

NTP 297-3601-184

DMS-10 Family

600-Series Generics

Circuit Interface for Lines, Trunks, and Test
Trunks

06.01

For Generic 602.20 Standard August 2006

NORTEL

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600-Series Generics

Circuit Interface for Lines, Trunks, and Test Trunks

Nortel Publications: NTP 297-3601-184
06.01
For Generic 602.20
Standard
August 2006

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Publication history

Issue	Date	Rating	For generic
01.01	August 2000	Preliminary	501
01.02	October 2000	Standard	501
02.01	January 2001	Preliminary	502
02.02	April 2001	Preliminary	502.10
02.03	June 2001	Standard	502.10
03.01	July 2002	Preliminary	503.10
03.02	August 2002	Standard	503.10
03.03	July 2004	Preliminary	505.10
03.03	August 2004	Standard	505.10
04.01	July 2005	Preliminary	601.10
04.01	August 2005	Standard	601.10
05.01	February 2006	Preliminary	602.10
05.01	March 2006	Standard	602.10
06.01	July 2006	Preliminary	602.20
06.01	August 2006	Standard	602.20

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Section 1: Introduction

Scope and purpose of this publication

This Nortel Networks Corporation technical publication (NTP) is to be used as a guide for designing and engineering connections between the DMS-10 switch and subscriber lines, intraoffice and interoffice trunks, and subscriber loop testing equipment.

Organization

This NTP comprises the following sections:

- Section 1 Introduction
- Section 2 Line Circuit Interfaces
- Section 3 Trunk Circuit Interfaces
- Section 4 Test Trunk Circuit Interfaces
- Section 5 Index

References

For more information about line, trunk, and test trunk interfaces, refer to the following NTPs:

- *General Description* (297-3401-100)
- *Features and Services Description* (297-3401-105)
- *Equipment Identification* (297-3401-150)
- *System Performance Specifications* (297-3401-180)

Section 2: Line circuit interfaces

Introduction

This section provides information concerning the functions, characteristics, and interconnections of the DMS-10 line circuits. It is to be used as a guide for selecting the correct line circuit pack and for designing or engineering the connection of the subscriber's line to the DMS-10 switch.

The circuits discussed include lines for Peripheral Equipment (PE), Line Concentrating Equipment (LCE), and Subscriber Carrier Equipment (SCE). For more detailed information on line circuit packs and cards, consult the schematic drawings (SDs).

Types of line circuits

The following types of circuit packs are available for the DMS-10 switch:

- NT2T00 Single-Party Line pack
- NT2T01 Two-Party Line pack
- NT2T02 Four-Party, Automatic Number Identification Line pack
- NT2T03 Miscellaneous Line pack
- NT2T04 Prepay Coin Line pack
- NT2T05 Eight-Party Line pack
- NT2T07 Multifrequency-Ringing, Two-Party Line pack
- NT2T08 Extended-Range, Two-Party Line pack
- NT2T09 Extended-Range, Eight-Party Line pack
- NT2T43 0-dB General Line pack
- NT2T44 0-dB Miscellaneous Line pack
- NT2T45 0-dB Prepay Coin Line pack
- NT2T67 0-dB, Superimposed Ringing Line pack
- NT2T69 0-dB Single-Party Line pack

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- NT2T75 0-dB, Multifrequency-Ringing, Eight-Party Line pack
- NT6X17 Type A Standard Line Circuit Card
- NT6X18AA Type B Line Circuit Card (coin)
- NT6X18AB Type B Line Circuit Card (coin with +48 V fraud protection)
- NT6X21AC P-Phone Line Card
- NT6X21AD P-Phone Line Card

All of the packs listed except for the NT6X17, NT6X18AA, NT6X18AB, NT6X21AC, and NT6X21AD are configured as peripheral equipment. The NT6X17, NT6X18AA, NT6X18AB, NT6X21AC, and NT6X21AD packs are configured as line concentrating equipment.

For an overview of the features supported by each line circuit pack or card, see Table 2-A. Note that ten-party service with coded ringing may be provided using an NT2T01, NT2T03, NT2T08, NT2T43, or NT2T44 line pack, if the office is equipped with software that supports coded ringing and if the appropriate ringing-code option is entered for the station.

Table 2-A: Line circuit pack and card features																		
Feature	Pack or Card Type																	
	N T 2 T 0 0	N T 2 T 0 1	N T 2 T 0 2	N T 2 T 0 3	N T 2 T 0 4	N T 2 T 0 5	N T 2 T 0 7	N T 2 T 0 8	N T 2 T 0 9	N T 2 T 4 3	N T 2 T 4 4	N T 2 T 4 5	N T 2 T 6 7	N T 2 T 6 9	N T 2 T 7 5	N T 2 T 7 7	N T 2 T 8 8	N T 2 T 8 1
Parties per line																		
1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2		x	x	x		x	x	x	x	x	x		x		x	x	x	
4		x	x	x		x		x	x	x	x		x		x		x	
8		x		x		x		x	x	x	x		x		x		x	
10		x		x				x		x	x							
Ringing																		
Attendant Recall				x							x							
Single Frequency	x	x		x	x			x		x	x	x	x	x				
Multifrequency			x	x		x	x		x		x				x	x	x	
Bridged	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Divided		x	x	x		x	x	x	x	x	x		x		x	x	x	
MBS																		x
Supervision																		
Pseudo Sleeve Lead				x							x						x	

