

# Cordless Phone

INSTALLATION INSTRUCTION



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# 1

## GENERAL

### 1.1

#### SCOPE

This installation instruction describes the installation and cabling of the INTEGRATED DECT function, which comprises DECT Extension Line Unit (ELU31 board), cabling, base stations and how the system shall be synchronized.

For information about old versions of product please refer to older version of this document. This document will only handle what is delivered in this release.

In this document ELU31/3 refers to ROF 137 5412/3 and ELU31/4 refers to ROF 137 5412/4. If not mentioned specifically ELU31 refers to ELU31/3 and ELU31/4, all boards are assumed to have latest FW, co operability is only guarantied between index /3 and /4 of latest FW.

INTEGRATED DECT functionality in the MX-ONE requires a number of software units (CTLP and CTLMP), specific hardware (ELU31 board), external base stations, and portable parts (PP).

The PPs communicate with a base station via radio channels. The channels are connected from the base station to the ELU31 board through a cable. The ELU31 board has an integrated switch that can set up switch paths between the PBX (via the backplane) and the radio channels in the base station.

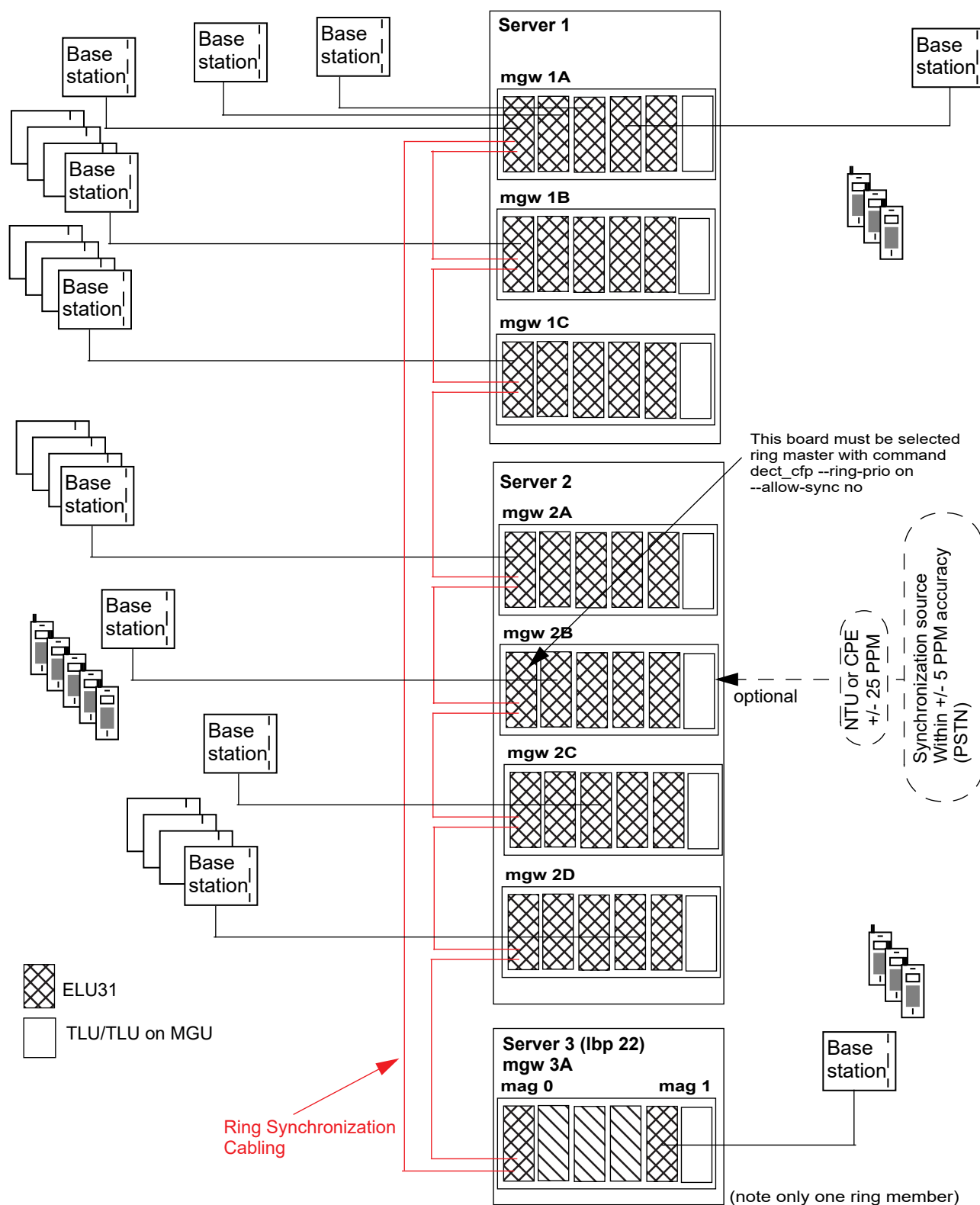
In order to secure INTEGRATED DECT functionality, the MX-ONE gateways must be synchronized to one reference timing source. For more information see chapter 3.4 Synchronization on page 8.

Synchronization ring has one obligation, that all base stations transmit the air data frames simultaneously. This is accomplished by sending data on the ring, delay compensated for the delay caused by distance, to all boards. This data together with PCM timing from the back plane is used to secure the air frame synchronization.

Synchronization ring has a possibility to distribute PCM timing between the different media gateways containing ELU31 boards. Synchronization ring master board distributes the PCM timing through the ring. Each ring member can be set as gateway synchronization source.

Accuracy on the delay values are critical. ACDM shall be used, to automatic calculate the delay values on the synchronization ring.

The customer installation will be covered by a number of base stations. Each base station is surrounded by other base stations, together forming the coverage area. The PPs are free to roam throughout this area, even during a call. The call will be switched from one base station to another unnoticeable, see chapter 1.3 Limitations on page 6. The users can roam their PPs and make and receive calls anywhere in the radio coverage area unless the PPs are turned off.



**Figure 1: A multi-server INTEGRATED DECT system. Mgw 2B receives external PCM synchronization from PSTN, PCM synchronization is distributed by ELU31 in synchronization ring to all mgws. Ring board in mgw 2B must be ring master board. Set by command `dect_cfp`**

Network Terminating Unit (NTU).

Customer Premises Equipment (CPE).

## 1.2 SAFETY AND REGULATORY INFORMATION FOR USA AND CANADA

### 1.2.1 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).

### 1.2.2 IC

The term "IC:" before the radio certification number only signifies that industry of Canada technical specification were met.

### 1.2.3 EXPOSURE TO RADIO FREQUENCY SIGNALS (SAR)

The wireless DECT phone and the DECT base station are radio transmitters and receivers. They are 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 Absorption Rate, or SAR. The SAR limit set by the FCC and Canada is 1.6 W/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 level. 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 the government-adopted requirements for safe exposure. The tests are performed in positions and locations (for example, at the ear and worn on the body) as required by the FCC for each model.

The SAR value for each model of DECT phone can be received from Mitel. 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 Mitel approved accessories. When carrying the phone while it is on, use only the specific belt clip that has been tested for compliance. Use of non-Mitel-approved accessories may violate the FCC RF exposure guidelines and should be avoided.

The FCC has granted an equipment authorization for the Mitel 5613 and Mitel 5614 with all reported SAR levels evaluated as in compliance with the FCC RF emission guidelines.

RF Exposure: The internal/external antennas used for base station must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is tested and shown to comply with SAR (Specific Absorption Rate) exposure limits specified in FCC 47 CFR § 2.1093 (d), IEEE Std. 1528 and RSS-102, Issue 4.

## 1.3

### LIMITATIONS

See installation planning 5/1531-ANF 901 14.

## 2 TOOLS & DOCUMENTS

### 2.1 TOOLS

- Site Survey Tool, LTT 999 05

### 2.2 DOCUMENTS

The following documents are useful at initiation of cordless extensions and installation of the DECT system.

- See document for *INTEGRATED DECT*
- See document for *GENERIC EXTENSION*
- Configuration Manual /User Guide for *DT413, DT423 and DT433*
- Configuration Manual /User Guide for *Mitel 5613 and 5614*
- Configuration Manual /User Guide for *DT390*
- Configuration Manual /User Guide for *DT690/DT692*
- Installation instructions for *INSTALLING MIVOICE MX-ONE*
- Command descriptions in *TECHNICAL REFERENCE GUIDE, UNIX COMMANDS, section Board Configuration*
- Installation Guide Base Station (See 32/1531-901 43)

## 3 PREPARATIONS

### 3.1 UPGRADING OF ELU31 BOARDS

Firmware (application FW and the Boot FW) for the ELU31 boards can be downloaded. See the command descriptions for *BOARD CONFIGURATION* in *TECHNICAL REFERENCE GUIDE, UNIX COMMANDS*.

**Note:** When changing from 16 individual board to 32 individual board it can be possible to increase the number of base stations, see Cordless Phone Installation Planning. If number of base station is changed, a site survey must be performed to verify correct operation in affected areas.

### 3.2 UPGRADING OF EXISTING BASE STATIONS

#### 3.2.1 BS3X0 AND BS3X2

The software for the base stations can be ordered from the supplier of MX-ONE system. It is to be stored on an MX-ONE Service Node, and loaded to the base stations.

The base stations are upgraded by using the *board\_sw* command, see the command descriptions for *BOARD CONFIGURATION* in *TECHNICAL REFERENCE GUIDE, UNIX COMMANDS*. The ELU31 have a function which checks for the correct firmware during the start of downloading it to the base station. Since there are a number of different types of RFPs that can be attached to the ELU31, at the board start phase the boards ask for the product number and compare it with the product number received in the software file. If they do not match no software is downloaded to the RFP.

### 3.3 GENERAL PREPARATIONS

Installation planning shall be completed (see the installation planning for *CORDLESS PHONE*), but pay special attention to the considerations described below:

- Do a coverage calculation for the DECT RFPs for specific areas within the building.
- Make sure that the power equipment in the Media Gateway is able to feed the number of base stations in the configuration.

### 3.4 SYNCHRONIZATION

#### 3.4.1 MIVOICE MX-ONE SYNCHRONIZATION

When an MX-ONE Classic gateway (with MGU) is connected to PSTN network interface, normally a primary rate interface (2048 kbit/s for E1 or 1544 kbit/s for T1), the PSTN network is an external timing source. This external timing source must be equal to or better than timing accuracy and stability required for Stratum 3 timing (note 1).



This system clock synchronization is more crucial when Integrated DECT is deployed in the MX-ONE system and more careful synchronization and timing planning must be considered.

Additional CPE network termination units placed between MX-ONE and the network interface such as multiplexor, repeaters or converters, must preserve a traceable timing to the reference source even in presence of wander/jitter in incoming bit rate as per ITU-T recommendation or equivalent ETSI specifications (note 2).

Any equipment that degenerate the timing characteristics shall only be used with certain restriction. Refer to Reference specification (note 39 for timing accuracy requirement and chapter 3.4.2 Synchronization configuration for DECT. on page 9.

**Note:** 1) Characteristics of stratum 3 timing reference

Accuracy, Adjustment Range  $4.6 \times 10^{-6}$

Pull-In-Range Must be capable of synchronizing to clock with accuracy of  $\pm 4.6 \times 10^{-6}$

Stability  $3.7 \times 10^{-7}/\text{day}$

**Note:** 2) Characteristics of network interfaces, bit rate and timing are specified in:

- ITU-T Recommendation G.823 (or equivalent ETSI EN 302 084) "The control of jitter and wander within digital networks which are based on the 2,048 kbit/s hierarchy".
- ITU-T Recommendation G.824(or equivalent ETSI EN 302 084) "The control of jitter and wander within digital networks which are based on the 1,544 kbit/s hierarchy".

