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Meridian 1

# **Intelligent peripheral equipment circuit cards for Sweden**

## **Option 11 - Description and Installation**

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# Revision history

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## About this document

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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 Sweden:

- NT5K83FA E&M Tie Trunk card
- NT5K02NB Flexible Analog line card
- NT5K96NB Flexible Analog line card.

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# E&M tie trunk circuit card

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## Functional description

The NT5K83FA 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 1-10 in the Option 11 main cabinet and in any slot in the expansion cabinet.

The NT5K83FA E&M Tie trunk card supports four analog trunks. Each trunk circuit can be individually configured as:

- 2-wire E&M BPO (Type V)
- 4-wire E&M , Type II
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk
- Music (Mus) trunk

## Common features

The NT5K83FA E&M Tie trunk card:

- has four switch settings (one per unit) used to select Type V E&M signaling.

**Note:** Systems using Phase 8B or later software can select BPO signaling in overlay 14.

- supports “wink”, “immediate start”, or “delay dial” signaling
- converts transmission signals from analog-to-digital and from digital-to-analog

- provides software selectable A-law or  $\mu$ -law operation
- enables and disables individual units or the entire card under software control
- provides indication of card status on the faceplate LED
- allows trunk type to be configured on a per unit basis in software
- provides termination and transhybrid balance matching against Swedish complex impedance for 2 wire E&M trunk circuits
- provides termination against 600 ohms for 4-wire 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 four switch settings on the NT5K83FA circuit card, one for each trunk unit. The switches are used to select Type V E&M signaling. (Type II E&M is selected in software).

*Note:* In order for Type V signaling to work, the TYP prompt in LD 14 must be set to TY1 or to BPO if available.

**Table 1**  
**NT5K83FA E&M Trunk card switch settings**

Signaling	Switch Setting (J1.x)	
	Pins 1-2	Pins 2-3
4-wire Type II RAN MUS PAG	Closed	Open
2-wire Type V (BPO)	Open	Closed

## Connections

Each unit on the E&M card 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 2 to 6 provide cross connect information for the NT5K83FA E&M Trunk card. Four pairs of interfaces exist on each unit.

- The first pair is the Receive Path.
- The second pair is the Transmit Path.
- The third pair (E&M) is used for signaling.
- The fourth pair is used for RAN, Paging, and Type 2 signaling.

**Table 2**  
**NT5K83FA E&M 2-wire Type V Trunk connections**

Lead	Pins	Pair color	Unit number
T0	27	W-O	Unit 0
R0	2	O-W	
E	28	W-G	Unit 0
M	3	G-W	
T1	31	R-BL	Unit 1
R1	6	BL-R	
E	32	R-O	Unit 1
M	7	O-R	
T2	35	R-S	Unit 2
R2	10	S-R	
E	36	BK-BL	Unit 2
M	11	BL-BK	
T3	39	BK-BR	Unit 3
R3	14	BR-BK	
E	40	BK-S	Unit 3
M	15	S-BK	

**Table 3**  
**NT5K83FA 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 4**  
**NT5K83FA 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 5**  
**NT5K83FA E&M 4 Wire (Transmission) Type II (Signaling) 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	
SIG0A SIG0B	29 4	BR-W W-BR	
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	
SIG1A SIG1B	33 8	R-G G-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	
SIG2A SIG2B	37 12	BK-O O-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	
SIG3A SIG3B	41 16	Y-BL BL-Y	

**Note:** The cable pair designated TA, TB is the transmit pair. The pair designated RA, RB is the receive pair.

### Self-test

When the NT5K83FA 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 NT5K83FA 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 NT5K83FA E&M trunk card is attached to a route with an associated route data block. The route data block is programmed in overlay 16.

**Note:** All prompts are defaulted except for those noted in Table 6. Default values are shown in brackets.

**Table 6**  
**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	0-511	Enter route number
TKTP	TIE, RAN, PAG	Define trunk type as Tie, Recorded announcement or Paging
ICOG	IAO	Incoming and Outgoing trunk
ACOD	XX	XX=Trunk route access code

### Trunk Data Block

Use overlay 14 to configure each of the trunk units on the NT5K83FA E&M trunk card. Default values are shown in brackets.

