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Meridian 1

# **United Kingdom Trunk Cards**

## Description

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## About this document

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This document describes trunk cards that are available for use only in the United Kingdom. It outlines the functions and applications of the following cards:

- NT5K17 Direct Dialling Inward Trunk card
- NT5K18 Exchange Line Trunk card
- NT5K19 Analog Tie Trunk card.

The above circuit cards have software enhancements that comply with United Kingdom standards. A software feature, “UK Analog Hardware Support”, has been created to provide assistance in configuring the cards. For a description of this feature, see *Features and Services for Generic X11 Supplementary Features Appendix 2 to 553—2311—105*.

## References

See the *Meridian 1 Planning & Engineering Guide* (NTCK04) for the following information:

- Master index
- System overview
- Installation planning
- System engineering
- Spares planning
- Equipment identification and ordering.

See the *Meridian 1 Installation and Maintenance Guide* (NTCK01) for the following information:

- Installation procedures
- Circuit card installation and testing
- System upgrades procedures
- General maintenance information
- Fault clearing
- Hardware replacement.

See the *Generic X11 Including Supplementary Features* (NTCK09) for the following information:

- an overview of software architecture
- procedures for software installation and management
- a detailed description of all software features and services.

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# NT5K17 — Direct Dialing Inward trunk card

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## Functional description

The NT5K17 Direct Dialing Inward (DDI) trunk card provides the interface between a trunk and either an NT8D37 Intelligent Peripheral Equipment (IPE) module or NT8D11 Common Equipment/Peripheral Equipment (CE/PE) module.

The NT5K17 DDI trunk card can be installed in any PE slot in an IPE or CE/PE module. Up to sixteen cards can be installed in each NT8D37 IPE module. The NT8D11 CE/PE module can hold up to ten DDI cards.

The NT5K17 DDI trunk card provides eight analog trunks, each trunk unit can be configured individually to operate as Direct Dialing Inward trunks.

Refer to the “UK Analog Hardware Support” feature to assist in configuring the NT5K17 circuit card. This feature is described in *Features and Services for Generic X11 Supplementary Features Appendix 2 to 553—2311—105*.

## Common features

Each NT5K17 DDI Trunk card:

- indicates self-test status during an automatic or manual self-test. Self-test pass is indicated on the faceplate LED.
- converts transmission signals from analog-to-digital and from digital-to-analog for up to 8 audio paths

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- provides for loss pads appropriate to 3 dB, 6 dB and 8 dB Public Switched Telephone Network (PSTN) lines as governed by the UK System Loss plan
- provides termination impedance to match the UK three-component complex network
- provides transhybrid balance matching against the UK complex impedance
- provides Analog-to-Digital and Digital-to-Analog call path losses for DDI trunk units, values downloadable in the initial configuration stage.

### **Microprocessor**

The NT5K17 DDI trunk card is equipped with an Intel 8052-type microprocessor that controls card operation. The microprocessor also provides the communication function for the card.

The NT5K17 DDI trunk card communicates with the controller card through a serial communication link. Features provided through the serial link include:

- card-identification
- self-test status reporting
- status reporting to the controller card
- maintenance diagnostics.

### **Signalling and control**

The signalling and control portion of the NT5K17 DDI trunk card operates with the Central Processing Unit (CPU) to control card hardware. The card receives messages from the CPU over a signalling channel and returns status information to the CPU over the same channel. The signalling and control portion of the card provides the means for analog loop terminations to establish, supervise, and take-down call connections.

### **Signalling interface**

Trunk signalling messages are three bytes in length. The messages are transmitted in channel zero of the DS-30X in A10 format.

Configuration information for the NT5K17 DDI trunk card is downloaded automatically from the CPU during power-up or manually by commands from maintenance programs.

## Physical description

### Measurements

Each NT5K17 DDI trunk card measures as follows:

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

### Connections

The NT5K17 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 A and B leads. For detailed termination and cross-connect information, see *System installation procedures (553—3001—210)*.

