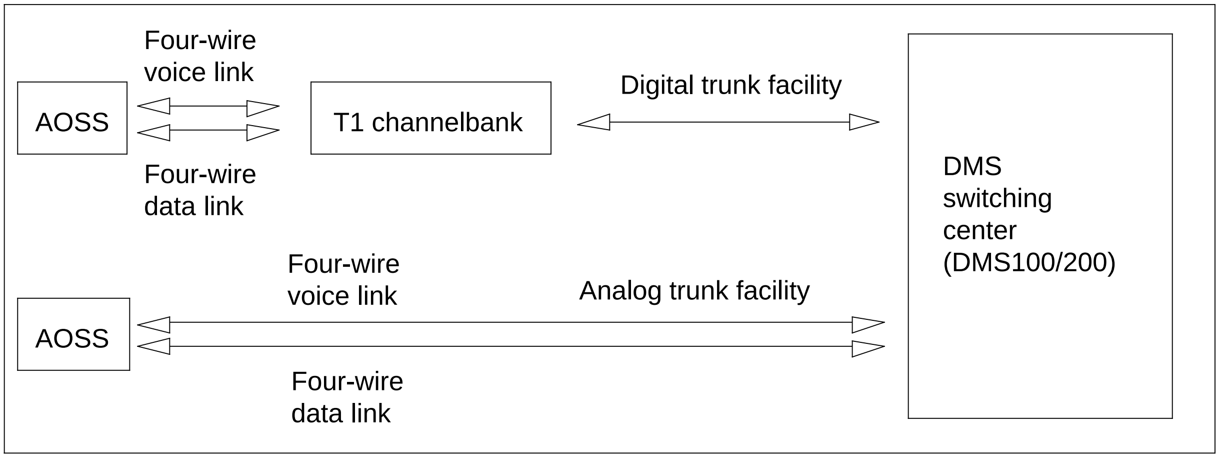
The headset jack assembly is a metal box that contains a jack telephone headset plug of the operator. You can mount this assembly in any location on the furniture of the AOSS position.

External operation

The AOSS can interface a DMS switch through a T1 channel bank and digital trunk facility or through an analog trunk facility. In these events, a four-wire analog voice link and a four-wire analog data link provide the AOSS-to-peripheral connection. The peripheral is a T1 channel bank or trunk module. This configuration appears in the following figure.

NT4X70 (continued)

NT4X70 AOSS interface to the DMS



Technical data

The technical data section provides specifications for the following:

- NT4X70 power requirements
- equipment dimensions
- environmental conditions
- transmission protocol
- voice transmission impedance

Power requirements

The NT4X70 power requirements appear in the following table.

Power requirements

Power supply	Current limit	Maximum design current	Normal current
+5 V	3.0 A	1.75 A	2.5 A
+12 V	2.5 A	1.75 A	0.13 A
-12 V	0.5 A	0.13 A	0.05 A

Additional NT4X70 power requirements appear in the following table.

Additional power requirements

	Voltage imput (ac) 60 Hz	Voltage imput (dc)
Nominal	115 V	-48 V
Minimum	105 V	-42 V
Maximum	125 V	-56 V
Nominal current	0.5 (+0.1/-0.1) A	0.6 (+0.2/-0.1) A

Equipment dimensions

The NT4X70 controller unit dimensions follow:

- Height: 432 mm (17 in)
- Width: 660 mm (26 in)
- Depth: 140 mm (5.5 in)

The NT4X70 keyboard/display module dimensions follow:

- Height: 210 mm (8.25 in)
- Width: 203 mm (8 in)
- Depth: 305 mm (12 in)

Environmental conditions

The NT4X70 performs under limited environmental limits. These limits appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10 °C to 30 °C (50 °F to 86 °F)	5 °C to 49 °C (41 °F to 120.2 °F)
Relative humidity	20% to 55%	20% to 80%

Note: At an ambient temperature of 21 °C (69.8 °F), the relative humidity is a maximum of 80%. At an ambient temperature of 49 °C (120.2 °F), the relative humidity is a maximum of 30%.

NT4X70 (end)

Voice transmission impedance

The NT4X70 specifications for voice transmission impedance appear in the following table.

Voice transmission impedance

Path	Insertion loss at 1000 Hz	Input impedance	Output impedance
Transmit	0 to -32 dB	75 ohms	600 ohms
Receive	-4 to -36 dB	600 ohms	300 ohms

NT4X71

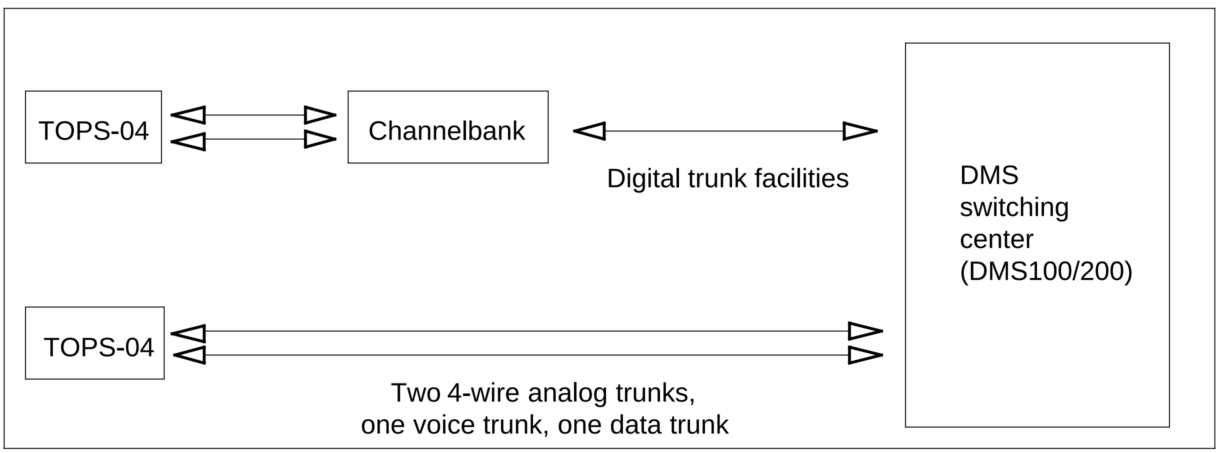
Product description

The Traffic Operator Position System-04 (TOPS-04) console provides an interface between the traffic operator and the DMS-100 Family of switches. The TOPS-04 console integrates with the switching system to provide the operator with the complete resources that toll and assist functions require. Toll and assist functions include routing, maintenance, administration, digit analysis and call detail recording.

The TOPS-04 console permits the traffic operator to exchange call-processing data with the switching system. The TOPS-04 console permits the traffic operator to exchange voice communication with the customer. The TOPS-04 console allows these two actions to occur at the same time. The TOPS-04 communicates over two four-wire analog trunks. One trunk is for voice. One trunk is for data.

The external interface of the TOPS-04 console with the DMS-100/200 configuration appears in the following figure.

NT4X71 TOPS-04 interface to the switching center



For local applications, the analog trunks connect to appropriate analog facilities on the DMS. For remote applications, the analog trunks can connect to a channel bank. The channel bank terminates the appropriate digital trunk facilities from the DMS.

The primary features of the NT4X71 follow:

- provides monitor display, 16 rows by 64 characters.
- provides keyboard, 79 keys.

NT4X71 (continued)

- provides duplex data transmission at 300 b/s.
- provides French or English language selection

Location

The NT4X71 is at the operator position.

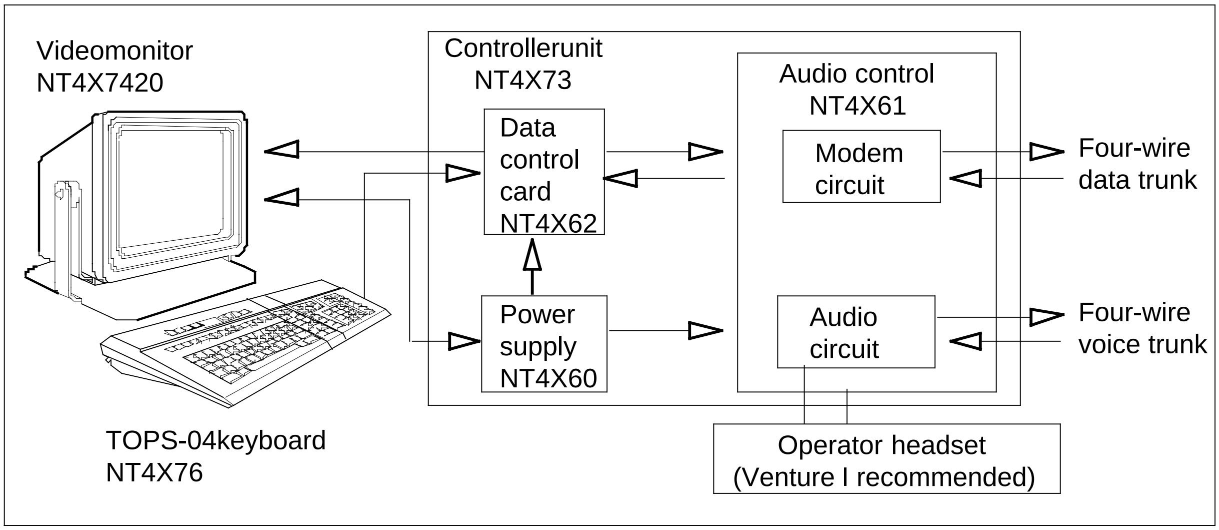
Functional description

The TOPS-04 console contains the following parts:

- TOPS 12 VDC monitor (NT4X7420).
- TOPS keyboard DMS regular (NT4X76AA).
- Controller unit (NT4X73).
- data control circuit card (NT4X62AA).
- audio control circuit card (NT4X61AA).
- TOPS power supply (NT4X60AB).
- operator headset (Venture headset recommended).

The NT4X71 configuration appears in the following figure.

NT4X71 TOPS-04 console configuration



Video monitor

The video monitor is a 12 in diagonal monochrome CRT. The video monitor receives a video signal from the controller circuit and displays characters in upper case. These characters appear in normal or flashing mode.

Keyboard

The keyboard contains 79 solid-state switches. These keys generate alphanumeric and symbol characters. Some of the keys generate control characters. The keyboard generates 125 ASCII characters.

Controller unit

The controller unit contains the audio control card, data control card and power supply.

Audio control card

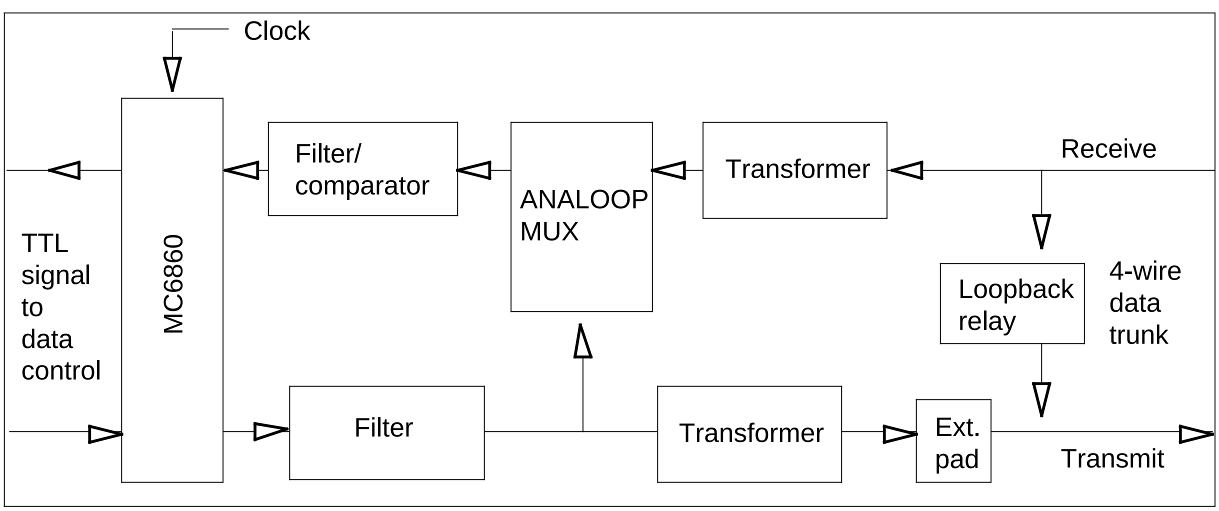
The audio control card contains the following two functional components:

- modem circuit
- audio circuit

In the receive direction, the modem circuit receives asynchronous serial data from the four-wire trunks. The modem circuit converts data from frequency shift key (FSK) transmission to transistor-transistor logic (TTL) level signals. The modem circuit transmits the serial data to the data control card.

In the transmit direction, the modem circuit receives asynchronous serial TTL data from the data control card. The modem circuit converts the asynchronous serial TTL data to an FSK signal for transmission on the four-wire analog trunks. The modem circuit for the audio control card appears in the following figure.

NT4X71 Audio control card, modem circuit



NT4X71 (continued)

A comparison of the activity sequence for received data in comparison with transmitted data for the modem circuit appears in the following table.

Receive and transmit activity sequence

Receive **(FSK signals from the data trunk)**	**Transmit** **(TTL signals from the data control card)**
The transformer receives data.	The modem circuit card receives data.
Data passes to the ANALOOP multiplexer (MUX).	The MC6860 chip and the filter/comparator circuit convert data to an FSK signal.
Data passes to the filter/comparator circuit when the modem is not in ANALOOP test mode.	Data passes through the transformer to the external pad circuit.
The filter/comparator circuit and the MC6860 convert data to a TTL signal.	The pad attenuates data. Data is transmitted on the four-wire data trunk.
Data transmits to the data control card.	
Note: The receive sequence assumes that the loopback relay is not active.	

The modem circuit has two test modes, the LOOPBACK test mode and the ANALOG test mode. A message from the central controller (CC) initiates the LOOPBACK test mode. The LOOPBACK test mode tests the trunk facilities between the switching center and the TOPS-04. The LOOPBACK test mode provides a direct connection between the incoming (IC) and outgoing (OG) trunk. The connection occurs for the voice and data trunks in the sequence given.

The ANALOOP test mode tests the modem circuit and data control card. The ANALOOP test routes the data again from the data control card back to the data control card. A switch on the face plate of the audio control card or the data control card initiates the ANALOOP test.

A comparison of the ANALOOP test mode and the LOOPBACK test mode appears in the following table.

ANLOOP and LOOPBACK activity sequence

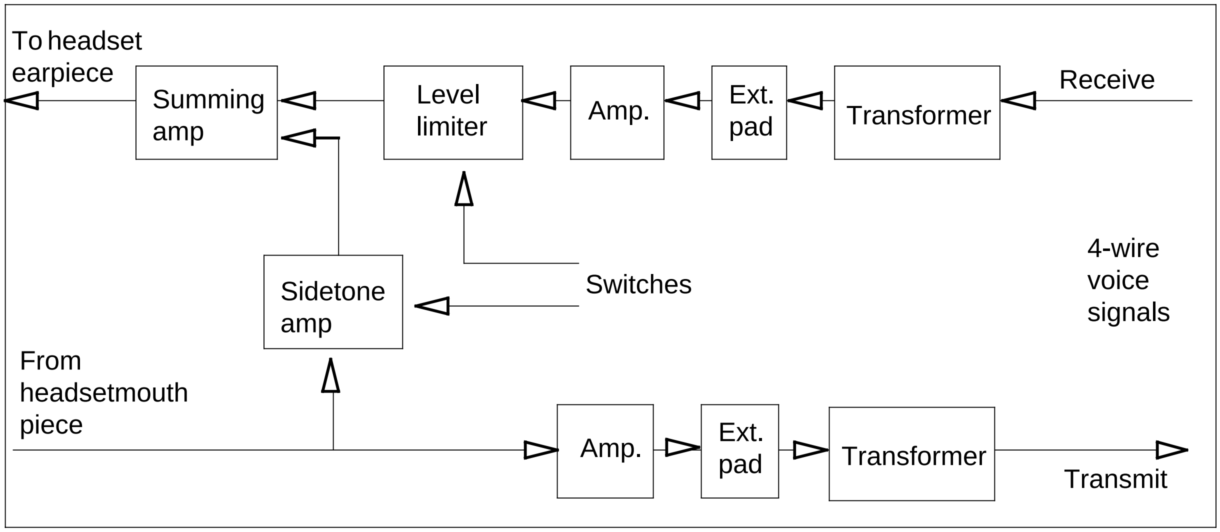
ANLOOP mode	LOOPBACK mode
The modem circuit card receives data.	The DMS sends a command to the data control card.
The filter/comparator circuit and the MC6860 chip converts data from a TTL signal to an FSK signal.	The data control card sends a signal to the modem circuit to operate the loopback relay.
The ANALOOP multiplexer (MUX) routes data back to the receive circuits.	The LOOPBACK relay shunts the incoming FSK signal from the IC trunk to the OG trunk.
The filter/comparator circuit and the MC6860 chip converts data from an FSK signal back to a TTL signal.	
Data is transmitted to the data control card.	
Note: The ANALOOP sequence assumes that the modem is in ANALOOP mode	

The audio circuit receives voice signals on the four-wire voice trunk. These voice signals are passed to the operator headset. The audio circuit transmits voice signals received from the operator headset to the four-wire voice trunk. The audio circuit provides switches to define the analog gain for sidetone feedback. The audio circuit provides switches to limit the level for incoming customer voice signals.

The audio circuit for the audio control card appears in the following figure.

NT4X71 (continued)

NT4X71 Audio control card, audio circuit



A comparison of the activity sequence for received data to transmitted data for the audio circuit of the audio control card appears in the following table.

Receive and transmit comparison

Receive	Transmit
The transformer receives data from the four-wire voice trunk. Data passes through the transformer and attenuates in an external pad.	Data passes from the mouthpiece through an amplifier and sidetone amplifier. To change the gain of the sidetone amplifier, use switches. The signal passes through an external pad circuit, an amplifier and a transformer. This event occurs before the signal transmits to the DMS over the four-wire voice trunk.
Data passes through an amplifier and a level-limiting circuit. This action makes sure that the incoming voice signal does not exceed a set power level. Data passes through a summing amplifier that combines a sidetone signal with the incoming voice signal. This action drives the operator headsets.	Sidetone feedback allows you to hear the operator voice in the headset earpiece.

Data control card

The data control card controls all data that the CC or the switching center and the operator exchange. This circuit card contains circuits to perform the following actions:

- exchange asynchronous serial data with the modem circuit
- receive data from the keyboard
- output the video signal to the monitor
- output characters to a blind operator interface
- initiate self-tests (ANALOOP) and perform warm and cold restarts

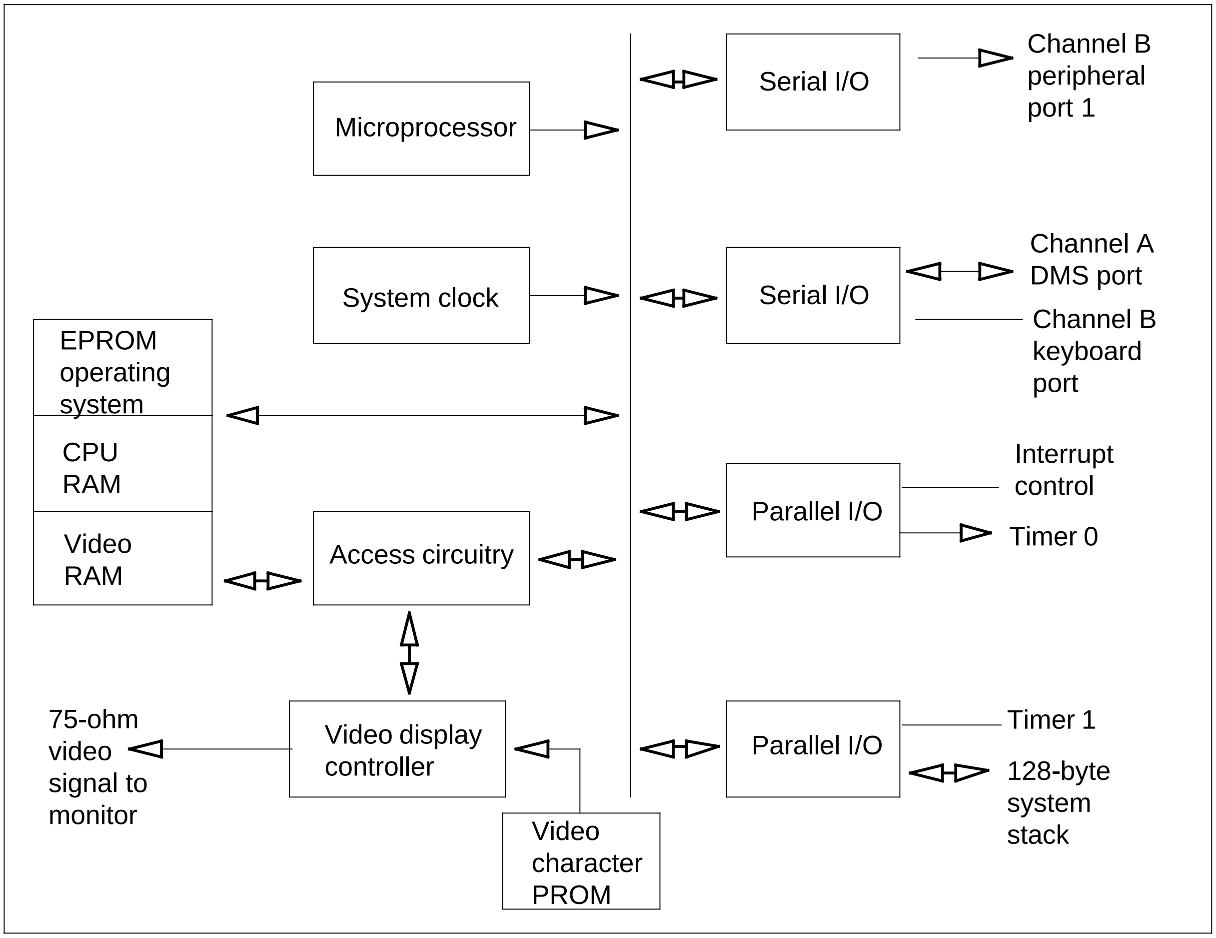
The data control card is a bus-oriented design that contains the following parts:

- one microprocessor
- two serial input/output (I/O) chips
- two parallel I/O chips
- erasable programmable read only memory (EPROM) operating system
- CPU scratch and video display RAM
- video controller
- crystal oscillator system clock
- switches

The data control card circuits appear in the following figure.

NT4X71 (continued)

NT4X71 Data control card



The microprocessor is an 8-bit CPU and the bus master of this circuit card. This microprocessor runs at a clock speed of 4.9152 MHz. Each of the two serial I/O (SIO) devices contain two bidirectional serial ports that are channels A and B. The two SIO devices are port-mapped and interrupt-driven.

Channel B on the first SIO device in the figure above transmits and receives serial data with the optional blind operator interface. These events occur at a rate of 300 b/s. Channel B is the peripheral port 1.

Channel A on the second SIO device transmits and receives serial data between the data control card and the modem circuit. These events occur at a rate of 300 b/s. Channel A is the DMS port. The data path between the data control card and the modem circuit occurs through the connector plug.

Channel B on the second SIO device receives ASCII character code output from keyboard at a rate of 9600 b/s. Channel B is the keyboard port.

The parallel I/O devices perform the following functions:

- use timer 0 (50-ms interrupt timer) for debounce timing of the headset
- use timer 1 (4 Hz video flash clock) to generate characters that flash
- use system stack, 128-byte

The EPROM operating system occupies the first 16 Kbytes of address locations. The CPU uses 4 Kbytes of RAM for dynamic variables. The video display is stored in 8 Kbytes of RAM. The microprocessor and the video controller can access the video RAM.

The video controller outputs a 75 ohm video signal. This signal depends on the characters in the video output RAM and the video character programmable read only memory (PROM). The video character PROM controls English or French character output.

The switches on the data control card control language selection for TOPS-04 display. The crystal oscillator produces a 4.9152 MHz system clock. The CPU uses the 4.9152 MHz system clock.

When you turn the power to the TOPS-04 console on, the data control card performs a cold restart. The cold restart initiates the following diagnostics and memory checks:

- CPU maze test
- ROM checksum
- RAM test
- SIO test
- modem test

The cold restart places the modem circuit in ANALOOP test mode for one second. This action establishes communication with the DMS. The ANALOOP test mode causes the modem circuit to establish a transmit carrier to the DMS.

When the operator headset is seated, the data control card performs a warm restart. A warm restart performs some diagnostics. A warm restart does not disturb the RAM or modem circuit.

NT4X71 (continued)

Power supply

The power supply (NT4X60AB) produces a set of dc current voltages. This event occurs from a 115 V (ac) 50/60 Hz source or a -48 V source.

Voice and data path

For the voice path, the following event occurs. The audio circuit in the audio control unit passes voice communication between the operator headset and the four-wire voice trunk. For the data path, the following event occurs. The modem circuit in the audio control unit converts the data signals that the modem circuit receives on the four-wire trunks. The modem circuit converts the signals from an analog signal to a digital signal. These data signals are passed to the data control card. The data control card uses these signals to produce an output on the video monitor.

The data control card receives data signals from the keyboard. The data control card passes the data signals to the modem circuit. The modem circuit converts the keyboard data to an analog signal for transmission over the four-wire data trunk.

TOPS-04/TUTOR-3B data path

The TOPS-04 console communicates with the TUTOR-3B training adapter (NT4X77). A connector plug that exchanges RS-232-C level signals allows access to data signals. The Electronic Industry Association (EIA) defines the RS-232-C level signals.

Data signals from the four-wire data trunk pass through the following circuits. The data signals must pass through the circuits before the data signals become accessible to the processor circuits of the data control card:

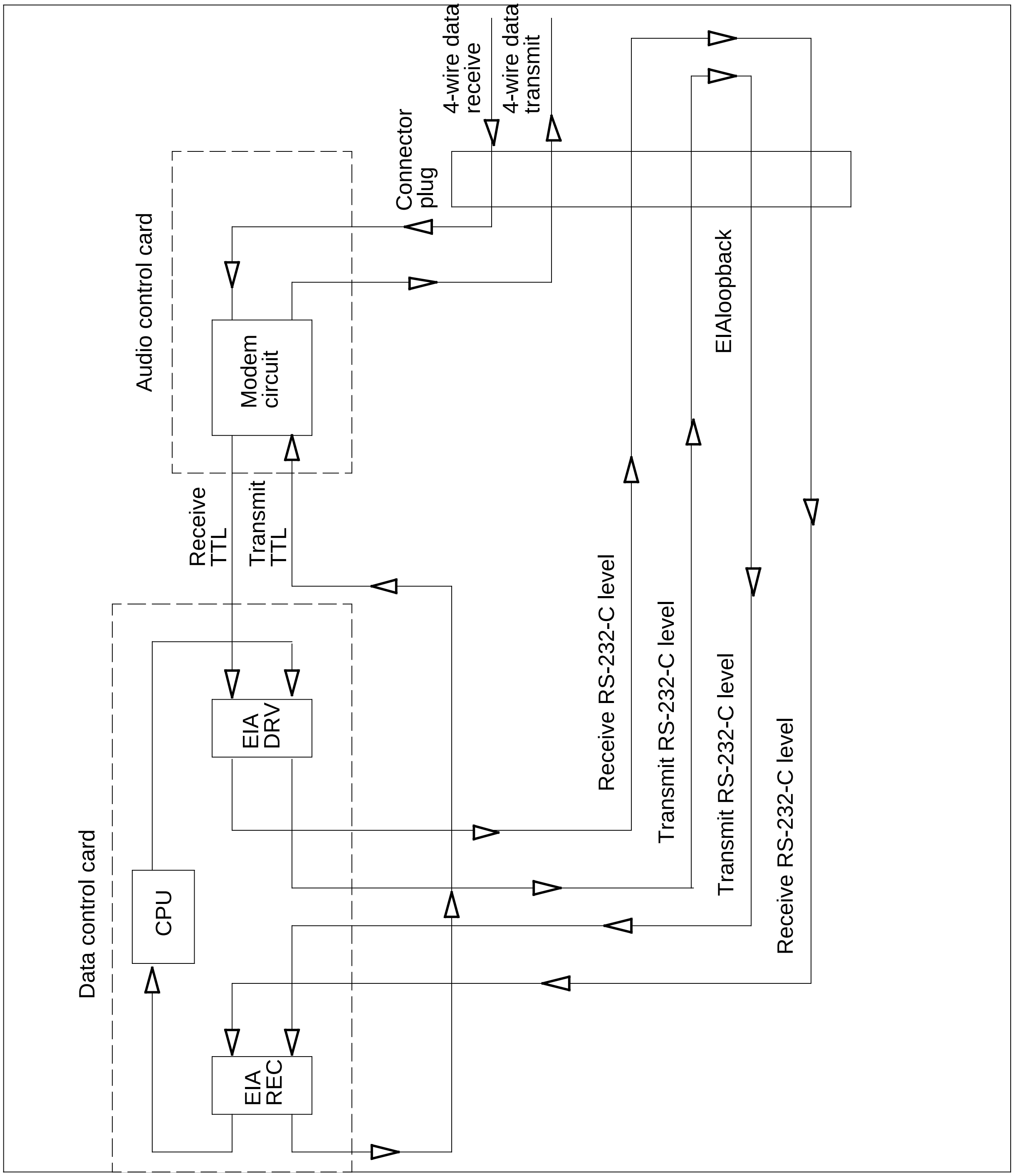
- FSK signals from the audio control circuit are routed to the EIA drivers (DRV) on the data control card.
- TTL signals from the audio control circuit are routed to the EIA DRV on the data control circuit.
- EIA drivers convert the received TTL signals to an RS-232-C level signal.
- The received RS-232-C level signals are routed through the connector plug. After this event, the signals are routed back to the EIA receivers on the data control card.
- The EIA receivers convert the data signals back to TTL signals. The processor circuits on the data control card uses the data signals.

The EIA drives convert data signals that the TOPS-04 console must transmit on the four-wire data trunk. The EIA drivers convert the data signals from TTL to RS-232-C level signals. These data signals route through the connector plug back to TTL before the data signals are sent to the audio control card. The audio control card converts the data signals to FSK for transmission to the four-wire data trunk.

The data path of the transmit (XMIT) and receive (REC) data signals appear in the following figure.

NT4X71 (continued)

NT4X71 Data path between audio and data control cards



Technical data

The technical data section provides specifications for the NT4X71 for the following:

- power requirements
- environmental conditions
- voice transmission specifications
- switch settings
- data transmission characteristics
- equipment dimensions

Power requirements

The NT4X71 input power requirements appear in the following table.

Input power requirements

Voltage	50/60 Hz(ac)	dc
Nominal	115	-48
Minimum	105	-42
Maximum	125	-56
Nominal current	0.5(±0.1)A	0.6(±0.2.-0.1)A

The NT4X71output power requirements appear in the following table.

Output power requirements

V(dc)	Typicalcurrent	Maximumdesign current	Currentlimit)
+5	1.20 A	1.75 A	3.0 A
+12	1.10 A	1.75 A	2.5 A
-12	0.05 A	0.13 A	0.5 A

NT4X71 (continued)

Environmental conditions

The NT4X71 performs under limited environmental controls which appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	4°C to 38°C (34.2°F to 53.1°F)	5°C to 49°C (41°F to 120.2°F)
Relative humidity	20% to 55%	20% to 80%

Note: At an ambient temperature of 21 °C (69.8 °F), the relative humidity is a maximum of 80%. At an ambient temperature of 49 °C (120.2 °F), the relative humidity is a maximum of 30%.

Voice transmission requirements

The NT4X71 voice transmission requirements appear in the following table.

Voice transmission requirement

Path	Input impedance	Output impedance	Signal strength
Transmit	75 ohms	600 ohms	Amplifier: +13 dB gain at 1000 Hz External pad: 0 to -32 dB attenuation at 1000 Hz
Receive	600 ohms	300 ohms	Amplifier: +1 dB gain at 1000 Hz

Switch settings

The NT4X71 switch settings appear in the following table.

Switch settings

Switch	Probe 600 ohms (dBm)	Probe 300 ohms (dBm)	S3-1	S3-2	Setting S3-3	S2-1	S2-2
S3	No limit	No limit	OFF	OFF	OFF	-	-
(Audio control card headset audio limiting level)	-25.0	-22.0	OFF	OFF	ON	-	-
	-28.3	-25.3	OFF	ON	OFF	-	-
	-34.0	-31.0	ON	OFF	OFF	-	-
	-37.5	-34.5	ON	ON	OFF	-	-
S2 (Audio control card sidetone limiting level)	No sidetone	No sidetone	-	-	-	OFF	OFF
	-19	-16	-	-	-	OFF	ON
	-15	-12	-	-	-	ON	OFF
	-11	-8	-	-	-	ON	ON

Data transmission characteristics

The NT4X71 data transmit and receive requirements appear in the tables on page 13. The transmission rate is 300 b/s.

Transmit path characteristics

CPU TTL output (logic)	Modem EIA input (electrical)	Modem output(frequency)
1	-V	1270 Hz (±10 Hz)
0	+V	1070 Hz (±10 Hz)

Note: You can adjust the level of the modem output level from 0 to -19 dBm.

Receive path characteristics

CPU TTL input (logic)	Modem EIA output (electrical)	Modem input (frequency)
1	-V	2225 Hz (±10 Hz)
0	+V	2025 Hz (±10 Hz)

Note: The modem receive level is 0 to -30 dBm.

Equipment dimensions

The NT4X71 monitor dimensions follow:

- Height: 414 mm (16.3 in.)
- Width: 457 mm (18 in.)
- Depth: 325 mm (12.8 in.)

The NT4X71 keyboard dimensions follow:

- Height: 76.2 mm (3 in.)
- Width: 407 mm (18.5 in.)
- Depth: 229 mm (12.8 in.)

The NT4X71 controller unit dimensions follow:

- Height: 432 mm (17 in.)
- Width: 660 mm (26 in.)
- Depth: 140 mm (5.5 in.)

NT4X77

Product description

The TUTOR-3B TOPS training adapter is a programmed controller that trains operators at the Traffic Operator Position System (TOPS) console. The NT4X77 simulates traffic and provides feedback to the trainee. The TUTOR-3B TOPS training adapter contains the TUTOR-3B display unit and the TUTOR-3B traffic simulator.

The TUTOR-3B display unit contains the display unit circuit card QPY313B. The TUTOR-3B traffic simulator contains the following components:

- cassette tape drive
- cassette motion controller circuit card (NT4X64BB)
- pre-amp circuit card (QPY370)
- audio control circuit card (QM984A/QM995A)
- central processor unit (CPU) input/output (I/O) circuit card (NT4X64BA)

Features

The primary usage features of the NT4X77 are as follows:

- simulates call-processing traffic at a TOPS console
- provides traffic simulation separate from the switch
- switches between live traffic mode and simulated traffic mode
- provides accurate customer voice from the audio cassette
- provides feedback to trainee for correct and incorrect keyboard and voice response
- displays a continuous summary of trainee performance
- switches between manual and automatic tape control

Location

The NT4X77 is at a customer-specified training location.

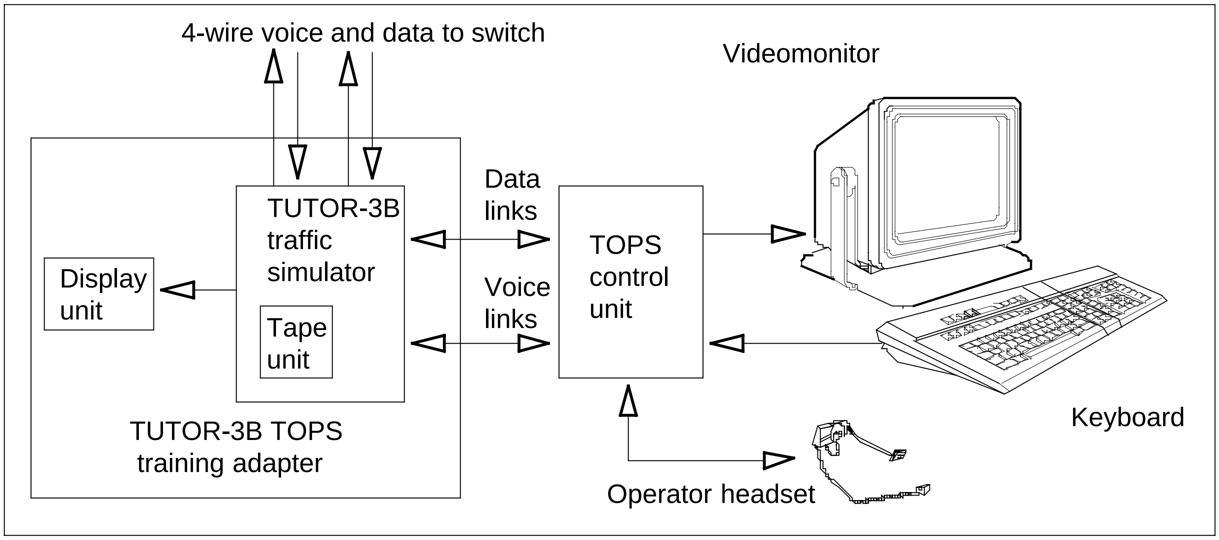
Functional description

The NT4X77 requires a course work cassette tape and a TOPS console (NT4X71). The TOPS console is the I/O device for the NT4X77. The cassette tape provides voice to the TOPS headset and data for the NT4X77 CPU and the TOPS monitor.

The interaction of the NT4X77 and the TOPS console appear in the following figure.

NT4X77 (continued)

NT4X77 External interface from the NT4X77 system



The TUTOR-3B traffic simulator communicates with the TOPS console by two sets of links. One set of links carries voice. The other set of links carries data. The NT4X77 also can connect the four-wire voice and data links from the switch. The power switch on the NT4X77 faceplate allows the TOPS console to switch between training mode and customer interface mode.

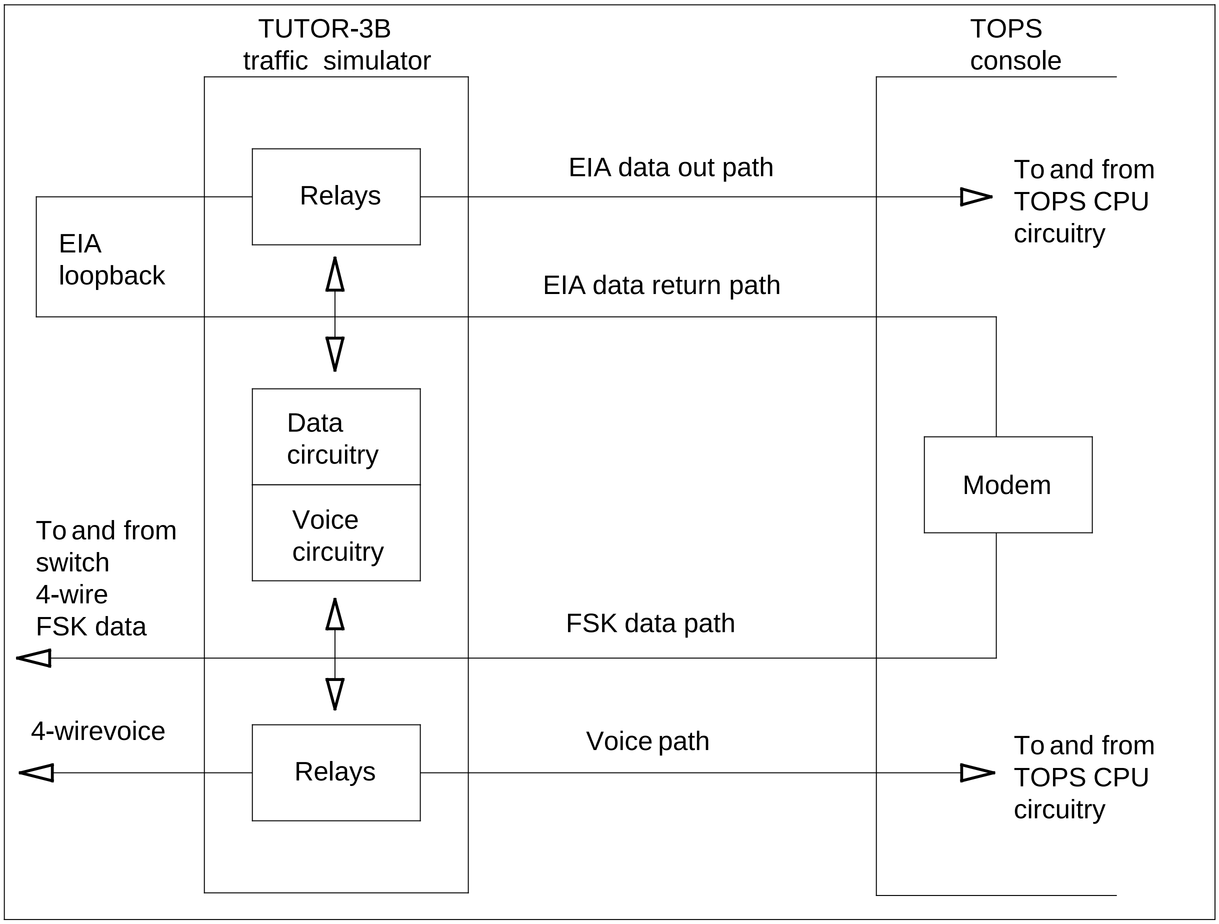
Signal paths

To switch between the two modes, provision the NT4X77 to make or break the voice and data paths. The paths are between the TOPS console and the switch. When the power to the NT4X77 is OFF, the TOPS console communicates with the switch. When the NT4X77 is turned ON, the voice and data paths between the switch and the TOPS console are broken. The NT4X77 and TOPS console have established communication.

The voice and data paths between the NT4X77 and TOPS console appear in the following figure.

NT4X77 (continued)

NT4X77 Voice and data path between TOPS and NT4X77



OFF setting

When the NT4X77 is OFF, the four-wire *voice signals* from the switch pass without interruptions through the relays of the NT4X77. The four-wire voice signals travel to the TOPS console.

When the NT4X77 is OFF, the *data signals* from the switch to the TOPS console pass through the circuits as follows:

1. Frequency shift key (FSK) data signals from the switch pass without interruptions to the TOPS modem along the FSK data path.
2. The modem converts the FSK signals to RS-232 level Electronic Industry Association (EIA) signals.
3. The EIA data signals return to the NT4X77 with the EIA data path.

NT4X77 (continued)

4. The EIA data signals are looped back to the relays in the NT4X77.
5. When the NT4X77 is OFF, the EIA signals pass through the relays to the TOPS CPU circuits with the EIA data path.

ON setting

When the NT4X77 is ON, the relays break the *voice path* between the TOPS and the switch. The NT4X77 voice circuits and the TOPS console exchange voice signals.

When the NT4X77 is ON, the relay breaks the EIA *data path* between the modem and the CPU circuits. A data signals exchange occurs between the NT4X77 data circuits and the TOPS CPU circuits exchange voice signals.

> ***Note:*** Communication between the NT4X77 and the TOPS console does not require a modem in the NT4X77. The system still maintains a modem carrier signal between the TOPS modem and the switch during training mode.

Connector plugs

All connections between the switch, the TUTOR-3B traffic simulator, and TOPS terminate on connector plugs. A description of the connector plugs appears in the table below.

Connector plug functions

Plug no.	Function
J01	The J01 connector plug provides connection to the display unit. Connect the display unit for correct operation.
J02	The J02 connector plug provides DMS connection and EIA data loopback. The NT4X77 functions separate from the DMS. You do not have to provision the J02 connector plug.
J03	The J03 connector plug provides connection to the TOPS console.

Functional blocks

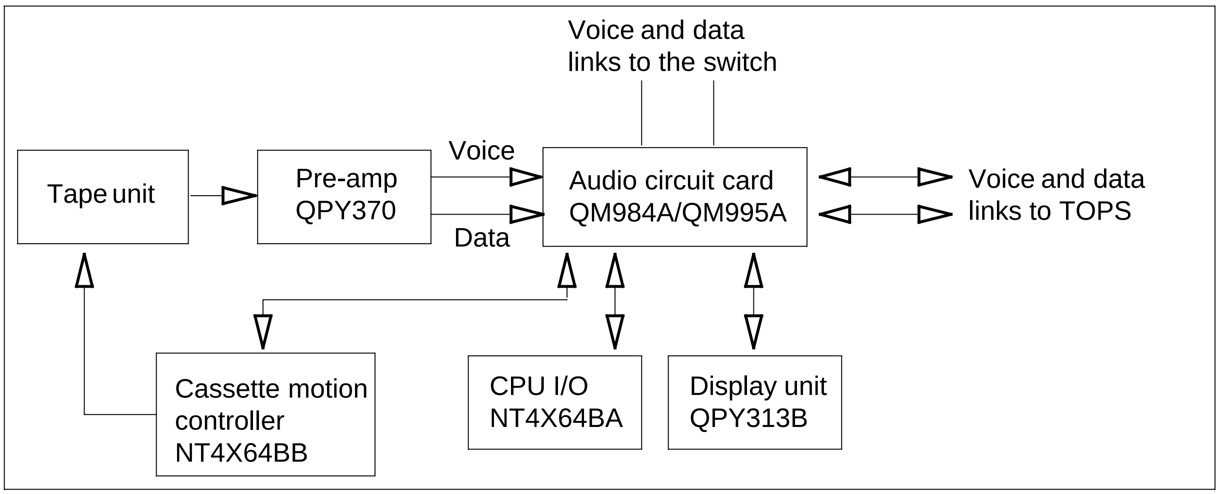
The NT4X77 has the following functional blocks:

- tape unit
- cassette motion controller card (NT4X64BB)

- pre-amp (QPY370)
- audio circuit card (QM984A/QM995A)
- CPU I/O circuit card (NT4X64BA)
- display unit (QPY313B)

The internal operation of the NT4X77 appears in the following figure.

NT4X77 Internal operation



Tape unit

The tape unit reads the course work information from a C-60, two-track, Phillips cassette. One track carries voice signals and the other track carries CPU data. You can play the tape in one direction only because the data uses both cassette tape tracks.

The tape unit on the TUTOR-3B traffic simulator is the Phi-Technologies Opto-Tack Deck model 5-087. The motion control circuit card operates the Phi-Technologies Opto-Tack Deck model 5-087 from a distance. To accomplish remote control, provide power to the correct motor at the correct

NT4X77 (continued)

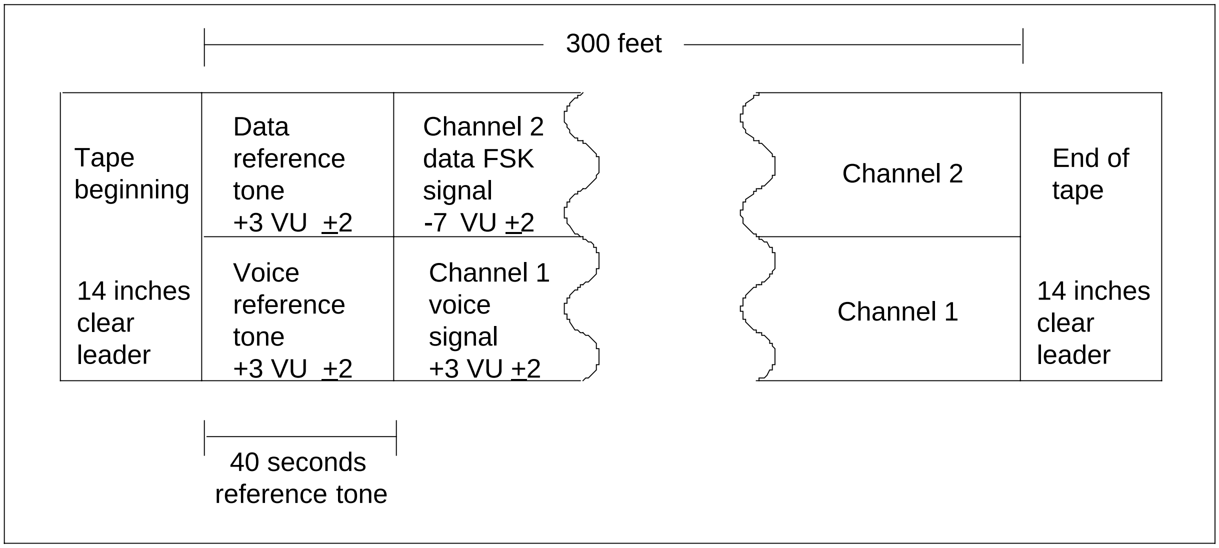
time. A description of the tape unit that contains the circuits appears in the following table.

Tape unit circuits

Circuits	Function
Forward and reverse reel-drive	This drive uses dc motors that are not regulated for fast forward and reverse. These motors operate on power the motion control card supplies.
Capstan drive Opto-Tach drive	This drive uses a dc motor that are not regulated for the play mode. An optical sensor provides feedback to the circuits on the motion control card to regulate the tape speed.
Cassette-in-place sensor	This sensor is a switch mechanism that outputs a cassette-in-place signal to the motion control card when the cassette tape is correctly seated.
Beginning-of-tape and end-of-tape sensors	A lamp and photocell circuits generate these signals. The lamp and photocell circuits detects the clear leader at the beginning and end of the tape.
Two-channel, two-track read head	This read head reads the voice and data signals on the cassette tape. The two-channel, two-track format means that you can play the tape in one direction only.

Program all course work on a standard C-60 Phillips cassette in a two-channel, two-track format. Use one track for voice. Use the other track for data. The cassette tape format appears in the following figure.

NT4X77 Cassette tape format



The beginning and end of the tape consists of a clear leader. The photocell and lamp circuits on the cassette unit detect the clear leader.

Each master provides a 40 s reference tone to make sure the correct recording level on the duplicates is present.

Record the cassette data signals as FSK tones. Use the following bit protocol for the exchange of the transmitted and received data:

- one start bit
- seven data bits for each ASCII character
- one parity bit
- one stop bit

Cassette motion controller card (NT4X64BB)

The cassette motion controller card is responsible for the following functions:

- provides cassette-in-place and clear-leader, oxide-detected status signals to the audio circuit card
- provides forward and reverse tape motor drive
- detects tape motion operating conditions that are not proper
- initiates reel braking on a stop signal or an end-of-tape signal
- drives the rewind motor backward in fast forward mode to provide a boost

NT4X77 (continued)

- drives the forward motor backward in rewind mode to provide a boost
- provides forward take-up delay which makes sure that the read head of the tape unit is in place. This function makes sure that the tape pinch roller engaged the capstan drive spindle before the forward reel activates.

Pre-amp (QPY370)

Send the data and voice signals from the tape to the pre-amp circuit card. Amplify data and voice signals to compensate for the frequency response of the cassette tape heads.

Audio circuit card (QM984A/QM995A)

The audio circuit card is the central interface and buffer for voice, data, status, and control signals. The audio circuit card passes voice signals from the pre-amp to the TOPS console headset. The audio circuit card detects trainee voice signals received for the TOPS console headset. The audio circuit card adds an error tone to the voice signal when the trainee response is not correct. Add the error tone on a signal from the CPU I/O circuit card.

The audio circuit card processes data signals from the pre-amp circuit card. The cassette data signals from the pre-amp circuit card are received as FSK signals. The cassette data signals convert to transistor-transistor logic (TTL) signals before the signals are sent to the CPU I/O circuit card.

The audio circuit card processes data signals from the TOPS console. The TTL data signals are received from the CPU I/O circuit card. The TTL data signals convert to EIA signals. The TTL data signals transfer to the TOPS console.

The audio circuit card provides tape motion control arbitration. Tape motion signals are received from the CPU I/O circuit card, switches on the display unit, or switches on the training simulator. The tape motion control arbitration circuits buffers the tape motion signals. The tape motion control arbitration circuits sends one signal at a time to the tape motion control circuit card.

The audio circuit card exchanges status and control signals between the following:

- the CPU I/O circuit card
- the cassette motion controller circuit card
- the display unit

CPU I/O circuit card (NT4X64BA)

The CPU I/O circuit card is the central controller (CC) for the NT4X77. The CPU I/O circuit card interfaces with the audio control circuit card to receive status and control signals from the following sources:

- cassette tape drive
- TOPS keyboard
- display unit
- cassette motion controller circuit card

The CPU uses these data signals to provide the following functions:

- format the TOPS display
- determine the expected keyboard or voice response, or both
- insert the error tone into the outgoing voice path
- control tape motion
- control output of the display unit

Display unit (QPY313B)

The display unit is the primary interface between the trainee or supervisor and the TUTOR-3B traffic simulator. The display unit has a set of switches and a set of light-emitting diodes (LEDs). The LEDs indicate the development of the present training session. The switches control tape motion and display unit output.

Signals from the CPU I/O circuit card drive the display unit. All signals to and from the display unit pass through the audio circuit card. The switches on the display unit are in series with the switches on the training simulator. You cannot operate the unless a display unit connects to the simulator.

The display unit contains the following circuits:

- seven-segment LED displaying elapsed time of current training session clock
- seven-segment LED displaying total number of wrong calls
- seven-segment LED displaying present simulation call number
- indicator LED displaying the number of erroneous calls the trainee made
- indicator LED signaling that a call processed correctly and the tape can advance

Note: Use this LED when the tape motion is in manual mode.

NT4X77 (continued)

- indicator LED displaying state of the tape motion (play, fast forward, reverse, and stop)
- switches controlling tape motion (play, fast forward, reverse, and stop)
- switches controlling display unit output mode (on, off)
- switches controlling tape advance mode (manual, automatic)

Note: In manual mode, this switch provides for manual tape advance.

Technical data

The technical data section provides specifications for the following:

- NT4X77 power requirements
- equipment dimensions
- environmental conditions
- cassette tape specifications
- pre-amp signal amplification
- FSK signals on tape
- EIA transmission specifications

Power requirements

The power supply produces +5 V, +12 V, and -12 V (dc) for all circuit cards. The power source is a standard 120 V (ac) 60-Hz electrical outlet. The power wiring is shielded and filtered to reduce transient noise. The NT4X77 power requirements appear in the following table.

Power requirements

Voltage	+5 V (dc)
	+12 V (dc)
	-12 V (dc)
Standard current draw	2.5 A
	550 mA
	135 mA
Input voltage	115 V (ac) at 60 Hz
Standard current draw	0.6 A (rms)
Reel-drive dc motor nominal voltage	8 V
Reel-drive dc motor nominal current	500 mA

Equipment dimensions

The NT4X77 dimensions are

- height: 584 mm (23 in.)
- width: 260 mm (10.25 in.)
- depth: 591 mm (23.25 in.)
- weight: 23 kg (50.5 lb)

Environmental conditions

The NT4X77 performs under limited environmental conditions that appear in the following table.

Ambient conditions

Conditions	Operating range	Short-term range
Temperature	10°C to 30°C	5°C to 49°C
	50°F to 86°F	41°F to 120.2°F
Relative humidity	20° to 55°	20° to 80°
Note: Expect a relative humidity of 80% at an ambient temperature of 21°C (69.8°F) maximum. At anambient temperature of 49°C (120.2°F), expect the relative humidity to be 30° maximum.		

Cassette tape specifications

The NT4X77 cassette tape specifications appear in the following table.

Cassette tape recording levels

Segment	Recording levels (volume units)	Channel
Reference tone data	+3 ±2	1
Reference tone voice	+3 ±2	2
Signal level data	-7 ±2	1
Signal level voice	+3 ±2	2
Note: The tape playback speed is 1.875 in. for each second.		

NT4X77 (end)

Pre-amp signal amplification

The NT4X77 pre-amp signal amplification specifications appear in the following table.

Pre-amp signal amplification

Signal	Amplification
Data signals	70 dB
Voice signals	50 dB

FSK signals on tape

The NT4X77 specifications for FSK signals on tape appear in the following table.

FSK signals on tape

FSK tone from tape (frequency)	TTL output from audio circuit card (logical)	Destination
1.6 kHz	0	space
1.0 kHz	1	mark

EIA transmission specifications

The specifications for EIA transmission between and TOPS appear in the following table.

EAI transmission specifications

EIA signal (frequency)	TTL signal (logical)	Destination
+V	0	space
-V	1	mark
Note: Data transmission and reception of asynchronous serial data is at a rate of 300 b/s.		

NT4X80BA

Product description

The NT4X80BA, 1 Mword metallic oxide semiconductor (MOS) memory card provides memory storage for a maximum of 1 048 576 words. This storage is 17 bits in width. The card uses 256 kbyte-by-1-bit N-channel MOS dynamic memory devices.

Buffer the address and data signals on the NT4X80BA card to prevent an excess of bus loading. The card contains a small amount of logic to make sure correct device handling occurs. The card does not provide sequential timing. The card depends on external inputs to provide correct timing.

The NT4X80BA operates in DMS-100 memory shelves NT3X32 and combined CPU/memory shelves NT3X41. The memory controller NT4X79AA or NT3X94AA supplies the card selection and control signals. The connector, card keying, and signal/pin assignment for common signals are the same as for the NT3X40/93.

The memory card can expand.

Functional description

Functional blocks

The 1 Mword memory card consists of the following functional blocks:

- memory array
- memory block decode
- address multiplexer and buffer
- data buffers
- control logic

Signaling

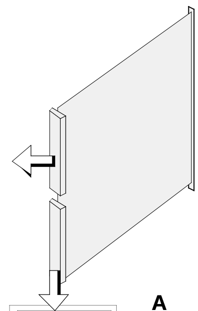
Pin numbers

The pin numbers for the NT4X80BA appear in the following figure.

NT4X80BA (continued)

NT4X80BA pin numbers

		A	B
1A	1B	Gnd	Gnd
2A	2B	+5V	+5V
3A	3B	+5V	+5V
4A	4B	Gnd	+5V
5A	5B		
6A	6B		
7A	7B	Gnd	Gnd
8A	8B	IMAD08-	IMAD09-
9A	9B	IMAD10-	IMAD11-
10A	10B	IMAD12-	IMAD13-
11A	11B	IMAD14-	IMAD15-
12A	12B	IMDT00-	IMDT01-
13A	13B	IMDT02-	IMDT03-
14A	14B	IMDT04-	IMDT05-
15A	15B	IMDT06-	IMDT07-
16A	16B		
17A	17B		
18A	18B	IMAD18-	IMAD19-
19A	19B		
20A	20B		
21A	21B		
22A	22B		
23A	23B		
24A	24B		
25A	25B		
26A	26B		
27A	27B		
28A	28B		
29A	29B		
30A	30B		
31A	31B	EN4X256-	Gnd
32A	32B	REFRESH	Gnd
33A	33B	IMAD17-	Gnd
34A	34B	MCP-	Gnd
35A	35B	CLK-	Gnd
36A	36B	WE-	Gnd
37A	37B		Gnd
38A	38B	DBEN-	Gnd
39A	39B		Gnd
40A	40B	Gnd	Gnd



		A	B
41A	41B		
42A	42B		
43A	43B		
44A	44B		
45A	45B		
46A	46B		
47A	47B		
48A	48B		
49A	49B		
50A	50B		
51A	51B	IMAD16-	Gnd
52A	52B	IMDT16-	Gnd
53A	53B	IMDT17-	Gnd
54A	54B		Gnd
55A	55B	BEA-	Gnd
56A	56B	BEB-	Gnd
57A	57B	BEC-	Gnd
58A	58B	BED-	Gnd
59A	59B		Gnd
60A	60B		Gnd
61A	61B		
62A	62B		
63A	63B		
64A	64B		
65A	65B		
66A	66B		
67A	67B		
68A	68B		
69A	69B		
70A	70B		
71A	71B	IMDT08-	IMDT09-
72A	72B	IMDT10-	IMDT11-
73A	73B	IMDT12-	IMDT13-
74A	74B	IMDT14-	IMDT15-
75A	75B	IMAD00-	IMAD01-
76A	76B	IMAD02-	IMAD03-
77A	77B	IMAD04-	IMAD05-
78A	78B	IMAD06-	IMAD07-
79A	79B	+5V	+5V
80A	80B	Gnd	Gnd

Technical data

Set up

Two methods are present for card selection and board enable. The two methods depend on the equipment in use.

If you use the NT4X79AA memory controller with an NT4X80BA, EN4X256- and 3X31EN- (pins 31A and 16B) are pulled high. This condition enables U91 (2H1) that allows IMAD 19:18 to select the correct 256 Kword memory block on the card. The four board enables that BEA- to BED- are pulled high. Only BEA- is asserted to generate CRDEN+ (card enable).

In program store expansion, if you use the NT3X94AA memory controller, one NT4X80BA memory card can be configured to appear as four separate NT3X93AA memory cards. Four separate board enable signals are necessary, BEA- to BED-. To enable this feature, strap low EN4X256-. Strap board enables BEB- to BED- (pins 56, 57, 58A) to board enables BE8 to BE10 (pins 63, 64, 65A) on the memory controller. Each board enable BEA- to BED- enables the correct 256 Kword block on the 1 Mword card.

Backpanel termination

For best performance with a number of cards plugged into a backpanel, use the backpanel terminator NT3X4309. Fit the backpanel terminator in slot 21 on the rear of the backpanel.

Power requirements

Fusing

The +5 V supply enters the card on two groups of pins:

- group A: 2A, 2B, 3A, and 3B
- group B: 79A, and 79B

Each group is fused separately on the card. The fuses protect the backplane from short circuits on the card. This protection occurs so that an oncard short does not corrupt the backpanel supply.

Decoupling

Provide enough decoupling of the power supply because of the current pulse nature of the dynamic MOS and Shottky TTL this card uses.

Distribute a large number of 0.1 μF capacitors at approximately one for every two pack intervals.

Decouple the +5 V supply by 10 μF capacitors at both entry groups. The memory array has a 10 μF capacitor nearby. The 470 pF capacitors in parallel

NT4X80BA (end)

with the 10 µF capacitors reduce interference because of electostatic and electromagnetic interference.

Both +5 V entry groups have a series 3.3 µH inductor. This indicator reduces disturbance to the backplane power supply on card insertion. This indicator helps reduce the large current surge during refresh.

The power requirements for the NT4X80BA appear in the following table.

NT4X80BA power requirements

Voltage	Current		
+5 V	1.85 A typ	2.35 A max	refresh cycle
	2.25 A typ	2.75 max	normal address cycle
	1.6 A typ	2.1 A max	standby

NT4X80CA

Product description

The NT4X80CA provides a memory storage of 4 Mwords, 17 bits wide. The storage contains 16 bits of memory data and 1 bit of parity for the enhanced input/output controller (EIOC). All DMS-250 sites with EIOC require the NT4X80CA to support features in BCS30 and up.

Location

Insert the NT4X80CA card in current EIOC memory shelves with little modification to the back panel. To the controller, the 4 Mword card appears as four separate 1 Mword cards. You can mix the NT4X80CA card with NT4X80AA cards. The NT4X79AA memory controller can enable 1 Mword or 4 Mword cards. The supported memory configurations are 7, 10, 13 and 16.

When you use a 4 Mword memory card, four board-enables go to that card. This action allows a maximum of 4 Mwords of memory to be addressed. One board-enable goes to a 1 Mword card.

Functional description

The NT4X79AA memory controller handles 16 Mwords. The 16 separate board-enable signals are available. The NT4X80CA card has four board-enable signals to address 4 Mwords of available memory.

Functional blocks

NT4X80CA has the following blocks:

- control
- memory interface
- data transmitter and receiver
- memory (with 16 banks)

Control

The control block generates the control signals that the memory interface block and the memory uses.

Memory interface

The memory interface decodes the 16 internal memory banks.

Data transmitter and receiver

The data transmitter and receiver handles data to and from the memory controller card.

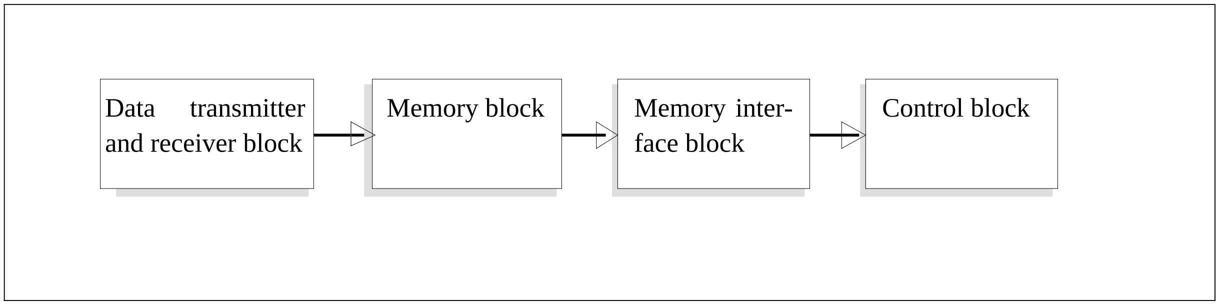
NT4X80CA (continued)

Memory

The memory block consists of 80 devices in 16 rows with five 256KX4 DRAM chips for each row. Four chips are for data. One chip is for parity. Each row is a bank. Four banks comprise a 1 Mword block. A bank is 256KX20, 16 bits for data and 1 bit for parity. Three bits are not used. The array consists of 16 memory banks.

The relationship between the functional blocks appears in the following figure.

NT4X80CA functional blocks



Signaling

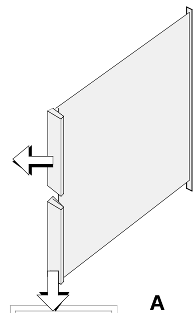
Pin numbers

The pin numbers for the NT4X80CA appear in the following figure.

NT4X80CA (continued)

NT4X80CA pin numbers

		A	B
1A	1B	GND	GND
2A	2B	+5 V	+5 V
3A	3B	+5 V	+5 V
4A	4B	GND	GND
5A	5B		
6A	6B		
7A	7B	GND	GND
8A	8B	IMAD08-	IMAD09-
9A	9B	IMAD10-	IMAD11-
10A	10B	IMAD12-	IMAD13-
11A	11B	IMAD14-	IMAD15-
12A	12B	IMDT00-	IMDT01-
13A	13B	IMDT02-	IMDT03-
14A	14B	IMDT04-	IMDT05-
15A	15B	IMDT06-	IMDT07-
16A	16B		
17A	17B		
18A	18B	IMDT18-	IMDT19-
19A	19B		
20A	20B		
21A	21B		
22A	22B		
23A	23B		
24A	24B		
25A	25B		
26A	26B	TESTPIN	
27A	27B		
28A	28B		
29A	29B		
30A	30B		
31A	31B		GND
32A	32B	REFRESH	GND
33A	33B	IMAD17-	GND
34A	34B	MCP-	GND
35A	35B	CLOCK-	GND
36A	36B	WE-	GND
37A	37B		GND
38A	38B	DBEN	GND
39A	39B		GND
40A	40B	GND	GND



		A	B
41A	41B		
42A	42B		
43A	43B		
44A	44B		
45A	45B		
46A	46B		
47A	47B		
48A	48B		
49A	49B		
50A	50B		
51A	51B	IMAD16-	GND
52A	52B	IMKT16-	GND
53A	53B		GND
54A	54B		GND
55A	55B	BEA-	GND
56A	56B	BEB-	GND
57A	57B	BEC-	GND
58A	58B	BED-	GND
59A	59B		GND
60A	60B		GND
61A	61B		
62A	62B		
63A	63B		
64A	64B		
65A	65B		
66A	66B		
67A	67B		
68A	68B		
69A	69B		
70A	70B		
71A	71B	IMDT08-	IMDT09-
72A	72B	IMTD10-	IMTD11-
73A	73B	IMTD12-	IMTD13-
74A	74B	IMTD14-	IMTD15-
75A	75B	IMAD00-	IMAD01-
76A	76B	IMAD02-	IMAD03-
77A	77B	IMAD04-	IMAD05-
78A	78B	IMAD06-	IMAD07-
79A	79B	+5 V	+5 V
80A	80B	GND	GND

NT4X80CA (end)

Technical data

Power requirements

The +5 V power supply enters the NT4X80CA card through two groups of pins:

- group A: 2A, 2B, 3A, and 3B
- group B: 79A and 79B

Fuse each group on the card separately.

The power requirements for the NT4X80CA appear in the following table. The maximum current draw is 6 A.

NT4X80CA power requirements

	Idle (standby)	Normal	Refresh
Standard	0.96 A	1.25 A	5.6 A
Maximum	1.31 A	1.6 A	5.95 A

NT4X98AA

Product description

The metallic test unit (MTU) is a microprocessor-controlled test unit used for line card tests and subscriber loop diagnostics.

The MTU contains two cards. These two cards are the NT4X97 MTU controller card and the NT4X98AA MTU analog card. The NT4X98AA card contains the measurement test head. The NT4X97 card controls the NT4X98AA card. The NT4X97 card uses a dedicated 22 conductor bus (MTU bus) to control the NT4X98AA card.

The measurement test head on the NT4X98AA uses a separate power supply. This separate power supply is isolated from the shelf power. Special caution was taken to separate the MTU power and grounding rails from each other. This action occurred for the digital circuits, the analog circuits, the tip test head and the ring test head. This action minimizes intercoupling of signal and noise on these circuits.

To control voltages, use the pulse-width modulator voltage regulation circuit with overvoltage protection. Electromagnetic interference (EMI) filters are also provided.

Output port registers control all onboard relays. The onboard relays arranges the terminations, channel selections and measurement configuration.

Functional description

The NT4X98AA card measures all the parameters of the subscriber loop:

- ac voltages
- dc voltages
- resistance and capacitance on each tip-to-ring (T-R), tip-to-ground (T-G), and ring-to-ground (R-G) configuration

The NT4X98AA card provides all the present functions of the line test unit (LTU). The NT4X98AA card also provides additional features like electronic business set (EBS) test capability and high frequency pulse measurement.

For each measurement state, apply stimulus voltages in the range of -100 V dc to +100 V dc through selected output registers to the test head terminals. The stimulus current is always monitored and converted to frequencies of digital pulses. The MTU controller counts the digital pulses. The MTU processes the digital pulses for analog-to-digital conversion and charge integration.

NT4X98AA (continued)

The zero-crossing detectors detect frequencies of the external ac signals. The frequencies of the external ac signals are sent to the MTU controller to generate synchronization signals. Each MTU analog board has two pairs of tip and ring appearances. The two pairs of tip and ring appearances are MTU virtual unit channel 0 and channel 1. The MTU virtual unit channel 0 and channel 1 time share the measurement hardware and common terminations. Each virtual unit has dedicated secondary terminations.

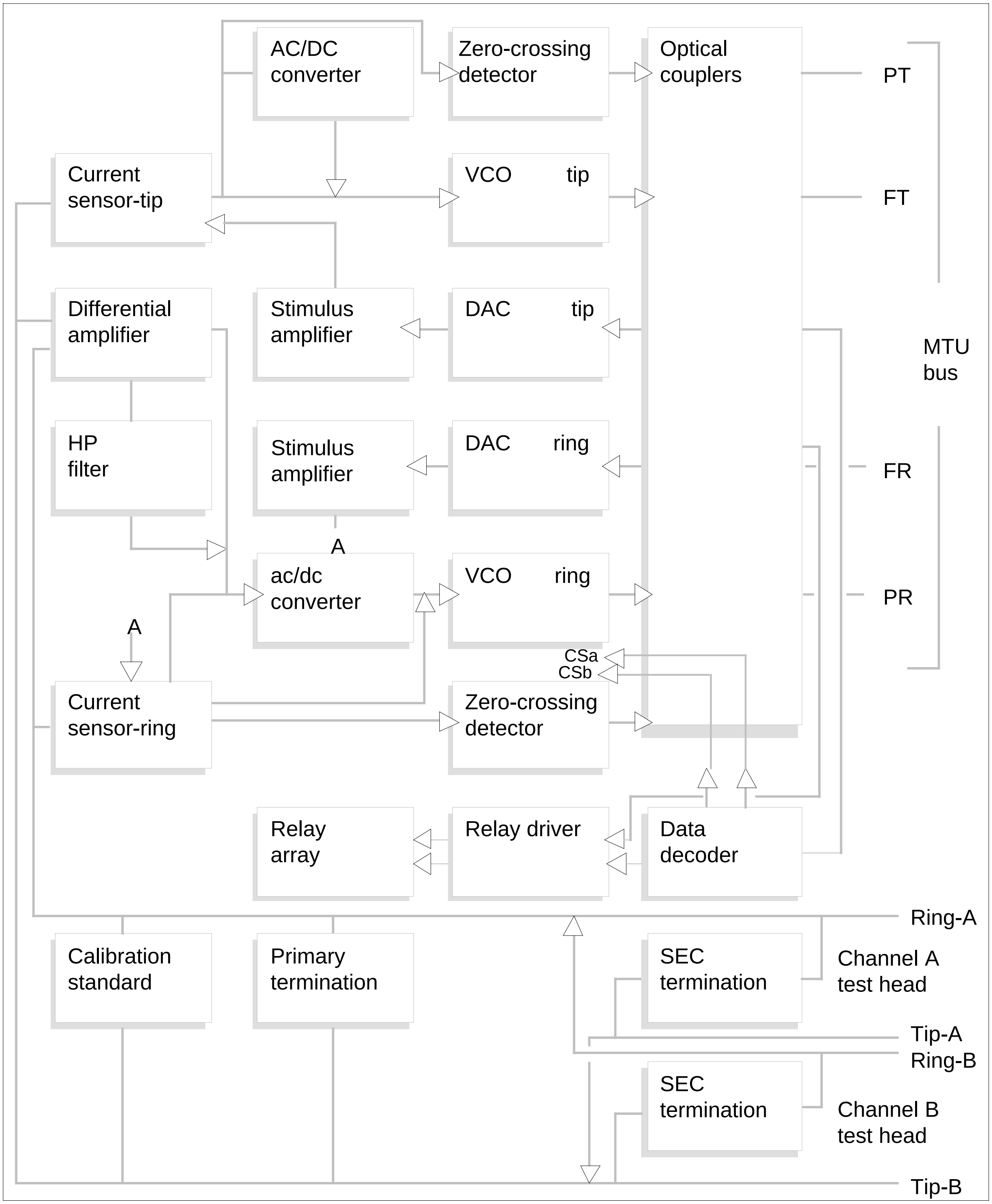
Functional blocks

NT4X98AA has the following functional blocks:

- current sensor (tip and ring)
- stimulus amplifier (tip and ring)
- digital-to-analog converter (DAC) (tip and ring)
- ac/dc converter (tip and ring)
- optical (opto) couplers
- zero-crossing detector (tip and ring)
- voltage-controlled oscillator (tip and ring)
- differential amplifier
- primary terminations
- secondary terminations
- calibration standard

The relationship between these functional blocks appears in the following figure.

NT4X98AA functional blocks



NT4X98AA (continued)

Current sensor (tip and ring)

The current sensor (tip and ring) is a differential amplifier. The amplifier senses the current flow in either direction on the test lead (tip and ring). The current sensor can work with very large common mode voltage.

When the MTU measures voltage, switch the common mode voltage to DMS ground. When the MTU measures resistance and capacitance, switch the common mode voltage to the output of the stimulus amplifier.

The current sensor has two gain levels. Use the normal gain level to measure voltages of less than 100 V. Use the low gain level to measure voltages between 100 V and 400 V.

Stimulus amplifier (tip and ring)

The stimulus amplifier (tip and ring) is a linear, current-to-voltage amplifier. The stimulus amplifier generates stimulus voltages from -100 V to +100 V with reference to a floating ground.

The MTU power supply powers the stimulus amplifier. The MTU power supply has a floating ground that refers to the battery and DMS ground. You can program the differential output voltages between the tip and ring amplifier from -200 V to +200 V. Connect the output of the tip or the ring stimulus amplifier to the DMS ground. This action selects this voltage to appear in one of three configurations: T-R, T-G, or R-G.

Digital-to-analog (tip and ring)

The DAC converts the digital setting to the analog DC current used to drive the stimulus amplifier.

ac/dc converter (tip and ring)

The ac/dc converter (tip and ring) is an active full-wave rectifier. Select the ac/dc converter when you measure ac voltage.

Optical couplers

An array of high speed couplers provide electrical isolation of the measurement test head from the DMS.

Zero-crossing detector (tip and ring)

The zero-crossing detector (tip and ring) detects the zero crossing of the input ac signal with a variable hysteresis for noise immunity. The height of the hysteresis relates to the average input ac voltage.

Voltage-controlled oscillator (tip and ring)

The voltage-controlled oscillator (tip and ring) converts input voltage into digital pulses with a range of 100 to 900 kHz, nominal 500 kHz. The voltage-controlled oscillator offers high linearity with less than 0.5% deviation.

The voltage-controlled oscillator center frequency is nominally 479 kHz. The operational dynamic range is a linear difference from 225 to 725 kHz.

Differential amplifier

The differential amplifier connects across the tip and ring. The differential amplifier measures high-frequency ac signals across T-R, T-G, or R-G.

Primary termination

The primary termination consists of a set of resistors that can connect to any terminal pair (T-R, T-G, R-G). The control keys select the configuration and the resistance value.

The primary termination is a common termination tree that both MTU virtual units time share. Connect the primary termination to the loop for short periods of time.

Secondary terminations

Secondary terminations connect across tip and ring. Each virtual unit has a set of secondary terminations. You can apply the secondary terminations to the loop for an indefinite length of time. This action does not affect the other virtual unit. Control relays can select the secondary terminations that provide different resistance and capacity values. The secondary terminations also provide talk battery to the loop through 200 Ω feed resistors. The talk battery voltage is -48 V on ring, ground or tip.

Calibration standard

Use the calibration standard for the self-calibration of the MTU. When the MTU self-calibrates, the MTU adjusts the internal calibration factors. The MTU adjusts internal calibration factors to compensate for and resist the result of component difference and temperature drift.

Technical data

Power requirements

The NT4X98AA power supply powers the measurement test head of the NT4X98AA. This switching mode power supply converts the -48 V battery voltage to the voltages for the test head.

NT4X98AA (end)

Isolate all output voltages from the battery ground, the shelf analog ground and the shelf digital ground.

Specifications for the power supply and power output of the appear in the NT4X98AA following tables.

