Meridian 1

Intelligent peripheral equipment circuit cards for New Zealand

Option 11 - Description and Installation

Document Number: Supplement to 553-3011-210
Document Release: Provisional 1.3
Date: July 1993

Printed in Canada

Revision history

July 1993

Provisional, release 1.3.

March 1993

Provisional, release 1.2.

November 1992

Provisional, release 1.1. Updated to include software release information in the "About this guide" section.

October 1992

Provisional, release 1.0.

Contents

About this document

This document is a Supplement to the Option 11 *Installation guide* (553-3011-210). It describes the functions and applications of the following circuit cards that are available for use in New Zealand:

- NT5K18BA Central Office Trunk card
- NT5K19BA E&M Tie Trunk card
- NT5K17BA Direct Dial Inward trunk card
- NT5K02LB Flexible Analog line card.

The above cards were introduced as part of the Phase 7C software program. They will go up one vintage with the introduction of Phase 8B software.

NT5K93 Central office trunk circuit card

Functional description

The NT5K18BA Central Office trunk card provides the interface between the Option 11 system and up to eight analog Central Office (CO) trunks. It can be installed in slots 1-9 in the main cabinet and in any slot in the expansion cabinet.

Trunk types supported

The Central office trunk card has eight identical units. The trunk type of each unit is configured independently in the trunk data block (LD 14) as one of the following:

- Central office - ground start
- Central office - loop start

The NT5K18BA central office card also supports Direct Inward System Access (DISA).

Common features

The NT5K18BA Central office trunk card:

- allows trunk type to be configured on a per unit basis
- provides disabling of individual units or the entire card through software
- indicates self-test status during an automatic or manual self-test
- converts transmission signals from analog-to-digital and from digital-to-analog

- provides complex terminating impedance in compliance with regulatory New Zealand standards
- provides complex balance impedance in compliance with regulatory New Zealand standards.

Physical description

Measurements

Each NT5K18BA Central office trunk card measures as follows:

Height:	318 mm (12.5 in.)
Depth:	254 mm (10 in.)

Switch settings

There are no option settings on the NT5K18BA Central office trunk card. All settings are configured in software.

Connections

The NT5K18BA Central office trunk card has eight units. Each trunk unit on the card connects to the backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Table 1 provides cross connect information for the NT5K18BA Central Office trunk card.

Table 1
NT5K18BA Central Office Trunk Card pair terminations

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
T1 R1	28 3	W-G G-W	Unit 1
	29 4	W-BR BR-W	
T2 R2	30 5	W-S S-W	Unit 2
	31 6	R-BL BL-R	
T3 R3	32 7	R-O O-R	Unit 3
	33 8	R-G G-R	
T4 R4	34 9	R-BR BR-R	Unit 4
	35 10	R-S S-R	
T5 R5	36 11	BK-BL BL-BK	Unit 5
	37 12	BK-O O-BK	
T6 R6	38 13	BK-G G-BK	Unit 6
	39 14	BK-BR BR-BK	
T7 R7	40 15	BK-S S-BK	Unit 7
	41 16	Y-BL BL-Y	

Self-test

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it has been configured in software) and the LED goes out. If the self-test fails, the LED will remain lit. The LED will also remain lit if one or more units on the card become disabled while the card is operating.

Trunk configuration

Route Data Block

Each trunk unit on the NT5K18BA central office trunk card is attached to a route with an associated route data block. Trunk timers are configured on a route basis.

Note: All prompts are defaulted except for those noted in Table 2. Default values are shown in brackets.

Table 2
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-127	Enter route number
TKTP	COT	Define trunk type as central office
ICOG	IAO	Incoming and Outgoing trunk
CNTL	YES	Change a trunk timer
TIMER	ICF 128	Incoming Flash Timer = 128 ms
	OGF 896	Outgoing Flash Timer = 896 ms
	EOD 3072	End of Dial Timer (Digipulse) = 3072 ms
	DSI 4992	Disconnect Supervision Timer = 4992 ms
	NRD 4992	No Ringing Detector Change Timer = 4992 ms
	ODT 3840	End of Dial Timer (Digitone) = 3840 ms
	RGV 128	Ring Validation Timer = 128 ms
	GTO 896	Guard Timer Outgoing = 896 ms
	GTI 896	Guard Timer Incoming = 896 ms
CDR	YES	Call Detail Recording allowed

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K18BA central office trunk. Default values are shown in brackets in Table 3.