### 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.

## Technical description

The technical details of the NT5K17 Direct Dialing Inward trunk card are outlined below.

### Power requirements

Table 1-1 lists the power requirements for the NT5K17 DDI trunk card.

**Table 1-1**  
**NT5K17 power requirements**

Vo ltage	Idle cu rrent	Ac tive current
+ 15.0 V dc	195 ma	195 ma
-15 V dc	240 ma	215 ma
+8.5 V dc	85 ma	85 ma
-48 V dc	50 ma	500 ma
+ 5.0 V dc	195 ma	175 ma

### Environmental specifications

Table 1-2 lists the environmental specifications for the NT5K17 DDI card.

**Table 1-2**  
**NT5K17 Environmental specifications**

Parameter	Sp ecificatio ns
Operating temperature	0 to 50 degrees C , ambient
Operating hum idity	5 to 95 % RH (non-condensing)
Storage temperature	- 50 to + 70 degrees C

### PAD switching

Loss values for the NT5K17 DDI trunk card are as follows:

Lo ss	An alo g-to -Digital	Digital-to -An alo g
PAD out	-4 d B	-3 d B

PAD in

-2 dB

-1 dB

The transmission properties of each trunk are characterized by the class-of-service (COS) assigned in the trunk data block (LD 14).

- PADs should be switched OUT when connecting to "long line" (0-8 dB) public exchange trunk interfaces.  
(COS = LOL)
- PADs may be switched IN when connecting to "short line" (0-6 dB) public exchange trunk interfaces.  
(COS = SHL)

## Direct Dialing Inward description

Each unit on the NT5K17 DDI card is capable of operating as a DDI trunk. Table 1-3 presents a summary of NT5K17 DDI trunk card signalling states. For information on features and signalling arrangements, refer to *Generic X11 including supplementary features* (PO730484 or NTCK09 in the UK)

### Idle State

When the public exchange presents a high impedance of 8.5K ohms or greater to the DDI unit, the NT5K17 DDI trunk card is in the idle state. Ground is present on the A wire and negative battery (-48V) is present on the B wire.

### Seize

The public exchange initiates a call by placing a low resistance loop (2.2 K ohms or less) across the A and B leads. The increased current flow will trigger a front end detector. A message is sent to the Central Processing Unit (CPU), and the microprocessor prepares for receipt of dialing digits.

### Dialing

The public exchange sends address digits in the form of make and break signals. Signalling rates are from 7 PPS to 12 PPS with a nominal rate of 10 PPS and a 40 to 84% break interval. Break impedance is 8.5 K ohms or greater, while make impedance is 2.22K ohms or less.

### Answer

When the terminating party answers, the DDI unit reverses battery and ground on the A and B leads (-48V on A and Ground on B).

**Far End Release**

The public exchange disconnects the call by sending a forward clear signal. The forward clear signal is a high impedance loop (8.5K 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. If this state lasts for greater than 150 ms, the CPU will send a release acknowledgement message to the DDI unit. The DDI unit will respond by returning to the idle state.

**Near End Release**

When the Meridian 1 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 public exchange detects the idle state, it restores the high impedance loop on the A and B wires. The CPU interprets the high impedance loop as a release acknowledgement signal from the public exchange.

**Backward Busy or Disabled**

When a DDI unit is busy or disabled and cannot accept a call, it sends a backward busy signal to the public exchange. In this state, both battery and ground are removed from the A and B wires.