**Note:** ETSI EN 300 175 -2 V2.3.1 (2010-06) Digital Enhanced Cordless Telecommunications (DECT) Common Interface (CI): Part 2: Physical Layer (PHL)

A free running MGU index 2 can provide synchronization to master ELU31/4 board, with ELU31/4 index 4 mode can then all mgw receive PCM synchronization. This must be used while using only SIP trunks.

Using free running MGU and having E1/T1 connected slip can occur to the other station. To avoid slip alarm notification send buffer can be activated on the MGU board see description MGU, Media Gateway Unit 1/1551-ANF90136 for more information.

### 3.4.2

### SYNCHRONIZATION CONFIGURATION FOR DECT.

In MX-ONE, all media gateways must provide system clock to all ELU31 boards with an accuracy and stability better then  $\pm 5$  PPM see Note: 1) Characteristics of stratum 3 timing reference on page 9. In addition, a synchronization ring is required for all ELU31 boards (inter-ELU31 cable ring) for proper DECT synchronization. The network timing source must be carefully planned so that all media gateways containing ELU31 are synchronized, to the same PSTN timing source or by help of other synchronization mechanism.

As described in 3.4.1, MX-ONE media gateway achieves this by regenerating system clock from an external PSTN timing source (normally primary rate interface, 2048 kbit/s for E1 or 1544 kbit/s for T1). As the network timing source is assumed to be a stratum 3 or higher network node, the timing accuracy and stability is better than  $\pm 25$  ppm.

It is critical that all media gateways are synchronized and the synchronization ring between ELU31 boards is intact for proper DECT operation. Any disturbances in the clock synchronization, loss of reference timing or impaired synchronization ring may cause major problems.

It should also be mentioned that certain disturbances can occur even under a normal operation between PSTN and MX-ONE media gateway. For instance in the presence of wander/jitter in incoming bit rate. During this situation, it is unavoidable that temporary performance degradation (e.g. internal hand over problem) can occur.

#### **Ways to distribute synchronization to media gateways**

- PCM timing can be distributed to all media gateways with the DECT synchronization ring. See chapter 3.4.3 Introduction to the synchronization ring on page 12. System need at least one external PSTN timing source or a MGU index 2 in the same media gateway as master ELU31.
- External PSTN PCM timing source to all media gateway with DECT boards.

#### **3.4.2.1**

#### *Media gateway with MGU, DECT synchronization ring PCM timing distribution*

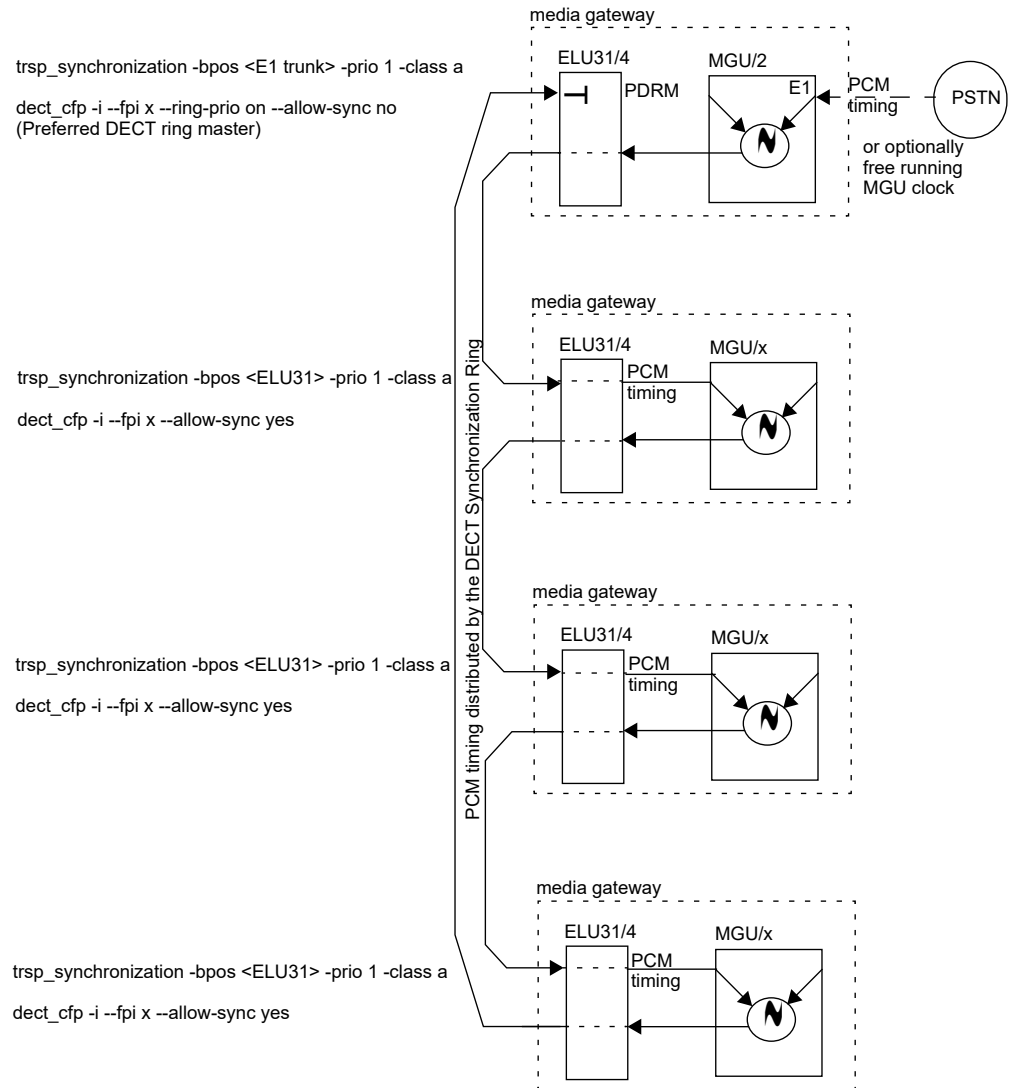
All ring members has the switch on each board set to "index 4 mode". Also must all ring members, except ring master, be programed to be synchronization provider, set by `dect_cfp` command.

Each media gateway can now select the ring member as PCM synchronization source. The PCM synchronization source is selected depending on data set by command `trsp_synchronization` and the status of that source. All ring members, that is except ring master, shall have the same class and priority.

ELU31/4 provides the possibility to distribute basic system timing (PCM-sync) to all media gateways, via the DECT Sync Ring, without the need for TDM trunks or Group Switch links.

When this PCM sync distribution is chosen the following 3 steps must be followed carefully to guarantee a stable DECT functionality:

1. A Preferred DECT Ring Master ELU31, PDRM, shall be appointed initially.  
The PDRM shall be located in a MGU magazine that either receives its PCM timing from:
  - a PSTN network (via E1/T1 interface) with traceable timing (note 1) or
  - a MGU/2 board (which have a free running oscillator with appropriate timing).
 This way the PDRM will be the source of the PCM timing for all Media Gateways having ELU31 Ring Members.  
The PDRM will become Ring Master as long as the DECT Ring is "intact".
2. The PDRM must never provide PCM timing towards its own MGU backplane.  
This is important to prevent a "sync loop scenario" which could cause the MGU oscillators to be unstable, resulting in serious impairment of the DECT functionality.  
Therefore: Make sure that the PDRM is not initiated with the `trsp_synchronization` command!
3. All Ring Members shall be initiated to provide PCM timing to the MGU backplanes. see example below:



**Figure 2: Media gateway with MGU, DECT synchronization ring PCM timing distribution.**

### 3.4.2.2

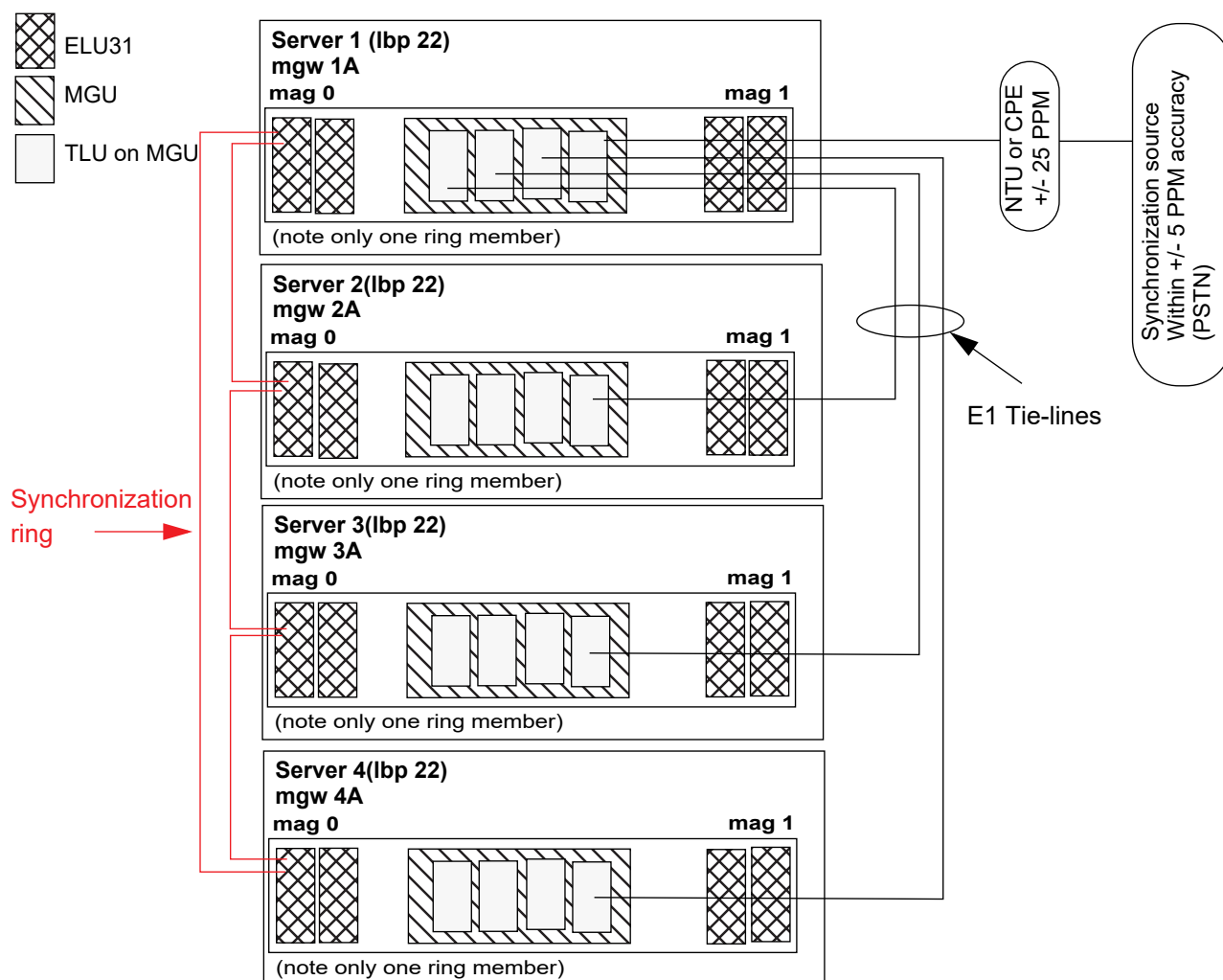
#### *Media gateway with MGU, Tie-line PCM distribution.*

Another way to synchronize all media gateways that contain ELU31 boards are to connect all media gateways with E1 tie line trunks. In the figure below. Mgw A in server 1 is connected to the reference timing (via CPE/NTU if used) and receiving the network timing. Other mgws are synchronized to mgw A in server 1 via E1 Tie-line links.

Even if ELU31 is not used as PCM timing distribution in this scenario the dip switch may be set in 'index\_4\_mode' to enable the clock diagnostics reporting.

