Technical Product Manual DCT1900 System

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Preface

What this manual describes ...

This manual describes how to configure, install, maintain and operate the DCT1900 Cordless Telephone System. It also describes the concepts and the hardware building blocks of the DCT1900 system to provide the reader with general knowledge about the system. Product specifications of the DCT1900 system products are also included.

Who should use this manual ...

This manual is written for telecommunication system managers, and people involved in planning, operation, installation and maintenance of the DCT1900 system.

It should be noted that only certified installers should be allowed to install and maintain the DCT1900 System. Therefore, the information contained in this manual is directed to personnel who have been properly trained and certified.

Where to find what ...

This manual is divided by means of separators into sections.

Section 1   Safety and Regulatory Information
Contains regulatory information, and information on how to handle Electrostatic Sensitive Devices (ESD) and lithium batteries.

Section 2   System Description
A general system description that includes the concept, capacity, characteristics, and hardware building blocks of the DCT1900. It also contains information about the numbering conventions for cabinets, system boards, peripherals and Base Stations.

Section 3   Product Specifications
Contains environmental/general specifications and compliance to regulations and standards for each product where applicable.

Section 4   Configuration Directions
This section gives detailed information on how to configure a DCT1900 system based on the user requirements, i.e. number of Base Stations, power supplies, system boards, cables and system limitations.

Section 5   Installation Instructions
Contains all necessary information to install the DCT1900 system. It includes information about required tools, firmware, recommended board positions, cabling and cabinets.

Section 6   Commissioning
Describes a series of checks and tests to verify that the system is working correctly after completing installation and initialization instructions.

Section 7   Maintenance
Maintenance is limited to fault finding of defective modules like system boards, Base Stations, fuses, power supplies, Portable Telephones, and cables. This section describes how to

maintain the system with the help of the system's internal diagnostics and test facilities, and by using fault finding procedures.

Section 8   Glossary
This section contains abbreviations used in this manual.

Section 9   Appendices
This section includes the following:
I   -CSMW Installer's User Guide
II   -Mini Installation and Maintenance Guide
III   -9p23 Users Guide
IV   -DT600 (DARLA) Portable User's Guide
V   -DT620 (DIXIE) Portable User's Guide
VI   -Remote Access and Remote Programming of the Portable Telephone
VII -9p23 Rack Charger Installation

Section 1

Safety and Regulatory Information

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CHAPTER 1
Safety

1.1   General

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- **Note:** *Avoid touching or punching down the Base Station signal and power pairs as there is -48Vdc present on these wires at all times.*
- Use caution when installing or modifying telephone lines.
- Avoid using a telephone (other than a cordless type) during an electrical storm. Electric shock from lightning may occur.
- Do not use the telephone to report a gas leak in the vicinity of the leak.
- Installation should conform to relevant national installation rules.
- The Modular Cabinet should be mounted in a restricted area.
- Do not mount the modular cabinet to a drywall using insertable plastic drywall plugs. These will not safely support the cabinet. See Installation section for recommended mounting.
- Suitable for mounting on concrete or other non-combustible surface only. [This refers to the floor covering/material beneath the cabinet(s)].
- Disconnect all power sources before servicing equipment.
- For the Modular Cabinet use Class II power sources (double insulated, conforms to UL1950, Uout $\leq$ 58 Vdc) only. The power source branch circuit over current protection must be rated 15A. The power source must be short circuit protected (15A maximum).
- A readily accessible disconnect device, that is suitably approved and rated, shall be incorporated in the field wiring.
- Connect to a reliably grounded -48Vdc SELV source.
- Use minimum 14 AWG copper conductors.
- Service is to be performed by qualified personnel only.
- Torque power supply terminal block screws to 7 in. - lbs
- The safety status of the different interconnection points of the system are as follows:
    - RS232A, RS232B ports: SELV circuits
    - Power Failure and General Alarm contacts: SELV circuits
    - Digital Trunk Unit (DTU) connections: TNV circuits
    - Digital Link Unit (DLU) connections: TNV circuits
    - Base Station connections: TNV circuits
    - Sync ports Central Processing Unit (CPU): SELV circuits

1.2 Electrostatic Sensitive Devices

> **ATTENTION**
>
> **Boards which contain Electrostatic Sensitive Devices (ESD) are**
>
> **indicated by the** **sign. For handling these boards refer to**
>
> **Chapter 3 "Protection of Microcircuits against Electrostatic**
> **Discharge (ESD)".**

1.3 Lithium Battery on CPU Board

The following warning is applicable for the Lithium battery on the CPU board.

> **CAUTION!**
>
> **DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE EQUIPMENT MANUFACTURER. DISPOSE OF USED BATTERIES ACCORDING TO MANUFACTURER'S INSTRUCTIONS.**

CHAPTER 2
Standards and Regulations

2.1   Standards and Regulations

The DCT1900 System adheres to the following standards and regulations:
- FCC Part 15
- UL 60950
- UTAM, Inc.
- ANSI/IEEE C95.1
- PWT - Personal Wireless Telecommunications

2.2   Radio Equipment: Handsets and Base Stations

- FCC Part 15, Subpart B - "Unintentional Radiators"
- FCC Part 15, Subpart D - "FCC Rules for Radio Frequency Devices"
- FCC Part 68.316, 68.317 - "FCC Compatibility With Hearing Aids
- ANSI/IEEE 95.1 - "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3KHz to 30GHz"
- TR41.6, SP-3614 - "Personal Wireless Telecommunications-Enhanced"
- TR41.6, T1A/EIA 662 - "Personal Wireless Telecommunications"
- UL 60950

2.3   Fixed Position System Equipment: Base Stations and Radio Exchange Cabinet

- UL 60950
- FCC Part 15 - "FCC Rules for Radio Frequency Devices."
- UTAM, Inc. - "Disablement Test Suite and LVP"

FCC PART 15

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING CONDITIONS: 1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND 2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

UTAM REQUIREMENTS

INSTALLATION OF THIS EQUIPMENT IS SUBJECT TO NOTIFICATION AND COORDINATION WITH UTAM, INC. ANY RELOCATION OF THIS EQUIPMENT MUST BE COORDINATED THROUGH, AND APPROVED BY UTAM. IF THERE ARE ANY INTERFERENCE PROBLEMS, UTAM MAY BE CONTACTED AT 1-800-429-8826 (UTAM).

THIS EQUIPMENT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A <u>CLASS A</u> DIGITAL DEVICE, PURSUANT TO PART 15 OF THE FCC RULES. THESE LIMITS ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINTS HARMFUL INTERFERENCE WHEN THE EQUIPMENT IS OPERATED IN A COMMERCIAL ENVIRONMENT. THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTION MANUAL, MAY CAUSE HARMFUL INTERFERENCE TO RADIO COMMUNICATIONS. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE HARMFUL INTERFERENCE IN WHICH CASE THE USER WILL BE REQUIRED TO CORRECT THE INTERFERENCE AT HIS OWN EXPENSE.

THE TERM "IC:" BEFORE THE RADIO CERTIFICATION NUMBER ONLY SIGNIFIES THAT INDUSTRY OF CANADA TECHNICAL SPECIFICATION WERE MET.

DO NOT TAMPER WITH THE WARRANTY SEAL ON THE BACK OF YOUR PHONE. TAMPERING WITH THIS SEAL CAN VOID YOUR WARRANTY. DO NOT ATTEMPT TO TAKE YOUR PHONE APART. DOING SO WILL VOID YOUR WARRANTY. YOUR PHONE DOES NOT CONTAIN CONSUMER SERVICEABLE COMPONENTS. SERVICE SHOULD ONLY BE PERFORMED BY AUTHORIZED SERVICE CENTERS.

Exposure to Radio Frequency Signals (SAR)

Your wireless phone is a radio transmitter and receiver. It is designed and manufactured not to exceed the emission limit for exposure to radio frequency (RF) energy set by the Federal Communications Commission of the US government and Canada. These limits are part of comprehensive guidelines and established permitted levels of RF energy for the general population. These guidelines are based on the safety standards previously set by both US and international standard bodies.

These standards include a substantial safety margin designed to assure the safety of all persons, regardless of age and health.

The exposure standards for wireless mobile phones employs a unit of measure known as the Specific Absoption Rate, or SAR. The SAR limit set by the FCC and Canada is 1.6W/kg averaged over one gram of tissue.

Tests for SAR are conducted using standard operating positions specified by the FCC with the phone transmitting at its highest certified power level in all tested frequency bands. Although the SAR is determined at the highest certified power level, the actual SAR level of the phone while operating can be well below the maximum value. This is because the phone is designed to operate at multiple power levels.

Before a phone model is available for sale to the public, it must be tested and certified to the FCC that it does not exceed the limit established by government-adopted requirement for safe exposure. The tests are performed in positions and locations (for exampe, at the ear and worn on the body) as required by the FCC for each model. The highest SAR value for this phone when tested for use at the ear is 0.076W/kg, and when worn on the body is 0.018Wkg. (Body worn measurements differ among phones depending upon available accesories and the FCC requirements.) While there may be differences between the SAR levels of various phones and at various positions, they all meet the government requirement for safe exposure.

For body worn operation, to maintain compliance with FCC RF exposure guidelines, use only Ascom approved accessories. When carrying the phone while it is on, use only the specific Ascom belt clip that has been tested for compliance.

Use of non-Ascom-approved accessories may violate the FCC RF exposure guidelines and shoud be avoided.

The FCC has granted an equipment authorization for this Ascom 9p23 phone with all reported SAR levels evaluated as in compliance with the FCC RF emissions guidelines. SAR information on this 9p23 phone is on file with the FCC and can be found under the Display Grant section of http://www.fcc.gov/oet/fccid after searching on FCC ID 04M9p23.

CHAPTER 3
Protection against Electrostatic Discharge (ESD)

3.1   General

Integrated circuits are sensitive to ESD.

To avoid damage caused by ESD, service engineers and other people must handle equipment and boards carefully.

Electronic equipment has become more resistive to ESD, but we see an increase of situations where static electricity can build up. This is caused by an increasing application of man–made fibers like nylon, acrylic, etc. which are capable of generating ESD of 10,000 Volts and more. Walking across a nylon carpet, even for a few feet, could cause a person to be charged–up to more than 10,000 Volts. Under these conditions, if a system board or a (C)MOS device is touched it could easily be damaged. Although the device may not be totally defective, it is often degraded, causing it to fail at a later date without apparent reason.

To make sure that equipment and parts are well protected during shipment, special packaging materials are utilized. System boards will be shipped in anti–static bags and (C)MOS devices and other sensitive parts in small shielded boxes.

3.2   ESD Handling

In the interest of quality and reliability, it is advisable to observe the following rules when handling system boards and parts.
1. Service personnel should ground themselves by using a wrist strap when exchanging system boards in a cabinet.
2. Keep system boards and sensitive parts in their protective packaging until they are needed.
3. When returning system boards or parts like EEPROMS to the factory, use the protective packaging as described.
4. Never underestimate the damaging power ESD can have and be especially careful when temperatures are below freezing point and during very warm weather in combination with low humidity. Make sure that the environmental conditions remain within the limits specified in Section 3, "Product Specifications" in this book.

PROTECT ESD SENSITIVE DEVICES

Boards with static sensitive devises can be recognized by the [symbol] **sign.**
Observe special handling rules.

Changing a PCB in system
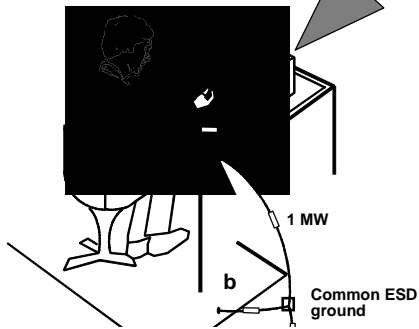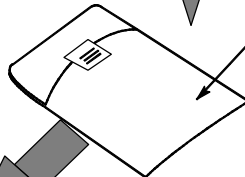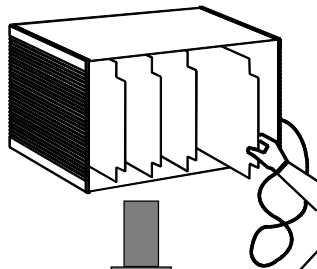**requires a grounded WRIST STRAP**

Some of the benefits of
protection are:

* less failures/service calls
* reduced maintenance costs
* high customer satisfaction

In the interest of quality and
reliability, System Boards and other
parts returned for exchange or
credit may be refused if the
proper protective packaging is
omitted.

CAUTION
Static sensitive components
Handle only at static
safe workstation

ATTENTIE
Elektrostatisch
gevoelige onderdelen
Alleen in beveiligde omgeving
behandelen

Put PCB in static shielding bag
for protection during transportation.
Avoid unnecessary handling.

For a completely safe repair
environment use:
a   Anti-static (conductive) table top/mat
b Conductive floor mat
c Wrist strap
d Conductive trays

1 MW

b

Common ESD
ground

For your personal safety use
APPROVED WRIST STRAPS

IMPORTANT NOTE

In the interest of quality and reliability, system boards, and other parts returned for
exchange or credit may be refused if the proper protective packaging is omitted!

Section 2

System Description

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CHAPTER 1
Introduction

The DCT1900 system is a pico–cellular, digital cordless telephone system that can be connected to a PBX or a Mobility Server via T1 or E1 links or standard analog ports. It is a PWT radio access system, and as such enables the user of the Portable Telephone to make and receive telephone calls anywhere in the area covered by the system.

The system consists of a RE connected to the PBX/Mobility Server, several Base Stations and Portable Telephones. The coverage is established by means of a pico–cellular network consisting of a number of Base Stations connected to the RE. By means of handovers from pico–cell to pico–cell, the user can roam within the covered area while maintaining the call without degradation of quality. Built–in voice encryption and phone authentication ensures privacy and secure communications.

All functions that are available on a normal wired analog telephone connected to the PBX are also available on the DCT1900 Portable Telephones when connected using an analog or T1 interface. The Portable Telephone will provide digital desk set features when connected to the PBX when using the Digital Link Unit (DLU).

The Freeset system is also capable of sending short messages to the portable display using the TAP interface to a server running a dedicated software application or a compatible messaging unit.

The DCT1900 system is based on digital cordless transmissions between the Base Station and the Portable Telephone. Speech encoding is done in the RE and Portable Telephone, using 32 kbit/s ADPCM. The radio transmissions between the Base Station and Portable Telephone use multiple carrier TDMA. Full duplex operation is achieved by using TDD.

One of the basic features of the system is the decentralized DCA technique, by which each Portable Telephone selects the best available speech channel. With DCA, channel selection is not limited to the moment of call set–up, but continues during the speech connection. DCA provides for optimum voice quality between the Portable Telephone and the Base Station as well as controlling the distribution of available channels per Base Station.

The DCT1900 system can be configured to meet user requirements with respect to the area to be covered and the number of Portable Telephones to be used. This system has been designed to operate in indoor/ outdoor environments and can support both low as well as high traffic density situations.

In a DCT1900 Standalone environment, the system contains a single RE connected to a PBX.

In a DCT1900 Mobility environment, the system contains multiple REs connected to the same telephone network via a Mobility Server.

CHAPTER 2
System Overview

The DCT1900 system may operate as a standalone system or as a mobility system when used in conjunction with the Mobility Server. Figures 2-1 and 2-2 show an overview of the environments in which the DCT1900 system may be applied.

The DCT1900 Standalone configuration consists of a single RE and its associated Base Stations con-nected to a PBX. In the standalone configuration the RE will connect towards the telephone network with either analog type trunks or a T1/E1 channel associated signalling trunk. The DLU provides an intelligent interface between the Freeset and a proprietary digital PBX. The DLU emulates a digital phone set of the PBX and allows Freeset users to take advantage of digital phone set features. A DCT1900 Standalone configuration provides for wireless phone service in a simple and cost efficient manner.

Digital Phone Set Features
> The DLU supports the following digital phone set features to the Freeset DCT1900 DT620 and 9p23 Portable Telephones:
> - Multiple Line Appearance
> - Caller Line Identity
> - Connected Line Identity
> - Redirected Party Number
> - Message Waiting Indication
> - Transfer
> - Conference
> - Hold
> - Reconnect
> - Call Back
> - Cancel Call Back

The DCT1900 Mobility configuration provides for one or more REs connected to a Mobility Server, which will then connect towards the telephone network. Large integrated networks of DCT1900 Portable Telephones can be built up using multiple REs and one or more Mobility Servers. The Mobility Server(s) provide the capability of intersystem handovers and roaming. In the case of an intersystem handover, a Portable Telephone user can be on a call while moving from the radio coverage area of one RE to the radio coverage area of another RE without any disruption to the call. In the case of roaming in a DCT1900 Mobility configuration, a Portable Telephone can originate or accept a call in the radio coverage area of any RE. Additional features that the DCT1900 Mobility configuration may support when combined with a compatible PBX are Calling Line ID type displays and message indicators.

DCT1900 features such as phone authentication, encryption, and handover between Base Stations on the same RE apply to either the DCT1900 Standalone configuration or the DCT1900 Mobility configuration. The signalling interfaces that the RE presents towards the phone network are different in the case of a DCT1900 Standalone and a DCT1900 Mobility configuration. Table 2-1 summarizes the signalling differences between the two configurations.

DCT1900 System Type	Signalling Format to Network	Signalling Functionality	Provides Connection to
Standalone	Analog	Interface is over a 3Khz analog 2-wire connection. Basic signalling states such as on-hook, off-hook and ringing supported by voltage and current conditions on the line.	PBX's
Standalone	Digital	Digital line interface over individual 2 wire connections. Proprietary digital signal encoding, which conveys basic call information and additional call information such as Calling Line Identifier, Call redirection numbers, message waiting indicators, multi-line operation, etc. There are 12 circuits per board and each circuit carries one voice call.	PBX's
Standalone	T1 CAS	Digital trunk interface operating at 1,544,000 bits per second supplying 24 voice channels per circuit. There are 2 circuits per board for a total of 48 voice channels. Signalling is done via robbed bit signalling with 2 bits per voice circuit encoding basic signalling states such as on-hook, off-hook and ringing.	PBX's
Standalone	E1 CAS	Digital trunk interface operation at 2,048,000 bits per second supplying 30 voice channels per circuit. There are 2 circuits per board for a total of 60 voice channels. E1 circuits use ISDN type protocol.	Ericsson MD110 proprietary
Mobility	T1 CCS or E1 CCS	Interface over a T1 line at 1,544,000 bps or an E1 line at 2,048,000 bps. One channel on the interface is dedicated to a digital signalling protocol operating at 64,000 bps. The digital signalling channel carries an ISDN type protocol, which conveys basic call information and additional call information such as Calling Line Identifier, Call redirection numbers, message waiting indicators, etc. Because the signalling channel occupies one of the time slots on the T1 or E1 interface, a T1 CCS trunk can carry 23 voice calls per circuit and an E1 CCS trunk can carry 30 voice calls per circuit. There are two circuits per board.	Mobility Server

Table 2-1 DCT1900 Network Signalling Summary
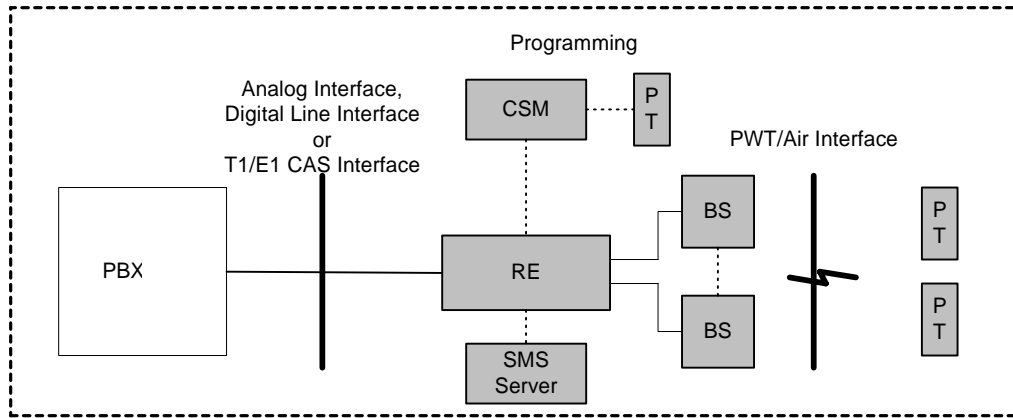
Fig. 2-1 System Overview DCT1900 Standalone Environment
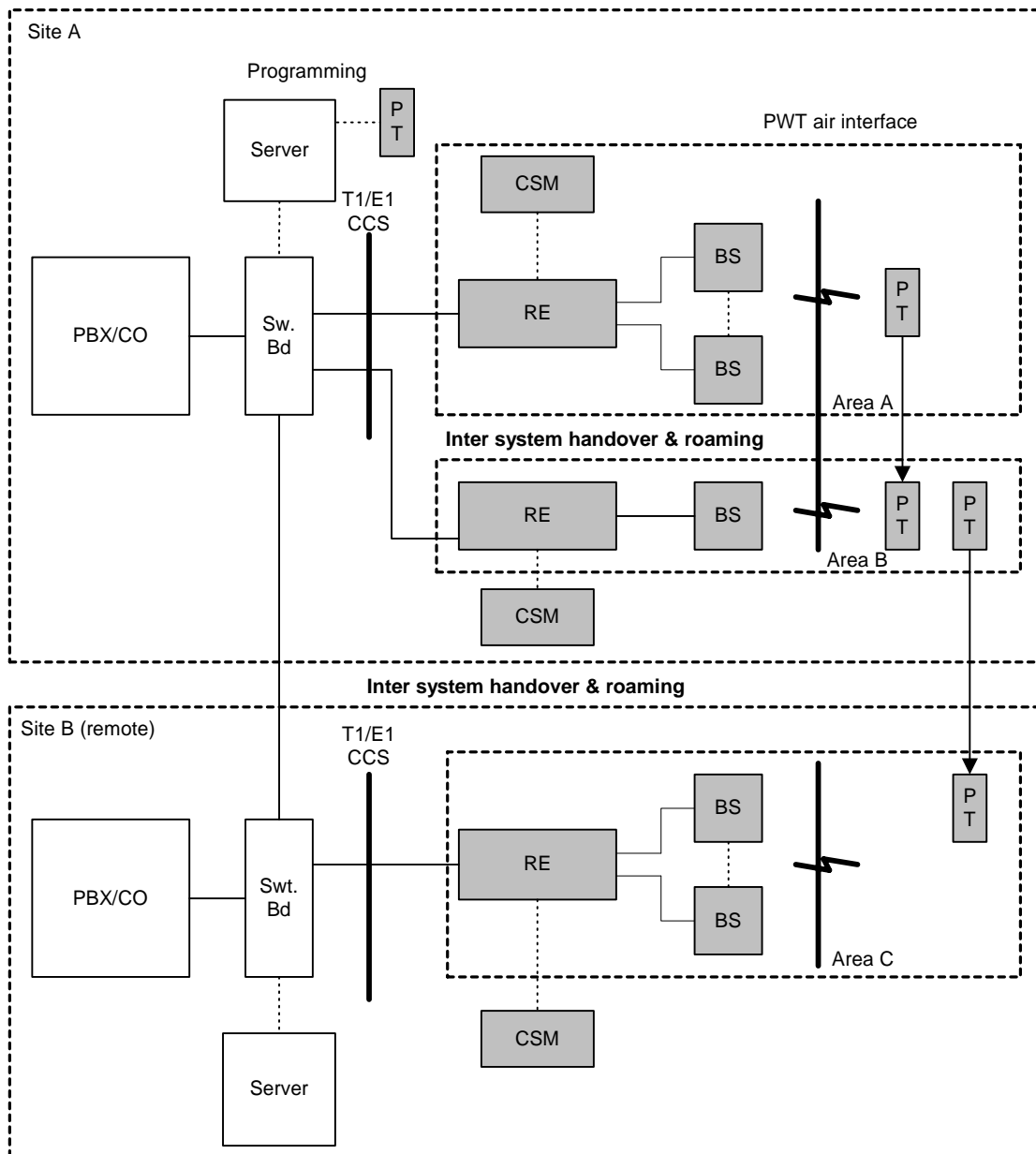
Fig. 2-2 System Overview DCT1900 Mobility Environment

In Figures 2-1 & 2-2 the relevant products covered by this manual are marked in gray. The following items are recognized:

- DCT1900:
  - RE : Radio Exchange
  - BS : Base Station
  - PT : Portable Telephone
  - CSM : Cordless System Manager
- Other:
  - PBX : Private Branch Exchange
  - MS : Mobility Server
  - CO : Central Office

2.1 Operational Concepts

Operational Environment
The DCT1900 is designed for mobility within the defined coverage area of the system. If the defined coverage area of one system is too small, then in conjunction with the MS, several DCT1900 systems can be connected together to act as if they were one large system.

Environmental External Dependencies
The DCT1900 system, as shown in Figures 2-1 & 2-2 depends on the following external systems to provide the required services:

- Private Branch Exchange (PBX)
- Mobility Server (MS)
- Central Office (CO)

Functional External Dependencies
The following external systems provide the following functions:

- The PBX is a switch, providing:
  - Standard switching services
  - Calling party identity
  - Voice mail services
  - Paging services
  - Access point to the Public Switched Telephone Network (PSTN)
- The MS is an adjunct to the PBX. It provides:
  - In combination with two or more DCT1900 systems, the ability to roam freely between different locations.
  - The ability to handover between different REs while in a call.
  - The ability via a single number (Portable User Number) to reach users in geographically different locations.
  - The means of configuring the MS and initializing and activating the Portable Telephones.
  - The ability to dial in to the server and use your office extension, change you personnal settings and acces you voice mail.
  - Message waiting indication
  - Call Waiting

System Architecture
The DCT1900 system provides a wireless infrastructure between the user and the MS/PBX. The system can serve multiple users at the same time.

The system can be split up in a fixed part (made up of one RE and multiple Base Stations) and many Portable Telephones. The basic configuration of a DCT1900 system allows:
- Several systems to provide the same service as one large system.   A user with one Portable Telephone is able to walk around in different areas covered by different systems without interrupting an ongoing call. This feature is known as **inter-system handover.**
- A user can use the same Portable Telephone in another area or remote site, keeping the same number. This feature is known as **inter-site roaming.**

Different aspects of the DCT1900 system are discussed below.

Radio Exchange Synchronization (DCT1900 Mobility Configuration only)
In order to support the inter-system handover capability, REs have to be synchronized. REs are synchronized using a master/slave concept, where one master RE supplies a synchronization signal to a number of slave REs. A slave RE can act as a master for three further slave REs, thus creating a multi level star network with a maximum of two levels, see Figure 2-3.
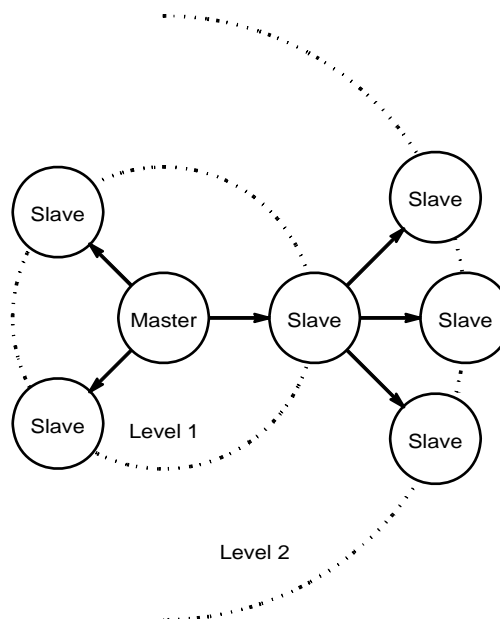
Figure 2-3 Synchronization Topology

In the master RE, it is possible to select the synchronization source between an internal clock and a T1 or E1 interface to the Mobility Server.

In case the synchronization is lost (e.g. due to cable failure) on a slave RE, the slave will generate an alarm on the Mobility interface to notify the MS. However, the slave will continue to operate and

will still synchronize slaves connected to it, effectively forming a separate "sub cluster" within which seamless handovers are still possible.

The delay in the cable used to synchronize the REs must be measured and entered into each of the slave REs. The accuracy of this delay measurement is very important and must be taken with care.

Registration
Registration entails the Portable Telephone establishing a link with the RE/MS, whereby the Portable Telephone tells the RE/MS who it is, i.e. extension number, system number range, home node number, and the RE/MS authorizes the Portable Telephone to use its resources to make and receive calls.

In the case of a DCT1900 mobility configuration with multiple Mobility Servers:
● If the MS is not the Home MS, then there must be a physical connection (QSIG Tie Line) between the Home MS and the MS the phone is trying to register to.
● The Portable Telephone's PUN and authentication key must be known by its' home MS.
● The system number of the RE must be within the system range initialized in the Portable Telephone.

Start of Registration
Registration starts whenever:
● The Portable Telephone is switched on and sees a system (within the allowed system range).
● When the Portable Telephone sees a system with better receive signal strength quality than the current one which is also in its system range (the Portable Telephone will roam to another system).
● The system asks the Portable Telephone to do so (initiated by the RE/MS). This function updates databases which may contain corrupted data (e.g. after restarts of system or RE/MS).

Note:
When a Portable Telephone goes out of range and comes back in range of the same RE, the registration procedure will not be repeated.

Registration Successful
If all requirements are met, the registration will succeed. Note that this dynamic behavior means that only at this point will a Portable Telephone be registered in a system. There will never be a fixed relation between a system and a PUN!

Registration Failures
The registration process may result in a rejection from the RE/MS. If the PUN of the Portable Telephone is not initialized in the RE/MS or when the authentication keys in the Portable Telephone and RE/MS are different, the Portable Telephone will be rejected. The result will be that the Portable Telephone will not try again. Only when the Portable Telephone is switched off and on again, or searched by the RE/MS or by the system, will it try to register again.

The process can also fail because of other reasons. For example, when a connection set–up failed or when congestion occurred in a particular Base Station RE/MS, the registration process will automatically start again after some time.

When a Portable Telephone moves from a RE where it was registered to a new RE and the registration fails on that new RE, it will still be registered in the RE where it came from.

De–registration

De–registration is the process where the authorization at registration is removed. Once the user is de-registered, he can no longer be reached. A user can de–register from the RE by switching the Portable Telephone off, or by roaming to another system.

Whenever the RE is not able to inform the MS (e.g. congestion in the MS) about the de-registration, the RE will repeat it every time there is an incoming call for that specific Portable Telephone.

Authentication

The authentication of a Portable Telephone is done during registration and at incoming or outgoing call establishment. It will be executed according to the PWT Standard Authentication Algorithm (PSAA). The algorithm uses the authentication key that is downloaded over the programming cable into the Portable Telephone during initialization.

In a DCT1900 Mobility Server configuration for performance reasons, a session key (temporary key, reissued at registration time) will be stored locally in the RE as the result of a registration, to allow authentication without consulting the MS during call establishment.

Inter System Handover (DCT1900 Mobility Configuration Only)

Inter system handover is the capability in a mobility configuration of a Portable Telephone that is handed over automatically to another RE when leaving the coverage area of one RE and moving into a coverage area of another RE. When a user moves to a new RE (refer to Figure 2–2), on request of the MS the old RE will remove the relation between the moved Portable Telephone and the old RE (de–registration) while the new RE adds the relation between it and the Portable Telephone (registration). Handovers from one RE to another can only be achieved when all of the following conditions apply:

- Base Stations of different RE's meet the PWT specifications.
- The REs involved are synchronized.
- Both REs have system numbers that fall within the Portable Telephone system range.
- The Portable Telephone detects a stronger signal from the new RE than the old RE.

If these conditions are not met, the inter system handover will not be seamless or the call can even be lost when the Portable Telephone tries to move to the new RE.

If two REs operate in overlapping areas, a Portable Telephone may need to choose between an intra system (to another Base Station of the same RE) and an inter system handover. In these situations, the Portable Telephone will prefer an intra system handover. In general, a 6dB signal strength improvement is required for an intra system handover while a 12dB improvement is required for an inter system handover.

Roaming (DCT1900 Mobility Configuration Only)

Roaming is a feature whereby a Portable Telephone moves between two geographically separate but electronically connected MSs with the attendant REs. When turned on in its home coverage area, the Portable Telephones' connectivity and functionality is normal. When turned on in the other MS coverage area, the Portable Telephone registers itself as a visitor and this MS communicates with the other MS to let it know that the Portable Telephone is now active on the other RE. Any calls to the Portable's PUN will then be routed to the new MS to be passed on to the Portable Telephone.

2.2   Roaming and Handover Handling by the Portable Telephone

Sections 2.2.1 and 2.2.2 describe when the Portable Telephone starts internal (intra cell, same Base Station), external (inter cell, another Base Station of the same RE) and inter system handovers (another Base Station of another RE) and location updates (roaming).

2.2.1   Unlocked Situation

When the Portable Telephone is first turned on, it will regularly scan the air interface. As soon as the Portable Telephone detects a bearer signal from a Base Station, it will lock to this bearer. A bearer is an active PWT air interface channel in which transmissions take place. When a Base Station is idle (there are no calls routed via this Base Station), it transmits a dummy bearer which is also referred to as a beacon signal. Dummy bearers enable the Portable Telephone to lock on to an idle Base Station and to scan the environment.

If the synchronizing system number is not part of one of the Portable Telephone subscriptions, the Portable Telephone will scan the air interface again.

If the synchronizing system number is part of the system range of one of the Portable Telephone subscriptions, that subscription will be selected and the Portable Telephone will use the bearer as a standby bearer. From this moment on the Portable Telephone will start to collect data concerning the situation in other channels on the air interface. This synchronous situation is described in the paragraphs below.

The Portable Telephone falls back to asynchronous roaming if during a certain period of time no valid frames are received. In this case all collected data concerning the situation in other channels is cleared.

To limit the energy consumption during the unlocked situation, the Portable Telephone will go into a sleep mode if it does not find a bearer within 10 minutes. The sleep mode will be interrupted every 2 minutes, when the Portable Telephone performs one full scan to see if there are any systems present.

2.2.2   Locked Situation

Environment Scanning by the Portable Telephone
If the Portable Telephone is locked to a standby bearer, it maintains a list of information for each channel on the air interface. This is called a history list, which contains the following information:

RSSI:	For each channel, a received "Received Signal Strength Indication" (RSSI) value is stored. For an active bearer, this is an indication of the strength of the received signal. For an idle channel, this is an indication of the noise level.
RQI:	For each channel with an active bearer or dummy bearer, a "Received Quality Indication" (RQI) value is stored. The RQI value is determined by the number of correctly/incorrectly received frames.
Base Station & System ID:	For each channel with an active bearer, the Portable Telephone will store the identification of the Base Station and RE.

System Status
A Portable Telephone contains a list of the current RE status. For each system, the status may be:
NOT_ALLOWED: The Portable Telephone is not allowed to access this RE.
TEMP_NOT_ALLOWED: The Portable Telephone is currently not allowed to access this RE, but may be allowed to access this RE in the future.
ALLOWED: The Portable Telephone is allowed to access this RE.

Roaming
If the Portable Telephone is locked to a certain Base Station, two types of roaming are supported: voluntary roaming, when a better bearer is available, or forced roaming, when the current bearer is no longer valid. If the Portable Telephone is locked to a RE, it regularly scans its environment. During the environment scan alternative REs are investigated and a bearer set–up may be attempted.

Voluntary Intra System Roaming
Voluntary intra system roaming takes place if the Portable Telephone detects a Base Station of which the signal strength is at least 6dB stronger than the current bearer, and remains at least this amount stronger during a number of consecutive frames.

Voluntary Inter System Roaming
Voluntary inter system roaming takes place when:
● The RE status of the other RE is higher than the system status of the current RE. If the RE status of the other RE is higher than the RE status of the current RE during a number of consecutive frames, a location update will be started.
● The RE status of the other RE is equal to the RE status of the current RE. If the RE status of the other RE is equal to the RE status of the current RE and the RSSI is at least 12dB stronger than the current bearer RSSI during a number of consecutive frames, a location update will be started.
● The RE status of the other RE is lower than the RE status of the current RE. If, during a number of consecutive frames, the RE status of the other RE is lower than the RE status of the current RE and the RSSI of the best bearer of a Base Station of the other RE is at least 12dB stronger and the Portable Telephone does not see any other Base Stations of this RE and the current Base Station has no further bearers available, the Portable Telephone will start a location update.

Forced Intra System Roaming
If the current bearer cannot be used any more, the Portable Telephone will immediately try to switch to the best bearer on the current RE.

Forced Inter System Roaming
If the bearers of the current RE cannot be used any more, the Portable Telephone will immediately try to switch to the best bearer of alternative REs.

Handover
During a call, two types of handover are supported again: voluntary handover and forced handover. If there are no problems with the current bearer, the Portable Telephone will investigate alternative bearers during a call. Handling of the forced handover is critical because in this case the speech service is disrupted.

Voluntary Intra System Handover
If the best bearer of another Base Station is at least 6dB or better during a number of consecutive frames, the Portable Telephone will start a handover to that Base Station.

Voluntary Inter System Handover
For handovers, only REs with the RE status ALLOWED and TEMP_NOT_ALLOWED are considered as alternatives:
- The RE status of the other RE is equal to the RE status of the current RE. If the best bearer of a Base Station of another RE is at least 12dB or better during a number of consecutive frames and there is a bearer free on this Base Station, an inter RE handover will be started.
- The system status of the other system is lower than the system status of the current system. If, during a number of consecutive frames, the RE status of the other RE is lower than the RE status of the current RE, and the best bearer of a Base Station of the other RE is at least 12dB better and of the current RE no other Base Station is detected and the current Base Station has no other bearers available, then a location update will be started.

Forced Intra System Handover
If the quality of the traffic bearer becomes unacceptably bad, an immediate attempt to find a different bearer is started. This may result in a handover.

Forced Inter System Handover
If a good bearer cannot be found within the current RE, alternative systems will be investigated in the history list. If no RE is found, the Portable Telephone quickly scans its environment to find a valid bearer. If a bearer is found and the network has not yet cleared the call, the Portable Telephone continues to scan its environment. If the network has cleared the call, e.g. because the search took too long, the Portable Telephone will release the call.

2.3   User Functions

The user functions are depending on type of interface between the RE and the connected Telephone Network, and the features supported by the connected Telephone Network.

2.3.1 DCT1900 Mobility Configuration and E1-CAS Standalone when connected to a MD110

Calling Party Number (ID)
Calling party number is the extension number shown to the user on a Portable Telephone display upon receipt of an incoming call and used to identify who is calling. The maximum length equals 24 digits.

Connected Party Number
This feature will enable the PBX to inform the user of the party to which it is connected. The maximum length is 24 digits. The message can be expected at outgoing call set–up or whenever the other party changes.

Redirecting Party Number
The same as connected party number, except that it will only be sent when the call is diverted towards another extension. The maximum length is 24 digits.

Message Waiting Indication
With this feature the PBX will be able to inform the user (on his Portable Telephone display) that there is a pending message in his/her voicemail box and/or short message list.

Message Waiting Clear
The opposite of message waiting indication. This message will inform the Portable Telephone (on its display) that there is no longer a message waiting in his/her voicemail box and/or short message list.

2.3.2 Standalone Digital Line Interface

Note that the following features are supported by the Digital Line Unit (DLU) and can be used by the Portable Telephone only if supported by the connected PBX.

Multi-line Operation
The Multi-line operation provides the user with up to four line appearances.

Calling Party Number (ID)
Calling party number identification displayed to the user on a Portable Telephone upon receipt of an incoming call used to identify who is calling. The maximum length equals 24 digits.

Called Party Number
This feature displays the number that the user has connected to after setting up a call. The maximum length is 24 digits.

Redirecting Party Number
Similar to called party number, except that it will only be sent when the call is diverted towards another extension. The maximum length is 24 digits.

Connected Party Number
This feature will enable the PBX to inform the user of the party to which number it has actually connected to, if different than dialed. The maximum length is 24 digits. The message can be expected at outgoing call set–up or whenever the other party changes.

Message Waiting Indication
With this feature the PBX will be able to inform the user (on his Portable Telephone display) that there is a pending message in his/her voicemail box and/or short message list.

Message Waiting Clear
The opposite of message waiting indication. This message will inform the Portable Telephone (on its display) that there is no longer a message waiting in his/her voicemail box and/or short message list.

Call Transfer
This feature gives the user of the Portable Telephone possibility to transfer an already connected call, either incoming or outgoing, to another extension or outside telephone number, depending on the PBX restrictions.

Conference Call

The user of the Portable Telephone has possibility to invite other extensions or outside telephone numbers to join a conference call.

Hold Call

Allows the user of the Portable Telephone to cut voice communication with an ongoing call without actually disconnecting it.

Reconnect Call

A call that is put on hold by the user of the Portable Telephone can also be resumed from the same Portable Telephone.

Callback

If the called number is occupied and hard to reach due to busy line, this feature registers the target extension to automatically call back when it is free.

Cancel Callback

Exits the Callback operation.

2.3.3 Standalone Analog Interface and T1 CAS Digital Interface

Basic signalling such as on-hook, off-hook and ringing are supported.

CHAPTER **3**
Hardware Building Blocks

The hardware building blocks of the DCT1900 system are (see Figure 3-1)
- RE
- Base Stations
- Portable Telephones
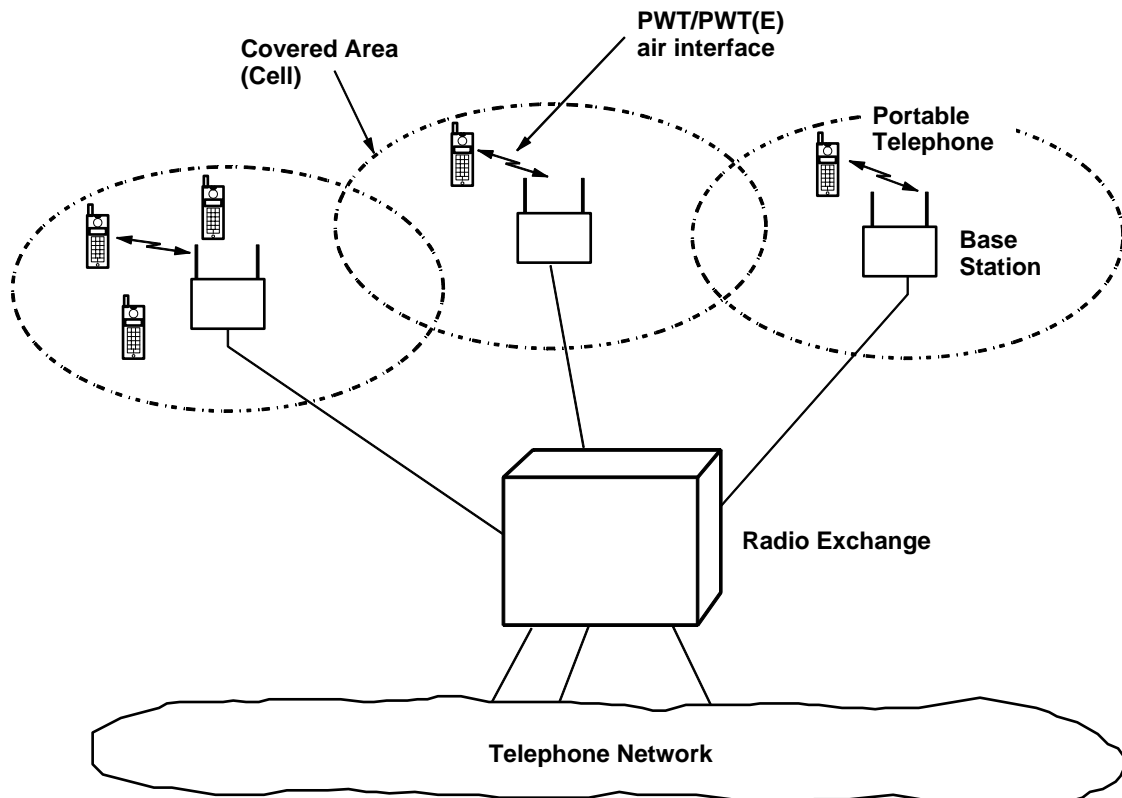
Fig. 3-1 Basic Parts of a DCT1900 System

3.1   Radio Exchange

The RE interfaces between the PBX/MS and the Base Stations. Incoming and outgoing calls are routed via the RE.

The RE may be connected to the PBX via an E1 connection, T1 connection, standard analog two–wire lines or possibly a digital interface. The RE may connect to the MS via an E1 or T1 CCS interface.

Standard RS232 ports on the cabinet make it possible to connect a personal computer and a printer or a SMS server (in SA mode) to the system. The personal computer is necessary for system initialization, system fault tracing, system statistics information retrieval, and Short

Message Service (SMS) source. The printer can print a hardcopy of the system error messages. In a multiple system configuration, up to 13 RE's can be cascaded together.

The RE consists of:
- –One to four Modular Cabinets. The 10 inch Modular Cabinet contain a MCCB and a backplane with 9 system board connectors, a rectifier circuit and a DC/DC converter.
- –A number of system boards.

The Modular Cabinet requires an external power source of -48Vdc.

3.2   Base Stations

The Base Station enables radio communications between the RE and Portable Telephones.

The Base Station has two main functions:
- To modulate a carrier with the digital encoded information (TDMA frame directed to Portable Telephone),
- To demodulate a modulated carrier (TDMA frame received from Portable Telephone).

A Base Station communicates with the RE via two (2B+D) interfaces, requiring two twisted pair cables. The two 2B channels (256 kbit/s) provide eight 32 kbit/s speech paths between a Base Station and a RE, enabling a Base Station to handle eight simultaneous calls. In addition to data communication, these two twisted pairs are also used to distribute power to the Base Stations. One or two additional pairs can be wired to provide a longer powering distance.

Two methods exist to power Base Stations:
- Via local power supply.
- Via Modular Cabinet.

With the first method, Base Stations are powered by -48Vdc which is *not* routed via the cabinet. The maximum cable length between Base Station and RE is only data limited and may reach up to 11,500 ft.

With the second method, power is distributed via the Modular Cabinet and Base Station cabling. The cable length between the Base Station and cabinets now depends on the number of twisted pairs used for power, the type of cable and environmental noise.

The number of Base Stations used in a system depends on the area to be covered and the traffic density. Typical in–house coverage is a 100-200 ft. radius. The cell size may vary between 40 ft. indoors and up to 1,000 ft. outdoors.

The air interface conforms to PWT MAC Layer and FCC part 15.

3.3   Portable Telephones

The Portable Telephone (PT) supports the basic functions of a normal wired DTMF–type telephone. The PT is available in three models: the 9p23, the DT600 and the DT620. Each is equipped with a 3-line 12 character dot matrix LCD display, backlit illumination keypad and display, and plastic keypad. See Section 3, "Product Specifications," Chapter 1, "Portable Telephones" and Chapter 12, "Portable Telephone Accessories" for further information. With the DLU, the 9p23 and DT620 PT will support up to 4 line appearances.

CHAPTER 4
Radio Exchange Boards

4.1   General

The RE can contain the following System Board types:
- Central Processing Unit   (CPU   REX-BRD0004)
                                (CPU2   REX-BRD9033 and REX-BRD9034)
- Speech Processing Unit   (SPU-S   REX-BRD0017)
- Cell Link Unit   (CLU   REX-BRD0014)
                                (CLU-S   REX-BRD0016)
- Speech Link Unit   (SLU   REX-BRD0015)
- Digital Trunk Unit   (DTU E1,CCS   REX-BRD0003)
                                (DTU E1, CAS REX-BRD0002)
                                (DTU T1, CAS REX-BRD0021)
                                (DTU T1, CCS REX-BRD0025)
- Line Termination Unit   (LTU   REX-BRD0007) (*Standalone only*)
                                (LTU2   REXBRD0019A)
- Digital Line Unit   (DLU REX-BRD0023) (*Standalone only*)

The RE consists of up to 4 Modular Cabinets. A Modular Cabinet contains, besides the slots for the System Boards, a MCCB and if required, a SDB.

4.2   Central Processing Unit - CPU1 (REX-BRD0004 or *2/ROFNB 157 19/2*),

CPU2 (REX-BRD9033 or REX-BRD9034)

The Central Processing Unit is responsible for overall control of a DCT1900 system. It contains two standard I/O ports (RS232) and synchronization ports. One CPU board is required per RE.

The CPU/CPU2 performs the following tasks:
- System initialization
- Call processing
- Intra system mobility management
- System testing and fault recovery
- System statistics information
- PWT air interface synchronization
- Short Message Service (SMS) message broadcast

4.3   Speech Link Unit – SLU (REX-BRD0015 or *ROFNB 157 16/1*)

The SLU is a combination of an SPU and a CLU on one board. It contains eight SPC (see Figure 4-1) and eight CLC (see Figure 4-1).

The SLU can be used to control Base Stations via twisted pair cables up to 1.3 miles. For longer distances up to 2.2 miles, a CLU must be used with appropriate powering and cable types.

See Paragraphs 4.4 and 4.5 for the description of the SPU and CLU.
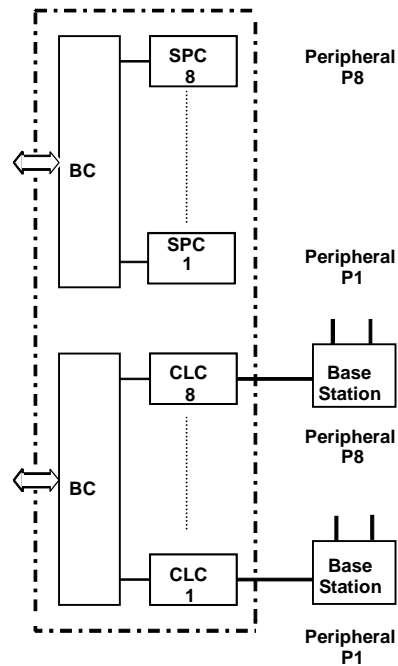
Fig. 4-1   SLU

4.4 Speech Processing Unit - SPU-S (REX-BRD0017 or *ROFNB 157 16/3*)

The SPU interfaces between a LTU/DTU and a CLU/SLU. Every SPU board contains eight Speech Processing Channels (SPC, see Figure 4-2). Every SPC handles the speech processing for one call. When a call is initiated, either by a Portable Telephone or by an incoming call, an SPC is assigned to the call.

The main functions of the board are:
- 64 kbit/s PCM to 32 kbit/s ADPCM transcoding and vice versa
- DTMF generation and dial tone detection
- Echo control
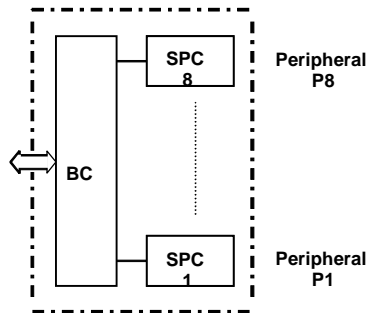
Fig.4-2   SPU

4.5 Cell Link Unit - CLU (REX-BRD0014 or *ROFNB 157 11/2*) or
CLU-S (REX-BRD0016 or *ROFNB 157 16/2*)

The CLU interfaces between a SPU and a Base Station. Every CLU board contains eight CLC (see Figure 4-3). Each CLC communicates with one Base Station.

The main functions of the board are:
● Provides eight simultaneous speech channels from the RE to a Base Station.
● Provides TDMA frame synchronization and power for the Base Stations.

The Base Station control, TDMA frame generation and radio link maintenance functions are implemented in the Base Station.

For signalling distances up to 2.2 miles, a CLU may be used with appropriate powering and cable types. For signalling distances up to 1.2 miles, a CLU-S may be used with appropriate powering and cable types.

Fig. 4-3 CLU/CLU-S

4.6   Digital Trunk Unit - DTU-E1

4.6.1 CCS - REX-BRD0003 or *2/ROFNB 157 13/6*

The DTU provides the digital interface between the MS and the RE. The physical connection with the MS is established via twisted pair cables.

Every DTU board contains 2 DTCs (see Figure 4-4), each equipped with identical firmware. Both DTCs support the Common Channel Signalling (CCS) interface.

Each CCS interface provides 30 (total 60 per board), communication channels to which Portable Telephones are assigned dynamically. These channels are shared by the Portable Telephones which means that although the RE can handle more Portable Telephones, only 30 calls per CCS interface can take place at the same time. The maximum number of Portable Telephones a RE can handle depends on the GOS (grade of service) and the traffic capacity of the RE configuration. However, there is a maximum of 60 concurrent off hooks and a maximum of 1 DTU-E1 card per mobility RE.
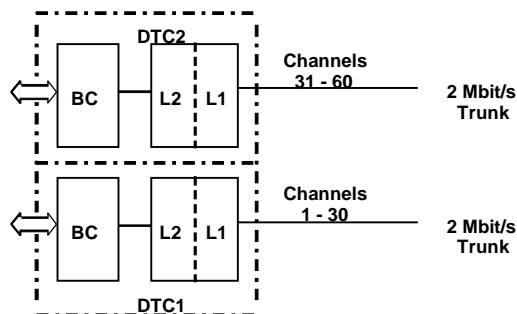
Fig. 4-4 DTU-E1 CCS

4.6.2 CAS - REX-BRD0002 or *2/ROFNB 157 13/1*

DTU-E1 CAS is used only in standalone configurations. The DTU provides the digital interface between the PBX and the RE. The physical connection with the PBX is established via twisted pair cables.

Every DTU board contains 2 DTCs (see Figure 4-5), each equipped with identical firmware. Both DTCs support the Channel Associated Signalling (CAS) interface.

Each CAS interface provides 30 (total 60 per board), communication channels to which Portable Telephones are assigned statically. Each channel is dedicated to a specific Portable Telephone number. The maximum number of Portable Telephones a RE can handle is 600. This is supported on 10 DTU E1 CAS cards.
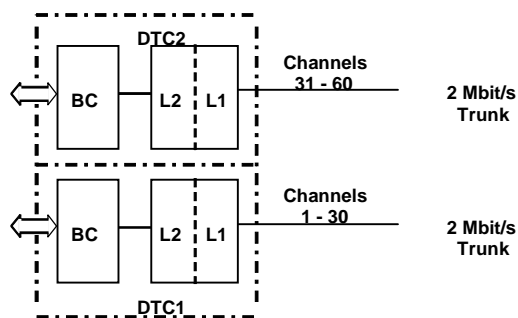
Fig. 4-5 DTU-E1 -CAS

4.7   Digital Trunk Unit - DTU-T1 CAS (REX-BRD0021 or *2/ROFNB 157 13/2*)

DTU T1 CAS is used only in Standalone configurations. The DTU provides the digital interface between the PBX and the RE. The physical connection with the PBX is established via 100 ohm twisted pair cables.

Every DTU board contains 2 DTCs (see Figure 4-6), each equipped with identical firmware. Both DTCs support the Channel Associated Signalling (CAS) interface.

Each CAS interface provides 24 (total 48 per board), communication channels to which Portable Telephones are assigned individually. Each channel is dedicated to a specific Portable Telephone number. The maximum number of Portable Telephones a RE can handle is 600. This is supported on 13 DTU T1 CAS cards.
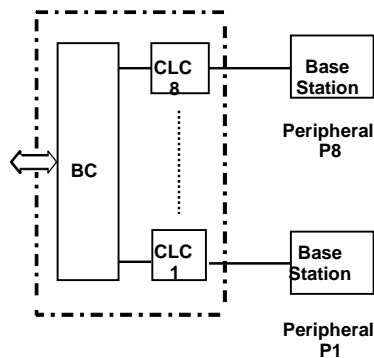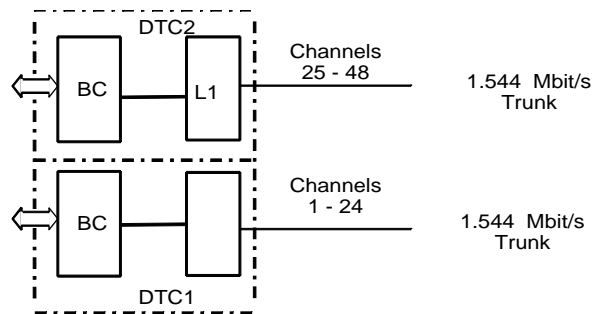

Fig. 4-6 DTU-T1 CAS

4.8   Digital Trunk Unit-DTU-T1 CCS (REX-BRD0025 or *2/ROFNB 157 13/3*)

The DTU provides the digital interface between the MS and the RE. The physical connection with the MS is established via 100 ohm twisted pair cables.

Every DTU board contains 2 DTCs (see Figure 4-7), each equipped with identical firmware. Both DTCs support the Common Channel Signalling (CCS) interface.

Each CCS interface provides 23 (total 46 per board), communication channels to which Portable Telephones are assigned dynamically. These channels are shared by the Portable Telephones which means that although the RE can handle more Portable Telephones, only 23 calls per CCS interface can take place at the same time. However, there is a maximum of 60 concurrent off hooks and a maximum of 2 DTU-T1 (CCS) cards per mobility RE.
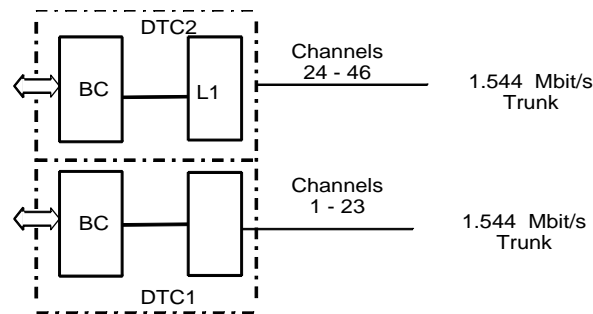
Fig. 4-7 DTU-T1 CCS

4.9 Line Termination Unit - LTU (REX-BRD0007 or *ROFNB 157 02/6*) LTU2 (REX-BRD0019A or ROFNB 157 25/2)

LTUs are used only in Standalone configurations. The LTU provides the analog interface between the PBX and the RE. Every LTU board contains 8 Line Termination Circuits (LTC, see Figure 4-8). An LTC interfaces to the PBX through a two–wire analog subscriber line. Every analog line is dedicated to a specific Portable Telephone number. The LTC terminates the line to the PBX like an ordinary wired analog telephone.

The main tasks of the LTU board are:
- To establish physical connection between the PBX and RE
- On/Off hook detection
- Ring signal detection
- R–button function handling
- Pulse dialing (not currently supported)
- Analog to digital speech processing [PCM (Pulse Code Modulation)] and vice versa
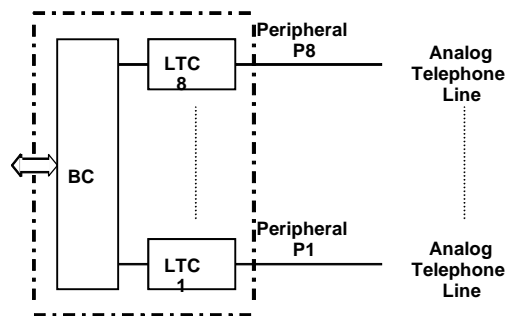
Fig. 4-8 LTU

4.10   Digital Line Unit - DLU (REX-BRD0023) Basic Board

The Digital Line Unit (DLU) card is used only in standalone configurations. The card provides the DCT1900 system with the ability to deliver features such as calling party name/number, message waiting indicator, and multi-line operation to the Portable Telephone.

Each card has 12 Digital Line Circuits (DLC, see Figure 4-9), to support 12 Portable Telephones. Each line is dedicated to a specific Portable Telephone number.

The DLU is designed to interface with various PBXs, such as Nortel Meridian 1, Nortel Norstar, Lucent 75 + 85 series, as well as 8400 Definity G1, G2, G3 PBXs.
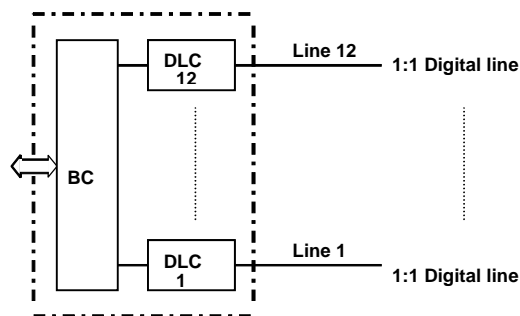
Fig. 4-9 DLU

4.11   Digital Line Unit - DLU (AWS1024) Meridian Board

4.12   Digital Line Unit - DLU (AWS1025) Norstar Board

4.13   Digital Line Unit - DLU (AWS1026) Lucent Board

4.14   Modular Cabinet Connection Board-MCCB (ROANB 101 28)

The MCCB provides connectors for a personal computer, a printer, 3 DTU E1 boards (coax connections), Base Station powering, for 7 CLU boards or SLU boards, and a general alarm (via a relay). The MCCB is located on the bottom plate of the Modular Cabinet.

4.15   Synchronization Distribution Board–SDB (REX-BRD0006 or *ROANB 101 38*)

The SDB allows the connection of one input and three output synchronization signals to the CPU via 120 ohm shielded twisted pair cables. It is located on the bottom plate of the Modular Cabinet near the MCCB. The synchronization signals are required to achieve PWT air interface synchronization between DCT1900 systems to allow seamless inter system handovers.
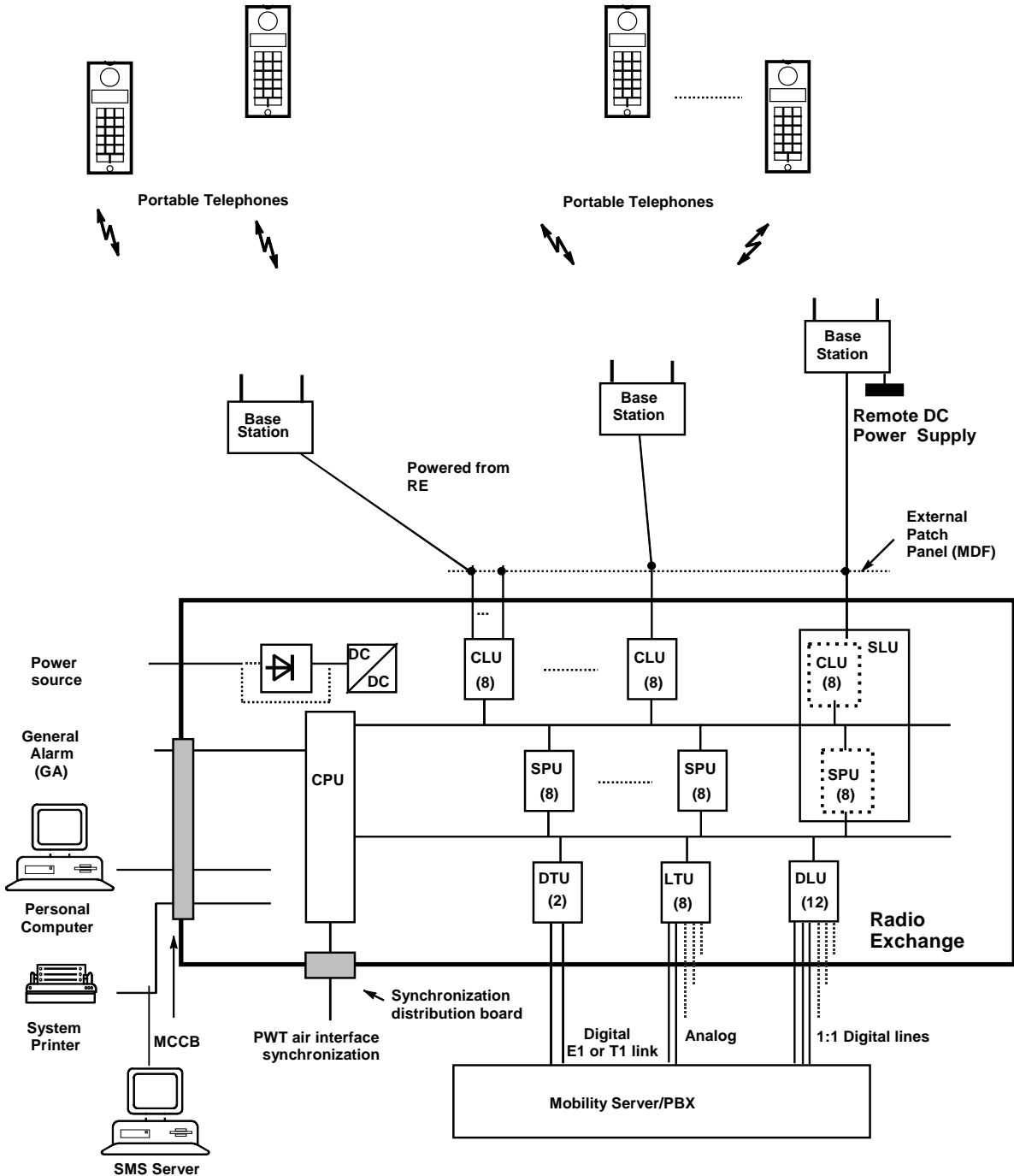
Fig. 4-10 Hardware Block Diagram of the DCT1900 System housed in a Modular Cabinet
Note: Numbers in ( ) are circuits per board.

CHAPTER 5
Other System Aspects

5.1   Installation and Maintenance

As each DCT1900 system is configured to meet specific user requirements, the RE must be assembled on location. The system must be initialized after the physical installation. DCT1900 system initialization, maintenance and updating, and fault finding and repair are accomplished with the aid of the CSMW Software program running on a personal computer.

Automatic System Maintenance is a built–in feature that will detect, report, isolate, and when possible, recover the system from errors.

All of the system boards in the RE have a number of light emitting diodes that enable maintenance personnel to quickly localize a faulty board. This feature is applicable during the power–up phase and operational use of the system.

5.2   Statistics

The CSMW software is capable of collecting statistical information. During operational use of the DCT1900 system, useful information can be registered. This information can consist of the total call time of all Portable Telephones per hour during a day or a period of days, highest number of simultaneous calls, call duration per user, distribution of calls according to the call length, load of Base Stations, status information of a call, handovers, etc. All this information is useful to analyze the performance of the DCT1900 system.

5.3   Capacity

5.3.1 Physical Limitations of the System Housed in the Modular Cabinet

Modular Cabinets per DCT1900 system   : 4
System boards per Modular Cabinet   : 9
Modular Cabinet Connection boards per Modular Cabinet   : 1
Synchronization Distribution Board per system   : 1

5.3.2 Traffic Limitations of the System

A system can handle a maximum of 60 simultaneous calls or 44.8 Erlang with a GOS of 0.5%. Each Base Station can handle a maximum of 8 simultaneous calls or 2.7 Erlang with a GOS of 0.5%.

5.3.3   Characteristics

Frequency band	:	1920-1930 MHz
Number of carriers	:	8 adjacent
Carrier spacing	:	1.25 MHz in 1920-1930 MHz band;
Transmission	:	MC/TDMA/TDD (Multiple Carrier/ Time–Division Multiple Access/ Time–Division Duplexing)
TDMA frame	:	10 ms
TDMA slot	:	0.417 ms
No. of slots per frame	:	24 (12 full duplex channels)
Total number of channels	:	96 (88 available for speech)
Bit rate	:	1152 kbit/s
Speech coding	:	32 kbit/s ADPCM (Adaptive Differential Pulse Code Modulation)
Modulation	:	π/4 DQPSK (Differential Quadrature Phase Shift Keying) with RRC baseband filtering with 50% bandwidth expansion ($\propto$ =0.5)

5.4 Numbering Conventions

Figures 5-1 and 5-2 show how cabinets, boards, peripherals, CLCs, LTCs and DTCs are numbered. The cabinet containing the CPU board is defined as Cabinet 1.
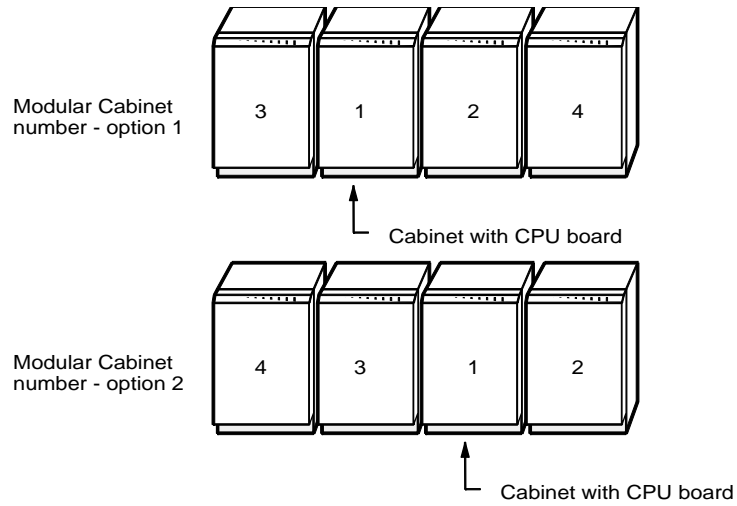
Fig.5-1 Modular Cabinet Numbering
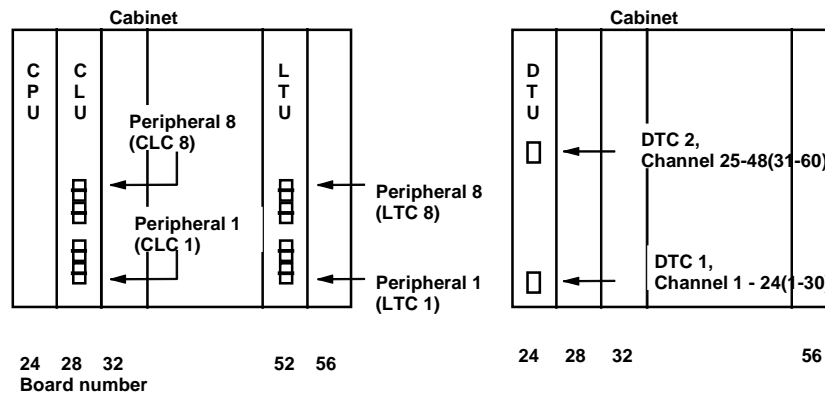
Fig. 5-2   Board, Circuit and Channel Numbering

Base Station Numbering

Base Stations are identified by hexadecimal numbers 08-FF which are referred to as Base Station numbers or Base Station identities. A range of eight hexadecimal numbers is assigned to the CLCs of a SLU/CLU when you add the first Base Station to it by means of the CSM software command *Base Station–Add.* When you add the first Base Station to another SLU/CLU the next free eight hexadecimal numbers are assigned to its CLCs. The first SLU/CLU receives 08-0F, the next SLU/CLU that has a Base Station added will be 10-17. The Base Station assigns Base Station numbers according to the CLC it is physically connected to. CLC 1 correlates to Base Station number 08, or 10, etc.

The hexadecimal numbers 00 to 07 are not used. Therefore the hexadecimal numbers 08 to 0F will be assigned to the first SLU/CLU used to add the first Base Station. Base Station numbering is 08-FF.

Given below is an example:
1. When you define the first Base Station of the *first* SLU/CLU, its CLCs (1 to 8) will get Base Station numbers 08 to 0F (hexadecimal).
2. When you define the first Base Station of the *second* SLU/CLU, its CLCs (1 to 8) will get Base Station numbers 10 to 17 (hexadecimal).
3. When you define the first Base Station of the *third* SLU/CLU, its CLCs (1 to 8) will get Base Station numbers 18 to 1F, etc.

If a SLU/CLU board is removed by the CSMW "Remove Board" command, a gap of 8 Base Station numbers may arise. When there is a gap in the numbering, and the first Base station is added to another SLU/CLU, the numbering system described above is used; the numbers in the gap are not used. If in such a situation all Base Station numbers are used (08 – FF), the Base Station numbers of the oldest "gap" are used.

Note that if there are gaps in the Base Station numbers, the Base Station numbers will shift after a system reset. If, for example, the *second* SLU/CLU is removed, then after a system reset the numbers are:
●   The CLCs of the *first* SLU/CLU still have Base Station numbers 08 to 0F
●   The CLCs of the *third* SLU/CLU now have Base Station numbers 10 to 17, etc.

Section 3

Product Specifications

Table of Contents

CHAPTER 1
Portable Telephones

1.1 DT600 Portable Telephone - KRC 101 1372 (no antenna), DARLA
(Discontinued)

Compliance to Regulations and Standards

Safety Standards	:	UL 1950
ANSI Standards	:	C63.17
PWT Standards	:	PWT 2, 3
PWT(E) Standards	:	Interoperability
UTAM Standards	:	Disablement Test Suite and Location Verification Procedure
Emissions Standards	:	FCC Part 15

Environmental

Temperature

Operating	:	14 to 131°F (-10 to 55°C)
Storage	:	-4 to 158°F (-20 to 70°C)

Relative humidity

Operating	:	15 to 95%, non condensing
Storage	:	5 to 95%, non condensing

Not waterproof

General Specifications

Size	:	5.7" x 2.1" x 1" (145 x 53 x 25mm)
Weight	:	6 oz. (170.4g)
Material housing	:	PC/ABS
Color	:	black
External contacts	:	for Portable initialization and downloading, monitor function of Desk Charger and Battery Pack charging

Transmitter Radio Specifications

RF carriers

Unlicensed:		Fc(MHz) = F2 - C x 1.25MHz, Where C = 0,1,2,3,4,5,6,7
		F2 = 1.929375GHz
Frequency band	:	1910 to 1930 MHz
Modulation method	:	$\pi/4$ DQPSK
Power spectrum	:	$\pi/4$ DQPSK, $\propto$ = 0.5 RRC
Peak output power	:	3 to 19.5 dBm
Output Spurious	:	as per ANSI C63.17 and ANSI C63.4
Harmonics	:	as per ANSI C63.17 and ANSI C63.4

Receiver Radio Specifications

Receiver sensitivity	:	typical -93 dBm and a minimum receiver sensitivity of -90 dBm with a B.E.R. of .001
Unwanted emissions	:	as per PWT Standards

User Interface

Ringer volume levels	:	12
Display	:	LCD, 12 active dot matrix, backlit
Top indicator	:	LED (red/green) for status indication
Keypad	:	17 hard keys, backlit
Volume control	:	2 side volume keys
Number memory	:	approx. 600 entries

Ringer Output

Sound output level	:	85 $\pm$ 5dB(A) at 10 cm

1.2 DT620 Portable Telephone - KRC 101 1374 (no antenna), DIXIE (Discontinued)

Compliance to Regulations and Standards

Safety Standards	:	UL 1950
ANSI Standards	:	C63.17
PWT Standards	:	PWT 2, 3
PWT(E) Standards	:	Interoperability
UTAM Standards	:	Disablement Test Suite and Location Verification Procedure
Emissions Standards	:	FCC Part 15

Environmental

Temperature		
Operating	:	14 to 131°F (-10 to 55°C)
Storage	:	-4 to 158°F (-20 to 70°C)
Relative humidity		
Operating	:	15 to 95%, non condensing
Storage	:	5 to 95%, non condensing
Not waterproof		

General Specifications

Size	:	5.7" x 2" x 1" (145 x 53 x 25mm)
Weight	:	6 oz. (170.4g)
Material housing	:	PC/ABS
Color	:	black
External contacts	:	for Portable initialization and downloading, monitor function of Desk Charger and Battery Pack charging

Transmitter Radio Specifications

RF carriers		
Unlicensed:		Fc(MHz) = F2 - C x 1.25MHz, Where C = 0,1,2,3,4,5,6,7
		F2 = 1.929375GHz
Frequency band	:	1910 to 1930 MHz
Modulation method	:	π/4 DQPSK
Power spectrum	:	π/4 DQPSK, $\propto$ = 0.5 RRC
Peak output power	:	3 to 19.5 dBm
Output Spurious	:	as per ANSI C63.17 and ANSI C63.4
Harmonics	:	as per ANSI C63.17 and ANSI C63.4

Receiver Radio Specifications

| Receiver sensitivity | : typical -93 dBm and a minimum receiver sensitivity of -90 dBm with a B.E.R. of .001 |
| Unwanted emissions | : as per PWT Standards |

User Interface

Ringer volume levels	: 12
Display	: LCD, 12 active dot matrix, backlit
Top indicator	: LED (red/green) for status indication
Keypad	: 17 hard keys, backlit
Volume control	: 2 side volume keys
Number memory	: approx. 600 entries

Ringer Output

| Sound output level | : $85 \pm 5dB(A)$ at 10 cm |

1.3   9p23 Portable Telephone - Messenger - 9p23-AAB4

Compliance to Regulations and Standards

ANSI Standards	: C63.17
PWT Standards	: PWT 2, 3
PWT(E) Standards	: Interoperability
UTAM Standards	: Disablement Test Suite and Location Verification Procedure
Safety Standards	: UL60950
Emissions Standards	: FCC Part 15

General Specifications

Size	: 5.6" x 2" x .825" (142 x 51 x 21mm)
Weight	: 6.8 oz. (193g)
Display	: Graphic 40 x 121 pixels LCD, backlight
Enclosure protection	: IP54-Classified
Free fall test	: IESC 68-2-32 procedure 1 Dropped 12 times from 1m
Color	: black/light gray
External contacts	: for monitor function of Desk Charger and Battery Pack charging
Internal contacts:	: for Portable initialization and downloading

Transmitter Radio Specifications

RF carriers	
Unlicensed:	: Fc(MHz) = F2 - C x 1.25MHz, Where C = 0,1,2,3,4,5,6,7 F2 = 1.929375GHz
Frequency band	: 1910 to 1930 MHz
Modulation method	: $\pi/4$ DQPSK
Power spectrum	: $\pi/4$ DQPSK, $\propto$ = 0.5 RRC
Peak output power	: 3 or 19.5 dBm
Output Spurious	: as per ANSI C63.17
Harmonics	: as per ANSI C63.17

Receiver Radio Specifications

Receiver sensitivity	:	typical -93 dBm and a minimum receiver sensitivity of -90 dBm with a B.E.R. of .001
Unwanted emissions	:	as per PWT Standards

User Interface

Ringer volume levels	:	10
Display	:	Graphic 40 x 121 pixels LCD, backlight
Top indicator	:	LED (red/green) for status indication
Keypad	:	19 hard keys
Volume control	:	2 side volume keys
Alarm control	:	1 top key
Number memory	:	approx. 1000 entries
Mute key	:	1 side key

Ringer Output

Sound output level	:	85 $\pm$ 5dB(A) at 10 cm

1.4   9p23 Portable Telephone - Medic - 9p23-BAB4

Same as specifications for the 9p23 Messenger except Medic color is light gray/blue.

1.5   9p23 Portable Telephone (Mark II) - Medic - 9p23-DAB4

Same as specifications for the 9p23 Messenger except Medic color is light gray/blue.

1.6   9p23 Portable Telephone (Mark II) - Messenger - 9p23-CAB4

Same as specifications for the 9p23 Messenger.

1.7   9p23 Programmer Set - 641302

The 9p23 Portable Telephone Programmer Set is required to program/activate the 9p23 Portable Telephones onto the DCT1900 Standalone RE and to the MS. This Programmer is also used to load software, custom phone books and PBX function data into Portable Telephones.

1.8   DT620 Programmer Set - NTM 201 2180

The DT620 Portable Telephone Programmer Set is required to program/activate the DT620 Portable Telephone onto the DCT1900 Standalone RE and to the MS. This is also used to download software, custom phone books and PBX function data into Portable Telephones.

CHAPTER 2
Base Stations

2.1   Base Station - KRC 101 1371

Technical Product Manual - DCT1900

To order a complete Base Station, use Part Number: <u>DB600-001</u>*

Compliance to Regulations and Standards

PWT standard	:	Parts 6,7,10
PWT(E) standard	:	Interoperability standard
ANSI standard	:	C63.17
UTAM standard	:	LVP
Safety Standard	:	UL60950
Emissions Standard	:	FCC parts 15

Environmental

Temperature
Operating	:	-31 to 169°F (-35 to 76°C)
Storage	:	-40 to 158°F (-40 to 70°C)

Relative humidity
Operating	:	15 to 90%, non condensing
Storage	:	5 to 95%, non condensing

General Specifications

Powering method	:	Centrally from the Radio Exchange, or using 48V external power supply or a DC adapter
Size	:	7.875" x 6.5""x 1.97" (200 x 165 x 50mm)
Weight	:	1lb. 2.5oz. (525g)
Material Cover	:	ABS molded plastic
Color Cover	:	light beige (NCS 1502–B)
Operating voltage	:	21 to 56 Vdc
Power Consumption	:	maximum power consumption shall be less than 6W

Transmitter Radio Specifications

All specifications mentioned here are measured at the RF connectors located next to the antennas.

RF carriers		
Unlicensed:		$Fc(MHz) = F2 - C \times 1.25MHz$, Where C = 0,1,2,3,4,5,6,7 $F2 = 1.929375GHz$
Frequency band	:	1850 to 1990 MHz
Center frequency stability	:	"10 ppm (crystal controlled)
Modulation method	:	$\pi/4$ DQPSK
Power spectrum	:	$\pi/4$ DQPSK $\beta/\propto = 0.5$ RCC1
Peak output power at		
RF–connector	:	3 to 19.5 dBm
Output Spurious	:	as per ANSI C63.17 and ANSI C63.4
Harmonics		as per ANSI C63.17 and ANSI C63.4
Typical RF output impedance	:	50Ω

Receiver Radio Specifications

All specifications mentioned here are measured on the RF connector.

