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NT5K02 and NT8D03 Analog Line Cards

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About this document

This document outlines the characteristics of the NT5K02 and NT8D03 Analog Line Cards. The information is intended to be used as a guide when connecting customer-provided apparatus to the line cards.

References

See the *Meridian 1 planning and engineering guide* for

- *Master index* (553-3001-000)
- *System overview* (553-3001-100)
- *System engineering* (553-3001-151)
- *Spares planning* (553-3001-153)
- *Equipment identification* (553-3001-154)

See the *Meridian 1 installation and maintenance guide* for

- *System installation procedures* (553-3001-210)

Note: *System installation procedures* contains the procedures for the analog line card cross-connections.

- *Circuit card installation and testing* (553-3001-211)
- *Fault clearing* (553-3001-510)
- *Hardware replacement* (553-3001-520)

2 About this document

See the *X11 software guide* for an overview of software architecture, procedures for software installation and management, and a detailed description of all X11 features and services. This information is contained in two documents:

- *X11 software management* (553-3001-300)
- *X11 features and services* (553-3001-305)

See the *X11 input/output guide* (553-3001-400) for a description of all administration programs, maintenance programs, and system messages.

Description

NT8D03 Analog Line Card (μ -Law)

The NT8D03 Analog Line Card provides talk battery and signaling for regular 2-wire common battery 500-type (rotary dial) and 2500-type (Digitone dial) telephones and key telephone equipment.

The analog line card interfaces to and is compatible with the equipment listed in Table 1.

Table 1
NT8D03 Analog Line Card application and compatibility

Equipment	Specifications
500-type rotary dial telephones: dial speed percent break interdigit time	8.0 to 22.5 pps 58 to 70% 150 ms
2500-type Digitone telephones: frequency accuracy pulse duration interdigit time speed	$\pm 1.5\%$ 40 ms 40 ms 12.5 digits/s

Physical description

Analog line cards are housed in:

- NT8D37 Intelligent Peripheral Equipment (IPE) Modules:
up to 16 cards
- NT8D11 Common/Peripheral Equipment (CE/PE) Modules:
up to 10 cards

The analog line card circuitry is mounted on a 31.75 by 25.40 cm (12.5 by 10 in.) printed circuit board.

The analog line card connects to the backplane through a 160-pin edge connector. The backplane is cabled to the input/output (I/O) panel, which connects to the main distribution frame (MDF), also called a cross-connect terminal, through 25-pair cables. Telephones then connect to the card at the MDF.

The faceplate of the analog line card is equipped with a red light emitting diode (LED) which lights when the card is disabled. When the card is installed, the LED remains lit for two to five seconds as a self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED does not follow the pattern described or operates in any other manner (such as continually flashing or remaining weakly lit), the card should be replaced.

Functional description

The analog line card contains an 8051-family microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- maintenance diagnostics

The analog line card also provides:

- 600-ohm balanced terminating impedance
- analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio telephone lines
- transmission and reception of scan and signaling device (SSD) signaling messages over a DS30X signaling channel in A10 format
- on-hook and off-hook status detection
- 20-Hz ringing signal connection and automatic disconnection when the telephone goes off-hook
- synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage
- loopback of SSD messages and Pulse Code Modulation (PCM) signals for diagnostic purposes
- correct initialization of all features, as configured in software, at power-up
- direct reporting of digits dialed (500 telephones) by collecting dial pulses

NT5K02 Flexible Analog Line Card (A-Law)

The NT5K02 Flexible Analog Line Card provides talk battery and signalling for regular 2-wire common battery 500-type (rotary dial), 2500-type (Digitone* dial) telephones and key telephone equipment. The telephones may have either ground button recall switches, high voltage message waiting lamps, or low voltage message waiting LEDs.

Application

The NT5K02 Flexible Analog Line Card is used as follows:

- NT5K02AA — High voltage message waiting analog line card typically used in Australia.
- NT5K02DA — Ground button low voltage message waiting analog line card typically used in France.
- NT5K02EA — Ground button low voltage message waiting analog line card typically used in Germany.