Table 2-A: (Continued) Line circuit pack and card features																		
Feature	Pack or Card Type																	
	N T 2 T 0 0	N T 2 T 0 1	N T 2 T 0 2	N T 2 T 0 3	N T 2 T 0 4	N T 2 T 0 5	N T 2 T 0 7	N T 2 T 0 8	N T 2 T 0 9	N T 2 T 4 3	N T 2 T 4 4	N T 2 T 4 5	N T 2 T 6 7	N T 2 T 6 9	N T 2 T 7 5	N T 2 T X 1 7	N T 2 T X 1 8	N T 2 T X 2 1
Loop Start	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Ground Start				x	x						x	x					x	
Loop Disconnect										x						x	x	
Answer Reversal				x		x	x				x						x	
Party Test (ANI)		x	x	x			x	x		x	x					x	x	
W78 Signaling																		x
Coin Control (dc)					x							x					x	
Extended Range								x	x									
0 dB										x	x	x	x	x	x	x	x	x

If coded ringing is provided in software.

Subject to ringer limitations.

Applies to NT6X18AB.

Subscriber Carrier Module (DMS-1)

A Subscriber Carrier Module (SCM) can be used to interface up to four Remote Concentrator Terminals (RCTs) with a DMS-10 switch, in which case the line packs are contained in the RCT. The following line packs can be used with an RCT:

- QPP405 Single-Party
- QPP407 Universal
- QPP409 Universal Coin
- QPP440 Frequency-Selective Ringing
- QPP445 Superimposed Ringing

Subscriber Carrier Module (SCM-10s)

The SCM-10S is a subscriber carrier module that provides a direct digital interface between the DMS-10 switch and SLC-96 subscriber loop carrier lines. The following types of line packs can be used in the SLC-96:

- S203 Single-Party, Key Line
- S221 Multiparty, Superimposed Ringing Line
- S233 Coin, PBX Line

For detailed information on these line packs, refer to the appropriate vendor documentation.

PE line circuits

The basic function for each PE line pack is to provide the interface between the subscriber's line and the DMS-10 switch. This interface is necessary for the following purposes:

- to terminate the tip (T) and ring (R) conductors with a balanced 900 Ω termination
- to provide a dc battery supply from ground and -48 V through a 200/200 Ω balanced-feed resistance
- to supervise the loop current to determine on-hook/off-hook status
- to provide connection of the ringing current to the loop
- to provide isolation of foreign potentials on the loop from portions of the transmission and signaling circuitry
- to convert from the two-wire transmission path of the loop to the four-wire transmission path of the system
- to provide analog-to-digital (A/D) and digital-to-analog (D/A) conversion of the transmission signals

In addition, the PE line pack includes a common multiplexing and signaling circuit that performs the following functions:

- interfaces the individual line circuits with the PE bus signaling channel
- re-times digital signals received from the PE bus
- decodes address information received from the PE bus and enables individual line circuits during selected timeslots

0-db line circuits

Each system using 0-dB line circuits in its PE must be equipped with an NT2T46 (Peripheral Processor) pack, mounted in any position of a PE shelf, in order to use the enhanced transmission (0-dB loss) capability of these circuits. This pack performs on-hook transhybrid loss measurements to determine the line balancing network required. In addition, an off-hook transhybrid loss measurement is used to check circuit stability and, if necessary, a 2-dB pad is inserted in the D/A side of the transmission to prevent singing. If the NT2T46 is not provisioned, the 0-dB feature is not enabled. Any 0-dB line circuits provided in such cases are operated with the 2-dB pads switched in.

LCE line circuits

LCE line circuit cards (NT6X17, NT6X18AA, NT6X18AB, NT6X21AC) can only be provisioned in Line Concentrating Module (LCM) Line Drawers (NT6X05). Though their function in the DMS-10 system is essentially identical to that of PE line packs, LCE line cards are physically much smaller than PE line packs (3 in. x 3.5 in. versus 12.5 in. x 10 in.). LCE line cards, however, contain only one circuit per pack, whereas PE line packs contain either two or four circuits per pack.

LCE line circuit cards can be configured, through software, as either 0-dB or 2-dB line circuits. For more information, see the NTP entitled *Data Modification Manual* (297-3401-311).

It should be noted that any LCM Line Drawer containing one or more NT6X18AB line circuit cards must also be equipped with a +48 V Power Converter card (NT6X23). For more information, see the NTP entitled *Equipment Identification* (297-3401-150).

Specifications for line circuits

Line circuits require the protection of 0.003-in. carbon block protectors (or equivalent) on tip (T) and ring (R) terminals. In addition, each line pack is equipped with relays that connect the line circuit to the shelf maintenance bus for switching or testing purposes.

Line packs vary in the type of subscriber loop signals accommodated and the options provided.

The tables on the following pages present information on the type of loop signals accommodated by DMS-10 line circuits.

The line circuit packs are presented in numerical order by pack number. For each pack, there is a table providing line circuit characteristics, followed by a block schematic for that pack.

The dialing specifications for line circuits can be found in the NTP entitled *System Performance Specifications* (207-3401-180).

Information about the declaration of the line circuits in software can be found in the NTP entitled *Data Modification Manual* (297-3401-311). Maintenance and testing of line circuits is addressed in the NTPs entitled *Maintenance Diagnostic Input Manual* (297-3401-506) and *Maintenance and Test Manual* (297-3401-511).