If redundant synchronization mechanism is required, a second PRI link is connected to a second PRI and designated as secondary synchronization source in the same gateway as the first PRI link

When CPE equipment is placed between the network interface and the MX-ONE system, the clocks provided by the CPE equipment must be traceable to the network timing source.



**Figure 3: Synchronization with MGU.**

### 3.4.3

## INTRODUCTION TO THE SYNCHRONIZATION RING

In a INTEGRATED DECT system where hand over between different fixed parts (ELU31 boards) is required, the boards **must** be synchronized.

Synchronization between all ELU31 boards in the system is handled via a synchronization ring structure. The ring consists of several logical interfaces.

Due to timing requirements it is important that all wire pairs follow the same path. Can not be divided to different cables.

Only one ELU31 board (RING MEMBER) in each magazine can be connected directly to the ring, the other ELU31 boards (BUS SLAVES) in the magazine receive synchronization through a bus connection. The bus synchronization in an LBP22 magazine will work over the backplane.

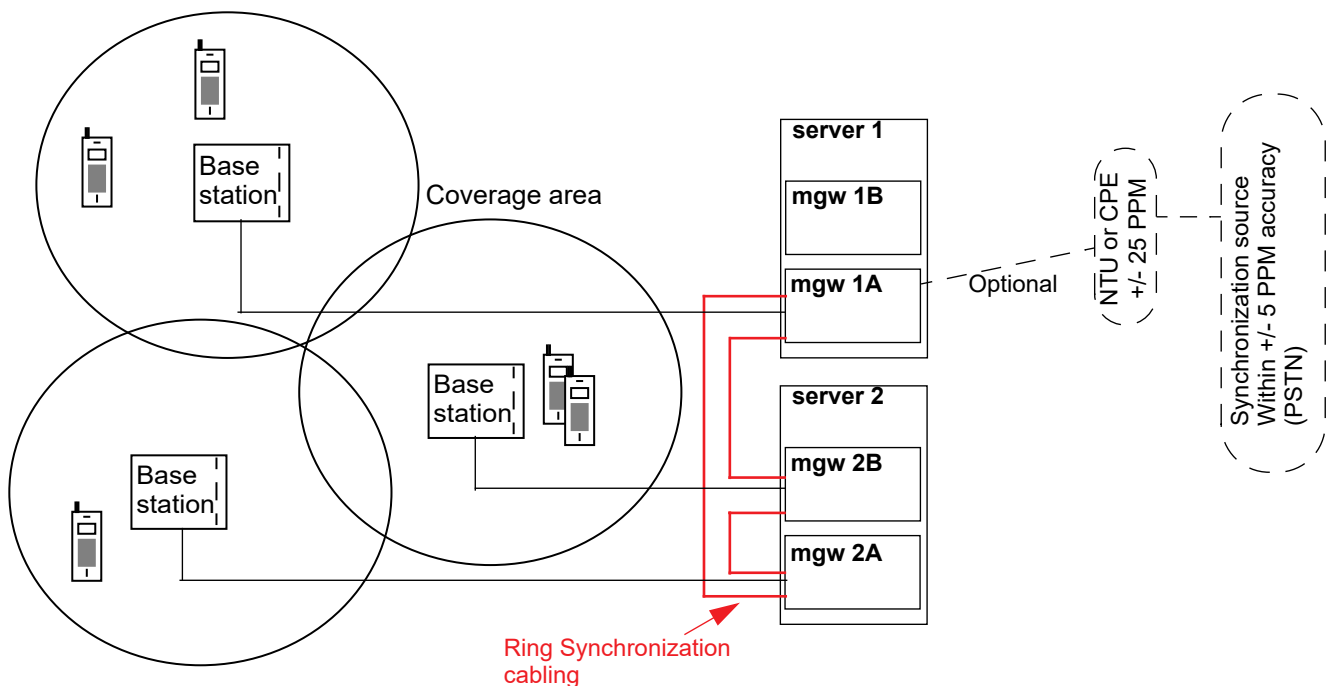
One of the RING BOARDS (default is the one with the lowest board position number, the lowest magazine number, and the lowest Server number selected) will be the selected to be RING MASTER, RING MASTER can be assigned by command `dect_cfp`. Called Preferred RING MASTER. RING MASTER transmitting the synchronization signals regularly.

If all ELU31 boards are in one magazine or if it is a one board system, a ring cable must be connected on the board at the lowest position. This is to give the boards their synchronization roles and to make sure that this board will act as a master. A system with unknown synchronization roles will not start connect base stations.

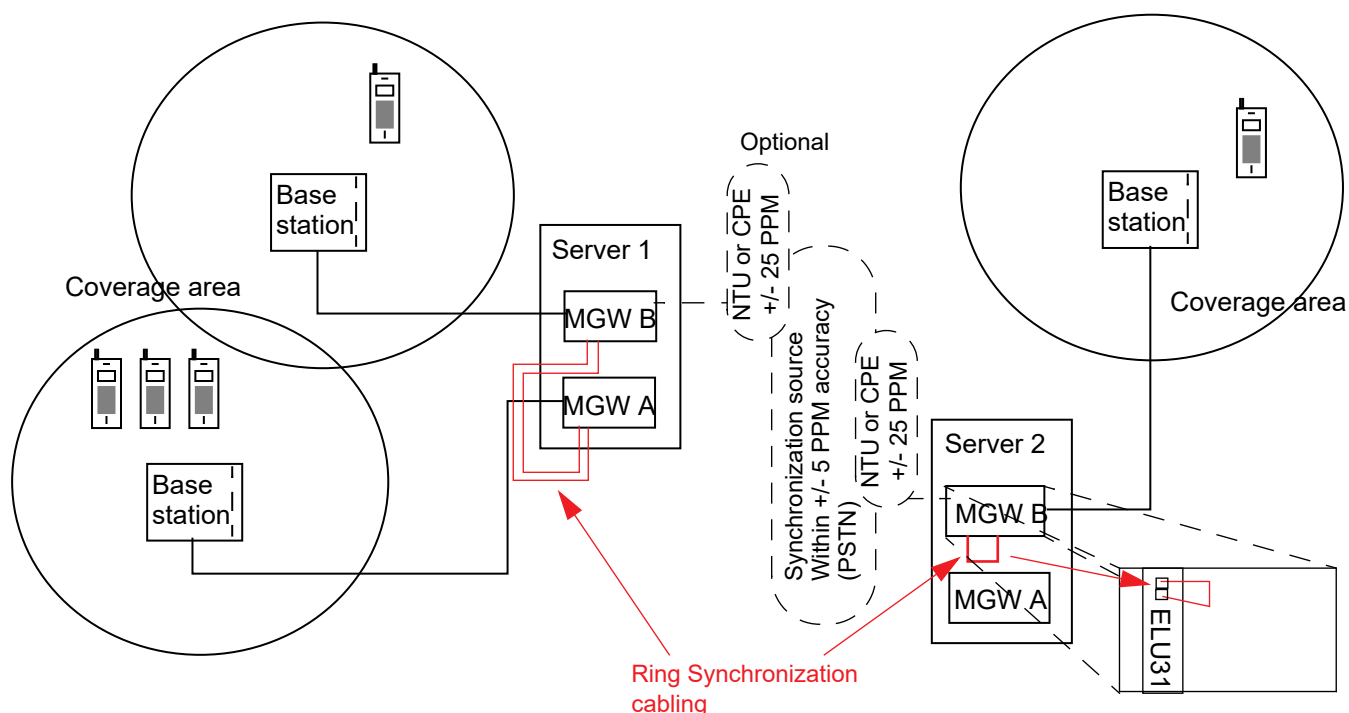
A remote gateway can be its own RING MASTER and have a separate synchronization ring (connect TX to RX). It shall have PCM synchronization source, free running MGU or tie line. Roaming will function but not hand over between separate synchronization rings.

If moving between separate synchronization rings, the PP will lose the connection to the Media Gateway, drop the call, and start a new search, eventually establish contact with the new Media Gateway. It is advisable to power off the PP and then power it on again, when entering a new location area with different synchronization domain, to avoid 'No System' on the display.

Ring member or bus slave board can be removed, inserted, or replaced without affecting the other boards connected to the synchronization ring with one exception. A reset of the master in a one magazine system will cause restarts of all base stations in the system, since the base stations must be restarted with new frame counter value, and that is only sent on the ring structure.



**Figure 4:** A synchronization ring is needed between the first board in all media gateways (the rest of the boards in mgw get sync from backplane) to achieve external hand over between those base stations which are connected to different boards.



**Figure 5: A synchronization ring is not needed between the boards when there is no radio coverage between them.**

**Note:** When moving between these two areas, the PP will lose connection and drop any ongoing calls. Power off and power on is recommended to minimize downtime.

There are two ways to install the synchronization cabling, see figure 6 Example of a star configuration on page 15 and figure 7 Example of a ring configuration on page 15. The ring configuration is only recommended when the distance in the star configuration will exceed the maximum distance between the ELU31 boards (1300 meters, see table 1 Maximum synchronization ring cable length between two ELU31 boards on page 18). The star configuration is preferred, though, as it gives more flexibility and is easier to maintain.