NT4X98AA power supply specifications

Type	Switching mode power supply
Operation mode	Flyback not continuous
Switching frequency	50 kHz
Maximum switching duty cycle	50%
Maximum output power	26 W

NT4X98AA output specifications

Outputs	Nominal	Max difference	Min load	Max load
+15 V	+15 V	+14.7 to +15.3	50mA	200mA
–15 V	–15 V	–14.7 to -15.3	50mA	200mA
+100 V	+110 V	+105 to +130	5mA	90mA
–100 V	–110 V	+105 to +130	5mA	90mA

4 NT5Xnnaa

NT5X00AC through NT5X98AA

NT5X00AC

Product description

The NT5X00AC test access network (TAN) module provides metallic connections. These connections are between a trunk test position or a test trunk. The access bus on a special type of trunk module. The DMS-300 switch has this special type of trunk module. The metallic connections are for tests. Use the TAN module with the NT5X12AB test access network equipment (TAE) frame. You can mount the module on the TAE frame in any of five positions: 4, 18, 32, 51, 65. Give position preference to the NT5X00AD test access network module in the 51 and 65 positions. To connect trunk modules, use the NT5X00AD TAN module. Do not use the NT5X00AC TAN module to connect trunk modules.

The telecommunication line must connect to the circuit through the TAN module before tests can run. When you test the line, dial the directory number or the line equipment number (LEN) of the tested line from the test desk. If the line is in the talking state, the system arranges a bridge connection. This bridge connection verifies that the line is in use. When a correct destination is reached, the system connects the test desk to a dialed line through the TAN module.

The following types of line card relays operate during the tests:

- a group of cutoff (CO) and test access (TA) relays
- TA relays only

Relays and connections are released after tests.

Use the QFF1D fuses with all TAN modules, with or without the NT5X02AA test position, test trunk controller. Each module has local interconnect cables. The type ordered depends on the position of the module on the frame. The presence of the test position, test trunk controller that can be provided with the module determines the type.

Parts

The NT5X00AC contains the following parts:

- NT0X50AC—filler faceplate
- NT0X70AA—trunk module processor
- NT2X09AA—multioutput power converter
- NT2X45AB—trunk module network interface
- NT2X53AA—trunk module control
- NT5X0001—test access network shelf assembly

- NT5X01AA—relay circuits
- NT5X02AA—test position, test trunk controller

Design

The parts of the NT5X00AC appear in the following table. A description of the NT5X00AC appears in the following figure.

NT5X00AC parts (Sheet 1 of 2)

PEC	Slot	Description
NT0X50AC	7F, 11F, 15F	*Filler face plate* The filler faceplate or panel fills empty card slots in the unit.
NT0X70AA	2F	*Trunk module processor* The TM processor performs or controls all operations accomplished by the components of the maintenance trunk module (MTM). The card has a firmware-driven microprocessor and two random-access memories (RAM). One RAM stores program information. The other RAM stores operational information. Operational information includes connection information for pulse code modulation (PCM) channel-to-trunk assignments. The TM includes circuits that generate the clock signal, check parity, and perform synchronization.
NT2X09AA	20F	*Multioutput power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the module. The NT2X09AA converter produces dc voltages of -5V, -15V, +5V, +12V, and +24V. The converter includes the following:. • a low-voltage monitor circuit • overvoltage • overcurrent protection • faceplate test jacks • a faceplate LED status indicator

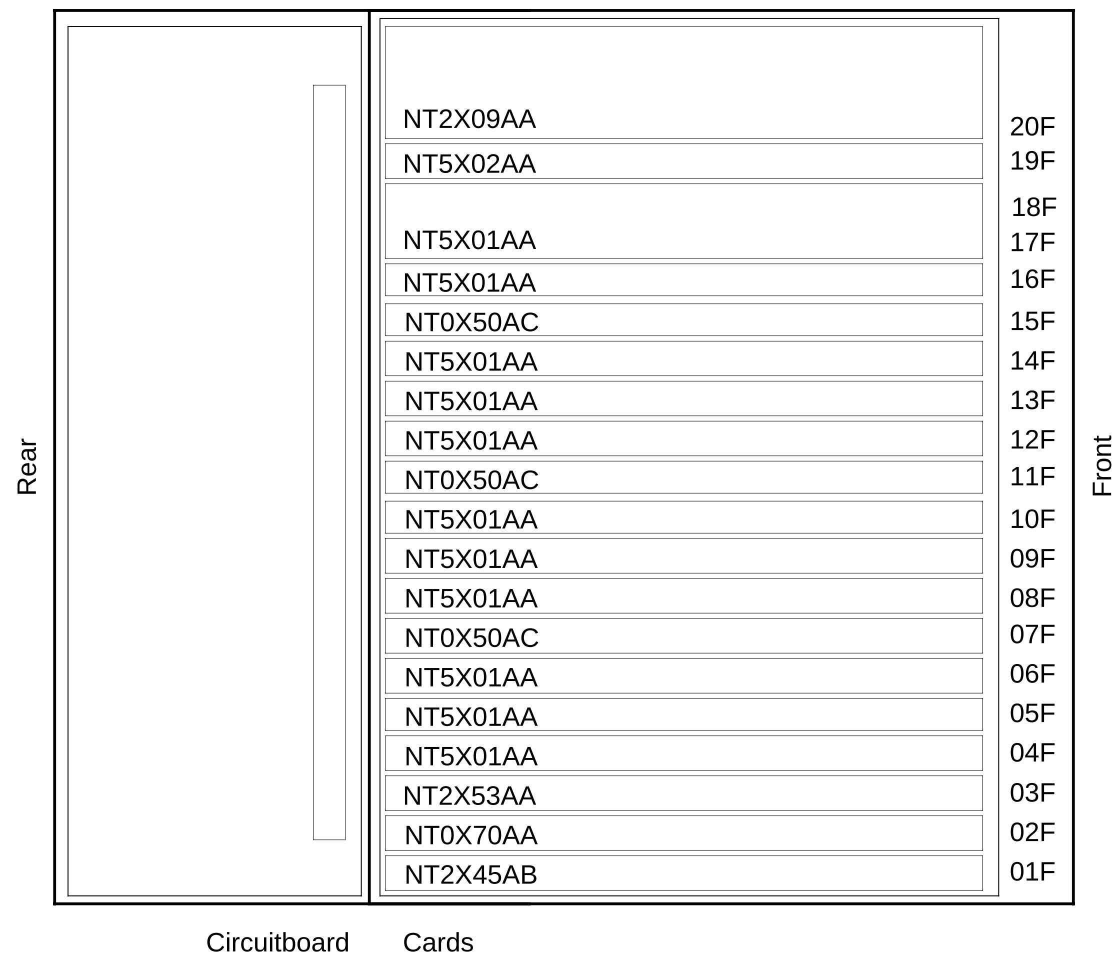
NT5X00AC (continued)

NT5X00AC parts (Sheet 2 of 2)

PEC	Slot	Description
NT2X45AB	1F	*Trunk module network interface* The TM interface card serves as network interface for both planes of the network. The card has the following: • message registers • bit and channel timing circuits • parity-checking circuits • circuits that format data again The card provides two 2-way interfaces for the two transmission paths from both network planes.
NT2X53AA	3F	*Trunk module control* The TM control card has circuit controllers that handle different messages. The control card exchanges information with the processor card over data and address buses. The control card produces enable signals for the circuits on the test and service circuit cards.
NT5X0001	-	*Test access network shelf assembly* The NT5X0001 test access network shelf assembly houses cards that comprise the TAN module.
NT5X01AA	4-6F, 8-10F, 12-14F, 16-18F	*Relay circuits* One group of three relay card slots is for each eight trunk module equipment (TME) frames that require metallic test access.
NT5X02AA	19F	*Test position, test trunk controller* The test position, test trunk controller card is used when the TAN module is cabled to a test position or test trunk.

NT5X00AC (end)

NT5X00AC part design



NT5X00D

Product description

The NT5X00D test access network (TAN) module with trunk module connections provides metallic connections. These metallic connections are between a trunk test position. The connections also can be between a test trunk and the access bus. The connections are on a special type of trunk module that the DMS-300 switch uses. The metallic connections are for test purposes. You use the TAN module with the NT5X12AB test access network equipment (TAE) frame. You can mount the TAN module on the TAE frame in only two positions. These positions are 51 and 65. You can mount a maximum of two modules on each frame. You must use the NT5X00D TAN module to connect trunk modules instead of the NT5X00AC TAN module. You give preference in position to the NT5X00D TAN module over the NT5X00AC TAN module in the 51 and 65 positions. This condition applies if you connect trunk modules.

The telecommunication line must connect to the circuit through the TAN module before tests can run. When you test the line, dial the directory number (DN) or the line equipment number (LEN) of the tested line from the test desk. If the line is in the talking state, the system sets up a bridge connection. The bridge connection verifies that the line is in use. When a correct destination is reached, the system connects the test desk to a dialed line through the TAN module.

The following types of line card relays operate during the tests:

- a combination of cutoff (CO) and test access (TA) relays
- TA relays only

Relays and connections are released following testing.

You use QFF1D fuses with all TAN modules, with or without the NT5X02AA test position, test trunk controller. Each module has local interconnect cables. The following two factors determine the type ordered:

- the position of the module on the frame
- if the module has the test position, test trunk controller

Parts

The NT5X00D contains the following parts:

- NT0X50AC—filler faceplate
- NT0X70AA—trunk module processor
- NT2X09AA—multioutput power converter

- NT2X45AB—trunk module network interface
- NT2X53AA—trunk module control
- NT5X0002—test access network shelf assembly
- NT5X01AA—relay circuits
- NT5X02AA—test position, test trunk controller

Design

The parts appear in the following table. The design of the NT5X00D appears in the following figure.

NT5X00D parts (Sheet 1 of 2)

PEC	Slot	Description
NT0X50AC	7F, 11F, 15F	*Filler faceplate* The filler faceplate or panel fills empty card slots in the unit.
NT0X70AA	2F	*Trunk module processor* The TM processor performs or controls all of the operations accomplished by the components of the maintenance trunk module (MTM). The card contains a firmware-driven microprocessor and two random-access memories (RAM). One RAM stores program information. One RAM stores operational information. Operational information includes connection information for pulse code modulation (PCM) channel-to-trunk assignments. The TM also includes circuits that generate the clock signal, check parity, and perform synchronization.
NT2X09AA	20F	*Multi-output power converter* The multi-output power converter converts the -48V dc to the lower voltages that the circuit cards in the module require. The NT2X09AA converter produces dc voltages of -5V, -15V, +5V, +12V, and +24V. The converter includes the following: • a low-voltage monitor circuit • overvoltage and overcurrent protection • faceplate test jacks • a faceplate LED status indicator

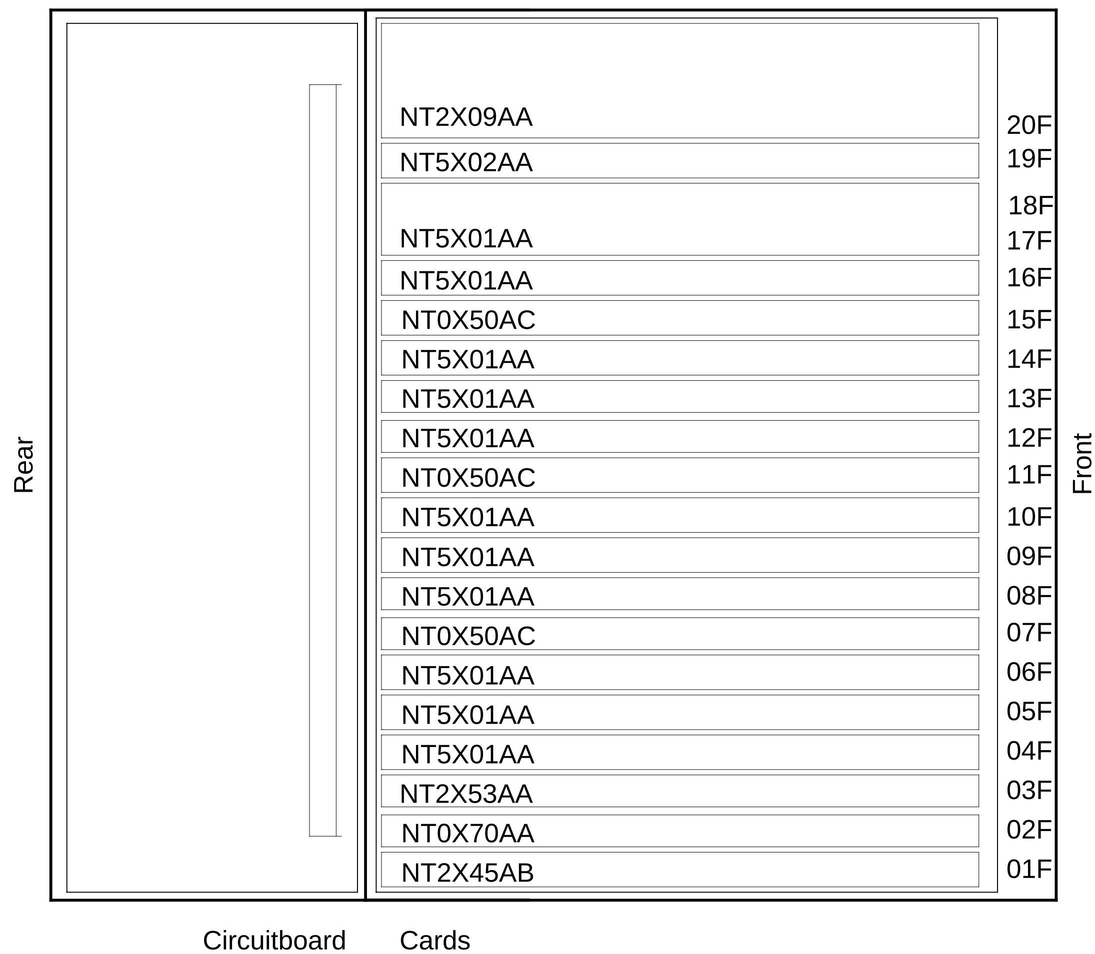
NT5X00D (continued)

NT5X00D parts (Sheet 2 of 2)

PEC	Slot	Description
NT2X45AB	1F	*Trunk module network interface* The trunk module (TM) interface card serves as the network interface for both planes of the network. The TM contains the following message registers: • bit and channel timing circuits • parity-checking circuits • circuits that reformat data The TM also provides two two-way interfaces for the transmission paths from both network planes.
NT2X53AA	3F	*Trunk module control* The trunk module (TM) control card contains the circuit controllers that handle different messages. The TM exchanges information with the processor card over data and address buses. The TM produces enable signals for the circuits on the test and service circuit cards.
NT5X0002	-	*Test access network shelf assembly* The NT5X0002 test access network shelf assembly houses the cards that comprise the NT5X00D TAN module. The NT5X0002 shelf assembly is like the NT5X0001 shelf assembly. The NT5X0002 shelf assembly has two local cables (NT5X0008 and NT5X0009) that aid in the connection of trunk modules.
NT5X01AA	4-6F, 8-10F, 12-14F, 16-18F	*Relay circuits* One group of three relay card slots is for each eight trunk module equipment (TME) frames that requires metallic test access.
NT5X02AA	19F	*Test position, test trunk controller* The test position, test trunk controller card is used when the TAN module is cabled to a test position or test trunk.

NT5X00D (end)

NT5X00D parts design



NT5X03AA

Product description

The NT5X03AA provides a voice and signaling interface. The interface is between a DMS-300 and a national network office. The network office must use Type-1 E trunk or signaling circuits.

Each card contains two Type-1 E&M trunk circuits.

Location

The card occupies one card position in a special eight-wire trunk module (TM) with a test access bus.

Functional description

The NT5X03AA exchanges control messages with the TM. The functions of the NT5X03AA are as follows:

- transmits near-end signaling to the far end
- receives far-end signaling
- processes voice frequency (VF) information

The VF information is received over the T and R leads. The sampling gate converts VF information to pulse amplitude modulation (PAM) signals, and sends the information to the TM for additional processing. The TM sends PAM signals. The PAM signals are received from the TM, and converted back to VF signals over the T1 and R1 leads.

Functional blocks

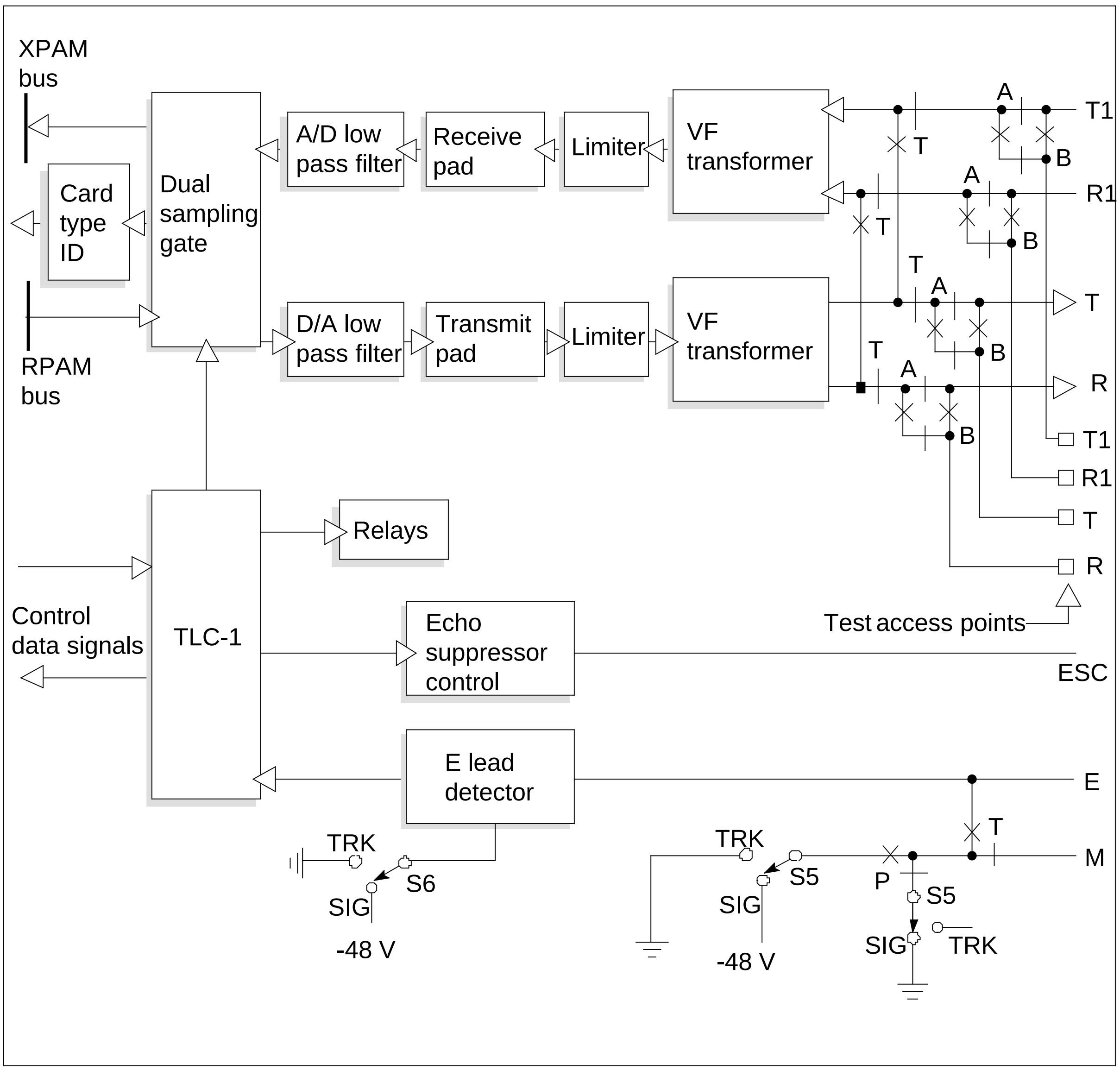
The NT5X03AA contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- VF transformers (two)
- E detector
- echo suppressor control
- relays (four)

- switches (two)
- card type identifier

The relationship between blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is identical.

NT5X03AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC

NT5X03AA (continued)

generates sampling pulses for the sampling gate. Each trunk circuit contains a separate TLC.

Dual sampling gate

In the receive direction, the sampling gate converts analog VF signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for additional processing. In the transmit direction, the gate converts PAM information that the receive PAM (RPAM) bus sends back into VF signals. The gate sends the signals over the T1 and R1 leads.

The card contains a single sampling gate that both trunk circuits use.

A/D low-pass filter

The functions of the A/D filter are as follows:

- accepts VF signals from the receive pads
- filters the signal to limit the bandwidth
- passes the signal to the sampling gate
- amplifies the signal

D/A low-pass filter

The functions of the D/A filter are as follows:

- accepts VF signals from the sampling gate
- filters the signal to limit the bandwidth
- passes the signal to the transmit pads
- amplifies the signal

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment to the VF signal level. This procedure occurs before the sampling gate converts the signal to digital form and is processed by the card. The adjustments occur in increases of 0.25 dB. Set the combinations of small switches to achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pads also contain a 60 Hz filter to remove line noise.

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment to the VF signal level. The adjustments occur in increases of 0.25 dB. Set the combinations of small switches to achieve the correct level.

The transmit level adjustments appears in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters prevent the overload of a circuit by a received or transmitted signal. One limiter is in the receive direction and one limiter is in the transmit direction.

NT5X03AA (continued)

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal. This single signal allows the receive circuit to process. In the transmit direction, the transmit circuit sends the signal to the transformer. The transmit circuit sends the converted signals over the T1 and R1 leads.

E detector

The E detector detects a far-end trunk seizure as indication of ground or battery on the E lead. Switch S6 determines if the detector responds to the indication of ground (trunk circuit operation) or battery (signal circuit operation). The detector transmits the trunk seizure information through the TLC to the TM.

Echo suppressor control

The echo suppressor control operates under software control. The echo suppressor control operates through the TLC to enable or disable an externally connected echo suppressor circuit. The echo suppressor control grounds the ESC lead to disable the echo suppressor. The echo suppressor control removes the ground to activate the suppressor.

NT5X03AA (continued)

Relays

Four relays are provided for testing and near-end signaling. The designator and purpose for each relay appears in the following table.

Relay operation

Relay	Operated	Released
T	Isolates the trunk circuit from the external transmission facilities and loops the transmission and signaling paths. This procedure allows the system to test the circuit internally. The following leads connect to each other: T and T1, R and R1, and E and M.	Normal operation
A, B	In different combinations, provides test access to a close test trunk position for different facilities A and B operated: test isolated external facilities (line) A operated, B released: test isolated internal facilities (drop) A released, B operated: monitor the facilities	Both A and B released: normal operation
P	Sends ground or battery on M lead as signal of near-end trunk seizure. Ground-sent when switch S5 is in the TRK (trunk circuit) position. Battery sent when switch S5 is in the SIG (signal circuit) position.	Sends open or ground on M lead as trunk open signal. Sends open when switch S5 is in the TRK (trunk circuit) position. Sends ground when switch S5 is in the SIG (signal circuit) position.

NT5X03AA (continued)

Switches

Two switches, S5 and S6, change the signaling properties so that the card can be used with signal circuits or trunk circuits. The purpose of the switches appears in the following table.

Switch functions

Switch	SIG position	TRK position
S5	Connects ground to M lead when near-end loop is open. Connects battery to M lead during the seizure of the near-end loop.	M lead open when near-end loop is open. Connects ground to M lead when near-end loop is seized
S6	Causes E-lead detector to respond to battery on E lead as signal of far-end trunk seizure	Causes E-lead detector to respond to ground on E lead as signal of far-end trunk seizure

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card is in the TM card slot.

Technical data

Each circuit on the card provides an impedance of 600 Ω.

The minimum receive level for the circuits is -2 dBm for digital test sequence (DTS) output, with a range of -2 to +13 dBm. The maximum transmit level is -3 dBm for DTS output, with a range of -3 to -18 dBm.

The signaling characteristics of the card appears in the following table.

Physical dimensions

The dimensions NT5X03AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.5 V to -55.8 V
Normal talk battery range (float charge)	-49 V to -53.5 V
Maximum talk battery discharge	-42.75 V
Maximum talk battery charge (equalizing)	-55.8 V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V
Longitudinal AC	120 V rms
Maximum E-lead external resistance	1000 Ω
Maximum M-lead current drain	60 mA

Power requirements

DANGER
Damage to equipment or loss of service
For use only on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to use in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12V ±0.3V
- -15V ±0.5V
- +22.8V to +27V (24V nominal)

NT5X03AA (end)

Power use is normally 500 mW for each idle trunk circuit.

NT5X04AA

Product description

The NT5X04AA provides a voice and signaling interface. This interface is between a trunk module (TM) in a DMS-300 office and a trunk circuit in a remote international switching office. The circuits are compatible with offices that comply with the International Telegraph and Telephone Consultative Committee (CCITT) #5 signaling system specification.

Each card contains two CCITT #5 trunk circuits.

Location

The card occupies one card position in a special eight-wire TM with a test access bus.

Functional description

The NT5X04AA exchanges control messages with the TM. The NT5X04AA transmits near-end signaling to the far end, receives far-end signaling and processes voice frequency (VF) information. The VF information is received over the T and R leads. The VF information is converted to pulse amplitude modulation (PAM) signals and sent to the TM for additional processing. The PAM signals are received from the TM, converted to VF signals and sent over the T1 and R1 leads.

Functional blocks

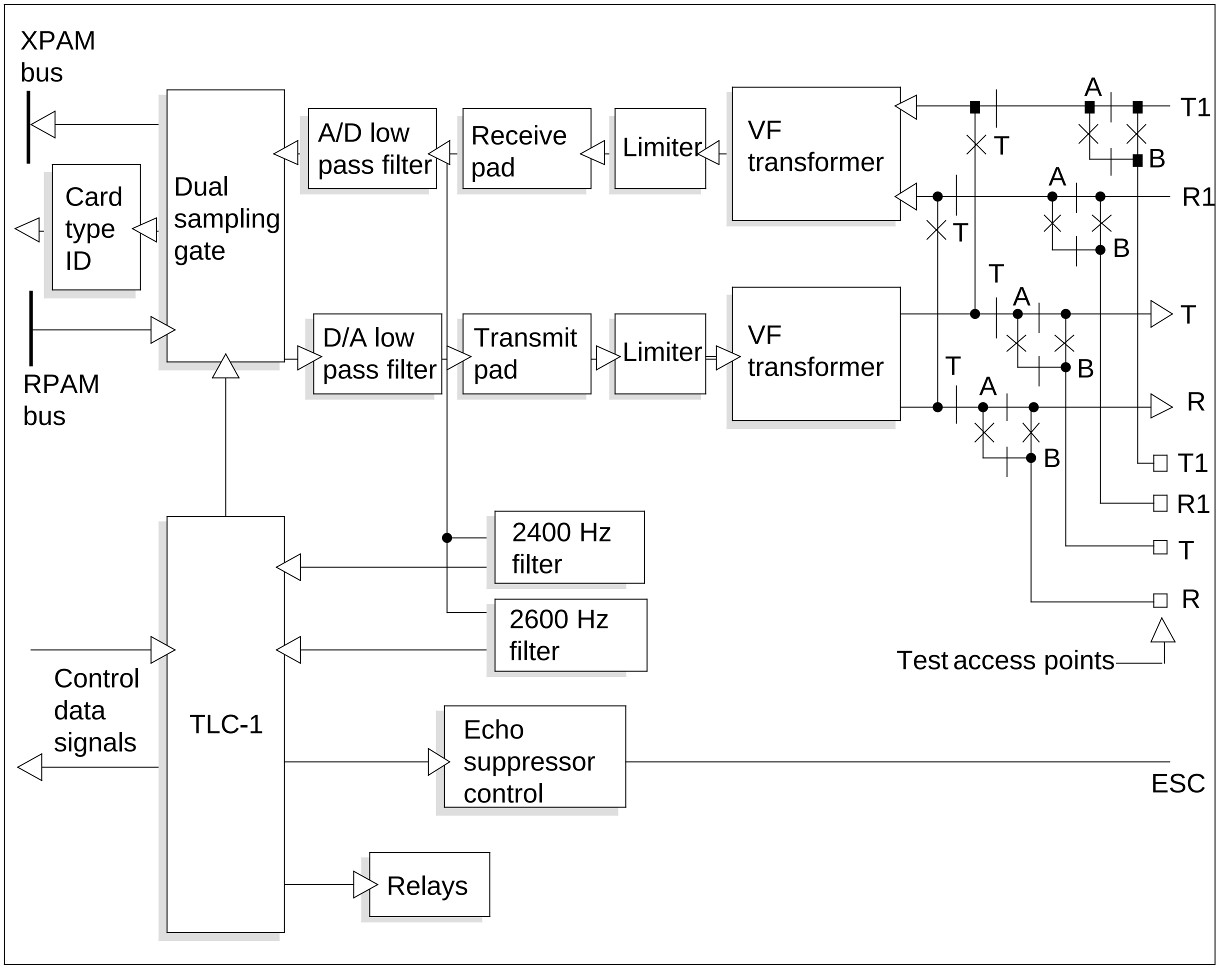
The NT5X04AA contains the following functional blocks:

- trunk logic circuit (TLC)
- dual sampling gate
- analog/digital (A/D) low-pass filter
- digital/analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- VF transformers (two)
- filters (two)
- echo suppressor control
- relays (four)
- card type identifier

NT5X04AA (continued)

The relationship between functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is identical.

NT5X04AA functional blocks



TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit contains a separate TLC.

Dual sampling gate

In the receive direction, the sampling gate converts analog VF signals to PAM signals and sends the signals over the transmit-PAM (XPAM) bus for additional processing. In the transmit direction, the gate converts PAM information received from the receive-PAM (RPAM) bus back into VF signals.

The gate sends the signals over the T1 and R1 leads. The transmit path contains near-end signaling tones represented by combinations of 2400 Hz and 2600 Hz tones. These tones are stored in digit format in the TM and inserted in the transmit path as required.

The card contains a single sampling gate that both trunk circuits use.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads, filters the signal to limit the bandwidth and passes the signal to the sampling gate. The filter amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate, filters the signal to limit the bandwidth and passes the signal to the transmit pads. The filter amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment to the level of the VF signal. This event occurs before the signal is converted to digital form and processed by the card. The adjustment occurs in 0.25 dB increments. This pad makes the adjustments when the pads sets combinations of miniature switches to achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pads contain a 60 Hz filter to remove line noise.

NT5X04AA (continued)

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment to the level of the VF signal sent over the trunk. The adjustments occur in 0.25-dB increments. This pad makes the adjustments when the pad sets combinations of miniature switches to achieve the correct level.

The transmit level adjustments appear in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are provided to prevent a received or transmitted signal from circuit overload. One limiter is provided in the receive direction and one limiter is provided in the transmit direction.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal. The receive unit processes this single signal. In the transmit direction, the transformer receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

Filters

A 2400 Hz filter and a 2600 Hz filter are provided. These filters detect the presence of CCITT #5 signaling tones that represent far-end signaling states in the receive path. Different combinations of 2400 Hz and 2600 Hz tones make up the CCITT #5 signaling tones. The VF information from the receive path is sent to the filters. This event occurs to check for the presence of a 2400 Hz tone, a 2600 Hz tone or both. When a tone is present, the filter sends a signal-present signal through the TLC to the TM.

The 2400 Hz filter detects frequencies from 2250 Hz to 2500 Hz. The 2600 Hz filter detects frequencies from 2500 Hz to 2750 Hz. These two filters do not operate when the signal at the T1 and R1 leads reaches or falls below -22 dBm.

Echo suppressor control

The echo suppressor control operates under software control through the TLC to enable or disable an echo suppressor circuit. The echo suppressor circuit connects from the outside. The echo suppressor control grounds the ESC lead to disable the echo suppressor and removes the ground to activate the suppressor.

Relays

Four relays are provided for testing and near-end signaling. The designator and purpose for each relay appears in the following table.

Relay operation

Relay	Operated	Released
T	Isolates the trunk circuit from the external transmission facilities and loops the transmission path. This action allows internal testing of the circuit. The T and T1 and R and R1 leads connect.	Normal operation
A, B	In different combinations, provides test access to a close test trunk position for different facilities A and B operated: test isolated external facilities (line) A operated, B released: test isolated internal facilities (drop) A released, B operated: monitor the facilities	Both A and B released: normal operation

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card is plugged in to the TM card slot.

Technical data

Both circuits on the card provide an impedance of 600 Ω The minimum receive level for the circuits is -2 dBm for digital test sequence (DTS) output, with a

NT5X04AA (end)

range of -2 dBm to +13 dBm. The maximum transmit level is -3 dBm for DTS output, with a range of -3 dBm to -18 dBm.

A list of signaling characteristics of the card appears in the following table.

Signaling characteristics

Characteristics	Value
Talk battery voltage	-42.50V to -55.80V
Normal talk battery range (float charge)	-49.00V to -53.50V
Maximum talk battery discharge	-42.75V
Maximum talk battery charge (equalizing)	-55.80V
Minimum insulation resistance	30 k Ω
Ground potential	±10 V
Longitudinal AC	120V rms
Maximum E-lead external resistance	1000 Ω
Maximum M-lead current drain	60 mA

Dimensions

The dimensions for the NT5X04AA circuit card follow:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

The card provides the following converted voltages:

- +12V ±0.3V
- -15V ±0.5V
- +22.8V to +27.0V (24.0V nominal)

Power use is normally 500 mW for each idle trunk circuit.

NT5X04AB

Product description

The NT5X04AB trunk circuit card provides a signaling and voice frequency (VF) interface. The VF is for speech and voice-band data transmissions. The transmissions occur between the trunk module (TM) in a DMS-300 office and a trunk circuit in a remote international switching office. Each card contains two trunk circuits identical to the NT5X04AA trunk circuit with an additional feature-guard tone detection. A guard tone detection circuit recognizes the guard tone that a V.22 modem sends. A guard tone detection circuit prevents the system from interrupting modem carrier frequency as a signaling frequency.

The NT5X04AB circuit card is compatible with the NT5X04AA circuit card.

Functional description

The NT5X04AB provides the following features:

- 600 Ω terminations, transformer coupled to a four-wire line
- switch selected level adjustment in both directions over a range of 0 to 15.75 dB in 0.25 dB steps
- tone validation circuits and receivers for CCITT 5 line signaling
- card-type identification to trunk module
- looparound test circuits
- line, drop and monitor test access on all transmission leads
- when connected, software control can enable or disable the external analog echo suppressor

Each trunk circuit on this card provides the transmission, signaling and supervisory facilities to handle two-way traffic. This two-way traffic occurs between a DMS-300 office and a remote international office. This procedure uses the CCITT 5 signaling system specification. The circuit card incorporates transformer couplings between the four-wire analog facilities and the four-wire trunk circuits.

The NT5X04AB uses two tones in each direction for signaling and supervisory purposes. These two tones are 2400 Hz and 2600 Hz. The tones for near-end signaling use are stored in digit format in the TM. The tones are converted to analog signals and transmitted over the VF transmit path. The 2400 Hz and 2600 Hz filters and receivers detect far-end signaling. Far-end signaling is the method to send signal present (SP) signals over the SP1 and SP2 leads. The SP signals are sent to the TM through the trunk logic circuit and the common data bus.

NT5X04AB (continued)

The circuit card incorporates transformer coupling between the four-wire analog facilities and the four-wire trunk circuits. The VF signal is from leads T1 and R1. The VF signal passes through the limiter to the receive level adjustment pad and analog-to-digital low-pass filter. This action limits the bandwidth and amplifies the signal. This procedure occurs in the receive direction of the four-wire analog facility.

Pulse amplitude modulated (PAM) samples from the decoder in the TM are applied to a common receive-PAM (RPAM) bus. This procedure occurs in the transmit direction of the four-wire circuits. The PAM are sampled and reconstructed to the original VF signal through the digital-to-analog low-pass filter. The digital-to-analog low-pass filter also provides signal amplification. The VF signal is passed to the T and R leads through the transmit level adjustment pad and limiter.

Level adjustments are provided in both directions in 0.25 dB steps. The adjustments consist of fixed pads. Miniature switches (S1, S2, S3, S4) connect the fixed pads in combinations. This condition allows the required amount of gain or loss. Level adjustment switch settings appear in the following table.

Level adjustment switch settings

Function	Circuit	Switch	Segment dB	Nominal
Receive	0/1	S1.0/1	3	3
			2	4
			1	2
		S2.0/1	3	1
			2	0.5
			1	0.25
Transmit	0/1	S3.0/1	3	8
			2	4
			1	2
		S4.0/1	3	1
			2	0.5
			1	0.25

Trunk logic circuit

The trunk logic circuit (TLC) accomplishes communication between the TM and the VF, signaling and supervisory circuits. The TLC is a communications buffer between the TM and the trunk circuits. The TLC generates the sampling pulses for the sampling gate.

Receiving far-end signaling

The two tone receivers and the 2400 Hz and 2600 Hz filters detect the correct combinations of correct signaling tones. These correct signaling tones are on the receive facility leads T1 and R1. When correct tones are present, the following procedure occurs. The tone receivers send corresponding signal-present signals to the TM through the leads SP1 and SP2 and the TLC. The tone receivers send these signals for additional processing under TM firmware control. The TM firmware is sent to conform to the CCITT 5 signaling system specification. The combinations of signals received provide the required format for items like line seizure and call answered and disconnect.

Sending near-end signaling

The two signaling tones are stored in digit format in the TM. Under TM firmware control, the tones pass to the transmit analog facility leads T and R. The tones pass by the RPAM bus, the dual sampling gate and the D-A filter.

Echo suppressor control

A transistor switch provides a ground on the echo suppressor circuit (ESC) line to disable an external analog echo suppressor circuit. This transistor switch is under program control and operates at a signal distribution through the TLC and common data bus.

Test circuits

Two test circuits are provided. The first circuit isolates the trunk circuit from the external transmission facilities. The first circuit provides looparound connections between the receive and transmit paths. This condition allows the card to be tested internally. This circuit is under the control of the relay T through the TLC. The second circuit provides test access over metallic facilities to a close trunk test position. This circuit is under control of the A and

NT5X04AB (continued)

B relays. The TA facilities with the A and B relays can test the transmission facilities. This procedure appears in the following table.

TA facilities

	Relay state	
Facilities to test	**A**	**B**
Test isolated external facilities (line)	1	1
Test isolated internal facilities	1	0
Monitor the facilities	0	01
Note: 1 = Relay operates, 0 = Relay releases		

Technical data

DANGER
Damage to equipment or loss of service
Only for use on telephone wiring that a Nortel Networks protector, catalog number 303M-12AIKE and a 26-AWG copper wire with thermoplastic insulation protects. The maximum fusing wire to use in series with the protector is 26 AWG.

A list of the signaling characteristics of the card appears in the following table.

(Sheet 1 of 2)

Characteristic	Minimum	Nominal	Maximum
Talk battery	-42.5V		-55.8V
Nominal range (float charge)	-49.0V		-53.5V
Maximum discharge (no charge)		-42.75V	
Maximum charge (equalizing)		-55.8V	
Insulation resistance	30 k Ω		
Ground potential		-10V	
Longitudinal AC		120Vrms	

NT5X04AB (end)

(Sheet 2 of 2)

Characteristic	**Minimum**	**Nominal**	**Maximum**
E- and M-lead restrictions			
E-lead external resistance			1000 Ω
M-lead current drain			60 mA
Signaling receivers			
Operating signal level range (levels at the T1 and R1 leads of each circuit)	-14 dBm		+2 dBm

NT5X06AA

Product description

The NT5X06AA provides a voice and signaling interface. This interface is between a trunk module (TM) in a DMS-300 office and a trunk circuit. The trunk circuit is in a far international switching office. The circuits are compatible only with offices that comply with the International Telegraph and Telephone Consultative Committee (CCITT) No. 6 signaling system specification.

Each card contains two CCITT No. 6 trunk circuits.

Location

The card occupies one card position in a special eight-wire TM with a test access bus.

Functional description

The NT5X06AA exchanges control messages with the TM. The functions of the NT5X06AA are as follows:

- transmits near-end signaling to the far-end
- receives far-end signaling
- processes voice frequency (VF) information

The VF information transmits over the T and R leads. The sampling gate converts the VF information to pulse amplitude modulation (PAM) signals. The sampling gate sends the PAM signals to the TM for additional processing. The TM sends PAM signals. The PAM signals are received from the TM. The PAM signals are converted back into VF signals, and sent back over the T1 and R1 leads.

Functional blocks

Each circuit in the NT5X06AA contains the following functional blocks:

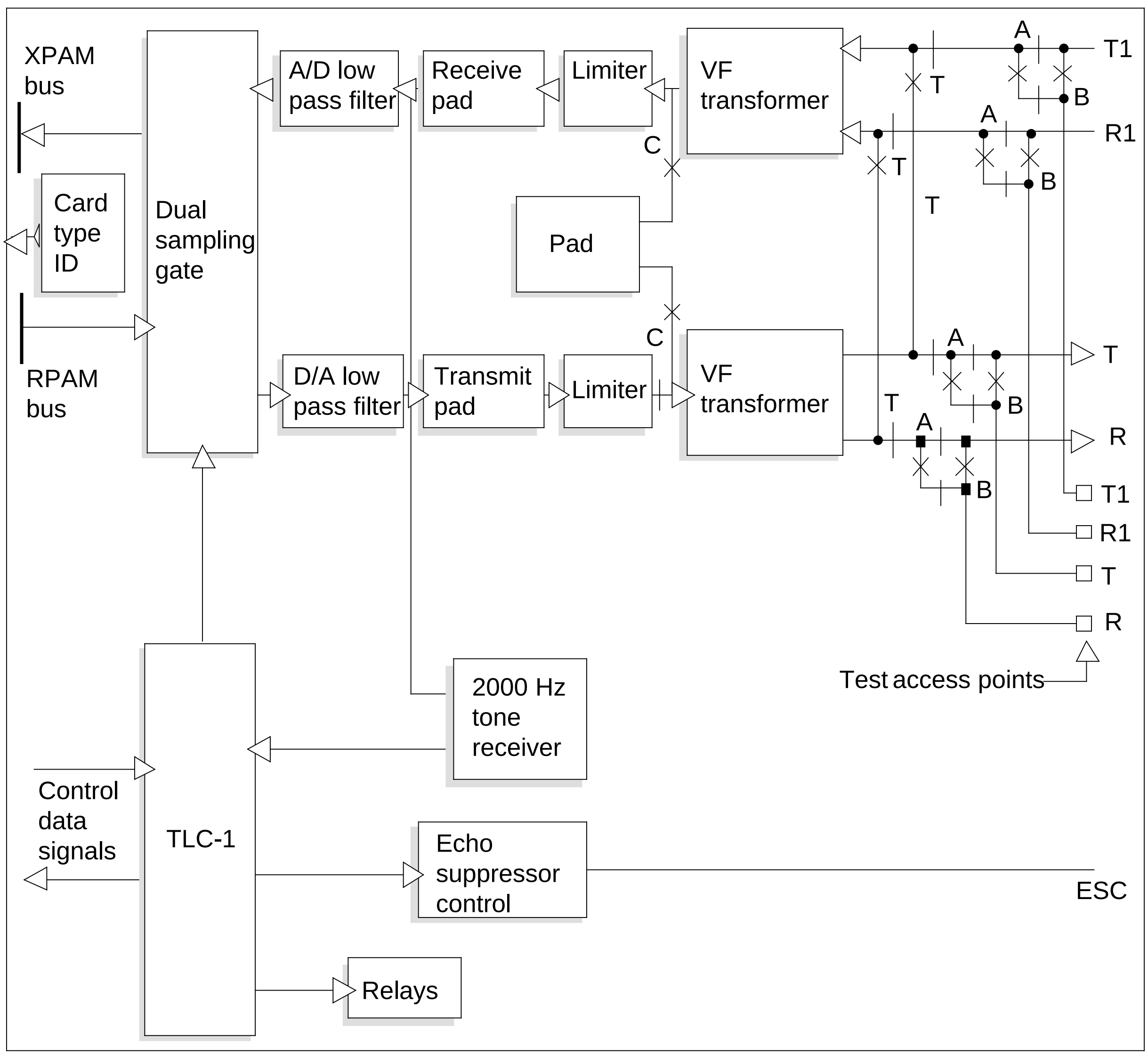
- trunk logic circuit (TLC)
- dual sampling gate
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- receive level adjustment pad
- transmit level adjustment pad
- limiters (two)
- VF transformers (two)

NT5X06AA (continued)

- pad
- 2000 Hz tone receiver
- echo suppressor control
- relays (four)
- card type identifier

The relationship between functional blocks in trunk circuit 1 appears in the following figure. Trunk circuit 0 operation is identical.

NT5X06AA functional blocks



NT5X06AA (continued)

TLC

The TLC handles communication between the card and the TM. The TLC serves as a communication buffer between the TM and the card. The TLC generates sampling pulses for the sampling gate. Each trunk circuit contains a separate TLC.

Dual sampling gate

In the receive direction, the sampling gate converts analog VF signals to PAM signals. The sampling gate sends the signals over the transmit PAM (XPAM) bus for further processing. In the transmit direction, the gate converts PAM information received from the receive PAM (RPAM) bus back into VF signals. The gate sends the signals over the T1 and R1 leads. The transmit path contains a 2000 Hz tone used to verify the transmission path. The system stores this tone in digit format in the TM and inserted in the transmit path. The sampling gate sends this tone to the far end, loops the tone at the far end. The sampling gate returns the tone to the near end. A returned signal indicates that the transmission path is correct.

The card contains a single sampling gate that both trunk circuits use.

A/D low-pass filter

The A/D filter accepts VF signals from the receive pads and filters the signal to limit the bandwidth. The filter passes the signal to the sampling gate and amplifies the signal.

D/A low-pass filter

The D/A filter accepts VF signals from the sampling gate and filters the signal to limit the bandwidth. The filter passes the signal to the transmit pads and amplifies the signal.

Receive level adjustment pad

The receive level pad provides a maximum of 15.75 dB of adjustment to the VF signal level. The pad performs this action before the level converts to digital form and is processed by the card. The adjustments occur in 0.25 dB increases. Set the combinations of small switches to achieve the correct level.

The receive level adjustments appear in the following table.

Receive level adjustments (Sheet 1 of 2)

Switch position	Adjustment (dB)
S1, position 3	8.00
S1, position 2	4.00

Receive level adjustments (Sheet 2 of 2)

Switch position	Adjustment (dB)
S1, position 1	2.00
S2, position 3	1.00
S2, position 2	0.50
S2, position 1	0.25

The receive level pads also contain a 60 Hz filter to remove line noise.

Transmit level adjustment pad

The transmit level pad provides a maximum of 15.75 dB of adjustment to the VF signal level sent over the trunk. The adjustments occur in 0.25 dB increases. Set the combinations of small switches to achieve the correct level.

The transmit level adjustments appears in the following table.

Transmit level adjustments

Switch position	Adjustment (dB)
S3, position 3	8.00
S3, position 2	4.00
S3, position 1	2.00
S4, position 3	1.00
S4, position 2	0.50
S4, position 1	0.25

Limiters

Two limiters are provided to prevent the overload of a circuit by a received or transmitted signal. One limiter is in the receive direction. One limiter is in the transmit direction.

VF transformers

The VF transformers provide interfaces between the four-wire trunk circuits in the card and the four-wire analog facilities. In the receive direction, the transformer converts the signals on the T and R leads to a single signal. The receive circuit processes this signal. In the transmit direction, the transformer

NT5X06AA (continued)

receives the signal from the transmit circuit. The transformer sends the converted signals over the T1 and R1 leads.

Pad

The pad adjusts the VF signal level when the transmit and receive paths are looped. The pad notifies the far end of a correct signal path.

2000 Hz tone receiver

A 2000 Hz tone receiver is provided to verify a 2000 Hz tone. This tone represents a correct transmission path in the receive path. The card sends the tone on the transmit path. The far end receives the tone, loops the VF path, and sends the tone back to the near end. The card sends the VF information from the receive path to the filters to check for the 2000 Hz tone. If a tone is present, the receiver sends a signal through the TLC to the TM.

The receiver detects tones from 1970 Hz through 2030 Hz at a level of -2 to -14 dBm. The receiver does not operate when the signal at the T1 and R1 leads reaches or drops below -22 dBm.

Echo suppressor control

The echo suppressor control operates under software control. The suppressor operates through the TLC to enable or disable an externally connected echo suppressor circuit. The echo suppressor control grounds the ESC lead to disable the echo suppressor and removes the ground to activate the suppressor.

Relays

Four relays are provided for testing and near-end signaling. The designator and purpose for each relay appears in the following table.

Relay operation

Relay	Operated	Released
T	Isolates the trunk circuit from the external transmission facilities and loops the transmission path. This action allows the system to test the circuit internally. The T and T1 and R and R1 leads connect.	Normal operation
A, B	In different combinations, provides test access to a close test trunk position for different facilities. A and B operated: test isolated external facilities (line) A operated, B released: test isolated internal facilities (drop) A released, B operated: monitor the facilities	Both A and B released: normal operation
C	Loops the transmit and receive paths at the VF transformers. The loop causes the 2000 Hz signal to return to the far-end, and indicates that the transmission path is correct.	Normal operation

Card type identifier

The card type identifier provides the TM with an identification code for inventory purposes. The card type identifier checks that the card plugs into the TM card slot.

Technical data

Both circuits on the card provide an impedance of 600 Ω.

The minimum receive level for the circuits is -2 dBm for digital test sequence (DTS) output, with a range of -2 to +13 dBm. The maximum transmit level is -3 dBm for DTS output, with a range of -3 to -18 dBm.

NT5X06AA (continued)

The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.5V to -55.8V
Normal talk battery range (float charge)	-49V to -53.5V
Maximum talk battery discharge	-42.75V
Maximum talk battery charge (equalizing)	-55.8V
Minimum insulation resistance	30 k Ω
Ground potential	±10V
Longitudinal AC	120V rms
Maximum E-lead external resistance	1000 Ω
Maximum M-lead current drain	60 mA

Physical dimensions

The dimensions for the NT5X06AA circuit card are as follows:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

NT5X06AA (end)

Power requirements

DANGER
Damage to equipment or loss of service
For use only on telephone wiring protected by a Nortel Networks protector, catalog number 303M-12AIKE, in combination with a 26-AWG copper wire with thermoplastic insulation. The maximum fusing wire to be used in series with the protector is 26 AWG.

The card provides the following converted voltages:

- +12V ±0.3V
- -15V ±0.5V
- +22.8V to +27V (24V nominal)

Power use is normally 500 mW for each idle trunk circuit.

NT5X08AC

Product description

The NT5X08AC alternating current (ac) modem shelf accommodates a maximum of 16 ac modem cards (A0302338). Provision a maximum of three ac modem shelves in one or all positions 33, 52 and 66 of the NT6X29AA data modem extension (DME) frame. The shelf modulates/demodulates serial binary data in dibits to and from phase shift keying (PSK). The PSK is the method of modulation that transmits serial binary data over analog channels.

Parts

The NT5X08AC contains the following parts:

- A0302338-ac modem cards

Design

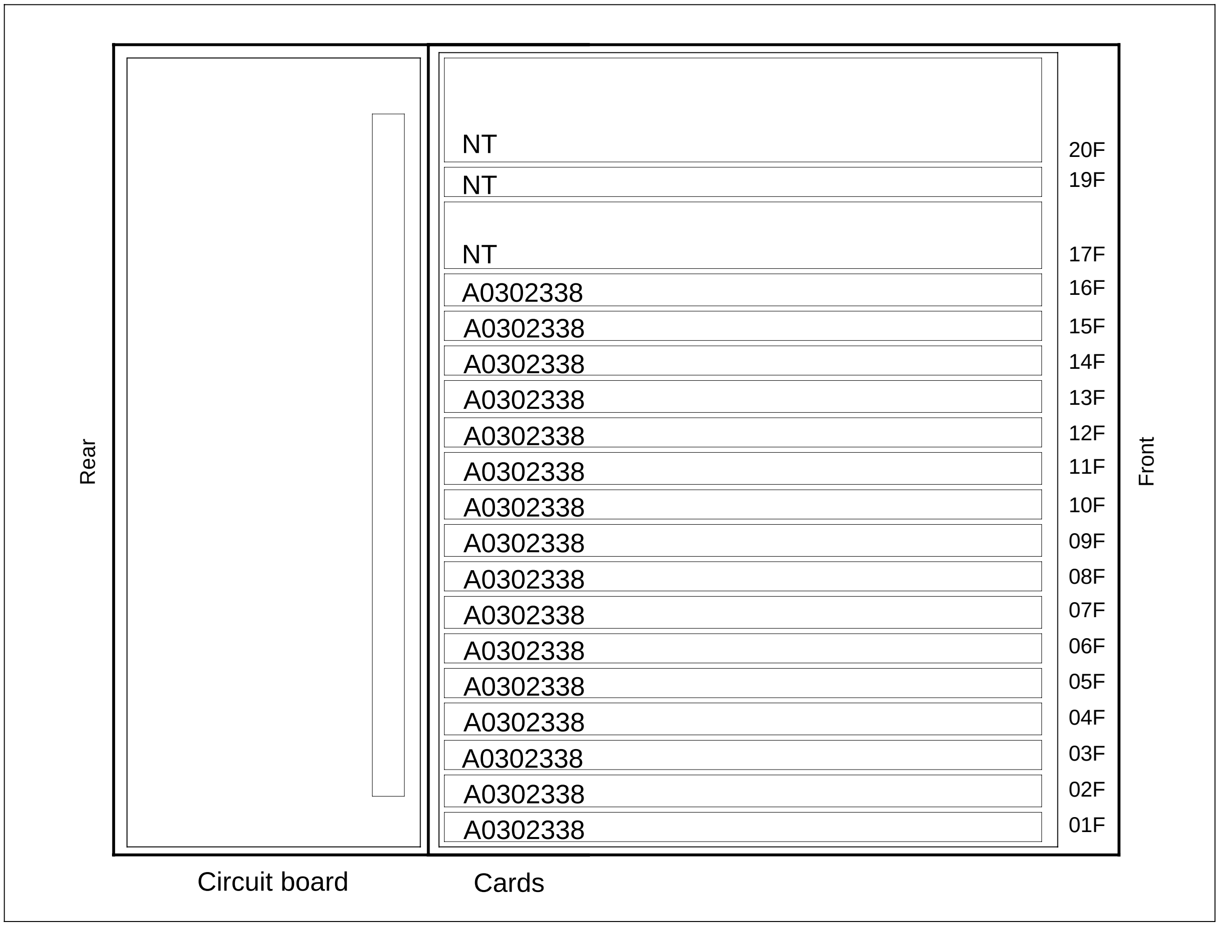
The parts of the NT5X08AC appear in the following table. The design of the NT5X08AC appears in the following figure.

NT5X08AC parts

PEC	Slot	Description
A0302338	1-16F	*Alternating current modem card* The A0302338 ac modem card, in with the NT6X65AA CCIS terminal card, route messages. Two ac modem cards are required for each signaling link.

NT5X08AC (end)

NT5X08AC design



NT5X12AB

Product description

The test NT5X12AB access network equipment (TAE) frame contains the components that provide metallic test access to trunks in DMS-300 offices and machines. The TAE frame provides space to mount a maximum of five NT5X00AC test access network (TAN) modules in positions 4, 18, 32, 51 and 65. Mount the NT5X00AD TAN module in positions 51 and 65 on the TAE frame. In addition to the TAN modules, the TAE frame contains the following components:

- NT0X82AB peripheral frame supervisory panel (FSP)
- NT0X0008 logic return cable assembly
- A0205202 QFF1A fuses
- A0205205 QFF1D fuses
- A0205210 QFF3A dummy fuses

To test the telecommunication line, connect the line to the circuit through the TAN modules in the TAE frame. During the test, the directory number or the line equipment number (LEN) of the tested line is dialed from the test desk. When the line is in the talking state, the system arranges a bridge connection to verify the line is in use. When a correct destination is reached, a connection is made between the test desk to a dialed line through the TAN module. A group of cutoff (CO) and test access (TA) relays, or TA relays only, on the line card are operated during the tests. Relays and connections are released after the test.

Parts

The NT5X12AB contains the following parts:

- A0205202-fuse-QFF1A
- A0205205-fuse-QFF1D
- A0205210-dummy fuse-QFF3A
- NT0X0008-logic return cable assembly
- NT0X82AB-peripheral FSP
- NT5X00AC-TAN module
- NT5X00AD-TAN module with trunk module connections

Fuse-QFF1A

The A0205202 fuse-QFF1A is a 1.33A fuse in fuse positions F09 through F13. This fuse is for TAN modules with the NT5X02AA test position, test trunk controller. See the table on page 3 for position of fuses.

NT5X12AB (continued)

Fuse-QFF1D

The A0205205 fuse-QFF1D is a 5.0A fuse that i in fuse positions F02 through F06. This fuse is for TAN modules that are equipped or not equipped with the NT5X02AA test position, test trunk controller. See the following table for position of fuses.

Dummy fuse-QFF3A

The A0205210 fuse-QFF3A is in fuse positions F02 through F06 and F09 through F13. These fuse positions are not equipped.

Logic return cable assembly

Each TAE frame uses the NT0X0008 logic return cable assembly when current offices that are not equipped with enhanced grounding, are extended.

Peripheral frame supervisory panel

The NT0X82AB peripheral FSP contains power control and alarm circuits. These items provide interface between the power distribution center (PDC) and the peripheral module (PM) frame of the DMS-100 Family. The FSP uses circuit breakers to protect the power control circuits and fuses to protect the alarm circuits. The FSP contains the following three types of cards:

- NT0X91AA converter drive and alarm
- NT0X91AB converter drive
- NT0X91AD converter drive

The FSP uses the NT0X91AA converter drive to monitor circuit breaker and fuse alarms.

Test access network module

The NT5X00AC TAN module provides metallic connections between a trunk test position or a test trunk and the access bus. This access bus is on a specified type of trunk module that the DMS-300 switch uses. The metallic connections are made for test purposes. Mount the TAN module in any of the following five positions on the TAE frame: 4, 18, 32, 51, 65.

Test access network module with trunk module connections

The NT5X00AD TAN module with trunk module connections provides metallic connections. The connections are made between a trunk test position or a test trunk and the access bus. This access bus is on a specified type of trunk module that the DMS-300 switch uses. The metallic connections are made for test purposes. Mount the NT5X00AD TAN module in the 51 and 65 positions on the TAE frame. Use the NT5X00AD TAN module to connect trunk modules. Do not use the NT5X00AC TAN module. This event occurs because the NT5X00AD test access network shelf assembly NT5X0002 has two local

NT5X12AB (continued)

cables. The connection of trunk modules process uses these cables. Positional preference is specified to the NT5X00AD TAN module over the NT5X00AC TAN module in the 51 and 65 positions.

Fuses and designation discs

Fuse rating (amps)	Fuse type	PEC	TAN module frame position	Fuse position
1.33	QFF1A	A0205202	04	F13
5.0	QFF1D	A0205205	18	F12
			32	F11
			51	F10
			65	F09

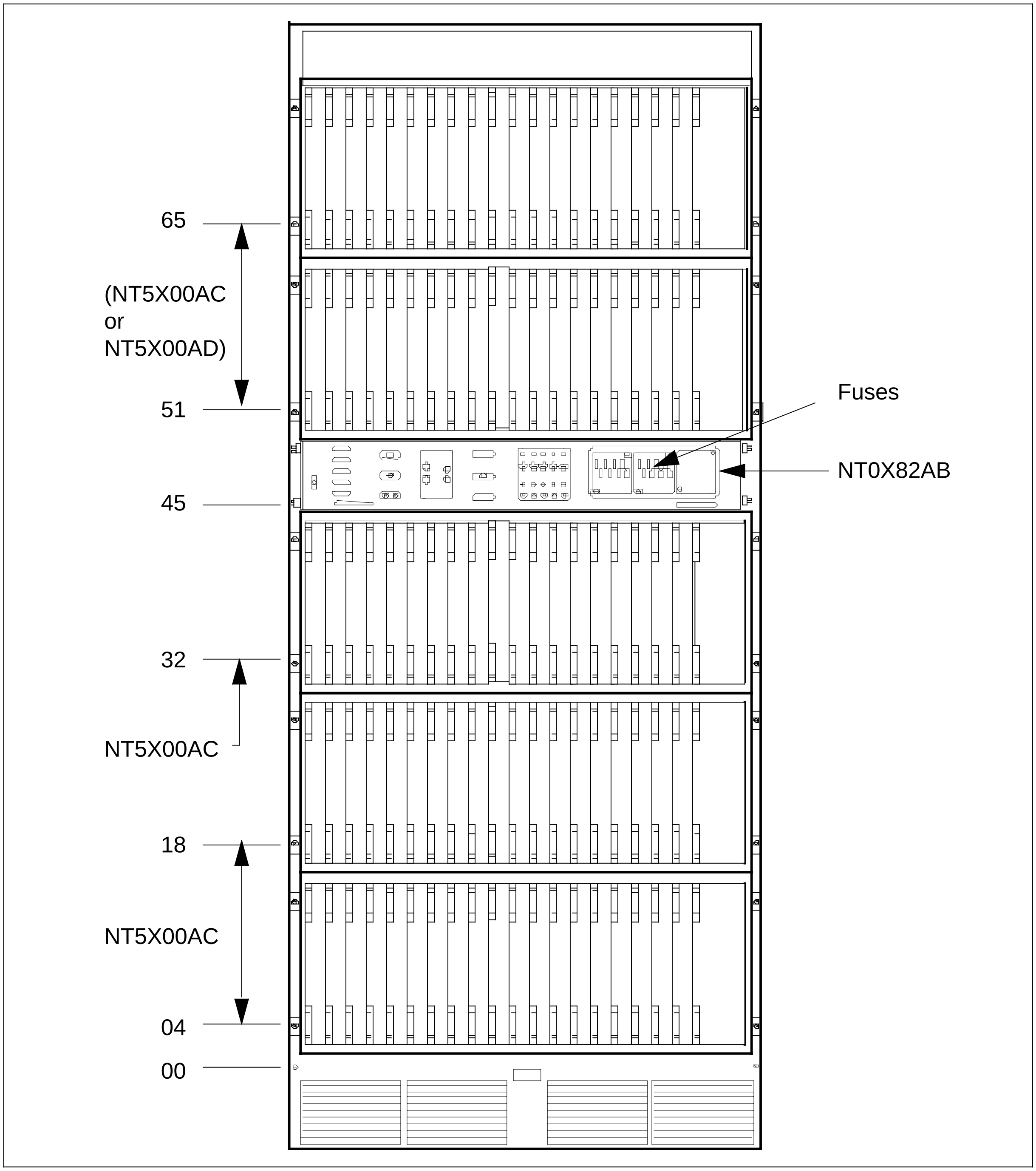
Note: The QFF1A fuses are for TAN modules that are not equipped with NT5X02AA test positions, test trunk controllers. The QFF1D fuses are for all TAN modules that are not equipped or equipped with the NT5X12AB test position, test trunk controller.

Design

The design of the NT5X12AB appears in the following figure.

NT5X12AB (end)

NT5X12AB design



NT5X13

Product description

The NT5X13 network frame is an all-digital telephone switching network that uses advanced integrated-circuit, solid-state electronic devices. The frame contains two network modules (NM). Each NM provides 1920 two-way switched speech connections between the input and output channels. A standard-size, 2.13 m (7 ft), single-bay equipment frame contains the two NMs.

The NM communicates with components of the DMS-100 system in 32-channel, serial data format. This data format is converted to parallel data for internal switching. When this event occurs, time switching is performed in 2 stages with the use of eight 16x16 time switches (TS). Four crosspoint cards, XPT-0 to XPT-3, contain these TSs. Switching occurs through the control of the data and connection memories in each switch.

The primary features of the NT5X13 follow:

- 4-wire, separate transmission paths for incoming (IC) and outgoing (OG) pulse code modulation (PCM) signals
- 2-stage time switching NM
- 64-port-by-64-port NM (fully equipped module)
- NM connects any of the 64 input ports to any of the 64 output ports
- 16- port by 16-port or 32-port by 32-port NM (partially equipped module)
- switches PCM signals in a 32-channel 2.56 Mb/s format
- 128 control and signaling channels (2 channels for each 32-channel port)
- 1920 speech channels (30 channels for each 32-channel port)
- 50 000 common channel signaling (CCS) traffic capacity (fully equipped), North American blocking information
- microprocessor firmware handles input/output (I/O) between the peripheral modules (PM) and the central control (CC) of the DMS-100
- speech path test facilities and message error checking

The NT5X13 has the following functional blocks:

- planes
- sides
- faces
- junctors

- ports
- NMC
- circuit cards
- control and status indicators

Planes

When in-service (InSv), a DMS-100 switching network contains pairs of NMs. One NM of a pair duplicates the connections of the other NM as a reliability back-up. The duplicated halves of a network are called planes. One plane is plane-0 and the other plane is plane-1. Each plane can contain a maximum 32 NMs.

Sides

Each NM has two sides, a receive side (side-A) and a transmit side (side-B). Side-A receives inputs from the PM and sends switched outputs to side-B of another or the same NM. The side-B receives inputs from side-A of another or the same NM and transmits switched outputs to the PM.

Faces

Each side has two faces, the peripheral face and the junctor face. The peripheral face of side-A connects to incoming channels on the speech links from the PM. The peripheral face of side-B connects to outgoing channels on the speech links to the PM. The junctor face of side-A transmits outgoing channels to the junctor face of side-B of another NM or the same NM. The speech link connecting (SLC) frame organizes speech link connections to the PM. The PM can be a trunk module (TM), digital carrier module (DCM) or link module (LM).

Junctors

Junctors are the connections that carry data from side-A to side-B of another or the same NM. Junctors have serial or parallel data format. When the office has more than five network pairs, all junctors have serial data format.

Several junctors are cables that carry 32 channels in serial data format for each junctor. The pattern of junctor connections varies to meet network traffic requirements. The digital network interconnecting (DNI) frame organizes serial junctor connections.

> ***Note:*** For speech link or junctor wiring, the specification is 26 AWG solid, tight twist.

Parallel junctors contain internal parallel buses. The buses run from the second-stage TS of side-A to the 1st-stage TS of side-B in the same NM. The

NT5X13 (continued)

parallel junctors carry parallel data and connect between the TS data memories. These junctors are used when the total number of network pairs in the office is five or less.

Cabling

For connectorized cables, the NM-to-CC and NM-to-NM cabling specification is 61 m (200 ft) maximum. The NM-to-PM cabling specification is 229 m (750 ft). The characteristic impedance is 90 to 110 ohms.

> ***Note:*** The difference between the length of the cables from a PM to plane-0 or plane-1 must not exceed 61 m (200 ft).

Ports

Ports are the entry and exit points on the peripheral and junctor faces. Each peripheral port carries 32 channels. These channels consist of 30 voice channels and 2 channels for signaling and test purposes. The voice channels carry PCM voice samples in serial data format. Each junctor port carries 31 voice channels and 1 signaling channel. Each TS has 16 (0-15) ports and each side has 4 sets (0-3) of first-stage and second-stage TS. A total of 64 (16 x 64) input and output ports for each side (ports 0-63) are present.

NMC

Part of an NM functions as a network message controller (NMC) for the two sides. The NMC provides two-way internal message handling. This handling occurs between the central message controllers (CMC) of the DMS-100 system and the crosspoint (XPT) switches or PM that connects to the peripheral ports.

Design

One network frame contains two NMs. One network frame contains four shelves that comprise the two NMs, a frame supervisory panel (FSP) and a cooling unit with an associated dc/ac inverter. Each shelf has a power converter.

The two top shelves contain the NM for plane-0 and the two lower shelves contain the NM for plane-1. In the DMS-100 equipment identification scheme, the frame is a combined network (NETC).

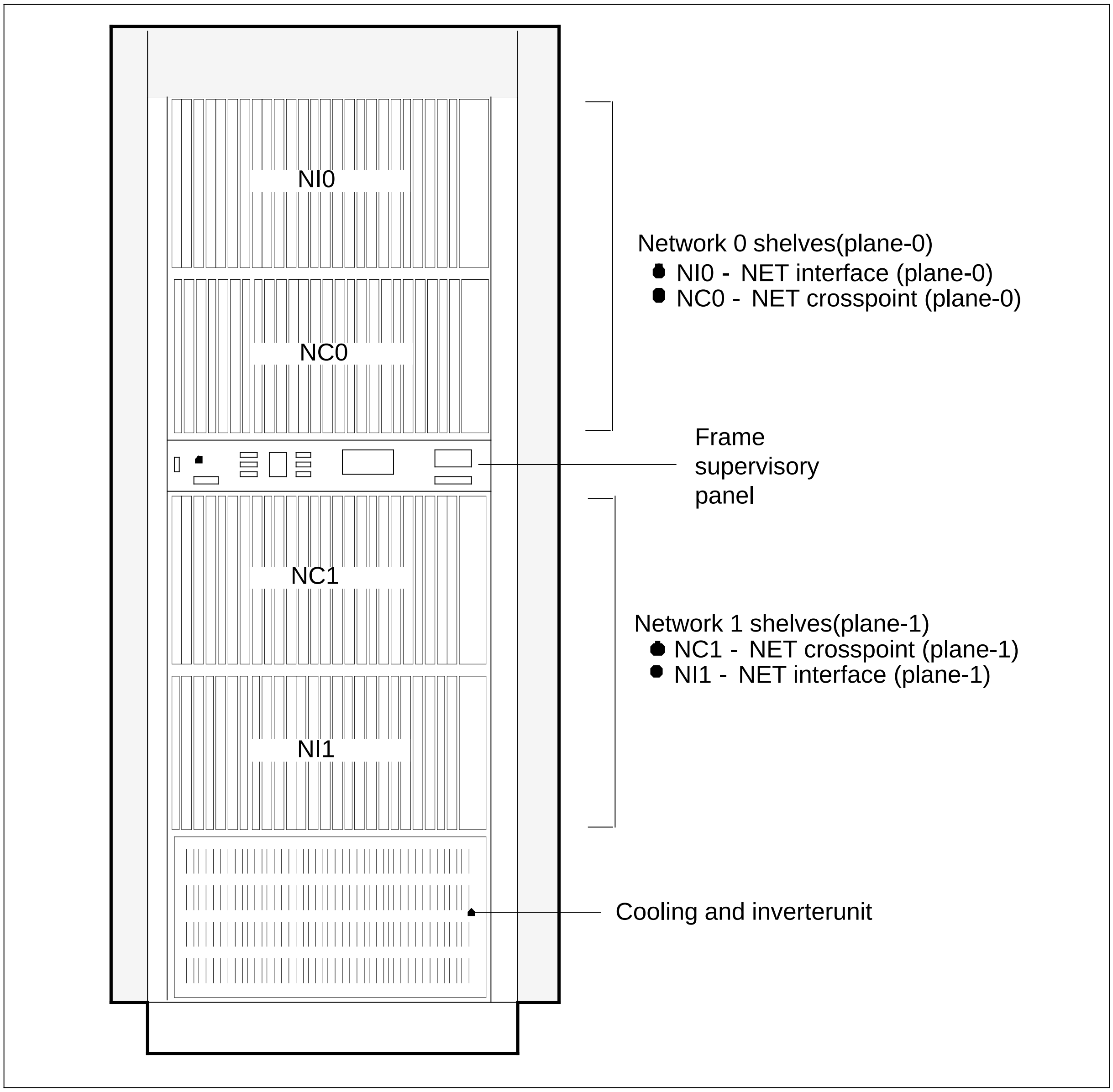
In plane-0, the top shelf contains speech interface and formatter cards for sides A and B and the P-side processor card. This shelf is the network interface (NI) shelf for plane-0 (NI0).

The shelf below contains the XPT cards, four for each side, the network control processor (NCP) card and the network clock card. This shelf is the network crosspoint (NC) shelf for plane-0 (NC0).

The NI and NC shelves for plane-1 have the same card complement, and the NI1 is below NC1.

The design of the appears in the following figure.

NT5X13 design



NT5X13 (continued)

Parts

The circuits to perform the switching and NMC functions are in the NT5X13 plug-in, printed circuit cards. The NT5X13 contains the following parts:

- NT3X72-Speech interface card
- NT3X73-Serial to parallel (S/P) formatter card
- NT3X70-Crosspoint (XPT) card
- NT3X86-Parallel to serial (P/S) formatter card
- NT3X74-Network control (NCP) processor
- NT3X75-P-side processor card
- NT3X76-Network clock card
- NT3X71-Test code card
- NT2X70AB-Power converter
- NT0X50-Filler face plate

NT5X13 parts (Sheet 1 of 3)

PEC	Slot	Description
NT3X72	01F-08F,16F-23F (NI0 and NC0)	*Speech interface card* The NT3X72 contains a biphase receiver and driver circuits that demodulate and modulate the signals on the speech links and junctors. The NT3X72 extracts and inserts signaling messages and test codes.
NT3X73	09F, 15F (NI0 and NC0)	*Serial to parallel (S/P) formatter card* Convert incoming 32-channel serial speech and signaling data to 32 sets of 10-bit parallel data. Enter this data in the data memory (DM) for each channel.
NT3X70	02F-09F (NC0) 13F-20F (NC1)	*Crosspoint (XPT) card* The NT3X70 contains first-stage and second-stage TS. The first-stage DMP stores parallel data that represent voice samples. Switching occurs when data transfers from the original location in the first-stage TS DM to another location in the second-stage DM. The connection memories (CM) perform switching. The system CC controls the CM through the NMC and CMC.

NT5X13 (continued)

NT5X13 parts (Sheet 2 of 3)

PEC	Slot	Description
NT3X86	11F, 13F (NI0 and NI1)	*Parallel to serial (P/S) formatter card* The NT3X86 accepts switched parallel data inputs from a second-stage TS and converts the data inputs to switched serial data. The serial data is output through the speech interface to the speech links.
NT3X74	10F (NC0) 12F (NC1)	*Network control processor (NCP)* The NT3X74 handles all messages from the system CC. The NCP acts on messages for the NM. The NCP has control buses to the XPT cards, the test code card, the clock card and the P-side message processor. Network connections occur through the control of the DM and CM of the first-stage and second-stage TS. This connection occurs in the A and B sides of the NM. To handle messages addressed to the PM route to the P-side processor.
NT3X75	14F (NI0 and NI1)	*P-side processor card* The NT3X75 handles message exchanges between an NM and the PM that connects to NM ports. Messages from a PM are extracted at the output of the S/P formatter. Messages addressed to a PM are inserted at the input to the formatter. On the network side, the processor accesses the NCP card and handles messages that pass through the NCP. The processor passes the NCP card between the system CC and PM.

NT5X13 (continued)

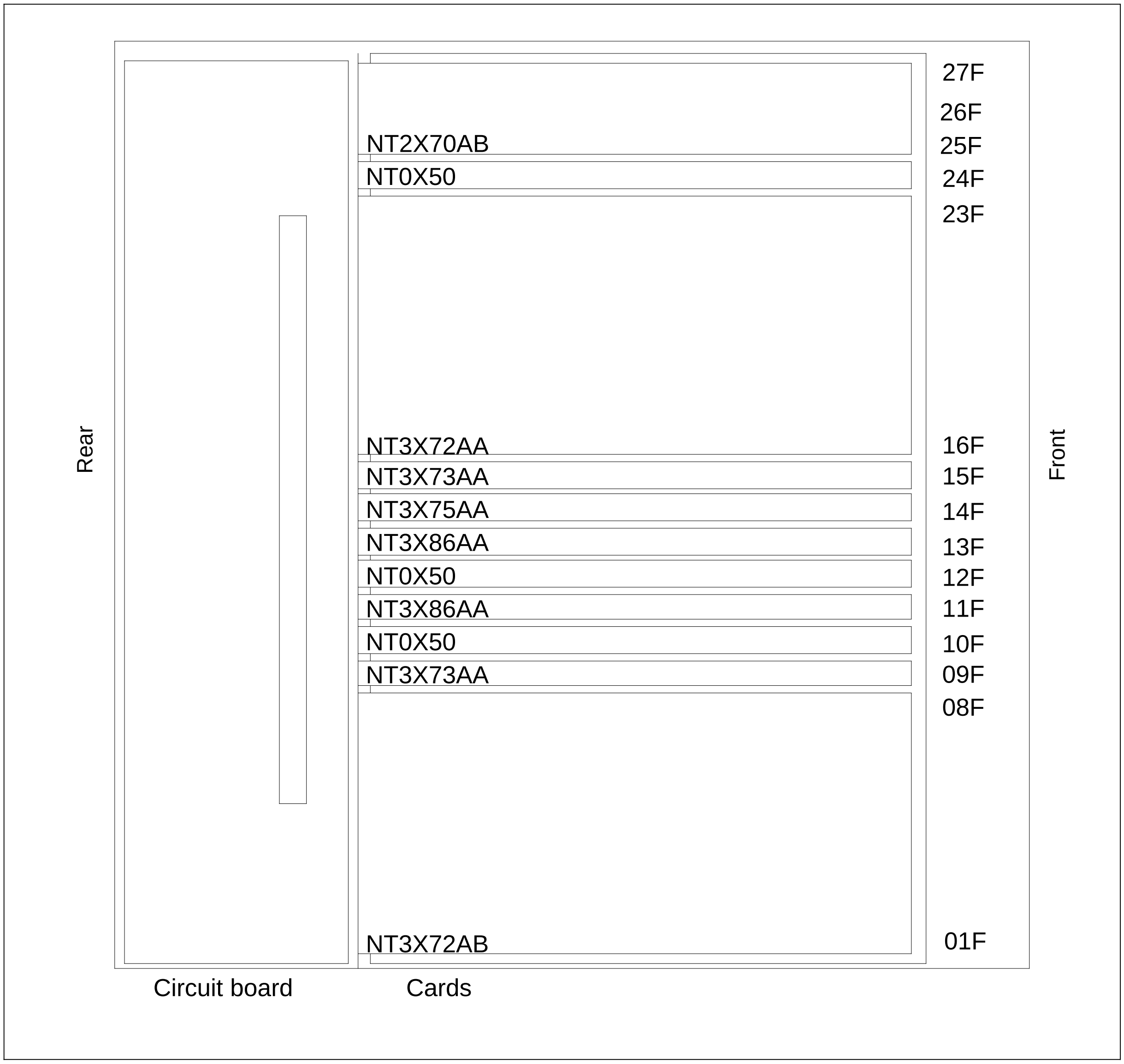
NT5X13 parts (Sheet 3 of 3)

PEC	Slot	Description
NT3X76	11F (NC0 and NC1)	*Network clock card* The NT3X76 contains a clock circuit that generates clock and synchronizing pulses. These pulses control timing in the NM and through the P-side processor to the PM. The clock circuit automatically synchronizes with timing pulses from the incoming data from the system CC. The NT3X76 contains two transmission interfaces that convert messages between the NCP and CC to serial data. This data is like the speech data format, and carries message data. The NCP, P-side processor and network clock cards comprise the circuits that performs the NMC function.
NT3X71	01F (NC0) 21F (NC1)	*Test card card* The NT3X71 contains circuits to insert and detect test codes and provides correct termination for the inter-TS links.
NT2X70AB	25F-27F (NI0 and NI1) 22F-24F (NC0 and NC1)	*Power converter* The NT2X70AB -48V (nominal) office battery supply to regulated and protected 5 V and 12 V outputs. This action occurs to operate the integrated circuits and solid-state devices in the NM. The power converters receive -48 V office battery supply through the NT0X28AK frame supervisory panel (FSP). The FSP contains power control, protection and alarm circuits.
NT0X50	10F,12F,24F (NI0 and NI1) 12F-21F, 25F-27F (NC0) 01F-10F, 25F-27F (NC1)	*Filler face place* The NT0X50 covers open slot positions on the shelf.

