NTTU USER'S MANUAL

VERSION 2.4

Issue date: 2002-10-10

Lucent Technologies Inc.

NTTU Installation Manual

Version History

Version	Comments/Changes	Date	Responsible
1.0	Original ATU Installation Manual	2000-1-28	N. Hernandez
2.0	Product designation changed to NTTU. Describes product after redesign for NEBS Level 3 and UL1950 compliance. Introduces Lucent comcode and serial number labels.	2000-9-14	A. Tenorio
2.1	Introduces CLEI codes and label per KS-22002 spec. A blank faceplate is introduced as orderable item. Changes in Lucent KS-23490 label list selection for serial number and comcode. Issues warning for use with intra-building wiring system only. Includes a Document Version History section.	2000-11-28	A. Tenorio
2.2	Document changes to the backplane, a safety cover to the –48VDC power supply connectors. Installation procedure is changed accordingly. Includes information on the fuse size required on the MMFU of the Miscellaneous Cabinet.	2001-01-17	A. Tenorio
2.3	Changes in circuit pack version numbers, comcodes and CLEI codes. Adds information relative to UL compliance. Corrects backplane drawings	2002-05-14	A. Tenorio
2.4	Adds section for Alarm Features Description. Title changed to NTTU User's Manual	2002-10-10	A. Tenorio

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I INTRODUCTION

The No-Test Trunk Unit (NTTU) is a signaling converter used to perform subscriber loop testing functions in response to a subscriber's complaint call or a line maintenance personnel's call for subscriber loop testing assistance. Subscriber loop conditions to be tested include: open loops, shorted loops, unexpected foreign potentials, loop resistance, loop insulation resistance and loop capacitance.

The NTTU is intended to be a replacement of the No-Test Trunk (NTT) SN107 test trunk circuit. It has been designed to comply with Bellcore Technical Reference TR-TSY-000536.

The NTTU is located between the Line Test Desk (LTD) and the Switch, see *Figure 1*. The NTTU performs the following functions:

- It establishes a Metallic Bus (MTB) connection for each channel, by means of internal relays.
- Analogue to digital conversion and PCM T1/E1 channel framing.
- PCM T1/E1 channel de-framing and digital to analogue conversion.
- MF signaling conversion from the analogue to the digital end.
- Execution of commands received from the Switch, carried in Time Slot 1 (DS0 number 1).

Important: Proper operation of the NTTU signaling converter requires software version **5E15-FR4 SU2** or higher for North America market installed in the 5ESS Switch.

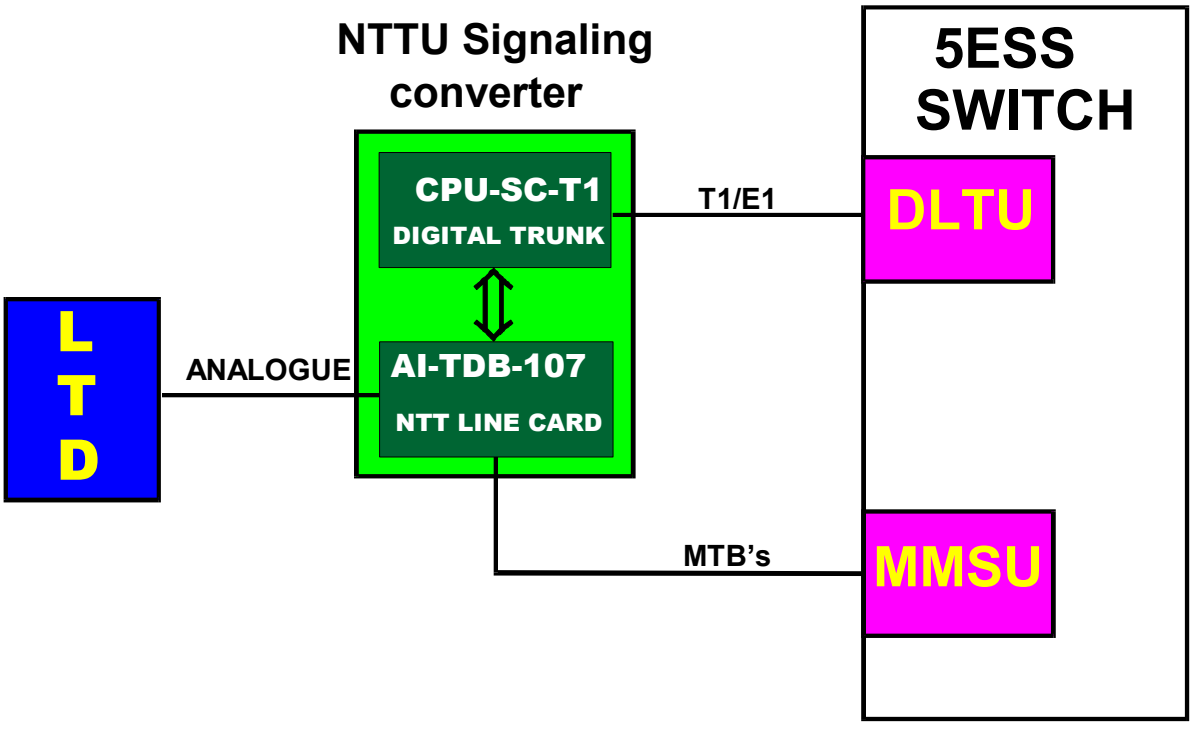

Figure 1. Logical connection of the NTTU.

II DESCRIPTION

The No-Test Trunk Unit (NTTU) system, as shown in *Figure 2*, is composed of the following parts:

a. One sub-rack or standard 19" cabinet with a capacity for one CPU and a maximum of 6 AI-TDB.
b. One Back panel that has the system input and output connection points, the powering points and the connections between each AI-TDB card and the CPU.
c. One Central Processing Unit and Digital Line Interface Card (CPU-SC-T1) which is located on the front part of the Sub-Rack in the first position from left to right. This card is where the system's main power switch is found.
d. The Analogue Interface Test cards (AI-TDB-107) are located in the remaining positions of the NTTU. Each one handles two analogue channels.
e. Front panel fastening screws.
f. Card guides.

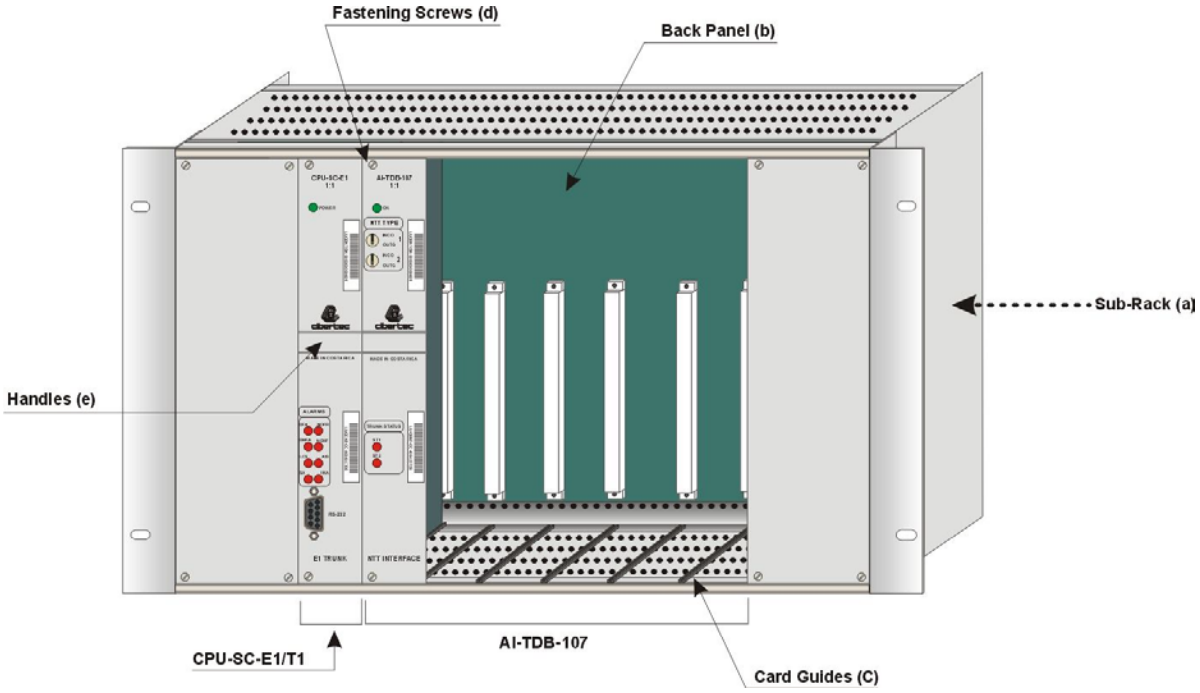

Figure 2. NTTU description.