Receiver sensitivity	:	typical -92 dBm with a B.E.R. = 10^{-3} at the radio interface
Input compression	:	better than -30 dBm at -1 dB compression point
Maximum input level	:	as per PWT
Typical C/I ratio	:	as per PWT
Typical C/N ratio	:	as per PWT
Unwanted emissions	:	as per PWT

Base Station Cable

Signal and power transport	:	2 unshielded twisted pairs
Express power transport	:	1 optional unshielded pair (should be twisted)
Maximum length	:	see Tables 2–1 and 2–2.

Cable			Maximum cable length			
Type	Wire size (Æ) AWG	Capacitance	Superimposed noise 8 mV/pHz		Superimposed noise 10 mV/pHz	
			CLU 11/2	SLU/CLU-S	CLU 11/2	SLU/CLU
Twisted pair	26ga	15 pF/ft.	7540 ft.	4920 ft.	6560 ft.	4260 ft.
Twisted pair	24ga	15 pF/ft.	11480 ft.	6880 ft.	9840 ft.	6230 ft.
Twisted pair	22ga	40 pF/ft.	6880 ft.	4260 ft.	5900 ft.	3930 ft.
Double twisted pair (J–Y (St)Y 2 2 0.6)	22ga	40 pF/ft.	6160 ft.	3930 ft.	4920 ft.	3280 ft.

Table 2–1 Maximum Cable Length for Locally Powered Base Stations

	Maximum Cable Length (feet)					
Wire size ($\varnothing$)	Power Supply Voltage 27.5 V		Power Supply Voltage 42 V		Power Supply Voltage 48 V	
	0 EPP	1 EPP	0 EPP	1 EPP	0 EPP	1 EPP
26 awg	418	627	1405	2107	1842	2763
24 awg	627	941	2107	3161	2763	4145*
22 awg	1026	1539	3448*	5172*	4522*	6782*

** Cable lengths should **never exceed** the values given in table 2–1, because of data limitations*

Table 2–2 Maximum Cable Length for Centrally Powered Base Stations

2.2   Straight Antenna - KRE 101 1733/55

This is a half-wave, dipole antenna . This antenna is removable, plug-in type with a polarized MCX (OSX) mating interface.

Tolerances

:	.XX $\pm$ .02
:	.XXX $\pm$ .010
:	Angular $\pm$ 2°

Environmental
Temperature
    Operating   : -40 to 176°F (-40 to 80°C)

General Specifications

Impedance	: 50 ohm
Frequency Range	: 1850 - 1990 MHz
VSWR	: 2:1
Power Handling-Average	: 1 W CW
Power Handling-Peak	: 3 W CW
Gain-Free Space	: 1.9 - 3.0 dBi
Color	: Similar to GE Cyclolac S157, color # 863405, NCS S 2005-Y20R

2.3   Right Angle Antenna - KRE 101 1750/55

This is a half-wave, dipole antenna. This antenna is removable, plug-in type with a polarized MCX (OSX) mating interface.

Tolerances

:	.XX $\pm$ .02
:	.XXX $\pm$ .010
:	Angular $\pm$ 2°

Environmental
Temperature
    Operating   : -40 to 176°F (-40 to 80°C)

General Specifications

Impedance	: 50 ohm
Frequency Range	: 1850 - 1990 MHz
VSWR	: 2:1
Power Handling-Average	: 1 W CW
Power Handling-Peak	: 3 W CW
Gain-Free Space	: 1.9 - 3.0 dBi
Color	: Similar to GE Cyclolac S157, color # 863405, NCS S 2005-Y20R

2.4   Mounting Kits

2.4.1   Outdoor/Wall Mounting Kit - NTM 201 1718

DCT1900 Base Stations may be mounted in a weatherproof fiberglass housing.   The housing is designed for pole or wall-mounting commercial electronic and telephone equipment in outdoor areas, as well as indoor industrial applications where chemical vapors and/or high dust contamination exists. See Section 5, Installation Instructions, Chapter 16, Base Station, Paragraph 16.7 for mounting instructions.

2.4.2   Indoor/Ceiling Mounting Kit - NTM 201 1754

DCT1900 Base Stations may be mounted on a ceiling. This kit is designed to secure the Base Station on the ceiling. See Section 5, Installation Instructions, Chapter 16, Base Station, Paragraph 16.6.1 and 16.6.2 for mounting instructions.

2.4.3   Adapter Mounting Plate Kit - NTM 201 1847

DCT1900 Base Stations may be mounted on a wall. This kit is designed to secure the Base Station on the wall when replacing DCT900 or DCT1800 Base Stations.

CHAPTER 3
Batteries

3.1   Batteries for the DT600

3.1.1 High Capacity NiMH - BKB 193 1021

Environmental
Temperature
    Operating   : 32 to 113°F (0 to 45°C)
    Storage   : -4 to 113°F (-20 to 45°C)

General Specifications
Size   : 1.81" x .79" x 4.33" (45.97 x 20.07 x 109.98mm)
Weight   : 5.96 oz. (169.26g)
Material housing   : PC/ABS
Color   : Black (NCS-9500)
Type   : Re-chargeable Nickel Metal Hydride pack
Voltage   : 6V
Capacity   : 1200mAH @68 °F ± 5°F
Talk Time   : 11 hours
Standby Time   : 22 hours

3.1.2 Vibrating Battery, NiMH - BKB 191 312

Environmental
Temperature
    Operating   : 32 to 113°F (0 to 45°C)
    Storage   : -6 to 113°F (-21 to 45°C)
    Discharging   : -4 to 169°F (-20 to 76°C)

General Specifications
Size   : 1.81" x .51" x 4.33" (45.97 x 12.95 x 109.98mm)
Weight   : 3.95 oz. (112.18g)
Material housing   : PC/ABS
Color   : Black (NCS-9500)
Type   : Re-chargeable Nickel Metal Hydride pack
Voltage   : 6V
Capacity   : 500mAH @68 °F ± 9°F
Talk Time   : 5 hours
Standby Time   : 10 hours

3.2   Batteries for the DT620

3.2.1 High Capacity NiMH Battery - BKB 193 104/75

Environmental

Temperature

Operating	: 32 to 113°F (0 to 45°C)
Storage	: -6 to 113°F (-21 to 45°C)
Discharging	: -4 to 169°F (-20 to 76°C)

General Specifications

Size	: 4.38" x 1.81" x .68" (111.3 x 46 x 17.3mm)
Weight	: 4 oz. (113.6g)
Material housing	: PC/ABS
Color	: Black
Type	: NiMH
Voltage	: 4.2 - 5.8V
Capacity	: 1200 mAH
Talk Time	: 11 hours
Standby Time	: 45 hours

3.2.2 Ultra-Slim Line NiMH Battery - BKB 193 105/75

Environmental

Temperature

Operating	: 32 to 113°F (0 to 45°C)
Storage	: -6 to 113°F (-21 to 45°C)
Discharging	: -4 to 169°F (-20 to 76°C)

General Specifications

Size	: 4.39" x 1.81" x .35" (111.4 x 46 x 8.9mm)
Weight	: 3 oz. (85.2g)
Material housing	: PC/ABS
Color	: Black
Type	: NiMH
Voltage	: 4.2 - 5.8V
Capacity	: 880 mAH
Talk Time	: 10 hours
Standby Time	: 34 hours

3.3   Batteries for the 9p23

3.3.1 Messenger Battery - 643100

General Specifications

Weight	: 2.7 oz. (76.5 g)
Material housing	: PC/ABS
Color	: Black
Type	: NiMH
Voltage	: 3.6V (nominal)
Capacity	: 900 mAH
Talk Time	: 12 hours
Standby Time	: 35 hours

Environmental

Operating temperature	: 14°F to +131°F (-10°C to 55°C)
Storage temperature	: -4°F to +158°F (-20°C to +70°C)

3.3.2 Messenger Battery with headset connection- 643101

Weight	: 2.7 oz. (76.5 g)
Material housing	: PC/ABS
Color	: Black
Type	: NiMH
Voltage	: 3.6V (nominal)
Capacity	: 900 mAH
Talk Time	: 12 hours
Standby Time	: 35 hours

Environmental

Operating temperature	: 14°F to +131°F (-10°C to 55°C)
Storage temperature	: -4°F to +158°F (-20°C to +70°C)

3.3.3 Medic Battery - 643102

Weight	: 2.7oz. (76.5 g)
Material housing	: PC/ABS
Color	: Light Gray
Type	: NiMH
Voltage	: 3.6V (nominal)
Capacity	: 900 mAH
Talk Time	: 12 hours
Standby Time	: 35 hours

Environmental

Operating temperature	: 14°F to +131°F (-10°C to 55°C)
Storage temperature	: -4°F to +158°F (-20°C to +70°C)

3.3.4 Medic Battery with headset connection- 643103

Weight	: 2.7 oz. (76.5 g)
Material housing	: PC/ABS
Color	: Light Gray
Type	: NiMH
Voltage	: 3.6V (nominal)
Capacity	: 900 mAH
Talk Time	: 12 hours
Standby Time	: 35 hours

Environmental

Operating temperature	: 14°F to +131°F (-10°C to 55°C)
Storage temperature	: -4°F to +158°F (-20°C to +70°C)

CHAPTER 4
Chargers

4.1   Chargers for the DT600

4.1.1   Desk Multi-Charger Kit - NTM 201 2022

Environmental
Temperature
    Operating   : 23 to 104°F (-5 to 40°C)
    Storage   : -4 to 113°F (-20 to 45°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Size   : 6.73" x 2.68" x 1.18" (170.9 x 68 x 29.97mm)
Weight   : 6.71 oz. (190.56g)
Material housing   : PC/ABS
Color   : Black (NCS-9500)
Powering   : No AC/DC converter is necessary as voltage adaption is done inside the charger.
RLR   : 4dB
Input Voltage   : 100-240VAC, 50-60Hz
Charging Time
    Front   : 1 hr. for light NiMH, 2 hrs. for high capacity NiMH
    Back   : 1.5 hr. for light NiMH, 3 hrs. for high capacity NiMH

4.1.2   Rapid Battery Charger Kit - BML 162 1016/72 *Discontinued*

Environmental
Temperature
    Operating   : 32 to 104°F (0 to 40°C)
    Storage   : -40 to 185°F (-40 to 85°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width x height : 5.2" x 2" x 1" (132.08 x 50.8 x 25.4mm)
Weight   : 3.5 oz. (994g)
Material housing   : PC/ABS
Color   : Black
Powering   : AC/DC converter, 115V
Indicators   : 4dB
Charging Time   : 1 hr. for light NiMH, 3 hrs. for high capacity NiMH

4.1.3   Rapid Desk Charger - BML 162 1001

Environmental

Temperature
    Operating   : -40 to 185°F (-40 to 85°C)
    Storage   : -40 to 185°F (-40 to 85°C)
Relative humidity   : 90 to 95% -/+ RH

General Specifications

Length x width x height   : 2.87" x 1.38" x 2.05" (72.9 x 35.05 x 52.07mm)
Weight   : 5.4 oz. (153.36g)
Material housing   : PC/ABS
Color   : Black
Powering   : 115 VAC, 60Hz 5%
Charging Current   : 750mA
Charging Time   : 1 hr., 9 min.

4.1.4   Rack Charger Kit - NTM 201 2057

Environmental

Temperature
    Operating   : 23-104°F (-5 to 40°C)
    Storage   : -4 to 158°F (-20 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications

Length x width x height   : 12.72" x 6.69" x 1.22" (323 x 170 x 31mm)
Weight   : 1 lb., 2 oz. (511g)
Material housing   : PC/ABS
Color   : Black
Powering   : 120 VAC, 60Hz, AC power cord
Charging Current   : 450-550mA
Charging Time   : 1.5 hrs. for light NiMH, 3 hrs. for high capacity NiMH

4.2   Chargers for the DT620

4.2.1   Rapid Charger - BML 162 098

Environmental

Temperature
    Operating   : 23 to 131°F (-5 to 55°C)
    Storage   : -40 to 185°F (-40 to 85°C)
Relative humidity   : 93%

General Specifications

Length x width x height   : 2.09" x 1.93" x 3.15" (53 x 49 x 80mm)
Weight   : 14.6 oz. (415g)
Material housing   : PC/ABS
Color   : Black
Powering   : 115V, 50Hz +/-5%
Charging Current   : 700mA
Charging Time   : 2 hrs. for ultra slim and slim NiMH, 3.5 hrs. for high cap NiMH

4.2.2 Desktop Charging Cradle - BML 162 112/04

Environmental

Temperature

Operating	: 23 to 131°F (-5 to 55°C)
Storage	: -40 to 185°F (-40 to 85°C)
Relative humidity	: 93%

General Specifications

Length x width x height	: 5" x 2.64" x 1.62" (127.2 x 69 x 41mm)
Weight	: 5 oz. (142g)
Material housing	: ABS
Color	: Black
Powering	: 6Vdc
Charging Current	: 400-600mA

Charging Time

Front	: 1.5 hrs. for slim NiMH, 2 hrs. for ultra slim and high cap NiMH
Back	: 30 min. for slim and ultra slim NiMH, 2 hrs. for high cap NiMH

4.2.3 Rack Charger Kit - NTM 201 2512

Environmental

Temperature

Operating	: 23 to 104" (-5 to 40°C)
Storage	: -4 to 158°F (-20 to 70°C)
Relative humidity	: 20 to 80%, non condensing

General Specifications

Length x width x height	: 12.72" x 6.69" x 1.22" (323 x 170 x 31mm)
Weight	: 1 lb., 2 oz. (511g)
Material housing	: PC/ABS
Color	: Black
Powering	: 120 VAC, 60Hz, AC power cord
Charging Current	: 450-550mA
Charging Time	: 1.5 hrs for slim NiMH, 3 hrs. for high capacity NiMH

4.2.4 Docking Station - DPY 901 034

Environmental

Temperature

Operating	: 41 to 122°F (5 to 50°C)
Relative humidity	: 5 to 90%, non condensing

General Specifications

Length x width x height	: 5.9" x 5.5" x 2.36" (150 x 140 x 60mm)
Weight	: 12.32 oz. (350g)
Material housing	: ABS
Color	: Black
Powering	: 5-6Vdc
Charging Current	: 600mA
Charging Time	: 2 hrs.

4.3 Chargers for the 9p23

4.3.1 9p23 Messenger Desktop Charger - 641303

Dimensions (L x H x D)	: 4" x 3" x 2.5" (109 x 76 x 69 mm)
Weight	: 3.7 onces
Color	: Grey
Case	: PC/ABS
Operating temperature	: 50°F to + 104°F
Power supply	: 110 V/ 9 -12 V, 0.4 A
Charging time	: 2 h

4.3.2 9p23 Medic Desktop Charger - 641304

Dimensions (L x H x D)	: 4" x 3" x 2.5" (109 x 76 x 69 mm)
Weight	: 3.7 onces
Color	: White
Case	: PC/ABS
Operating temperature	: 50°F to + 104°F
Power supply	: 110 V/ 9 -12 V, 0.4 A
Charging time	: 2 h

4.3.3 9p23 Non-Modular Rack Charger - AWS1068

Dimensions (L x H x D)	: 7" x 7" x 2.5" (184 x 184 x 62 mm)
Weight	: 30 onces
Case	: PC/ABS, light grey
Operating temperature	: 32°F to + 104°F
Maximum relative humidity	: 85% (non condensing)
Supply voltage	: 100-250 V AC (47-63 Hz)
Output current	: max 8 A
Charging time	: 1 h for 750mAh cells

4.3.4 9p23 Modular Rack Charger US Power Module - 641300

Dimensions (L x H x D)	: 7" x 7" x 2.5" (184 x 184 x 62 mm)
Weight	: 30 onces
Case	: PC/ABS, light grey
Operating temperature	: 32°F to + 104°F
Maximum relative humidity	: 85% (non condensing)
Supply voltage	: 100-250 V AC (47-63 Hz)
Output current	: max 8 A

4.3.5 9p23 Modular Rack Charger 4 Slot Charging Module - RC23

Dimensions (L x H x D)	: 7" x 7" x 2.5" (184 x 184 x 62 mm)
Weight	: 30 onces
Case	: PC/ABS, light grey
Operating temperature	: 32°F to + 104°F
Maximum relative humidity	: 85% (non condensing)
Supply voltage	: 100-250 V AC (47-63 Hz)
Output current	: max 8 A
Charging time	: 1 h for 750mAh cells

CHAPTER 5
Cabinets

5.1   Modular Cabinet - REX-BAS9021 or *BDVNB 101 01/2 or BDVNB 101 01/3*

Compliance to Regulations and Standards
Revisions R2 and R3 of the Modular Cabinet comply with the following regulations and standards:

Safety Standard	: UL 60950
EMC Standards	: FCC, Part 15, Class A

Environmental

Temperature	
Operating	: 32 to 104°F (0 to 40°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 10 to 95%, non condensing

General Specifications

Size	: 10.08" x 11.85" x 17.01" (256 x 301 x 432mm)
Weight	: 20.50 lbs. (9307g)
Housing material	: zinc plated steel sheet
Color of cabinet	: coral white (NCS 1002–R)
Color of bottom drawer	: green (NCS 5020–B30G)
Application information	: for indoor use, wall mounted
Enclosure Class	: IP 20
Number of System Boards	: maximum 9

5.2   Modular Cabinet Backplane - ROANB 101 23

The backplane is provided with a rectifier bridge and a DC/DC converter.

Input voltage	: 36 to 42 Vac, or 44 to 58 Vdc
Maximum input power	: 230 W for AC, or 570 W for DC
Output on 5V, +12V and –12V	: Total maximum is 40 W
5 Vdc output	: Max. 40 W
+12 Vdc output	: Max. 12 W
– 12 Vdc output	: Max. 12 W
48 Vdc output (not regulated)	: Max. 160 W if AC input, or max. 530 W if DC input

5.3   Modular Cabinet Connection Board, MCCB - ROANB 101 28

The Modular Cabinet is provided with the MCCB mounted.

Length x width	: 7.5" x 5.3" (190.5 x 134.62mm)
Alarm output ratings	
Power	: 10 VA maximum
Voltage	: 50 Vdc maximum
Current	: 0.75 Adc maximum

5.4   Synchronization Distribution Board, SDB -REX-BRD0006 or *ROANB 101 38*

The SDB is mounted to the Modular Cabinet during system installation. It is part of the Sync Kit - see Paragraph 5.5 only required in multiple system configurations.

Length x width   : 2.6" x 2.2" (66 x 56mm)
Connector for external cables   : shielded modular jacks RJ12 with six terminals

5.5   Installation Set Sync Port CPU

The installation set comprises material to install the sync ports which enable PWT air interface synchronization between DCT1900 systems. The set comprises the following material:

SDB   : Synchronization Distribution Board to be mounted to the
                                               modular cabinet which enables the connection of
                                               synchronization cabling.
CPU/SDB cables   : Connects the CPU to the SDB.
CE Label   : CE marking label to be used if the cabinet is CE marked.

CHAPTER 6
System Boards

6.1   Digital Trunk Unit (DTU–E1 CAS, CCS) - REX-BRD0002 or *2/ROFNB 157 13/1*

Compliance to Regulations and Standards
The DTU–E1 provides 2 standard CEPT primary rate interfaces and meets the following requirements:

CE regulation	: 91/263/EEC
CE marking	: $C\!E0344X$ (this marking is not placed on the DTU–E1 board because the DCT1900 system is already covered by the CE marking of the cabinet)
Leased line CTR	: CTR12
G.703	: Electrical characteristics of the 2.048 Mbit/s synchronization interface
G.704	: Synchronization frame structure at 2.048 Mbit/s
G.823	: Input jitter requirements
G.732	: Characteristics of primary rate PCM multiplex equipment operating at 2.048 Mbit/s
I.431	: Primary rate layer 1

Environmental
Temperature
Operating	: 32 to 104°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 20 to 80%, non condensing

General Specifications
Length x width	13.5" x 7.7" (343 x 195.6mm)

Digital Trunk Specification
Number of primary rate interfaces per DTU board	: 2
Bit rate	: 2.048 Mbit/s
Signalling	: Common Channel Signalling (CCS), using firmware set NTM/RYSNB 101 17/3
	: Channel Associated Signalling (CAS), using firmware set RYS 105 664

6.2 Digital Trunk Unit, DTU-T1, CAS - REX-BRD0021 or *2/ROFNB 157 13/2*

Compliance to Regulations and Standards
The DTU–T1 provides 2 standard T1 interfaces. The DTU–T1 complies with the following EIA/TIA recommendation:

EIA/TIA 464	: Private Branch Exchange (PBX) Switching Equipment for Voice–band Applications.

Environmental
Temperature

Operating	: 32 to 104°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 20 to 80%, non condensing

General Specifications

Length x width	13.5" x 7.7" (343 x 195.6mm)

Digital Trunk Specification
Number of T1

interfaces per DTU	: 2
Bit rate	: 1.544 Mbit/s
Signalling	: Channel Associated Signalling with bit Robbing (CAS BR) according to EIA/TIA 464–A FXS DSX–1, using firmware set RYS 105 660

6.3 Digital Trunk Unit -DTU–T1,CCS - REX-BRD0021 or *2/ROFNB 157 13/3*

The DTU–T1 provides 2 standard T1 interfaces. The DTU–T1 complies with the following EIA/TIA recommendation:

EIA/TIA 464	: Private Branch Exchange (PBX) Switching Equipment for Voice–band Applications.

Environmental
Temperature

Operating	: 32 to 104°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 20 to 80%, non condensing

General Specifications

Length x width	13.5" x 7.7" (343 x 195.6mm)

Digital Trunk Specification
Number of T1

interfaces per DTU	: 2
Bit rate	: 1.544 Mbit/s
Signalling	: Common Channel Signalling with a 64Kbps D channel using Q.931 protocol with proprietary extensions for mobility management, using firmware RYS 105 650.

6.4 Central Processing Unit (CPU1) - REX-BRD0004 or *2/ROFNB 157 19/2*

Environmental

Temperature

Operating	:	32 to 104°F (0 to 70°C)
Storage	:	-40 to 158°F (-40 to 70°C)
Relative humidity	:	20 to 80%, non condensing

General Specifications

Length x width		13.5" x 7.7" (343 x 195.6mm)
RS232 I/O ports	:	2

Sync

Input ports	:	1 via coupler
Output ports	:	3 via RS422 type drivers
Lock in time	:	# 5 minutes after reset and power on
		# 5 minutes after a signal interruption # 3 minutes
		# 8.8 hours during normal operation
Loss of sync	:	immediate after interface failure

6.5 Central Processing Unit (CPU2)-REX-BRD9033, REX-BRD9034

Environment

Temperature

Operating	:	32 to 104°F (0 to 70 °C)
Storage	:	-40 to 158°F (–40 to 70 °C)
Relative humidity	:	20 to 80%, non condensing

General Specifications

Length x width	:	344 x 195 mm
RS232 I/O ports	:	2

Sync

Input ports	:	1 via RJ45
Output ports	:	3 via RJ45
Lock in time	:	# 5 minutes after reset and power on
		# 5 minutes after a signal interruption # 3 minutes
		# 8.8 hours during normal operation
Loss of sync	:	immediate after interface failure

6.6   Speech Link Unit, SLU - REX-BRD0015 or *ROFNB 157 16/1*

Environmental
Temperature
    Operating   : 32 to 104°F (0 to 70°C)
    Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width   13.5" x 7.7" (343 x 195.6mm)

Current Limitation
Current limitation of the Base
Stations power   : 1.3 A (T = 25 °C)
                         0.75 A (T = 70 °C)

Transport Data Rate
Data rate between SLU and
Base Station   : 384 kbit/s

Speech Coding
Telephone exchange side   : 64 kbit/s PCM (A–law or µ–law, country dependent,
                             downloaded from CPU)
Base Stations side   : 32 kbit/s ADPCM

DTMF Levels
Country dependent (downloaded from CPU)

Artificial Leakage
Only if a DTU is used   : -24 dB

Dial Tone Detection
Sensitivity level   : -29 dBm
Detection time   : 800 ms
Frequencies   : 350/440 Hz

6.7   Speech Processing Unit, SPU-S - REX-BRD0017 or *ROFNB 157 16/3*

Environmental

Temperature
Operating   : 32 to 104°F (0 to 70°C)
Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications

Length x width   13.5" x 7.7" (343 x 195.6mm)

Speech Coding

Telephone exchange side   : 64 kbit/s PCM (A–law or μ–law, country dependent, downloaded from CPU)
Base Stations side   : 32 kbit/s ADPCM

DTMF Levels

Country dependent (downloaded from CPU)

Artificial Leakage

Only if a DTU is used   : -24 dB

Dial Tone Detection

Sensitivity level   : -29 dBm
Detection time   : 800 ms
Frequencies   : 350/440 Hz

6.8   Cell Link Unit, CLU - REX-BRD0014 or *ROFNB 157 11/2*

Environmental

Temperature
Operating   : 32 to 104°F (0 to 70°C)
Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non-condensing

Fusing

Power to the Base Stations is fused by two replaceable 1.0 AT fuses per Base Station.

Transport Data Rate

384 kbit/s

General Specifications

Length x width   13.5" x 7.7" (343 x 195.6mm)

6.9   Cell Link Unit, CLU-S - REX-BRD0016 or *ROFNB 157 16/2*

Environmental
Temperature
    Operating   : 32 to 104°F (0 to 70°C)
    Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width   13.5" x 7.7" (343 x 195.6mm)

Current Limitation
Current limitation of the Base
Stations power   : 1.3 A (T = 25 °C)
                    0.75 A (T = 70 °C)

Transport Data Rate
Data rate between SLU and
Base Station   : 384 kbit/s

Speech Coding
Base Stations side   : 32 kbit/s ADPCM

6.10   Line Termination Unit, LTU - REX-BRD0007 or *ROFNB 157 02/06*

Compliance to Regulations and Standards
EIA-470   : USA

Environmental
Temperature
    Operating   : 32 to 158°F (0 to 70°C)
    Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width   13.5" x 7.7" (343 x 195.6mm)

Telephone Line Interface Specifications
Insulation   : 1.5 kVac between line and secondary circuitry
                                      : 1 kVac between line and cabinet

DC Characteristics
Range of line current   : 10-100mA
On–hook equivalent resistance :   > 1MΩ between wires a and b for 50 - 250 V

AC Characteristics
On–hook impedance   : > 100 kΩ for voice signals
                                         > 15 kΩ for ringing signal
Off–hook impedance   : return loss optimized against 210Ω + (880Ω // 150 nF)

Ringing Detection
Ringing voltages   : 10 - 90 Vrms
Frequency range   : > 20 Hz

Pulse Dialing
Waveform   : 60ms pulse, 40ms pulse-USA, Sweden
Selected digit N generates   : N + 1 pulse or
                                         N pulses and digit 0 generates 10 pulses
Resistance during pulsing   :   > 5 MΩ and < 560Ω
Line voltage   : limited to 100 - 14Vdc

DTMF Dialling
The DTMF signals are determined by the combination of the SPU and the SICOFI parameters.

Speech Coding
Method   : software selectable
AD Gain   : determined by SICOFI parameters
DA Gain   : determined by SICOFI parameters
Hybrid balance impedance   : determined by SICOFI parameters

6.11   Line Termination Unit , LTU2 - REX-BRD0019A

Compliance to Regulations and Standards
EIA-470   : USA

Environmental
Temperature
  Operating   : 32 to 158°F (0 to 70°C)
  Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width   13.5" x 7.6" x .8" (344 x 192 x 20 mm)
Weight   .95 lb (430 grams) (excluding packaging)

Telephone Line Interface Specifications
Insulation   : 1.5 kVac between line and secondary circuitry
                                     : 1 kVac between line and cabinet

DC Characteristics
Range of line current   : 60 mA max.
On–hook equivalent resistance : > 9 MΩ between wires a and b for 200 Vdc
Resistance to earth (in quiescent
and loop state)   : 1 GΩ between wires a/b and E-wire for up to 250 Vdc

AC Characteristics
On–hook impedance   : Software programmable 600Ω or complex
Off–hook impedance   : See 'Ringing Detection'
Return Loss   : 15 dB min.
Relative levels   : Software programmable
Input (AD loss) range   : 6 to -11dBr against 270Ω + (750 Ω // 150 nF)
Output (DA loss) range   : 12 to -4.5 dBr against 270Ω + (750 Ω // 150 nF)
Balancing impedance   : Software programmable; 600 Ω, 900 Ω or complex
Longitudinal conversion loss   : 60 dB min. between 50 Hz and 4 KHz

Ringing Detection
Ringing voltages   : 10 kΩ min. between 24 to 90 Vrms, 25 to 50 Hz
Impedance for voice signals   : 100 kΩ min. at AC voltages up to 2 V (peak),300 Hz to 3400 Hz
Capacity   : 1 μF +/- 5%
Ringing voltages   : 24 to 120 Vrms
Insensitive to signals   : 17 Vrms max.
Frequency range   : Software programmable between 16 and 64 Hz

Pulse Dialing
Make/break period   : Software programmable between 0 to 255 ms
Selected digit N generates   : N pulses and digit 0 generates either 10 pulses (default)
Line Voltage during pulsing   :   Limited to 240 Vdc

DTMF Dialling
The DTMF signals are determined by the combination of the output level of LTU and SPU parameters.

Speech Coding
Standard   : G.712
Method   : 64 kbit/s A-law or μ−law PCM'
Speech Coding
Method   : software selectable
AD Gain   : determined by SICOFI parameters
DA Gain   : determined by SICOFI parameters
Hybrid balance impedance   : determined by SICOFI parameters

6.12 Digital Line Unit, DLU - REX-BRD0023

AWS1024 Meridian, AWS1025 Norstar, AWS1026 Lucent

The DLU has 12 analog front ends (ports) that provide 12 digital line interfaces to the PBX.

Compliance to Regulations and Standards

Safety	: ANSI/UL 60950
	: CSA 22.2-950 3rd edition
Electrostatic discharge	: EN 61000-4-2
Radiated susceptibility	: EN 61-4-3
Electrically Fast	
Transients (burst)	: EN 61000-4-4
Conducted disturbances	: EN 61000-4-6
Radiated and	
Conducted Emissions	: EN 55022, procedure CISPR 22 and CISPR 16 Class A

Environmental

Temperature	
Operating	: 32 to 158°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 95% max, non condensing at 77 to 158°F (25 - 70°C)

General Specifications

Length x width	: 13.0" x 7.0 x 0.79" (340 x 178 mm)
Maximum Power Consumption	: 3.0 W at 5V
	1.2 W at -12V
RS232 serial port	: 1 via a DB9 female connector

Digital Line Specification

Number of digital	
interfaces per DLU	: 12
Bit rate	: Automatically adjusted for the PBX type it is configured for.
Signalling	: Proprietary digital signal encoding.

CHAPTER 7
Firmware (on EPROM)

7.1 CPU DCT1900 Firmware (Mobility) - RYS 105 447

Firmware for CPU REX-BRD0004 or *2/ROFNB 157 19/2*.

7.2 CPU DCT1900 Firmware (Standalone) - RYS 105 657

Firmware for CPU REX-BRD0004 or *2/ROFNB 157 19/2*.

7.3 DTU–E1 CCS Firmware Set - NTM/RYSNB 101 17/3

Signalling: Common Channel Signalling (CCS)
Firmware for REX-BRD0002 or *2/ROFNB 157 13/1*

7.4 DTU–E1 CAS Firmware Set - RYS 105 664

Signalling: Channel Associated Signalling (CAS)
Firmware for REX-BRD0002 or *2/ROFNB 157 13/1*

7.5 DTU-T1 CCS Firmware - RYS 105 650

Signalling: Common Channel Signalling (CCS)
Firmware for REX-BRD0021 or *2/ROFNB 157 13/2*

7.6 DTU-T1 CAS Firmware Set - RYS 105 660

Signalling: Channel Associated Signalling (CAS)
Firmware for REX-BRD0021 or *2/ROFNB 157 13/2*

7.7 SLU Firmware - RYS 105 446; RYSNB 101 19; RYSNB 101 20

Firmware for REX-BRD0015 or *ROFNB 157 16/1.*

7.8 SPU-S Firmware - RYSNB 101 20

Firmware for REX-BRD0017 or *ROFNB 157 16/3.*

7.9 SPU-S DSP Firmware - REX-SW0013 or *RYS 105 446* (μ-Law); RYSNB 101 22/1 (A-Law)

Firmware for REX-BRD0017 or *ROFNB 157 16/3* and REX-BRD0017 or *ROFNB 157 16/1.*

7.10 CLU Firmware - RYT/ROFNB 157 11/2

Firmware for REX-BRD0014 or *ROFNB 157 11/2.*

7.11 CLU-S Firmware - RYSNB 101 19

Firmware for REX-BRD0016 or *ROFNB 157 16/2* and REX-BRD0017 or *ROFNB 157 16/1.*

7.12 LTU Firmware - REX-SW0012 or *RYS 105 661*

Firmware for REX-BRD0007 or *ROFNB 157 02/03.*

7.13 LTU2 Firmware - REX-LTU2FW01/1H

Firmware for REX-BRD0019A or *ROFNB 157 25/2.*

CHAPTER 8
Power Supply Units

8.1   Modular Power Supply Kit - AWS 1071 (300W) *New*

Length x width x height	: 9" x 4.5" x 2"
Input voltage	: 88 to 132 VAC
DC Output	: 48V/6.5A
Operating temperature	: 32°F to 113°F (0 to 45°C)

8.2   Modular Power Supply Kit - NTM 201 1786 (300W)

Length x width x height	: 8.5" x 5" x 1.75" (216 x 127 x 44.5mm)
Input voltage	: 102-130/240W:3.5A H.8A,50-60Hz
DC Output	: 48V/6.25A
Operating temperature	: -40 to 185°F (-40 to 85°C)

8.3   Modular Power Supply Kit - NTM 201 1752 (200W) *Discontinued*

Length x width x height	: 12" x 6.5" x 4" (304.8 x 165 x 101.6mm)
Input voltage	: 102-120/200-240V 7A, 50 or 60 Hz
DC Output	: 48V/4.16A
Operating temperature	: -40 to 185°F (-40 to 85°C)

8.4   Remote Base Station Power Supply Kit - NTM 201 1785

Length x width x height	: 6.25" x 2.88" x 7" (158.75 x 73 x 177.8mm)
Input voltage	: 102 to 132Vac, 50 or 60Hz, 2.5A
DC Output	: 24 ± 1.5Vdc at 4.0A or 48 ± 1.5Vdc at 2.0A
Operating temperature	: -22 to 122°F (-30 to 50°C)

8.5   Remote Base Station Plug-In Power Supply - BML 161 139

Length x width x height	: 4.72" x 2.67" x 2.22" (120 x 68 x 56.4mm)
Input voltage	: 120 Vac, 60Hz, .625A
DC Output	: .25A
Operating temperature	: -22 to 122°F (-30 to 50°C)

CHAPTER 9
Cables

9.1   Cables for Modular Cabinet

Interconnection Set - NTMNB 101 105
To interconnect two adjacent Modular Cabinets.

Flat cable	: Connects the backplanes, two 34–pin connectors
Shielding gaskets (4)	: Connects the metal housing of the cabinets
Safety ground cable	: Connects the ground of the cabinets

CLU/MDF Cable Set – NTM/TSRNB 101 29
This cable set consists of two similar cables. The only difference is the position of the shielding clamp.

Cable length	: 16.40 ft. (4.95m), 2 cables
Wires	: 12 twisted pairs (each cable)
Connector CLU side	: 32 pins, DIN41612 (each cable)
Connector MDF side	: Amphenol 50 pin (contains hood and connection for 24AWG-26AWG): Cable Diameter = .350 - .425
	P/N: 1-229912-1 (mate plug)
	Cable Diameter = .425 - .500
	P/N: 3-22912-1

CLU/MDF Cable Set Long - NTM/TSRNB 101 46

Cable length	: 82.02 ft. (24.78m), 2 cables
Wires	: 12 twisted pairs (each cable)
Connector CLU side	: 32 pins, DIN 41612
Connector MDF side	: none

CLU/MCCB Power Cable – TSRNB 101 33

Cable length	: 19.69 in. (500mm)
Wires	: 2
Connector CLU side	: 2 pins, Ericsson power connector
Connector MCCB side	: 2 pins, MOLEX mini–fit, Jr

DTU/MCCB Cable – TSRNB 101 37

Cable length	: 18.90 in. (480mm)
Wires	: 2 coaxial pairs
Connector DTU side	: 10 pins, DIN41612
Connector MCCB side	: 10 pins, DIN41612

DTU/PBX Cable Set - NTM/TSRNB 101 49 (AWS1033)

Cable length	: 49.21 ft. (14.87m), 2 cables
Wires	: 2 twisted pairs (each cable)
Connector DTU side	: 16 pins, DIN41612
Connector PBX side	: 8 pins, DIN41612.

DTU-T1/MDF Twisted Pair Cable - TRSNB 101 50 (AWS1034)

Cable length	: 16.40 ft. (4.95m)
Wires	: 4 twisted pairs
Connector DTU side	: two 8 pin connectors, DIN41612
Connector MDF side	: none

LTU/MDF Cable Set - NTM/TSRNB 101 31

Cable length	: 16.40 ft. (4.95m), 2 cables
Wires	: 24 twisted pairs
Connector DLU side	: 16 pins, DIN4612 (6 connectors)
Connector PBX side	: 25 pair male Amphenol

DLU/PBX Cable Set - AWS1019

Cable length	: 16.40 ft. (4.95m), 2 cables
Wires	: 24 gauge, 12 twisted pairs, non-shielded, (each cable)
Connector DTU side	: 8 pins, RJ45, (24 connectors)
Connector PBX side	: 25 pair male Amphenol

PABX Cable (E1) - TSRNB 101 12

Cable length	: 49.21 ft. (14.87m)
Wires	: 2 coaxial pins
Connector DTU side	: 10 pins, DIN41612
Connector PBX side	: none

PC/SMS Cable - TSRNB 101 22/D

Cable Length	: 9.84 ft. (2.97m)
Connector DCT1900 side	: 9 pin sub–D, female
Connector PC side	: 9 pin sub–D, female

Printer Cable - TSRNB 101 23

Cable Length	: 9.84 ft. (2.97m)
Connector DCT1900 side	: 9 pin sub–D, female
Connector printer side	: 25 pin sub–D, male

Modem Cable - TSR 951 282

Cable length	: 10 ft. (3.02m)
Wires	: 4 conductor
Connector - System	: DB - 9 male, plastic housing
Connector - Modem	: DB - 25 male, plastic housing

Sync Cable - TSR 951 284

Cable length	: 20 ft. (6.04m)
Wires	: 6 conductor
Connector - System/Sync Port	: 6 pin shielded RJ12 connector
Connector - Modem	: 6 pin shielded RJ12 connector

DT600 Portable Telephone Programming Cable - KRY 101 1135/8

Cable length	: 5 ft. (1.5m)
Wires	: 6 conductor
Connector - Portable side	: 14 pin connector
Connector - PC side	: RJ12 connector

DT620 Portable Telephone Programming Cable - KRY 101 1135/10

Cable length	: 5 ft. (1.5m)
Wires	: 6 conductor
Connector - Portable side	: 12 pin connector
Connector - PC side	: RJ12 connector with offset latch

DLU Programming Cable - AWS1027

Cable Length	: 9.84 ft. (2.97m)
Connector DLU side	: 9 pin sub–D, male
Connector PC side	: 9 pin sub–D, female

CHAPTER 10
Software

Note:
The following abbreviations are used in this chapter: CSMW = Cordless System Manager, which now includes the Statistics package.

10.1 CSMW Software Kit, UTAM - REX-MTC9023

Software application and CSMW Users manual on CD. Floppy disk copies may be ordered from you distributor.

Minimum PC configuration
- Minimum Personal Computer Configuration
- Windows 95, 98, ME, NT 40.0 or 2000
- 10MB disk space
- Super VGA monitor or better
- Comctl32.dll version 4.72 or later (with oder version, the buttons in the toolbar maybe invisible). The newest version is available at http://www.microsoft.com/msdownload/ieplatform/ie/comctrlx86.asp
- Keyboard
- Mouse
- 2 dedicated com ports
- CD ROM drive

10.2 CSMW Software Kit, International - REX-MTC9022

Software application and CSMW Users manual on CD. Floppy disk copies may be ordered from you distributor.

Minimum PC configuration
- Windows 95, 98, ME, NT 40.0 or 2000
- 10MB disk space
- Super VGA monitor or better
- Comctl32.dll version 4.72 or later (with oder version, the buttons in the toolbar maybe invisible). The newest version is available at http://www.microsoft.com/msdownload/ieplatform/ie/comctrlx86.asp
- Keyboard
- Mouse
- 2 dedicated com ports
- CD ROM drive

10.3 Feature and Phonebook Download Tool - AWS1092

To be used with Portable Telephones (DT600, DT620, 9p23) and Programmer Set 6412302.

Minimum PC configuration
- Windows 95, 98, ME, NT 40.0 or 2000
- 10MB disk space
- 2 COM port
- CD ROM drive

10.4   Site Survey Tool Configuration Manager - LZY 213 1104

For configuration of Portable Telephones for the Site Survey Tool (LTT 601 103)
IBM compatible diskette   : 3.5"/1.44Mb

Minimum PC configuration
● MS-WINDOWS 95/NT 4.0 or higher compatible 486 PC
● MS-WINDOWS 95/NT 4.0 or higher
● One COM–port (V.24)
● 3.5 inch high density floppy drive (1.44 Mb)

CHAPTER 11
Accessories-Portable Telephone

11.1 Accessories for the DT600

Batteries
High Capacity NiMH Battery - BKB 193 1021
Vibrating Battery, NiMH - BKB 191 312

Chargers
Desk Multi-Charger Kit - AWS1001
Rack Charger Kit - NTM 201 2057

Cases
Standard Case - AWS1005B
Extended Case - AWS1002B
Standard Case White- AWS1005W
Nylon Pouch - KRY 101 1753

Headset Adaptors
Headset Adapter without hook switch- KRY 105 120
Headset Adapter with hoof switch- KRY 101 1776

General
Antenna, Micro - KRE 101 1843/1
Silent Call Alert - KRY 105 1014/55
Replacement Flip - SXA 120 1131/2

11.2   Accessories for the DT620

Batteries
High Capacity NiMH Battery - BKB 193 104/75
Ultra-Slim Line NiMH Battery - BKB 193 105/75

Chargers
Desktop Multicharger - AWS1007
Docking Station - DPY 901 034
Rack Charger Kit, 115VAC - NTM 201 2512/1
Rack Charger Kit, 230VAC - NTM 201 2512/2

Cases
Standard Case - AWS1003B
Extended Case - AWS1004B
Standard Case White- AWS1003W

Headset Adaptors
Headset Adapter - RPM 113 2067
Portable Handsfree w/Adapter - RLF 501 06/02

General
Antenna, Micro - KRE 101 1843/1
Antenna, Micro Red - AWS1021
Silent Call Alert - KRY 101 1763/03

11.3   Accessories for the 9p23

Batteries
9p23 Messenger Battery - 643100
9p23 Medic Battery - 643102
9p23 Messenger Battery w/Headset Connection - 643101
9p23 Medic Battery w/Headset Connection - 643103

Chargers
9p23 Mesenger Desktop Charger w/110v - 641303
9p23 Medic Desktop Charger w/110v - 641304
9p23 Modular Rack Charger, US Power Module - 641300
9p23 Modular Rack Charger, 4 Slot Module - RC23
9p23 RC23 U.S. Conversion Package - 641301

Headsets and Adapters
9p23 Headset w/mic on boom - F150067
9p23 Headset w/hearing protection and earmuff hook swt. - 653045
9p23 Headset w/cable mic - F150068
9p23 Messenger Battery w/Headset Connection - 643101
9p23 Medic Battery w/Headset Connection - 643103
9p23 Headset Adapter Cable - AWS1110 (This adapter enables the use of non-proprietary headsets.

General
9p23 Programmer Set - 641302

Section 4

Configuration Directions

Table of Contents

CHAPTER 1
Introduction

The DCT1900 system was developed as a modular system in order to obtain maximum flexibility in initial configuration and future growth. Each system can be configured to satisfy the specific customer requirements.

The Configuration Directions provide an explanation of the different factors that influence the size of a system and their acceptable values. Restricting limitations are also discussed. The factors that determine the final configuration of a system are:
- number of Base Stations
- number of Portable Telephones in the coverage area
- traffic requirements for the system

Furthermore, the system has a number of restrictions that give limitations to the configuration. These items are explained in the following chapters.

To determine a system configuration, the limitations of the system must be known first. These are described in Chapter 2.

The number of Base Stations determine the number of CLCs to be used. The number of CLCs, together with the cable lengths, define the power requirements for the power supply and the number of SLUs and/or CLUs to be used. The required number of Base Stations can be found by doing a site survey. Site Surveys and Base Station powering are discussed in Chapters 3 and 4.

The traffic requirements for a system are determined by the amount of Portable Telephones in the coverage area (visiting Portable Telephones included), the estimated traffic generated per Portable Telephone and the GOS accepted by the customer. These figures define the number of SPUs required. Traffic requirements are explained in Chapter 5.

When the number of each system board type needed in a system is known, the number of cabinets, power supplies, internal cables, etc. can be calculated. The relationships between all these parts are outlined in Chapter 6.

CHAPTER 2
Limitations of the System

2.1   Modular Cabinets

Cabinet

A system can support up to 4 cabinets. Each cabinet provides space for a combination of 9 system boards. This means that the total size of the system may be 36 system boards. All boards, except for the CPU which is always placed in cabinet 1, can in principle be placed in any slot. However, due to the MCCB layout and power limitations not all combinations are allowed. Powering limitations of the Modular Cabinet are discussed in paragraph 2.2.

Connection Board

A Modular Cabinet has only one MCCB which is factory fitted. The MCCB provides Base Station power connections for a total of 7 CLU and/or SLU boards.

Power Supply

Modular Cabinets are powered by an external -48Vdc supply. Base Stations may be powered by the same power supply or by a second external power supply connected to the MCCB.

Base Stations

The number of Base Stations is limited to 120. A number of Base Stations can be powered via a single cabinet as mentioned above. Furthermore, the external power source specifications can limit the maximum number of Base Stations.

Number of Portable Telephones

The number of Portable Telephones that can be supported by the Standalone DCT1900 system is 600 when digital trunks (DTUs) are used, 144 when digital links (DLUs) are used and 208 Portable Telephones when analog lines (LTUs) are used. The number of Portable Telephones supported by the DCT1900 Mobility System controlled by the MS but cannot exceed 2048 for a single RE.

CPU Firmware

The memory space reserved by the CPU for each type of board is limited to a maximum of 15 CLU boards, 8 SPU/SLU, 34 LTU, 10 DTU-E1 , 34 DLU and 13 DTU-T1.

Cabling

When the cable length is only data limited, Base Stations may be connected up to a distance of 2.2 miles away from the REs when using a CLU board, or 1.3 miles when using a SLU/CLU-S board. In case the cable length is power limited, the distance depends on the powering method that is used (see Chapter 4).

For the DTU E1 card, in case a cable other than the Ericsson supplied cable is used between the RE and the PBX to cover a longer distance, this cable should not attenuate more than 6dB at 1.024 MHz (e.g. a cable with an attenuation of 2 dB/100 m at 1.024 MHz gives a maximum distance of 328 yards). The maximum length of 100 ohm cable used to connect the DTU-T1 to a PBX/Centrex is 666 ft.

All twisted pair cables are shielded signal cables and the shield must be tied to ground by using the ground strip at the bottom of the cabinet. This ground strip provides cable connections for any combination of up to 8 twisted pair shielded cable sets.

Synchronization Distribution (DCT1900 Mobility Configuration Only)
A DCT1900 system can provide synchronization to three other DCT1900 systems if it is the
synchronization master or is connected to a synchronization master (only two levels are allowed,
see also Figure 2–1). If PWT air interface (frame) synchronization is required between DCT1900
systems, then the DCT1900 systems have to be connected to each other by means of an external
sync cable. The maximum external sync cable length is .8 mile (this value depends on the core
diameter of the cable, refer to Chapter 18, Paragraph 18.2 of the Installation Instructions for more
details).

Fig. 2–1 Synchronization Topology

Technical Product Manual - DCT1900
Configuration Directions, Limitations of the System
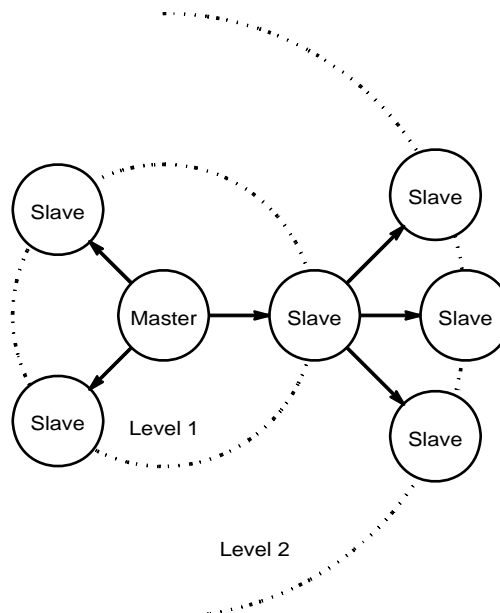
2.2   Modular Cabinet Powering Restrictions

Although the Modular Cabinet has space for 9 boards, not all board combinations are allowed due to power limitations of the DC/DC converter on the backplane. This converter is specified as follows:

+5 V	can supply 40 W at maximum
+12 V	can supply 12 W at maximum
-12 V	can supply 12 W at maximum
total	must be <40 W

Table 2–1 shows the power consumption per board type. From this table, it can be calculated if a configuration matches the power requirements. The values given to the ±12V of the LTU indicates the power consumption in the case where all LTU circuits are off hooks.

Note:
Due to a minimum required power consumption from the DC/DC converter, at least two boards must be present in each cabinet.

Board Type	5 V	+12 V	-12 V
CPU-2 REX-BRD9033 REX-BRD9034	6 W		
CPU REX-BRD0004	9.6 W	1 W	1 W
SPU-S REX-BRD0017	3.55 W		
SLU REX-BRD0015	6.9 W		
CLU-S REX-BRD0016	3.45 W		
CLU REX-BRD0014	3.6 W		
DTU-E1,CCS/CAS REX-BRD0002	4.5 W		
DTU-T1,CAS REX-BRD0021	6 W		
DTU-T1 CCS REX-BRD0021	6 W		
LTU REX-BRD0007	1.5 W	.75 W	.75 W
LTU-2 REX-BRD0019	2.5 W		

DLU   REX-BRD0023
          AWS1024
          AWS1025
          AWS1026
	6.5 W		1.2 W

Table 2–1 Power Consumption per Board

Config-DCT1900/R8/mw
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2-3

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CHAPTER 3
Base Station Planning

The major task in configuring a DCT1900 system is defining the number of Base Stations required to cover an area to a satisfactory level. This Chapter describes how a Base Station plan can be made in order to gain full area coverage. Chapter 5, Paragraph 5.2 explains how traffic requirements additionally influence the number of Base Stations.

Another aspect of Base Station configuration is powering of Base Stations. The various ways of distributing power to the Base Stations and the requirements on the power supply are described in Chapter 4.

3.1 Introduction

The radio environment or the cell that is covered by a Base Station is not a spherical shape as often suggested in drawings. If a snapshot could be taken of the cell, it would become clear that its shape is more of a cloud form. The momentary size and shape vary depending on the material of which walls and floors are made of, the position and material of furniture, machines, air–conditioning and the position of the Base Station in such an environment. Because of these unpredictable conditions it is not possible to give any hard rules for calculating the number of Base Stations in a given situation.

Base Station planning is not very difficult. However, size, architecture and the structure of buildings and their influence on the RF field pattern cannot be foreseen. The quickest and simplest way to do the Base Station Plan is by measuring. During a site survey, an average cell size can be determined, with the help of a Site Survey Tool. This forms the basis of Base Station planning. Experience is the best guide in making a Base Station plan.

The guide–lines listed below will help give a better view on the local situation when the placement of Base Stations is being planned. Paragraph 3.6 explains how a site survey can be done.

3.2 Total Area Coverage

- The in–house cell size in offices may be in a range of 30-200 ft. radius; see Figure 3–1.
- The cell size in exhibition halls or production halls may go up to a 660 ft. radius when there is enough free space for radio signals to travel.
- The cell size outdoors in free space may be up to 1000+ ft. radius.
- Base Stations should not be placed near the outer walls of the building as this reduces the effective coverage area, except of course when a parking area, for example, has to be covered.
- Base Stations may partially cover the floors immediately above and below as well. The useful range through floors and ceiling varies between a 0 and 26 ft. (2 floors) radius; see Figure 3–1.

3.3 Absorption and Reflection

- The cell size depends on the materials used in walls, ceilings and floors.
- Plain, light or reinforced concrete, wood and plaster all absorb and pass radio waves in different ways.
- Metal walls and large metal cabinet rows reflect all signals, resulting in greatly reduced coverage behind these areas.

- X–ray rooms in hospitals protected by lead walls, computer rooms in banking buildings protected against unwanted interference, etc. do not allow radio signals to enter.
- Exhibition halls or production halls may give reflections due to huge metal structures. This causes interference which reduces the capacity and coverage area per Base Station.

3.4   Departmental Differences

- More traffic is generated in sales, purchasing, technical support departments, cafeterias, etc. than finance & administration or research & development. Consequently, a higher traffic capacity is needed in these areas requiring additional Base Stations to be installed. More details follow in Chapter 5.

3.5   Architecture

- Central areas giving access to stairs and elevators may require extra Base Stations due to heavier constructions.
- Coverage in elevators may require Base Stations closer to or in the elevator shaft.
- Corners and irregularities in the construction (partial renovation, extensions of older buildings etc.) have an influence.
- Concentration of air–conditioning ducts, etc. may influence the coverage.

132 ft.

Base Station 1

Base Station 2

Base Station 3

11.4 ft.

Front view of a building

office					conference room
corridor					
pantry	office				Base Station 1

54 ft.

Top view of top floor
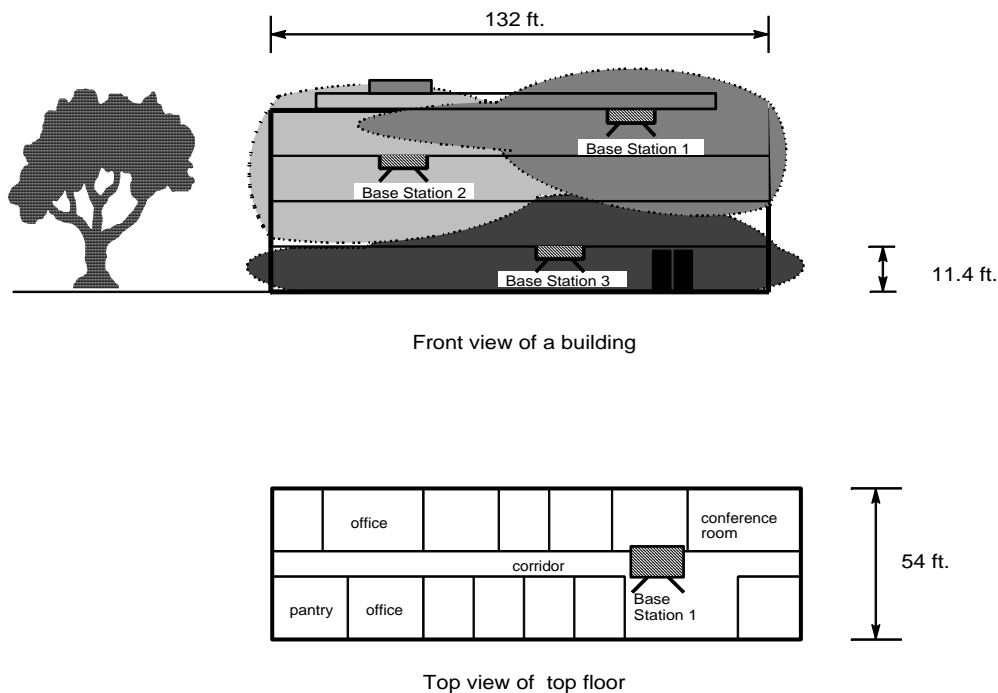
Fig. 3–1 Example of the locations of Base Stations in a building

3.6 Site Survey

To satisfy area coverage and traffic demands, the site must be surveyed in order to determine the number and position of Base Stations. To do a site survey, a site survey tool and floor plans of the building are required. With the help of these tools proper Base Station planning can be done. Samples must be taken to determine an average cell size. With the average cell size, Base Station positions can be indicated on the map together with the area covered by each Base Station. Difficult spots can be mapped as well. After this, the planned positions can be verified with the site survey tool and with the help of the traffic requirements, a final plan can be made.

When doing the survey with the Site Survey Tool, read the instructions below:

1. Observe the building to find a "typical area"

   Modern buildings usually have standard constructions. In older buildings, due to renovations or expansions, areas with different structures may exist. However, inside these areas a uniformity in structure can be found again.

   Find an area with a typical structure for the building and of about the expected cell size. This area will be used to determine the typical cell size. With a building with different structures, find the cell size of each of those areas, so that differences in "typical cell size" can be detected.

2. Measure the horizontal cell size on the middle floor, see Figure 3–2, (1)

   The cell size is measured by setting up a call with a portable and listening to the speech quality. This test is more accurate, faster and easier to use than the RQI indicator of the Portable Telephone's DCS.   See Section 6, "Commissioning" in this manual.

   The cell size can be determined as follows:
   - Install a Base Station in the middle of the "typical area" and power the Site Survey Tool.
   - Switch a Portable Telephone to DCA mode and set up a call.
   - Walk away from the Base Station in one direction. Also enter rooms with the Portable Telephone switching to your left and right hand.
   - The edge of the cell is found as soon as crackling sounds and/or mutes appear. Step back to where no mutes or sounds were heard. Verify whether the RQI remains stable on 20 and measure the distance to the Base Station. Within a cell, no mutes or clicks should be heard and the RQI should be stable on value 20.
   - Do the same in the opposite direction.
   - The two distances should be about the same. This is the horizontal coverage on the floor of the Base Station.

3. Measure horizontal range on floor above, see Figure 3–2, (2)

   Go to the floor above, leaving the Base Station on its current location and measure the horizontal coverage here.

4. Measure horizontal range on floor below, see Figure 3–2, (3).

   Go to the floor below, leaving the Base Station on its current location and measure the horizontal coverage again.

Note:
If the building is quite transparent to radio signals, the vertical coverage can reach to another floor above and below.

In this way the horizontal and vertical coverage of a single Base Station in a typical area is found. The cell size found can be taken as an average and used to calculate the total number of Base Stations. From Figure 3–2 it is clear that three Base Stations can cover a building as seen in Figure 3–1.

Depending on the size of the building and the type of construction, one or two more "random checks" in typical areas can be done to verify the first measurement. The typical cell size is then found by averaging the values.
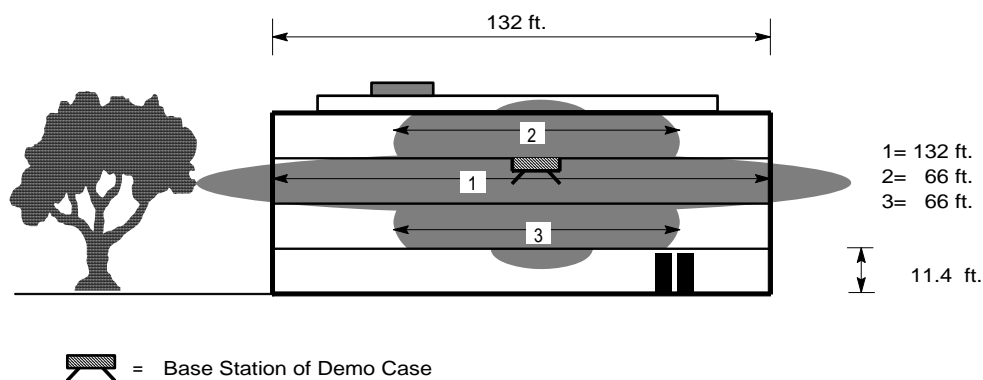
Fig. 3–2 Measurement of Typical Cell Size

5. Making a plan
   - With the "typical cell size" found, make a sketch of all Base Station positions on the floor plan. Indicate the expected coverage for each Base Station on the map.
   - Verify with the Site Survey Tool if the real coverage is as expected from the map.
   - Especially verify coverage in difficult areas such as elevators, stairways and discontinuities in construction.
   - If weak areas are found, see if re–positioning of Base Stations solves it; otherwise, plan an extra base station.
   - Take into consideration that in free space, with antennas in upright position, the coverage is horizontal more than vertical. Although in normal office environments this effect is negligible due to the amount of reflections, it still may be worth trying to place Base Stations horizontally in order to get more vertical coverage such as in stairways.
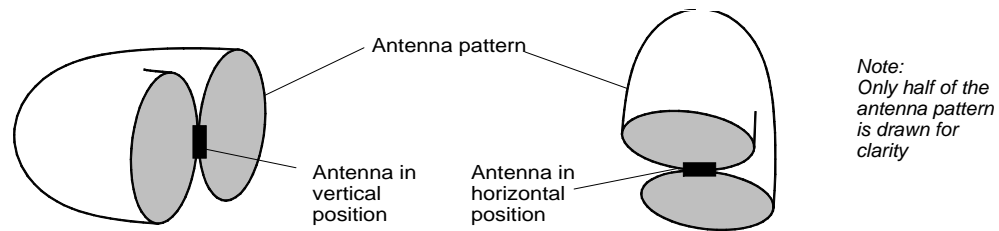
Fig. 3–3 Antenna Pattern

6. Finalizing the plan
    -   When all Base Station positions on the map are verified and the plan is in place, discuss with the parties concerned whether, due to local traffic requirements, (see Chapter 5, Section 5.2), extra Base Stations are needed in particular areas. Integrate these Base Stations with the plan.

Thus a final Base Station plan is made and tested simultaneously.

3.7   Base Station Count Estimating

Base station counts may be estimated by using the approximation formula seen below. Enter the total coverage area of interest as well as the anticipated radius of coverage.

$$N = \frac{(Atotal)}{(2 \times (R^2))}$$

N = number of base stations
Atotal = total coverage area
R = anticipated coverage radius

CHAPTER 4
Base Station Powering

4.1   General

After a Base Station plan has been made (see Chapter 3), it must be established which powering method is more suitable to power the Base Stations. The methods for powering a Base Station are:
- Via the RE
- By a remote power supply

The choice of the method depends upon:
- The distance between the RE and the Base Stations
- The total number of Base Stations
- Whether power back–up is needed or not
- Installation costs

Paragraph 4.2 describes the powering of Base Stations by means of a remote power supply. Paragraph 4.3 describes the powering options for the Modular Cabinet. The tables used in this chapter are given in Paragraph 4.4.

The length limits for the Base Station cable are described below.

Data Limited Length of the Base Station Cable
Data transmission via twisted pairs is limited to a certain range. The "data limited" length of the cables between the RE and the Base Stations depends on the system board used (CLU or SLU), the characteristics of the cable, and the noise on the cable. Table 4–1 shows the data limited length for some cables.

Note:
Since it is not possible to predict the noise level in an environment and its influence on a cable, the values from the table should be taken as a guide-line more than a rule. Practically, the maximum length may exceed these values, in case there is less noise and vice versa if there is more noise.

Power Limited Length of Base Station Cable
When a Base Station is powered via the cabinet, the maximum length between the Base Station and the RE depends on the supply voltage, the number of twisted pairs used and the wire size. The length of the cable should never exceed the "data–limited" length of the cable.

4.2   Powering Base Stations by a Remote Power Supply

When Base Stations are powered by a remote power supply, only a cable with two twisted pairs is required between a Base Station and the RE for data transfer (see Figure 4–1).

Powering Base Stations with a remote power supply can be done by using the EPP pins on the Base Station connector. Base Stations can be powered individually or in clusters from a central power source. A cluster can be e.g. Base Stations on the same floor or in the same building, assuming that Base Stations within the cluster are close enough to the remote power supply. The length of the cable between the Base Station and the RE is "data limited". See Table 4-1 for the maximum cable length.
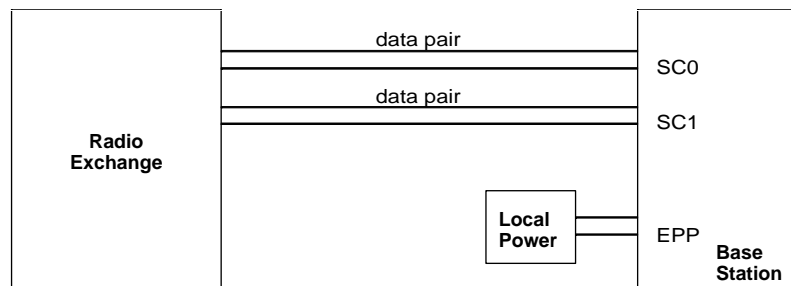
Fig. 4–1 Powering Base Stations by a remote Supply

4.3   Powering Base Stations via the Modular Cabinet

Base Stations are powered via the following path:
- External source-MCCB-CLU/SLU-Base Station

Base Stations are connected to the CLU or SLU via an MDF by 2, 3 or 4 twisted pair cables. The maximum permissible length depends on the wire size and the number of pairs used between the MDF and Base Station. The CLU/MDF cable contains only one Express Powering Pair (EPP), but this may be doubled up on the MDF. Table 4–2 shows the maximum cable lengths.

4.3.1 –48V External Source Powering

Via an external -48V source, any configuration of cabinets and Base Stations can be powered as long as the power specifications of the external source are met. This method is suitable for any situation where PBX power is available (see Figure 4–2) or any other -48V supply with sufficient current capacity. The maximum cable lengths are given in Table 4–2 (42V and 48V column).
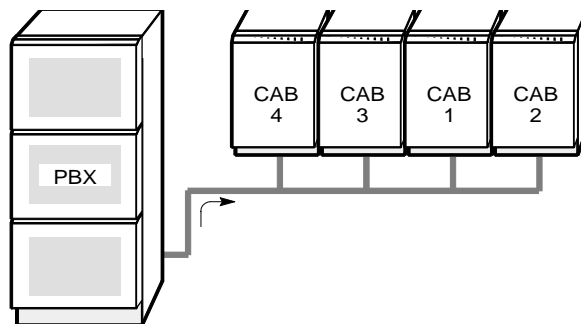
Fig. 4-2 Modular Cabinets powered by PBX

Note:

When using the PBX option refer to the PBX supplier and/or PBX documentation to assure that the PBX power supply matches the worst case power requirements of the DCT1900 system.

The external source must supply –48Vdc, which may be connected to the backplane for powering the system boards and directly to the MCCB for powering the Base Stations. Each cabinet uses 50 Watts maximum to power the Boards.

Tables 4-3 and 4-4 can be used to calculate the power requirements for the Base Stations. Table 4-3 has to be used when a battery back–up is used. Table 4-4 has to be used when no battery back–up is used. The alternative method described in Paragraph 4.5 can be used as well.

The number of Base Stations powered per Modular Cabinet is limited by the MCCB which can connect up to a total of 7 CLUs and SLUs to distribute Base Station power.
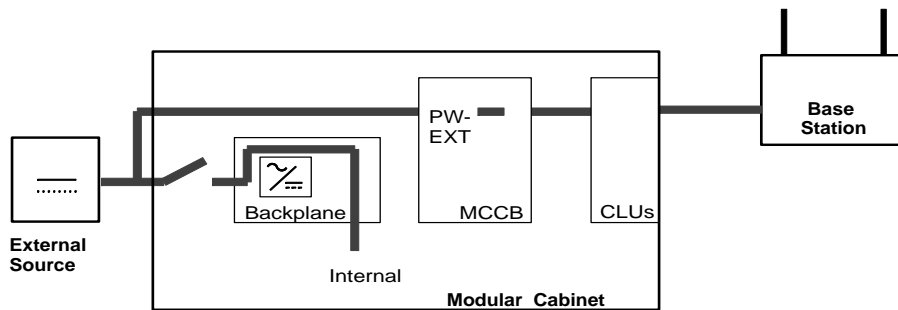
Fig. 4-3 Powering Base Stations via Modular Cabinet with External Source

4.4   Tables

In this Paragraph the Tables for the maximum cable length between the Base Stations and the RE and tables for the power consumption of the Base Stations and their cables are given.

Table 4–1 gives the "data limited" length of the cable and Table 4–2 gives the "power limited" length of the cable. See Paragraph 4.1 for the description of these terms.

How the Values in the Tables are Calculated

The power limited lengths have been calculated using the following formula. This formula can be used for supply voltages of 42V and higher.

$$l_{\max} = \frac{n}{4} \times \left(\frac{U^2}{P_{Base} \times R_{tp}} - \frac{4 \times R}{R_{tp}} \right)$$

where:
n = number of twisted pairs (when using data pairs only: n=2)
U = power supply voltage
P_{Base} = worst case power consumption of Base Station = 7.5W
R_{tp} = resistance of twisted pair per meter (double value of single wire)
R = dc losses in filters, transformers and connectors = 1Ω

If the supply voltage is 42 Volts or lower, the following formula must be used to calculate to the power limited lengths:

$$l_{\max} = n \times \left(\frac{U_{\min} \times (U - U_{\min})}{P_{Base} \times R_{tp}} - \frac{R}{R_{tp}} \right)$$

where:
n = number of twisted pairs (when using data pairs only: n=2)
U = power supply voltage
$U_{\min}$ = minimum input voltage of Base Station = 21V
P_{Base} = worst case power consumption of Base Station = 7.5W
R_{tp} = resistance of twisted pair per meter (double value of single wire)
R = dc losses in filters, transformers and connectors = 1Ω

Tables 4-3 and 4-4 give the power consumed by the Base Stations and their cables for different supply voltages. The consumed power ranges from about 7.5W for zero length cables to 15W maximum cable lengths (given in Table 4–2). The consumed power has been calculated using the following formula:

$$P = U \times \frac{U - \sqrt{U^2 - 4 \times \left(\frac{l' R_{tp}}{n} + R \right) \times P_{Base}}}{2 \times \left(\frac{l \times R_{tp}}{n} + R \right)}$$

where:
n = number of twisted pairs (when using data pairs only: n=2)
U = power supply voltage
P_{Base} = worst case power consumption of Base Station = 7.5W
R_{tp} = resistance of twisted pair per meter (double value of single wire)
R = dc losses in filters, transformers and connectors = 1Ω
l = length of the cable

The following resistance values for the twisted pairs are used:

- 26 AWG wire cable   : .082 Ω/ft.
- 24 AWG wire cable   : .055 Ω/ft.
- 22 AWG wire cable   : .034 Ω/ft.

Tables

Cable			Maximum cable length			
Type	**Wire size ($\varnothing$) AWG**	**Capacitance**	**Superimposed noise 8 mV/pHz**		**Superimposed noise 10 mV/pHz**	
			CLU 11/2	**SLU CLU-s**	**CLU 11/2**	**SLU CLU-s**
Twisted pair	26ga	15 pF/ft.	7540 ft.	4920 ft.	6560 ft.	4260 ft.
Twisted pair	24ga	15 pF/ft.	11480 ft.	6880 ft.	9840 ft.	6230 ft.
Twisted pair	22ga	40 pF/ft.	6880 ft.	4260 ft.	5900 ft.	3930 ft.
Double twisted pair (J–Y (St)Y 2 2 0.6)	22ga	40 pF/ft.	6160 ft.	3930 ft.	4920 ft.	3280 ft.

Table 4–1 "Data Limited" Cable Length

Worst Case Power Consumption of Base Station =				**7.5**	**W**
Based pm Class 3 =				**23**	**dbm**
Minimum Input Voltage of Base Station =				**21**	**V**
	Maximum Cable Length (feet)				
Wire size ($\varnothing$)	**Power Supply Voltage 27.5 V**		**Power Supply Voltage 42 V**		**Power Supply Voltage 48 V**
	0 EPP	**1 EPP**	**0 EPP**	**1 EPP**	**0 EPP**	**1 EPP**
26 awg	418	627	1405	2107	1842	2763
24 awg	627	941	2107	3161	2763	4145*
22 awg	1026	1539	3448*	5172*	4522*	6782*

** Cable lengths should **never exceed** the values given in Table 4–1, because of data limitations*

Table 4–2 Maximum Cable Length when Powering via Data Pairs and Express Powering Pairs

Cable length (Feet)	26 AWG (0.4 mm) wire size ($\varnothing$)			24 AWG (0.5 mm) wire size ($\varnothing$)			22 AWG (0.64 mm) wire size ($\varnothing$)		
	1 pair	2 pairs	3 pairs	1 pair	2 pairs	3 pairs	1 pair	2 pairs	3 pairs
0	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
82	8.8	8.6	8.6	8.7	8.6	8.6	8.6	8.6	8.5
164	9.1	8.8	8.7	8.9	8.7	8.6	8.7	8.6	8.6
246	9.5	9.0	8.8	9.1	8.8	8.7	8.9	8.7	8.6
328	10.0	9.1	8.9	9.4	8.9	8.8	9.0	8.7	8.7
410	10.7	9.3	9.0	9.7	9.0	8.8	9.2	8.8	8.7
492	11.6	9.5	9.1	10.0	9.1	8.9	9.3	8.9	8.7
574	13.1	9.8	9.3	10.5	9.3	9.0	9.5	8.9	8.8
656	-	10.0	9.4	10.9	9.4	9.1	9.7	9.0	8.8
738	-	10.3	9.5	11.6	9.5	9.1	9.9	9.1	8.9
820	-	10.7	9.7	12.5	9.7	9.2	10.1	9.2	8.9
902	-	11.1	9.9	14.0	9.9	9.3	10.3	9.2	9.0
984	-	11.6	10.0	-	10.0	9.4	10.6	9.3	9.0
1066	-	12.2	10.2	-	10.2	9.5	10.9	9.4	9.1
1148	-	13.1	10.5	-	10.5	9.6	11.3	9.5	9.1
1230	-	14.7	10.7	-	10.7	9.7	11.7	9.6	9.2
1312	-	-	10.9	-	10.9	9.8	12.2	9.7	9.2
1476	-	-	11.6	-	11.6	10.0	14.0	9.9	9.3
1640	-	-	12.5	-	12.5	10.3	-	10.1	9.4
1804	-	-	14.0	-	14.0	10.6	-	10.3	9.5
1968	-	-	-	-	-	10.9	-	10.6	9.7
2132	-	-	-	-	-	11.3	-	10.9	9.8
2296	-	-	-	-	-	11.8	-	11.3	9.9
2460	-	-	-	-	-	12.5	-	11.7	10.1
2624	-	-	-	-	-	13.3	-	12.2	10.2
2788	-	-	-	-	-	15.0	-	12.9	10.4
2952	-	-	-	-	-	-	-	14.0	10.6
3116	-	-	-	-	-	-	-	-	10.8
3280	-	-	-	-	-	-	-	-	11.0
3444	-	-	-	-	-	-	-	-	11.3
3608	-	-	-	-	-	-	-	-	11.6
3772	-	-	-	-	-	-	-	-	11.9
3936	-	-	-	-	-	-	-	-	12.2
4100	-	-	-	-	-	-	-	-	12.7
4264	-	-	-	-	-	-	-	-	13.2
4428	-	-	-	-	-	-	-	-	14.0
4592	-	-	-	-	-	-	-	-	15.4

Table 4–3 Power Consumption (Watts) of Base Stations and Cabling when Powered with 42V

Cable length (Feet)	26 AWG (0.4 mm) wire size (∅)			24 AWG (0.5 mm) wire size (∅)			22 AWG (0.64 mm) wire size (∅)		
	1 pair	2 pairs	3 pairs	1 pair	2 pairs	3 pairs	1 pair	2 pairs	3 pairs
0	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
82	8.7	8.6	8.6	8.6	8.6	8.5	8.6	8.5	8.5
164	9.0	8.7	8.6	8.8	8.6	8.6	8.7	8.6	8.6
246	9.3	8.8	8.7	9.0	8.7	8.6	8.8	8.6	8.6
328	9.6	9.0	8.8	9.2	8.8	8.7	8.9	8.7	8.6
410	10.0	9.1	8.9	9.4	8.9	8.7	9.0	8.7	8.6
492	10.4	9.3	9.0	9.6	9.0	8.8	9.1	8.8	8.7
574	11.0	9.4	9.1	9.8	9.1	8.9	9.2	8.8	8.7
656	11.7	9.6	9.2	10.1	9.2	8.9	9.3	8.9	8.7
738	12.9	9.8	9.3	10.4	9.3	9.0	9.5	8.9	8.8
820	16.0	10.0	9.4	10.8	9.4	9.0	9.6	9.0	8.8
902	-	10.2	9.5	11.2	9.5	9.1	9.7	9.0	8.8
984	-	10.4	9.6	11.7	9.6	9.2	9.9	9.1	8.9
1066	-	10.7	9.7	12.4	9.7	9.2	10.1	9.1	8.9
1148	-	11.0	9.8	13.4	9.8	9.3	10.3	9.2	8.9
1230	-	11.3	10.0	16.0	10.0	9.4	10.5	9.3	9.0
1312	-	11.7	10.1	-	10.1	9.4	10.7	9.3	9.0
1476	-	12.9	10.4	-	10.4	9.6	11.2	9.5	9.1
1640	-	16.0	10.8	-	10.8	9.7	11.9	9.6	9.2
1804	-	-	11.2	-	11.2	9.9	12.8	9.7	9.2
1968	-	-	11.7	-	11.7	10.1	14.6	9.9	9.3
2132	-	-	12.4	-	12.4	10.3	-	10.1	9.4
2296	-	-	13.4	-	13.4	10.5	-	10.3	9.5
2460	-	-	16.0	-	16.0	10.8	-	10.5	9.6
2624	-	-	-	-	-	11.0	-	10.7	9.7
2788	-	-	-	-	-	11.4	-	10.9	9.8
2952	-	-	-	-	-	11.7	-	11.2	9.9
3116	-	-	-	-	-	12.2	-	11.5	10.0
3280	-	-	-	-	-	12.7	-	11.9	10.1
3608	-	-	-	-	-	14.6	-	12.8	10.4
3936	-	-	-	-	-	-	-	14.6	10.7
4264	-	-	-	-	-	-	-	-	11.0
4592	-	-	-	-	-	-	-	-	11.4
4920	-	-	-	-	-	-	-	-	11.9
5248	-	-	-	-	-	-	-	-	12.4
5576	-	-	-	-	-	-	-	-	13.2
5904	-	-	-	-	-	-	-	-	14.6

Table 4–4 Power Consumption (Watts) of Base Stations and Cabling when Powered with 48V

4.5   Alternative for Calculating the Power Consumption per Base Station

In Figure 4–4 the power consumption of the Base Station and the cabling is given as a function of the cable length in terms of percentage. This relation is almost independent of the number of cable pairs, cable resistance and supply voltage. Table 4–5 also gives this relation in steps of 5 percent. The table can be used as follows.
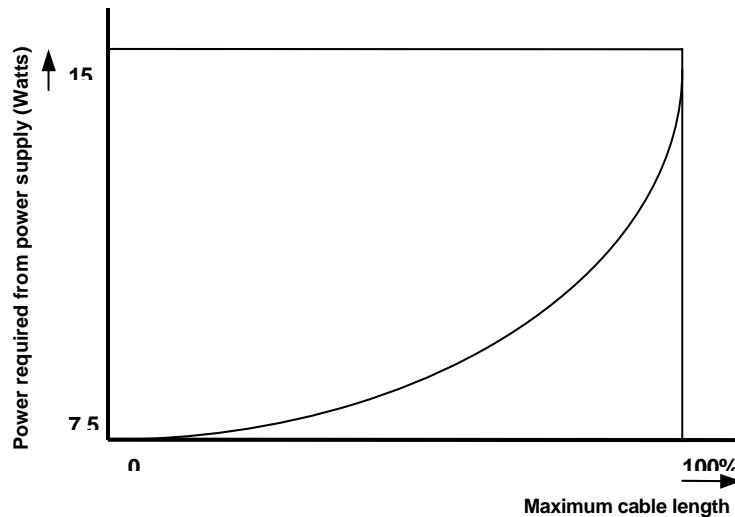
Fig. 4–4 Power Consumption from Power Supply Related to Cable Length

Example

- supply voltage   : 48V
- number of EPP (Express Powering Pairs)   : 0
- wire size   : 24 AWG (R_{tp} =0.055 Ω/m)
- length   : 820 ft.