The parts layout appears in the following figures.

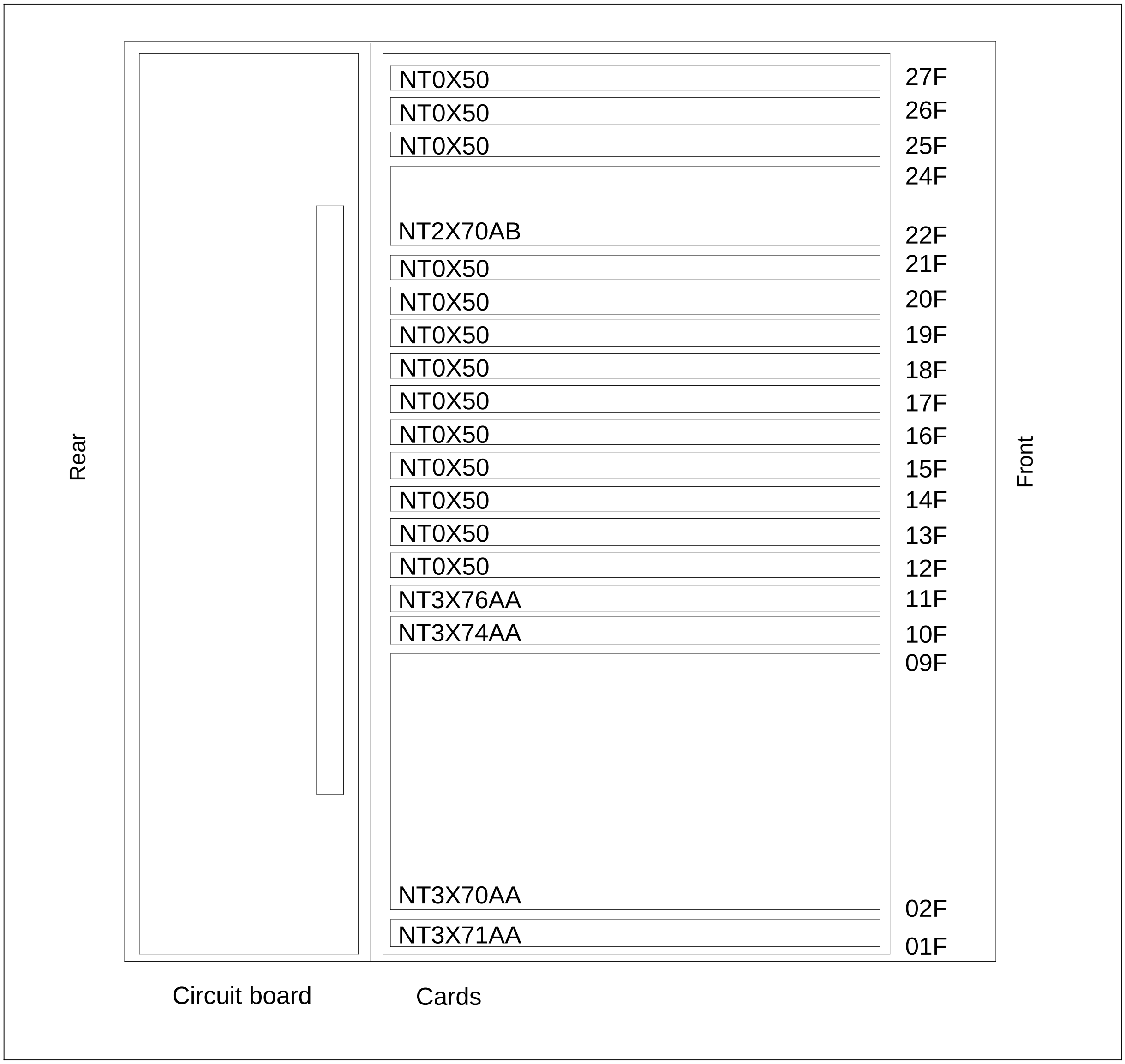
NT5X13 (continued)

NI0 shelf parts (plane 0)



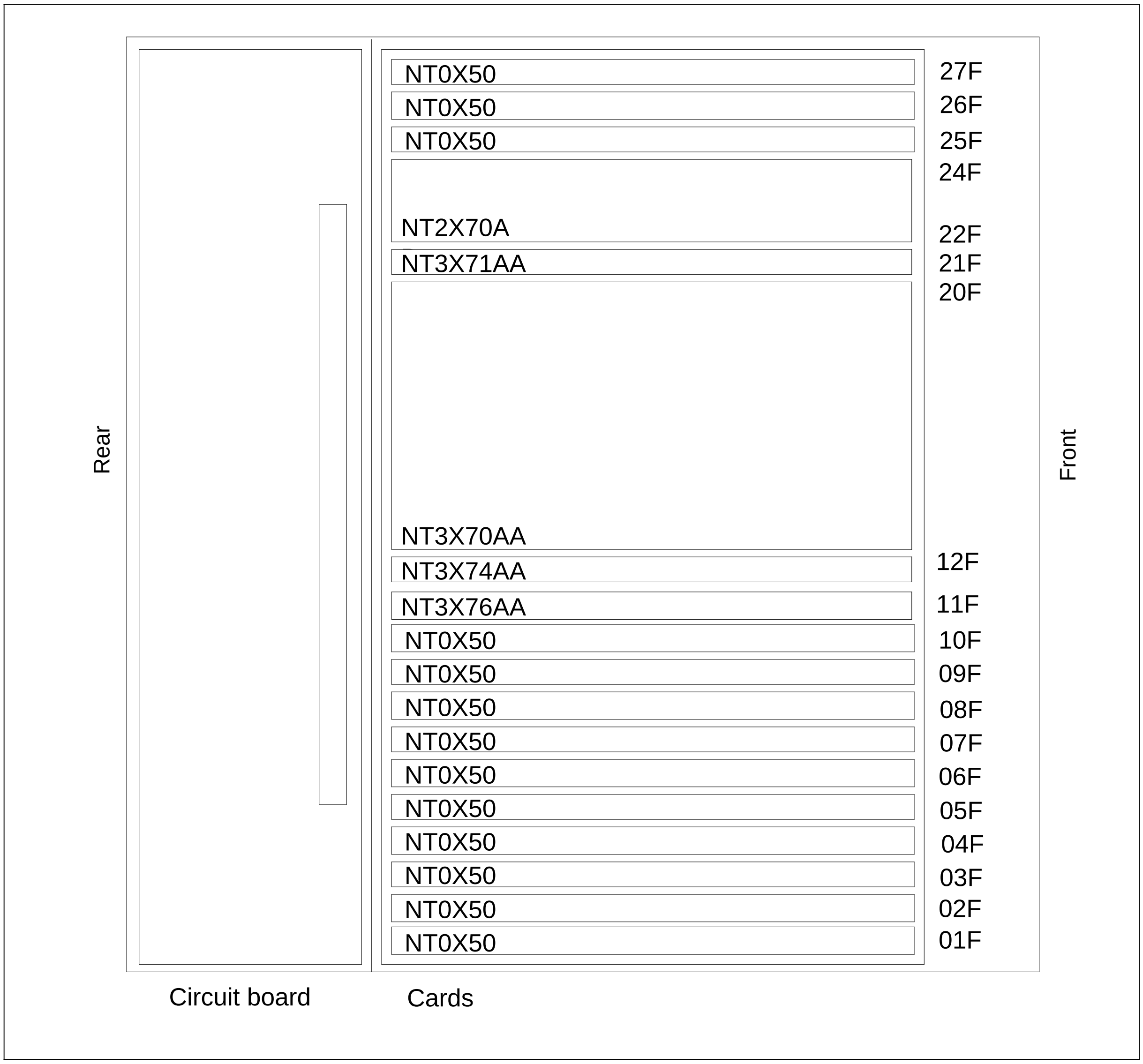
NT5X13 (continued)

NC0 shelf parts (plane 0)



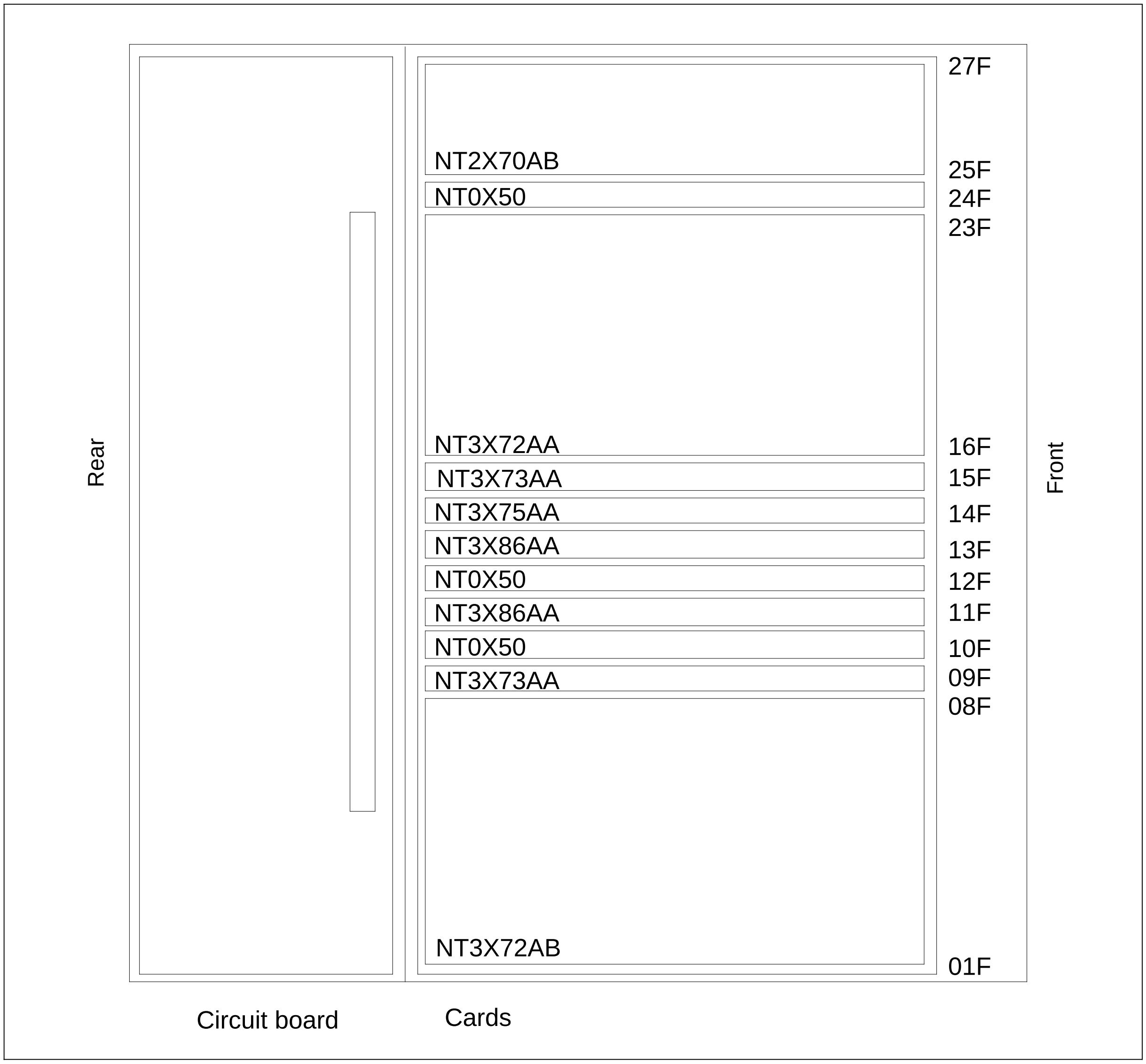
NT5X13 (continued)

NC1 shelf parts (plane 1)



NT5X13 (end)

NI1 shelf parts (plane 1)



NT5X18AA

Product description

The NT5X18AA network interface (NI) shelf is a speech interface. The NT5X18AA contains encoding and decoding logic for clock and frame pulse data alignment buffers. The NT5X18AA also contains logic for balanced ac data-driving and data-receiving circuits. Data passes to and from the corresponding peripheral module (PM), the junctors, and other networks. Data transmission occurs in the DS30 format. This event occurs so the pulse code modulation (PCM) data and clock and frame pulse can be sent over a single wire pair.

The NT5X18AA NI, plane 1 shelf, designated NI1, is in the NT5X13AA NETC frame at shelf position 18. The network interface shelf for plane 0 is at shelf position 65. The network interface shelf for plane 0 is designated NI0 and with the product engineering code (PEC) NT5X16AA. The NI1 and NI0 have identical configurations. The NI1 and NI0 each contain two sets of eight speech cards.

One set of speech interface (IF) cards interfaces with the junctors. The other set of IF cards interfaces with the PM by the peripheral-side (P-side) links. Each set of cards are called IF-0 through IF-7. Each IF card accepts eight ports from the PMs or junctors. This condition gives the shelf a total of 64 ports.

Each side of the shelf has an associated serial-to-parallel (SP) and parallel-to-serial (PS) formatter card. These cards are located between the IF cards for the two sides. The shelf also contains a P-side processor card that handles part of the network message controller (NMC) function. The part of the NMC function involves messages between the NET and the associated PM.

Parts

The NT5X18AA contains the following parts:

- NT2X07AB-Power converter, 5V/12V
- NT3X72AB-Network port serial interface circuit pack
- NT3X73AA-Network SP formatter circuit pack
- NT3X75AA-Network P-side message processor circuit pack
- NT3X86AA-Network PS formatter circuit pack

NT5X18AA (continued)

Design

Descriptions of the parts that comprise the NT5X18AA shelf appear in the following table. The design of the NT5X18AA appears in the following figure.

NT5X18AA parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	10F, 12F, 24F	*Filler faceplate .875* The NT0X50AA fills the slots 10F, 12F, and 24F, which are not in use.
NT2X07AB	25F	*Power converter, 5 V/12 V* The NT2X07AB provides to the NI a regulated dc power supply with an output of +5V or +12V required by the circuit cards. Input to the converter comes from a nominal -48V dc office battery.

NT5X18AA parts (Sheet 2 of 4)

PEC	Slot	Description
NT3X72AB	1F-8F, 16F-23F	*Network port serial interface circuit pack* The NT3X72AB provides eight bi-directional, 2.56 Mbps serial port interfaces. Each card interface contains decoders and data alignment buffers for the incoming circuits, and contains encoders and buffers for the outgoing circuits. Insertion of test code (TC) must occur on the incoming speech path. Removal occurs on any path. **Incoming circuit**. The decoders can accommodate eight 32-channel ports (0-7) of incoming serial PCM at 2.56 Mbps from the PM. A 64-port network module (NM) requires eight IFs, designated IF-0 through IF-7. Each IF outputs eight sets of 32-channel PCM samples that the decoder circuits change from the incoming pulse trains to 10-bit serial data format. The serial data stream from each decoder is paired with a data stream from another port. For example, port-0 and port-1, and each pair of data streams is interleaved on a 5.12 Mbps serial (1 pair) bus to the SP formatter. Four 5.12 Mbps serial buses (1 pair each) carry the total of eight streams (four pairs). The streams are carried from IF-0 (ports 0-7) to the SP formatter. A like arrangement of four-pair, 5.12 Mbps serial buses carries data from IF-1 (ports 8-15). This event makes a total of 16 data streams (8 pairs) per couple of IF cards (IF-0, IF-1). The other ports (16-63) on IF-2 through IF-7 are also paired. Output 16 data streams for each couple of IF cards.

NT5X18AA (continued)

NT5X18AA parts (Sheet 3 of 4)

PEC	Slot	Description
NT3X72AB (continued)	1F-8F, 16F-23F	*Network port serial interface circuit pack* Ports are identified by the absolute port number in the range of 0-63. Port-0 on IF-0 has absolute port number-0. Port-7 on IF-7 has absolute port number-63. Other port references are numbered in the same method. *Outgoing circuit*. In the outgoing direction, each IF card receives four 5.12 Mbps binary serial speech buses. Each bus carries a pair of data streams from the PS formatter. The IF card demultiplexes these speech buses to the 2.56 Mbps format and inserts internal messages. The data streams pass to the encoders. The encoders change the data stream into pulse trains for outgoing transmission through the appropriate ports.
NT3X73AA	9F, 15F	*Network serial-to-parallel formatter circuit pack* Converts incoming serial data received from the speech interface cards to the parallel format required for the crosspoint cards. The SP formatter consists of four identical sections. Each section converts 16 ports (8 pairs) of speech data into a 512-channel, 10-bit parallel bus. The four SP formatter sections receive 32 (4 sections x 8 pairs) serial data buses from eight serial interface cards. The SP formatter outputs four 10-bit parallel buses, one to each of the four crosspoint cards that comprise one side of an NM.

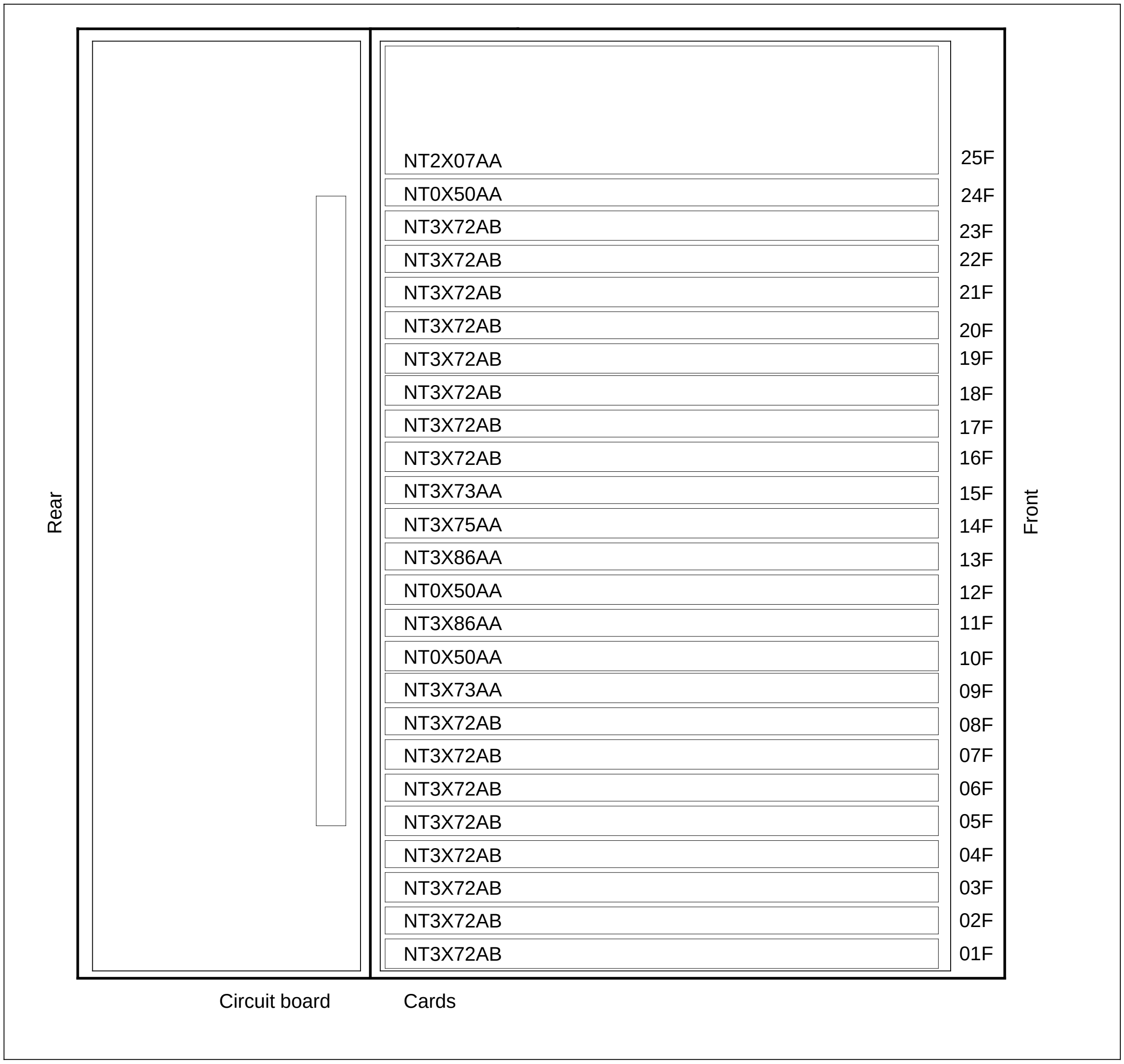
NT5X18AA (continued)

NT5X18AA parts (Sheet 4 of 4)

PEC	Slot	Description
NT3X75AA	14F	*Network P-side message processor circuit pack* The NT3X75AA network P-side message processor card handles message exchanges between an NM and the PM. The P-side of the processor connects across the four parallel buses between the formatters and the XPT cards on the A-side and B-side of the peripheral faces. Messages from a PM are extracted at the output of the SP formatter. Messages to a PM are inserted at the input to the PS formatter. The processor can access the channel-zeros that go to and come from the PM. Four message transactions that occur at the same time can be handled. Each parallel bus must handle each message transaction one at a time. On the network side, the processor has access to a message buffer on the network control processor card (NCP)-NT3X74. Messages received from peripherals are deposited in this buffer. The NCP relays these messages to the CC or the computing module. The P-side processor can scan this buffer for outgoing messages. These messages are sent to the PM the message headers specifies.
NT3X86AA	11F, 13F	*Network parallel-to-serial formatter card* The NT3X86AA network PS card converts incoming parallel speech buses. The card converts the buses from the XPT cards to the serial format that the serial-port IF cards requires. The PS formatter consists of four identical sections. Each section converts a 512-channel, 10-bit parallel bus to 16 (8 pairs) serial buses. The PS formatter receives four parallel buses. One bus is from each of the four XPT cards that comprise one side of an NM. The PS formatter card outputs 32 (4 sections x 8 pairs) dual port (1-pair) serial data buses to eight serial IF cards.

NT5X18AA (end)

NT5X18AA design



NT5X25

Product description

The NT5X25 trunk circuit card provides signaling and voice frequency (VF) interfaces. The signalling and VF interfaces occurs between a DMS-100 Family digital switch equipped for private branch exchange (PBX) service and a local central office (CO). This card operates with the trunk module (TM) of the DMS-100 switch. Each card accommodates two trunk circuits. Under software control, each trunk circuit can handle one-way IC or one-way OG calls. The contains circuits that allows PBX stations (or attendants) to make outgoing (OG) calls by dial pulse (DP) or Digitone (DGT). Incoming (IC) calls from the CO connect to the PBX attendant.

Perform a self-test on the card through the TM. When test circuits are active, the trunk circuits are isolated from the transmission facilities. This event allows the performance of VF loop around and signaling tests.

The primary features of the NT5X25 follow:

- 900 ohms of input impedance
- built-in 2-wire-to-4-wire (2W/4W) termination set
- card-type identification signal to the TM
- IC loop-start (LS) or ground-start (GS) operation, that you select by a miniature card-mounted switch for IC mode
- OG ground-start operation for OG mode
- LS or GS switch position signal to the TM
- switch-selected level adjustment pads (0 or 2 dB in transmit and receive voice paths)
- tip-ground and loop polarity detection
- loop supervision of CO disconnect
- 20 Hz ringing detection

Location

The NT5X25 circuit card occupies a slot in a 2-wire, 4-wire, or 8-wire TM.

Functional description

Each trunk circuit on this card provides the transmission, signaling, and supervision facilities to handle traffic. The traffic occurs between a DMS-100 switch with PBX service and a line appearance at a local CO. A circuit can operate in IC or OG mode.

NT5X25 (continued)

The circuit functions follow:

- process VF signals
- exchange control messages with the TM
- receive far-end signaling, like LS or GS and 20 Hz ringing
- transmit near-end signaling to the far end, like GS seizure and outpulsing of DP or DGT

The relationship with the NT5X25 functional blocks appear in the following table.

VF circuits

The VF circuit includes a 2W/4W terminating set. This set provides an interface between the two-wire analog transmission facility and the four-wire trunk circuit. A fixed network provides balancing for the terminating set.

Receiving

Received VF signals pass through the 2W/4W termination set and through the limiter to the receive level adjustment pad and the 60 Hz filter. The receive level adjustment pad has two level settings: 0 dB and 2 dB. Select the setting by a miniature switch (S2). The VF signal enters the low-pass, analog-to-digital (A/D) filter that limits signal bandwidth and provides amplification. The sampling gate signal samples the signal at an 8 kHz rate. The pulse amplitude modulation (PAM) samples of the signal that result are applied to a common transmit PAM (XPAM) bus. The encoder in the TM processes the signal more.

Transmitting

In the transmit direction of the four-wire circuit, PAM samples from the decoder in the TM are received on the common receive PAM (RPAM) bus. These signals sample and reconstruct the original VF analog signal through the sampling gate and digital-to-analog (D/A) filter. This event can amplify the signal. The termination set passes the VF signal through the transmit level adjustment pad and limiter. The transmit level adjustment pad has two level settings (0 dB and 2 dB). The S3 selects these settings manually.

Signaling and supervision circuits

The trunk logic circuit (TLC) is a communication buffer between the signaling and supervisory circuits and the TM through the control data bus. The TLC can generate the sampling pulses for the sampling gate. The TLC controls the availability of card-type identification voltage to the TM.

The loop/ground detector receives supervision signals from the far end. The loop/ground detector senses tip-ground and loop polarity conditions and sends appropriate logic signals to the TLC. The signals depend on which condition is present at the input. The 20 Hz ringing signals appear at the ringing detector and are converted to a logic signal. The logic signal is present at the TLC when ringing persists. The signal holds during the silent interval between rings.

System software that acts through the TLC operates relays K2 and K3. These develop transmit signaling from the card to the far end. When the K3 relay operates, the K2 relay performs outpulsing to the far end in response to digits received through the TLC. The system applies K2 relay pulsing to the pulsing timer. The pulsing timer provides a steady-operated state to relays K5 and K6 when a digit outpulses.

The K5 relay connects a loop resistor across T and R. The K6 relay disconnects the transmission facilities from the voice paths to the 2W/4W termination set. The contacts of relays K5 and K6 interlock. When pulsing stops, the K5 relay releases after the K6 relay. This event prevents the transmission path from opening before the loop resistor is connected. This event prevents the loop resister from disconnecting before the transmission path closes. The K6 relay connects an artificial battery (through the K4 contacts) to the 2W/4W terminating set. This action persists when the K2 relay is pulsing and relays K5 and K6 operate.

Trunk circuit function

The trunk circuit function is described in terms of the CO to PBX (IC mode) and the PBX to CO (OG mode).

CO to PBX

In the IC mode, you can arrange the trunk circuit to receive LS or GS IC calls. Use the switch S1A to the LS or GS position. Through switch S1B, the TM reports the S1A setting. This condition provides an indication to the TLC when the S1A is sent to GS. In LP and GS modes, operation begins when the ringing detector detects 20 Hz ringing from the CO.

For the LS mode, S1A and S1B open, the trunk circuit provides a high impedance to the CO when idle. The tip and ring (T/R) leads are isolated from the termination set and the alternating current (ac) ringing detector is connected. When 20 Hz ringing appears on the T/R leads, the ringing detector sends a signal to the TLC. This event alerts the PBX attendant. When the attendant is available, the PBX responds through operation of K2 and K3. This action disconnects the ringing detector and connects the VF paths. When this event occurs, a low-resistance, direct current (dc) loop is placed across the T/R leads. The loop and polarity detector now monitors loop current and polarity from the CO.

NT5X25 (continued)

For the GS mode, S1A and S1B closed, a high-resistance, negative battery is present on the tip lead of the card. The loop/ground detector is now set to detect tip-ground. During seizure, the CO places a ground on the tip that the loop/ground detector detects. The TLC receives the appropriate logic signal. The system software checks the ringing detector for the presence of 20 Hz ringing, and alerts the PBX attendant. When the attendant is available, relays K2 and K3 are operated the same as with LS. The VF paths connect. This event sets the loop/ground detector to monitor loop current and polarity from the CO.

PBX to CO

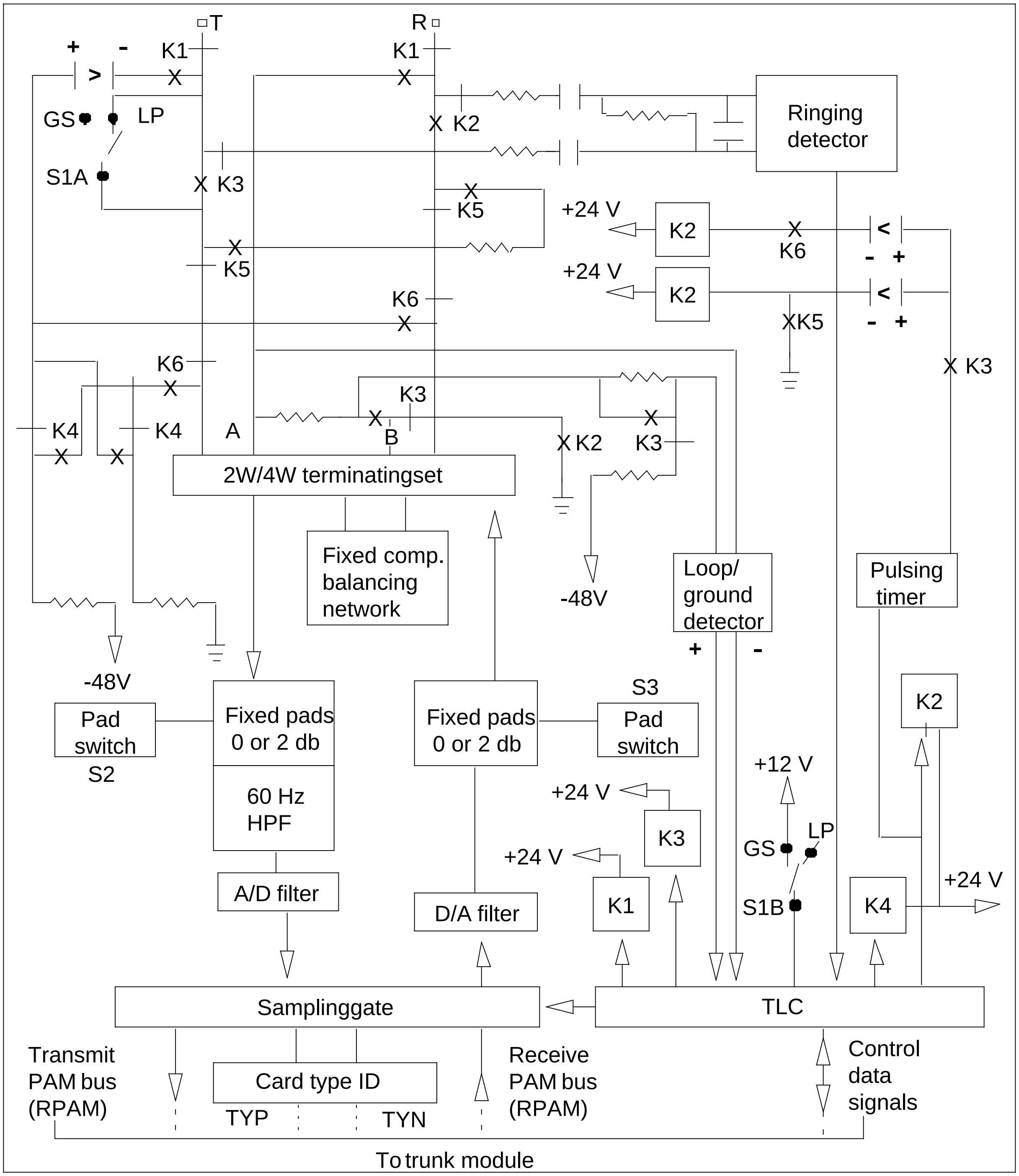
In the OG mode, switch S1, A and B, are in the GS mode. During the idle state, the tip lead at the CO is open. To seize the trunk, the PBX operates the K2 relay to place a low-resistance ground on the ring lead to CO. When the CO is ready to receive digits, the CO responds with a ground on tip and returns a dial tone. The PBX software operates the K3 relay. The K3 relay removes the ring lead ground and connects the loop detector for supervision. The K2 relay transmits the DP as an earlier section describes.

Test circuits

The test circuit simulates far-end supervisory signals and tests the operation of the loop/ground detector in LS and GS modes. During the test sequence, the K1 relay is operated. The K1 relay isolates the T/R leads of the transmission facility from the card circuits and connects the test circuits instead. This event provides the additional effect of VF loop-around path between the transmit and receive sides of the 2W/4W termination set. Maintenance software in the DMS system performs the test sequences. The maintenance software acts through the TLC and applies different groups of relays K2, K3 and K4.

NT5X25 (continued)

NT5X25 functional blocks



NT5X25 (continued)

Technical data

The technical data section provides the following specifications for the NT5X25:

- power requirements
- equipment dimensions
- environmental conditions
- signaling characteristics
- transmission specifications

Power requirements

The NT5X25 power requirements appear in the following table.

Power requirements

Power use	Converted voltages
500 mW (normal)	+12V ±0.3V
	-15V ±0.5V
	+22.8V to +27.0V, (+24V nominal)

Equipment dimensions

The dimensions of the NT5X25 circuit card are as follows:

- height: 353 mm (13.9 in.)
- width: 29 mm (1.125 in.)
- depth: 267 mm (10.5 in.)
- weight: 1.36 kg (3 lb)

Environmental conditions

The environmental conditions that limit the NT5X25 appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10°C to 30°C (50°F to 86°F)	5 °C to 49 °C (41 °F to 120.2 °F)
Relative humidity	20% to 55%	20% to 80%

Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the relative humidity 30% maximum.

Signaling characteristics

The NT5X25 signaling characteristics appear in the following table.

Signaling characteristics

Signaling	Characteristics
Talk battery	-42.5V to -55.8V
Normal range (float charge)	-49.0V to -53.5V
Maximum discharge (no charge)	-42.75 V
Maximum charge (equalizing)	-55.8V
Insulation resistance	30 kohm minimum
Ground potential difference	±3V maximum
Longitudinal induction (60 Hz, talk state)	40 mA for each conductor
Long supervision range maximum external loop -45V CO battery	2000 ohms
Outpulsing range	The working limits of the pulse receiving or repeating circuit determines the outpulsing range.

Transmission specifications

The NT5X25 transmission specifications follow.

- With the LS or GS switch in the appropriate position, the input impedance for the talk state is 900 ohms +2.15 uF. With the LS or GS switch in the appropriate position, the input impedance for the idle state is 1600 ohms to 40 kohms.
- LS is measured across T/R with 40V (rms) and 20 Hz placed over 105V (dc).
- GS is measured with tip-grounded 40V (rms) and 20 Hz placed over 104V (dc).
- The maximum receive level (nominal) at the T/R leads of the trunk circuit with the S2 set to in is +2 dBm for digital test sequence (DTS) output.

NT5X25 (end)

- The minimum receive level (nominal) at the T/R leads of the trunk circuit with the S2 set to out is 0 dBm. This level is for DTS output.
- The maximum transmit level (nominal) at the T/R leads of the trunk circuit with the S3 set to out is 0 dBm. This level is for DTS input.
- The minimum transmit level (nominal) at the T/R leads of the trunk circuit with the S3 set to in is -2 dBm. This level is for DTS input.
- The normal connecting circuit is SD26030.

NT5X29AA

Product description

The NT5X29AA common channel interoffice signaling (CCIS) continuity checker card provides multichannel service circuits. These circuits identify and generate standard single or two-frequency tones.

The card contains separately controlled detector and sender circuits. These circuits operate with the maintenance trunk module (MTM) in a DMS-100 digital switching system.

Location

The card plugs in to the two preferred positions that are next to each another in the MTM.

Functional description

The NT5X29AA uses the receive data (RDAT) and the transmit data (XDAT) buses. The NT5X29AA uses these features to receive pulse code modulation (PCM) format or signal distribution (SD) words. The NT5X29AA uses these features to send coded messages and responses from the tone detector circuits and the tone generator.

Functional blocks

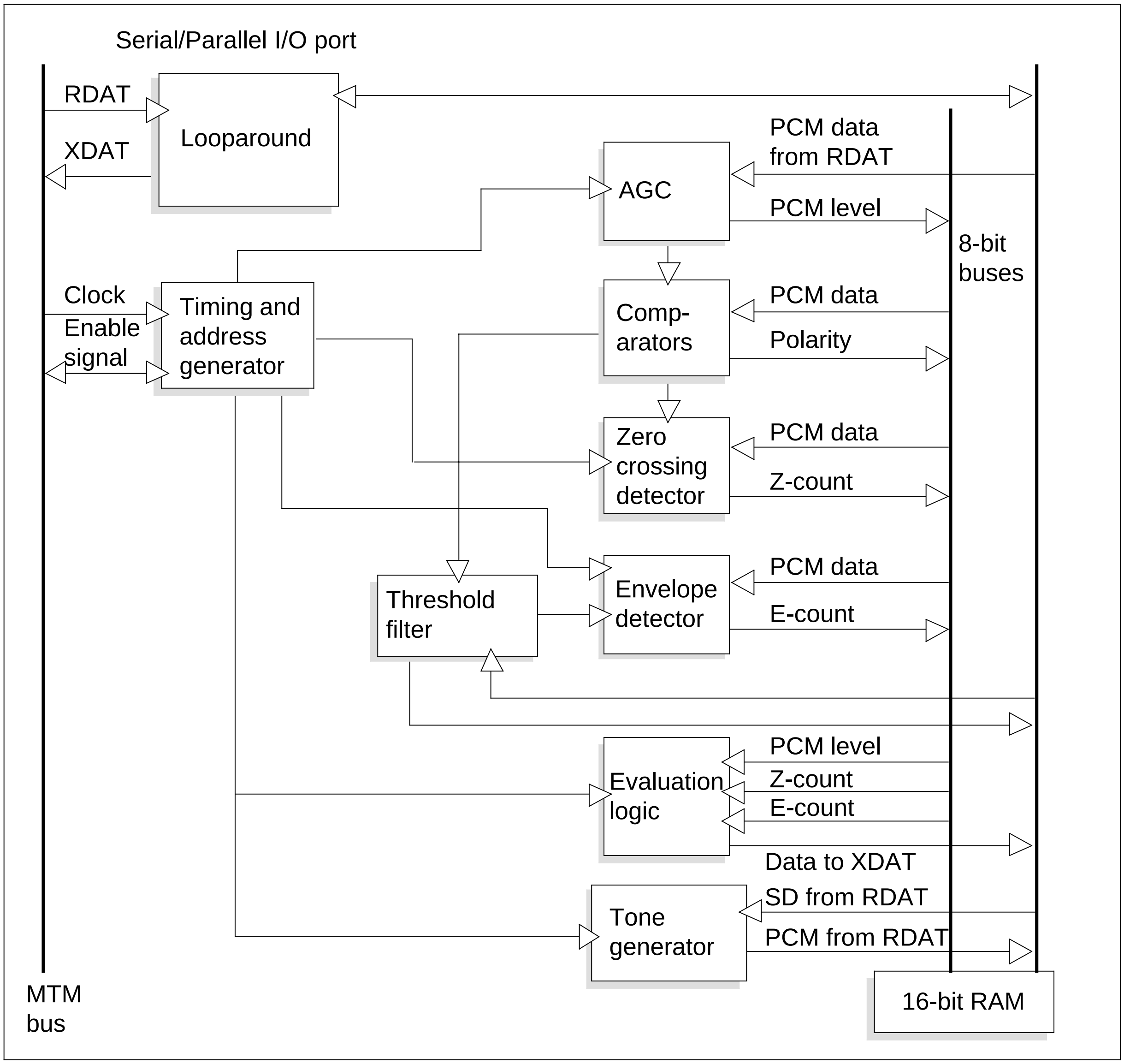
The NT5X29AA contains the following functional blocks:

- automatic gain control (AGC)
- comparator
- zero crossing detector
- envelope detector
- threshold filter
- evaluation logic
- tone generator
- 16-bit RAM

NT5X29AA (continued)

- timing and address generator
- looparound

NT5X29AA functional blocks



AGC

The AGC receives a single or two-frequency tone in 8-bit PCM format. The AGC linearizes the signal to a level compatible with the zero-crossing detector and the envelope detector. The AGC produces a 4-bit code that represents the original PCM sample. The 4-bit code is an input to the evaluation logic circuit. The timing and address generator sets the AGC in 20 ms intervals.

Comparator

The comparator circuit provides reference values and smoothing of the Z-count and the E-count data. The zero crossing detector and the envelope detector use this data.

Zero crossing detector

The zero crossing detector counts the number of occurrences of PCM zero codes in a fixed threshold. The zero crossing detector determines the frequency of a tone. The output of the detector (Z-count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 10 ms intervals.

Envelope detector

The envelope detector produces a count that represents the difference between the two frequencies in a two-frequency tone. The output of the detector (E-count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 100 ms intervals.

Threshold filter

The threshold filter circuit provides reference values and smoothing of the Z-count and E-count data. The zero crossing detector and the envelope detector use this data.

Evaluation logic

The evaluation logic circuit receives PCM level, Z-count and E-count signals. The evaluation logic circuit uses two ROMs to produce a coded signal to the MTM. The signal corresponds to the identity and the level of the tone. The circuit sends the signal to the MTM during channel 0.

The evaluated data code assignments for the card appear in the following table. Evaluated data are known codes that correspond to the tone identity. This assignment system simulates hysteresis.

Evaluate data code assignments (Sheet 1 of 2)

Tone/Level	Tone code	Level code
Quiet	00	
Noise	01	
1780 (low) -28 dBm	02	00 or 01 (00=very low)
1780 (low) -23 dBm	02	04
1780 (low) -28 or -23 dBm	02	02

NT5X29AA (continued)

Evaluate data code assignments (Sheet 2 of 2)

Tone/Level	Tone code	Level code
1780 (high) -28 dBm	04	00 or 01 (00=very low)
1780 (high) -23 dBm	04	04
1780 (high) -28 or -23 dBm	04	02
2010 (low) -28 dBm	08	00 or 01 (00=very low)
2010 (low) -23 dBm	08	10
2010 (low) -28 or -23 dBm	08	08
2010 (high) -28 dBm	10	00 or 01 (00=very low)
2010 (high) -23 dBm	10	10
2010 (high) -28 or -23 dBm	10	08

NT5X29AA (continued)

The raw data code assignments for the scan word channels appears in the following table. Raw data contains two words that represent the level, frequency and difference frequency of the input tone.

Raw data code assignments

Channel	Bit number	Purpose
0	0	Level code, Least significant bit (LSB)
	1	Level code, 2nd bit
	2	Level code, 3rd bit
	3	Level code, Most significant bit (MSB)
	4	Frequency code, LSB
	5	Frequency code, 2nd bit
	6	Frequency code, 3rd bit
	7	Frequency code, 4th bit
16	0	Frequency code, 5th bit
	1	Frequency code, MSB
	2	Difference frequency, LSB
	3	Difference frequency, 2nd bit
	4	Difference frequency, 3rd bit
	4	Difference frequency, 4th bit
	5	Difference frequency, MSB
	7	Difference frequency, MSB

The level code does not require decoding. The code indicates the strength of the input level. If the number is larger, the level increases.

To determine the frequency code and the difference frequency code, convert the binary number to the decimal value. Divide the decimal value by 2, and round the number to the nearest ten. Multiply the number by 100 for the frequency code, or 10 for the difference frequency.

NT5X29AA (continued)

Two examples of decoding follow:

Decoding examples

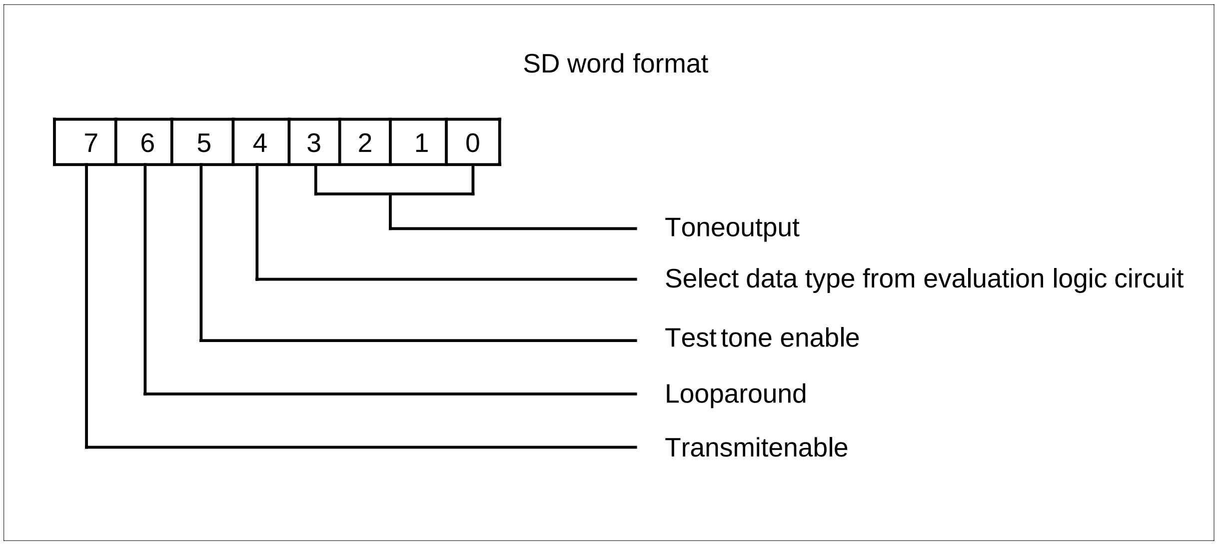
Frequency decoding	Difference frequency decoding
Binary number = 001011	Binary number = 10101
Decimal value = 10	Decimal value = 21
Divide by 2 = 5.5	Divide by 2 = 10.5
Approximate to 5	Approximate to 10
Multiply by 100 = 500 Hz	Multiply by 10 = 100 Hz

Tone generator

The tone generator circuit stores tones in PCM format in the PROM. The circuit uses a code in the SD word to address a segment of the PROM. The circuit sends the selected tone to the MTM in PCM format.

The 8-bit SD word format appears in the following figure. The table describes the bit number and code of the format.

NT5X29AA SD word format



SD word format (Sheet 1 of 2)

Bit number	Purpose	Code	Result
7	Transmit enable	1	Enable XDAT bus to send PCM tone
		0	PCM output is not available
6	Looparound	1	Connect XDAT to RDAT for diagnostic test
		0	Normal XDAT
5	Test tone enable	1	Select test tone
		0	Select normal tone
4	Select data type from evaluation logic circuit	1	Select evaluated data
		0	Select raw data
3210	Tone output		
	If bit 5 = 1	1000	400 Hz modulated with 40 Hz
		1001	600 Hz modulated with 120 Hz

NT5X29AA (continued)

SD word format (Sheet 2 of 2)

Bit number	Purpose	Code	Result
		1010	950 Hz
		1011	1400 Hz
		1100	1800 Hz
		1101	Noise at -5 dBm0
		1110	Noise at -26 dBm0
		1111	Noise at -46 dBm0
	If bit 5 = 0	00XX	1780 Hz CCIS tone
		01XX	2010 Hz CCIS tone

16-bit RAM

The 16-bit RAM circuit provides parameters of the 16-tone detector channels, and retains the counts of completed operations.

Timing and address generator

The timing and address generator controls data movement through the I/O port circuits. The card can handle 16 channels of RDAT and XDAT activity. The card can handle selected channels that enable signals from the MTM control. When enable lines control the circuit, the circuit sends data on the RDAT, XDAT, and internal buses.

Looparound

The looparound circuit is for testing. To test this circuit, the system loops the PCM sample back to the XDAT bus.

Technical data

The NT5X29AA card has a level measurement range of 0 to -38 dBm0, and a frequency measurement resolution of ±100 Hz. This card has a difference frequency resolution of ±10 Hz.

Physical dimensions

The physical dimensions for the NT5X29AA circuit card are as follows:

- overall height: 353 mm (13.9 in.)
- overall depth: 277 mm (10.9 in.)
- overall width: 56 mm (2.2 in.)

NT5X29AA (end)

Power requirements

An MTM power converter supplies power to the NT5X29AA through the MTM backplane. The power requirements for the NT5X29AA are a voltage of +5V and current of 2 A.

NT5X29AB

Product description

The NT5X29AB service observing circuit card provides multichannel service circuits. The NT5X29AB provides these circuits to identify and generate standard single or two-frequency tones.

The card contains separately controlled detector and sender circuits that operate with the maintenance trunk module (MTM). The remote operator number identification (RONI), and DMS-100 equipment with TOPS use this card.

Location

The card plugs in to the two preferred positions in the MTM that are next to each other.

Functional description

The NT5X29AB uses the receive data (RDAT) and the transmit data (XDAT) buses. The NT5X29AB uses these features to receive pulse code modulation (PCM) format or signal distribution (SD) words. The NT5X29AB uses these features to send coded messages and responses from the tone detector circuits and the tone generator.

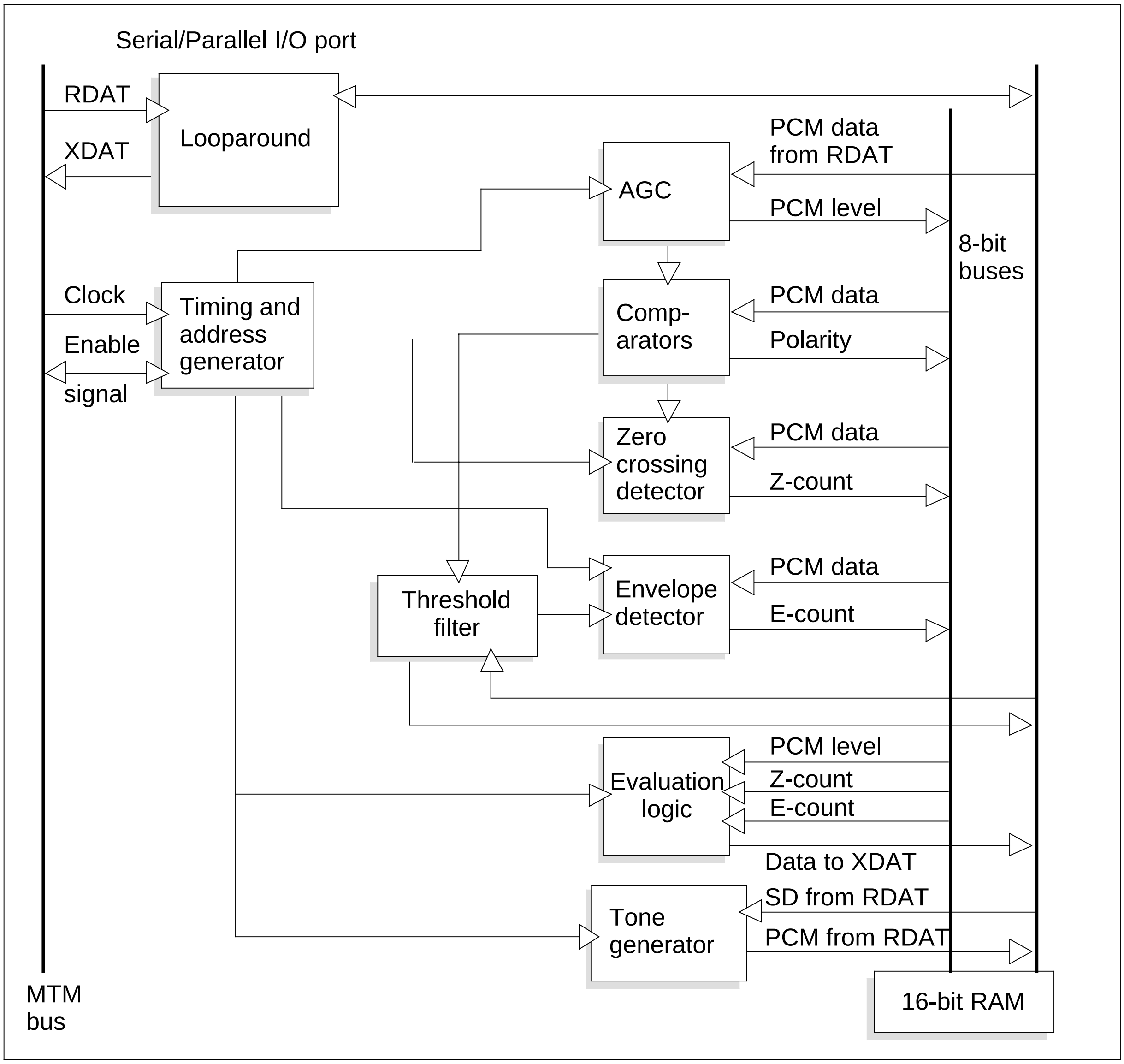
Functional blocks

The NT5X29AB contains the following functional blocks:

- automatic gain control (AGC)
- comparator
- zero crossing detector
- envelope detector
- threshold filter
- evaluation logic
- tone generator
- 16-bit RAM

- timing and address generator
- looparound

NT5X29AB functional blocks



AGC

The AGC receives a single or two-frequency tone in 8-bit PCM format. The AGC linearizes the signal to a level compatible with the zero-crossing detector and the envelope detector. The AGC produces a 4-bit code that represents the original PCM sample. The 4-bit code is used as an input to the evaluation logic circuit. The timing and address generator resets the AGC in 20 ms intervals.

NT5X29AB (continued)

Comparator

The comparator circuit provides reference values and smoothing of the Z-count and the E-count data. The zero crossing detector and the envelope detector use this data.

Zero crossing detector

The zero crossing detector counts the number of occurrences of PCM zero codes in a fixed threshold. The detector determines the frequency of a tone. The output of the detector (Z-count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 10 ms intervals.

Envelope detector

The envelope detector produces a count that represents the difference between the two frequencies in a two-frequency tone. The output of the detector (E-count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 100 ms intervals.

Threshold filter

The threshold filter circuit provides reference values and smoothing of the Z-count and E-count data. The zero crossing detector and the envelope detector use this data..

Evaluation logic

The evaluation logic circuit receives PCM level, Z-count and E-count signals. The circuit uses two ROMs to produce a coded signal to the MTM. The signal corresponds to the identity and the level of the tone. The circuit sends the signal to the MTM during channel 0.

The evaluated data code assignments for the card appear in the following table. Evaluated data are known codes that correspond with the tone identity. This assignment system simulates hysteresis.

Evaluated data code assignments (Sheet 1 of 2)

Tone	Code	Min level (dBm)
Quiet	00	-38
Ringing (440 Hz + 480 Hz)	01	-30
Busy (480 Hz + 620 Hz)	02	-30
480 Hz (DMS/TOPS only)	04	-30
Gateway (low) 950 Hz	10	-28

NT5X29AB (continued)

Evaluated data code assignments (Sheet 2 of 2)

Tone	Code	Min level (dBm)
Gateway (mid) 1400 Hz	20	-28
Gateway (high) 1800 Hz	20	-28
Any other tone	08	-38

The the raw data code assignments for the scan word channels appear in the following table. Raw data contains two words that represent the level, frequency and difference frequency of the input tone.

Raw data code assignments

Channel	Bit number	Purpose
0	0	Level code, least significant bit (LSB)
	1	Level code, 2nd bit
	2	Level code, 3rd bit
	3	Level code, Most significant bit (MSB)
	4	Frequency code, LSB
	5	Frequency code, 2nd bit
	6	Frequency code, 3rd bit
	7	Frequency code, 4th bit
16	0	Frequency code, 5th bit
	1	Frequency code MSB
	2	Difference frequency, LSB
	3	Difference frequency, 2nd bit
	4	Difference frequency, 3rd bit
	5	Difference frequency, 4th bit
	6	Difference frequency, MSB
	7	Difference frequency, MSB

NT5X29AB (continued)

The level code does not require decoding. The code indicates the strength of the input level. If the number is higher, the level is higher.

To determine the frequency code and the difference frequency code, convert the binary number to its decimal value. Divide the decimal value by 2, and round the number to the nearest ten. Multiply the number by 100 for frequency code or 10 for difference frequency. Two examples of decoding follow:

Examples of decoding

Frequency decoding	Difference frequency decoding
Binary number = 001011	Binary number 10101
Decimal value = 11	Decimal value = 21
Divide by 2 = 5.5	Divide by 2 = 10.5
Approximate to 5	Approximate to 10
Multiply by 100 = 500 Hz	Multiply by 10 = 100 Hz

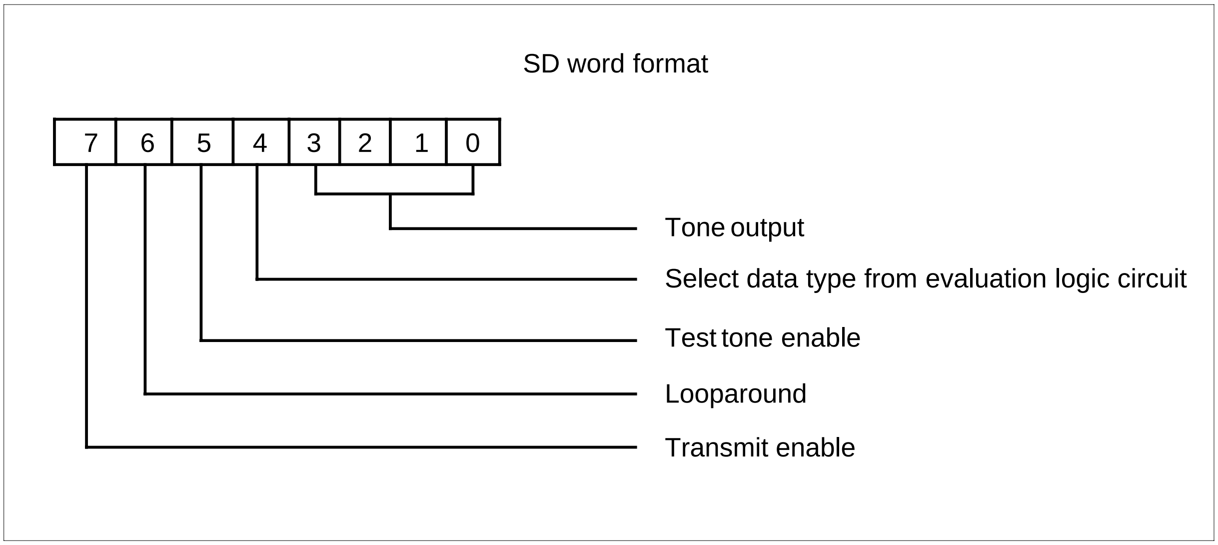
Tone generator

The tone generator circuit stores tones in PCM format in the PROM. The circuit uses a code in the SD word to address a segment of the PROM. The circuit sends the selected tone to the MTM in PCM format.

The 8 bit SD word format appears in the following table. The table describes the bit number and code of the format.

NT5X29AB (continued)

NT5X29AB SD word format



SD word format (Sheet 1 of 2)

Bit format	Purpose	Code	Result
7	Transmit enable	1	Enable XDAT bus to send PCM tone.
		0	The PCM output is not available.
6	Looparound	1	Connect XDAT to RDAT for diagnostic test.
		0	Normal XDAT
5	Test tone enable	1	Select test tone
		0	Select normal tone
4	Select data type from evaluation logic circuit	1	Select evaluated data
		0	Select raw data
3210	Tone output		
	If bit 5 = 1	1000	400 Hz modulated with 40 Hz
		1001	600 Hz modulated with 120 Hz

NT5X29AB (continued)

SD word format (Sheet 2 of 2)

Bit format	Purpose	Code	Result
		1010	950 Hz
		1011	1400 Hz
		1100	1800 Hz
		1101	Noise at -5 dBm0
		1110	Noise at -26 dBm0
		1111	Noise at -46 dBm0

16-bit RAM

The 16-bit RAM circuit provides parameters of the 16-tone detector channels and retains the counts of completed operations.

Timing and address generator

The timing and address generator controls data movement through the I/O port circuits. The card can handle 16 channels of RDAT and XDAT activity. Enable signals from the MTM control the selected channels. When enable lines control the circuit, the circuit sends data on the RDAT, XDAT and internal buses.

Looparound

To use the looparound circuit for testing, the system loops the PCM sample back to the XDAT bus.

Technical data

The NT5X29AB card has a level measurement range of 0 to -38 dBm0, and a frequency measurement resolution of ±100 Hz. The NT5X29AB has a difference frequency resolution of ±10 Hz.

Physical dimensions

The physical dimensions for the NT5X29AB circuit card are as follows:

- overall height: 353 mm (13.9 in.)
- overall depth: 277 mm (10.9 in.)
- overall width: 56 mm (2.2 in.)

NT5X29AB (end)

Power requirements

An MTM power converter supplies power to the NT5X29AB through the MTM backplane. The power requirements for the NT5X29AB are a voltage of +5V and current of 2 A.

NT5X29AC

Product description

The NT5X29AC audio, answer detect Digitone multifrequency card provides multichannel service circuits. The card provides these circuits to identify and generate standard single or two-frequency tones.

The card contains separately controlled detector and sender circuits. These circuits operate with the maintenance trunk module (MTM) in a DMS-100 digital switching network.

Location

The card plugs in to the two preferred positions in the MTM that are near to each other.

Functional description

The NT5X29AC uses the receive data (RDAT) and the transmit data (XDAT) buses. The NT5X29AC uses these features to receive pulse code modulation (PCM) format or signal distribution (SD) words. The NT5X29AC uses these features to send coded messages and responses from the tone detector circuits and the tone generator.

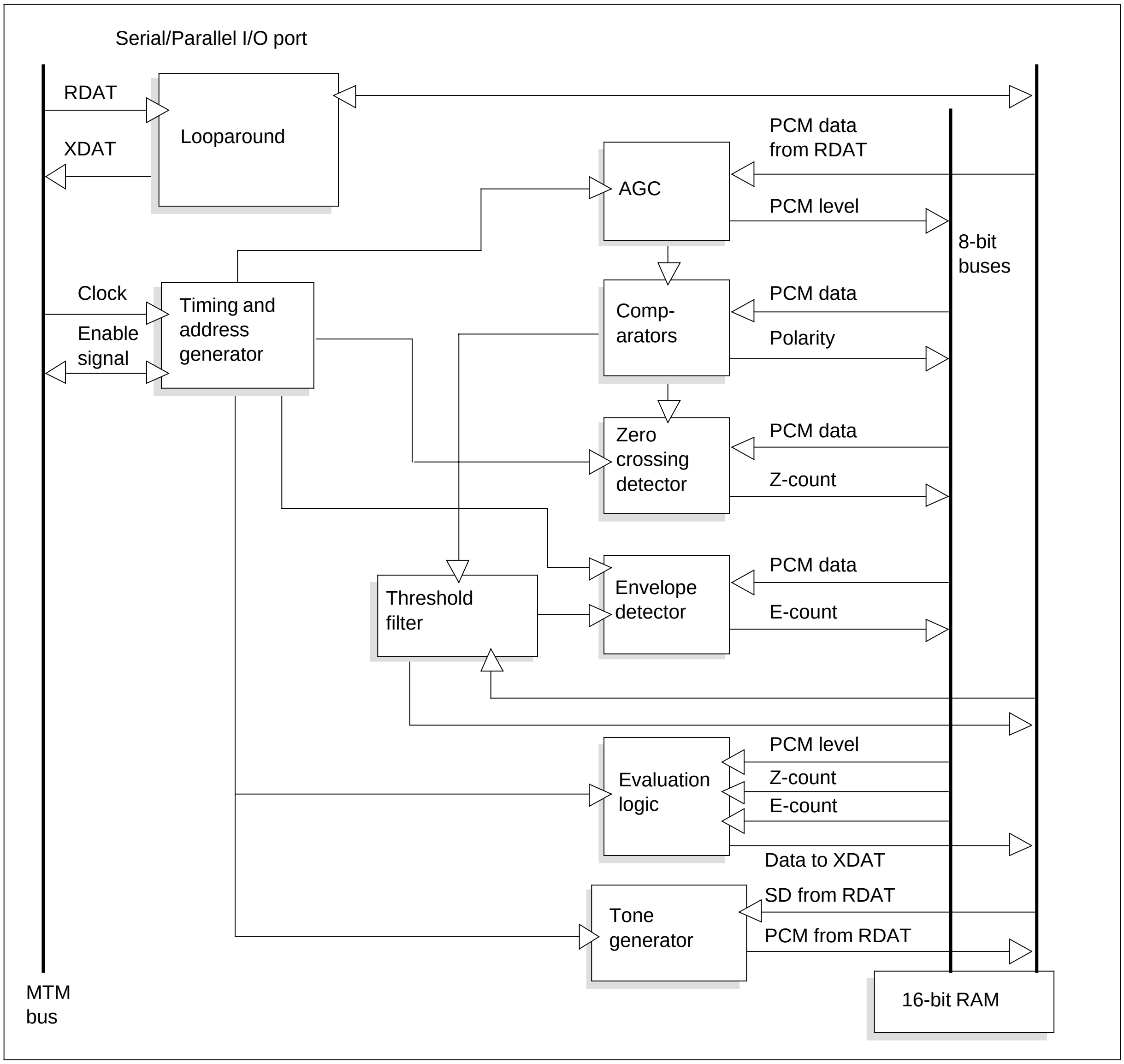
Functional blocks

The NT5X29AC contains the following functional blocks:

- automatic gain control (AGC)
- comparator
- zero crossing detector
- envelope detector
- threshold filter
- evaluation logic
- tone generator
- 16-bit RAM

- timing and address generator
- looparound

NT5X29AC functional blocks



AGC

The AGC receives a single or two-frequency tone in 8-bit PCM format. The AGC linearizes the signal to a level compatible with the zero-crossing detector and the envelope detector. The AGC produces a 4-bit code that represents the original PCM sample. The 4-bit code is used as an input to the evaluation logic circuit. The timing and address generator resets the AGC in intervals of 20 ms.

NT5X29AC (continued)

Comparator

The comparator circuit provides reference values and smoothing of the Z-count and the E-count data. The zero crossing detector and envelope detector use this data.

Zero crossing detector

The zero crossing detector counts the number of occurrences of PCM zero codes in a fixed threshold. The detector determines the frequency of a tone. The output of the detector (Z-count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 10 ms intervals.

Envelope detector

The envelope detector produces a count that represents the difference between the two frequencies in a two-frequency tone. The output of the detector (E-count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 100 ms intervals.

Threshold filter

The threshold filter circuit provides reference values and smoothing of the Z-count and E-count data. The zero crossing detector and envelope detector use this data.

Evaluation logic

The evaluation logic circuit receives PCM level, Z-count and E-count signals. The circuit uses two ROMs to produce a coded signal to the MTM. The signal corresponds to the identity and the level of the tone. The circuit sends the signal to the MTM during channel 0.

The evaluated data code assignments for the card appear in the following table. Evaluated data are known codes that correspond to the tone identity. This assignment system simulates hysteresis.

Evaluated data code assignments

Tone	Code	Min level (dBm)
Quiet	00	-38
Audible ringing	01	-32
Voice	03	-38
Busy/reorder	05	-30
Dial tone	07	-19

NT5X29AC (continued)

The raw data code assignments for the scan word channels appear in the following table. Raw data contains two words that represent the level, frequency and difference frequency of the input tone.

Raw data code assignments

Channel	Bit number	Purpose
0	0	Level code, least significant bit (LSB)
	1	Level code, 2nd bit
	2	Level code, 3rd bit
	3	Level code, Most significant bit (MSB)
	4	Frequency code, LSB
	5	Frequency code, 2nd bit
	6	Frequency code, 3rd bit
	7	Frequency code, 4th bit
16	0	Frequency code, 5th bit
	1	Frequency code MSB
	2	Difference frequency, LSB
	3	Difference frequency, 2nd bit
	4	Difference frequency, 3rd bit
	5	Difference frequency, 4th bit
	6	Difference frequency, MSB
	7	Difference frequency, MSB

The level code does not require decoding. The code indicates the strength of the input level. If the number is higher, the level is higher.

To determine the frequency code and the difference frequency code, convert the binary number to the decimal value. Divide the binary number by 2 and

NT5X29AC (continued)

round the number to the nearest ten. Multiply the number by 100 for frequency code, or 10 for difference frequency. Two examples of decoding follow:

Decoding examples

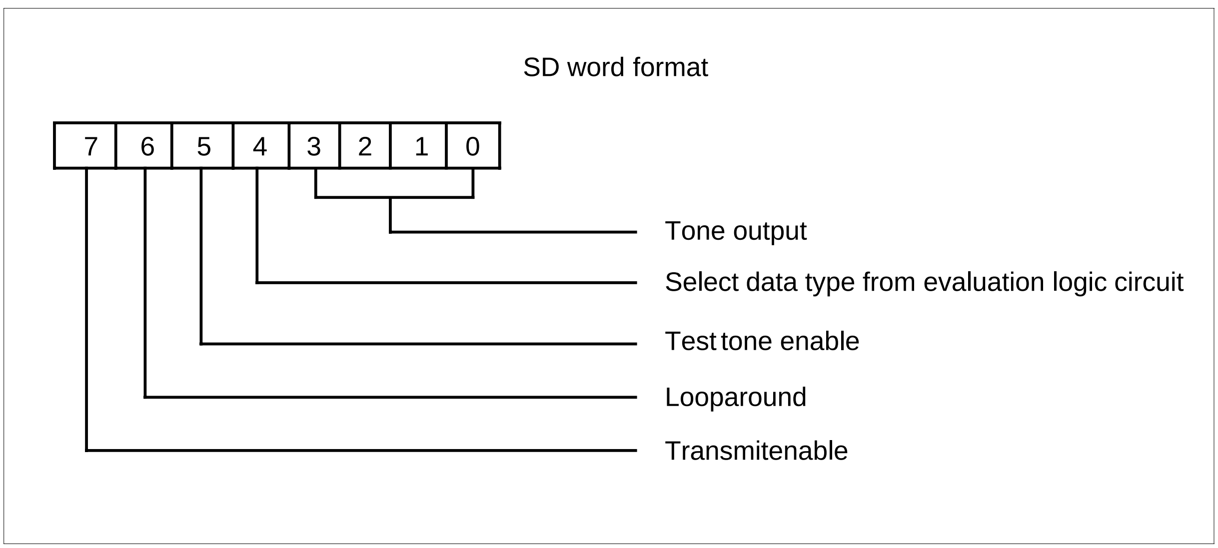
Frequency decoding	Difference frequency decoding
Binary number = 001011	Binary number 10101
Decimal value = 11	Decimal value = 21
Divide by 2 = 5.5	Divide by 2 = 10.5
Approximate to 5	Approximate to 10
Multiply by 100 = 500 Hz	Multiply by 10 = 100 Hz

Tone generator

The tone generator circuit stores tones in PCM format in the PROM. The circuit uses a code in the SD word to address a segment of the PROM. The circuit sends the selected tone to the MTM in PCM format.

The 8-bit SD word format appears in the following figure.

NT5X29AC SD word format



The bit and number code of the format appears in the following table.

SD word format

Bit number	Purpose	Code	Result
7	Transmit enable	1	Enable XDAT bus to send PCM tone.
		0	The PCM output is not available
6	Looparound	1	Connect XDAT to RDAT for diagnostic test.
		0	Normal XDAT
5	Test tone enable	1	Select test tone
		0	Select normal tone
4	Select data type from evaluation logic circuit	1	Select evaluated data
		0	Select raw data
3210	Tone output		
	If bit 5 = 1	1000	400 Hz modulated with 40 Hz
		1001	600 Hz modulated with 120 Hz
		1010	950 Hz
		1011	1400 Hz
		1100	1800 Hz
		1101	Noise at -5 dBm0
		1110	Noise at -26 dBm0
		1111	Noise at -46 dBm0

16-bit RAM

The 16-bit RAM circuit provides parameters of the 16-tone detector channels and retains the counts of completed operations.

Timing and address generator

The timing and address generator controls data movement through the I/O port circuits. The card can handle 16 channels of RDAT and XDAT activity. Enable signals from the MTM control the selected channels. When enable lines control the circuit, the circuit sends data on the RDAT, XDAT and internal buses.

NT5X29AC (end)

Looparound

To use the looparound circuit for testing, the system loops the PCM sample back to the XDAT bus.

Technical data

The NT5X29AC card has a level measurement range of 0 to -38 dBm0 and a frequency measurement resolution of ±100 Hz. The NT5X29AC has a difference frequency resolution of ± 10 Hz.

Physical dimensions

The physical dimensions for the NT5X29AC circuit card are as follows:

- overall height: 353 mm (13.9 in.)
- overall depth: 277 mm (10.9 in.)
- overall width: 56 mm (2.2 in.)

Power requirements

An MTM power converter supplies power to the NT5X29AC through the MTM backplane. The power requirements for the NT5X29AC are a voltage of +5V and current of 2 A.

NT5X29BA

Product description

The NT5X29BA A-law circuit card provides multichannel service circuits. The NT5X29BA provides these circuits to identify and generate standard single or two-frequency tones. These tones are for use in the United Kingdom.

The card contains separately controlled detector and sender circuits. These circuits operate with the maintenance trunk module (MTM) in a DMS-100 digital switching network.

Location

The card plugs in to two preferred positions in the MTM that are next to each other.

Functional description

The NT5X29BA uses the receive data (RDAT) and the transmit data (XDAT) buses. The NT5X29BA uses these features to receive pulse code modulation (PCM) format or signal distribution (SD) words. The NT5X29BA uses these features to send coded messages and responses from the tone detector circuits and the tone generator.

Functional blocks

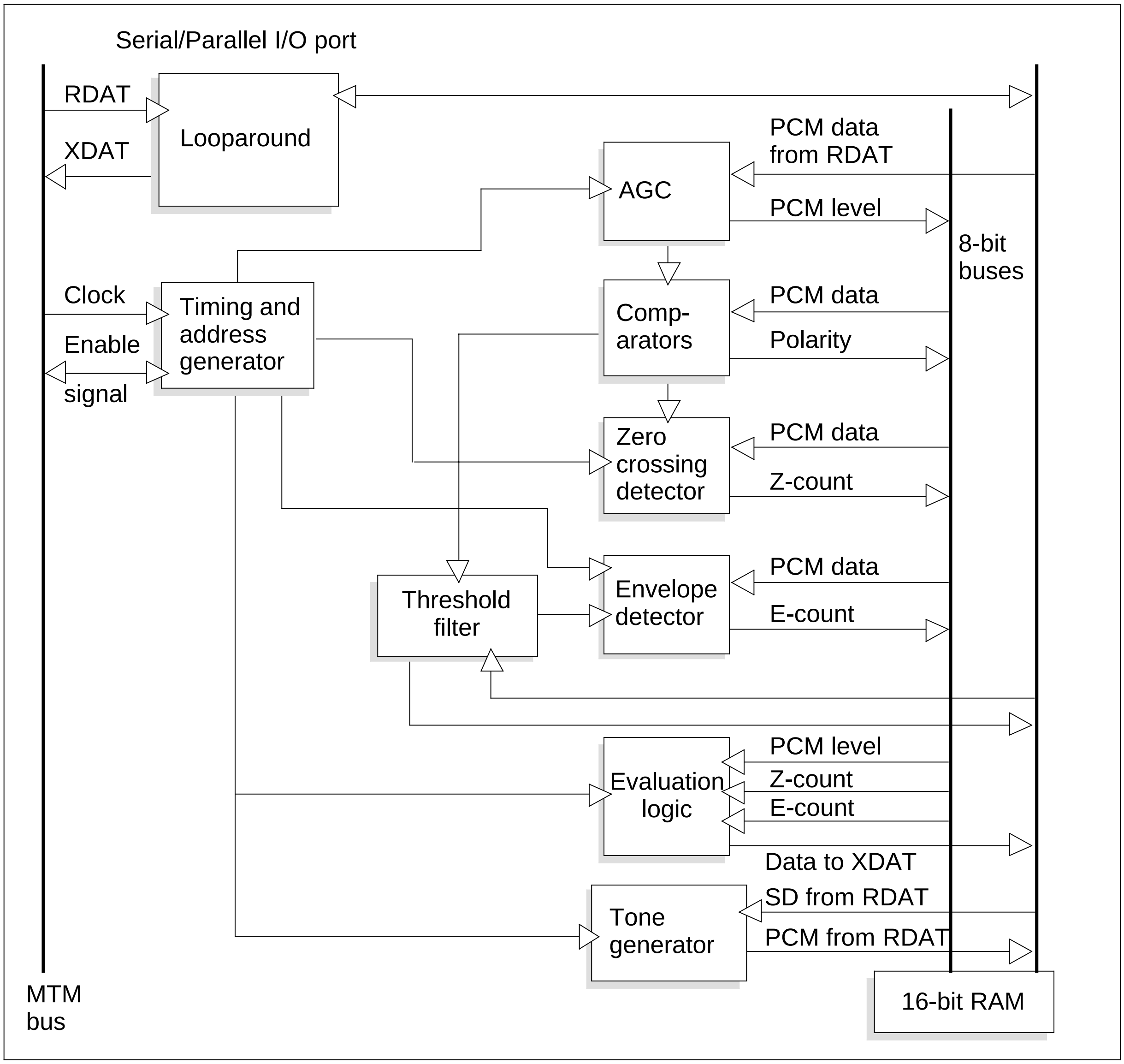
The NT5X29BA contains the following functional blocks:

- automatic gain control (AGC)
- comparator
- zero crossing detector
- envelope detector
- threshold filter
- evaluation logic
- tone generator
- 16-bit RAM

NT5X29BA (continued)

- timing and address generator
- looparound

NT5X29BA functional blocks



AGC

The AGC receives a single or two-frequency tone in 8-bit PCM format. The AGC linearizes the signal to a level compatible with the zero-crossing detector and the envelope detector. The AGC produces a 4-bit code that represents the original PCM sample. The 4-bit code is used as an input to the evaluation logic circuit. The timing and address generator resets the AGC in 20 ms intervals.