Table 3
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	COT	Central Office Trunk
TN	CC UU	Terminal number of the unit in Option 11 format: Card number, Unit number
XTRK (see note)	XCOT	Type is IPE COT
CDEN	(8D)	Card density is 8D (default)
SIGL	LOP	Loop Start signalling
CLS	SHL, (LOL) DTN, (DIP) BAT, (XBAT)	Attenuation Pads In, (Out) Digitone signalling, (Digipulse) Battery supervision enabled, (disabled)

Note: This prompt is required only for the first unit defined on each NT5K18BA card.

Technical description

Power requirements

Table 4 provides the power requirements for the NT5K18BA Central office trunk card.

Table 4
NT5K18BA Power requirements

Voltage	Active current
± 15.0 V dc (See note 1)	330 ma
+ 8.5 V dc (see note 2)	70 ma
- 48.0 V dc	30 ma
+ 5.0 V dc	250 ma

Note 1: Analog circuitry is powered with +/- 12V generated from +/- 15V.

Note 2: 8.5V is regulated to provide 5V.

Environmental specifications

Table 5 lists the environmental specifications of the NT5K18BA Central office trunk card.

Table 5Table 1-5
NT5K18BA Environmental specifications

Parameter	Specifications
Operating temperature	0 to 50 degrees C, ambient
Operating humidity	5 to 95 % RH (non-condensing)
Storage temperature	- 40 to + 70 degrees C

Pad switching

Loss values for the NT5K18BA Central office trunk card are given in Table 6.

Table 6T
NT5K18BA loss values

Central office line loss	Analog to Digital loss	Digital to Analog loss
0 to 3 dB	-6 dB	0 dB
3 to 6 dB	-8 dB	-3 dB

Trunk types description

Each NT5K18BA Central office trunk card unit is capable of operating as one of the following:

- Central office - Ground Start
- Central office - Loop Start

Ground start operation

Ground start operation is configured in software and implemented through software download messages.

Idle State

In the idle state, a ringing detector is connected across the tip and ring leads. The capacitance between the tip and ring leads is 1.8 μF with a resistance greater than 5 kΩ. The central office applies -50V to the ring wire, while the tip wire is open circuit.

Call placed by Option 11

The Option 11 places a call by establishing a dc path between the tip and ring leads and applying ground to the ring wire. The central office acknowledges by applying ground to the tip wire and returning dial tone. When dial tone is received, the Option 11 removes ground from the ring lead.

Dialling
The Option 11 sends digits in the form of loop disconnect signalling or Dual Tone Multi-frequency (DTMF) digits.

Answer
When the called party answers, the central office reverses polarity on the line. The Option 11 interprets the polarity reversal as an answer signal.

Call placed by central office

Fastguard signal
Before applying ringing to the Option 11, the central office sends a Fastguard signal (battery reversal) that is used to busy a trunk circuit against outgoing calls. The NT5K18BA trunk card, however, can not detect battery reversal in the idle state.

Ringing
The central office applies ringing to the ring wire and -50V dc to the tip wire. The Option 11 ringing detector trips to indicate an incoming call.

Answer
The Option 11 answers the call by placing a loop between the tip and ring leads. The central office responds by removing the ringing and reversing battery on the tip and ring leads.

Central office disconnect

The central office sends a disconnect signal by returning to the polarity of the idle state and removing the potential from the tip lead. The Meridian 1 responds by removing the dc loop between the tip and ring leads.

Option 11 disconnect

The Option 11 disconnects the call by removing the dc loop between the tip and ring leads. The central office responds by returning to the polarity of the idle state and removing the potential from the tip lead.

Loop start operation

Loop start operation is configured in software and is implemented in the card through software download messages.

Idle state

In the idle state, a ringing detector is connected across the tip and ring leads. The capacitance between the tip and ring leads is 1.8 µF with a resistance greater than 5 kΩ. The central office applies -50V to the ring wire and ground to the tip wire.

Call placed by Option 11

To place a call, the Option 11 places a low resistance loop across the tip and ring leads.

Dialling
The Option 11 sends digits in the form of loop disconnect signalling or Dual Tone Multi-frequency (DTMF) digits.

Answer
When the called party answers, the central office reverses polarity on the line. The Option 11 interprets the polarity reversal as an answer signal.

Call placed by central office

Fastguard signal
Before applying ringing to the Option 11, the central office sends a Fastguard signal (battery reversal) that is used to busy a trunk circuit against outgoing calls. The NT5K18BA trunk card, however, can not detect battery reversal in the idle state.

Ringing
The central office applies ringing to the ring wire and -50V dc to the tip wire. The Option 11 ringing detector trips to indicate an incoming call.

Answer
The Option 11 answers the call by placing a loop between the tip and ring leads. The central office responds by removing the ringing and reversing battery on the tip and ring leads.