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Table 2-B: NT2T00, Single-Party Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing: Type	Single-frequency, bridged
Capacity	Maximum of six NE-C4A ringers (or equivalent) per line
Ring Trip	During silent or ringing period
Ringing Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start
Supervision	Normal polarity conditions are continuously applied
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Insertion Loss	2 dB nominal

Table 2-C: NT2T01, Two-Party Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing: Type	Single-frequency, divided or bridged
Capacity	Maximum of six NE-C4A ringers (or equivalent) to ground per T and R conductor
Ring Trip	During silent or ringing period
Ringing Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start
Supervision	Battery reversal is provided only in conjunction with ringing
	Office ground may be interrupted during test for external ground Party test (ANI)
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Insertion Loss	2 dB nominal

Table 2-D: NT2T02, Four-Party, ANI Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing:	
Type	Multifrequency, divided or bridged
Capacity	Maximum of six NE-C4A ringers (or equivalent) to ground per frequency
Ring Trip	During silent or ringing period
Ringing Voltage	Depending on frequency, 87 V through 158 Vac
Signaling	Loop start
Supervision	Normal polarity conditions are continuously applied
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Insertion Loss	2 dB nominal

Note: This pack can only be used with the Dual PE shelf (J0T59) or with the Dual PE Trunk shelf (J0T59A-1, L2). An external +48V power supply is required if this circuit pack is used with a single PE shelf.

Table 2-E: NT2T03, Miscellaneous Line pack characteristics	
Circuits per Pack	Two
Hardware Options	Ground start or loop start
Ringing:	
Type	Single-frequency, bridged or divided; or four-frequency, bridged or divided
Capacity	Maximum of six ringers to ground per line per frequency or six ringers per frequency to T and R
Ring Trip	During silent or ringing period
Ringing Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start or ground start
Supervision	Battery reversal may be provided Sleeve lead Tip party test for two-party ANI
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Insertion Loss	2 dB nominal

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Table 2-F: NT2T04, Prepay Coin Line pack characteristics	
Circuits per Pack	Two
Hardware Options	Ground-start/loop-start coin-control voltage on T and R; or coin-control voltage on T only
Ringing: Type Ring Trip	Single-frequency, bridged During silent or ringing period
Ringing Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start or ground start
Supervision	Office ground may be interrupted for ground start operation or for coin ground test A $\pm 130\text{V}$ coin control may be applied to T or T and R Bridged -48 V may be switched to +48 V supervision during call setup
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Insertion Loss	2 dB nominal

Table 2-G: NT2T05, Eight-Party Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing: Type Capacity Ring Trip	Four-frequency, divided or bridged Maximum of six ringers to ground per frequency per T or R conductor During silent or ringing period
Ringing Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start
Supervision	Battery reversal may be provided in conjunction with ringing only
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Insertion Loss	2 dB nominal

Table 2-H: NT2T07, Multifrequency-Ringing, Two-Party Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing: Type	Multifrequency, divided or bridged
Capacity	Maximum of six bridged ringers per frequency
Ring Trip	During silent or ringing period
Ringing Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start
Supervision	Battery reversal may be provided Office ground may be interrupted during test for external ground Party test (ANI)
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Insertion Loss	2 dB nominal

Table 2-I: NT2T08, Extended-Range, Two-Party Line pack characteristics																
Circuits per Pack	Two															
Hardware Options:																
Balance Network (two required, one per circuit)	<table border="0"> <tr> <td><u>Cable</u></td> <td><u>Balance Network</u></td> </tr> <tr> <td>H88 Loaded</td> <td>QNB65A</td> </tr> <tr> <td>D66b Loaded</td> <td>QNB65C</td> </tr> <tr> <td>Unloaded</td> <td>QNB65B</td> </tr> <tr> <td>Colocated 900 ohm termination</td> <td>NT2T25</td> </tr> </table>	<u>Cable</u>	<u>Balance Network</u>	H88 Loaded	QNB65A	D66b Loaded	QNB65C	Unloaded	QNB65B	Colocated 900 ohm termination	NT2T25					
<u>Cable</u>	<u>Balance Network</u>															
H88 Loaded	QNB65A															
D66b Loaded	QNB65C															
Unloaded	QNB65B															
Colocated 900 ohm termination	NT2T25															
Gain Squelch	Switch closed to fix gain (0 dB A/D, -2 dB D/A) for applications using external gain or when assigned as a standby circuit															
Ringing: Type	Single-frequency, divided or bridged															
Capacity (C4A Ringers)	<table border="0"> <thead> <tr> <th><u>Loop Resistance</u></th> <th><u>Number of Ringers</u></th> <th><u>Divided per Conductor</u></th> </tr> <tr> <th colspan="3"><u>Bridged</u></th> </tr> </thead> <tbody> <tr> <td>Up to 2 kΩ</td> <td>3</td> <td>6</td> </tr> <tr> <td>2.0-2.6 kΩ</td> <td>2</td> <td>4</td> </tr> <tr> <td>2.6-4.5 kΩ</td> <td>2</td> <td>2</td> </tr> </tbody> </table>	<u>Loop Resistance</u>	<u>Number of Ringers</u>	<u>Divided per Conductor</u>	<u>Bridged</u>			Up to 2 k Ω	3	6	2.0-2.6 k Ω	2	4	2.6-4.5 k Ω	2	2
<u>Loop Resistance</u>	<u>Number of Ringers</u>	<u>Divided per Conductor</u>														
<u>Bridged</u>																
Up to 2 k Ω	3	6														
2.0-2.6 k Ω	2	4														
2.6-4.5 k Ω	2	2														
Ring Trip	During silent or ringing period															
Ringing Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal															