**Table 1-3**  
**Summary of NT5K17 DDI Trunk card signalling states**

Signal	Public Exchange State	Meridian 1 State
Idle	High Impedance Loop (8.5K ohm s or greater)	Ground on A wire -48V on wire
Seize	Low Impedance Loop (2.2 K ohm s or less)	—
Dialing	Break: High Impedance Loop Make: Low Impedance Loop	—
Answer	—	-48V on wire Ground on B wire
Public Exchange disconnects first (Far End Release)	High Impedance Loop	—
Far End Release acknowledgement	—	Ground on A wire -48V on B wire
Meridian 1 disconnects first (Near End Release)	—	Ground on A wire -48V on B wire
Near End Release acknowledgement	High Impedance Loop	—
Backward Busy	—	Open Circuit on A wire Open Circuit on B wire

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## NT5K18 — Exchange Line trunk card

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### Functional description

The NT5K18 Exchange Line trunk card provides the interface between a trunk and either an NT8D37 Intelligent Peripheral Equipment module (IPE) or NT8D11 Common Equipment/Peripheral Equipment (CE/PE) module.

The Exchange Line trunk card can be installed in any PE slot in an IPE or CE/PE Module. Up to sixteen cards can be installed in one NT8D37 IPE module. An NT8D11 CE/PE module can hold up to ten NT5K18 Exchange Line trunk cards.

Refer to the “UK Analog Hardware Support” feature to assist in configuring the NT5K18 circuit card. This feature is described in *Features and Services for Generic X11 Supplementary Features Appendix 2 to 553—2311—105*.

### Trunk types supported

The Exchange Line 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:

- Exchange line - ground start
- Exchange line - loop start with disconnect clear release
- Exchange line - loop start with loop guarded release

The Exchange Line trunk card also supports Direct Inward System Access (DISA).

### **Common features**

The NT5K18 Exchange Line trunk card:

- allows trunk type to be configured on a per unit basis
- indicates self-test status during an automatic or manual self-test
- provides card-identification for auto configuration, and for determining the serial number and firmware level of the card
- converts transmission signals from analog-to-digital and from digital-to-analog
- provides complex terminating impedance in compliance with regulatory UK standards
- provides complex balance impedance in compliance with regulatory UK standards.

### **Microprocessor**

The NT5K18 Exchange Line trunk card is equipped with an Intel 8052-type microprocessor which controls card operation. The microprocessor also provides the communication function for the card.

The NT5K18 Exchange Line trunk card communicates with the controller card through a serial communication link. Features provided through the link include:

- card-identification
- self-test status reporting
- status reporting to the controller card
- maintenance diagnostics.

### **Signalling and control**

The signalling and control portion of the NT5K18 Exchange Line trunk card operates with the CPU to control the card hardware. The card receives messages from the CPU over a signalling channel in the DS-30X loop and returns status information to the CPU over the same channel. The signalling and control portion of the card provides the means for analog loop terminations to establish, supervise, and take-down call connections.

## Signalling interface

Trunk signalling messages are three bytes in length. The messages are transmitted in channel zero of the DS-30X in A10 format.

Configuration information for the NT5K18 Exchange Line Trunk Card is downloaded from the CPU automatically during power-up or manually by commands from maintenance programs.

## Physical description

A physical description of the NT5K18 Exchange Line trunk card is given below.

### measurements

Each NT5K18 Exchange Line trunk card measures as follows:

Height: 318 mm (12.5 in.)

Depth: 254 mm (10 in.)

### Connections

The NT5K18 Exchange Line 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 A and B leads. For detailed termination and cross-connect information, see *System installation procedures (553—3001—210)*.

### 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.

## Technical description

The technical details of the NT5K18 Exchange Line trunk card are outlined below.

### Power requirements

Table 2-1 provides the power requirements for the NT5K18 Exchange Line trunk card.

**Table 2-1**  
**NT5K18 Power requirements**

Vo ltage	Idle cu rrent	Ac tive current
+ 15.0 V dc	330 ma	330 ma
+ 8.5 V dc	70 ma	70 ma
- 48.0 V dc	30 ma	30 ma
+ 5.0 V dc	250 ma	250 ma

### Environmental specifications

Table 2-2 lists the environmental specifications of the NT5K18 Exchange Line trunk card.