Call disconnect

Option 11 disconnect
The Option 11 disconnects the call by removing the dc loop between the tip and ring leads. The central office responds by returning to the polarity of the idle state.

Central office disconnect—outgoing call from Option 11
The central office sends a disconnect signal by reversing the polarity on the tip and ring leads The Option 11 responds by releasing the call.

Central office disconnect—incoming call from central office
The central office disconnects the call by sending a clear forward signal, which is an 800 to 1100 ms break on the tip or ring wires. The clear forward signal is sent only on incoming calls to the Option 11 and may not always be provided. On receipt of the signal, the Option 11 returns to the idle state.

Features description

Battery supervision

Battery supervision, rather than Periodic Pulse Metering (PPM), is used on the NT5K18BA trunk card to support Call Detail Recording (CDR). Polarity detectors on the card monitor battery reversals at the start and end of calls. Messages from the polarity detectors are used by software to start and end the CDR timer.

Battery supervision is configured in overlay 14 by setting the class of service prompt to BAT.

Inverted dialling

In New Zealand, digipulse signalling follows a "10-*n*" system, where *n* represents the digit dialed. Inverted dialling is illustrated in Table 1-7.

Table 7
Inverted dialling

Digit dialed	Digit sent to central office
0	10
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1

Inverted dialling is configured in overlay 56 by setting the RVDL prompt to 1.

E&M tie trunk circuit card

Functional description

The NT5K19BA E&M Tie trunk card provides the interface between the Option 11 system and up to four analog trunks. It can be installed in slots 1-9 in the main cabinet and in any slot in the expansion cabinet.

The NT5K19BA E&M Tie trunk card supports four analog trunks. Each trunk circuit can be individually configured as:

- 4-wire E&M Type 1 tie trunk (DC5)
- Recorded Announcement trunk (RAN)
- Music trunk (MUS)
- Paging trunk (PAG)

Common features

The NT5K19BA E&M Tie trunk card:

- converts transmission signals from analog-to-digital and from digital-to-analog
- provides software selectable A-law or μ-law operation
- enables and disables individual units or the entire card under software control
- provides outpulsing on the card. Make break ratios are defined in software and downloaded during power up and by software commands.
- provides indication of card status on the faceplate LED

- allows trunk type to be configured on a per unit basis in software
- provides termination against 600 ohms for 4-wire DC5 E&M trunk circuits
- provides flexible transmission for various loss plans
- provides paging (PAG), recorded announcement (RAN), and Music (MUS) interfaces.

Physical description

Switch settings

There are no option switches on the NT5K19BA E&M Tie trunk card. All settings are configured in software.

Connections

The NT5K19BA E&M Tie trunk card has four units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Tables 8 to 10 show cross connect terminations for the NT5K19BA E&M trunk card.

Table 8
NT5K19BA E&M 2-Wire Paging trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	27 2	W-O O-W	Unit 0
A PG	29 4	W-BR BR-W	
T1 R1	31 6	R-BL BL-R	Unit 1
A PG	33 8	R-G G-R	
T2 R2	35 10	R-S S-R	Unit 2
A PG	37 12	BK-O O-BK	
T3 R3	39 14	BK-BR BR-BK	Unit 3
A PG	41 16	Y-BL BL-Y	

Table 9
NT5K19BA E&M 2-wire Recorded Announcement trunk connections

Lead designations	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
SIG B SIG A	29 4	W-BR BR-W	
T1 R1	30 5	W-S S-W	Unit 1
SIG B SIG A	33 8	R-G G-R	
T2 R2	34 9	R-BR BR-R	Unit 2
SIG B SIG A	37 12	BK-O O-BK	
T3 R3	38 13	BK-G G-BK	Unit 3
SIG B SIG A	41 16	Y-BL BL-Y	

Table 10
NT5K19BA E&M 4-Wire Type 1 and Type 2 connections

Lead designations	Pins	Pair color	Unit number
RA RB	26 1	W-BL BL-W	Unit 0
TA TB	27 2	W-O O-W	
E M	28 3	W-G G-W	
RA RB	30 5	W-S S-W	Unit 1
TA TB	31 6	R-BL BL-R	
E M	32 7	R-O O-R	
RA RB	34 9	R-BR BR-R	Unit 2
TA TB	35 10	R-S S-R	
E M	36 11	BK-BL BL-BK	
RA RB	38 13	BK-G G-BK	Unit 3
TA TB	39 14	BK-BR BR-BK	
E M	40 15	BK-S S-BK	
Note: The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.			

Self-test

When the NT5K19BA E&M Tie trunk card is installed and power is applied to it, a self-test is performed on the card. The red LED on the NT5K19BA faceplate flashes three times, then remains continuously lit until the card is enabled in software. If the self-test fails, the LED will remain lit after the card is enabled.