With this information the maximum cable length can be read from Table 4–2. The maximum length can also be calculated using the formulas in Paragraph 4.4. When using these formulas, you must use n=2 for the number of pairs (2 data pairs, no express powering pairs). With both methods the result is 2763ft.

The length of the cable is (820/2763) 100%+29.7% of the maximum cable length. Round up this value (30%) and read the dissipated power from Table 4–5. The dissipated power is 8.3W.

Relative length x (in %)	Total power consumption (Watt)
0	7.5
5	7.7
10	7.8
15	7.9
20	8.0
25	8.1
30	8.3
35	8.4
40	8.6
45	8.7
50	8.9
55	9.1
60	9.3
65	9.5
70	9.8
75	10.1
80	10.4
85	10.9
90	11.5
95	12.3
100	15.0

Table 4–5 Power Consumption Related to Cable Length

CHAPTER 5
Traffic Capacity of the System

The traffic capacity of the DCT1900 system is mainly determined by the RE and in exceptional cases also by the Base Stations. The RE can handle a maximum of 60 simultaneous calls, and a single Base Station has a capacity of 8 simultaneous calls.

5.1   Traffic Capacity of the Radio Exchange

The traffic capacity of the RE is determined by:
● Total traffic (Erlang)
● The GOS accepted by the customer.
● The number of speech circuits available, with a limit of 60.

Erlang is a measurement of telephone traffic. One Erlang is equal to one full hour of use, or 60 x 60 = 3,600 seconds of phone conversation. You convert CCS (hundred call seconds) into Erlangs by dividing by 36.

The GOS is the probability that a call cannot be made because of congestion in the system. The customer has to indicate which GOS is acceptable. A GOS of 1%, or 0.01, means an average of 1 blocked call in every 100 calls.

SPU and SLU boards provide for 8 speech circuits. When a total of 8 SPU and SLU boards are installed, then 64 circuits are available, of which only 60 can be used simultaneously, as the DCT1900 system can handle only a maximum of 60 simultaneous calls.

The two parameters mentioned above (GOS and number of speech circuits) and the total amount of traffic (Erlang) that is required are related to each other. Table 5–1 below shows how these parameters are related for certain values. This table is used to calculate from a given GOS and Erlang value the number of SPUs/SLUs needed. The Erlang value is the total traffic generated by all Portable Telephone users (including visiting Portable Telephone users) in the coverage area of the system.

Number of SPUs/SLUs	Speech circuits	GOS (GOS)			
		2% (1/50)	1% (1/100)	0.5% (1/200)	0.1% (1/1000)
1	8	3.6	3.2	2.7	2.1
2	16	9.8	8.9	8.1	6.7
3	24	16.6	15.3	14.2	12.2
4	32	23.8	22.1	20.6	18.2
5	40	31.0	29.0	27.3	24.5
6	48	38.4	36.1	34.2	30.9
7	56	45.9	43.3	41.2	37.5
8	60	49.7	46.9	44.8	40.8

Table 5–1   Erlang Table–B values for given GOS and Number of Speech Circuits

As a RE can handle only as many simultaneous calls as the number of available speech circuits while the number of Portable Telephones in the respective coverage area can be as many as 600, a lack of speech circuits may occur in some occasions. To limit these occurrences, take into account the number of regular (home) Portable Telephone users plus the maximum number of visiting Portable Telephone users at a certain time while determining the required traffic capacity. Table 5–2 shows what Erlang values mean in call–minutes for a Portable Telephone.

mErlang	Minutes per hour	mErlang	Minutes per hour
50	3	250	15
100	6	300	18
150	9	500	30
200	12	750	45

Table 5–2 Erlang Values Expressed in Call–Minutes

Example: A customer ordering a system that can handle 55 Portable Telephones (local users and visiting users), generating 200 mE each in average, requires a system with a traffic capacity of 11 E. With an accepted GOS of 0.5% the number of SPUs/SLUs is found as follows:
The total traffic is 11 E. In the column of 0.5% GOS, the next higher value of 11 E is 14.2 E, resulting in 3 SPUs/SLUs.
So, the system should be equipped with 3 SPUs/SLUs, offering the client 14.2 E instead of 11. This means that the system has an over–capacity 3.2 E, which allows expansion of the system with 16 Portable Telephones without reducing the GOS or the need of more SPUs or SLUs.

According to Table 5–1 60 circuits with an accepted GOS of 0.5% result in a maximum traffic capacity of the system of 44.8 E. When each Portable Telephone generates 150 mE in average, the system has a capacity of serving approximately 300 Portable Telephones.

5.2   Traffic Capacity of the Base Stations

The total traffic that is being generated by all Portable Telephones (visiting Portable Telephones included) of the system should be in accordance with the capacity of the cordless network as well. A Base Station, having 8 channels available, has an Erlang value of 2.7 with a GOS of 0.5%. This value can be read from the Table 5-1. This means that each Base Station can serve 18 Portable Telephones, assuming that Portable Telephones generate 150 mE each during busy hours (13.5 Portable Telephones if 200 mE each).

Example: Suppose that in the building of the customer in the example in paragraph 5.1, full coverage can be achieved by 4 Base Stations. This means that all Portable Telephones generate together 55 x 0.200 = 11 E, while the Base Stations traffic capacity is only 4 x 2.7 = 10.8 Erlang. This is too little. This discrepancy can be solved by adding another Base Station near the busiest part of the building.

From an average point of view, the total capacity offered by the cordless network is generally more than sufficient. In certain places, traffic demands may vary such that locally the network is often blocking, or has a lower GOS than required. For instance, a purchasing department may easily generate 300 mE per Portable Telephone during a busy hour, with 6 persons giving a very high

load on the Base Station close by. It may be necessary to add a Base Station in this area to have enough capacity for others to call as well.

5.3   Traffic Capacity of the System

The traffic capacity limitations of both the RE and the cordless network are discussed on the previous page. A user making calls will first face a blocking chance by the cordless network and then face another blocking chance by the system. These two parameters are statistically independent and should therefore be summed to find the overall blocking probability of the system.

When an overall GOS of 0.5% is required, the system must be configured such that the GOS of the RE summed with the GOS of the network together result in a GOS of 0.5%.

CHAPTER 6
Relation between Parts

Radio Exchange

Item	Connects	Remarks
Modular Cabinet	9 System Boards 1 Connection Board 2 Power Supplies	Number of System Boards may be less due to power limitations. Up to 4 cabinets can be chained. An MCCB is factory mounted.
CPU	PC, Printer, General Alarm, SMS and PWT air interface synchronization signals	Only 1 per system (also with a multi–cabinet system). CPU/SDB synchronization cables. ***Note: Sync Kit required for each CPU. FPGA must be installed.***
SLU	8 calls 8 Base Stations	An SLU consists of an SPU part and a CLU part. The SLU can be combined with SPU and CLU boards. The SPU part provides for 8 speech paths. The CLU part can connect 8 Base Stations. CLU/MDF Cables and CLU/MCCB Power cables. Quantity depends on required traffic capacity and GOS.
DTU-E1, CCS	60 simultaneous calls	Two 2–Mbit links, each link having 30 channels to which Portable Telephones are assigned dynamically. The maximum number of Portable Telephones depends on the GOS and the traffic capacity of the RE configuration (1 per RE)
DTU-T1, CCS	46 simultaneous calls	Two 1.544-Mbits, each link having 23 channels to which Portable Telephones are assigned dynamically. The maximum number of Portable Telephones depends on the GOS and the traffic capacity of the RE configuration (1 or 2 per RE).
DTU-E1, CAS	60 individual extensions	Two 2–Mbit links, each link having 30 channels to which Portable Telephones are assigned on a dedicated basis. (Max. 10 per system)
DTU-T1, CAS	48 individual extensions	Two 1.544-Mbits, each link having 24 channels to which Portable Telephones are assigned on a dedicated basis. (Max. 13 per system)
LTU	8 PBX lines (analog, 2 wires)	LTU/MDF Cable Set- 1 cable supports 3 LTUs . A maximum of 272 Portable Telephones supported.
DLU	12 PBX lines (1:1 digital lines)	DLU/PBX Cable Set- 1 cable supports 2 DLUs. Each DLU supports 12 Portable Telephones.
CLU	8 Base Stations – 2.2 miles	CLU/MDF Cables and CLU/MCCB power cables.
CLU-S	8 Base Stations – 1.2 miles	
SPU	8 calls	The SPU provides 8 speech paths. Quantity depends on required traffice and GOS.
MCCB	3+7 CLU or 3+7 SLU power ports for Base Station power PC, Printer/SMS and General Alarm	Modular Cabinet Connection Board
SDB	1 input and 3 output PWT air interface synchronization connections	To be mounted on the bottom plate of the Modular Cabinet.

Power Supplies

Items Modular Cabinet	Connects	Remarks
Power Supply Unit	Mains to Modular Cabinet.	Powers system boards and a maximum of 24 Base Stations.

Cables

Items Modular Cabinet		
CLU/MDF Cable or CLU/MDF Cable, Long	1 set per CLU or SLU	A set consists of 2 cables with different cable clamp positions. Normal version is 16 ft. Long version is 82 ft. Connects 8 Base Stations to one 66 block.
CLU/MCCB Power Cable	1 per CLU or SLU	Only when Base Stations are powered via the cabinet.
DTU/PBX Cable set (E1-CCS or CAS)	1 per DTU	A set consists of 2 cables with different cable clamp positions.
DTU/PBX Cable Set (T1-CCS or CAS)	1 per DTU	One cable with two connectors for two circuits.
LTU Cable Set	1 per 3 LTUs	Connects 24 extensions to one 66 block.
DLU Cable Set	1 per 2 DLUs	Connects 48 extensions to one 66 block.
PC Cable	1 per system	
Printer Cable	1 per system	
CPU/SDB Cables	4 per CPU	Part of the sync port installation set
SMS Cable	1 per Unit	Comes with SMS system
Mains Power Cord	1 per Unit	Comes with power supply kit

Section 5

Installation Instructions

Table of Contents

CHAPTER 1
Introduction

This section describes how to install the DCT1900 system. It comprises information about required tools, firmware, recommended board positions, cabling of system and power supplies, system cabinets, Base Stations and field–replaceable units such as power supplies and System Boards.

This section is set–up in a modular format.   Each component of the system is described in separate chapters.

Chapter 1   : *Introduction*
Introduces you to this document.

Chapter 2   : *General*
Informs you about environmental conditions, ESD handling, tools and other items you need for installation.

Chapter 3   : *Installation steps for the Modular Cabinet*
Gives all installation steps for the Modular Cabinet in sequence. For more detailed information, references regarding certain aspects are given to other chapters or other sections of the manual.

Chapter 4   : *Modular Cabinet*
Describes the mounting of the Modular Cabinet.

Chapters 5-15   : *System Boards*
CPU, CLU, CLU-S, SLU, SPU-S, DTU-E1(CAS, CCS), DTU-T1(CAS,CCS), LTU, DLU.

Chapter 16   : *Base Station*

Chapters 17-18   : *Connection Boards*
MCCB and SDB

Chapters 19-24   : *Cabling for the Modular Cabinet*
Describes the installation of all cables for the Modular Cabinet.

Chapter 25   : *Use of TDR*

Chapter 26   : *Modular Cabinet Cables*
Describes all cables for the Modular Cabinet.

CHAPTER 2
General

2.1 Environmental Requirements

The building (rooms) in which the RE and Base Stations are to be installed must comply with the following:

- The air shall be free from dust and smoke. It shall not contain gases or acid fumes that can affect the condition of metal parts or insulation materials.
- Relative humidity may vary between 20 – 90% for the Modular Cabinet. The temperature may vary between 32°F and +104°F for the RE. The temperature may vary between -50°F and +131°F for the Base Stations.
- The equipment must not be exposed to direct sunlight due to the risk of overheating.
- When Base Stations are to be mounted outdoors they must be mounted in an outdoor environmentally sealed enclosure.
- Every effort should be made to place the Base Stations and especially the RE in a "quiet" EMI environment.

2.2 Safety and Regulatory Information

Before starting any installation, read Section 1, "Safety and Regulatory Information" in this manual. This section contains important safety instructions.

2.3 ESD Socket

The cabinets are equipped with a banana plug socket to connect an anti–static wrist strap. When the front cover has been removed, you can find this socket on the right upper edge of the power switch bracket.

ATTENTION
Boards containing Electrostatic Sensitive Devices (ESD) circuits are indicated by the sign. For handling these boards refer to the section, "Safety and Regulatory Information" in this Manual.

2.4 Installation Tools

The following installation tools are required:
- ESD wrist strap
- multimeter
- torx screwdrivers (T10, T20)
- small straight slot screwdriver
- wire stripper
- needle nose pliers
- cutting pliers
- electric drill

- equipment to measure the delay times of Base Station cables and external synchronization cables-TDR
- Siemens 66 block
- punch down tool

2.5   Equipment Verification

Obtain a copy of the order that was placed for the system and verify the order against the shipping forms found on the boxes containing all the DCT1900 equipment.

2.6   Miscellaneous Items

Check that the following additional items are available:
- Base Station cables (see Chapter 16, Paragraph 16.2)
- RJ45 plugs and crimper for Base Stations
- Material for external sync cables as specified in Chapter 18, Paragraph 18.2 if PWT air interface synchronization is required in a multi DCT1900 system environment.
- IBM compatible personal computer as specified in Installer's Quick Guide (CSMW)
- Epson compatible printer (optional)
- #10-12 gauge wire to connect the Modular Cabinet to protective ground.

2.7   Switch Room

Verify that there is an adequate wall space to mount the equipment. Verify the locations and availability of adequate power and earth ground.

CHAPTER 3
Modular Cabinet – Installation Steps

3.1 Introduction

Paragraph 3.2 describes the recommended board positions. This paragraph should be read before starting any installation.

Paragraph 3.3 describes the main steps of installation and the order in which they should be carried out. It can be used by inexperienced engineers, or experienced engineers as a reference or check–list. Each step refers to a chapter where more information can be found.

Paragraphs 3.4 through 3.9 contain installation procedures which are not related to specific units described in other chapters.

3.2 Recommended Board Positions

Recommendations are given for the system board positions below. These rules are given to facilitate proper framing synchronization, avoid crossing of cables and to ensure sufficient length of the dedicated cables.

front view

CPU	DLU DTU LTU	DLU DTU LTU		SPU	SPU			CLU *SLU	CLU *SLU
24	28	32	36	40	44	48	52		56

Indicates that the CPU is required to be in this position in cabinet 1

The board position numbers are not indicated on the rack unless the labels are installed.
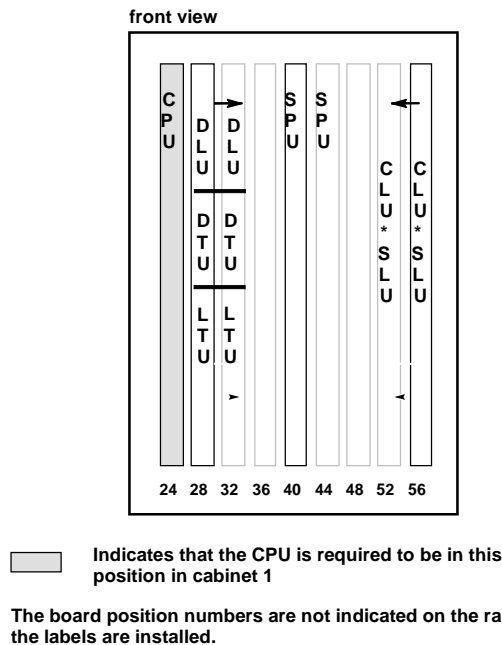
Fig. 3–1 Recommended Board Positions

CPU
The CPU is always placed at the farthest left position in the cabinet. In a multi cabinet configuration the CPU must be placed in cabinet 1 (refer to Figure 4-1 in Chapter 4).

CLUs/SLUs
CLUs and SLUs are placed on the right hand side of the cabinet. In this position CLU/MDF cables do not influence the accessibility of the MCCB.

SPUs
SPUs are placed in the middle of the cabinet.

DLUs/DTUs
DTUs/LTUs/DLUs are placed on the left hand side of the cabinet next to the CPU. If both DLUs and DTUs are used, it is recommended that the DLU be placed closest to the CPU.

LTUs
LTUs should be placed in the cabinet from left to right in groups of three. One LTU/MDF cable is designed to support three LTU boards installed side by side.

Note:
CLU/SLU, SPU, LTU, DTU and DLU boards will work in any position in the cabinet.

3.3   Main Steps of Installation

Installing Directly to the Wall

1. Unpack the system (except system boards). See Paragraph 3.4

2. Charge Portable Telephone batteries. See Paragraph 3.5

3. Pre–mount the Modular Cabinet(s). See Paragraph 4.5 or 4.6

4. Install SDB if required. See Paragraph 4.7

5. Place the board position label. See Paragraph 3.8

6. Mount the Modular Cabinet(s). See Paragraph 4.8

7. If applicable interconnect Modular Cabinets. See Paragraph 4.11

8. Connect protective earth ground to the cabinet. See Paragraph 4.9

9. Install the power cabling of the cabinet. See Chapter 19, Power Cabling

10. Connect the static strap. See Paragraph 4.10

11. Install the system boards. See Chapters 5 to 14

12. Install the cabling. See Chapters 6 to 18

13. Mount the Base Stations and test the Base
    Station cables. See Chapter 16

14. Switch on the DCT1900 system. See Paragraph 3.6

15. Initialize the DCT1900 system. See "CSM Installer's Quick Guide (Appendix I)

16. Place the securing bar. See Paragraph 4.12

17. Place the cabinet number labels, board name
    labels and cable position labels. See Paragraph 3.8 & 3.9.

18. Commissioning. See Section 6, "Commissioning"

3.4   Unpacking

The system is delivered in several cardboard boxes. To unpack, do the following:
1.   Read ESD instructions in Section 1 "Safety and Regulatory Information".
2.   Open the cardboard boxes and take out the shipping list.
3.   Check the contents of the boxes with the shipping list .
4.   Report any discrepancies or damages to cabinet(s) or board(s).

3.5   Charging Portable Telephone Batteries

After installation the system must be tested with the Portable Telephones. Charge the batteries
prior to installation to avoid flat batteries. Charging the batteries completely takes some time
depending on the type of the charger. Refer to the DT600 Portable User Guide - LZB 119 2665,
DT620 Portable User Guide - LZT 123 3105 or 9p23 User Guide - AWS1090 for battery charging
instructions.

3.6   Switching On/Off

Note:
Simultaneous switching on of cabinets will result in erroneous system start–up.

Multi Cabinet Configuration
● Power on: first switch on all cabinets except cabinet 1 and then switch on cabinet 1.
● Power off: first switch off cabinet 1 and then switch off the other cabinets.

Base Stations Powered via PW-EXT
Base Stations can be switched on prior to the cabinet or vice-versa.

Printer
When the RE is reset or switched on, always press the on–line button of the printer at least twice
so that the printer is on–line. The RE will only detect a printer if a change from on–line to off–line
state is received.

3.7   Labels

With each cabinet, a label sheet is delivered containing labels of all system board names, cabinet
numbers, board positions and cable positions.

3.8   Board Position Label

The board position label can be placed on the leading edge of the shelf below the system boards
as indicated in Figure 3–2. The label should be placed before installing the cabling.

Note:
The board position label should not be placed on the leading edge at the top of the cabinet for this will isolate the enclosure EMI shielding.

Board Position label
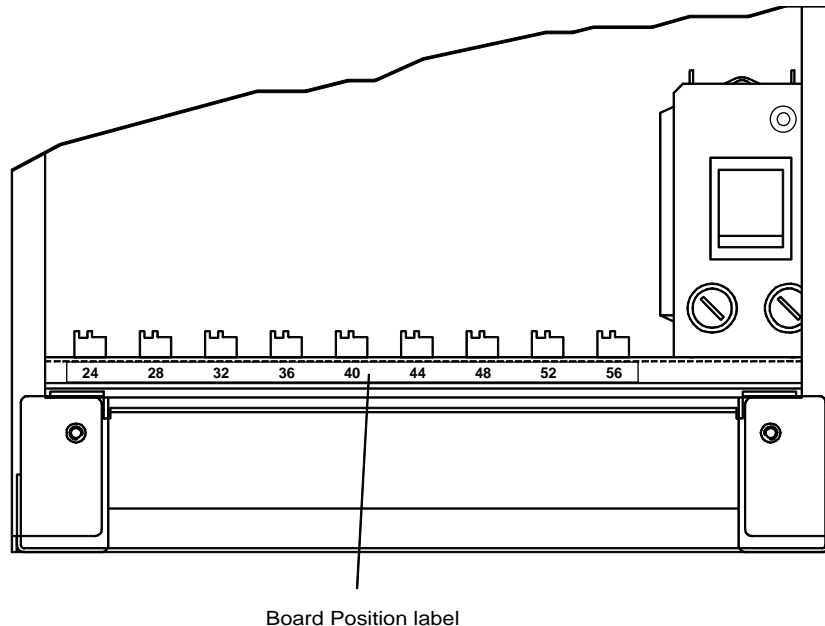
Fig. 3–2 Position of the Board Position Label

3.9   Cabinet Number Labels, Board Name Labels and Cable Position Labels

Label each item with the corresponding label after installation is completed. Labelling cables is important to avoid misconnection of cables after maintenance has been carried out.

The cable position labels indicate the board position and the position of the connector where the plug is connected. Figure 3–3 gives the standard connector positions on all boards (position 1–4) and two examples of the labeling. If more than one position is used by the plug, mark the plug with the lower position used.

No label

Position 4

Position 3

48/3

Position 2

24/3

Position 1

24/2

48/1

CLU at board position 48

CPU at board position 24
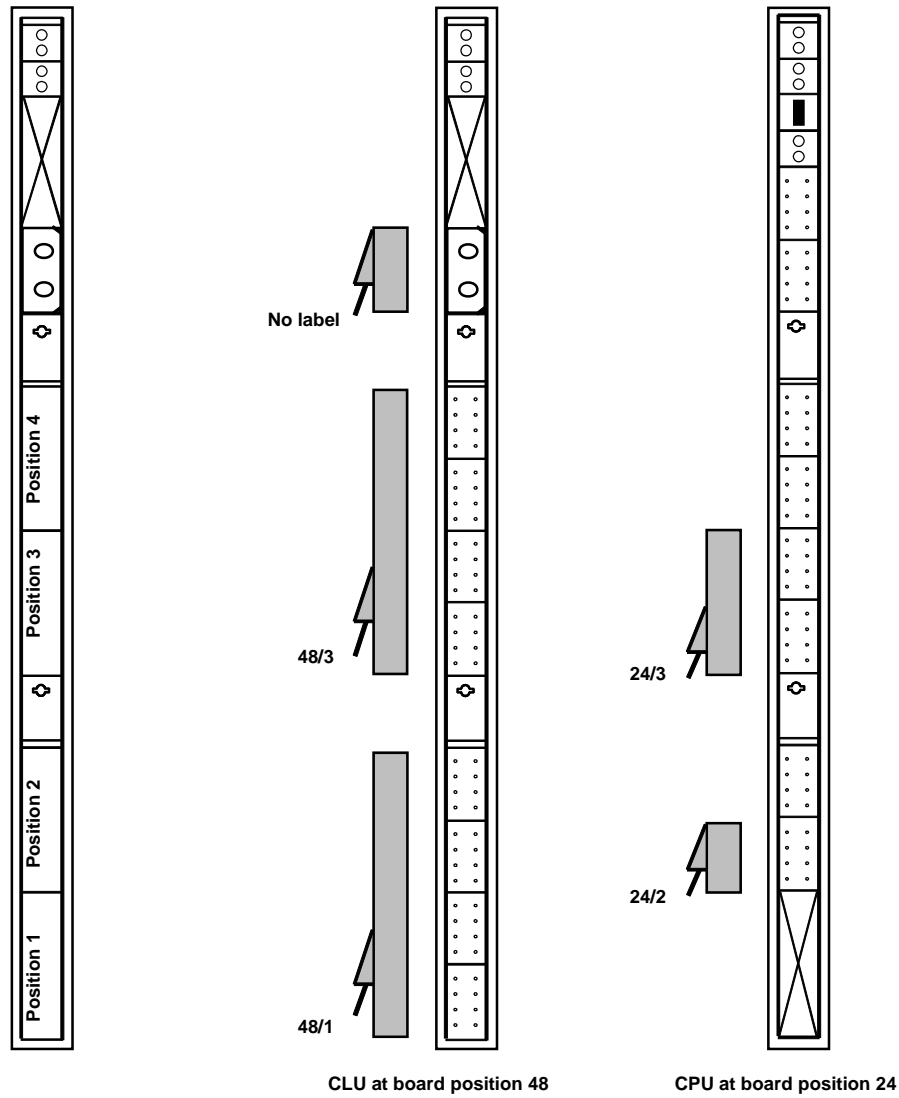
Fig. 3–3 Connector Positions and Examples of Cable Labelling

CHAPTER 4
Modular Cabinet – REX-BAS9021 or *BDVNB 101 01/2*
or BDVNB 101 01/3

4.1 Contents of the Box

The cardboard box in which the Modular Cabinet is shipped contains the cabinet itself and the following material:

- 1 mounting bracket.
- a bag with modular cabinet mounting material:
    - cabinet mounting material:
        - screws ($\varnothing$5 30),
    - tie–wraps,
    - M3 x 6 screws with torx heads for cable clamps,
    - M4 x 6 screws with torx heads and washers for protective ground cable.
- labels

Note:
The bag may contain more material than actually needed.

4.2 Fuses

4.2.1 Modular Cabinet BDVNB 101 01/2 and BDVNB 101 01/03 (R2 & R3)

- Has 4 fuses
- 2 fuses located on the MCCB on the bottom of the cabinet (Figure 4-2)

Replace these (4) fuses only with UL listed 250V 15A fuse.
Ascom Part Number: 7006100123

4.2.2 Modular Cabinet REX-BAS9021, REX-BAS9021A, REX-BAS9021/1B, REX-BAS9021/4B, BDVNB 101 01/3 (R4)

- Has 6 fuses
- 2 Fuses located on the MCCB on the botom of the cabinet (Figure 4-2)
- 2 Fuses located on the bottom of the new power switch bracket (Figure 4-3)

Replace these (4) fuses only with UL listed 250V 15A fuses.

- 2 fuses located on the top of the new power switch bracket (Figure 4-3)

Replace these (2) fuses only with the UL listed 250V 3A fuses.

These fuses are common parts and maybe purchased from various vendors.

4.3   Installation Area for the Modular Cabinet(s)

- Do not mount the cabinet to drywall using plastic drywall plugs. Recommended mounting of the Modular Cabinet(s) is to a plywood back board which is securely mounted to the wall in the switch room. The plywood board should be a minimum of 1/2" thick and be secured to the wall by the appropriate hardware (i.e. toggle bolts, wood, or sheet metal screws, depending on the stud types) to ensure that the plywood will support the weight of the cabinets with all cards and cables installed.
- The RE may consist of up to 4 Modular Cabinets. The Modular Cabinets must be mounted next to each other (see Figure 4–1).
- The Modular Cabinet(s) must be mounted to the wall at a position where they are easily accessible for installation and maintenance of the system. Take into consideration that the number of cabinets may be expanded in the future.
- The Modular Cabinet(s) should be mounted at the normal working height. The lower edge of the Modular Cabinet(s) should be about 5.25 ft. above the floor.
- Above the Modular Cabinet(s) there should be at least 4" free space for air circulation.
- Modular Cabinets must be separated approximately 1/8" from each other.
- Do not mount anything within 1.5 ft. of the bottom of the cabinets to allow the bottom plate to swing down and to allow for cable entry from the bottom of the cabinet. See Fig. 4–1 Installation of the Modular Cabinet(s)
- Do not mount the cabinet(s) over flammable surfaces.
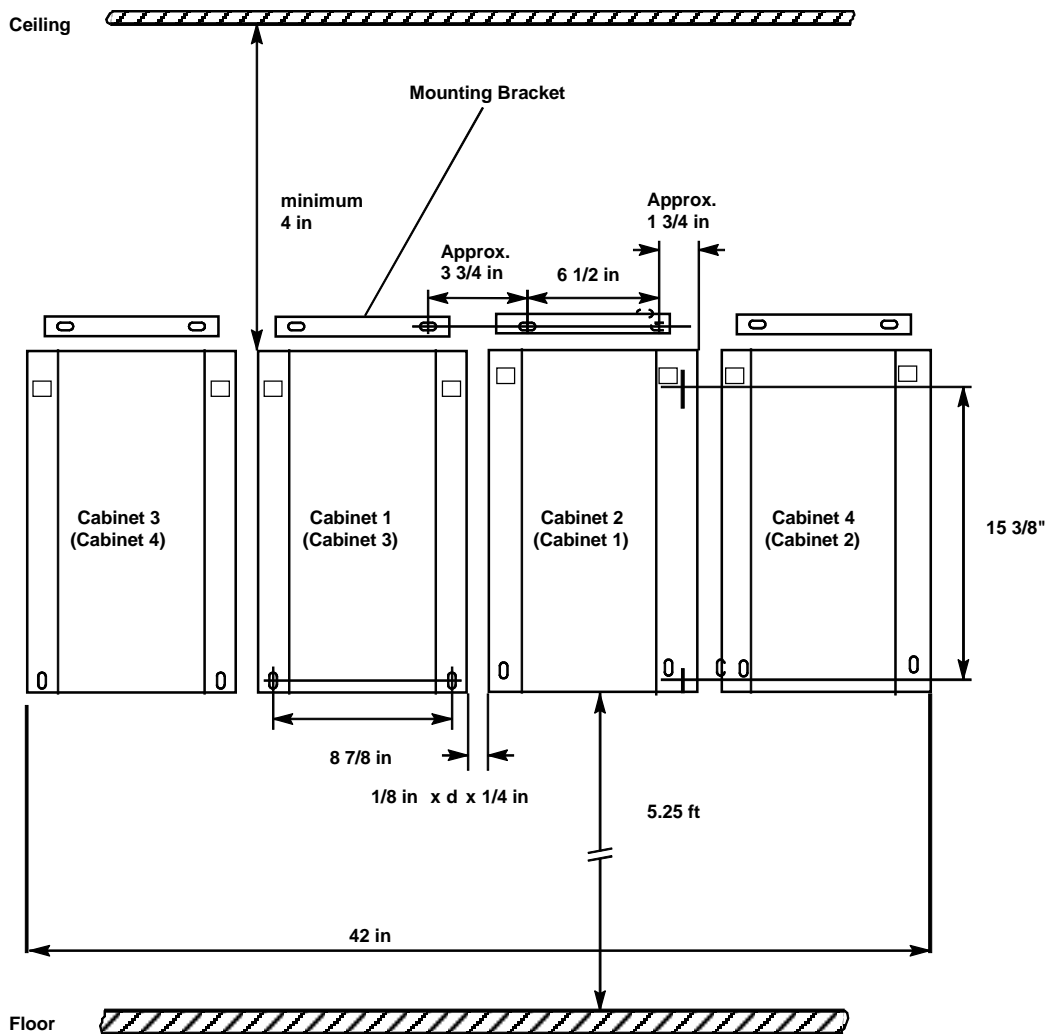
Notes:

- The mounting brackets are drawn above the cabinets. When the cabinets are mounted to the wall, the mounting brackets are not visible.
- An alternative cabinet numbering is given between parentheses.
- A typical sheet of plywood (48" wide) will hold all four cabinets.
- All cable entrances are from the bottom.
- The cabinet with the CPU board is always cabinet 1.

Fig. 4-1 Installation of the Modular Cabinet(s)

4.4   Parts of the Modular Cabinet

Figure 4–2 shows a drawing of the Modular Cabinet and its most important parts.

Bottom view

SDB that must be installed in the same cabinet as the CPU (Mobility Only)

MCCB

Terminal block for Power connection of the cabinet

Front view

Left side view

Backplane   Power on/off switch   Fuses   Wrist strap connector   Power filter   Drawer
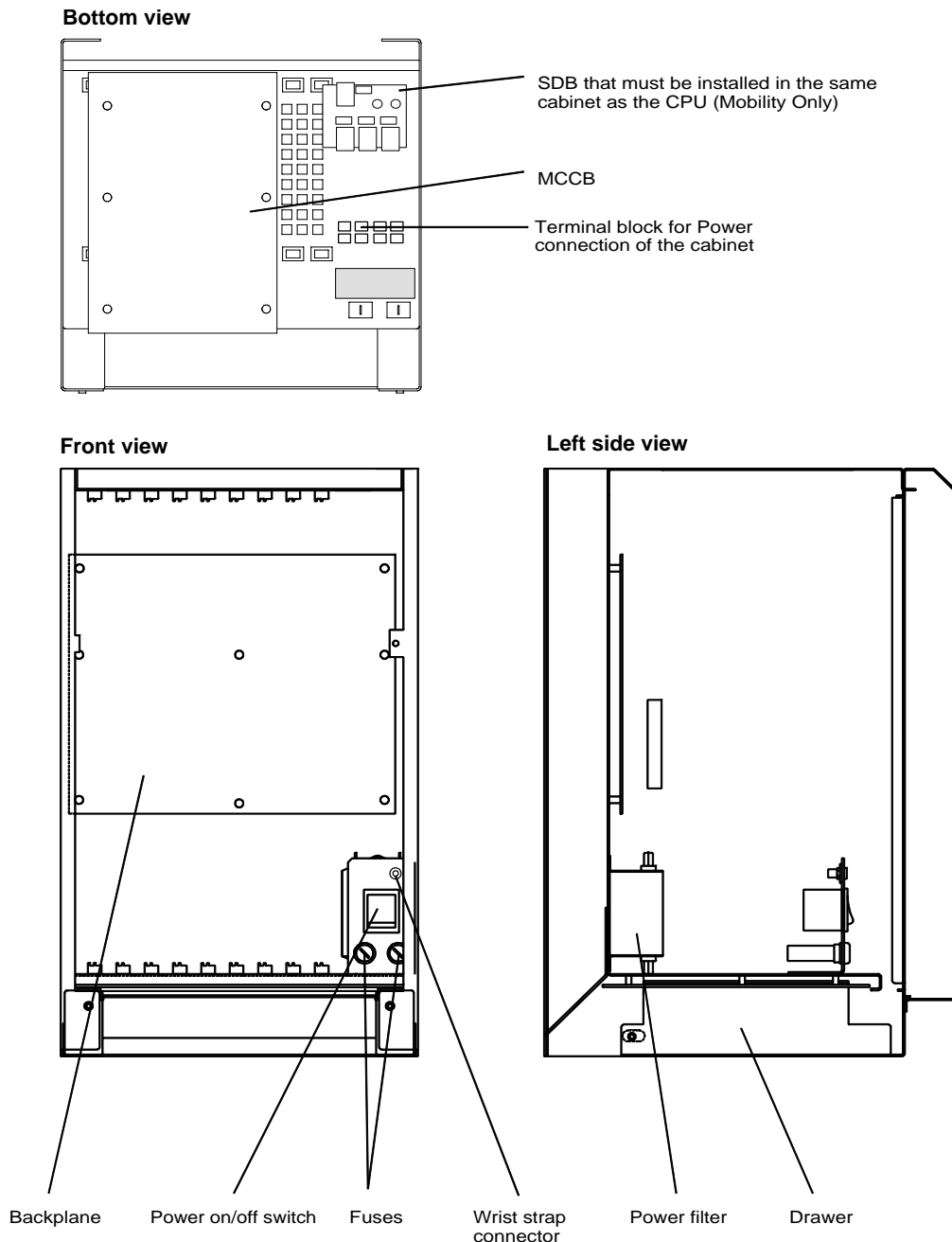
Fig. 4–2 Modular Cabinet (BDVNB 101 01/2 & BDVNB 101 01/03)

Left Side View   Front View

Fuse

wrist strap
connector

power on/off

switch

Fuse

Fig. 4-3 Modular Cabinet(REX-BAS9021) Power Switch Assembly
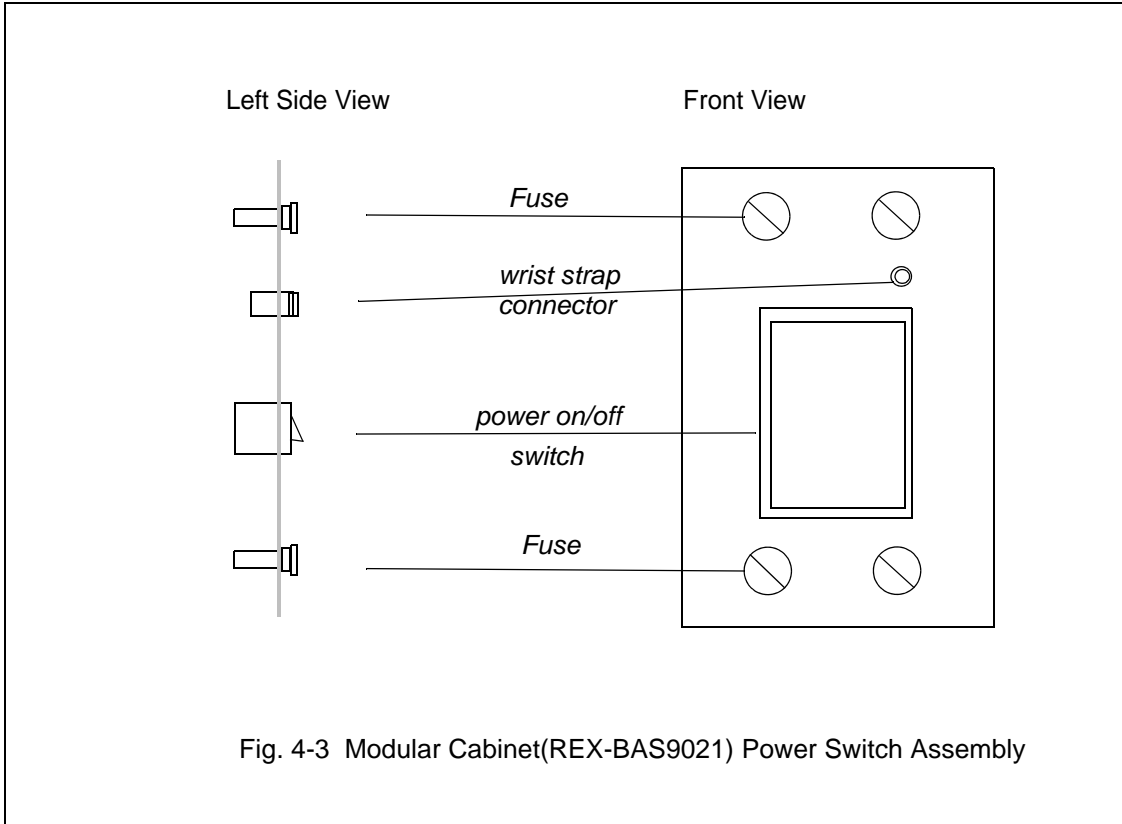
4.5   Pre–mounting of a Modular Cabinet in a One Cabinet System

1. Refer to paragrah 4.4.
2. Remove the front cover of the cabinet (see Figure 4–4):
    -   Remove the screws that secure the cover (1).
    -   Lift the front cover approximately 3/8" (2).
    -   Remove the cover by lifting the lower edge towards you (3).
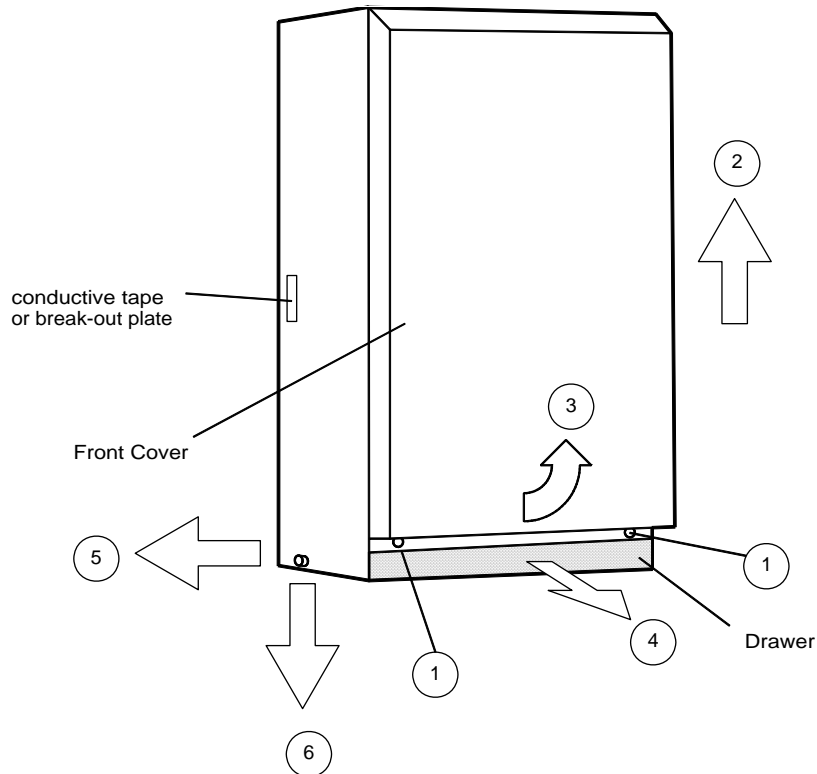
Fig. 4–4 Removal of the Front Cover and the Drawer

3. Remove the drawer for easy installation:
    -   Open the drawer by pulling it toward you (4).
    -   Release the drawer by pulling the left or right hand side of the drawer down as indicated in Figure 4–4 (5) and remove the drawer (6). The drawer is hinged by the two screws on its sides. These do not need to be removed to take the drawer out. Replace the two front cover screws so that they do not get lost.
4. Remove the screw of the securing bar at the front of the Modular Cabinet and remove the securing bar. Replace the screw so it does not get lost.
5. Secure the mounting bracket to the wall, so that the bottom side of the Modular Cabinet is about 5.25 ft. above the ground using the appropriate hardware (typically #8 wood or sheet metal screws). See Fig. 4-1.
6. Hang the cabinet onto the mounting bracket and mark the location of the two retaining holes on the bottom of the cabinet.
7. Remove the cabinet and drill the lower mounting holes as needed.
8. Continue with Paragraphs 4.8 or 4.9 as needed.

4.6   Pre–mounting of Modular Cabinets in a Multi Cabinet System

When a system consists of two to four Modular Cabinets, the Modular Cabinets have to be interconnected using an interconnection set for the Modular Cabinet. In this paragraph only the shielding gasket of the interconnection set is discussed. The use of the other items of the interconnection set is described in Paragraph 4.11. Refer to paragraph 4.4.

1. Remove the cover of the cabinet (see Figure 4–4):
    - Loosen the screws that secure the cover (1).
    - Lift the front cover approximately 3/8" (2).
    - Remove the cover by lifting the lower edge towards you (3).
2. Remove the drawer for easy installation:
    - Open the drawer by pulling it towards you (4).
    - Release the drawer by pulling the lower side of the Modular Cabinet as indicated in Figure 4–4 (5) and remove the drawer (6). Replace the two front cover screws so that they do not get lost.
3. Remove the screw of the securing bar at the front of the Modular Cabinet and remove the securing bar. Replace the screw so it does not get lost.
4. Remove the conductive tape or break–out plates in the side panels that are going to be positioned next to the other cabinet's side panels.
5. Place the shielding gaskets as indicated in Figure 4–5.
6. Using the appropriate hardware (typically #8 wood or sheet metal screws), secure the mounting bracket to the wall, so that the bottom side of the Modular Cabinet is about 5.25 ft. above the ground. See Fig. 4-1.
7. Hang the cabinet onto the mounting bracket and mark the location of the two retaining holes on the bottom of the cabinet.
8. Remove the cabinet and drill the lower mounting holes as needed.
9. Repeat this procedure for the other cabinets. The cabinets must be placed against each other, so that the shielding gasket will always have good contact with each other. For Modular Cabinets with revisions R2 and R3 the distance adjustment plate can be used (see Figure 4–6). (The space between the cabinets should never be more than .125".)
10. Continue with Paragraphs 4.7 or 4.8 as needed.
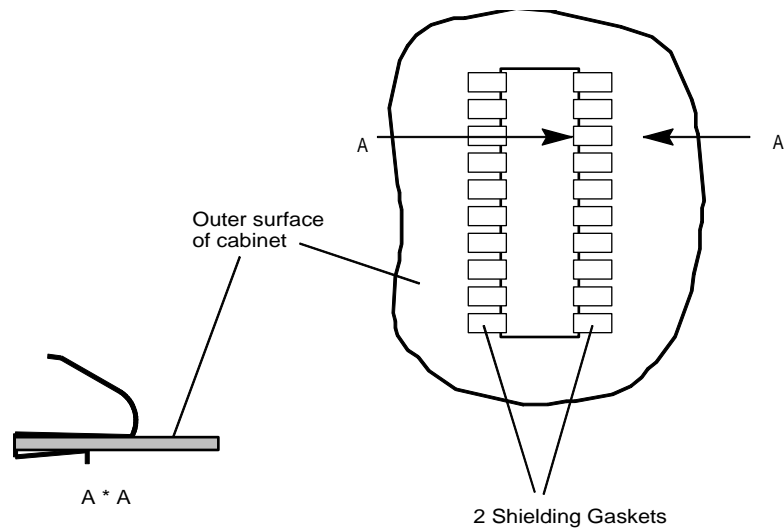
Fig. 4–5 Placement of the Shielding Gaskets
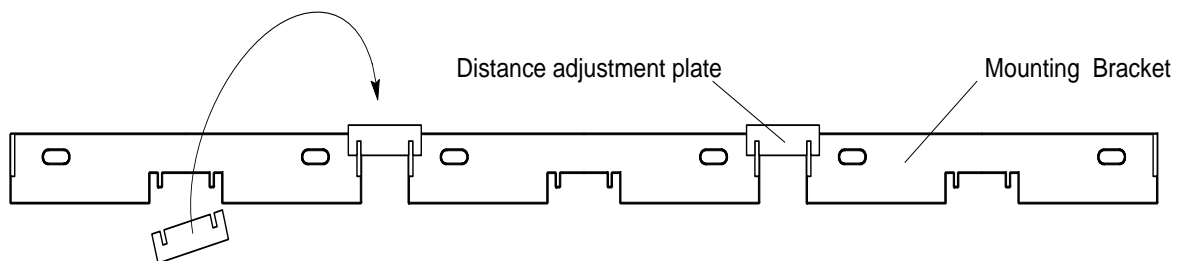
Fig. 4-6 Spacing the Mounting Brackets of the Modular Cabinets

4.7   Installation of the Synchronization Distribution Board (Mobility System Only)

Note: Not required in cabinets using CPU2 boards

The SDB must be installed in the Modular Cabinet that will contain the CPU. The best way to install the SDB is to have the cabinet on a desk on its back and with the drawer removed. For mounting the SDB the following material is required:

- **Sync port installation set: NTMNB 101 107**
  - SDB
  - Two spacers
  - Two spring washers
- **Torx screwdriver nr. 20**

Follow the next steps for mounting the SDB:
1. Unscrew the left fixation screw of the mains switch bracket (refer to Figure 4–2 for the location and orientation).
2. Insert a spacer in the left side screw hole and tighten the spacer using a Torx screwdriver.
3. Repeat steps 1 and 2 for the right side screw.
4. Mount the SDB as indicated in Figure 4–7 and tighten screws (maximum torque 0.59 lb./ft.).
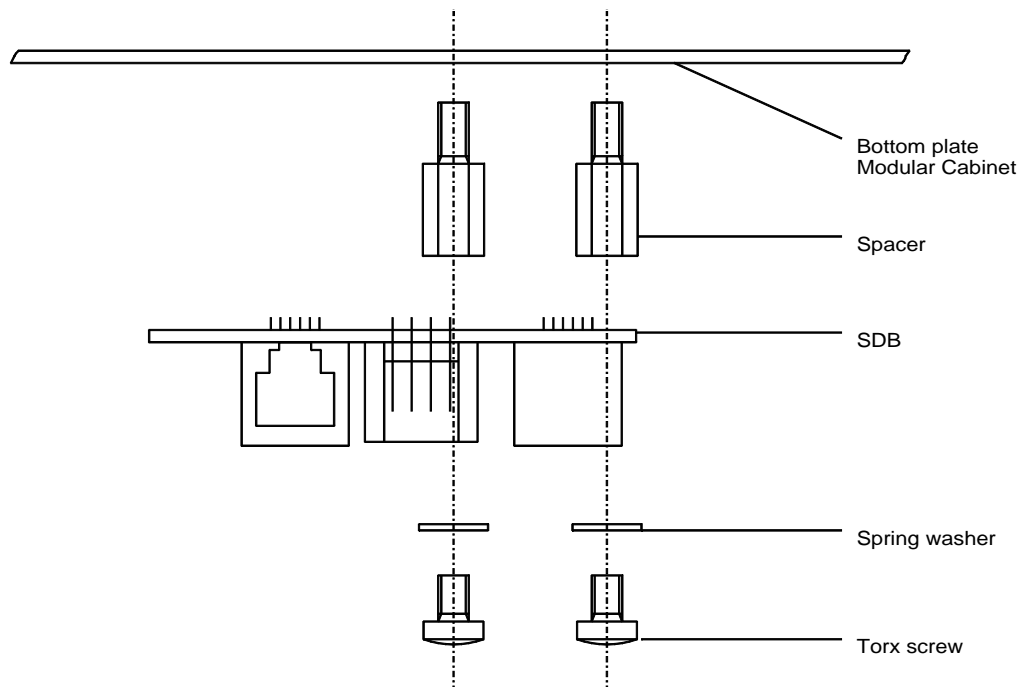
Fig. 4–7 Mounting of the Synchronization Distribution Board

4.8   Mounting the Modular Cabinet(s) to the Wall

1. Hang the Modular Cabinet(s) up using the mounting bracket(s). In a multi cabinet configuration, the cabinets must be placed against each other, so that the shielding gasket will always make good contact with each other.
2. Secure the cabinet(s) to the wall by inserting and fastening the screws at the bottom of the cabinet(s).

4.9   Connection to Protective Ground

The Modular Cabinet must always be connected to PBX ground or protective ground.

1. Connect the protective ground to the ground terminal screw lug on the ground strip (see Figure 4–8) of one of the cabinets, using a #10-#12 gauge wire ground cable.

Protective ground
connections
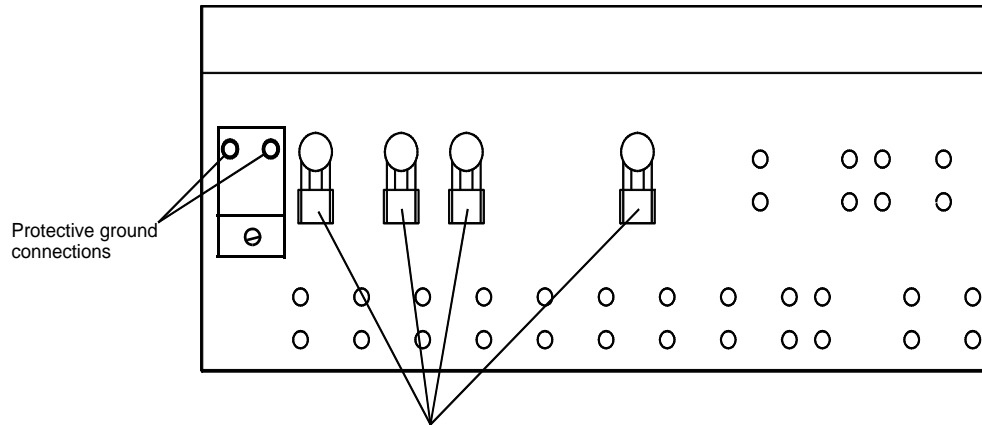
Fig. 4–8 Ground Plate

Warning

To prevent the ground connection from contact corrosion, only a tinned ground lug should be connected to the ground strip.

4.10   Connection of Wrist Strap for ESD

After mounting the Modular Cabinet(s), the installer has to protect against damaging system boards by ESD. The installer must use a wrist strap which must be connected to the cabinet at the connector indicated in Figure 4–2 and Figure 4-3.

Note:
The Modular Cabinet must be connected to protective ground.

Flat Cable

**R-network
R201, R202
and R207**

**R-network
R401, R402
and R407**

I **R-network installed**

R-network removed

Protective Ground Cable
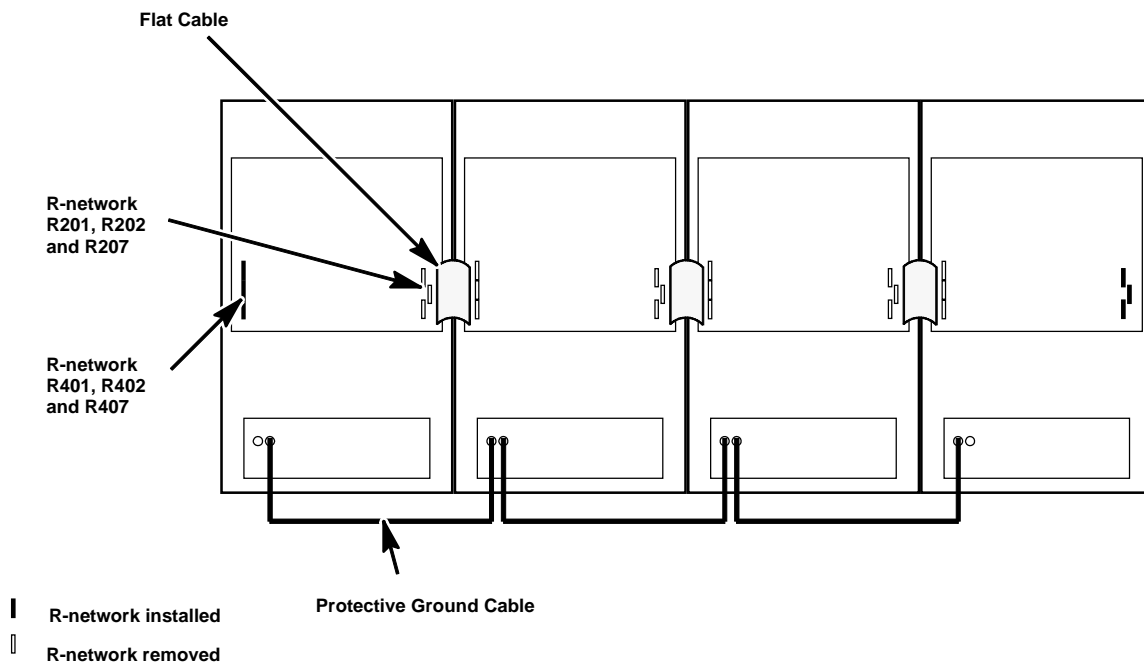
Fig. 4-9 Example of Interconnecting the System Bus and the Ground Plates
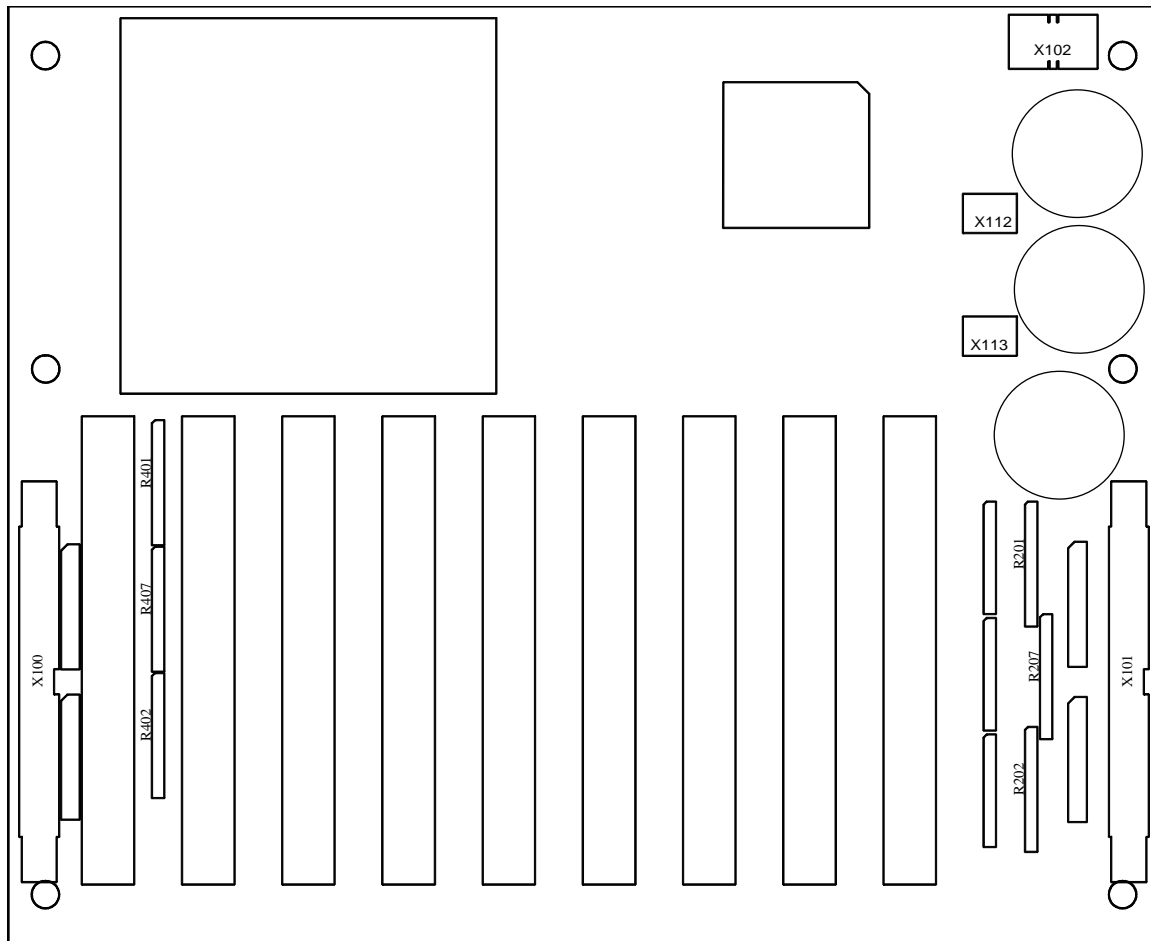
Fig. 4-10 Backplane of Modular Cabinet

4.11 Interconnecting Modular Cabinets

After the Modular Cabinets have been mounted to the wall, the backplanes of the cabinets have to be interconnected using the flat ribbon cable from the interconnection set, NTMNB 101 105 (see Figure 4-9).   Install one end of the cable in one of the cabinets. Feed the other end of the cable through the sides of the cabinets and insert it into the connector on the back plane. Make sure the connector's latch closes.

Ensure that an earth ground has been run to cabinet #1 (see Figure 4-8). Take the green/yellow ground cable from the interconnection set and connect the cable from the ground plate of the first cabinet to the ground plate of the second cabinet. Continue connecting the ground cables to the third and fourth cabinets as they are installed (see Figure 4-9).

The system bus on the backplane is terminated on both sides with R–networks in a SIL socket. When the Modular Cabinets are connected together, R–networks must be present only at both ends of the extended bus (see Figure 4–9).

Procedure

1. If the system boards are already installed, temporarily remove the boards that block access to the R–networks.

Note:
Follow paragraph 4.10 for ESD.

2. Remove all R–networks (R201, 202, 207, 401, 402, & 407) from the backplanes with the exception of:
   - R201, R202 and R207 on the last cabinet on the right.
   - R401, R402 and R407 on the last cabinet on the left.

See Figure 4–9.
See Figure 4–10 for the exact placement of the R–networks.

3. Where system boards have been removed, re–insert the boards.

4.12 Placing the Securing Bar

After all system boards have been placed in the cabinet(s), mount the securing bar(s) as shown in Figure 4–11.
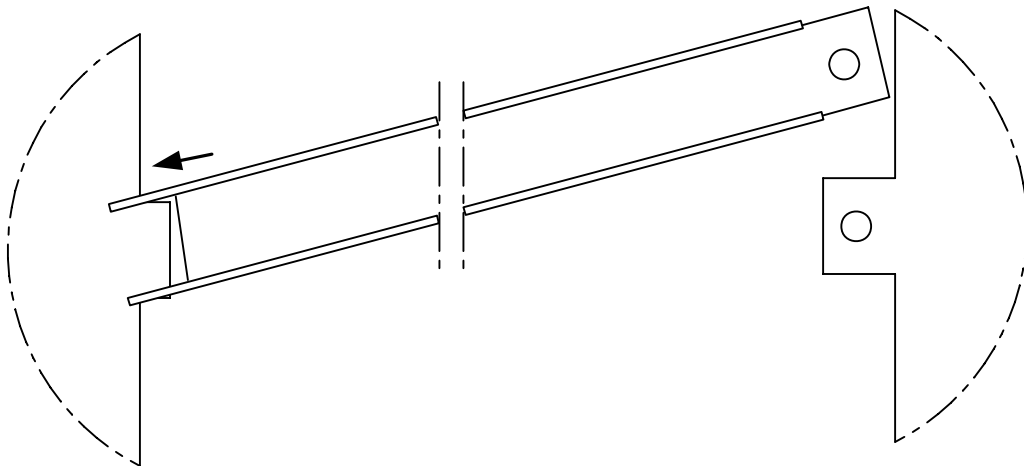
Fig. 4–11 Placement of the Securing Bar

4.13 Add a Cabinet

Adding a cabinet to an existing sytem requires planning to assure a successful addition with minimal downtime and problems. Both software and hardware changes need to be made to the existing system during the upgrade procedure.

Read the entire procedure before starting this operation!

There are some special things to take into account for the addition of a cabinet.

- Any cabinet needs to have a minimum of two circuit boards installed in it for the power supply to operate correctly.
- If your new cabinet is ordered with only one circuit board, then you need to plan on moving another circuit board out of an existng cabinet. This may entail moving cables. *Any movement of existing boards should be done after the cabinet is added and the system is back on line.*
- What board(s) are you placing in the new cabinet and what slots are they going into? Refer to Section 5, Chapter 3.2.
- Watch the power consumption totals for the backplane in each cabinet. Refer to Section 4, Chapter 2.2.
- When am I going to do this? Downtime needs to be scheduled for this operation. Allow <u>plenty of time</u> and let all users know the schedule.
- You will be removing termination resistors and knockout plates. The rule is "*Where two cabinets touch, remove the termination resistors and knockout plates in both cabinets at that point.*"

<u>Pre-planning Questions</u>

- Where do you physically add the new cabinet? On which side of the existing cabinet(s) do you install the new cabinet?
  Examine your current system and compare it to Figure 4-1. Are you adding cabinet 2, or 3, or 4? Plan to add your new cabinet in the location identified in this figure. Make sure the appropriate location on the wall is cleared out for the new cabinet.

- Where will the power supply(s) for the new cabinet be mounted?
  Power supply should not be mounted directly beneath cabinets because the heat from the power supply will rise directly into the cabinet. Mount them off to the side of the cabinets or at least 3 feet below the cabinets.

- Where will the additional LTU/CLU/SLU/DTU blocks be mounted?
  66 blocks should not be mounted directly beneath the bottom of the cabinets as the blocks will interfere with the drop down bottom of the cabinet and you might short something out on the block. Leave as least a foot or two of free space below the cabinets.

- How will the LTU/CLU/SLU/DTU cables be routed?
  All cables coming into or out of the cabinets come out of the bottom of the cabinets. Leave enough free space under the cabinets to form and route the cables to their termination point

The actual operation of adding a cabinet takes place in two steps, before the scheduled downtime and during the scheduled downtime. Before the scheduled downtime you can:

- Prepare the new cabinet.
- Hang the mounting bracket for the new cabinet.

Once this is done and you are at the scheduled downtime you can:

- Add the new cabinet via CSMW.
- Power down the existing cabinets.
- Mount the new cabinet.
- Power the system back up.
- Testing and back up.

Preparing the new cabinet

Once the new cabinet location has been decided, you must prepare for installation. *For the purpose of this discussion, we are adding a second cabinet to an existing one cabinet system.* The following procedure works for this or a third or a fourth cabinet. The only differences will be which side of the backplane and cabinet you will be working with.

We will be adding the second cabinet to the right hand side of cabinet #1 as you look at cabinet #1.

- Unpack the new cabinet. Make sure you get the bracket. It is in a plastic bag on the top of the packaging. Once you take the cabinet out of the plastic bag, remove the labels from the back of the cabinet.
- Remove the front cover, bottom plate, and card retention bar. Keep the covers, bar, and screws together.
- Lay the cabinet on its back and examine the backplane. Since the left side of the new cabinet is going up against cabinet #1, this is the side we are interested in.
- Locate the (3) termination resistors, R401, R402, and R407 on the backplane. Refer to Figures 4-9 and 4-10. With a pair of needle nose pliers pull the resistor packs up off the sockets on the backplane. DO THIS CAREFULLY. Save the resistors.
- Locate the knockout plate on the left side of the new cabinet. Refer to Figure 4-4. Remove this plate. DO THIS CAREFULLY. It is recommended that you use a fine tip pair of cutters to cut the plate out.
- Open the interconnect kit, NTMBN 101 05. Remove (2) of the metal shielding gaskets, refer to Figure 4-5, and install them into the knockout hole on the side of the new cabinet.
- Place the card slot label along the bottom of the cabinet directly below the card guides.
- Place the cabinet label along the top edge of the cabinet above the card guides.

At this point, it might be a good idea to verify that the power wiring of the cabinet is correct. Take one of the power supplies for the new cabinet and hook it up to the terminal block on the bottom of the cabinet. Refer to Figure 19-2 for connection information.

- Turn the power supply on and measure the voltage of the terminal block. The voltage should be -48VDC.
- If the voltage is correct, turn the cabinet power switch on. Measure the voltage on the terminal block again.
- Turn the cabinet power switch off.

- Insert a circuit board into the cabinet in any slot. Turn the cabinet power switch on. If everything is all right, then a green LED at the very top of the circuit board should be lit. Ignore any other LEDs.
- Turn off the cabinet power switch and remove the circuit board. Turn off the power supply and disconnect the cabinet power supply.

The new cabinet is ready to be mounted.

Hang the mounting bracket for the new cabinet.

Normally the mounting brackets for the cabinets are all mounted at the same time. Since we are adding a cabinet to an existing installation, we do not have that luxury. There are two ways to mount the new bracket.

Method 1 - This can only be done when the system is shut down.

- When cabinet 1 is shut down, remove it from the bracket on the wall. Use the spacer off of the new bracket, See Figure 4-6, and spot the screw holes for the new bracket.
- Drill new holes for the new bracket and secure it to the wall.
- Replace cabinet number 1 on its bracket and secure it to the wall.

Method 2 - Done while existing system is running.

- Measure from the top right hand corner of cabinet one, 1 7/8" over and 7/8" down. This is the spot for the left hand mounting bracket screw. Place the new bracket on the wall, center the left hand mounting hole over the mark you just made, level the bracket, and mark the center of the right hand mounting hole.
- Drill the holes for the screws and secure the bracket to the wall.

Do not mount the new cabinet !

SCHEDULE DOWN TIME!!!!

Add the new cabinet via CSMW.

Before the new cabinet is physically added, it must be added in the CSM software.

- Connect the maintenance PC to the system and start the CSM program.
- Back up the existing system.
- Change the authority level to Distributor.
- Go to System-Configuration-System tab.
- Change the number of cabinets to 2. (2 in our example)
- Click OK.
- Reset the system via CSMW or by using the black reset button on the CPU board.
- After the system comes back up, log back on the system, and verify that it says 2 cabinets.
- Back the system up again. Give the back up a new name.

Power down the existing cabinet(s)

- Power down the existing system.

- Remove any circuit boards in the three slots next to the side of the existing cabinet that is going up against the new cabinet. *For our example, this would be slots 48, 52, and slot 56.* Remember what you pulled out and label them.
- Remove the (3) termination resistors, R201, R202, and R207, from the right hand side of the backplane. Refer to Figures 4-9 and 4-10. <u>DO THIS CAREFULLY</u>. Save the resistors.
- Remove the knockout plate from the right hand side of the existing cabinet. See Fig. 4-4. <u>DO THIS CAREFULLY.</u>
- Take the remaining two metal shielding gaskets from the installation kit, NTMNB 101 05, and insert them into the hole whre the knockout plate was.

<u>Mount the new cabinet</u>

- Hang the new cabinet on the bracket on the wall. Position it to the right hand side of the bracket. This should give you enough room between the brackets so that the shielding brackets do not interfere with each other as you set the new cabinet against the wall.
- Once the new cabinet is on the bracket, push it up against the existing cabinet as close as possible. This will compress the fingers of the shielding gaskets.
- While holding the new cabinet up against the existing cabinet, mark the location of the two mounting holes on the bottom of the new cabinet.
- Drill the holes and secure the new cabinet to the wall with screws.
- Remove the green ground wire from the installation kit, NTMNB 101 05, and connect it between the grounding plates of the new and existing cabinets. See Figure 4-8.
- Take the flat ribbon cable from the installation kit, NTMNB 101 05, and feed it <u>GENTLY</u> through the knockout holes between the cabinets. The connectors on this cable are keyed. Look at the cable before you feed it through. Make sure you have it oriented correctly.
- Gently seat the connectors into the backplane connectors.
- Place the circuit boards that you previously pulled out of the existing cabinet back into the correct slots in the existing cabinet.
- Mount the power supply(s) for the new cabinet.
- Connect the power supply(s) to the cabinet.
- Turn the power supply(s) on and verify the presence and polarity of voltage on the terminal block on the bottom of the cabinet.

If you have not previously tested the cabinet and verified that it powers a board correctly, now is the time to do it.

- Insert a circuit board into the cabinet in any slot. Turn the cabinet power switch on. If everything is all right, then a green LED at the very top of the circuit board should be lit. Ignore any other LEDs.
- Turn off the cabinet power switch and remove the circuit board.
- Place the circuit board(s) for this cabinet in the correct slot(s).

<u>Powering the system back up</u>

- Turn the power switch for the new cabinet on.
- Turn the power switch for cabinet #1 on.
- The system should initialize as it did when it was single cabinet system, but you should see the lights on the card(s) in the second cabinet turn on and off also.
- Connect the maintenance PC to the system and log onto the CSMW.
- Verify that the CSMW shows the boards in both cabinets.
- Do a system back up. Give it a new name.

Testing and back up

- Verify that all existing portables are working.
- Verify that all existing base stations are working.

Now is the time to add any connections to LTU/SLU/CLU/DTU boards or to move any boards that you have decided to move. Which you do first depends on what you are doing and it is up to you to decide the order of these operations.

- Add or move any boards.
- Add or move any cables and 66 blocks.
- Label or re-label the 66 blocks.
- When you are done adding or moving things, **DO** a system back up. Give it a new name.
- Put the card retention bar on the cabinet.
- Put the bottom plate back on the cabinet.
- Place the front cover on the cabinet and secure it.

CHAPTER 5
Central Processing Unit (CPU) – REX-BRD0004 or *2/ROFNB 157 19/2*

5.1   General

Maintenance
The CPU contains the following field–exchangeable parts (see Figure 5–4):
- CPU Firmware (Mobility) - RYS 105 447
- CPU Firmware (Standalone) - RYS 105 657
- CPU Firmware, Poll Processor - REX-SW0014 or *RYS 105 663*
- Sync FPGA (Field Programmable Gate Array) - RYSNB 101 24
- Lithium Battery (type DL2032)

The CPU firmware is delivered as a separate item.

The lithium battery is a back-up power supply for the Real Time Clock (RTC) on the CPU board. The RTC supplies the system date (year, month, day) and time (hours, minutes, seconds). If the lithium battery dies, the system will require UTAM activation whenever the CPU power is cycled unless it has been initialized as a non-UTAM system.

5.2   Board Description

Functionality
The CPU board is used in both a Standalone (SA) system and in a Mobility Server (MS) system. The firmware that is resident on the CPU board determines which type of system the board will function in.

Firmware RYS 105 657 is for Standalone Systems
Firmware RYS 105 447 is for Mobility Server Systems

Synchronization
If the CPU resides in a system that is part of multiple system configuration, PWT interface and frame synchronization is required. When the PWT air interface is synchronized, efficient use of the network capacity and seamless handovers between systems are possible when the coverage areas overlap. To achieve PWT air interface synchronization in a multiple system configuration, the respective CPUs (responsible for the frame timing) have to be in sync. CPUs are synchronized using a master/slave concept, where one master CPU supplies a synchronization signal to a number of slave CPUs. A slave CPU can act as a master for a further three slave CPUs, thus creating a multi level star network with a maximum of two levels, see Figure 5-1.
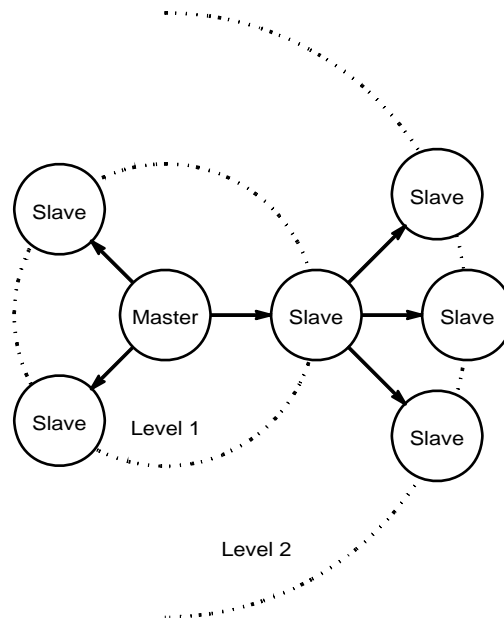
Fig. 5–1 Synchronization Topology

Strap Settings
As the master CPU determines the timing in the star network, it can either generate the frame timing on its own or synchronize it to an external source like a 2 Mbit/s link (DLU or DTU). Synchronizing to a 2 Mbit/s or 1.544Mbit/s link reduces the likelihood of frame slips on the link but is only allowed when the clock stability is better than 2 ppm. In the Master/Stand Alone mode the CPU provides the frame timing on its own. As a Slave/Standalone the CPU receives framing sync from the master RE. In Figure 5–2 an overview of the strap settings is given.

When setting the CPU up as a master or slave, both of the Air Interface master/slave jumpers must be set the same. Refer to Figure 5.2 for the correct configuration.

When the CPU is strapped as a master, the frame timing strap must be set correctly. Refer to Figure 5.2 for the correct configuration.

When the CPU is strapped as a slave, the function of the frame timing strap is disabled and the position of this strap is irrelevant. If the CPU is strapped as a slave then there must be a Sync cable from the Sync Out on the master RE connected to the Sync In connector on the slave.

Refer to Chapters 17 and 19 in Section 5 of the TPM for information on Sync cable connectivity.

Air Interface synchronization master/slave straps

Frame timing synchronization source strap

Synchronizes to a 2 Mbit/s(DLU) link(1.544) (DTU), only allowed when master (Accepting framing clock from DTU or DLU source)

Stand alone (default), mandatory when slave (Providing framing clock to DTU or DLU source)

Master (default)

Slave, frame timing sync. source strap must be in stand alone position

Not allowed

Not allowed

Warning: Wrong installation will damage board. Follow Section 5.3 carefully if this FPGA chip needs to be installed.

Fig. 5–2 Strap Settings

Connectors
The CPU has the following front connectors (see Figure 5–4):
● Sync in
● Sync out (3x)
● Printer port
● PC port
● GA port

The Sync In and Sync Out ports on the CPU are connected via two methods.

Method 1: Refer to Chapter 18, Synchronization Distribution Board and Chapter 20, Modular Cabinet CPU Cabling. This method is the older method which incorporates an internally mounted, inside the modular cabinet, Synch Distribution board and cables.

Method 2: Refer to Chapter 20, Modular Cabinet CPU Cabling, a newer method of connecting sync cables directly between master and slave CPUs without using internally mounted sync board and cables.

Note: *The Sync Distribution Boad (SDB) and cables mentioned in method 1 are no longer availabe or included in new systems. Method 2 must be used for any new installations or if the SDB and cables must be replaced on an existing installation.*

The SMS/printer, PC and general alarm ports are connected to the MCCB via factory installed cables.

Interface characteristics of the printer and PC ports are:
● asynchronous, 2400-115200 bit/s
● 8 data bits, 1 stop bit, no parity
● X–on/X–off

LEDs
The following LEDs are located on the front of the CPU board:

LED1	Green	: Normally on. Power On LED
LED2	Red	: Normally off. Watch–dog LED
LED3	Red	: Normally lit very weak. Communication with backplane LED (not significant)
LED4	Red	: Normally off. Board Error LED
LED5	Red	: Normally off. Info, error or service message received, but not read yet
LED6	Green	: Test and Maintenance active. On during actual testing, or during RS232 activity on the PC port.

Reset Button
The CPU is provided with a reset button. If this button is pressed, the CPU and the rest of the RE are reset and perform a cold start as if the RE was switched off and on again.

Note:
Resetting the CPU may cause the synchronization slave CPUs, connected to this CPU, to lose their synchronization. Immediate synchronization can be enforced by resetting the slave CPUs after the synchronization master CPU has been reset. Bear in mind that a synchronization slave CPU can be a clock provider to other slave CPUs.

5.3 Installation

For the installation of the CPU board refer to Figure 5–4 and perform the following steps:

1. Use ESD ⚠ precautions.
2. Insert the CPU firmware, RYS 105 447 or RYS 105 657 in the proper socket. (See Fig. 5-4)
3. Make sure FPGA is installed. Otherwise see FPGA installation (Figure 5-3).
4. Set the straps, shown in Figure 5–2, in the correct position as described in Paragraph 5.2.
5. Remove the insulation foil between the positive contact of the battery holder and the lithium battery.
6. Insert the CPU board gently into the card slot in board position 24. The cabinet in which the CPU board resides automatically becomes cabinet 1.

For FPGA installation use the following steps: *Note: FPGA is installed by manufacturer in most cases.*

1. Use ESD ⚠ precautions.
2. Be sure the notched corner of the chip is aligned with the blocked corner of the CPU socket. ***Note:*** *This notch will **not** prevent the chip from being inserted incorrectly!*
3. Seat with firm but even force until the chip is recessed into the CPU socket.