**Table 2-2**  
**NT5K18 Environmental specifications**

Parameter	Sp ecificatio ns
Operating temperature	0 to 50 degrees C , ambient
Operating hum idity	5 to 95 % RH (non-condensing)
Storage temperature	- 50 to + 70 degrees C

## PAD switching

The transmission properties of each trunk are characterized by the class-of-service (COS) assigned in the trunk data block (LD 14).

- PADs should be switched OUT when connecting to "long line" (0-8 dB) public exchange trunk interfaces.  
(COS = LOL)
- PADs may be switched IN when connecting to "short line" (0-6 dB) public exchange trunk interfaces.  
(COS = SHL)

## Trunk types description

Each NT5K18 Exchange Line trunk card unit is capable of operating as one of the following:

- Exchange line - Ground Start
- Exchange line - Loop Start with Loop Disconnect Clear Release
- Exchange line - Loop Start with Loop Guarded Release

In addition, all exchange line types support Periodic Pulse Metering (PPM), or Subscriber Pulse Metering (SPM), as it is sometimes called.

For information on features and signalling arrangements, see *Generic X11 including supplementary features* (PO730484 or NTCK09 in the UK).

## Ground start operation

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

### Idle State

In the idle state, the A wire from the Public Exchange is open and a high resistance potential is present on the A wire of the trunk. The A wire is monitored for the application of ringing from the Public Exchange.

### Call placed by Public Exchange

The Public Exchange places a call by applying ringing to the A wire. The Exchange Line Trunk card scans for ringing detection before presenting the call to an attendant and tripping the ringing. A low resistance is placed across the A and B wires and a speech path is established.

**Call placed by Meridian 1**

The Meridian 1 places a call by applying ground to the B wire and the Public Exchange acknowledges by applying ground to the A wire. The Meridian 1 then places the trunk unit into the on-line state (low impedance loop), and removes the ground from the B wire. When the Public Exchange is ready to receive digits, it returns dial tone. The Meridian 1 sends digits in the form of Dual Tone Multifrequency (DTMF) tones or dial pulses.

**Public Exchange disconnects first**

The Public Exchange disconnects a call by removing the ground on the A wire of the trunk. The Meridian 1 detects the drop in current and responds by returning to the idle state.

**Meridian 1 disconnects first**

The Meridian 1 disconnects a call by removing its on-line state and drawing only a very low current from the A and B wires.

**Loop start operation**

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

**Idle state**

When the Exchange Line trunk is idle, it provides a high impedance toward the public exchange for isolation and dc detection. The public exchange applies -50V dc on the B wire of the trunk and ground on the A wire.

**Call placed by Public Exchange**

The public exchange initiates a call by applying ringing to the B wire and -50 V dc to the A wire. The Meridian 1 ringing detector is tripped and the Exchange Line trunk card place a low resistance dc loop between the A and B wires. This low resistance loop serves as a called subscriber answer signal (CSA) to the public exchange. The public exchange responds by removing the ringing signal and returning the A and B wires to their normal conditions.

**Call placed by Meridian 1**

To place a call from a telephone set or attendant console, the Meridian 1 places a low resistance loop across the A and B leads. When the public exchange is ready to receive digits, it returns dial tone. The Meridian 1

sends digits in the form of Dual Tone Multifrequency (DTMF) tones or dial pulses.

**Call disconnect**

Calls can be disconnected by either Loop Disconnect Clear operation or by Loop Guarded release operation.

**Loop Disconnect Clear operation**

The Meridian 1 ends a call by disconnecting the A and B wires for at least 350 milliseconds. The public exchange responds by sending a clear signal, and the Meridian 1 returns to the idle state when the signal is detected.

The public exchange disconnects a call by sending the disconnect clear signal, which is done by removing one or both of the idle conditions from the A and B wires for a timed period. When the Meridian 1 receives the signal, it returns to the idle state.

**Loop Guarded Release operation**

The Meridian 1 clears a call by replacing its on-line state by a high impedance state. When the public exchange detects the high impedance state, it sends a guarded release signal. Within 220 milliseconds of receiving the guarded release signal, the Meridian 1 will return to the idle state.