Trunk configuration

Route Data Block

Each trunk unit on the NT5K19BA E&M trunk card is attached to a route with an associated route data block. The route data block is configured in LD 16.

Note: All prompts are defaulted except for those noted in Table 4.

Table 11
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-127	Enter route number
TKTP	TIE, (RAN), (PAG)	Trunk type is either tie, (recorded announcement), or (paging)
ICOG	IAO	Incoming and outgoing trunk
ACOD	XX	XX=the trunk route access code

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K19BA E&M trunk card.

Table 12
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	TIE, (RAN), (PAG)	Trunk type is either tie, (recorded announcement), or (paging)
TN	CC UU	Terminal number of the unit in Option 11 format Card, Unit
XTRK (see note)	XFEM	Type is IPE E&M
SIGL	EM4	4-wire E&M speech
TYP	TY1	Type 1 signalling
STRI	IMM, (WNK), (DDL)	Incoming Start immediate, (wink), (delayed dial)
STRO	IMM, (WNK), (DDL)	Outgoing Start immediate, (wink), (delayed dial)
SUPN	YES, (NO)	Answer and disconnect supervision allowed, (disallowed)
CLS	TRC, (NTC)	Attenuation pads In, (Out)

Note: This prompt required only for the first unit defined on each NT5K19BA card.

Technical description

Power requirements

Table 6 lists the power requirements for the NT5K19BA trunk card.

Table 13
NT5K19BA Power requirements

Voltage	Active Current
+/- 15.0 V dc	150 ma
+8.5 V dc	35 ma
+ 5 V dc	110 ma
-48 V dc	80 ma

Environmental specifications

Table 7 provides the environmental specifications for the NT5K19BA E&M Tie trunk card.

Table 14Table 2-7
NT5K19BA Environmental specifications

Parameter	Absolute Limit
Operating temperature	10-45 degrees C, ambient
Operating humidity	20 to 80% RH (non condensing)
Storage temperature	-20 to +60 degrees C

Pad switching

Nominal loss values for the NT5K19BA E&M trunk card are given in Table 8.

Table 15
Loss values for NT5K19BA E&M trunk card

	Analog-to-Digital	Digital-to-Analog
4-wire E&M (Short)	-3 dB	0 dB
4-wire E&M (Long)	-5 dB	-2 dB
RAN/MUS	3.5 dB	not applicable
PAG	not applicable	3.5 dB

Trunk types description

- Each unit on the NT5K19BA E&M Tie trunk card supports:
- 4-wire E&M Type 1 tie trunk (DC5)
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk
- Music (MUS) trunk.

4-wire E&M trunk operation (DC-5)

The NT5K19BA E&M Tie trunk card supports the United Kingdom DC5-A method of signalling, which is used between a Private Branch Exchange (PBX) and co-sited equipment. The two signalling wires used, E and M, are electrically separated from the associated speech circuit. Signals are sent on the M wire and received on the E wire.

Send signals

All signals are sent in the form of either Earth-On or Earth-Off applied to the M wire, where:

- Earth-On is the application of ground to the M wire through a resistance of 1250 ohms, and
- Earth-Off is the removal of the Earth-On condition such that the resistance to earth is greater than 500 kΩ.

In both Earth-On and Earth-Off conditions, a grounded 1μF capacitor is applied to the M wire.

Receive signals

All received signals are in the form of Earth-On or Earth-Off applied to the E wire, where:

- Earth-On is the application of ground to the E wire through a resistance of 1500 ohms.
- Earth-Off is the application of ground to the E wire through a resistance of greater than 400K ohms.

In both Earth-On and Earth-Off conditions, a grounded 1µF capacitor is applied to the E wire.

Idle state

In the Idle state, the M wire receives an "Idle signal" from the Option 11 and is placed in the Earth-Off condition.

Seize

To place an outgoing call, the Option 11 at the near end sends a seizing signal through the M-wire to the far end. The far end recognizes the seize signal, busies the circuit against outgoing calls, and prepares to receive digits. The continued receipt of the seizing signal by the far end is accepted as a "hold" signal.

Delay dialling/proceed to send

In some system configurations, the sending of address information can be delayed until the incoming Private Branch Exchange (PBX) is ready to receive. When the incoming PBX receives the seize signal, it sends a "delay dialling" signal to the outgoing PBX. Dialling is delayed until the incoming PBX applies a "proceed to send" signal to the M wire.