**Table 7**  
**LD 14 Route Data Block**

Prompt	Response	Comments
REQ	NEW	Define a new trunk unit
TYPE	TIE, RAN, PAG	Trunk type Tie, (Recorded announcement), (Voice paging)
TN	CC UU	Terminal number of the unit: Card, Unit
XTRK (see note)	XFEM	Type is IPE XFEM
SIGL	EM4, EAM,	4 wire E&M, 2-wire E&M,
EMTY	TY1, (TY2)	Type 1 signaling, (Type 2) Also use TY1 for Type V or BPO
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
CLS	DTN, (DIP)	Digitone, (Dialpulse)

*Note:* This prompt is required only for the first unit defined on each NT5K83FA card.

## Technical description

### Power requirements

Table 8 lists the power requirements for the NT5K83FA trunk card.

**Table 8**  
**NT5K83FA Power requirements**

<b>Voltage</b>	<b>Active Current</b>
+/- 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 9 provides the environmental specifications for the NT5K83FA E&M Tie trunk card.

**Table 9**  
**NT5K83FA Environmental specifications**

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

## Transmission parameters

Loss values for all modes of operation on the E&M trunk card are as follows:

Mode	Pads	A/D Loss (dB)	D/A Loss (dB)
4 wire Mode	Pad out	-3.5	3.5
(EM4)	Pad in	2.5	3.5
RAN		0.0	N/A
PAGING		N/A	0.0
2 wire Mode	Pad out	-2.0	3.0
(EAM)	Pad in	0.0	5.0

## Trunk types description

Each unit on the NT5K83FA E&M Tie trunk card supports:

- 2 wire E&M Type II, Type V (BPO)
- 4 wire E&M Type II
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk

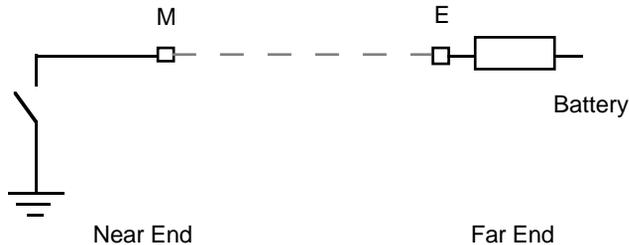
## E&M trunk operation

The NT5K83FA E&M tie trunk supports Type II, and Type V methods of signaling.

## Type I and Type V (BPO) E&M send and receive signals

Type I and Type V (BPO)E&M signaling use two signaling leads, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M lead and received on the E lead as shown in Figure 1. Earth is used for the signal return path.

**Figure 1**  
**Type V (BPO) signaling**



### Send signals

In Type V (BPO) mode, all signals are sent as either “Earth on” or “Earth off” applied to the M wire. Earth off consists of open circuit applied to the M wire, Earth on is the application of ground to the M wire.

### Receive signals

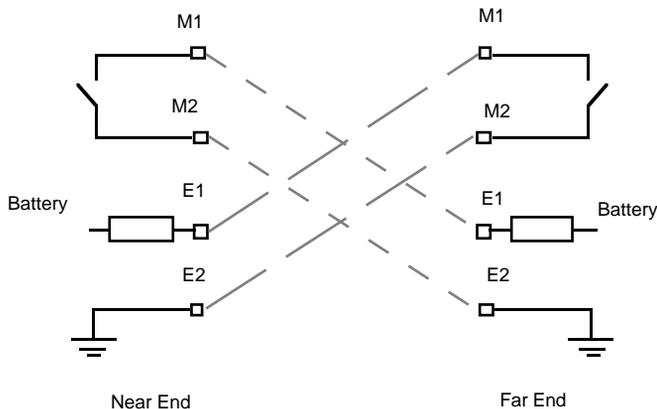
All signals are received as either “Earth on” or “Earth off” applied to the E wire, where:

- Earth on is the application of ground to the E wire through a resistance of up to 1500 ohms
- Earth off is the application of ground to the E wire through a resistance of up to 20 Kohms.

### Type II E&M send and receive signals

Type II E&M operation uses two signaling pairs, E and M, that are electrically separated from the associated speech circuit. Signals are sent on the M pair and received on the E pair as shown in Figure 2.