The public exchange clears a call by sending the guarded release signal, which is done by removing one or both of the idle conditions on the A and B wires for a specified time. When the current on the PSTN line has fallen to less than 1 ma, the Meridian 1 will return to the idle state within 220 milliseconds.

## Features description

### Periodic Pulse Metering (PPM)

All trunk types on the NT5K18 circuit card support the Periodic Pulse Metering (PPM) feature, or Subscriber Pulse Metering (SPM), as it is sometimes called.

Periodic Pulse metering allows the user of each telephone on a Meridian 1 to keep an accurate record of Public Switched Telephone Network (PSTN) and Direct Outward Dialing (DOD) calls for billing or administration.

*N* Although the PPM feature is configured on a per trunk basis, the message which is downloaded to hardware is on a per card basis. When PPM is assigned to a unit, every unit on the card automatically receives the feature.

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For information on PPM feature requirements, feature interactions, and feature implementation, refer to *Generic X11 Including Supplementary Features appendix 2 to 553—2311—105*.

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## NT5K19 — Analog Tie trunk card

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### Functional description

The NT5K19 Analog Tie trunk card provides the interface between a trunk facility and either an NT8D37 Intelligent Peripheral Equipment module (IPE) or NT8D11 Common Equipment/Peripheral Equipment (CE/PE) module.

The NT5K19 Analog Tie trunk card can be installed in any PE slot in an NT8D37 IPE module or NT8D11 CE/PE module. Up to sixteen cards can be installed in one NT8D37 IPE module. The NT8D11 CE/PE module can hold up to ten NT5K19 Analog Tie trunk cards.

Refer to the “UK Analog Hardware Support” feature to assist in configuring the NT5K19 circuit card. This feature is described in *Features and Services for Generic X11 Supplementary Features Appendix 2 to 553—2311—105*.

### Trunk types supported

The NT5K19 Analog Tie trunk card supports four analog trunks. Each trunk circuit can be individually configured as:

- 4-wire E&M Type 1 Tie trunk (DC5)
- 2-wire E&M Type 1 Tie trunk (DC5)
- 2280 Hz Tie trunk (AC15)
- Recorded Announcement trunk (RAN)
- Music trunk (MUS)
- Paging trunk (PAG)
- Emergency Recorder trunk (RCD).

### 3-2 NT5K19 Analog Tie Trunk Card

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*N* Type I signalling uses two signalling wires plus ground.  
*o*  
*t*  
*e*  
:

#### **Common features**

The NT5K19 Analog Tie trunk card:

- converts transmission signals from analog-to-digital and from digital-to-analog
- enables and disables individual ports or the entire card under software control
- provides outpulsing on the card. Make break ratios are defined in software and down loaded during power up and by software commands.
- provides indication of card status from self-test diagnostics on faceplate Light Emitting Diode (LED)
- allows trunk type to be configured on a per port basis in software
- provides termination against 600 ohms for 4-wire E&M trunk circuits
- provides termination and transhybrid balance matching against the UK three component complex impedance network for 2-wire E&M trunk circuits
- provides termination against 600 ohms for AC15 trunk circuits
- provides for loss pads appropriate to low loss lines or point-to-point lines on 4-wire E&M and AC15 connections
- provides a Paging, Recorded Announcement, Emergency Recorder, and Music interface.

#### **Trunk circuit features**

Each NT5K19 trunk circuit is capable of providing the following:

- 2-wire and 4-wire E&M Type 1 trunk (DC5-A) operation
- 2280 Hz Tie trunk (AC15-A) operation
- Paging access
- Recorded Announcement access

- Music on Hold access
- Emergency Recorder access.

### **Signalling and control**

The signalling and control portion of the trunk card works with the Meridian 1 Central Processing Unit (CPU) to operate the card hardware. The card receives messages from the Meridian 1 CPU over a signalling channel in the DS30X loop and returns status information to the CPU over the same channel. The signalling and control portion of the card provides the means for analog loop terminations to establish, supervise and take-down call connections.