Semi-circle

Beveled edge

FPGA

Notched corner

Arrow

Blocked corner

Socket
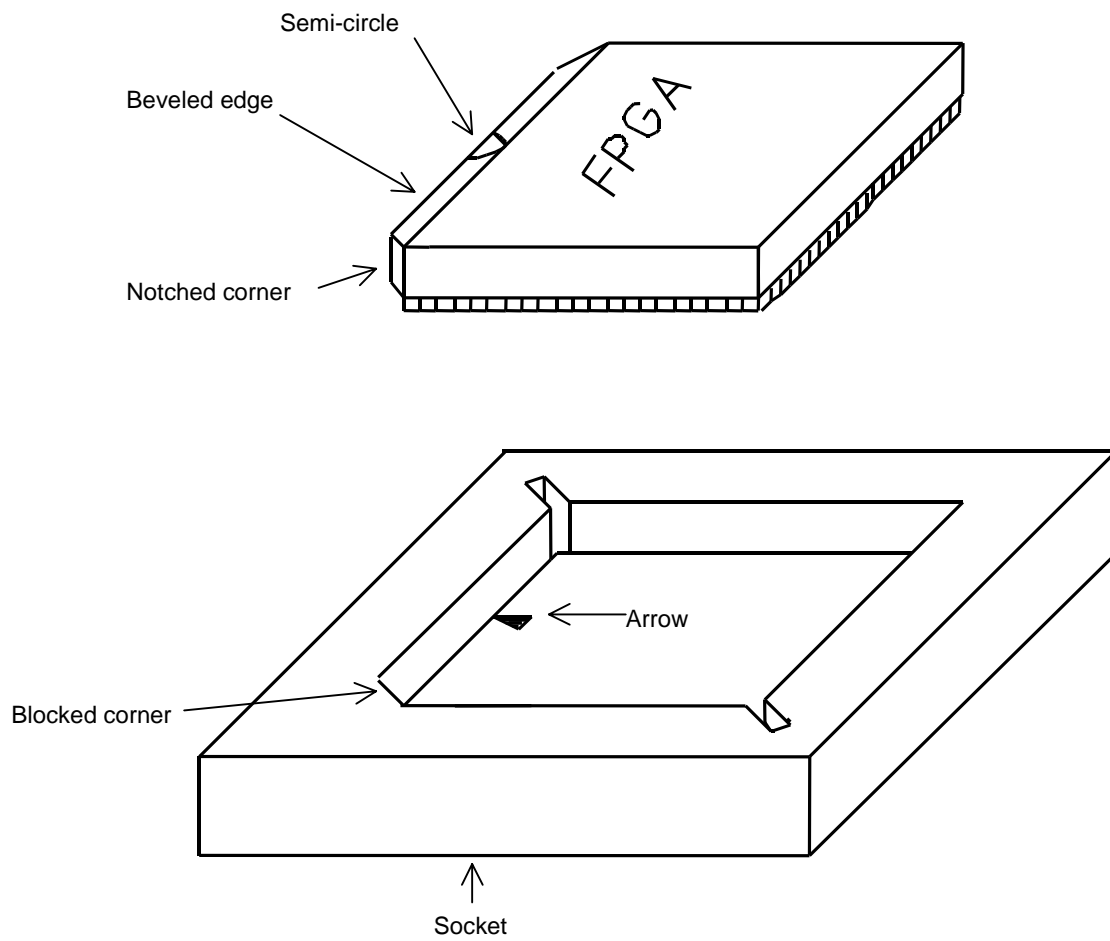
Fig. 5-3 FPGA Installation
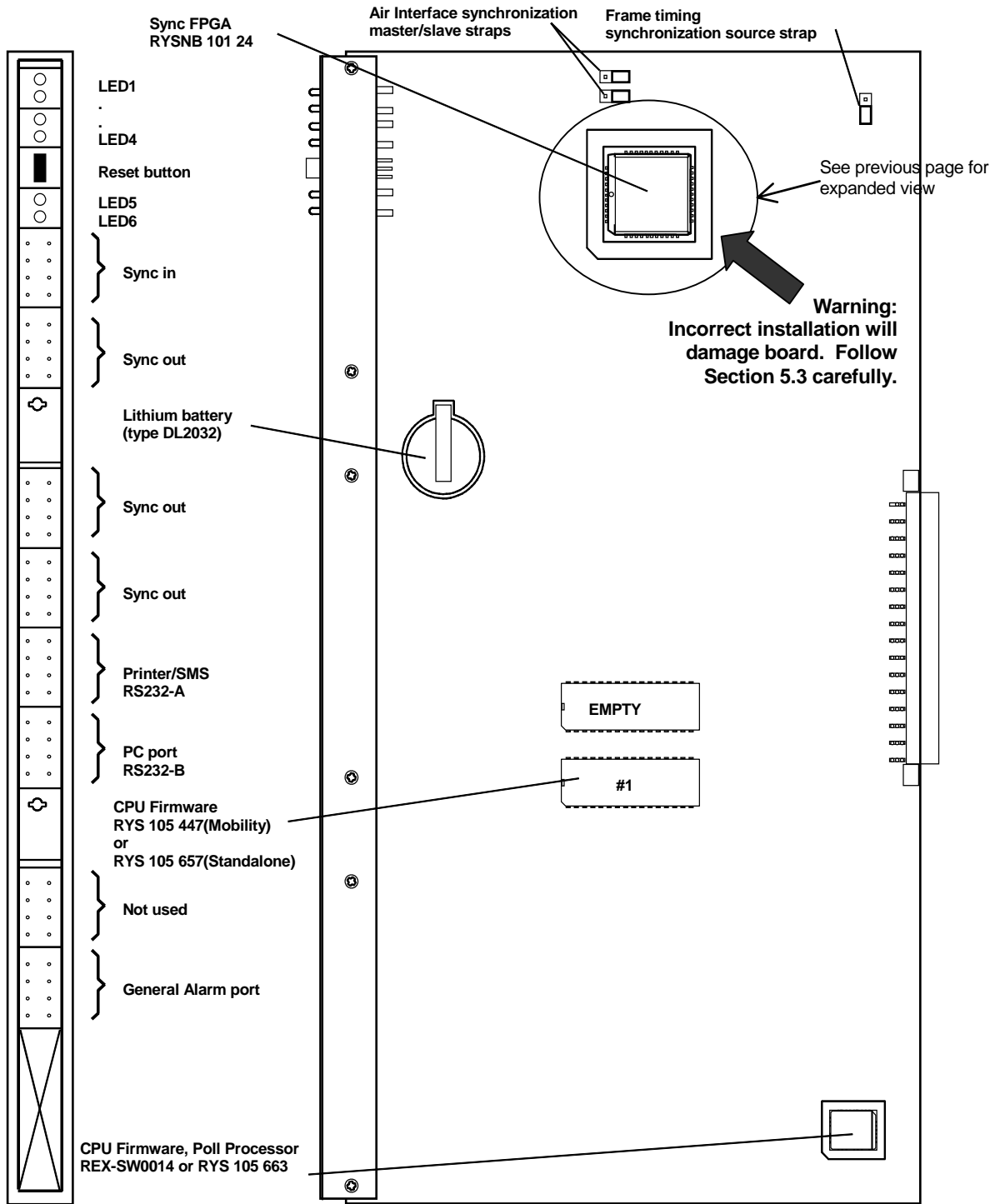
Fig. 5-4 CPU-REX-BRD0004 or 2/ROFNB 157 19/2 cont.

CHAPTER **6**
System Boards

6.1 Digital Trunk Unit (DTU–E1 CAS, CCS) - REX-BRD0002 or *2/ROFNB 157 13/1*

Compliance to Regulations and Standards
The DTU–E1 provides 2 standard CEPT primary rate interfaces and meets the following
requirements:

CE regulation	: 91/263/EEC
CE marking	: $C\!\!\!\!\in\!\!0344X$ (this marking is not placed on the DTU–E1 board because the DCT1900 system is already covered by the CE marking of the cabinet)
Leased line CTR	: CTR12
G.703	: Electrical characteristics of the 2.048 Mbit/s synchronization interface
G.704	: Synchronization frame structure at 2.048 Mbit/s
G.823	: Input jitter requirements
G.732	: Characteristics of primary rate PCM multiplex equipment operating at 2.048 Mbit/s
I.431	: Primary rate layer 1

Environmental
Temperature

Operating	: 32 to 104°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 20 to 80%, non condensing

General Specifications

Length x width	13.5" x 7.7" (343 x 195.6mm)

Digital Trunk Specification

Number of primary rate interfaces per DTU board	: 2
Bit rate	: 2.048 Mbit/s
Signalling	: Common Channel Signalling (CCS), using firmware set NTM/RYSNB 101 17/3
	: Channel Associated Signalling (CAS), using firmware set RYS 105 664

6.2 Digital Trunk Unit, DTU-T1, CAS - REX-BRD0021 or *2/ROFNB 157 13/2*

Compliance to Regulations and Standards
The DTU–T1 provides 2 standard T1 interfaces. The DTU–T1 complies with the following EIA/TIA recommendation:

EIA/TIA 464	: Private Branch Exchange (PBX) Switching Equipment for Voice–band Applications.

Environmental
Temperature

Operating	: 32 to 104°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 20 to 80%, non condensing

General Specifications

Length x width	13.5" x 7.7" (343 x 195.6mm)

Digital Trunk Specification

Number of T1 interfaces per DTU	: 2
Bit rate	: 1.544 Mbit/s
Signalling	: Channel Associated Signalling with bit Robbing (CAS BR) according to EIA/TIA 464–A FXS DSX–1, using firmware set RYS 105 660

6.3 Digital Trunk Unit -DTU–T1,CCS - REX-BRD0021 or *2/ROFNB 157 13/3*

The DTU–T1 provides 2 standard T1 interfaces. The DTU–T1 complies with the following EIA/TIA recommendation:

EIA/TIA 464	: Private Branch Exchange (PBX) Switching Equipment for Voice–band Applications.

Environmental
Temperature

Operating	: 32 to 104°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 20 to 80%, non condensing

General Specifications

Length x width	13.5" x 7.7" (343 x 195.6mm)

Digital Trunk Specification

Number of T1 interfaces per DTU	: 2
Bit rate	: 1.544 Mbit/s
Signalling	: Common Channel Signalling with a 64Kbps D channel using Q.931 protocol with proprietary extensions for mobility management, using firmware RYS 105 650.

6.4 Central Processing Unit (CPU1) - REX-BRD0004 or *2/ROFNB 157 19/2*

Environmental

Temperature

Operating	: 32 to 104°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)

Relative humidity   : 20 to 80%, non condensing

General Specifications

Length x width   13.5" x 7.7" (343 x 195.6mm)

RS232 I/O ports   : 2

Sync

Input ports	: 1 via coupler
Output ports	: 3 via RS422 type drivers
Lock in time	: # 5 minutes after reset and power on
	# 5 minutes after a signal interruption # 3 minutes
	# 8.8 hours during normal operation
Loss of sync	: immediate after interface failure

6.5 Central Processing Unit (CPU2)-REX-BRD9033, REX-BRD9034

Environment

Temperature

Operating	: 32 to 104°F (0 to 70 °C)
Storage	: -40 to 158°F (–40 to 70 °C)

Relative humidity   :   20 to 80%, non condensing

General Specifications

Length x width   : 344 x 195 mm

RS232 I/O ports   : 2

Sync

Input ports	: 1 via RJ45
Output ports	: 3 via RJ45
Lock in time	: # 5 minutes after reset and power on
	# 5 minutes after a signal interruption # 3 minutes
	# 8.8 hours during normal operation
Loss of sync	: immediate after interface failure

6.6   Speech Link Unit, SLU - REX-BRD0015 or *ROFNB 157 16/1*

Environmental

Temperature
  Operating   : 32 to 104°F (0 to 70°C)
  Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications

Length x width   13.5" x 7.7" (343 x 195.6mm)

Current Limitation

Current limitation of the Base
Stations power   : 1.3 A (T = 25 °C)
                                       0.75 A (T = 70 °C)

Transport Data Rate

Data rate between SLU and
Base Station   : 384 kbit/s

Speech Coding

Telephone exchange side   : 64 kbit/s PCM (A–law or μ–law, country dependent,
                                       downloaded from CPU)
Base Stations side   : 32 kbit/s ADPCM

DTMF Levels

Country dependent (downloaded from CPU)

Artificial Leakage

Only if a DTU is used   : -24 dB

Dial Tone Detection

Sensitivity level   : -29 dBm
Detection time   : 800 ms
Frequencies   : 350/440 Hz

6.7 Speech Processing Unit, SPU-S - REX-BRD0017 or *ROFNB 157 16/3*

Environmental
Temperature
  Operating   : 32 to 104°F (0 to 70°C)
  Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width   13.5" x 7.7" (343 x 195.6mm)

Speech Coding
Telephone exchange side : 64 kbit/s PCM (A–law or μ–law, country dependent, downloaded from CPU)
Base Stations side   : 32 kbit/s ADPCM

DTMF Levels
Country dependent (downloaded from CPU)

Artificial Leakage
Only if a DTU is used   : -24 dB

Dial Tone Detection
Sensitivity level   : -29 dBm
Detection time   : 800 ms
Frequencies   : 350/440 Hz

6.8 Cell Link Unit, CLU - REX-BRD0014 or *ROFNB 157 11/2*

Environmental
Temperature
  Operating   : 32 to 104°F (0 to 70°C)
  Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non-condensing

Fusing
Power to the Base Stations is fused by two replaceable 1.0 AT fuses per Base Station.

Transport Data Rate
384 kbit/s

General Specifications
Length x width   13.5" x 7.7" (343 x 195.6mm)

6.9   Cell Link Unit, CLU-S - REX-BRD0016 or *ROFNB 157 16/2*

Environmental

Temperature

    Operating   : 32 to 104°F (0 to 70°C)

    Storage   : -40 to 158°F (-40 to 70°C)

Relative humidity   : 20 to 80%, non condensing

General Specifications

Length x width   13.5" x 7.7" (343 x 195.6mm)

Current Limitation

Current limitation of the Base

Stations power   : 1.3 A (T = 25 °C)

                         0.75 A (T = 70 °C)

Transport Data Rate

Data rate between SLU and

Base Station   : 384 kbit/s

Speech Coding

Base Stations side   : 32 kbit/s ADPCM

6.10   Line Termination Unit, LTU - REX-BRD0007 or *ROFNB 157 02/06*

Compliance to Regulations and Standards
EIA-470   : USA

Environmental
Temperature
    Operating   : 32 to 158°F (0 to 70°C)
    Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width   13.5" x 7.7" (343 x 195.6mm)

Telephone Line Interface Specifications
Insulation   : 1.5 kVac between line and secondary circuitry
                               : 1 kVac between line and cabinet

DC Characteristics
Range of line current   : 10-100mA
On–hook equivalent resistance :   > 1MΩ between wires a and b for 50 - 250 V

AC Characteristics
On–hook impedance   : > 100 kΩ for voice signals
                                > 15 kΩ for ringing signal
Off–hook impedance   : return loss optimized against 210Ω + (880Ω // 150 nF)

Ringing Detection
Ringing voltages   : 10 - 90 Vrms
Frequency range   : > 20 Hz

Pulse Dialing
Waveform   : 60ms pulse, 40ms pulse-USA, Sweden
Selected digit N generates   : N + 1 pulse or
                                 N pulses and digit 0 generates 10 pulses
Resistance during pulsing   :   > 5 MΩ and < 560Ω
Line voltage   : limited to 100 - 14Vdc

DTMF Dialling
The DTMF signals are determined by the combination of the SPU and the SICOFI parameters.

Speech Coding
Method   : software selectable
AD Gain   : determined by SICOFI parameters
DA Gain   : determined by SICOFI parameters
Hybrid balance impedance   : determined by SICOFI parameters

6.11   Line Termination Unit , LTU2 - REX-BRD0019A

Compliance to Regulations and Standards
EIA-470   : USA

Environmental
Temperature
   Operating   : 32 to 158°F (0 to 70°C)
   Storage   : -40 to 158°F (-40 to 70°C)
Relative humidity   : 20 to 80%, non condensing

General Specifications
Length x width   13.5" x 7.6" x .8" (344 x 192 x 20 mm)
Weight   .95 lb (430 grams) (excluding packaging)

Telephone Line Interface Specifications
Insulation   : 1.5 kVac between line and secondary circuitry
                                 : 1 kVac between line and cabinet

DC Characteristics
Range of line current   : 60 mA max.
On–hook equivalent resistance :   > 9 MΩ between wires a and b for 200 Vdc
Resistance to earth (in quiescent
and loop state)   : 1 GΩ between wires a/b and E-wire for up to 250 Vdc

AC Characteristics
On–hook impedance   : Software programmable 600Ω or complex
Off–hook impedance   : See 'Ringing Detection'
Return Loss   : 15 dB min.
Relative levels   : Software programmable
Input (AD loss) range   : 6 to -11dBr against 270Ω + (750 Ω // 150 nF)
Output (DA loss) range   : 12 to -4.5 dBr against 270Ω + (750 Ω // 150 nF)
Balancing impedance   : Software programmable; 600 Ω, 900 Ω or complex
Longitudinal conversion loss   : 60 dB min. between 50 Hz and 4 KHz

Ringing Detection
Ringing voltages   : 10 kΩ min. between 24 to 90 Vrms, 25 to 50 Hz
Impedance for voice signals   : 100 kΩ min. at AC voltages up to 2 V (peak),300 Hz to 3400 Hz
Capacity   : 1 μF +/- 5%
Ringing voltages   : 24 to 120 Vrms
Insensitive to signals   : 17 Vrms max.
Frequency range   : Software programmable between 16 and 64 Hz

Pulse Dialing
Make/break period   : Software programmable between 0 to 255 ms
Selected digit N generates   : N pulses and digit 0 generates either 10 pulses (default)
Line Voltage during pulsing   :   Limited to 240 Vdc

DTMF Dialling

The DTMF signals are determined by the combination of the output level of LTU and SPU parameters.

Speech Coding

Standard   : G.712
Method   : 64 kbit/s A-law or μ–law PCM'

Speech Coding

Method   : software selectable
AD Gain   : determined by SICOFI parameters
DA Gain   : determined by SICOFI parameters
Hybrid balance impedance : determined by SICOFI parameters

6.12 Digital Line Unit, DLU - REX-BRD0023

AWS1024 Meridian, AWS1025 Norstar, AWS1026 Lucent

The DLU has 12 analog front ends (ports) that provide 12 digital line interfaces to the PBX.

Compliance to Regulations and Standards

Safety	: ANSI/UL 60950
	: CSA 22.2-950 3rd edition
Electrostatic discharge	: EN 61000-4-2
Radiated susceptibility	: EN 61-4-3
Electrically Fast	
Transients (burst)	: EN 61000-4-4
Conducted disturbances	: EN 61000-4-6
Radiated and	
Conducted Emissions	: EN 55022, procedure CISPR 22 and CISPR 16 Class A

Environmental

Temperature	
Operating	: 32 to 158°F (0 to 70°C)
Storage	: -40 to 158°F (-40 to 70°C)
Relative humidity	: 95% max, non condensing at 77 to 158°F (25 - 70°C)

General Specifications

Length x width	: 13.0" x 7.0 x 0.79" (340 x 178 mm)
Maximum Power Consumption	: 3.0 W at 5V
	1.2 W at -12V
RS232 serial port	: 1 via a DB9 female connector

Digital Line Specification

Number of digital	
interfaces per DLU	: 12
Bit rate	: Automatically adjusted for the PBX type it is configured for.
Signalling	: Proprietary digital signal encoding.

CHAPTER 7
Cell Link Unit (CLU) – REX-BRD0014 or *ROFNB 157 11/2*

7.1   General

The CLU is used to control up to 8 Base Stations via twisted pair cables with a maximum length of 2.2 miles.

Maintenance
The CLU contains the following field–exchangeable parts (see Figure 7–1):
● CLU Firmware, Board Controller - RYT/ROFNB 157 11/2
● Two 1 AT fuses for each Base Station circuit (see Figure 7–1)

7.2   Board Description

Straps
Not applicable.

Connectors
The CLU has 4 connectors at the front by which the CLCs are connected to the Base Stations and 1 connector for input of the Base Station power:

CLC 1–8	: To connect Base Station 1 to 8.
Base Station Power	: To connect -48 Volts from the MCCB for powering the Base Stations.

The power connector does not have a polarity. It makes no difference which pin becomes plus or minus.

LEDs

LED1	Green	: Normally on. Power On LED
LED2	Red	: Normally off. Watch–dog LED
LED3	Red	: Normally off. Board not polled LED
LED4	Red	: Normally off. Base Station in NEW state or board error

**CLU Firmware, Board Controller
RYSNB 101 19**

LED1

LED4

**Base
Station
Power**

CLC8

CLC7

CLC6

CLC5

6,7: SC0
2,3: SC1
5,8: EPP0
1,4: EPP1

CLC4

CLC3

CLC2

CLC1

7	8
5	6
3	4
1	2

P1   **P0**

Base 8

Base 7

Base 6

Base 5

Base 4

Base 3

Base 2

Base 1

Fuses

Fig. 7–1 CLU - REX-BRD0014 or ROFNB 157 11/2

Fig. 7–2 Power Distribution on the CLU

7.3   Installation

1. Insert the CLU into the card guides in the specified slot position.
2. Gently push the board into the back connector until it locks. Don't use any force.
3. Connect the CLU power cable, TSRNB 101 33.
4. Connect the CLU signal cable, NTM/TSRNB 101 29.

CHAPTER 8
Cell Link Unit (CLU-S) –REX-BRD0016 or *ROFNB 157 16/2*

8.1 General

The CLU-S is used to control up to 8 Base Stations via twisted pair cables with a maximum length of 1.3 miles.

Maintenance
The CLU-S contains the following field–exchangeable part (see Figure 8–1):
- CLU Firmware, Board Controller - RYSNB 101 19

8.2 Board Description

Straps
Not applicable.

Connectors
The CLU has 4 connectors at the front by which the CLCs are connected to the Base Stations and 1 connector for input of the Base Station power:

CLC 1–8	: To connect Base Station 1 to 8.
Base Station Power	: To connect -48 Volts from the MCCB for powering the Base Stations.

The power connector does not have a polarity. It makes no difference which pin becomes plus or minus.

LEDs

LED1	Green	: Normally on. Power On LED
LED2	Red	: Normally off. Watch–dog LED
LED3	Red	: Normally off. Board not polled LED
LED4	Red	: Normally off. Base Station in NEW state or board error

LED1

LED4

Base
Station
Power

P1   P0

CLC8

CLC7

CLC6

CLC5

6,7: SC0
2,3: SC1
5,8: EPP0
1,4: EPP1

CLC4

CLC3

CLC2

CLC1

Base 8

Base 7

Base 6

Base 5

Base 4

Base 3

Base 2

Base 1

7   8

5   6

3   4

1   2

Thermistor

CLU Firmware, Board Controller
RYSNB 101 19

Fig. 8–1 CLU-S - REX-BRD0016 or ROFNB 157 16/2

Fig. 8–2 Power Distribution on the CLU-S

8.3   Installation

1. Insert the CLU-S into the card guides in the specified board position.
2. Gently push the board into the back connector until it locks. Don't use any force.
3. Connect the CLU power cable, TSRNB 101 33.
4. Connect the CLU signal cable, NTM/TSRNB 101 29.

CHAPTER 9
Speech Link Unit (SLU) – REX-BRD0015 or *ROFNB 157 16/1*

9.1   General

The SLU is a combination of an SPU and a CLU on one board. The CLU part is used to control up to 8 Base Stations via twisted pair cables with a maximum length of 1.3 miles. The SPU section has 8 speed circuits.

Maintenance
The SLU contains the following field–exchangeable parts (see Figure 9–1):
- SPU Firmware, Board Controller - RYSNB 101 20
- CLU Firmware, Board Controller - RYSNB 101 19
- SPU-S DSP Firmware, Board Controller - REX-SW0013 or RYS 105 446

9.2   Board Description

Straps
Not applicable.

Connectors
The CLU part has 8 connectors at the front by which the CLCs are connected to the Base Stations and 1 connector for input of the Base Station power:

CLC 1–8	: To connect Base Station 1 to 8.
Base Station Power	: To connect -48 volts from the MCCB for powering the Base Stations.

The power connector does not have a polarity. It makes no difference which pin becomes plus or minus.

LEDs
SPU part:

LED1	Green	: Normally on. Power On LED SPU
LED2	Red	: Normally off. Watch–dog LED SPU
LED3	Red	: Normally off. Board not polled LED SPU
LED4	Red	: Normally off. Board Error LED SPU

CLU part:

LED1	Green	: Normally on. Power On LED CLU
LED2	Red	: Normally off. Watch–dog LED CLU
LED3	Red	: Normally off. Board not polled LED CLU
LED4	Red	: Normally off. Base Station in NEW state or board error CLU

SPU-DSP Firmware, Board Controller
REX-SW0013 or RYS 105 446

SPU Firmware, Board Controller
RYSNB 101 20

SPU part

LED1

LED4

CLU part

LED1

LED4

Base Station Power

P1   P0

CLC8

Base 8

CLC7

Base 7

CLC6

Base 6

CLC5

Base 5

6,7: SC0
2,3: SC1
5,8: EPP0
1,4: EPP1

Base 4

CLC4

7 8

Base 3

5 6

CLC3

3 4

Base 2

1 2

CLC2

CLC1

Base 1

CLU Firmware, Board Controller
RYSNB 101 19

Thermistor

Fig. 9–1 SLU - REX-BRD0015 or ROFNB 157 16/1
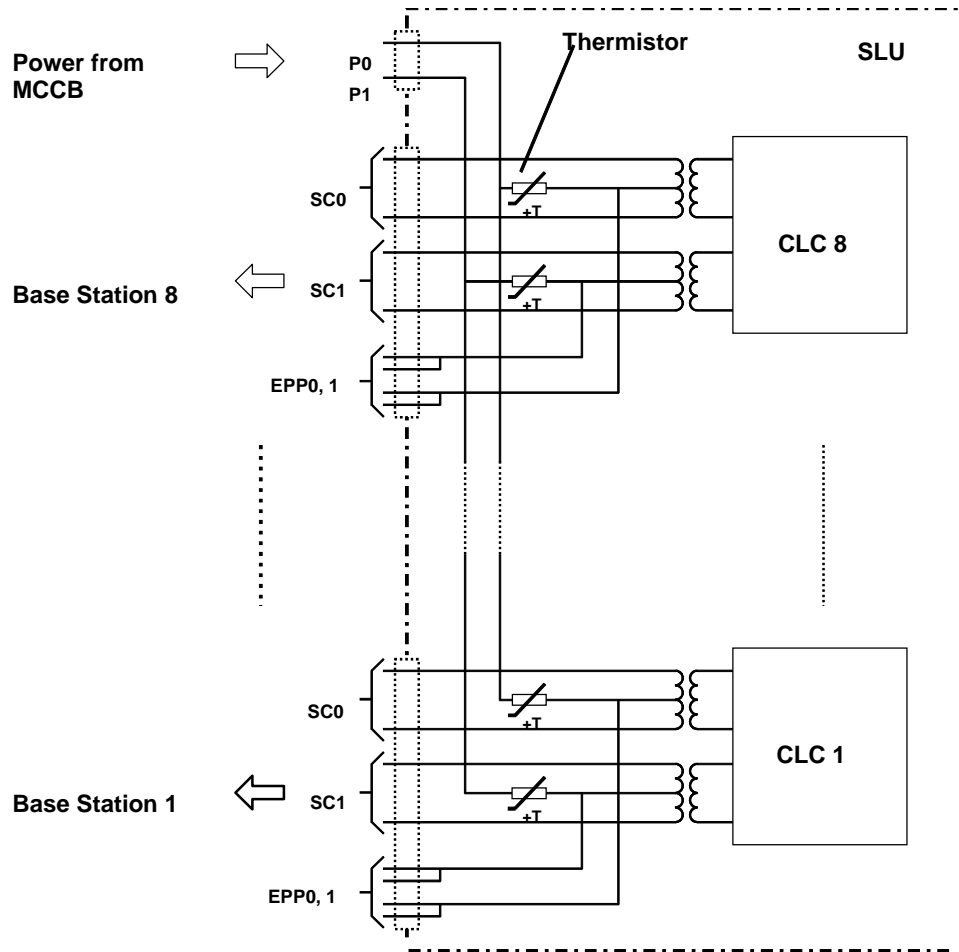
Fig. 9–2 Base Station Power Distribution on the SLU

9.3   Installation

1. Insert the SLU into the card guide in the specified board position.
2. Gently push the board into the back connector until it locks. Don't use any force.
3. Connect the CLU power cable, TSRNB 101 33.
4. Connect the CLU signal cable, NTM/TSRNB 101 29.

CHAPTER 10
Speech Processing Unit (SPU–S) – REX-BRD0017 or *ROFNB 157 16/3*

10.1 General

Maintenance

The SPU–S contains the following field–exchangeable parts (see Figure 10–1):

- SPU Firmware, Board Controller, RYSNB 101 20
- SPU-S DSP Firmware, Board Controller, REX-SW0013 or RYS 105 446

10.2 Board Description

Straps and Connectors

Not applicable.

LEDs

LED1	Green	: Normally on. Power On LED
LED2	Red	: Normally off. Watch–dog LED
LED3	Red	: Normally off. Board not polled LED
LED4	Red	: Normally off. Board Error LED

10.3 Installation

1. Insert the SPU–S gently into the card guide in its specified board position
2. Gently push the board into the back connector until it locks. Don't use any force.

**SPU-DSP Firmware, Board Controller
REX-SW0013 or RYS 105 446**

**SPU-S Firmware, Board Controller
RYSNB 101 20**

LED1

LED4
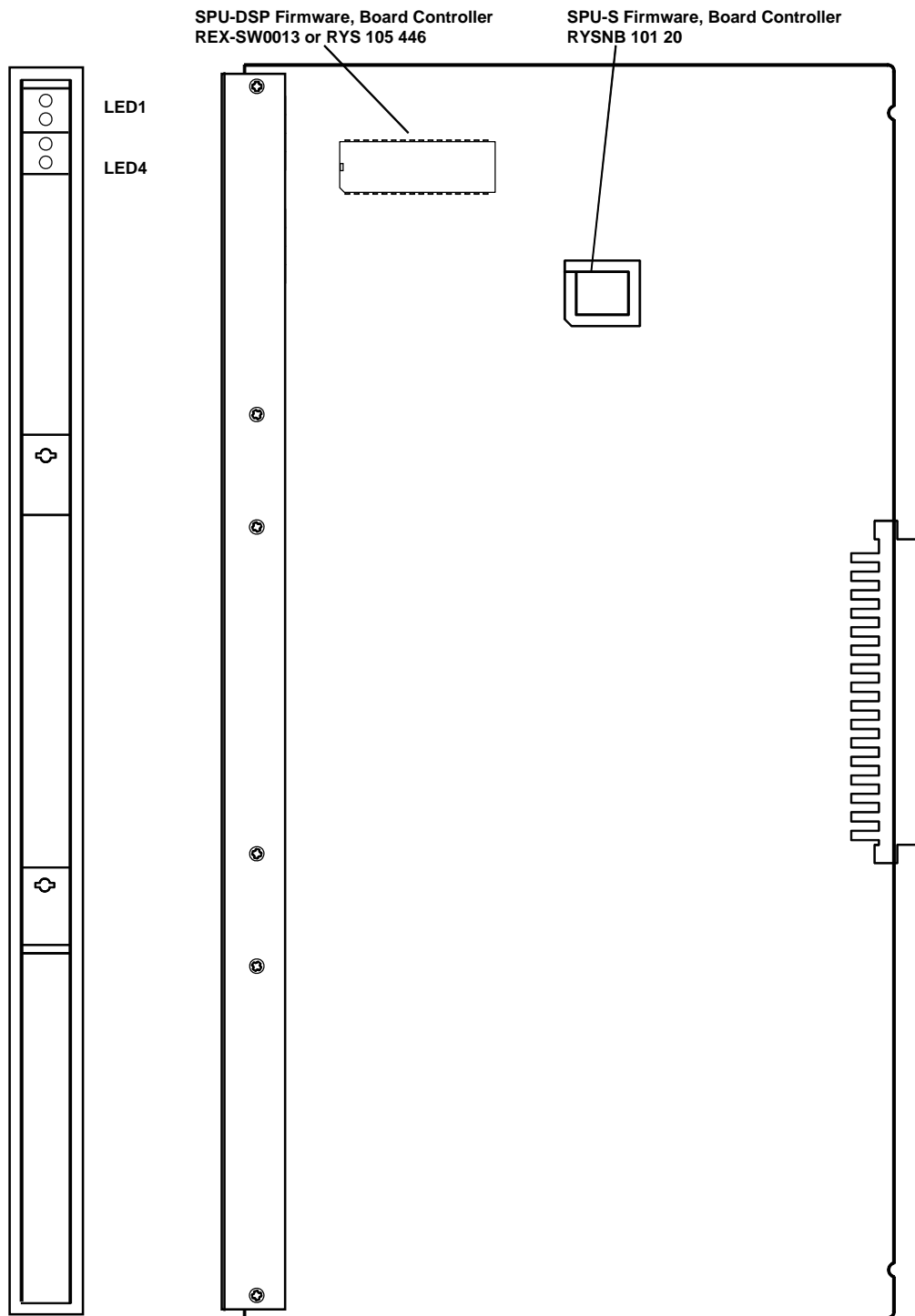
Fig. 10–1 SPU–S - REX-BRD0017 or ROFNB 157 16/3

CHAPTER 11
Digital Trunk Unit (DTU–E1) – REX-BRD0002 or *2/ROFNB 157 13/1*

11.1 General

The DTU–E1 provides 60 communication channels via two 2 Mbit/s links.

Maintenance
The DTU–E1 has the following field–exchangeable parts (see Figure 11–2 for placement & orientation):
- DTU–E1 CCS Firmware Set NTM/RYSNB 101 17/3
- DTU–E1 CAS Firmware Set RYS 105 664
- The DTU–E1 Firmware Set is delivered as a separate item

11.2 Board Description

The DTU–E1 Board contains two identical DTCs (DTC1 and DTC2), each with their own identical connectors and LEDs.

Straps
By means of straps, the type of cable to be used can be selected: coaxial pairs or 120 ohm twisted pairs (symmetrical). In Figure 11–1 an overview of the strap settings is given, for the location refer to Figure 11–2.

Note:
The straps should be placed in the twisted pair position (120 Ω).
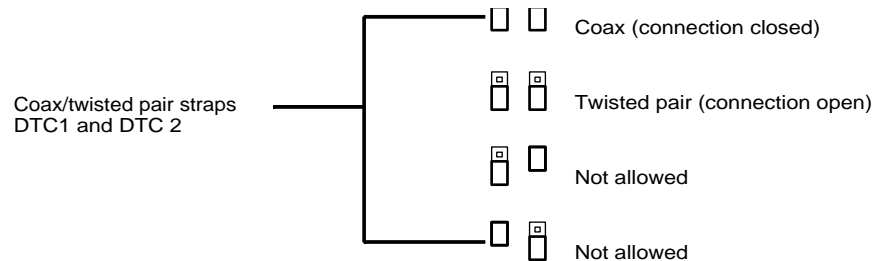
Fig. 11–1 Strap Settings DTC1/DTC2

Connectors
The DTU–E1 board has 4 connectors at the front, two for each DTC. One is for coax cable and the other one is for twisted pair cable connection. See Figure 11-2.

LEDs
Each DTC has its own LEDs:
LED1   Green   : Normally on. Power On LED
LED2   Red   : Normally off. Watch–dog LED
LED3   Red   : Normally off. Board not polled LED
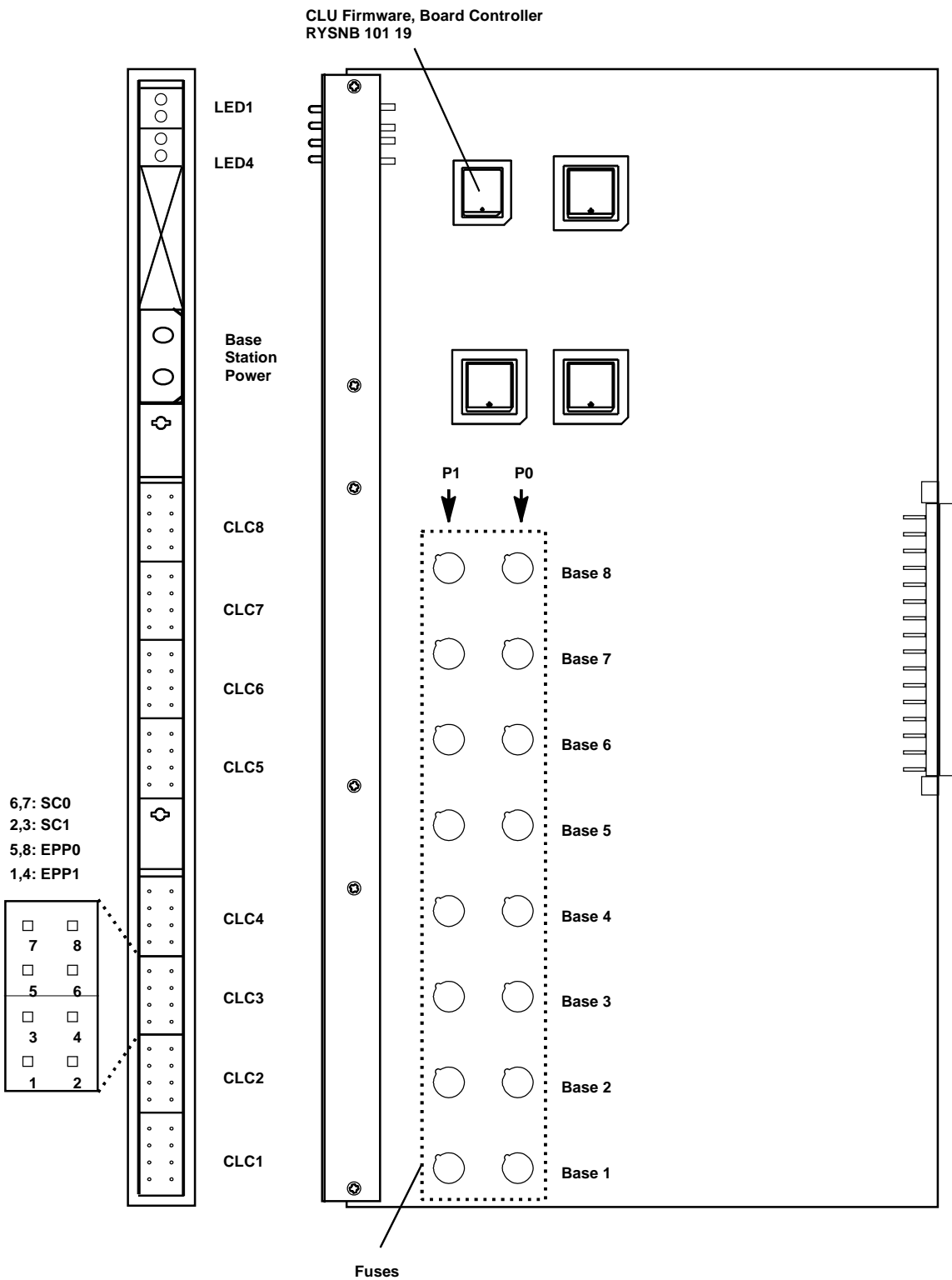LED4   Red   : Normally off. Board Error LED

11.3   Installation

1.   Place the DTU–E1 Firmware Set PROMs into the IC sockets as indicated and check the strap settings (see Figure 11–1).
2.   Insert the DTU–E1 into the card guides in the specified board position.
3.   Gently push the board into the backplane connector until it locks. Don't use any force.
4.   Connect the twisted pair cables for cable set AWS1033 to the front of the board.
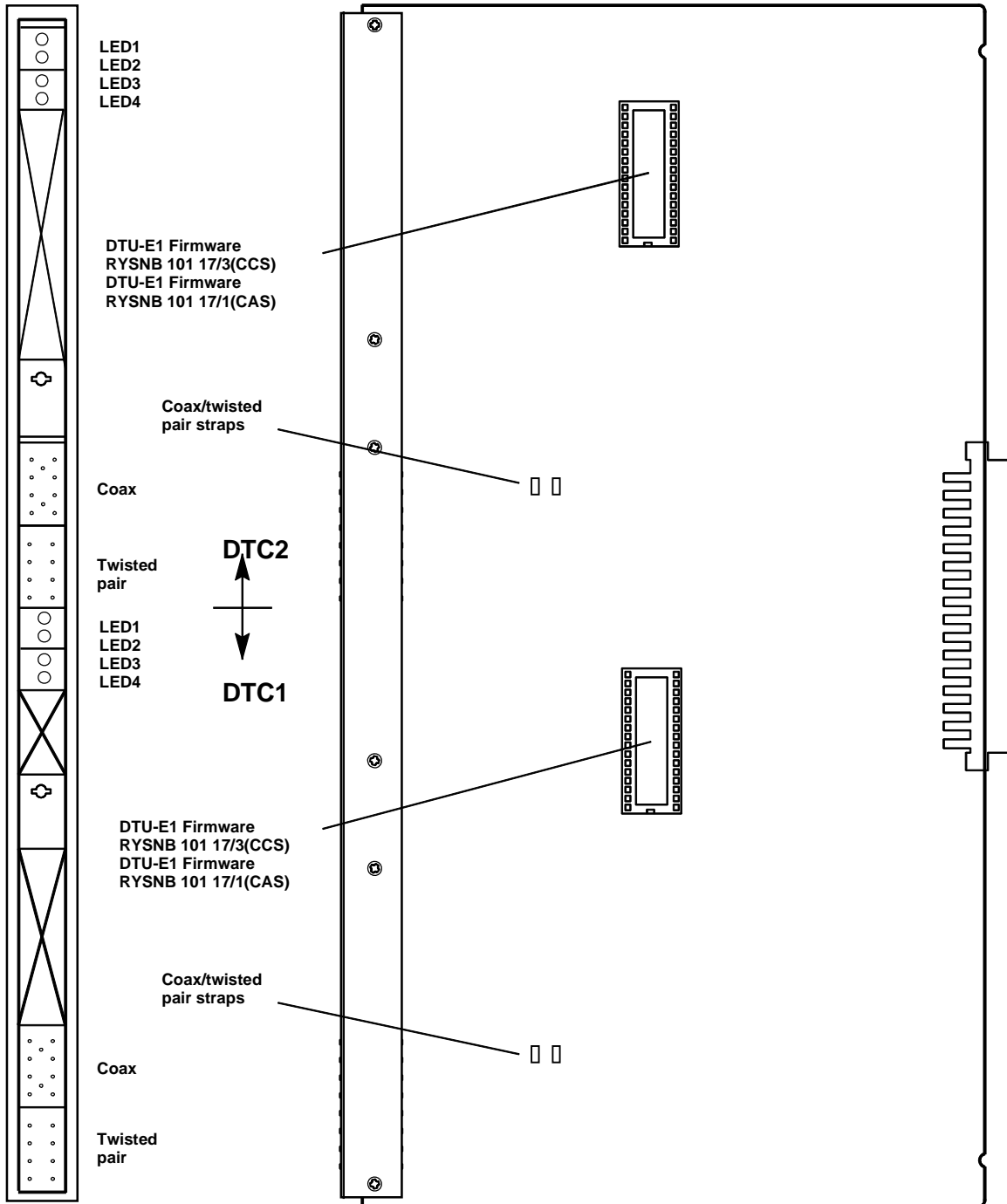
Fig. 10–2 DTU–E1 – REX-BRD0002 or 2/ROFNB 157 13/1

CHAPTER 12
Digital Trunk Unit (DTU-T1, CAS) - REX-BRD0021 or *2/ROFNB 157 13/2*

12.1   General

The DTU–T1 provides 48 communication channels with the PBX via two 1.544Mbit/s links.

Maintenance
The DTU–T1 has the following field–exchangeable parts (see Figure 12-1 for placement & orientation):
● DTU–T1 CAS Firmware RYS 105 660 (Factory Installed)

12.2   Board Description

The DTU–T1 Board contains two identical Digital Trunk Circuits (DTC1 and DTC2), each with their own identical connectors and LEDs.

Jumpers
The line length selection can be adjusted with the three jumpers, 1, 2, and 3 (see Table 13-1).

Cables
The DTU-T1 interfaces via 100 ohm twisted pair cable only (AWS1034)

Connectors
The DTU–T1 board has two connectors on the front, one for each DTC. The connectors are for twisted pair connections to the PBX.

LEDs
Each DTC has its own LEDs:
LED1	Green	: Normally on. Power On LED
LED2	Red	: Normally off. Watch–dog LED
LED3	Red	: Normally off. Board not polled LED
LED4	Red	: Normally off. Board Error LED

12.3   Installation

1. Place the DTU–T1 Firmware PROMs and set the jumpers (see Figure 12-1 and Table 12-1).
2. Insert the DTU–T1 on to the card guide in the specified board position.
3. Gently push the board into the backplane connector until it locks. Don't use any force.
4. Connect the cable, AWS1034, to the front of the board.

Cable length (Ft.)	Jumper placed		
	1	**2**	**3**
0 – 164	Y	N	N
66 – 262	N	Y	N
197 – 426	Y	Y	N
361 – 656	N	N	Y
459 – 754	Y	N	Y
689 – 951	N	Y	Y
886 – 1050	Y	Y	Y

Table 12–1 Setting of the Jumpers
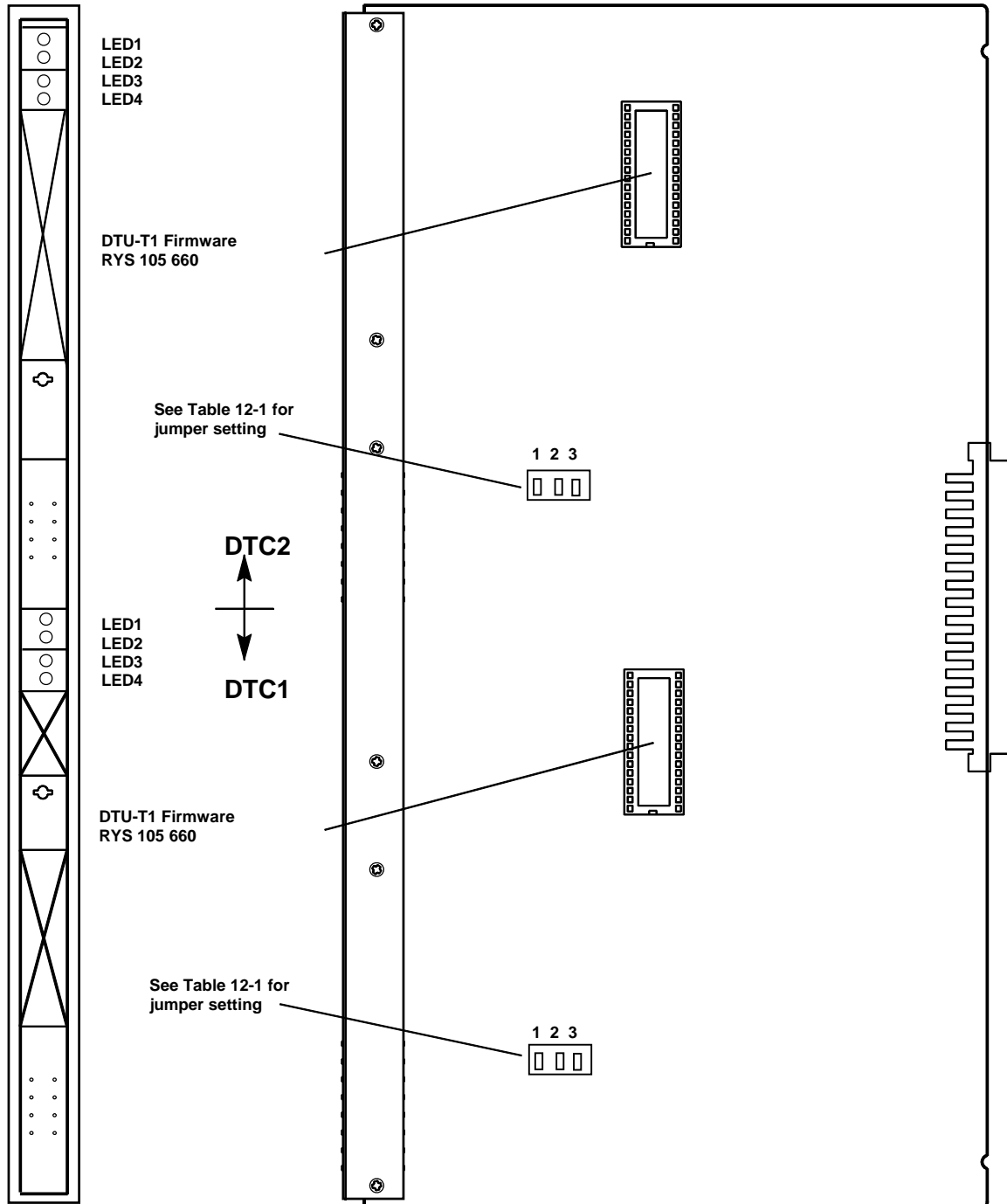
Fig. 12–1 DTU–T1 – REX-BRD0021 or 2/ROFNB 157 13/2

CHAPTER 13
Digital Trunk Unit (DTU-T1, CCS) - REX-BRD0025 or *2/ROFNB 157 13/3*

13.1   General

The DTU–T1 provides 46 (23B+D) communication channels via two 1.544Mbit/s links (primary rate interfaces).

Maintenance
The DTU–T1 has the following field–exchangeable parts (see Figure 13-1 for placement & orientation):
● DTU–T1 CCS Firmware RYS 105 650
● The DTU–T1 CCS Firmware is pre-installed on the board.

13.2   Board Description

The DTU–T1 Board contains two identical Digital Trunk Circuits (DTC1 and DTC2), each with their own identical connectors and LEDs.

Cables
The DTU-T1 interfaces via 100 ohm twisted pair cable only (AWS1034).

Jumpers
The line length selection can be adjusted with the three jumpers 1, 2 and 3 (see Table 13-1).

Note:
The jumper settings should be 3 O, 2 O and 1 C if the DTC is externally looped back via the twisted pair connector.

Connectors
The DTU–T1 board has 4 connectors at the front, two for each DTC. Only the twisted pair connector is used. See Figure 13-1.

LEDs
Each DTC has its own LEDs:
LED1   Green   : Normally on. Power On LED
LED2   Red   : Normally off. Watch–dog LED (not significant)
LED3   Red   : Normally off. Board not polled LED
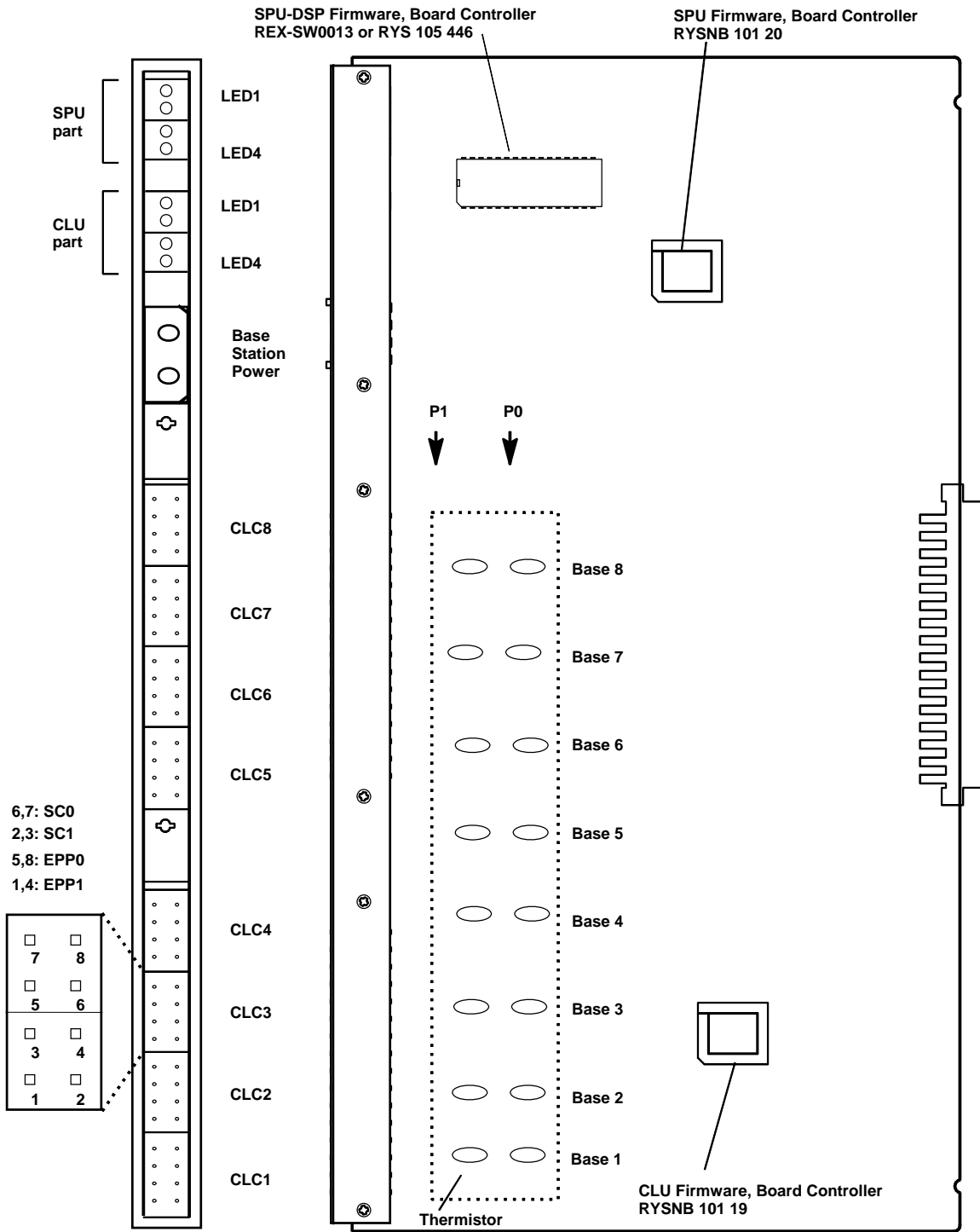LED4   Red   : Normally off. Board Error LED

13.3   Installation

1.   Place the DTU–T1 Firmware PROMs and check the strap setting (see Figure 13-1).
2.   Insert the DTU–T1 into the card guide in the specified board position.
3.   Gently push the board into the backplane connector until it locks. Don't use any force.
4.   Connect the cable, AWS1034 to the front of the board.

Cable length (Ft.)	Jumper placed		
	1	2	3
0 – 164	Y	N	N
66 – 262	N	Y	N
197 – 426	Y	Y	N
361 – 656	N	N	Y
459 – 754	Y	N	Y
689 – 951	N	Y	Y
886 – 1050	Y	Y	Y

Table 13–1 Setting of the Jumpers

LED1
LED2
LED3
LED4

DTU-T1 Firmware
RYS 105 650

See Table 13-1
for jumper setting

1 2 3

Coax

Twisted
pair

DTC2

LED1
LED2
LED3
LED4

DTC1

DTU-T1 Firmware
RYS 105 650

See Table 13-1
for jumper setting

1 2 3

Coax

Twisted
pair
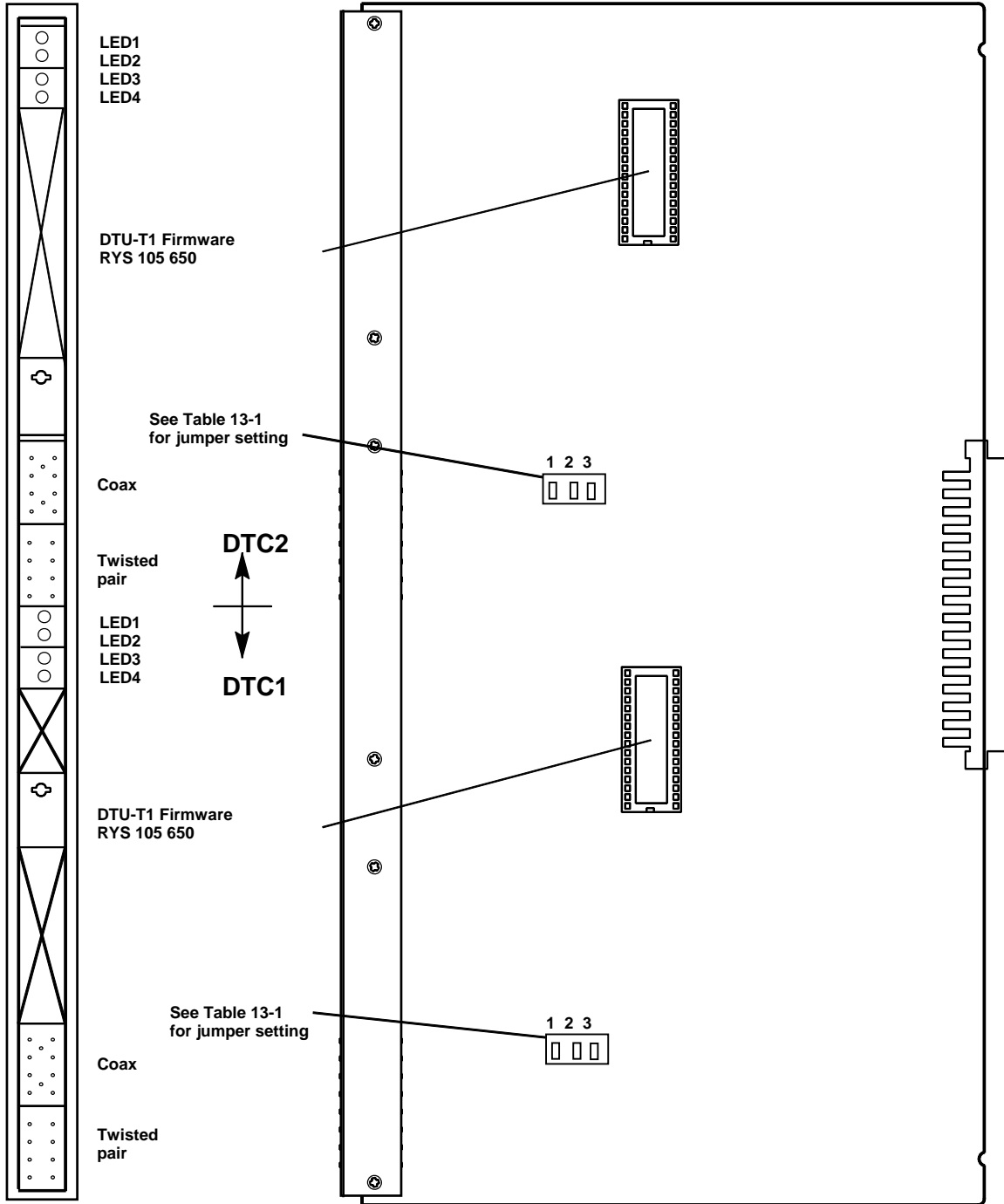
Fig. 13–1 DTU–T1– REX-BRD0021 or 2/ROFNB 157 13/3

Technical Product Manual - DCT1900

Installation Instructions, Line Termination Unit (LTU) – REX-BRD0007 or ROFNB 157 02/6 and LTU2 - REX-BRD0019A or ROFNB

CHAPTER 14
Line Termination Unit (LTU) – REX-BRD0007 or *ROFNB 157 02/6* and LTU2 - REX-BRD0019A or *ROFNB 157 25/2*

14.1   General

The LTU supports 8 two wire analog connections to a PBX.

Maintenance
The LTU contains the following field–exchangeable part (see Figure 14-1):
● LTU Firmware - REX-SW0012 or RYS 105 661
● LTU2 Firmware - REX-LTU2FW 01/1H

Note: LTU2 can only be used with CPU2 board.

14.2   Board Description

Jumpers
Not applicable.

Connectors
The LTU has 4 connectors at the front by which Line Termination Circuits (LTCs) are connected to the PBX/Centrex.
1.   LTC1 – LTC4: connection of PBX line 1 to 4
2.   LTU Ground: connection of signalling earth (ELR)
3.   LTC5 – LTC8: connection of PBX line 5 to 8
4.   Pin a is tip, pin b is ring. Pins a' and b' are not used.

LEDs
LED1   : Normally on. Power On
LED2   : Normally off. Watch–dog
LED3   : Normally off. Board not polled
LED4   : Normally off. Board Error

14.3   Installation

1.   Insert the LTU gently into the card guide in its specified board position (See Figure 14-1).
2.   Gently push the board into the back connector until it locks. Do not use any force.
3.   Connect the connectors from cable set NTM/TSRNB 101 31 to the front of the board.

Technical Product Manual - DCT1900

Installation Instructions, Line Termination Unit (LTU) – REX-BRD0007 or ROFNB 157 02/6 and LTU2 - REX-BRD0019A or ROFNB

LED1
LED2
LED3
LED4

LTC8
LTC7

LTC6
LTC5

LTU Ground

LTC4
LTC3

LTC2
LTC1

LTU Firmware REX-SW0012 OR RYS 105 661

LTU2 Firmware REX-LTU2FW01/1H
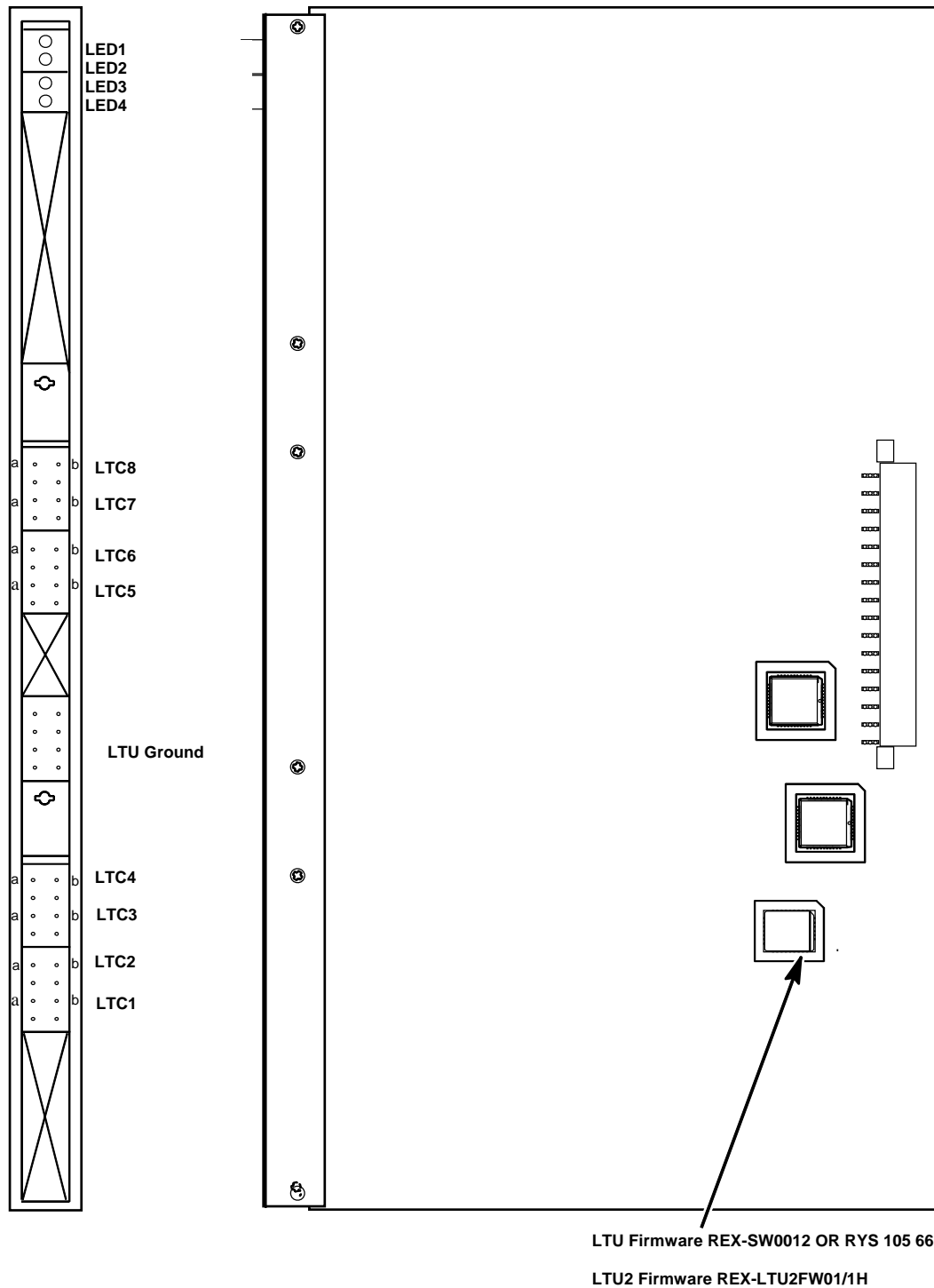
Fig. 14–1 LTU - REX-BRD0007 or ROFNB 157 02/6 and
LTU2 - REX-BRD0019A or ROFNB 157 25/2

CHAPTER 15
Digital Line Unit (DLU) - REX-BRD0023
AWS1024 Meridian, AWS1025 Norstar, AWS1026 Lucent

15.1   General

There are 12 transformer-isolated digital front ends (ports) on the board that provide 12 individual digital lines. These digital lines can support up to 12 Portable Telephones.

Maintenance

Upgrades and re-programming of the DLU board's flash memory are done via the RS232 serial cable and the serial port on the face of the DLU board (COM 1). The board does not need to be removed from the system during reprogramming but all twelve ports will be out of service during this process. The RJ-45 connectors should be disconnected from the DLU board before downloading software.

The boards may be inserted into or removed from a live system. Other boards already in the system however, may reset during live insertion.

The DLU will come pre-programed with software specific to each PBX. The DLU board will have a specific part number for each PBX it is to integrate with.

The DLU is programable to accommodate the need for software enhancements and fixes.
Note:
Boards should be inserted /removed one at a time. All connections to the RJ45 connectors and the DB9 connector should be removed prior to live insertion or removal.

15.2   Board Description

Jumpers
Not applicable

Cables
The DLU interfaces via cable set AWS1019. Each cable serves 2 boards.

Connectors

COM 1	: The RS232 serial port is for field service.
JP6 (ports 1 - 6)	: The RJ45 connectors on the front end are for twisted pair connections to the PBX. There are 12 connectors, one for each
JP7 (ports 7 - 12)	DLC. (The Tip/Ring connections appear on pair 1 (pins 4 and 5) of the RJ45 connector).
JP5	: Backplane connector, female DIN96 R type.

LEDs

LED1	Green	: Normally on. Power On LED
LED2	Red	: Normally off. Watch–dog LED
LED3	Red	: Normally off. Board not polled LED
LED4	Red	: Normally off. Board Error LED.

15.3   Installation

1. Insert the DLU on to the card guide in the selected board position.
2. Gently push the board into the backplane connector until it locks. Don't use too much force.
3. Connect the connectors from cable set AWS1019 to the front of the board according to the numbered positions.

15.4   Programming

CPU Settings
The information below is for a Stand Alone Radio Exchange strapped as a Master.

The CPUs frame timing sychronization source strap must be strapped to sync externally. If the Radio Exchange has a DTU, it will synchronize from this link first. If no DTU is present, it will use the DLU link for synchronization. See Figure 5-1, Chapter 5, Section 5 and Figure 6-2, Chapter 6, Section 5 for further strap guidance for CPU1 and CPU2.

Set-Up
The following must be connected and set-up before you can update the DLU.
*   Make sure the Radio Exchange is powered on the CPU1 is at least release R5C or higher, and the CPU2 is at least R2A or higher.
*   DLU must be inserted into the Radio Exchange.
*   DLU interface cable must be connected from an available COM port on the PC to the front COM port of the DLU being updated.

<Application>.hex Version Download Procedure
Before continuing, make sure all requirements listed above are met. The following steps will explain how to donwload the newest application software for the DLU.

1. At the DLU> prompt, press **da** and **return**. Terminal should display "Erasing the download area......" and "Begin transmission now, CTRL-C to abort" and "DLU>"
2. Press **File:Send File** in the Tera Term application; select the <application>.hex file you want to download and press **Open**. A pop up window should display the filename you are sending and the bytes being transferred. When the file is completely transferred (~2 min.), the window will disappear and the board should reset. On the display you should see ">>>Boot DLU [PBX type] Ver: Application version....." and "DLU>"

\<FPGA\>.mcs Version Download Procedure

1. At the DLU> prompt in the terminal window, press **df** and **return**. Should see "Erasing download area, blocks 3,4,5 and "Transmit \<fpga\>.mcs file now, CTRL-C to abort" and "DLU".

2. Press **File:Send File** in the Tera Term application; select the \<FPGA\>.mcs file you want to download and press **open**. A pop up window should display the filename you are sending and the bytes being transferred. When the file is completely transferred (~4 min.), the window will disapper and the board should reset. On the display you should see ">>>Boot DLU[PBX type] Ver: Application version H/W:FPGA version......." and "DLU".

At this point, if both of these procedures have completed without error, you have successfully upgraded the DLU board.
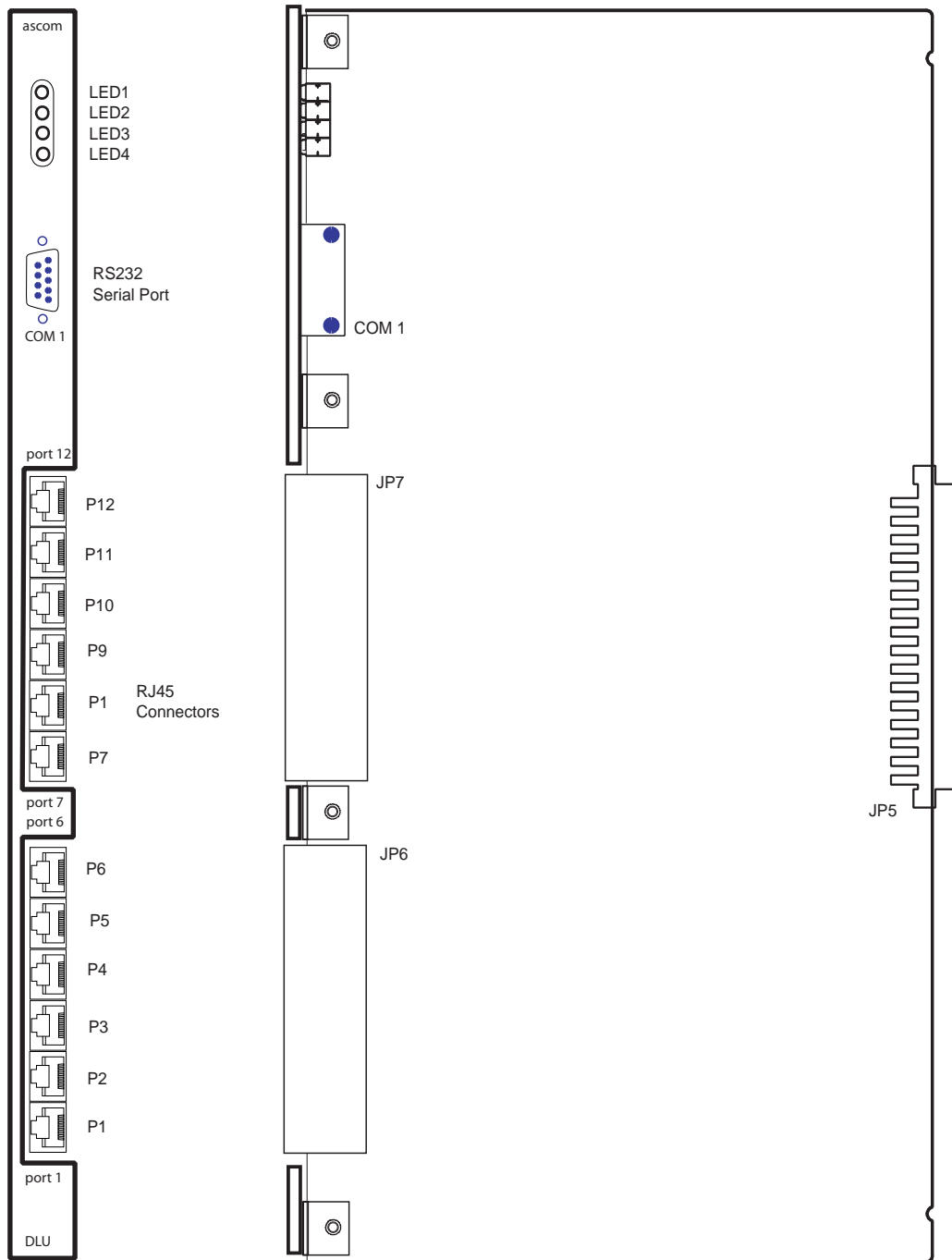
Fig. 15–1 DLU - REX-BRD0023

CHAPTER 16
Base Station – KRC 101 1371

To order a complete Base Station, use Part Number: DB600-001

16.1   General

The Base Station is connected to the RE by means of minimum CAT3, unshielded twisted pair cables via a RJ45 connector.

Contents of the Box
The box in which the Base Station is packed contains:
● A Base Station
● Mounting Bracket

Power Distribution
Base Stations can be powered by:
● The RE via the data pairs
● The RE via the data pairs and the EPP pair(s) - for extended distances
● A local AC/-48V DC Adaptor
● An external -48V supply

Note:
For more information about power distribution, refer to Section 4, Chapter 4 "Base Station Powering".

Firmware
If necessary, the firmware in the Base Station can be updated by downloading the firmware into the Base Station. Downloading can be performed without disconnecting the Base Stations. The new firmware is stored in flash memory. How to download the firmware is described in CSMW Help files.

Connectors
X838	: 8–pin RJ45 modular jack
X839	: 8–pin RJ45 modular jack
X840	: 6–pin RJ11 modular jack - for engineering use only

The two RJ45 connectors are interconnected on the board, but only one is connected at a time. Cabling must be terminated on a modular jack(RJ45).

LEDs (Fig. 16-1)

LED1	Power LED	Green	:	Base Station powered
LED2	Status LED	Green/Red/Orange	:	Base Station Status

LED 1	LED 2	Meaning
OFF	OFF	Base Station is not operational. There is no power.
GREEN	OFF	Base Station is operational. There are no active connections.
GREEN	GREEN	Connection(s) is(are) made with the base station.
GREEN	RED	Base Station is unlocked. Base Station is not synchronized to RE.
GREEN	FLASHING RED/GREEN	Base Station is operational but not available (self test, not initialized, no communication with CCFP, no UTAM approval)
GREEN	ORANGE	Base Station is downloading.

Table 16-1 Meaning of LED1 and LED2
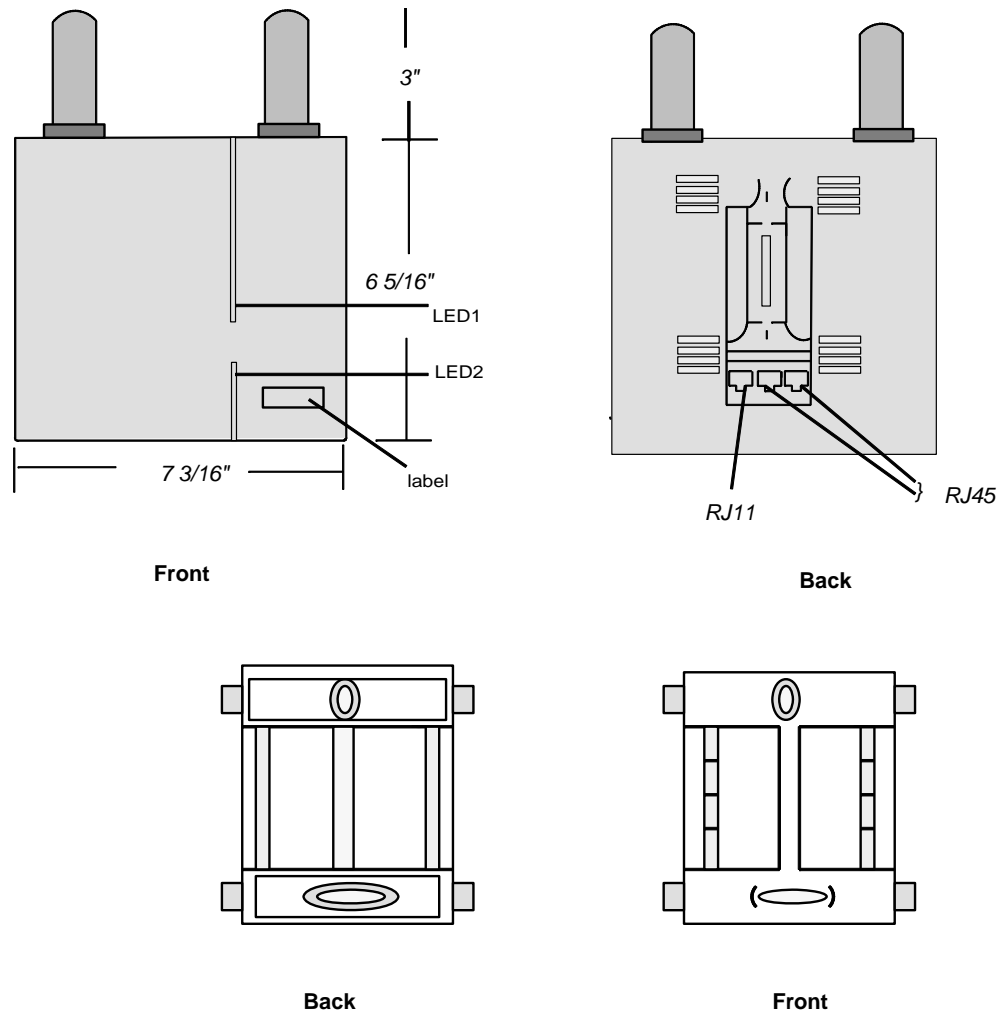
Fig. 16-1 Base Station Cover and Back

16.2 Base Station Cabling

Each Base Station requires a minimum of 2 pairs of CAT3 unshielded twisted pair cable. These two pair will be SC0 (signalling channel 0) and SC1 (signalling channel 1). Besides being used for signalling there is also 48 volts provided between the two pair to power the Base Station. One pair is at a -48V potential with respect to the other pair.

How far a Base Station may be powered on the two pair is shown in a chart in Section 4, Chapter 4, Table 4-3. If the cable distance to the Base Station exceeds the value in the chart for 2 pair, then the EPP (Express Power Pair) may be used. The EPP is a third pair of wires brought out of the Radio Exchange that supplies -48V. The EPP contains two wires, EPP0 and EPP1, where EPP1 is positive with respect to EPP0.

The cable set, NTM/TSRNB 101 29, that connects the CLU/SLU to the MDF brings out the three pairs mentioned above: SC0, SC1, and EPP. Refer to Fig. 21-3, 66 Block Diagram in Chapter 21 for the pin out of the 66 Block where this cable terminates.

A minimum of -21V DC is required at the Base Station for it to operate. When a Base Station is located too far away from the Radio Exchange to be powered by the Radio Exchange, then power can be provided by a local -48V power supply or an AC to 48V DC adaptor. The power supply or adapter should be placed in the last Intermediate Distribution Frame before the Base Station. Hook the output of the power supply/adapter to the EPP wires going to the Base Station; DO NOT connect the EPP wires at the Radio Exchange. Only the two data pairs should go from the Radio Exchange to the Base Station in this situation. The EPP wires are picked up in the last Intermediate Distribution Frame where the Base Station's power source is located.

16.3   Base Station Cable Delay Measurement

The cable delay in each of the cable pairs going to every Base Station must be measured in order to program the Base Station delays into the system at initialization time. This is necessary in order to synchronize all Base Stations in the system.

Base Station cable delay may be measured by two methods, ADM or measurement with a TDR (Time Domain Reflectometer).

ADM, or Automatic cable Delay Measurement, is a feature where the CPU automatically measures the delay in the cable hooked up to a Base Station. Beginning with the hardware and software releases listed below, the DCT1900 system can automatically determine the correct Base Station cable delay. This means that it is no longer mandatory to have a TDR (Time Domain Reflectometer) on each and every job site to measure the cable delays.

Item	Hardware PN	Rev	Firmware/Software	Application	Firmware PN	Rev
CPU1	REX-BRD0004	R1A	DCT1900 Firmware	Mobility	RYS 105 447	R2A
			DCT1900 Firmware	Standalone	RYS 105 657	R2A
CPU2	REX-BRD9033	R1A	DCT1900 Firmware	Standalone		
CPU2	REX-BRD9034	R1A	DCT1900 Firmware	Mobility		
SLU	REX-BRD0015	R3B	CLU-S Board Controller	MOB & SA	RYSNB 101 19	R2A
CLU-S	REX-BRD0016	R3A	CLU-S Board Controller	MOB & SA	RYSNB 101 19	R2A
CSM	NTM 201 2087	R2B	Unlicensed	Standalone	LZY 213 1031	R2B
CSM	NTM 201 1813	R2B	Unlicensed	Mobility	LZY 213 903	R2A
CSMW	REX-MCT9023	R3C	UTAM	MOB & SA		
CSMW	REX-MCT9022	R3C	International	MOB & SA		

Table 16-2 Minimum Release Requirements to Support ADM

Note:
ADM will not be supported if the system is not comprized of the listed minimum release levels. The Automatic delay measurement does not work with the CLU boards (REX-BRD0014 or ROFNB 157 11 or ROFNB 157 11/2)

Correct implementation of the automatic delay measurement requires that the base station be connected to the Radio Exchange and powered when adding the base station using the CSMW software. In previous installations the software requested the measured delay value. With the above revisions, **entering the default value of 0.1 microseconds** will initiate the Auto Delay Measurement. In the "Add Base Station" command process, the SLU/ CLU-S will talk to the base station and determine the time delay. This determined value will never be displayed in any of the system screens. **The delay table will always reflect the value of .1** if it was chosen. If you enter a TDR measured value other than 0.1, e.g.: 1.5, then this value will be used and displayed by the system.

In automatic mode the system determines the cable delay measurement every time the base station is powered, reset or when it is added.

Procedure
1. Install and terminate the Base Station cable with a RJ-45 connector.
2. Mount and connect the Base Station.
3. At the base station window, refresh and verify that the status is **NEW** for every Base Station to be added. If it is not, then trouble shoot the lines and hardware. In addition, a red LED on each of the CLU-S/SLU boards indicates a newly connected Base Station.
4. Add the Base Stations by selecting the CLU address, the base station port and the cable delay value which can be set to automatic or manual.
5. After all of the Base Stations have been added, each new base station will have a "Pending" status if the RE was initialized as a UTAM system. If the RE was initialized as a non-UTAM system, the status will change to AVAILABLE.
6. Activate the Base Stations with the correct UTAM password if the RE was initialized as a UTAM system.
7. Refresh the window to see the status of the new Base Stations as "Available."
8. Back up the system data.
9. Set two or more portables in engineering mode to perform a "walk around" test. Check for proper system operation, voice quality, handovers, and coverage.

Note:
The new DCT1900 Auto Delay Measurement system does not eliminate the need to use a TDR. The quality of the cable, and the possibility of wiring errors could negate the automatic measurement capability.

The second method, using a TDR, is explained in the following paragraph.