**Figure 2**  
**E&M Type II signaling**



**Send signals**

All signals are sent as either an “Open” or “Closed” condition applied to the M wire pair.

**Receive signals**

All signals are received as either an “Open” or “Closed” condition applied to the E wire, where:

- The Closed condition is a resistance of up to 2 Kohms applied to the E wire pair
- The Open condition is a resistance of greater than 20 Kohms applied to the E wire pair.

**Type II and Type V signaling**

Tables 10 and 11 provide a summary of signaling states for Type I, Type II, and Type V signaling respectively.

**Idle state**

In the Idle state, the Option 11 applies an idle signal to the M wire to indicate that it is free to accept incoming calls.

**Seize**

To place an outgoing call, the Option 11 at the near end sends a seizing signal through the M lead to the far end. The incoming end recognizes the seize signal and prepares to receive digits.

**Holding**

The continued receipt of the seize signal is seen by the incoming end as a hold signal.

**Dialing**

The Option 11 sends digits through the M lead in the form of 10 pps of the open-circuit condition.

**Answer**

When the called party answers, the far end sends an “answer” signal through the M lead.

**Call disconnect**

Either party can disconnect the call by applying a clear signal to the M lead. 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 10**  
**Summary of NT5K83FA Type II signaling states**

Signal	Outgoing PBX sending condition—M wire	Incoming PBX sending condition—M wire
Idle	Open	Open
Seize	Closed	—
Hold	Continuation of seizing signal	—
Digit Pulse	Open pulses in step with dial pulses	—
Answer	—	Closed
Clear forward	Open for longer than 300 milliseconds	—
Clear back	—	Open for longer than 300 milliseconds

**Table 11**  
**Summary of NT5K83FA Type V signaling states**

<b>Signal</b>	<b>Outgoing PBX sending condition—M wire</b>	<b>Incoming PBX sending condition—M wire</b>
Idle	Earth off	Earth off
Seize	Earth on	—
Hold	Continuation of seizing signal	—
Digit Pulse	Earth off pulses in step with dial pulses	—
Answer	—	Earth on
Clear forward	Earth off for longer than 300 milliseconds	—
Clear back	—	Earth off for longer than 300 milliseconds

### **Recorded Announcement trunk operation**

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

The NT5K83FA E&M Tie trunk card supports the following types of announcement machines:

- Start mode announcement machines
- Continuous mode announcement machines

Recorded announcement machines 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:

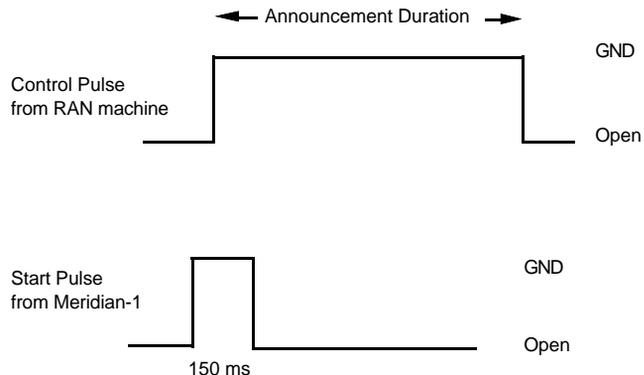
- an impedance of 4 ohms or less
- ground to the trunk unit when playing and an open circuit when idle. This is done through a control lead to the trunk circuit.
- default signal level of -9 dBm (in 600Ω) adjustable to a level of 10 dBm.

To start the announcement, the NT5K83FA 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 NT5K83FA 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 3 shows recorded announcement in start mode.

**Figure 3**  
**Recorded announcement - start mode**



### Continuous mode

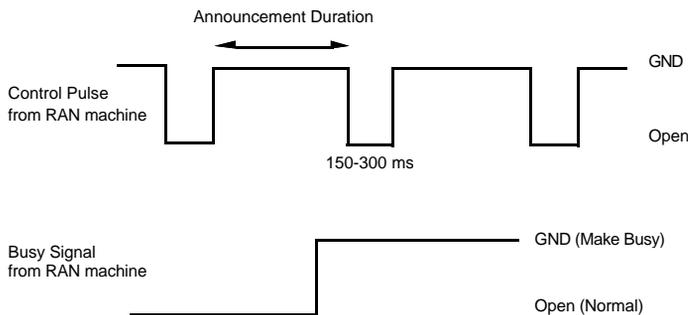
The requirements for continuous mode announcement machines are as follows:

- 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 or erasing a message or if the machine is malfunctioning. The busy signal will be used by the Option 11 for maintenance purposes.