Comparator

The comparator circuit provides reference values and smoothing of the Z-count and the E-count data. The zero crossing detector and the envelope detector uses this data.

Zero crossing detector

The zero crossing detector counts the number of occurrences of PCM zero codes in a fixed threshold. The detector determines the frequency of a tone. The output of the detector (Z count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 10 ms intervals.

Envelope detector

The envelope detector produces a count that represents the difference between the two frequencies in a two-frequency tone. The output of the detector (E count) is sent to the evaluation logic circuit. The timing and address generator resets the detector in 100 ms intervals.

Threshold filter

The threshold filter circuit provides reference values and smoothing of the Z-count and E-count data. The zero crossing detector and the envelope detector uses this data.

Evaluation logic

The evaluation logic circuit receives PCM level, Z-count and E-count signals. The circuit uses two ROMs to produce a coded signal to the MTM. The signal corresponds to the identity and the level of the tone. The circuit sends the signal to the MTM during channel 0.

The evaluated data code assignments for the card appear in the following table. Evaluated data are known codes that correspond to the tone identity. This assignment system simulates hysteresis.

Evaluated data code assignments

Tone	Code	Min level (dBm)
Quiet	00	-29
Audible ringing	01	-27
Voice	03	-27
Busy/reorder	05	-27
Dial tone	07	-27

NT5X29BA (continued)

The raw data code assignments for the scan word channels appear in the following table. Raw data contains two words that represent the level, frequency and difference frequency of the input tone.

Raw data code assignments

Channel	Bit number	Purpose
0	0	Level code, least significant bit (LSB)
	1	Level code, 2nd bit
	2	Level code, 3rd bit
	3	Level code, Most significant bit (MSB)
	4	Frequency code, LSB
	5	Frequency code, 2nd bit
	6	Frequency code, 3rd bit
	7	Frequency code, 4th bit
16	0	Frequency code, 5th bit
	1	Frequency code MSB
	2	Difference frequency, LSB
	3	Difference frequency, 2nd bit
	4	Difference frequency, 3rd bit
	5	Difference frequency, 4th bit
	6	Difference frequency, MSB
	7	Difference frequency, MSB

The level code does not require decoding. The code indicates the strength of the input level. If the number is higher, the level is higher.

To determine the frequency code and the difference frequency code, convert the binary number to its decimal value. Divide the binary number by 2, and round the number to the nearest ten. Multiply the number by 100 for frequency code or 10 for difference frequency. Two examples of decoding follow:

Decoding examples

Frequency decoding	Difference frequency decoding
Binary number = 001011	Binary number 10101
Decimal value = 11	Decimal value = 21
Divide by 2 = 5.5	Divide by 2 = 10.5
Approximate to 5	Approximate to 10
Multiply by 100 = 500 Hz	Multiply by 10 = 100 Hz

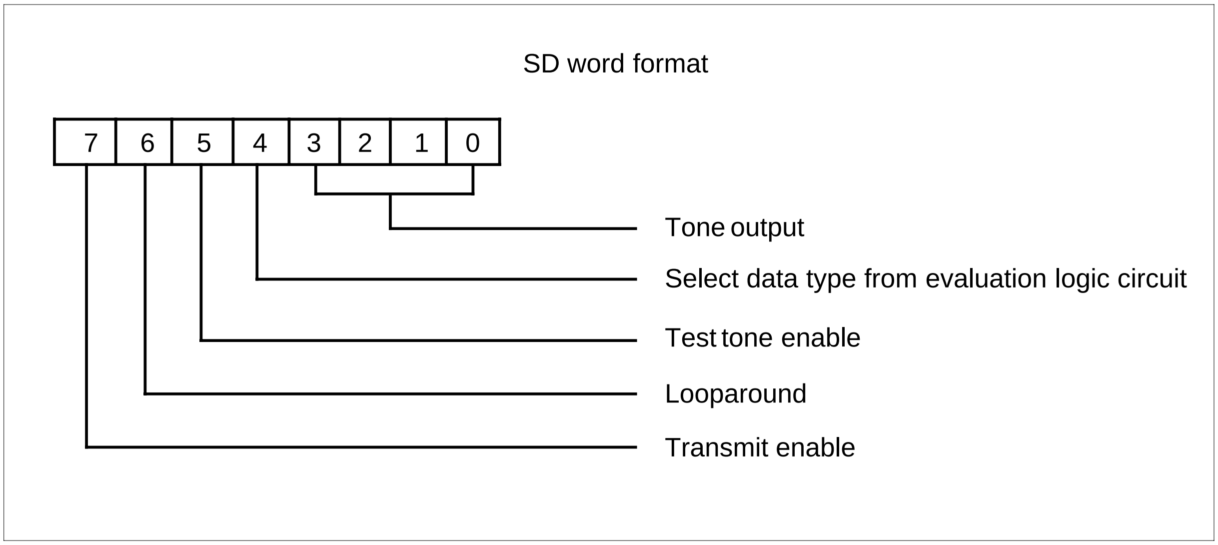
Tone generator

The tone generator circuit stores tones in PCM format in the PROM. The circuit uses a code in the SD word to address a segment of the PROM. The circuit sends the selected tone to the MTM in PCM format.

The 8-bit SD word format appears in the following figure. The table describes the bit number and code of the format.

NT5X29BA (continued)

NT5X29BA SD word format



SD word format (Sheet 1 of 2)

Bit format	Purpose	Code	Result
7	Transmit enable	1	Enable XDAT bus to send PCM tone
		0	The PCM output is not available
6	Looparound	1	Connect XDAT to RDAT for diagnostic test
		0	Normal XDAT
5	Test tone enable	1	Select test tone
		0	Select normal tone
4	Select data type from evaluation logic circuit	1	Select evaluated data
		0	Select raw data
3210	Tone output		
	If bit 5 = 1	1000	400 Hz modulated with 40 Hz
		1001	600 Hz modulated with 120 Hz
		1010	950 Hz

SD word format (Sheet 2 of 2)

Bit format	Purpose	Code	Result
		1011	1400 Hz
		1100	1800 Hz
		1101	Noise at -5 dBm0
		1110	Noise at -26 dBm0
		1111	Noise at -46 dBm0

16-bit RAM

The 16-bit RAM circuit provides parameters of the 16-tone detector channels and retains the counts of completed operations.

Timing and address generator

The timing and address generator controls data movement through the I/O port circuits. The card can handle 16 channels of RDAT and XDAT activity. Enable signals from the MTM control selected channels. When enable lines control the circuit, the circuit sends data on the RDAT, XDAT and internal buses.

Looparound

To use the looparound circuit for testing, the system loops the PCM sample back to the XDAT bus.

Technical data

The NT5X29BA card has a level measurement range of 0 to -38 dBm0, and a frequency measurement resolution of ±100 Hz. The NT5X29BA has a difference frequency resolution of ±10 Hz.

Physical dimensions

The physical dimensions for the NT5X29BA circuit card are as follows:

- overall height: 353 mm (13.9 in.)
- overall depth: 277 mm (10.9 in.)
- overall width: 56 mm (2.2 in.)

Power requirements

An MTM power converter supplies power to the NT5X29BA through the MTM backplane. The power requirements for the NT5X29BA are a voltage of + 5V and current of 2 A.

NT5X30AA

Product description

The NT5X30AA 101 communication test line (CTL) circuit card provides a 2-wire voice and signaling interface. The interface is between a trunk module (TM) and a MAP terminal. The interface is configured as a line test position (LTP) or a trunk test position (TTP).

In the local operation, the card connects to 1A2 key equipment, a foreign exchange (FX) carrier channel unit, a dial long line (DLL) circuit. The card also connects to one 500-type telephone set. In the remote operation, the card connects to a DE3 FX channel unit QPP 371 and a QVF 12 A/C DLL circuit.

Location

The card plugs in to a 2-wire, 4-wire, or 8-wire TM.

Functional description

The NT5X30AA transmits and receives voice frequency (VF) and pulse amplitude modulation (PAM) signals between the transmission facility and the TM. The card uses relays to provide test and ringing functions and contains a built-in ringing supply.

Functional blocks

The NT5X30AA contains the following functional blocks:

- 2-wire to 4-wire terminating set
- two limiter circuits
- plug-in balancing network
- fixed resistive pad and filter
- level adjustment circuit
- pad control circuit
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- sampling gate
- card type ID circuit
- loop/ring trip detector
- ringing source circuit
- trunk logic circuit (TLC)

- ringing gate
- relays

2-wire to 4-wire terminating set

In the receive direction, the 2-wire to 4-wire terminating set receives a VF signal from the tip (T) and ring (R) leads. The set functions as an interface between the 2-wire facility and the trunk circuit. In the transmit direction, the terminating set connects the signal to the 2-wire path.

Limiter circuits

The two limiter circuits restrict the signal voltage on the VF signals that the system receives and transmits.

Plug-in balancing network

The plug-in balancing network balances the terminating set for the 2-wire facility that connects to the 4-wire trunk.

Fixed resistive pad and filter

The fixed resistive pad and filter sets the signal receive level to 0 dBm and uses a filter to block 60 Hz signal components.

Level adjustment circuit

The level adjustment circuit uses adjustments, that the pad control circuit provides, to adjust the level of the transmit signal. The circuit provides a maximum adjustment of 7 dB in 1 dB increments. The adjustments are as follows:

Level adjustments

Relay	Adjustment
K1	4 dB
K2	2 dB
K3	1 dB

Pad control circuit

The pad control circuit functions in the transmit direction. This compensates for different level points and connecting circuits in local or toll office environments.

NT5X30AA (continued)

A/D low-pass filter

In the receive direction, the A/D low-pass filter receives a VF signal from the fixed resistive pad and filter. The filter also limits the signal bandwidth, and amplifies the signal.

D/A low-pass filter

In the transmit direction, the D/A low-pass filter receives a VF signal from the sampling gate. The filter also limits the signal bandwidth, and amplifies the signal.

Sampling gate

The sampling gate uses an 8 kHz sampling rate to produce PAM samples. These samples are for transmission to the TM, and use a transmit-PAM (XPAM) bus. The gate receives PAM samples of the signal from the TM through the receive-PAM (RPAM) bus. The gate changes the signal to an analog format.

Card type ID circuit

The card type ID circuit uses a voltage signal that the TLC sends, to identify the card type. The card type ID circuit transmits this information to the TM.

Loop/ring trip detector

The loop/ring trip detector identifies an answer condition. The detector detects direct current in the T and R leads during the ringing and silent intervals.

Ringing source circuit

The ringing source circuit is a built-in ringing supply that applies a 20 Hz ringing source to the card.

TLC

The TLC functions as a communications buffer between the VF signaling and testing relays and the TM. The TLC generates sampling pulses for the sampling gate. The TLC also controls the voltage that identifies the type of card to the TM.

Ringing gate

The ringing gate receives a re-ring from the TLC and transmits the signal to the K6 relay. This action sends a re-ring to a circuit on permanent hold.

Relays

Six relay circuits receive signals from the TLC and provide test and ringing functions. The relays and relay operated and released functions appear in the following table appear in the following table.

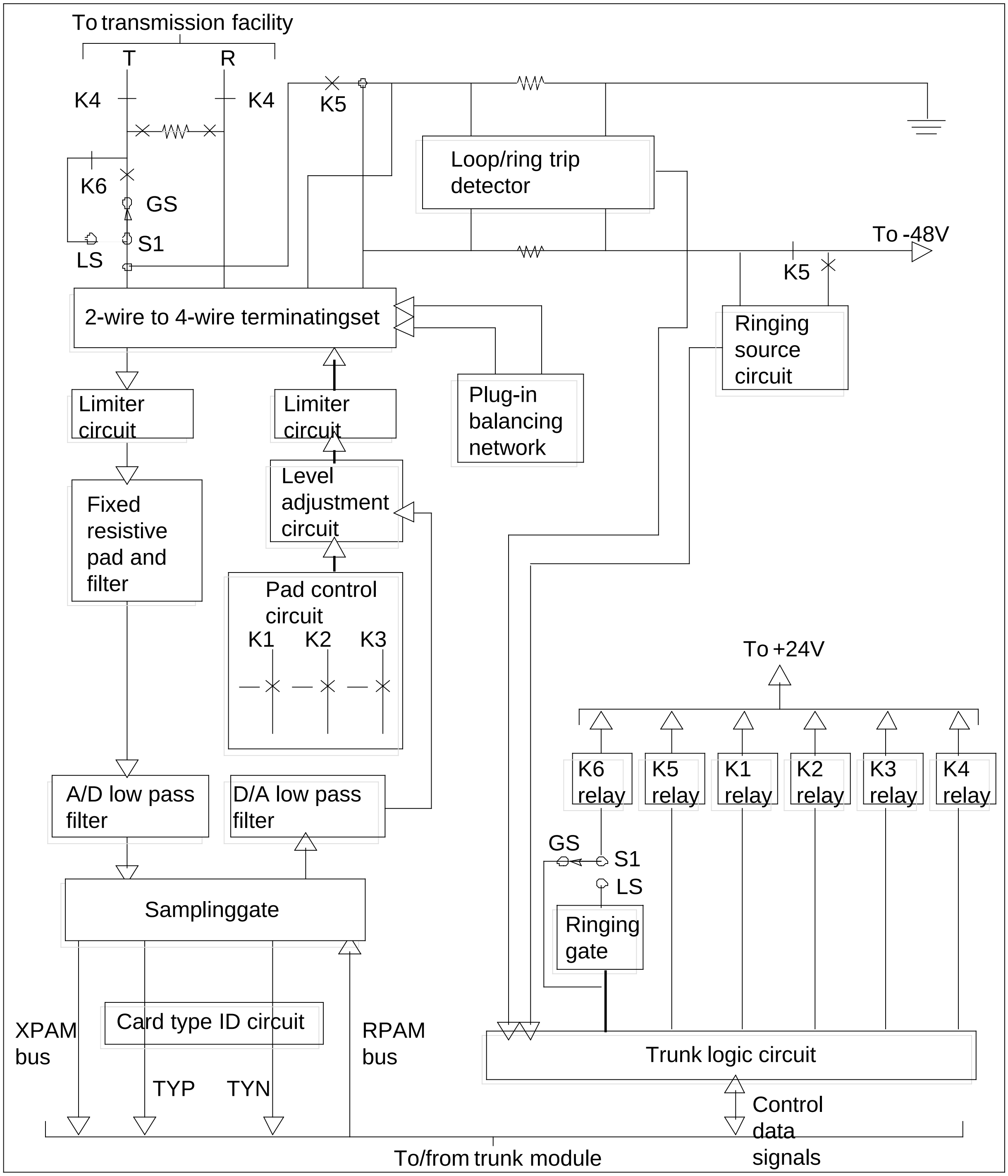
Relay operation

Relay	Operated	Released
K1	Introduces a 4 dB pad to compensate for different level points and connecting circuits in local or toll office environments	Pad removed
K2	Introduces a 2 dB pad to compensate for different level points and connecting circuits in local or toll office environments	Pad removed
K3	Introduces a 1 dB pad to compensate for different level points and connecting circuits in local or toll office environments	Pad removed
K4	Isolates the trunk circuit from the external 2-wire facility and looping T and R leads to provide testing	Normal operation
K5	Activates the ringing generator. To apply ringing to the R lead through the terminating set	Ringing deactivated
K6	Opens the T lead for 2 s and releases the hold connection to provide a re-ring	Normal operation

The relationship between the functional blocks appears in the following table.

NT5X30AA (continued)

NT5X30AA functional blocks



Technical data

Incoming trunks use the ground start mode of operation. The signaling characteristics of the card appear in the following table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75V to -55.80V
Normal talk battery range (float charge)	-49.00V to -53.50V
Maximum talk battery discharge (no charge)	-42.75V
Maximum talk battery charge (equalizing)	-55.80V
Minimum insulation resistance	30 k Ω
Ground potential	±10.00 V
Supervision and pulsing	700 Ω external resistance 500 Ω external conductor loop
Ringing	20 Hz 50-60 V rms; ac/dc ringing
Ringing load	1 - C4A bridged ringer or 1 - ringing bridge with an impedance of 7 k Ω at 20 Hz; 30 k Ω dc resistance

Transmission specifications

The NT5X30AA uses 19-gauge, 22-gauge, 24-gauge, or 26-gauge H88 loaded and non-loaded cables. The cables can be a maximum of 2743 m (9000 ft) long. The outgoing trunks use the loop start mode of operation. The transmission characteristics appear in the following table.

Transmission characteristics (Sheet 1 of 2)

Characteristic	Value
Transmit D/A level range	-6 dBm to +1 dBm for digital test sequence (DTS) input

NT5X30AA (end)

Transmission characteristics (Sheet 2 of 2)

Characteristic	Value
Receive A/D level range	0 dBm for DTS output
Input impedance	900 Ω

Dimensions

The dimensions of the NT5X30AA follow:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

The NT5X30AA consumes 500 mW of power and converts voltages of +12V ±0.3V, -15V ±0.5V, and +24.0V nominal (+22.8V to +27.0V).

NT5X30BA

Product description

The 101 communication test line circuit card (NT5X30BA) provides a 2-wire voice and signaling interface between a trunk module (TM) and a maintenance and adminstration position (MAP). This interface is configured as a line test position (LTP) or a trunk test position (TTP). The NT5X30BA circuit card is used in the United Kingdom (UK). The NT5X30BA circuit card is used as an originating communication trunk or as a terminating 101 trunk.

The NT5X30BA circuit card connects to a BT700 type set and a UK approved key telephone set. Operation with multiple loop telephone sets require the use of external key telephone equipment that provides lamp control, line hold and ringing functions. The NT5X30BA circuit card plugs in to a 2-wire, 4-wire or 8-wire TM.

Location

The NT5X30BA circuit card plugs in to a 2-wire, 4-wire, or 8-wire TM.

Functional description

The (NT5X30BA) circuit card transmits and receives voice frequency (VF) and pulse amplitude modulation (PAM) signals between the transmission facility and the TM. The NT5X30BA circuit card uses relays to provide test and ringing functions and contains a built-in ringing supply. Incoming trunks use the ground start mode of operation. Outgoing trunks use the loop start mode of operation.

Functional blocks

Functional blocks of the (NT5X30BA) circuit card are:

- 2-wire to 4-wire terminating set
- limiter circuits
- plug-in balancing network
- fixed resistive pad and filter
- level adjustment circuit
- pad control circuit
- analog-to-digital (A/D) low-pass filter
- digital-to-analog (D/A) low-pass filter
- sampling gate
- card type ID circuit
- loop/ring trip detector

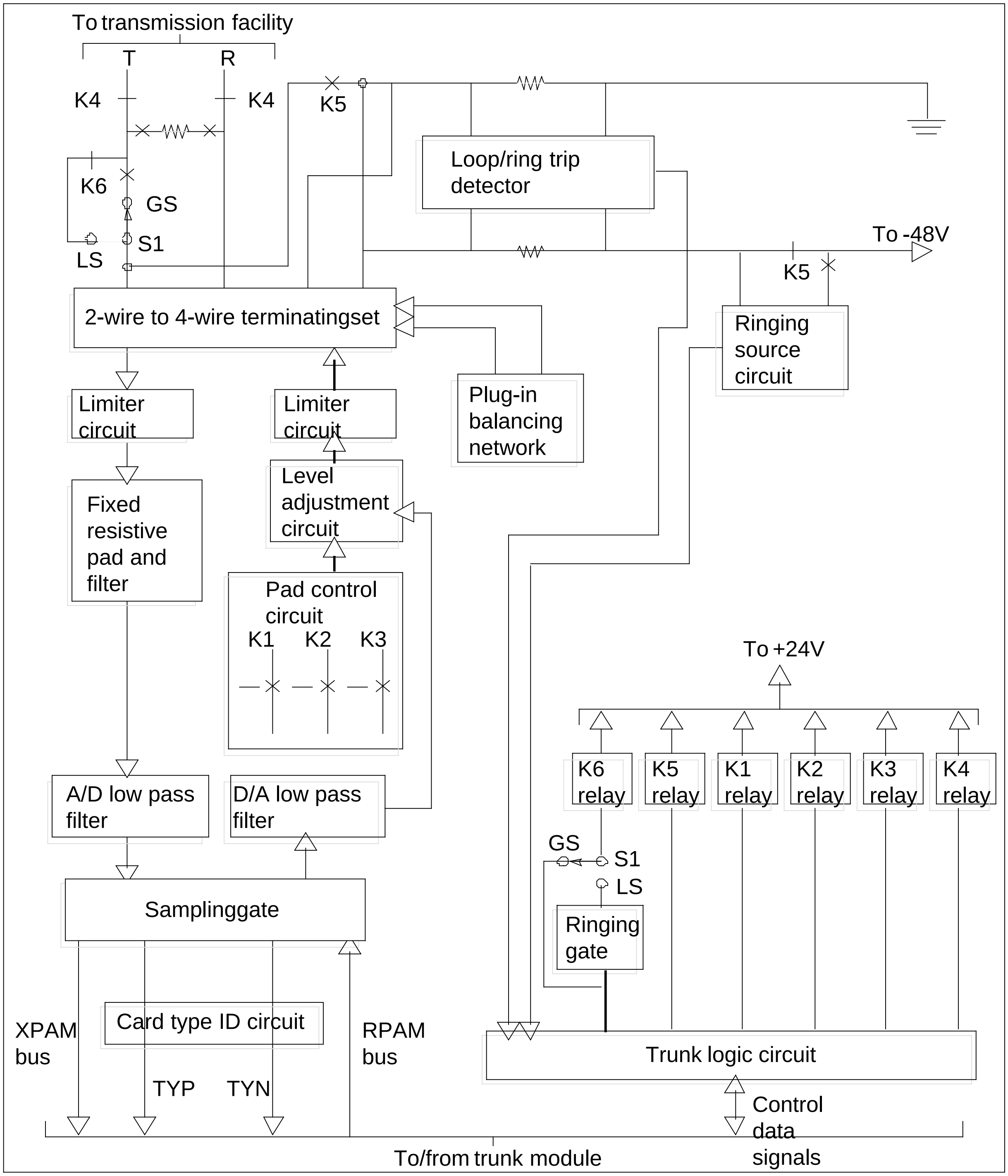
NT5X30BA (continued)

- ringing source circuit
- trunk logic circuit (TLC)
- ringing gate
- relays

The next figure displays the functional blocks of the NT5X30BA circuit card.

NT5X30BA (continued)

NT5X30BA functional blocks



NT5X30BA (continued)

2-wire to 4-wire terminating set

In the receive direction, the 2-wire to 4-wire terminating set receives a VF signal from the tip (T) and ring (R) leads. The terminating set functions as an interface between the 2-wire facility and the trunk circuit. In the transmit direction, the terminating set connects the signal to the 2-wire path.

Limiter circuits

The signal voltage on the VF signals are restricted by the limiter circuits.

Plug-in balancing network

The plug-in balancing network balances the terminating set for the 2-wire facility that connects to the 4-wire trunk.

Fixed resistive pad and filter

The fixed resistive pad and filter sets the signal receive level to 0 dBm and uses a filter to block 60 Hz signal components.

Level adjustment circuit

The level adjustment circuit uses information the pad control circuit provides, to adjust the level of the transmit signal. The adjustment circuit provides a maximum adjustment of 7 dB in 1 dB increments. The next table contains transmit level adjustment information for the NT5X50BA circuit card.

Transmit level adjustments

Relay	Adjustment
K1	4 dB
K2	2 dB
K3	1 dB

Pad control circuit

The pad control circuit functions in the transmit direction. This compensates for different level points and connecting circuits in local or toll office environments.

A/D low-pass filter

In the receive direction, the A/D low-pass filter receives a VF signal from the fixed resistive pad and filter. The filter limits the signal bandwidth, and amplifies the signal.

NT5X30BA (continued)

D/A low-pass filter

In the transmit direction, the D/A low-pass filter receives a VF signal from the sampling gate. The filter limits the signal bandwidth, and amplifies the signal.

Sampling gate

The sampling gate uses an 8 kHz sampling rate to produce PAM samples. These samples are for transmission to the TM and use a transmit-PAM (XPAM) bus. The sampling gate receives PAM samples of the signal from the TM through the receive-PAM (RPAM) bus. The sampling gate changes the signal to an analog format.

Card type ID circuit

The card type ID circuit uses a voltage signal sent by the TLC to identify the card type. The card type ID circuit transmits this information to the TM.

Loop/ring trip detector

The loop/ring trip detector identifies an answer condition. The detector detects direct current in the T and R leads during the ringing and silent intervals.

Ringing source circuit

The ringing source circuit is a built-in ringing supply that applies a 25 Hz ringing source to the circuit card.

Trunk logic circuit

The TLC functions as a communications buffer between the VF signaling, testing relays and the TM. The TLC generates sampling pulses for the sampling gate. The TLC also controls the voltage that identifies the type of card to the TM.

Relays

Relay circuits receive signals from the TLC and provide test and ringing functions. The next table contains a description of relays K1 throught K5.

Relay operation (Sheet 1 of 2)

Relay	Operated	Released
K1	Introduces a 4 dB pad to compensate for different level points and connecting circuits in local or toll office environments	Pad removed
K2	Introduces a 2 dB pad to compensate for different level points and connecting circuits in local or toll office environments	Pad removed

NT5X30BA (continued)

Relay operation (Sheet 2 of 2)

Relay	Operated	Released
K3	Introduces a 1 dB pad to compensate for different level points and connecting circuits in local or toll office environments	Pad removed
K4	Isolates the trunk circuit from the external 2-wire facility and looping T and R leads to provide testing	Normal operation
K5	Activates the ringing generator. To apply ringing to the R lead through the terminating set	Ringing deactivated

Technical data

The signaling characteristics of the NT5X30BA circuit card appear in the next table.

Signaling characteristics

Characteristic	Value
Talk battery voltage	-42.75V to -55.80V
Normal talk battery range (float charge)	-49.00V to -53.50V
Maximum talk battery discharge (no charge)	-42.75V
Maximum talk battery charge (equalizing)	-55.80V
Minimum insulation resistance	30 k Ω
Ground potential	±10.00 V
Supervision and pulsing	700 Ω external resistance
	500 Ω external conductor loop
Ringing	20 Hz 50-60 V rms; ac/dc ringing
Ringing load	1 - C4A bridged ringer or 1 - ringing bridge with an impedance of 7 k Ω at 20 Hz; 30 k Ω dc resistance

Transmission specifications

The signaling characteristics of the NT5X30BA circuit card appear in the next table.

Transmission characteristics

Characteristic	Value
Transmit D/A level range	-7 dBm to 0 dBm for digital test sequence (DTS) input
Receive A/D level range	+5 dBm for DTS output
Input impedance	Switchable 600 Ω or balanced network with 1000 Ω, 300 Ω and 220 μF capacitance

The gain of the NT5X30BA circuit card is defined in accordance with the UK practice for insertion loss as follows:

A-D gain	-10 Log(base 10) P/lmW
D-A gain	10 Log(base 10) p/lmW

where

P = V2/600 Ω

V in the A-D direction is the input voltage between T and R for the DTS-out.

V in the D-A direction is the output voltage between T and R for DTS-in.

Balance network

The balance network plug-in information for the NT5X30BA circuit card is listed in the next table.

Balance network options

Application	Balance network product code
Complex or 600 Ω (switchable)	NT2X77BA/BB

NT5X30BA (end)

Dimensions

The dimensions of the NT5X30BA circuit are:

- height: 353 mm (13.9 in.)
- depth: 267 mm (10.5 in.)
- width: 29 mm (1.125 in.)

Power requirements

The NT5X30BA circuit card uses 500 mW of power and converts voltages of +12V ±0.3V, -15V ±0.5V, and +24.0V nominal (+22.8V to +27.0V).

NT5X64

Product description

The NT5X64 -series communication modules (CM) are used at MAP terminals in DMS-100 switching offices. The CMs are also used at test positions like line test positions (LTP) and trunk test positions (TTP) in DMS-100 switching offices. The CM can connect to lines from NE-1A2 key telephone systems (KTS) that are in DMS 100 Family offices. These connections provide voice communications between test positions.

The CMs can make new installations or replace present LOGIC 10-type key telephone sets and 20-type key telephone sets. The CM can plug in to KTS connectors used for LOGIC key telephone sets. Some interconnection changes must occur at the KTS quick-connect blocks.

Features

The primary NT5X64-series usability features include:

- connection features
- operational features
- optional configuration features

Connection features

The connection features are as follows:

- connects to a maximum of 40 lines from an NE-1A2 KTS
- interfaces with central office lines, communications trunks, public address systems, order wire circuits, and intercom trunks when connected to the KTS
- connects to COMPANION and LOGIC handsfree units (HFU), LOGIC or NT0C26CA INDEX-type automatic dialers (ADR), QSR2F-20 headsets, and NE-G3DRN handsets (desk-mount CM only)
- requires some connection changes at KTS quick-connect blocks, but is plug-compatible with KTS system cabling for LOGIC key telephone sets

NT5X64 (continued)

Operational features

The operational features include two internal buses, telephone and conference, that have the following characteristics:

- telephone bus
  - accesses an attendant for callers in descending order of priority based on the line number
- conference bus
  - supports one conference with a maximum of five callers
  - allows callers to enter and exit a conference without dropping callers on other lines
  - allows an attendant to enter or exit a conference without dropping callers on other lines
  - allows lines, in any configuration, to form a conference
- provides line hold without limit to the number of calls on hold at one time
- provides talk/monitor feature for two headsets
- provides buzzer warning of incoming calls

Optional configuration features

The optional configuration features are as follows:

- two mounting types
  - desk-mount
  - rack-mount, mounts in NT5X92 frame assemblies
- two unit types
  - basic unit for up to 20 KTS lines
  - optional extension unit for an additional 20 KTS lines
- three keypad assemblies
  - DIGIPULSE (DGP) desk-mount CM only
  - DIGITONE (DGT)
  - multi-function

Note: The multi-function keypad assembly produces DGP, DGT, and multi-frequency (MF) dialing signals. These signals are selected with a talk with transfer switch on the basic CM unit.

Location

The NT5X64-series CMs are at a MAP or test position.

Functional description

The CM contains a basic unit that allows the connection to a maximum of 20 KTS lines. The CM also contains an optional extension unit that allows connection to an additional 20 KTS lines.

A desk-mount and a rack-mount are the types of packaging acceptable for installation in NT5X82-type frame assemblies. These packages are acceptable for installation in frame assemblies equal to the NT5X82-type frame assembly.

Functional blocks

The NT5X64 has the following functional blocks:

- line key (LK)
- telephone bus setting
- conference bus setting
- hold circuits
- attendant key
- headsets and handsets
- circuitry for an ADR and/or an HFU
- HF/OFF/CM switch (S2)
- NORM/AUTO-DIAL switch (S1)
- keypad assemblies
- DGT and DGP keypad assemblies
- multi-function keypad
- buzzer

The functional blocks appear in the following figures for the Cm basic unit and the CM extension unit.

Line key

Lines from the NE-1A2 KTS that enter the CM can connect to a telephone bus or a conference bus. These lines connect with a three-position illuminated LK switch.

NT5X64 (continued)

Telephone bus setting

The LK contacts associated with the telephone bus are in a chain configuration. When an LK connects a KTS line to the telephone bus, all KTS lines of a higher number disconnect. This arrangement allows one caller at a time to gain access to the CM attendant. This access is in order of priority based on the line number. Line 0 has the highest priority of access to the attendant. The last line, line 19 on basic units and line 39 on extension units, has the lowest priority.

Conference bus setting

Each KTS line that connects to the conference bus circuit with an LK enters one port of a five-port conference bridge. Four bridges are in the CM basic unit and four bridges are in the CM extension unit. Ports on the same bridge are inductively coupled in a 1:1 ratio. A pair of capacitors couples to the conference bus. This arrangement allows connection of a KTS line that enters the CM to the other line. The circuit layout limits the number of KTS lines that can connect to form a conference to a maximum of five lines.

The NE-1A2 KTS controls the LK lamps and provides the indications described in the following table.

LK lamp indications

Indication	Meaning
Off	The line is idle.
Steady lit red lamp	The line is in use. For desk-mount units, a steady lit red lamp indicates the connection is to the conference bus. For rack-mount units, the connection is to the telephone bus.
Steady lit green lamp	The line is in use. For desk-mount units, a steady lit green lamp indicates the connection is to the telephone bus. For rack-mount units, the connection is to the conference bus.
Yellow lamp flashes at 60 indications for each minute (IPM)	An incoming call occurs. A buzzer sounds.
Yellow lamp winks at 120 IPM	The line is on hold.

Hold circuits

You can put a line on hold not including of the bus line connection. When you press the hold key (HK), the hold circuit activates and flashes the hold lamp. This action has a preset duration of three seconds. Three seconds is enough time to move an LK to the NORMAL setting without dropping the line associated with the LK.

Attendant key

A three-position illuminated attendant key (AK) switch connects the CM telephone circuit to the conference bus or the telephone bus. The AK is identical in construction to the LK except the AK does not have the center yellow filter. The AK allows the attendant to talk to callers on lines that connect to one of the two buses.

Headsets and handsets

Two pairs of jacks (AB and CD) are provided to connect one handset or two headsets. The CM telephone circuit network accepts one talk input at a time. The talk transfer switch (S3) connects the transmit line for one of the two pairs of jacks to the CM telephone circuit. The talk transfer switch disconnects the transmit line from the pair of jacks that remain.

Circuitry for an ADR and/or an HFU

The CM basic unit is equipped with an auxiliary equipment spade lug connection field (AUX-EQUIP INTERFACE FIELD). The CM contains this field to connect an ADR, an HFU, or an ADR and an HFU.

HF/OFF/CM switch (S2)

The CM attendant uses the HF/OFF/CM switch to control an optional HFU wired to the CM. The HFU wiring connects to the CM through the AUX-EQUIPMENT INTERFACE FIELD. This field is on the CM basic unit process control block (PCB). When placed in the HF position, S2 disconnects the ring line from the CM telephone circuit and provides a ground return for the HFU. This completes the power circuit for the HFU and activates the HFU. In the CM position, S2 disconnects the HFU and connects the CM telephone circuit. In the OFF position, the CM telephone circuit and the HFU do not connect to the internal circuits of the CM.

NORM/AUTO-DIAL switch (S1)

The NORM/AUTO-DIAL switch connects or disconnects an optional ADR terminated at the AUX-EQUIPMENT INTERFACE FIELD of the CM.

In the NORM position, the tip and ring (T/R) leads of the telephone access circuit connect directly to the CM telephone and dial circuits.

In the AUTO-DIAL position, the T/R leads of the telephone access circuit are split. This split allows connection of an ADR through the AUX-EQUIP INTERFACE FIELD.

Keypad assemblies

You can order the CM with DGP, DGT, or multi-function keypad assemblies.

NT5X64 (continued)

DGT and DGP keypad assemblies

The DGT and DGP keypad assemblies have twelve keys with Arabic numbers 0-9, an asterisk (*) and an octothorpe (#). These two keypad assemblies provide DGT and DGP dialing signals respectively.

Multi-function keypad

The multi-function keypad has sixteen keys with Arabic numbers 0-9. The multi-function also has special-function keys marked */KP, #/ST, STP/FO, ST2P/F, ST3P/I, and RE-DIAL/P. Set the dial mode switch to select three groups of functions. The dial mode switch is fitted only to CM basic units equipped with the multi-function keypad.

A +5V, -12V power supply and a mute circuit are included when the CM is equipped with a MF keypad. The +5V, -12V power supply provides the operating power for the keypad. The mute circuit reduces the amount of the tone level fed to the attendant's headset (or handset), when MF or DGT signals are dialed.

The following table describes the key functions that are associated with the setting of the dial mode switch.

Dial mode switch key functions (Sheet 1 of 2)

Dial mode switch setting	Keys	Function
DGP position	Arabics 0 through 9	These keys produce DGP dialing signals.
	RE-DIAL/P (functions as the RE-DIAL key)	When you press REDIAL, the last number keyed transmits again. To activate the redial function, all LK must return to the NORMAL position before you select the LK.
	STP/FO, ST2P/F, ST3P/I, RE-DIAL/P (functions as FO, F, I, and P respectively)	Functions are not assigned to these keys.
DGT position	Arabics 0 through 9	These keys produce DGT dialing signals.
	*/KP (functions as an *)	This key produces DGT dialing signals.

Dial mode switch key functions (Sheet 2 of 2)

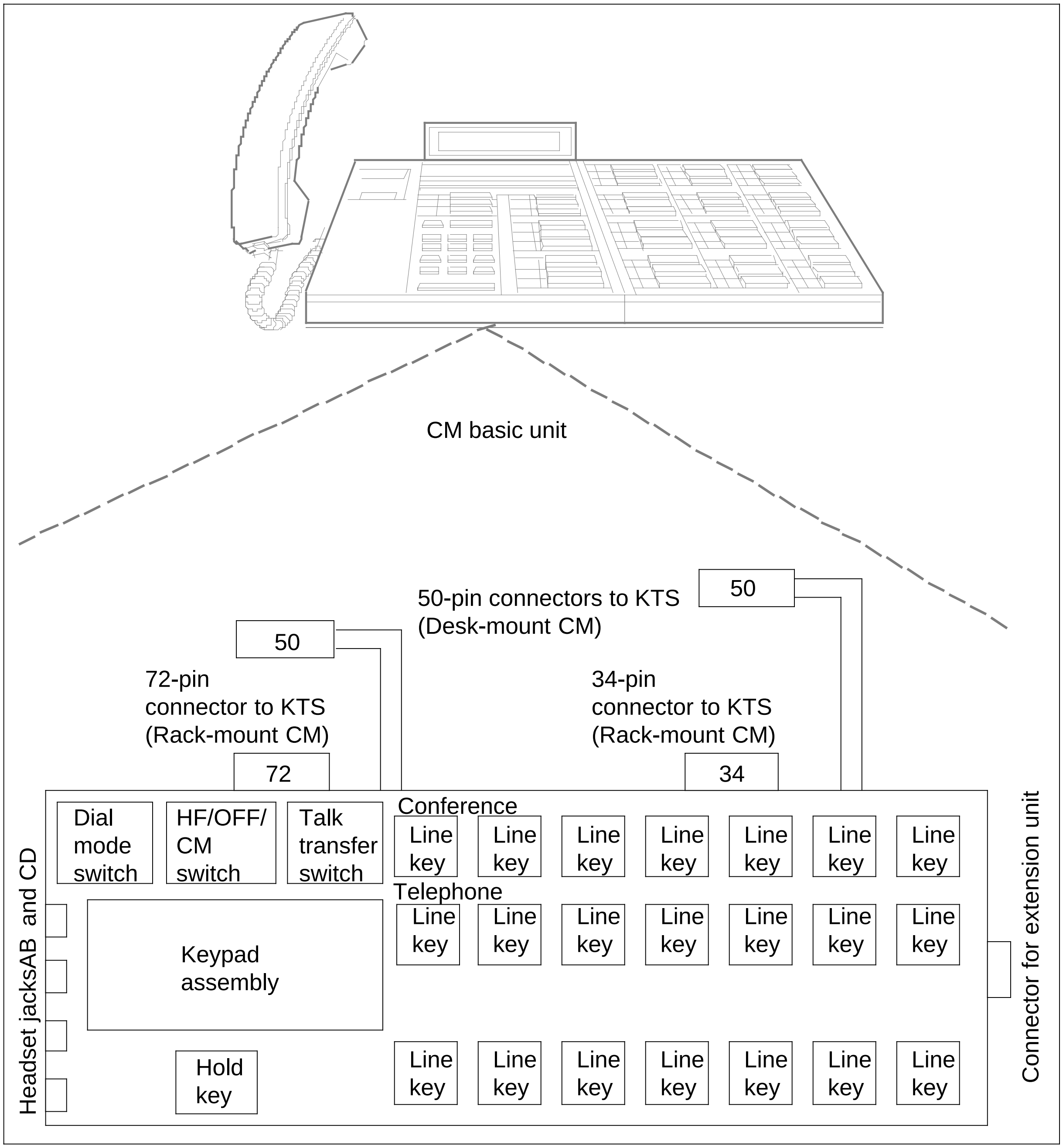
Dial mode switch setting	Keys	Function
	#/ST (functions as an #)	This key produces DGT dialing signals.
	STP/FO, ST2P/F, ST3P/I, RE-DIAL/P (functions as FO, F, I, and P respectively)	These keys produce DGT dialing signals FO, F, I, and P as the operating company requires.
MF position	Arabics 0 through 9	These keys produce multi-frequency (MF) dialing signals.
	*/KP, #/ST, STP/FO, ST2P/F, ST3P/I (functions as KP, ST, STP, ST2P, and ST3P respectively)	These keys produce multi-frequency (MF) dialing signals KP, ST, STP, ST2P, ST3P for traffic service position (TSP) applications or as the operating company requires.
	RE-DIAL/P	A function key is not assigned to this key.

Buzzer

The NE-1A2 KTS circuits to which the CM is connected, operates the buzzer in the CM. The buzzer sounds to indicate incoming calls.

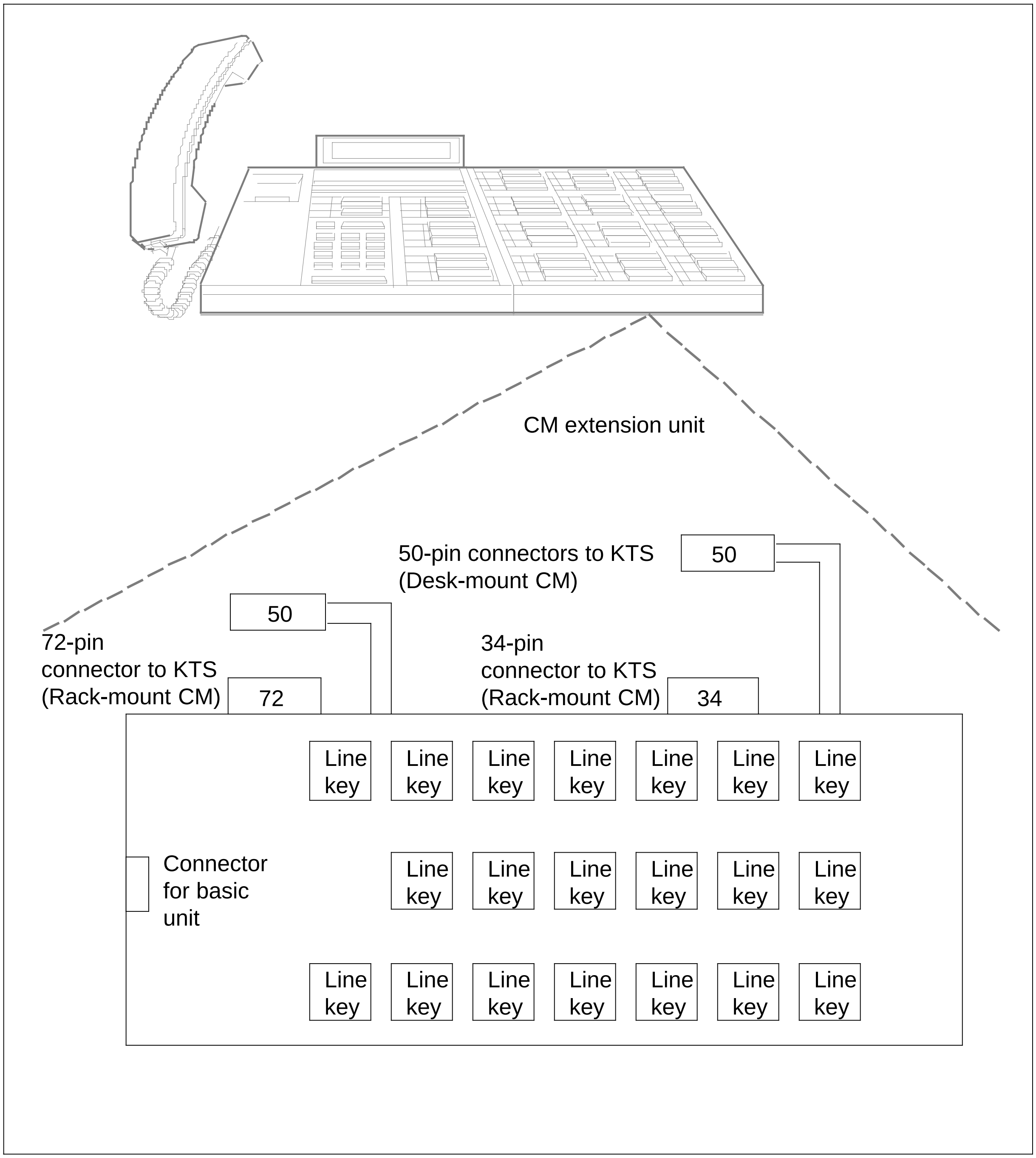
NT5X64 (continued)

NT5X64 CM basic unit



NT5X64 (continued)

NT5X64 CM extension unit



NT5X64 (continued)

Technical data

The technical data section provides specifications for the NT5X64-series power requirements, environmental conditions, equipment dimensions, and connecting circuits.

Power requirements

The NT5X64-series power requirements appear in the following table.

Power requirements

NT5X64AA	-24V (dc) 10V (ac)	250 mA 75 mA
NT5X64AB	-24V (dc) 10V (ac)	250 mA 75 mA
NT5X64AC	-24V (dc) 10V (ac)	280 mA 750 mA (floating ground)
Note: Provision all 10V (ac) distribution facilities to allow less than a 2V drop from the source to the load.		

Environmental conditions

The NT5X64-series equipment performs under limited environmental controls. The limited environmental controls appear in the following table shows.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10 °C to 30 °C	5 °C to 49 °C
	(50 °F to 86 °F)	(41 °F to 120.2 °F)
Relative humidity	20% to 55%	20% to 80%

Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the relative humidity is expected to be 30% maximum.

Equipment dimensions

The following table provides the -series equipment dimensions.

Equipment dimensions

PEC description	PEC code	Height	Length	Width
CM basic unit, desk mount				
DGP keypad	NT5X64AA	140 mm (5.5 in.)	304.8 mm (12 in.)	222.3 mm (8.75 in.)
DGT keypad	NT5X64AB	140 mm (5.5 in.)	304.8 mm (12 in.)	222.3 mm (8.75 in.)
Multi-function keypad	NT5X64AC	140 mm (5.5 in.)	304.8 mm (12 in.)	222.3 mm (8.75 in.)
CM basic unit, rack mount				
Multi-function keypad	NT5X64BA	222.3 mm (8.75 in.)	323.9 mm (12.75 in.)	352.8 mm (13.89 in.)
CM extension unit, desk-mount	NT5X64AD	140 mm (5.5 in.)	177.8 mm (7 in.)	222.3 mm (8.75 in.)
CM extension unit, rack-mount	NT5X64BC	222.3 mm (8.75 in.)	209.6 mm (8.25 in.)	342.6 mm (13.49 in.)

Connecting circuits

The NT5X64-series connecting circuits appear in the following table.

Connecting circuits

KTS	NE-1A2
Key telephone unit	QUN10D
Handsfree unit (LOGIC)	QUSIC-20
Handsfree unit (COMPANION)	QUS1B
Automatic dialer (LOGIC)	NT0C25AA
Automatic dialer (INDEX)	NT0C26CA
Headset	QSR2F
Headset	NE-G3DRN-3 (desk-mount CM only)

NT5X92

Product description

The NT5X92AA common audible alarm panel and the NT5X92AB alarm extension unit used together comprise an alarm extension circuit. The alarm extension circuit expands the alarm facilities at a remote line module (RLM) site of DMS-100 Family switching equipment.

The primary usability features of the NT5X92 are as follows:

- allows a maximum of ten common audible alarm panel locations in one building
- has an audible disable (AD) with reset
- allows the reset of the common audible alarm panel circuit and does not affect alarm signals that are extended to other panels
- reactivates the common audible alarm circuit after the alarm resets when the new alarm occurs
- extends a maximum of five exit alarm panels (NT0X64) for a combined critical (CR), major (MJ), minor (MN) and audible (AUD) alarm signal
- maintains all alarm and control leads normally extended to the alarm control and display (ACD) panel (NT0X63AC) and provides for a second ACD panel
- makes individual CR, MJ, and AUD alarm indications to non-DMS equipment with Form-C relay contacts

Location

The alarm extension unit is in a standard DMS-100 remote service equipment frame. The common audible alarm panels are wall-mounted or column-mounted at locations that require audible alarm indications.

Functional description

The NT5X92AA common audible alarm panel and the NT5X92AB alarm extension unit function as an alarm extension circuit. The NT5X92AA common audible alarm panel consists of a -48V buzzer enclosed in a metal box. The operation of the common audible alarm (CAA) relay in the NT5X92AB alarm extension unit activates the buzzer. This action supplies group to the buzzer. A maximum of ten NT5X92AA can connect to one NT5X92AB for simultaneous audible alarms at different locations.

The NT5X92AB alarm extension unit contains six relay assemblies and a terminal strip that mounts on a 26 in. mounting plate.

The first four relay assemblies contain alarm relays CR, MJ, MN, and AUD. The fifth contains the CAA relay. Input ground signal for an NT2X57 signal distribution (SD) card enters the alarm extension unit. The SD card enters this unit when the DMS-100 alarm system software activates an alarm condition. The CAA relay and the related alarm relays extend the alarm to the NT5X92AA, NT0X63AC, and NT0X64 panels. The relays also extend the alarm to non-DMS equipment. Audible devices remain active until the CAA circuit is reset. The alarm condition in the alarm extension unit stays on until the input signal from the SD card clears.

The relay assemble that remains, contains the AD relay and an audible alarm reset (AAR) relay. Relay AD prevents the CAA from activation, even if any of the alarms are present. Relay AD operates when the AD key is set in one of the two ACD panels. The active AD relay opens the common control ground path to disable audible alarm devices. When set, the AD state remains until the circuit is reset.

The CAA and AD states are reset when personnel activate the ARR key in one of the alarm control and display (ACD) panels. Activation of the key operates relay AAR. Relay AAR releases the CAA and AD relays. The release of CAA silences audible devices with the removal of the extended grounds. The release of CAA does not affect the CR, MJ, MN, or AUD alarm state. The release of relay AD removes the AD condition from the circuit.

The terminal strip on the NT5X92AB alarm extension unit cross-connects alarm point ABS-PDC, CRPP, MJPP, MNPP, power distribution center (PDC), and OAU from the SD card to the ACD panels. The lamp control lead cross-connects from the ACD units to the scan card for test purposes.

Functional blocks

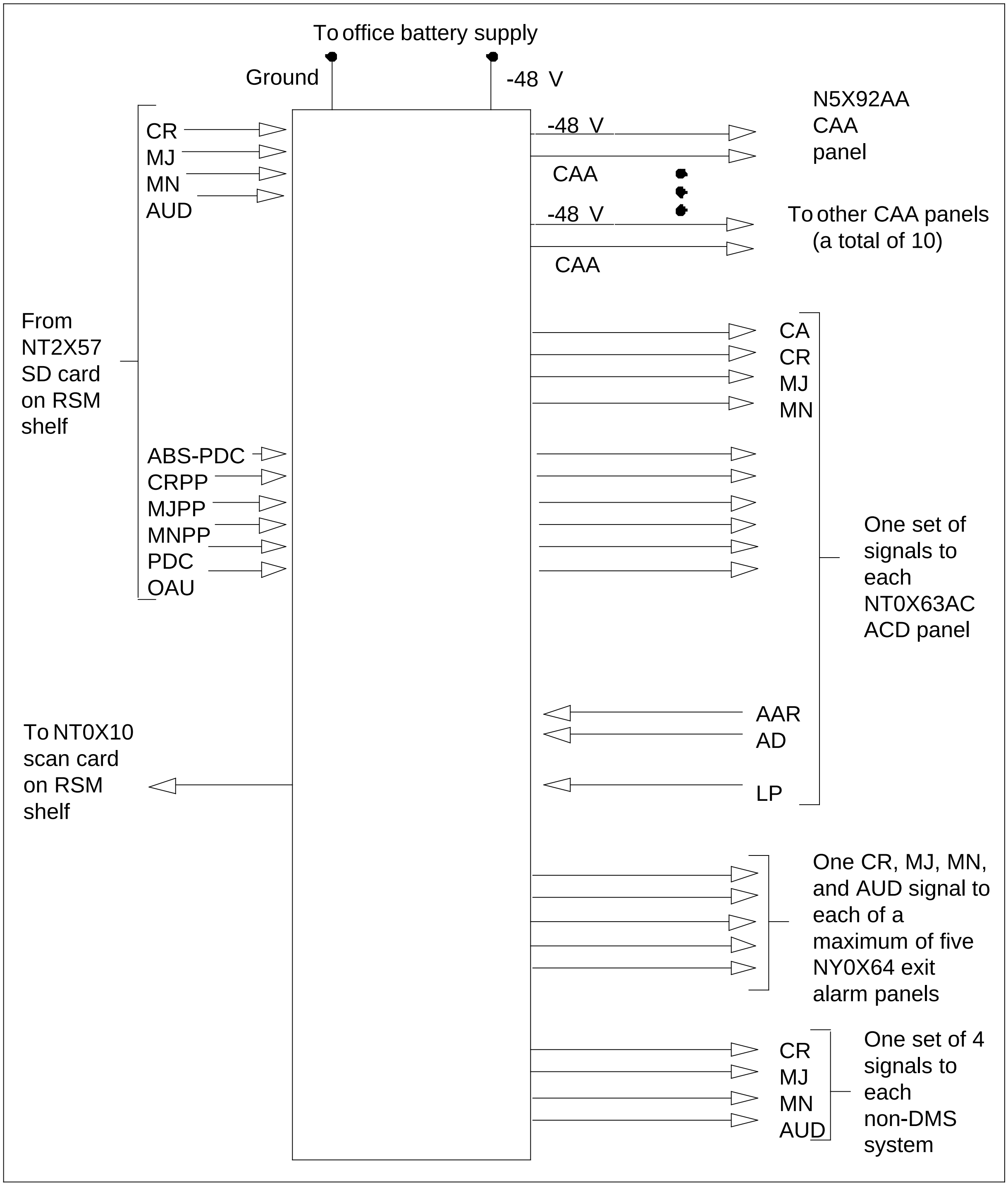
The NT5X92 has the following functional blocks:

- common audible alarm panel
- alarm extension unit

The relationship between the functional blocks appears in the following figure.

NT5X92 (continued)

NT5X92 functional blocks



Technical data

The technical data section provides specifications for the NT5X92 power requirements, equipment dimensions, environmental conditions, and common alarm panel signal requirements.

Power requirements

The NT5X92 power requirements appear in the following table.

Power requirements

Voltages	-42.7V to -55.8V (52V nominal)
Current	500 mA maximum

Equipment dimensions

The common audible alarm panel dimensions are 127 mm (5 in.) high, 152 mm (6 in) wide, and 102 mm (4 in.) deep. The approximate weight is 1.3 kg (2.87 lb).

The alarm extension unit dimensions are 51 mm (2 in.) in high, 660 mm (26 in.) wide, and 152 mm (6 in.) deep. The approximate weight is 2.0 kg (4.4 lb).

Environmental conditions

The NT5X92 performs under limited environmental controls. The limited environmental controls appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10 °C to 30 °C	5 °C to 49 °C
	(50 °F to 86 °F)	(41 °F to 120.2 °F)
Relative humidity	20% to 55%	20% to 80%

Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the expected relative humidity is 30% maximum.

NT5X92 (end)

Common alarm panel signal requirements

The common alarm panel signal requirements appear in the following table.

Audible signal for common audible alarm panel

Signal quality	Specification
Frequency	2900 ±500 Hz
Cadence	The cadence is on and off intermittently with a 50% duty cycle at a rate of approximately 5 pulses each second.

NT5X95AA

Product description

The NT5X95AA miscellaneous applique equipment shelf provides housing for the miscellaneous applique circuit packs (CP).

The applique CPs are used as adapters. The applique CPs provide an interface between a DMS-100 Family trunk circuit and an item of Nortel Networks. The applique CPs also provide an interface between a DMS-100 Family trunk circuit and other manufacturers equipment, or for special purposes.

Parts

The NT5X95AA shelf contains the following parts:

- NT0X50AC—Filler face plate
- NT0X50AE—Filler face plate
- NT2X09AA—Multi-output power converter
- NT5X97AA—Alternate use trunk applique circuit

Design

The following table provides a description of the NT5X95AA parts. The design of the NT5X95AA appears in the following figure.

NT5X95AA parts (Sheet 1 of 2)

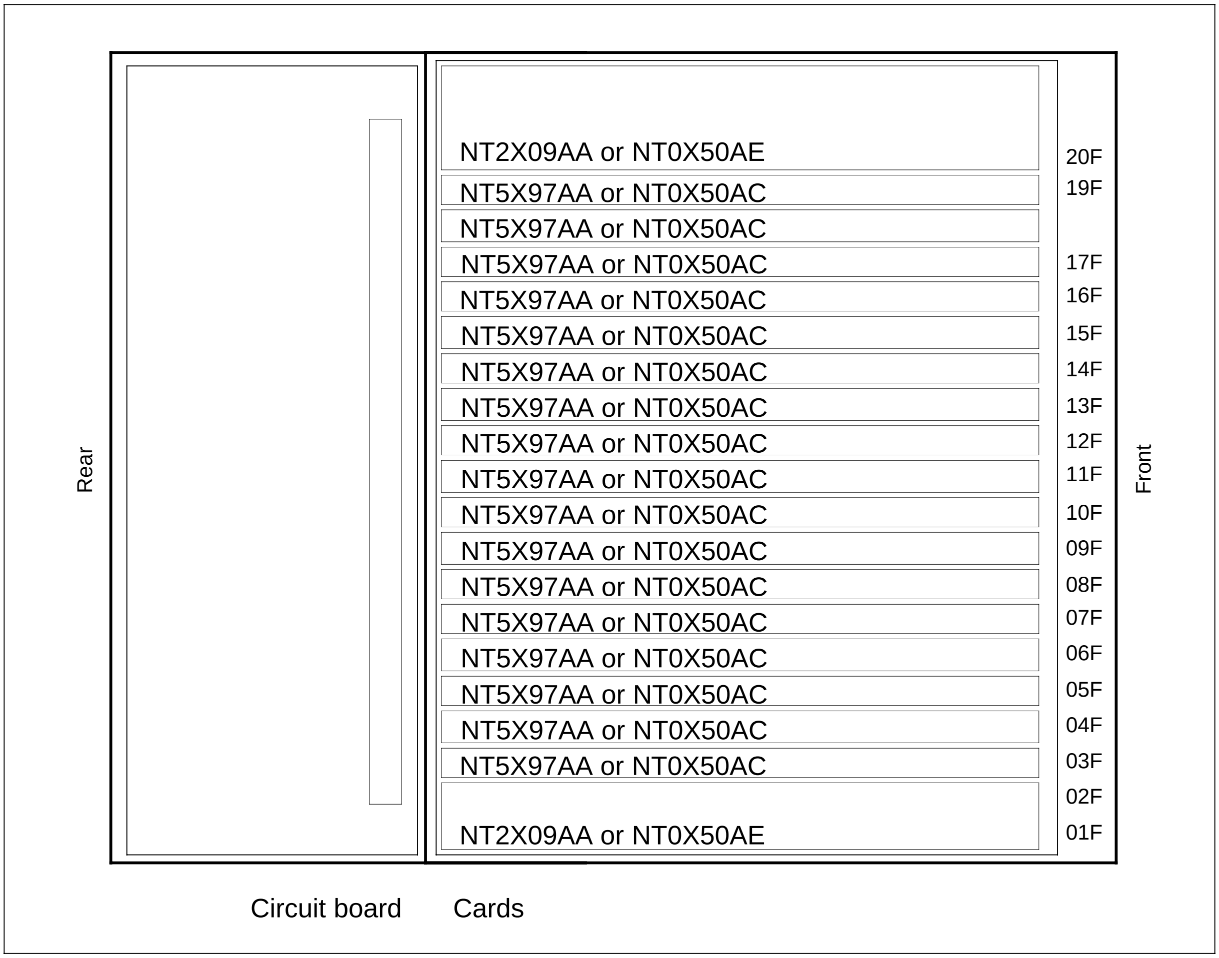
PEC	Slot	Description
NT0X50AC	(provisionable) 03F-19F	*Filler face plate 1.12* The NT0X50AC fills card slots 03-19 when that are not in use.
NT0X50AE	(provisionable) 1F, 20F	*Filler face plate 2.62* The NT0X50AE fills card slots 1 or 20 when the card slots that are not in use.

NT5X95AA (end)

NT5X95AA parts (Sheet 2 of 2)

PEC	Slot	Description
NT2X09AA	(provisionable) 1F, 20F	*Multi-output power converter* The NT2X09AA provides a regulated, common-ground dc power supply, that offers five different output voltages: +24V, +12V, +5V, -15V, and -5V.
NT5X97AA	03-10, and 11-19 (provisionable)	*Alternate use trunk applique circuit card* The NT5X97AA is a 4-wire, 3-port circuit designed to interface a 4-wire analog transmission facility. The circuit uses single-frequency (SF) signaling to two DE-3/4 SF channel units (QPP601A). The NT5X97AA application is with an SL-100 switch where one channel unit operates as a tie trunk during the normal business day. The other channel unit operates as a foreign exchange (FX) trunk during night time operation. An external ground applied to the NT5X97AA controls which trunk, tie, or FX connects through the NT5X97AA to the far-end transmission facility. Each NT5X97AA CP accommodates two applique circuits and plugs in an NT5X95AA shelf.

NT5X95AA design



NT5X97

Product description

The NT5X97 alternate use trunk applique circuit is a four wire, three-port circuit. This circuit interfaces a four-wire analog transmission facility. The circuit uses single-frequency (SF) signaling to two DE-3/4 SF channel units (QPP601A). Applique circuits are used as adapters. This use provides an interface between a DMS-100 Family trunk circuit and an item of Nortel Networks (NT). The applique circuits also provide an interface between a DMS-100 Family trunk circuit and other manufacturer equipment or for special purposes.

The NT5X97 application involves an SL-100 switch. One channel unit operates as a tie trunk during the normal business day. The other channel unit is a foreign exchange (FX) trunk during night operation.

An external ground applied to the NT5X97 controls which trunk, tie, or FX connects through the NT5X97 to the far-end transmission facility.

The primary usability features of the NT5X97 are as follows:

- 600-ohm terminations, transformer-coupled to a four-wire line
- direct analog carrier interface
- transparent to SF signaling
- two-way SF supervision and detection
- 0 dB transmission loss on through path
- 23 dB loopback on idle port
- SF or multifrequency (MF) signaling
- tie trunk or tone-on-idle FX applications
- built-in ground detectors for FX and tie trunk control using scan points
- out-of-service (OOS) loopback

Location

Each NT5X97 circuit card plugs in to an NT5X95 miscellaneous applique equipment shelf. The location of the NT5X95 depends on the customer. The NT5X95 is normally close to the trunk module (TM) interface and maintenance trunk module (MTM).

Functional description

The functions of the NT5X97 are as follows:

- process voice frequency (VF) signals
- control which trunk, tie or FX, connects to the analog transmission facility
- prevent a change of state between tie and FX trunk during a busy state (no SF tone)
- monitor scan point states
- transmit near-end SF signaling to the far end
- receive far-end SF signaling

This section describes the functions of the NT5X97 in terms of the VF circuits, tie and FX control, control alarm. This section also describes the functions in terms of OOS loopback, SF signaling, SF receiver, and clock and timer.

VF circuits

The applique circuit incorporates transformers T1, T2, T3, and T4. This provides VF interfaces between the four-wire analog facilities and the four-wire QPP601A SF channel units. Level adjustments are not available. The applique circuit has 0 dB insertion loss. The circuit is transparent to VF band signals that pass through uninhibited.

Tie and FX control

The following control the connection of the tie or FX trunk through the NT5X97 to the far-end transmission facility:

- the position of the option switch S1A
- a 6.7 s timer
- the state of the tie trunk control lead (TIE SC)
- the idle state of the facility

Switch S1A controls if the SF tone monitors both directions or if SF tone that comes from the analog transmission facility is monitored. The Technical data section in this hardware description provides more information on how to position the switch. The presence of the SF tone starts the timer. The absence of the SF tone indicates a busy condition. When this condition occurs, the timer is reset to zero. The timer output controls a latch that indicates the status of TIE SC lead. The latch only changes states after a full timer interval occurs.

The TIE SC lead connects to a ground detector. A ground on the TIE SC lead causes relays K1 and K3 to release. This action occurs if the output of the timer indicates an idle circuit. When released, relays K1 and K3 connect the

NT5X97 (continued)

QPP601A SF channel unit. This unit is a tie unit through the NT5X97 to the analog transmission facility.

An open TIE SC lead causes relays K1 and K3 to operate. This action connects the QPP601A SF channel unit. This unit is a FX unit. The K1 and K3 connects through the NT5X97 to the analog transmission facility.

Control alarm

A control alarm can detect control lead faults. Switch S1B controls the use of this feature. The “Technical data” section in this hardware description provides additional information about how to position the switch.

The two control leads FX SC and TIE SC must be in opposite states. One c lead must be grounded. The other lead must be open. If two similar states occur, like two grounded or two open control, relay K2 releases. This action gives a contact closure.

If the alarm function is not required, the FX SC control lead does not need to be wired. The control lead does not need to be wired because the control of the K1 and K3 relays is through the TIE SC control lead only.

OOS loopback

Only one FX channel unit tie can connect to the NT5X97 through path of the to the far-end analog transmission facility. When the unit connects, the unit is the in-service (INSV) trunk.

The OOS trunk has the transmit path of the OOS trunk looped-back through the contacts of the receive path of the DOS trunk. The transmit path loops back to the receive path of the DOS trunk. The transmit path loops through the contacts at relays K1 and K3, and a 23 dB attenuator. The receive output of a QPP601A channel unit is at a nominal +7 dBm (OTLP). The 23 dB reduces this level to -16 dBm. The nominal transmit level the QPP601A channel unit requires is -16 dBm. The QPP601A receives SF tone of the QPP601A at the correct level. The DMS-100 equipment considers the channel unit idle.

SF signaling

The QPP601A channel units receives near-end signaling through the FX-T, FX-R, TIE-T, and TIE-R leads. The SF tone indicates an on-hook. The SF tone absent indicates an off-hook condition. Use of a low-level tone is for on-hook supervision between regular calls. Use of a high-level tone is for DP after every transition. The transition is from a off-hook to an on-hook for a specified duration.

Far-end signaling is received from the analog transmission facility through the T1 and T2 leads. Treat the absence or presence of the SF tone in the same way. Far-end and near-end signaling treat the use of low-level or high-level tones the same way.

SF receiver

The SF receiver with a guard detector and a signal detector, detects on-hook and off-hook supervision. The presence or absence of a 2600 Hz tone indicates on-hook and off-hook supervision.

The signal and guard detectors separate incoming VF signals are to signal and guard parts. The signal part contains a narrow band of frequencies centered on 2600 Hz. The guard part includes every other frequency in the VF band. The signal and guard detectors produce dc voltages in proportion to the input amplitudes. The guard detector has 10 dB more gain than the signal detector units through path.

The guard detector prevents signaling that speech initiates. When the incoming 2600 Hz tone is absent (off-hook condition) or during dialing, the signal detector output is compared against a minimum threshold plus the dc output. The dc output is from from the guard detector. This comparison occurs to determine a signal component presence. An almost pure 2600 Hz tone is required to operate the SF receiver.

Clock and timer

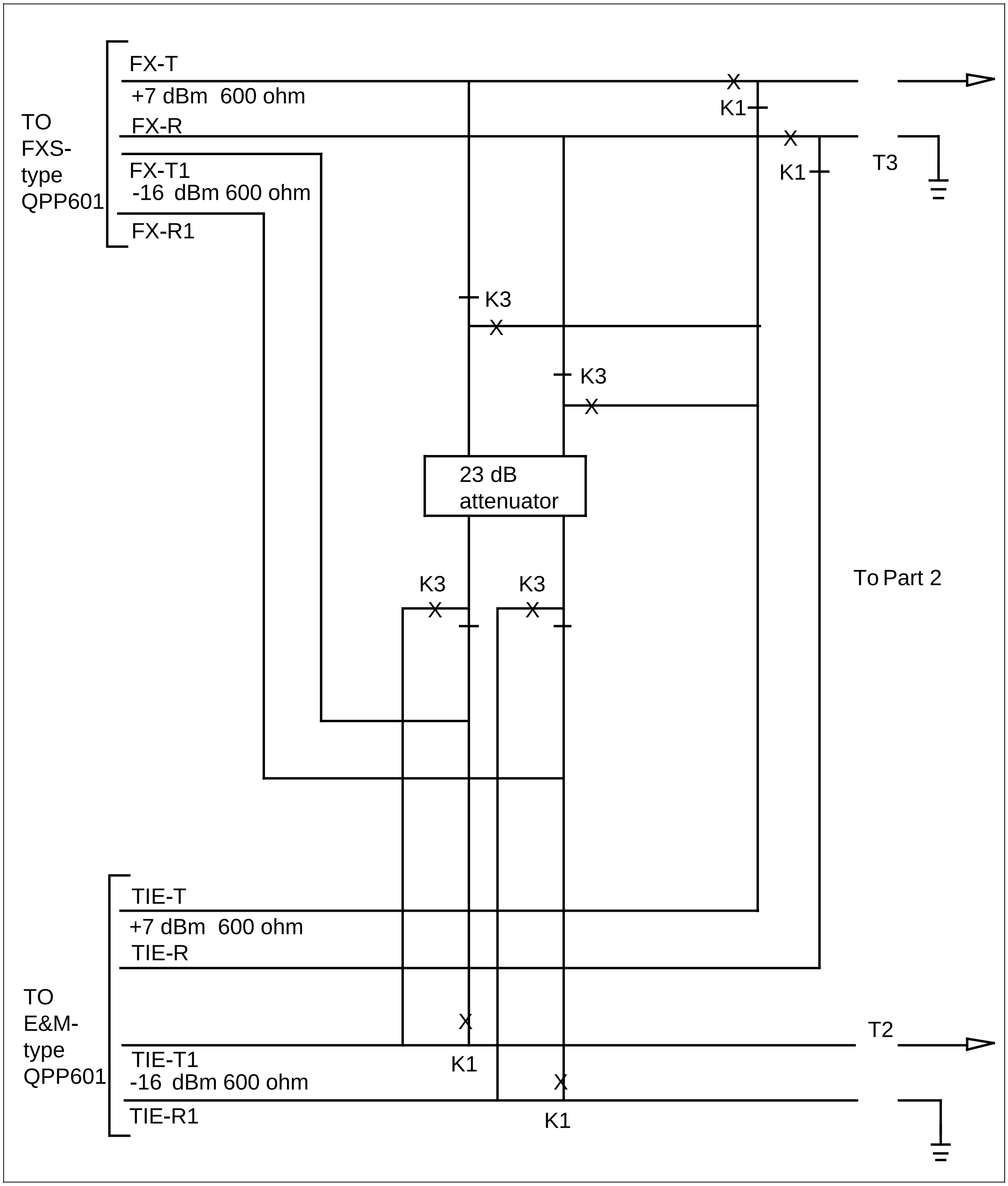
Each applique circuit contains a free-running clock with a nominal period of 0.56 s. This clock debounces a status change on the TIE SC leads. The clock also clocks a counter to a twelve count that produces a nominal 7 s timer. The timer is 6.7 s to bridge a nominal 2 s on and 4 s off-ringing interval when in FX mode is in use.

Functional blocks

A simple block diagram of one of the two applique circuits on a NT5X97 circuit pack appears in the following figures.

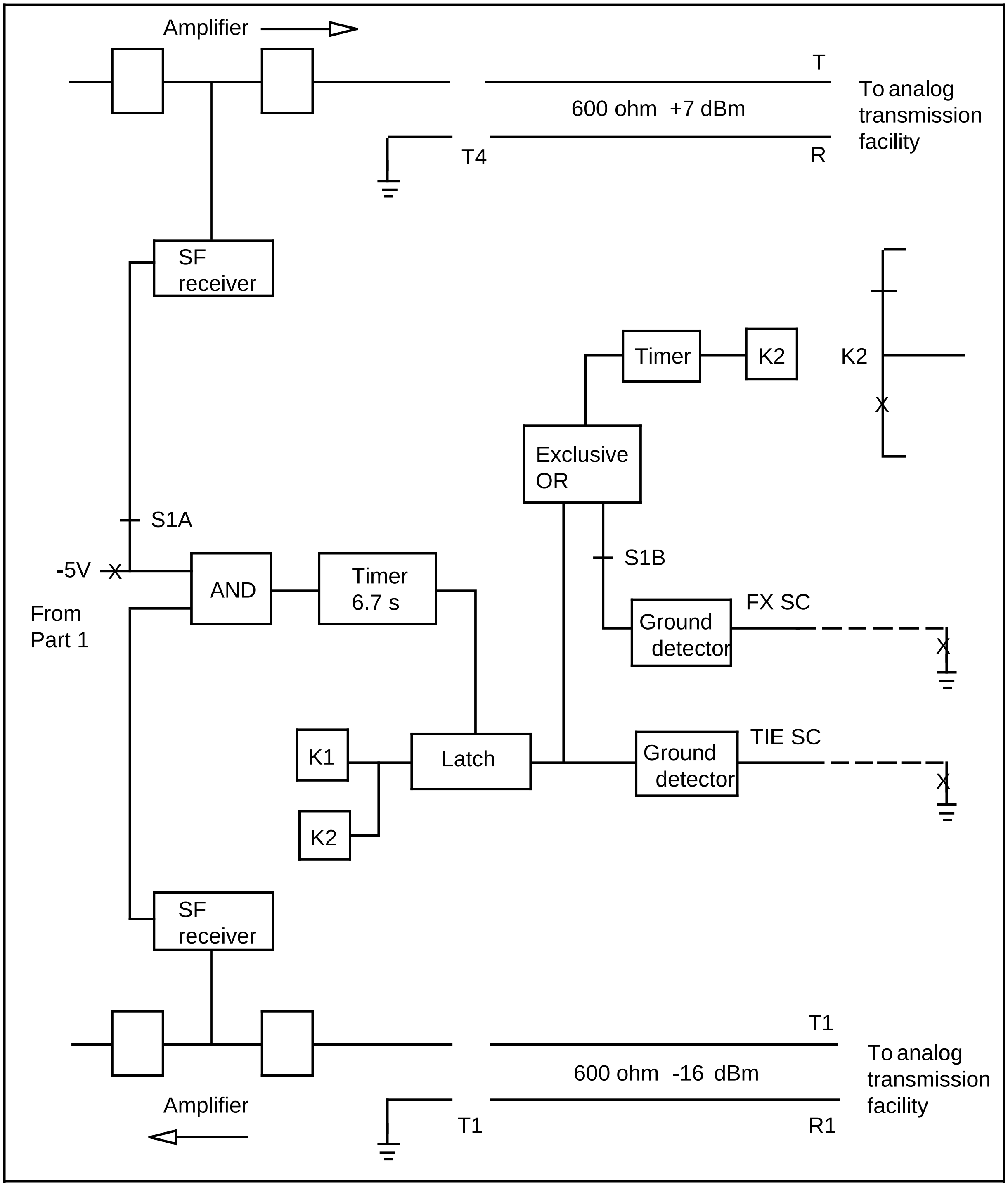
NT5X97 (continued)

NT5X97 Applique circuit simplified (Part 1)



NT5X97 (continued)

NT5X97 Applique circuit simplified (Part 2)



NT5X97 (continued)

Technical data

The technical data section provides specifications for the NT5X97 power requirements, transmission specifications, environmental conditions, switch S1 settings, equipment dimensions. The technical data section also provides specifications for signaling characteristics.

Power requirements

The power consumption for each circuit for the tie trunk state normally is 1.3 W. The power consumption for each circuit for the FX trunk state normally is 2.6 W. Other NT5X97 power requirements appear in the following table.

Power requirements

Converted voltages	+12 ±0.3V	-25	±0.5 V	
Currents	+22.8 to 27.0V	(T24 nominal)	+5	±0.1 V

Transmission specifications

The NT5X97 transmission specifications appear in the following table .

Transmission specifications

Talk circuit impedance	600 ohms
Nominal receive level from QPP601A at FX-T, FX-R, TIE-T, TIE-R	+ 7 dBm
Nominal transmit level to QPP601A at FX-T1, FX-R1, TIE-T1, TIE-R1	-16 dBm
Nominal receive level from analog transmission facility at T1 and R1	-16 dBm
Nominal transmit level to analog transmission facility at T and R	+ 7 dBm

Environmental conditions

The NT5X97 performs under the limited environmental conditions that appear in the following table.

Ambient conditions

Condition	Operating range	Short-term range
Temperature	10°C to 3°C (50°F to 86°F)	5°C to 49°C (41°F to 120.2°F)
Relative humidity	20% to 55%	20% to 80%
Note: A relative humidity of 80% is expected at an ambient temperature of 21°C (69.8°F) maximum. At an ambient temperature of 49°C (120.2°F), the relative humidity is expected to be 30% maximum.		

Switch S1 settings

The NT5X97 switch S1 settings appear in the following table.