- NT5K02FA — Ground button low voltage message waiting analog line card with 600 Ω termination (A/D -4dB, D/A -1dB).
- NT5K02GA — Same as NT5K02FA with different loss plan (A/D -4dB, D/A -3dB)
- NT5K02HA — Ground button low voltage message waiting analog line card typically used in Belgium.
- NT5K02JA — Low voltage message waiting analog line card typically used in Denmark.
- NT5K02KA — Ground button low voltage message waiting analog line card typically used in Netherlands.
- NT5K02LA — Analog line card typically used in New Zealand.
- NT5K02MA — Ground button low voltage message waiting analog line card typically used in Norway.
- NT5K02NA — Ground button low voltage message waiting analog line card typically used in Sweden.
- NT5K02PA — Ground button low voltage message waiting analog line card typically used in Switzerland.
- NT5K02QA — Ground button low voltage analog line card typically used in United Kingdom.

Physical description

Analog line cards are housed in:

- NT8D37 Intelligent Peripheral Equipment (IPE) Modules:
up to 16 cards
- NT8D11 Common/Peripheral Equipment (CE/PE) Modules:
up to 10 cards

The analog line card circuitry is mounted on a 31.75 by 25.40 cm (12.5 by 10 in.) printed circuit board.

The analog line card connects to the backplane through a 160-pin edge connector. The backplane is cabled to the input/output (I/O) panel, which connects to the main distribution frame (MDF), also called a cross-connect terminal, through 25-pair cables. Telephones then connect to the card at the MDF.

The faceplate of the analog line card is equipped with a red light emitting diode (LED) which lights when the card is disabled. When the card is installed, the LED remains lit for two to five seconds as a self-test runs. If the self-test completes successfully, the LED flashes three times and remains lit until the card is configured and enabled in software, then the LED goes out. If the LED does not follow the pattern described or operates in any other manner (such as continually flashing or remaining weakly lit), the card should be replaced.

Functional description

The analog line card contains an 8051-family microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- maintenance diagnostics

The analog line card also provides:

- 600-ohm balanced terminating impedance
- analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio phone lines
- transmission and reception of scan and signaling device (SSD) signaling messages over a DS30X signaling channel in A10 format
- on-hook and off-hook status detection
- 20-Hz ringing signal connection and automatic disconnection when the station goes off-hook
- synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage
- loopback of SSD messages and Pulse Code Modulation (PCM) signals for diagnostic purposes
- correct initialization of all features at power-up
- direct reporting of digit dialed (500 sets) by collecting dial pulses
- ground button detection

Technical summary

NT8D03 Analog Line Card

Analog line interface

The NT8D03 Analog Line Card meets the EIA/TA464 standard for ONS Type II line cards.

Input impedance

The impedance at tip and ring is 600 ohms with a return loss of

- 20 dB for 200-500 Hz
- 26 dB for 500-3400 Hz

Insertion loss

On a line to line connection, the total insertion loss at 1 kHz is $4 \text{ dB} \pm 1 \text{ dB}$. This is arranged as 3.5 dB loss for analog to PCM, and 0.5 dB loss for PCM to analog.

Frequency response

The loss values in Table 2 are measured relative to the loss at 1 kHz.

Table 2
NT8D03 Analog Line Card frequency response

Frequency (Hz)	Minimum (dB)	Maximum (dB)
60	20.0	—
200	0.0	5.0
300	-0.5	1.0
3000	-0.5	1.0
3200	-0.5	1.5
3400	0.0	3.0

Message channel noise

The message channel noise C-weighted (dBrnC) on 95 percent of the connections (line to line) with both ends terminated in 600 ohms does not exceed 20 dBrnC.

Table 3 provides a technical summary of the analog line card.