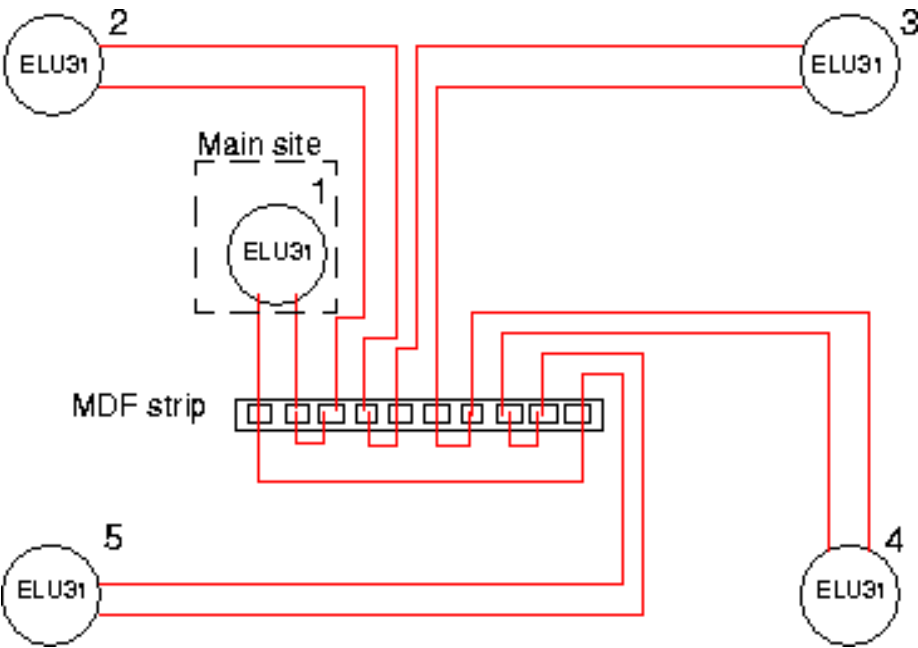


Figure 6: Example of a star configuration

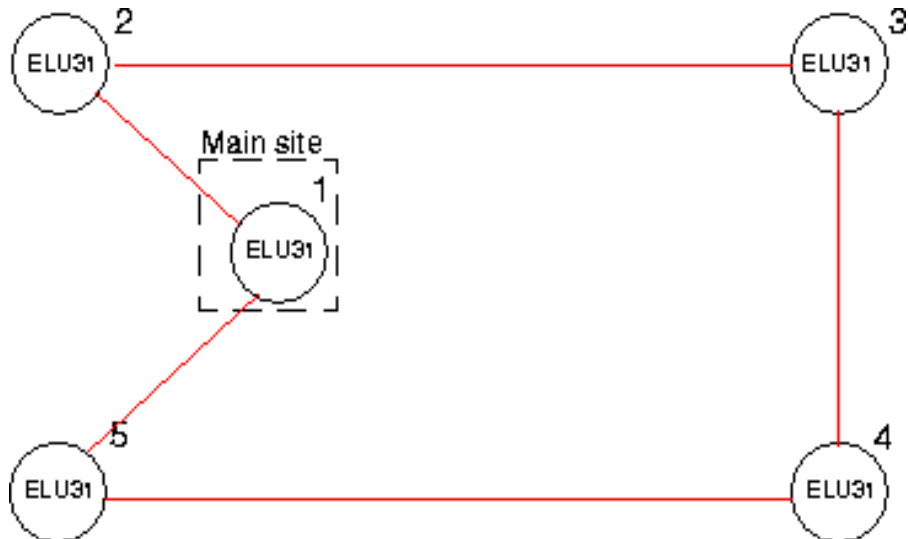


Figure 7: Example of a ring configuration

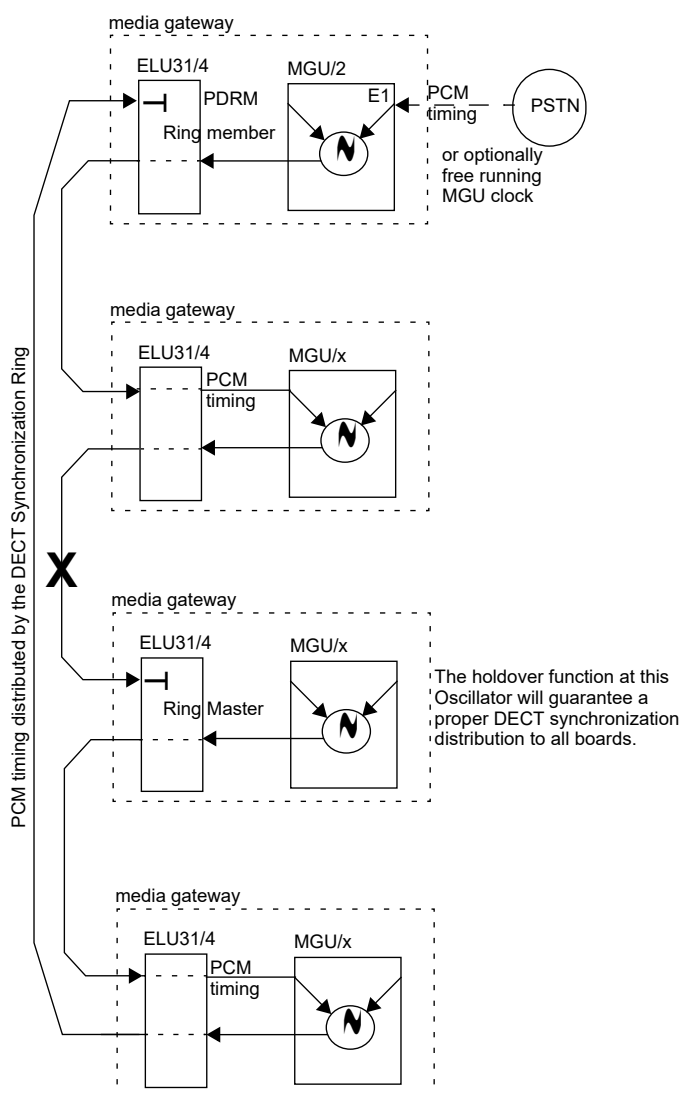
## 3.4.3.1

*Fault scenarios.***Broken ring:**

If the ring is broken (either by an unplugged ring cable or a restarted ring board) a new Ring Master will automatically be appointed (by the ring negotiation).

This new Ring Master will stop providing PCM clock to its MGU. In stead the Holdover function of this MGU oscillator will guarantee a continuous and stable PCM timing that can be distributed to all media gateways having Ring boards.

Therefore the new Ring Master will continue to create the DECT Sync signal without interruption. This DECT Sync will be distributed to all other Ring boards as long as the fault situation remains.

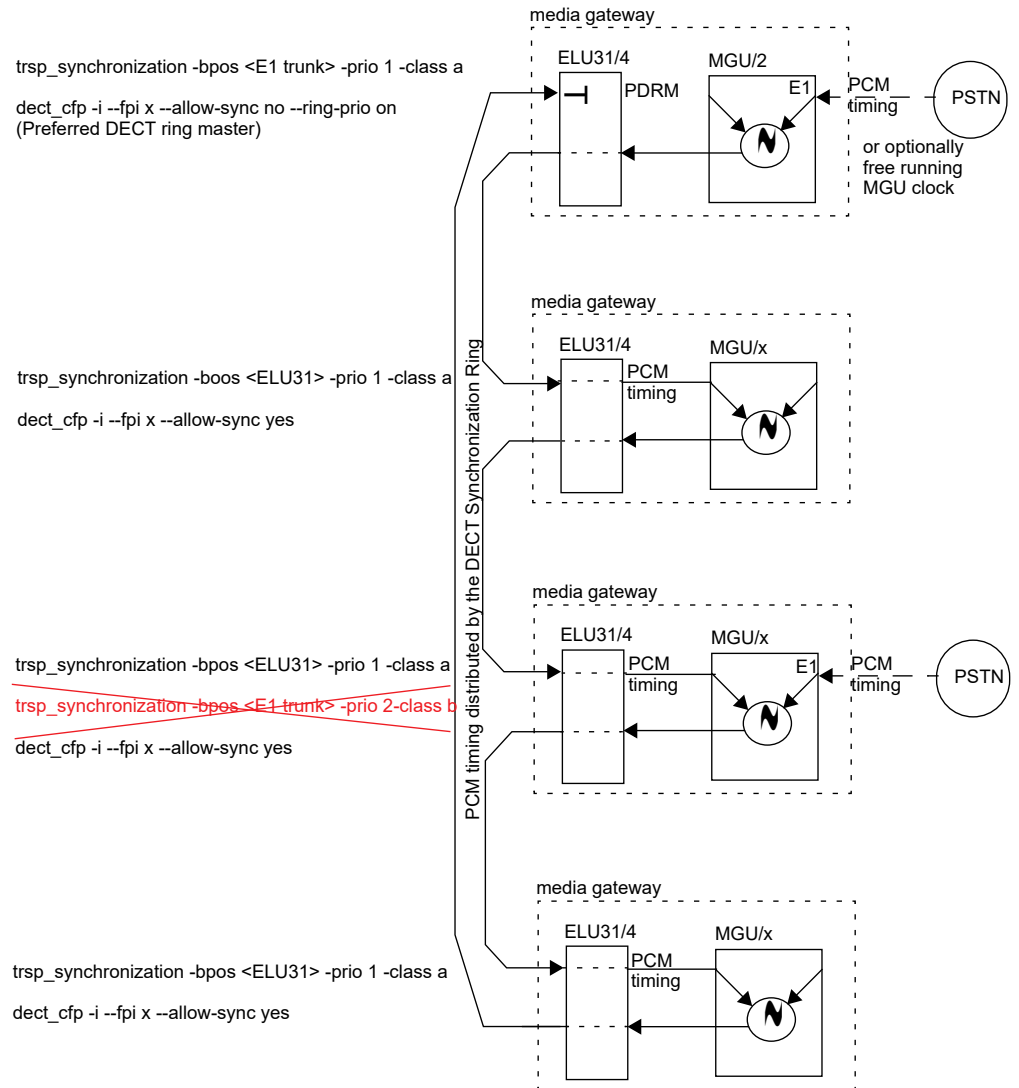


**Figure 8: Single break in the synchronization ring.**

**Faulty configuration:**

E1/T1 in other media gateway than where Preferred DECT Ring Master is located. It is very important that they are not used as possible synchronization source.





**Figure 9: Faulty synchronization configuration.**

### 3.4.4

## MEASUREMENT OF RING TRANSMISSION DELAY

#### 3.4.4.1

### *ACDM measurements for cable delay*

Automatic cable delay measurement (ACDM) shall be used. It is recommended that all ring members and ring master are ELU31/4 in 'index\_4\_mode'.

Since the ACDM function only compensates for the delay caused due to the SYNC Cables connected between the two boards in the ring, the user can provide an additional delay manually in the ELU31 by using the COMP parameter, if needed. This delay is in addition to the delay calculated by the ACDM.

The RING MEMBERS may be given a delay value (see the command dect\_cfp) to compensate for the delay caused by the cable to this board.

#### **Delay compensation for ACDM error**

The resolution of ACDM will cause an "error" in the delay value. The error is always positive and is adding up for every ring member.

This can be controlled by command `diagnostic_print -unit CTLP -lim 'ring master lim' -request 'accumulated dect sync difference on master'`

The total ring delay due to the number of boards in the ring can be compensated manually. Thus the user can provide the additional delay value for the ring using the COMP parameter and make the ring stable.

If the accumulated dect synchronization difference on master does not exceed 2000 ns can following step be ignored. An ELU31 board causes a delay itself, which also must be compensated. This means that after 4 boards, in the ring, must additional delay value be added. The additional delay entered using the COMP parameter is used for compensating for this delay.

ACDM does this measurement automatically to validate the result can two methods be used. The typical delay across a 1 km copper cable is 5.35 micro seconds (approx 40 steps), this value will change with different cable types, 500 m copper cable is approx 23 steps, the other method is to manually measure the delay.

### 3.4.5

## MAXIMUM LENGTH OF THE SYNCHRONIZATION RING CABLE

The cable used for the synchronization ring must be a twisted pair cable. It should also follow the general cable data mentioned earlier in this document, see chapter 7.2 Cable requirements on page 46. The table below lists the maximum cable length of any individual segment:

**Table 1 Maximum synchronization ring cable length between two ELU31 boards**

Wire diameter (mm)	Maximum cable length per individual segment (meters)
0.4	600
0.5	890
0.6	1300

There is no theoretical limit to the number of ring segments per system. However it is recommended that if the total cable length for one sync ring is more than 3 km or if the sum of cable delays for one sync ring is more than 20 microseconds a careful verification of the sync stability is strongly recommended using the `diagnostic_print` commands for CTLP.

### 3.4.6

## PHYSICAL MEDIA

The media used it is essential that the behavior is equal to a copper medium. The following parameters and general cable data, see chapter 7.2 Cable requirements on page 46, must be fulfilled by the media in order to provide the necessary quality of the PCM clock synchronization distribution.

- Delay over media must be less than 25 micro seconds including cabling from or to the ELU31 board.
- Jitter and wander must be less than +/- 50 ns.
- It must be possible to measure the delay across the distance covered by the media.

## 4 UNPACKING

### 4.1 ELU31 BOARD

#### 4.1.1 MEASURES

- Ensure that the correct product has been delivered.
- Remove the anti-static plastic wrapping.
- Check that the board has not been damaged during transport. If the board has been damaged and must be replaced or repaired in the service shop, report this immediately.

### 4.2 BASE STATION

- Ensure that the product has correct product number and R-state.
- Check that the base station has not been damaged during transport. If the base station has been damaged report this immediately.

### 4.3 NON-STANDARD ANTENNAS

- Ensure that the product has correct product number and R-state.
- Check that the antenna(s) has not been damaged during transport. If the antenna(s) has been damaged report this immediately.

### 4.4 PORTABLE PART

- Ensure that the product has the correct product number and R-state.
- Check that the PP has not been damaged during transport. If the PP has been damaged report this immediately.

### 4.5 SARI NUMBER

- Ensure that an envelope containing the SARI number (product number LZT 102 3114) has been received. See also the operational directions for *CORDLESS EXTENSION*.
- Received SARI value has to be used in the system.

## 5

# MOUNTING & INSTALLATION

For the following mounting descriptions the figures in this section should be used as a reference.