### **Microprocessor**

The microprocessor provides an intelligent interface between an analog trunk and the Meridian 1 system core.

The NT5K19 Analog Tie trunk card uses the Intel 83C51FA microprocessor. It contains 8K of Read Only Memory (ROM) and 256 bytes of Random Access Memory (RAM). It operates asynchronously to the system clock, and is interrupt driven to provide synchronization with system events.

### **Signalling interface**

Signalling messages for the trunk are three bytes in length. The messages are transmitted in channel zero of the DS30X in A10 format.

Configuration information for the NT5K19 Analog Tie trunk is automatically downloaded from the Meridian 1 CPU during power up and manually by commands from maintenance programs.

## **Physical description**

The physical characteristics of the NT5K19 Analog Tie trunk card are given below.

### **Measurements**

Each NT5K19 Analog Tie trunk card measures as follows:

Height: 318 mm (12.5 in.)

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Depth: 254 mm (10 in.)

**Connections**

The NT5K19 Analog Tie trunk card has four units. Each 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 A and B leads. For detailed termination and cross-connect information, see *System installation procedures (553—3001—210)*.

**Technical description**

The technical details of the NT5K19 Analog Tie trunk card are outlined below.

**Power requirements**

Table 3-1 lists the power requirements for the NT5K19 Analog Tie trunk card.

**Table 3-1**  
**NT5K19 Power requirements**

<b>Vo ltage</b>	<b>Idle Cu rrent</b>	<b>Ac tive Cu rrent</b>
+/- 15.0 V dc	200 ma	200 ma
- 15 V dc	160 ma	160 ma
+8 V dc	55 ma	55 ma
+ 5 V dc	120 ma	120 ma
-48 V dc	10 ma	40 ma

### Environmental specifications

Table 3-2 provides the environmental specifications for the NT5K19 Analog Tie trunk card.

**Table 3-2**  
**NT5K19 Environmental specifications**

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

### PAD switching

Table 3-3 presents the digital-to-analog and analog-to-digital loss for the NT5K19 Analog Tie trunk card.

**Table 3-3**  
**NT5K19 loss values**

Trunk type	Digital-to - Analog loss	Analog-to - Digital loss
2-wire E&M	0 dB	-3 dB
4-wire E&M (PAD out)	0 dB	0 dB
4-wire E&M (PAD in)	4 dB	0 dB
AC 15 (PAD out)	0 dB	0 dB
AC 15 (PAD in)	4 dB	0 dB
Paging	4 dB	—
RA N/M usic	—	3 dB
Emergency Recorder	4 dB	3 dB

The loss PADs for AC15 and 4-wire E&M trunks are selected by the class of service (COS) assigned to the trunk data block (LD 14).

- PADs should be switched OUT when trunks are connected using on-premise wiring.  
(COS = NTC)
- PADs should be switched IN when trunks are connected using a leased circuit.  
(COS = TRC)

## Trunk types description

Each unit on the NT5K19 Analog Tie trunk card can operate as one of the following:

- 2-wire and 4-wire E&M trunk (DC-5)
- 2280 Hz Tie trunk (AC15)
- Recorded Announcement (RAN) trunk
- Paging (PAG) trunk
- Music (MUS) trunk
- Emergency Recorder (RCD) trunk.

For information on features and signalling arrangements, see *Generic X11 Including Supplementary Features* (PO730484, or NTCK09 in the U.K).

### 2-wire and 4-wire E&M Type 1 trunk operation (DC-5)

The NT5K19 Analog Tie trunk card supports the United Kingdom DC5-A method of signalling, which is used between a 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. Earth-On is the application of ground to the M wire through a resistance of 1250 ohms, while Earth-Off is the removal of the Earth-On condition. In both Earth-On and Earth-Off conditions, a grounded 1 $\mu$ F 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. 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 1 $\mu$ F capacitor is applied to the M wire.