Parts list

The NTTU (No-Test Trunk Interface Unit) consists of the following modules:

Module	Description	Lucent comcode	CLEI Code	ECI Code
CPU-SC-T1	T1 Trunk interface & controller unit	408648079	E5IC3TWCAA	291278--1
AI-TDB-107	NTT interface, 2 channels	408648061	E5ATAAAAAA	291277--9
ATU-RCK	NTTU Subrack assembly	408435709	E5MAAA0BRA	436990--2

Other options include:

Module	Description	Assembly comcode	CLEI Code	ECI Code
CPU-SC-E1	E1 Trunk interface & controller unit	408435766	E5IC4T0CAA	273890--2
AI-TDB-715	ALTA interface, 2 channels	408435774	E5ATBB0AAA	273882--4
26N608-LU1	Blank faceplate, to cover unused AI-TDB-107 or AI-TDB-715 slots	408484129	N/A	N/A

The NTTU operates very much the same as a Channel Bank. It has a PCM trunk controller card and analog test trunk circuit packs are added as needed.

A maximum of 6 AI-TDB-107 or AI-TDB-715 can be plugged into the ATU-RCK cabinet for a total capacity of 12 analog No-Test Trunks.

The AI-TDB-107 is intended to be a replacement of Lucent's SN-107 circuit pack. It is an NTT interface for use in North America, and complies with Bellcore Technical Reference TR-TSY-000536.

The AI-TDB-715 is a replacement for Lucent's SN-715 circuit pack. This is an ALTA/ RLTD interface for use in Taiwan. It complies with FSD No. 1198, Issue 3.0.

It is not possible to combine NTT interfaces (AI-TDB-107) with ALTA interfaces (AI-TDB-715) without risking malfunction of the NTTU signaling converter.

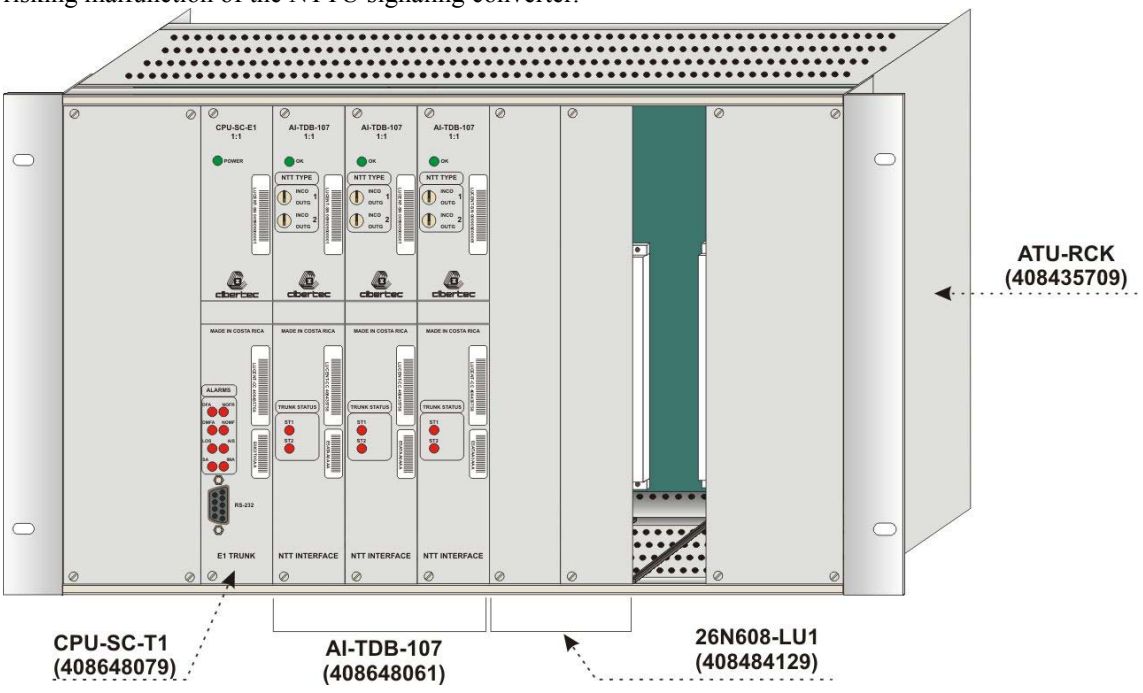

Figure 3. NTTU orderable items sample with Lucent comcodes

Parts description

ATU-RCK (Lucent comcode 408435709)

The ATU-RCK is the subrack assembly including the backplane where the circuit packs are plugged in. It has 7 open slots for inserting the ATU circuit packs.

The leftmost position (Slot No. 1) is for the Framer unit. It can be either the CPU-SC-T1 or CPU-SC-E1 depending on the desired DLTU configuration.

The other six positions to the right (slots 2 thru 7) are intended for insertion of the analog test trunk interfaces. They can be either the NTT version (AI-TDB-107) or the ALTA version (AI-TDB-715). Each of these analog test trunk interfaces has a capacity of 2 analog channels, for a maximum combined capacity of serving 12 analog channels with 1 ATU Signaling Converter.

Warning: Be careful not to combine a mix of AI-TDB-107 and AI-TDB-715 in the same backplane. Doing so may cause malfunction of the ATU signaling converter.

AI-TDB-107 (Lucent comcode 408648061)

This is the Analog No-Test Trunk (NTT) interface circuit pack. It has a capacity of two analog trunks. It is reserved for use in the NAR market, as well as international markets using the NTT option. It is a functional replacement of the SN-107 circuit pack. The AI-TDB-107 designation has been used for familiarity.

Elements on the faceplate:

a. Circuit Pack name or apparatus code (AI-TDB-107) along with the version compatibility information (2:2). It should be read as "Version 2 : Backward compatible with version 2".
b. OK Status, green LED. There is no on/off switch. The ATU is powered on by inserting the CPU-SC-E1 circuit pack into the leftmost backplane connector. Doing so also powers up all the AI-TDB-107 or AI-TDB-715 plugged in. Whenever there is a failure or alarm in any of the analog trunk channels in the circuit pack, the LED will go off to signal the alarm/failure condition.
c. NTT Type Selection Switches: Two switches are provided to select the operation mode of each analog trunk. Available modes are:

Incoming: Test calls are initiated at the LTD side. MF Signaling is sent to the 5ESS to address the called subscriber line to be tested.

Outgoing: Test calls are terminated at the LTD side. The test is initiated at the subscriber side.

d. Serial number Label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 6 label, dimensions .400" x 1.923".
e. Manufacturer's Name and Logo: Cibertec Int.
f. Extraction handle. Aluminum extruded handle.
g. Country of origin information: Made in Costa Rica.
h. Comcode label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 7 label, dimensions .400" x 1.923". Assigned comcode is 408648061.

i. Trunk Status LEDs. Two LEDs are provided to indicate the channel status. The LEDs are lit when the analog trunk is seized. They are blinking to indicate the blocked condition (test calls cannot be made in the blocking condition).
j. CLEI code label. This is a barcode label as per Lucent KS-22002 Specification, List 28, dimensions .400" x 1.100". Assigned CLEI (Common Language Equipment Identifier) code is E5ATAAAAAA, ECI (Equipment Catalog Identifier) code is 291277--9.
k. Circuit pack description: In this case "NTT Interface".
l. Fixing screws at top and bottom of the faceplate. They firmly attach the circuit pack to the subrack assembly.