Regarding slicing and bundle of the pairs in the cable between the ELU31 board and MDF/MDM, see document *Installing MiVoice MX-ONE, installation instruction*.

At the initial time when the system is installed and the ring is connected for the very first time it is a requirement that the ring cabling is complete. This is the first time the ring boards assume their roles and if the ring is not complete the roles cannot be decided. Until the synchronization ring is complete no base stations will start.

**Note:** Too big or too fast alterations in the system may lead to that the synchronization ring gets disrupted. When this happens, the whole system will restart.

When the system is up and running and a Media Gateway is powered down and up or a ELU31 board is replaced or added, only base stations connected to these units will be affected.

### 5.1

## ELU31 BOARD

For information see section 9.2.1 ELU31 board on page 51.

### 5.2

## BASE STATIONS

#### 5.2.1

### COMMON LIMITATION FOR BS3X0 AND BS3X2

Limitation of number of base station per ELU31 board due to power consumption see chapter 6.2 Dimensioning on page 42.

Another limitation for the number of base stations that can be connected to one ELU31 board is the traffic intensity. One base station can handle 8 simultaneous calls and one 16 slot board can handle 16 simultaneous calls and one 32 slot board can handle 32 simultaneous calls. This limitation for the number of base stations per ELU31 board is depending on the number of users in the area, traffic per user, and grade of service.

### 5.3

## CABLES BETWEEN ELU31 BOARD AND BASE STATIONS

Cables are referred to as pairs in this section. One pair is a twisted cable pair with data as described earlier, see chapter 7.2 Cable requirements on page 46.

The base stations are connected to the ELU31 board via MDF or MDM. Two or three pairs are needed where two pairs (SC0, SC1) are for signaling and power and the third pair (EPP) for express power (to be used when needed).

The two communication pairs SC0 and SC1 to the base station must not be interchanged. The base station will not work although the power ON light is on. The EPP pair needs only to be used when the base station is located at a long distance from the ELU31 board. Interchanging SC0, SC1 and EPP will not destroy the base station or the ELU31 board.

The maximum line length to the base stations depends on wire size and power consumption in the base station. See chapter 6 Powering on page 42 for details on cable length and power consumption.

A list of the different standard cables used for connection of the ELU31 board to, MDM and MDF is provided in the chapter 7 Cabling on page 45.

The cable used to connect the base station to the MDF or MDM is described earlier, see chapter 7.2 Cable requirements on page 46.

To see the cable connections for base station see chapter "Pinning" in "Installation Guide Base Station".

## 5.4

## BASE STATION CABLE LENGTH

Care should be taken not to exceed the allowed length of the base station cable. For details see table 2 Maximum cable length, when powering via data pairs and express powering pairs. For BS3x0 and BS3x2 latest version. on page 21

In case of installation in places where already installed cables are reused make sure that the quality of the present network comply with the requirements, see chapter 6.2 Dimensioning on page 42.

It is also possible to measure the voltage at the base station. This should be done when 8 calls are active at the same base station. The voltage should comply with the requirements, see chapter 9.3.1 Base stations on page 54.

**Table 2 Maximum cable length, when powering via data pairs and express powering pairs. For BS3x0 and BS3x2 latest version.**

Cable diameter (mm)	Base station with	
	0 EPP	1 EPP
0.4	1 600	1 700
0.5	1 700	1 700
0.6	1 700	1 700

**Table 3 Maximum cable length, when powering via data pairs and express powering pairs. For BS330 and BS340 prior R4H.**

Cable diameter (mm)	Base station with		
	0 EPP	1 EPP	2 EPP
0.4	645	965	1 290
0.5	965	1 450	1 600
0.6	1 585	1 700	1 700

All figures are in meters, and based at 42 V DC

The individual signaling twisted cable pairs and the EPP pair follow an earlier recommendation, see table 9 Twisted pair cable data on page 46

5.5 FRONT CONNECTOR ELU31, TWISTED PAIR CABLE

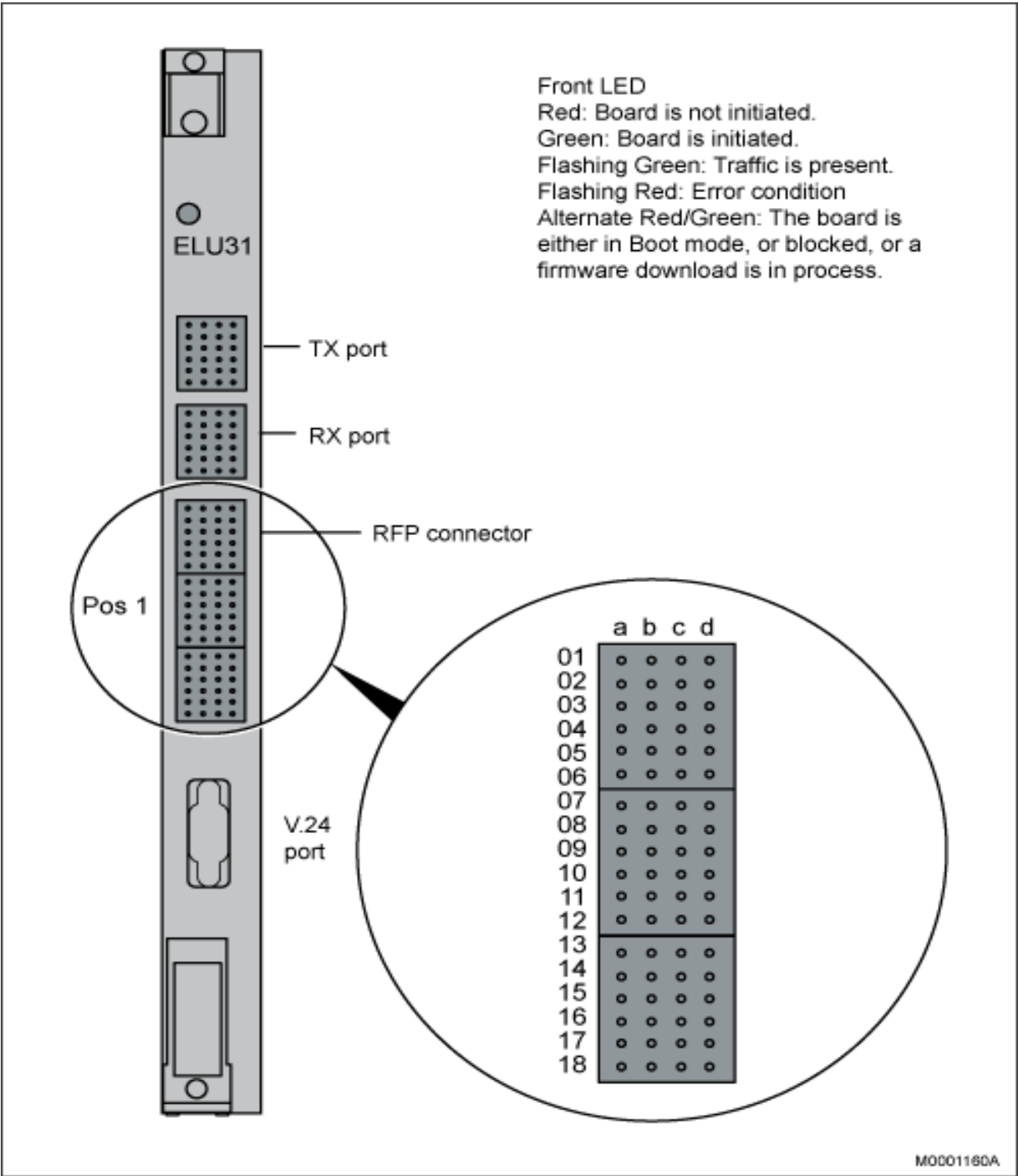
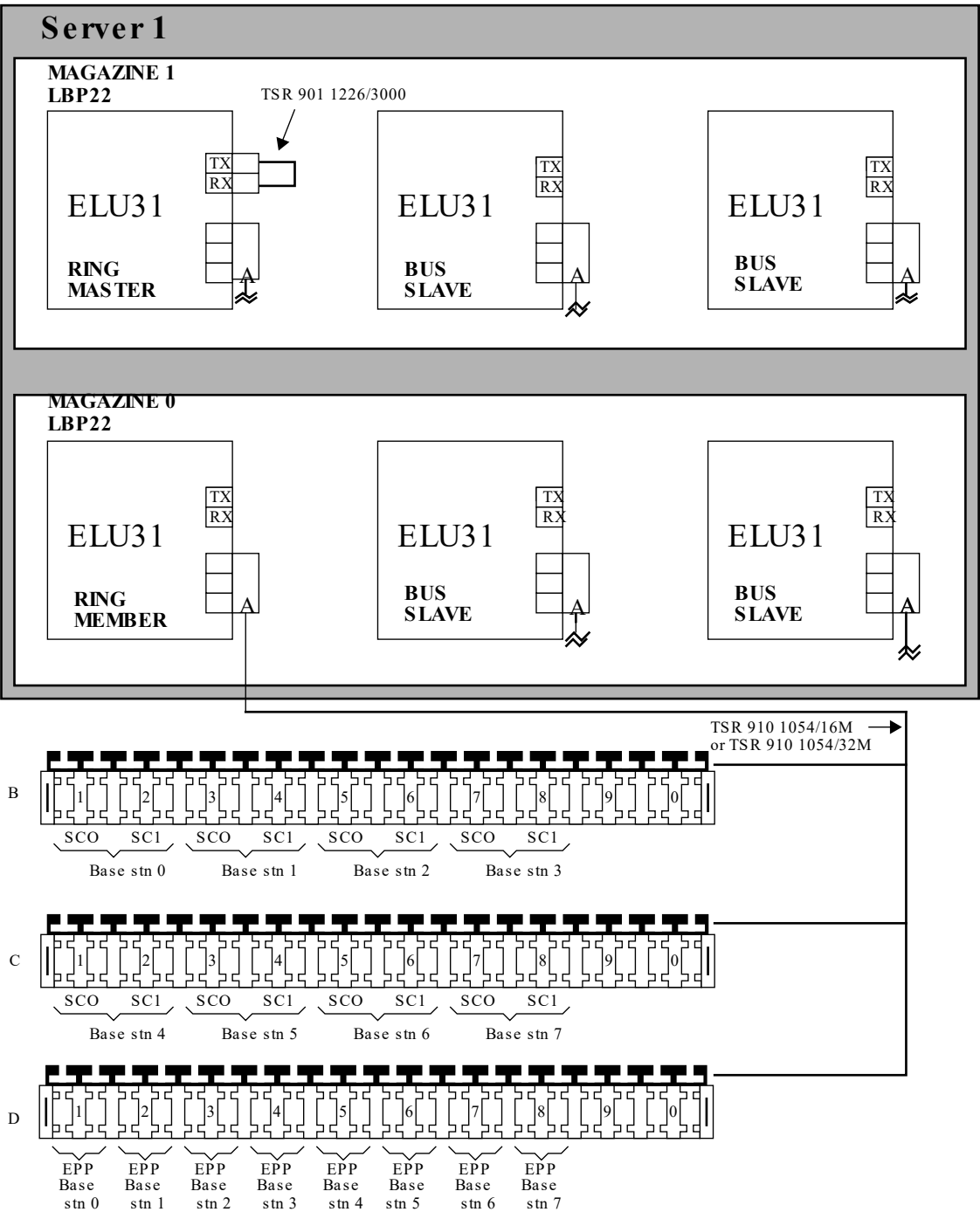


Figure 10: ELU31 board front connections

For information about ELU31 front connectors and cabling see Installing MX\_ONE 6/1531-ASP 11301.