Base Station delays are measured at the RE with a TDR connected first to cable data pair SC0 and then to cable SC1 with the cable open ended at the far end and then shorted at the far end. While it is not necessary to determine the delay in the EPP pairs, if they are used, it is recommended that these pairs be checked with the TDR to ensure that they are going to where they are supposed to be and are not open/shorted anywhere.
1. Make sure that the Base Station cable is unplugged from the Base Station.
2. Disconnect the relevant connector from the relevant CLU or SLU.
3. Connect the TDR to cable pair SC0 or SC1 or EPP (refer to Chapter 25 on how to use the TDR).
4. Measure the cable delay. The measured delay is the time between sending a pulse down the line and receiving the echo. The resulting value must have an accuracy of 200 ns (corresponding with 18–27 ft.).

5. Enter the measured delay value into the correct column on the Base Station identification and Location chart (refer to "Table 21-1, Example of Base Station Administration" in Chapter 21) along with the Base Station number and location.
6. Repeat the delay measurement for all Base Stations connected to the CLU or SLU.
7. Re–connect the connectors to the CLU or SLU.

If applicable, repeat the delay measurement for the Base Stations connected to the other CLUs and SLUs.

16.4   Installation Criteria

The Base Station should always be mounted such that the antennas are vertical with respect to the floor or ceiling. Two types of antennas are available to facilitate the correct orientation of the Base Station. One set is a vertical antenna for wall mounting of the Base Station and the other set is a right angle antenna that allows the Base Station to be mounted on the ceiling.

The Base Station should never be mounted above the ceiling tiles as this reduces the coverage area. Base Stations should not be mounted near large metal objects, such as pipes or air conditioning conduits. Do not mount Base Stations directly on I-Beams or lamp poles, as these objects tend to distort the RF field which reduces the effectiveness of the RF coverage area. Use the Base Station outdoor wall mounting kit (see Paragraph 16.3.4) or a factory hanging device (see Paragraph 16.3.2). Do not mount the Base Station more than 20 ft. high.

Note:
When mounting Base Stations near to each other to provide additional call capacity, it is necessary to maintain at least 40 inches spacing between Base Stations.

The location where the Base Station is to be mounted is determined either by a previous site survey or by the needs of the customer when adding to a system.

The following is a recommended order of installing a Base Station:
-   Base Station cable delay measurement
-   Mounting the Base Station - indoor
-   Mounting the Base Station - outdoor
-   Connecting the Base Station plug to the cable

16.5   Connecting the Base Station Plug to the Cable

Note:
Make sure that there is no power applied to the Base Station cable on which you are working. Either the power cable or the signal cable on the front of the CLU/SLU should be disconnected before connecting the cable to the RJ45 plug. -48V DC for powering the Base Stations is provided between the data pairs and on the EPP wires.

1. Cut the Base Station cable to the correct length and connect the cable to the RJ45 Modular Jack (see Fig. 16-2 Connector Pinning).
2. If an external power supply or AC/DC converter is used to power the Base Station, it is recommended that this device be located in the last IDF in the signal path. Connection of the output voltage from these devices will be made to the EPP pairs going out to the Base Station.

RJ45
modular jack

Pin 1 = EPP1 - green/white
Pin 2 = EPP0 - white/green
Pin 3 = SC1-0 - white/blue
Pin 4 = SC0-0 - white/orange
Pin 5 = SC0-1 - orange/white
Pin 6 = SC1-1 - blue/white

SC=Serial   Channel
EPP=Express Power Pair
NC=Not   Connected

EPP1 EPP0 SC1-0 SC0-0 SC0-1 SC1-1 NC NC
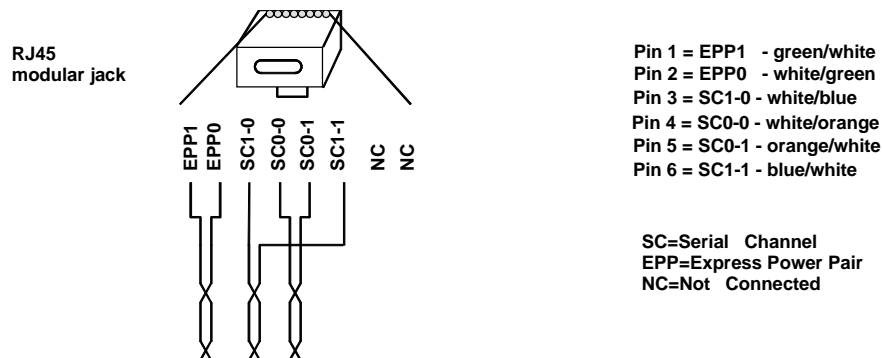
Fig. 16–2 Connector Pinning

Note:
After completion of the installation, Base Stations must be added using the CSMW "Installer Quick Guide".

16.6   Base Station Mounting - Indoor

16.6.1 Wall Mount

The Base Station comes with its own Base Station mounting bracket. The necessary antenna are ordered and shipped separately. The Base Station is to be mounted such that when wall mounted the top of the antenna is at least 6 inches below the ceiling. If the ceiling is made of metal or contains a metal plate, the distance between the metal plate and the antenna must be at least one foot.

Once the location where the Base Station is to be mounted has been determined, take the mounting plate (see Fig. 16-1, Base Station Cover and Back) and spot it where the Base Station is to be mounted.
1.   Mark the location for the mounting hardware.
2.   Secure the rear bracket to the wall. Use #6 mounting hardware. The side of the bracket with the part no. SXANB 101 127/X goes towards the wall.
3.   Plug the Base Station cable into either one of the RJ45 jacks on the back of the Base Station.
4.   Place the Base Station over the rear plate on the wall and slide it down until the Base Station locks in place onto the rear bracket.
5.   Connect the antenna to the Base Station, then slide the rubber grommet supplied with the antenna kit down over the antennas until they are firmly seated in the Base Station itself.

16.6.2 Ceiling Mount

A kit, part number NTM 201 1754   is provided for the ceiling mounting of base stations. Ine kit is required for each ceiling mounted base station. Teh following instructions, also the kit are included for reference.
Instructions - Ceiling Mount Kit
1.   Cut out center portion of mounting clip to make room for ceiling clip threads.
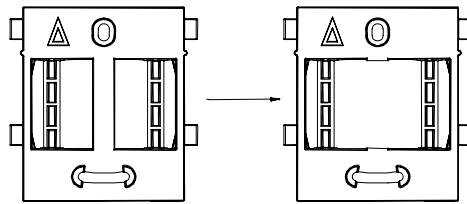
Fig. 16-3 Cut Mounting Clip

2. Adhere plastic spacer to the mounting clip.
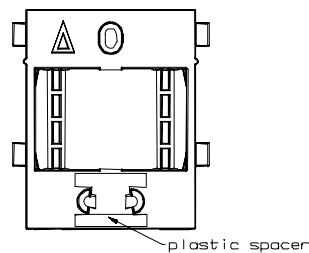
plastic spacer

Fig. 16-4 Mounting Clip with Plastic Spacer

3. Assemble the mounting clip to the ceiling bracket.
    From the bracket side, screw in the 6-32 screws with a #6 washer. Place mounting clip over screws and lock each screw in place with a 6-32 lock nut and a #6 washer. DO NOT OVERTIGHTEN.

6-32 screw
#6 narrow washer
ceiling bracket
mounting clip
6-32 lock nut
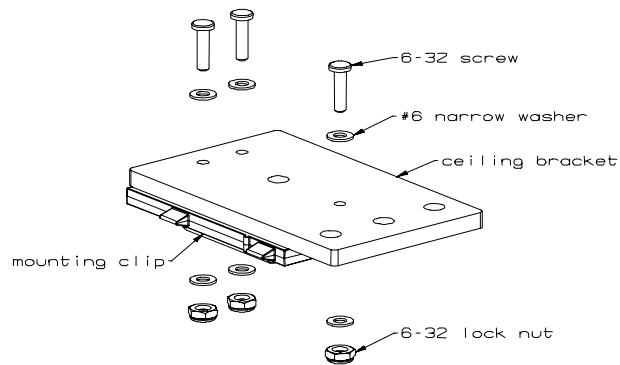
Fig. 16-5 Ceiling Bracket

4. Assemble the ceiling clips to the bracket.
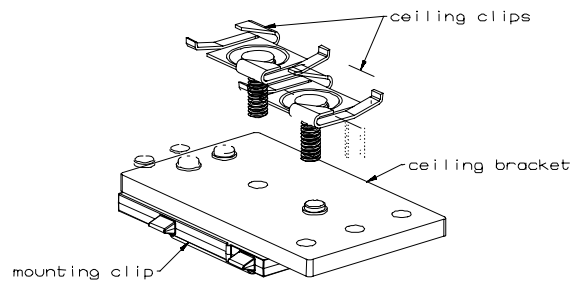
Fig. 16-6 Attaching Ceiling Clips to the Ceiling Bracket

a. Twist ceiling clip clockwise into the bracket until it bottoms out on the bracket.
b. Twist ceiling clip counterclockwise less than 1/2 turn to the orientation shown below.
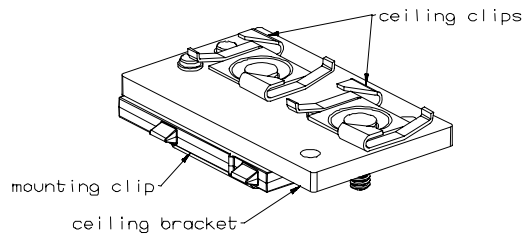
Fig. 16-7 Ceiling Clips Attached to Ceiling Bracket

5. Clip this assembly into the base station as shown. Disregard the arrows and "top" embossments.
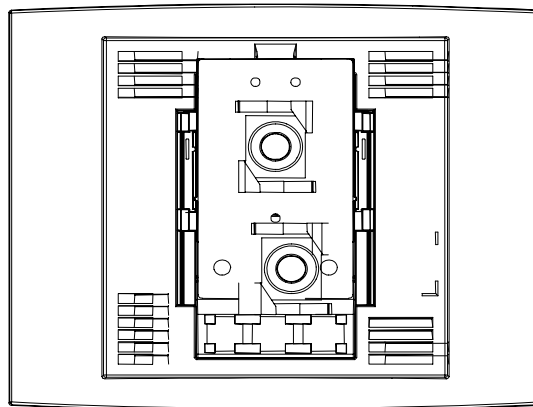
Fig. 16-8 Ceiling Bracket with Ceiling Clips attached to Base Station

6. Screw in the two 1/4-20 screws with the captured star washers as shown. Check that the assembly is locked to the base station.
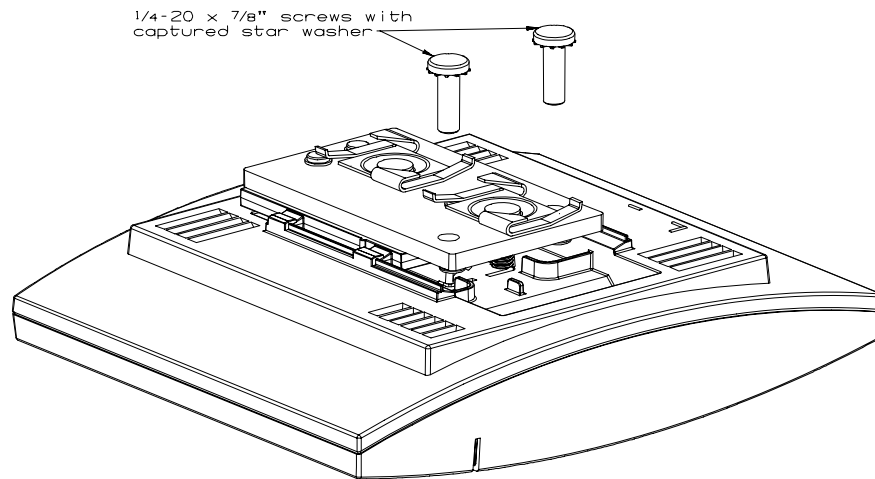
Fig. 16-9 Inserting Washers into Ceiling Bracket

7. Twist the ceiling clips clockwise and then back counterclockwise onto the ceiling grid.

16.6.3 Base Station Mounting to Factory Ceiling (I Beams)

Direct mounting of the DCT1900 Base Station to an I beam in the ceiling is not allowed because of the distortion caused to the radiated field pattern of the Base Station. Included in the following discussion is a recommended method of securing the Base Station to the overhead while not affecting the Base Stations' radiation pattern.

Mounting Technique
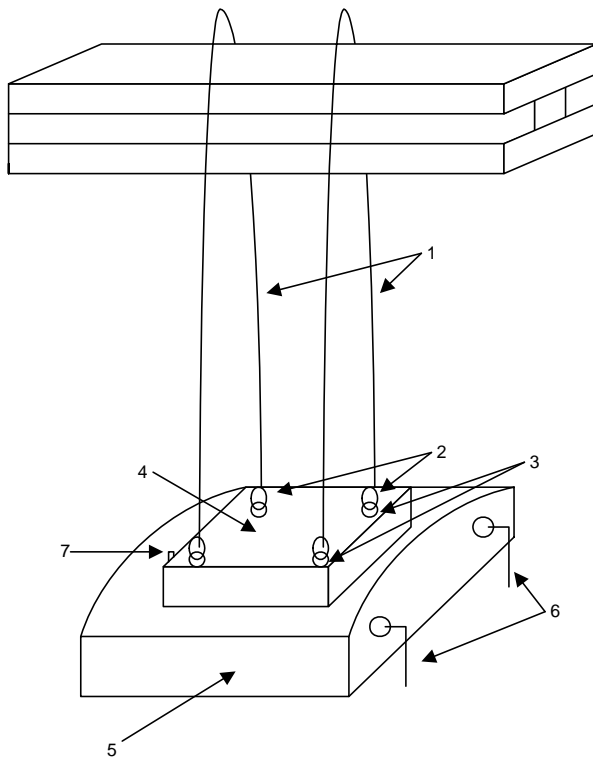
1: Small link chain, white or unpainted depending on ceiling color. Purchased at Home Depot (or similar store). TYPICAL (2) 6 foot lengths.

2: 1/8" Quick Link. Manufacturer - Campbell, p.n. 764-5106, quantity of 4. Purchased at Home Depot.

3: #8 Screw Eye - Quantity of 4. Purchased at Home Depot.

4: 5.5" x5" piece of 3/4" thick Melamine. Purchased at Home Depot and cut to size.

5: DCT1900 Base Station - DB600-001 .

6: DCT1900 Right Angle Antenna Set - KRE 101 1750/55 - quantity of 1.

7: Base Station cable connected to RJ45.

Fig. 16-10 Mounting to Factory Ceiling

The chain is to be used as two continuous pieces. Loop the chains around the I Beam and connect them to the screw eyes with the Quick Links. (See Figure 16-10.)

Always use right angle antennas.

Once the Base Station is mounted and the cable is connected to the base station, make sure that the Base Station cable is tie wrapped to one of the chains. This acts as a retention device so that the Base Station does not slide off of the mounting bracket.

See Figure 16-11 for screw mounting dimensions.
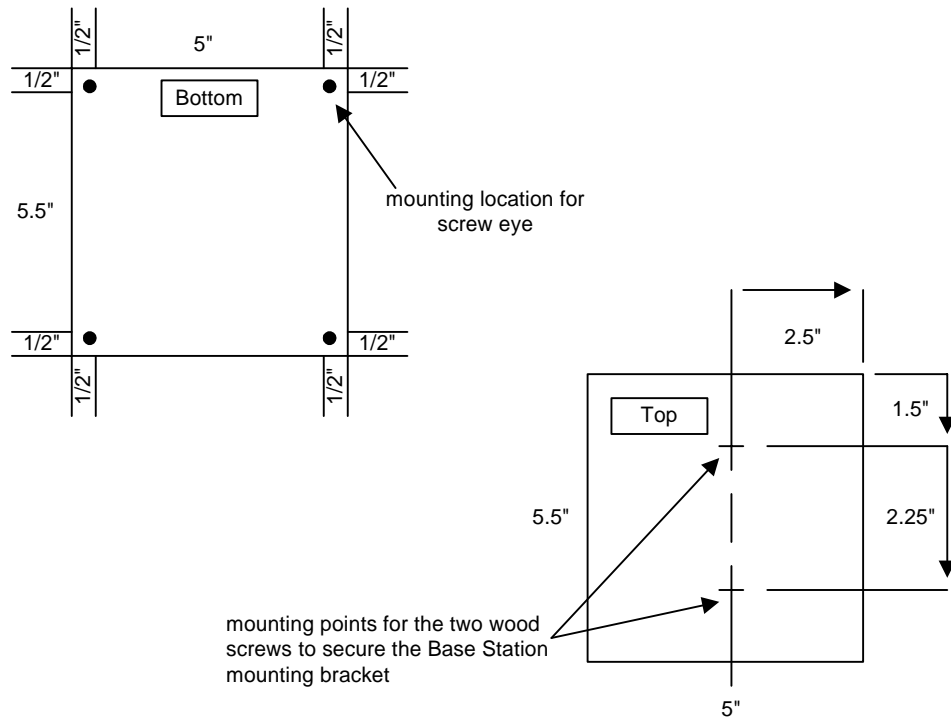
Fig. 16-11 Mounting Locations

16.7   Base Station Mounting - Outdoor

*Warning: **Installation of outside equipment is to be installed in accordance with required electrical code to include NEC 725, 800, 810 AND CEC 54, 60 (Lightning and ground requirements).***

When mounting outdoors or to exterior building walls or large metal objects or to lamp posts, it is imperative that the Base Station is not placed directly up against any or these objects. Use of the outdoor/wall mounting kit, NTM 201 1718, is recommended. The following instructions are contained within the outdoor/wall mounting kit, NTM 201 1718.

Outdoor Base Station Mounting Instruction

Introduction

For outdoor and campus applications, standard (indoor) DCT1900 Base Stations are mounted in the weatherproof fiberglass housing. This industry recognized (NEMA, UL, IEC, CSA) housing is designed for pole or wall-mounting commercial electronic and telephone equipment in outdoor areas, as well as indoor industrial applications where chemical vapors and/or high dust contamination exists.

Precise determination of Base Station location is identified at the time of an RF site survey to provide optimal coverage (per Base Station). Housings can sometimes be directly mounted on building surfaces, however radio coverage is generally not optimal under this condition. In

locations where coverage area and range need to be optimized, it is important to mount Base Stations several wavelengths (~6-18") away from building surfaces, and in the case of large metal building surfaces, absolutely imperative.

The components within the Outdoor Base Station Mounting Kit provide this needed functionality. The key components consist of two Mounting Plates and two Mounting Arms. The Small-Pattern Mounting Plate is <u>always</u> used on the weatherproof housing (to avoid placing too much metal near the Base Station). The Large-Pattern Mounting Plate is secured to the building surface. It has a larger surface area with several hole spacings for flexibility in mounting on varied and irregular building surfaces. The Mounting Arms are supplied in 3 lengths depending on the application need. The combinations of these components provide the installer the ability to securely mount the housing on almost any axis or location, as can be seen in Figure 16-12.
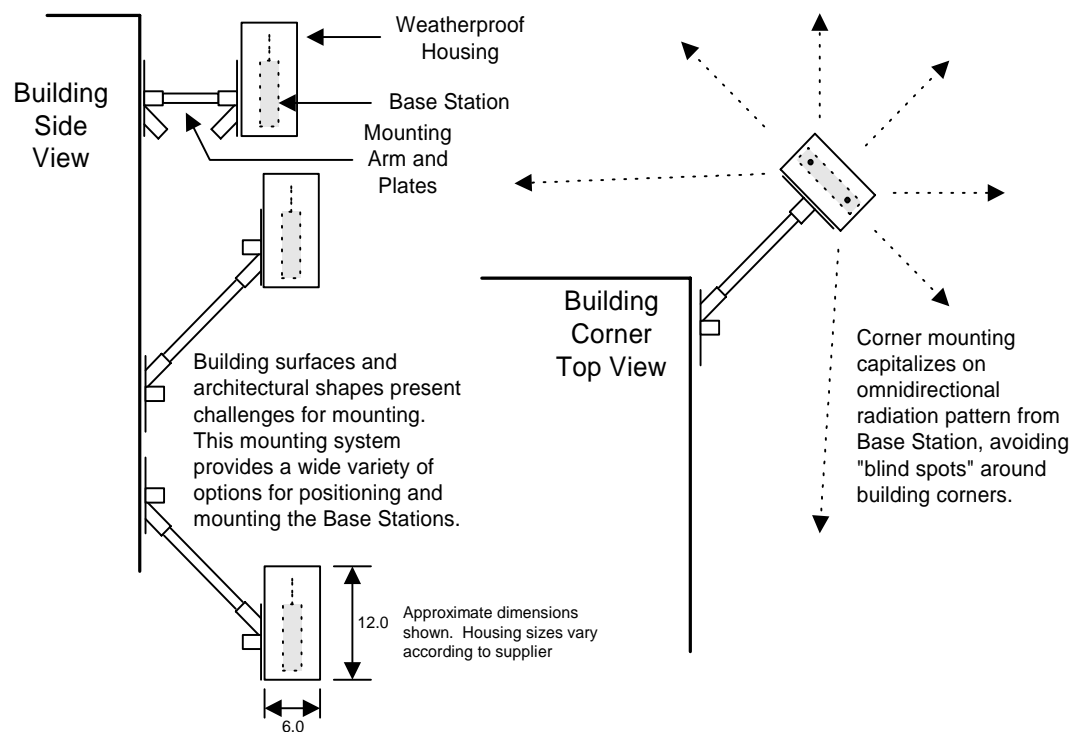
Fig. 16-12 Mounting Views

In many outdoor and campus applications, coverage is a major issue. To minimize the number of Base Stations, they need to be strategically placed to create the best overlapping radio cells. For example, it is common to place Base Stations at the corners of tall buildings to capitalize on the omnidirectional radiation characteristics of the unit. The Mounting Kit provides this capability.

Mounting Instructions
1. Secure Large Pattern Mounting Plate to the Building Surface
    The mounting plates and arm are made of lightweight aluminum, and the Weatherproof Housing (including the Base Station) weighs approximately 7 lbs. To insure structural integrity and safety, the mounting plate must be secured firmly to the building surface using at least four of the 3/8" dia. stainless steel fasteners provided in the kit.

Note that mounting fasteners differ according to the building surface being mounted to.

When mounting to wood surfaces, standard 3/8" "lag bolts" are to be used. Generally however, buildings of concrete and/or brick construction are most common. In these cases the Mounting Plate must be secured with 4 expanding anchors suitable for this type of construction. Two types of expanding anchors are included in the kit and must be installed as follows:

Caution: Note that the correct anchor must be chosen for these types of construction and must be mounted in 3/8" holes drilled at least 1 1/2" deep.

For solid concrete: ITW Ramset/Red Head "Trubolt Wedge Anchor"
Part No. WW-3822 Tightened @ 25.ft. lbs.

For solid concrete,
hollow concrete block, ITW Ramset/Red Head "Dynabolt" Sleeves,
or brick: Part No. SHN-3817 Tightened @ 15 ft. lbs.

Proper installation of the above fasteners provides more than 1300 lbs. of pull or shear strength (per fastener).

2. Secure the Base Station Mounting Bracket to the Inside of the Weatherproof Housing
See Figure 16-13. Locate the mounting bracket (supplied with the Base Station) in the position and drill two 5/32" diameter holes for mounting. Apply a small amount of silicon-seal to the surfaces. Next, secure the Base Station Mounting Bracket with two 6-32 x 5/8" pan-head screws, locking hex nut and flatwashers provided.

3. Secure Small Pattern Mounting Plate to the Weatherproof Housing Outer Surface
See Figure 16-14 Position the Small Pattern Mounting Plate on the lower back side of the weatherproof housing and, using it as a drill guide, drill four 0.375" diameter holes through the housing. Apply a small amount of silicon rubber seal within and around the holes on the **INSIDE** surface of the housing and then mount the plate in the orientation desired for the application using the provided 3/8"-16 x 1" hardware (bolt, flatwasher and nut). The blot head and washer shall be mounted from inside the housing as shown. Use silicon-seal to insure a weatherproof seal around the bolt head and washer.

4. Provide Signal/Power Cable Access Into the Housing
Depending on the desired orientation of the weatherproof housing, choose a satisfactory cable-entry point on or near the bottom of the housing and drill a 0.375" hole to accommodate the provided 1/4" rubber grommet. Use silicon-seal to weatherproof this cable-entry as needed.

5. Secure the Weatherproof Housing and Mounting Arm to the Plate Mounted on the Building Surface
The weatherproof housing can now be attached to the building using either length of Mounting Arm provided in the kit. It may be desirable to run the signal/power cable to the Base Station inside the Mounting Arm, entering and exiting the cable through the slots provided. Using the 5/16"-18 bolt and locking hex-nut provided, lock the Mounting Arm in place using the locating holes in the Mounting Plate tubes at each end. (Do not overtighten the hardware as this could distort the tubes, making future disassembly difficult.)

Caution: *Mounting Arms of 12" and 18" are provided. The "creative" use of longer mounting arms is NOT ALLOWED as considerable forces could be generated due to combinations of housing weight, length of the mounting arm, wind loading, earthquakes and/or vibration. These forces could result in pulling out the mounting anchors from the building with destructive results including falling hardware, including possible injury or death to people below.*

6. Complete the Installation of the Base Station
   After securing the weatherproof housing to the building surface (above), terminate the signal/ power cable inside the housing with the recommended Modular Plug(s), leaving a service-loop of approximately 12". Connect the Modular Plug(s) to the DCT1900 Base Station and install it in the housing by hanging it on the bracket already mounted inside the housing from earlier steps.

   After verification of operation, secure the hinged door of the weatherproof housing.
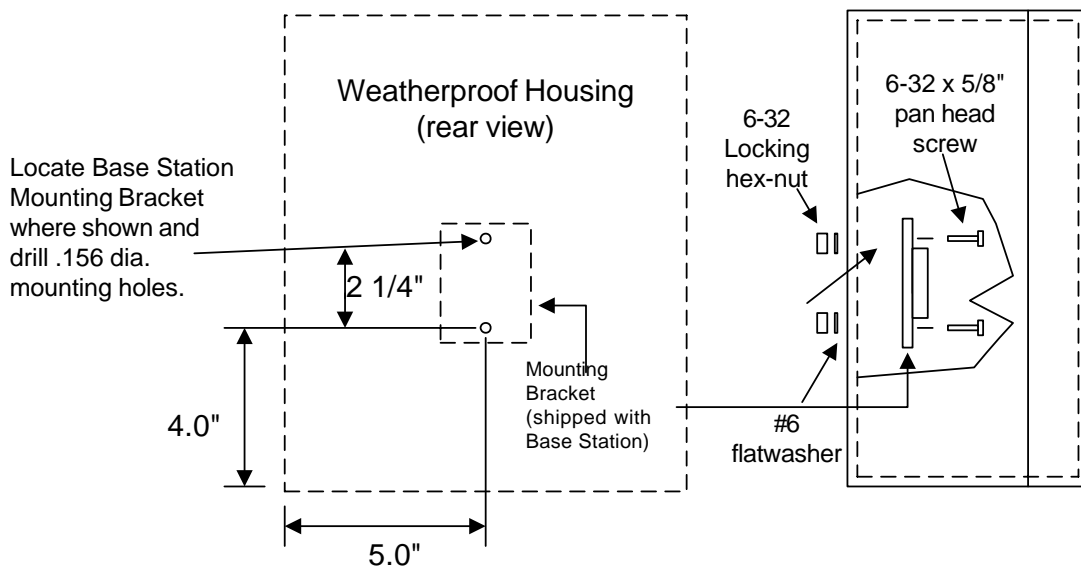
Fig. 16-13 Base Station Mounting Bracket Attachment to Housing

Weatherproof
Housing (rear view)

Locate Small
Pattern
Mounting
Plate where
shown and
drill .375 dia.
mounting
holes

3.0"

5.0"

3/8"
Hex Nut

3/8"
Flat
Washer

3/8"
Bolt
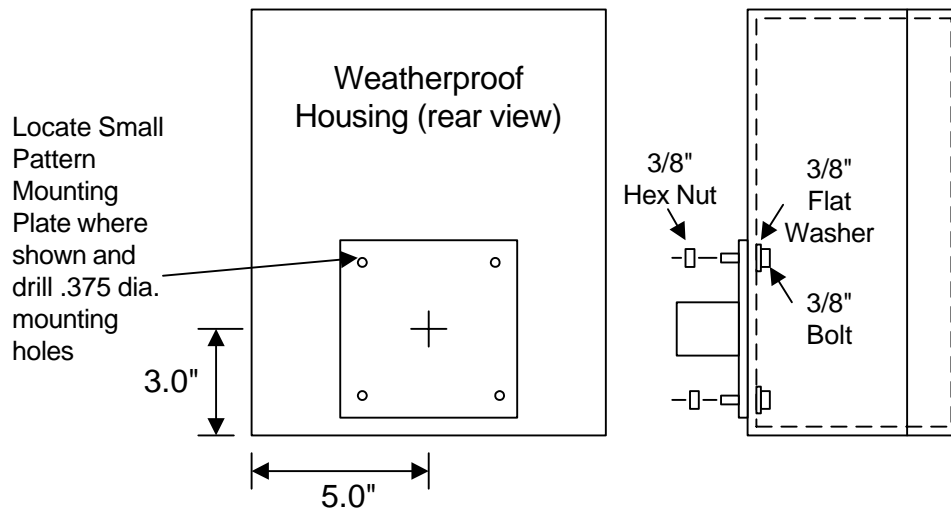
Fig. 16-14 Mounting Plate Attachment to Housing

.156r

2.50 X .312 slot, 2 places
(both ends, one side of tube only)

.312 dia
4 places

0.975

Dimension A
(see table)

0.975

Dimension A Length

Part Number

Part Number	Dimension A Length
1301-SXA 120 8411/1	6.00"
1301-SXA 120 8411/2	12.00"
1302-SXA 120 8411/3	18.00"
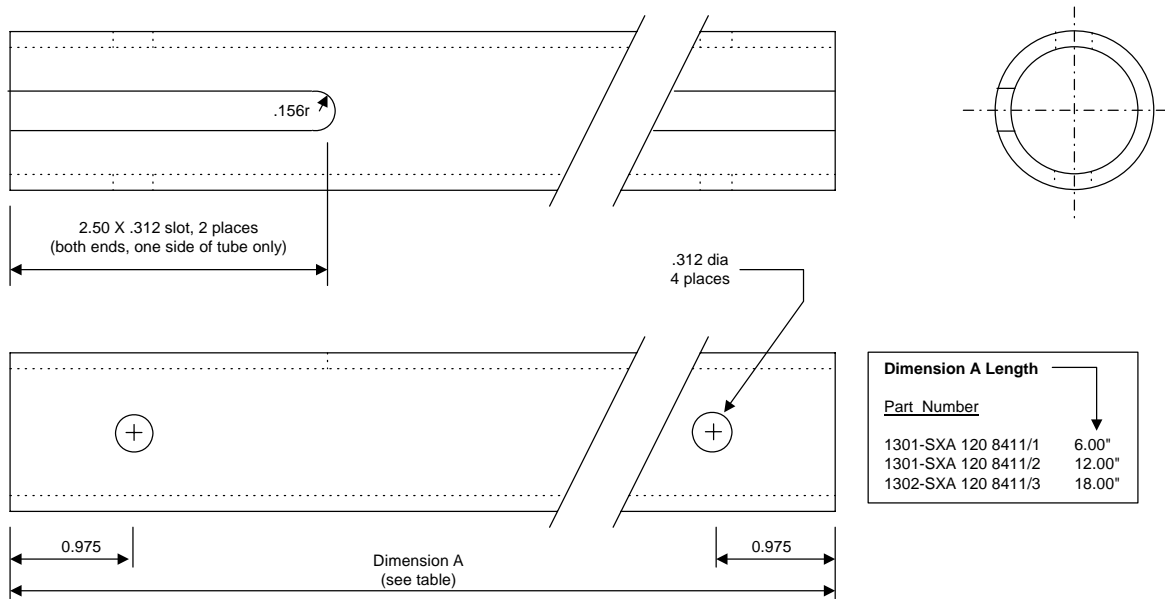
SCALE: 1:1

NOTES:
1.   Material: 1.00" Schedule 40 6061-T6 aluminum tubing (O.D. = 1.315", Wall = 0.133")
2.   Finish: clear anodize type II
3.   Dimensions: X.XX = +/- .030", X.XXX = +/- .010"

Fig. 16-15 Mounting Arm
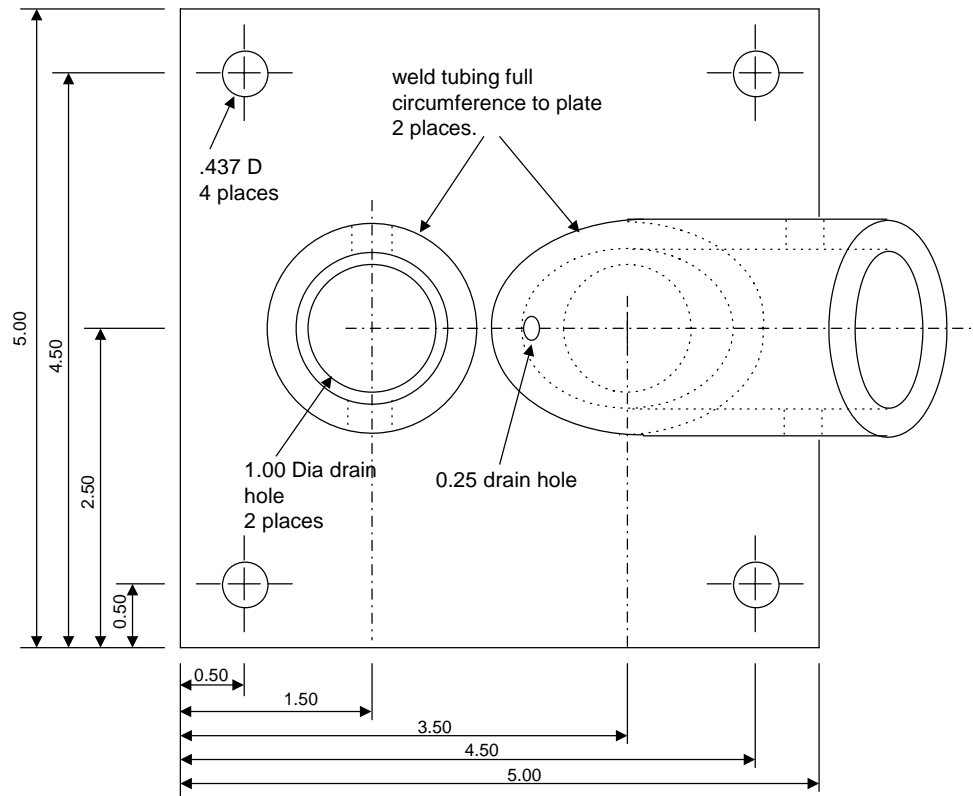
Fig. 16-16 Mounting Plate (Small Pattern)
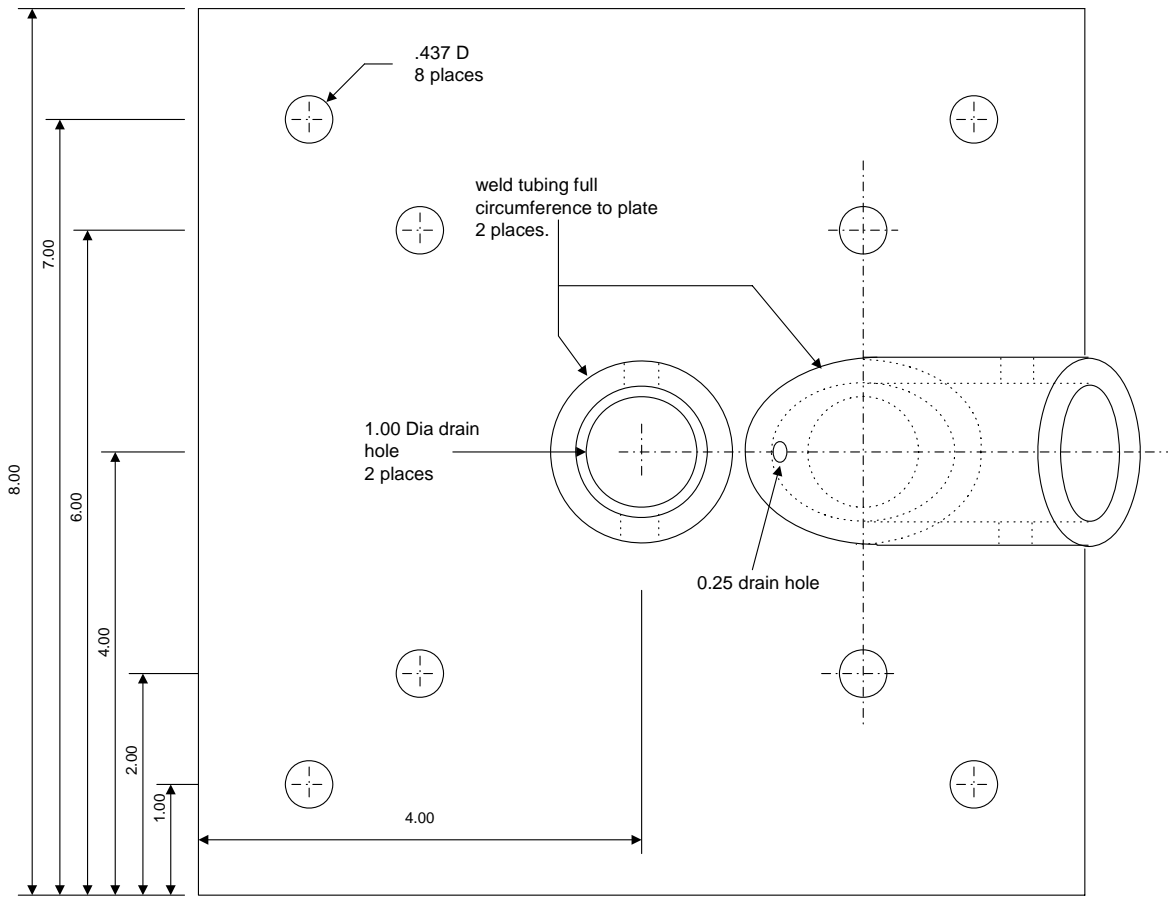
Fig. 16-17 Mounting Plate (Large Pattern)

CHAPTER 17
Modular Cabinet Connection Board (MCCB) - ROANB 101 28

17.1 Board Description

The MCCB (see Fig. 17–3) is installed on the bottom of the Modular Cabinet above the bottom plate. The MCCB is used to make the following interconnections:

- Between the backplane power and a maximum of 3 CLUs/SLUs for powering Base Stations.
- Between the external power input and a maximum of 7 CLUs/SLUs for powering Base Stations.
- Between the PBX signalling ground to a maximum of 7 LTUs when earth signalling is used (instead of timed break signalling).
- Between the CPU, a PC, and a printer or TAP 1.8 compliant device.
- Between the general alarm output of the CPU and an alarm device.

A maximum of 3 CLUs/SLUs can be provided with Base Station power via the backplane. In that case the 48V from the backplane is connected to the PW–BP input of the MCCB (see Fig. 17–1). When more CLUs have to be powered, an external -48V power supply can be connected to the PW–EXT input of the MCCB. In this way a maximum of 7 CLUs can be powered.
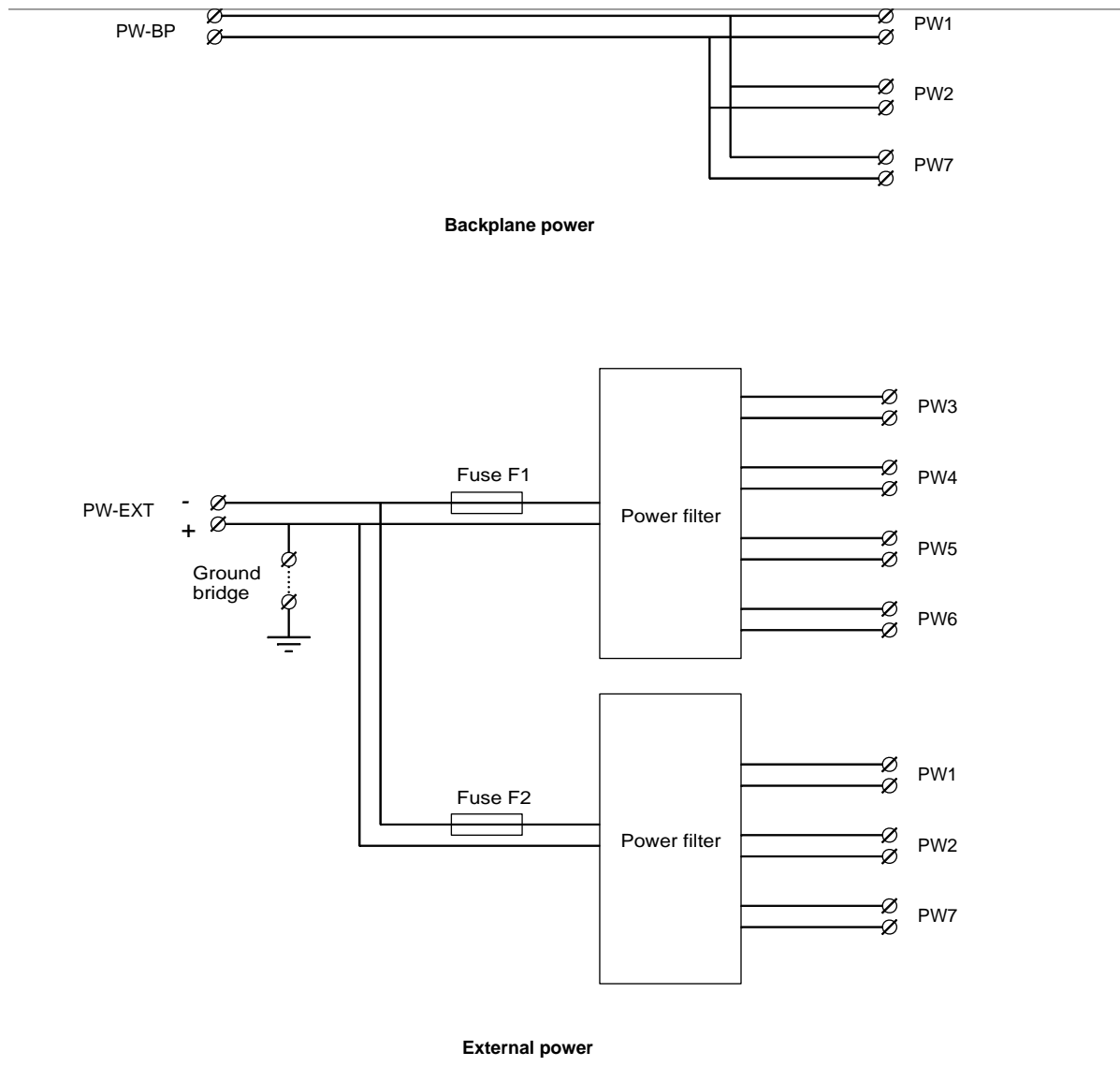
Fig. 17–1 Power Distribution on the MCCB

Fuses

The MCCB is provided with two fast 15A fuses (see Fig. 17–1 and Fig. 17–3) to protect the external power supply from short circuit. Only use the following fuses: 7006100123, 250/15A.

DTU Cable Ground Strap Settings

The straps on the MCCB connect the cable shield of the PBX/MCCB coax cables to ground. The MCCB is delivered with all straps in the ground position (see Fig. 17–2). This setting gives the best EMC protection.
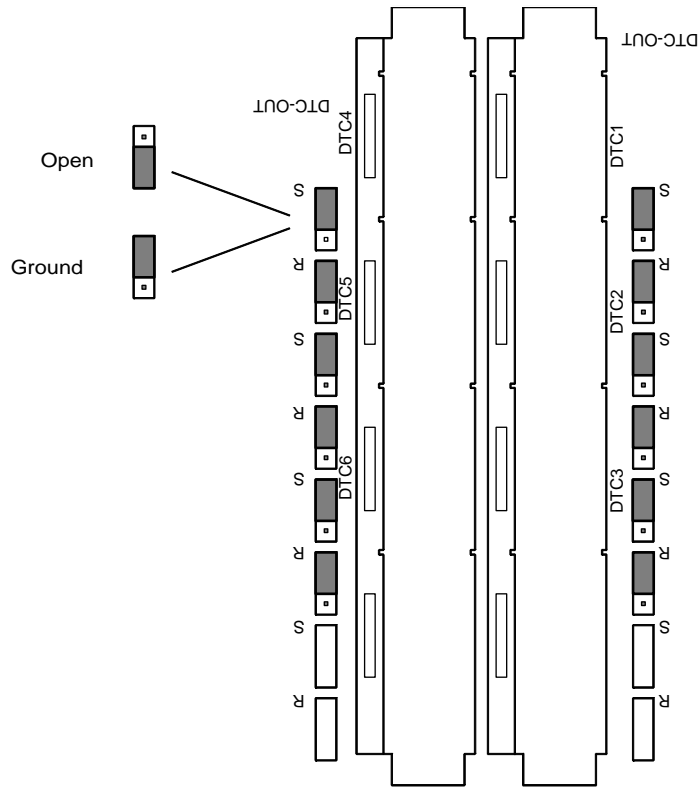
Fig. 17–2 DTU Coax Cable Ground Strap Settings on MCCB

DTC In/Out Connectors

There are two rows of connectors for connection of the DTU-E1 coaxial cables. Each row has connectors for up to 8 DTU-E1 input and output cables.

Due to the construction of the cabinet and the placement of the MCCB, two connectors on the DTC In side and two connectors on the DTC Out side cannot be used. Refer to Fig. 17-3 and use only the labelled connectors DTC 1-6.

Connectors

Ground bridge	:	For connecting the plus pole of PW–EXT to ground.
DTC1, DTC2, DTC3, DTC4, DTC5, DTC6 (DTC–OUT)	:	For connection of 6 coaxial DTU-E1 cables (PBX/MCCCB cables) to the PBX.
DTC1, DTC2, DTC3, DTC4, DTC5, DTC6 (DTC–IN)	:	For connection of 6 coaxial DTU-E1 cables (DTU/MCCB cables) to the DTU.
GA–IN	:	For connection of the General Alarm input (General Alarm cable) from the CPU board.
GA–OUT	:	General Alarm output to alarm device.
LTU1, LTU2, LTU3, LTU4, LTU5, LTU6, LTU7	:	For signalling ground cables (LTU/MCCB ground cable) to 7 LTUs.
PBX	:	For the signalling ground connection to the PBX. This connection is only used when earth signalling is used.
PC	:	For connection to PC (PC Cable).
PR	:	For connection to printer (printer cable).
PW–BP	:	For the power connection to the backplane (MCCB power cable, for Base Station powering).
PW1, PW2, PW3 (backplane power)	:	For power cable to 3 CLUs/SLUs (CLU/MCCB power cable) when using the backplane power.
PW–EXT:	:	For optional external power supply (for Base Station powering).
PW1, PW2, PW3, PW4, PW5, PW6, PW7 (external power)	:	For power cable to 7 CLUs/SLUs (CLU/MCCB power cable) when using external power.
RS232	:	For cable to CPU for PC and printer (RS232 to MCCB cable).

17.2 Installation

The Modular Cabinet is delivered with the MCCB mounted. The cables to the CPU are already connected to the MCCB. For installation of these cables and the installation of the other cables refer to the relevant chapters.
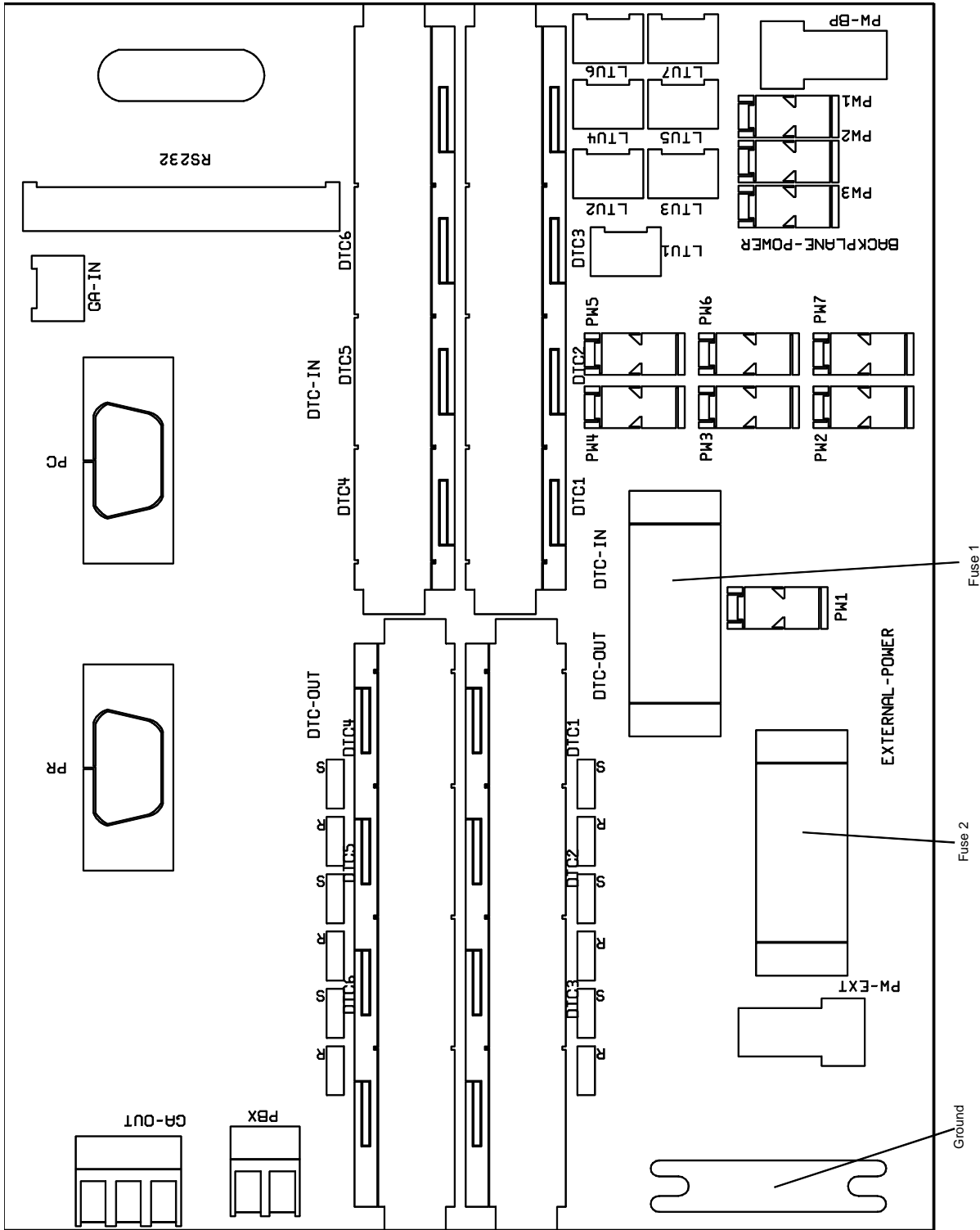
Fig. 17-3 Modular Cabinet Connection Board (MCCB) - ROANB 101 28

CHAPTER 18
Synchronization Distribution Board (SDB) – REX-BRD0006 or ROANB 101 38

18.1 Board Description

The SDB (see Fig. 18–1) if installed is located on the bottom plate of the Modular Cabinet near the MCCB and allows the connection of one input and three output synchronization signals to the CPU via shielded twisted pairs cables. The synchronization signals are required to achieve PWT air interface synchronization between systems to allow seamless inter system handovers. An electrical schematic diagram is shown in Fig. 18–2. This board is not factory installed.

Note: Refer to Chapter 20 for CPU2 synchronization.
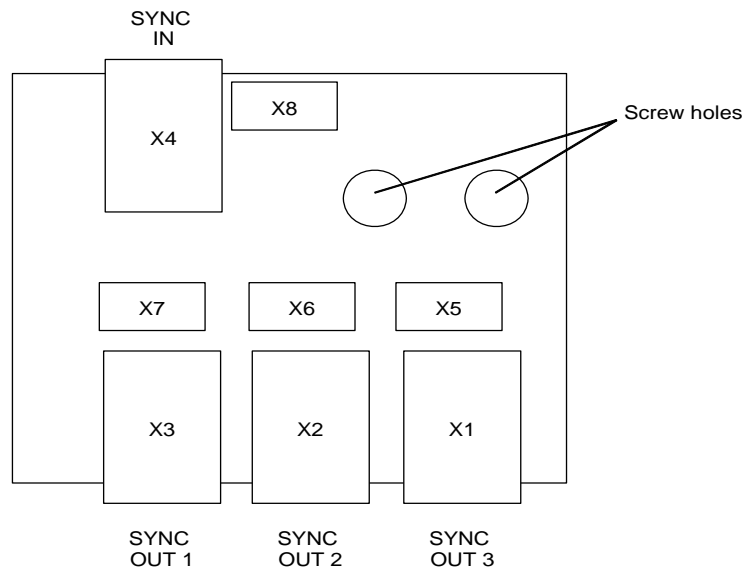
Fig. 18-1 Synchronization Distribution Board - REX-BRD0006 or ROANB 101 38

Connectors

X1, X2, X3	: External cable connection sync out.
X4	: External cable connection sync in.
X5, X6, X7	: Sync out connection to CPU.
X8	: Sync in connection to CPU.

1 2 3 4   1 2 3 4   1 2 3 4   1 2 3 4

X5   X6   X7   X8

To CPU

CIRCUIT GND

CIRCUIT GND

X1 A B   X2 A B   X3 A B   X4 A B

To other CPU

1 2 3 4 5 6   1 2 3 4 5 6   1 2 3 4 5 6   1 2 3 4 5 6

RJ Connectors

GND(shield)   GND(shield)   GND(shield)   GND(shield)

SYNC OUT   SYNC OUT   SYNC OUT   SYNC IN
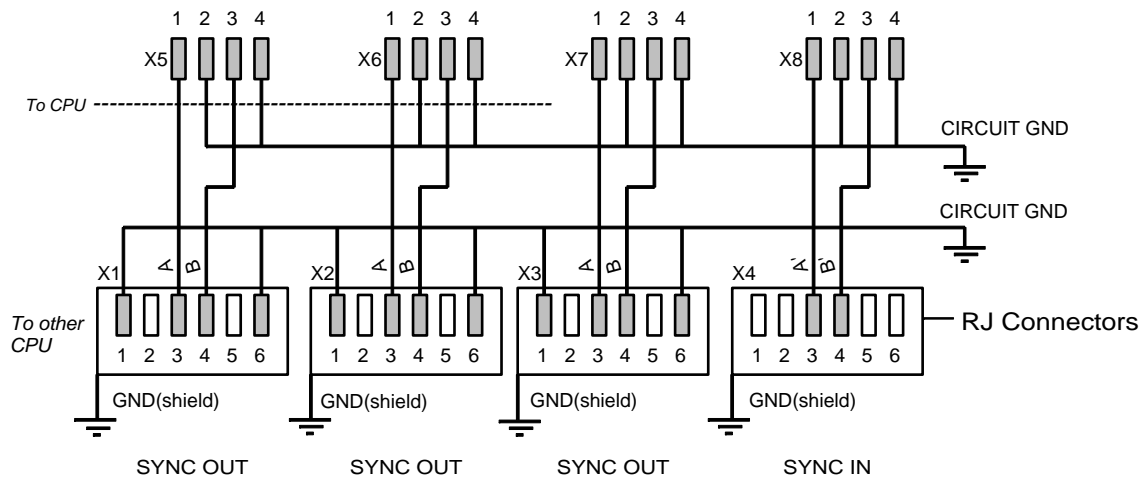
Fig. 18–2 Electrical Schematic Diagram

18.2 Installation

The SDB comes as part of the installation set sync port kit (NTMNB 101 107) and must be installed in the cabinet where the CPU1 is going to reside (refer to Paragraph 4.7 of Chapter 4). For the installation of the cables to the CPU1 refer to Chapter 19, CPU1 Cabling. The external sync in and out cables are part of the sync port kit and are required if PWT air interface synchronization is needed in a multi DCT1900 system environment. They must meet the requirements in Paragraph 18.3 (see Figure 18-3).

18.3 External Sync Cable

When there are multiple DCT1900 systems with overlapping coverage areas it is necessary to synchronize the CPUs of the systems together. This is done by connecting an external sync cable from one of the sync out ports on the master CPU's sync board to the sync in port on one of the slave CPU's sync board.

A pre-made external sync cable, TSR 951 284, is available. The specifications for this cable are included below. If this cable is not long enough then a cable must be constructed on site. Refer to the enclosed specifications to construct this cable. If the 6 conductor shielded flat cable is not available then a single pair of 120 ohm twisted shielded pair may be used.

The signal delay in the external sync cable must be determined. For the cable TSR 951 284 it is $0.04\mu s$. A cable made on site must be measured using a TDR (Refer to Paragraph 18.4).

Once the delay is known, this value is entered into the slave system's CPU during its' initialization. Refer to the Cordless System Software User's Guide (LZB 119 2664), Appendix I, on how to enter this delay.

External Sync Cable (TSR 951 284)

Cable length	:	20 ft.
Wires	:	6 conductor shielded flat cable
Working Voltage	:	300V
Connector - System/Sync Port	:	6 pin shielded RJ 12 connector
Connector - Modem	:	6 pin shielded RJ 12 connector
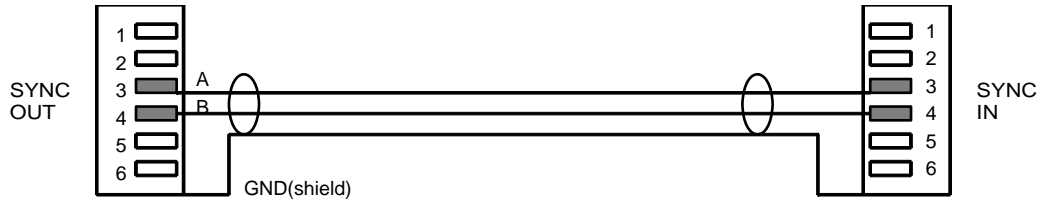
Figure 18–3 Wiring Diagram External Sync Cable

18.4 Sync Input Cable Delay Measurement

The external sync input cable delay must be measured in order to input the system synchronization delay into the system at initialization. The system synchronization delay compensates for the delay introduced by the cable. The external sync input cable delay is measured as follows:

1. Make sure that the other end of the external sync input cable is not connected.
2. Connect a TDR to the terminals 3 and 4 on this end.
3. Measure the cable delay. The resulting value must have an accuracy of 50ns (corresponding to 16ft. – 33ft.).
4. Note the cable delay value.

CHAPTER 19
Modular Cabinet – Power Cabling

19.1 Introduction

This chapter describes the installation of the power cables in two different versions of the Modular Cabinet. The installation depends on the number of external -48Vdc power supplies and on how the Base Stations are powered.

WARNING
Disconnect or switch off all power supply sources before servicing any power supply circuit.

19.2 Modular Cabinet - BDVNB 101 01/3 (R2, R3)

Fig. 19–1 shows the power distribution in a Modular Cabinet powered by external -48Vdc supplies.
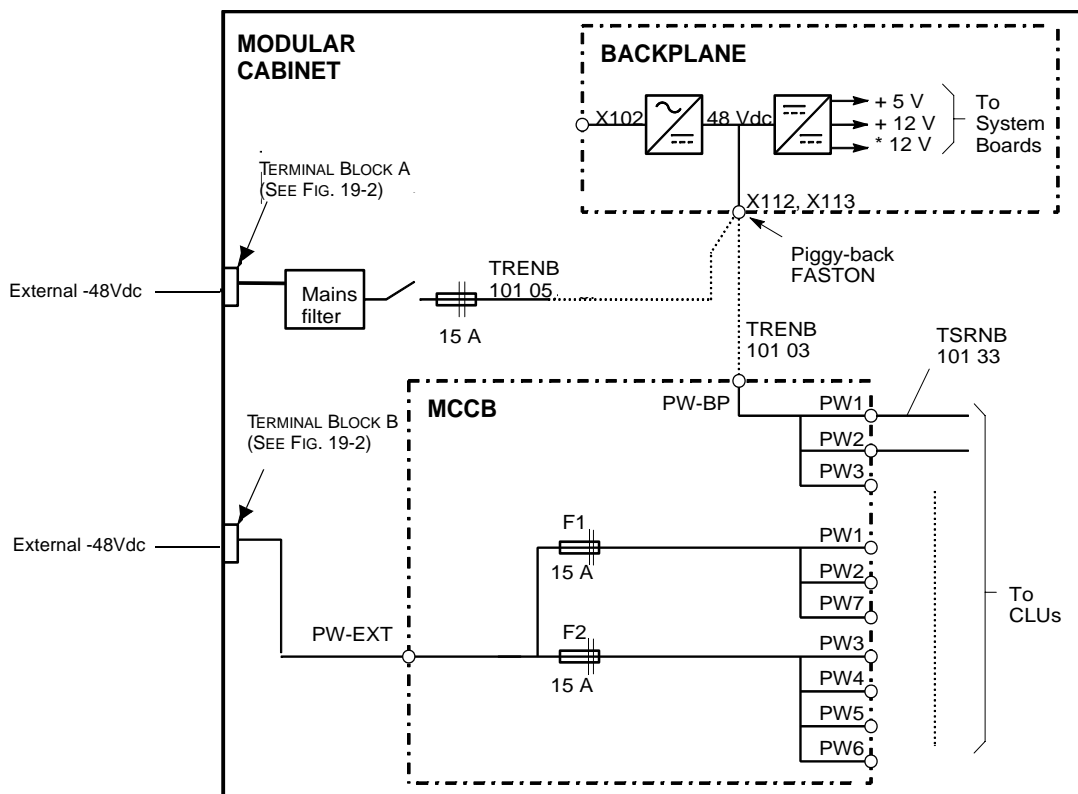
Fig. 19-1 Power Distribution Powered by External -48Vdc

Factory Fitted Power Cabling

The Modular Cabinet is delivered with the following powering cables fitted:

- Cable TRENB 101 02 (#190248) between the filter and the fuse holders (see Fig. 19–3).
- Cable TRENB 101 04 (#190250) between the switch and the two fuse holders.
- Cable TRENB 101 05 (#190251)between the switch and connector X112, X113 on the backplane (see Fig. 19–4). The end of the cable with the piggy–back faston is connected to the switch.
- Cable TRENB 101 03 (#190249)between connectors X112/X113 and connector PW–BP on the MCCB.
- Cable #190253 (red cable) in two locations: between terminal block A and filter and between terminal block B and MCCB terminal PW-BP (see Fig. 19-2).
- Cable #190254 (black cable) in two locations: between terminal block A and filter and between terminal block B and MCCB terminal PW-EXT (see Fig. 19-2).

All cables are connected with the red wires (+) connected at the left–hand side, except for the PW-EXT connection. The red wire of cable TRENB 101 03 is connected to connector X112(+).

In the following paragraphs it is assumed that the cables are fitted as described above. If you altered the wiring, change it as described above.

Fig. 19–2 Power Connection to the Modular Cabinet

DC: +

Top of Filter

Filter

DC: -

Power on/off switch

Fuses
(2 each - 7006100123 15 A/250 V)
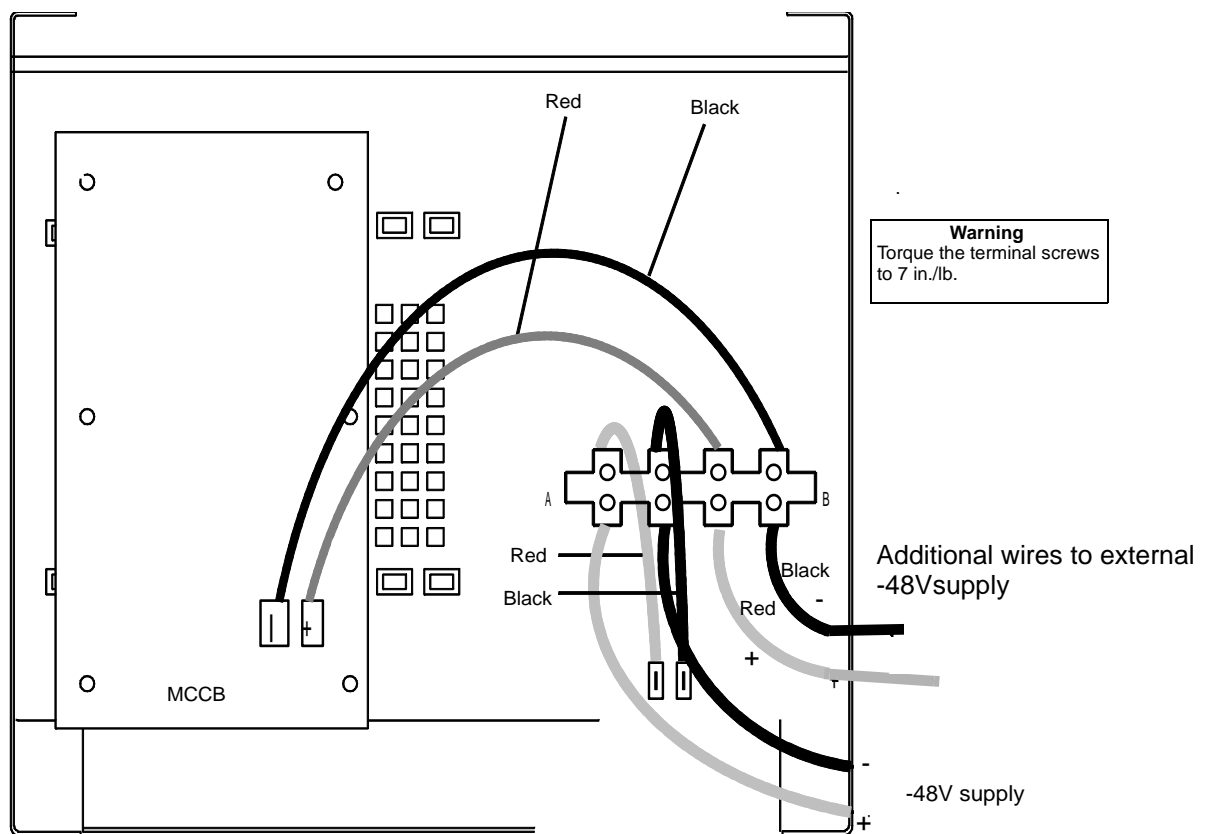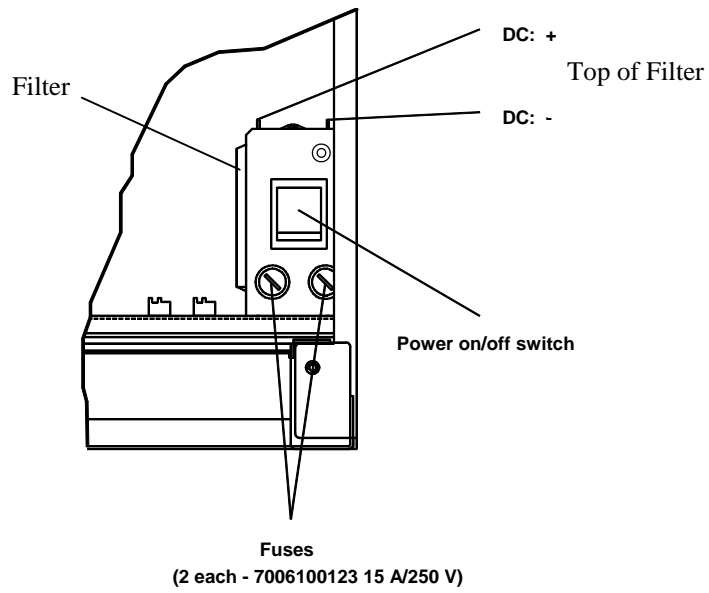
Fig. 19–3 Power Connections to Top of Filter

X102

AC input connector

+ X112

DC input/output connectors

- X113
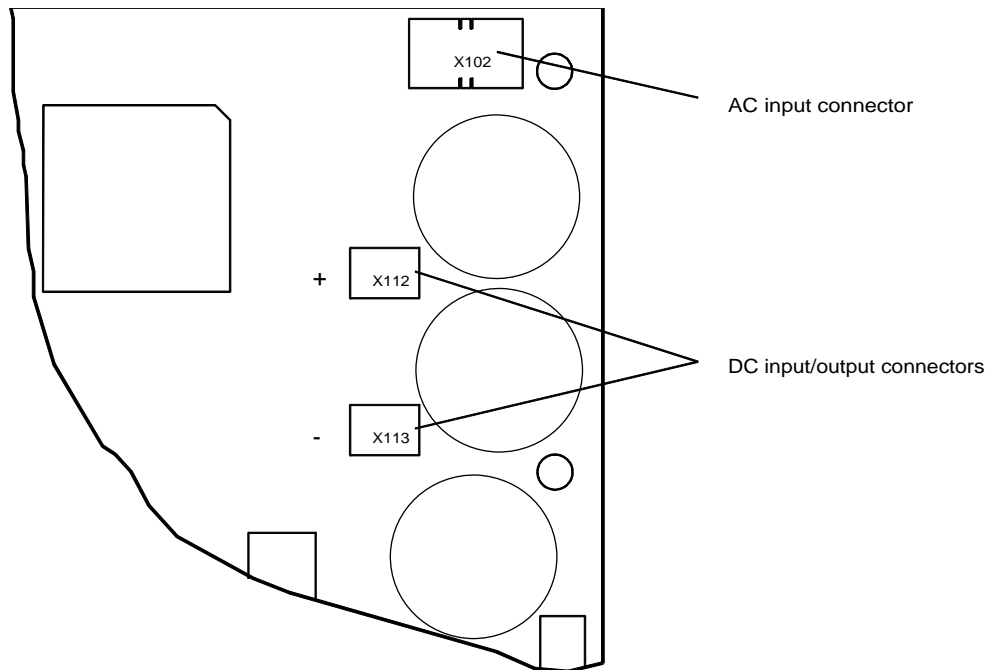
Fig. 19–4 Power Connections on the Backplane

19.3 Installation

Modular Cabinet Powered by an External 300 Watt –48Vdc Power Supply

When the Modular Cabinet is powered by an external -48V power supply, Base Station power can be supplied to the CLUs/SLUs in the following ways:

- to maximum 3 CLUs/SLUs via the backplane PW-BP connection on the MCCB
- to maximum 4 CLUs/SLUs via the PW–EXT connection on the MCCB

The advantage of powering via the backplane is that the Base Station is switched off when the Modular Cabinet is switched off by the switch on the cabinet.

When combining both methods, a maximum of 7 CLUs/SLUs can be provided with Base Station power.

Modular cabinet powered by a -48Vdc PBX power supply

When the modular cabinet is powered by a -48Vdc PBX power supply, Base Station power can be supplied into the CLUs/SLUs in the following ways:

- to a maximum of 3 CLUs/SLUs via the PW-BP connection on the MCCB
- to a maximum of 7 CLUs/SLUs via the PW-EXT connection on the MCCB

When combining both methods, a maximum of 9 CLUs/SLUs can be provided with Base Station power.

WARNING

When using the PBX power supply, make sure that the capacity of the supply is sufficient to power both the PBX and the Modular Cabinet.

Base Station Power Supplied to a Maximum of 3 CLUs via the Backplane

Fig.19–5 gives a schematic diagram of this configuration. Fig. 19-6 gives the cable diagram of this configuration.
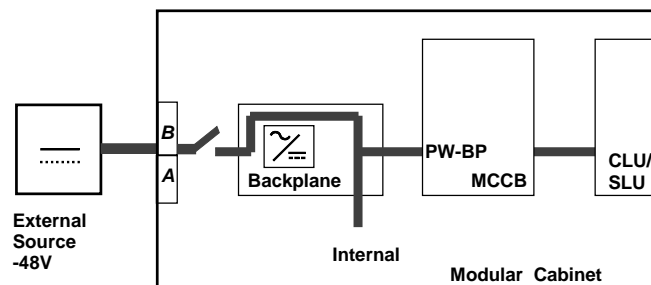
Fig. 19-5 Schematic Diagram of Powering the Modular Cabinet
and 3 CLUs/SLUs by an External Source

1. Connect a power cable from terminal block A to the DC power source.

Note:

The positive pole of the external DC source is connected to the ground of the Modular Cabinet via the backplane and a jumper from the (+) side of the input filter.
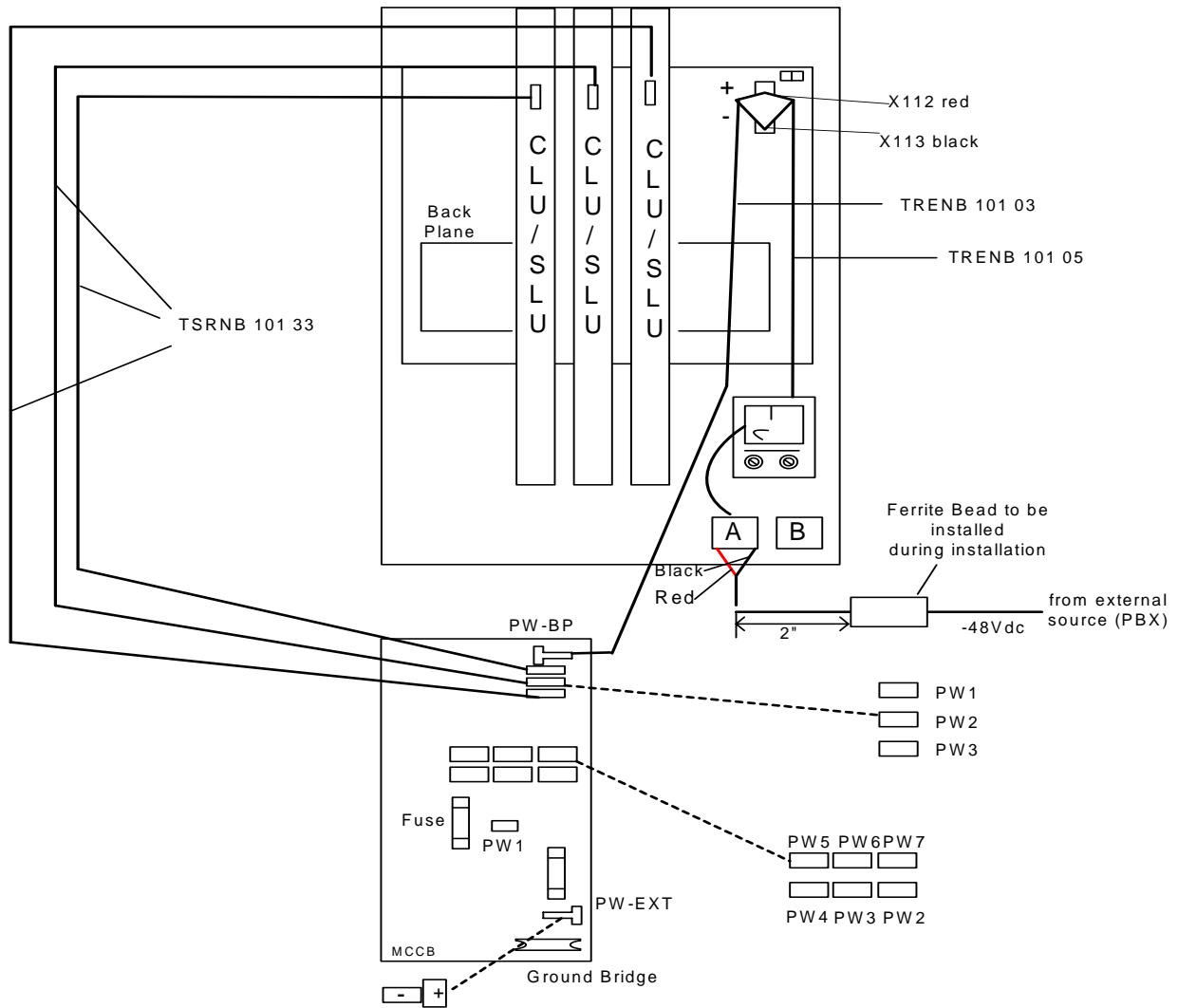
Fig. 19–6 Cable Diagram of Powering the Modular Cabinet and
3 CLUs/SLUs by an External Source

Base Station Power Supplied to a Maximum of 7 CLUs/SLUs via the PW–EXT Input on the MCCB

This requires a power supply with a capacity greater than 300W, such as a PBX power supply.