Wink start/proceed to send

Wink start can also be used to delay the sending of address information. When the incoming PBX receives the seize signal, it returns a "wink start" signal (Earth-on signal of 140 to 290 ms). Dialling is delayed until the incoming PBX applies a "proceed to send" signal to the M wire.

Dialling

Digits are sent through the near end M wire in the form of 10 pps of the Earth-Off condition. Dual Tone Multifrequency (DTMF) digits can also be used for dialling.

Answer

When the called party answers, the far end sends an "answer" signal through the M wire.

Call disconnect

Either party can disconnect the call by applying a clear signal to the M wire. The far end applies a “clear back” signal, while the near end applies a “clear forward” signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 9 provides a summary of NT5K19BA DC-5 signalling states.

Table 16
Summary of NT5K19BA DC-5 signalling states

Signal	Outgoing PBX sending condition — M Wire	Incoming PBX sending condition — M Wire
Idle	Earth-Off	Earth-Off
Seize	Earth-On	—
Hold	Continuation of seize signal	—
Delay dialling (optional)	—	Earth-On
Proceed to send (optional)	—	Earth-Off
Digit Pulse	Earth-Off pulses in step with dial pulses	—
Answer	—	Earth-On
Far End Release	Earth-Off for longer than 300 milliseconds	—
Near End Release	—	Earth-Off for longer than 300 milliseconds

Recorded Announcement/Music trunk operation

When used in the Recorded Announcement/Music mode, the trunk circuit is connected to a customer provided recorded announcement machine or a music source.

Machines supported

The NT5K19BA E&M Tie trunk card supports the following types of announcement machines:

- Start mode announcement machines
- Continuous mode announcement machines.

Recorded announcers supported include the Cook Digital 4-channel announcer and the Audichron HQI-112.

Start mode

In start mode, the E&M Tie trunk card provides a startpulse to the announcement machine to begin playback of the message. The announcement source requires the following:

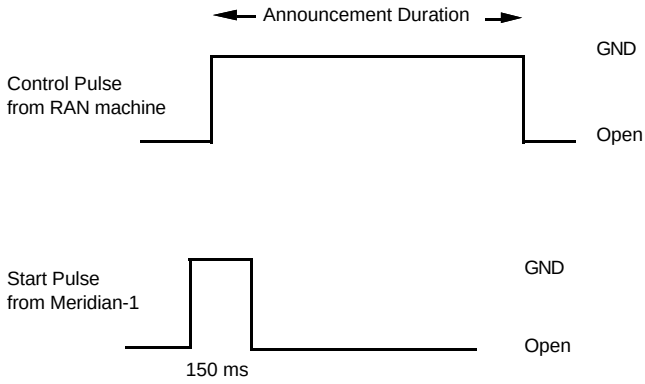
- an impedance of 4 ohms or less
- ground to the trunk unit when playing and an open circuit when idle. This is done through a control lead to the trunk circuit.
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

To start the announcement, the NT5K19BA E&M Tie trunk card provides a momentary ground signal (150 ms) to the source. The announcement machine should then start playing its message.

The NT5K19BA trunk card expects status information from the announcement machine, that is, whether it is idle or playing. For this reason, the announcement machine requires a control lead to the trunk circuit.

Figure 1 shows recorded announcement in start mode.

Figure 1
Recorded announcement—start mode



Continuous mode

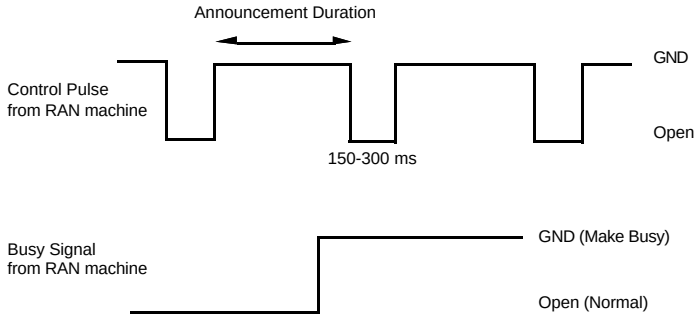
The requirements for continuous mode announcement machines are as follows:

- an impedance of 4 ohms or less
- generation of a control pulse (150 - 300 ms) at the start of the announcement period
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

The announcement machine may provide a separate busy signal when the machine is recording, erasing a message, or if the machine is malfunctioning. The busy signal will be used by the Option 11 for maintenance purposes.

Figure 2 shows recorded announcement in continuous mode.

Figure 2
Recorded announcement—continuous mode



Music source

The music source should provide an impedance of 600 Ω. The default signalling level should be -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

Paging trunk operation

When used in the paging mode, the trunk circuit is connected to a customer-provided paging amplifier system. When accessed, the card provides a loop closure. In a typical application, the loop closure will cut off a music supply and switch the paging trunk transmission path to the paging amplifier.