AI-TDB-715 (Lucent comcode 408435774)

This is the ALTA Analog Trunk interface circuit pack. It has a capacity of two analog trunks. It is reserved for use in Taiwan. It is a functional replacement of the SN-715 circuit pack. The AI-TDB-715 designation has been used for familiarity.

Elements on the faceplate:

a. Circuit Pack name or apparatus code (AI-TDB-107) along with the version compatibility information (1:1). It should be read as "Version 1 : Backward compatible with version 1".
b. OK Status, green LED. There is no on/off switch. The ATU is powered on by inserting the CPU-SC-E1 circuit pack into the leftmost backplane connector. Doing so also powers up all the AI-TDB-107 or AI-TDB-715 plugged in. Whenever there is a failure or alarm in any of the analog trunk channels in the circuit pack, the LED will go off to signal the alarm/failure condition.
c. Serial number Label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 6 label, dimensions .400" x 1.923".
d. Manufacturer's Name and Logo: Cibertec Int.
e. Extraction handle. Aluminum extruded handle.
f. Country of origin information: Made in Costa Rica.
g. Comcode label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 7 label, dimensions .400" x 1.923". Assigned comcode is 408435774.
h. Trunk Status LEDs. Two LEDs are provided to indicate the channel status. The LEDs are lit when the analog trunk is seized. They are blinking to indicate the blocked condition (test calls cannot be made in the blocking condition).
i. CLEI code label. This is a barcode label as per Lucent KS-22002 Specification, List 28, dimensions .400" x 1.100". Assigned CLEI (Common Language Equipment Identifier) code is E5ATBB0AAA, ECI (Equipment Catalog Identifier) code is 273882--4.
j. Circuit pack description: In this case "ALTA Interface".
k. Fixing screws at top and bottom of the faceplate. They firmly attach the circuit pack to the subrack assembly.

CPU-SC-E1 (Lucent comcode 408435766)

This circuit pack is the main unit of the signaling converter. It contains the PCM Framer interface for international markets (E1 = 2 Mbit/s interface). Use of this framer board automatically indicates use of A-Law codecs.

Elements on the faceplate:

a. Circuit Pack name or apparatus code (CPU-SC-E1) along with the version compatibility information (1:1). It should be read as "Version 1 : Backward compatible with version 1".
b. Power On, green LED. There is no on/off switch. The ATU is powered on by inserting the CPU-SC-E1 circuit pack into the leftmost backplane connector. Doing so also powers up the AI-TDB-107 or AI-TDB-715 plugged in.
c. Serial number Label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 6 label, dimensions .400" x 1.923".
d. Manufacturer's Name and Logo: Cibertec Int.
e. Extraction handle. Aluminum extruded handle.
f. Country of origin information: Made in Costa Rica.
g. Comcode label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 7 label, dimensions .400" x 1.923". Assigned comcode is 408435766.
h. Alarm Indicators: Group of 8 LEDs used to indicate alarm/failure conditions in the signaling converter, as follows:
    1. DFA (Distant Frame Alarm). This is equivalent to the Remote Alarm Indication (RAI). An alarm indication is being received from the far end of the E1 trunk (the 5ESS).
    2. NOFR (No Frame). The ATU signaling converter is receiving signal on the E1 port, but is unable to find frame information in the incoming digital stream.
    3. DMFA (Distant Multiframe Alarm). The ATU signaling converter is receiving a remote multiframe alarm indication in timeslot 16 of the E1 digital stream.
    4. NOMF (No MultiFrame). Cannot find frame information in timeslot 16 of the E1 digital stream.
    5. LOS (Loss of Signal). This is to indicate the loss of incoming signal on the digital Rx port of the ATU signaling converter.
    6. AIS (Alarm Indication Signal) This is an all-ones alarm condition being received on the digital Rx port from the far end.
    7. SA (Service Alarm). The ATU requires service.
    8. IMA (Immediate Maintenance Alarm) The ATU signaling converter requires immediate maintenance action.
j. CLEI code label. This is a barcode label as per Lucent KS-22002 Specification, List 28, dimensions .400" x 1.100". Assigned CLEI (Common Language Equipment Identifier) code is E5IC4T0CAA, ECI (Equipment Catalog Identifier) code is 273890--2.
k. RS-232 port. This is a serial communication port. Use is reserved for special maintenance purposes.
l. Circuit pack description: In this case "E1 Trunk".
m. Fixing screws at top and bottom of the faceplate. They firmly attach the circuit pack to the subrack assembly.

CPU-SC-T1 (Lucent comcode 408648079)

This is the PCM Framer interface for the NAR market, as well as other customers using the T1 (DS1) digital stream format. Use of this PCM interface automatically indicates use of μ-Law codecs.

Elements on the faceplate:

a. Circuit Pack name or apparatus code (CPU-SC-T1) along with the version compatibility information (2:2). The "2" on the left meaning "This is version 2", and the "2" on the right meaning "Backward compatible with version 2".
b. Power On, green LED. There is no on/off switch. The ATU is powered on by inserting the CPU-SC-T1 circuit pack into the leftmost backplane connector. Doing so also powers up the AI-TDB-107 or AI-TDB-715 plugged in.
c. Serial number Label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 6 label, dimensions .400" x 1.923".
d. Manufacturer's Name and Logo: Cibertec Int.
e. Extraction handle. Aluminum extruded handle.
f. Country of origin information: Made in Costa Rica.
g. Comcode label: This is a barcode label as per Lucent KS-23490 Specification Issue 9 on Barcode, Serial and Comcode. This is a List # 7 label, dimensions .400" x 1.923". Assigned comcode is 408648079.
h. Alarm Indicators: Group of 6 LEDs used to indicate alarm/failure conditions in the signaling converter, as follows:
    1. YEL (Yellow Alarm). This is equivalent to the Remote Alarm Indication (RAI). An alarm indication is being received from the far end of the DS1 trunk (the 5ESS).
    2. RED (Red Alarm). This is equivalent to the Out Of Frame (OOF) condition. The ATU signaling converter is receiving signal on the DS1 port, but is unable to find frame information in the incoming digital stream.
    3. LOS (Loss of Signal). This is to indicate the loss of incoming signal on the DS1 port of the ATU signaling converter.
    4. AIS (Alarm Indication Signal) This is an all-ones alarm condition being received on the DS1 port from the far end.
    5. SA (Service Alarm). The ATU requires service.
    6. IMA (Immediate Maintenance Alarm) The ATU signaling converter requires immediate maintenance action.

i. CLEI code label. This is a barcode label as per Lucent KS-22002 Specification, List 28, dimensions .400" x 1.100". Assigned CLEI (Common Language Equipment Identifier) code is E5IC3TWCAA, ECI (Equipment Catalog Identifier) code is 291278--1.
j. RS-232 port. This is a serial communication port. Use is reserved for special maintenance purposes.
k. Circuit pack description: In this case "T1 Trunk".
l. Fixing screws at top and bottom of the faceplate. They firmly attach the circuit pack to the subrack assembly.

III INSTALLATION

MECHANICAL INSTALLATION

a. Verify package contents.

Contents:
-NTTU equipment
-Installation Manual
-NTTU Operation Manual
-Installation Accessories

b. Remove the NTTU from the package by holding on to the aluminum sides. Do not grip the plastic guides, or the Back panel as these are very fragile parts of the equipment.

c. Verify that all electronic cards are correctly inserted by pressing gently against the central handle. See *Figure 2*.

d. Gently tightening the fastening screws.

e. Before mounting the NTTU in the rack, take into consideration that the depth of the NTTU is 400.00mm (14.75") (See *Figure 4*) so it is important to leave a space wide enough to accommodate the equipment cabling (150mm to 200mm (5.9" to 7.9")) in the rear part. See Figure 5.

f. The mounting should be done in a 19" rack or frame. See *Figure 6*. If the NTTU is to be installed in a 23" rack, such as the 5ESS Miscellaneous Cabinet, you will require the adapter bracket.

g. Fix the NTTU in the rack or frame using 4 fastening screws as indicated in *Figure 6*.