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Table 2-I: (Continued) NT2T08, Extended-Range, Two-Party Line pack characteristics											
Signaling	Loop start										
Supervision	Battery reversal is provided with ring-party divided ringing Office ground or +48 V is interrupted during tip-party test										
Loop Detection Limits	4500 ohms, including 200-ohm telephone set										
Transmission	Voice frequency gain is added automatically as follows: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th><u>Loop Resistance (Ω)</u></th> <th><u>Gain (dB)</u></th> </tr> </thead> <tbody> <tr> <td>0-800</td> <td>-1</td> </tr> <tr> <td>800-1400</td> <td>+1</td> </tr> <tr> <td>1400-2200</td> <td>+3.5</td> </tr> <tr> <td>2200-4500</td> <td>+6.5</td> </tr> </tbody> </table>	<u>Loop Resistance (Ω)</u>	<u>Gain (dB)</u>	0-800	-1	800-1400	+1	1400-2200	+3.5	2200-4500	+6.5
<u>Loop Resistance (Ω)</u>	<u>Gain (dB)</u>										
0-800	-1										
800-1400	+1										
1400-2200	+3.5										
2200-4500	+6.5										

Note: This pack can only be used with the Dual PE shelf (J0T59) or with the Dual PE Trunk/PMS shelf (J0T90), with a maximum of five packs in any one shelf.

Table 2-J: NT2T09, Extended-Range, Eight-Party Line pack characteristics			
Circuits per Pack	Two		
Hardware Options:			
Balance Network (two required, one per circuit)	<u>Cable</u>	<u>Balance Network</u>	
	H88 Loaded	QNB65A	
	D66b Loaded	QNB65C	
	Unloaded	QNB65B	
	Colocated 900 ohm termination	NT2T25	
Gain Squelch	Switch closed to fix gain (0 dB A/D, -2 dB D/A) for applications using external gain or when assigned as a standby circuit		
Ringling:			
Type	Single-frequency, divided or bridged		
Capacity (C4A Ringers)	<u>Loop Resistance</u>	<u>Number of Ringers</u>	<u>Divided per Conductor</u>
		<u>Bridged</u>	
	Up to 2 k Ω	3	6
	2.0-2.6 k Ω	2	4
	2.6-4.5 k Ω	2	2
Ring Trip	During silent or ringing period		
Ringling Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal		
Signaling	Loop start		
Supervision	Battery reversal is provided with ring-party divided ringing		
Loop Detection Limits	4500 ohms, including 200-ohm telephone set		
Transmission	Voice frequency gain is added automatically as follows:		

Table 2-J: (Continued)
NT2T09, Extended-Range, Eight-Party Line pack characteristics

	Loop Resistance (Ω)	Gain (dB)
	0-800	-1
	800-1400	+1
	1400-2200	+3.5
	2200-4500	+6.5

Note: This pack can only be used with the Dual PE shelf (J0T59) or with the Dual PE Trunk/PMS shelf (J0T90), with a maximum of five packs in any one shelf.

Table 2-K:
NT2T43, 0-dB General Line pack characteristics

Circuits per Pack	Four
Hardware Options	None
Ringing: Type Capacity Ring Trip Ringing Voltage	Single-frequency, divided or bridged Maximum of six NE-C4A ringers (or equivalent) to ground per T and R conductor During silent or ringing period Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start
Supervision	ANI testing by simplexing T and R Independent battery reversal
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Transmission	900 ohms nominal impedance with two balance networks: 1650 ohms in parallel with 5 nF 800 ohms in parallel with 50 nF Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.

Note: This pack can be used with any PE shelf, but requires that the system be equipped with a Peripheral Processor pack (NT2T46).

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Table 2-L: NT2T44, 0-dB Miscellaneous Line pack characteristics	
Circuits per Pack	Two
Hardware Options	None
Ringling: Type	Single-frequency or multifrequency, divided or bridged
Capacity	Maximum of six ringers to ground per frequency per T or R conductor
Ring Trip	During silent or ringing period
Ringling Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start, ground start, or loop disconnect
Supervision	Battery reversal may be provided Office ground interrupted during test for external ground
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Transmission	900 ohms nominal impedance with two balance networks: 1650 ohms in parallel with 5 nF 800 ohms in parallel with 50 nF Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.

Note: This pack can be used with any PE shelf, but requires that the system be equipped with a Peripheral Processor pack (NT2T46).

Table 2-M: NT2T45, 0-dB Prepay Coin Line pack characteristics	
Circuits per Pack	Two
Hardware Options	Ground start/loop start Coin-control voltage on T and R or coin-control voltage on T only
Ringling: Type	Single-frequency, bridged
Ring Trip	During silent or ringing period
Ringling Voltage	Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start or ground start
Supervision	Office ground may be interrupted for ground start supervision or for coin ground test. ±130 V coin control applied to T or to T and R bridged -48 V may be switched to +48 V supervision during call setup
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)

Table 2-M: (Continued) NT2T45, 0-dB Prepay Coin Line pack characteristics	
Transmission	<p>900 ohms nominal impedance with two balance networks:</p> <p>1650 ohms in parallel with 5 nF</p> <p>800 ohms in parallel with 50 nF</p> <p>Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.</p>

Note: This pack can only be used with the Dual PE shelf (J0T59) or with the Dual PE Trunk/PMS shelf (J0T90), and also requires that the system be equipped with a Peripheral Processor pack (NT2T46).