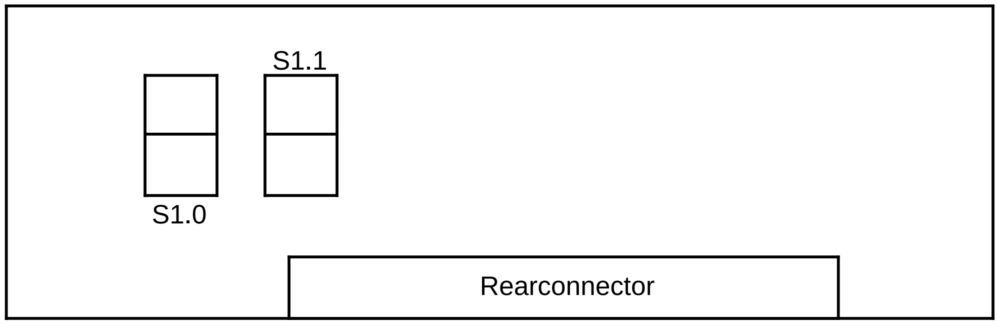
Switch S1 settings

Section	Position	Effect
A	farthest away from the edge of the printed circuit board	SF tone in both directions is monitored
A	nearest to the edge of the printed circuit board	SF tone coming only from the analog transmission facility is monitored
B	farthest away from the edge of the printed circuit board	FX SC and TIR SC leads are monitored (See **Note**)
B	nearest to the edge of the printed circuit board	monitoring feature disables
Note: If both leads are in the same state, either ground or open, the system releases alarm relay K2.		

The part side appears in the following figure. The illustration is not to scale.

NT5X97 (continued)

NT5X97 part side



Equipment dimensions

The NT5X97 dimensions are 353 mm (13.9 in.) high, 267 mm (10.5 in.) deep, and 29 mm (1.125 in.) wide. The approximate weight of the NT5X97 is 1.36 kg (3 lb).

Signaling characteristics

The NT5X97 signaling characteristics appear in the following table.

Signaling characteristics (Sheet 1 of 2)

Characteristic	Value
Talk battery	-42.75V to -55.8V
• Normal range or float charge	• -49.0 to -53.5V
• Maximum discharge or no charge	• -42.75V
• Maximum charge or equalizing	• -55.8V
Insulation resistance	30 kohms minimum
SF detectors FX-T,FX-R,TIE-T,TIE-R	
• Center frequency	• 2600 Hz ± 0..3%
• High level SF	• -1 dBm (see Note)
• Low level SF	• -13 dBm (see Note
• Detection bandwidth-narrow	• 100 Hz at -10 dBm input signal (typical)
• Minimum sensitivity	• -26 dBm ± dB
• Maximum sensitivity	• +7 dBm ± dB (guard detector out)
Note: High level SF -8 dBm0, low level -20 dBm0 to 0 TLP	

NT5X97 (end)

Signaling characteristics (Sheet 2 of 2)

Characteristic	Value
• Signal to guard ratio	• 10 dB
SF detectors T1 and R1	
• frequency	• 2600 Hz ± 0.3%4
• High level SF	• -24 dBm (see Note)
• Low level SF	• -36 dBm (see Note)
• Detection bandwidth-narrow	• 100 Hz at -33 dBm input signal (typical)
• Minimum sensitivity	• -49 dBm +2 dB
• Maximum sensitivity	• -16 dBm +1 dB
• Signal to guard ratio	• 10 dB
Note: High level SF -8 dBm0, low level -20 dBm0 to 0 TLP	

NT5X98AA

Product description

The NT5X98AA auxiliary fuse panel distributes A feed power to a maximum of 15 separately fused TOPS. The NT5X98AA also distributes A feed power to emergency stand-alone circuits (ESAC). The NT5X98AA panel distributes B feed power to a maximum of 15 separately fused TOPS or ESAC loads. Each fuse is rated at 1.33 A.

The NT5X98AA panel is at shelf position 40 in the NT0X02AB frame.

Parts

The NT5X98AA contains the following parts:

- NT5X9802—Auxiliary fuse panel assembly
  - — A0205210—Dummy fuse
- A0205202—Fuse (QFF1A)

Design

The following table provides a description of the parts that comprise the NT5X98AA auxiliary fuse panel.

NT5X98AA parts

PEC	Slot	Description
NT5X9802	-	Auxiliary fuse panel assembly The NT5X9802 is the mounting unit on which that fuse assemblies are fixed. The NT5X9802 comes with A0205210 dummy fuses installed in fuse positions F16 and F32.
A0205202	F01-F15 F17-F32	Fuse (QFF1A) This fuse is a 1.33 A fuse.
A0205210	F01-F32	Dummy Fuse (QFF3A) The A0205210 dummy fuse fills new fuse holder positions that are not in use.

NT5X98AA (continued)

The following table provides the fuse/terminal assignments for the NT5X98AA.

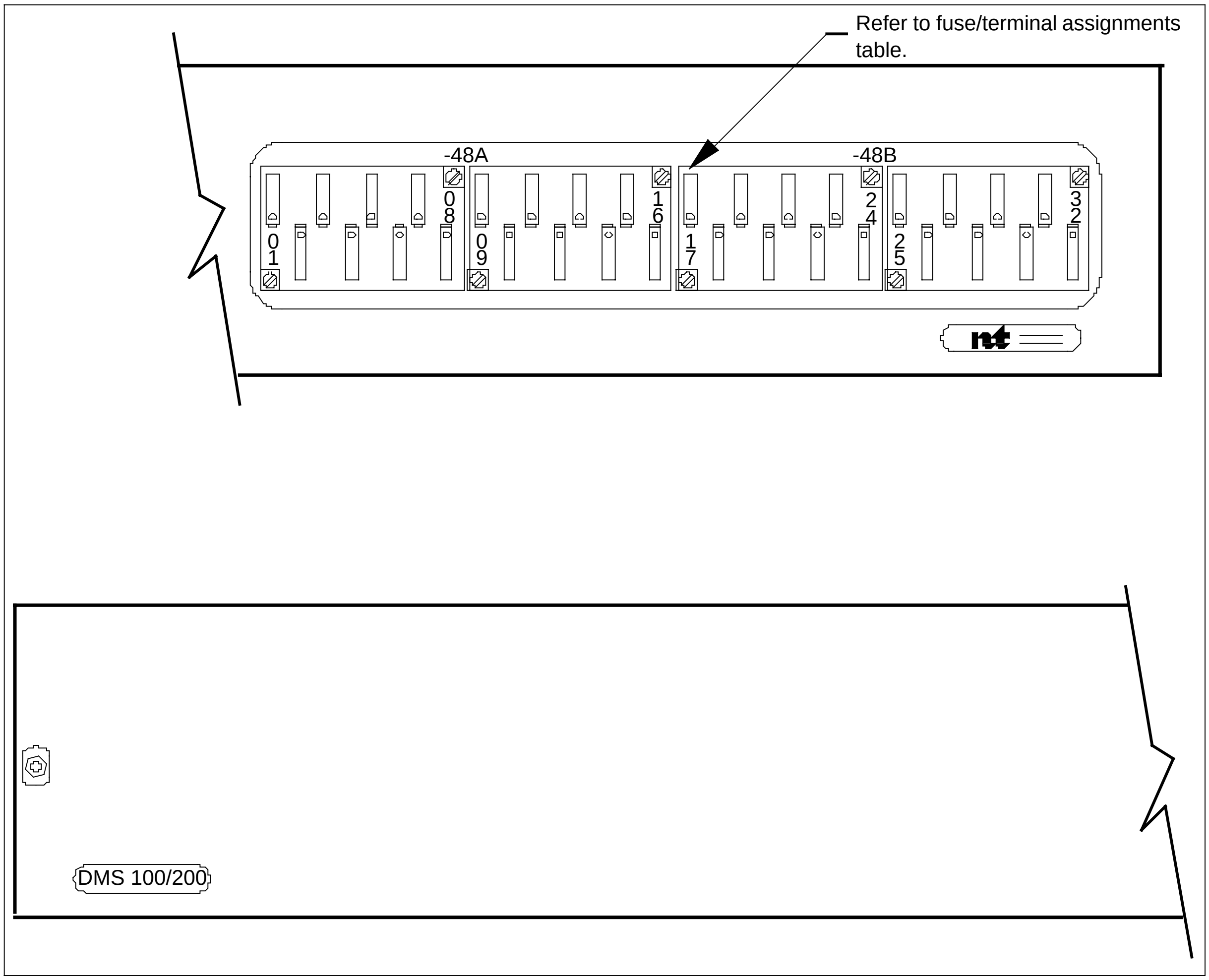
Fuse/terminal assignments

Fuse loc.	Max rating (amps)	PDC feed	FSP terminal	comments
F01	1.33	A	TB2-1	TOPS/ESAC circuit
F02	1.33	A	TB2-2	TOPS/ESAC circuit
F03	1.33	A	TB2-3	TOPS/ESAC circuit
F04	1.33	A	TB2-4	TOPS/ESAC circuit
F05	1.33	A	TB2-5	TOPS/ESAC circuit
F06	1.33	A	TB2-6	TOPS/ESAC circuit
F07	1.33	A	TB2-7	TOPS/ESAC circuit
F08	1.33	A	TB2-8	TOPS/ESAC circuit
F09	1.33	A	TB2-9	TOPS/ESAC circuit
F10	1.33	A	TB2-10	TOPS/ESAC circuit
F11	1.33	A	TB2-11	TOPS/ESAC circuit
F12	1.33	A	TB2-12	TOPS/ESAC circuit
F13	1.33	A	TB2-13	TOPS/ESAC circuit
F14	1.33	A	TB2-14	TOPS/ESAC circuit
F15	1.33	A	TB2-15	TOPS/ESAC circuit
F16	Dummy	-	-	Not used
F17	1.33	B	TB4-1	TOPS/ESAC circuit
F18	1.33	B	TB4-2	TOPS/ESAC circuit
F19	1.33	B	TB4-3	TOPS/ESAC circuit
F20	1.33	B	TB4-4	TOPS/ESAC circuit
F21	1.33	B	TB4-5	TOPS/ESAC circuit
F22	1.33	B	TB4-6	TOPS/ESAC circuit

NT5X98AA (end)

The design of the appears in the following figure.

NT5X98AA front view



5 NT6Mnnaa

NT6M56AB through NT6M71AB

NT6M56AB

Product description

The NT6M56AB fan filter printed circuit board (PCB) assembly is a low-pass filter. This assembly prevents the feedback of fan-generated noise on the line.

Location

The assembly is part of the distributed processing peripheral (DPP) in the DMS-100 switching network.

Functional description

The assembly uses an 18,000 μH power line choke and a 220 μF capacitor. The assembly uses these components to create an inductive capacitance network to filter fan noise. A $^1/_4$-A fuse is available for protection.

NT6M66AC

Product description

The disk interface printed circuit board (PCB) assembly links the processing unit and the disk controller PCB in the distributed processing peripheral (DPP). The DPP is a part of the DMS-100 system.

Location

The assembly is in the All slot of the DPP card rack. The DPP holds two assemblies.

Functional description

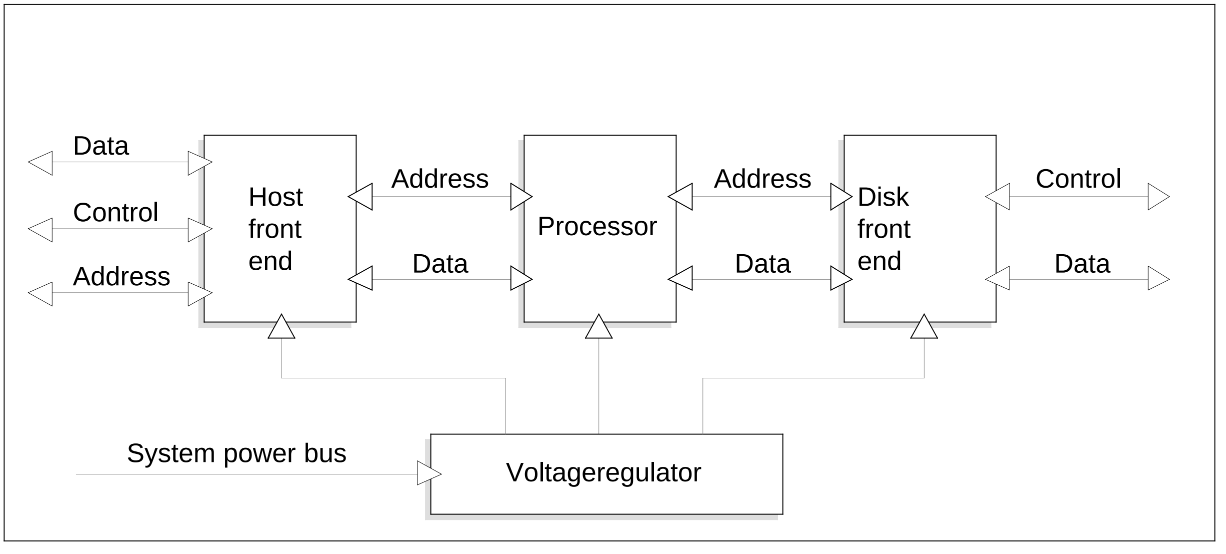
The NT6M66AC assembly interfaces with the DPP processing unit and the DPP disk assembly to perform timing, read/write, and interrupt functions.

Functional blocks

The NT6M66AC has the following functional blocks:

- host front end
- processor
- disk front end
- voltage regulator

The NT6M66AC functional blocks



Host front end

The host front end communicates with the DPP processing unit to control read/write activities. The circuit communicates with the processing unit

NT6M66AC (end)

through 32-kbyte dual-ported random access memory (RAM). The circuit controls access to the RAM through two programmable array logic (PAL) devices and two sets of buffers. The PAL devices contain address decoding and buffer control logic.

The host front end completes pending write operations when the host or disk processor must read data from the RAM. The system holds the data until the requesting processor is ready to accept the data.

Processor

The processor performs reset timing, generates interrupts, and links the host front end to the disk front end. This process uses the following:

- a central processing unit (CPU)
- a direct memory access (DMA)
- an erasable programmable read-only memory (EPROM)
- a RAM
- memory
- input/output (I/O) decoding

The processor accesses the reset port every 262 ms to make sure that a reset does not occur. The processor also uses the DMA integrated circuit to generate a vectored interrupt.

Disk front end

The disk front end functions as a peripheral of the processor. The disk front end uses a bus controller and two buffers to interface with the disk controller PCB. The system buffers signals that the disk front end controls before the signals go on the disk bus.

Voltage regulator

The voltage regulator receives 8V dc from the system power bus. The voltage receiver regulates the 8V dc to 5V dc for the PCB circuits to use.

NT6M68AA

Product description

The NT6M68AA Bus terminator printed circuit board (PCB) assembly terminates the end of the system bus. The assembly is part of the DMS-100 distributed processing peripheral (DPP).

Location

The assembly is in the A14 slot of each DPP card rack.

Functional description

The NT6M68AA provides resistor packs to terminate the end of the system bus. This action makes sure oscillation of the signals on the system bus does not occur. Each signal line connects to two resistors. A pullup connects to +5 Vdc. A pulldown connects to logic ground.

Power requirements

The voltage regulator U9 supplies voltage reference to the circuits on the assembly. The U9 receives power from the power supply logic. The power supply logic is normally 8 Vdc but the power supply logic can be a maximum of 10 Vdc. When the voltage leaves the voltage regulation circuit, the voltage must be 5 Vdc. The system distributes the voltage to the pullup circuits on the PCB assembly.

NT6M71AB

Product description

The NT6M71AB circuit provides output voltages of -12 V, +5 V, +8.5 V, and +12.0 V. The circuit requires an input voltage between -42 V and -60 V.

Technical description

Physical dimensions

The physical dimensions of the NT6M71AB circuit are as follows:

- height: 109.47 mm (4.31 in.)
- depth: 306 mm (12.05 in.)
- width: 168.02 mm (6.615 in.)

Power requirements

The output voltages the circuit NT6M71AB provides have the following characteristics:

Output voltages provided by NT6M71AB

Output number	Nominal voltage	Minimum voltage	Maximum voltage	Maximum current	Max. ripple peak to peak
1	+12.0 V	11.77 V	12.25 V	6.0 A	200 mV
2	+8.5 V	7.90 V	8.60 V	15.0 A	150 mV
3	+5.0 V	4.85 V	5.30 V	5.0 A	150 mV
4	-12.0 V	-11.75 V	-13.20 V	1.5 A	250 mV

6 NT6Xnnaa

NT6M56AB through NT6X02DD (continued in Vol. 3)

NT6X01AA

Product Description

The NT6X01AA common peripheral controller equipment (CPCE) frame houses the following common peripheral controller (CPC) modules:

- line group controller (LGC)
- digital trunk controller (DTC)
- line trunk controller (LTC)
- subscriber module urban (SMU)
- subscriber module-100S remote (SMS-R)

Each of the CPC modules is in two shelves next to each other. One of these shelves is a pair of shelves in positions 51 and 65. The other shelf is a pair of shelves in positions 18 and 32.

There are four types of CPCE frames:

- line group equipment (LGE) frame
- digital trunk equipment (DTE) frame
- line trunk equipment (LTE) frame
- subscriber module equipment (SME) frame

The type of CPC module in the bottom of the frame determines the frame type.

Parts

NT6X01AA has the following parts:

- NT0X0009-logic return cable assembly
- NT0X28AM-frame supervisory panel
- NT3X90AA-cooling inverter unit
- NT3X90AB-cooling inverter unit
- NT3X90AC-device controller cooling inverter unit
- NT6X0201-ISDN controller array shelf assembly
- NT6X02AB-common peripheral controller filler faceplate
- NT6X02NA-common peripheral controller module

Logic return cable assembly

Each CPCE frame uses an NT0X0009 logic return cable assembly. The frame uses the cable assembly when current offices that are not equipped with enhanced grounding are extended.

Frame supervisory panel

The NT0X28AM frame supervisory panel (FSP) contains power control and alarm circuits. The power control and alarm circuits provide interface between the power distribution center (PDC) and the equipment frames of the DMS-100 Family.

The following provide power control to the common peripheral control equipment (CPCE) frame:

- four circuit breakers (CB)
- one NT0X91AA converter drive and alarm
- one NT0X91AE converter drive and protection card

One FSP is on each single-bay equipment frame. The FSP monitors office battery and alarm battery supply (ABS) fuses and cooling or inverter units. If a cooling or inverter unit fails, fan fail indications, frame fail indications and aisle alarm outputs signal problems. Converter fail lines connect to the light-emitting diode (LED) indicators on the power converters in the associated frame. A frame fail indication on the FSP front panel and an aisle alarm output monitor the converter fail lines. The lines are monitored when a converter or fuse failure occurs.

The converter fail lines operate the following:

- a LED indicator on the front panel of the FSP below the associated power feed circuit breaker
- a LED indicator in the shelf power converter

Four service jacks on the front panel provide access to two telephone (TEL-A, TEL-B) pairs and two data (DATA-A, DATA-B) pairs. Other frames can use the service jacks with the FSP. The service jacks use connectors on the FSP to provide interframe and interaisle communications. The FSP also features a mechanical interlock that contains a small cover that slides. The cover allows access to only two of the circuit breakers at a time.

Cooling inverter unit

The cooling inverter provides forced-air cooling.

NT6X01AA (continued)

Device controller cooling inverter unit

The NT3X90AC device controller (DC) cooling inverter provides forced-air cooling.

ISDN controller array shelf assembly

The NT6X0201 integrated services digital network (ISDN) controller array shelf assembly contains 25 cards that include the following:

- NT6X02NA common peripheral controller
- NTBX02AA D-channel handler (DCH)
- NTBX01AA ISDN signaling pre-processor
- NT6X50AB DS-1 interface card

Common peripheral controller filler faceplate

The NT6X02AB is a filler faceplate package designed to fill unequipped shelves on an NT6X01AA CPCE frame. You can use the filler faceplate in shelf mounting positions 51 and 65 or 18 and 32.

Common peripheral controller module

The NT6X02NA ISDN common peripheral controller (CPCI) module is the common circuit pack fill for ISDN peripheral controller applications. The NT6X01AA CPCE frame houses the following CPCI modules:

- LGC
- DTC
- LTC
- SMS
- SMR
- SMU
- SMS-R

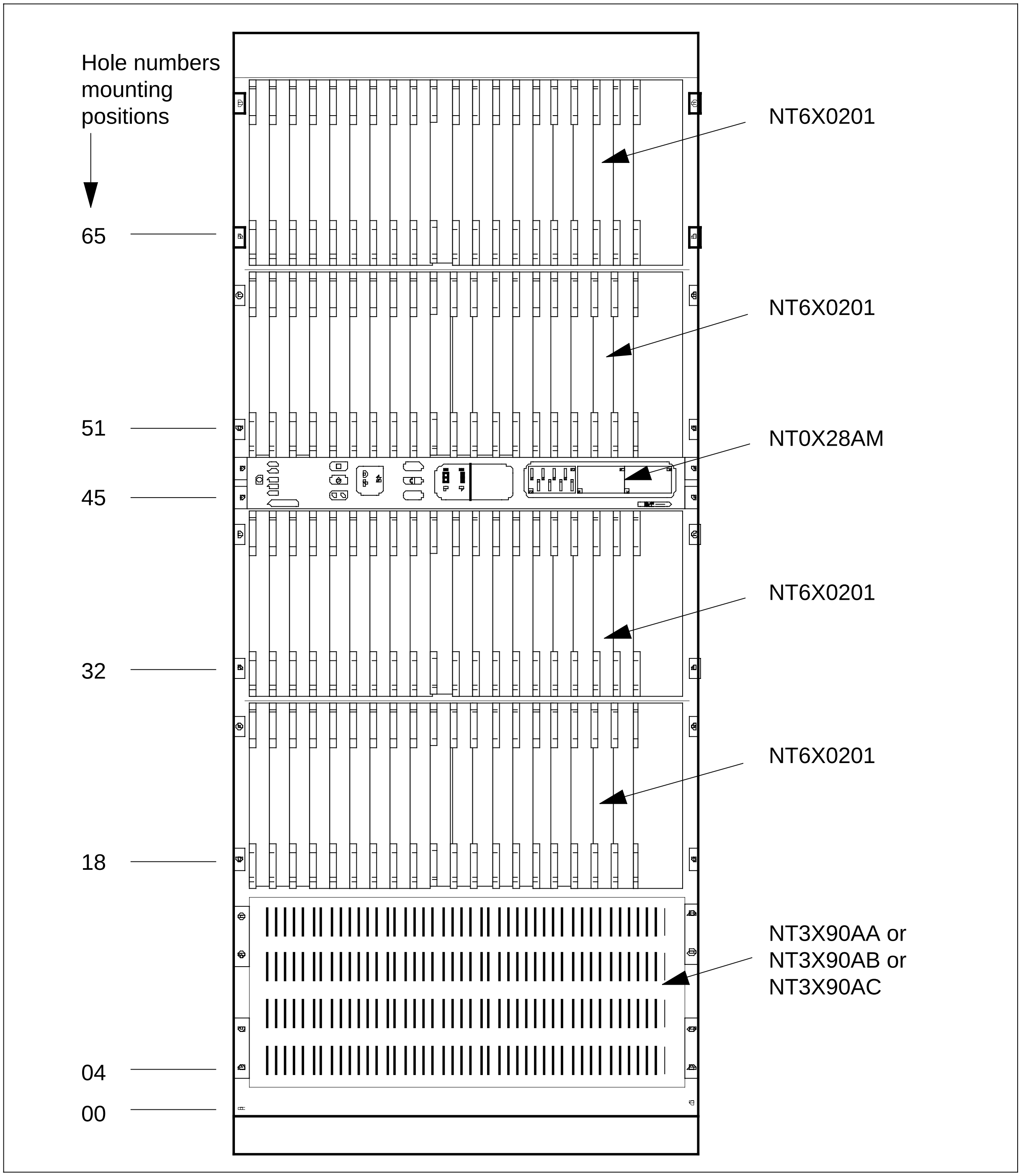
The type of CPCI module in the bottom of the frame determines the frame type.

Design

The design of the NT6X01AA appears in the following figure.

NT6X01AA (end)

NT6X01AA parts



NT6X01AB

Product description

The NT6X01AB ISDN common peripheral controller equipment (CPEI) frame is a single bay frame. The frame houses a maximum of two dual-shelf ISDN common peripheral controller/digital trunk controller (CPCI/DTC) modules. Each dual-shelf module is in two shelves next to each other. One pair of shelves is in positions 65 and 51. The other pair of shelves is in positions 32 and 18.

Each CPCI module contains two shelves. Each shelf can house up to 25 cards.

There are four types of CPCI modules:

- ISDN line group controller (LGCI)
- ISDN line trunk controller (LTCI)
- ISDN digital trunk controller (DTCI)
- digital trunk controller (DTC)

Different types of CPCI modules are combined on frames when required. The bottom module in the frame determines the frame name. If the bottom module is an LGCI, the frame is an integrated services digital network (ISDN) line group equipment (LGEI) frame. If the bottom module is an LTCI, the frame is an ISDN line trunk equipment (LTEI) frame. If the bottom module is a DTCI, the frame is an ISDN digital trunk equipment (DTEI) frame. If the bottom module is a DTC, the frame is a digital trunk equipment (DTE) frame.

Parts

The NT6X01AB contains the following parts:

- NT0X28EB-frame supervisory panel
- NT3X90AC-device controller cooling inverter unit
- NT6X0215-ISDN controller array shelf assembly
- NT6X02AB-CPC filler faceplate
- NT6X02AI-DTC common card
- NT6X02LE-foreign exchange peripheral module DTC common
- NT6X02NA-CPC module

Frame supervisory panel

The NT0X28EB FSP contains power control and alarm circuits. The power control and alarm circuits provide interfaces between the power distribution center (PDC) and the equipment frames of the DMS-100 Family. The FSP also provides a focal point for monitoring of the switching system. The NT0X28EB provides alarms to warn of problems within the central control complex (CCC) frame. Problems can be a fan or power converter unit that does not operate. The FSP also provides controls like controls for manual override of an alarm. The FSP provides test facilities. These facilities include the four service jacks that provide access to two telephone lines and two data lines. The telephone lines are TEL-A and TEL-B. The data lines are DATA-A and DATA-B. The power control and alarm circuits are on cards NT0X36AB power control and alarm (PCA).

Device controller cooling inverter unit

The NT3X90AC device controller (DC) cooling inverter provides forced-air cooling.

ISDN controller array shelf assembly

The NT6X0215 ISDN controller array shelf assembly contains 25 cards. The shelf assembly can be in any or all of positions 18, 32, 51, and 65 of the CPEI frame.

Common peripheral controller filler faceplate

The NT6X02AB is a filler faceplate package designed to fill shelves on an NT6X01AA CPCE frame that are not equipped. You can use the filler face plate in shelf mounting positions 51 and 65 or 18 and 32.

Digital trunk controller common circuit pack

The NT6X02AI DTC common CP is used with non-ISDN trunking required for DMS-250 applications. The non-ISDN trunking uses A/B bit signaling. The DTC is used in conjunction with an ISDN primary rate interface (PRI). The DTC must be converted to an ISDN DTCI CP.

Foreign exchange peripheral module digital trunk controller common circuit pack

The FXPM DTC applications on DMS-250 systems use the NT6X02LE foreign exchange peripheral module (FXPM) DTC common circuit pack. This circuit pack is also used with non-ISDN trunking that DMS-250 applications require. The non-ISDN trunking uses A/B bit signaling.

ISDN common peripheral controller module

The NT6X02NA ISDN common peripheral controller (CPCI) module is the common circuit pack fill for ISDN peripheral controller applications.

NT6X01AB (continued)

The following CPCI modules are in the NT6X01AB CPEI frame:

- LGC
- DTC
- LTC
- SMS
- SMR
- SMU
- SMS-R

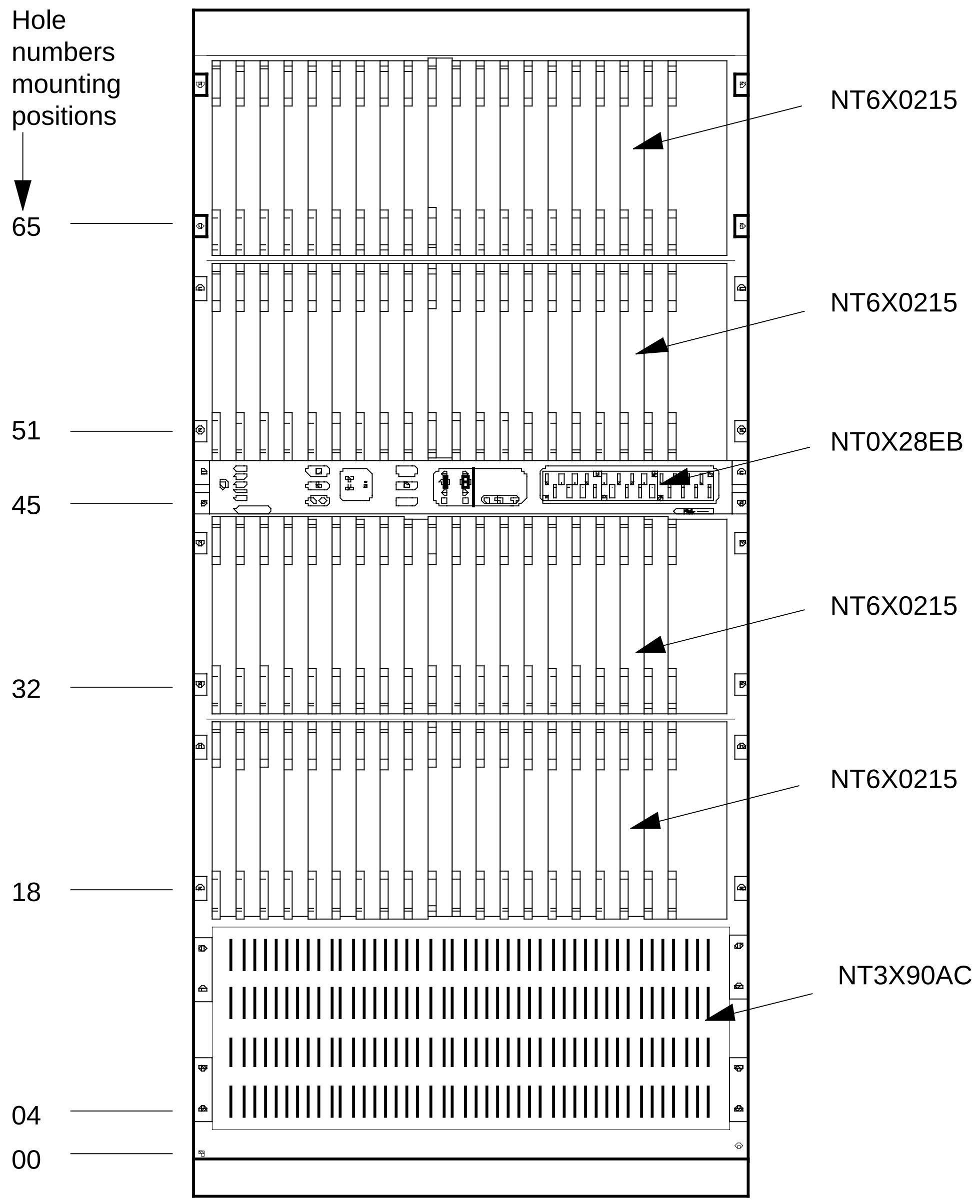
The type of CPCI module housed in the bottom of the frame determines the frame type.

Design

The design of the NT6X01AB appears in the following figure.

NT6X01AB (end)

NT6X01AB parts



NT6X01AC

Product description

The NT6X01AC offshore common peripheral controller equipment (CPCE) frame is a single bay frame based on the domestic NT6X01AB ISDN CPCE frame. Applications outside North America (offshore) use the NT6X01AC. The NT6X01AC supports PCM-30 links, ISDN services, the Extended Network and common channel signaling 7 (CCS7) features. The frame supports these features on two peripheral modules (PM). The PMs are the PCM-30 line group controller (PLGC) and PCM-30 digital trunk controller (PDTC). The offshore CPCE frame contains a maximum of two dual-shelf peripheral controller modules. The dual-shelf peripheral controller modules can be LGC or DTC. These modules support PCM-30 links, ISDN services and CCS7 features. Each dual-shelf module is in two shelves next to each other. One pair of shelves is in positions 65 and 51. The other pair of shelves is in positions 32 and 18.

The PLGC module supports the following services on stranded line concentrating module (LCM) types:

- ISDN
- Centrex
- electronic business set (EBS)
- integrated business network (IBN)
- plain ordinary telephone service (POTS)

The PLGC module also has PCM-30 peripheral-side (P-side) links. These links are for peripheral remote line concentrating module (PRLCM) and offshore remote switching center interface. The PLGC requires the NTBX01AA ISDN preprocessor card because the PLGC cannot function as a non-ISDN peripheral.

The PDTC module uses PCM-30 links to support CCS7 and R1 signaling in offshore applications. This module does not support ISDN services like primary rate interface.

Each module contains of two shelves. The shelf assembly requires two NT6X02NA common peripheral controller (CPC) common circuit packs to become a module.

The line group controller (LGC) and digital trunk controller are the types of CPC modules that the offshore CPCE frame can use. Different types of CPC modules are combined on frames when required. The bottom module in the frame determines the frame name. If the bottom module is an LGC, the frame is a line group equipment (LGE) frame. If the bottom module is a DTC, the frame is a non-ISDN digital trunk equipment (DTE) frame.

Parts

The NT6X01AC contains the following parts:

- NT0X0009-logic return cable assembly
- NT0X28EB-frame supervisory panel
- NT3X90AC-device controller cooling inverter unit
- NT6X0216-controller array shelf assembly offshore
- NT6X02AB-CPC filler faceplate
- NT6X02NA-CPC common circuit pack
- NT6X02UB-LGC/DTC offshore common CP
- NTZZ37DA-International CIPE DS512 Network Interface

Logic return cable assembly

Each frame uses an NT0X0009 logic return cable assembly. The frames use the cable assembly when current offices that are not equipped with enhanced grounding are extended.

Frame supervisory panel

The NT0X28EB FSP contains power, control and alarm circuits. The power, control and alarm circuits provide interfaces between the power distribution center (PDC) and the equipment frames of the DMS-100 Family. The FSP also provides a focal point for monitoring of the switching system. The NT0X28EB provides alarms to warn of problems in the central control complex (CCC) frame. Problems can be a fan or power converter unit that does not work. The FSP also provides controls like controls for manual override of an alarm. The FSP also provides test facilities. These facilities include the four service jacks that provide access to two telephone lines and two data lines. The telephone lines are TEL-A and TEL-B. The data lines are DATA-A and DATA-B. The power control and alarm circuits are on circuit packs NT0X36AB power control and alarm (PCA).

Device controller cooling inverter unit

The NT3X90AC device controller (DC) cooling inverter provides forced-air cooling.

NT6X01AC (continued)

Controller array shelf assembly offshore

The NT6X0215 controller array shelf assembly contains 25 cards. The shelf assembly can be in any or all of positions 18, 32, 51, and 65 of the offshore CPCE frame.

Common peripheral controller filler faceplate

The NT6X02AB is a filler faceplate package designed to fill shelves on an NT6X01AA CPCE frame that are not equipped. You can use the filler face plate in shelf mounting positions 51 and 65 or 18 and 32.

Common peripheral controller (CPC) common circuit pack

The NT6X02NA is the common circuit pack fill for peripheral controller applications in non Extended Network offices. The CPC modules like LGC and DTC are housed in the NT6X01AC offshore CPCE frame.

Line group controller/digital trunk controller offshore common circuit pack

Offshore peripheral controller applications use the NT6X02UB LGC/DTC offshore common CP. This CP replaces the NT6X02UA LGC/DTC offshore common CP. Two types of modules are present. The type of services required determine the names of these modules. The PLGC module supports ISDN, Centrex, EBS, IBN, and POTS services in applications outside North America. The PDTC module supports CCS7 and R1 signaling in applications outside North America.

International CIPE DS512 Network Interface

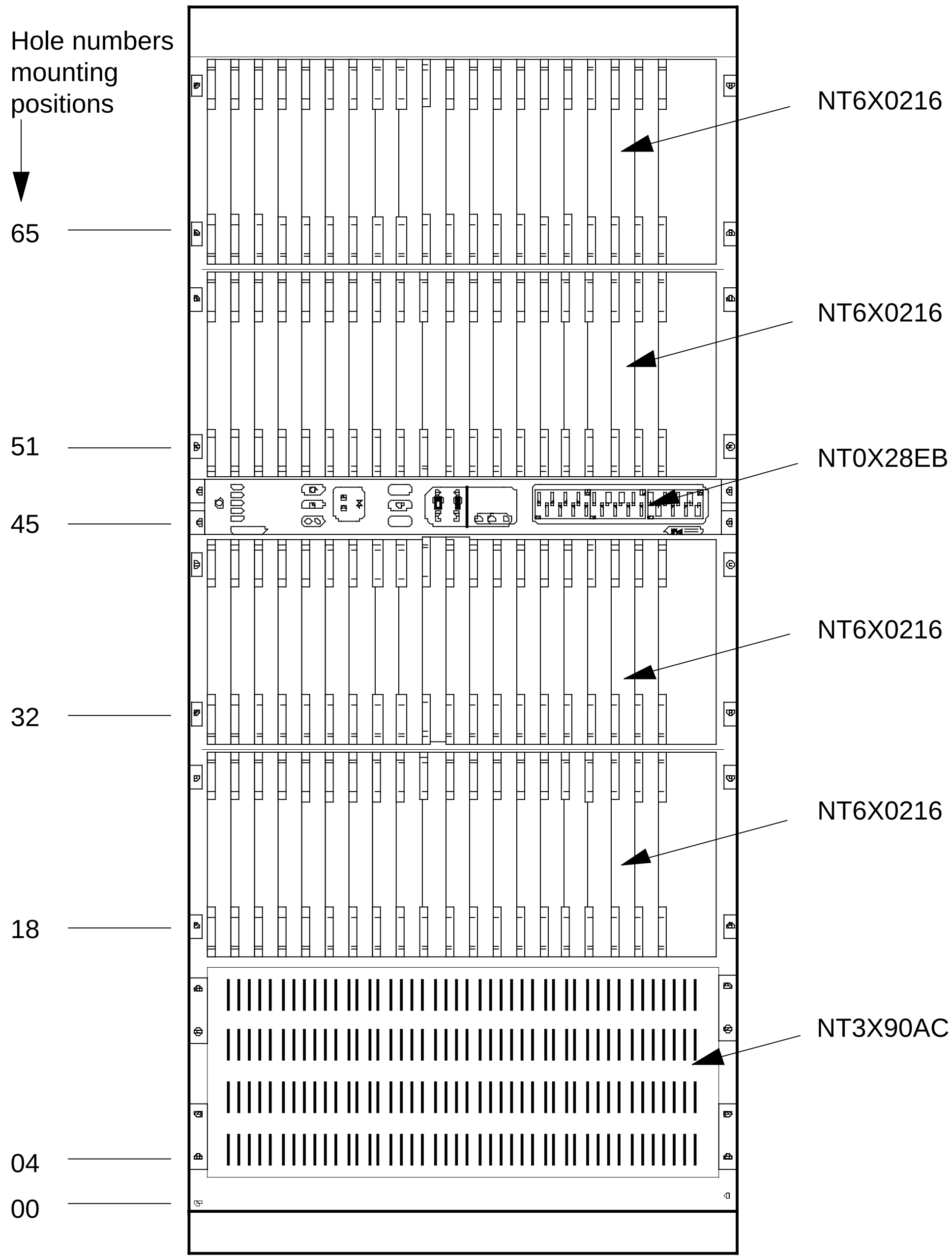
When an Extended Network office requires a fiber network interface, an NTZZ37DA PEC must be provided for each LGC or DTC module. The NTZZ37DA PEC contains two XPM DS512 link control cards (NT6X40FA) and two DS-512 link paddle board cards (NT6X40GA). This circuit card pair connects 512 pulse code modulation circuits to the Extended Network with a fiber optic cable.

Design

The design of the NT6X01AC appears in the following figure.

NT6X01AC (end)

NT6X01AC parts



NT6X01BA

Product description

The NT6X01BA international line group equipment (ILGE) or digital trunk equipment (IDTE) frame is a common peripheral controller equipment (CPCE) frame. The NT6X01BA houses common peripheral controller (CPC) modules like international line group controllers (ILGC) and international digital trunk controllers (IDTC). Each CPC module occupies two shelves, one shelf next to the other shelf. A pair of shelves is in positions 51 and 65. Another pair of shelves is in positions 18 and 32.

There are two types of international CPCE frames. The types are the international line group equipment (ILGE) frame and the international digital trunk equipment (IDTE) frame. If necessary, ILGC and IDTC modules combine on the frames. The type of CPC module in the bottom of the frame determines the frame type.

A CPC module on an ILGE or IDTE frame has the following:

- two NT6X0211 controller array shelf assemblies
- a set of ILGC or IDTC common circuit pack fills
- the wiring between the shelf assemblies

Each ILGC/IDTC module requires four cables on each plane to the speech link connecting (SLC) panel or frame. There are four speech link cable groups next to each other for each module. The ILGC module is the host office peripheral controller module for all subscriber lines in host or remote locations. The IDTC module is the peripheral controller module for all digital trunking, except for host remote links.

Parts

The NT6X01BA contains of the following parts:

- NT0X28AM-frame supervisory panel
- NT3X90AA-cooling inverter unit
- NT3X90AB-cooling inverter unit
- NT3X90AC-device controller cooling inverter unit
- NT6X0211-controller array shelf assembly
- NT6X02AB-common peripheral controller filler faceplate
- NT6X02NA-common peripheral controller module

Frame supervisory panel

The NT0X28AM frame supervisory panel (FSP) contains power, control and alarm circuits. The circuits provide interface between the power distribution center (PDC) and the equipment frames of the DMS-100 Family.

The following provide power control to the common peripheral control equipment (CPCE) frame:

- four circuit breakers (CB)
- one NT0X91AA converter drive and alarm
- one NT0X91AE converter drive and protection circuit pack

Each single-bay equipment frame has one FSP. The FSP monitors office battery, alarm battery supply (ABS) fuses, and cooling or inverter units. If a cooling or inverter unit fails, fan fail indications, frame fail indications and aisle alarm outputs signal problems. Converter fail lines connect to the light-emitting diode (LED) indicators on the power converters in the associated frame. A frame fail indication on the FSP front panel and an aisle alarm output monitor these lines. The lines are monitored for a converter or fuse failure.

The converter fail lines operate the following:

- an LED indicator on the front panel of the FSP below the associated power feed circuit breaker
- the LED indicator in the shelf power converter

Four service jacks on the front panel provide access to two telephone (TEL-A, TEL-B) pairs and two data (DATA-A, DATA-B) pairs. When the service jacks and FSP on other frames work together, the service jacks provide communications between frames and between aisles. The service jacks use connectors on the FSP to provide the communications. The FSP also features a mechanical interlock that has a small cover that slides. The cover allows access to only two circuit breakers at a time.

Cooling inverter unit

The cooling inverter unit provides forced-air cooling.

Device controller cooling inverter unit

The NT3X90AC device controller (DC) cooling inverter provides forced-air cooling.

NT6X01BA (continued)

Controller array shelf assembly

The NT6X0211 controller array shelf assembly has 25 circuit packs that include the following:

- NT6X02NA common peripheral controller
- NTBX02AA D-channel handler (DCH)
- NTBX01AA ISDN signaling preprocessor
- NT6X50AB DS-1 interface circuit pack

Common peripheral controller filler face plate

The NT6X02AB is a filler face plate package to fill unequipped shelves on an NT6X01AA CPCE frame. You can use the filler face plate in shelf mounting positions 51 and 65 or 18 and 32.

Common peripheral controller module

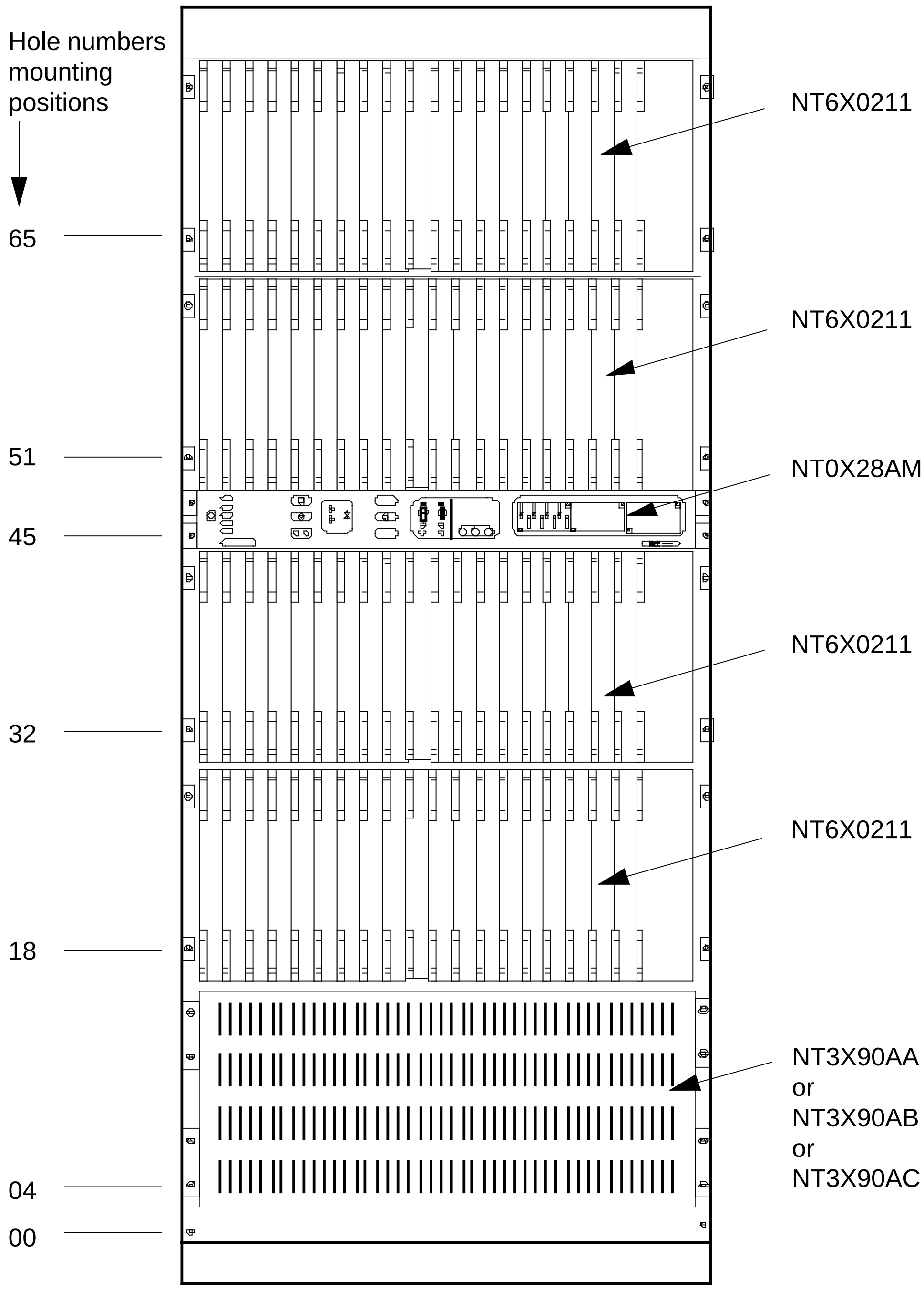
The NT6X02NA common peripheral controller (CPC) module is the common circuit pack fill for peripheral controller applications. The NT6X01BA CPCE frame contains the CPC modules like LGC, DTC, LTC, SMR, and SMS-R. The type of CPC module in the bottom of the frame determines the frame type.

Design

The design of the NT6X01BA appears in the following figure.

NT6X01BA (end)

The NT6X01BA parts



NT6X02AA

Product description

The NT6X02AA line trunk controller (LTC) common circuit pack (CP) fill provides an interface between the following:

- central-side (C-side) DS30 links to the network
- peripheral-side (P-side) DS30A links and/or DS-1 links to subsidiary peripheral modules

The LTC divides into two units. One unit is active and provides the necessary processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). Only one CC is active at a time and provides control for both units. The NT6X01AA subscriber module equipment (SME) frame contains the LTC common CPs.

The LTC has C-side interface also. The C-side ports can support a maximum 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each of these DS30 interface cards can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards so that the even-numbered links connect to plane 0 of the network. The odd-numbered links connect to plane 1 of the network. Interface with the network module (NM) and the CC requires a minimum of three link pairs.

Each DS30 card in the LTC powers 256 (8×32) channels for each plane. Each DS30 card powers the 256 channels to the formatter cards in units 0 and 1. Each formatter card handles 512 channels or 256 channels from each unit for each plane. The two network planes combine in the formatter. In the formatter, each channel has the selection of one plane or the other plane. The 512 speech channels are added to the 128 internal service channels. The 512 speech channels convert to a 640-channel bus to the CC.

The LTC uses DS-1 interface CPs or filler faceplates for slots 1 through 5. Slots 6 and 7 use DS30A line concentrating module (LCM) interface cards or filler faceplates. Slot 18 uses the NT6X43AA messaging interface CP.

Parts

The LTC common CP fill contains the following parts:

- NT0X50AA-Filler faceplate or panel
- NT2X70AB-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) card

- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X43AA-Messaging interface CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AA-LTC processor card
- NT6X46AA-Signaling processor memory (SPM) card
- NT6X47AA-Master processor memory (MPM) CP
- NT6X48AA-DS30A LCM interface CP
- NT6X50AA-DS-1 interface CP
- NT6X70AA-Continuity tone detector CP

Design

The design of the NT6X02AA appears in the following table and diagram.

NT6X02AA parts (Sheet 1 of 4)

Product engineering code (PEC)	Slot	Description
NT0X50AA	1F-7F, 13F, 15F-17F, 19F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. Each shelf contains a maximum of five spare card slots. Slots 15, 16, and 17 have access to the signaling processor (SP) address bus and the parallel speech bus. Spare slots 13 and 19 do not have access to the SP address bus and the parallel speech bus.
NT2X70AB	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the CP fill. Each power converter supplies +5 V and 12 V for the cards on the CP fill. Power to the DS-1 cards prevents loss of cards that are not duplicated during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AA (continued)

NT6X02AA parts (Sheet 2 of 4)

Product engineering code (PEC)	Slot	Description
NT6X40AA	22F, 23F	The *DS30 network interface card* The DS30 network interface card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 network interface card provides a two-way voice and data interface. Each port of a DS30 network interface card contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card has two sections. These sections are the clock section and the formatting section. The clock section of the card generates the 10.24-MHz shelf clock. The formatting section of the card provides the following: • parallel-to-serial conversion of the coded voice signals. The card receives the voice signals from the CSM interface card and sends the signals to the C-side links • serial-to-parallel conversion of the coded voice signals that the card receives from the C-side interface cards • network plane selection • parity error generation for test purposes • T1 clock generation
NT6X42AA	20F	*Channel supervision message CP* The CSM interface card performs the following functions: • extraction of the CSM bit from the C-side channels • assembly of the CSM for each channel • insertion of the CSM in the outgoing C-side bytes The CSM CP performs parity checking on all incoming bytes and parity generation on all outgoing bytes.
NT6X43AA	18F	*Messaging interface CP* The messaging interface CP provides interface for the parallel speech bus. The messaging interface CP extracts control messages received on channel zero from the control module (CM).

NT6X02AA (continued)

NT6X02AA parts (Sheet 3 of 4)

Product engineering code (PEC)	**Slot**	**Description**
NT6X44AA	14F	*Time switch* The TS converts between the serial stream and the parallel stream. The serial stream is from or to the DS30, DS30A LCM, or DS-1 interface cards. The parallel stream is for the internal speech bus. When the extended multiprocessor system (XMS)-based peripheral module (XPM) processor controls the TS, the TS associates interface CPs with time slots on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AA	8F, 12F	*Line trunk controller processor* The LTC processor runs the programs that control the operation and maintenance of a peripheral module (PM). The LTC processor performs the following functions: • digit collection • channel assignment • explanation of messages for the central CC and PM
NT6X46AA	11F	*Signaling processor memory card* The SPM card has RAM to store data and software applications.
NT6X47AA	9F, 10F	*Master processor memory CP* The MPM CP contains RAM to store data and software applications for the master processor and the XPM processor CP. The SP uses a portion of the memory management unit to access a part of the MPM.
NT6X48AA	6F, 7F	The *DS30A line concentrating module interface CP* The DS30A LCM interface CP has 10 separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56-Mbps bit stream. Each DS30A port has a looparound circuit for fault isolation.

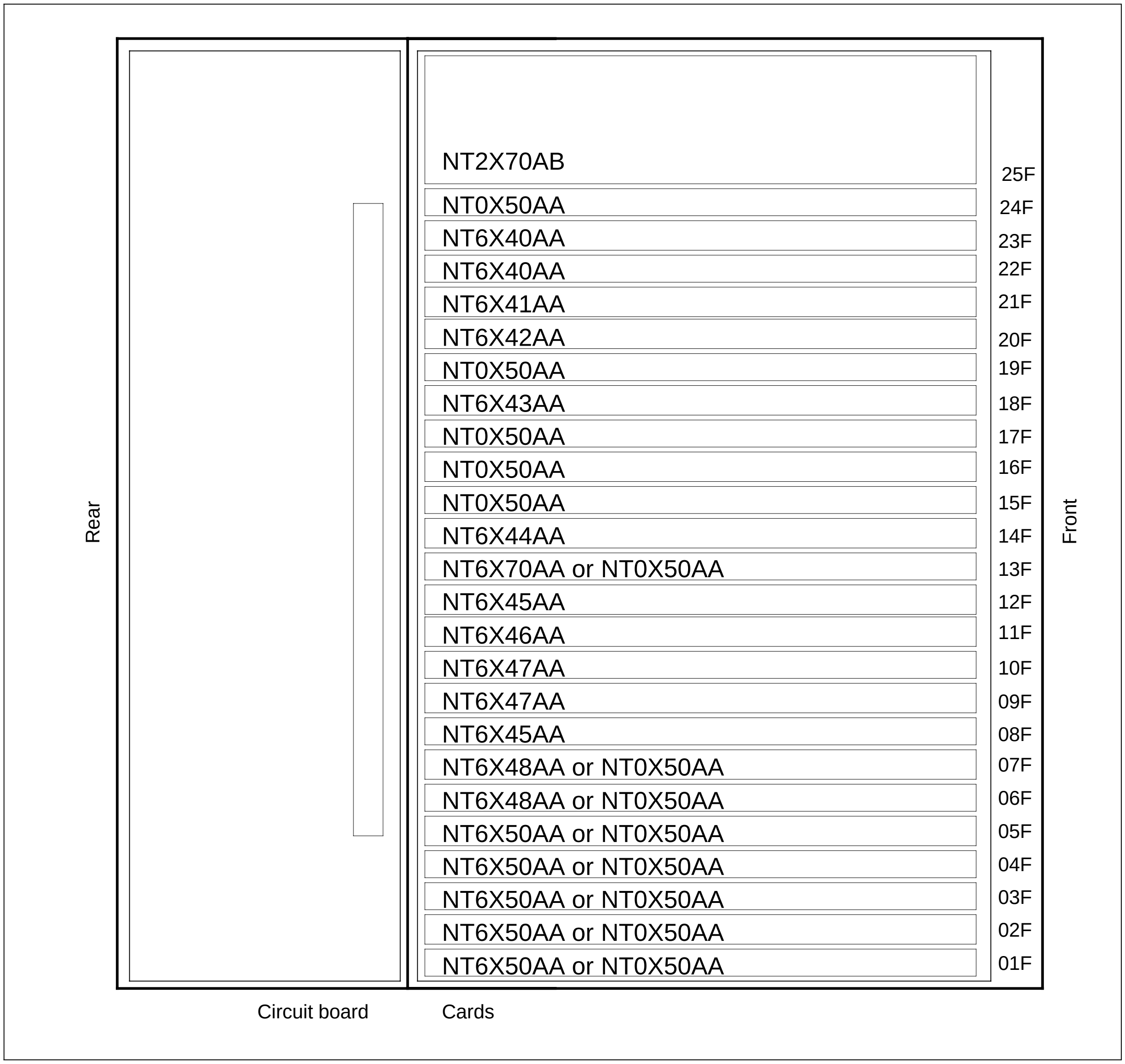
NT6X02AA (continued)

NT6X02AA parts (Sheet 4 of 4)

Product engineering code (PEC)	Slot	Description
NT6X50AA	1F-5F	The *DS-1 interface CP* The DS-1 interface CP has two DS-1 ports. Each LTC common CP fill can have one to 10 cards. Each DS-1 port provides a two-way voice, data, and signaling interface. The CP provides the following: • looparound paths for each DS-1 port to allow isolation of faults • transmission of local alarms • detection of remote alarms • detection of error conditions like loss of synchronization, bipolar error and slip
NT6X70AA	13F	*Continuity tone detector CP* The continuity tone detector CP detects tones for call processing to verify the continuity of the voice/data path between LTCs. The continuity tone detector CP monitors and records the frequency and level of the tones. The continuity tone detector CP retains this data for the XPM processor CP to use in the LTC.

NT6X02AA (end)

The NT6X02AA parts



NT6X02AC

Product description

The NT6X02AC digital trunk controller (DTC) common circuit pack (CP) fill provides an interface. The interface occurs between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS-1 trunks. The DTC divides into two units. One unit is active and provides the necessary processing and control functions. The second unit is in a standby mode. The second unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). Only one CC is active at a time and provides control for both units.

The DTC has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each of these DS30 interface cards can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. The even-numbered links are connected to plane 0 of the network, and the odd-numbered links to plane 1. The interface cards require a minimum of three link pairs for interface with the network module (NM) and the CC.

Each DS30 card in the DTC powers 256 (8×32) channels for each plane. Each DS30 card powers the 256 channels to the formatter cards in units 0 and 1. Each formatter handles a total of 512 channels (256 channels from each unit) for each plane. The two network planes combine in the formatter. In the formatter, selection of one plane or the other occurs for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the CC.

The DTC uses DS-1 interface CPs or filler faceplates for slots 1 to 5. Slot 13 uses a continuity tone detector CP or a filler faceplate. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). Slot 17 uses a specialized tone receiver (STR) or a filler faceplate. Slot 18 uses the NT6X69AB common peripheral processor (CPP) messaging protocol and tone CP.

Parts

The DTC common CP fill has the following parts:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) card
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP

- NT6X44AA-Time switch (TS) CP
- NT6X45AC-DTC processor card
- NT6X46AB-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X62AA-STR
- NT6X69AA-CPP messaging protocol and tone CP
- NT6X70AA-Continuity tone detector CP
- NT6X79AA-Common peripheral control equipment tone generator CP
- NT6X92BB-UTR

Design

The design of the NT6X02AC appears in the following table and diagram.

NT6X02AC parts (Sheet 1 of 5)

Product engineering code (PEC)	Slot	Description
NT0X50AA	1F-to-7F, 9F, 13F, 15F-to-17F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. Each shelf has a maximum of five spare card slots. Slots 15, 16, and 17 have access to the signaling processor (SP) address bus and the parallel speech bus. Spare slots 13 and 19 do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the CP fill. Each power converter supplies +5 V and 12 V for the cards on the CP fill. Power to the DS-1 cards prevents loss of cards that are not duplicated during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AC (continued)

NT6X02AC parts (Sheet 2 of 5)

Product engineering code (PEC)	Slot	Description
NT6X40AA	22F, 23F	The *DS30 network interface card* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface and contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card has two sections: the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of coded voice signals. The signals are from the CSM interface card to the C-side links. The formatting section also provides serial-to-parallel conversion of coded voice signals from the following: • the C-side interface cards • network plane selection • parity error generation for test purposes • T1 clock generation
NT6X42AA	20F	*Channel supervision message CP* The CSM interface card performs the following functions: • extraction of the CSM bit from the C-side channels • assembly of the CSM for each channel • insertion of the CSM in the outgoing C-side bytes • parity checking on all incoming bytes • parity generation on all outgoing bytes

NT6X02AC (continued)

NT6X02AC parts (Sheet 3 of 5)

Product engineering code (PEC)	Slot	Description
NT6X44AA	14F	*Time switch* The TS converts between the serial stream and the parallel stream. The serial stream is from or to the DS30, DS30A LCM, or DS-1 interface cards. The parallel stream is for the internal speech bus. When the extended multiprocessor system (XMS)-based peripheral module (XPM) processor controls the TS, the TS associates interface CPs with time slots on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Digital trunk controller processor* The line trunk controller (LTC) processor CP runs the programs that control the operation and maintenance of a peripheral module (PM). This CP performs functions like digit collection, channel assignment and explanation of messages for the central CC and PM.
NT6X46AB	11F	*Signaling processor memory card* The SPM card contains RAM to store data and software applications.
NT6X47AB	10F	*Master processor memory CP* The MPM CP contains RAM to store data and software applications for the master processor and the XPM processor CP. The SP uses the memory management unit to access a section of the MP memory.
NT6X50AA	1F-to-5F	The *DS-1 interface CP* The DS-1 interface CP has two DS-1 ports. Each LTC common CP fill can have 1 to 10 cards. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow isolation of faults. The CP also provides transmission of local alarms and the detection of remote alarms. The CP detects error conditions like a loss of synchronization, bipolar error, and slip.

NT6X02AC (continued)

NT6X02AC parts (Sheet 4 of 5)

Product engineering code (PEC)	Slot	Description
NT6X50AB	1F-to-5F	The *DS-1 interface CP* The DS-1 interface CP has two DS-1 ports. Each LTC common CP fill can have 1 to 10 cards. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow isolation of faults. The CP also provides transmission of local alarms and the detection of remote alarms. The CP detects error conditions like a loss of synchronization, bipolar error, and slip.
NT6X62AA	17F	*Specialized tone receiver* The STR card allows the DTC shelf to detect and report specified tones on a maximum of 480 on channels. An STR can scan a maximum of 480 channels at one time. In the DMS-250, this card enables a subscriber in the talking state to press # or * and dial out digits to make a new connection. The subscriber does not need to dial the carrier access and authorization codes again. Only a DTC with an extended SP memory and a CPP messaging protocol and tone CP can have the STR card.
NT6X69AA	18F	*Common peripheral processor messaging protocol and tone CP* The CPP protocol and tone CP provides interface for the parallel speech bus. This CP extracts control messages received on channel zero from the control module (CM).
NT6X70AA	13F	*Continuity tone detector CP* The continuity tone detector CP detects tones for call processing to verify the continuity of the voice/data path between LTCs. This CP monitors and records the frequency and level of the tones. The continuity tone detector CP retains this data for the XPM processor CP in the LTC to use.
NT6X79AA	19F	*Common peripheral control equipment tone* generator CP The common peripheral control equipment tone generator protocol and tone CP provides interface for the parallel speech bus. This CP extracts control messages received on channel zero from the control module (CM).

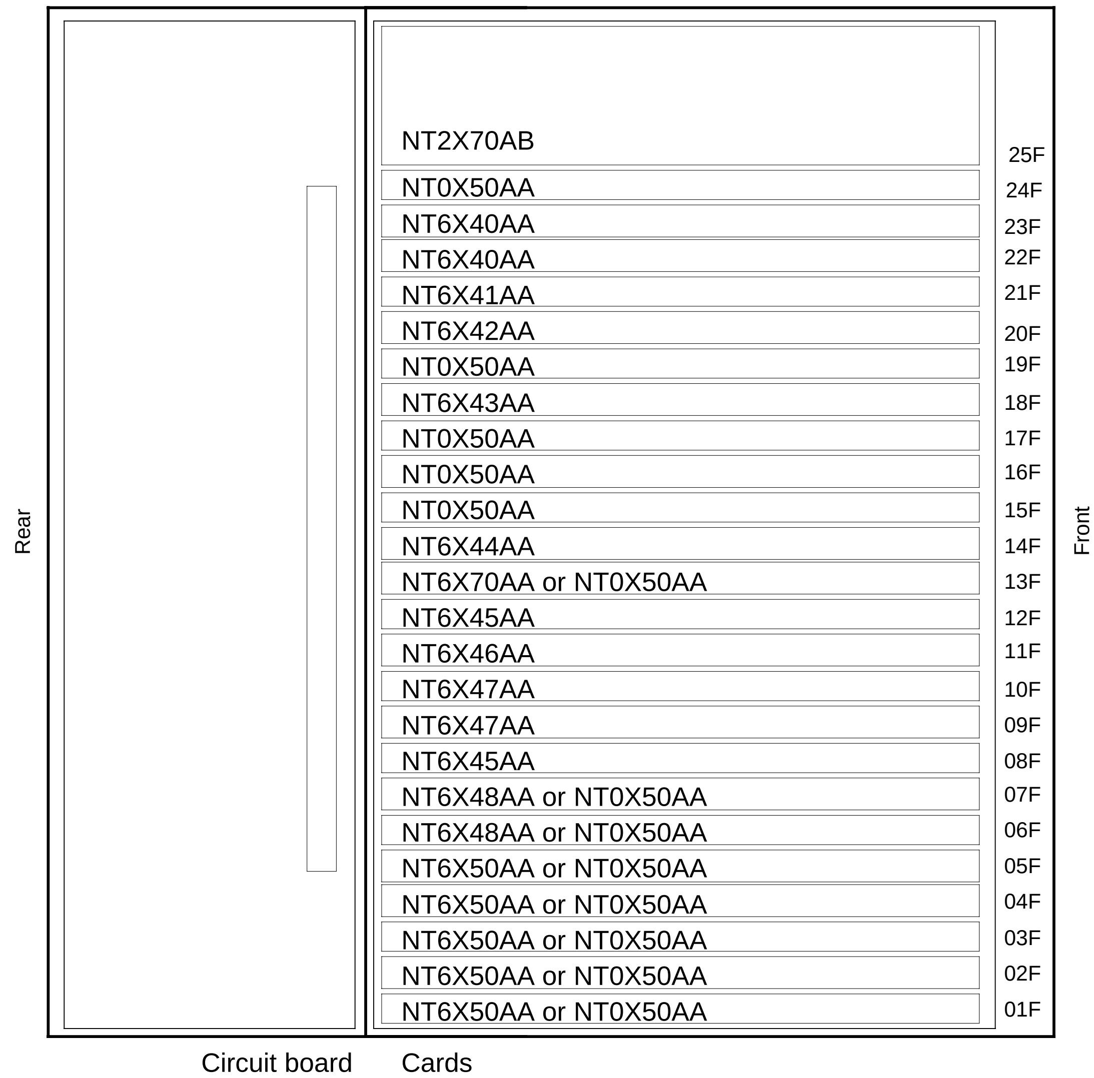
NT6X02AC (continued)

NT6X02AC parts (Sheet 5 of 5)

Product engineering code (PEC)	Slot	Description
NT6X92AA	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones like dual-tone multifrequency (DTMF) and multifrequency (MF). The TS switches the tone samples to the parallel speech bus. The UTR collects tone samples during correct time slots. The UTR analyzes the samples and identifies the tones. The results are sent to the SP.

NT6X02AC (end)

The NT6X02AC parts



NT6X02AD

Description

The NT6X02AD line trunk controller (LTC) common circuit pack (CP) fill provides an interface. This interface can be between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links. This interface can be between C-side DS30 links to the network and DS-1 links to secondary peripheral modules. The LTC common CP fill has two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode. This unit takes over call processing if a fault occurs in the active unit. Each unit has a control complex (CC), but only one CC is active at a time. The active CC provides control for both units. The NT6X01AA subscriber module equipment (SME) frame houses the LTC common CP fills.

The LTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each DS30 interface card can handle a maximum of eight DS30 ports. The four DS30 cards distribute the link assignments. Links are distributed so that the even-numbered links connect to plane 0 of the network, and the odd-numbered links connect to plane 1. A correct interface requires a minimum of three link pairs with the network module (NM) and the CC.

Each DS30 card in the LTC powers 256 (8×32) channels for each plane to the formatter cards. This action occurs for formatter cards in both units 0 and 1. Each formatter handles a total of 512 channels 256 channels from each unit for each plane. The formatter combines the two network planes where one plane is selected, by channel. The 512 speech channels are added to the 128 internal service channels. These channels convert to a 640-channel bus to the control complex.

The LTC uses DS-1 interface CPs or filler faceplates for slots 1 to 5. Slots 6 and 7 use the DS30A line concentrating module (LCM) interface cards or filler faceplates. Slot 18 uses the NT6X69AA common peripheral processor (CPP) messaging protocol and tone CP. Slot 19 uses the NT6X79AA common peripheral control equipment (CPCE) tone generator CP.

Parts

The LTC common CP fill contains the following parts:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) card

NT6X02AD (continued)

- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TM) CP
- NT6X45AC-Digital trunk controller (DTC) processor card
- NT6X46AB-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) CP
- NT6X48AA-DS30A LCM interface CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X69AA-CPP messaging protocol and tone CP
- NT6X70AA-Continuity tone detector CP
- NT6X79AA-CPCE tone generator CP
- NT6X92BB-Universal tone receiver (UTR)

Design

The design of the NT6X02AD in the following table and figure

NT6X02AD parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. A maximum of five spare card slots can be present in each shelf. Three of the slots 15, 16 and 17 have access to the signaling processor (SP) address bus and the parallel speech bus. The other two spare slots 13 and 19 do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the CP fill. Each power converter supplies +5 V and 12 V for the cards on the CP fill. The system provides power to the DS-1 cards so that loss of cards that are not duplicated does not occur during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AD (continued)

NT6X02AD parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40AA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions. These versions are the NT6X40AA that has eight ports and the NT6X40AC that has 16 ports. The card provides a C-side interface for DS30 links to the network. Each DS30 NI card port provides a two-way voice and data interface and contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains two sections. These sections are the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the encoded voice signals received from the CSM interface card and for the C-side links. The card provides serial-to-parallel conversion of the encoded voice signals received from the C-side interface cards. The cards provide network plane selection, parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM interface card performs several functions. The card extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The card inserts the CSM into the outgoing C-side bytes. The CSM CP performs parity check on all incoming bytes and parity generation on all outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream tand the parallel stream. The serial stream is received from or transmitted to the DS30, DS30A LCM, or DS-1 interface cards. The parallel stream is on the internal speech bus. The TS associates any DS30, DS30A LCM, or DS-1 interface CP with any time slot on the parallel speech bus. The TS transfers data between the associated channel and the time slot. This procedure occurs when the time switch is under the control of the XMS-based peripheral module (XPM) processor.

NT6X02AD (continued)

NT6X02AD parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X45AC	8F, 12F	*Digital trunk controller processor* The DTC processor operates the programs that control the operation and maintenance of a peripheral module. The DTC processor performs functions like digit collection, channel assignment, and interpretation of messages for the central control complex and peripheral module.
NT6X46AB	11F	*Signaling processor memory card* The SPM stores data and software applications in RAM.
NT6X47AB	10F	*Master processor memory CP* The MPM CP stores data and software applications in RAM for the master processor (MP) and the XPM processor. The SP has access to part of the MP memory when the SP uses the memory management unit.
NT6X48AA	6F, 7F	*DS30A line concentrating module interface* CP The DS30A LCM interface CP contains 10 separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 mega bit per second bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. There are 1 to 10 provisionable cards for each LTC common CP fill. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow isolation of faults. The CP provides transmission of local alarms and the detection of remote alarms. The CP aprovides the detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. There are 1 to 10 provisionable cards for each LTC common CP fill. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow fault isolation. The CP provides transmission of local alarms and the detection of remote alarms. The CP provides the detection of error conditions like loss of synchronization, bipolar error, and slip.

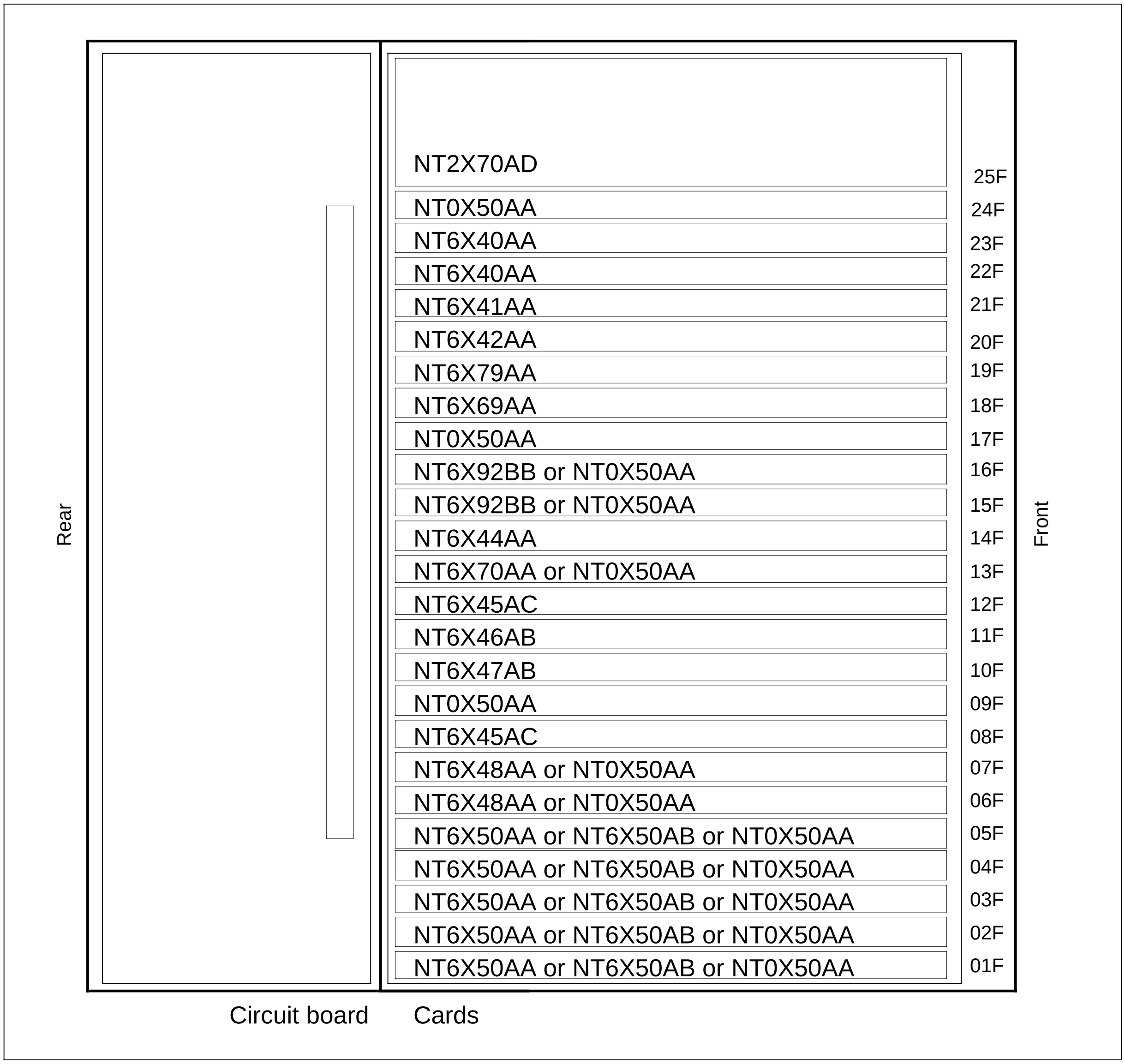
NT6X02AD (continued)

NT6X02AD parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X69AA	18F	*Common peripheral processor messaging* protocol and tone CP The CPP protocol and tone CP provides interface for the parallel speech bus. The CPP protocol and tone CP extracts control messages received on channel zero from the control module (CM).
NT6X70AA	13F	*Continuity tone detector CP* The continuity tone detector CP detects tones in use during call processing. This process verifies the continuity of the voice/data path between LTCs. The continuity tone detector CP monitors and records the frequency and level of the tones. The continuity tone detector CP retains this data for the XPM processor CP in the LTC to use.
NT6X79AA	19F	*Common peripheral control equipment tone generator CP* The CPCE tone generator protocol and tone CP provides interface for the parallel speech bus. The CPCE tone generator protocol and tone CP extracts control messages received on channel zero from the control module (CM).
NT6X92BB	15F, 16F	Universal tone receiver *The UTR is a 32-channel tone receiver* that detects tones. These tones include dual-tone multifrequency (DTMF) and multifrequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects the TS switches at appropriate time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the SP.

NT6X02AD (end)

NT6X02AD components



NT6X02AE

Product Description

The NT6X02AE line group controller (LGC) common circuit pack (CP) fill provides an interface. This interface can be between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links. This interface can be between C-side DS30 links to the network and DS-1 links to auxiliary peripheral modules (PM). The LGC common CP fill has two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode. This unit takes over call processing if a fault occurs in the active unit. Each unit has a control complex (CC), but only one CC is active at a time. The active CC provides control for both units.

The LGC common CP fill has C-side interface. The C-side ports can support up to 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each of these DS30 interface cards can handle up to eight DS30 ports. Link assignments are distributed over the four DS30 cards. Link assignments are distributed so that the even-numbered links connect to plane 0 of the network, and the odd-numbered links connect to plane 1. A correct interface requires a minimum of three link pairs with the network module (NM) and the CC.

Each DS30 card in the LGC powers 256 (8×32) channels for each plane to the formatter cards. This condition applies to formatter cards in both units 0 and 1. Each formatter handles a total of 512 channels or 256 channels from each unit for each plane. The two network planes are combined in the formatter where one plane or the other is selected by channel. The 512 speech channels are added to the 128 internal service channels. The channels convert to a 640-channel bus to the control complex.

The LGC uses DS-1 interface cards or filler faceplates for slots 1 through 5. A DS30A line concentrating module (LCM) interface card or a filler faceplate can be in slot 6. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). The NT6X69AB common peripheral processor (CPP) messaging protocol and tone CP is in slot 18. The NT6X79AA common peripheral control equipment (CPCE) tone generator CP is in slot 19.

Parts

NT6X02AE contains the following parts:

- NT0X50AA-Filler faceplate or panel
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) card

NT6X02AE (continued)

- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AC-LGC processor card
- NT6X46AB-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) card
- NT6X48AA-DS30A LCM interface card
- NT6X50AA-DS-1 interface card
- NT6X50AB-DS-1 interface card
- NT6X69AA-CPP messaging protocol and tone CP
- NT6X79AA-CPCE tone generator CP
- NT6X92BB-UTR

Design

The design of the NT6X02AE appears in the following table and figure.