Features description

Inverted dialling

In New Zealand, digipulse signalling follows a "10-*n*" system, where *n* represents the digit dialed. Inverted dialling is illustrated in Table 17

Table 17
Inverted dialling

Digit dialed	Digit sent to central office
0	10
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1

Inverted dialling is configured in overlay 56 by setting the RVDL prompt to 1.

Direct Dial Inward trunk card

Functional description

The NT5K17BA Direct Dial Inward (DDI) trunk card provides the interface between the Option 11 system and up to eight analog DDI trunk lines. It can be installed in slots 1-9 in the main cabinet and in any slot in the expansion cabinet.

Common features

Each NT5K17BA DDI Trunk card:

- allows trunk signalling type to be configured on a per unit basis
- allows individual units or the entire board to be disabled by software
- provides indication of card status on the faceplate LED
- converts transmission signals from analog-to-digital and from digital-to-analog for up to 8 audio paths
- supports the New Zealand loss plan
- detects up to 22 pulses per second
- provides termination impedance to match the New Zealand 3-component complex network
- provides transhybrid balance matching against the New Zealand complex impedance
- provides Analog-to-Digital and Digital-to-Analog call path losses for DDI trunk units, values downloadable in the initial configuration stage.

Physical description

Measurements

Each NT5K17BA DDI trunk card measures as follows:

Height:	318 mm (12.5 in.)
Depth:	254 mm (10 in.)

Connections

The NT5K17BA DDI trunk card has eight units. Each trunk unit on the card connects to the backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel, and the I/O panel is cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Hardware installation

Table 18 shows cross connect information for the NT5K17BA DDI trunk card.

Table 18
NT5K17BA Direct Inward Dial trunk card pair terminations

Lead	Pins	Pair color	Unit number
T0 R0	26 1	W-BL BL-W	Unit 0
	27 2	W-O O-W	
T1 R1	28 3	W-G G-W	Unit 1
	29 4	W-BR BR-W	
T2 R2	30 5	W-S S-W	Unit 2
	31 6	R-BL BL-R	
T3 R3	32 7	R-O O-R	Unit 3
	33 8	R-G G-R	
T4 R4	34 9	R-BR BR-R	Unit 4
	35 10	R-S S-R	
T5 R5	36 11	BK-BL BL-BK	Unit 5
	37 12	BK-O O-BK	
T6 R6	38 13	BK-G G-BK	Unit 6
	39 14	BK-BR BR-BK	
T7 R7	40 15	BK-S S-BK	Unit 7
	41 16	Y-BL BL-Y	

Self-test

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it has been configured in software) and the LED goes out. If the self-test fails, the LED will remain lit. The LED will also remain lit if one or more units on the card become disabled while the card is operating.

Trunk configuration

Route Data Block

Each trunk unit on the NT5K17BA DDI trunk card is attached to a route with an associated route data block. The route data block is configured in LD 16.

Note: All prompts are defaulted except for those noted in Table 19

Table 19
LD 16 Route Data Block

Prompt	Response	Comments
REQ	NEW	
TYPE	RDB	Define a new Route Data Block
CUST	0-99	Enter customer number
ROUT	0-127	Define route number
TKTP	DID	Trunk type is Direct Inward Dial
ICOG	ICT	Incoming only trunk
ACOD	XX	XX=Trunk route access code
CNTL	YES	Change controls or timers
TIMR	EOD 19968 ICF 0 GTI 128	End of Dial Timer = 19968 ms Incoming Flash Timer = 0 ms Guard Timer Incoming = 128 ms
NEDC	ETH	Near end disconnect control from either end
FEDC	ETH	Far end disconnect control from either end

Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K17BA DDI trunk card. Default values are shown in brackets in Table 20.

Table 20
LD 14 Route Data Block

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	DID	Type is Direct Inward Dial
TN	CC UU	Terminal number of the unit: Card, Unit
XTRK	XDID	Type is IPE DID
SIGL	LDR	Loop Dial Repeating signalling
STRI	IMM	Incoming start is immediate dial
CLS	SHL, (LOL)	Attenuation Pads In, (Out)

Note: This prompt required only for the first unit defined on each NT5K17BA card.

Technical description

Power requirements

Table 21 lists the power requirements for the NT5K17BA DDI trunk card.

Table 21
NT5K17BA power requirements

Voltage	Idle current	Active current
+15.0 V dc	195 ma	195 ma
-15.0 V dc	240 ma	125 ma
+8.5 V dc	85 ma	85 ma
-48 V dc	50 ma	550 ma
+ 5.0 V dc	195 ma	175 ma

Environmental specifications

Environmental specifications for the DDI card are shown in Table 22.