5.6 ONE SERVER SYSTEM WITH THE SYNCHRONIZATION CABLE IN FRONT, WITH MDF(ELU31)



**Figure 11: One Server system with the synchronization cable in front and Main Distribution Frame (MDF) 19/ASB 501 04**

The LBP22 backplane consists of both magazine 0 and 1 so only one ring master is needed.

5.7

TWO SERVER SYSTEM WITH THE SYNCHRONIZATION CABLE IN FRONT, WITH MDF(ELU31)

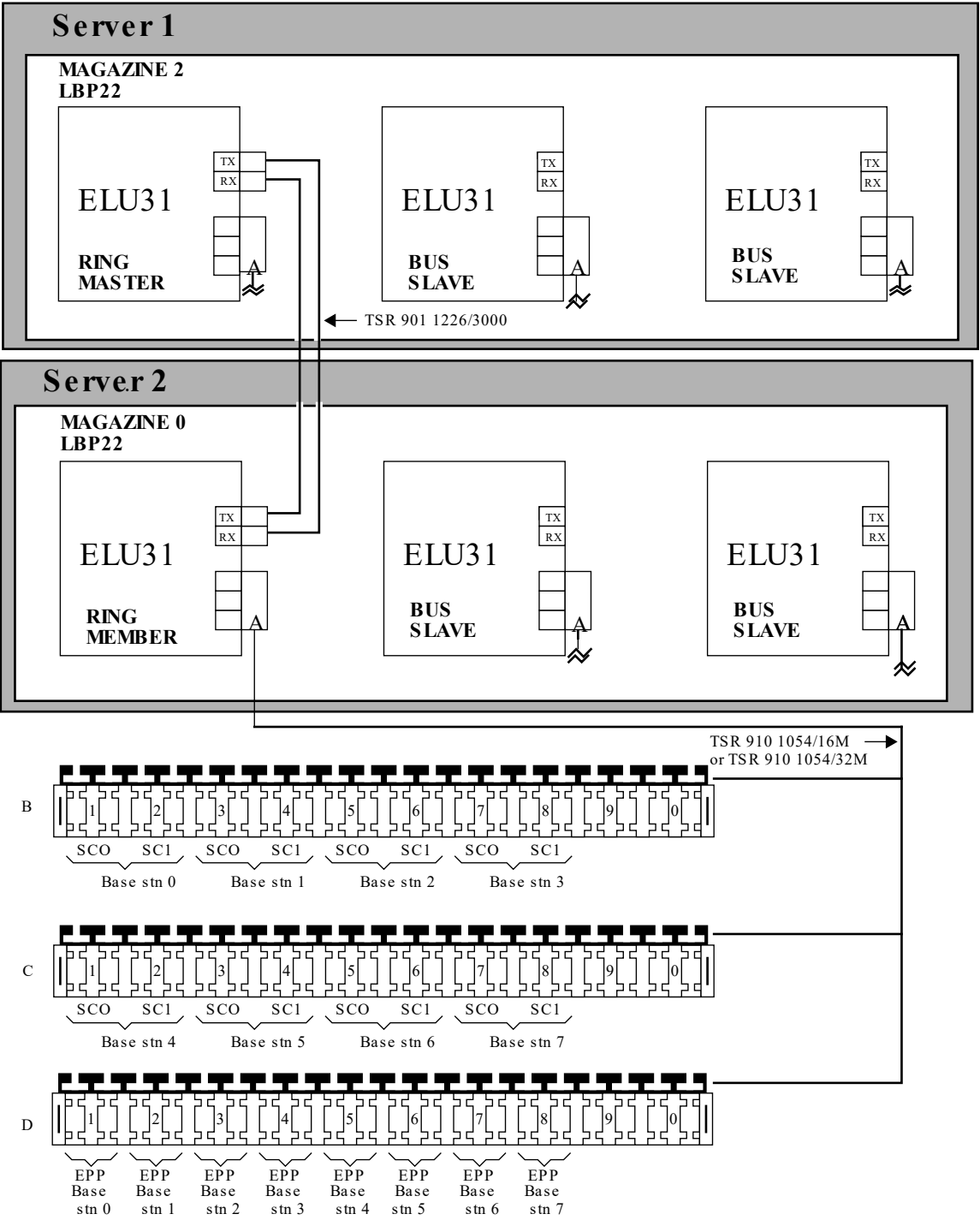


Figure 12: Two Server system with the synchronization cable in front and Main Distribution Frame (MDF) 19/ASB 501 04



5.8 MULTI-SERVER SYSTEM WITH REMOTE GATEWAY,  
WITH MDF (ELU31)

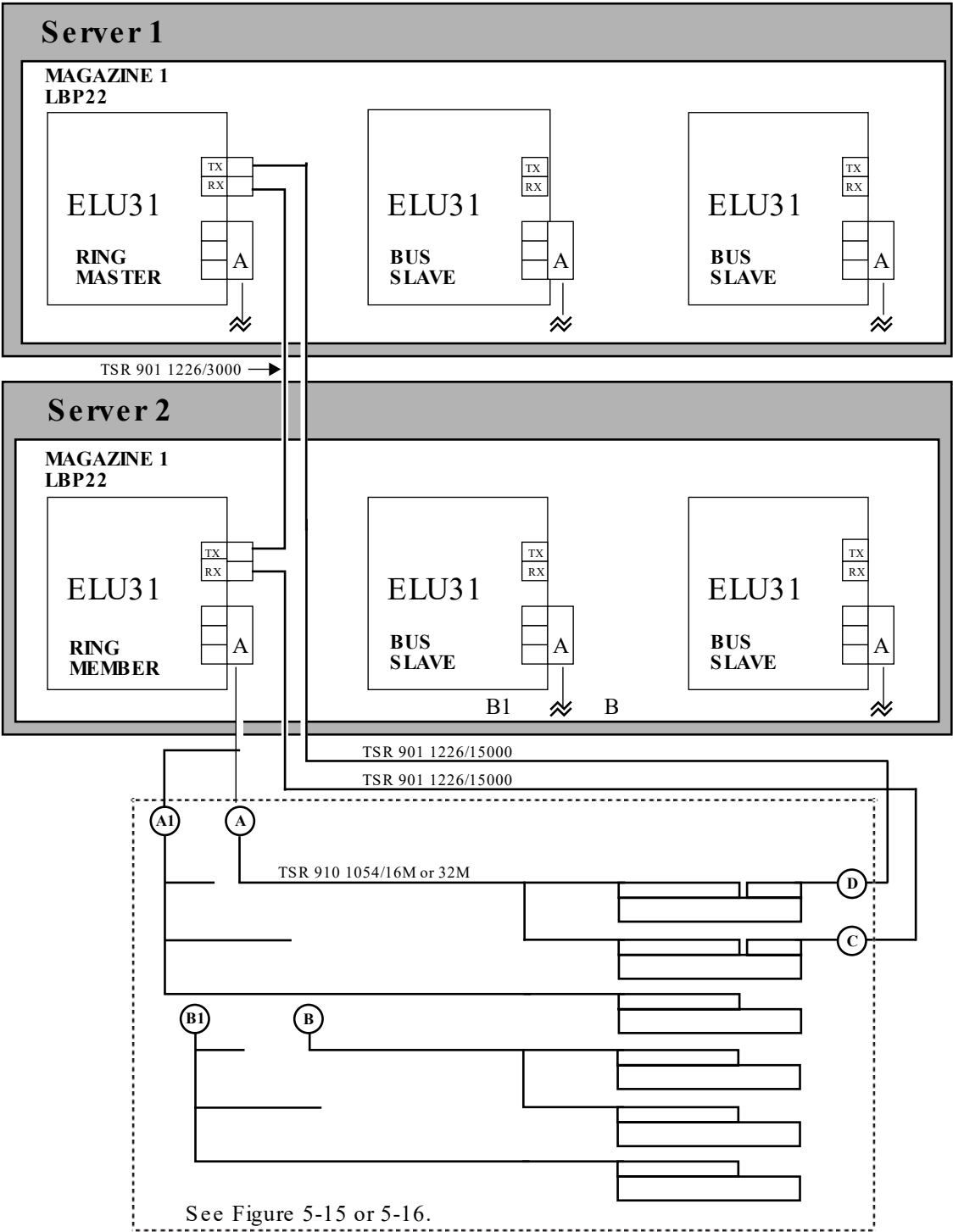


Figure 13: Multi-Server with MDF connections 07/ASB 501 04 or 09/ASB 501 04

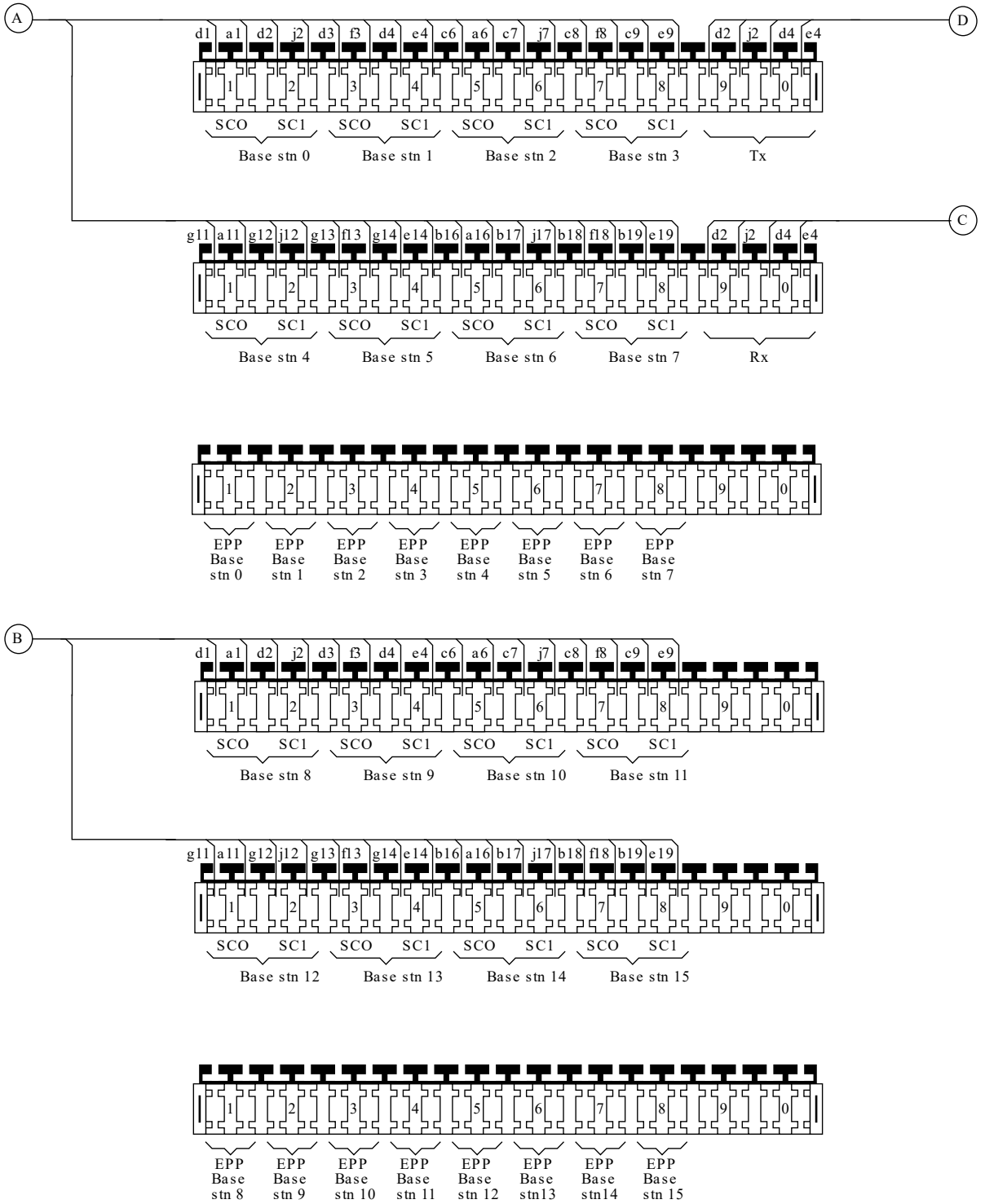


Figure 14: MDF connection of the cables from figure 31 (without EPP)



Figure 15: MDF connection of the cables from figure 35 (with EPP)

## 5.9

## MOUNTING OF BASE STATION BS3X0 AND BS3X2

### 5.9.1

### GENERAL

The base station is connected to the ELU31 board by means of a standard twisted pair cable. The base station can be fixed to a wall, a ceiling, a pole or a beam, by means of the mounting bracket included. When fixing the base station to a wall or ceiling the included plugs and screws must be used. When fixing it to a pole or beam a (not included) strap.