NT6X02AE parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. There can be a maximum of five spare card slots in each shelf. Slots 15, 16, and 17 have access to the signaling processor (SP) address bus and the parallel speech bus. Spare slots 13 and 19 do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the CP fill. Each power converter supplies +5 V and 12 V for the cards on the CP fill. The system provides power to the DS-1 cards to make sure loss of cards that are not duplicated does not occur during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AE (continued)

NT6X02AE parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40AA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions. These versions are the NT6X40AA that has eight ports and the NT6X40AC that has 16 ports. The card provides a C-side interface for DS30 links to the network. Each DS30 NI card port provides a two-way voice and data interface and contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains two sections. These sections are the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the encoded voice signals received from the CSM interface card and for the C-side links. The card provides serial-to-parallel conversion of the encoded voice signals received from the C-side interface cards. The cards provide network plane selection, parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM interface card performs several functions. The card extracts the CSM bit from the C-side channels, assembles the CSM for each channel. The card inserts the CSM into the outgoing C-side bytes. The CSM CP performs parity checks on all incoming bytes and parity generation on all outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream and the parallel stream. The serial stream is received from or transmitted to the DS30, DS30A LCM, or DS-1 interface cards. The parallel stream is on the internal speech bus. The TS associates any DS30, DS30A LCM, or DS-1 interface CP with any time slot on the parallel speech bus. The TS transfers data between the associated channel and the time slot. This procedure occurs when the time switch is under the control of the XMS-based peripheral module (XPM) processor.

NT6X02AE (continued)

NT6X02AE parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X45AC	8F, 12F	*Digital trunk controller processor* The line trunk controller (LTC) processor CP operates the programs that control the operation and maintenance of a PM. The LTC performs functions like digit collection, channel assignment and interpretation of messages for the central control complex and PM.
NT6X46AB	11F	*Signaling processor memory card* The SPM card stores data and software applications in RAM.
NT6X47AB	10F	*Master processor memory CP* The MPM CP stores data and software applications in RAM for the master processor and the XPM processor CP. The SP uses the memory management unit to have access to part of the MP memory.
NT6X48AA	6F, 7F	*DS30A line concentrating module interface CP* The DS30A LCM interface CP contains ten separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56-Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. These 1 to 10 provisionable cards for each LTC common CP fill. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow isolation of faults. The CP provides transmission of local alarms and the detection of remote alarms. The CP provides the detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. There are 1 to 10 provisionable cards for each LTC common CP fill. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow isolation of faults. The CP provides transmission of local alarms and the detection of remote alarms. The CP provides detection of error conditions like loss of synchronization, bipolar error, and slip.

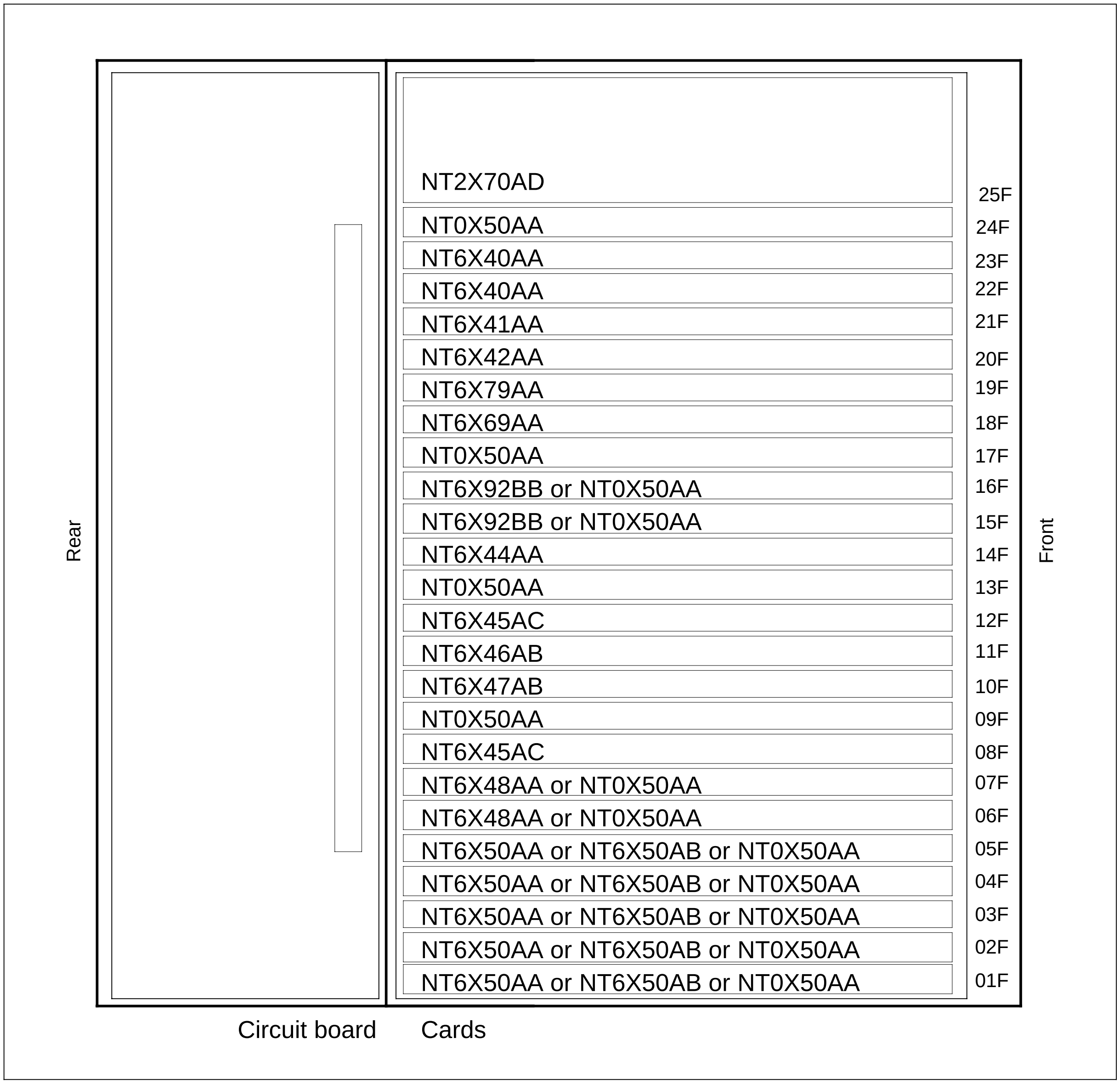
NT6X02AE (continued)

NT6X02AE parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X69AA	18F	*Common peripheral processor messaging protocol and tone CP* The CPP protocol and tone CP provides interface for the parallel speech bus. The CPP protocol and tone CP extracts control messages received on channel zero from the control module (CM).
NT6X79AA	19F	*Common peripheral control equipment tone generator CP* The CPCE tone generator protocol and tone CP provides interface for the parallel speech bus. The CPCE tone generator protocol and tone CP extracts control messages received on channel zero from the control module (CM).
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects a number of tones. These tones include dual-tone multifrequency (DTMF) and multifrequency (MF). The TS switches tone samples to the parallel speech bus and are collected by the UTR at appropriate time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the SP.

NT6X02AE (end)

NT6X02AE components



NT6X02AF

Product Description

The NT6X02AF digital trunk controller (DTC) common circuit pack (CP) fill provides an interface. This interface is between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS-1 digital trunks. The DTC common CP fill has two units. One unit is active and provides the necessary processing and control functions. The other unit is in a standby mode. This unit takes over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). Only one CC is active at one time and provides control for the units.

The DTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each DS30 interface card can handle a maximum of eight DS30 ports. The four DS30 cards distribute the link assignments so that:

- the even-numbered links connect to plane 0 of the network
- the odd-numbered links connect to plane 1

A correct interface with the network module (NM) and the CC requires a minimum of three links.

Each DS30 card in the DTC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels for each plane or 256 channels from each unit. The formatter combines the two network planes where the selection of one plane or the other occurs for each channel. The 512 speech channels are added to the 128 internal service channels. The channels are converted to a 640-channel bus to the control complex.

The DTC uses DS-1 interface cards or filler faceplates for slots 1 through 5. Slot 13 uses a continuity card or a filler faceplate. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). Slot 17 uses a specialized tone receiver (STR) or a filler faceplate. Slot 18 uses the NT6X69AB common peripheral processor (CPP) messaging protocol and tone CP.

Parts

The NT6X02AF contains the following parts:

- NT0X50AA-Filler faceplate or panel
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) card

NT6X02AF (continued)

- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AC-DTC processor card
- NT6X46AB-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) card
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X62AA-Specialized tone receiver
- NT6X69AA-CPP messaging protocol and tone CP
- NT6X70AA-Continuity card
- NT6X79AA-Common peripheral control equipment tone generator CP
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AF.

NT6X02AF parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. There can be a maximum of five spare card slots in each shelf. Three of the slots (15, 16, and 17) have access to the signaling processor (SP) address bus and the parallel speech bus. Two spare slots (13 and 19) do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48 V dc to the lower voltages that the circuit cards require in the CP fill. Each power converter supplies +5 V and 12 V for the cards on the CP fill. The system provides power to the DS-1 cards to prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AF (continued)

NT6X02AF parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40AA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions: the NT6X40AA that has 8 ports and the NT6X40AC that has 16 ports. The card provides a C-side interface for DS30 links to the network. Each DS30 NI card port provides a two-way voice and data interface and contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains two sections. These sections are the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the encoded voice signals received from the CSM interface card and for the C-side links. The card provides serial-to-parallel conversion of the encoded voice signals received from the C-side interface cards. The cards provide network plane selection, parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM interface card performs several functions. The card extracts the CSM bit from the C-side channels. The card assembles the CSM for each channel and inserts the CSM in the outgoing C-side bytes. The CSM CP performs parity checks on all incoming bytes and parity generation on all outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream and the parallel stream. The serial stream is received from or transmitted to the DS30, DS30A LCM, or DS-1 interface cards. The parallel stream is on the internal speech bus. The TS associates any DS30, DS30A LCM, or DS-1 interface CP with any time slot on the parallel speech bus. The TS transfers data between the associated channel and the time slot. This procedure occurs when the time switch is under the control of the XMS-based peripheral module (XPM) processor.

NT6X02AF (continued)

NT6X02AF parts (Sheet 3 of 4)

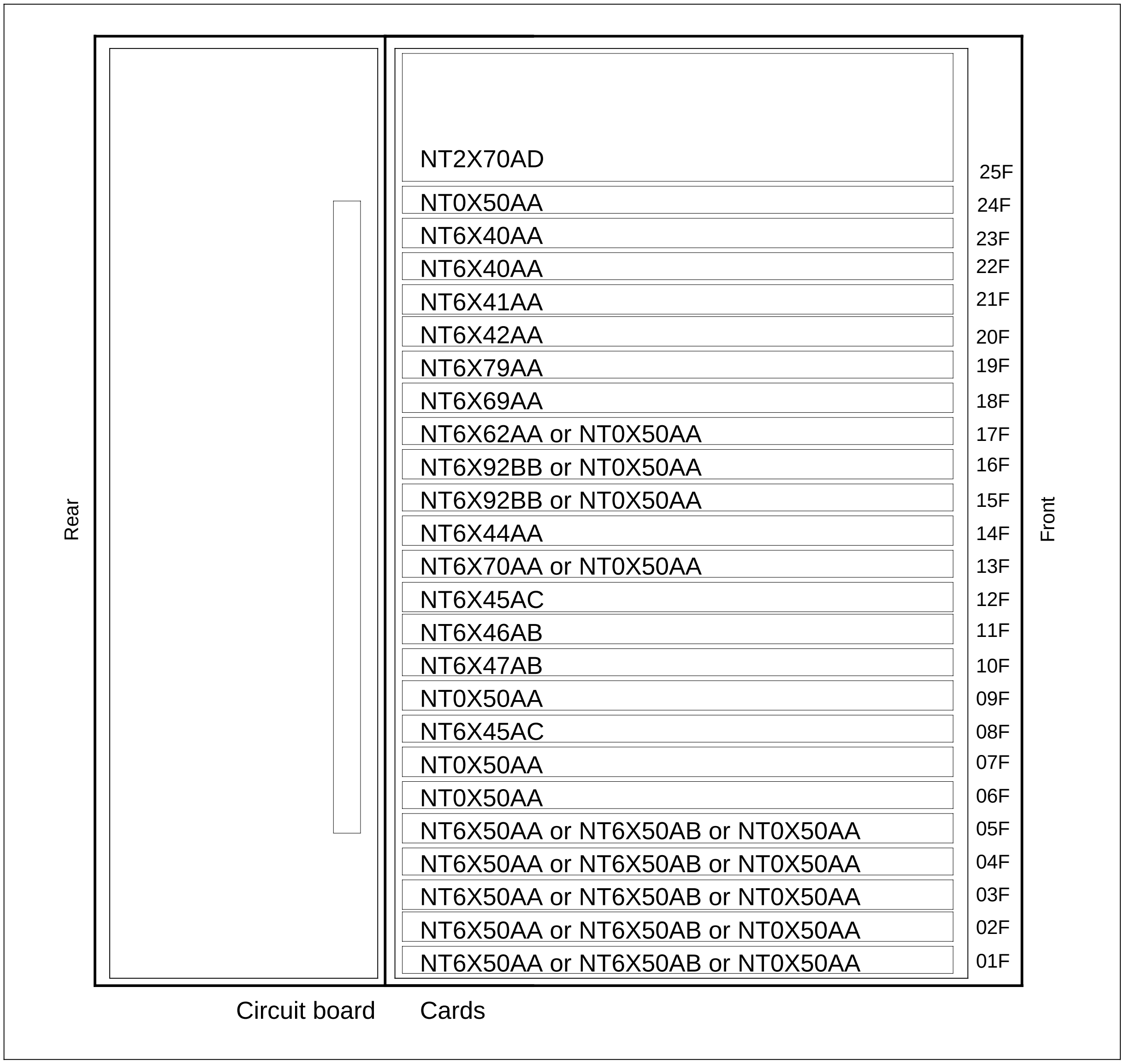
PEC	Slot	Description
NT6X45AC	8F, 12F	*Digital trunk controller processor* The DTC operates the programs that control the operation and maintenance of a peripheral module. The DTC performs functions like digit collection, channel assignment, and interpretation of messages for the central control complex and peripheral module.
NT6X46AB	11F	*Signaling processor memory card* The SPM card stores data and software applications in random access memory (RAM).
NT6X47AB	10F	*Master processor memory CP* The MPM CP has RAM that stores data and software applications in RAM for the master processor (MP) and the XPM processor CP. The SP has access to part of the MP memory when the SP uses the memory management unit.
NT6X50AA	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. There are 1 to 10 provisionable cards for each LTC common CP fill. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow fault isolation. The CP provides transmission of local alarms and the detection of remote alarms. The CP provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. There are 1 to 10 provisionable cards for each LTC common CP fill. Each port provides a two-way voice, data, and signaling interface. The CP provides looparound paths for each DS-1 port to allow fault isolation. The CP provides transmission of local alarms and the detection of remote alarms. The CP provides detection of error conditions like loss of synchronization, bipolar error, and slip.

NT6X02AF parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X62AA	17F	*Specialized tone receiver* The STR card allows the DTC shelf to detect and report specified tones on one or all channels. There can be a maximum of 480 channels. An STR can scan a maximum of 480 channels at one time. The DMS-250 uses this card to allow a subscriber in the talking state to press # or * and dial out digits to make a new connection without re-dialing the carrier access and authorization codes. The STR card can only be provisioned in a DTC with an extended SP memory and a CPP messaging protocol and tone CP.
NT6X69AA	18F	*Common peripheral processor messaging protocol and tone CP* The CPP protocol and tone CP provides interface for the parallel speech bus. The CPP protocol and tone CP extracts control messages received on channel zero from the control module (CM).
NT6X70AA	13F	*Continuity card* The continuity card detects tones that are in use during call processing to verify the continuity of the voice/data path between DTCs. The card monitors and records the frequency and level of the tones. The continuity card retains this data for use by the SP in the DTC.
NT6X79AA	19F	*Common peripheral control equipment tone generator CP* The common peripheral control equipment (CPCE) tone generator protocol and tone CP provides interface for the parallel speech bus. The CPCE tone generator protocol and tone CP extracts control messages received on channel zero from the CM.
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects a number of tones. These tones include dual-tone multifrequency (DTMF) and multifrequency (MF). The TS switches tone samples to the parallel speech bus and are collected by the UTR at appropriate time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the SP.

NT6X02AF (end)

NT6X02AF parts



NT6X02AG

Product Description

The NT6X02AG line trunk controller (LTC) common circuit pack (CP) fill provides an interface. The interface is between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links. The interface can also be between central-side (C-side) DS30 links to the network and DS-1 links to subsidiary peripheral modules (PM). The LTC common CP fill has two units. One unit is active and provides the necessary processing and control functions. The other unit is in a standby mode. This unit takes over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active at a time. This CC provides control for the units. The NT6X01AA common peripheral controller equipment (CPCE) frame houses the LTC CP fills.

The LTC common CP fill also has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 network interface CPs support the C-side links. Each DS30 network interface CP can handle a maximum of eight DS30 ports. The four DS30 CPs distribute the link assignments so that:

- the even-numbered links connect to plane 0 of the network
- the odd-numbered links connect to plane 1

A proper interface with the network module (NM) and the CC requires a minimum of three link pairs.

Each DS30 network interface CP in the LTC CP fill powers 256 (8×32) channels for each plane. The CP powers these formatter cards in units 0 and 1. Each formatter handles a total of 512 channels for each plane or 256 channels from each unit. The formatter combines the two network planes where one plane or the other is selected for each channel. The 512 speech channels are added to the 128 internal service channels and are converted to a 640-channel bus to the control complex.

The LTC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. Slots 6 and 7 use the DS30A interface CPs or filler faceplates. Slot 18 uses the NT6X69AA common peripheral processor (CPP) message protocol CP. Slot 19 uses the NT6X79AA CPCE tone generator CP.

Parts

The NT6X02AG contains the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter

NT6X02AG (continued)

- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AC-Line group controller/digital trunk controller processor
- NT6X46AB-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X69AA-CPP message protocol CP
- NT6X70AA-Continuity tone detector
- NT6X79AA-CPCE tone generator CP
- NT6X92BB-Universal tone receiver (UTR)

Design

The design of the NT6X02AG appears in the following table and figure.

NT6X02AG parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F 15F-17F, 19F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. There is a maximum of five spare card slots in each fill. Three of the slots (15, 16 and 17) have access to the signaling processor (SP) address bus and the parallel speech bus. Two spare slots (13 and 19) do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48 V dc to the lower voltages that the circuit cards in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. The system provides power to the DS-1 CPs to prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AG (continued)

NT6X02AG parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: the NT6X40AA that has eight ports and the NT6X40AC that has 16 ports. The card provides a C-side interface for DS30 links to the network. Each DS30 NI card port provides a two-way voice and data interface and contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides the following: • parallel-to-serial conversion of the coded voice signals received from the CSM interface card and destined for the C-side links • serial-to-parallel conversion of the coded voice signals received from the C-side interface cards • network plane selection • parity error generation for test purposes • T1 clock generation
NT6X42AA	20F	*Channel supervision message CP* The CSM CP performs several functions. The CSM CP extracts the CSM bit from the C-side channels. The CSM CP assembles the CSM for each channel and inserts the CSM into the outgoing C-side bytes. The CSM CP also performs parity checks on all incoming bytes and parity generation on all outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream and the parallel stream used on the internal speech bus. The serial stream is received from or transmitted to the DS30 interface card or DS-1 interface card. The TS also associates any of the DS30 interface cards and DS-1 interface cards with the time slots on the parallel speech bus. The TS transfers data between the associated channel and the time slot. This procedure occurs when the TS is under the control of the SP.

NT6X02AG (continued)

NT6X02AG parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X45AC	8F, 12F	*Master processor card* The MP card operates the programs that control the operation and maintenance of a PM. The card performs functions like digit collection, channel assignment and interpretation of messages for the central control complex and PM.
NT6X46AB	11F	*Signaling processor memory card* The SPM card stores data and software applications in random access memory (RAM).
NT6X47AB	9F, 10F	*Master processor memory card* The MPM card stores data and software applications in RAM for the master processor and the SP. The SP has access to a portion of the MP memory when the SP uses the memory management unit.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. Each LTC module can have 1 to 10 cards. Each port provides a two-way voice, data and signaling interface. The card provides the following: • looparound paths for each DS-1 port to allow fault isolation • transmission of local alarms and the detection of remote alarms • detection of error conditions like loss of synchronization, bipolar error and slip
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. Each LTC module can have 1 to 10 cards. Each port provides a two-way voice, data and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card also provides detection of error conditions like loss of synchronization, bipolar error and slip.
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus. The card extracts control messages received on channel zero from the control module.

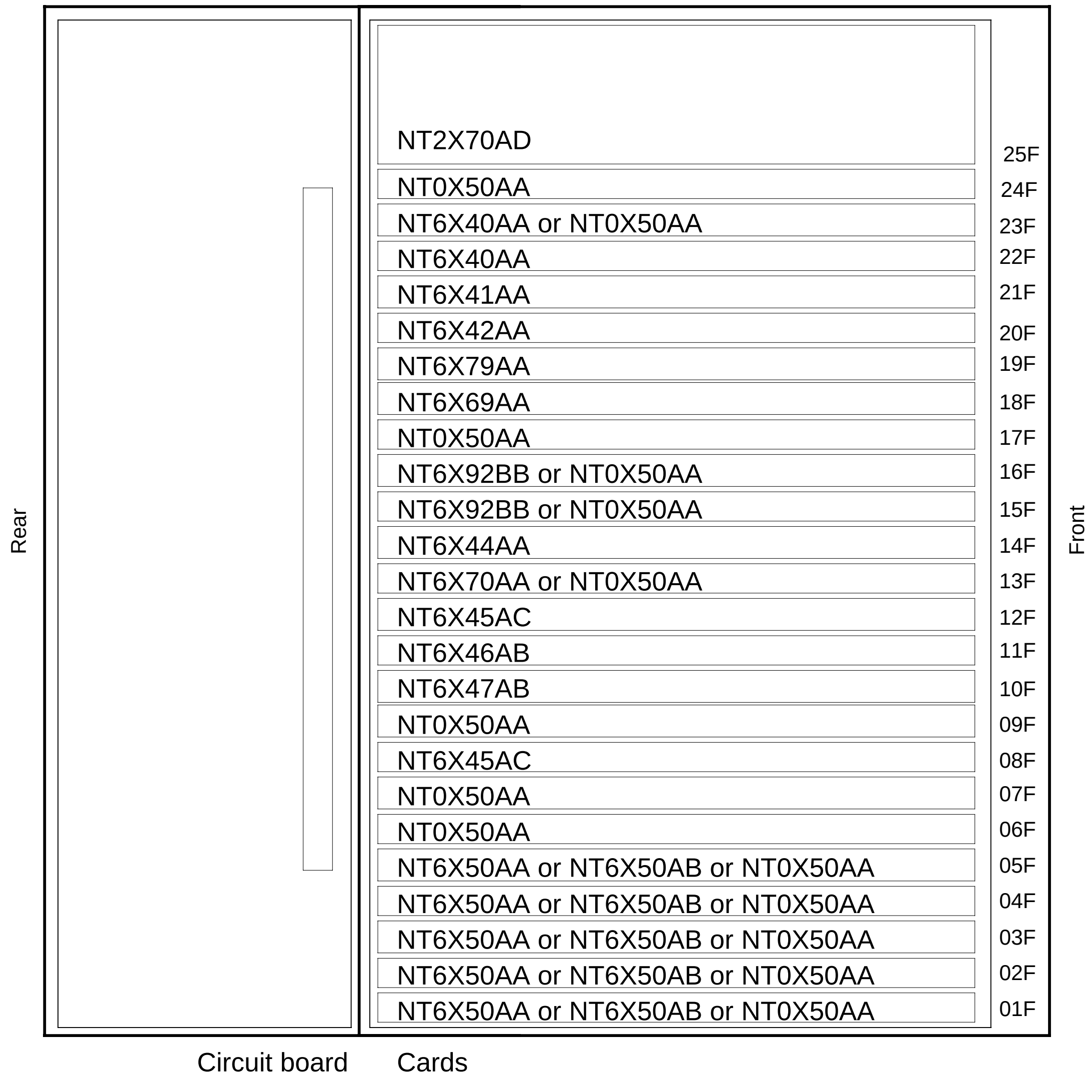
NT6X02AG (continued)

NT6X02AG parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X70AA	13F	*Continuity card* The continuity card detects tones used in call processing to verify the continuity of the voice/data path between LTCs. The card monitors and records the frequency and level of the tones. The continuity card retains this data for use by the SP in the LTC.
NT6X79AA	19F	*Common peripheral controller equipment tone generator CP* The messaging card provides interface for the parallel speech bus. The card extracts control messages received on channel zero from the control module.
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects a number of tones. These tones include dual-tone multifrequency (DTMF) and multifrequency (MF). The TS switches tone samples to the parallel speech bus and are collected by the UTR at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the SP.

NT6X02AG (end)

NT6X02AG parts



NT6X02AH

Product Description

The NT6X02AH line group controller (LGC) common circuit pack (CP) fill provides an interface. The interface is between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links and/or DS-1 links to subsidiary peripheral modules (PM). The LGC common CP fill consists of two units. One unit is active and provides the necessary processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units.

The LGC common CP fill has C-side interfaces. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 network interface CPs support the C-side links. Each DS30 network interface CPs can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 CPs. The even-numbered links connect to plane 0 of the network. The odd-numbered links connect to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 CP in the LGC CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels, 256 channels from each unit, for each plane. The two network planes combine in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels convert to a 640-channel bus to the control complex.

The LGC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. A DS30A interface CPs or a filler faceplate can be used in slot 6. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). The NT6X69AB common peripheral processor (CPP) message protocol CP is used in slot 18. The NT6X79AA common peripheral controller equipment (CPCE) tone generator CP is used in slot 19.

Parts

The NT6X02AH consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter ±V and 12-V CP
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter

NT6X02AH (continued)

- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AB-Time switch (TS) CP
- NT6X45AC-LGC/digital trunk controller (DTC) processor
- NT6X46AB-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X48AA-DS30A interface CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X69AA-CPP message protocol circuit pack
- NT6X79AA-CPCE tone generator CP
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AH.

NT6X02AH parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 19F, 23F, 24F	*Filler faceplate* The filler faceplate is used to fill empty card slots in the CP fills. A maximum of five spare card slots is available in each fill. Three of the slots, 15, 16, and 17, have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies + 5V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AH (continued)

NT6X02AH parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The voice signals go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from components and functions. The components are the C-side interface cards. The functions are network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP also performs parity checks on incoming bytes, and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the following two streams. The serial stream from (or to) the DS30 or DS-1 interface cards, and the parallel stream used on the internal speech bus. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Line group controller/digital trunk controller processor* The LGC/LGC processor runs the programs that control the operation and maintenance of a peripheral module. The LGC/LGC performs functions like digit collection, channel assignment, and description of messages for the central control complex and peripheral module.

NT6X02AH (continued)

NT6X02AH parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X46AB	11F	*Signaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the master processor (MP) and the SP. The SP has access to a part of the MP memory through the SP memory management unit.
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56-Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. This card provides transmission of local alarms and the detection of remote alarms. This card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides the detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus and extracts control messages received on channel zero from the control module (CM).

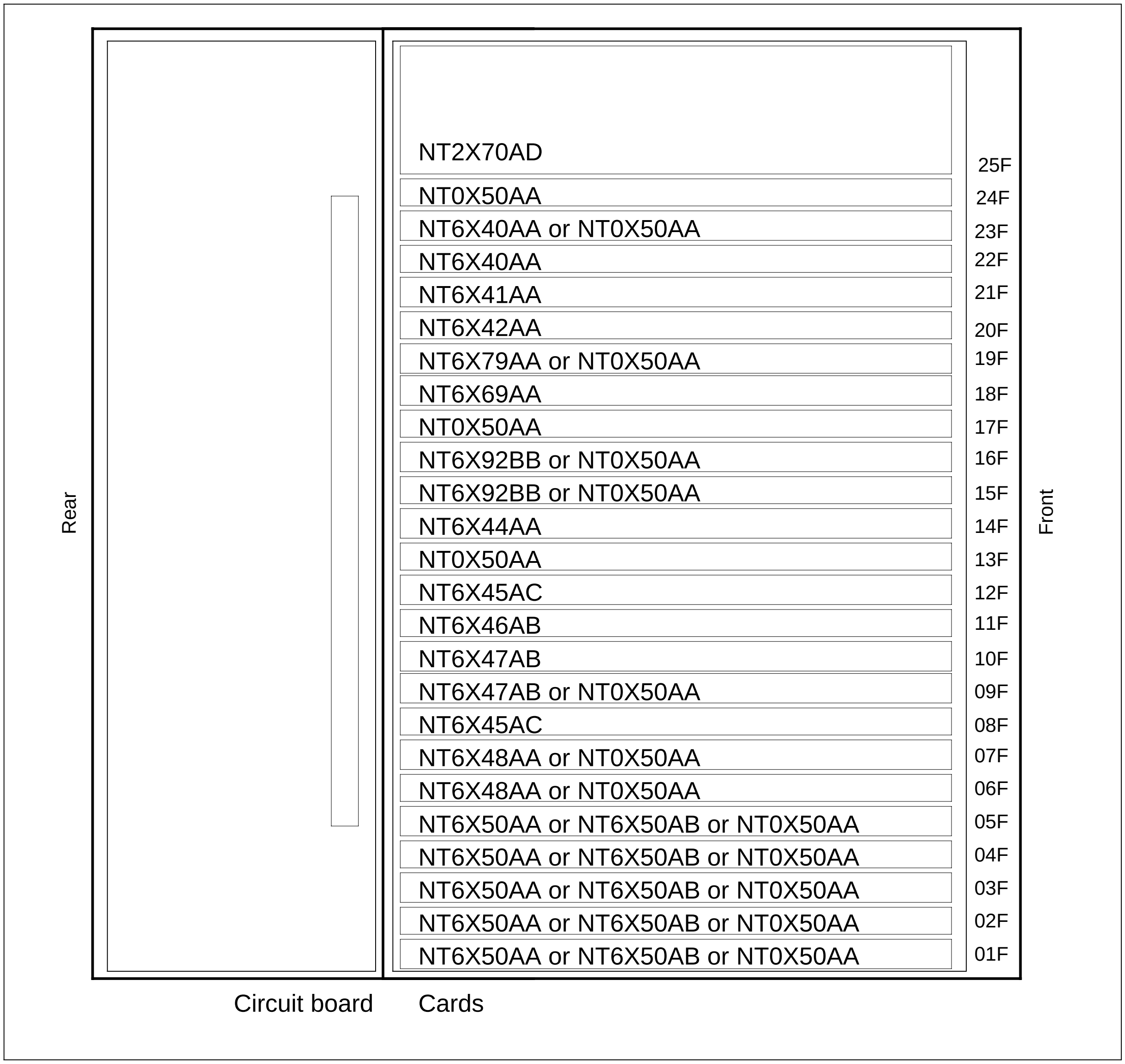
NT6X02AH (continued)

NT6X02AH parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X79AA	19	*Common peripheral controller equipment tone generator CP fill* The CPCE tone generator CP provides interface for the parallel speech bus and extracts control messages received on channel zero from the CM.
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS CP switches tone samples to the parallel speech bus. The UTR collects tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the XPM processor.

NT6X02AH (end)

NT6X02AH parts



NT6X02AK

Product Description

The NT6X02AK line trunk controller (LTC) common circuit pack (CP) fill provides an interface. The interface is between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links and/or DS-1 links to subsidiary peripheral modules (PM). The LTC common CP fill consists of two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units. The LTC CP fills are in the NT6X01AA common peripheral controller equipment (CPCE) frame.

The LTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each of these DS30 interface CPs can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 CP in the LTC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels (256 channels from each unit) for each plane. The two network planes are combined in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels and convert to a 640-channel bus to the CC.

The LTC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. You use the DS30A interface CPs or filler faceplates in slots 6 and 7. Slots 15 and 16 can use universal tone receiver (UTR) cards or filler faceplates. You can use the NT6X69AB common peripheral processor (CPP) message protocol CP in slot 18.

Parts

The NT6X02AK consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter CP
- NT3X90AC-Device controller (DC) cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP

NT6X02AK (continued)

- NT6X44AA-Time switch (TS) CP
- NT6X45AF-Master processor (MP)
- NT6X46BA-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X48AA-DS30A interface CP
- NT6X50AA-DS-1 interface CP
- NT6X69AB-CPP message protocol CP
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AK.

NT6X02AK parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 19F, 23F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill contains a maximum of five spare card slots. Three of the slots (15, 16, and 17) have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (8 ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface and contains a looparound circuit for fault isolation.

NT6X02AK (continued)

NT6X02AK parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides signals that go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards. The formatting section provides network plane selection. The formatting section provides parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CM extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM CM inserts the CSM in the outgoing C-side bytes. The CSM CP performs parity checking on incoming bytes and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream used on the internal speech bus. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AF	8F, 12F	*Master processor card* The MP card runs the programs that control the operation and maintenance of a PM. The MP card performs functions like digit collection, channel assignment, and description of messages for the central control complex and PM.
NT6X46BA	11F	*Signaling processor memory card* The SPM card consists of RAM that stores data and software applications.

NT6X02AK (continued)

NT6X02AK parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the MP and the SP. The SP has access to a part of the MP memory through the memory management unit.
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X69AB	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus and extracts control messages received on channel zero from the control module (CM).
NT6X70AA	13F	*Continuity card* The continuity card detects tones used in call processing to verify the continuity of the voice/data path between LTCs. The card monitors and records the frequency and level of the tones. The continuity card retains this data for use by the SP in the LTC.

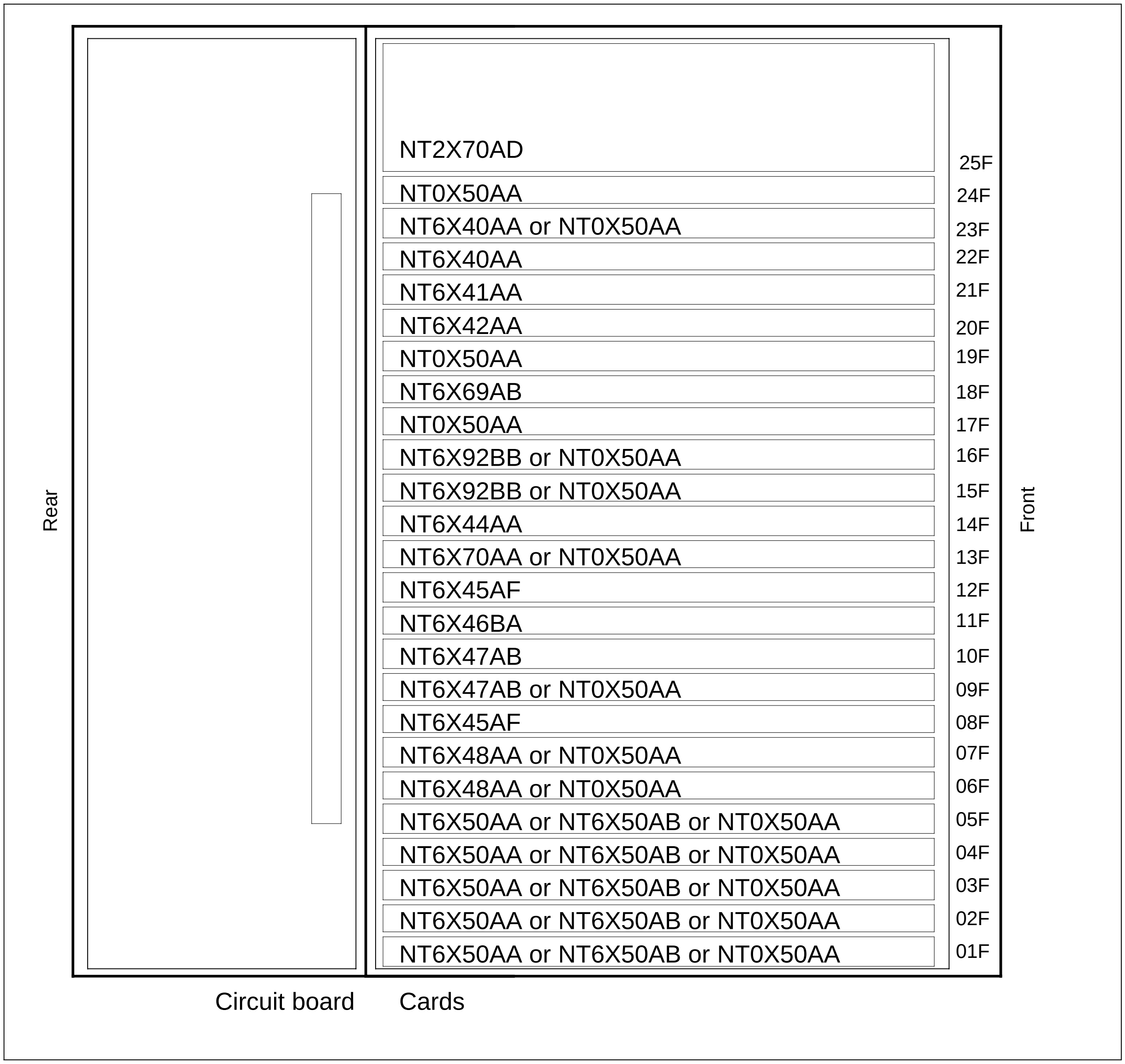
NT6X02AK (continued)

NT6X02AK parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects many tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects the tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the SP.

NT6X02AK (end)

NT6X02AK parts



NT6X02AL

Product Description

The NT6X02AL line group controller (LGC) common circuit pack (CP) fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links and/or DS-1 links to subsidiary peripheral modules (PM). The LGC common CP fill consists of two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units.

The LGC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each DS30 interface card can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 card in the LGC CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels (256 channels from each unit) for each plane. The two network planes are combined in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the CC.

The LGC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. You can use the DS30A interface CPs or filler faceplates in slots 6 and 7. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). You can use a common peripheral processor (CPP) message protocol CP in slot 18.

Parts

The NT6X02AL consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter CP
- NT3X90AC-DC cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CPs
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP

NT6X02AL (continued)

- NT6X44AA-Time switch (TS) CP
- NT6X45AF-XMS-based peripheral module (XPM) processor
- NT6X46BA-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X48AA-DS30A interface CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X69AB-Common peripheral processor message protocol CP
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AL.

NT6X02AL parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 19F, 23F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill has a maximum of five spare card slots. Three of the slots, 15, 16, and 17, have access to the SP address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power to the DS-1 CPs is provided to prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (8 ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.

NT6X02AL (continued)

NT6X02AL parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The signals go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards. The formatting section provides serial-to-parallel conversion of the coded voice signals from the network plane selection. The formatting section provides parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels, and assembles the CSM for each channel. The CSM CP inserts the CSM to the outgoing C-side bytes. The CSM CP performs parity checks on incoming bytes and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AF	8F, 12F	*XMS-based peripheral module processor* The XMS-based peripheral module processor runs the programs that control the operation and maintenance of a PM. The processor performs functions like digit collection, channel assignment, and description of messages for the central control complex and PM.
NT6X46BA	11F	*Signaling processor memory card* The SPM card consists of RAM that stores data and software applications.

NT6X02AL (continued)

NT6X02AL parts (Sheet 3 of 4)

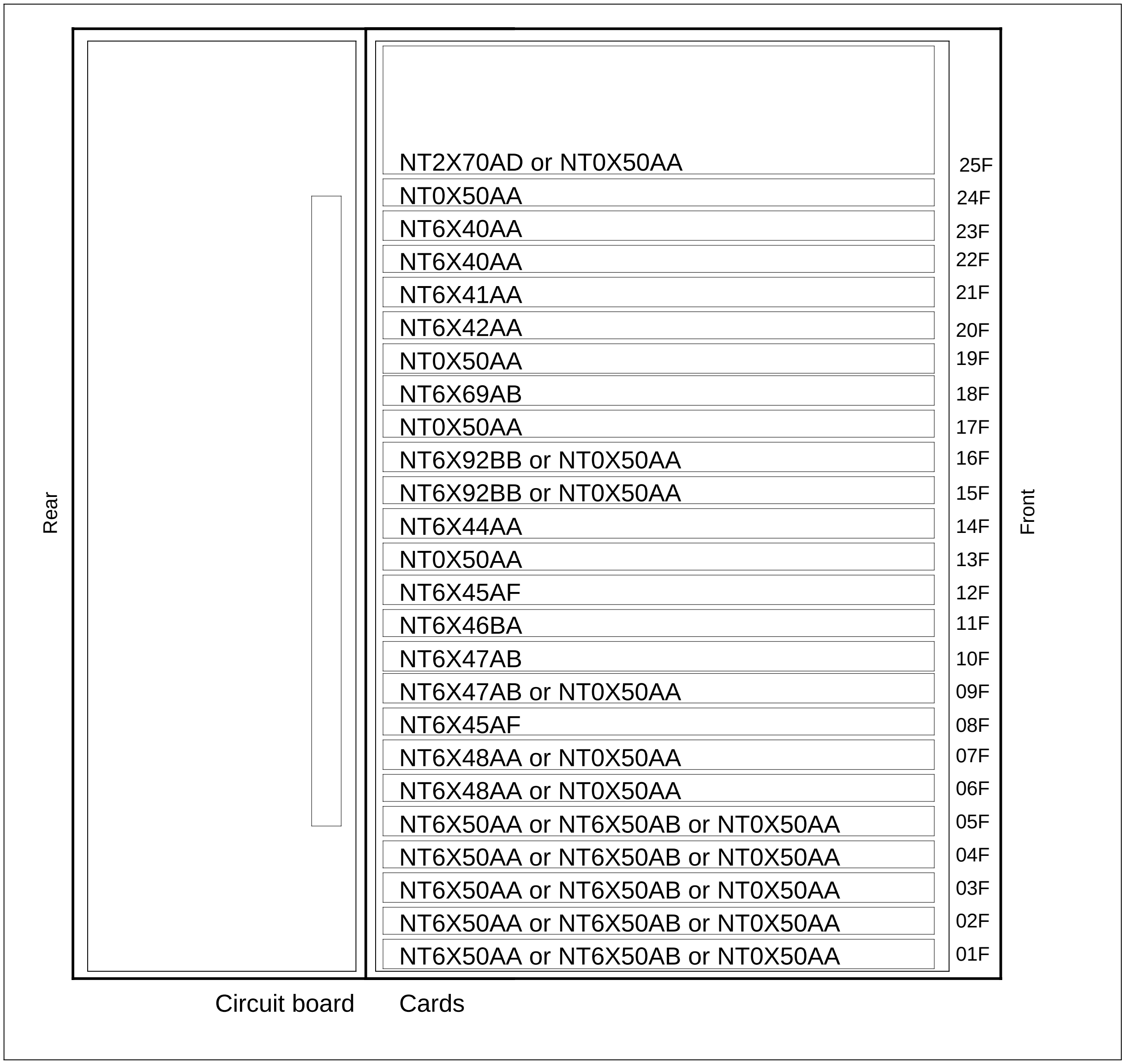
PEC	Slot	Description
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the MP and the SP. The SP has access to a part of the MP memory through the memory management unit.
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten different ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. Each port provides transmission of local alarms and the detection of remote alarms. Each port provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X69AB	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus. The card extracts control messages received on channel zero from the control module.

NT6X02AL parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects the tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the XPM processor.

NT6X02AL (end)

NT6X02AL parts



NT6X02AM

Product description

The NT6X02AM digital trunk controller (DTC) common circuit pack (CP) fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS-1 digital trunks. The DTC common CP fill consists of two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units.

The DTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each DS30 interface CP can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 CP in the DTC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels, 256 channels from each unit, for each plane. The two network planes are combined in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the CC.

Parts

The DTC common CP fill consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter CP
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AC-Master processor (MP)
- NT6X46BA-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X69AA-CCP message protocol CP
- NT6X79AA-Common peripheral controller equipment tone generator CP

NT6X02AM (continued)

Design

The following table and figure describe the design of the NT6X02AM.

NT6X02AM parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	6, 7F, 9F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill has a maximum of five spare card slots. Three of the slots, 15, 16, and 17, have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT6X40AA	22F, 23F	*DS30 Network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides parallel-to-serial conversion of the signals that go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards and network plane selection. The formatting section provides parity error generation for test purposes, and T1 clock generation.

NT6X02AM (continued)

NT6X02AM parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP performs parity checks on incoming bytes and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the signaling processor (SP) controls the TS, the TS associates with the DS30 interface cards and DS-1 interface cards. The DS-1 interface cards have the time slots on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that control the operation and maintenance of a peripheral module (PM). The MP card performs functions like digit collection, channel assignment, and description of messages for the central control complex and PM.
NT6X46BA	11F	*Signaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.
NT6X47AB	10F	*Master processor memory card* The MP memory (MPM) card consists of RAM used to store data and software applications for the MP and the SP. The SP has access to a part of the MP memory through the memory management unit.
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten different ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.

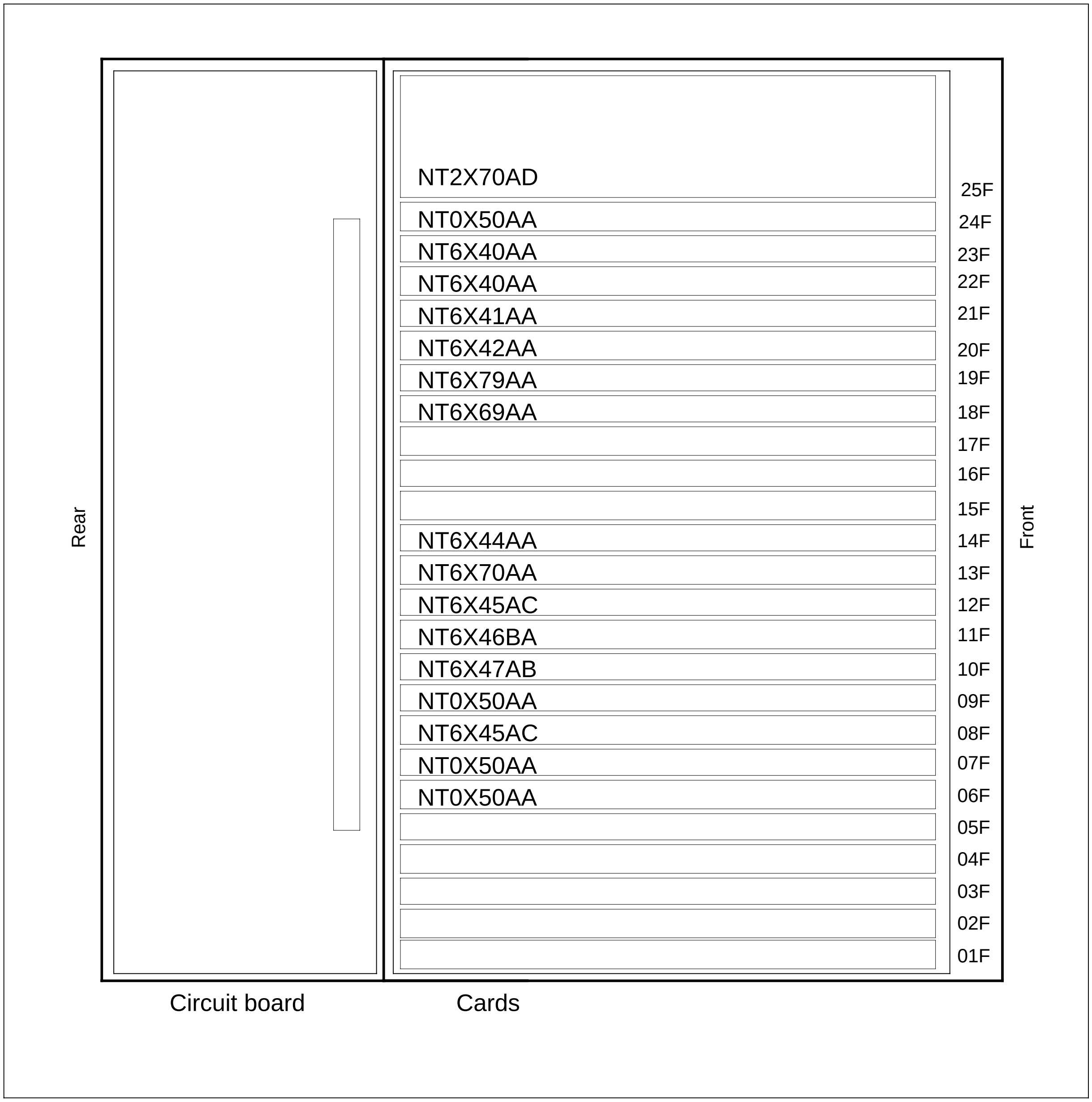
NT6X02AM (continued)

NT6X02AM parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module (CM).
NT6X79AA	19F	*Common peripheral controller equipment tone generator CP* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the CM.

NT6X02AM (end)

NT6X02AM parts



NT6X02AQ

Product description

The NT6X02AQ digital trunk controller (DTC) common CP fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS-1 digital trunks. The DTC common CP fill consists of two units. One unit is active and provides processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units.

The DTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each DS30 interface CP can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 CPs. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 CPs in the DTC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels, 256 channels from each unit, for each plane. The two network planes are combined in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the CC.

Parts

The DTC common CP fill consists of the following parts:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter CP
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AC-Line group controller(LGC)/(DTC) processor
- NT6X46AB-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP

- NT6X69AA-CPP message protocol CP
- NT6X79AA-Common peripheral controller equipment (CPCE) tone generator CP

Design

The following table and figure describe the design of the NT6X02AQ.

NT6X02AQ parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	6F, 7F, 9F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill has a maximum of five spare card slots. Three of the slots, 15, 16, and 17, have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT6X40AA	22F, 23F	*DS30 Network interface CP* The DS30 NI card is available in two versions: NT6X40AA, eight ports, and NT6X40AC, 16 ports. The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides parallel-to-serial conversion of the signals that go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards and network. The formatting section provides plane selection, parity error generation for test purposes, and T1 clock generation.

NT6X02AQ (continued)

NT6X02AQ parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP performs parity checks on incoming bytes, and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the SP controls the TS, the TS associates with the DS30 interface cards. The TS associates with the DS-1 interface cards with the time slots on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Line group controller/digital trunk controller processor* The LGC/DTC processor runs the programs that control the operation and maintenance of a peripheral module (PM). The LGC/DTC processor performs functions like digit collection, channel assignment, and description of messages for the central control complex (CCC) and PM.
NT6X46AB	11F	*SIgnaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.
NT6X47AB	10F	*Master processor memory card* The MPM card consists of RAM used to store data and software applications for the master processor (MP) and the signaling processor (SP). The SP has access to a part of the MP memory through the memory management unit.
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus and extracts control messages received on channel zero from the control module (CM).

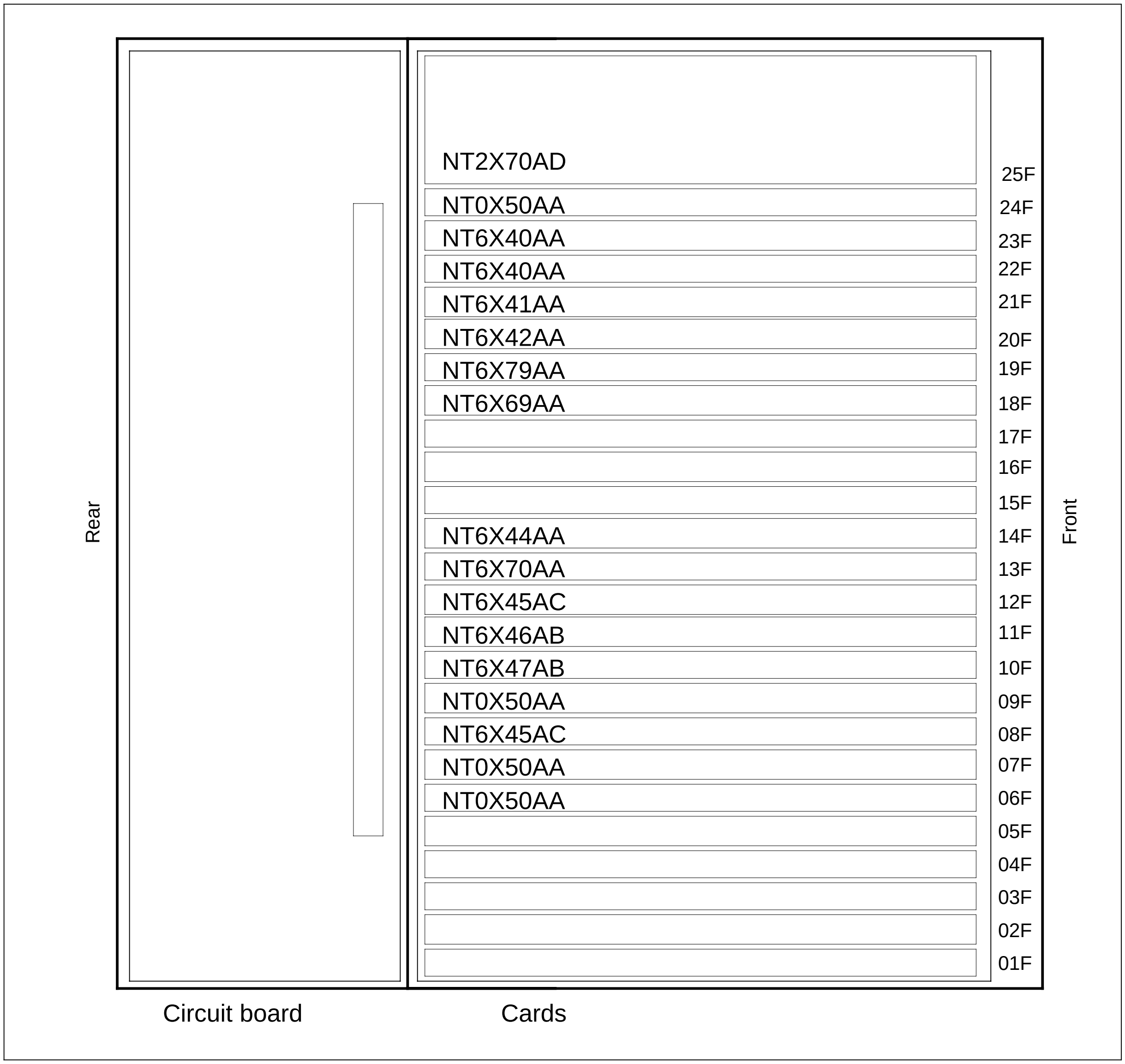
NT6X02AQ (continued)

NT6X02AQ parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X70AA	13F	*Continuity tone detector* The continuity tone detector detects tones used in call processing to verify the continuity of the voice/data path between DTCs. The tone monitors and records the frequency and level of the tones. The continuity tone detector retains this data for use by the XPM processor in the DTC.
NT6X79AA	19F	*Common peripheral controller equipment tone generator CP* The CPCE tone generator CP provides interface for the parallel speech bus. The CPCE tone generator CP extracts control messages received on channel zero from the CM.

NT6X02AQ (end)

NT6X02AQ parts



NT6X02AR

Product description

The NT6X02AR digital trunk controller (DTC) common circuit pack (CP) fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS-1 digital trunks. The DTC common CP fill consists of two units. One unit is active and provides processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units.

The DTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each of these DS30 interface CPs can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 CPs. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 CPs in the DTC common powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels, 256 channels from each unit, for each plane. The two network planes are combined in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the control complex.

The DTC common CP fills uses DS-1 interface CPs or filler faceplates for slots 1 through 5. Slot 13 uses a continuity tone detector or a filler faceplate. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). Slot 17 uses a specialized tone receiver (STR) or a filler faceplate. You use the NT6X69AB common peripheral processor (CPP) message protocol CP in slot 18.

Parts

The DTC common CP fill consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter CP
- NT3X90AC-DC cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP

NT6X02AR (continued)

- NT6X45AF-Line group controller (LGC)/digital trunk controller (DTC) processor
- NT6X46BA-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X62AA-STR
- NT6X69AB-CPP message protocol CP
- NT6X70AA-Continuity tone detector
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AR.

NT6X02AR parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 19F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill contains a maximum of five spare card slots. Three of the slots, 15, 16, and 17, have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 Network interface CP* The DS30 NI card is available in two versions: NT6X40AA (8 ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.

NT6X02AR (continued)

NT6X02AR parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides parallel-to-serial conversion of the signals that go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards and network plane selection. The formatting section provides parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels, and assembles the CSM for each channel. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP performs parity checking on incoming bytes, and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AF	8F, 12F	*Line group controller/digital trunk controller processor* The LGC/DTC processor runs the programs that control the operation and maintenance of a PM. The LGC/DTC performs functions like digit collection, channel assignment, and description of messages for the central control complex and PM.
NT6X46BA	11F	*Signaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.

NT6X02AR (continued)

NT6X02AR parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X47AB	10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the master processor (MP) and the SP. The SP has access to a part of the MP memory through the memory management unit.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each line trunk controller (LTC) module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card also provides transmission of local alarms and the detection of remote alarms. The card also provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X62AA	17F	*Specialized tone receiver* The STR allows the DTC common CP fill to detect and report specified tones on one or channels (to 480). An STR can scan a maximum of 480 channels at one time. You use this receiver in the DMS-250 to enable a subscriber in the talking state to depress # or * and dial out digits. A subscriber dials digits to make a new connection and does not dial the carrier access and authorization codes again. The STR can be provisioned in a DTC with an extended XPM processor memory and a CPP message protocol CP.
NT6X69AB	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module (CM).

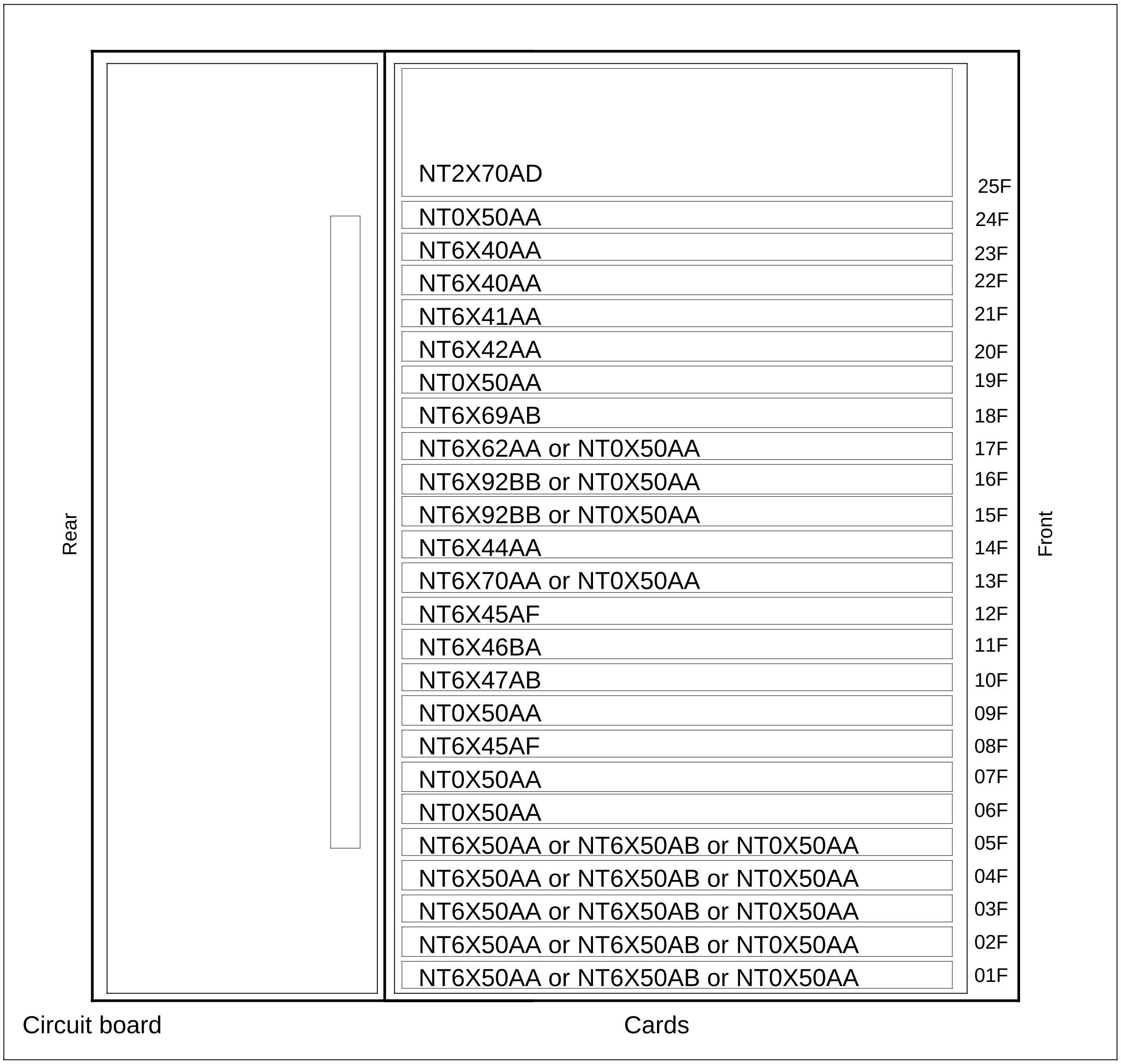
NT6X02AR (continued)

NT6X02AR parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X70AA	13F	*Continuity tone detector* The continuity tone detector detects tones used in call processing to verify the continuity of the voice/data path between DTCs. The detector monitors and records the frequency and level of the tones. The continuity tone detector retains this data for use by the XPM processor in the DTC.
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the XPM processor.

NT6X02AR (end)

NT6X02AR parts



NT6X02AS

Product description

The NT6X02AS digital trunk controller (DTC) common circuit pack (CP) fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS-1 digital trunks. The DTC common CP fill consists of two units. One unit is active and provides processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units.

The DTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each DS30 interface CP can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 card in the DTC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels, 256 channels from each unit, for each plane. The two network planes are combined in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the CC.

The DTC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. Slot 13 uses a continuity tone detector or a filler faceplate. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). Slot 17 uses a specialized tone receiver (STR) or a filler faceplate. You use the NT6X69AB common peripheral processor (CPP) message protocol CP in slot 18.

Parts

The DTC common CP fill consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AE-Power converter ±2 V
- NT3X90AC-DC cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP

NT6X02AS (continued)

- NT6X45AC-Line group controller (LGC)/digital trunk controller (DTC) processor
- NT6X45BA-XMS-based peripheral module (XPM) processor
- NT6X46AC-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X55AB-DS0 interface CP
- NT6X62AA-STR
- NT6X69AA-Common peripheral processor (CPP) message protocol CP
- NT6X70AA-Continuity tone detector
- NT6X79AA-Common peripheral controller equipment tone generator CP
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AS.

NT6X02AS parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 24F	*Filler faceplate* You use the filler faceplate is to fill empty card slots in the CP fills. Each fill has a maximum of five spare card slots. Three of the slots, 15, 16, and 17, have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AE	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AS (continued)

NT6X02AS parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40AA	22F, 23F	*DS30 Network interface CP* The DS30 NI card is available in two versions: NT6X40AA (8 ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides parallel-to-serial conversion of the signals that go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards and network plane selection. The formatting section provides parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels, and assembles the CSM for each channel. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP also performs parity checks on incoming bytes, and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the signaling processor (SP) controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Line group controller/digital trunk controller processor* The LGC/DTC processor runs the programs that control the operation and maintenance of a peripheral module (PM). The LGC/DTC processor performs functions like digit collection, channel assignment, and description of messages for the central control complex (CCC) and PM.

NT6X02AS (continued)

NT6X02AS parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X45BA	8F, 12F	*XMS-based peripheral module* The XPM controls the formatter, the CSM CP, and the TS CP. The XPM processor collects the incoming control messages to the LGC/DTC processor for transmission. The LGC/DTC processor and the XPM processor communicate through direct memory access (DMA) that allows the to read and write to parts of the LGC/DTC processor memory. The LGC/DTC processor cannot access the XPM processor memory.
NT6X46AC	11F	*Signaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the master processor and the SP. The SP has access to a part of the MP memory through the memory management unit.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each line trunk controller (LTC) module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.

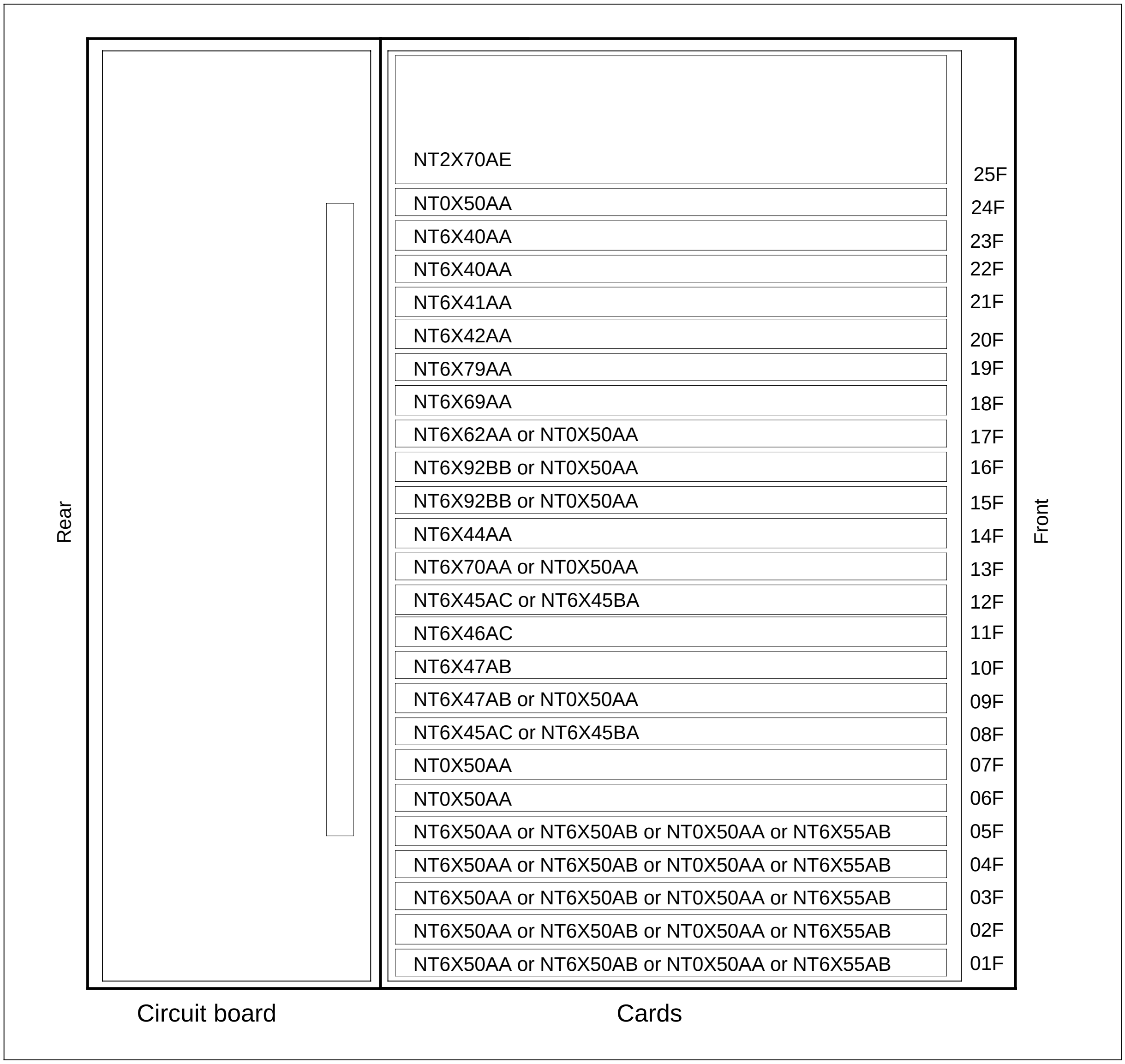
NT6X02AS (continued)

NT6X02AS parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X55AB	1F-5F	*DS0 interface card* The DS0 interface card provides physical level access for one 64 Kbps DS0 link in the DTC common CP fill. This interface CP can create CCS7 link access to a signal transfer point node for the DTC. The DS0 interface CP on a signal switching point can respond to network-initiated loopback requests.
NT6X62AA	17F	*Specialized tone receiver* The STR allows the DTC common CP fill to detect and report specified tones on one or channels (to 480). An STR can scan a maximum of 480 channels at one time. You use this CP in the DMS-250 to enable a subscriber in the talking state to depress # or * and dial out digits. The subscriber dials digits to make a new connection and does not have to dial the carrier access and authorization codes again. The STR can be provisioned in a DTC with an extended XPM processor memory and a CPP message protocol CP.
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus and extracts control messages received on channel zero from the control module (CM).
NT6X70AA	13F	*Continuity tone detector* The continuity tone detector detects tones used in call processing to verify the continuity of the voice/data path between DTCs. The card monitors and records the frequency and level of the tones. The continuity tone detector retains this data for use by the XPM processor in the DTC.
NT6X79AA	19F	*Common peripheral controller equipment tone generator CP* The CPCE tone generator CP provides interface for the parallel speech bus. The tone generator extracts control messages received on channel zero from the CM.
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the XPM processor.

NT6X02AS (end)

NT6X02AS parts



NT6X02AT

Product Description

The NT6X02AT line group controller (LGC) common circuit pack (CP) fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links. The CP fill provides an interface between DS-1 links to auxiliary peripheral modules. The LGC common CP fill consists of two units. One unit is active and provides processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex. One control is active and provides control for the two units.

The LGC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each DS30 interface CP can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 CPs. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 CP in the LGC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels (256 channels from each unit) for each plane. The two network planes are combined in the formatter where one plane or the other is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the control complex.

The LGC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. You can use a DS30A interface CP or a filler faceplate in slot 6. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). You use the NT6X69AB common peripheral processor (CPP) message protocol CP in slot 18. You use the NT6X79AA common peripheral controller equipment (CPCE) tone generator CP in slot 19.

Parts

The NT6X02AT consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter CP
- NT2X70AE-Power converter ±2 V
- NT3X90AC-DC cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter

NT6X02AT (continued)

- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AC-Line group controller (LGC)/digital trunk controller (DTC) processor
- NT6X45BA-XMS-based peripheral module (XPM) processor
- NT6X46AC-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X48AA-DS30A interface CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X69AA-Common peripheral processor (CPP) message protocol CP
- NT6X78AA-Custom local area signaling service modem resource CP
- NT6X79AA-Common peripheral controller equipment (CPCE) tone generator CP
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AT.

NT6X02AT parts (Sheet 1 of 5)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill has a maximum of five spare card slots. Three of the slots (15, 16, and 17) have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots (13 and 19) that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.

NT6X02AT (continued)

NT6X02AT parts (Sheet 2 of 5)

PEC	Slot	Description
NT2X70AE	25F	*Power converter* The power converter converts the -48 V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies +5 and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 Network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides parallel-to-serial conversion of the signals that go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards and network plane selection. The formatting section provides parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels, and assembles the CSM for each channel. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP performs parity checks on incoming bytes and parity generation on outgoing bytes.

NT6X02AT (continued)

NT6X02AT parts (Sheet 3 of 5)

PEC	Slot	Description
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the signaling processor (SP) controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Line group controller/digital trunk controller processor* The LGC/DTC processor runs the programs that control the operation and maintenance of a peripheral module (PM). The LGC/DTC performs functions like digit collection, channel assignment, and description of messages for the central control complex and PM.
NT6X45BA	8F, 12F	*XMS-based peripheral module processor* The XPM processor controls the formatter, the CSM CP, and the TS CP. The XPM processor collects the incoming control messages to the LGC/DTC processor for transmission. The LGC/DTC processor and the XPM processor communicate through direct memory access (DMA). The DMA allows the XPM processor to read and write to parts of the LGC/DTC processor memory. The LGC/DTC processor cannot access the XPM processor memory.
NT6X46AC	11F	*SIgnaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the master processor (MP) and the SP. The SP has access a part of the MP memory through the memory management unit.
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.

NT6X02AT (continued)

NT6X02AT parts (Sheet 4 of 5)

PEC	Slot	Description
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each line trunk controller (LTC) module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card allows the detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card also provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module (CM).
NT6X78AA	13F	*Custom local area signaling service modem resource CP* The CLASS modem resource card provides different residential (RES) enhanced features. The CLASS modem can be provisioned in slot 16 of the SMU shelf. You require the CMR card if the calling number delivery (CND) feature is provisioned.
NT6X79AA	19F	*Common peripheral controller equipment tone generator CP* The CPCE (CPCE) tone generator CP provides interface for the parallel speech bus. the CPCE CP extracts control messages received on channel zero from the control module (CM).

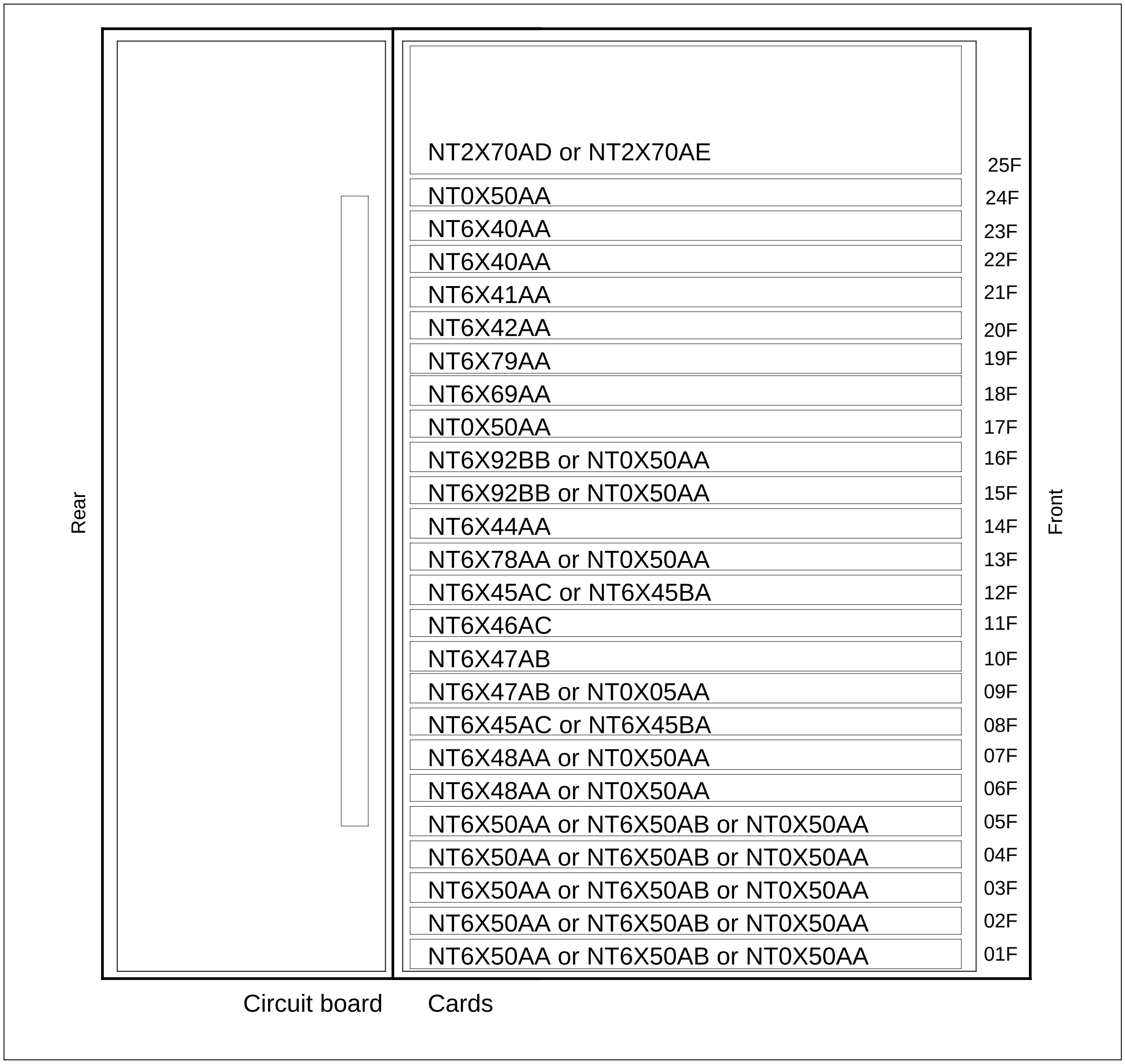
NT6X02AT (continued)

NT6X02AT parts (Sheet 5 of 5)

PEC	Slot	Description
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects tone signals at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the XPM processor.

NT6X02AT (end)

NT6X02AT parts



NT6X02AU

Product Description

The NT6X02AU line trunk controller (LTC) common circuit pack (CP) fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links. The CP fill provides an interface between DS-1 links to auxiliary peripheral modules (PM). The LTC common CP fill consists of two units. One unit is active and provides processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units. The LTC common CP fills are in the NT6X01AA common peripheral controller equipment (CPCE) frame.

The LTC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each DS30 interface CP can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 CPs. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 CP in the LTC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels, 256 channels from each unit, for each plane. The two network planes are combined in the formatter where one plane or the other is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the control complex.

The LTC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. You use the DS30A interface CPs or filler faceplates in slots 6 and 7. Slots 15 and 16 can use universal tone receivers (UTR) or filler faceplates. You use the NT6X69AA common peripheral processor (CPP) message protocol CP in slot 18. You use the the NT6X79AA CPCE tone generator CP in slot 19.

Parts

The NT6X02AU consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter
- NT2X70AE-Power converter
- NT3X90AC-Device controller cooling inverter unit

- NT6X40AA-DS30 network interface (NI)
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS) CP
- NT6X45AC-Line group controller/digital trunk controller processor
- NT6X45BA-XMS-based peripheral module processor
- NT6X46AC-Signaling processor memory (SPM)
- NT6X47AB-Master processor memory (MPM)
- NT6X48AA-DS30A interface CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X69AB-CPP message protocol CP
- NT6X70AA-Continuity tone detector
- NT6X78AA-Custom local area signaling service modem resource CP
- NT6X78AB-Custom local area signaling service modem resource CP
- NT6X79AA-CPCE tone generator CP
- NT6X92BB-UTR

Design

The following table and figure describe the design of the NT6X02AU.