Fig. 19–7A & Fig. 19-7B give a schematic diagram of this configuration. Fig. 19–8 gives the cable diagram of this configuration.
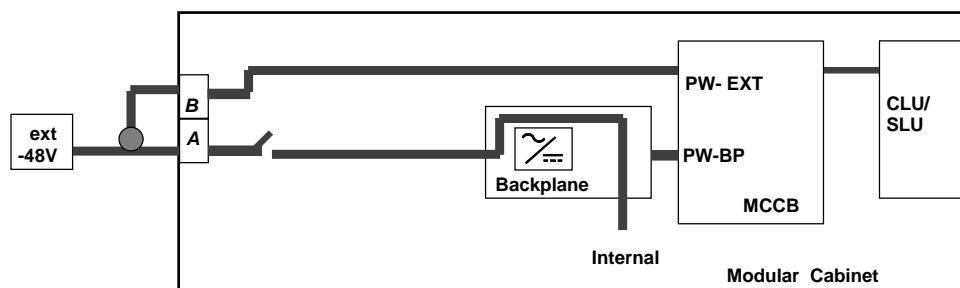
Fig. 19-7A - Schematic Diagram of Powering Modular Cabinet and 7 CLUs/SLUs with an External Power Supply
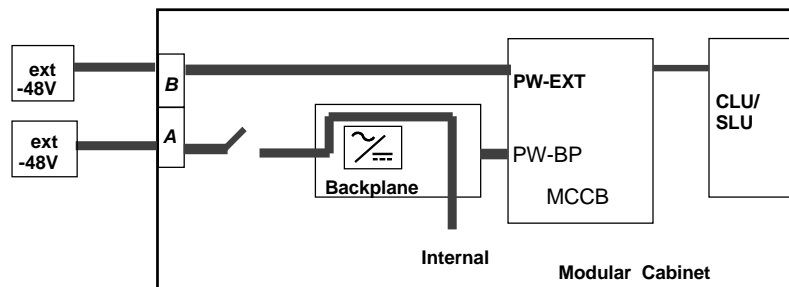
Fig. 19-7B Schematic Diagram of Powering the Modular Cabinet and 7 CLUs/SLUs with two separate -48V External Power Supply
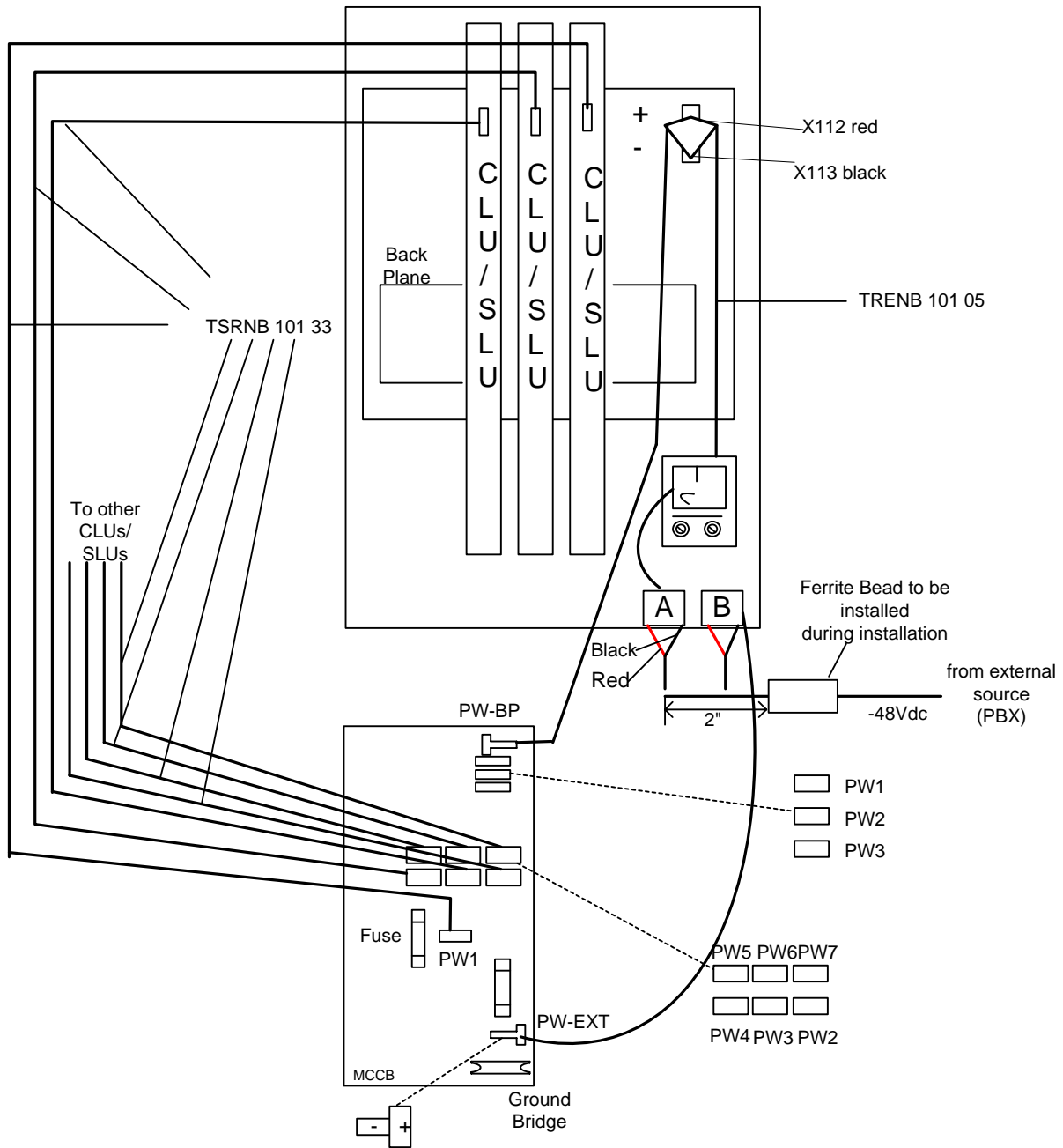
Fig. 19–8 Cable Diagram of Powering the Modular Cabinet and 7 CLUs by an External Source

19.4 Modular Cabinet - REX-BAS9021A/1B

Figure 19–9 shows the power distribution in a Modular Cabinet powered by external -48Vdc supplies.
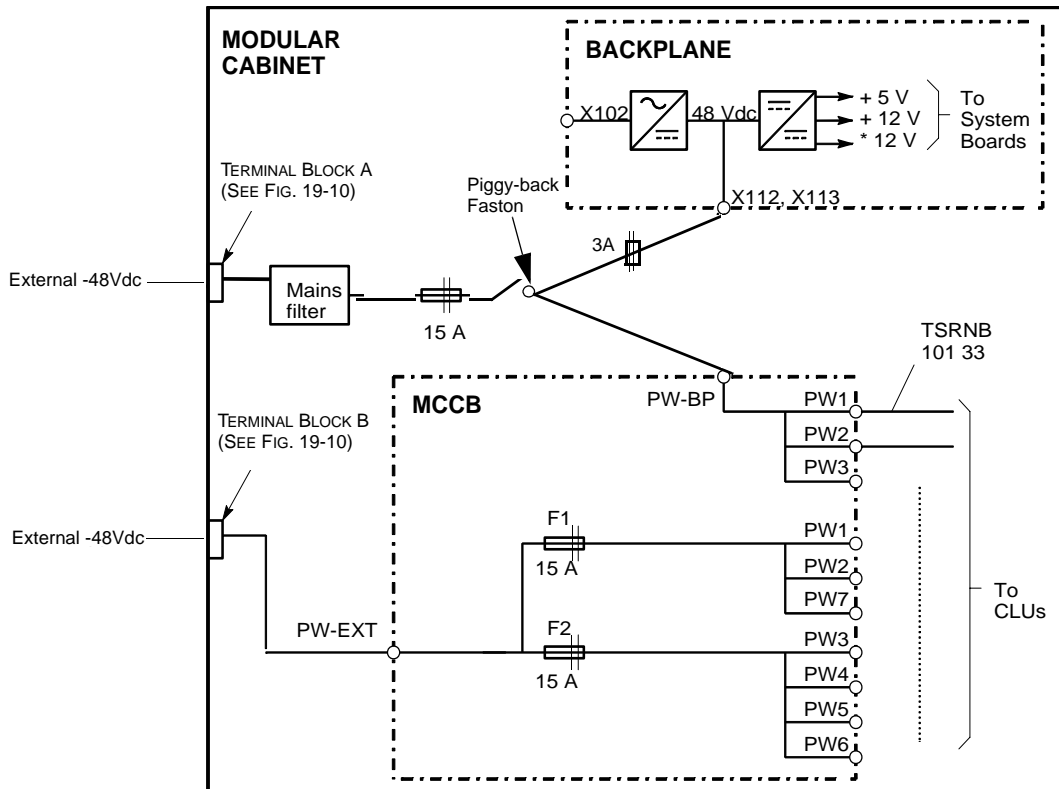
Fig. 19-9 Power Distribution Powered by External -48Vdc

Factory Fitted Power Cabling

The Modular Cabinet is delivered with the following powering cables fitted:

- Cable TRENB 101 02 (190248) between the filter and the lower fuse holders (see Figure 19–11).
- Cable TRENB 101 04 (#190250) between the switch and the lower two fuse holders.
- Cable between the switch and the upper fuse holders. The end of the cable with piggy-back faston is connected to the switch.
- Cable between the switch and connector PW–BP on the MCCB. Connects to piggy-back faston on the switch.
- Cable between the upper fuse holders and connector X112, X113 on the backplane (see Figure 19–12).
- Cable #190253 (red cable) in two locations: between terminal block A and filter and between terminal block B and MCCB terminal PW-EXT (see Figure 19-10).
- Cable #190254 (black cable) in two locations: between terminal block A and filter and between terminal block B and MCCB terminal PW-BP (see Fig. 19-10).

All cables are connected with the red wires (+) connected at the left–hand side except for PW-EXT connection. The red wire of cable is connected to connector X112(+).

In the following paragraphs it is assumed that the cables are fitted as described above. If you altered the wiring, change it as described above.

Botton view

Fig. 19-10 Power Connection to the Modular Cabinet

Fig. 19–11 Power Connections to Top of Filter
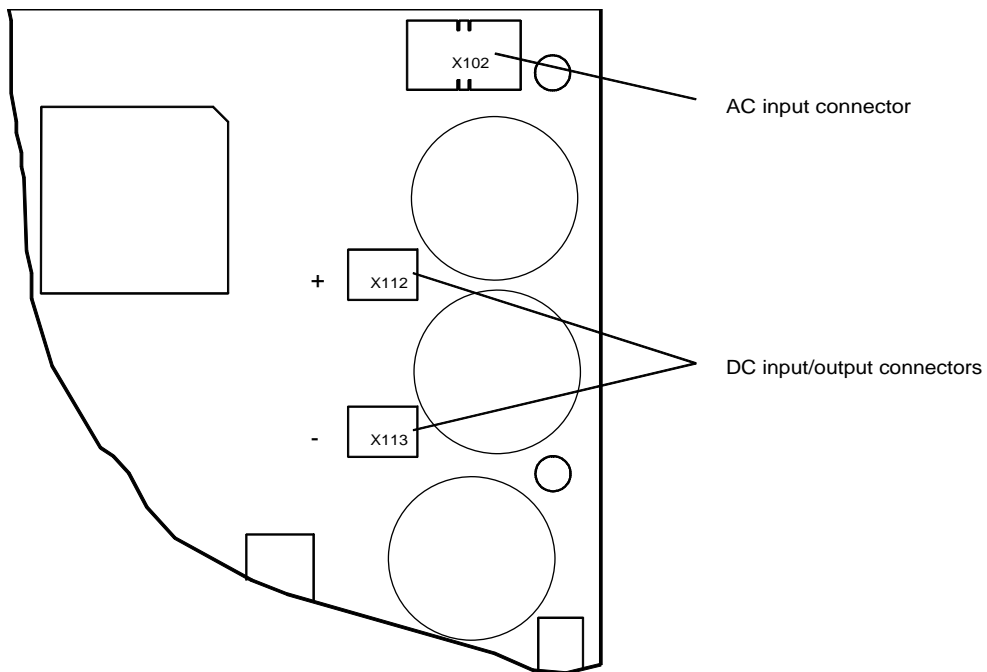
Fig. 19–12 Power Connections on the Backplane

19.5 Installation

Modular Cabinet Powered by an External 300Watt -48Vdc Power Supply
When the Modular Cabinet is powered by an external -48V power supply, Base Station power can be supplied to the CLUs/SLUs in the following ways:
- to maximum 3 CLUs/SLUs via the backplane PW-BP connection on the MCCB
- to maximum 4 CLUs/SLUs via the PW–EXT connection on the MCCB

The advantage of powering via the backplane is that the Base Station is switched off when the Modular Cabinet is switched off by the switch on the cabinet.

When combining both methods, a maximum of 7 CLUs/SLUs can be provided with Base Station power.

Modular cabinet powered by a -48Vdc PBX power supply
When the modular cabinet is powered by a -48Vdc PBX power supply, Base Station power can be supplied into the CLUs/SLUs in the following ways:
- to a maximum of 3 CLUs/SLUs via the PW-BP connection on the MCCB
- to a maximum of 7 CLUs/SLUs via the PW-EXT connection on the MCCB

When combining both methods, a maximum of 9 CLUs/SLUs can be provided with Base Station power.

Warning
**When using the PBX power supply, make sure that the capacity of the supply
is sufficient to power both the PBX and the Modular Cabinet.**

Base Station Power Supplied to a Maximum of 3 CLUs via the Backplane
Figure 19–13 gives a schematic diagram of this configuration. Figure 19-14 gives the cable diagram of this configuration.
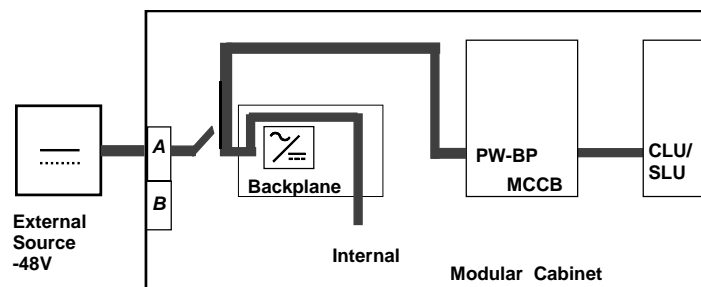
Fig. 19-13 Schematic Diagram of Powering the Modular Cabinet and 3 CLUs/SLUs by an External Source

1. Connect a power cable from terminal block A to the DC power source.

Note:
The positive pole of the external DC source is connected to the ground of the Modular Cabinet via the backplane and a jumper from the (+) side of the input filter.
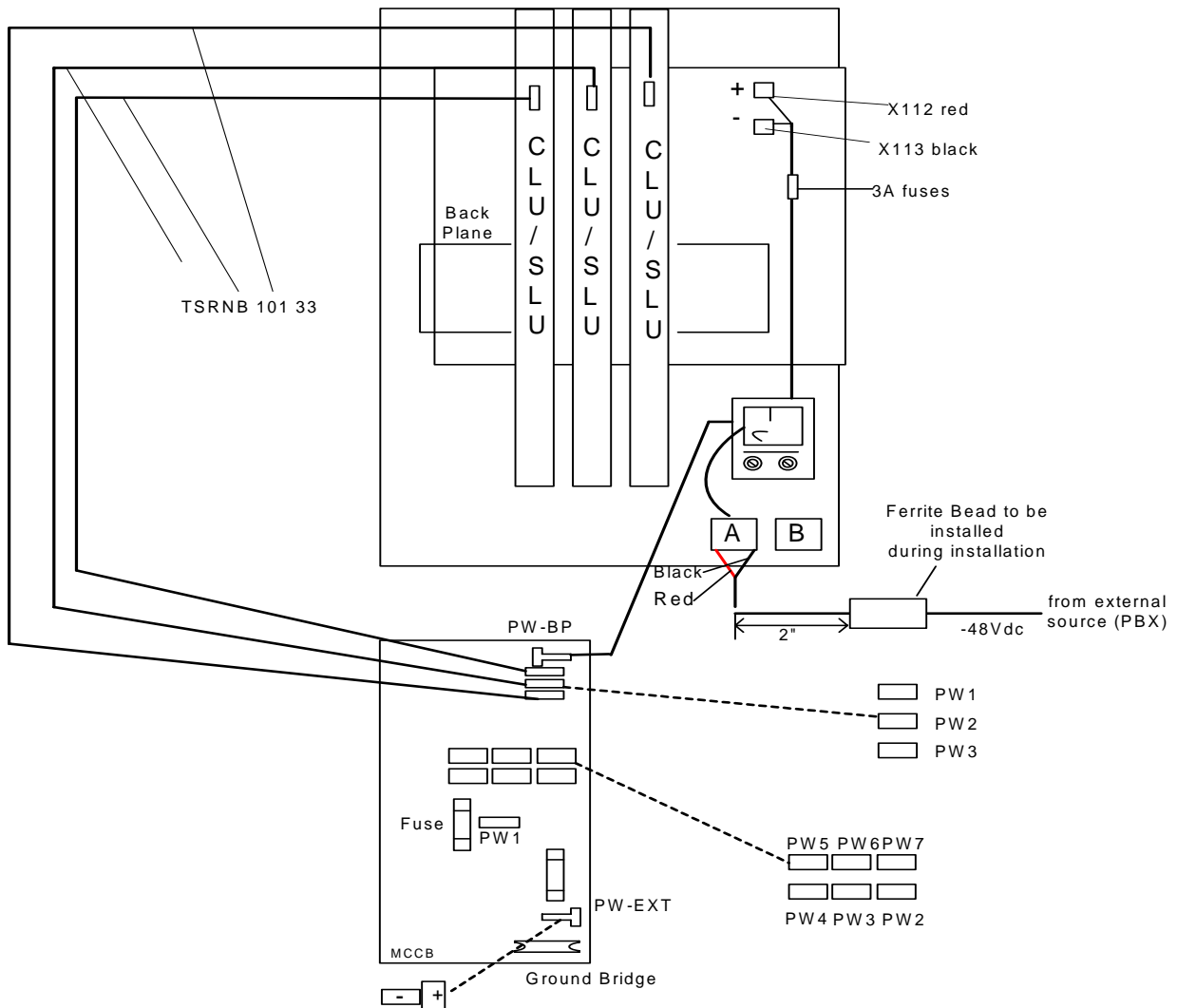
Fig. 19–14 Cable Diagram of Powering the Modular Cabinet and
3 CLUs/SLUs by an External Source

Base Station Power Supplied to a Maximum of 7 CLUs/SLUs via the PW–EXT Input on the MCCB

This requires a power supply with a capacity of greater than 300W, such as a PBX power supply.

Figures 19–15A & 19-15B give a schematic diagram of this configuration. Figure 19–16 gives the cable diagram of this configuration.
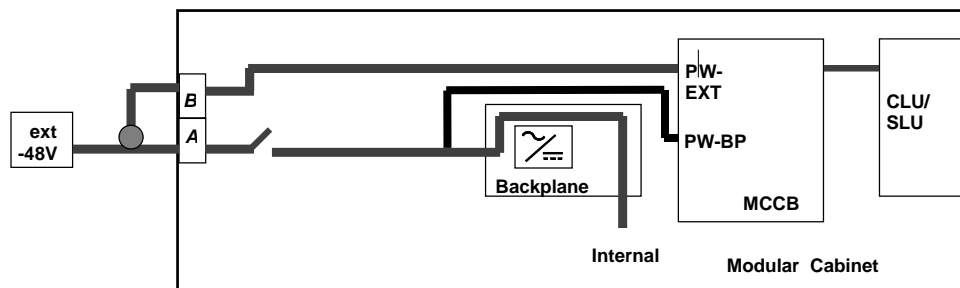
Fig. 19 -15A - Schematic Diagram of Powering Modular Cabinet and 7 CLUs/SLUs with an External Power Supply
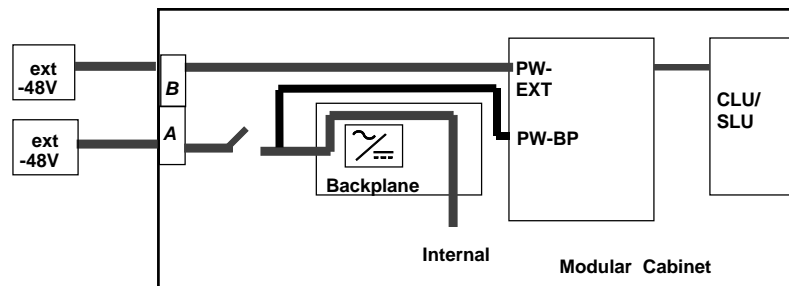
Fig. 19-15B Schematic Diagram of Powering the Modular Cabinet and 7 CLUs/SLUs with two separate -48V External Power Supply

Back
Plane

CLU/SLU

CLU/SLU

CLU/SLU

+ X112 red
- X113 black

3A fuses

TRENB 101 05

TSRNB 101 33

To other
CLUs/
SLUs

Ferrite Bead to be
installed
during installation

A B

Black
Red

2"

from external
source
(PBX)

-48Vdc

PW-BP

PW1
PW2
PW3

PW1

PW5 PW6 PW7

PW-EXT

PW4 PW3 PW2

MCCB

Ground
Bridge

- +
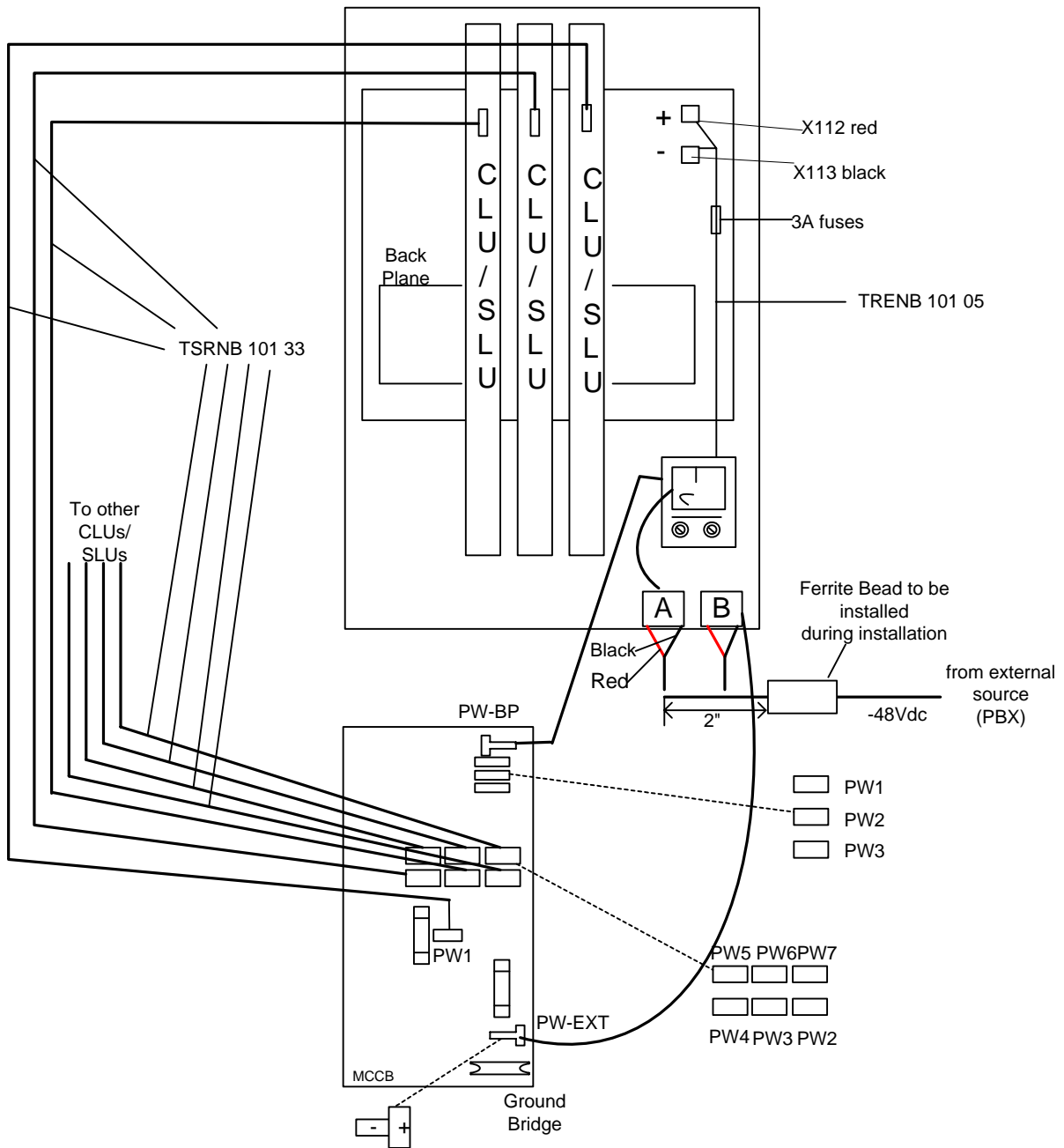
Fig.19–16 Cable Diagram of Powering the Modular Cabinet and 7 CLUs by an External Sources

CHAPTER 20
Modular Cabinet – CPU Cabling

20.1 Introduction

This chapter describes all the cabling connected to the CPU1, REX-BRD0004 or 2/ROFNB 157 19/2, and to the CPU2, REX-BRD9033 or REX-BRD9034.

Connections to the CPU1/CPU2 board include:
- Printers - via the MCCB board
- PCs - via the MCCB board
- Other CPU boards - via the SDB or directly
- Alarm Devices - via the MCCB board

Warning

The printer and PC must be placed in a restricted area if connected directly to the modular cabinet.

The printer and PC must be connected to AC mains with a suitable power cord: safety earth to safety earth, non-earth to non-earth (the safety earth must be guaranteed).

20.2   CPU1 Cabling
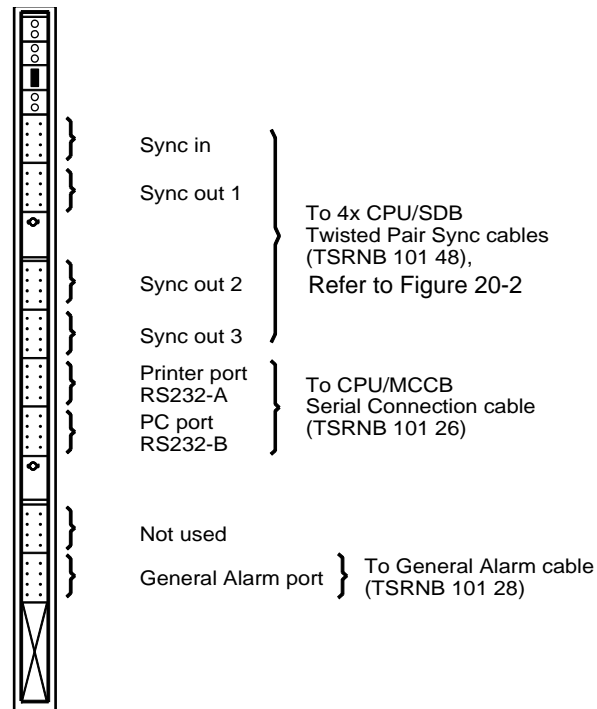
Fig. 20-1 Connections to the CPU1

Connections to the MCCB

1. Remove the tie-wrap that is holding the CPU/MCCB serial connection cable (TSRNB 101 26) and the general alarm cable (TSRNB 101 28) together. Both cables are already connected to the MCCB.
2. Connect the CPU/MCCB serial connection cable (TSRNB 101 26) to the Printer and PC port on the CPU (see Figure 20-1).
3. Connect the General Alarm cable (TSRNB 101 28) to the General Alarm port on the CPU.
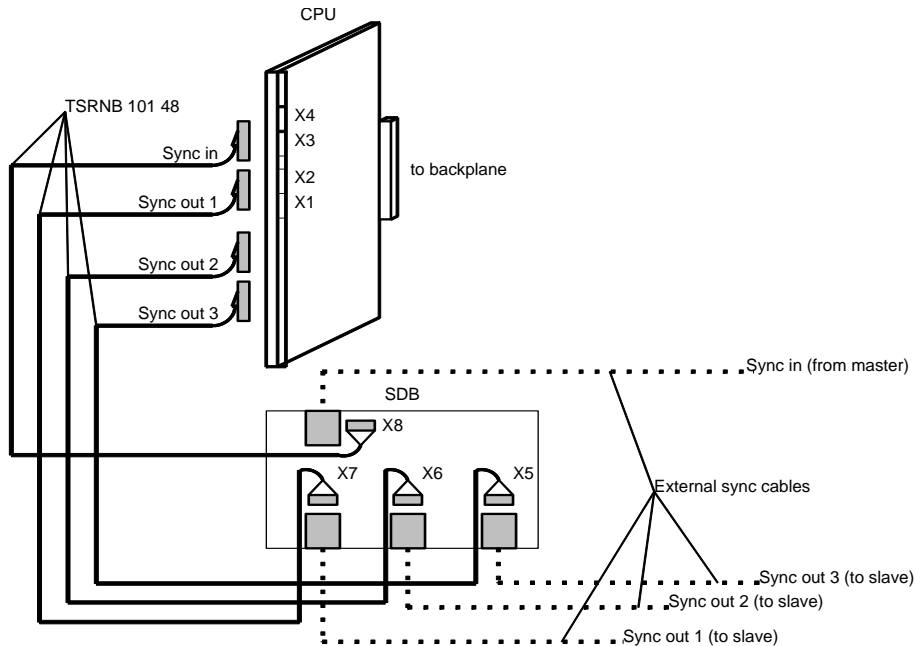
Fig. 20-2 Connections to SDB

Connections to the SDB

For the connections to the SDB also refer to Chapter 18:

1. Ensure that the SDB is installed on the bottom plate of the cabinet and that the CPU strap settings are in the proper position. The required material is part of the installation set, sync port kit (NTMNB 101 107).
2. Connect the CPU/SDB Twisted Pair Sync cables (TSRNB 101 48) as indicated in Figure 20–2 (see also Figure 20–1).
3. Connect the external sync in cable to a sync out outlet of another DCT1900 when this CPU is not the synchronization master.
4. Connect the external sync out cables to the sync in inlets of the DCT1900 systems that are synchronization slaves to this CPU.
5. Fasten the external sync cables to the cable tie blocks on the ground strip (see Figure 20–3) using tie wraps.
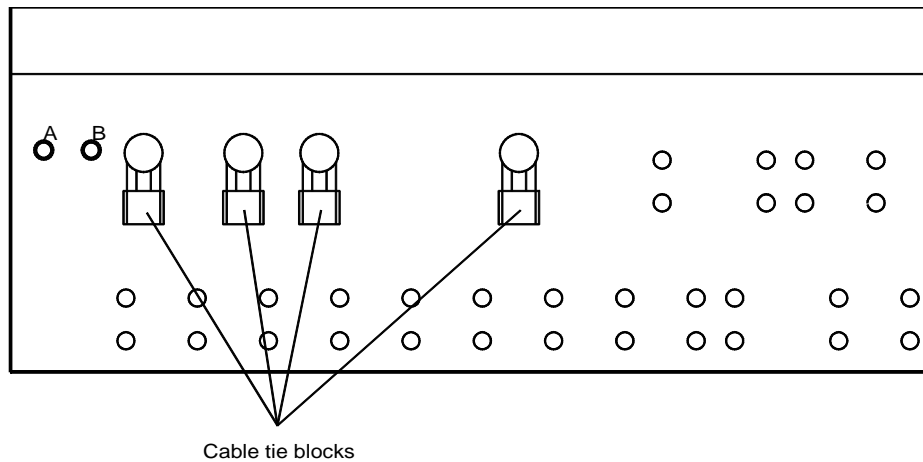
Fig. 20-3   Cable Tie Blocks on the Ground Strip

Connection to the PC, Printer, and SMS System

1. Connect PC cable (TSRNB 101 22D) to the PC connector on the MCCB and to the PC.
2. Connect the printer cable (TSRNB 101 23) to the PR connector on the MCCB and to the printer. For Short Message Service (SMS), connect the printer connector on the MCCB to the RS232 on the PC running the SMS application using cable TSRNB 101 23 (DB25) or TSRNB 101 22D (DB9).
3. Fasten the cables to the cable tie blocks on the ground strip (see Figure 20–3) using tie wraps.
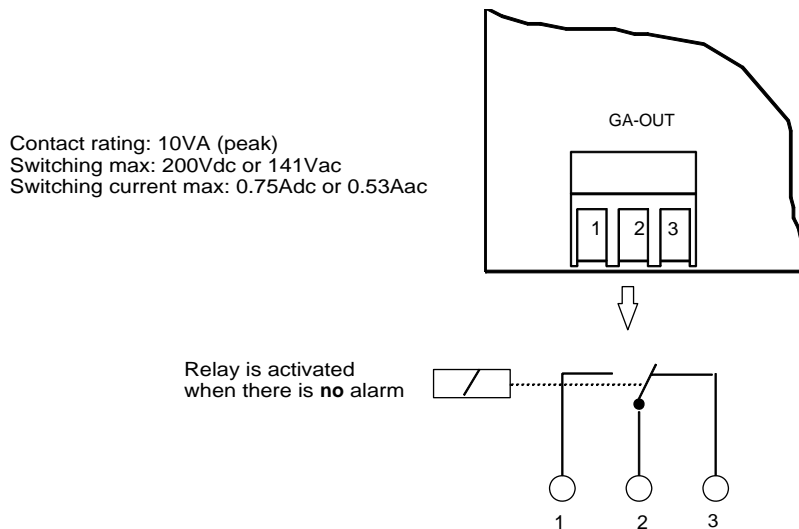
Fig. 20-4   General Alarm Connector (MCCB)

Connection to Alarm Device
The General Alarm relay is normally activated when the Modular Cabinet is switched on. If the
CPU generates a general alarm, the alarm relay is deactivated.
1. Connect an alarm device to the GA–OUT connector on the MCCB (see Figure 20–4). When
    the alarm device needs to make contact, connect the alarm device between contacts 1 and 2.
    When the alarm device needs to break contact, connect the alarm device between contacts 2
    and 3.
2. Fasten the cable to the cable tie blocks on the ground strip (see Figure 20–3) using a tie wrap.

20.3   Synchronization Data Board (SDB) replacement Cable (AWS1154)

The SDB and its attendant cables have been replaced with a simpler, easier to install cable
assembly. The cable assembly connects directly to the front of the CPU1 board. No internal
cables or SDB are required when using this cable.

The part number for this cable is AWS1153 and it is a 25 feet long.

CPU1 Sync Port Pin Connections
The CPU1 board uses a modular type plug for connection to the Sync In and Sync Out connectors.
(see Figure 20-5).

The connector pins are arranged by column and row. There are 3 columns on the connector,
designated A, B, and C. There are seven rows of pins numbered 1-7. To identify the pins, while
holding the connector as if to plug it into the board, the part number marking (RNV 304 002)

should be on the left, with the pins facing towards you. Pin A1 is in the upper left corner, while pin C7 is in the lower right corner.

Note: There are no pins in rows 2, 4, or 6. The pins that will be utilized for the Sync signal are pins A3 and C5 (blue pair). The same pin-out is used for both the input and the output connectors.

Connecting CPU1 to CPU1
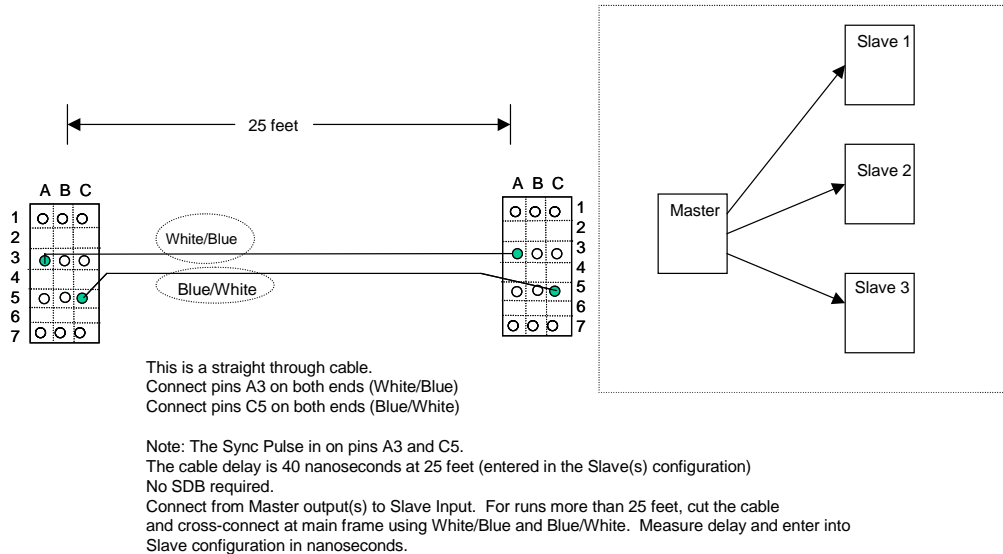
Fig. 20-5   CPU1 Sync Replacement Cable (AWS1154)

Connection of the Sync Cable
CPU1 to CPU1 (Figure 20-5)
When connecting a CPU1 to another CPU1, it is only necessary to connect the output of the master to the input of the slave. Locate an output position, insert the cable, and plug the other end into the slave CPU input. Enter the delay into the slave CPU configuration, and ensure that the option straps are set properly (Refer to Section 5, Chapter 5, CPU1 Board). Once this information is entered, and the straps are set properly, create a service report using CSMW and check the slave CPU. It should show SLAVE, SYNC AVE.

For runs up to 25 feet, the cable provided has a delay of 40 nanoseconds. For runs longer than 25 feet, it will be necessary to cut the provided cable, and terminate it at the punch down blocks at both ends. Cross connect the blue pair (straight connection), and using a Time Domain Reflectometer (TDR), read the delay in nanoseconds, and enter the value into the slave CPU.

20.4   CPU2 Cabling
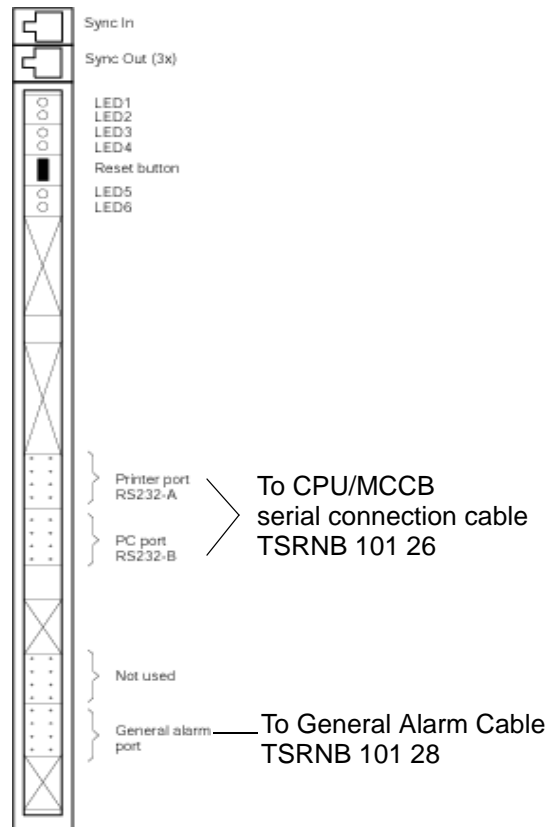
Fig. 20-6 CPU2 Board Connections

Connections to the MCCB
1. Remove the tie-wrap that is holding the CPU/MCCB serial connection cable (TSRNB 101 26) and the General Alarm cable (TSRNB 101 28) together. Both cables are already connected to the MCCB.
2. Connect the CPU/MCCB serial connection cable (TSRNB 101 26) to the Printer and PC port on the CPU (see Figure 20-6).
3. Connect the General Alarm cable (TSRNB 101 28) to the General Alarm port on the CPU.

Connection to the PC, Printer, and SMS System
1. Connect PC cable (TSRNB 101 22D) to the PC connector on the MCCB and to the PC.
2. Connect the printer cable (TSRNB 101 23) to the PR connector on the MCCB and to the printer. For Short Message Service (SMS), connect the printer connector on the MCCB to the RS232 on the PC running the SMS application using cable TSRNB 101 23 (DB25) or TSRNB 101 22D (DB9).
3. Fasten the cables to the cable tie blocks on the ground strip (see Figure 20–3) using tie wraps.

Connection to Alarm Device

The General Alarm relay is normally activated when the Modular Cabinet is switched on. If the CPU generates a general alarm, the alarm relay is deactivated.

1. Connect an alarm device to the GA–OUT connector on the MCCB (see Figure 20–4). When the alarm device needs to make contact, connect the alarm device between contacts 1 and 2. When the alarm device needs to break contact, connect the alarm device between contacts 2 and 3.
2. Fasten the cable to the cable tie blocks on the ground strip (see Figure 20–3) using a tie wrap.

CPU2 Sync Port Connector

The CPU2 has two RJ45 connectors, one for Sync In and one for Sync Out. (Figure 20-6)

The RJ-45 pins are identified as pins 1-8. While holding the RJ-45 connector with the locking tab down and looking into the end that the cable is inserted into, pin 1 is on the far left, and pin 8 is on the far right. Only pins 4 and 5 (orange pair) are used on the Input. The Output uses pins 1 & 2 (blue pair), 4 & 5 (orange pair), and 7 & 8 (green pair), providing 3 output signals on one cable.

CPU2 Sync Cable (AWS1153)

The cable used to synchronize 2 or more CPU2 boards is AWS1153. This cable is 25 ft. long and is terminated at both ends in RJ45 connectors. The measured delay for this cable is 40 nanoseconds.

Connection to the Sync Cable
CPU2 to CPU2 - 2 REs (Figure 20-7)

When connecting a CPU2 to another CPU2, connect the sync cable, AWS1153 between the Sync Out on the Master Radio Exchange CPU2 board and the Sync In on the Slave Radio Exchange CPU2 board. Make sure that both the Master and Slave CPU2 boards are strapped correctly. Refere to CPU2 board Section 5, Chapter 6. Enter the cable dealy, for this cable, 40 nanoseconds into the Slave CPU2.
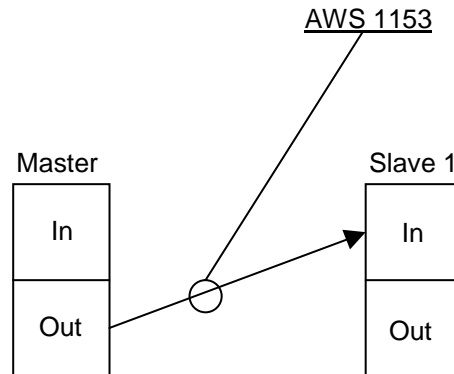
Fig. 20-7 CPU2 Sync Cable for up to 2 REs

CPU2 to CPU2 - More than 2 REs (Figure 20-8)
When connecting more than 2 REs together using CPU2, it will be necessary to cut the supplied cable, AWS1153, and terminate it to a punch-down block. From the master CPU2, the outputs will be on the blue, orange, and green pairs. Cross-connect each output to the orange pair of each slave's cable. Measure the delay of each cable, and enter the value into each slave's configuration in nanoseconds.
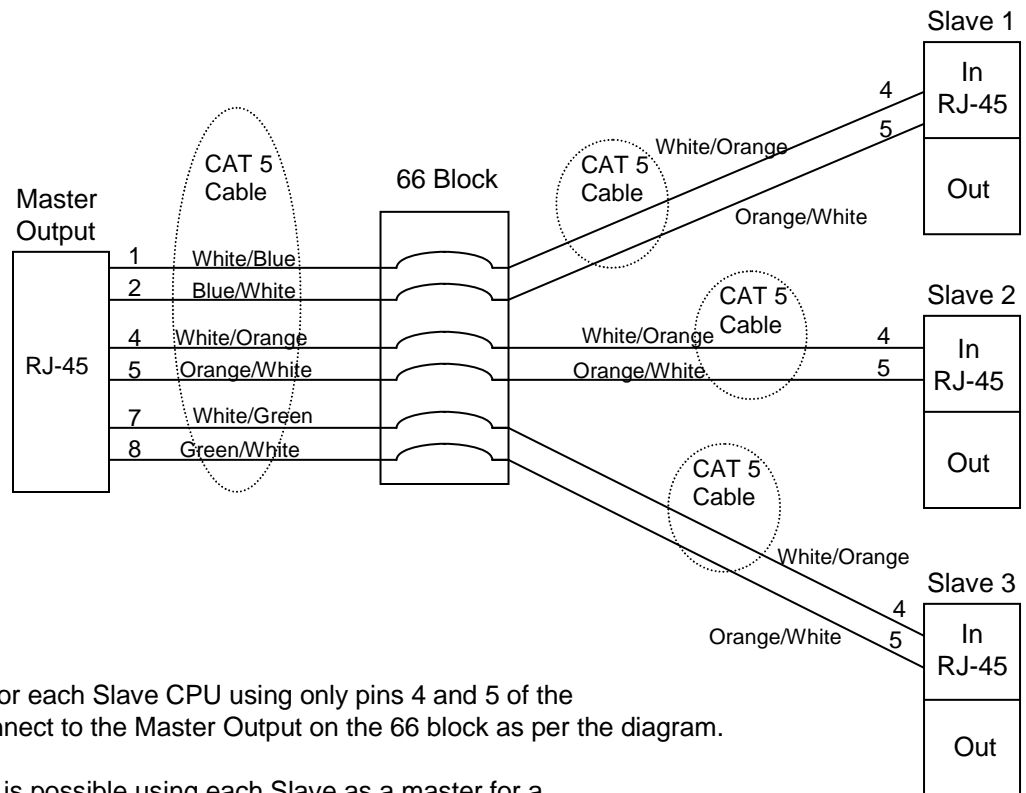
Make a cable for each Slave CPU using only pins 4 and 5 of the
RJ-45, and connect to the Master Output on the 66 block as per the diagram.

Daisy chaining is possible using each Slave as a master for a
Sub-cluster configuration (maximum of 2 levels of slaves).

The cable delay must be measured for each connection, entered in each slave's configuration
in nanoseconds.

Fig. 20-8 CPU2 Sync Cable for more than 2 REs

20.5 Mixing CPU1 and CPU2 based Systems

Connection of the Sync Cable
CPU1 to CPU2 - CPU 1 Master (Figure 20-9)
When connecting CPU1 master to CPU2 slave, it will be necessary to cut the supplied cables and
terminate them at the punch-down blocks. Cross connect the CPU1 blue pair to the CPU2 orange
pair, pins 4 & 5 in the RJ45. Measure the delay, and enter the value into the CPU2 (slave)
configuration in nanoseconds.

CPU2 to CPU1 - CPU2 Master, Multiple REs (Figure 20-10)
 If connecting a CPU2 as master with a CPU1 as a slave, it will be necessary to cut the supplied
cables and terminate them at on a punch down block. The CPU2 will have an output on the blue,
orange, and green pairs, while the CPU1 will have an input on the blue pair. Cross connect one of
the CPU2 outputs to the blue pair of the CPU1 input. This can be repeated for up to 3 slaves REs.
Measure the delay and enter the value into the slave configuration in nanoseconds.
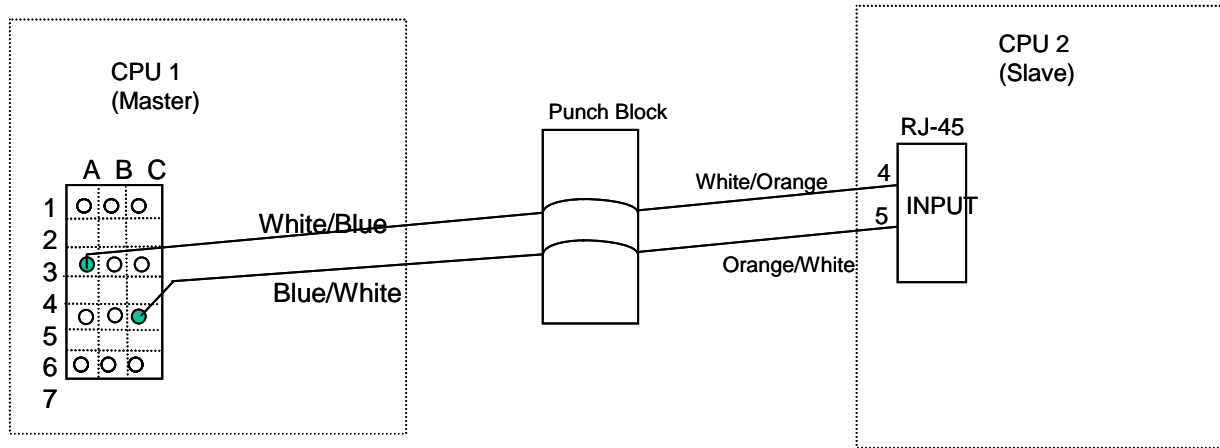
Connect Pins A3 and C5 of CPU 1 to pins 4 and 5 of CPU 2.

Using CAT 5 cable at 25 feet, the delay is
40 nanoseconds, entered into the Slave CPU configuration.

For longer runs, cut the cable and cross-connect at the 66 block.
Measure the delay, and enter in the slave configuration in nanoseconds.

Fig. 20-9 CPU1 to CPU2 Connection
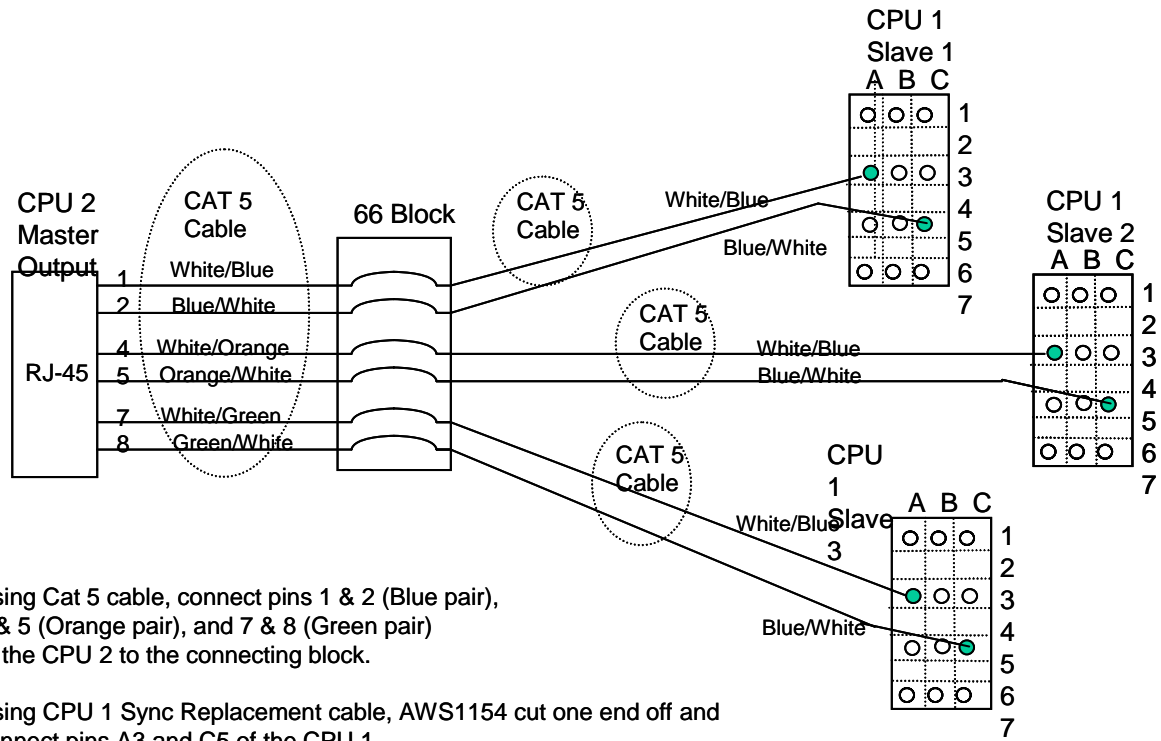
Using Cat 5 cable, connect pins 1 & 2 (Blue pair),
4 & 5 (Orange pair), and 7 & 8 (Green pair)
of the CPU 2 to the connecting block.

Using CPU 1 Sync Replacement cable, AWS1154 cut one end off and
connect pins A3 and C5 of the CPU 1
to the connecting block (White/Blue and Blue/White).

Cross-connect CPU 2 to CPU 1 at the block. Measure the delay,
and enter the value in nanoseconds into each slave's configuration.

Fig. 20-10   CPU2 to CPU1, CPU2 Master, CPU1 Slave, Multiple REs

CHAPTER 21
Modular Cabinet – CLU/SLU to Base Station Cabling

21.1   Introduction

This chapter describes all the cabling between the CLU or SLU and the Base Station. Refer to Chapter 19 on how to supply Base Station power for CLUs or SLUs.

The Modular Cabinet is provided with a ground strip to connect the CLU or SLU cables to ground (see Fig. 21–1). These ground connections are necessary for EMI suppression reasons.

Two cables sets are used to interconnect the CLU/SLU to the MDF. Cable set NTM/TSRNB 101 29 is 16 ft. long and is terminated in a 25 pair amphenol. Cable set NTM/TSRNB 101 46 is two 82 ft. 12 pair cables unterminated.

Note:
The orientation of the shielding clamps shall be according to Fig. 21–1. If the clamp is positioned at the wrong side, remove the clamp and fit it such that it is positioned correctly.

Shielding clamp at the back row

Shielding clamps at the front row
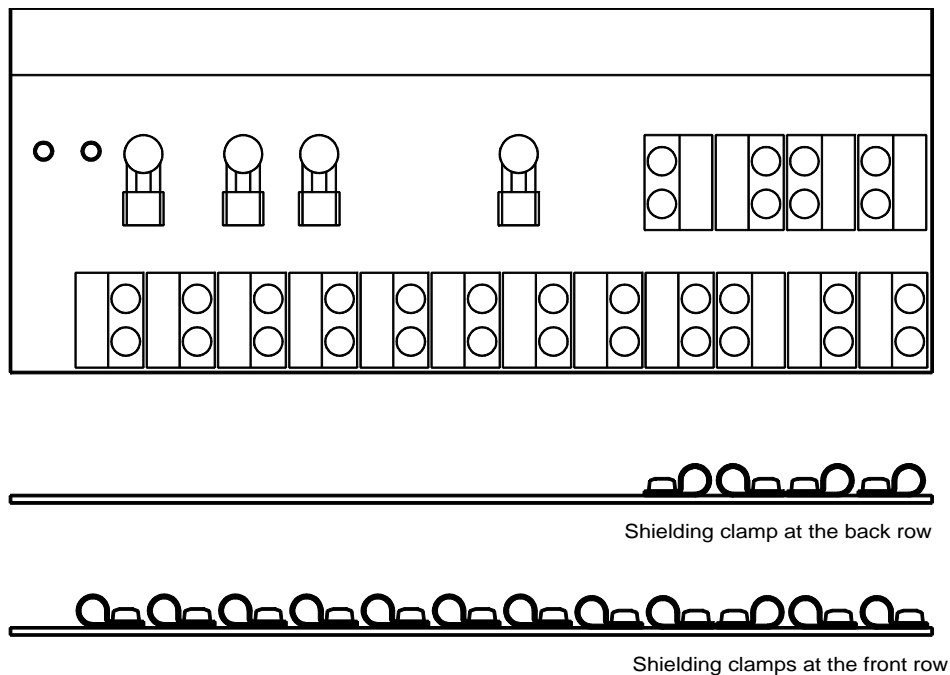
Fig. 21–1 Ground Strip with Shielding Clamps

21.2   Installation of Cables

Note:

Base Stations with cables longer than 1.3 miles up to 2.17 miles must always be connected to a CLU with product code REX-BRD0014 or ROFNB 157 11/2.

Base Station with cables of up to 1.3 miles can be connected to a CLU/SLU with product code REX-BRD0014 (ROFNB 157 11/2) or REX-BRD0015 (ROFNB 157 16/1) or REX-BRD0016 (ROFNB 157 16/2).

CLU/SLU to the MDF

Cable sets NTM/TSRNB 101 29 and NTM/TSRNB 101 46 connect from the CLU/SLU boards in the modular cabinet to 66 blocks (or equivalents) on the MDF. Refer to the Table 21-2 and 21-3 for the pinout of the respective cables.

1. Connect the plug of CLU/MDF cable TSRNB 101 29/2 (or the long cable TSRNB 101 46/2) to the upper connector of the furthest right CLU or SLU as shown in Fig. 21–2.
2. Connect the plug of CLU/MDF cable TSRNB 101 29/1 (or the long cable TSRNB 101 46/1) to the lower connector of the same CLU or SLU as in the previous step.
3. Screw the shielding clamp of TSRNB 101 29/2 (or TSRNB 101 46/2) to the furthest right free position on the ground strip using two M3 x 10 torx screws delivered with the Modular Cabinet.
4. Screw the shielding clamp of TSRNB 101 29/1 (or TSRNB 101 46/1) to the next furthest right free position on the ground strip.
5. Connect the cable set TSRNB 101 29 to the provided 66 blocks via the 25 pair amphenol connector. Connect the cable set TSRNB 101 46 to the provided 66 blocks, or any other block by punching the wires down.   Circuit wiring is shown in Table 21-2.

Note:

To meet EMC requirements, the cable should never be cut to a length shorter than 8.20 ft.
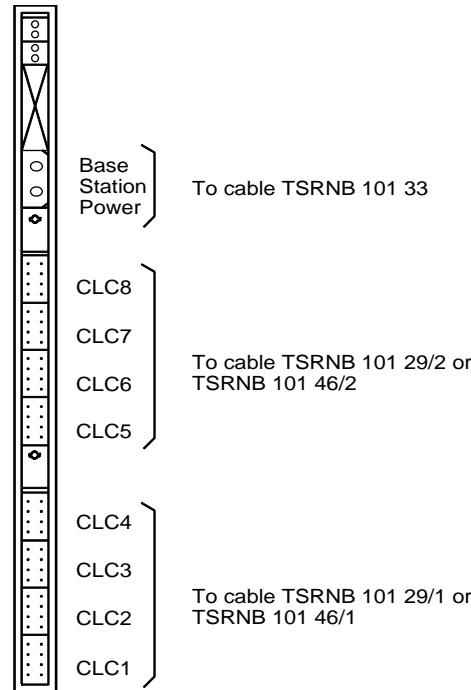
Fig. 21–2 CLU/MDF Cable Connections on the CLU or SLU

Base Station Power
The following installation steps are necessary when the Base Stations are powered via the Modular Cabinet. Refer to Chapter 19 on how to supply Base Station power to the MCCB.
1. Connect connectors PW1 on the MCCB to the Base Station power connectors on the furthest left CLU or SLU using the CLU/MCCB Power cable (see Fig. 21–2).
2. Connect PW2 – PW7 to the power connections of the other CLU or SLUs starting at the next CLU or SLU.

Cabling from the MDF to the Base Station
Refer to Section 4, Chapter 4, Base Station Powering for cable type information. Figure 21-3 shows the pinout of the 66 blocks that the cable set NTM/TSRNB 101 29 terminates on. **NOTICE** that only 3 pairs are brought out for each base station. These are SC0, SC1 and EPP0/1.

You must hook up the first 2 pair, SC0 and SC1, for each base station. The third pair, EPP0/1, is only used when additional power is required due to cabling distances. (Refer to Section 4, Chapter 4, Base Station Powering).

If a fourth pair (white/brown pair) is required then it may be punched down on top of the existing EPP0/1, pair (white/green pair).

DCT1900 66 BLOCK BASE STATION WIRING
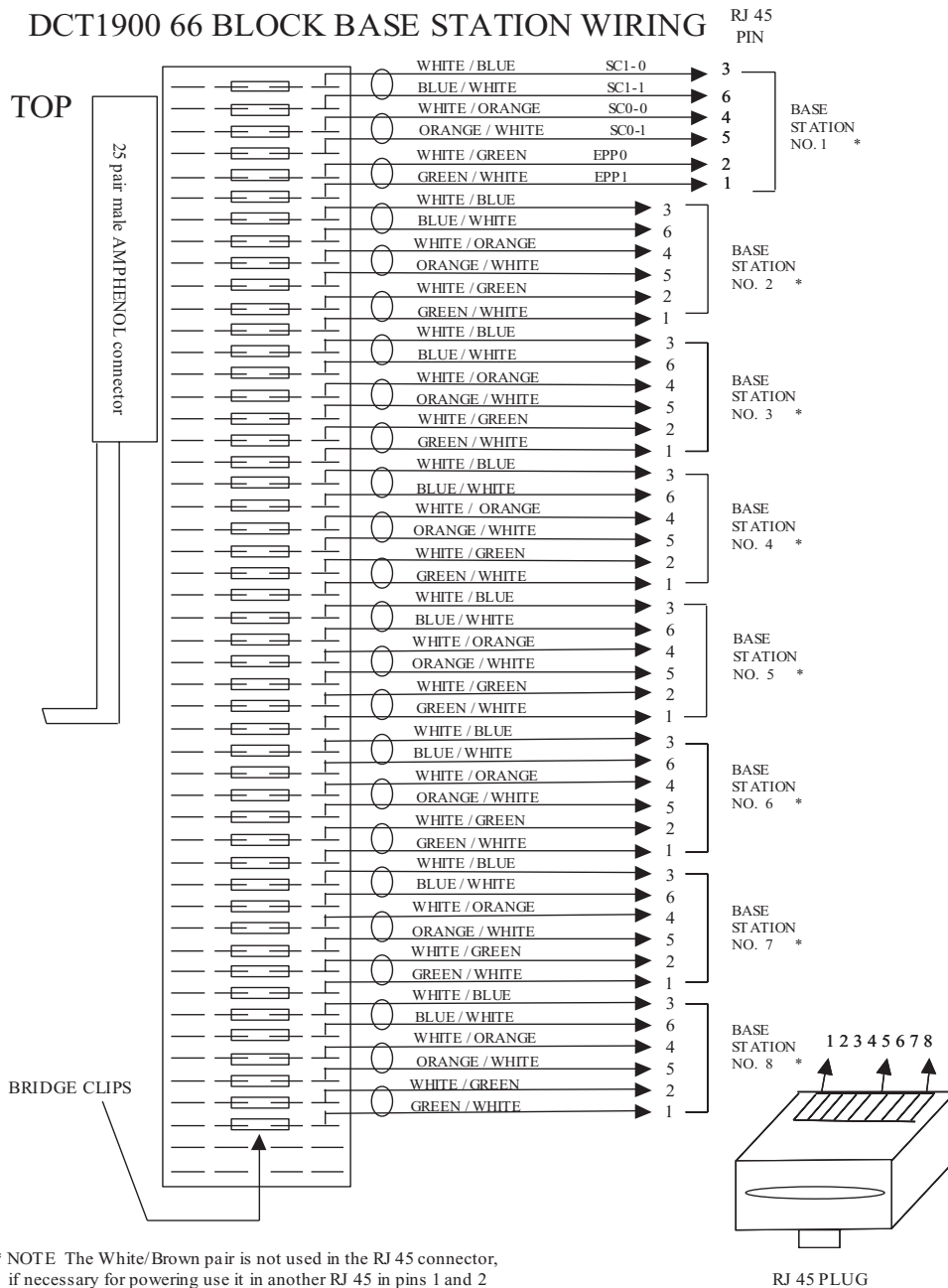
Fig. 21-3 66 Block Diagram

-------------------------------- BE AWARE -------------------------------------

----THIS IS <u>NOT PINNED OUT AS A 568A OR 568B CONNECTOR</u>-----

PIN 1

Green/White

White/Green

White/Blue

White/Orange

White/Brown

Brown/White

Blue/White

Orange/White
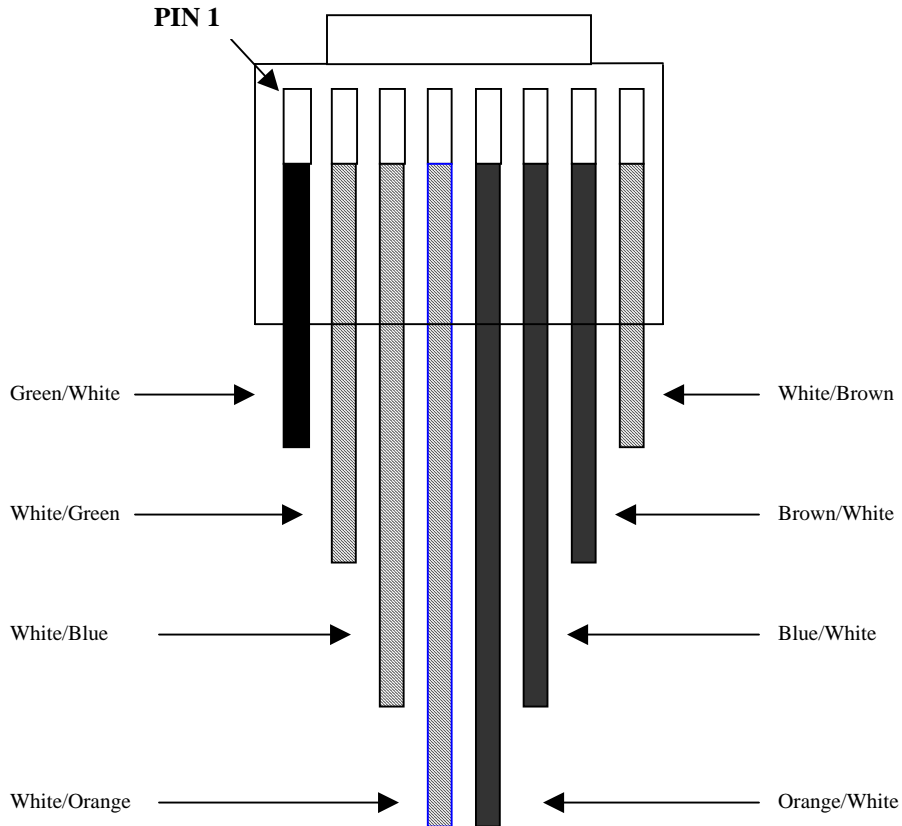
Fig. 21-4 Base Station RJ-45 Connector

If a base station is going to be powered locally, using an AC/DC adapter in the last IDF, then only the first two pair, SC0 and SC1, should be hooked up for that Base Station on the 66 block. In the last IDF, connect the output of the AC/DC adapter to the white/green pair going out to the RJ45 connector (Fig. 21-4) of the Base Station as shown in Figure 21-5.

FROM MDF	HOUSE PAIRS	66 BLOCK IN IDF	RJ 45 PINS

```
                                                                    W/B
WHITE/BLUE – SC1-0      ─────────────────────┌──────┐──────────────────  3
                                             │      │    B/W
BLUE/WHITE – SC1-1      ─────────────────────│      │──────────────────  6
                                             │      │    W/O
WHITE/ORANGE – SC0-0    ─────────────────────│      │──────────────────  4
                                             │      │    O/W
ORANGE/WHITE – SC0-1    ─────────────────────│      │──────────────────  5
                                             │      │    W/G (-)
                              (-)   ┌────────│      │──────────────────  2
                                    │        │      │    G/W (+)
                                    │   ┌────│      │──────────────────  1
                                    │   │    └──────┘
                              (+)   │   │
                                    │   │
                                ┌───┴───┴───┐
                                │  AC/DC    │
                                │  ADAPTER  │
                                └───────────┘
```
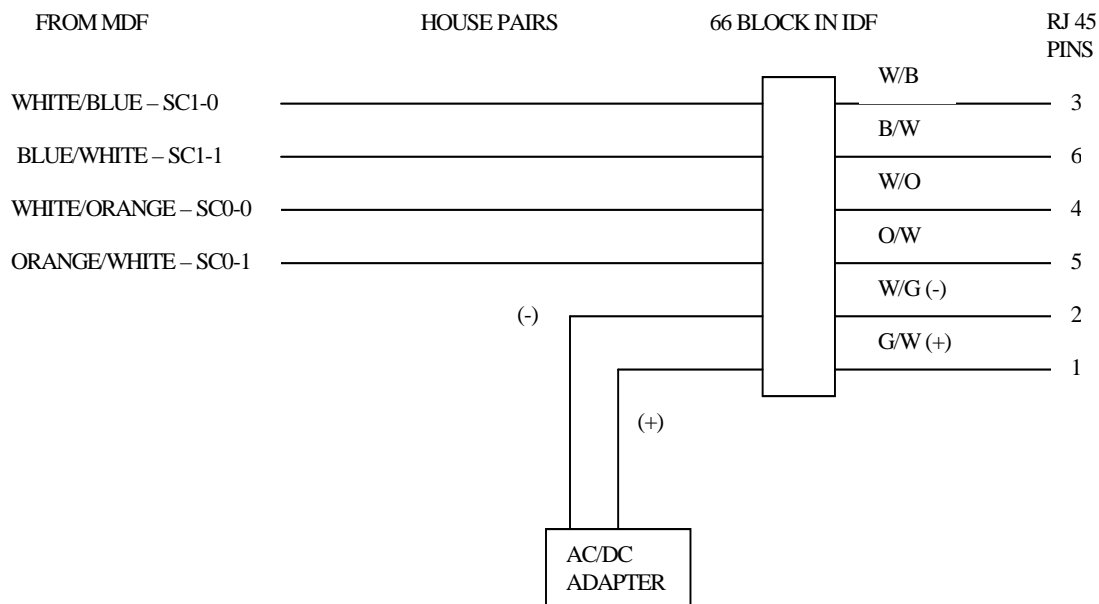
Fig. 21-5 Local Powering of a Base Station

*Note: If a Base Station is going to be powered locally, then the CLU/SLU board that it is connected to **MUST NOT** have the CLU/MCCB power cable (TSRNB 101 33) hooked up to it. This means that all 8 Base Stations on that CLU/SLU board can only be powered locally!*

Warning

IF Base Station cables go outside the building, the system must be protected from lightning strikes by surge arresters.

Refer to Ascom Application Note AN_0252 for UL approval Lightning Protection Devices and Installation Procedures.

Record Keeping

Make a copy of the Base Station identification and location sheet included at the end of this chapter and fill in the information as you add your Base Stations. Refer to Section 2, Chapter 5, paragraph 5.4 in this manual for Base Station Numbering. An example of how to fill in the sheet starting with cable pair 1 of the CLU/MDF cable TSRNB 101 29/1 (see Table 21-3) or TSRNB 101 4611 (see Table 21-2) is given in Table 21-1.

Base Station Id	Cabinet number	CLU or SLU board position	CLC number	Delay *	Location of Base Station
40	1	56	1	.6	Building A, floor 1, room 100
41	1	56	2	.8	Building A, floor 2, room 122
43	1	56	3	.2	Building A, floor 2, corridor at room 050

Table 21–1 Example of Base Station Administration

Note: Delay* - If you are using the SLU or CLU-S boards, then the delay will .1 for all Base Stations.

Cable	Cable pair	Colour	CLC	Signal
/1	1	white – blue	CLC1	SC1
	2	white – orange		SC0
	3	white – green		EPP0 – EPP1
	4	white – brown	CLC2	SC1
	5	white – grey		SC0
	6	red – blue		EPP0 – EPP1
	7	red – orange	CLC3	SC1
	8	red – green		SC0
	9	red – brown		EPP0 – EPP1
	10	red – grey	CLC4	SC1
	11	black – blue		SC0
	12	black – orange		EPP0 – EPP1
/2	1	white – blue	CLC5	SC1
	2	white – orange		SC0
	3	white – green		EPP0 – EPP1
	4	white – brown	CLC6	SC1
	5	white – grey		SC0
	6	red – blue		EPP0 – EPP1
	7	red – orange	CLC7	SC1
	8	red – green		SC0
	9	red – brown		EPP0 – EPP1
	10	red – grey	CLC8	SC1
	11	black – blue		SC0
	12	black – orange		EPP0 – EPP1

Table 21–2 Identification of the Cable Pairs in NTM/TSRNB 101 46

Connector	Cable Pair-Pin	Wire Color	25 Pair Connector Pin	Signal Name
1	1-3	White	26	SC1-0 Circuit 1
1	1-2	Blue	1	SC1-1
1	2-7	White	27	SC0-0
1	2-6	Orange	2	SC0-1
1	3-5	White	28	EPP0
1	3-4	Green	3	EPP1
1	4-11	White	29	SC1-0 Circuit 2
1	4-10	Brown	4	SC1-1
1	5-15	White	30	SC0-0
1	5-14	Gray	5	SC0-1
1	6-13	Red	31	EPP0
1	6-12	Blue	6	EPP1
1	7-19	Red	32	SC1-0 Circuit 3
1	7-18	Orange	7	SC1-1
1	8-23	Red	33	SC0-0
1	8-22	Green	8	SC0-1
1	9-21	Red	34	EPP0
1	9-20	Brown	9	EPP1
1	10-27	Red	35	SC1-0 Circuit 4
1	10-26	Gray	10	SC1-1
1	11-31	Black	36	SC0-0
1	11-30	Blue	11	SC0-1
1	12-29	Black	37	EPP0
1	12-28	Orange	12	EPP1

Table 21-3 CLU to 66 Block Cabling

2	1-3	White	38	SC1-0 Circuit 5
2	1-2	Blue	13	SC1-1
2	2-7	White	39	SC0-0
2	2-6	Orange	14	SC0-1
2	3-5	White	40	EPP0
2	3-4	Green	15	EPP1
2	4-11	White	41	SC1-0 Circuit 6
2	4-10	Brown	16	SC1-1
2	5-15	White	42	SC0-0
2	5-14	Gray	17	SC0-1
2	6-13	Red	43	EPP0
2	6-12	Blue	18	EPP1
2	7-19	Red	44	SC1-0 Circuit 7
2	7-18	Orange	19	SC1-1
2	8-23	Red	45	SC0-0
2	8-22	Green	20	SC0-1
2	9-21	Red	46	EPP0
2	9-20	Brown	21	EPP1
2	10-27	Red	47	SC1-0 Cicuit 8
2	10-26	Gray	22	SC1-1
2	11-30	Blue	23	SC0-1
2	12-29	Black	49	EPP0
2	12-28	Orange	24	EPP1

Table 21-3 CLU to 66 Block Cabling (cont.)

Base Station Identification and Location Sheet

Base Station ID	Cabinet Number	CLU or SLU Board Position	CLC Number	Delay	Location of Base Station

CHAPTER 22
Modular Cabinet – DTU Cabling

22.1 Introduction

This chapter describes the installation of the cabling between the DTU(s) and MS/PBX by means of twisted pair cables. The description is applicable for DTU-E1CAS, REX-BRD0002 or *2/ROFNB 157 13/1,* DTU-E1 CCS REX-BRD0003 *or 2/ROFNB 157 13/6* and DTU-T1, REX-BRD0021 or *2/ROFNB 157 13/3* and *2/ROFNB 157 13/2* .

The Modular Cabinet is provided with a ground strip to connect the cables from the DTUs and the CLUs/SLUs to ground. These ground connections are necessary for EMI suppression.

Note:
The orientation of the shielding clamps shall be according to Figure 22–1. If the clamp is positioned at the wrong side, remove the clamp and fit it such that it is positioned correctly.


Shielding clamp at the back row

Shielding clamps at the front row
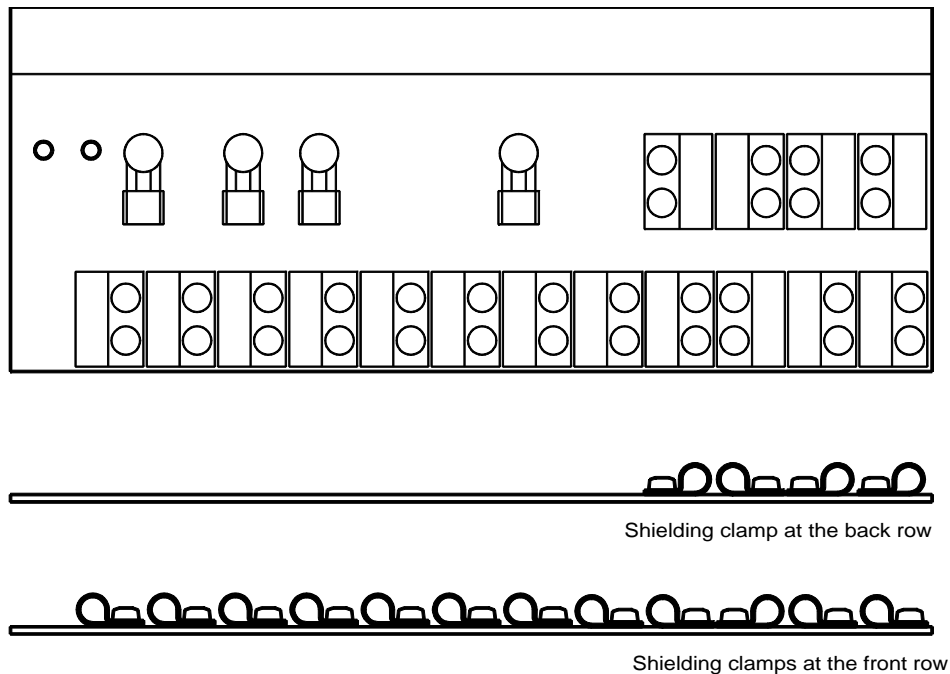
Fig. 22–1 Ground Strip with Shielding Clamps

22.2   Installation - DTU-E1

Connecting the DTUs to the MS/PBX
1. Ensure the DTU strap settings are in the twisted pair position (refer to Chapter 11).
2. Connect the lower X2 plug of DTU twisted pair cable AWS1034 to the lower connector of the DTU as shown in Figure 22–2.
3. Connect the upper X1 plug of DTU twisted pair cable to the upper connector.
4. Screw the shielding clamp of the cable to the furthest left free position on the ground strip using two M3 x 10 torx 10 screws delivered with the Modular Cabinet.
5. Connect the other end of the DTU cable as required - normally punched down on the Main Distribution Frame (MDF) or "66" block.

Dual DTU E1 cable
AWS1034

X1

X2

X2

XMIT pairs

X1

BRN ORN
WHT WHT
GRN BLU
WHT WHT

RCV pairs

View looking into DTU board edge
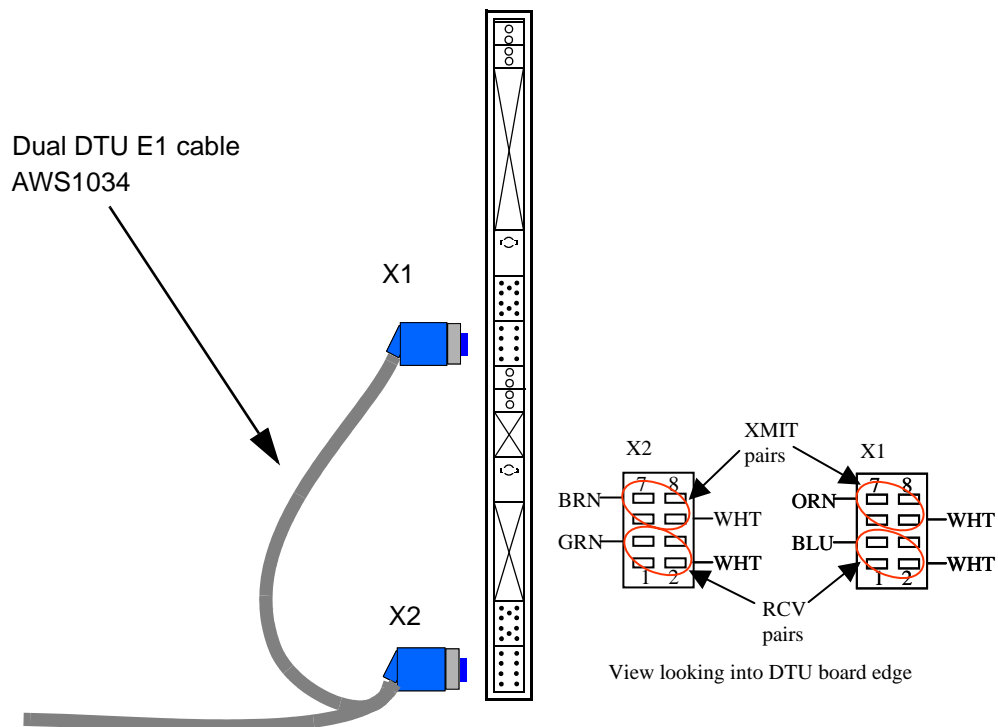
Fig. 22–2 DTC Connections on the DTU-E1

22.3   Installation - DTU-T1 (CAS or CCS)

Connecting the DTUs to the MS/PBX
1.   Ensure the DTU strap settings are in the twisted pair position (refer to Chapters 12 & 13).
2.   Connect the lower X2 plug of the DTU twisted pair cable AWS1033 to the lower connector of the furthest left DTU as shown in Figure 22-3.
3.   Connect the upper X1 of the DTU twisted pair cable to the upper connector.
4.   Screw the shielding clamp of the cable the furthest left free position on the ground strip using two M3 x 10 torx screws delivered with the Modular Cabinet.
5.   Connect the other end of the DTU cable as required - normally punched down on the Main Distribution Frame (MDF) or "66" block.
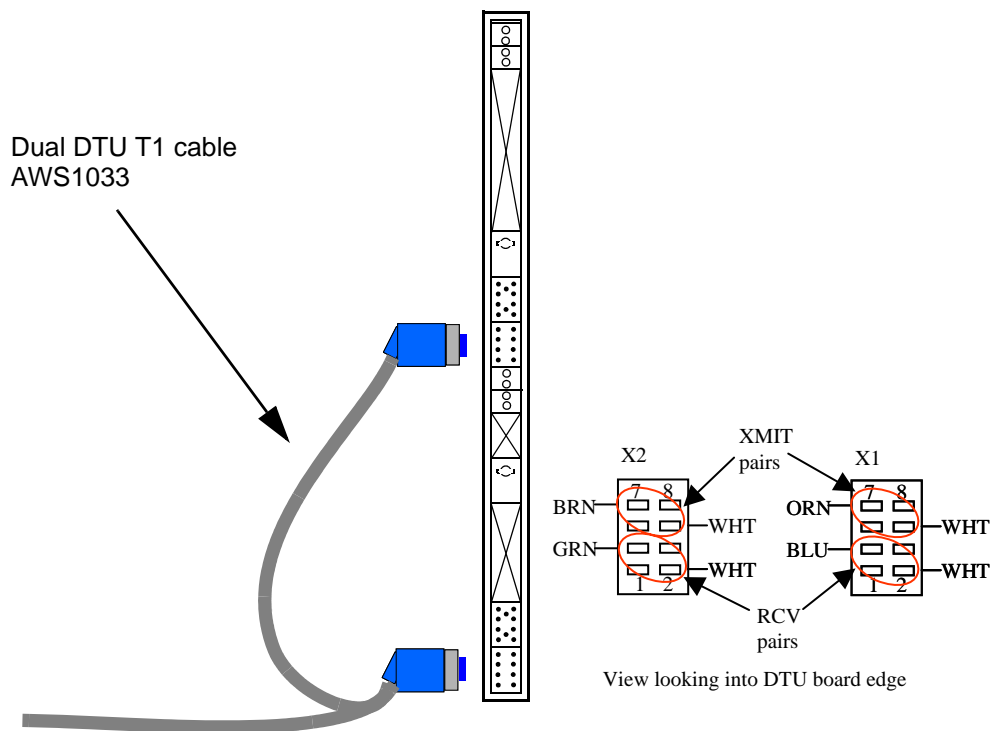
Fig. 22–3 DTC Connections on the DTU-T1

CHAPTER 23
Modular Cabinet – LTU Cabling

23.1   Introduction

This chapter describes the installation of the cabling between the LTU(s) and the PBX. The LTU cable set, NTM/TSRNB 101 31, consists of two 12 pair cables terminated in one 25 pair amphenol connector. The other end of each cable ends in three Ericsson half connectors. Refer to Chapter 26, Modular Cabinet cables, for a cable schematic and physical description.

Each LTU cable is designed to connect three LTU boards, thus 24 analog extensions, to a single 66 Block. The cable terminates in a 25 pair male amphenol connector which mates with a Siemens 66m250 Block or the connector can be cut off and the cables punched down on other types of blocks. Refer to Table 23-1 for a pin out of the cable

The Modular Cabinet is provided with a ground strip to connect the cables from the LTUs and the CLUs to ground. These ground connections are necessary for EMI suppression reasons.

Note:
The orientation of the shielding clamps shall be according to Figure 23-1. If the clamp is positioned at the wrong side, remove the clamp and position it properly.