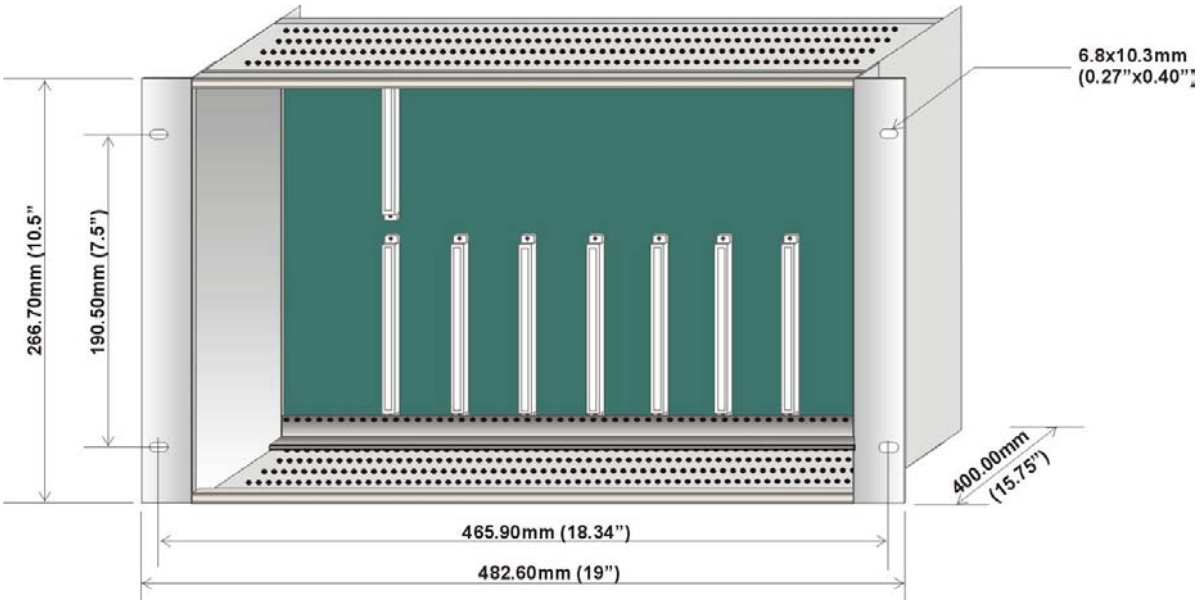

Figure 4. Sub-Rack dimensions.

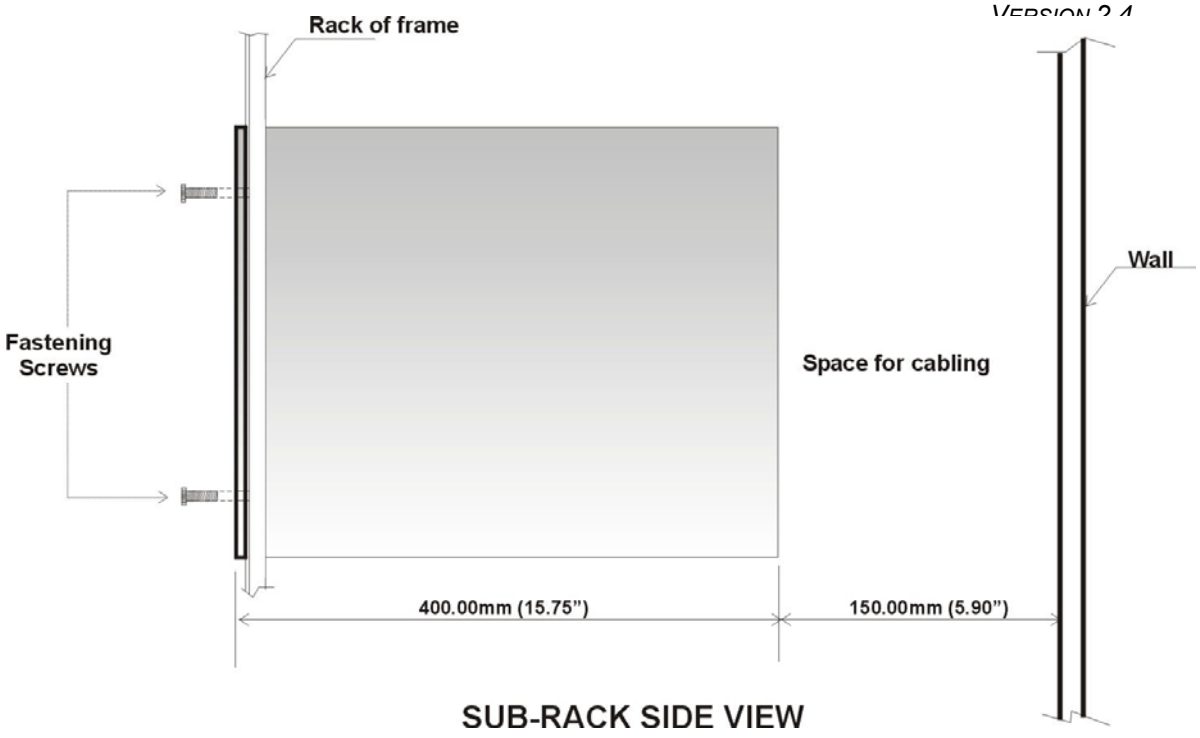

Figure 5. Sub-Rack cabling's space requirements.

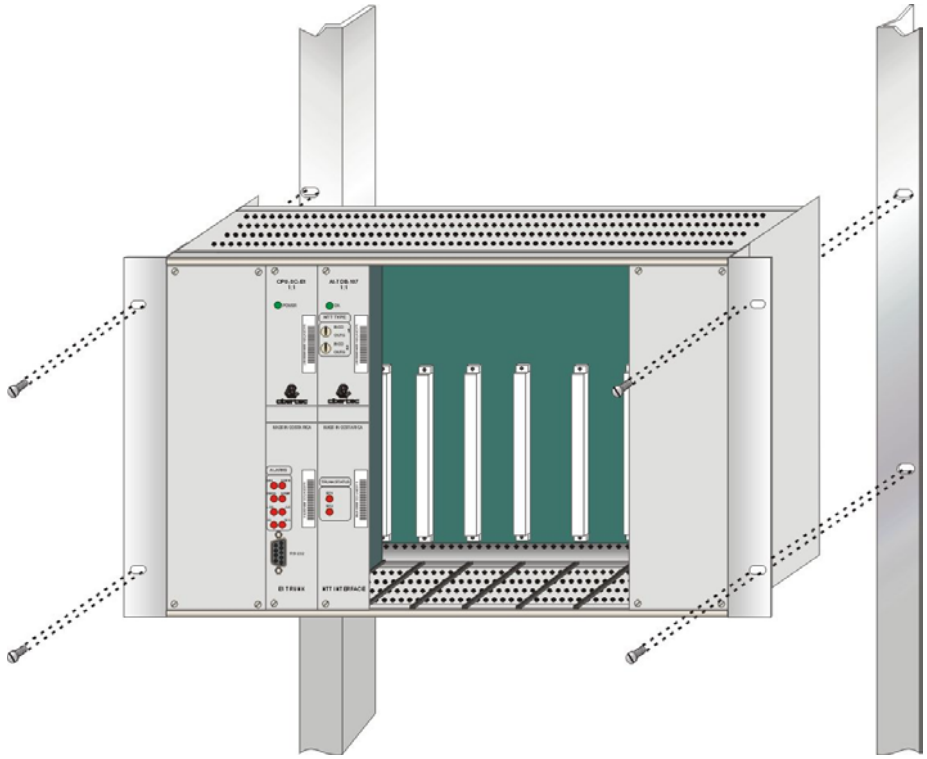

Figure 6. Sub-Rack Mounting Directions.

ELECTRICAL INSTALLATION

IMPORTANT NOTICE
This equipment is suitable for connection to **intra-building** or non-exposed **wiring or cabling only**.