NT6X02AU parts (Sheet 1 of 5)

PEC	Slot	Description
NT0X50AA	1F-7F,9F, 13F,15F-17F, 19F, 23F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill contains a maximum of five spare card slots. Three of the slots, 15, 16, and 17, have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slots, 13 and 19, that remain do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies + 5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.

NT6X02AU (continued)

NT6X02AU parts (Sheet 2 of 5)

PEC	Slot	Description
NT2X70AE	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies + 5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface and contains a looparound circuit for fault isolation.
NT6X40AC	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface and contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides parallel-to-serial conversion of the signals that go to the C-side links. The formatting section provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards and network plane selection. The formatting section provides parity error generation for test purposes and T1 clock generation.

NT6X02AU (continued)

NT6X02AU parts (Sheet 3 of 5)

PEC	Slot	Description
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels, and assembles the CSM for each channel. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP performs parity checking on incoming bytes and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. the time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AF	8F, 12F	*Master processor card* The master processor (MP) card runs the programs that control the operation and maintenance of a peripheral module. The MP card performs functions like digit collection, channel assignment, and description of messages. The MP describes messages for the central control complex and peripheral module.
NT6X45BA	8F,12F	*Signaling processor card* The SP card controls the formatter, the CSM card, and the TS card. The SP collects the incoming control messages from the message protocol card (MPC). The SP passes outgoing control messages to the MPC for transmission. The MP and SP communicate through direct memory access (DMA). This DMA allows the SP to read and write to parts of the MP memory. The MP cannot access the SP memory.
NT6X46BA	11F	*Signaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the MP and the SP. The SP has access to a part of the MP memory through the memory management unit.

NT6X02AU (continued)

NT6X02AU parts (Sheet 4 of 5)

PEC	Slot	Description
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisionable for each LTC module. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X70AA	13F	*Continuity card* The continuity card detects tones used in call processing to verify the continuity of the voice/data path between LTCs. The card monitors and records the frequency and level of the tones. The continuity card retains this data for use by the SP in the LTC.
NT6X69AB	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module.

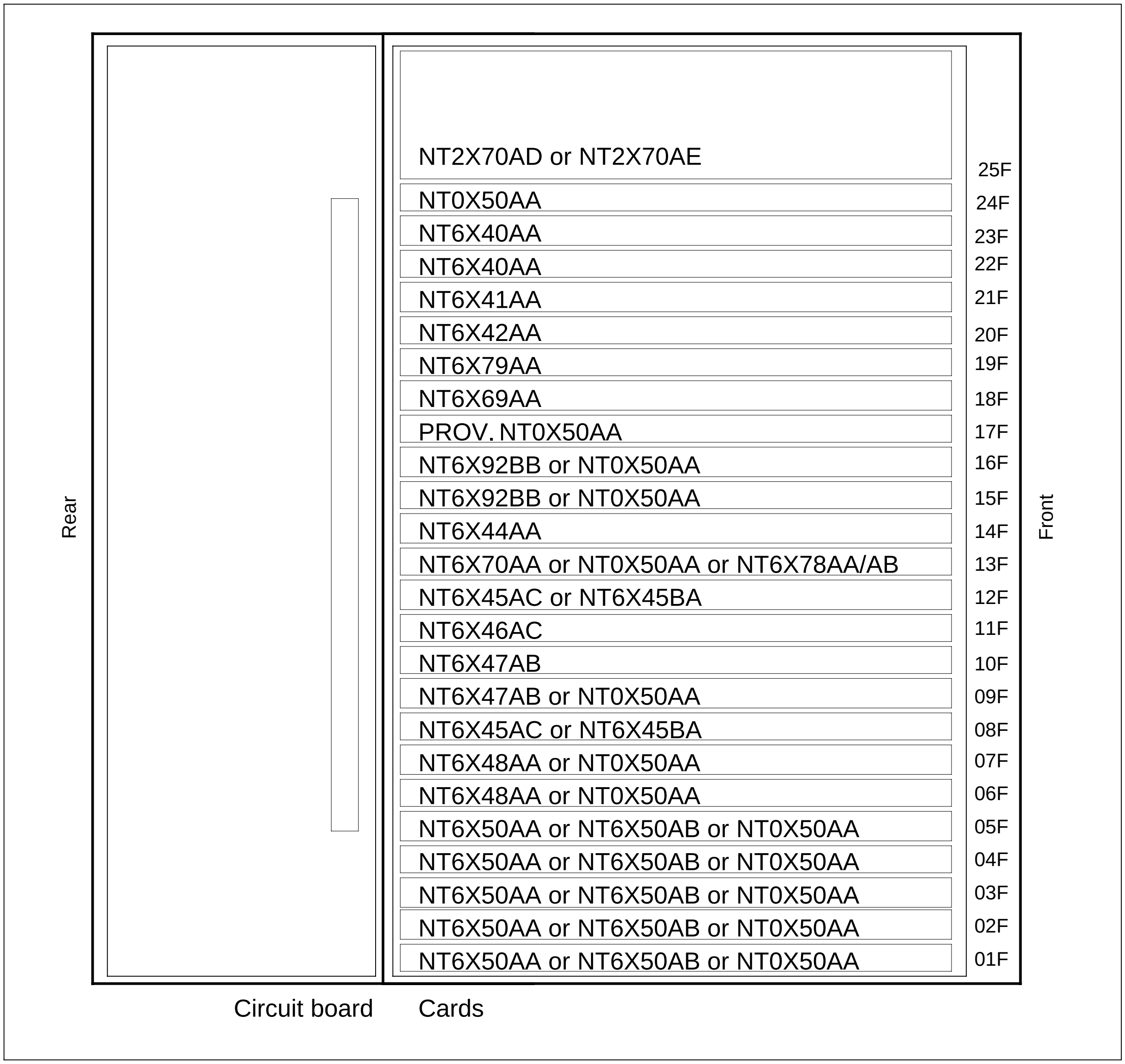
NT6X02AU (continued)

NT6X02AU parts (Sheet 5 of 5)

PEC	Slot	Description
NT6X78AA	13F	*Custom local area signaling service modem resource CP* The CLASS modem resource card provides different residential (RES) enhanced features. The CLASS modem can be provisioned in slot 16 of the SMU shelf. You require the CMR card if the calling number delivery (CND) feature is provisioned.
NT6X78AB	**13F**	*Custom local area signaling service modem resource CP* The CMR card provides different RES enhanced features. The CMR card can be provisioned in slot 16 of the SMU shelf. You require the CMR card if the CND feature is provisioned.
NT6X85AB	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. One to ten cards are provisionable for each SMU. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card provides detection of error conditions like loss of synchronization, bipolar error, and slip.
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the SP.

NT6X02AU (end)

NT6X02AU parts



NT6X02AW

Product Description

The subscriber carrier module urban (SMU) shelf provides a digital interface to urban remote control terminals in a digital loop carrier system. This digital loop carrier system is the subscriber loop concentrator (SLC). Business and/or residential applications can use the SMU shelf.

When integrated into the DMS-100 switch, the DMS-1 urban remote terminal becomes the remote carrier urban (RCU) module. This integrated configuration provides subscribers with the full digital resources the DMS-100 switch offers. The SMU shelf eliminates the separate control terminal cards that each subscriber line requires. This elimination reduces main distribution frame (MDF) wiring and activity and saves office space. While the CT serves only one remote terminal, the SMU shelf serves multiple RCU modules.

The SMU shelf consists of two units. One unit is active and provides the necessary processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. The SMU replaces two of the three line cards and one multiplexer. This replacement reduces the cost of the standard subscriber carrier.

Each RCU has eight digroups that provide DS-1 links to the SMU. Each digroup consists of 24 pulse code modulation (PCM) channels. Time-division multiplex (TDM) assembles the PCM channels. When all digroups are equipped, 192 channels are available (8 digroups, each with 24 PCM channels). Each one of the two SMU message processors in the RCU uses a separate channel. A maximum of 190 channels remain available for traffic.

The shelf provides an interface for RCUs only. The shelf does not provide an interface to any other remote system. A standard DMS-100 single bay frame houses the SMU shelf pairs. This bay is the subscriber module equipment (SME) frame (NT6X01AA). This bay contains two pairs of shelves. Each pair is a module. Module 0 comprises the lower two shelves and module 1 comprises the upper two shelves. Each module is designated NT6X02EA. The node the link serves is assigned an exclusive DS-1 link. This node is a line appearance on a digital trunk (LDT) node.

The SMU shelf uses DS-1 interface cards or filler face plates for slots 1 through 5. The SMU shelf can also provision filler face plates in slots 6, 7, and 13.

The SMU modules use copper or fiber speech links to interface with the enhanced network (ENET). Both configurations require the NT6X69AC card.

NT6X02AW (continued)

The SMU requires three components when the SMU uses fiber speech links to connect to the ENET. These components are as follows:

- XPM DS-512 link control (NT6X40CA)
- XPM DS-512 link card (NT6X40DA)
- FXPM bracket assembly kit (NT6X02BU)

Parts

The NT6X02AW consists of the following components:

- NT0X50AA-Filler face plate
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI)
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44CA-Time switch (TS)
- NT6X45AC-Master processor (MP) card
- NT6X45BA-Signaling processor (SP) card
- NT6X46AC-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) card
- NT6X69AB-Common peripheral processor (CPP) message protocol and tone CP
- NT6X78AA-Custom local area signaling service modem resource
- NT6X80BA-Pad/ring
- NT6X85AB-DS-1 interface CP

NT6X02AW (continued)

Design

The design of the NT6X02AW appears in the following table and figure.

NT6X02AW parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F,9F, 13F, 15F-17F,24F	*Filler face plate* The filler face plate fills empty card slots in the CP fills. Each fill consists of a maximum of five spare card slots. Three slots (15, 16, and 17) have access to the SP address bus and the parallel speech bus. The spare slots that remain (13 and 19) do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48 V dc to the lower voltages the circuit cards require in the fill. Each power converter supplies +5 V and 12 V for the cards in the fill. Power converters supply power to the DS-1 CPs to prevent loss of cards during a power failure. These cards are cards which have no duplicates.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port of a DS30 NI card contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the encoded voice signals. The formatter receives voice signals from the CSM interface card and these signals are sent to the C-side links. This section provides serial-to-parallel conversion of the encoded voice signals. The formatter receives these signals from the C-side interface cards, network plane selection, parity error generation for test purposes and T1 clock generation.

NT6X02AW (continued)

NT6X02AW parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM CP also inserts the CSM into the outgoing C-side bytes. The CSM CP also performs parity checks on all incoming bytes and parity generation on all outgoing bytes.
NT6X44CA	14F	*Time switch* The TS converts between the serial stream received from, or transmitted to, the DS30 interface card or DS-1 interface card and the parallel stream. The internal speech bus uses this parallel stream. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with time slots on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that control the operation and maintenance of a peripheral module (PM). This card performs functions like digit collection, channel assignment and description of messages for the central control complex (CCC) and PM.
NT6X45BA	8F,12F	*Signaling processor card* The SP card controls the formatter, the CSM card and the TS card. The SP collects all the incoming control messages from the message protocol card (MPC). The SP also passes all outgoing control messages to the MPC for transmission. The MP and SP use direct memory access (DMA) to communicate. The DMA allows the SP to read and write to sections of the MP memory. The MP cannot access the SP memory.
NT6X46AC	11F	*Signaling processor memory card* The SPM card consists of RAM. This RAM stores data and software applications.
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM. This RAM stores data and software applications for both the MP and the SP. The SP has access to a section of the MP memory through the use of a memory management unit.

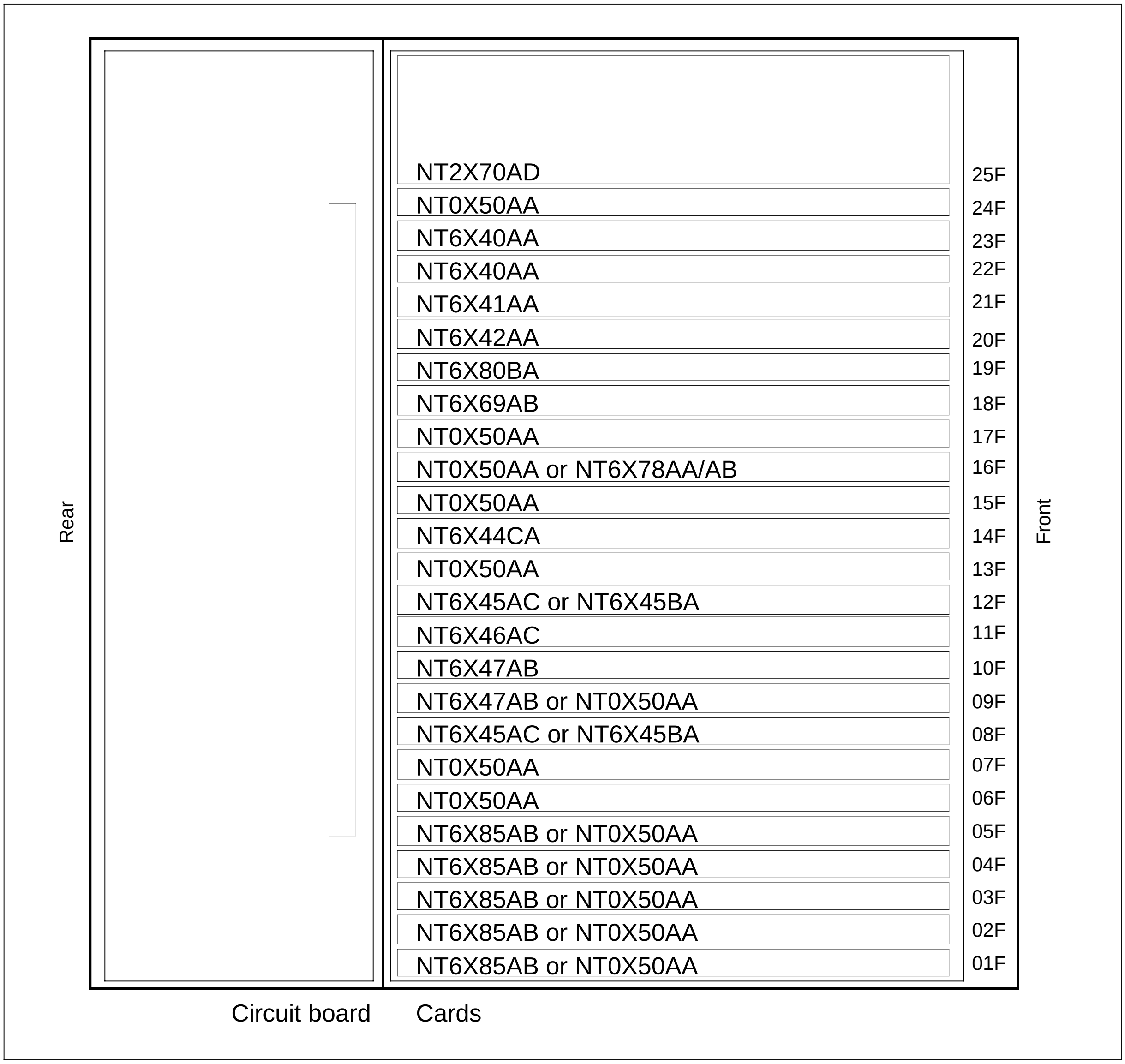
NT6X02AW (continued)

NT6X02AW parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X69AB	18F	*Common peripheral processor message protocol and tone CP* The messaging card provides interface for the parallel speech bus. The card also extracts control messages that channel zero receives from the control module.
NT6X78AA	16F	*Custom local area signaling service modem resource CP* The CLASS modem resource card provides different residential (RES) enhanced features. Slot 16 of the SMU shelf can house this card. The calling number delivery (CND) feature requires the CMR card.
NT6X80BA	19F	*Pad/ring* The pad/ring card uses PCM to generate ringing frequency instructions. The TS card switches frequencies on the DS-1 channels. These channels are associated with the subscriber loops that must ring.
NT6X85AB	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. One to ten cards are provisionable for each SMU. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card also provides detection of error conditions like loss of synchronization, bipolar error, and slip.

NT6X02AW (end)

NT6X02AW parts



NT6X02AY

Product Description

The NT6X02AY line group controller (LGC) common circuit pack (CP) fill provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links and/or DS-1 links to subsidiary peripheral modules. The LGC common CP fill consists of two units. One unit is active and provides processing and control functions. The other unit is in a standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). One CC is active and provides control for the two units.

The LGC common CP fill has C-side interfaces. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each DS30 interface CP can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. The even-numbered links connect to plane 0 of the network, and the odd-numbered links to plane 1. You require a minimum of three link pairs for proper interface with the network module (NM) and the CC.

Each DS30 interface CPs in the LGC common CP fill powers 256 (8×32) channels for each plane to the formatter cards. The formatter cards are in units 0 and 1. Each formatter handles 512 channels (256 channels from each unit) for each plane. The two network planes are combined in the formatter where one plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the control complex.

The LGC common CP fill uses filler faceplates in slots 1 through 5. You can use the DS30A interface CPs or filler faceplates in slots 6 and 7. You can use the NT6X69AB common peripheral processor (CPP) message protocol CP in slot 18. You can use the NT6X79AA common peripheral controller equipment (CPCE) tone generator CP in slot 19.

Parts

The NT6X02AY consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AB-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI)
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) CP

NT6X02AY (continued)

- NT6X44AA-Time switch (TS) CP
- NT6X45AC-LGC/digital trunk controller (DTC) processor
- NT6X46AB-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X48AA-DS30A interface CP
- NT6X69AA-CPP message protocol CP
- NT6X79AA-CPCE tone generator CP
- NT6X92BA-Universal tone receiver (UTR)

Design

The following table and figure describe the design of the NT6X02AY.

NT6X02AY parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 24F	*Filler faceplate* You use the filler faceplate to fill empty card slots in the CP fills. Each fill contains a maximum of five spare card slots. Three of the slots, 15, 16, and 17, have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slot, 13, that remains does not have access.
NT2X70AB	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies + 5 V and 12 V for the cards in the fill. Power to the DS-1 CPs prevents loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a loop-around circuit for fault isolation.

NT6X02AY (continued)

NT6X02AY parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of two sections: the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The formatting section of the card provides parallel-to-serial conversion of the signals that go to the C-side links. The card provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards and network plane selection. The card provides parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CP extracts the CSM bit from the C-side channels and assembles the CSM for each channels. The CSM CP inserts the CSM in the outgoing C-side bytes. The CSM CP also performs parity checks on incoming bytes, and parity generation on outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream from (or to) the DS30 interface card or DS-1 interface card and the parallel stream. The parallel stream is used on the internal speech bus. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Line group controller/digital trunk controller processor* The LGC/DTC processor runs the programs that control the operation and maintenance of a peripheral module. The LGC/DTC performs functions like digit collection, channel assignment, and description of messages for the central control complex and peripheral module.
NT6X46AB	11F	*Signaling processor memory card* The SPM card consists of random access memory (RAM) that stores data and software applications.

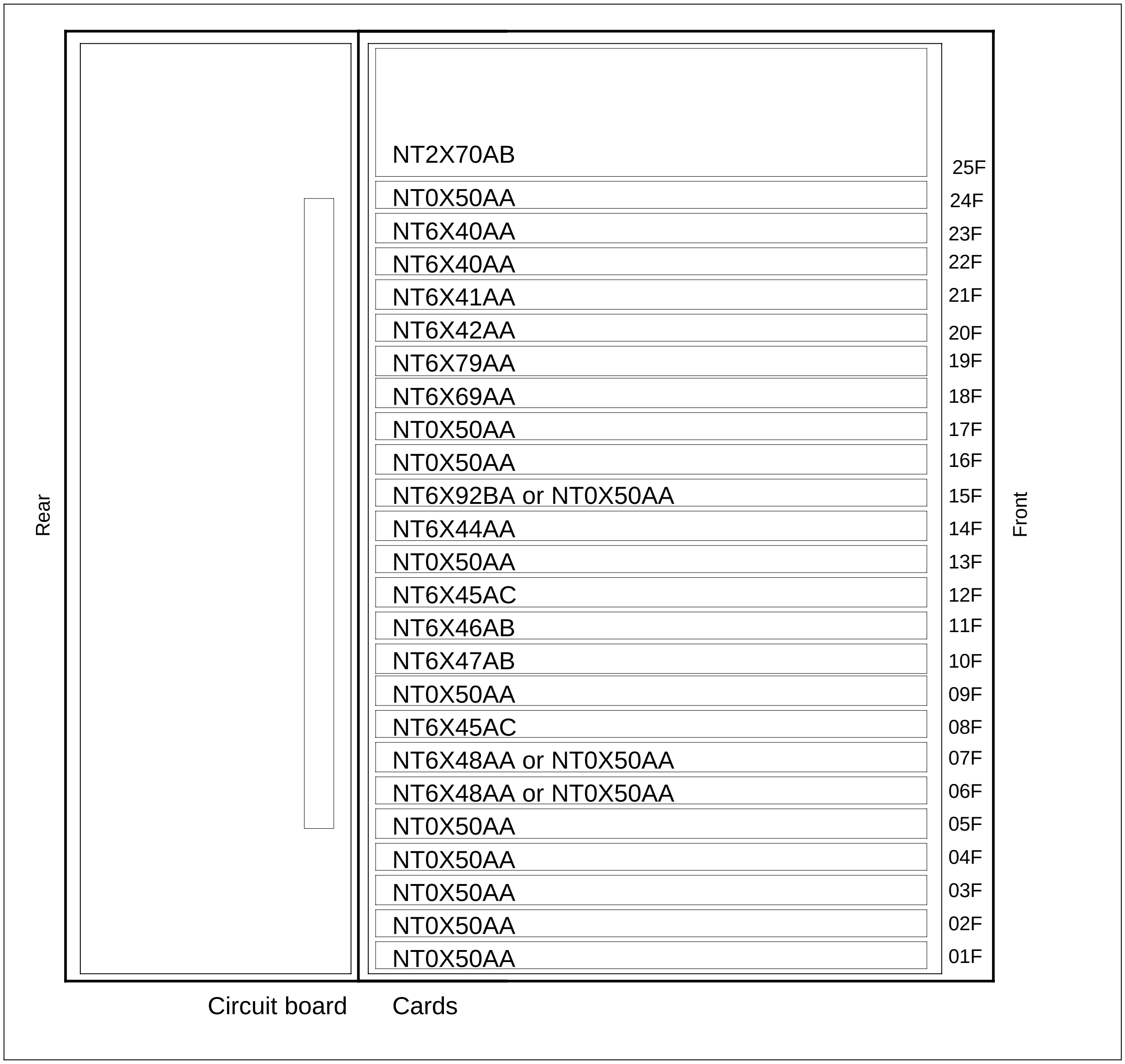
NT6X02AY (continued)

NT6X02AY parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X47AB	10F	*Master processor memory card* The MPM card consists of RAM that stores data and software applications for the MP and the SP. The SP has access to a part of the MP memory through the memory management unit.
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 Mbps bit stream. Each DS30A port contains a loop-around circuit for fault isolation.
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module (CM).
NT6X79AA	19F	*Common peripheral controller equipment tone generator CP* The CPCE tone generator CP provides interface for the parallel speech bus. The tone generator extracts control messages received on channel zero from the CM.
NT6X92BA	15F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones, like dual-tone multi-frequency (DTMF) and multi-frequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends the results to the XPM processor.

NT6X02AY (end)

NT6X02AY parts



NT6X02AZ

Product Description

The NT6X02AZ line group controller (LGC) common circuit pack (CP) fill provides an interface. This interface can be between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links. This interface can also be between C-side DS30 links to the network and DS-1 links to subsidiary peripheral modules (PM). The LGC common CP fill consists of two units. One unit is active and provides the necessary processing and control functions. The other unit is in standby mode. This unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). Only one CC is active at a time. The CC provides control for both units.

The LGC common CP fill has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface CPs support the C-side links. Each of these DS30 interface CPs can support a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 CPs. This distribution allows even-numbered links to connect to plane 0 of the network, and odd-numbered links to plane 1. Correct interface with the network module (NM) and the CC requires a minimum of three link pairs.

Each DS30 card in the LGC CPs powers 256 (8×32) channels for each plane. Each card channels these powers to the formatter cards in both units 0 and 1. Each formatter handles a total of 512 channels for each plane. The formatter handles 256 channels from each unit. The two network planes are combined in the formatter. In this formatter, a plane is selected for each channel. The 512 speech channels are added to the 128 internal service channels. The speech channels are converted to a 640-channel bus to the control complex.

The LGC common CP fill uses DS-1 interface CPs or filler faceplates for slots 1 through 5. Slot 6 can use the DS30A interface CPs or a filler faceplate. Slots 15 and 16 use a filler faceplate or a universal tone receiver (UTR). Slot 18 uses the NT6X69AB common peripheral processor (CPP) message protocol CP. Slot 19 uses the NT6X79AA common peripheral controller equipment (CPCE) tone generator CP.

Parts

The NT6X02AZ consists of the following components:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) CP
- NT6X41AA-Speech bus formatter

- NT6X42AA-Channel supervision message (CSM) CP
- NT6X44AA-Time switch (TS)
- NT6X45AC-LGC/digital trunk controller (DTC) processor
- NT6X46AB-Signaling processor memory (SPM) CP
- NT6X47AB-Master processor memory (MPM) CP
- NT6X48AA-DS30A interface CP
- NT6X50AA-DS-1 interface CP
- NT6X50AB-DS-1 interface CP
- NT6X69AA-CPP message protocol CP
- NT6X79AA-CPCE tone generator CP
- NT6X92BB-UTR

Design

The design of the NT6X02AZ appears in the table and figure that follow.

NT6X02AZ parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. A maximum of five spare card slots are present in each fill. Three slots (15, 16 and 17) have access to the signaling processor (SP) address bus and the parallel speech bus. The spare slot that remains (13) does not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48 V dc to the lower voltages that the circuit cards require in the fill. Each power converter supplies + 5 V and 12 V for the cards in the fill. The power converter supplies power to the DS-1 CPs to prevent loss of cards during a power failure. These cards are cards that do not have duplicates.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02AZ (continued)

NT6X02AZ parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40AA	22F, 23F	*DS30 network interface CP* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port also contains a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card consists of the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section provides parallel-to-serial conversion of the encoded voice signals. The formatter receives these voice signals from the CSM interface card and the voice signals are sent to the C-side links. This section also provides serial-to-parallel conversion of encoded voice signals. The formatter receives these signals from the C-side interface cards, network plane selection, parity error generation for test purposes and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM CP performs several functions. The CSM CP extracts the CSM bit from the C-side channels. The CMS CP assembles the CSM for each channel and inserts the CSM into the outgoing C-side bytes. The CSM CP also performs parity checks on all incoming bytes and parity generation on all outgoing bytes.
NT6X44AA	14F	*Time switch* The TS converts between the serial stream received from, or transmitted to, the DS30 interface card or DS-1 interface card and the parallel stream. The internal speech bus uses the parallel stream. When the SP controls the TS, the TS associates DS30 interface cards and DS-1 interface cards with time slots on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Line group controller/digital trunk controller processor* The LGC/DTC processor runs the programs that control the operation and maintenance of a peripheral module (PM). This processor performs functions like digit collection, channel assignment and description of messages for the central control complex (CCC) and PM.

NT6X02AZ (continued)

NT6X02AZ parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X46AB	11F	*Signaling processor memory card* The SPM card consists of random access memory. This memory stores data and software applications.
NT6X47AB	10F	*Master processor memory card* The MPM card consists of RAM. The RAM stores data and software applications for the MP and the SP. The SP has access to a section of the MP memory through the use of a memory management unit.
NT6X48AA	6F, 7F	*DS30A interface card* The DS30A interface card contains ten separate ports. Each port provides a two-way voice and data interface and carries a 32-channel, 2.56 Mbps bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to ten cards are provisioned for each LTC module. Each port provides a two-way voice, data and signaling interface. The card provides looparound paths for each DS-1 port. These paths allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card also provides detection of error conditions like loss of synchronization, bipolar error and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. One to 10 cards are provisioned for each LTC module. Each port provides a two-way voice, data and signaling interface. The card provides looparound paths for each DS-1 port. These paths allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The card also provides detection of error conditions like loss of synchronization, bipolar error and slip.
NT6X69AA	18F	*Common peripheral processor message protocol CP* The messaging card provides an interface for the parallel speech bus. The messaging card extracts control messages that channel zero receives from the control module.

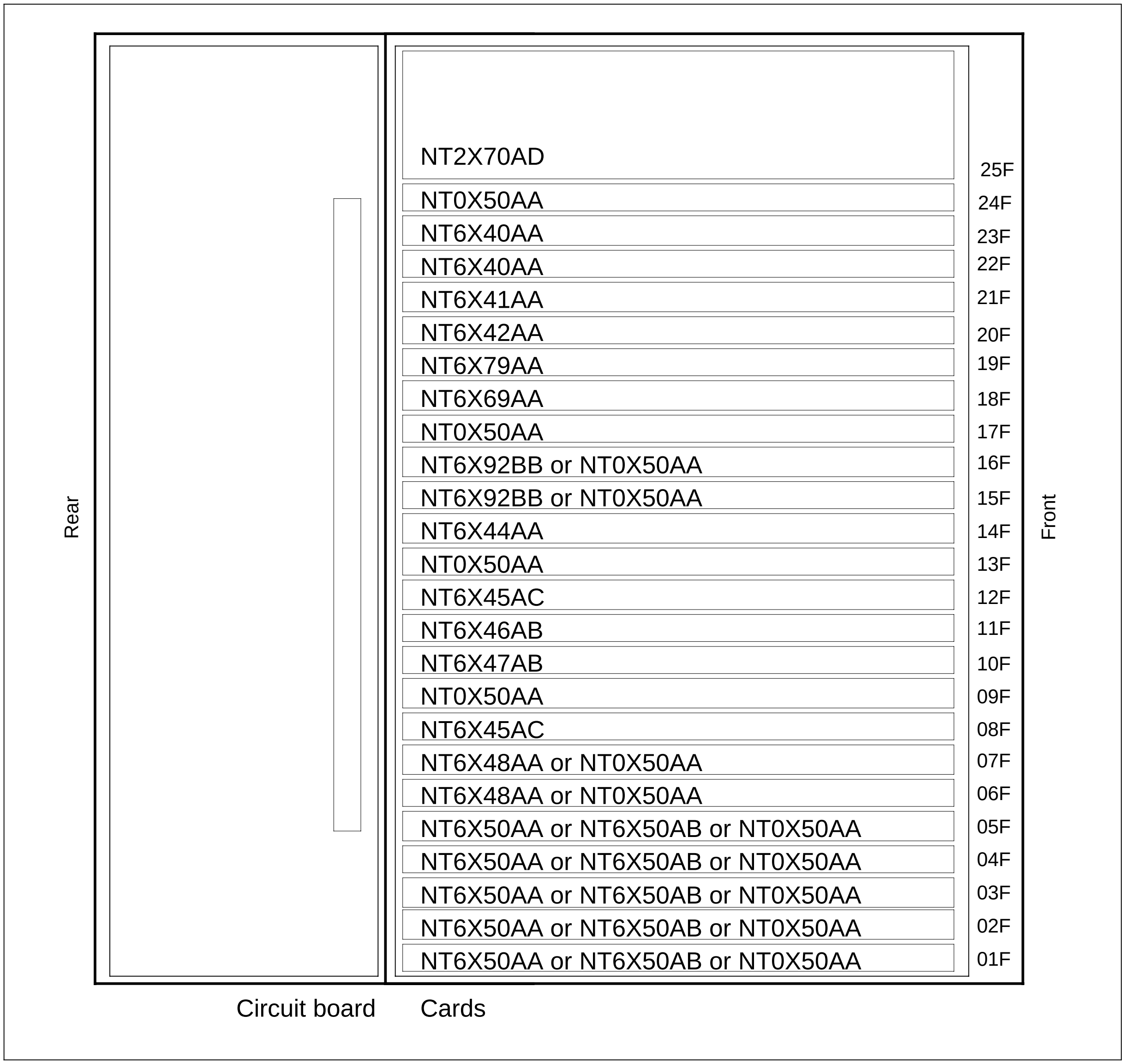
NT6X02AZ (continued)

NT6X02AZ parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X79AA	19F	*Common peripheral controller equipment tone generator CP* The CPCE tone generator CP provides an interface for the parallel speech bus. The CPCE tone generator CP extracts control messages that channel zero receives from the control module (CM).
NT6X92BB	15F, 16F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects many tones. These tones include dual-tone multifrequency (DTMF) and multifrequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects these tone samples at correct time slots. The UTR analyzes the samples and identifies the tones. The system sends results to the XPM processor.

NT6X02AZ (end)

NT6X02AZ parts



NT6X02BA

Product Description

The NT6X02BA international digital trunk controller (IDTC) shelf provides an interface between central-side (C-side) DS30 links to the network and PCM30 digital trunks. The IDTC shelf is like the North American version of the DTC. These two versions are different because the IDTC uses international digital trunks. The North American version uses North American DS-1 digital trunks. The IDTC shelf consists of two units. One unit is active and provides the necessary processing and control functions. The other unit is in a standby mode and can take over call processing if the active unit develops a fault. Each unit has a control complex (CC). Only one CC is active at a time and provides control for both units. The IDTC shelves are in the NT6X01BA international common peripheral equipment (ICPCE) frame.

The IDTC shelf also has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface circuit packs (CP) support the C-side links. Each DS30 interface card can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. The even-numbered links connect to plane 0 of the network. The odd-numbered links connect to plane 1. Correct interface with the network module (NM) and the CC requires a minimum of three link pairs.

Each DS30 card in the IDTC shelf powers 256 (8×32) channels for each plane to formatter cards in units 0 and 1. Each formatter handles a maximum of 512 channels for each plane. Each formatter handles 256 channels from each unit. The two network planes are combined in formatter. One plane is available for each channel. The 512 speech channels are added to the 128 internal service channels. The 512 speech channels are converted to a 640-channel bus to the control complex.

The IDTC shelf uses PCM30 interface cards or filler faceplates for slots 1 to 4. Slots 5 and 6 use filler faceplates. Slot 7 uses the NT6X44AB time switch card. Slots 8 and 9 use universal tone receiver (UTR) cards. Slot 10 uses the NT6X43BA messaging card.

Parts

NT6X02BA contains the following components:

- NT0X50AA-Filler faceplate or panel.
- NT2X70AD-Power converter.
- NT3X90AC-Device controller cooling inverter unit.
- NT6X27AA-PCM30 interface card.
- NT6X28AA-Signaling card.

- NT6X40AB-DS30 network interface (NI) card.
- NT6X41AA-Speech bus formatter.
- NT6X42AA-Channel supervision message (CSM) CP.
- NT6X43BA-Messaging card.
- NT6X44AB-Time switch (TS) CP.
- NT6X45AD-Master processor (MP) card.
- NT6X46AB-Signaling processor memory (SPM) card.
- NT6X47AB-Master processor memory (MPM) card.

Design

The design of the NT6X02BA appears in the table and figure that follows.

NT6X02BA parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F, 15F-17F, 19F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP fills. A maximum of five spare card slots are available in each fill. Slots 15, 16, and 17 have access to the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 do not have access to the SP address bus and the parallel speech bus.
NT2X70AD	25F	*Power converter* The power converter converts the -48 V dc to the lower voltages needed by the circuit cards in the fill. Each power converter supplies +5 V and -12 V for the cards in the fill. Power is available for the DS-1 CP. The power is available to prevent loss of cards during a power failure. These cards are cards that do not have copies.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02BA (continued)

NT6X02BA parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X27AA	1F-4F	*PCM30 interface card* The pulse code modulation (PCM) 30 interface card provides an interface. The interface is between an NT6X02 common peripheral controller (CPC) and European-standard PCM30 trunk transmission equipment. The PCM30 interface card translates PCM voice signals and signaling data. The PCM30 translates signals and data between two 32-channel, 2.048 Mbps external PCM 30 trunk circuits and one 64-channel, 5.12 Mbps duplicated port in the CPC. The card receives data streams from the four-wire PCM trunk transmission equipment. The card converts the high-density bipolar 3 (HDB3) data to a DS30 format. This conversion is for transmission to the DS-60 TS card. The card receives PCM30 data from the TS card. The card converts the data to an HDB3 format for transmission to the trunk transmission equipment. A looparound function is available for test purposes.
NT6X27AB	4F	*PCM30 interface card* The PCM30 interface card provides an interface between an NT6X02 CPC and European-standard PCM30 trunk transmission equipment. The PCM30 interface card translates PCM voice signals and signaling data. The card translates signals and data between two 32-channel, 2.048 Mbps external PCM 30 trunk circuits and one 64-channel, 5.12 Mbps duplicated port in the CPC. The card receives data streams from the four-wire PCM trunk transmission equipment. The card converts the high-density bipolar 3 (HDB3) data to a DS30 format. This conversion is for transmission to the DS-60 TS card. The card receives PCM30 data from the TS card. The card converts the data to an HDB3 format for transmission to the trunk transmission equipment. A looparound function is available for test purposes.
NT6X28AA	19F	*Signaling card* The NT6X28AA signaling card extracts signaling information from the parallel speech buses of the IDTC. The NT6X28AA inserts signaling information in the parallel speech buses of the IDTC. The NT6X28AA uses channel time slot (CTS) 16 to extract and insert the signaling information. The signaling card uses CTSO to communicate and control status information between the processor and the PCM30 interface card.

NT6X02BA (continued)

NT6X02BA parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X40AB	22F	*DS30 network interface circuit pack* The DS30 NI card is available in two versions: NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.
NT6X41AB	22F	*Speech bus formatter* The speech bus formatter card contains the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section provides parallel-to-serial conversion of the encoded voice signals. The CSM interface card provides the signals, which are for the C-side links. The formatter provides serial-to-parallel conversion of the encoded voice signals. The formatter provides network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	21F	*Channel supervision message circuit pack* The CSMCP extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM CP inserts the CSM into the outgoing C-side bytes. The CSM CP performs parity checks on all incoming bytes, and parity generation on all outgoing bytes.
NT6X43BA	10F	*Messaging card* The messaging card provides an interface for the parallel speech bus. The messaging card extracts control messages that channel zero receives from the control module (CM).
NT6X44AB	7F	*Time switch* The TS converts between the serial stream that is received from or transmitted to the DS30 interface card or DS-1 interface card and the parallel stream. The internal speech bus uses the parallel stream. When the SP controls the TS, the TS associates DS30 interface cards and DS-1 interface cards with a time slot on the parallel speech bus. The TS transfers data between the associated channel and the time slot.

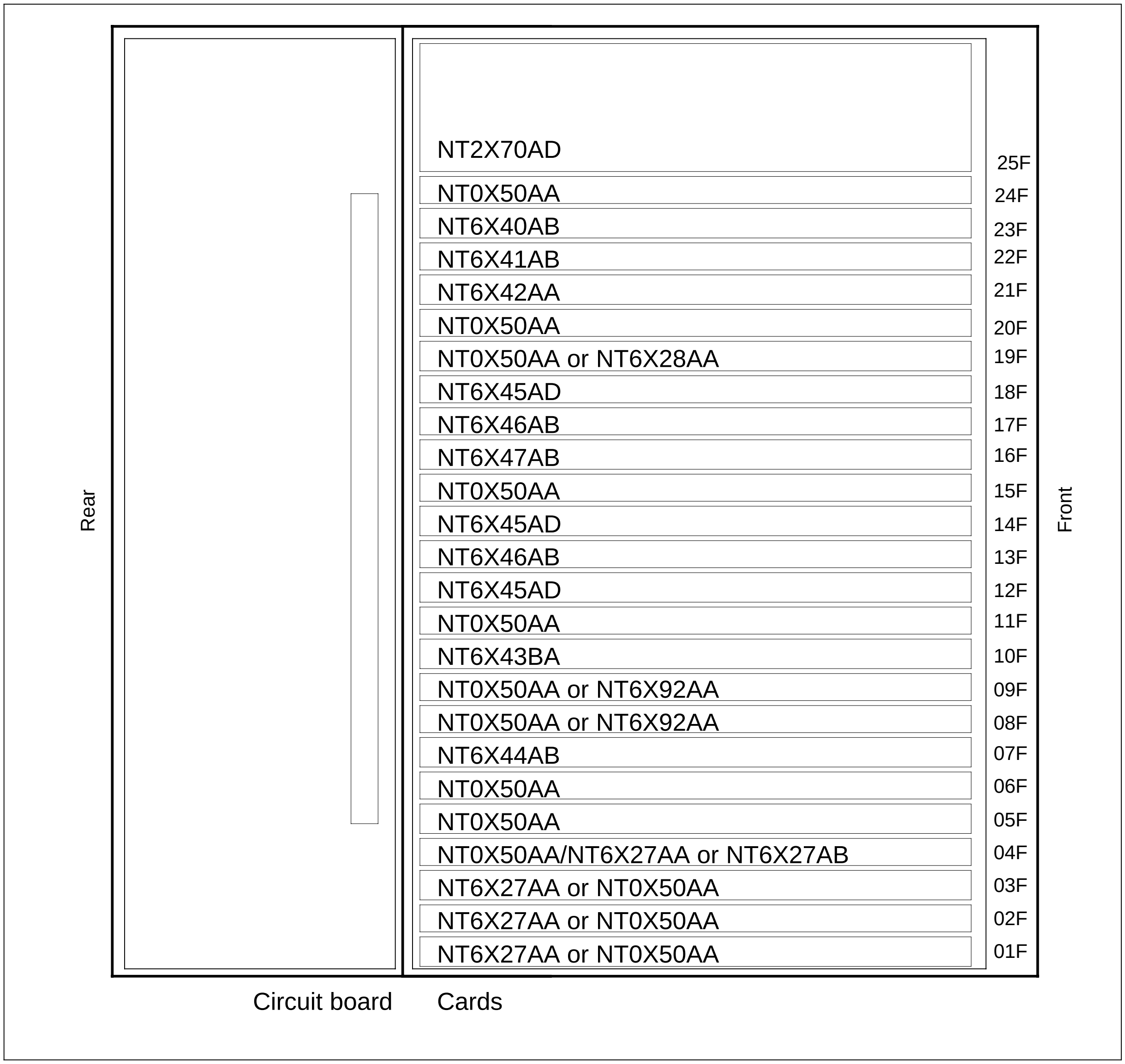
NT6X02BA (continued)

NT6X02BA parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X45AD	8F, 12F	*Master processor card* The MP card runs programs that control the operation and maintenance of a peripheral module. The MP card collects digits, assigns channels, and reads messages for the central control complex and peripheral module.
NT6X46BA	11F	*Signaling processor memory card* The SPM card contains RAM for data storage and software application.
NT6X47AB	9F,10F	*Master processor memory card* The MPM card consists of RAM. The RAM stores data and software application for the MP and SP. The SP uses a memory management unit to access a part of the MP memory.
NT6X50AA	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. Each line trunk controller (LTC) module has access to one to ten cards. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow fault isolation. The card provides local alarm transmission and remote alarm detection. The card provides error condition detection. Three error conditions are loss of synchronization, bipolar error, and slip.
NT6X50AB	1F-5F	*DS-1 interface card* The DS-1 interface card contains two DS-1 ports. Each LTC module has access to one to ten cards. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow fault isolation. The card provides local alarm transmission and remote alarm detection. The card provides error condition detection. Three error conditions are loss of synchronization, bipolar error, and slip.

NT6X02BA (end)

NT6X02BA parts



NT6X02BK

Product Description

The NT6X02BK international line group controller (ILGC) shelf provides an interface. The interface is between Central-side (C-side) DS30 links to the network and pulse code modulation (PCM)30 links to auxiliary peripheral modules (PM). The ILGC shelf is like the North American version of the LGC. The ILGC is different from the LGC because the ILGC uses the NT6X43BA international messaging card and firmware. The ILGC supports DS30 diagnostics instead of DS-1 diagnostics. The ILGC uses the Turkish dialing plan digit analysis logic. The ILGC shelf has two units. One unit is active and provides the necessary processing and control functions. The second unit is in standby mode. The second unit can take over call processing if a fault occurs in the active unit. Each unit has a control complex (CC). Only one CC is active at a time and provides control for both units. The ILGC shelves are in the NT6X01BA international common peripheral equipment (ICPCE) frame.

The ILGC shelf has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each of these DS30 interface cards can handle a maximum of eight DS30 ports. Link assignments are distributed over the four DS30 cards. Even-numbered links connect to plane 0 of the network, and the odd-numbered links connect to plane 1. Correct interface with the network module (NM) and the CC requires a minimum of three link pairs.

Each DS30 card in the ILGC shelf powers 256 (8×32) channels for each plane to formatter cards in units 0 and 1. Each formatter handles a maximum of 512 channels for each plane. Each formatter handles of 256 channels from each unit. The network planes are combined in the formatter. A plane is available for each channel. The 512 speech channels are added to the 128 internal service channels. The channels are converted to a 640-channel bus to the control complex.

The ILGC shelf uses PCM30 interface cards or filler faceplates for slots 1 through 4. Slots 5 and 6 use filler faceplates. Slot 7 uses the NT6X44AB time switch (TS) card. Slots 8 and 9 use universal tone receiver (UTR) cards. Slot 10 uses the NT6X43BA messaging card.

Parts

The NT6X02BK contains the following components:

- NT0X50AA-Filler faceplate or panel.
- NT2X70AE-Power converter.
- NT3X90AC-Device controller cooling inverter unit.
- NT6X27AA-PCM30 interface card.

NT6X02BK (continued)

- NT6X27AB-PCM30 interface card.
- NT6X40AC-DS30 network interface (NI) card.
- NT6X41AB-Speech bus formatter.
- NT6X42AA-Channel supervision message (CSM).
- NT6X43BA-Messaging card.
- NT6X44AB-TS card.
- NT6X45AD-Master processor (MP) card.
- NT6X46BA-Signaling processor memory (SPM) card.
- NT6X47AB-Master processor memory (MPM) card.
- NT6X92CA-UTR.

Design

The following table describes the design of the NT6X02BK.

NT6X02BK parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-3F, 5F, 6F, 8F, 9F, 11F, 15F, 19F, 20F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the Circuit packs (CP) fills. Each fill has a maximum of five spare card slots. Slots 15, 16, and 17 have access to the SP address and parallel speech bus. Slots 13 and 19 do not have access to the SP address and parallel speech bus.
NT2X70AE	25F	*Power converter* The power converter converts the -48 V dc to the lower voltages that the circuit cards in the fill require. Each power converter supplies +5 V and 12 V for the cards in the fill. The power converter provides power to the DS-1 CP to prevent the loss of cards during a power failure. These cards are cards that do not have copies.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02BK (continued)

NT6X02BK parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X27AA	1F-4F	*PCM30 interface card* The PCM30 interface card provides an interface between an NT6X02 common peripheral controller (CPC) and European-standard PCM30 trunk transmission equipment. The PCM30 interface card translates PCM voice signals and signaling data. The card provides translation between two 32-channel, 2.048 Mbps external PCM30 trunk circuits and one 64-channel, 5.12 Mbps duplicated port in the CPC. The card receives data streams from the four-wire PCM trunk transmission equipment. The PCM30 converts the high-density bipolar 3 (HDB3) data to a DS30 format. The conversion is for transmission to the DS-60 TS card. The card receives PCM30 data from the TS card. The card converts the data to an HDB3 format for transmission to the trunk transmission equipment. A looparound function is available for test purposes.
NT6X27AB	4F	*PCM30 interface card* The PCM30 interface card provides an interface between an NT6X02 CPC and European-standard PCM30 trunk transmission equipment. The PCM30 interface card translates PCM voice signals and signaling data. The PCM30 translates PCM signals and data between two 32-channel, 2.048 Mbps external PCM30 trunk circuits and one 64-channel, 5.12 Mbps duplicated port in the CPC. The card receives data streams from the four-wire PCM trunk transmission equipment. The PCM30 converts the high-density bipolar 3 (HDB3) data to a DS30 format. The conversion is for transmission to the DS-60 TS card. The card receives PCM30 data from the TS card. This card converts the data to an HDB3 format for transmission to the trunk transmission equipment. A looparound function is available for test purposes.
NT6X40AC	23F	*DS30 network interface circuit pack* The DS30 NI card is available in two versions. The versions are the NT6X40AA with eight ports and NT6X40AC with 16 ports. The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port of a DS30 NI card contains a looparound circuit for fault isolation.

NT6X02BK (continued)

NT6X02BK parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X41AB	22F	*Speech bus formatter* The speech bus formatter card has two sections. The sections are the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the encoded voice signals. The voice signals were received from the CSM interface card and go to the C-side links. The speech bus formatter provides serial-to-parallel conversion of the encoded voice signals received from the C-side interface cards. The formatter provides network plane selection, parity error generation for test purposes and T1 clock generation.
NT6X42AA	21F	*Channel supervision message circuit pack* The CSM CP extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM CP inserts the CSM into the outgoing C-side bytes. The CSM CP performs parity checking on all incoming bytes and parity generation on all outgoing bytes.
NT6X43BA	10	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module (CM).
NT6X44AB	7F	*Time switch* The TS converts between the serial stream and the parallel stream that is for use on the internal speech bus. The serial stream is received from or transmitted to the DS30 interface card or DS-1 interface card. When SP controls the TS, the TS associates any DS30 interface card with any time slot on the parallel speech bus. When the SP controls the TS, the TS associates DS30 cards with DS-1 interface cards. The TS transfers data between the associated channel and the time slot.
NT6X45AD	12F, 14F, 18F	*Master processor card* The MP card runs the programs that control the operation and maintenance of a PM. The MP card collects digits. The card assigns channels and describes messages for the central control complex and PM.

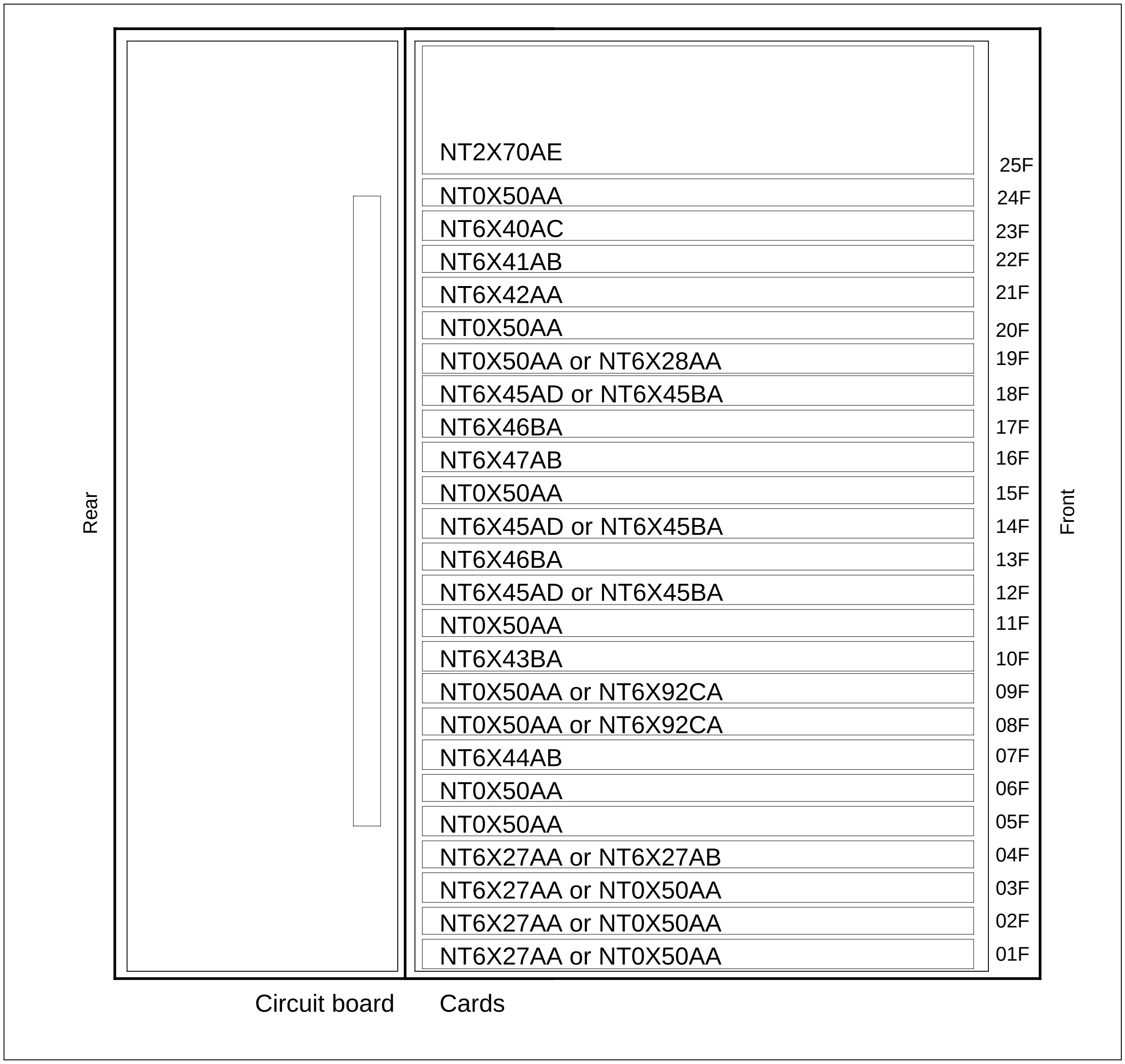
NT6X02BK (continued)

NT6X02BK parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X46BA	13F, 17F	*Signaling processor memory card* The SPM card contains RAM to store data and software applications.
NT6X47AB	16F	*Master processor memory card* The MPM card contains RAM to store data and software applications for the MP and the SP. The SP can use memory management unit to access a part of the MP memory.
NT6X92CA	8F, 9F	*Universal tone receiver* The UTR is a 32-channel tone receiver that detects tones like dual-tone multifrequency (DTMF) and multifrequency (MF). The TS switches tone samples to the parallel speech bus. The UTR collects the tone samples at appropriate time slots. The UTR analyzes the samples and identifies the tones. The results are sent to the SP.

NT6X02BK (end)

NT6X02BK parts



NT6X02CA

Product Description

The subscriber module remote (SMR) shelf provides a digital interface to remote control terminals. The remote control terminals are in a digital loop carrier system know as the subscriber loop concentrator (SLC). Business and residential applications can use the SMR shelf.

When integrated in the DMS-100 switch, the DMS-1 rural remote terminal becomes the remote concentrator terminal (RCT). This integrated configuration provides subscribers with the full digital resources of the DMS-100 switch. The SMR does not require separate control terminal (CT) cards. The SMR reduces main distribution frame (MDF) wiring and activity and saves office space. The CT only serves one remote terminal (RT). The SMR shelf serves multiple RCT modules.

The SMR shelf has two units. One unit is active and provides the required processing and control functions. The second unit is in standby mode and can take over call processing if the active unit develops a fault. The SMR replaces two line cards and one multiplexer to reduce the cost of the subscriber carrier.

Each RCT has a maximum of 8 digroups that provide DS-1 links to the SMR. Each digroup contains 24 pulse code modulation (PCM) channels. The time-division multiplex (TDM) assembles the PCM channels. A total of 192 channels are present (8 digroups $\times$ 24 PCM channels), when all digroups are equipped. Each SMR message processor in the RCT uses a separate channel, which leaves a maximum of 190 channels available for traffic.

The SMR and RCT use B words to exchange messages over DS-1 links. The B words have 24 B-bits. The B-words contain the least significant bit from every twelfth frame channel. The B words contain three eight-bit bytes. The function byte instructs the RCT on the type of operation to execute. The function byte instructs the RCT on the type of memory or register to access. The address byte contains the address on which the system runs the operation. The RCT provides return information for the data byte. The SMR-RCT subsystem uses B words for system control functions. The exchange of alarm and maintenance information and channel assignment are examples system control functions.

The shelf provides an interface for RCTs. The shelf does not provide an interface to any other remote system. A standard DMS-100 single bay frame contains the SMR shelf pairs. This bay is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame contains two pairs of shelves. Each pair of shelves is a module. The lower two shelves are module 0 and the two upper shelves are module 1. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node.

The SMR shelf uses DS-1 interface cards or filler faceplates for slots 1 to 5. Slot 13 uses an A/B interface card and slot 14 uses a time switch (TS) card. Slot 18 uses a messaging card. Slot 19 uses a pad/ring card.

The SMR shelf features protection switching to make sure communication continues between an SMR and RCT. Communication continues if a DS-1 line that connects the SMR and RCT fails. Communication continues if the switch operator puts the line out of service. The RCT or SMR modules can initiate protection switches. The module that detects the fault determines the module that initiates the switch. The switch operator can manually initiate the protection switches.

The SMR modules can provide an interface to the enhanced network (ENET) with copper or fiber speech links. Both configurations require the NT6X69AC card. The SMR connection to the ENET with fiber speech links, requires the following three parts:

- XPM DS-512 link control (NT6X40CA)
- XPM DS-512 link card (NT6X40DA)
- FXPM bracket assembly kit (NT6X02BU)

Parts

The NT6X02CA contains the following parts:

- NT0X50AA-Filler faceplate or panel
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AC-DS30 network interface (NI) card
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CHM)
- NT6X43AA-Messaging card
- NT6X44AB-TS card
- NT6X45AC-Master processor (MP) card
- NT6X45BA-MP card
- NT6X46AB-Signaling processor memory (SPM) card
- NT6X46BA-SPM card
- NT6X47AB-Master processor memory (MPM) card
- NT6X47AC-MPM card

NT6X02CA (continued)

- NT6X50AA-DS-1 interface card
- NT6X78AA-CLASS modem resource (CMR) card
- NT6X80AA-Pad/ring
- NT6X81BA-A/B interface card

Design

The design of the appears in the following table and figure.

NT6X02CA parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf has a maximum of five spare card slots. Slots 15, 16, and 17 have access to the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 cannot access the signaling processor (SP) address bus and the parallel speech bus.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to lower voltages that the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. Power is available to the DS-1 cards to prevent the loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AC	20F	*DS30 network interface card* The DS30 NI card is available in two versions. The versions are NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface and a looparound circuit for fault isolation.
NT6X42AA	20F	*Channel supervision message* The CSM interface card extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM card inserts the CSM in the outgoing C-side bytes. The CSM interface card checks parity on all incoming bytes and generates parity on all outgoing bytes.

NT6X02CA (continued)

NT6X02CA parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card has the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the encoded voice signals received from the CSM interface card. The signals are for the C-side links. The card provides serial-to-parallel conversion of the encoded voice signals from the C-side interface cards. The CSM interface card provides network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X43AA	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module (CM).
NT6X44AA	14F	*Time switch* The TS receives the serial stream from the DS30 interface card or DS-1 interface card. The TS can also send a serial stream to the DS30 interface card or DS-1 interface card. The TS converts between the serial stream or the parallel stream that the internal speech bus uses. When the SP controls the TS, the TS associates DS30 interface cards and DS-1 interface cards with time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs programs that operate and maintain a peripheral module (PM). The MP card collects digits, assigns channels, and interprets messages for the central control complex and peripheral module.
NT6X46AB	11F	*Signaling processor memory card* The SPM card contains RAM to store data and software applications.
NT6X47AB	9F, 10F	*Master processor memory card* The MPM card contains RAM to store data and software applications for the MP and SP. The SP can access part of the MP memory with the SP memory management unit of the SP.

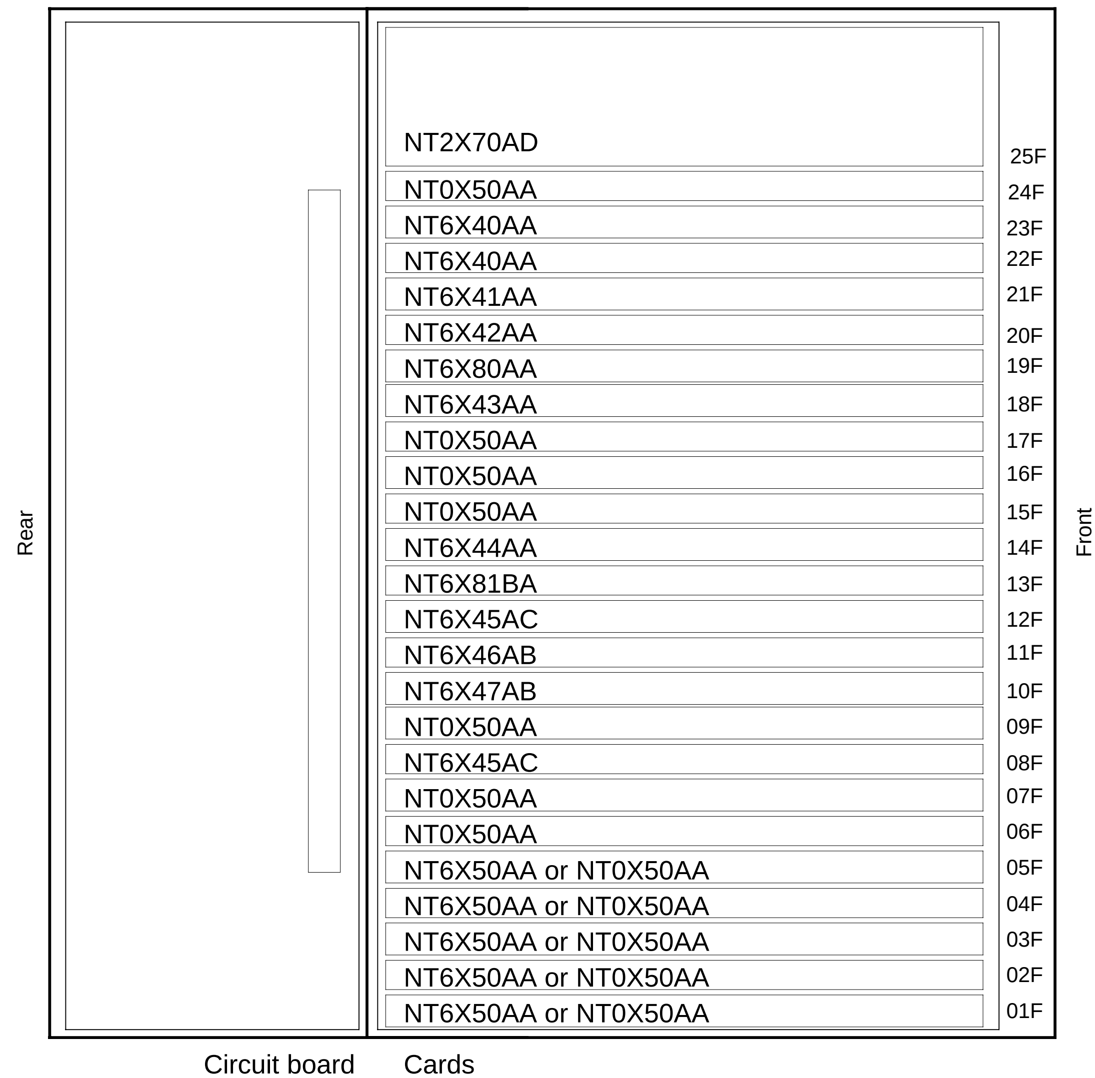
NT6X02CA (continued)

NT6X02CA parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X50AA	1F-5F	*DS-1 Interface card* The DS-1 interface card contains two DS-1 ports. Each SMR module can have 1 to 10 cards. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow fault isolation. The card transmits local alarms and detects remote alarms. The DS-1 card detects error conditions like synchronization loss, bipolar error, and slip.
NT6X80BA	19F	*Pad/ring* The pad/ring card generates ringing frequency instructions with PCM. The TS card switches the frequencies on the DS-1 channels. The DS-1 channels associate with the subscriber loops to ring.
NT6X81AA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. These signaling bits provide each channel with ringing, hook status detection, and ANI and coin functions.

NT6X02CA (end)

NT6X02CA components



NT6X02CC

Product description

The subscriber module remote (SMR) shelf provides a digital interface to remote control terminals. The remote control terminals are in a digital loop carrier system known as the subscriber loop concentrator (SLC). Business and/or residential applications can use the SMR shelf.

The DMS-1 rural remote terminal becomes the remote concentrator terminal (RCT) when the rural remote terminal integrates in the DMS-100 switch. This integrated configuration provides subscribers with the full digital resources of the DMS-100 switch. The SMR does not require separate control terminal (CT) cards. The SMR reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves one remote terminal (RT). The SMR shelf serves multiple RCT modules.

The SMR shelf has two units. One unit is active and provides processing and control functions. The second unit is in standby mode and can take over call processing if the active unit develops a fault. The SMR replaces two line cards and one multiplexer to reduce the cost of the subscriber carrier.

Each RCT has a maximum of 8 digroups. The digroups provide DS-1 links to the SMR. Each digroup contains 24 pulse code modulation (PCM) channels. The time-division multiplex (TDM) assembles the digroups PCM channels. A total of 192 channels are available (8 digroups $\times$ 24 PCM channels) when all digroups are equipped. Each SMR message processor in the RCT uses a separate channel. This condition leaves a maximum of 190 channels available for traffic.

The SMR and RCT use B words to exchange messages over DS-1 links. The B words have 24 B-bits. The B-words contain the least significant bit from every twelfth frame channel. Three eight-bit bytes make B words. The function byte instructs the RCT on the type of operation to execute. The function byte instructs the RCT on the type of memory or register to access. The address byte contains the address on which the system runs the operation. The RCT provides return information for the data byte. The SMR-RCT subsystem uses B words for system control functions.

The shelf provides an interface for RCTs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame contains the SMR shelf pairs. This bay is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame contains two pairs of shelves. Each pair is a module. The two lower shelves are module 0 and the two upper shelves are module 1. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node .

The SMR shelf uses DS-1 interface cards or filler faceplates for slots 1 to 5. Slot 13 uses an A/B interface card, and slot 14 uses a time switch (TS) card. Slot 18 uses a messaging card. Slot 19 uses a pad/ring card.

The SMR shelf features protection switching to make sure communication continues between an SMR and an RCT. Communication continues if a DS-1 line that connects the SMR and RCT fails. Communication continues if the switch operator puts the line out of service. The RCT or SMR can initiate protection switches. The module that detects the fault determines the modules that initiates the switch. The switch operator can initiate the switch manually.

The SMR modules can provide an interface to the enhanced network (ENET) with copper or fiber speech links. Both configurations require the NT6X69AC card. The SMR connection to the ENET that uses fiber speech links, requires the following three parts:

- XPM DS-512 link control (NT6X40CA)
- XPM DS-512 link card (NT6X40DA)
- FXPM bracket assembly kit (NT6X02BU)

Parts

The subscriber module remote shelf contains the following parts:

- NT0X50AA-Filler faceplate
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM)
- NT6X43AA-Messaging card
- NT6X44AB-TS card
- NT6X45AF-Master processor (MP) card
- NT6X46BA-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) card
- NT6X50AA-DS-1 interface card
- NT6X80AA-Pad/ring
- NT6X81BA-A/B interface card

NT6X02CC (continued)

Design

The design of the NT6X02CC appears in the following table and figure.

NT6X02CC parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf has a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 cannot access the SP address bus and the parallel speech bus.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. Power is available to the DS-1 cards to prevent the loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card has the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the encoded voice signals. The CSM interface card provides the signals for the C-side links. The card provides serial-to-parallel conversion of the encoded voice signals from the C-side interface cards. The CSM interface card provides network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message* The CSM interface card extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM interface card inserts the CSM into the outgoing C-side bytes. The card checks the parity of all incoming bytes and generates parity for all outgoing bytes.
NT6X43AA	18F	*Messaging card* The messaging card provides an interface for the parallel speech bus and extracts control messages. The control module (CM) sends messages to channel zero.

NT6X02CC (continued)

NT6X02CC parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X44AB	14F	*Time switch* The TS receives the serial stream from the DS30 interface card or DS-1 interface card. The TS can also send a serial stream to the DS30 interface card or DS-1 interface card. The TS converts between the serial stream and the parallel stream that the internal speech bus uses. When the SP controls the TS, the TS associates DS30 interface cards and DS-1 interface cards with the time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AF	8F, 12F	*Master processor card* The MP card runs programs that operate and maintain a peripheral module (PM). The MP card collects digits, assigns channels and interprets messages for the central control complex and peripheral module.
NT6X46BA	11F	*Signaling processor memory card* The SPM card contains RAM for data storage and software applications.
NT6X47AB	9F, 10F	*Master processor memory card* The MPM card contains RAM to store data and software applications for the MP and SP. The SP can access part of the MP memory with the SP memory management unit.
NT6X50AA	1F-5F	*DS-1 Interface card* The DS-1 interface card contains two DS-1 ports. Each SMR module can have 1 to 10 cards. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow fault isolation. The card transmits local alarms and detects remote alarms. The DS-1 card detects error conditions like synchronization loss, bipolar error, and slip.

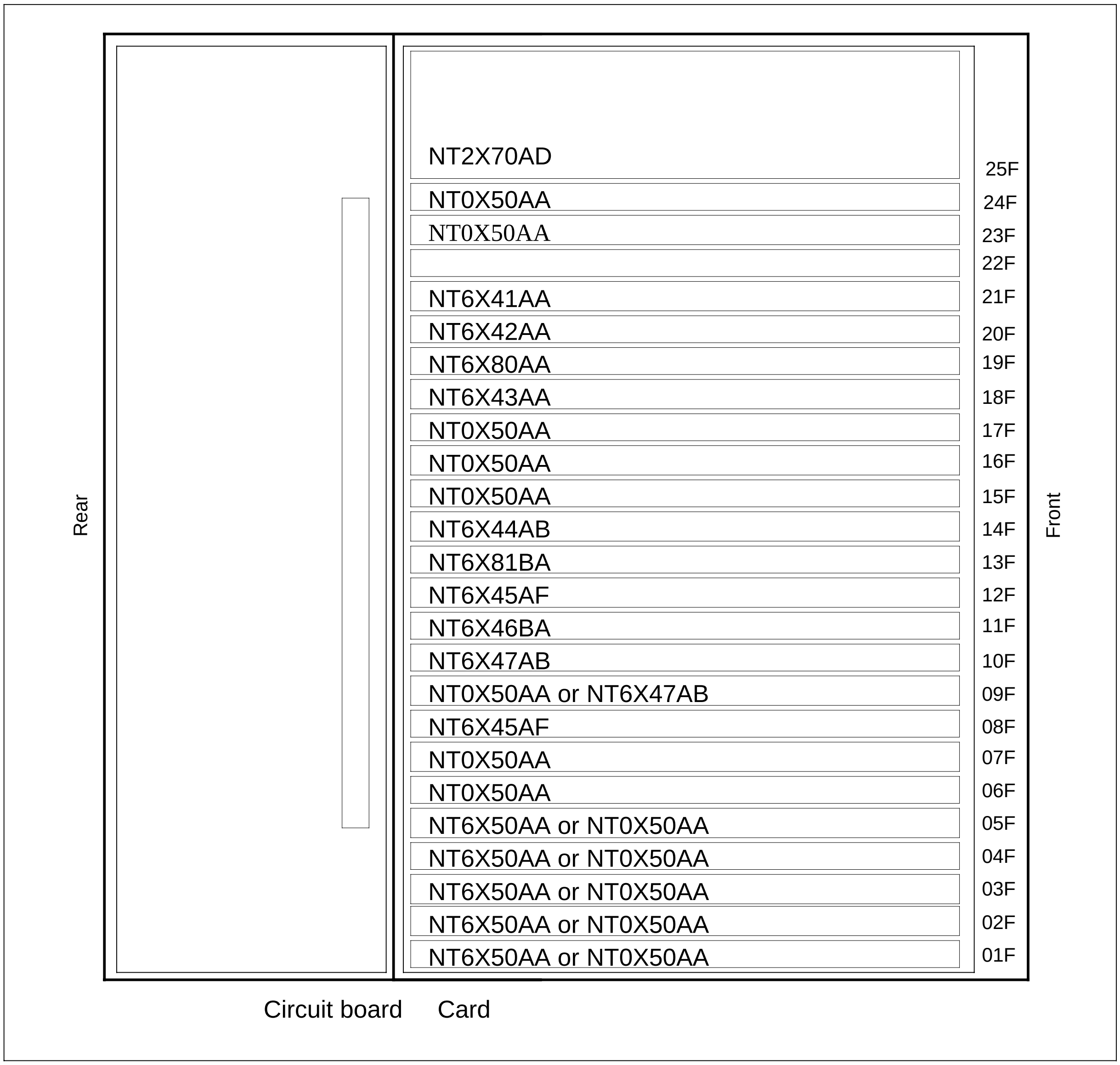
NT6X02CC (continued)

NT6X02CC parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X80AA	19F	*Pad/ring* The pad/ring card generates ringing frequency instructions with PCM. The TS card switches the frequencies on the DS-1 channels. The DS-1 channels associate with the subscriber loops to ring.
NT6X81BA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. These signaling bits provide each channel with ringing, hook status detection, and ANI and coin functions.

NT6X02CC (end)

NT6X02CC parts



NT6X02CD

Product description

The NT6X02CD line trunk controller (LTC) common circuit pack (CP) fill provides an interface. The NT6X02CD provides an interface between central-side (C-side) DS30 links to the network and peripheral-side (P-side) DS30A links and/or DS-1 links to subsidiary peripheral modules. The LTC has two units. One unit is active and provides processing and control functions. The second unit is in standby mode and can take over call processing if the active unit develops a fault. Each unit has a control complex (CC). Only one CC is active at a time and can control both units. The NT6X01AA subscriber module equipment (SME) frame contains the LTC common CPs.

The LTC has C-side interface. The C-side ports can support a maximum of 16 pairs of DS30 links to the network. Four DS30 interface cards support the C-side links. Each DS30 interface card can handle a maximum of eight DS30 ports. The four DS30 cards contain the distributed link assignments. The even-numbered links connect to plane 0 of the network. The odd-numbered links connect to plane 1. Interface with the network module (NM) and the CC requires a minimum of three link pairs.

Each DS30 card in the LTC powers 256 (8 x 32) channels to the formatter cards in units 0 and 1. The channels are in each plane. Each formatter handles 512 channels. Each unit provides 256 channels in each plane. The two network planes are combined in the formatter. The system selects one plane or the other for each channel. The 512 speech channels are added to the 128 internal service channels. The system converts the channels to a 640-channel bus to the control complex.

The LTC uses DS-1 interface CPs or filler faceplates for slots 1 to 5. Slots 6 and 7 use DS30A line concentrating module (LCM) interface cards or filler faceplates. Slot 18 uses the NT6X43AA messaging interface CP.

Parts

The LTC common CP fill contains of the following parts:

- NT0X50AA-filler faceplate or panel
- NT2X70AB-power converter
- NT3X90AC-device controller cooling inverter unit
- NT6X40AA-DS30 network interface (NI) card
- NT6X41AA-speech bus formatter
- NT6X42AA-channel supervision message (CSM) CP
- NT6X43AA-messaging interface CP

- NT6X44AA-time switch (TS) CP
- NT6X45AA-LTC processor card
- NT6X46AA-signaling processor memory (SPM) card
- NT6X47AA-master processor memory (MPM) CP
- NT6X48AA-DS30A LCM interface CP
- NT6X50AA-DS-1 interface CP
- NT6X70AA-continuity tone detector CP

Design

The design of the NT6X02CD appears in the following table and figure.

NT6X02CD parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 13F, 15F-17F, 19F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the CP shelves. Each shelf has a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 cannot access the signaling processor (SP) address bus and the parallel speech bus.
NT2X70AB	25F	*Power converter* The power converter converts the -48V (dc) to the lower voltages that the circuit cards in the CP fill require. Each power converter supplies +5V and 12V for the cards on the CP fill. Power is available to the DS-1 cards to prevent the loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced-air cooling.
NT6X40AA	22F, 23F	*DS30 network interface card* The DS30 network interface card is available in two versions. The two versions are NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 network interface card provides a two-way voice and data interface. Each port contains a looparound circuit for fault isolation.

NT6X02CD (continued)

NT6X02CD parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card has the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section provides parallel-to-serial conversion of the encoded voice signals from the CSM interface card. The CSM interface card provides the signals for the C-side links. The card provides serial-to-parallel conversion of the encoded voice signals from the C-side interface cards. The CSM interface card provides network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message CP* The CSM interface card extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM interface card inserts the CSM into the outgoing C-side bytes. The CSM CP performs parity checks on all incoming bytes and generates parity on all outgoing bytes.
NT6X43AA	18F	*Messaging interface CP* The messaging interface CP provides interface for the parallel speech bus and extracts control messages. The control module (CM) sends control messages to channel zero.
NT6X44AA	14F	*Time switch* The TS receives the serial stream from the DS30 interface card or DS-1 interface card. The TS can also send a serial stream to the DS30 interface card or DS-1 interface card. The TS converts between the serial stream and the parallel stream. When the XMS-based peripheral module (XPM) controls the TS, the TS associates the following interface CPs with the time slots: • DS30 • DS30A LCM • DS-1 The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.