Table 2-N: NT2T67, 0-dB, Superimposed-Ringing Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing: Type Capacity Ring Trip Ringing Voltage	<p>Single-frequency, divided or bridged</p> <p>Maximum of six NE-C4A ringers (or equivalent) to ground per polarity per T and R conductor</p> <p>For loops of less than 300 Ω, a maximum of four ringers per polarity per conductor are allowed to avoid pre-tripping</p> <p>During silent or ringing period</p> <p>Depending on frequency, 87 V through 158 Vac superimposed on +48 V or -48 Vdc nominal</p>
Signaling	Loop start
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Transmission	<p>900 ohms nominal impedance with two balance networks:</p> <p>1650 ohms in parallel with 5 nF</p> <p>800 ohms in parallel with 50 nF</p>
	Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.

Note: This pack can only be used with the Dual PE shelf (J0T59) or with the Dual PE Trunk/PMS shelf (J0T90), and also requires that the system be equipped with a Peripheral Processor pack (NT2T46).

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Table 2-O: NT2T69, 0-dB, Single-Party Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing: Type Ring Trip Ringing Voltage	Single-frequency, bridged During silent or ringing period Depending on frequency, 87 V through 158 Vac/Vdc superimposed on -48 Vdc nominal
Signaling	Loop start
Supervision	Normal polarity conditions are continuously applied except during ringing transitions Battery reversal and battery interruption capabilities are not provided
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Transmission	900 ohms nominal impedance with two balance networks: 1650 ohms in parallel with 5 nF 800 ohms in parallel with 50 nF Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.

Note: This pack can be used with any PE shelf, but requires that the system be equipped with a Peripheral Processor pack (NT2T46).

Table 2-P: NT2T75, 0-dB, Multifrequency-Ringing, Eight-Party Line pack characteristics	
Circuits per Pack	Four
Hardware Options	None
Ringing: Type Capacity	Multifrequency, divided or bridged Maximum of six NE-C4A ringers (or equivalent) to ground per frequency, per R or T conductor
Ring Trip Ringing Voltage	During silent or ringing period Depending on frequency, 87 V through 158 Vac, superimposed on -48 Vdc nominal
Signaling	Loop start
Supervision	Normal polarity conditions are continuously applied
Loop Detection Limits	<1900 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)

Table 2-P: (Continued) NT2T75, 0-dB, Multifrequency-Ringing, Eight-Party Line pack characteristics	
Transmission	900 ohms nominal impedance with two balance networks: 1650 ohms in parallel with 5 nF 800 ohms in parallel with 50 nF Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.

Note: This pack can only be used with the Dual PE shelf (J0T59) or with the Dual PE Trunk/PMS shelf (J0T90), and also requires that the system be equipped with a Peripheral Processor pack (NT2T46).

Table 2-Q: NT6X17AA/AC, Standard Line Circuit Card type A, NT6X17BA, World Line Card type A, and NTEX17 Data-enhanced Data Subscriber Line (DSL) card characteristics	
Circuits per Pack	One
Hardware Options	None
Ringing: Type Capacity Ring Trip Ringing Voltage	Multifrequency, divided or bridged Maximum of five NE-C4A ringers (or equivalent) to ground per frequency, per R or T conductor During silent or ringing period Depending on frequency, 87 V through 158 Vac, superimposed on -48 Vdc nominal
Signaling	Loop start, loop disconnect
Supervision	Normal polarity conditions are continuously applied
Loop Detection Limits	<2000 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Transmission	900 ohms nominal impedance with two balance networks: 1650 ohms in parallel with 5 nF 800 ohms in parallel with 50 nF 900 ohms in parallel with 2.16 μ F (NTEX17 and NT6X17BA only)
	Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.

Note 1: This circuit card can only be provisioned in a Line Concentrating Module drawer.

Note 2: The NT6X17BA templates limit loop current to 50mA on short loops.

Table 2-R: NT6X18AA/AB, Line Circuit Card type B (coin) and NT6X18BA, World Line Card type B characteristics	
Circuits per Pack	One
Hardware Options	NT6X18AA, NT6X18BA: None NT6X18AB: Must be used in conjunction with an NT6X23 card for +48 V coin fraud-protection feature.
Ringing: Type Capacity Ring Trip Ringing Voltage	Multifrequency, divided or bridged Maximum of five NE-C4A ringers (or equivalent) to ground per frequency, per R or T conductor During silent or ringing period Depending on frequency, 87 V through 158 Vac, superimposed on -48 Vdc nominal
Signaling	Loop start, ground start, or loop disconnect
Supervision	Normal polarity conditions are continuously applied
Loop Detection Limits: Residential Coin	< 2000 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage) <1600 ohms, including 200-ohm telephone set (14-mA loop detector threshold at float voltage)
Transmission	900 ohms nominal impedance with two balance networks: 1650 ohms in parallel with 5 nF 800 ohms in parallel with 50 nF 900 ohms in parallel with 2 μ F (world line card only) Two gain settings are automatically switched by the DMS-10 switch. A 0-dB setting produces a zero cross-office loss, and a -2 dB setting produces the equivalent loss of the standard line circuits.

Note: This circuit card can only be provisioned in a Line Concentrating Module Drawer.