All of the NTTU's connection points are found in its rear part, as shown in *Figure 7*.

1. **Analogue Connection Block** (ACB) four wires: Tip and Ring, Sleeve and Sleeve ground, and the MTB (metallic bus). Two independent MTB circuits are provided per channel.
2. **Digital Connection Block** (DCB) TX and RX and its respective monitoring points.
3. **Power Supply**
4. **Remote Alarm Connection**

There is a safety cover plate on top of both the power supply connectors as well as the alarm connection points. Some of these terminals have a voltage potential of –48VDC, they should remain covered all the time when not in maintenance or installation to prevent accidental contact of a craftsperson with this dangerous voltage.

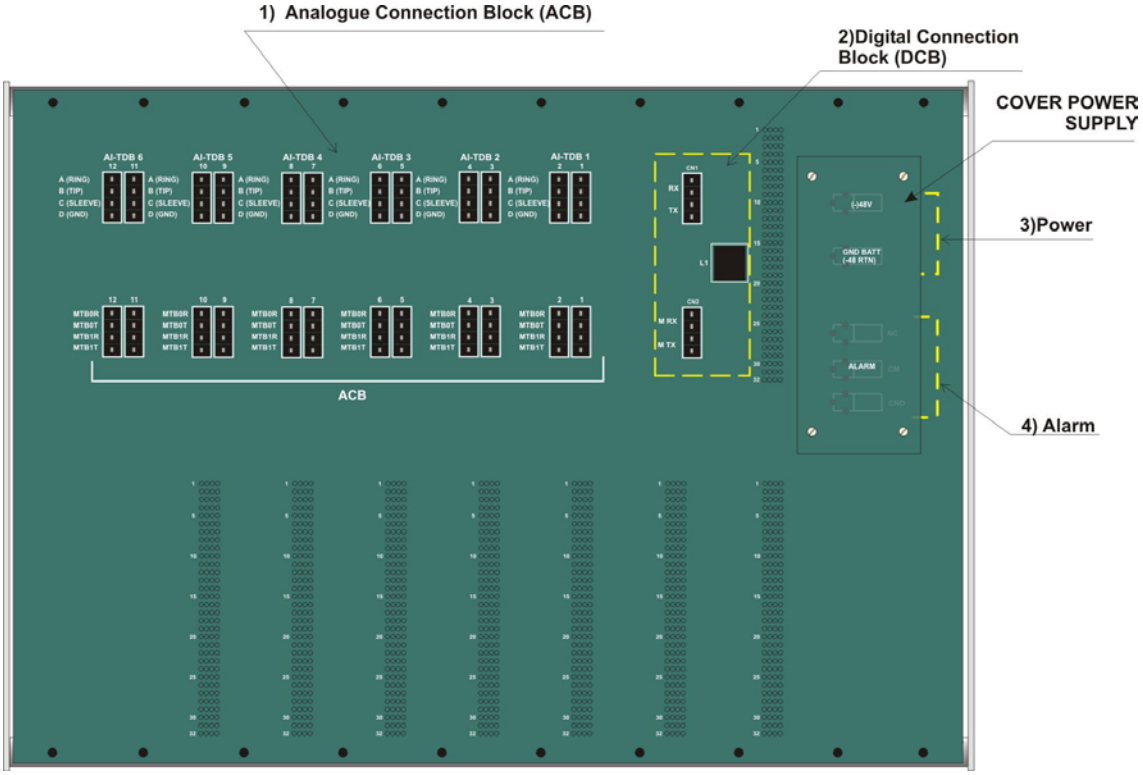

Figure 7. NTTU connection points.

2. ANALOGUE CONNECTION BLOCK (ACB)

The ACB is made up of various columns and each one corresponds to a channel as indicated in *Figure 8*. These channels are numbered from 1 to 12 and can be seen from the rear part of the NTTU, from right to left. See *Figure 8*.

Each column is sectioned in two groups of 4 pins. The upper group corresponds to points A and B, C and D; or Tip (T) and Ring (R), Sleeve (S) and Sleeve Ground (G) according to the nomenclature used in Taiwan and the U.S.A., respectively. The lower group corresponds to the MTBs.

This block is designed to be cabled with wire wrap using AWG22 cable. *Figure 9* shows the connection pin dimensions.
Note: One AI-TDB-107 or AI-TDB-715 services two analog channels each.

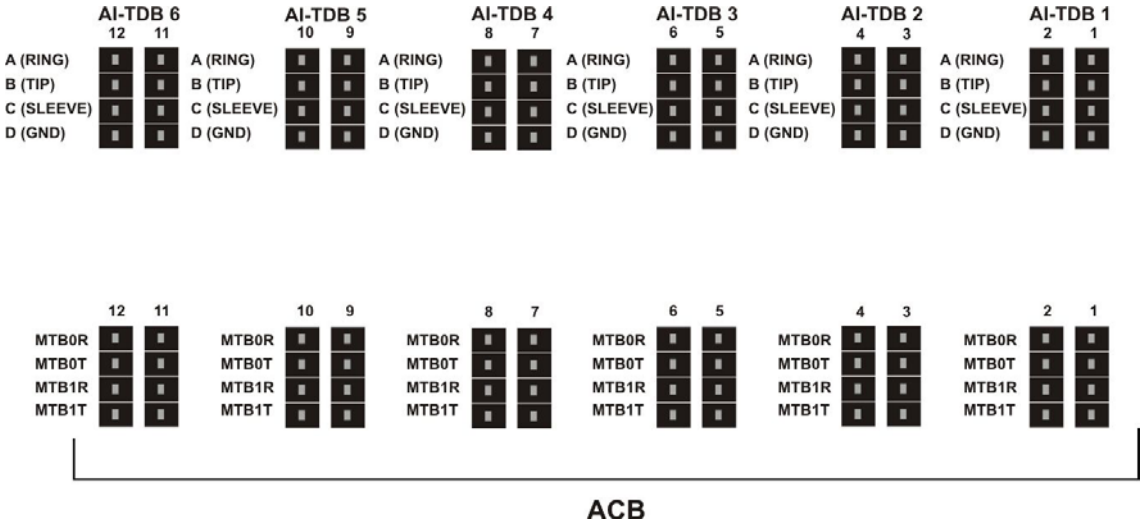

Figure 8. Analogue Connection Block detail.

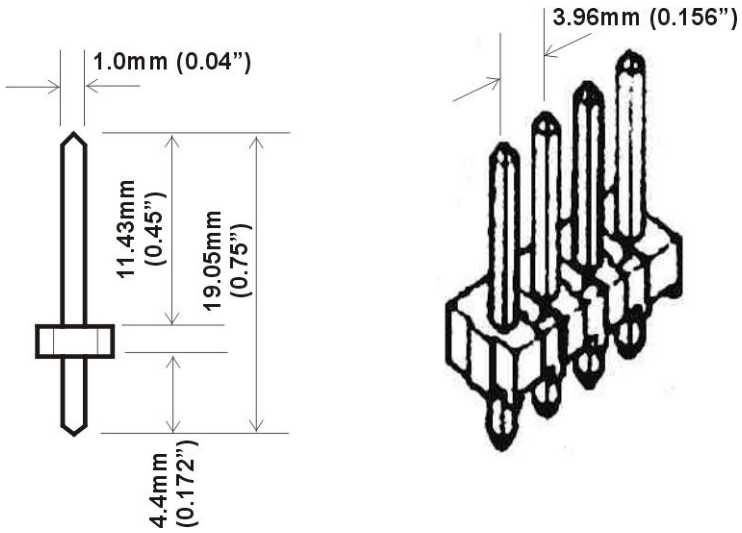

Figure 9. Connection pin dimensions.

2. DIGITAL CONNECTION BLOCK (DCB)

This block is made up of a column of four 75 Ohms coaxial cable connections (optional) and a column of four pairs of connection pins for 120 Ohms twisted pair. See details in *Figure 10*.