#### Content of the box.

See chapter “BS3x0” or “BS3x2” in “Installation Guide Base Station”.

#### Power distribution

Base stations can be powered by:

- SC0 and SC1 pairs from the ELU31 boards.
- SC0 and SC1 pairs and Express Powering Pairs (EPP) from the ELU31 boards.

For cabling see figure 16 Connections when using 2 EPP pairs on page 29 and chapter 6.2 Dimensioning on page 42.

#### Software

If necessary, the software in the base station can be updated by downloading new software to the base station. Downloading can be performed without disconnecting the base stations. The new software is stored in a flash memory. How to download the software is described in the command descriptions for *BOARD CONFIGURATION* in *TECHNICAL REFERENCE GUIDE, UNIX COMMANDS*.

#### Connectors

Two 8-pin RJ45 modular jacks for data and powering.

A 6-pin RJ12 modular jack for factory testing.

The two data/powering connectors are interconnected on the board.

Two female MCX connectors for the antennas (BS34x only)

#### Orderable items (Only applicable for BS34x)

For outdoor applications and applications requiring special antenna arrangement, there is a possibility to connect non-standard antennas to the BS34x. For external antennas, one of the following non-standard antennas can be used.

**Table 4** Orderable items

Item	Product number	Quantity
Omnidirectional single antenna set	NTM/KRENB 101 119/1	1
Directional dual antenna set	NTM/KRENB 101 121/1	1
Directional Single antenna	NTM/KRENB 101 118/1	1

**Note:** Two omni-directional single antenna sets are required per BS34x base station.

#### Visual indications

See chapter “BS3xx” in “Installation Guide Base Station”

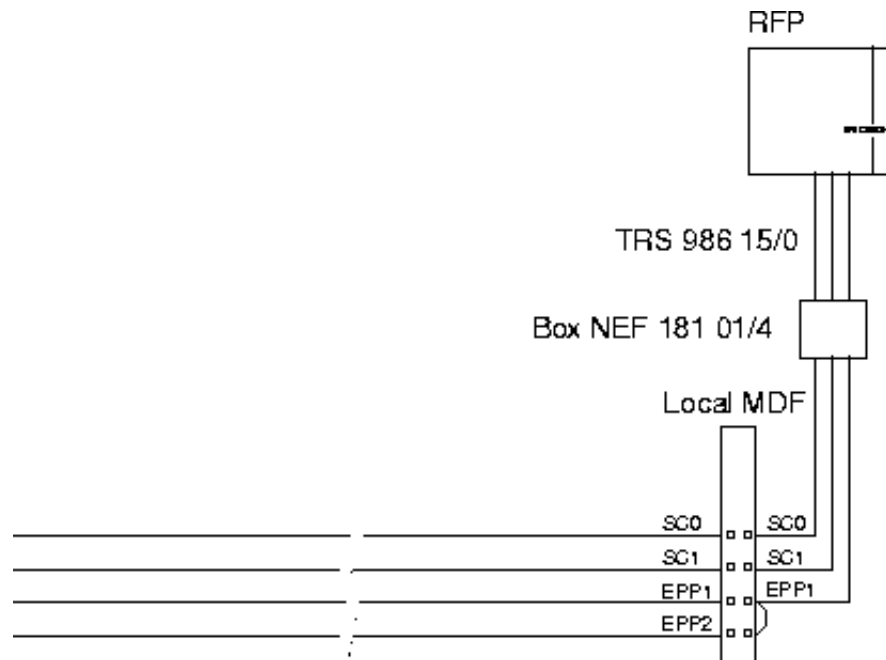
## 5.9.2

## BASE STATION CABLING

The base station cable must be a twisted pair cable with 2 pairs minimum for connection of the data lines. Also power is distributed via these data pairs.

A three-pair cable may be used when additional power wires (EPP) are required to increase the distance between the base station and the ELU31.

The base station is connected to the local MDF via a terminal box, NEF 181 01/4 and a terminal cord, TRS 986 15/0, see figure 16 Connections when using 2 EPP pairs on page 29. The terminal box, NEF 181 01/4, is connected to the local MDF using screw connectors in both ends. Then the terminal cord, TRS 986 15/0, is connected between the terminal box and the base station.



**Figure 16: Connections when using 2 EPP pairs**

The data wires of the same twisted pair may be interchanged. For instance SC0-0 and SC0-1, see figure 16 Connections when using 2 EPP pairs on page 29, may be interchanged. Also the EPP pair is insensitive for polarity reversal. Data pairs must not be interchanged.

## 5.9.3

## INSTALLATION

Base stations can be mounted vertically or horizontally. Mount the base stations at places and positions as determined in the system configuration plan. The base station must be placed such that it is not facing large metal objects such as large heating pipes.

With the Outdoor housing (a weatherproof box) the BS33x base station can be mounted to a wall or a pole outside of buildings, see chapter 5.11 Outdoor housing SDC 905 04/1 for base stations on page 37

**Note:** The BS34x base station cannot be mounted with the antennas pointing downwards as the mounting bracket does not support it.

**Note:** Fixing the base station to metal surface requires special consideration and is not recommended for several reasons. If this is unavoidable try to ensure a distance between the base station and the metal surface of, preferably, 1 meter. If this is

not possible to achieve the best option to use is base station with internal antennas/BS33x.

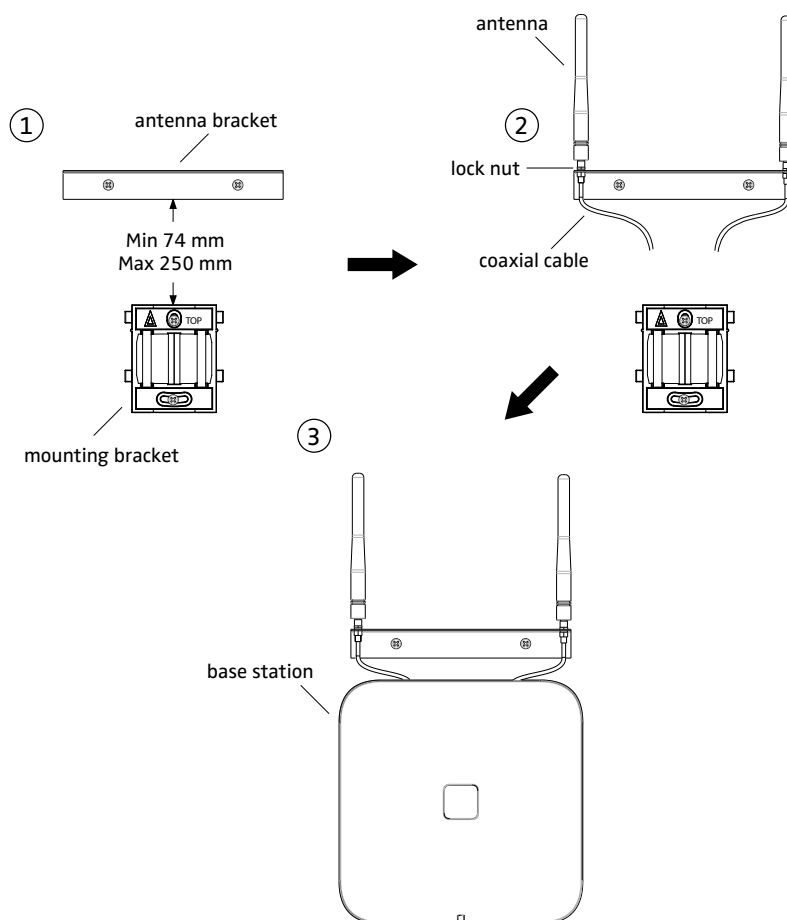
**Note:** Ensure that during the installation of an base station, each base station is given an extra length (5-10 metres) of cable because it is possible that it will have to be moved for one reason or another.

**Fixing the mounting bracket**

See chapter "Installation of the Base Station" in "Installation Guide Base Station".

### Fixing the standard antennas to the BS342.

For detailed instructions please see Installation guide , Base station (32/1531- ANF 901 43)



**Figure 17: Mounting the standard antennas on the BS342 base station**

**Note:** Mounting of the provided standard antennas on the Base station BS342, the antennas can be found in the provided antenna set, NTM/KRENB 101 116. The X-rings SCGNB 101 104 that are included in the antenna set should **not** be used.

## 5.10

### NON-STANDARD ANTENNAS.

The antennas in the figure and table below, see figure 18 Antenna NTM/KRENB 101 118/1, NTM/KRENB 101 119/1 and NTM/KRENB 101 121/1 on page 32 and table 5 Characteristics for recommended non-standard antennas on page 32 are recommended.



**Figure 18: Antenna NTM/KRENB 101 118/1, NTM/KRENB 101 119/1 and NTM/KRENB 101 121/1**

**Table 5 Characteristics for recommended non-standard antennas**

	Antenna types		
Product number	NTM/KRENB 101 118/1	NTM/KRENB101 119/1	NTM/KRENB 101 121/1
Gain	10.5 dBi	6.2 dBi +/- 0.3 dBi	8 dBi
Frequency range	1 880 - 1 920 MHz	1 880 - 1 930 MHz	1 850 - 1 990 MHz
Radiation in horizontal plane	directional beam width at -3 dB: 69 degrees	omni-directional within +/- 0.4 dB	directional beam width at -3 dB: 85 degrees
Radiation in vertical plane	beam width at 3 dB: 31 degrees	beam width at -3 dB: 24 degrees +/- 2 degrees	beam width at 3 dB: 75 degrees
Impedance	50 ohms	50 ohms	50 ohms
Maximum power	10 W.	10 W.	75 W.
Connector	One MCX male connectors at end of 1 m of RG316 coaxial cable	One MCX male connector at end of 1 m of RG316 coaxial cable	Two MCX male connectors at end of 1 m of RG316 coaxial cable
Weight	0.82 kg	0.3 kg	0.11 kg
Size	270 x 140 x 35 mm	395 x 16 mm	101 x 95 x 32 mm
Test results	600 m maximum range	450 m maximum range	600 m maximum range

**Note:** BS34x standard antenna can be replaced with two directional antennas NTM/KRENB 101 118/1 or two omnidirectional antennas NTM/KRENB101 119/1

**Note:** When using directional antennas NTM/KRENB 101 118/1 must both be directed to cover the same area.

**Note:** The gain above is compared to the standard 2 dBi gain antennas.

**Note:** The maximum is what the antenna can support, not what it can take from ELU31.



Above mentioned antennas are delivered with a 1 m coaxial cable with a male MCX connector fixed to the antenna. In some outdoor applications it is handy to place the base station indoor and feed the coaxial cable through the wall towards the antenna(s). If additional coaxial cable is used an important aspect is the loss in the coaxial cable between the base station and the antenna. The loss is supposed to be less than the difference between the gain of the non-standard antenna and the gain of the standard antenna. See table 6 Recommended coaxial cable on page 33 for recommended coaxial cable.