Table 2-S: NT6X21AC/AD, P-Phone Line Card characteristics	
Circuits per pack	One
Hardware Options	Must be used in conjunction with an M5000-Series business set (Meridian Business Sets feature)
Ringing: Type	MBS
Signaling	W78 Signaling protocol
Supervision	On/off-hook supervision from the subscriber is sent as a message to the line card using W78 Signaling protocol
Loop Detection Limits: Residential	< 1230 ohms, not including set
Transmission	900 ohms nominal impedance with one balance network: 1650 ohms in parallel with 5 nF NT6X21AC: Two gain settings are automatically switched by the DMS-10 switch: a 0-dB setting produces a zero cross-office loss; a -2 dB setting produces the equivalent loss of the standard line circuit. NT6X21AD: Two gain settings are DIP switch-selectable: 0 or 3.5dB in the digital-to-analog direction.

Note: This circuit card can only be provisioned in a Line Concentrating Module Drawer.

Section 3: Trunk circuit interfaces

Introduction

This section outlines the functions, interconnections, and characteristics of the analog trunks used to interface the DMS-10 switch with interoffice or intraoffice trunks. The information contained herein is to be used as a guide when designing or engineering the connection of the DMS-10 switch to other switching systems. For more detailed information on trunk packs, consult the schematic drawings (SDs).

Types of trunk circuits

The following trunk circuit packs are available for use with the DMS-10 switch:

- NT2T20 Four-Wire E&M Signaling Trunk
- NT2T21 Two-Wire E&M Signaling Trunk
- NT2T23 Miscellaneous Loop Trunk
- NT2T24 Outgoing Loop Trunk
- NT2T27 Four-Wire, E&M Signaling Trunk, Switch Pad Control
- NT2T85 Digital Recorded Announcement Trunk pack

Hardware options on the trunk unit and software options in the DMS-10 switch permit the interfacing of E&M trunk units primarily with channel units associated with carrier facilities. The loop trunk applications generally require the use of external voice frequency (VF) equipment.

Digital trunks

Information on digital trunks is contained in the NTPs entitled *General Description* (297-3401-100) and *Equipment Identification* (297-3401-150).

Trunk circuit functions

The basic functions for each trunk pack are the same: to provide the interface between the trunk and the DMS-10 switch. This interface is necessary for:

- digital-to-analog (D/A) and analog-to-digital (A/D) conversion of the signal
- direct current (dc) isolation from the facility
- scanning and signal distribution
- signal detection

Specifications

Trunk circuits vary in the types of signaling they accommodate, their available options, and in the types of trunks to which they can interface. These characteristics are listed for each pack type, arranged according to pack number in Tables 3-A through 3-F.

The tables on the following pages present information on the types of signaling accommodated by, and the interface options of, DMS-10 analog trunk circuits. The trunk circuit packs are presented in numerical order by pack number. For each trunk pack, there is a table providing trunk circuit characteristics.

Installation

Information about the declaration of trunk circuits in software can be found in the NTP entitled *Data Modification Manual* (297-3401-311). Maintenance and testing of trunk circuits is addressed in the NTPs entitled *Maintenance Diagnostic Input Manual* (297-3401-506) and *Maintenance and Test Manual* (297-3401-511).

Circuits per Pack	Two
Hardware Options	Switch-selectable insertion loss options
Supervision	E&M signaling using Type II interface
Transmission: Impedance Input Overload	600 ohms nominal at Main Distribution Frame
Application	Incoming Outgoing Two-way
Signaling	Delay dial A or B Immediate dial Wink

Table 3-A: (Continued) NT2T20, Four-Wire E&M Signaling Trunk pack characteristics	
Circuits per Pack	Two
Pulsing	DP (loop) Digitone MF
Coin Control	In-band, multiwink
Ringback	In-band, wink, multiwink

For insertion loss option settings, refer to the NTP entitled *DIP Switch Settings for Printed Circuit Packs and Balance Networks* (297-3401-316).

Table 3-B: NT2T21, Two-Wire E&M Signaling Trunk pack characteristics	
Circuits per Pack	Two
Hardware Options:	
Insertion Loss	Switch-selectable insertion loss options
Supervision	E&M signaling using Type II interface
Transmission:	
Impedance (Ω)	900 ohms nominal
Input Overload	at Main Distribution Frame
Application	Incoming Outgoing Two-way
Signaling	Delay dial A or B Immediate dial Wink
Pulsing	DP (loop) MF
Coin Control	In-band, multiwink
Ringback	In-band, wink, multiwink

For insertion loss option settings, refer to the NTP entitled *DIP Switch Settings for Printed Circuit Packs and Balance Networks* (297-3401-316).

DMS-10 is incompatible with Expanded Inband Signaling.

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Table 3-C: NT2T23, Miscellaneous Loop Trunk pack characteristics											
Circuits per Pack	Two										
Hardware Options:											
Insertion Loss	Switch-selectable insertion loss options										
Optional Balance Networks (two required, one per circuit)	<table border="0"> <thead> <tr> <th><u>Cable</u></th> <th><u>Balance Network</u></th> </tr> </thead> <tbody> <tr> <td>H88 Loaded</td> <td>QNB65A</td> </tr> <tr> <td>D66 Loaded</td> <td>QNB65C</td> </tr> <tr> <td>Unloaded</td> <td>QNB65B</td> </tr> <tr> <td>Colocated Repeater</td> <td>NT2T25</td> </tr> </tbody> </table>	<u>Cable</u>	<u>Balance Network</u>	H88 Loaded	QNB65A	D66 Loaded	QNB65C	Unloaded	QNB65B	Colocated Repeater	NT2T25
<u>Cable</u>	<u>Balance Network</u>										
H88 Loaded	QNB65A										
D66 Loaded	QNB65C										
Unloaded	QNB65B										
Colocated Repeater	NT2T25										
Loop Detection Range	Selectable insertion loss options 0 through 3000 ohms 3000 through 4500 ohms										
Supervision:											
Transmit	Battery/ground reversal										
Receive	High/low, loop										
Pseudo Sleeve Lead	For application with incoming trunks from colocated SxS with externally provided auxiliary circuit (for example, SD3Y92-01 or SD32524-01 OGT applique circuit).										
Transmission:											
Impedance (Ω)	900 ohms nominal										
Input Overload	at Main Distribution Frame										
Application	Incoming										
Signaling:											
Outpulsing	MF										
Inpulsing	DP (loop) DP battery/ground MF										
Coin Control	Inband, wink, multiwink										
Ringback	Inband, multiwink, multiwink										