- The pair indicated as RX (DC1) corresponds to the NTTU's digital DS1 input coming from the 5ESS Switch's DLTU.
- The pair indicated as TX (DC2) corresponds to the NTTU's digital DS1 output going to the 5ESS Switch's DLTU.
- The pair indicated as M TX (DC3) and M RX (DC4) is provided to connect a monitoring instrument. These monitoring points provide 20dB attenuation.

See *Figure 9* for pin dimensions.

IMPORTANT NOTICE
This equipment is suitable for connection to **intra-building** or non-exposed **wiring or cabling only**.

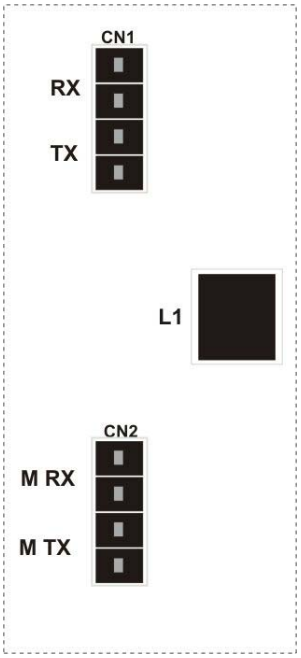

Figure 10. Digital Connection Block detail.

3. POWER SUPPLY

Check that the main switch is turned off before powering the NTTU.

Remove the safety cover plate located on top of both the power supply connectors and the alarm connection point by unscrewing the four securing screws. (see *Figure 11*)

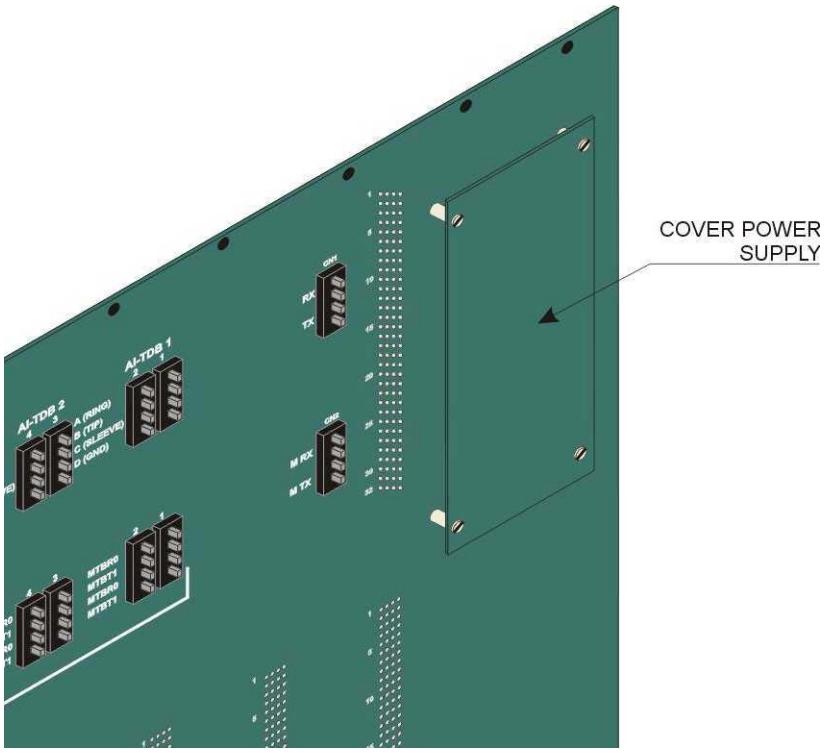

Figure 11. NTTU backplane view showing the safety cover plate for –48VDC power supply connection.

The power block provides two "Quick Terminals"; one to connect to ground (GND), and the other for the –48 VDC. See *Figure 12*.

The terminals for the cabling are part of the installation kit supplied by the factory. See *Figure 13* for the Quick Terminal characteristics.

Use Lucent power supply cable for powering the NTTU. Attach the quick connect terminals to the end of the cable. Slide them securely to the power lugs in the NTTU backplane. The power lugs are properly labeled on the backplane. Make sure to use quick connect terminals with a rubber sleeve over the contact area for safety.

-48VDC power should be taken from the MMFU in the Miscellaneous Cabinet where the NTTU is to be installed. **A fuse size of 1.5 A is required at the MMFU to power the NTTU.**

Put the safety cover back in place after completing power supply installation using the four screws provided.

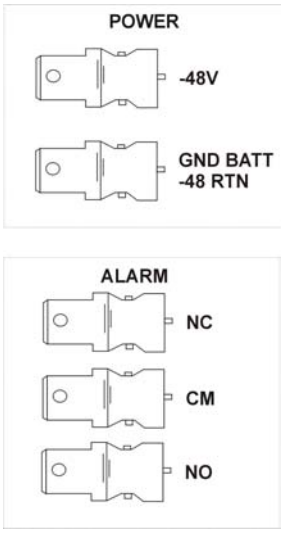

Figure 12. Power and remote alarm connections.

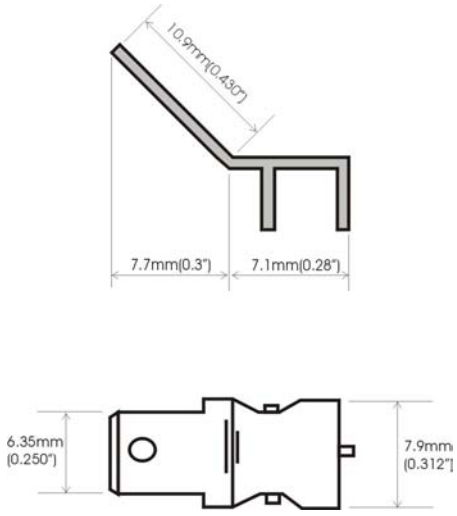

Figure 13. Quick Terminal dimensions.

4. REMOTE ALARM CONNECTION

The NTTU provides a connection point for alarm concentration. It is a dry contact relay, all three contacts are provided: Common contact (CM), Normally Open (NO) and Normally Closed (NC). So that any alarm configuration can be wired.

The remote alarm contact points are protected by a safety cover plate (see *Figure 7* and *Figure 11*). Care should be taken when doing installation/maintenance duties in this area. It is recommended to power off the unit by removing the corresponding fuse at the MMFU. If the alarm installation/maintenance is to be done while in service, extreme care should be taken not to touch the power supply connectors above the alarm connection points.

Make sure to put the safety cover back in place after completing alarm installation or maintenance using the four screws provided.

NTTU Alarm Features Description

Objective:
The purpose of this document is to describe the current self-diagnostic and alarm capabilities of the NTTU system.

It applies to equipment under the following Lucent comcodes and Telcordia CLEI codes detailed as follow:

Product	Lucent comcode	CLEI Code	ECI Code
CPU-SC-T1	408648079	E5IC3TWCAA	291278--1
AI-TDB-107	408648061	E5ATAAAAAA	291277--9
ATU-RCK	408435709	E5MAAA0BRA	436990--2

Other Requirements
Proper operation of the NTTU system requires use of 5ESS software version 5E15-FR4 SU2 or higher for North America market.

Background

The NTTU system is a special purpose signaling converter used to allow access to the 5ESS metallic line testing (MLT) capabilities when using conventional analog No-Test Trunks (NTT) specified as per Telcordia document TR-TSY-000536.

The NTTU system is made up of two type of electronic circuit packs:

- CPU-SC-T1: This is the controller card and where the NTTU operating software (firmware) resides. It contains a T1 framer and is in charge of doing the signaling conversion of analog line signals from the NTT (No-Test Trunk) analog line cards into digital signals and viceversa. It is also in charge of decoding the Control Channel implemented on DS0 #1 of the T1 link towards the 5ESS.
- AI-TDB-107: This is the analog line card for NTT line termination. It contains two NTT channels, each one is equipped with a SLIC (Subscriber Line Interface Circuit) to provide the BORSCH functions on the tip/ring loop, as well as circuitry for operating the required Sleeve-Ground relay and sensors for the different sleeve currents (Positive high/low, Negative high/low)

The NTTU system must have 1 CPU-SC-T1 controller card and up to 6 AI-TDB-107 linecards, each with 2 trunks/channels per circuit pack, for a maximum capacity of 12 analog NTT trunks that can be connected and served by the NTTU signaling converter.