Table 22
NT5K17BA Environmental specifications

Parameter	Specifications
Operating temperature	0 to 50 degrees C, ambient
Operating humidity	5 to 95 % RH (non-condensing)
Storage temperature	- 50 to + 70 degrees C

Pad switching

Loss values for the NT5K17BA DDI trunk card are as follows:

Table 23
NT5K17BA loss values

CO line loss	Analog-to-Digital	Digital-to-Analog
0 to 3 dB	-6 dB	0 dB
3 to 6 dB	-8 dB	-3 dB

Direct Dial Inward description

Each unit on the NT5K17BA DDI card operates as a DDI trunk. Table 3-8 presents a summary of NT5K17BA DDI trunk card signalling states.

Idle State

When the central office presents a high impedance of 8.5K ohms or greater to the DDI unit, the NT5K17BA DDI trunk card is in the idle state. Ground is present on the tip wire and negative battery (-50V) is present on the ring wire.

Seize

The central office initiates a call by placing a low resistance loop (2.2 K ohms or less) across the tip and ring leads. The increased current flow will trigger a front end detector on the Option 11. A message is sent to the Central Processing Unit (CPU), and the microprocessor prepares for receipt of dialling digits. A seizure acknowledge signal is sent to the central office within 150 milliseconds.

Dialling

The central office sends address information in the form of loop disconnect signalling or dual tone multifrequency (DTMF) digits.

Loop disconnect signalling

Loop disconnect pulses are detected at speeds of up to 22 pulses per second. The minimum interdigit pause is 230 milliseconds. Inverted dialling, rather than conventional dialling, is supported in New Zealand. (Inverted dialling is described in the *Features description* section that follows).

DTMF signalling

DTMF signalling is used with the NT5K48AA Extended Tone Detector Card. When the NT5K17BA DDI card receives DTMF tones from the central office, it passes them directly to the NT5K48AA XTD card. The following frequencies are used:

Table 24
DTMF digits

	High Group (Hz)			
Low Group (Hz)	**1209**	**1336**	**1477**	**1633**
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Answer

When the terminating party answers, the DDI unit reverses battery and ground on the tip and ring leads (-48V on Tip and Ground on Ring) and establishes a speech path.

Far End Release

The central office disconnects the call by presenting a high impedance loop of 9K ohms or greater in the direction of the DDI unit.

When the DDI unit detects the high impedance loop, it sends a change of state message to the CPU. The CPU sends a release acknowledgement message back to the DDI unit, which will respond by returning to the idle state.

Near End Release

When the Option 11 disconnects the call, the CPU sends a message to the DDI unit, which in turn will respond by returning to the idle state. When the central office detects the idle state, it restores the high impedance loop on the tip and ring wires. The CPU interprets the high impedance loop as a release acknowledgement signal from the central office.

Backward Busy or Disabled

When a DDI unit is busy or disabled, it sends a backward busy signal to the central office. In this state, both battery and ground are removed from the tip and ring wires.

Table 25
Summary of NT5K17BA DDI Trunk card signalling states

Signal	Central Office State	Option 11 State
Idle	High Impedance Loop (9K ohms or greater)	Ground on Tip -50V on Ring
Seize	Low Impedance Loop (2.2K ohms or less)	—
Dialling	Loop disconnect signalling or DTMF	—
Answer	Low Impedance Loop (2.2K ohms or less)	-50V on Tip Ground on Ring
Central Office disconnect (Far End Release)	High Impedance Loop (9K ohms or greater)	—
Far End Release acknowledgement	—	Ground on Tip -48V on Ring
Option 11 disconnect (Near End Release)	—	Ground on Tip -48V on Ring
Near End Release acknowledgement	High Impedance Loop (9K ohms or greater)	—
Backward Busy	—	Open Circuit on Tip Open Circuit on Ring

Features description

Inverted dialling

In New Zealand, digipulse signalling follows a “10-*n*” system, where *n* represents the digit dialed. Inverted dialling is illustrated in Table 26.

Table 26
Inverted dialling

Digit dialed	Digit sent to central office
0	10
1	9
2	8
3	7
4	6
5	5
6	4
7	3
8	2
9	1

Inverted dialling is configured in overlay 56 by setting the RVDL prompt to 1.

Flexible analog line circuit card

Functional description

The NT5K02LB Flexible analog line card with message waiting provides an interface for up to 16 analog (500/2500-type) telephones lines. It can be installed in slots 1-9 in the main cabinet and in any slot in the expansion cabinet.