Figure 4 shows recorded announcement in continuous mode.

**Figure 4**  
**Recorded announcement - continuous mode**



### Music source

The music source should provide an impedance of 600 Ω. The default signaling 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.

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# Flexible analog line circuit card

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## Functional description

The Flexible analog line card provides an interface for up to 16 analog (500/2500-type) telephones lines. It can be installed in slots 1-10 in the Option 11 main cabinet and in any slot in the expansion cabinet.

There are two types of Flexible Analog Line cards available for use in Sweden:

- the NT5K02NB line card with message waiting
- the NT5K96NB line card without message waiting.

## Common features

Both Flexible Analog line cards provide the following features:

support of digipulse or digitone telephones

- telephone on-hook and off-hook detection based on loop current
- ground button detection
- relay for connecting an ac ringing signal
- collection of dial pulses (10 and 20 pps) from 500-type telephones
- analog to digital and digital to analog conversion for 16 analog telephone lines
- terminating impedance of 600 ohms

- software selectable A-Law or  $\mu$ -Law companding
- provision of line current to telephones. Line current is limited on short loops or under fault conditions. Otherwise, current varies according to loop length to allow automatic gain compensation.

## 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 NT5K02NB is equipped with a red LED which lights when all the assigned units on the circuit card are disabled.

## Technical description

### Power requirements

Table 12 lists the power requirements for Flexible Analog line card.

**Table 12**  
**NT5K02NB and NT5K96NB power requirements**

<b>Voltage</b>	<b>Idle current</b>	<b>Maximum current (all units active)</b>
+15.0 V dc	120 ma	120 ma
-15.0 V dc	48 ma	48 ma
+ 8.5 V dc	250 ma	280 ma
-48.0 V	0 ma	320 ma
- 48.0 V dc	60 ma	700 ma
Ring V ac	0 ma	160 ma (See note)

*Note:* 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 13 lists the environmental specifications of the Flexible Analog line card.

**Table 13**  
**NT5K02NB and NT5K96NB environmental specifications**

<b>Parameter</b>	<b>Specifications</b>
Operating temperature	0 to 45 degrees C, ambient
Operating humidity	10 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  $\Omega$  at -48 V excluding the telephone set. The minimum and maximum values of current feed are 11 ma to 30 ma respectively. A resistance of more than 16 kohm is recognized as an idle or release signal.

Table 14 lists the number of telephone sets that can be supported by the loop.

**Table 14**  
**Loop limits**

<b>Loop resistance including telephone sets</b>	<b>Number of telephone sets</b>
350 $\Omega$ or less	2
Over 350 $\Omega$ to a maximum of 1300 $\Omega$	1

### **Ringers**

A maximum of 5 NE-C4A ringers can be supported on one unit. Ringing is supplied to the telephones at a frequency of 25 Hz +/- 3Hz or 50 Hz +/- 1 Hz. The maximum rms voltage must not exceed 85V in no load operation.

### **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 as a result of a reversal of the Tip and Ring leads.

### **Digipulse dialing**

The Flexible Analog line card collects all digits of 7-13 pps.

### **Ground button detection**

The ground button detector sends a recall signal 30 to 50 ms after the application of ground through a resistance R to either the Tip or Ring of a telset connected in a balanced loop of up to 1000 Ohms. The loop resistance (R) to the ground signal can be between 0 and 500  $\Omega$ .

The ground must be applied for a time greater than the minimum hookflash time. This time is downloaded from software and is known as the ground button validation time.

### **Transmission parameters**

Loss values for the NT5K02NB and NT5K96NB Flexible Analog Line cards are as follows:

Analog to Digital loss: 0.0 dB +/- 0.5 dB

Digital to Analog loss: +5.0 dB +/- 0.5 dB

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# **Intelligent peripheral equipment circuit cards for Sweden**

Option 11 - Description and  
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