For switch-selectable options, refer to the NTP entitled *DIP Switch Settings for Printed Circuit Packs and Balance Networks* (297-3401-316).

Tandem applications.

DMS-10 is incompatible with Expanded Inband Signaling.

Table 3-D: NT2T24, Outgoing Loop Trunk pack characteristics											
Circuits per Pack	Two										
Hardware Options:											
Insertion Loss	Switch-selectable insertion loss options										
Optional Balance Networks (two required, one per circuit)	<table border="0"> <thead> <tr> <th><u>Cable</u></th> <th><u>Balance Network</u></th> </tr> </thead> <tbody> <tr> <td>H88 Loaded</td> <td>QNB65A</td> </tr> <tr> <td>D66 Loaded</td> <td>QNB65C</td> </tr> <tr> <td>Unloaded</td> <td>QNB65B</td> </tr> <tr> <td>Colocated Repeater</td> <td>NT2T25</td> </tr> </tbody> </table>	<u>Cable</u>	<u>Balance Network</u>	H88 Loaded	QNB65A	D66 Loaded	QNB65C	Unloaded	QNB65B	Colocated Repeater	NT2T25
<u>Cable</u>	<u>Balance Network</u>										
H88 Loaded	QNB65A										
D66 Loaded	QNB65C										
Unloaded	QNB65B										
Colocated Repeater	NT2T25										
Outpulsing and Battery/ Ground Resistance	Switch-selectable outpulsing options Loop, battery/ground (200/200 ohms or 574/574 ohms), MF										
Supervision:											
Transmit	Loop										
Receive	Battery/ground reversal										
Transmission:											
Impedance (Ω)	900 ohms nominal										
Input Overload	at Main Distribution Frame										
Application	Outgoing										
Signaling:											
Outpulsing	DP (loop) DP battery/ground MF										
Coin Control	Inband, multiwink										
Ringback	Inband, wink, multiwink										

For switch-selectable options, refer to the NTP entitled *DIP Switch Settings for Printed Circuit Packs and Balance Networks* (297-3401-316)

DMS-10 is incompatible with Expanded Inband Signaling.

Table 3-E: NT2T27BB, Four-Wire E&M Signaling Trunk Pack with Pad Switching characteristics	
Circuits per Pack	Two
Hardware Options:	
Type I Interface	Switch-selectable option
Type II Interface	Switch-selectable option
Insertion Loss	Switch-selectable insertion loss options
Supervision	E&M signaling using Type II or Type I interface
Transmission:	
Impedance (Ω)	600 ohms nominal
Input Overload	at Main Distribution Frame
Application	Incoming

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Table 3-E: (Continued) NT2T27BB, Four-Wire E&M Signaling Trunk Pack with Pad Switching characteristics	
Circuits per Pack	Two Outgoing Two-way
Signaling	Delay dial A or B Immediate Wink
Pulsing	DP (loop) Digitone MF
Coin Control	In-band, multiwink
Ringback	In-band, wink, multiwink

For switch-selectable option settings, refer to the NTP entitled *DIP Switch Settings for Printed Circuit Packs and Balance Networks* (297-3401-316).

Table 3-F: NT2T85, Digital Recorded Announcement Trunk pack characteristics	
Circuits per Pack	Four
Hardware Options: Message Length Optional Batteries	Switch-selectable option ² - Up to 16 s A0299802 (Two required) Hardware options - switch selectable
Application	Recorded announcement

For switch-selectable option settings, refer to the NTP entitled *DIP Switch Settings for Printed Circuit Packs and Balance Networks* (297-3401-316).

Section 4: Test trunk circuit interfaces

Introduction

This section describes the Line and Trunk Test pack (NT2T19), which is used to test various DMS-10 switch functions, and the DMS-10 test trunk circuit interfaces that are required to interconnect and match the inputs/outputs of subscriber loop testing equipment with the DMS-10 switch. These circuits provide interfaces to the following manually operated test equipment:

- Noller NP612 Remote Test System
- Badger NP612A Remote Test System
- No. 14 Local Test Desk (LTD)
- No. 3 Local Test Cabinet (LTC)
- Model 3703 Local Test Cabinet (LTC)

These circuits also provide interfaces to the following automated test equipment:

- Centralized Automatic Loop Reporting System (CALRS)
- Loop Reporting System (LRS-1, LRS-10, LRS-100)
- Mechanized Loop Testing (MLT) System

For a description of the test equipment and how it works when it is used to access a subscriber's line or equipment by way of the DMS-10 switch, refer to the NTP entitled *General Maintenance Information* (297-3401-500).