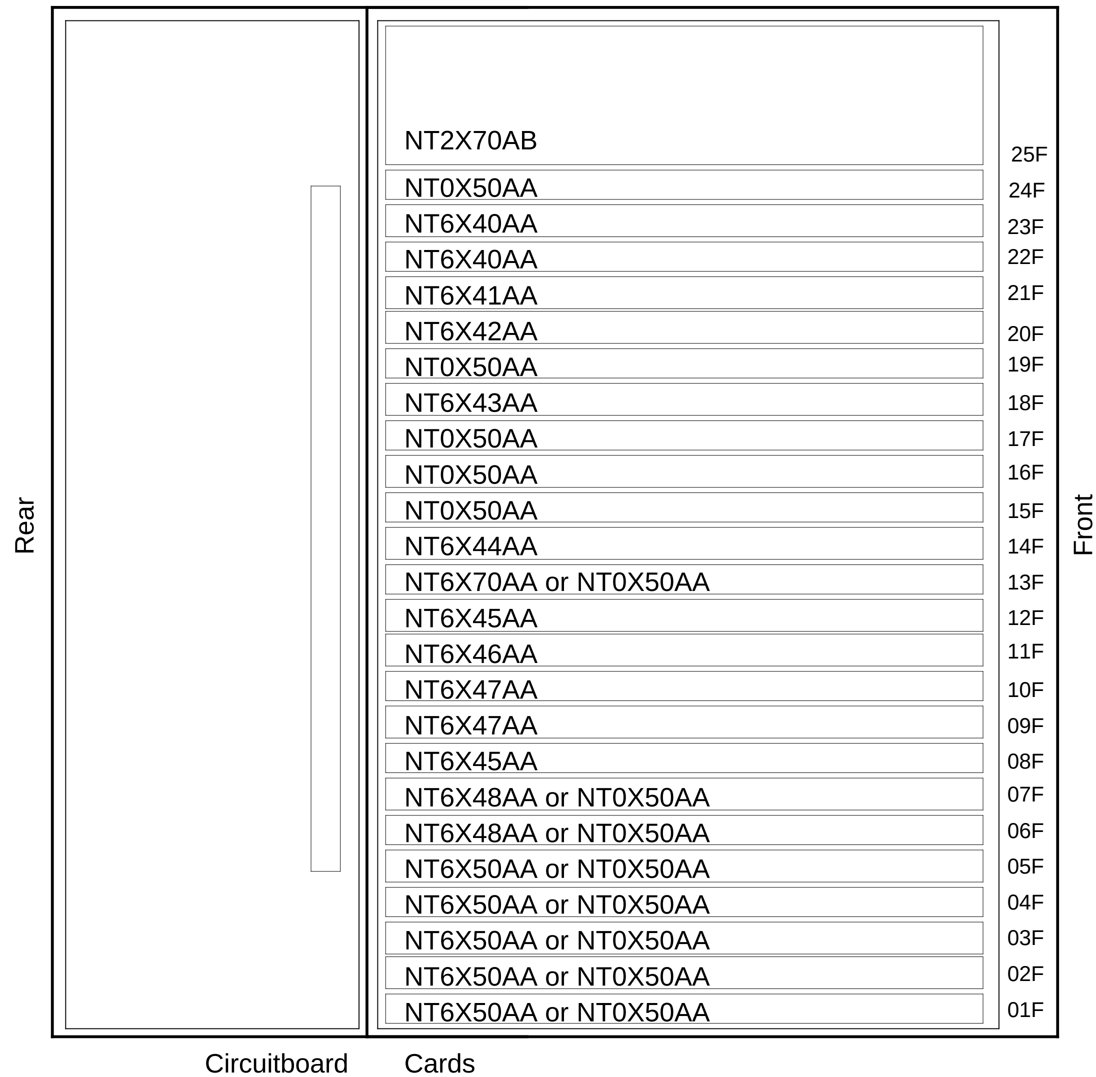
NT6X02CD (continued)

NT6X02CD parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X45AA	8F, 12F	*Line trunk controller processor* The LTC processor runs programs that operate and maintain a peripheral module. The LTC processor collects digits, assigns channels, and interprets messages for the central control complex and peripheral module.
NT6X46AA	11F	*Signaling processor memory card* The SPM card contains RAM for data storage and software applications.
NT6X47AA	9F, 10F	*Master processor memory CP* The MPM CP contains RAM to store data and software applications for the master processor and XPM processor CP. The SP can access part of the MPM with the SP memory management unit.
NT6X48AA	6F, 7F	*DS30A line concentrating module interface CP* The DS30A LCM interface CP contains ten separate ports. Each port provides a two-way voice and data interface. Each port carries a 32-channel, 2.56-Mb/s bit stream. Each DS30A port contains a looparound circuit for fault isolation.
NT6X50AA	1F-5F	*DS-1 interface CP* The DS-1 interface CP contains two DS-1 ports. Each LTC common CP fill contains 1-10 cards Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to isolate faults. The card transmits local alarms and detects remote alarms. The DS-1 card detects error conditions like synchronization loss, bipolar error, and slip.
NT6X70AA	13F	*Continuity tone detector CP* The continuity tone detector CP detects tones used in call processing. The continuity tone detects and checks the continuity of the voice/data path between LTCs. The continuity tone detector CP monitors and records the frequency and level of the tones. The continuity tone detector CP retains this data. The XPM processor CP in the LTC uses this data.

NT6X02CD (end)

NT6X02CD parts



NT6X02CP

Product description

The subscriber module remote (SMR) shelf provides a digital interface to remote control terminals. The remote control terminals are in a digital loop carrier system known as the subscriber loop concentrator (SLC). Business and/or residential applications can use the SMR shelf.

When integrated in the DMS-100 switch, the DMS-1 rural remote terminal becomes the remote concentrator terminal (RCT). This integrated configuration provides subscribers with the full digital resources of the DMS-100 switch. The SMR does not require separate control terminal (CT) cards. The SMR reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves one remote terminal (RT). The SMR shelf serves multiple RCT module.

The SMR shelf has two units. One unit is active and provides the processing and control functions. The second unit is in standby mode and can take over call processing if the active unit develops a fault. The SMR replaces two line cards and one multiplexer to reduce the cost of the subscriber carrier.

Each RCT has a maximum of 8 digroups that provide DS-1 links to the SMR. Each digroup contains 24 pulse code modulation (PCM) channels. The time-division multiplex (TDM) assembles the PCM channels. A total of 192 channels are available (8 digroups $\times$ 24 PCM channels) when all digroups are equipped. Each SMR message processor in the RCT uses a separate channel. This condition leaves a maximum of 190 channels available for traffic.

The SMR and RCT exchange messages over DS-1 links with B words. The B words contain 24 B-bits. The B words contain the least significant bit from every twelfth frame channel. The B words contain three eight-bit bytes. The function byte instructs the RCT on the type of operation to execute. The function byte instructs the RCT on the type of memory or register to access. The address byte contains the address on which the system runs the operation. The RCT provides return information for the databyte. The SMR-RCT subsystem uses the B words for system control functions. The exchange of alarm and maintenance information and channel assignment are system control functions.

The shelf provides an interface for RCTs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame contains the SMR shelf pairs. This bay frame is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame has two pairs of shelves. Each shelf pair is a module. The lower two shelves module 0 and the two upper shelves are module 1. Each node has an assigned DS-1 link. The node is a line appearance on a digital trunk (LDT) node.

NT6X02CP (continued)

The SMR shelf uses DS-1 interface cards or filler faceplates for slots 1 to 5. Slot 13 uses an A/B interface card and slot 14 uses a time switch (TS) card. Slot 18 uses a messaging card, and slot 19 uses a pad/ring card.

The SMR shelf features protection switching to make sure communication continues between an SMR and an RCT. Communication continues between an SMR and RCT if a DS-1 line that connects the SMR and RCT fails. Communication continues if the switch operator puts the line out of service. The RCT or SMR can initiate the protection switches. The module that detects the fault determines the module that initiates the switch. The switch operator can manually initiate protection switches.

The SMR modules can provide an interface to the enhanced network (ENET) with copper or fiber speech links. Both configurations require the NT6X69AC card. The SMR connection to the ENET that uses fiber speech links, requires the following three parts:

- XPM DS-512 link control (NT6X40CA)
- XPM DS-512 link card (NT6X40DA)
- FXPM bracket assembly kit (NT6X02BU)

Parts

The SMR shelf contains the following parts:

- NT0X50AA-Filler faceplate or panel
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message (CSM) card
- NT6X43AA-Messaging card
- NT6X44AA-TS card
- NT6X45AC-Master processor (MP) card
- NT6X46AB-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) card
- NT6X50AA-DS-1 interface card
- NT6X80BA-Pad/ring
- NT6X81AA-A/B interface card

NT6X02CP (continued)

Design

The design of the NT6X02CP appears in the following table and figure.

NT6X02CP parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf has a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 cannot access the signaling processor (SP) address bus and the parallel speech bus.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. Power to the DS-1 cards is available to prevent the loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card has the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section provides parallel-to-serial conversion of the encoded voice signals from the CSM interface card. The CSM interface card provides the signals for the C-side links. The CSM interface card provides serial-to-parallel conversion of the encoded voice signals from the C-side interface cards. The CSM interface card provides network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message* The CSM interface card extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM interface card inserts the CSM into the outgoing C-side bytes. The CSM interface card checks parity on all incoming bytes and generates parity on all outgoing bytes.

NT6X02CP (continued)

NT6X02CP parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X43AA	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received from the control module (CM) on channel zero.
NT6X44AA	14F	*Time switch* The TS receives the serial stream from the DS30 interface card or DS-1 interface card. The TS can also send a serial stream to the DS30 interface card or the DS-1 interface card. The TS converts between the serial stream and the parallel stream that the internal speech bus uses. When the SP controls the TS, the TS associates DS30 interface cards and DS-1 interface cards with time slots. The time slots are on the parallel speech bus. When the SP controls the TS, the TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs programs that operate and maintain a peripheral module. The MP card collects digits, assigns channels, and interprets messages for the central control complex and peripheral module.
NT6X46AB	11F	*Signaling processor memory card* The SPM card contains RAM for data storage and software applications.
NT6X47AB	9F	*Master processor memory card* The MPM card contains RAM to store data and software applications for the MP and the SP. The SP can access part of the MP memory with the SP memory management unit.
NT6X50AA	1F-5F	*DS-1 Interface card* The DS-1 interface card has two DS-1 ports. Each SMR module can contain one to ten cards. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for DS-1 ports to isolate faults. The card transmits local alarms and detects remote alarms. The card can detect error conditions like synchronization loss, bipolar error, and slip.

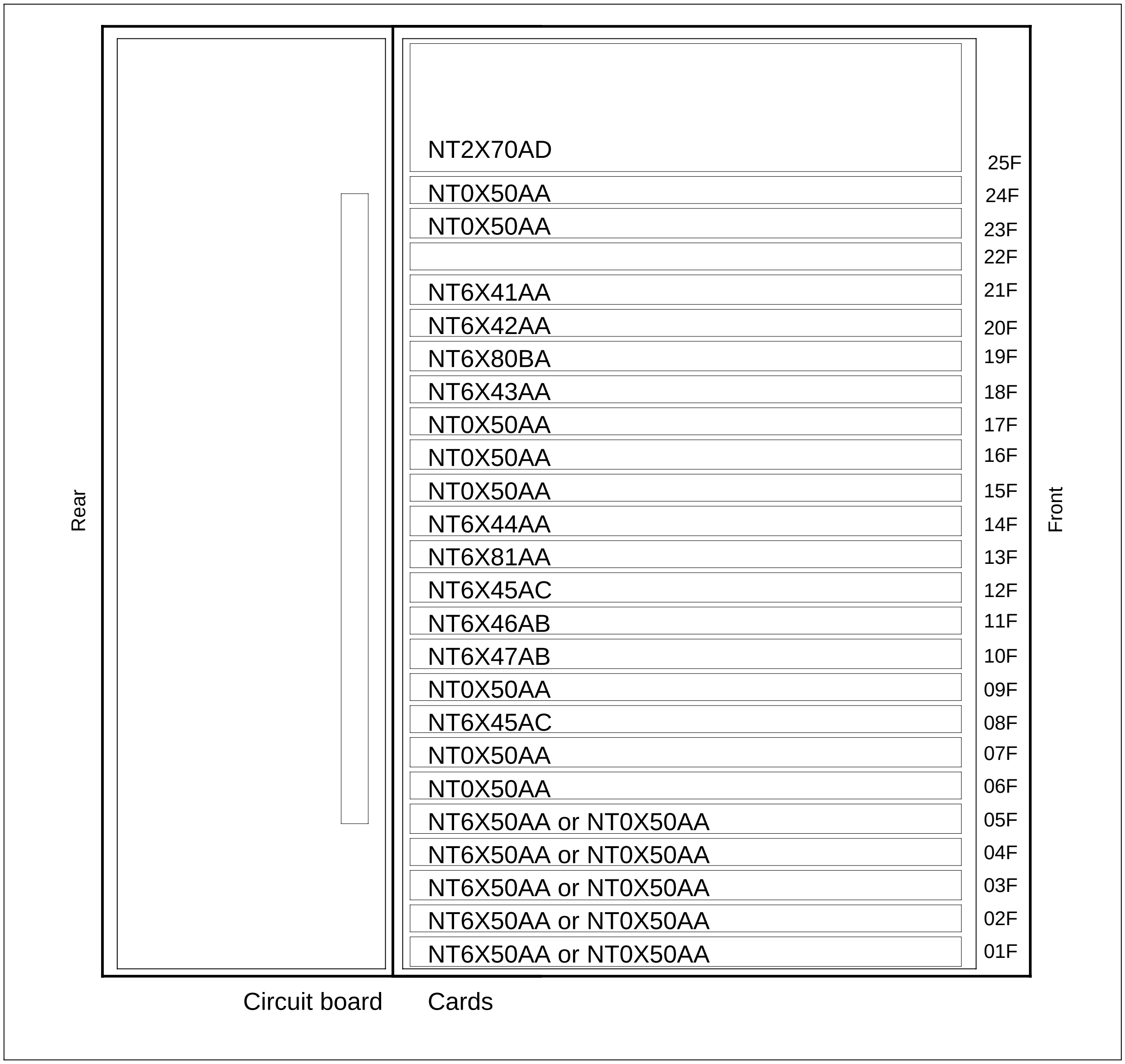
NT6X02CP (continued)

NT6X02CP parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X80BA	19F	*Pad/ring* The pad/ring card generates ringing frequency instructions with PCM. The TS card switches the frequencies to the DS-1 channels. The DS-1 channels associate with subscriber loops to ring.
NT6X81AA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. The signaling bits for each channel are used for ringing, hook status detection, and ANI and coin functions.

NT6X02CP (end)

NT6X02CP parts



NT6X02CQ

Description

The subscriber module remote (SMR) shelf provides a digital interface to remote control terminals in a digital loop carrier system. The digital loop carrier system is the subscriber loop concentrator (SLC). Business and/or residential applications can use the SMR shelf.

When integrated in the DMS-100 switch, the DMS-1 rural remote terminal becomes the remote concentrator terminal (RCT). This integrated configuration provides subscribers with the full digital resources of the DMS-100 switch. The SMR does not require separate control (CT) cards. The SMR shelf reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves one remote terminal (RT) and the SMR shelf serves more than one RCT module.

The SMR shelf has two units. One unit is active and provides processing and control functions. The second unit is in standby mode and can take over call processing if the active unit develops a fault. The SMR replaces two line cards and one multiplexer to reduce the cost of the subscriber carrier.

Each RCT has a maximum of 8 digroups that provide DS-1 links to the SMR. Each digroup contains 24 pulse-code-modulation (PCM) channels that the time-division multiplex (TDM) assembles. There are 192 channels available (eight digroups × 24 PCM channels) when all digroups are equipped. Each SMR message processor in the RCT uses a separate channel, which leaves a maximum of 190 channels available for traffic.

The SMR and RCT use B words to exchange messages over DS-1 links. The B words contain 24 B-bits. The B words consist of B-Bits, the least significant bit from every twelfth frame channel. The B-words contain three eight-bit bytes. The function byte instructs the RCT on the operation to execute. The function byte instructs the RCT on the memory or register to access. The address byte contains the address where the system runs the operation. The RCT provides return information from the data byte. The SMR-RCT subsystem uses B words for system control functions. The exchange of alarm and maintenance information and channel assignment are examples of system control functions.

The shelf provides an interface for RCTs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame contains the SMR shelf pairs. This bay is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame has two pairs of shelves. Each pair of shelves is a module. The lower two shelves are module zero and the two upper shelves are module one. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node.

NT6X02CQ (continued)

The SMR shelf uses DS-1 interface cards or filler faceplates for slots one through five. Slot 13 uses an A/B interface card. Slot 14 uses a time switch (TS) card. Slot 18 uses a messaging card. Slot 19 uses a pad/ring card.

The SMR shelf features protection switching to make sure communication continues between an SMR and an RCT. Communication continues if a DS-1 line that connects the SMR and the RCT fails. Communication continues if the switch operator puts the line out of service. The RCT or SMR can initiate protection switches. The module that detects the fault initiates the switch. The switch operator can initiate protection switches manually.

The SMR modules can provide an interface to the enhanced network (ENET) using copper or optical fiber speech links. Both configurations require the NT6X69AC card. The SMR connections to the ENET with optical fiber speech links require the following three parts:

- XPM DS-512 link control (NT6X40CA)
- XPM DS-512 link card (NT6X40DA)
- FXPM bracket assembly kit (NT6X02BU)

Parts

The SMR shelf contains the following parts:

- NT0X50AA-Filler faceplate or panel
- NT2X70AD-Power converter
- NT3X90AC-Device controller cooling inverter unit
- NT6X40AC-DS30 network interface card
- NT6X41AA-Speech bus formatter
- NT6X42AA-Channel supervision message
- NT6X43AA-Messaging card
- NT6X44AB-TS card
- NT6X45AC-Master processor (MP) card
- NT6X46AC-Signaling processor memory (SPM) card
- NT6X47AB-Master processor memory (MPM) card
- NT6X50AA-DS-1 interface card
- NT6X78AA-CLASS modem resource (CMR) card
- NT6X80AA-Pad/ring
- NT6X81BA-A/B interface card

Design

The design of the NT6X02CQ appears in the following table and figure.

NT6X02CQ parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf has a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 cannot access the signaling processor (SP) address bus and the parallel speech bus.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. Power to the DS-1 cards is available to prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	20F	*DS30 network interface card* The DS30 network interface card is available in two versions. The two versions are NT6X40AA (eight ports) and NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 network interface card provides a two-way voice and data interface. Each port has a looparound circuit for fault isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card has two sections. The two sections are the clock section and the formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section provides parallel-to-serial conversion of the coded voice signals from the CSM interface card. The CSM interface card provides signals for the C-side links. The card provides serial-to-parallel conversion of the coded voice signals from the C-side interface cards. The CSM interface card provides network plane selection, parity error generation for test purposes, and T1 clock generation.

NT6X02CQ (continued)

NT6X02CQ parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X42AA	20F	*Channel supervision message* The CSM interface card extracts the CSM bit from the C-side channels and assembles the CSM for each channel. The CSM interface card inserts the CSM into the outgoing C-side bytes. The CSM performs parity checks on all incoming bytes and generates parity on all outgoing bytes.
NT6X43AA	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages received on channel zero from the control module (CM).
NT6X44AA	14F	*Time switch* The TS receives the serial stream from the DS30 interface card or DS-1 interface card. The TS can send a serial stream to the DS30 interface card on DS-1 interface card. The TS converts between the serial stream and the parallel stream that the internal speech bus uses. When the TS controls the SP, the TS associates DS30 interface cards and DS-1 interface cards with time slots. The time slots are on the parallel speech bus. The TS transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module. The MP card collects digits, assigns channels, and explains messages for the central control complex and peripheral module.
NT6X46AC	11F	*Signaling processor memory card* The SPM card contains RAM to store data and software applications.
NT6X47AB	9F, 10F	*Master processor memory card* The MPM card contains RAM to store data and software applications for the master processor and the XPM processor CP. The SP can access part of the MPM with the SP memory management unit.

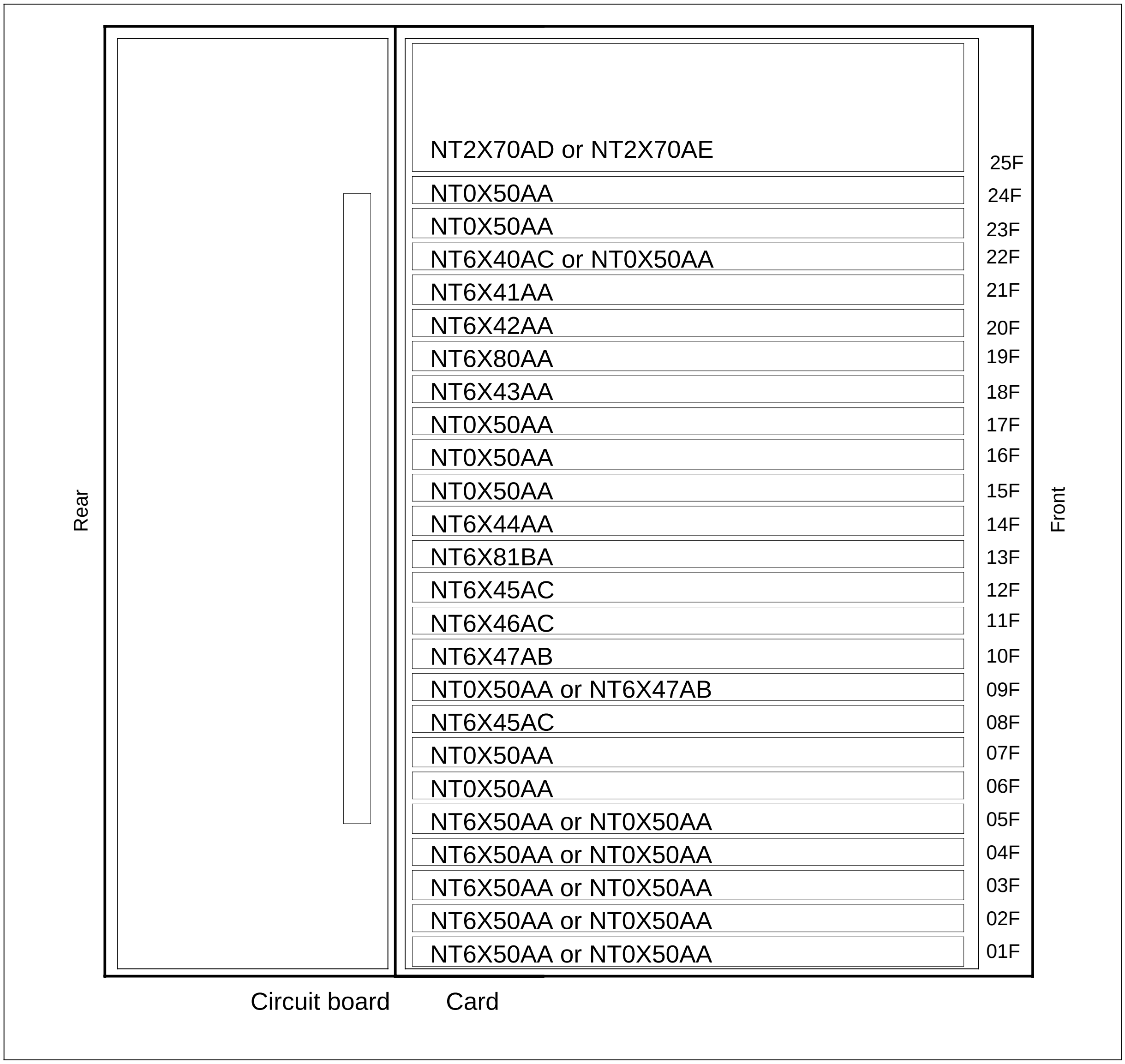
NT6X02CQ (continued)

NT6X02CQ parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X50AA	1F-5F	*DS-1 Interface card* The DS-1 interface card contains two DS-1 ports. Each SMR module contains one to ten cards. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of faults. The card provides transmission of local alarms and the detection of remote alarms. The DS-1 card detects error conditions like synchronization loss, bipolar error, and slip.
NT6X80AA	19F	*Pad/ring* The pad/ring card uses PCM to generate ringing frequency instructions. The TS card switches the frequencies on the DS-1 channels that associate with the subscriber loops to ring.
NT6X81BA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. These signaling bits provide each channel with ringing, hook status detection, and ANI and coin functions.

NT6X02CQ (end)

NT6X02CQ parts



NT6X02CS

Description

The subscriber module remote (SMR) shelf provides a digital interface to remote control terminals in a digital loop carrier system. The digital interface is the subscriber loop concentrator (SLC). Business and residential applications can use the SMR shelf.

When integrated in the DMS-100 switch, the DMS-1 rural remote terminal is the remote concentrator terminal (RCT). This integrated configuration provides subscribers the full digital resources of the DMS-100 switch. The SMR shelf does not require separate control terminal (CT) cards for each subscriber line. The SMR shelf reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves one remote terminal (RT). The SMR shelf can serve multiple RCT modules.

The SMR shelf contains two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode and takes over call processing if a defect occurs in the active unit. The SMR replaces two line cards and one multiplexer and to reduce the cost of the subscriber carrier.

Each RCT contains a maximum of eight digroups. The digroups provide DS-1 links to the SMR. Each digroup contains 24 pulse-code-modulation (PCM) channels assembled by time-division multiplex (TDM). Eight equipped digroups contains a total of 192 available channels (eight digroups × 24 PCM channel). Each of the two SMR message processors in the RCT uses a separate channel. A maximum of 190 channels are available for traffic.

The SMR and RCT use B words to exchange messages though DS-1 links. The B words contains 24 B-bits assembled from the least significant bit of every twelth frame channel. Each B word contains three eight-bit bytes contain B words. The function byte instructs the RCT on the type of operation to run and the type of memory or register to access. The address byte contains the address of the operation to run. The data byte contains return information from the RCT. The SMR-RCT subsystem uses B words for system control functions. These functions include an exchange of alarm and maintenance information and channel assignment.

The shelf provides an interface for RCTs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame contains the SMR shelf pairs. This bay frame is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame contains two pairs of shelves. Each pair of shelves is a module. The lower two shelves contain module 0. The two upper shelves are module 1. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node.

NT6X02CS (continued)

The SMR shelf contains DS-1 interface cards or filler faceplates in slots 1 to 5. Slot 13 contains an A/B interface card. Slot 14 contains a time switch (TS) card. Slot 18 contains a messaging card. Slot 19 contains a pad/ring card.

The SMR shelf has protection switching. To make sure communication continues between an SMR and an RCT. Proction switching makes communication continues if a DS-1 line that connects the SMR and RCT fails. The RCT or SMR can automatically start protection switches. The module that detects the fault starts the protection switch. The switch operator can start a manual protection switch when the operator must put the switch out of service.

The SMR modules provide an interface to the enhanced network (ENET) through copper or optical fiber speech links. Both configurations require the NT6X69AC card. When the SMR connects to the ENET with optical fiber speech links, the SMR requires the following parts:

- the XPM DS-512 link control (NT6X40CA)
- the XPM DS-512 link card (NT6X40DA)
- the FXPM bracket assembly kit (NT6X02BU)

Parts

The SMR shelf contains the following parts:

- the NT0X50AA-Filler faceplate or panel
- the NT2X70AD-Power converter
- the NT3X90AC-Device controller cooling inverter unit
- the NT6X40AA-DS30 network interface (NI) card
- the NT6X41AA-Speech bus formatter
- the NT6X42AA-Channel supervision message (CSM) card
- the NT6X43AA-Messaging card
- the NT6X44AA-TS card
- the NT6X45AC-Master processor (MP) card
- the NT6X46AB-Signaling processor memory (SPM) card
- the NT6X47AB-Master processor memory (MPM) card
- the NT6X50AA-DS-1 interface card
- the NT6X80BA-Pad/ring
- the NT6X81AA-A/B interface card

Design

The design of the NT6X02CS appears in the following table and figure.

NT6X02CS parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf contains a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. The power converters prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	20F	*DS30 network interface card* The DS30 NI card is available in two versions. The two versions are the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit to isolate faults.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains a clock section and a formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of coded voice signals. The CSM interface card sends the voice signals to the C-side links. The formatting section provides serial-to-parallel conversion of coded voice signals from the C-side interface cards, network plane selection, parity error generation for test purposes, and T1 clock generation.

NT6X02CS (continued)

NT6X02CS parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X42AA	20F	*Channel supervision message* The CSM interface card performs several functions: • The card removes the CSM bit from the C-side channels. • The card assembles the CSM for each channel. • The card inserts the CSM in the outgoing C-side bytes. • The card performs parity checking on all incoming bytes. • The card performs parity generation on all outgoing bytes.
NT6X43AA	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card obtains control messages that the control module (CM) sends on channel zero.
NT6X44AA	14F	*Time switch* The timeswitch (TS) converts between a serial stream and a parallel stream. The DS30 interface card or the DS-1 interface card sends and receives the serial stream. The internal speech bus uses the parallel stream. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards. The TS associates the cards with the time slots on the parallel speech bus. The TS also transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module (PM). The MP card collects digits, assigns channels, and interprets messages for the central control complex and PM.
NT6X46AB	11F	*Signaling processor memory card* The SPM card contains RAM storage data and software applications.
NT6X47AB	10F	*Master processor memory card* The MPM card contains RAM storage data and software applications for the MP and the SP. The SP can access a part of the MP memory with the memory management unit of the SP.

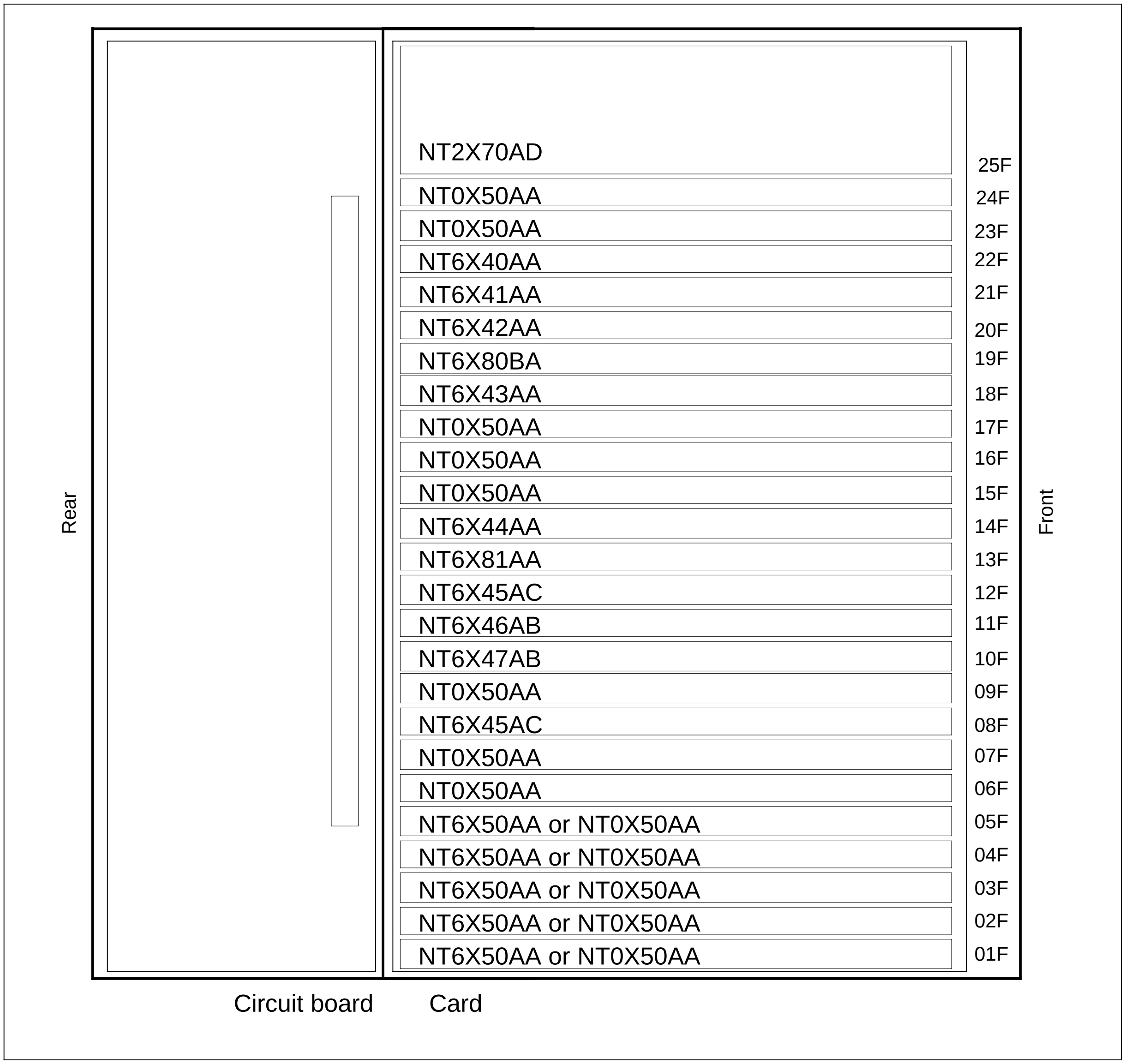
NT6X02CS (continued)

NT6X02CS parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X50AA	1F-5F	*DS-1 Interface card* The DS-1 interface card contains two DS-1 ports. Each SMR module can supply one to ten cards. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to isolate faults. The card transmits local alarms. The card provides also detects remote alarms and error conditions like a loss of synchronization, a bipolar error, and a slip.
NT6X80BA	19F	*Pad/ring* The pad/ring card uses the PCM to generate ringing frequency instructions. The TS card switches the frequencies on the DS-1 channels. These channels are for the subscriber loops to ring.
NT6X81AA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. The signaling bits for each channel to detect ringing and hook status and ANI and coin functions.

NT6X02CS (end)

NT6X02CS parts



NT6X02DA

Description

The subscriber module SLC-96 (SMS) shelf provides a digital interface to remote control terminals in a digital loop carrier system. The digital interface is the subscriber loop concentrator (SLC). Business and residential applications can use the SMS shelf.

When integrated in the DMS-100 switch, the DMS-1 rural remote terminal is the remote concentrator SLC-96 (RCS). This integrated configuration provides subscribers the full digital resources of the DMS-100 switch. The SMS shelf does not require separate control terminal (CT) cards for each subscriber line. The SMS shelf reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves one remote terminal (RT). The SMS shelf can serve multiple RCT modules.

The SMS shelf contains two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode and takes over call processing if a defect occurs in the active unit. The SMS replaces two line cards and one multiplexer and to reduce the cost of the subscriber carrier.

Each RCS contains a maximum of eight digroups. The digroups provide DS-1 links to the SMS. Each digroup contains 24 pulse-code-modulation (PCM) channels assembled by time-division multiplex (TDM). Eight equipped digroups contain a total of 192 available channels (eight digroups $\times$ 24 PCM channels). Each of the two SMS message processors in the RCS use separate channels. A maximum of 190 channels are available for traffic.

The SMS and RDS use words to exchange messages through a derived data link (DDL). The DDL is a 2.2 Kbps data path. The system takes Fs framing bits from SCM superframes. The system replaces the framing bits with DDL bits to form DDL. In the SMS-RCS subsystem, two SCM superframes pass without system changes. The system removes Fs bits from the next four superframes and replaces them with the DDL bits. The DDL link has 24 DDL bits. The system removes the Fs bits from a card in the RCS or the time switch (TS) card in the SMS shelf.

The 8085 microprocessor of the A-bit/B-word DDL card sends DDL messages to the timeswitch (TS). The microprocessor extracts the DDL messages from incoming PCM. The DDL facility software in the signaling processor (SP) processes DDL messages.

The shelf provides an interface for RCSs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame houses the SMS shelf pairs. This bay frame is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame contains two pairs of

NT6X02DA (continued)

shelves. Each pair of shelves is a module. The lower two shelves contain module 0. The two upper shelves contain module 1. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node.

The SMS shelf contains the SLC-96 DS-1 interface cards or filler faceplates in slots 1 to 7. Slot 13 contains an A/B interface card. Slot 14 contains a TS card. Slot 18 contains a messaging card. Slot 19 contains a pad/ring card.

The SMS shelf has protection switching. To make sure communication continues between an SMS and an RCS. Protection switching makes communication continues if a DS-1 line that connects the SMS and RCS fails. The RCS or SMS can automatically start protection switches. The module that detects the fault starts the protection switch. The switch operator can start a manual protection switch when the operator must put the switch out of service.

The SMS modules provide an interface to the enhanced network (ENET) through copper or optical fiber speech links. Both configurations require the NT6X69AC card. When the SMS connects to the ENET with optical fiber speech links, the SMS requires the following parts:

- the XPM DS-512 link control (NT6X40CA)
- the XPM DS-512 link card (NT6X40DA)
- the FXPM bracket assembly kit (NT6X02BU)

Parts

The SMS shelf contains the following parts:

- the NT0X50AA-Filler faceplate
- the NT2X70AE-Power converter
- the NT3X90AC-Device controller cooling inverter unit
- the NT6X40AA-DS30 network interface (NI) card
- the NT6X41AA-Speech bus formatter
- the NT6X42AA-Channel supervision message (CSM) interface card
- the NT6X43AA-Messaging card
- the NT6X44AB-TS card
- the NT6X45AC-Master processor (MP) card
- the NT6X45BA-MP
- the NT6X46AB-Signaling processor memory (SPM) card
- the NT6X47AB-Master processor memory (MPM) card

- the NT6X80AA-Pad/ring
- the NT6X85AA-SLC-96 DS-1 interface card
- the NT6X86AA-A/B interface card

Design

The design of the NT6X02DA appears in the following table and figure.

NT6X02DA parts (Sheet 1 of 3)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf contains a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 do not have access.
NT2X70AE	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. The power converters prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.
NT6X40AA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions. The two versions are the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit to isolate faults.

NT6X02DA (continued)

NT6X02DA parts (Sheet 2 of 3)

PEC	Slot	Description
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals. The CSM interface card sends the voice signals to the C-side links. The formatting section provides serial-to-parallel conversion of coded voice signals from the C-side interface cards, network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message* The CSM interface card performs several functions: • The card removes the CSM bit from the C-side channels • The card assembles the CSM for each channel • The card inserts the CSM in the outgoing C-side bytes • The card performs parity checking on all incoming bytes • The card performs parity generation on all outgoing bytes
NT6X43AA	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card removes control messages that the control module (CM) sends on channel zero.
NT6X44AB	14F	*Time switch* The timeswitch (TS) converts between a serial stream and a parallel stream. The DS30 interface card or the DS-1 interface card sends and receives the serial stream. The internal speech bus uses the parallel stream. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards. The TS associates the cards with the time slots on the parallel speech bus. The TS also transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module (PM). The MP card collects digits, assigns channels, and interprets messages for the central control complex and PM.

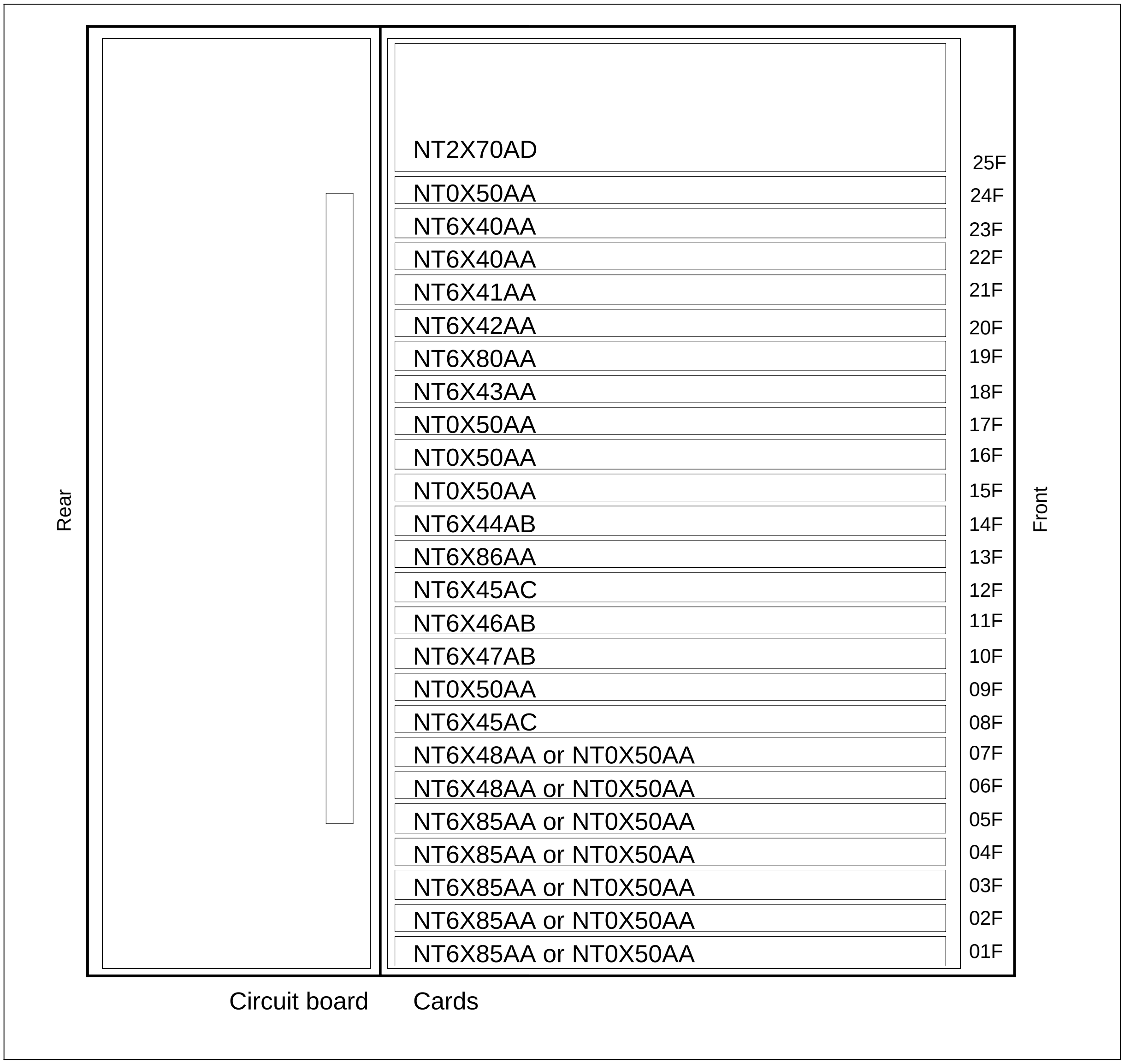
NT6X02DA (continued)

NT6X02DA parts (Sheet 3 of 3)

PEC	Slot	Description
NT6X46AB	11F	*Signaling processor memory card* The SPM card contains RAM storage data and software applications.
NT6X47AB	9F, 10F	*Master processor memory card* The MPM card contains RAM storage data and software applications for the MP and the SP. The SP can access a part of the MP memory with the memory management unit of the SP.
NT6X80AA	19F	*Pad/ring* The pad/ring card uses the PCM generate ringing frequency instructions. The TS card switches the frequencies on the DS-1 channels. These channels are for the subscriber loops to ring.
NT6X85AA	5F	*SLC-96 DS-1 interface card* The SLC-96 DS-1 interface card contains two DS-1 ports. Each SMS module has one to ten cards. The DS-1 interface card operates in DDL mode or non-DDL mode. In the DDL mode, the card converts transistor-transistor logic (TTL)-level PCM values of the SMS TS to bipolar levels of the DS-1 link. The card also converts the bipolar levels of the DS-1 link to the TTL-level PCM values of the SMS TS. The card inserts DDL supervisory message bits into outgoing (network to SLC-96) DS-1 framing = bit time slots. The card also extracts the associated bits from incoming (SLC-96 to network) frames. In non-DDL mode, DDL message capability is the same as that of a DS-1 line interface card. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of defects. The card also provides transmission of local alarms and the detection of remote alarms and error conditions like loss of synchronization, bipolar error, and slip.
NT6X86AA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. The signaling bits for each channel to detect ringing and hook status and ANI and coin functions.

NT6X02DA (end)

NT6X02DA parts



NT6X02DB

Description

The subscriber module SLC-96 (SMS) shelf provides a digital interface to remote control terminals in a digital loop carrier system. The digital interface is the subscriber loop concentrator (SLC). Business and residential applications can use the SMS shelf.

When integrated in the DMS-100 switch, the DMS-1 rural remote terminal is the remote concentrator SLC-96 (RCS). This integrated configuration provides subscribers the full digital resources of the DMS-100 switch. The SMS shelf does not require separate control terminal (CT) cards for each subscriber line. The SMS shelf reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves one remote terminal (RT). The SMS shelf can serve multiple RCT modules.

The SMS shelf contains two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode and takes over call processing if a defect occurs in the active unit. The SMS replaces two line cards and one multiplexer and to reduce the cost of the subscriber carrier.

Each RCS contains a maximum of eight digroups. The digroups provide DS-1 links to the SMS. Each digroup contains 24 pulse code modulation (PCM) channels assembled by time-division multiplex (TDM). Eight equipped digroups contain a total of 192 available channels (eight digroups × 24 PCM channels). Each of the two SMS message processors in the RCS use separate channels. A maximum of 190 channels are available for traffic.

The SMS and RDS use words to exchange messages through a derived data link (DDL). The DDL is a 2.2 Kbps data path. The system takes Fs framing bits from SCM superframes. The system replaces the framing bits with DDL bits to form DDL. In the SMS-RCS subsystem, two SCM superframes pass without system changes. The system removes Fs bits from the next four superframes and replaces them with the DDL bits. The DDL link has 24 DDL bits. The system removes the Fs bits from a card in the RCS or the time switch (TS) card in the SMS shelf.

The 8085 microprocessor of the A-bit/B-word DDL card sends DDL messages to the timeswitch (TS). The microprocessor extracts the DDL messages from incoming PCM. The DDL facility software in the signaling processor (SP) processes DDL messages.

The shelf provides an interface for RCSs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame houses the SMS shelf pairs. This bay frame is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame contains two pairs of

NT6X02DB (continued)

shelves. Each pair of shelves is a module. The lower two shelves contain module 0. The two upper shelves contain module 1. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node.

The SMS shelf contains the SLC-96 DS-1 interface cards or filler faceplates in slots 1 to 7. Slot 13 contains an A/B interface card. Slot 14 contains a TS card. Slot 18 contains a messaging card. Slot 19 contains a pad/ring card.

The SMS shelf has protection switching. Protection switching makes sure communication continues between an SMS and an RCS if a DS-1 line that connects the SMS and RCS fails. The RCS or SMS can automatically start protection switches. The module that detects determines this action. The switch operator can start a manual protection switch when the operator must put the switch out of service.

The SMS modules provide an interface to the enhanced network (ENET) through copper or optical fiber speech links. Both configurations require the NT6X69AC card. When the SMS connects to the ENET with optical fiber speech links, the SMS requires the following parts:

- the XPM DS-512 link control (NT6X40CA)
- the XPM DS-512 link card (NT6X40DA)
- the FXPM bracket assembly kit (NT6X02BU)

Parts

The SMS shelf contains the following parts:

- the NT0X50AA-Filler faceplate
- the NT2X70AD-Power converter
- the NT2X70AE-Power converter
- the NT3X90AC-Device controller cooling inverter unit
- the NT6X40BA-DS30 Network interface (NI) card
- the NT6X40CA-DS30 NI card
- the NT6X41AA-Speech bus formatter
- the NT6X42AA-Channel supervision message (CSM) interface card
- the NT6X44AB-TS card
- the NT6X45AC-Master processor (MP) card
- the NT6X45BA-MP card
- the NT6X45CA-MP card

- the NT6X46BA-Signaling processor memory (SPM) card
- the NT6X46AC-SPM card
- the NT6X47AC-Master processor memory (MPM) card
- the NT6X69AB-Messaging card
- the NT6X80AA-Pad/ring
- the NT6X85AB-SLC-96 DS-1 interface card
- the NT6X86AA-A/B interface card

Design

The design of the NT6X02DB appears in the following table and figure.

NT6X02DB parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf contains a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. The power converters prevent loss of unduplicated cards during a power failure.
NT2X70AE	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards in the shelf require. Each power converter supplies +5V and 12V for the cards on the shelf. The power converters prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02DB (continued)

NT6X02DB parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40BA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions. The two versions are the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit to isolate faults.
NT6X40CA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions. The two versions are the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit to isolate faults.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals. The CSM interface card sends the voice signals to the C-side links. The formatting section provides serial-to-parallel conversion of coded voice signals from the C-side interface cards, network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message* The CSM interface card performs several functions: • The card removes the CSM bit from the C-side channels • The card assembles the CSM for each channel • The card inserts the CSM in the outgoing C-side bytes • The card performs parity checking on all incoming bytes • The card performs parity generation on all outgoing bytes

NT6X02DB (continued)

NT6X02DB parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X44AB	14F	*Time switch* The timeswitch (TS) converts between a serial stream and a parallel stream. The DS30 interface card or the DS-1 interface card sends and receives the serial stream. The internal speech bus uses the parallel stream. When the SP controls the TS, the TS associates the DS30 interface cards and DS-1 interface cards. The TS associates the cards with the time slots on the parallel speech bus. The TS also transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module (PM). The MP card collects digits, assigns channels, and interprets messages for the central control complex and PM.
NT6X46AC	11F	*Signaling processor memory card* The SPM card contains RAM storage data and software applications.
NT6X46BA	11F	*Signaling processor memory card* The SPM card contains RAM storage data and software applications.
NT6X47AC	9F, 10F	*Master processor memory card* The MP card runs the programs that operate and maintain a peripheral module (PM). The MP card collects digits, assigns channels, and interprets messages for the central control complex and PM.
NT6X69AB	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card removes control messages that the control module (CM) sends on channel zero.
NT6X80AA	19F	*Pad/ring* The pad/ring card uses the PCM generate ringing frequency instructions. The TS card switches the frequencies on the DS-1 channels. These channels are for the subscriber loops to ring.

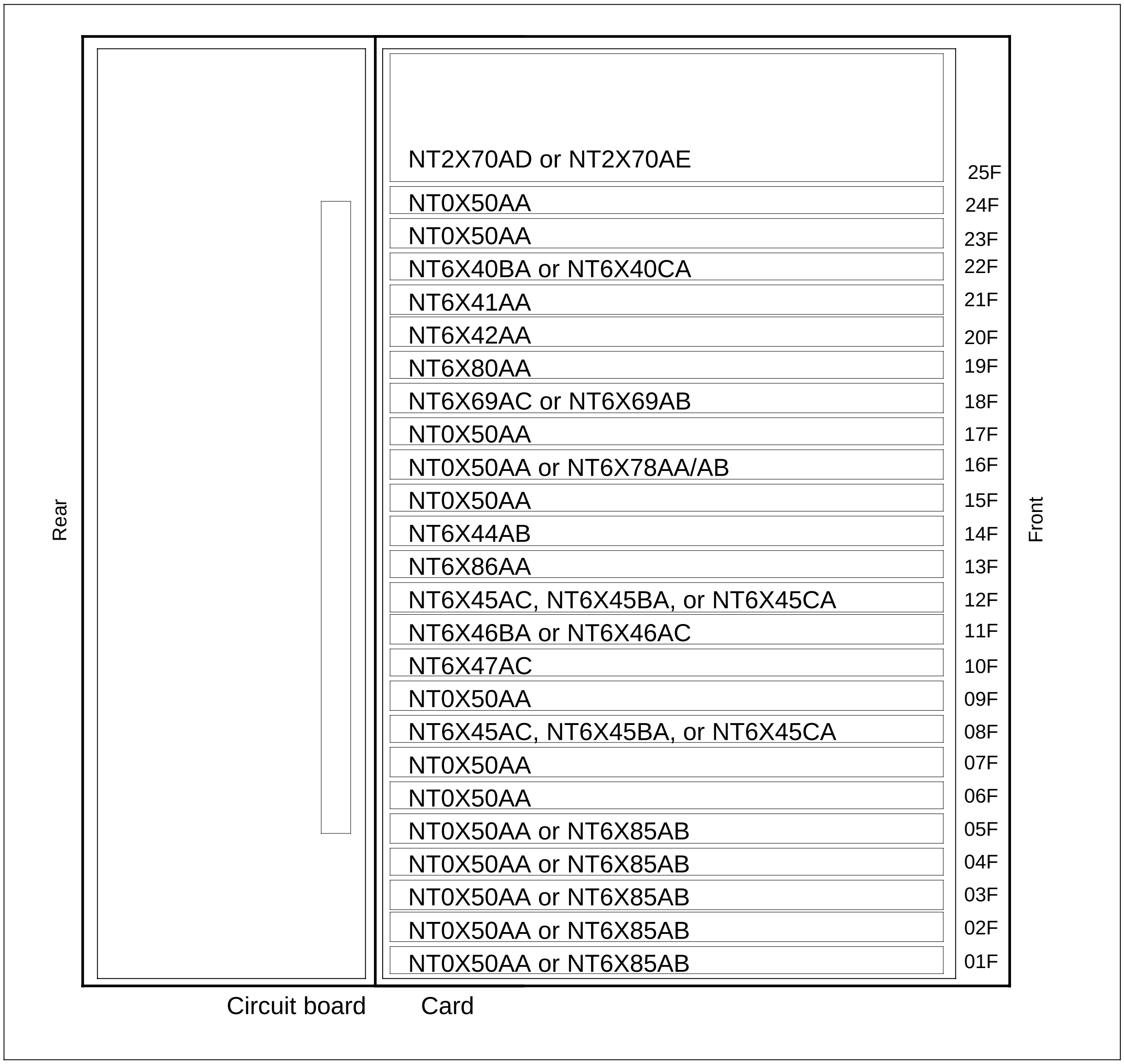
NT6X02DB (continued)

NT6X02DB parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X85AB	5F	*SLC-96 DS-1 interface card* The SLC-96 DS-1 interface card contains two DS-1 ports. Each SMS module has one to ten cards. The DS-1 interface card operates in DDL mode or non-DDL mode. In the DDL mode, the card converts transistor-transistor logic (TTL)-level PCM values of the SMS TS to bipolar levels of the DS-1 link. The card also converts the bipolar levels of the DS-1 link to the TTL-level PCM values of the SMS TS. The card inserts DDL supervisory message bits into outgoing (network to SLC-96) DS-1 framing = bit time slots. The card also extracts the associated bits from incoming (SLC-96 to network) frames. In non-DDL mode, DDL message capability is the same as that of a DS-1 line interface card. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of defects. The card also provides transmission of local alarms and the detection of remote alarms and error conditions like loss of synchronization, bipolar error, and slip.
NT6X86AA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. The signaling bits for each channel to detect ringing and hook status and ANI and coin functions.

NT6X02DB (end)

NT6X02DB parts



NT6X02DC

Description

The subscriber module SLC-96 (SMS) shelf provides a digital interface to remote control terminals in a digital loop carrier system. The carrier system is the subscriber loop concentrator (SLC). Business and residential applications can use the SMS shelf.

When integrated into the DMS-100 switch, the SLC-96 remote terminal is the remote carrier SLC-96 (RCS). This integrated configuration provides subscribers with the full digital resources that the DMS-100 switch offers. The SMS eliminates the separate control terminal (CT) cards needed for each subscriber line. The SMS shelf reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves only one remote terminal (RT). The SMS shelf serves multiple RCS modules.

The SMS shelf contains two units. One unit is active and provides the processing and control functions. The other unit is in a standby mode and takes over call processing if a defect occurs in the active unit. The SMS replaces two line cards and one multiplexer and to reduce the cost of the subscriber carrier.

Each RCS contains a maximum of eight digroups. The digroups provide DS-1 links to the SMS. Each digroup contains 24 pulse-code-modulation (PCM) channels assembled by time-division multiplex (TDM). Eight equipped digroups contain a total of 192 available channels. These channels include eight digroups × 24 PCM channels. Each of the two SMS message processors in the RCS use separate channels. A maximum of 190 channels are available for traffic.

The SMS and RDS use words to exchange messages through a derived data link (DDL). The DDL is a 2.2 Kbps data path. The system takes Fs framing bits from SCM superframes. The system replaces the framing bits with DDL bits to form DDL. In the SMS-RCS subsystem, two SCM superframes pass without system changes. The system removes Fs bits from the next four superframes and replaces them with the DDL bits. The DDL link has 24 DDL bits. The system removes the Fs bits from a card in the RCS or the time switch (TS) card in the SMS shelf.

The 8085 microprocessor of the A-bit/B-word DDL card sends DDL messages to the time switch (TS). The microprocessor extracts the DDL messages from incoming PCM. The DDL facility software in the signaling processor (SP) processes DDL messages.

The shelf provides an interface for RCSs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame houses the SMS shelf pairs. This bay frame is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame contains two pairs of shelves. Each pair of shelves is a module. The lower two shelves contain module 0. The two upper shelves contain module 1. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node.

The SMS shelf uses the SLC-96 DS-1 interface cards or filler faceplates for slots 1 to 5. Slot 13 contains an A/B interface card. Slot 14 contains a TS card. Slot 16 can contain a filler faceplate or a CLASS modem resource (CMR) card. Slot 18 contains a messaging card. Slot 19 contains a pad/ring card. Slot 23 can contain a DS30 network interface (NI) card or filler faceplate.

The SMS shelf has protection switching. To make sure communication continues between an SMS and an RCS. Protection switching makes communication continue if a DS-1 line fails. The DS-1 line connects the SMS and RCS. The RCS or SMS can activate the protection switches. The module that detects the fault, activates the protection switch. The switch operator can start a manual protection switch when the operator must put the switch out of service.

The SMS modules provide an interface to the enhanced network (ENET) through copper or optical fiber speech links. Both configurations require the NT6X69AC card. When the SMS connects to the ENET with optical fiber speech links, the SMS requires the following parts:

- the XPM DS-512 link control (NT6X40CA)
- the XPM DS-512 link card (NT6X40DA)
- the FXPM bracket assembly kit (NT6X02BU)

Parts

The SMS shelf contains of the following parts:

- the NT0X50AA-Filler faceplate
- the NT2X70AD-Power converter
- the NT2X70AE-Power converter
- the NT3X90AC-Device controller cooling inverter unit
- the NT6X40BA-DS30 NI card
- the NT6X40CA-DS30 NI card
- the NT6X41AA-Speech bus formatter
- the NT6X42AA-Channel supervision message (CSM) interface card
- the NT6X44AB-TS card

NT6X02DC (continued)

- the NT6X45AC-Master processor (MP) card
- the NT6X45BA-MP card
- the NT6X45CA-MP card
- the NT6X46BA-Signaling processor memory (SPM) card
- the NT6X46AC-SPM memory
- the NT6X47AC-Master processor memory (MPM) card
- the NT6X69AB-Messaging card
- the NT6X80AA-Pad/ring
- the NT6X85AB-SLC-96 DS-1 interface card
- the NT6X86AA-A/B interface card

Design

The design of the appears in the following table and figure.

NT6X02DC parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf contains a maximum of five spare card slots. Slots 15, 16, and 17 can access the signaling processor (SP) address bus and the parallel speech bus. Slots 13 and 19 do not have access.
NT2X70AD	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require. A power converter supplies +5V and 12V for the cards on the shelf. The power converters prevent loss of unduplicated cards during a power failure.
NT2X70AE	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require. A power converter supplies +5V and 12V for the cards on the shelf. The power converters prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air cooling.

NT6X02DC (continued)

NT6X02DC parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40BA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions. The two versions are the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit to isolate faults.
NT6X40CA	22F, 23F	*DS30 network interface card* The DS30 NI card is available in two versions. The two versions are the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit to isolate faults.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains the clock section and the formatting section. The clock section generates the 10.24 MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals. The CSM interface card sends the voice signals to the C-side links. The formatting section provides serial-to-parallel conversion of coded voice signals from the C-side interface cards, network plane selection, parity error generation for test purposes, and T1 clock generation.
NT6X42AA	20F	*Channel supervision message* The CSM interface card performs several functions: • The card removes the CSM bit from the C-side channels • The card assembles the CSM for each channel • The card inserts the CSM in the outgoing C-side bytes • The card performs parity checking on all incoming bytes • The card parity generation on all outgoing bytes

NT6X02DC (continued)

NT6X02DC parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X44AB	14F	*Time switch* The time switch (TS) converts between a serial stream and a parallel stream. The DS30 interface card or the DS-1 interface card sends and receives the serial stream. The internal speech bus uses the parallel stream. When the SP controls the TS, the TS associates the DS30 and DS-1 interface cards. The interface cards have time slots on the parallel speech bus. The TS also transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module (PM). The MP card collects digits, assigns channels, and reads messages for the central control complex and PM.
NT6X46AC	11F	*Signaling processor memory card* The SPM card contains RAM storage data and software applications.
NT6X46BA	11F	*Signaling processor memory card* The SPM card contains RAM storage data and software applications.
NT6X47AC	9F, 10F	*Master processor memory card* The MPM card contains RAM storage data and software applications for the MP and the SP. The SP accesses a part of the MP memory with the memory management unit of the SP.
NT6X69AB	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card removes control messages that the control module (CM) sends on channel zero.
NT6X80AA	19F	*Pad/ring* The pad/ring card uses the PCM to generate ringing frequency instructions. The TS card switches the frequencies on the DS-1 channels. These channels are for the subscriber loops to ring.

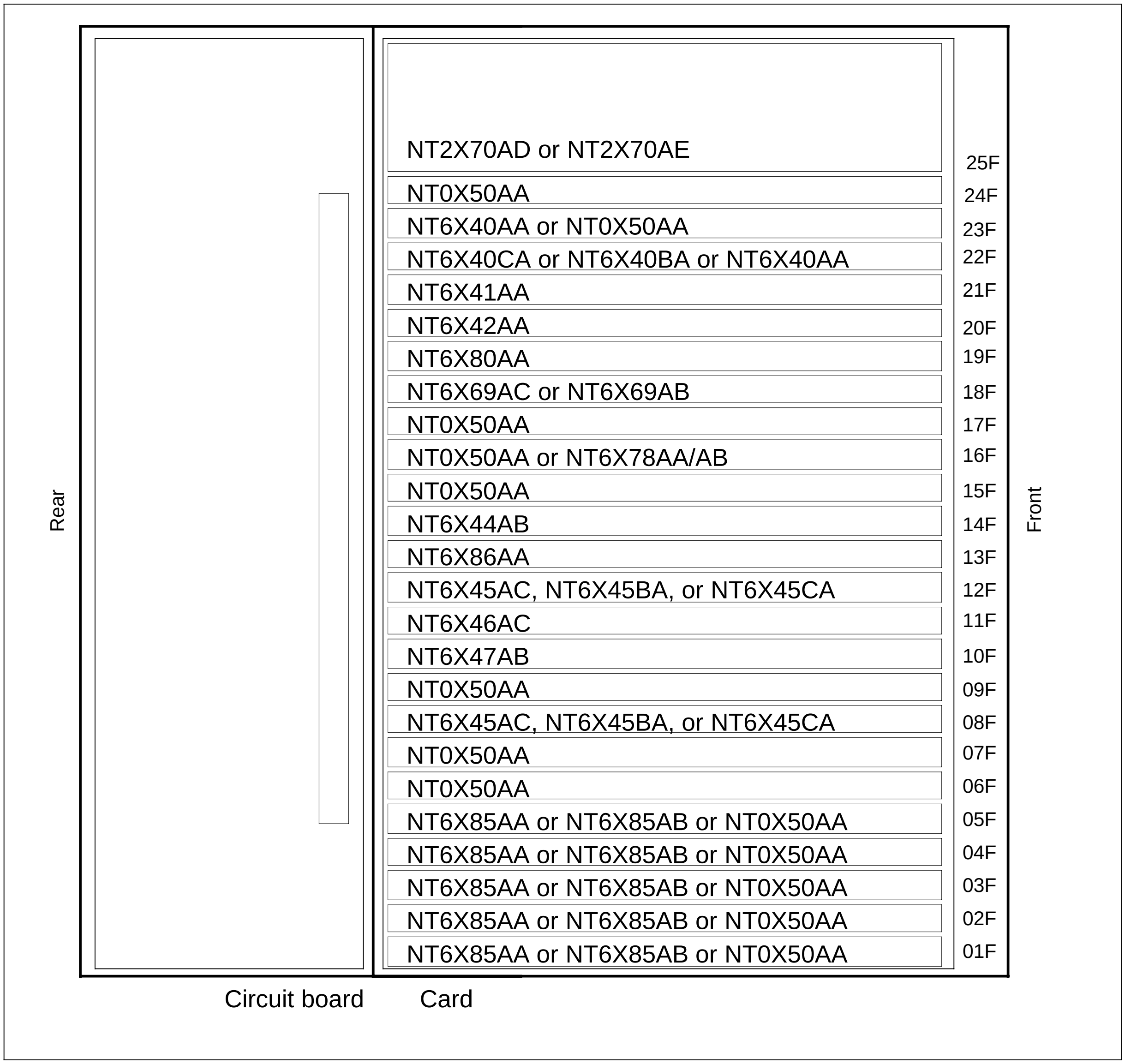
NT6X02DC (continued)

NT6X02DC parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X85AB	5F	*SLC-96 DS-1 interface card* The SLC-96 DS-1 interface card contains two DS-1 ports. A SMS module can have a maximum of ten cards. The DS-1 interface card operates in DDL mode or other DDL mode. In the DDL mode, the card converts transistor-transistor logic (TTL)-level PCM values of the SMS TS to bipolar levels of the DS-1 link. The card also converts the bipolar levels of the DS-1 link to the TTL-level PCM values of the SMS TS. The card inserts DDL supervisory message bits into outgoing (network to SLC-96) DS-1 framing = bit time slots. The card also extracts the associated bits from incoming (SLC-96 to network) frames. In non-DDL mode, DDL message capability is the same as that of a DS-1 line interface card. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to allow isolation of defects. The card also provides transmission of local alarms and the detection of remote alarms and error conditions like loss of synchronization, bipolar error, and slip.
NT6X86AA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. The signaling bits for each channel to detect ringing and hook status and ANI and coin functions.

NT6X02DC (end)

NT6X02DC components



NT6X02DD

Description

The subscriber module SLC-96 (SMS) shelf provides a digital interface to remote control terminals in a digital loop carrier system. The digital loop carrier system is the subscriber loop concentrator (SLC). Business and/or residential applications can use the SMS shelf.

When integrated into the DMS-100 switch, the SLC-96 remote terminal is the remote carrier SLC-96 (RCS). This integrated configuration provides subscribers with the full digital resources that the DMS-100 switch offers. The SMS shelf does not require separate control terminal (CT) cards for each subscriber line. The SMS shelf reduces main distribution frame (MDF) wiring and activity and saves office space. The CT serves only one remote terminal (RT). The SMS shelf can serve more than one RCS module.

The SMS shelf contains two units. One unit is active and provides the processing and control functions. The other unit is in standby mode and can take over call processing if a fault occurs in the active unit. The SMS replaces two line cards and one multiplexer to reduce the cost of the subscriber carrier.

The RCS can contain a maximum of eight digroups. The digroups provide DS-1 links to the SMS. Each digroup contains 24 pulse-code-modulation (PCM) channels assembled by time-division multiplex (TDM). Eight equipped digroups contain a total of 192 available channels (8 digroups × 24 PCM channels. Each of the two SMS message processors in the RCS use a separate channel. A maximum of 190 channels are available for traffic.

The SMS and RDS exchange messages through a derived data link (DDL). The DDL is a 2.2 Kbps data path. The Fs framing bits from the SCM superframes are replaced with DDL bits. The data path consists of these DDL bits. In the SMS-RCS subsystem, two SCM superframes pass without changes by the system. The system removes the Fs bits of the next four SCM superframes and replaces these bits with DDL bits. The DDL link contains 24 DDL bits. The system removes the Fs bits from a card in the RCS or the time switch (TI) card in the SMS shelf.

The 8085 microprocessor of the A-bit/B-word DDL card sends DDL messages to the TS. The microprocessor extracts the DDL messages from incoming PCM. DDL facility software in the signaling processor (SP) processes DDL messages.

The shelf provides an interface for RCSs. The shelf does not provide an interface to other remote systems. A standard DMS-100 single bay frame contains the SMS shelf pairs. The bay frame is the subscriber module equipment (SME) frame (NT6X01AA). The bay frame contains two pairs of

NT6X02DD (continued)

shelves. Each pair of shelves is a module. The two lower shelves are both module 0. Both of the upper shelves are module 1. Each node has a DS-1 link assigned. The node is a line appearance on a digital trunk (LDT) node.

The SMS shelf uses the SLC-96 DS-1 interface cards or filler faceplates for slots 1 to 7. Slot 13 contains an A/B interface card. Slot 14 contains a TS card. Slot 16 contains a filler faceplate or CLASS modem resource (CMR) card. Slot 18 contains a messaging card. Slot 19 contains a pad/ring card.

The SMS shelf has protection switching to make sure that communication continues between an SMS and an RCS. Protection switching makes sure communication continues if a DS-1 line that connects the SMS and RCS fails. The RCS or the SMS can initiate the protection switches. The module that detects the fault can initiate the protection switch. The switch operator can initiate the manual protection. The operator initiates the protection switch to place the switch out-of-service.

The SMS modules provide an interface to the enhanced network (ENET) with copper or optical fiber speech links. Both configurations require the NT6X69AC card. When the SMS connects to the ENET with optical fiber speech links, the SMS requires the following parts:

- the XPM DS-512 link control (NT6X40CA)
- the XPM DS-512 link card (NT6X40DA)
- the FXPM bracket assembly kit (NT6X02BU)

Parts

The SMS shelf contains the following parts:

- the NT0X50AA-Filler faceplate
- the NT2X70AD-Power converter
- the NT2X70AE-Power converter
- the NT3X90AC-Device controller cooling inverter unit
- the NT6X40BA-DS30 network interface (NI) card
- the NT6X40CA-DS30 NI card
- the NT6X41AA-Speech bus formatter
- the NT6X42AA-Channel supervision message (CSM) interface card
- the NT6X44AB-TS card
- the NT6X45AC-Master processor (MP) card
- the NT6X45BA-MP card

- the NT6X45CA-MP card
- the NT6X46BA-Signaling processor memory (SPM) card
- the NT6X46AC-SPM card
- the NT6X47AC-Master processor memory (MPM) card
- the NT6X69AB-Messaging card
- the NT6X80AA-Pad/ring
- the NT6X85AB-SLC-96 DS-1 interface card
- the NT6X86AA-A/B interface card

Design

The design of the NT6X02DD appears in the following table and the figure that follows the table.

The following table and figure indicate the design of the NT6X02DD.

NT6X02DD parts (Sheet 1 of 4)

PEC	Slot	Description
NT0X50AA	1F-7F, 9F, 13F 15F-17F, 23F, 24F	*Filler faceplate* The filler faceplate fills empty card slots in the shelves. Each shelf contains a maximum of five spare card slots. Slots 15, 16, and 17 can access the SP address bus and the parallel speech bus. Slots 13 and 19 do not have access.
NT2X70AE	25F	*Power converter* The power converter converts the -48V dc to the lower voltages that the circuit cards require. A power converter supplies +5 V and 12 V for the cards on the shelf. The power converters prevent loss of unduplicated cards during a power failure.
NT3X90AC	-	*Device controller cooling inverter unit* The cooling inverter provides forced air for cooling.
NT6X40BA	22F, 23F	*DS30 network interface card* The DS30 NI card is available as the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a central-side (C-side) interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for defect isolation.

NT6X02DD (continued)

NT6X02DD parts (Sheet 2 of 4)

PEC	Slot	Description
NT6X40CA	22F, 23F	*DS30 network interface card* The DS30 NI card is available as the NT6X40AA (8 ports) and the NT6X40AC (16 ports). The card provides a C-side interface for DS30 links to the network. Each port of a DS30 NI card provides a two-way voice and data interface. Each port contains a looparound circuit for defect isolation.
NT6X41AA	21F	*Speech bus formatter* The speech bus formatter card contains a clock section and a formatting section. The clock section generates the 10.24-MHz shelf clock. The formatting section of the card provides parallel-to-serial conversion of the coded voice signals. The CSM interface card transmits the coded voice signals to the C-side links. The formatting section provides serial-to-parallel conversion of coded signals from the C-side interface cards. The formatting section also provides network plane selection, parity error generation for tests and T1 clock generation.
NT6X42AA	20F	*Channel supervision message* The CSM interface card can perform several functions. The card removes the CSM bit from the C-side channels. The card assembles the CSM for each channel. The card inserts the CSM to the C-side bytes. The card performs parity checking on all incoming bytes and performs parity generation on all outgoing bytes.
NT6X44AB	14F	*Time switch* The TS converts between a serial stream and a parallel stream. The DS30 interface card or DS-1 interface card sends or receives the serial stream. The internal speech bus uses the parallel stream. When SP controls TS, the TS associates DS30 and DS-1 interface cards with time slots on the parallel speech bus. The TS also transfers data between the associated channel and the time slot.
NT6X45AC	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module. The MP collects digits, assigns channels and reads messages for the central control complex and peripheral module.

NT6X02DD (continued)

NT6X02DD parts (Sheet 3 of 4)

PEC	Slot	Description
NT6X45BA	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module. The MP card collects digits, assigns channels and reads messages for the central control complex and peripheral module.
NT6X45CA	8F, 12F	*Master processor card* The MP card runs the programs that operate and maintain a peripheral module. The MP card collects digits, assigns channels and reads messages for the central control complex and peripheral module.
NT6X46AC	11F	*Signaling processor memory card* The SPM card contains RAM that stores data and software applications.
NT6X46BA	11F	*Signaling processor memory card* The SPM card contains RAM that stores data and software applications.
NT6X47AB	9F, 10F	*Master processor memory card* The MPM card contains RAM that stores data and software applications for both the MP and the SP. The SP can access a part of the MP memory with the memory management unit of the SP.
NT6X69AB	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages that the control module (CM) sends pm channel zero.
NT6X69AC	18F	*Messaging card* The messaging card provides interface for the parallel speech bus. The messaging card extracts control messages that the CM sends on channel zero.
NT6X80AA	19F	*Pad/ring* The pad/ring card uses the PCM to generate ringing frequency instructions. The TS card switches the frequencies on the DS-1 channels. These channels are for the subscriber loops to ring.

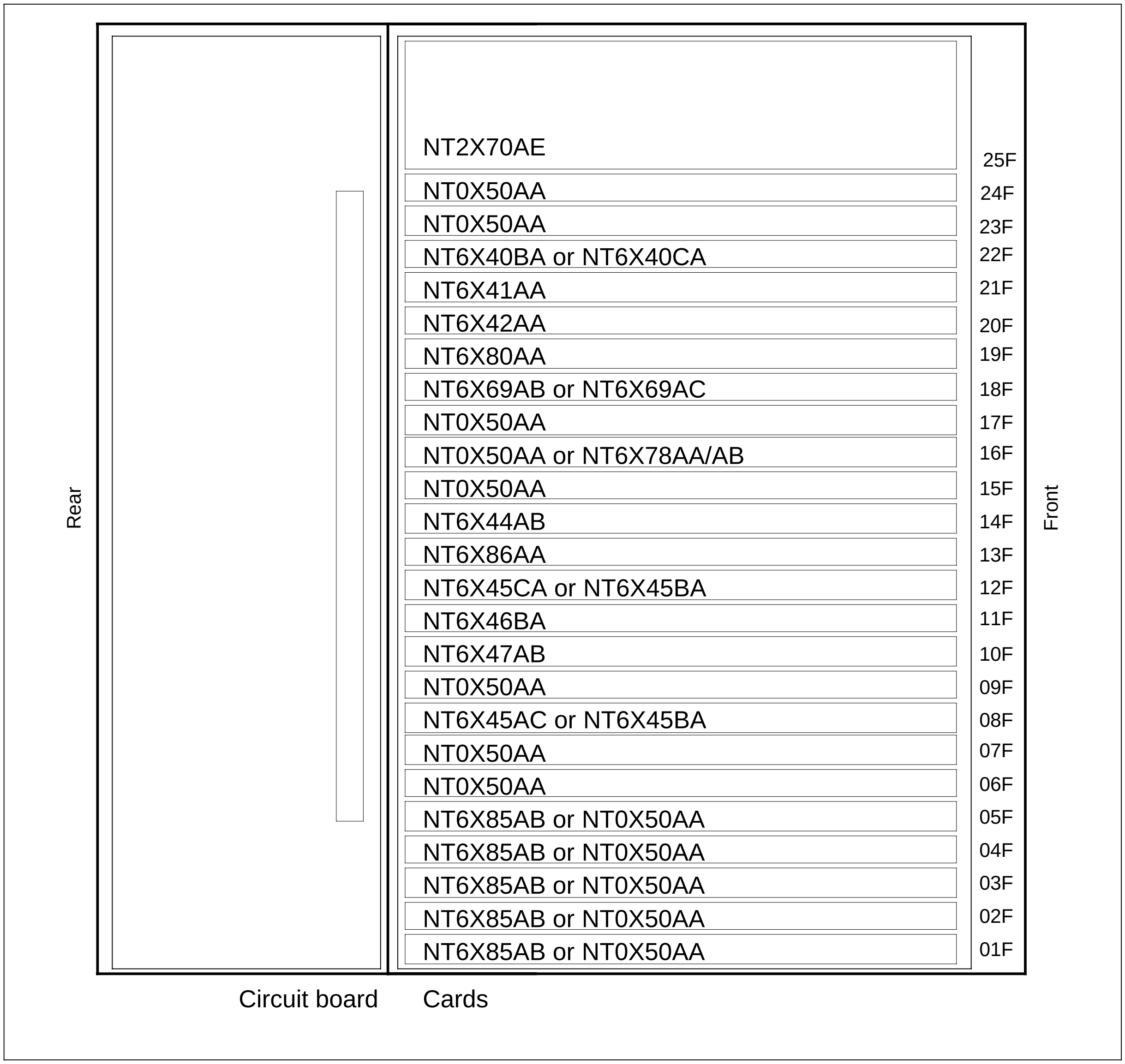
NT6X02DD (continued)

NT6X02DD parts (Sheet 4 of 4)

PEC	Slot	Description
NT6X85AB	5F	*SLC-96 DS-1 interface card* The SLC-96 DS-1 interface card contains two DS-1 ports. Each SMS module contains a maximum of ten cards. The DS-1 interface card operates in one of two modes: (1) DDL mode and (2) non-DDL mode. In the DDL mode, the card converts transistor-transistor logic (TTL)-level PCM values of the SMS TS to bipolar levels of the DS-1 link. The card also converts the bipolar level of the DS-1 link to TTL-level PCM values of the SMS TS. The card inserts DDL supervisory message bits into outgoing (network to SLC-96) DS-1 framing = bit time slots. The card extracts the corresponding bits from incoming (SLC-96 to network) frames. In non-DDL mode, DDL message capability is the same as a DS-1 line interface card. Each port provides a two-way voice, data, and signaling interface. The card provides looparound paths for each DS-1 port to isolate faults. The card transmits local alarms and detects remote alarms and error conditions. Error conditions can include the loss of synchronization, bipolar error, and slip.
NT6X86AA	13F	*A/B interface card* The A/B interface card inserts and extracts A and B bits from the PCM stream. The system uses the signaling bits for each channel to detect ringing, hook status and ANI and coin functions.

NT6X02DD (end)

NY6X02DD components



DMS-100 Family

Hardware Description Manual

Volume 2 of 5

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