Shielding clamp at the back row

Shielding clamps at the front row
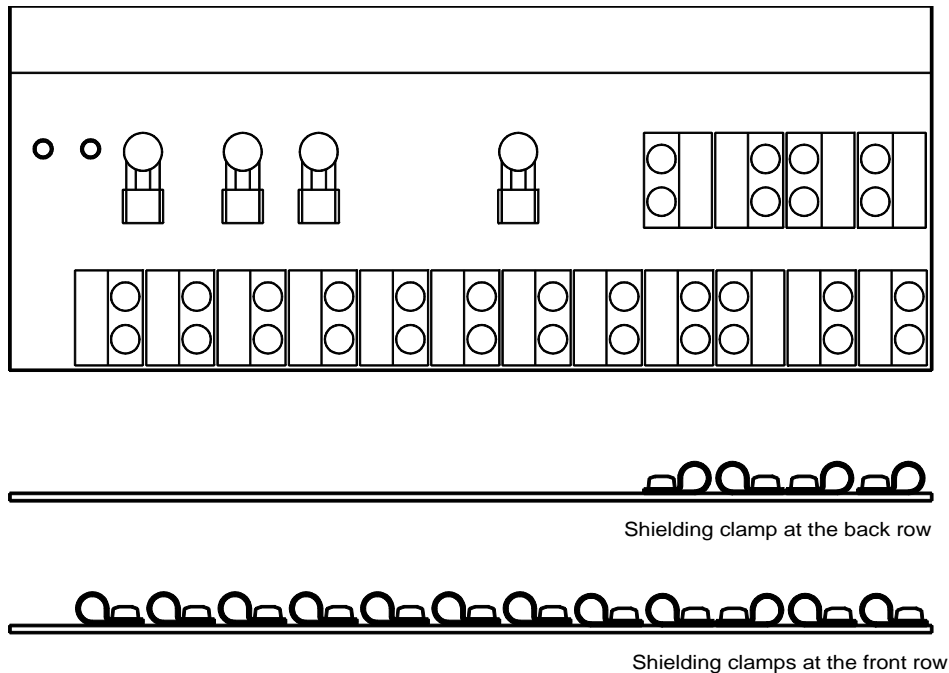
Fig. 23–1 Ground Strip with Shielding Clamps

23.2   Installation

The six connectors on the LTU end of the cables are labelled 1 through 6 and should be installed as shown in Figure 23-2. Connectors 1 & 2 go to the first LTU, connectors 3 & 4 go to the second LTU, and cables 5 & 6 go to the third LTU.

LTU Ground
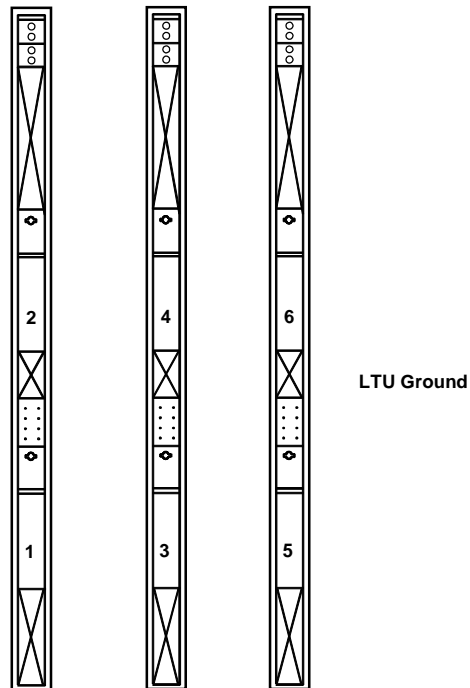
Fig. 23-2 LTU/MDF Cable Connections to the LTU

The amphenol end of the cable is pinned out as follows:

Connector	Cable Pair-Pin	Wire Color	25 Pair Connector Pin	Signal Name
1	1-5	White	26	Analog Channel - 1T
1	1-6	Blue	1	Analog Channel - 1R
1	2-1	White	27	Analog Channel - 2T
1	2-2	Orange	2	Analog Channel - 2R
1	3-5	White	28	Analog Channel - 3T
1	3-6	Green	3	Analog Channel - 3R
1	4-1	White	29	Analog Channel - 4T
1	4-2	Brown	4	Analog Channel - 4R
2	5-5	White	30	Analog Channel - 5T
2	5-6	Gray	5	Analog Channel - 5R
2	6-1	Red	31	Analog Channel - 6T
2	6-2	Blue	6	Analog Channel - 6R
2	7-5	Red	32	Analog Channel - 7T
2	7-6	Orange	7	Analoog Channel - 7R
2	8-1	Red	33	Analog Channel - 8T
2	8-2	Green	8	Analog Channel - 8R
3	9-5	Red	34	Analog Channel - 9T
3	9-6	Brown	9	Analog Channel - 9R
3	10-1	Red	35	Analog Channel - 10T
3	10-2	Gray	10	Analog Channel - 10R
3	11-5	Black	36	Analog Channel - 11T
3	11-6	Blue	11	Analog Channel - 11R
3	12-1	Black	37	Analog Channel - 12T
3	12-2	Orange	12	Analog Channel - 12R
4	1-5	White	38	Analog Channel - 13T
4	1-6	Blue	13	Analog Channel - 13R
4	2-1	White	39	Analog Channel - 14T
4	2-2	Orange	14	Analog Channel - 14R
4	3-5	White	40	Analog Channel - 15T
4	3-6	Green	15	Analog Channel - 15R
4	4-1	White	41	Analog Channel - 16T
5	4-2	Brown	16	Analog Channel - 16R
5	5-5	White	42	Analog Channel - 17T
5	5-6	Gray	17	Analog Channel - 17R
5	6-1	Red	43	Analog Channel - 18T
5	6-2	Blue	18	Analog Channel - 18R

Table 23-1 LTU to 66 Block Cabling

Connector	Cable Pair-In	Wire Color	25 Pair Connector Pin	Signal Name
5	7-5	Red	44	Analog Channel - 19T
5	7-6	Orange	19	Analog Channel -19R
5	8-1	Red	45	Analog Channel - 20T
5	8-2	Green	20	Analog Channel - 20R
6	9-5	Red	46	Analog Channel - 21T
6	9-6	Brown	21	Analog Channel - 21R
6	10-1	Red	47	Analog Channel - 22T
6	10-2	Gray	22	Analog Channel - 22R
6	11-5	Black	48	Analog Channel - 23T
6	11-6	Blue	23	Analog Channel - 23R
6	12-1	Black	49	Analog Channel -24T
6	12-2	Orange	24	Analog Channel -24R

Table 23-1 LTU to 66 Block Cabling (cont.)

Analog channel 1 tip/ring will appear at the top of the 66 Block. Analog channel 24 tip/ring will appear on the second to the last pair of the punch down clips at the bottom of the Block. Pair 25 is not used and is not connected.

Note:
To meet the EMC requirements, the cable should never be cut to a length shorter than 8.2 ft.

Signalling Ground for LTU when using Earth Signalling for Recall
The signalling ground is only applicable when earth signalling is used instead of timed break signalling. The MCCB connect the signalling ground from the PBX to maximum of 7 LTUs.
1. Connect the PBX signalling ground from the MDF to the PBX screw connector on the MCCB.
2. If more Modular Cabinets are used in a system, chain the PBX connectors.
3. Connect an LTU/MCCB ground cable (TSRNB 101 035) to the LTU1 connector on the MCCB.
4. Connect the other end of the LTU/MCCB ground cable to the LTU ground connector on the furthest left LTU (see Fig. 23-2).

CHAPTER 24
Modular Cabinet – DLU Cabling

24.1   Introduction

This chapter describes the installation of the cabling between the DLU(s) and the PBX.   The DLU cable set, AWS1019, consists of (12) 2 pair cables individually terminated in a RJ11 connector.

Each DLU cable is designed to connect two DLU boards, thus 24 digital extensions, to a single 66 Block. The cable terminates in a 25 pair male AMP connector which mates with a Siemens 66m250 Block or the connector can be cut off and the cables punched down on other types of blocks. Refer to Table 24-1 for a pin out of the cable

The Modular Cabinet is provided with a ground strip to connect the cables from the DLUs and the CLUs to ground. These ground connections are necessary for EMI suppression reasons.

24.2   Installation

The 24 connectors on the DLU end of the cables are labelled P1 through P24 and should be installed as shown in Fig. 24-2. Connector 1 goes to the first port of the DLU which is at the bottom of the board. The male AMP is connected to the 66 Block.

The orientation of the shielding clamps should be as shown in Fig. 24-1.

Shielding clamp at the back row

Shielding clamps at the front row
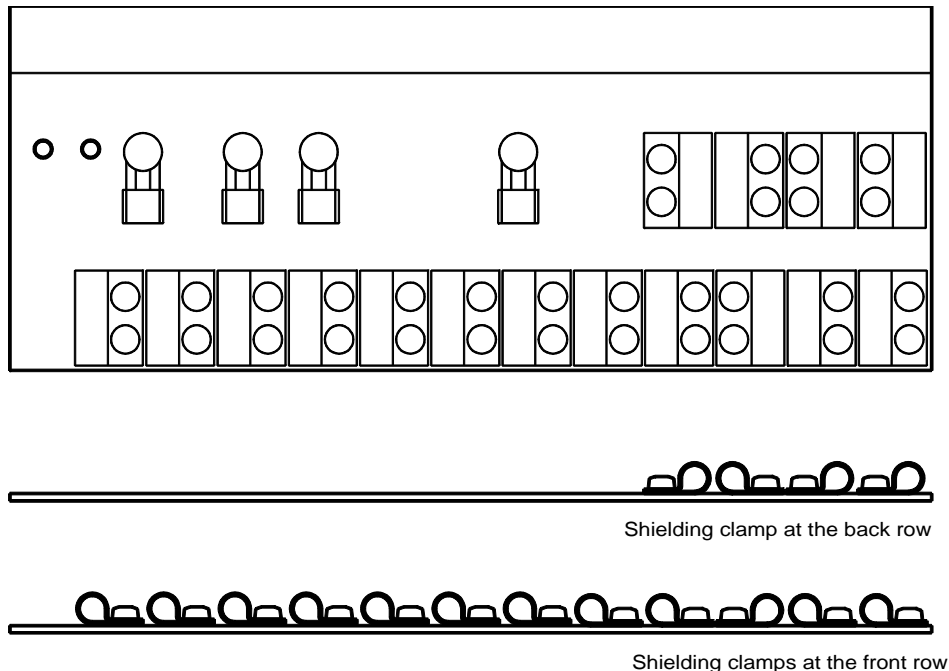
Fig. 24–1 Ground Strip with Shielding Clamps
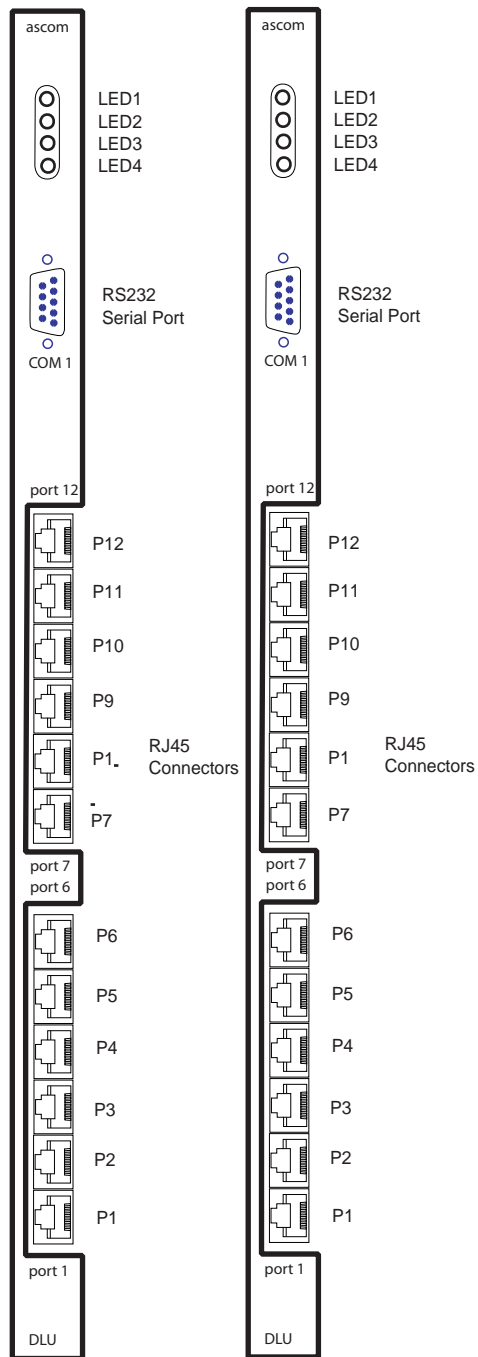
Fig. 24–2 DLU Board

24.3   Connection to PBX's

Connecting the DLUs to the PBX

1. Screw the shielding clamp of AWS1019 to the furthest left free position on the ground strip using two M3 x 10 torx screws delivered with the Modular Cabinet.
2. Connect the RJ-45 terminated end of the DLU cable by matching the labeled terminations with the corresponding board position indicated in Fig. 24-2.
3. Connect the male AMP connector to the 66 block.
4. If 66 blocks are not permissible in the switch room due to preference or standardization practices the AMP connector may be cut off and the cable may be punched down in standard telecom color code. See Table Fig. 24-1 for the pinout of the AWS1019 DLU/MDF Cable.

DLU Cable Diagram:

Cable #	Wire Pair	Color	From	To	Color	From	To
1	BLU/WHT	BLU	J1-1	P1-4	WHT	J1-26	P1-5
1	ORG/WHT	ORG	J1-2	P2-4	WHT	J1-27	P2-5
1	GRN/WHT	GRN	J1-3	P3-4	WHT	J1-28	P3-5
1	BRN/WHT	BRN	J1-4	P4-4	WHT	J1-29	P4-5
1	SLT/WHT	WHT	J1-5	P5-4	WHT	J1-30	P5-5
1	BLU/RED	BLU	J1-6	P6-4	RED	J1-31	P6-5
1	ORG/RED	BLU	J1-7	P7-4	RED	J1-32	P7-5
1	GRN/RED	BLU	J1-8	P8-4	RED	J1-33	P8-5
1	BRN/RED	BLU	J1-9	P9-4	RED	J1-34	P9-5
1	SLT/RED	BLU	J1-10	P10-4	RED	J1-35	P10-5
1	BLU/BLK	BLU	J1-11	P11-4	BLK	J1-36	P11-5
1	ORG/BLK	BLU	J1-12	P12-4	BLK	J1-37	P12-5
2	BLU/WHT	BLU	J1-13	P13-4	WHT	J1-38	P13-5
2	ORG/WHT	BLU	J1-14	P14-4	WHT	J1-39	P14-5
2	GRN/WHT	BLU	J1-15	P15-4	WHT	J1-40	P15-5
2	BRN/WHT	BLU	J1-16	P16-4	WHT	J1-41	P16-5
2	SLT/WHT	BLU	J1-17	P17-4	WHT	J1-42	P17-5
2	BLU/RED	BLU	J1-18	P18-4	RED	J1-43	P18-5
2	ORG/RED	BLU	J1-19	P19-4	RED	J1-44	P19-5
2	GRN/RED	BLU	J1-20	P20-4	RED	J1-45	P20-5
2	BRN/RED	BLU	J1-21	P21-4	RED	J1-46	P21-5
2	SLT/RED	BLU	J1-22	P22-4	RED	J1-47	P22-5
2	BLU/BLK	BLU	J1-23	P23-4	BLK	J1-48	P23-5
2	ORG/BLK	BLU	J1-24	P24-4	BLK	J1-49	P24-5

Table. 24-1 Pinout

CHAPTER 25
Use of TDR

25.1   Introduction

When programming Remote Base Stations using the CSMW Software, it is necessary to determine the time delay of the Base Station cable. This is done using a TDR (Time Domain Reflectometer). See the following paragraph for instruction on how to measure the delay of the Base Station cable.

25.2   Determining the Delay of Remote Base Station Cable

The following instructions explain how delay is measured using the Tektronix model 1503B or 1503C TDR.

Refer to Figure 25-1 for an illustration of the front panel controls. In this illustration, each control is numbered and the numbers are used to identify each control in the procedure that follows.
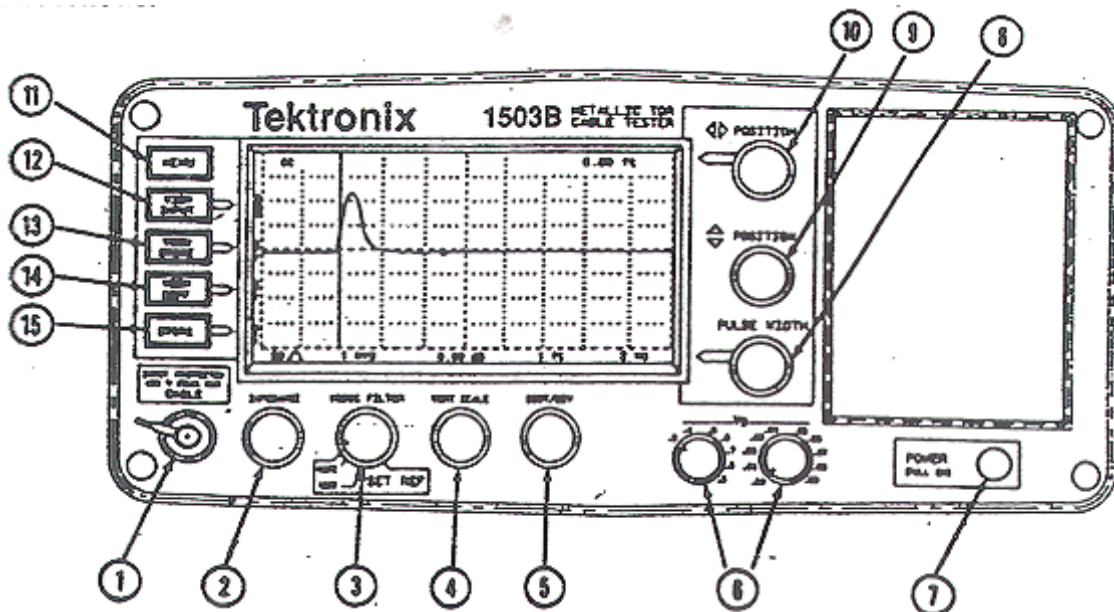
Fig.25-1 TDR Controls

1. Turn power on (7). When you see a horizontal trace and division marks on the screen, the TDR is ready to use.
2. Set Impedance (2) to 93 ohms.
3. Set Noise Filter (3) to 1 AVG.
4. Set Vertical Scale (4) to 0.00dB
5. Set DIST/DIV (5) to 100 ft.
6. Set V_p (6) to .99.
7. Set Pulse Width (8) to 100 nS.
8. Center the trace using the vertical POSITION control (9).
9. Connect the test cable (terminated with two alligator clips) to the input jack (1).

10. A waveform similar to the one shown in Figure 25-1 should be displayed, however the vertical pulse will be located at the left edge of the screen. This is the transmitted pulse the TDR uses to determine the length of the cable.
11. Rotate the horizontal POSITION control (10) until the vertical line it controls is all the way against the left edge of the screen. At this point, the upper right corner of the display should show either 0.00 ft. or some negative value.
12. Connect the pair to be measured to the test cable using the alligator clips. At this point the pair should not be connected to either the base station or the radio exchange, and should be left open-circuited at the far end. Adjust the DIST/DIV control (5) until the display shows not only the transmitted pulse on the left (as in Figure 25-1) but also the reflected pulse farther to the right. This pulse should have the same polarity (positive) as the transmitted pulse. It may be necessary to adjust the Vertical Scale (4) control and/or the Pulse Width control (8) so that the transmitted and reflected pulses are clearly defined and separated as in Figure 25-2.
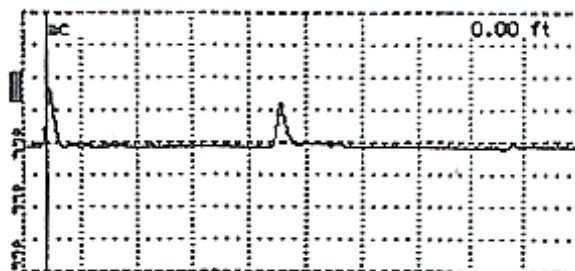
Figure 24-2 Transmitted and Reflected Pulses

Now, adjust the horizontal Position control (10) until the vertical line it controls is exactly at the leading edge of the reflected pulse. At this point, have someone short the pair at the far end while observing the display. The reflected pulse should invert as the pair is shorted. If not, the pair may be open at some point or you may be testing the wrong pair. Correct the condition and retest until the proper result is obtained.

Have the person at the far end remove the short and observe that the reflected pulse returns to positive polarity and that it is still aligned with the vertical line. If the pulse has shifted, this is an indication that the pair may be open on one side. Correct the condition and retest until the proper result is obtained.

Note the indication in the upper right corner of the display, indicated in feet. Multiply this indicated length in feet by the constant .001025 microseconds/foot. This will yield the delay of the pair in microseconds.

Example: *Assume a reading of 167.7 ft.*
167.7 ft. x .001025 = .17189 microseconds

Record the calculated delay in microseconds. This value will be used to determine the proper value to enter when adding a Remote Base Station using the Cordless System Manager software for windows.

As the system allows entries only in increments of 0.1, it will be necessary to round.

Examples:
.17189 should be rounded to .2
.13125 should be rounded to .1

Follow this procedure for each Remote Base Station pair to ensure that they are in good condition and that the delay is identical for pairs that go to the same base station.

CHAPTER 26
Modular Cabinet – Cables

This chapter gives an overview of the cables used in a system with Modular Cabinets. The main purpose of this overview is to enable cable repair if necessary.

26.1   Mains Power Cord - RPM 113 3563

26.2   Power Cable Filter/Switch – TRENB 101 02

The power cable filter/switch (see Figure 26–1) is a 2–wire 2.5mm^2 cable with two connectors on both sides. It is used to supply power from the filter to lower fuse holders in the Modular Cabinet. This cable does not need to be ordered separately. It is factory connected to the switch.

K1

K3

K4

K2

7.9 in

Cap

Faston
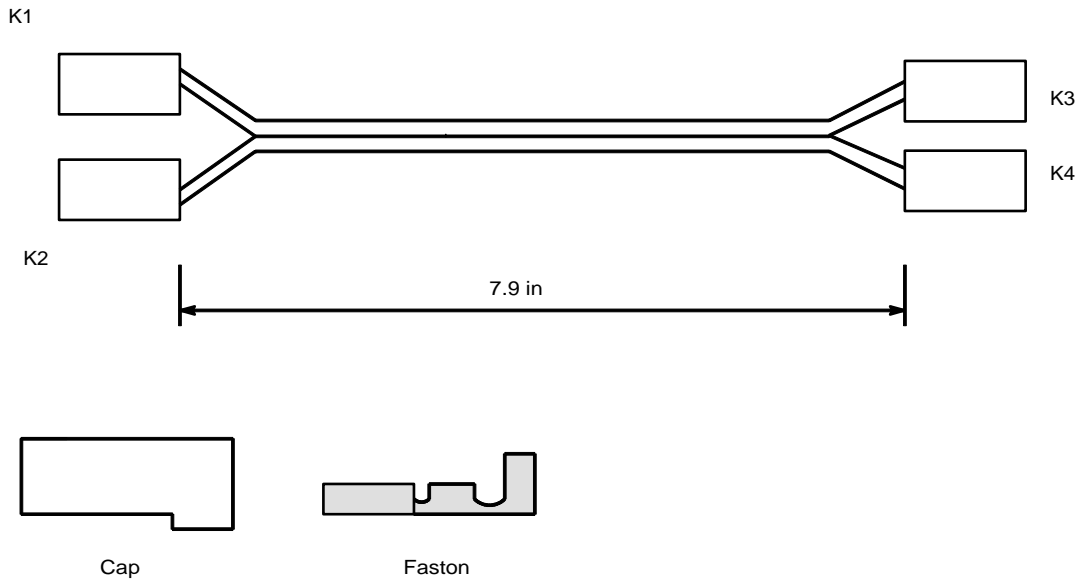
Fig. 26–1 Power Cable Filter/Switch – TRENB 101 02

26.3   MCCB Power Cable – TRENB 101 03

The MCCB power cable (see Figure 26–2) is a 2–wire unshielded cable with connectors on both sides. It is used to supply power from the backplane or power switch (via the piggy–back fastons) to the MCCB which takes care of the power distribution to the CLUs and SLUs. This cable does not need to be ordered separately. It is factory connected to the backplane/power switch.
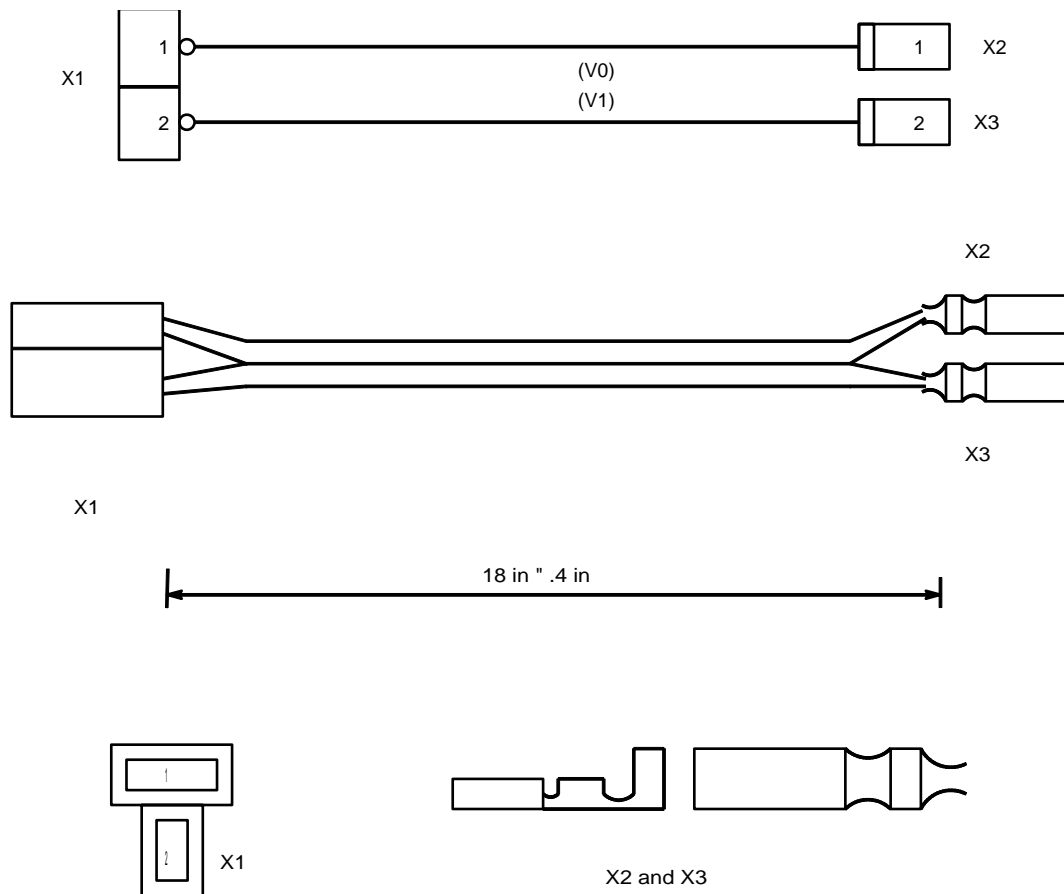
Fig. 26–2 MCCB Power Cable – TRENB 101 03

26.4   Power Cable Switch/Fuse – TRENB 101 04

The power cable switch/fuse is a 2–wire 2.5mm^2 cable with two connectors on both sides. It is used to supply power from the on/off switch to the fuse–holder in the Modular Cabinet. This cable does not need to be ordered separately. It is factory connected between the switch and the fuse.

K1

K3

K4

K2

4 in " .4 in
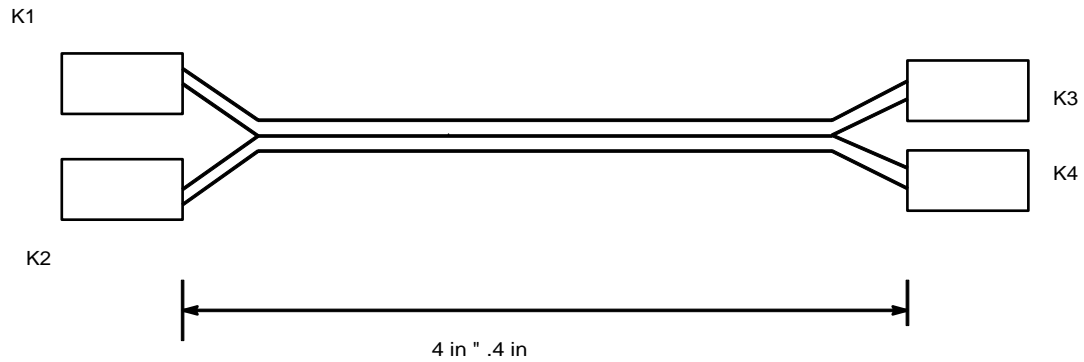
Fig. 26–3 Power Cable Switch/Fuse – TRENB 101 04

26.5   Power Cable Switch/Backplane – TRENB 101 05

The power cable switch/backplane (see Figure 26–4) is a 2–wire 2.5mm^2 cable with two connectors on both sides. It is used to supply power from the switch to the backplane in the Modular Cabinet. On the switch side two piggy–back fastons are attached. Two fastons are mounted on the side of the fuse holder. This cable does not need to be ordered separately. It is factory connected between the fuse holder and the backplane.
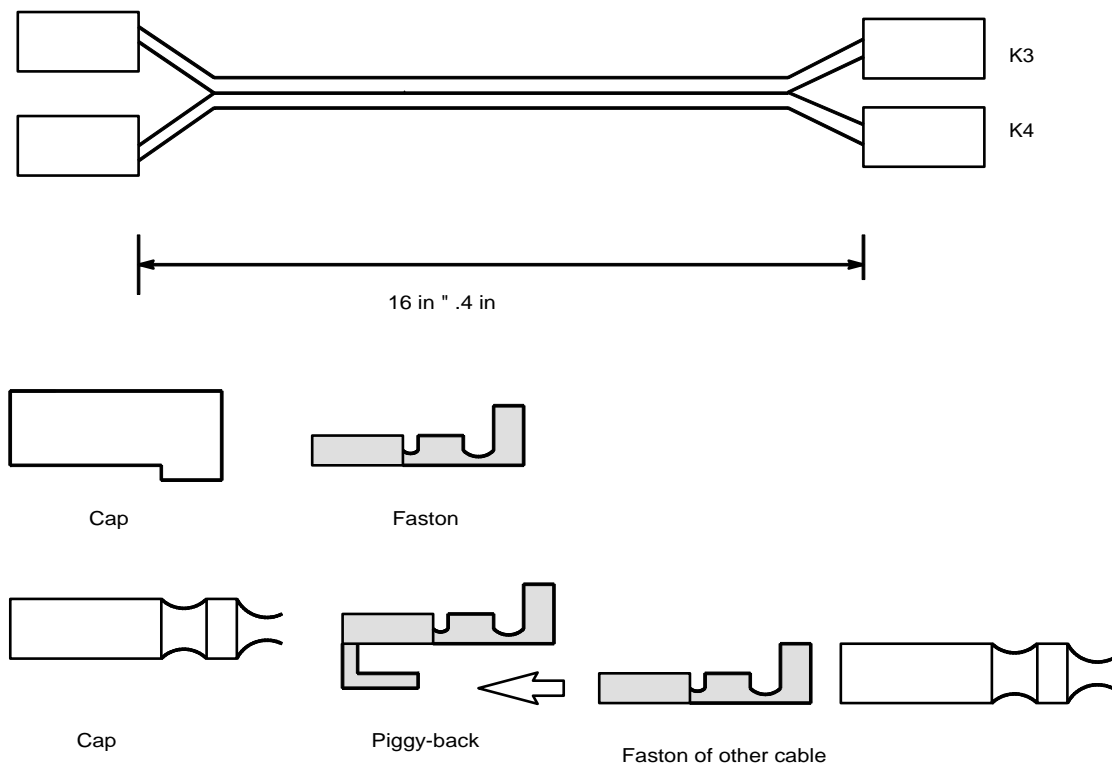
Fig. 26–4 Power Cable Fuse/Backplane – TRENB 101 05

26.6 PC or SMS Cable – TSRNB 101 22D

The PC cable (see Figure 26–5) is used to connect both the CSM PC and a SMS Server or device to the MCCB. The maximum permissible length for self–made cables is 49 ft.

Straight exit (for PC)

90° exit (for MCCB)

118 in

SIGNAL	PIN		PIN	SIGNAL
RX	2		2	RX
TX	3		3	TX
RTS	7		8	RTS
CTS	8		7	CTS
DCD	1		1	DCD
GND	5		5	GND
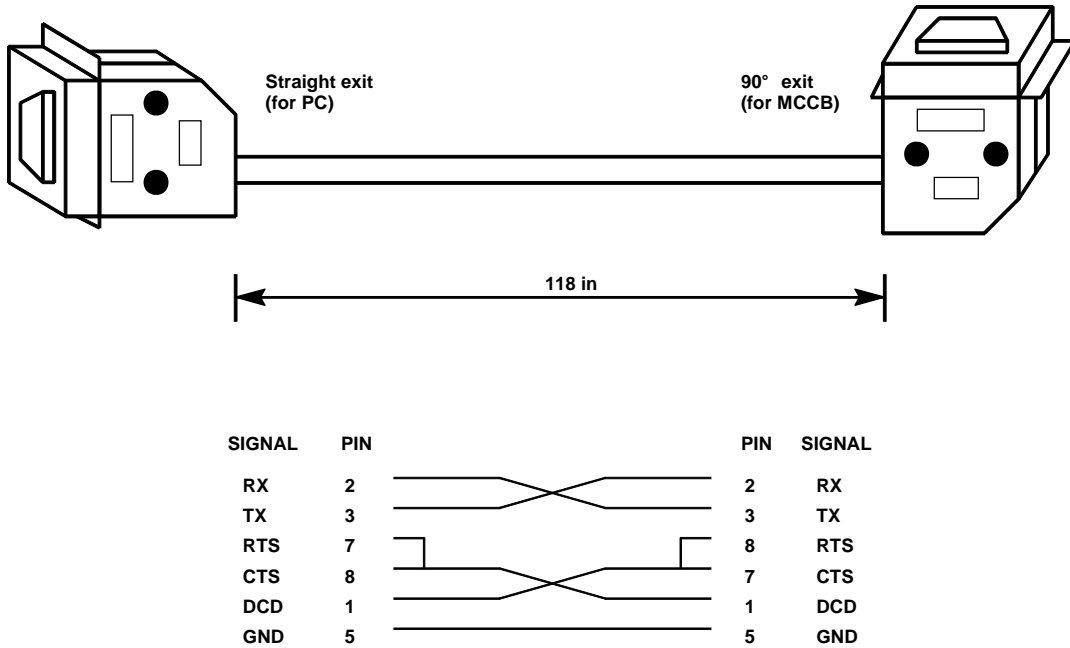
Fig. 26–5 PC Cable - TSRNB 101 22D

26.7   Printer Cable – TSRNB 101 23

The printer cable (see Figure 26–6) is used to connect the printer to the MCCB. The maximum permissible length for self–made cables is 49 ft.

**Straight exit
(for Printer)**

**90° exit
(for MCCB)**

761 in.
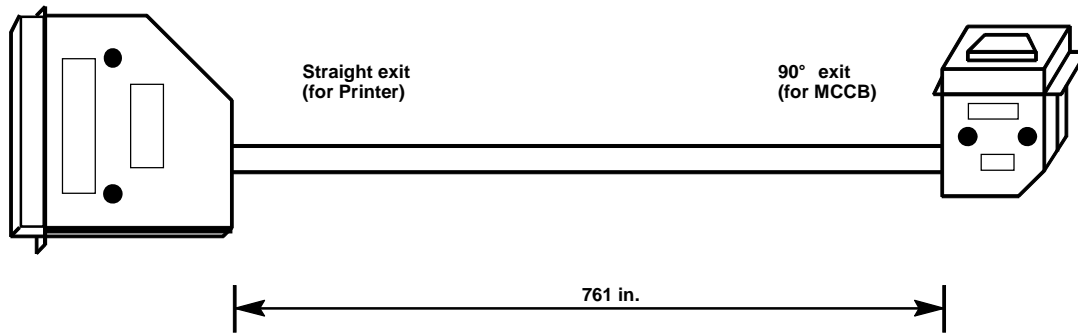
SIGNAL	PIN		PIN	SIGNAL
TX	2		2	RX
RX	3		3	TX
DTR	20		1	DCD
RTS	4		8	CTS
DCD	8		4	DTR
CTS	5		7	RTS
GND	7		5	GND

***   In some cases pin 20 and 4 on the 25 pin SUB-D connector must be
interconnected for a correct functioning printer**

Fig. 26–6 Printer Cable - TSRNB 101 23

26.8   CPU/MCCB Serial Connection Cable – TSRNB 101 26

The CPU/MCCB serial connection cable (see Figure 26–7 and 26–8) is used to connect the two serial communication channels on the CPU board (for printer and PC) with the two RS232 connections on the MCCB. This cable does not need to be ordered separately. It is factory connected to the MCCB.
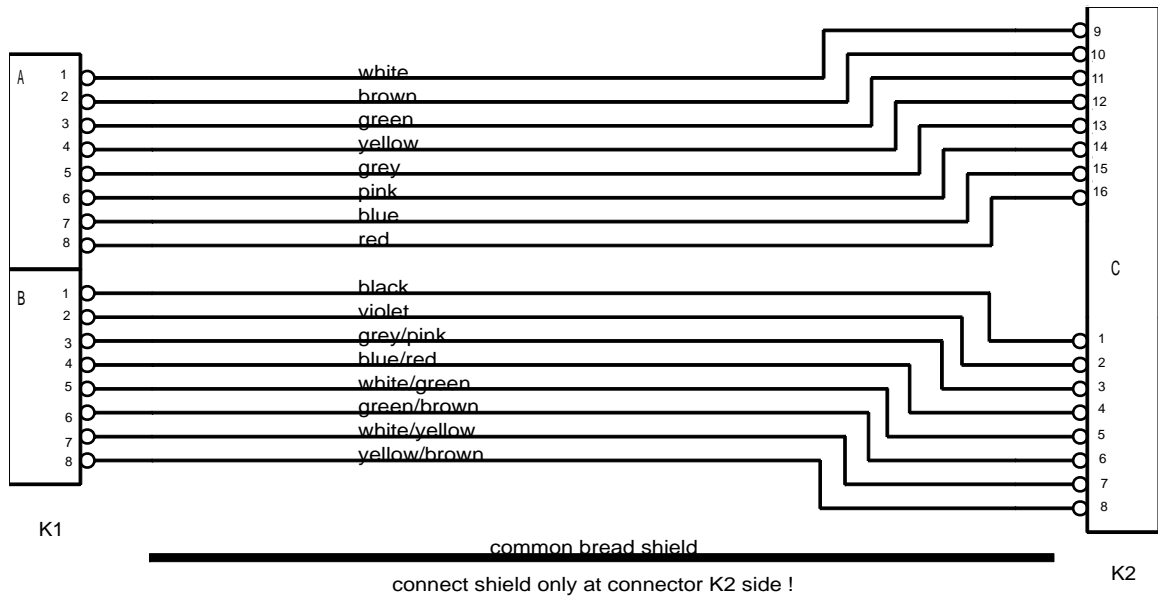
Fig. 26–7 CPU/MCCB Serial Connection Cable – TSRNB 101 26

Fold back shield

K1

K2

.6 " .04 in   2 " .20 in

11 " .4 in

A   B

notch> 7 5 3 1   7 5 3 1

8 6 4 2   8 6 4 2   K1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

K2
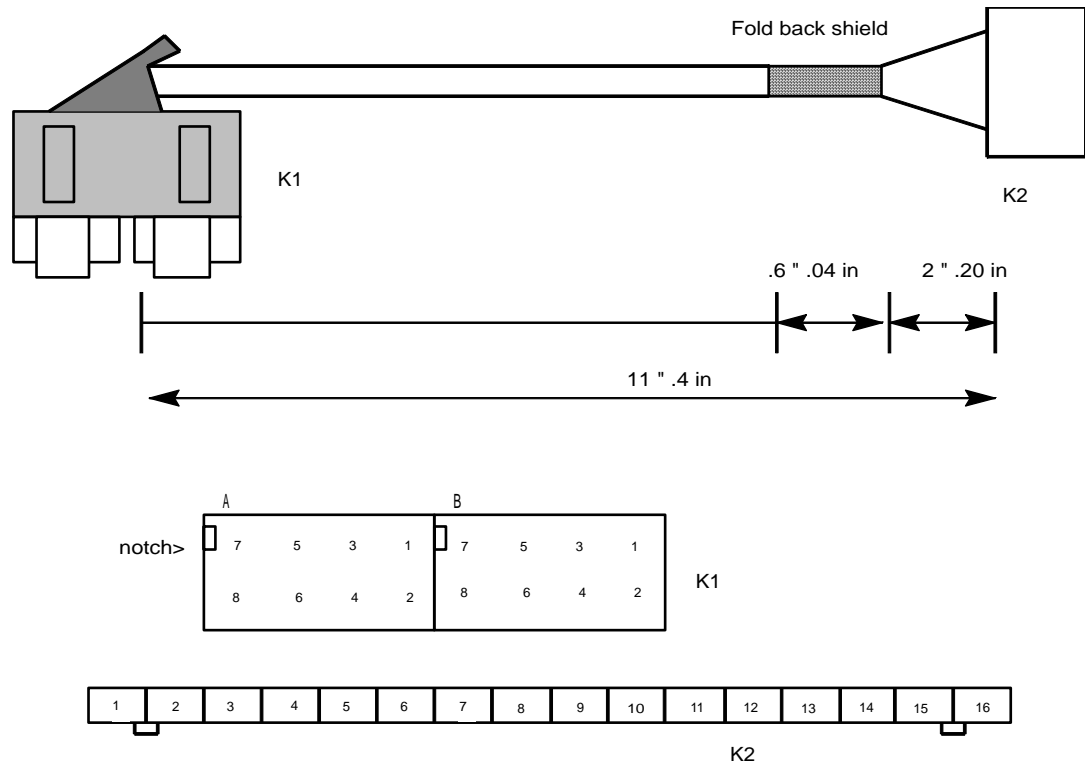
Fig. 26–8 CPU/MCCB Serial Connection Cable – TSRNB 101 26

26.9   General Alarm Cable – TSRNB 101 28

The general alarm cable (see Figure 26–9) is used to connect the general alarm output of the CPU to the MCCB. This cable does not need to be ordered separately. It is factory connected to the MCCB.
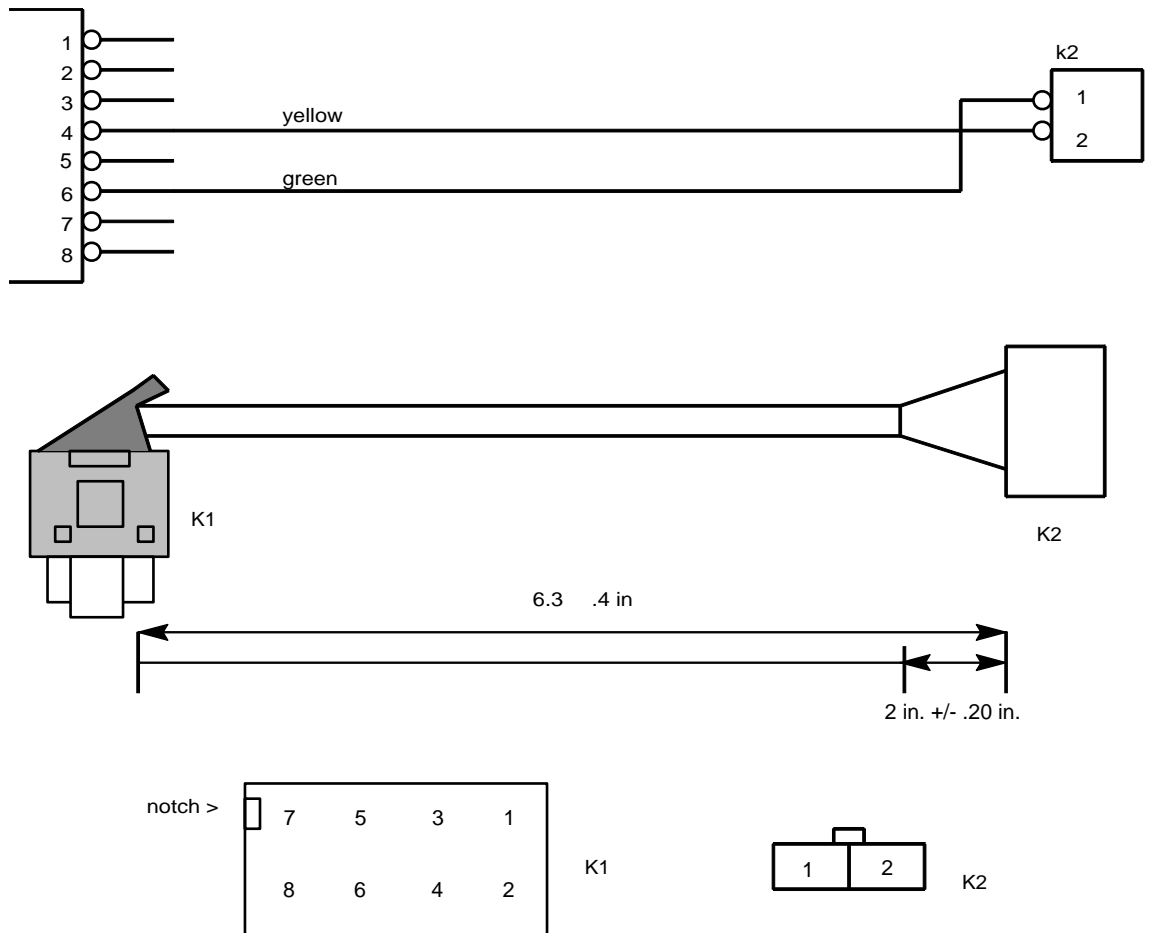
Fig. 26–9 General Alarm Cable – TSRNB 101 28

26.10 CLU/MDF Cable Set – NTM/TSRNB 101 29

The CLU/MDF Cable Set (see Figures 26-10 through 26-12) consists of two shielded cables (TSRNB 101 29/1 and TSRNB 101 29/2). The cables are used to connect a CLU or a SLU to the MDF. The shielding of the cables is connected to the cabinet via a clamp which also functions as a strain relief. The only difference between the two cables is the location on the cable where the clamp is attached to the shielding. This is respectively 13 in. from the connector for cable TSRNB 101 29/1 and 18 in. for cable TSRNB 101 29/2. The cables are terminated in a male, 25 pair amphenol connector for ease of connection to the MDF. If the MDF blocks do not support this type of connector, then the connector may be cut off and the wires punched down on the MDF.

The cable set supports eight Base Stations. This may be on one block via the 25 pair connector or across several blocks if the connector is cut off.

DIN CONNECTOR
K1

25 PAIR CONNECTOR

DIN	Color	Pair	Signal	CKT
29	Black/Orange	37	EP0	
28	Orange /Black	12	EP1	
31	Black/Blue	36	SC0	CKT 4
30	Blue/Black	11	SC0	
27	Red/Slate	35	SC1	
26	Slate/Red	10	SC1	
21	Red/Brown	34	EP0	
20	Brown/Red	9	EP1	
23	Red/Green	33	SC0	CKT 3
22	Green/Red	8	SC0	
19	Red/Orange	32	SC1	
18	Orange/Red	7	SC1	
13	Red/Blue	31	EP0	
12	Blue/Red	6	EP1	
15	White/Slate	30	SC0	CKT 2
14	Slate/White	5	SC0	
11	White/Brown	29	SC1	
10	Brown/White	4	SC1	
5	White/Green	28	EP0	
4	Green/White	3	EP1	
7	White/Orange	27	SC0	CKT 1
6	Orange/White	2	SC0	
3	White/Blue	26	SC1	
2	Blue/White	1	SC1	

Fig. 26–10 CLU Cable Connector A

DIN CONNECTOR
K2

25 PAIR CONNECTOR

K2	Wire	25 Pair	Signal	CKT
29	Black/Orange	49	EP0	
28	Orange/Black	24	EP1	
31	Black/Blue	48	SC0	
30	Blue/Black	23	SC0	CKT 8
27	Red/Slate	47	SC1	
26	Slate/Red	22	SC1	
21	Red/Brown	46	EP0	
20	Brown/Red	21	EP1	
23	Red/Green	45	SC0	
22	Green/Red	20	SC0	CKT 7
19	Red/Orange	32	SC1	
18	Orange/Red	7	SC1	
13	Red/Blue	31	EP0	
12	Blue/Red	6	EP1	
15	White/Slate	30	SC0	
14	Slate/White	5	SC0	CKT 6
11	White/Brown	29	SC1	
10	Brown/White	4	SC1	
5	White/Green	28	EP0	
4	Green/White	3	EP1	
7	White/Orange	27	SC0	
6	Orange/White	2	SC0	CKT 5
3	White/Blue	26	SC1	
2	Blue/White	1	SC1	

Fig. 26–11 CLU Cable Connector B
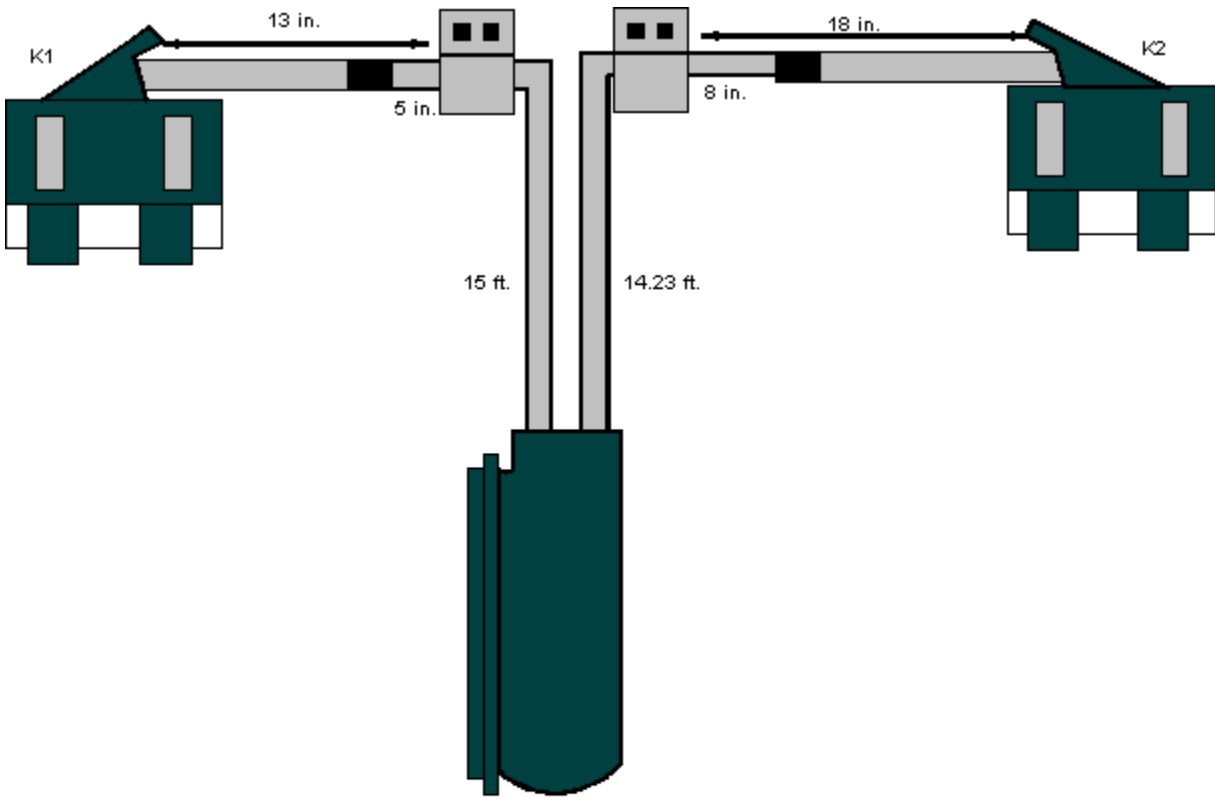
Fig. 26–12 CLU/MDF Cable Set NTM/TSRNB 101 29

26.11 LTU/MDF Cable Set – NTM/TSRNB 101 31

The LTU/MDF Cable Set (see Figure 26-13) is used for the connection of the LTU to an MDF. It consists of two shielded cables with a connector at one side. The shield of the cable is connected to the Modular Cabinet by a clamp. The only difference between the two cables is the location of this clamp on the cable. The clamp is placed on respectively 14 in. from the connector for the TSRNB 101 31/1, and 19 in. for the TSRNB 101 31/2. The clamp also functions as a pull relief. The length of the cable is 16.40 ft.
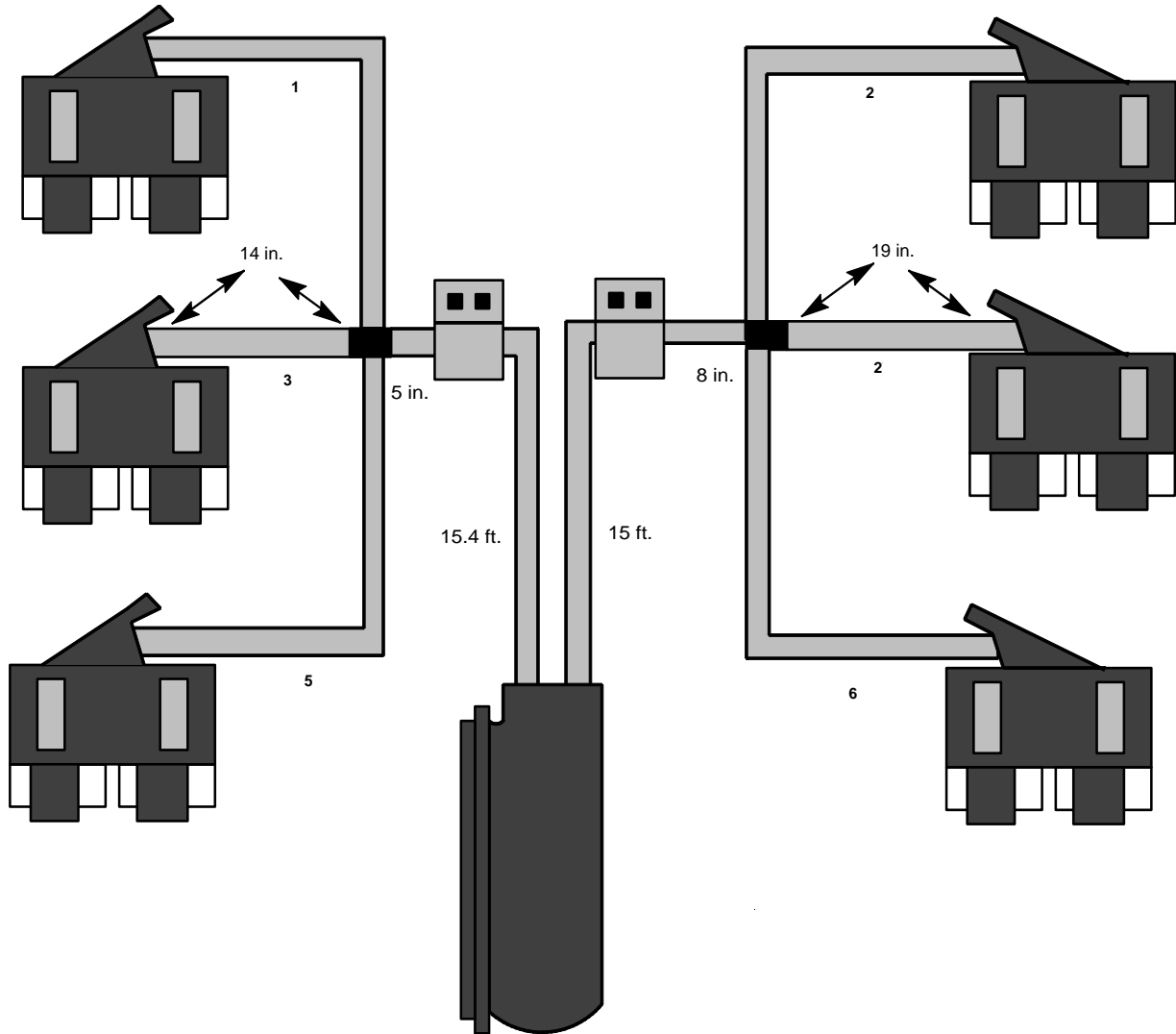
Fig. 26–13 LTU/MDF Cable Set – NTM/TSRNB 101 31

26.12 CLU/MCCB Power Cable – TSRNB 101 33

The CLU/MCCB power cable is a 2-wire unshielded cable which is used to supply power from the MCCB to the CLU/SLU which takes care of the power distribution to the Base Stations.
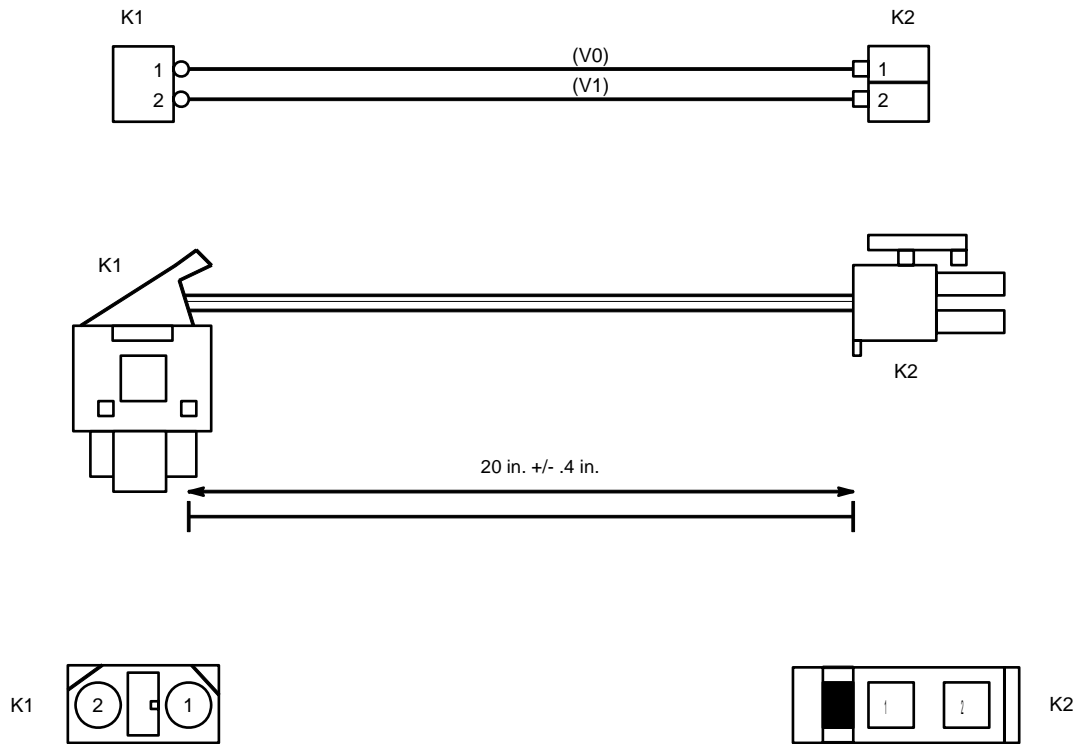
Fig. 26–14 CLU/MCCB Power Cable – TSRNB 101 33

26.13 CLU/MDF Cable Set, Long – NTM/TSRNB 101 46

The CLU/MDF cable set long (see Figures 26–15 and 26–16) consists of two shielded cables (TSRNB 101 46/1 and TSRNB 101 46/2). The cables are used to connect a CLU/SLU to the MDF. The shielding of the cables is connected to the cabinet via a clamp which also functions as a strain relief. The only difference between the two cables is the location on the cable where the clamp is attached to the shielding. This is respectively 13 in. from the connector for cable TSRNB 101 46/1 and 18 in. for cable TSRNB 101 46/2. The length of the cable is 82 ft.

K1/K2

Pin	Color		Signal
32			
31	black		SC0
30	blue		SC0
29			EP0
	black	orange	
28			EP1
27			SC1
	red		
26			SC1
25	grey		
24			
23	red		SC0
22	green		SC0
21			EP0
	red	brown	
20			EP1
19			SC1
	red		
18			SC1
17	orange		
16			
15	white		SC0
14	grey		SC0
13			EP0
	red	blue	
12			EP1
11			SC1
	white		
10			SC1
9	brown		
8			
7	white		SC0
	orange		SC0
6			
5			EP0
	white	green	
4			EP1
3			SC1
	white		
2			SC1
1	blue		
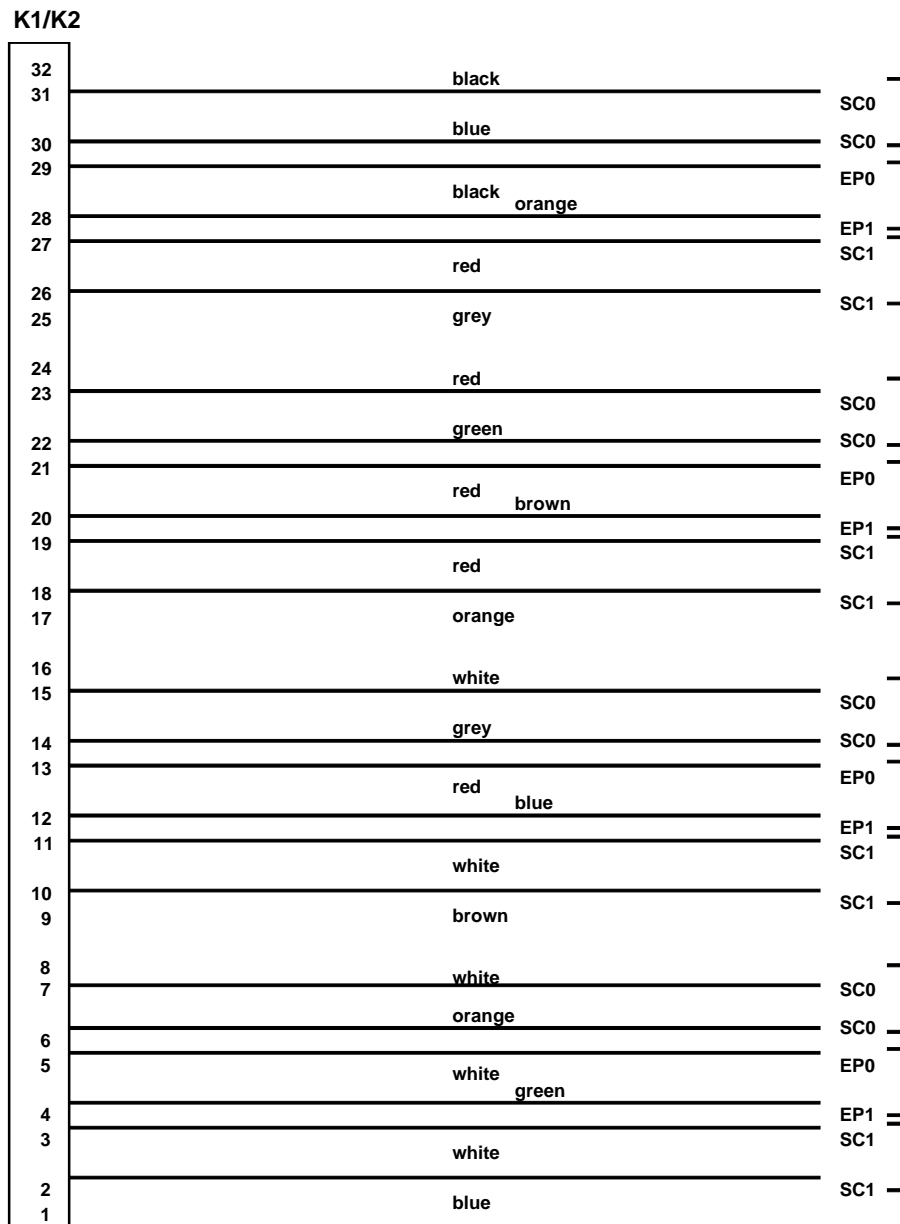
Fig. 26–15 CLU/MDF Cable Set NTM/TSRNB 101 46

K1/K2

K1 / K2
13 IN. / 18 IN.

2 in

82 ft " 4 in

K1/K2

32	30	28	26	24	22	20	18	16	14	12	10	8	6	4	2
31	29	27	25	23	21	19	17	15	13	11	9	7	5	3	1
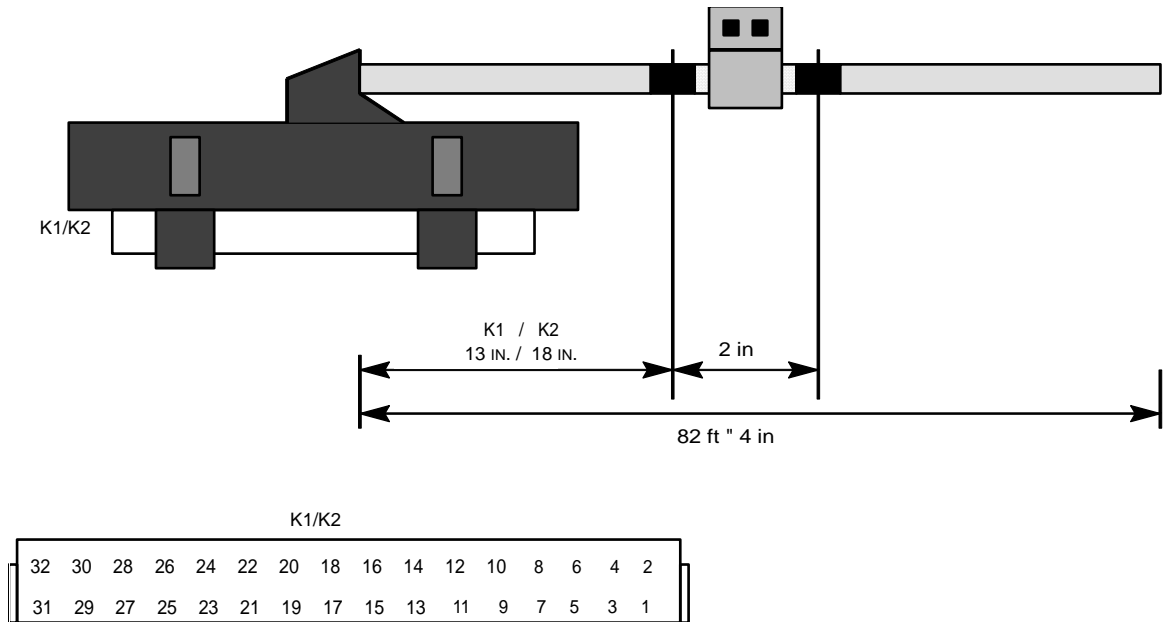
Fig. 26–16 CLU/MDF Cable Set NTM/TSRNB 101 46 (cont'd)

26.14 CPU1/SDB Twisted Pair Sync Cable – TSRNB 101 48

The CPU/SDB twisted pair sync cable connects a CPU1 sync port to the SDB and is a part of the installation set sync port NTMNB 101 107. The cable comprises two unshielded twisted pairs and has a length of 24" (see Figure 26–17).
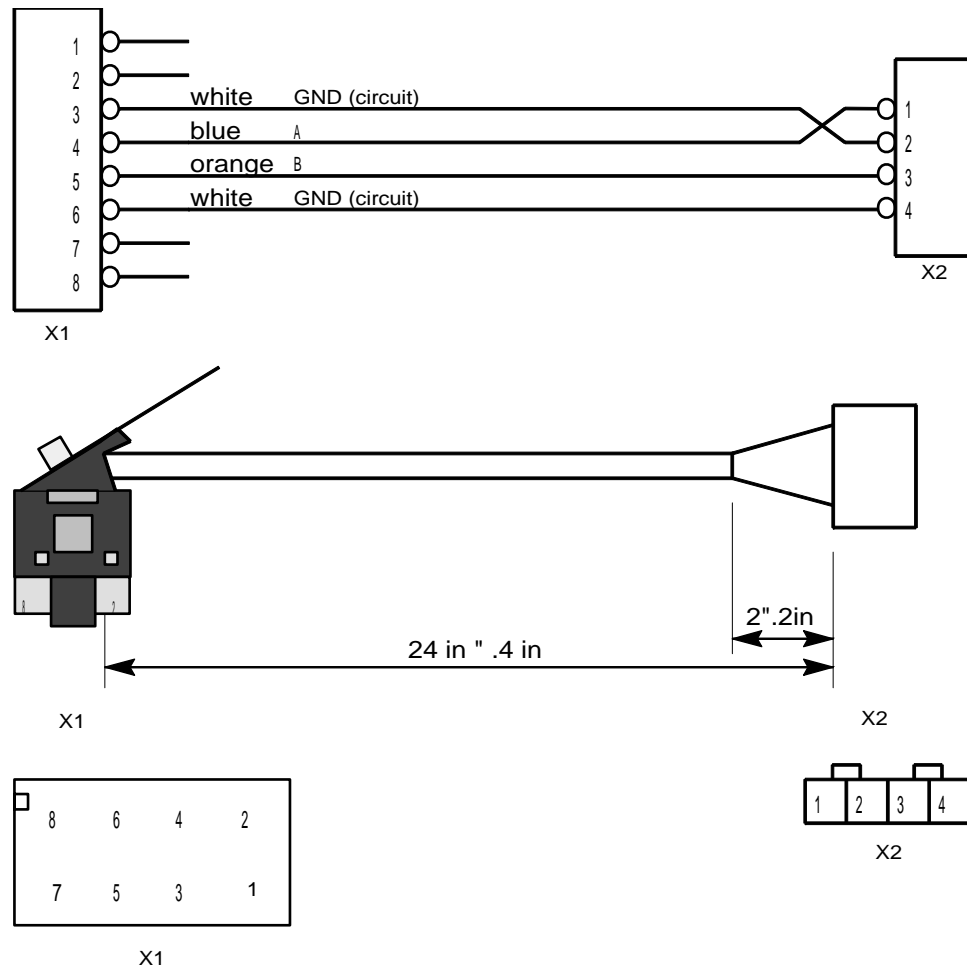
Fig. 26–17 CPU1/SDB Twisted Pair Sync Cable TSRNB 101 48

26.15 DTU Twisted Pair Cable Set – NTM/TSRNB 101 49 or AWS1033 (E1-120 ohm)

The DTU twisted pair cable AWS1033 (see Figures 26–18) consists of a 120 ohm shielded cable terminated with two connectors. The cable is used to connect a DTU-E1 to a MS or PBX via a MDF(Main Distribution Frame). The shielding of the cables is connected to the cabinet via a clamp which also functions as a strain relief. The length of the cable is 16ft. Excess cable length may be trimmed at installation.
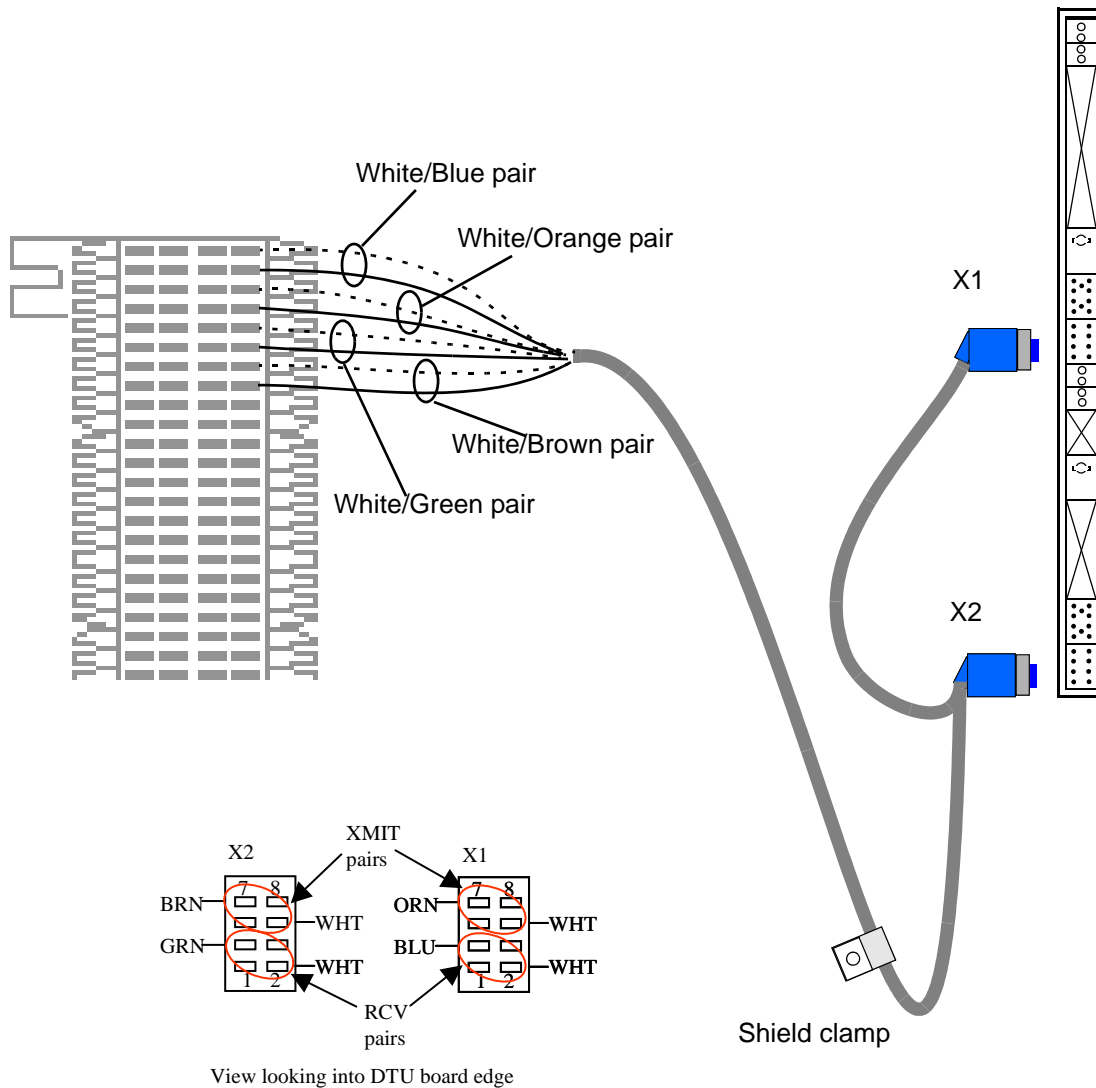
Fig. 26–18 DTU Twisted Pair Cable - E1

26.16 DTU/MDF Twisted Pair Cable – TSRNB 101 50 or AWS1034 (T1 - 100 ohm)

The DTU/MDF twisted pair cable AWS1034 (see Figure 26–19) consist of a 100 ohm shielded cable terminated with two connectors. The cable is used to connect a DTU to a MS or PBX via a MDF (Main Distribution Frame). The shielding of the cables is connected to the cabinet via a clamp which also functions as a strain relief. The length of the cable is 16 ft. Excess cable length may be trimmed at installation.

The TSRNB 101 50 cable is terminated at one end in 2 RJ45 connectors. These should be cut off to allow for punch down.
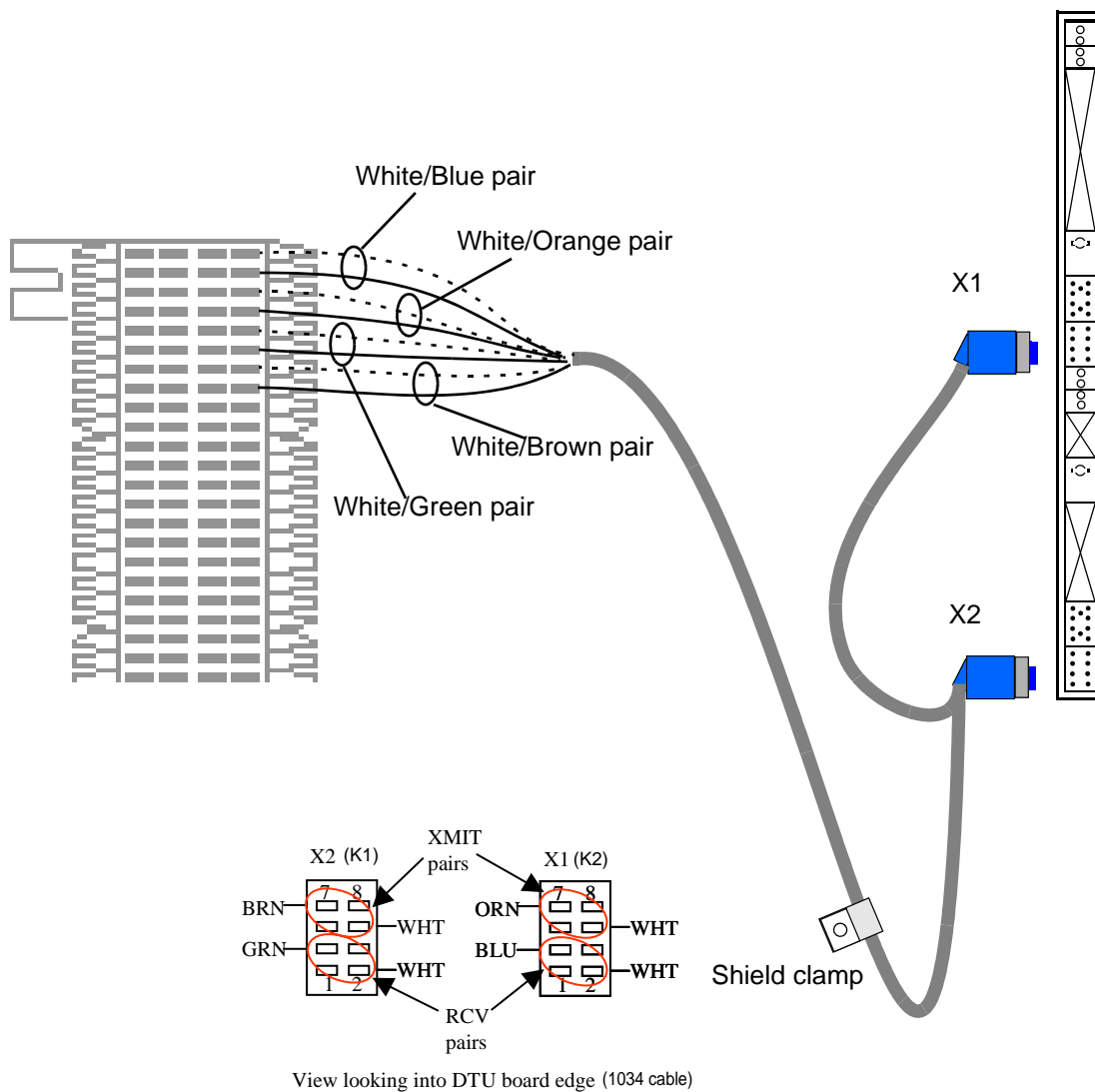
Fig. 26–19 DTU Twisted Pair Cable - T1

26.17 SYNC Cable - TSR 951 284

The sync cable is used on all DCT1900 MS applications that require intersystem handover between multiple REs with CPU1 boards. REs must be synchronized in order to support the intersystem handover.

The cable shall be shielded and have a length of 20 ft. Each end of the cable shall be terminated (crimped) with a 6-pin RJ12 connector. The GND (shield) shall be terminated at each connector (see Figure 26-20). Delay is .04usec.
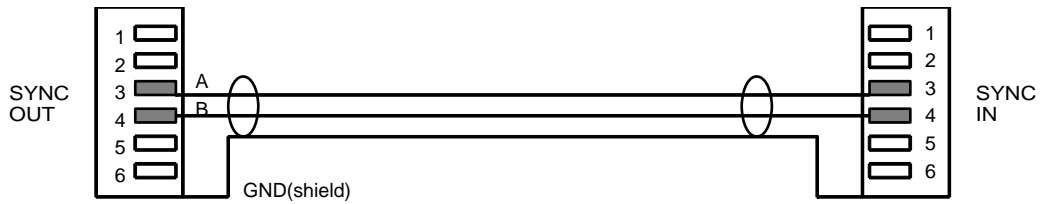
Fig. 26–20 Wiring Diagram External Sync Cable

Section 6

Commissioning

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CHAPTER 1
Introduction

This section describes a series of checks and tests that have to be executed after completing the installation and initialization of the DCT1900 system. The purpose of these tests is to verify that the DCT1900 system is functioning properly after the installation is completed. If it appears that a part is malfunctioning while the system is installed correctly (i.e.: no cabling faults, no configuration faults), the technician must consult Section 7, "Maintenance" included in this manual for fault finding.

Note:
Be sure that all batteries in the Portable Telephones are charged up before executing the tests.

CHAPTER 5
Synchronization Test

5.1   General

This test checks if two DCT1900 systems, whose coverage areas partly overlap and are connected to the same synchronization network, are correctly synchronized. The test is performed by setting up a call and moving from the coverage area of one DCT1900 system to the other.