Incoming Test Trunk (NT2T16)

The Incoming Test Trunk (ITTK) pack (NT2T16) provides the interface between a DMS-10 switch and a No. 14 Test Desk (remote), No. 3 Test Cabinet (on-site), or a Model 3703 Test Cabinet. It may also be used to interface with a Loop Reporting System (LRS-1, LRS-10, LRS-100), a Centralized Automatic Loop Reporting System (CALRS), a Lordel T-9/15 Automatic Line Insulation Test (ALIT) set, or a Mechanized Loop Testing (MLT) system.

The ITTK pack allows testing of all DMS-10 subscriber loops by way of the maintenance access bus (metallic access). The particular line to be tested is selected by accessing the test trunk, then dialing the directory number (DN) of the subscriber loop to be tested. Call processing recognizes the special class of service for the Incoming Test Trunk and, instead of completing the call, connects the subscriber loop to the test trunk.

Noller/Badger interface

Three circuit packs (described below) provide the interface between the DMS-10 switch and a Noller NP612 Remote Test System or a Badger NP612A Remote Test System. These three packs are used to interface a Noller NP612 Master Station (at a central test location) with a Noller NP612 Remote Test System and the subscriber loops served by the DMS-10 switch. The master station accesses subscriber loops by way of Direct Distance Dialing (DDD) or toll network. Subscriber loops in the DMS-10 switch are accessed by the maintenance access bus under control of the Noller Master Station.

Special test codes are used for the DMS-10 switch, which constitute a departure from normal Noller test procedures. See the NTP entitled *General Maintenance Information* (297-3401-500) for connection information and special Noller test procedures.

Noller Test Trunk (NT2T17)

The Noller Test Trunk pack contains digital-to-analog (D/A) and analog-to-digital (A/D) conversion circuitry. It provides the access to the maintenance bus of the DMS-10 switch through the main distribution frame (MDF) cross-connections.

Miscellaneous Line (NT2T03 for 2 dB)

The Miscellaneous Line pack provides the three-wire terminating line necessary to access the test equipment from the distant Noller master station. The third wire (S-lead) is used to seize the test equipment. For additional information and a schematic diagram, see the "Line circuit interfaces" section of this NTP.

Auxiliary Ringing and Tone (NT2T40)

The Auxiliary Ringing and Tone pack demultiplexes the DMS-10 multifrequency ringing supply to obtain four individual ringing frequencies. In addition, it supplies a +10 dBm busy tone.

Note: The Auxiliary Ringing and Tone pack (NT2T40) is not required if the Central Office has external equipment and uses only one ringing frequency, such as fully selective or semiselective superimposed ringing.

Line and Trunk Test pack (NT2T19)

The Line and Trunk Test pack tests the basic signaling and transmission functions of all line and trunk circuit packs in the DMS-10 switch and also performs a self-test. The tests, which are only “Go/No-Go” types of tests, verify whether the line and trunk circuits of the DMS-10 switch are operational within preassigned limits.

Only one Line and Trunk Test pack is required for each DMS-10 system; the pack can be located in any Peripheral Equipment shelf. An analog pack (NT2T15) and a logic pack (NT2T18) are connected by a common faceplate to form the Line and Trunk Test pack. Only one backplane edge connector is required; however, the width of the unit requires two adjacent slots.

The Line and Trunk Test pack accesses the circuit under test (CUT) from both the digital switching (PCM) Network (by way of a Peripheral Control pack) and the analog tip and ring (by way of the maintenance access bus) or any other analog signaling leads.

The Line and Test Trunk pack is operated by the free-running Peripheral Equipment Diagnostic (PED) program, which is loaded automatically once every 24 hours, if so scheduled. Maintenance personnel can request an interactive version of this program to test a particular line or trunk circuit pack for repair purposes.

The tests performed by the Line and Trunk Test pack are:

- transmission-for performance of the circuit in send or receive direction. Test tones are generated (digital and analog) and the power content is measured. A return loss test is also performed.
- dc measurements-for presence of talk battery, coin control signals, and reverse battery as applicable
- off-hook detection-eight different terminations simulate possible loop conditions
- ring trip-checks that ringing is present, places a termination on the line, and checks for removal of ringing
- self test-checks its own operation and reports failures to maintenance personnel by way of the maintenance terminal

Incoming/Outgoing Test Trunk pack (NT2X90AD)

The Incoming/Outgoing Test Trunk pack provides an interface between the Remote Maintenance Module (RMM) in an RLCM or OPM, and a No. 14 Local Test Desk (LTD), a No. 3 Local Test Cabinet (LTC), a Centralized Automated Loop Reporting System (CALRS), or a LORDEL T-915 Automatic Line Insulation Test (ALIT) set. The Incoming/Outgoing Test Trunk pack enables operating company personnel to access the subscriber lines located locally or remotely by way of the Metallic Test Access pair at the MDF. All DMS-10 testing capabilities supported by the ITTK interface (NT2T16) are now supported by way of the NT2X90AD pack at the remote site.

The NT2X90AD pack is required only when vendor test equipment is to be used for subscriber loop testing. One Incoming/Outgoing Test Trunk pack is required for each OPM. In the RLCM, a single NT2X90AD pack can support up to four RLCMs co-located at the same remote site (same site ID).

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DMS-10 Family

600-Series Generics

Circuit Interface for Lines, Trunks, and Test Trunks

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NTP number: NTP 297-3601-184
Release: 06.01
For Generic 602.20
Status: Standard
Date: August 2006