### **Idle state**

In the Idle state, the M wire receives an "Idle signal" from the Meridian 1 and is placed in the Earth-Off condition.

### **Seize**

To place an outgoing call, the Meridian 1 at the near end sends a seizing signal through the M-wire to the far end. The incoming end (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.

### **Dialing**

Digits are sent through the near end M wire in the form of 10 pps pulses of the Earth-Off condition or DTMF digits.

### **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 3-4 provides a summary of NT5K19 DC-5 signalling states.

**Table 3-4**  
**Summary of NT5K19 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	—
Dialing:		
Digit Pulse	Earth-Off pulses in step with dial pulses	—
DTMF	DTMF digits	—
Answer	—	Earth-On
Far End Release	Earth-Off for longer than 300 milliseconds	—
Near End Release	—	Earth-Off for longer than 300 milliseconds

### **AC15 trunk operation (2280 Hz Tie trunk)**

The NT5K19 Analog Tie trunk card supports the United Kingdom AC15-A method of signalling, which is used between two PBX machines. The system is based on a single voice frequency, 2280 Hz, method of signalling.

In this system, four signalling wires are used: one pair for forward signals and one pair for backward signals. The transmit pair through which signals are transmitted is the receive pair at the far end. All signals are in the form of either tone-on or tone-off. Table 3-5 provides a summary of signals in both transmit and receive directions.

### 3-10 NT5K19 Analog Tie Trunk Card

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**Table 3-5**  
**NT5K19 tone-on and tone-off signalling**

Signalling direction	Tone-On	Tone-Off
Transmit	Signalling tone of 2280 Hz +/- 5 Hz	Removal of the Signalling tone
Receive	Signalling tone of 2280 Hz +/- 15 Hz	Any frequency or combination of frequencies with total power less than -40 dBmO

Tone-on signals are received at two power levels, high and low, depending on the length of the tone. Table 3-6 summarizes tone-on power levels.

**Table 3-6**  
**NT5K19 tone-on receive levels**

Duration of tone	High/Low Tone-On	dB Level
less than 300 ms	High	-4 to -20 dBmO
300 to 550 ms	High	-4 to -20 dBmO
greater than 550 ms	Low	-14 to -30 dBmO

#### **Idle state**

In the idle state, the PBX machines at both ends of the circuit apply an idle signal to indicate they are free to accept incoming calls. Both PBX machines are in the tone-on condition.

#### **Seize**

To place an outgoing call, the outgoing PBX applies a seize signal to the signalling path. The outgoing PBX is now in the tone-off state. The PBX at the incoming end recognizes the seize signal, busies the circuit against outgoing calls, and prepares to receive digits.

**Dialing**

The outgoing PBX sends address digits in the form of 10 pps pulses of signalling tone (2280 Hz). Dual Tone Multifrequency (DTMF) transfer of address information can also be used.

**Answer**

When the called party answers, the incoming PBX applies an answer signal to the signalling path. The incoming PBX is now in the tone-off condition. The continued receipt of the seizing signal is accepted by the incoming PBX as a forward hold signal. The continued receipt of the answer signal is accepted by the outgoing PBX as a backward hold signal.

**Call disconnect**

Either party can disconnect the call by applying the appropriate signal. The incoming PBX applies a “clear back” signal, while the outgoing PBX applies a “clear forward” signal. The circuit remains busy until both clear forward and clear backward signals have been exchanged.

Table 3-7 provides a summary of NT5K19 AC15 signalling states.

**Table 3-7**  
**Summary of NT5K19 AC15 signalling states**

Signal	Outgoing PBX	Incoming PBX
Idle	Tone-on	Tone-on
Seize	Tone-off	—
Forward Hold	Tone-off	—
Dialing	Tone-on pulses corresponding to digit signal sent	—
Answer	—	Tone-off
Backward Hold	—	Tone-off
Clear Forward	Tone-on for longer than 300 ms	—

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Clear Back	—	To ne-on for longer than 300 ms
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### **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.