The CPU-SC-T1 connects to the 5ESS at a DLTU module or can be also connected to a DNUS.

CPU-SC-T1 Alarm Indications

The figure to the left shows the faceplate of the CPU-SC-T1 circuit pack. On the faceplate, there is a group of 6 red LEDs used to indicate alarm/failure conditions in the signaling converter, as follows:

a. YEL (Yellow Alarm). This is equivalent to the Remote Alarm Indication (RAI). An alarm indication is being received from the far end of the DS1 trunk (the 5ESS).
b. RED (Red Alarm). This is equivalent to the Out Of Frame (OOF) condition. The NTTU signaling converter is receiving signal on the DS1 port, but is unable to find frame information in the incoming digital stream.
c. LOS (Loss of Signal). This is to indicate the loss of incoming signal on the DS1 port of the NTTU signaling converter.
d. AIS (Alarm Indication Signal) This is an all-ones alarm condition being received on the DS1 port from the far end.
e. SA (Service Alarm). The NTTU requires service. This LED indicator is also linked to a dry contact relay used as a scanpoint for centralized alarm systems. The NTTU alarm relay activation is notified on the 5ESS 105 or 119 alarm page (See Lucent 5ESS Manual for details).
f. IMA (Immediate Maintenance Alarm) The NTTU signaling converter requires immediate maintenance action.

Most of the LED indicators on the CPU-SC-T1 faceplate are directly related to DS1 alarms occurring on the digital stream (LOS, RED, YEL, AIS). However, the SA and IMA indicators are also used to signal failures at either the CPU level or at the trunk pack level (AI-TDB-107).

DS1 Alarm conditions

LOS - Loss of Signal

Loss of incoming signal. Triggered when the incoming PCM DS1 signal to the NTTU is removed or lost. LOS detection also involves sending a Remote Alarm Indication (RAI/YEL) to the remote end. Notice that detection of the LOS condition is accompanied by activation of the SA luminous indicator, as well as activation of the dry contact alarm relay.

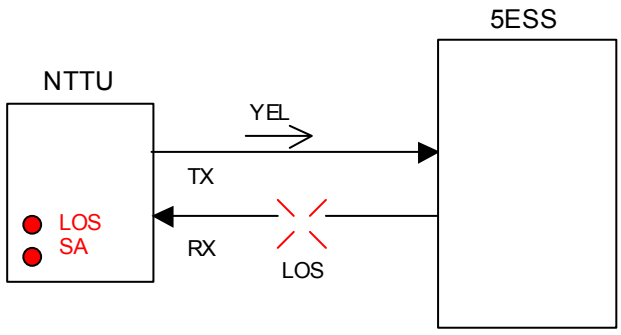

Figure 14. Loss of Incoming Signal (LOS) alarm

AIS - Alarm Indication Signal

AIS is an all-ones signal. AIS alarm goes off when the all-ones signal has been present for 1.5 seconds. Detection of the AIS condition is made as per ANSI T1.231-1997.

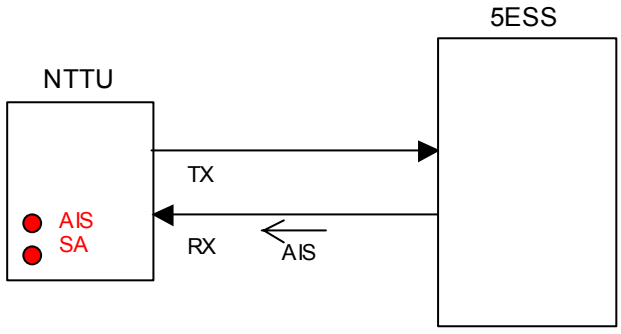

Figure 15. Alarm Indication Signal (AIS) activation

YEL - Yellow Alarm

This is equivalent to the Remote Alarm Indication (RAI). Indicates reception of a signal from the remote end indicating it has lost the incoming signal. Detection of the RAI/YEL condition is made as per ANSI T1.231-1997.

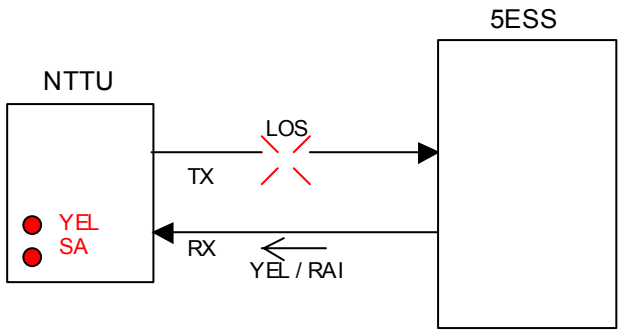

Figure 16. Remote Alarm Indication (RAI, also known as Yellow Alarm) condition

RED - Red Alarm

This is equivalent to the Out Of Frame (OOF) condition. The NTTU signaling converter is receiving signal on the DS1 port, but is unable to find frame information in the incoming digital stream. An out-of-frame condition is present on the incoming stream for 2.55 seconds. The RED alarm is removed when the out-of-frame condition has been absent for 16.6 sec.

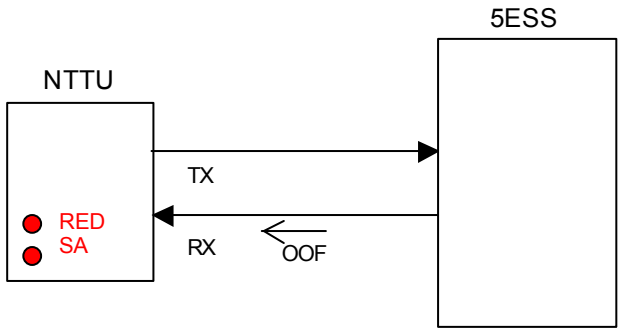

Figure 17. Red alarm condition

Notice that for all cases of a DS1 alarm condition, the SA (Service Alarm) visual indicator is also illuminated. Activation of the SA indicator also implies activation of the dry contact alarm relay located at the NTTU backplane, which in turn should be reflected on the 5ESS 105 or 119 alarms page.

Self Diagnostic and Internal Fault Conditions

The NTTU runs on internal firmware stored on ROM for a Motorola 68000 processor. The firmware includes self diagnostic routines to identify CPU failures as well as analog trunk packs failure. Each fault condition detection procedures and treatment is discussed next.

CPU Failure

The CPU failures can be classified in two groups:
Controlled CPU failures: Those impacting functional sections of the CPU pack, not including the microprocessor. The NTTU firmware currently (as of version NCSNR00F) includes self-diagnostic capabilities that detect an internal CPU failure. Upon detection of the failure the NTTU enters an alarm state and activates the following alarm resources available: SA LED + alarm relay, IMA LED, and additionally generates an AIS towards the 5ESS.
Functional areas that can be diagnosed under this group are:

- DSP coprocessor: in charge of decoding MF commands coming from the 5ESS in the Control Channel.
- Main microprocessor software traps for hardware failures such as: bus error, invalid opcode, spurious interrupt and others.

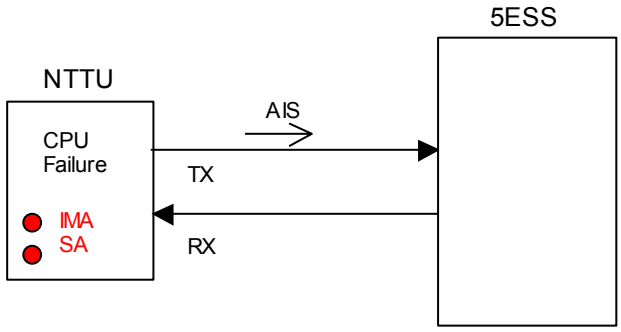

Figure 18. Controlled CPU alarm condition

Uncontrolled CPU failures: Those with a direct impact on the main microprocessor of the CPU pack. This kind of failures would not allow the microprocessor to enter the alarm state in an orderly fashion, and activation of the alarm signals is not guaranteed. Examples of this type of CPU failures include:

- unseating of the EPROM memories from its sockets due to vibration. Very unlikely, the NTTU has passed NEBS level 3 earthquake and vibration tests.
- Erasure of the contents of the programmable logic devices due to ESD discharge. Very unlikely, the NTTU has passes NEBS level 3 tests for ESD immunity. The ESD discharge could be due to mishandling during transport or installation, but the failure would be self-evident to the craftsman doing the installation at the moment of powering-up the unit.
- Watchdog reset: The CPU circuitry includes a watchdog circuit which shall reset the unit upon two conditions: power supply variation outside the ±5% tolerance or the microprocessor failed to retrigger the monostable timing circuit due to some hardware or software failure. If the failure is recurring, it would be seen as an intermittent CGA condition by the 5E and as an intermittent relay alarm activation.