Common features

The NT5K02LB Flexible Analog line card provides the following features:

- analog to digital and digital to analog conversion for 16 analog telephone lines
- software selectable A-Law or µ-Law companding
- telephone on-hook and off-hook detection
- ground button detection
- relay for connecting an ac ringer
- variable loop current to allow automatic gain compensation according to loop length
- card-identification for auto configuration
- flashing high voltage 1 Hz message waiting signal.

Physical description

Switch settings

There are no option switches on the Flexible Analog line card. All settings are configured in software.

Connections

The Flexible Analog line card has 16 units. Each unit connects to the shelf backplane through an 80-pin connector. The backplane is cabled to the input/output (I/O) panel which is then cabled to the cross-connect terminal. At the cross-connect terminal, each unit connects to external apparatus by tip and ring leads.

Faceplate LED

The faceplate of the NT5K02LB is equipped with a red LED which lights when all of the assigned units on the circuit card are disabled.

Technical description

Power requirements

Table 27 lists the power requirements for the NT5K02 Flexible Analog line card.

Table 27
NT5K02 Flexible Analog line card power requirements

Voltage	Idle current	Maximum current (all units active)
+15.0 V dc (see note 1)	120 ma	120 ma
-15.0 V dc (see note 1)	24 ma	24 ma
+ 8.5 V dc (see note 2)	250 ma	280 ma
-48.0 V	0 ma	160 ma
- 48.0 V dc	60 ma	700 ma
-100.0 V dc	0 ma	48 ma
Ring V ac	0 ma	160 ma (See note 3)

Note 1: Analog circuitry is powered with +/- 12V generated from +/- 15V. The maximum current imbalance between the +/- 15V rails is 100 ma per circuit pack.

Note 2: 8.5V is regulated to give 5V.

Note 3: This figure reflects 10 ma for ringing one telephone per unit. There may be more than one telephone or ringer on a unit.

Environmental specifications

Table 28 lists the environmental specifications of the Flexible Analog line card.

Table 28
NT5K02 Flexible Analog line card environmental specifications

Parameter	Specifications
Operating temperature	0 to 45 degrees C, ambient
Operating humidity	5 to 95 % Relative Humidity
Storage temperature	- 40 to + 70 degrees C

Signalling

Loop operation

The Flexible Analog Line Card is loop start, with a loop limit of 1000 Ω at -48 V excluding the telephone set. The minimum values of current and voltage at the telephone set are 25 ma and 10V respectively.

Table 29 lists the number of telephone sets that can be supported by the loop.

Table 29
Loop limits

Loop resistance including telephone sets	Number of telephone sets
350 Ω or less	2
Over 350 Ω to a maximum of 1800 Ω	1

Ringers

Ringing is supplied to the telephones at a frequency of 25 Hz with a voltage of 80 Vrms. The peak voltage is no higher than 125V.

The Flexible Analog Line Card supports any number of ringers up to a maximum ac impedance presented to the line of 350 ohms. Table 30 shows the number of ringers supported for various loop lengths.

Table 30
Ringers supported on each unit of the NT5K02LB card

Number of Ringers	1	2	3	4	5
Loop Length (Ω)	1000	1000	850	600	350

Message waiting indicator

The message waiting indicator consists of a lamp flashing at a rate of 1 Hz at the telephone set. (A continuously lit lamp as a message indicator is not provided). The lamp is activated by the application of high voltage (-100V) to the ring lead.

Hookflash special features

Pressing the hookflash for a specified length of time is seen by the NT5K02LB card as a request for special services. To access special features, the hookflash must be pressed for at least 140 milliseconds, but no longer than 850 milliseconds.

Digipulse dialling

The NT5K02LB Analog line card recognizes loop disconnect signals with the following limits:

Break pulse:50 to 76 ms

Make pulse:28 to 46 ms

A make pulse for longer than 350 ms is seen as an interdigit pause. Make and break pulses of 5 ms or less are rejected.

Ground button detection

The ground button detector sends a recall signal 30 to 50 ms after the application of a ground on either the Tip or Ring of the line. The ground must be applied for a time greater than the minimum hookflash time. The loop resistance to the ground signal can be between 0 and 500 ohms.

The transmission path is interrupted for no longer than one second after the ground recall signal has been applied.

Transmission parameters

Loss values for the NT5K02LB Flexible Analog Line card are as follows:

Analog to Digital loss:3.5 dB

Digital to Analog loss:8.5 dB

Meridian 1

Intelligent peripheral equipment circuit cards for New Zealand

Option 11 - Description and Installation

Publication number: Supplement to 553-3011-210
Document release: Provisional 1.3
Date: July 1993
Printed in Canada