The NT5K19 Analog Tie trunk card supports the following announcement machines:

- Start mode announcement machines  
(for example, Code-A-Phone)
- Continuous mode announcement machines  
(for example, Audichron)

#### **Start mode**

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

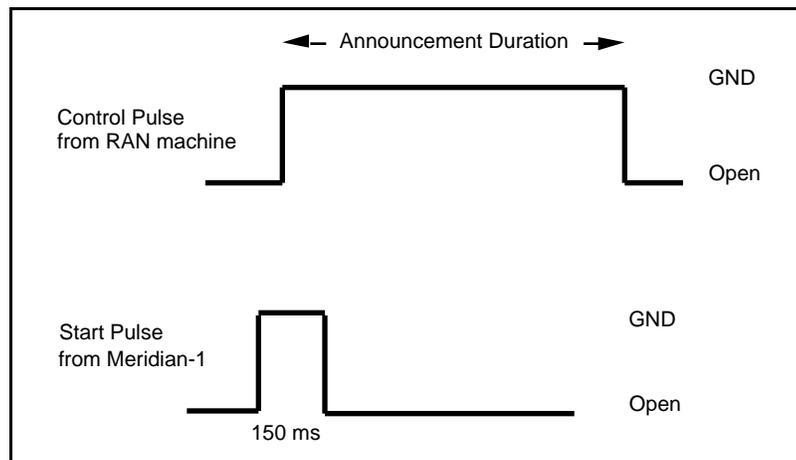
- an impedance of 4 ohms or less
- ground to the trunk unit when playing and an open circuit when idle. This is done through a control lead to the trunk circuit.
- default signal level of -9dBm (in 600  $\Omega$ ) adjustable to a level of 10 dBm.

To start the announcement, the NT5K19 Analog Tie trunk card provides a momentary ground signal (150 ms) to the source. The announcement machine should then start playing its message.

The NT5K19 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 3-1 shows recorded announcement in start mode.

**Figure 3-1**  
**Recorded announcement - start mode**



**Continuous mode**

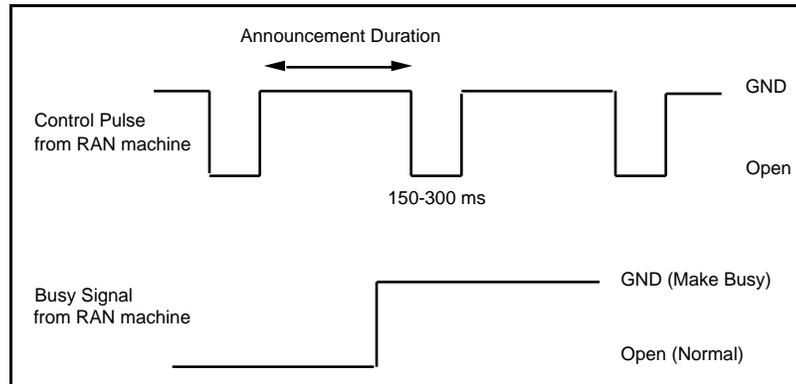
The requirements for continuous mode announcement machines are as follows:

- 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 -9dBm (in 600 ) 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 Meridian 1 for maintenance purposes.

Figure 3-2 shows recorded announcement in continuous mode.

**Figure 3-2**  
**Recorded announcement - continuous mode**



### Music source

The music source should provide an impedance of 600  $\Omega$ . The default signalling level should be -9dBm (in 600  $\Omega$ ) 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 circuit card will provide 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.

### Emergency Recorder (RCD) operation

The interface to an emergency recorder (RCD) unit is the same as to that of a RAN unit in continuous mode. The recorders must be voice activated, since the Meridian 1 does not supply the recorder with a start pulse when the trunk is in use.

The transmission path provided by the Meridian 1 is bothway. If warning tone needs to be applied, it can be supplied by the recording device.

Meridian 1

## **United Kingdom Trunk cards**

Description

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