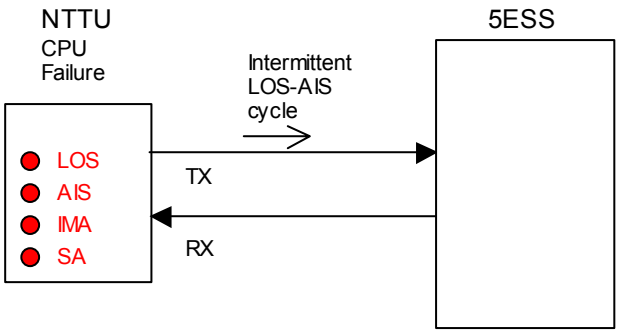

Figure 19. Uncontrolled CPU failure condition

Trunk Pack Failure

Communication of the CPU with the analog trunk packs is done through the NTTU backplane system. The exchange of information is done using serial TDM (time division multiplexing) digital streams. The information contained in these streams can be separated into operation commands coming from the CPU towards the analog trunk interface front-ends (AI-TDB-107), and also status information from the analog interface (on-hook/off-hook detection, tip/ring polarity, sleeve current, etc.).

In the NTTU original design there was no provision for special diagnostic or self-test capabilities of the analog linecards. That means implementing a self-test routine would have to rely on available status information being read from the linecards by the CPU.

Going into further detail, the analog linecard status information is read by the CPU in the form of an 8-bit word including the following information: tip/ring off-hook detection, tip/ring polarity sensors, sleeve current values, incoming/outgoing trunk selection, and card presence/absence indication.

The final implementation of the self-diagnostic relies on checking the linecard status word against a list of 'valid' bit combinations. An invalid status word would then be interpreted as a trunk pack error or failure. There will be some trunk pack failure conditions that won't be recognized or represented by an invalid status word, and hence, won't be indicated as an alarm condition.

The expected behavior for these error conditions is as follows:

- Activation of the SA (Service Alarm LED) and associated alarm relay output
- Turn off the OK status LED indicator on the faulty trunk pack
- Generate a 'pack absent' indication using the CAS (Channel Associated Signaling) B bit on the affected pack. There is a provision on the 5ESS software to generate an alarm (ROP message) for detection of pack removal on provisioned NTT trunks.
- The CPU will try to reinitialize the faulty trunk pack every 3 seconds

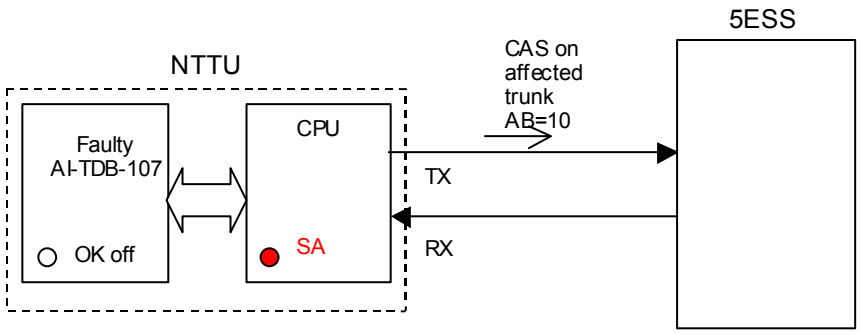

Figure 20. Trunk pack failure indication

Other failure modes of the trunk packs

- Blown fuse on the trunk pack. The trunk pack would be seen as 'removed' from the NTTU backplane by the CPU. This condition will be indicated by the CAS B bit. There is a provision on the 5ESS software to generate an alarm for detection of pack removal on provisioned NTT trunks.
- Blown fuse on the tip/ring interfaces. The AI-TDB-107 includes overvoltage and overcurrent protections on the tip ring interfaces. Overcurrent protection is achieved using line fuses (1.25 A), if these fuses are blown; there is no way for the NTTU to recognize the failure. The MLT would see unsuccessful connection attempts on that trunk.
- MTB failures: No indication.

Quick Troubleshooting Guide

The different failure conditions of the NTTU can be identified by examining the visual LED indicators as described in the following table.

Visual indication	**Failure condition**
SA plus one of the following: LOS, RED, YEL, AIS depending on the type of alarm	T1 (DS1) alarm
SA + IMA	Controlled CPU failure
SA + IMA + all other LEDs	Uncontrolled CPU failure
SA + OK LED off at the affected trunk pack	Trunk pack failure

Table 1. Quick troubleshooting guide using visual indicators on the NTTU

Feature availability

The features here described shall be present in all NTTU units provisioned with firmware version number NCSNR00G or later, residing on the CPU-SC-T1 pack (comcode 408648079). Effective 02/08/2002.

IV SPECIFICATIONS

NTTU General specifications

- T1/E1 Digital Channel.
- Maximum capacity: 12 analogue channels.
- Digital Channel Impedance: 120 Ohms.
- Impedance in the audio channel: 900 Ohms + 2.2μF.
- Powering –48VDC ±10%, to be taken from the MMFU of the Miscellaneous Cabinet
- Fuse required at the MMFU: 1.5 A
- Stand-by energy consumption: 120mA for the CPU + 23mA for each AI-TDB.
- Maximum energy consumption during operation: 120mA for the CPU + 90mA for each AI-TDB.

SUB-RACK

- Dimensions: 266.70 x 482.60 x 400.00mm H x W x D (10.5" x 19"x 15.7").
- Standard Industrial Dimensions
    - DIN 41494 version for 19" Rack.
        - Internal width: 84T.
        - Height: 6U.
- Weight: 3.5 Kilograms

Intelligent PCM Unit CPU-SC-E1/T1

- 1 PCM unit per T1/E1.
- Line interface:
    - Timing signal: The timing signal may be chosen between 2 possible sources:
        - Clock extract from incoming signal.
        - Internal clock of 1544 kbit/s ± 50 ppm and 2048 kbit/s ± 50 ppm for T1 and E1, respectively.
    - Binary speed: 1544 kbit/s ± 50 ppm and 2048 kbit/s ± 50 ppm for T1 and E1, respectively.
    - Base frame: G.704 Recommendation.
- Digital interface
    - Audio channels: 64 Kbit/s, 30 in each frame following G.704 recommendation.
    - Coding law: μ-Law and A-Law PCM coding for T1 and E1, respectively; following G.711 recommendation.
- Main Unit Processor: Motorola CISC.
- Power requirements: -48 VDC ± 10%, 120mA.
- Power supply: Independent power supply, DC/DC converter -48 to 5 VDC.
- Protection fuse of 250mA.
- Main unit dimensions: 233.4 x 40 x 280mm H x W x D (9.2" x 1.6"x 11").
- Weight: 482 grams.

AI-TDB-107 Card

- 2 analogue No-Test Trunks channels per card.
- Protection fuse of 250mA.
- Dimensions: 233.4 x 40 x 280mm H x W x D (9.2" x 1.6" x 11").
- Weight: 389 grams.

Agency Approvals

The NTTU system has been certified to comply with NEBS Level 3 requirements for intrabuilding installation.

UL recognized component per UL1950 3rd edition. CCN: WYQQ2 Component – Telephone Appliances and Equipment. UL file E216733.