5.2   Test

1. Check if both DCT1900 systems report "system synchronization available" by observing the system screen of the CSMW Software (menu: System Manager-Control-System). If a system is not synchronized you can force synchronization by a system reset (ongoing calls are dropped), assuming that the synchronization network is set–up correctly.
2. Ensure that the Portable Telephone is correctly initialized and that both DCT1900 systems are in the same system range using the configuration tool.
3. Switch off the Portable Telephone and move to the coverage area of one of the DCT1900 systems.
4. Switch on the Portable Telephone and observe if the Portable Telephone registers itself to the system.
5. Make a call to a fixed or stationary telephone.
6. Monitor the speech quality while moving to the coverage area of the other DCT1900 system. If the call is not dropped and the speech quality remains good (no crackling sounds or mutes), then both systems are correctly synchronized.
7. You can verify the result by moving back again while making a call.

CHAPTER 4
Radio Coverage Verification

4.1   General

The radio coverage verification consists of two tests:
- Base Station test
- Area coverage test

Ensure that the Base Stations are properly installed. Please take the following into account:
- Mounting
- Wiring
- Initialization (CSMW Software)

The Base Station should always be mounted such that the antennas are vertical with respect to the floor or ceiling. Two types of antennas are available to facilitate the correct orientation of the Base Station. One set is a vertical antenna for wall mounting of the Base Station and the other set is a right angle antenna that allows the Base Station to be mounted on the ceiling.

The Base Station should never be mounted above the ceiling tiles as this reduces the coverage area. Base Stations should not be mounted near large metal objects, such as pipes or air conditioning conduits. Do not mount Base Stations directly on I-Beams or lamp poles, as these objects tend to distort the RF field which reduces the effectiveness of the RF coverage area. Use the Base Station outdoor wall mounting kit (see Section 5, Installation Instructions, Chapter 16, Base Station – KRC 101 1371, Paragraph 16.7) or a factory hanging device (see Section 5, Installation Instructions, Chapter 16, Base Station – KRC 101 1371, Paragraph 16.6.3). Do not mount the Base Station more than 20 ft. high.

Note:
When mounting base stations nearby each other to provide additional call capacity, it is necessary to maintain at least 40 inches spacing between base stations.

The location where the Base Station is to be mounted is determined either by a previous site survey or by the needs of the customer when adding to a system.

The following is a recommended order of installing a Base Station:
- Base Station cable delay measurement
- Mounting the Base Station - indoor
- Mounting the Base Station - outdoor
- Connecting the Base Station plug to the cable

4.2   Base Station Test

The purpose of this test is to check if all Base Stations are operational.

Test
1. Put a Portable Telephone in the DCA mode (refer to Section 7, "Maintenance" in this manual).
2. Take the floor plan of the area where the Base Stations are indicated with their corresponding Base Station number or use the Base Station identification and location sheet in Section 5, "Installation Instructions" in this manual.

3. Move closer to each Base Station and check that the Portable Telephone locks to it (the DCA should display the correct Base Station number).

After having checked that all Base Stations are operational, proceed to the area coverage test.

4.3 Area Coverage Test

The purpose of this test is to verify that the field strength is sufficient within the coverage area and that the Base Station delay values are correct. Sufficient field strength and proper Base Station delay values enable good speech quality everywhere within the covered area (rooms, elevator shafts, staircases). This test is executed with two Portable Telephones and requires two persons.

Test
1. Place the Portable Telephone in the DCA mode (refer to Section 7, "Maintenance" in this manual).
2. Call the other Portable Telephone.
3. One Portable Telephone user should now start moving around in the covered area.
4. Both users must check that a good speech quality is maintained everywhere. Pay special attention to areas such as edges of a building and areas behind metal structures where reduced speech quality is likely.
5. Mark areas where RQI is not stable on 20_{hex} and where cracking sounds or mutes are heard.

4.4 Radio Coverage Verification

This test procedure is in addition to 4.3, "Area Coverage Test."

Test
1. Place the Portable Telephone in DCA mode (refer to Section 7, "Maintenance" in this manual).
2. Call the other Portable Telephone, or any other phone, and leave the call up for the duration of the testing.
3. Select the new DCA menu item MER tests. Scroll down to GEN. Setup (yes), scroll down to DCA-SERVICE (yes), scroll down to MER tests (yes).
4. Scroll down to MER long (yes). A counter on the upper left of the screen will start counting to F03C (10 minutes). MER short counter will be set to 7D0 (20 seconds) if MER short is selected.
5. MER test Portable user should now start moving around the covered area.
6. The test can be paused and/or unpaused using the ↑ key. The frame counter can be reset to zero restarting the test using the ↓ key. Once the test is started it will not stop unless the test is paused or the total number of frames is reached, regardless of whether or not the user stays in a MER test screen.

DISPLAY LAYOUT MER TEST

```
[Frame Count]   [Total Frames
                      or MER]
[SYNC]    [A-CRC]   [X-CRC]
```

[1.] Frame Count
The frame count field contains a running counter of the number of frames that have been examined.

[2.] Total Frames or MER
When a test is in progress this field contains the total number of frames for which the test will run. At the completion of a test this field contains the message error rate (PERCENTAGE).

[3.] SYNC
This field contains the number of SYNC errors encountered.

[4.] A-CRC
This field contains the number of A-CRC errors encountered.

[5.] X-CRC
This field contains the number of X-CRC errors encountered.

7. Monitor the frame counter if the walk around takes more than 10 minutes. Record the results of each 10-minute test and restart the test. If the walk around takes less than 10 minutes continue to walk the coverage area until the 10 minutes are up.
8. To be good, the average MER percentage should be no more than 1.00%
9. Watch out for the 5-minute SPU timer. (Keep talking).
10. Upon completion of the test exit DCA mode and power off the phone.
    (DO NOT LEAVE THE PHONE IN DCA MODE)

4.5   Evaluation

After having performed the Base Station test and the area coverage test, the results should be evaluated. If the coverage is not sufficient you should review the Base Station plan and move or add Base Stations.

CHAPTER 3
Portable Telephone Test

3.1 General

This test checks for a complete connection of a Portable Telephone through the DCT1900 system to the MS/PBX. Furthermore, it checks that the Portable Telephone has been correctly initialized. The test is performed by setting up and answering a call.

3.2 Portable Telephone Test

1. Ensure that the Portable Telephone is initialized using the configuration tool (CSMW for Standalone).
2. Switch off the Portable Telephone and move to the coverage area of the DCT1900 system to be tested with the Portable Telephone.
3. Switch on the Portable Telephone and observe if the Portable Telephone registers itself to the system.
4. Go off–hook and check for dial tone.
5. Make a call to a fixed or stationary telephone.
6. Verify CLI when available.
7. Go on–hook again and ask someone to call you.
8. Answer the call and check if the call is set–up correctly.
9. Go on–hook again and test other Portable Telephones by repeating steps 2 through 8.
10. Verify caller line ID by with an appropriate desk set.
11. Verify multiple line appearance by making multiple calls to a Portable Telephone from various extensions
12. Verify PBX feature functionality such as hold, transfer, conference, call back and reconnect.

3.3 Portable Telephone Test for SMS

1. Ensure Paragraph 3.2 is done.
2. Ensure that the Radio Exchange and the external SMS source are configured for SMS.
3. Switch the Portable Telephone on and ensure it registers.
4. Referring to the SMS application documentation, send an SMS message to the Portable Telephone.
5. Look for Message ring to ensure the message was received by the Portable Telephone.
6. Select Read Message.

CHAPTER 2
Visual Checks

2.1 General

Visual inspection consists of checking the LEDs on the system boards and the availability of all system boards and Base Stations.

2.2 LEDs on the System Boards

Check the following LEDs:
1. On the CPU board only the upper–most green LED (LED1) must be on. LED6 blinks periodically according to the setting of the ACK test (see Section 7, "Maintenance" in this manual).
2. All green LEDs on all other system boards must be on.
3. Red LEDs must be off. In certain situations a red LED on the DTU board can be on, see Paragraph 2.3.

2.3 Availability of all System Boards and Base Stations

The status of the system boards and Base Stations can be checked with the help of the system menu of the CSMW Software. All hardware/peripherals must have the AVE status. However, for the DTU, CLU and SLU boards the following exceptions may be applicable:

- DTU board
  A Digital Trunk Circuit (DTC) that is not connected to the PBX must have its corresponding L1 with the status NEW and L2 with no status indication (LED4 is on).

- CLU and SLU board
  Peripherals (CLCs) that are not connected to Base Stations will have the status PNP (Possibly Not Present). Peripherals with initialized (delay value specified) Base Stations should have the status AVE. A CLC with a non-initialized Base Station has the status NEW causing LED4 of the CLU or SLU board to be on.

CHAPTER 6
Radio Exchange Tests

6.1   General Alarm

This test is only necessary if an alarm device is connected to the general alarm relay on the MCCB.

6.2   Test

Generate a general alarm by e.g. disconnecting a CLU signal cable or a CLU/MDF cable set from a CLU or a SLU board. The alarm device connected to the general alarm relay must be activated.

6.3   Battery Back–up

This test must be executed if a back–up battery is used. The purpose of this test is to verify that the battery back–up operates properly.

6.4   Test

Switch off the mains. The DCT1900 system must continue to function correctly. Switch on the mains again to complete the test.

Section 7

Maintenance

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CHAPTER 1
Maintenance Philosophy

1.1 Concept of Maintenance

The DCT1900 maintenance philosophy is to undertake component repair and replacement at the Ascom Wireless Solutions Repair Department. Site maintenance is therefore limited to module replacement only. These modules are easily replaceable elements, like System Boards, Base Stations, fuses, Portable Telephones, desk chargers, etc.

The main purpose of this section is to describe how a malfunctioning system's faulty modules can be found and replaced, i.e. corrective maintenance. Furthermore, background information is given about the system's internal diagnostic–and–test facilities to indicate the reliability and functionality of the Test and Maintenance software (see Chapter 2).

Qualified Personnel
Since maintenance is strictly reserved to qualified installation and maintenance engineers ONLY, persons who have not received instructions for accessing the equipment are not allowed to access the DCT1900 system. Any such actions will be considered as unauthorized access. Authorized access is restricted to engineers who are properly trained and certified by authorized DCT1900 system trainers.

1.2 Preventive Maintenance

Although preventive maintenance is not applicable to the DCT1900 systems, some words may be said about it:

Wiring
Accurate and secure installation of wires may prevent any future wiring failures, loose contacts, etc.

Safety Requirements
Whenever the system is being accessed, all ESD precautions must be taken. **Do not** touch boards without having yourself connected to the ground by a wrist–strap.

Read Chapter 3, "Protection against Electrostatic Discharge" in Section 1, "Safety and Regulatory Information" in this manual.

End–user Guidance
End–users and customers should be fully aware of all DCT1900 features and the functionalities/ features of the Portable Telephone. Informing end–users of how to operate the Portable Telephone and advising them to read the Portable Telephone User's Guide may prevent many initial complaints.

Configuration Back–up on Floppy
Whenever something has changed to the system configuration (especially when passwords have been changed), a back–up of these changes should be made on a diskette using the *"Save Configuration"* function of the CSMW.

CHAPTER 2
Test and Maintenance Software

2.1 Introduction

The DCT1900 system has a powerful Test & Maintenance module incorporated in the system software. This software module regularly tests the entire system to locate possible faults in an early stage and to isolate the faulty circuits, thus minimizing the reduction in system service and to generate subsequent error messages and alarms. This chapter describes the functions of the test and maintenance software which are:

- Error handling (Paragraph 2.2)
- Testing (Paragraph 2.3)
- Resetting (Paragraph 2.4)

Paragraph 2.2 gives an explanation of how T&M diagnosis verifies and eliminates faults and makes up a fault report.

For a good understanding of this chapter, the following shall be noted (see Figure 2–1):

- Board Controllers
  BC are micro controllers, which control all communication between the various circuit boards and CPU. The SPU-S, CLU and the LTU have one board controller, the DTU and the SLU have two board controllers.

- Peripherals (P1..P8).
  Each board, except for the CPU and the DTU, has a number of peripherals, i.e. a number of identical circuits which act as a single device. The SPU has eight peripherals (SPCs) to handle eight calls. The LTU has 8 peripherals to which PBX line ports are connected to. A CLU/CLU-S has eight peripherals to which base stations can be connected. The SLU is a SPU and a CLU combined on one board, each with its own board controller, peripherals and board address. The DTU board has no peripherals but contains two identical circuits each controlled by a board controller and has subsequently two board addresses. The CLU, CLU-S, SPU, SLU and LTU peripherals are controlled by a board controller.

- Peripheral or board controller state.
  The state of a board controller or peripheral is identified as "new", "available", "malfunction-ing", etc. The actual state of such a circuit can be obtained by means of the CSMW software. For more information refer to the CSMW "Installer's User Guide" Appendix I.
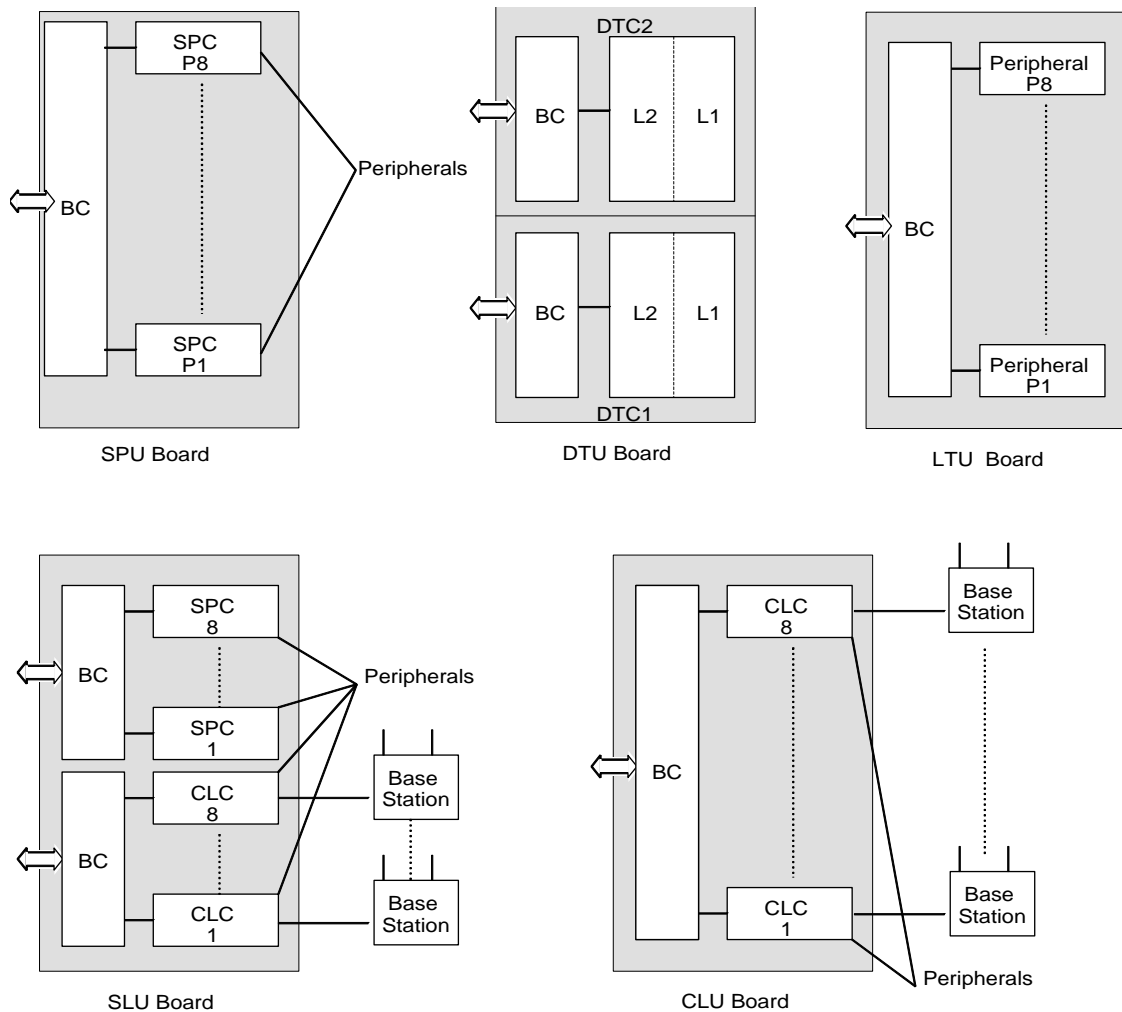
Fig. 2–1 Board Controllers and Peripherals

2.2   Error Handling

The T&M software in the CPU is activated either on detection of operational faults, or when a test has to be executed. A description of tests that T&M can perform is found in Section 2.3. This section deals with fault handling.

Operational faults and faults detected during tests will cause T&M to start up a fault handling procedure by which T&M tries to verify and clear the error. Figure 2–2 shows the different steps of the fault handling procedure. The two conditions for reception of a fault message cause the start of the flow.

All messages received by T&M are stored in either the Info or the Fault table. Not all messages that are received are faults. Some are of the category "information only". In this case, the message is logged in the "Info" table with the status code L (logged). In all other cases, a message will be written in the "Fault" table, with another status code. When the message deals with a persistent fault the following occurs:

- An additional fault report will be written in a third table called "Service" table.
- A general alarm is raised.
- An alarm message is sent to the MS (Mobility only).
- A warning is generated by the CSMW software when running.

Note:
Red LED5 on the CPU board is on if there are messages in the "Info", "Fault" or "Service" tables that have not been read by means of the CSMW software.

2.2.1 Diagnostics

After T&M has concluded that the message is not an info but a fault message, T&M starts to decode, locate and verify the fault. This is done by the diagnostics module. After verification, T&M will isolate the faulty circuit to prevent usage by the system. This is done by changing its status temporarily to Test Mode (TME). When the fault cannot be verified, i.e. the fault cannot be found, the fault message in the Fault table will be completed with the status code C (cleared). This could indicate the occurrence of an intermittent fault.

2.2.2 Fault Counters

After verification of the fault, T&M knows exactly what type of fault occurred and where. A fault counter for this fault will be incremented. When the fault counter exceeds its threshold value, no further measures are taken, but immediately a GA will be activated with fault code 3 in the service table. The function of the fault counter is to count faults that can be cleared by maintenance, see Paragraph 2.2.3, but continue to re–appear, i.e. intermittent faults. When too many of these "intermittent faults" are counted within a specific time limit, an alarm shall be raised. The fault counter is halved every 24 hours to avoid generation of alarms when intermittent faults only occur occasionally.
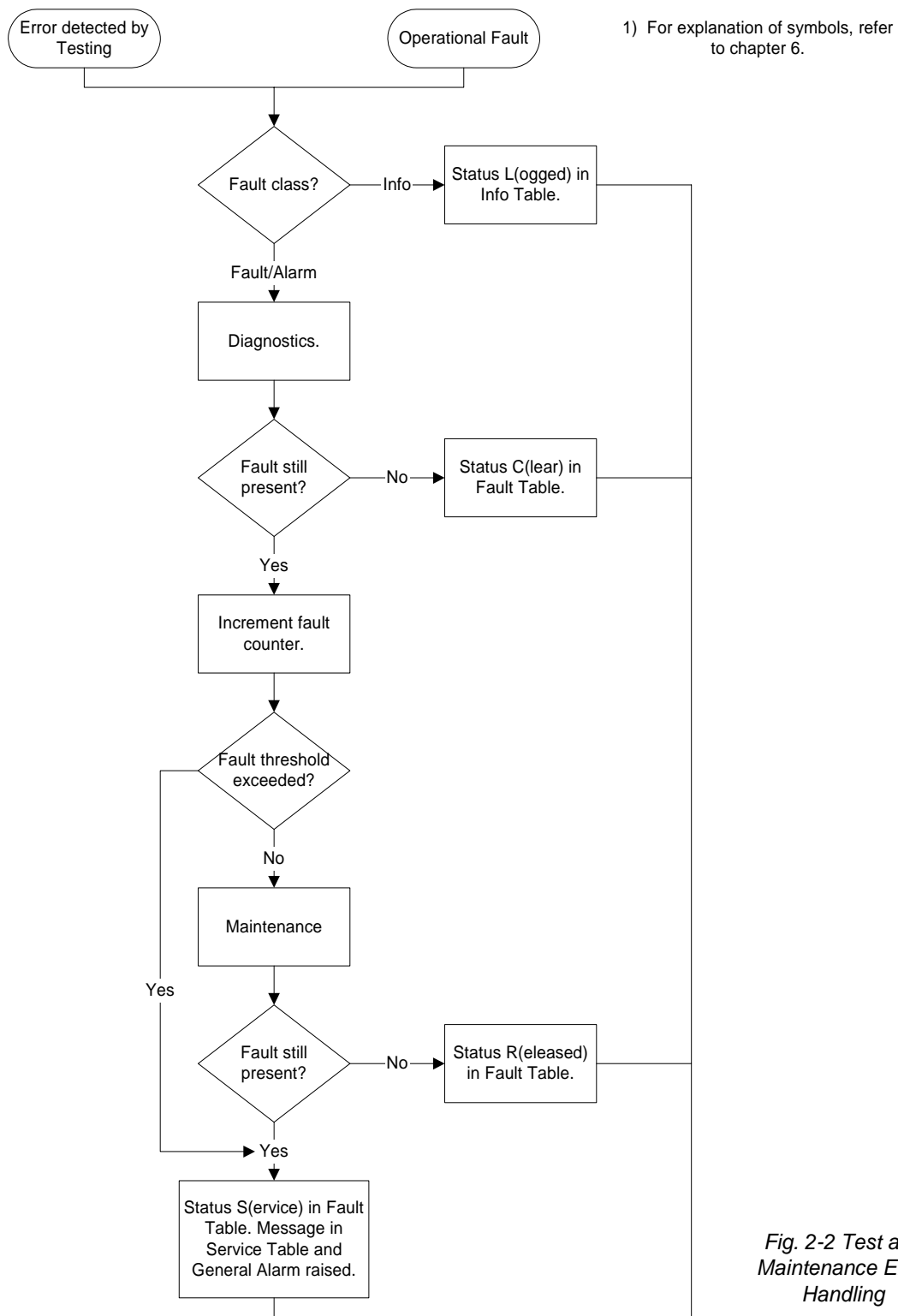
Fig. 2-2 Test and Maintenance Error Handling

2.2.3 Maintenance

If the fault counter does not exceed its limits, T&M will now try to correct the error by resetting the circuit or board. This is called a T&M reset. This reset causes the circuit or board to start a self test. When the fault is cleared after this, the fault is intermittent. T&M will release the circuit by changing its state to AVE. In the Fault Table the fault message will be completed with the status code R (released).

When the fault returns after the self test, the fault is persistent. T&M will take the circuit out of service by changing its state to malfunctioning, MFG, and raise an alarm. This alarm is called a general alarm. A general alarm will cause the following:
● The general alarm relay on the MCCB is activated.
● An alarm message is sent to the MS (Mobility only).
● A "system service required" window appears on the PC screen when the CSM software is running.
● A fault report is written in the service table.
● The fault message in the fault table is completed with the status code S (service).
● The faulty circuit or board is set to MFG.

It should be noted that service is only required when a general alarm occurs. For those faults where a message is only written into the info and fault tables, no service is required because the system is not malfunctioning yet. The service table can be read out by executing the *Select File - Create Service Report* command. The error message in the table indicates the fault code, the malfunctioning board or circuit, its position in the system and a time–and–date stamp.

2.2.4 Error Tables

The three different error tables, as indicated above are:
● Info table
● Fault table
● Service table

All tables have a size of 40 messages each. The info and fault table are cyclic buffers. The buffer always holds the last 40 messages. These two tables may never be cleared, except by a CPU reset or a system power down.

The service table is a non–cyclic buffer. This means that when full, new error messages will not be logged. All service tables may be cleared by accessing the *Clear Service Message* command under *System* on the CSMW menu bar*.*

All tables can be displayed by the *Distributor–Diagnostics–Info–Error tables* menu of the CSMW software.

2.3   Testing

The T&M module has three tests available to check the overall system performance and to report any deviations in performance. These tests are:

- Board power–on test
- Ack test
- 24h test

2.3.1 Board Power–on Test

A board power–on test is an individual test performed on a board after power is applied to that board. The test is initiated not only after insertion of the board in an operational system, but also after a system power–on. When powering on the system, a board power–on test is executed simultaneously on all boards.

The board power–on test has the following phases:

- Board test
- Board announcement
- Test result messaging
- Watch–dog test

Board Test

As soon as power is applied to the system or when a single board is inserted into a system under power, a self test is initiated on each board or on the single added board. This self test is under control of the board controller. During this board test, the board controllers and peripherals, if present, go through different states. The board test consists of:

ROM/RAM test	:	All processors on the board start up a ROM/RAM test. The ROM's check sum is verified and a read/write test is performed in RAM.
Communication test	:	All board controllers test if they can communicate with the peripheral circuits on the board.
Internal loop back test	:	A "speech–signal" is generated at one end of the board on a speech path and routed to the other end where a loop back is created, thus re–routing the signal to its originating point for verification. Thus, continuity tests are performed for all speech paths on the board. On the CLU and the CLU part of the SLU, the speech test is looped back by the Base Station thus testing the wiring to the Base Stations as well.
State test	:	The various states that a board can be in are tested.
DTU link test	:	For each DTC the primary rate communication link is checked.

Board Announcement

After completion of the board test, the board controller will set a message ready for the CPU. By means of this message the board will identify itself to the CPU. A polling processor on the CPU board will collect the message from the board controller of the board. By this board announcement the CPU knows the exact position of each board in the system. After the board announcement, the board controllers and peripherals will have the status: NEW.

Test Result Messaging

After the board announcement, the CPU requests the board to send the result of the board test. Upon the type of message received, T&M may decide to re–test a board and to make an error report. When the test results are positive, the board controllers and peripherals will be given a new

status AVE. Base Stations that are wired to the CLU/SLU and have power but have not been added to the system through the CSMW will get the status NEW. Erroneous boards or peripherals will get the status MFG.

Watch–dog Test
Board controllers have a watch–dog circuit which is periodically refreshed. The watch-dog circuit resets the controller when running in a loop. The watch–dog test is a test initiated by the CPU asking all controllers to test their watch–dog circuitry. The processor is forced to run in a loop, after which the watch–dog circuit should reset the processor again. The watch–dog on the CPU board is never tested.

2.3.2 Ack Test

The Ack test is a periodic test by which the CPU sends a message to all microprocessors in the system. Each processor shall respond with an acknowledgement. If a processor does not respond, an error is detected, and T&M will start a verification test. The test runs at a default setting every 2 minutes. The Ack test does not interfere with system service. By means of the CSMW software the periodic running of the Ack test can be stopped or started and the test interval time can be changed by selecting *System-Configuration-Automatic System Test*.

2.3.3 24–Hour Test

The 24–Hour (24–H) test is a periodic system test that runs once every 24 hours. The test is similar to the power–on test, but all tests run under supervision of the CPU (T&M) instead of the board controllers. Excluded from the 24–H test are boards or peripherals occupied in call handling. T&M will wait for them to become free, while prohibiting new involvement in calls. These circuits will get status Test Mode AwaiTing (TMT). Circuits that are free from call handling are blocked immediately. Circuits that are being tested will get status TME.

The system test reduces the system service noticeably. Boards or peripherals will be temporarily taken out of service during the test or while waiting to be tested. The test should therefore run after office hours. The default start time is 01:20 a.m. By means of the CSMW software, the start time can be changed, or the daily running of the 24 hour test can be stopped by selecting *System-Configuration-Automatic System Test*.

2.4 Resets

In the DCT1900 system, different types of resets can be generated, each caused by different actions and with different results on reset counters and error tables. Table 2–1 shows the relation between action, reset type and result on counters.

2.4.1 Reset Types

CPU Power–on Reset
A CPU power–on reset is generated when:
- System is switched on.
- CPU reset button is pressed.
As a result a board power–on test is started by the entire system.

Board Power–on Reset

A board power–on reset is generated when:

- System is switched on.
- CPU reset button is pressed.
- Board inserted in the system.

As a result, the board power–on test is started on the board.

Watch–dog Reset

There are two different watch–dog resets: an expected and an unexpected. An expected watch–dog reset happens during the watch–dog test, which is the final test of the board power–on test. An unexpected watch–dog reset happens during normal operation when the CPU or the board controller is reset by their watch–dog circuit. A CPU watch–dog reset results in a restart of the system. A watch–dog reset from a board controller results in a power–on test for that board.

Backplane Reset (SW)

When the last board of a specific kind is not responding any more, the system cannot work or a minimum configuration error occurs. When one of the elementary functions is not available any more, the CPU will force the system to restart (power on test) to check what is wrong. Minimum configuration errors occur when:

- Last SPU-S is removed.
- Last DTU/LTU is removed.
- Last Base Station is removed. This can be caused by:
    - The last CLU and the last SLU are removed.
    - The last Base Station of the last CLU or SLU is removed, while still having CLUs or SLUs connected (connection of Base Stations is detected by the system).

T&M Reset

When T&M detects an error, it sends a reset to the appropriate board controller or peripheral to start up a local test. When the fault persists, an error message will be written in the service table and a general alarm is generated.

When the fault is intermittent, there will be no error signalling to the outside world, but the error message remains in the Fault table and the absolute and relative reset counters are incremented. When the reset counter exceeds its threshold level, an error message is written in the service table and a subsequent alarm is generated.

2.4.2 Reset Table

In order to keep a reset–history, the CPU has a reset table where all resets are counted for each board. Also, resets to the various circuits on the CPU board are counted. The value of the counter in the reset table can be viewed by selecting *System-Show Reset History* in the CSMW.

Two counter types exist for counting these resets: absolute counters and relative counters.

Absolute Counters

An absolute counter counts all resets since the associated board was placed in the system. This counter is cleared only at re–initialization or when the board is pulled out with a *Replace/Remove* action. Absolute counters have no threshold level.

Relative Counters

A relative counter counts all resets since the power–on. The counter is cleared each time the power is cycled or at a CPU reset (button or watch–dog). Relative counters have a threshold level. When the threshold level is exceeded, a general alarm with fault code 3 is generated. Relative counter values are halved every 24 hours.

Counters for CPU

The CPU board has the following counters for CPU circuits:

Absolute Counters:

Power On reset	: increments at every power on.
Watch–dog reset	: increments at every unexpected CPU watch–dog reset.

Relative Counters:

HSCX reset	: increments at every HSCX reset.
HDLC A reset	: increments at every HDLC A reset.
HDLC B reset	: increments at every HDLC B reset.
8031 (BC) reset	: increments at every 8031 reset.

Note:

HSCX = High Level Serial Controller Extended
HDLC = High Level Digital Link Control

Counters for Board Controllers

The CPU has the following counters for Board Controllers:

Absolute Counter	: increments on all type of resets, see Table 2–1.
Relative Counter	: increments at error (T&M reset/BC), increments at board insertion (backplane reset).

Counters for Peripherals

The CPU has the following counters for peripherals:

Relative Counter	: increments at error (T&M reset/P).

Action	Reset type	Results in	Error Tables cleared	CPU PO	CPU WD	CPU REL	BC ABS	BC REL	P REL
System switched on	CPU power–on Reset Board power–on Reset	Power–on test CPU Power–on test all boards	x	+		0	+	0	0
CPU reset button pressed	CPU power–on Reset Board power–on Reset	Power–on test CPU Power–on test all boards	x	+		0	+	0	0
Minimum configuration lost	Backplane Reset (SW)	Power–on test all boards					+	+	=
Board inserted in system	Board power–on Reset	Power–on test board					+	0	0
Power–on/System test	Board watch–dog Reset (expected)	Normal termination of test							
Error situations:									
T&M receives error message	T&M reset/BC T&M reset/P	Power–on test board					+ =	+ =	= +
CPU in loop	CPU watch–dog Reset	Power–on test CPU Power–on test all boards	x		+	0	+	0	0
Board Processor in loop	Board watch–dog Reset (unexpected)	Power–on test board					+	+	=
Initialization	no reset	NA	x	0	0	0	0	0	0
Board removal	NA	NA	NA	0	0	0	0	0	0

PO	: Power–on	all boards	: means all boards, except the CPU	+	: counter increments by 1
WD	: Watch–dog	NA	: Not Applicable	0	: counter reset
REL	: Relative	P	: Peripheral	=	: not changed
ABS	: Absolute	BC	: Board Controller		

Table 2–1 Reset Counters and Error Tables

CHAPTER 3
Fault Signalling

3.1   Introduction

This chapter describes how maintenance personnel or system managers are informed about faults in the DCT1900 system. Faults are signalled to the outside world in the following ways:
- General Alarm/Service Message
- System Screen of CSMW software
- Individual user complaints
- Common user complaints
- Alarms to MS (Mobility only)

Furthermore, LEDs and the service display of the Portable Telephone are discussed. Although they cannot be taken as fault signaling devices, they can help diagnose faults.

3.2   General Alarm/Service Message

When the CPU has classified a fault as "service" (persistent faults), a general alarm is raised, see Chapter 2, Paragraph 2.2. Upon a general alarm, a general alarm signal is activated and a "fault" report is written in the service table, which can be read by the CSMW software. The fault report indicates the type of fault, type of board, location and time and date. The format of a fault report and a list of fault codes can be found in Chapter 4.

The local system manager or maintenance engineer is informed about a general alarm in three ways:
- General alarm signal
- "System Service Required" message on the PC–screen when the CSMW software is running
- Alarm message to the MS
- LED 5 on the CPU will also be turned on in the case of a general alarm. However, it may also be on as a result of an "info" or "fault" error table entry.

General Alarm Signal
The general alarm signal from a CPU is routed via the general alarm cable to the MCCB where it activates a general alarm relay. Via this make/break relay contact, a lamp or a buzzer or any other type of alarm device can be activated. The alarm signalling can be cleared by selecting from the CSMW menu bar *System-Reset-Alarm Relay.*

"System Service Required"
When the PC is running the CSMW software, a pop–up window containing the message "System Service Required" appears on the PC screen as soon as the general alarm is activated. If CSMW software is started after the occurrence of a general alarm, the "System Service Required" message will not appear on the screen. The general alarm signal is the only warning.

Alarm Message
When a fault is classified as "service" and posted in the service table, an alarm message is sent to the MS which enables remote monitoring of the operational state of a DCT1900 system. This capability is only applicable in the Mobility configuration.

3.3 Checking Component Status through Cordless System Manager

Checking radio

Checking radio exchange components maybe done to verify fault reports from the service table or to check proper connection of base stations after installation. It is possible to check the status of a system board and its peripheral circuits in the Radio Exchange window of the CSMW. This screen is activated by checking the *Radio Exchange* selection under the menu bar option, *View*. Base Station status is viewed through the Base Station window by checking the *Base Stations* selection under the menu bar option *View.*

Note:
Red LED5 on the CPU board is on if there are messages in the info, fault or service table that have not been read by means of the CSMW software.

Explanation of States

AVE   : Available. Circuit is operational. DTUs can only become available when a digital trunk is connected, Base Stations only when programmed with a delay value.

MFG   : Malfunctioning found defective.
- Circuit is found defective.
- Board is replaced/removed without following the correct procedure.
- Downloading of software to Base Station was not successful.
- DLU port has lost connection

PNP   : Possibly Not Present.
- Base Station not connected to the CLU board or SLU board.
- Base Station has lost power.
- System board is temporarily removed (replace board command); the status of the board controller of the particular board becomes PNP and the status of the peripherals remain unchanged.
- Base Station is being downloaded with software.
- DLU port is programmed but not connected

OCD   : Occupied. Circuit is in use for a call.
TME   : Test Mode. Circuit is under test (e.g.: by the 24–Hour test).
TMT   : Test Mode AwaiTing. Circuit is queued to be tested.
NEW   : New circuit.
- New Base Station connected to the CLU or SLU, but the delay value has not been programmed. Base Station has not been added to the system.
- During power on test all peripherals and board controllers have the status "New" after board announcement to CPU.
- When the downloading of software to a Base Station is successful.
- DLU port is connected but not programed

A special summary of peripherals states is given below:

Base Station (BS) States

MFG : Base Station defective, data cable wiring fault, or download of software incorrect. Also a fuse on CLU/SLU is down.

PNP : Base Station is not connected, has lost power, has blown fuse or is being downloaded.

NEW : Base Station operational but not programmed with delay or not added into the system via CSMW.

AVE : Base Station is connected, powered and programmed.

PND : Base Station is connected, powered and programmed but must be UTAM activated. Refer to the CSMW "Installer's Quick Guide" for more information.

DLU Port States

NEW : Connected but not programmed.

PNP : Programmed but not connected.

AVE : Connected and programmed.

MFG : Port was connected and programmed but has encountered a problem.

DTU Layer States – Layer 1 (L1)

NEW : No physical connection to MS/PBX.

MFG : Physical link is connected, but malfunctioning or improper signalling format

AVE : Physical connection is correct at layer 1.

DTU Layer States – Layer 2 (L2)

Only valid when layer 1 is AVE, otherwise the field of L2 remains empty.

MFG : No multiframe synchronization received.

AVE : Multiframe synchronization received.

System Synchronization States (valid with Mobility Server only)

The system synchronization states are only applicable if the CPU is a slave CPU:

MFG : No sync signal or not yet synchronous with the sync signal at the CPUs sync input connection

AVE : Synchronous with the sync signal at the CPU sync input connection.

PBX : MS number.

LinkGroup : MS connection number.

3.4   Individual User Complaints

Individual user complaints are received from only one user or, theoretically speaking, from two or more users who are not related to each other, for example being in different areas etc.

Individual user complaints point to parts in the system that can only be accessed by that particular Portable Telephone. These parts are the Portable Telephone itself, the charger, etc. Unlike faults, for instance in Base Stations or system boards, which affect more than one user and mostly cause error reports, these types of faults cannot be detected by the system simply because of their nature. However, individual complaints are generally easy to trace.

Before any part of the system is suspected, it should be made clear that no handling faults have occurred. Typical handling faults are:

- Portable Telephone out–of–range, battery empty or Portable Telephone not switched on.
- "Hook flash" set on (if applicable), causing difficulties in going on or off hook.
- Audio and ringing volume too low.
- "Ringing" switched off.
- Improper handling of unit, damage due to dropping or inserting battery improperly.

3.5 Common User Complaints

Common user complaints are similar complaints received from several users at the same time. Somehow these complaints have a common source and fault finding is based on finding that common aspect:

Faults occurring in same area	: A Base Station may be suspected.
Blocking calls	: Lack of resources in SPCs (SPUs and/or SLUs) or air capacity.
Lost calls	: During an inter system handover calls may get dropped due to an improper PWT air interface synchronization of the systems involved.

3.6 Alarms to Mobility Server (DCT1900 Mobility Configuration Only)

To inform the MS about its operational state, the DCT1900 system can send the following alarms:

Alarm1	: System start–up ready, system is available.
Alarm2	: Non serious fault detected.
Alarm3	: Serious fault detected. The general alarm signal is raised and a service message is generated. Also, it is possible that calls are not handing over to a base station because of improper time delay values. May relate to "fault occurring in same area."

3.7 LEDs

LEDs can be found on all system boards and Base Stations. Those LEDs may not and cannot be taken as alarm signalling devices because they are usually out-of-sight. However, sometimes they may give additional information to maintenance personnel.

All system boards have four identical LEDs at the top, except the DTU board which has two rows of four LEDs. The CPU board is equipped with two extra LEDs. Base Stations have two LEDs. An explanation is given of those LEDs below.
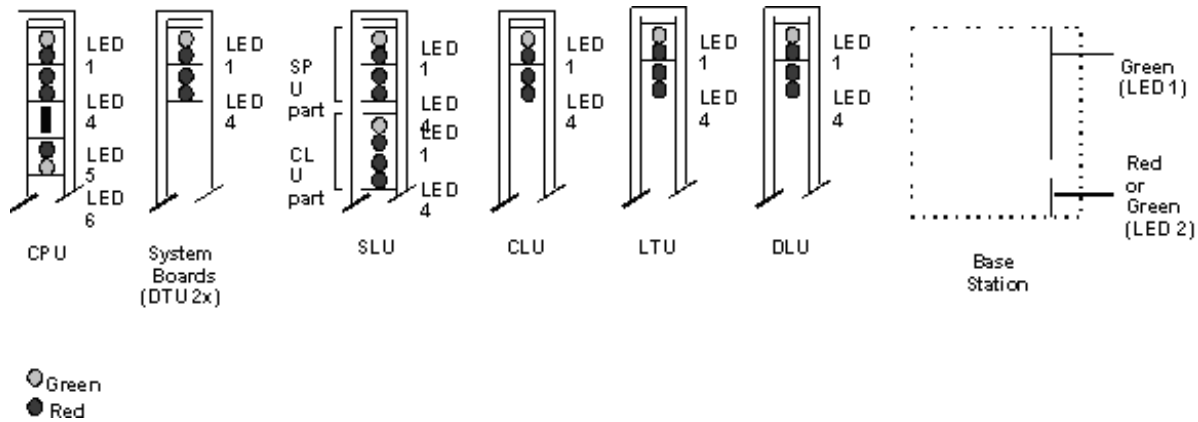
Fig 3–1 LEDs in the System

3.7.1 LEDs on System Boards

Each board has four LEDs at the top. The SLU has two times four LEDs because it consists of a SPU and a CLU on one board, each with its own board controller and board address. The DTU also has two times four LEDs because it contains a duplication of circuits with two board controllers, each with their own address.

LED 1
LED 1 is the "board powered" LED, illuminating when the board is powered. On all boards this green LED shall be on.

LED 2
LED 2 is the "watch–dog reset" LED, illuminating when the board controller receives a watch–dog reset. This LED normally only flashes during the power–on and 24–Hour test when the watch–dog circuit is being tested.

LED 3
LED 3 is the "board not polled" LED, illuminating when the board has not been polled by the CPU poll processor for a period of time. As a result the CPU may not know the board any more, giving it the state of PNP.

LED 4
LED 4 is the "error" LED, generally indicating an error on the board. On the CLU, the CLU part of the SLU board, and the DTU boards, this LED can be active for other reasons. Therefore, it may not always be taken as an error indicator.

A CLU board or the CLU part of an SLU board will light LED 4 when Base Stations are in NEW state, which means that a delay value is not yet programmed. The LED will turn off automatically after programming the last Base Station of the CLU or if one Base Station is connected at a time, the LED will turn off when added via CSM.

A DTU will light LED 4 when no trunk is connected. The DTU has no error, but the LED indicates that no external clock is detected. The LED turns off as soon as a trunk is connected.

3.7.2 LEDs on CPU

The CPU is the only board having six LEDs. LEDs 1 to 4 are identical to the LEDs on other boards. LED 5 and 6 are found below the reset button.

LED 5

LED 5 on the CPU board is the "message–received–LED." When a message is written in one of the info, fault, or service tables, LED 5 is turned on. The LED is cleared immediately after reading the appropriate error table as it assumes that the reader then takes notice of the message.

LED 6

LED 6 on the CPU is the "T&M–active–LED." This LED turns on when the test and maintenance module is activated. This is the case when tests are executed, error messages are received or the error handling procedure is running, see Chapter 2, Paragraph 2.2. As soon as T&M is ready the LED is off. Because T&M does not run continuously, the LED often blinks.

3.7.3 LEDs on Base Station

Power LED
Green LED indicates the Base Station is powered.

LED 1 and 2
LED 1 and 2 are software controlled. One LED is a single green (LED 1) and the second LED is a dual red/green LED, (LED 2, the yellow color is obtained by turning both red and green color LEDs on). The different combinations are explained in Table 3-1.

LED 1	LED 2	Meaning
OFF	OFF	Base Station is not operational. There is no power.
GREEN	GREEN	Connection(s) is(are) made with the base station.
GREEN	RED	Base Station is unlocked.
GREEN	YELLOW	All available channels are used.
GREEN	RED,GREEN FLASHING IN SEPARATE TIME	Base Station is operational but not available(self test, not initialized, no communication with CCFP, no UTAM approval)
GREEN	RED,GREEN FLASHING IN SEPARATE TIME	Base Station is mulfunctioning.
GREEN	ORANGE	Base Station is downloading.

Table 3–1 Meaning of LED1 and LED2

3.8   Dynamic Channel Allocation (DCA) Display – Portable Telephone

The Portable Telephones can be switched to DCA mode. In this mode the Portable Telephone displays information regarding the radio interface, like Base Station number, carrier, time slot number, RSSI, RQI, etc., while calls can still be made and received normally. The call indicator shows the user the hook status.

Note:
Activating the DCA mode reduces the normal functioning of the Portable Telephone. It is therefore recommended only to use this facility in exceptional cases, e.g. when service requires such an action.

3.8.1 Activating DCA mode

1. Switch off the Portable Telephone   : [ON/ OFF]

2. Switch on again with special code: [2] + [8] + [ON/ OFF] (Press the 3 keys simultaneously for longer than 1 second)

3. The display in Figure 3-2 is momentarily visible. Then the display will change to the normal standby mode display.

```
Line 1:  (S/W number)
Line 2:  (S/W revision level)
```
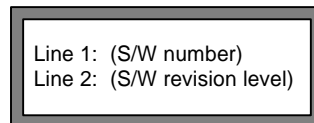
Fig. 3-2 Service Display

4. For 9p23 Portables, while on hook:

    -Push the *Menu* button on the down arrow button

    -Scroll up or down until you reach *Advanced Config*

    -Push the *Select* button

    -You see <DCA-Servic>

    -Push the *Select* button

    -Scroll down through the following menu items

        1. Link Info
        2. ALL-FP + RSS
        3. FP-Info
        4. Channel Inf
        5. Time Slots
        6. Sys Order
        7. Sys List
        8. MER tests
        9. Last Error

    -Press *Select* to make a menu choice

    -Press *Back* several times to exit the DCA-Services menu

    -Turn the portable off when your testing is done

    -To use DCA mode while on a call:

        - Turn the phone on in DCA mode

        - Make the call

        - Once a call is established

            - Press the down arrow

            - You will be at menu option 1-Link Info

            - Press *Select* to choose this option or scroll down the list for the other selection

To terminate the call processing the back button or the off button until you return to the standby mode display and hang up the call.

When you are done testing, turn the portable off to exit DCA mode.

5. For DT600 and DT620 scroll menu down to:Gen. Setup (press Yes)
   Note: If using the DT620 or the DT600 rev. R2B and higher, go directly to DCA-Service.
   Scroll menu key down to   : DCA-Service (press Yes)
   Scroll menu key down to   : Desired Function:
   > 1. Link Info
   > 2. ALL–FP+RSS
   > 3. FP–Info
   > 4. ChannelInf
   > 5. TimeSlots
   > 6. SYSOrder
   > 7. SYSList
   > 8. MER tests
   > 9. Last Error

Inhibiting activation of the service display can only be done by switching–off the Portable Telephone followed by a normal switch–on.

3.8.2 Explanation of DCA Service Displays

Data is always displayed in hexadecimal numbers. The Base Station number relates to the physical connection in the RE. Refer to Section 2, "System Description", Chapter 5, Paragraph 5.4, "Numbering Conventions" in this manual to find this relation.

Note:
A Portable Telephone is always blind for the two adjacent time slots. For example, a Portable Telephone is locked on a Base Station on time slot 5. If it approaches a Base Station that has only one active channel (traffic or beacon) on time slot 4 or time slot 6, the Portable Telephone will not see that Base Station. The display remains unchanged until the current channel or the channel of the second Base Station changes. Consider this when using the menus below.

Link Info
The link info menu has two display options which can be selected by pressing either *UP* or *DOWN* key. The following display is entered by pressing *UP* key*:*

<div>

```
┌─────────────────┐
│ Fp CS SsQuBd    │
│ 0A FB  E02024   │
└─────────────────┘
```

</div>
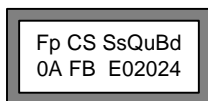
Fp	:	Fixed Part: Base Station number (hexadecimal)
C	:	Carrier (A...H)
S	:	Time Slot number (0...9, A, B)
Ss	:	Signal strength (RSSI - Receive Signal Strength Indicator)
Qu	:	Quality of the received signal (RQI - Receive Quality Indicator)
Bd	:	Bad frame count; Number of bad sync or A-field CRC errors received (counter wraps back to zero)

The following display is entered by pressing *DOWN key:*

```
┌─────────────────┐
│ ┌─────────────┐ │
│ │ Nnnn FP A AT │ │
│ │ 23DE 11 A  0 │ │
│ └─────────────┘ │
└─────────────────┘
```

Nnnn	: System Number (hexadecimal)
FP	: Power level, F for Fixed Part, P for Portable Part; 0=2mw, 1=90mw, 2=200mw
A	: Registration type (U = unregistered, A = definitively registered, a = temporarily registered, n = rejected)
A	: Action (' ' = simplex bearer, - = no action, ♦ = registration, ∙ = location update or system hand over)
T	: Link type (0 = beacon, 4 = traffic)

The Link Info option can be used for site surveys and commissioning of the system. All information regarding the speech/beacon channel and system to which the Portable Telephone is locked is visible. The signal strength theoretically varies between 00_{hex} and FF_{hex}. In practice, values will lie between 28_{hex} and $F0_{hex}$, of which 30_{hex} means noise, and $F0_{hex}$ means optimum quality. Typical values are 80_{hex} .. $B0_{hex}$.

All–FP+RSS

```
┌─────────────────┐
│ ┌─────────────┐ │
│ │ FpSsFpSsFpSs │ │
│ │ XX--XX--XX-- │ │
│ └─────────────┘ │
└─────────────────┘
```

| Fp | : Fixed Part (hexadecimal) |
| Ss | : RSSI Value |

Show 3 fixed stations number and best channels' RSSI of those fixed stations. Users can use UP/DOWN key to scroll through all fixed stations within a system.

FP–Info

```
┌─────────────────┐
│ ┌─────────────┐ │
│ │ N Fp  Ss CB D │ │
│ │ 1 10 87 21 0 │ │
│ └─────────────┘ │
└─────────────────┘
```

N	: Index to current fixed station in current system's list
Fp	: Fixed Part
Ss	: RSSI value
C	: Number of channels of the fixed station
B	: Number of bearers
D	: Number of attempts

Show information of a fixed station. User can use UP/DOWN to scroll the list of all fixed stations of a chosen system. If no fixed station is chosen, the best (FIRST_RFP) fixed station of the chosen system is the default. If no system is chosen, the best existing system (FIRST_SYSTEM) is the default.

ChannelInf

```
┌─────────────────┐
│ ┌─────────────┐ │
│ │ CSTSsQuStEFp │ │
│ │             │ │
│ └─────────────┘ │
└─────────────────┘
```

C	: Carrier Number
S	: Time Slot Number
T	: Dummy Channel
Ss	: RSSI value
Qu	: Quality of received signal
St	: rx-status of current channel
E	: Signalling error
Fp	: Fixed Part (hexadecimal)

This option enables the display of information for a selected channel. Data is updated at every 8 frames. UP will increment DCA_carrier by one and scroll back to FIRST_CARRIER if beyond limits, DOWN will increment DCA_timeslot by one and scroll back to FIRST_SLOT if beyond limits.

TimeSlots

```
0123456790AB
-----BXB---
```
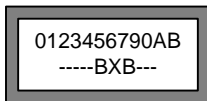
0-B	:	Free time slot
B	:	Blind time slot
X	:	Time slot in active use

This shows status of all 12 time slots on the carrier of the master bearer.

SysOrder

```
NnnnSsNnnnSs
01F4A5xxxx--
```
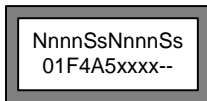
Nnnn	:	System number
Ss	:	RSSI value

Scroll through current list of systems and display the system number and RSSI of its best RFP's best channel. Two systems are displayed at a time. UP/DOWN can be used to scroll through the list.

SysList

```
E Nnnn ASs F
1 01F4 AA2 3
```
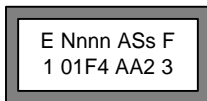
E	:	Index to current system in the list
Nnnn	:	System number
A	:	System allowed
Ss	:	RSSI value
F	:	Number of RFPs

Display information about a chosen system on the list of systems or the best one (FIRST ENTRY), if the selected one is not found. Users can use UP/DOWN to scroll through the list of systems.

MER tests
1. MER short
2. MER long

1	2
3 4	5

1	:	Frame Count
2	:	Total Frames or MER
3	:	Number of SYNC errors encountered
4	:	Number of A-CRC errors encountered
5	:	Number of X-CRC errors encountered

Last Error

Error 41

This menu informs you of the last fatal error that occurred in the portable telephone.

CHAPTER 4
Service Messages

4.1 Service Message Format

Service messages are displayed in the service table have the following format:

```
Fault  35   on DTU circuit   1   76   2      10/07  14:25
```

| Fault Code | Board Type | Cabinet | Board Number | BC/Periph. Number | Date: MM/DD | Time: HH:MM |
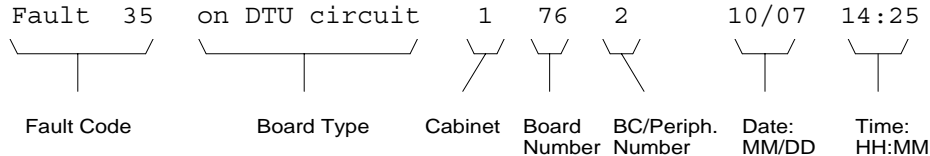
Fault Code	:	Number identifying the fault, see Table 4-1.
Board Type	:	Name of the board. When the fault points to a peripheral, the word "circuit" is added.
Cabinet	:	Cabinet number in the system.
Board Number	:	Location of the board in the cabinet, see Section 2 System Description, Chapter 5, Paragraph 5.4, "Numbering Conventions."
Peripheral Number	:	Peripheral (interface, circuit) number. Only when fault concerns a peripheral.
Date	:	Date when fault was reported.
Time	:	Time when fault was reported.

A DTU board actually has no peripherals, but comprises two completely separate circuits, called DTCs. However, to distinguish between the upper and lower digital trunk circuits, the peripheral number is used. The upper DTC is indicated as peripheral 2 and the lower DTC as peripheral 1. For more information, refer to Section 2, System Description, Chapter 5, Paragraph 5.4, "Numbering Conventions."

To distinguish between the four possible types of DTU boards, the following board type designations have been defined:

EIC	:	DTU-E1, CCS
T1C	:	DTU-T1, CCS
E1A	:	DTU-E1, CAS
T1A	:	DTU-T1, CAS

4.2 Handling Error Messages

How to display messages
Service messages, faults and information messages are displayed in the Service Message window. To view the Service Messages window, check *Service Messages* under menu option *View.*

How to remove messages
Messages can be removed from the Service Messages window by selecting *System-Clear-Service-Messages* or by right clicking in the *Service Message* window and selecting *Clear Service Messages.*

4.3 Fault Codes

Table 4-1 shows all fault reports that may appear in the service table.

Comment to the Table

● Column 1 - Fault numbers in sequence

● Column 2 - Service class:
  - Class 1

    Faults in this class mean that communication with a board or peripheral is lost. In most cases there is a physical reason. Check on proper connection. Execute a *Reset Board* by the *System manager–Control* menu and check that the fault disappears. If not successful, proceed to class 3.

  - Class 2

    Faults in this class can be minor faults that can be cleared by a board reset. Execute a *Reset Board* by the *System Manager–Control* menu and check that the fault disappears. If not successful, proceed to class 3.

  - Class 3

    Faults in this class are in most cases fatal errors that require board replacement. It is recommended that you ensure that the fault is a hard fault by executing a *Reset Board* and checking if the fault disappears. If not successful, execute the *Replace Board* command from the *System Manager–Control* menu and replace the board with a spare board. The new board is automatically tested and taken into service. If the fault persists, call your local supplier for service.

● Column 3 - Fault threshold
  This column indicates the number of times a fault may occur intermittently. This means that after detection of the fault, the fault does not reappear when tested, see Paragraph 2.2. If this intermittent occurrence exceeds its threshold number within 24 hours, a status code S (service) will be written in the fault table, a fault report is written in the service table, and the general alarm is activated. The counter values are halved every 24 hours. Threshold value 99 is equivalent to infinite.

● Column 4 - Fault description
  This column gives a brief description of the fault. In Paragraph 4.3.1 comments are given for some fault codes.

Fault Code	Service class	Fault Threshold	Description
1	2	5	Unexpected message/primitive. Message received but not within specified time
2	1	99	Board/CPU communication error or time out. Message corrupted or not received
3	2	99	Threshold fault counter or Reset counter exceeded
4	3	1	Board controller ROM error
5	3	1	Board controller RAM error
6	3	2	Internal loopback error
7	2	5	Peripheral state error - State of peripheral differs from state listed in CPU data base
8	1	30	Base Station not present - wiring fault or power lost
9	3	2	Peripheral ROM error
10	3	2	Peripheral RAM error
11	2	99	Peripheral status unknown. Two simultaneous faults: status can not be obtained
12/13	2	99	Board status unknown. No communication with board: status can not be obtained
14	2	5	Peripheral communication error or time out. Message corrupted or not received
15	2	2	Board signalling link was cut. When a board is not polled, it resets itself and after communication has recovered it sends this message to CPU
16	1	10	Board controller poll response error
17	3	99	CPU main processor RAM error
18	3	99	CPU main processor ROM error
19	3	99	CPU EEPROM error
20	2	1	CPU real time clock test failed
21	3	2	CPU–poll processor (8031) RAM error
22	3	2	CPU–poll processor (8031) ROM error
23	1	2	CPU–poll processor communication error
26	2	5	CPU internal buffer overflow
27	2	99	Board controller watchdog reset
28	1	2	HSCX error. Serial communication controller on CPU of signalling highway
29	3	99	Signalling highway down. No communication between CPU and **all** other boards
33	1	1	Initialization procedure not successful. Due to e.g.: no communication with board
34	1	99	Portable Telephone related circuit not present. LTC or DTU–channel
35	2	30	Layer 1 fault at link with PBX: no physical connection or DTU error, L1 = MFG - this fault may disappear automatically. CPU will set L1 and L2 to AVE again. The service error message and general alarm remain and must be cleared manually
36	2	30	Layer 1 fault at link with PBX: Error in trunk unit of remote PBX (PBX did detect the error), L1 = MFG - see note at fault 35
37	1	4	Layer 2 fault at link with PBX: No multiframe synchronization, L1=AVE, L2=MFG - see note at fault 35
38	1	2	DTU or DLU hardware failure
39	1	99	PC communication error - when statistics runs, logging is stopped. Statistics must be set "ON" again.
40	3	3	SPU parameters on board have wrong checksum
41	2	99	System Sync Delay hardware out of lock
50	1	*	Minimum configuration error, see Chapter 2, Paragrah 2.4.1, "Backplane Reset"
51	2	*	Subject is unreliable. Fault is not continuously present
52	2	*	Subject could not be tested after maintenance action due to a coincidence - Subject must be verified if operational. It may be 'AVE' but not working. Reset subject

*Not handled by tam_dbas, so threshold is effectively infinite

Table 4–1 Fault Codes in Service Table

4.3.1 Comment to Fault Codes

- Fault 17 ... 26, 28, 29, 41   CPU faults. Replacement of the CPU requires saving of its data to PC first by *"System Manager-Save/Restore".* If not possible any more, restore the new CPU with the most recent save file on disk (EEPROM.SAV and SPU_S.SAV).

- Fault 35, 36, 37   These faults may disappear automatically. The DTU sends a message to T&M and T&M clears the fault status: L1 = AVE and L2 = AVE. However, the service error message remains and the general alarm as well. They must be cleared by *"Clear Service."*

- Fault 52   Maintenance personnel must verify if the subject is operational or not. It may occur that a subject is given "AVE," but not working any more. If not working, reset the subject and wait for new fault message. If operational then simply wait to see if the fault reappears.

CHAPTER 5
Part Replacement

5.1   General Rules

- Always protect yourself with a properly connected ESD wrist–strap before touching any board.
- Pack replaced boards immediately in ESD safe material. Use the packing materials from the replacement board.
- When sending a board in for repair, always include a printout of the corresponding fault report from the service table. If possible also include prints of info, fault and reset tables. Return the board together with a completed "RMA Form" (ask your service manager or distributor).
- Please observe that some CSMW software commands used in this chapter require a distributor privilege level.

5.2   Replacing a System Board

All system boards, except the CPU, use the same board replacement procedure. There is no need to switch off the system when replacing boards, except for the CPU.

Before replacing a faulty system board, the board must be set free from traffic. This is done by the *Replace* command. No new traffic is accepted, while existing calls can be terminated normally. These busy circuits will be blocked immediately after the call has ended. After the message *"you can now replace the board,"* the board is set free.

Procedure
1. Select *Board* in Radio Exchange window by left clicking on the listed board.
2. Right click and select *Replace* or choose *Board-Replace* from the menu bar.
3. Choose if you want to wait for calls to terminate before execution.
4. Wait until the message "*you can now replace the board*" appears on the PC screen
5. Disconnect cables from board **(mark their position!).**
6. Remove the board.
7. Insert the new board in exactly the same position.
8. Re–connect cables.
9. Put the defective board in ESD bag and box.

After insertion, the board will start its board–power–on test. After the test is finished, the board will be taken into service automatically.

5.3   Replacing the CPU

If possible, back–up the contents of the EEPROM to the PC by selecting *File-System Backup.*

The most "elegant" procedure is to make the system free of traffic before replacing the CPU board. This can be done by executing the *System Manager–Control–Replace board* command for all SPU and SLU boards starting at the board with the highest board number. When the last board *"can be replaced,"* exit the CSMW software program. Also, let the users know that the system will be out-of-service before removing the CPU.

Procedure
1. Switch off the system.
2. Disconnect the cables from the CPU.
3. Replace the CPU and re–connect the cables.
4. Switch the system on.
5. After LED 6 has turned off, start up the CSMW software.
6. If the CPU has been initialized before with an incompatible version of the CSMW software, DCT1900 CSMW software will not start. If so, please contact your distributor.
   If the spare CPU is new, the CSMW will come up with the *"Initialization"* screen and the system shall be initialized with default data, e.g. by pressing only "Enter"–key.
   The EEPROM has to be downloaded with proper data from a previously "saved" file.
7. Download the original system data from PC to EEPROM by selecting *File-System Restore*.

5.4   Replacing a Base Station

- If the state is MFG:
  - Disconnect Base Station.
  - Connect new Base Station.
  - Select base station in *Base Station* window.
  - Execute the *Reset* command.
- If the state is AVE
  - Select Base Station in *Base Station* window.
  - Execute *Delete* command by right clicking in window.
  - Wait until message *"Base Station deleted"*
  - Replace Base Station.
  - Execute the *Add* command by right clicking in window.

5.5   Expansion of Modular Cabinet System

Expanding the Modular Cabinet system means that a new cabinet has to be interconnected to an existing cabinet. Modular Cabinets are interconnected in a fixed sequence. The correct cabinet sequence and all other details can be found in Section 5, "Installation Instructions," Chapter 4 in this manual.

A special interconnection set is available to connect the cabinets. This set can only be mounted when a number of boards are removed at the side where the interconnection is to be made. Therefore, before starting, make a printout of the *system* screen of the current system to determine the current board positions and ensure that all cables are marked properly. Thus you can make sure that the current cabinet can be re–installed as it was. Ensure that you have an up–to–date back–up of the CPU data (save configuration) as well.

Because a number of boards have to be removed from the current system, make sure that you have proper ESD safe boxes to put the boards in.

Procedure
1. Print out all board positions by the *System Manager–Control–System* command. Use the *Print* key (F7) and the *Page–Down* key.
2. Save the EEPROM data, *System Manager–Save/Restore-Save Configuration.*
3. Switch off the power of all cabinets, and disconnect battery and mains.
4. Remove the front cover of the cabinet to which the new cabinet must be connected.

5. For the three slots farthest to the right, disconnect the cabling and remove the boards (the three slots farthest to the left if the **new** cabinet comes at the **left** side).
6. Remove the break–out plate or conductive tape from the side panel adjacent to the new cabinet.
7. Place the shielding gaskets from the interconnection set in the created hole with its springs outside, see Section 5, "Installation Instructions."
8. Remove the brake–out plate or conductive tape of the new cabinet, at the correct side, and fit the shielding gaskets.
9. Mount the new cabinet to the wall. Keep a distance of .3" to the adjacent cabinet.
10. Feed the flat cable through the hole and connect it to the backplane connectors on both sides.
11. Secure the new cabinet to the wall by the retaining screws.
12. Remove the R–networks from the backplane of both cabinets, at adjacent sides (see Section 5, "Installation Instruction," Chapter 4, "Modular Cabinet.")
13. Interconnect the ground strips of both cabinets using the protective ground cable.
14. Re–install the boards and cabling of the "old" cabinet.
15. Install the new cabinet according to Section 5, Chapter 4, "Installation Instructions" in this manual.

The easiest way to install a Modular Cabinet's cabling is to put the cabinet on its back on a desk.

5.6   Re–positioning Boards

The CPU keeps initialization data of all boards in its memory. This data is related to the board position. If the procedures below are maintained, no initialization data will be lost and significant time on re–configuring a system can be saved.

- SPU boards:
    - Execute *Remove* command for the SPU and re–insert the SPU in the new position.

- DTU boards (for DCT1900 Mobility Configuration) :
    - Execute *Remove* command for the DTU. Remove and re-insert in the new position.

- DTU boards (for DCT1900 Standalone Configuration):
    - Execute *Replace* command for the DTU. Remove and re-insert in the new position.
    - *Refresh* Radio Exchange window.
    - Move all extensions to the new board position by using the *Change Line Connection* command.
    - Execute *Remove* command for the old DTU position.
    - Alternatively, all extensions on the DTU board can be deleted followed by re-initialization of the extension numbers and associated Portable Telephones. If this is preferred, execute the *Delete Extension Number* command in the *Cordless Phones* window.

- LTU and DLU boards:
    - Same as for DTU Standalone

- CLU boards:
    - Execute *Replace* command for the CLU. Remove and re-insert into new position.
    - *Refresh* Radio Exchange and Base Station windows.
    - Execute *Remove* command for the old CLU position.

- Execute *Add* command for the New Base Stations in the Base Stations window.

- SLU boards:
  - Execute *Replace* command for the CLU. Remove and re-insert into new position.
  - *Refresh* Radio Exchange and Base Station windows.
  - Execute *Remove* command for the old CLU position.
  - Execute *Add* command for the New Base Stations in the Base Stations window.

5.7 Adding Boards

New boards placed into the system are automatically detected by the CPU within 1 minute.

5.8 Fuses

In a Modular Cabinet system, the following replaceable fuses are found:

Modular Cabinet – Fuses near power switch
Left fuse, in + rail, red wire:
- Protection against overload AC.
- Protection against overload DC supply (non–earthed).
- Protection against reversed DC supply (non–earthed) connection.
- Protection against reversed PBX (–48V) connection.
- Protection against DC supply with grounded – rail.

Right fuse, In – rail, black wire.
- Protection against overload PBX supply with grounded + rail (–48V).
- Protection against overload AC.
- Protection against overload DC supplies (non–earthed).
- Protection against reversed DC supply (non–earthed) connection.

Replacement:
1. Switch off Modular Cabinet.
2. Replace fuse.
3. Switch on Modular Cabinet.

Modular Cabinet – Fuse near power switch to Backplane
- Protects backplane.

Modular Cabinet – Fuses on the MCCB in Modular Cabinet
The fuses on the MCCB are only used for the "external power" connection.

Front fuse:
- Protection against overload in Base Station powering via PW3/4/5/6.

Rear fuse:
- Protection against overload in Base Station powering via PW1/2/7.

Replacement:
1. Remove the power cable connected to PW–EXT.
2. Replace the fuse.
3. Re–connect the power cable.

5.9 Board Reset

To reset a board execute one of the following procedures.

Procedure A
1. Execute a *Reset-board* by the *System Manager-Control menu.*

Procedure B
1. Execute a *Replace board* by the *System Manager–Control menu.*
2. Disconnect board from back plane connector.
3. Insert board again. The board will now automatically be tested and taken into service.

CHAPTER 6
Fault Finding Procedures

6.1   Introduction

These fault finding procedures are designed to help maintenance personnel locate and eliminate faults in the shortest possible time. The fault finding extends to the level of a replaceable part (DTU, SPU, power supply unit, etc.). Although cabling and connection errors are not covered, suggestions will be given to check these items when the fault is presumed to be introduced by them. The basic assumptions for the fault finding are:

- Only one fault at a time.
- The fault is persistent (not intermittent).
- Fault is not due to cabling or bad connections.

The execution of the following steps will avoid unnecessary fault finding:

- Analysis of the fault symptoms.
- Visual inspection of the system (cabling, connections, power cords).

If these steps do not solve the fault, the flowcharts given in Paragraph 6.4 can be used.

6.2   Symbols used in the Flow Charts

Question
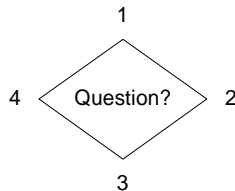
This symbol contains a question with two or three possible answers being "Yes", "No", or other Text.
Inputs are points 1 or 4 and outputs are points 2 or 3 or 4.

Instruction

This symbol contains an instruction for the maintenance engineer.

References

This symbol is used as a starting point for a procedure (e.g. START), as a reference to another flowchart, or to end a procedure (END).

This symbol is used as a reference within one flowchart. This can be to a part of the flowchart on another page (e.g. A or B) or to a part of the flowchart on the same page (e.g. 1).

Flow

Arrows indicate the normal flow.

6.3   How Defective Items are Indicated

When the flowcharts lead to a possible cause, this is indicated by a statement giving the name of the defective part or the cause of the problem, e.g. a defective SPU board is indicated by the statement "SPU." When there are more possible items, they are listed in order of decreasing probability.

6.4   Fault Finding Flowcharts

GENERAL ALARM

System Manager - Control - Service

Fault 8, 35, 36, 37, or 41? —No→ Replace indicated board

Yes

Fault 8? —Yes→ Check availability of indicated Base Station in System Manager - Control - System → Base Station available? —Yes→ Connection between the indicated CLU/SLU and Base Station has been broken for a short time

No

No

A

Fault 35? —Yes→ Check availability of indicated DTU board in System Manager - Control - System → BC and L1 and L2 of DTU available? —Yes→ Connection between the indicated DTU and Mobility Server/PBX has been broken for a short time

No

No

Check the DTU to MS/PBX/Centrex Cabling.

Fault 36? —Yes→ Error in Mobility Server/PBX Digital Trunk controller

No

Cabling correct? —No→ DTU cabling to Mobility Server/PBX

B

Yes

- DTU
- Error in Mobility Server
- PBX

```
                    ( A )
                      │
                      ▼
            ┌──────────────────┐
            │  Check supply    │
            │  voltage at Base │
            │  Station         │
            └──────────────────┘
                      │
                      ▼
              ◇ Voltage <½ x ◇ ──Yes──▶ ◇ Base Station ◇ ──No─▶  • When using CLU check related fuse.
              ◇ PSU voltage? ◇         ◇ powered by an ◇          • When using Mod. Cab. check fuses on MCCB
                      │                ◇ adaptor?     ◇          • Check Base Station wiring.
                     No                      │                   • Check Base Station.
                      ▼                     Yes
            ┌──────────────────┐             │
            │ Check Base Station│            ▼
            │ data lines        │         Adapter
            │ connections       │
            └──────────────────┘
                      │
                      ▼
              ◇ Cable correct? ◇ ──No──▶ Base Station
                      │                  Cable
                     Yes
                      ▼
            ┌──────────────────┐
            │  Check CLU/SLU   │
            │  wiring.         │
            └──────────────────┘
                      │
                      ▼
              ◇ Cable correct? ◇ ──No──▶ CLU/SLU Signal
                      │                  Cable
                     Yes
                      ▼
                • Base
                  Station
                • CLU/SLU
```

B

Fault 37?

No multiframe
synchronization
- Error in MS/PBX Digital
  Trunk Controller
- Excessive noise on
  trunk cabling

Yes →

No

Check air interface
sync provider

Fault 41

Out of order
or reset?

System is not synchronized
and when the air interface
sync provider is up and
running:
- Wait until
  synchronization is
  acheived (might take a
  while) or
- Force synchronization
  by system reset
  (ongoing calls are
  dropped)

Yes →

No

Check sync input
cable connection at
CPU and SDB.

Connection
correct?

No →
- Sync input cable
  connection
- SDB

Yes

CPU

1) A malfunctioning Base Station can be detected by:
   - testing the Base Station with the Portable Telephone in the Service Display Mode (see Paragraph 3.8) or
   - checking the load of the Base Station by System Manager-Statistics-Display-Station-Station Load or
   - checking the operation of the Base Stations by System Manager-Statistics-Settings-View on Line

2) When going off hook on the Portable Telephone, the hook symbol on the display does not become stable and the Portable Telephone automatically goes on hook.

COMMON USER COMPLAINT

All Portables out of range? — Yes → Green LED on all Boards on? — No →

Green LED on all Boards on? — Yes → CPU

All Portables out of range? — No →

Portables of one area out of range? — Yes → PSU of associated cabinet

Portables of one area out of range? — No →

Complaints come from same area? — Yes → Poor coverage of an area caused by lack of Base Stations, a malfunctioning Base Station or no air interface synchronization between adjacent systems

Complaints come from same area? — No →

Blocked calls? — Yes → Lack of resources in Base Stations or SPUs

Blocked calls? — No →

INDIVIDUAL USER COMPLAINT

Check fuses at power switch Check power source

Fuses and power source okay? — No → Replace fuse or repair power source

Fuses and power source okay? — Yes → Replace Backplane

6-6

```
                    ┌──────────────────┐
                    │ INDIVIDUAL USER  │
                    │    COMPLAINT     │
                    └──────────────────┘
                             │
                             ▼
```

                                                                                    • Portable Telephone not within
                                                                                      covered area.

         Display of   Out of   Is the correct   • Portable Telephone not
      Portable remains ──No──▶ range message ──Yes──▶ PUN selected? ──Yes──▶   initialized for the system.
       totally blank?   displayed?   • Portable Telephone defective.
                                                                                    • System out of order, see
            │   │   │   "Common User Complaint."
           Yes   No   No

            ▼   ▼
```
   ┌──────────────────┐      ┌──────────────┐      Open Select PUN menu under
   │  Replace battery │      │ NO DIAL TONE │      Gen. Set-Up and select "A"
   │ pack by a charged│      └──────────────┘      (automatic)
   │ one and switch on│
   │  Portable again. │
   └──────────────────┘
            │
            ▼
```

         Display of
      Portable returns ──Yes──▶ Replaced Battery Pack is flat or
          again?   defective.

            │
            No

            ▼
```
   ┌──────────────────┐
   │ Battery contacts?│
   │ Take out battery │
   │ and gently bend  │
   │ forward the      │
   │ battery contacts │
   │ from Portable.   │
   │ Insert battery   │
   │ again.           │
   └──────────────────┘
            │
            ▼
```

         Display of
      Portable returns ──Yes──▶ Portable Telephone had loose
          again?   battery contacts.

            │
            No

            ▼
         Portable
         Telephone
          defect

1) Other Portable Telephones do receive dial tone when locked to the same Base Station.

NO DIAL TONE

Press the "YES" key on the Portable.

Flashing or stable hook icon displayed?

No → Switch off the Portable and then on again. Press "YES" key. → Flashing or stable hook icon displayed now? → Yes → Portable okay now. Dial tone will be heard. → END

No

Portable Telephone defect

Yes

Flashing hook icon stable after a few seconds?

Turns off after some flashing. → No speech channels available in Base Stations, SPUs or SLUs: Try again later or on another location. If this doesn't solve the problem, the Portable Telephone is defective.

Check that associated extension number is registered in Mobility Server/PBX and not blocked. Otherwise Portable Telephone is defective.

INDIVIDUAL USER
COMPLAINTS

Portable display
remains blank —Yes→ Connect Basic Charger —Yes→ Display turns on? —No▶ Portable Telephone defect

No

Yes

Battery is low (Battery icon flashes).
Leave charger connected until battery
is charged (icon stable).

"NoSystem"
displayed —Yes→
- Portable Telephone not within coverge area
- Portable Telphone not initialized for the system
- Portable Telephone defective
- System out of order, see "Common User Complaint"

No

"No Access"
displayed —Yes→
- System does not recognize Portable Telphone
- Portable Telphone is set for large system range
- Portable Telephone defective
- System out of order, see "Common User Complaint"

No

"BatteryLow"
displayed —Yes▶ Connect charger to charge the battery

No

"PhoneBook
empty" displayed —Yes▶ No names stored in the fixed, nor in the personal phone book. "Call Name" menu is not active.

No

"MemoryFull"
displayed —No——▶ "Connect Battery"
displayed —Yes▶ Battery not properly fit or defect. Message appears only if a charger connected.

Yes

No

Personal phone book memory is full. A
name has to be deleted first before a
new one can be added.

".....Error"
displayed —No▶ NO DIAL TONE

Yes

ERRORS

1) For all faults correction actions are given. If after correction a fault re-appears, the Portable Telphone should be sent for repair.

```
        ┌─────────────┐
        │   ERRORS    │
        └─────────────┘
               │
               ▼
        ◇ System List Error ◇ ──Yes──▶  Initialization data missing or
               │                         corrupted. Re-initialize Portable
               No                        Telphone.
               ▼
        ◇ Buzzer Data Error ◇ ──Yes──▶  Ringing cadence data missing
               │                         or corrupted.  Re-initialize
               No                        Portable Telephone.
               ▼
        ◇ Fixed Phone book Error ◇ ──Yes──▶  Fixed phone book data missing or
               │                               corrupted.  If phone book was loaded, all
               No                              data is lost.  Re-download phone book.
               ▼
        ◇ User Data Error ◇ ──Yes──▶  User data corrupted.  All data (preferences) will be
               │                        replaced with defaults, speed dial numbers will be
               No                       cleared. This fault occurs only once; after cycling the
               ▼                        power the fault disappears, because defaults are set.
        ◇ Initialization Error ◇ ──Yes──▶  Error occured during initialization process.
               │                             Restart initialization.
               No
               ▼
        ┌─────────────┐
        │     END     │
        └─────────────┘
```

CSM PROBLEM

"No connection with DCT1900" message on PC display? — Yes → Check PC cabling: from COM1 via connection board to CPU → Cabling correct? — No → Correct cabling

Cabling correct? — Yes ↓

- Verify COM1 port of PC
- Verify CPU board
- Verify Serial PC cable

No ↓

"No connection with Portable Telphone" on PC display? — Yes → Check PC cabling: from COM2 to the Portable Telephone → Cabling correct? — No → Correct cabling and ensure Portable Telphone serial attachment is secure.

Cabling correct? — Yes ↓

Verify Portable Telephone in INIT mode

No ↓

Incorrect ring type displayed on Portable Telephone — Yes → Check cadence parameters under System Manager-Administrate-Portables-Ringing. These settings should match your PBX data.

No ↓

Verify CSM installation

Section 8

Glossary

Table of Contents

CHAPTER 1
Glossary

The following are abbreviations used in the entire Technical Product Manual:

ADPCM	Adaptive Differential Pulse Code Modulation
ANSI	Adavanced Nurse Call Intergration
AVE	Available
BC	Board Controller
CAS	Channel Associated Signalling
CCS	Common Channel Signalling
CLC	Cell Link Circuit
CLU	Central Link Unit
CPU	Central Processing Unit
CSMW	Cordless System Manager for Windows
DCA	Dynamic Channel Allocation
DCT	Digital Cordless Telephone
DLU	Digital Line Unit
DQPSK	Differential Quadrature Phase Shift Keying
DTC	Digital Trunk Circuit
DTMF	Dual Tone Multiple Frequency
DTU	Digital Trunk Unit
EAS	External Application System
EDI	Enhanced Digital Integration
EPP	Express Powering Pair
ESD	Electrostatic Discharge
FPGA	Field Programmable Gate Array
GA	General Alarm
GOS	Grade of Service
LTU	Line Termination Unit
MC	Multiple Carrier
MCCB	Modular Cabinet Connection Board
MDF	Main Distribution Frame
MFG	Malfunctioning
MLI	Multiple Line Appearance
MS	Mobility Server
NEW	New Circuit
OCD	Occupied
PBX	Private Branch Exchange
PND	Pending Activation
PNP	Possibly Not Present
PRI	Primary Rate Interface
PSA	PWT Standard Authentication Algorithm
PSTN	Public Switch Telephone Network
PUN	Personal User Number
PWT	Personal Wireless Telecommunication
RAM	Random Access Memory
RE	Radio Exchange
RO	Read Only Memory
RQI	Received Quality Indication
RRC	Root Raise Cosine

RSSI	Received Signal Strength Indication
RTC	Real Time Clock
SDB	Synchronization Distribution Board
SLU	Speech Link Unit
SPU	Speech Processing Unit
TDD	Time Division Duplexing
TDMA	Time Division Multiple Access
TDR	Time Domain Reflectometer
T&M	Test & Maintenance
TME	Test Mode
TMT	Test Mode AwaiTing

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