Table 3
NT8D03 Analog Line Card technical summary

Characteristics	Description
Impedance	600 Ω
Loop limit (excluding telephone)	1000 Ω at nominal -48 V (excluding telephone)
Leakage resistance	30,000 Ω
Ring trip	During silent or ringing intervals
Ringing voltage	86 V ac
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (approximately -44.5 V on ring and -2.5 V on tip at nominal -48 V battery)
Power input from backplane	-48 (can be as low as -42 for DC-powered systems), +15, -15, +8.5 V and ringing voltage
Insertion loss	4 dB \pm 1 dB at 1020 Hz 3.5 dB loss for analog to PCM 0.5 dB loss for PCM to analog

Power requirements

Table 4 provides the power requirements for the analog line card.

Table 4
NT8D03 Analog Line Card power requirements

Voltage (+/-)	Tolerance	Idle current	Active current	Maximum
+15.0 V dc	0.50 V dc	48 mA	0 mA	48 mA
+8.5 V dc	1.00 V dc	150 mA	8 mA	280 mA
-48.0 V dc	2.40 V dc	48 mA	40 mA (Note 1)	688 mA
-48.0 V dc	2.40 V dc	0 mA	10 mA (Note 2)	320 mA
86.0 V ac	5.00 V ac	0 mA	10 mA (Note 3)	160 mA

Note 1: Current required for each line off hook.
Note 2: Each active ringing relay requires 10 mA of battery voltage.
Note 3: Reflects the current for ringing a single DN telephone. There may be as many as five ringers on each line.

Foreign and surge voltage protection

In-circuit protection against power line crosses or lightning is not provided on the analog line card. When the card is used to service off-premise telephones, primary and secondary MDF protection must be installed. Off-premise telephones served by cable pairs routed through the central office, or crossing a public right-of-way, can be subject to a requirement for on-card protection, and MDF protectors may not be acceptable. Check local regulations before providing such service.

Overload level

Signal levels exceeding +6.5 dBm0 applied to the tip and ring cause distortion in speech transmission.

Backplane pin layout

Table 5 shows the I/O pin designations at the backplane connector, which is arranged as an 80-row by 2-column array of pins. Normally, these pin positions are cabled to 50-pin connectors at the I/O panel in the rear of each module, for connection with 25-pair cables to the MDF.

The information in Table 5 is provided as a reference and diagnostic aid at the backplane, since the cabling arrangement may vary at the I/O panel. See *System installation procedures* (553-3001-210) for cable pinout information at the I/O panel.

Table 5
NT8D03 Analog Line Card backplane pinout assignments

Backplane pinout		Lead designations	
12A	12B	R0	T0
13A	13B	R1	T1
14A	14B	R2	T2
15A	15B	R3	T3
16A	16B	R4	T4
17A	17B	R5	T5
18A	18B	R6	T6
19A	18B	R7	T7
62A	62B	R8	T8
63A	63B	R9	T9
64A	64B	R10	T10
65A	65B	R11	T11
66A	66B	R12	T12
67A	67B	R13	T13
68A	68B	R14	T14
69A	69B	R15	T15

Note: These pinouts apply to both NT8D37 and NT8D11 backplanes.

NT5K02 Flexible Analog Line Card

Analog line interface

The technical characteristics for the NT5K02 Flexible Analog Line (A-Law) card are comparable with those for the Analog Line card with the following exceptions:

Input impedance

The impedance at Tip and Ring is 600 ohms with a return loss of
 15 dB for 300-600 Hz
 20 dB for 600-3400 Hz

Countries with termination impedances other than 600Ω are listed in Table 6:

Table 6
Termination impedances

Country	Code	Termination
Australia	NT5K02AA	220+820//120uF
Belgium	NT5K02HA	150+830//72nF
Denmark	NT5K02JA	430+820//33nF
France	NT5K02DA	180+910//150nF
Netherlands	NT5K02KA	340+422//150nF
New Zealand	NT5K02LA	370+620//310nF
Norway	NT5K02MA	120+820//110nF
Sweden	NT5K02NA	200+1000//100nF
Switzerland	NT5K02PA	180+470//68nF
United Kingdom	NT5K02QA	300+1000//220nF
Germany	NT5K02EA	220+820//115nF

Insertion loss

On a station line-to-line connection, the total insertion loss at 1 KHz is as listed in Table 7 with a reference level of 0 dBm0.

Table 7
Insertion losses

Country	Gain (dB)			Tolerance (dB) A-A
	A/D	D/A	A/A	
France	1.4	-8.4	-7.0	+/- 0.7
Germany	0	-7.0	-7.0	+/- 0.7
Australia	-1.5	-7.5	-9.0	+/- 0.7
Sweden	-6.0	-5.0	-11.0	+/- 1.0
United Kingdom	-3.0	-4.0	-7.0	+/-0.7

Note: Other countries may also be accommodated with component substitution.

Frequency response

The loss values in the Table 8 below are measured relative to the loss at 1 KHz with a reference level of -10 dBm0:

Table 8
Frequency responses

Freq	Frequency Response (Loss) A-A							
	Australia		Germany		France		Sweden	
	Min	Max	Min	Max	Min	Max	Min	Max
200 Hz	0.0 dB	-	0.0 dB	-	0.0 dB	-	0.0 dB	-
300 Hz	-0.6 dB	2.0 dB	-0.7 dB	2.0 dB	-0.6 dB	2.0 dB	-0.6 dB	2.0 dB
500 Hz	-0.6 dB	0.6 dB	-0.7 dB	0.7 dB	-0.6 dB	1.0 dB	-0.6 dB	1.1 dB
3000 Hz	-0.6 dB	1.0 dB	-0.7 dB	0.7 dB	-0.6 dB	1.0 dB	-0.6dB	1.1 dB
3200 Hz	-0.6 dB	2.0 dB	-0.5 dB	1.5 dB	-0.6 dB	2.0 dB	-0.6 dB	3.0 dB
3400 Hz	-0.6 dB	2.0 dB	0.0 dB	2.0 dB	-0.6 dB	2.0 dB	-0.6dB	3.0 dB

Idle channel noise

The idle channel noise (psophometric weighted) on 95% of the connections (line to line) with both ends terminated with the appropriate termination shall not exceed -65 dBm0p.

A technical summary of the Flexible Analog Line card is given in Table 9.

Table 9
Technical summary

Impedance	600Ω or see Table 6
Loop limit (including set)	1000Ω at nominal -48V 1800Ω at nominal -48V (for Australia)
Leakage resistance	30,000Ω
Ring trip	During silent or ringing intervals
Ringing voltage	86V ac
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (-48 V on ring; ground on tip)
Power input from shelf backplane	See Table 10
Insertion loss	See Table 7

Ringer limitations

Five or fewer of type NE-C4A (or equivalent) ringers per line.

No. of ringers	2	3	4	5
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Note: Ring source impedance must be ≥ 1 kohms for Australia including the line feed resistors.

Ground button detection

The ground button detector will send a “recall signal” 30-50 ms after the application of ground through a resistance R to either Tip or Ring of a telset connected in a balanced loop of up to 1000Ω. Resistance R may be of value 0 to 500Ω.

Power requirements

The NT5K02 Flexible Analog Line card has the following power requirements:

Table 10
Power requirements

Voltage (+/-)	Tolerance	Idle current	Active current	Max
+ 15.0 V dc	0.05 V dc	120 ma	0 ma	120 ma
- 15.0V dc	0.05 V dc	48 ma	0 ma	48 ma
+ 8.5V dc	1.00 V dc	250 ma	8 ma	280 ma
- 48.0 V dc	2.40 V dc	60 ma	40 ma	700 ma
- 48.0 V dc	2.40V dc	0 ma	(1) 10 ma	320 ma
86.0 V ac	5.00 V ac	0 ma	(2) 10 ma	160 ma
-120.0 V dc	5.00 V dc	0 ma	1 ma	32 ma

Notes: (1) Each active ringing relay requires 10 ma of battery voltage.

(2) Reflects the current for ringing a single station set. There may be as many as five ringers on each line.

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NT5K02 and NT8D03 Analog Line Cards

Description

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