**Table 6 Recommended coaxial cable**

Type	Huber+Suhner G 03232-01
Diameter	5 mm
Loss (at 2 Ghz)	0.72 dB/m

#### **General installation remarks**

- Avoid sharp bends on the coaxial cable.
- If antennas are used outdoor, make sure that the antennas and coaxial cable are suitable for outdoor use.
- Use good quality coaxial cable with minimum loss.
- Outdoor connections must be made water-tight by using self vulcanizing (rubber) tape. Next use electrical tape to block out direct sunlight on the vulcanizing tape.
- Lightning protection is advisable if non-standard antennas are used outdoors. Surge protection circuits can be placed on top of the base station antenna connector.

#### **Mounting instructions for antenna NTM/KRENB 101 118/1**

The antenna set NTM/KRENB 101 118/1 contains the following items:

- Antenna
- Antenna housing/Mounting bracket
- Metal mounting bracket
- Screws, plugs and hose clip

The antenna can be mounted both on a wall and a pole. When mounted on a wall, the antenna can be mounted using the metal mounting bracket or not. If the metal bracket is used, it will be possible to adjust the angle of the antenna.

Connect the two antenna MCX male connectors to the BS340 base station MCX female connectors where the standard antennas normally are connected, BS340 see chapter 5.9.3 Installation on page 29.

**Mounting instructions for antenna NTM/KRENB 101 119/1**

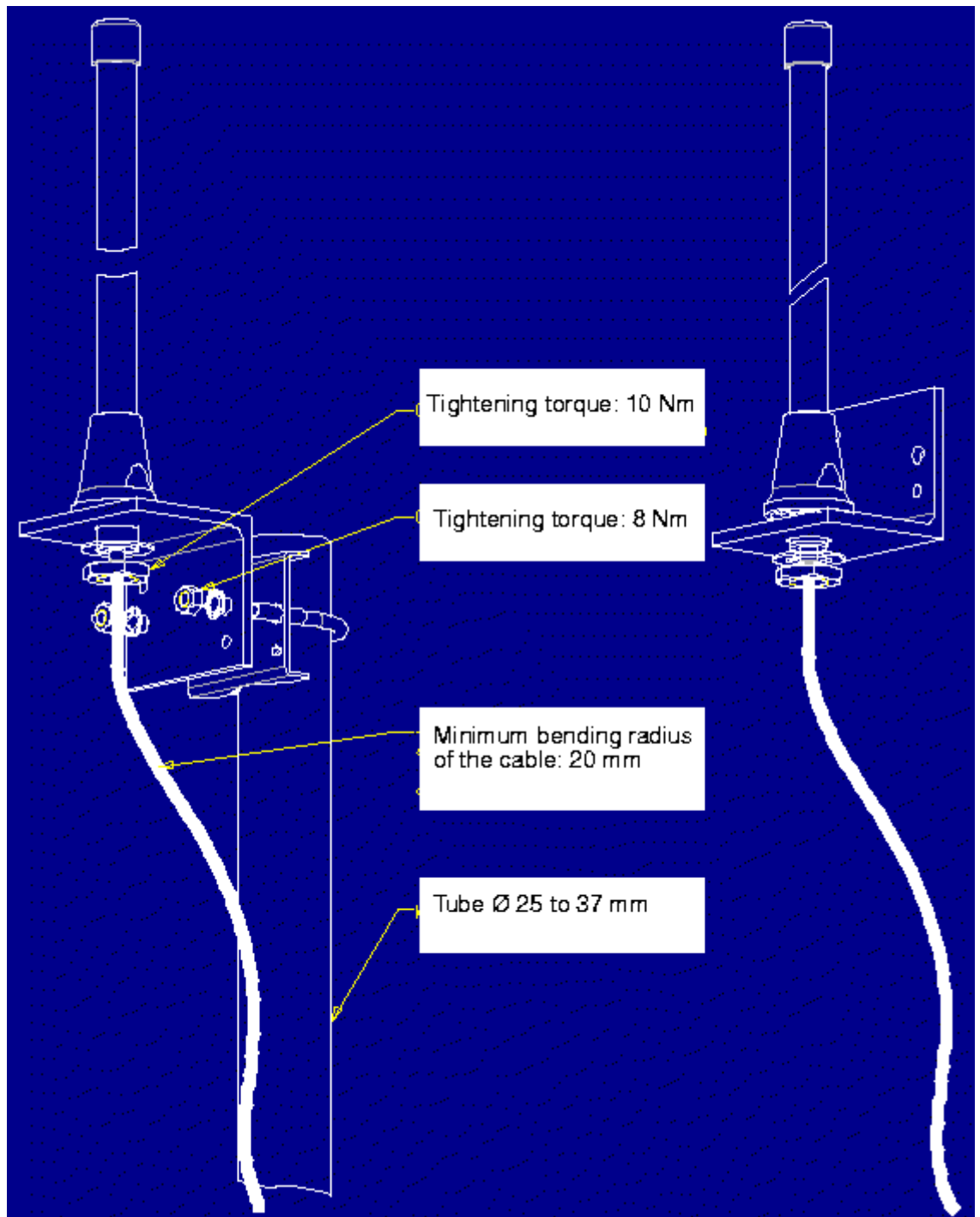
The antenna set NTM/KRENB 101 119/1 contains the following items:

- Antenna
- Wall mounting bracket
- Pole mounting clamp

Two antennas must always be connected to one base station, both covering the same area.

The antenna can be mounted on a wall or on a 25 to 37 mm diameter tube. When mounted on a vertical wall the supplied wall mounting bracket should be used, the bracket can be used both turned upwards and downwards. Screws to fasten the bracket on the wall has to be purchased locally. Two Ø 4 mm screws are needed. When mounted on a tube, both the supplied wall mounting bracket and the pole mounting clamp should be used. The wall mounting bracket has to be turned downwards. Please see figure 19 Mounting antenna NTM/KRENB 101 119/1 on page 35 for details.

Tests have shown that for antenna NTM/KRENB101 119/1 a distance of 50 cm between the antennas is recommended, this to avoid the shadowing effect.



**Figure 19: Mounting antenna NTM/KRENB 101 119/1**

For BS342 see figure 17 Mounting the standard antennas on the BS342 base station on page 31.

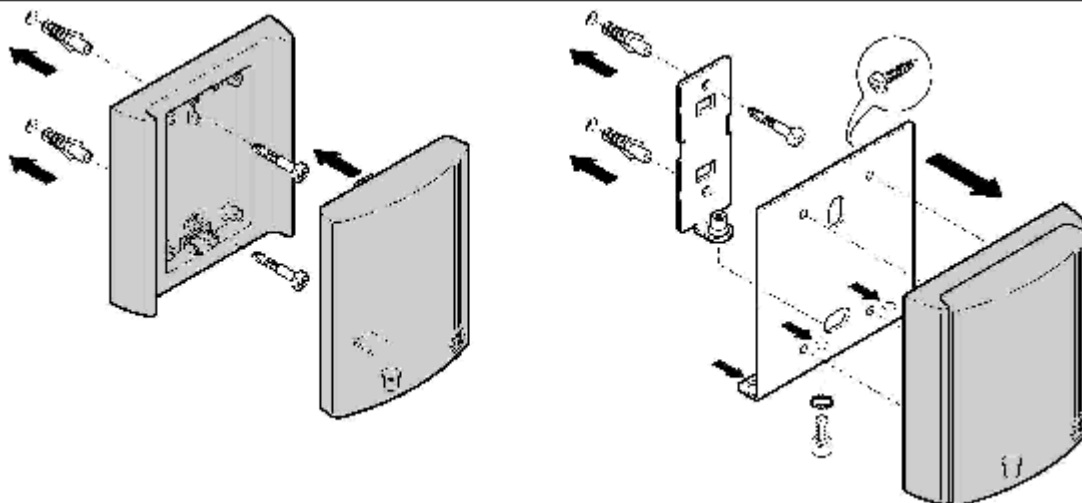
**Mounting instructions for antenna NTM/KRENB 101 121/1**

The antenna set NTM/KRENB 101 121/1 contains the following items:

- Antenna
- Antenna housing/Mounting bracket
- Metal mounting bracket

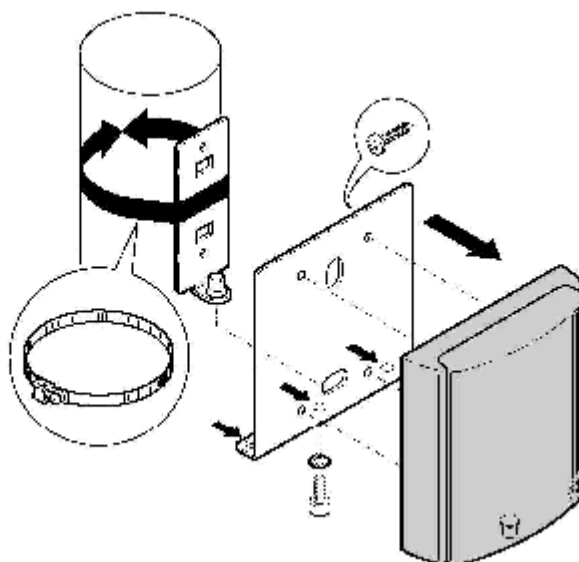
- Screws, plugs and hose clip

The antenna can be mounted both on a wall and a pole. When mounted on a wall, the antenna can be mounted using the metal mounting bracket or not. If the metal bracket is used, it will be possible to adjust the angle of the antenna, see figure 20 Mounting antenna NTM/KRENB 101 121/1 on a wall on page 36 for details.



**Figure 20: Mounting antenna NTM/KRENB 101 121/1 on a wall**

When the antenna is mounted on a pole, the provided metal mounting bracket has to be used. The provided hose clip can be used to fasten the mounting bracket to the pole. Please, see figure 21 Mounting antenna NTM/KRENB 101 121/1 on a pole on page 36 for details.



**Figure 21: Mounting antenna NTM/KRENB 101 121/1 on a pole**

Connect the two antenna MCX male connectors to the BS340 base station MCX female connectors where the standard antennas normally are connected, for BS340 see figure 17 Mounting the standard antennas on the BS342 base station on page 31.

## 5.11 OUTDOOR HOUSING SDC 905 04/1 FOR BASE STATIONS

### 5.11.1 GENERAL

The Outdoor housing SDC 905 04/1 is a weatherproof protection case for the BS3x0 and BS3x2 base station. It can be placed directly against a wall or a pole (using the optional pole mounting set NTM 501 04). Typical applications are base station coverage of car parks, large factory sites and the like.

The Outdoor housing provides no warming up of the base station. It has no built-in lightning protection, if mounted to an exposed position, then a separate lightning protection installation must exist.



**Figure 22: The outdoor housing.**

The mounting plate is drilled 2 times and two wooden screws for mounting the base station BS3x0/3x2 are mounted to the plate

### 5.11.2 SPECIFICATIONS FOR THE OUTDOOR HOUSING

<b>Physical</b>	Specifications subject to change without prior notice.
Dimensions	W x H x D: 300 mm x 400 mm x 200 mm.
Weight	53 kg (base station not included)
Material	Enclosure and door: fiberglass-reinforced unsaturated polyester
Rear mounting plate	2.0 or 3.0 mm sheet steel, zinc-plated.

Cable glands	1 x cable gland M 20x1.5, polyamide, RAL 7035 for local power cable 1 x cable gland M 25x1.5, polyamide, RAL 7035 for data cable
Signal lamp holder	P9MLVD with green lens P9PDNVO and light bulb 24 Volt/2 Watt
<b>Not included function:</b>	No cooling or warming up of the installed base station (Base station operating temperature range: -10°C to +55°C)
	No lightning protection
<b>Compliance to:</b>	Regulations and standards
Electrical safety	IP66
Approvals	UL, CSA and Australian
<b>Pole mounting set:</b>	NTM 501 04 (optional)
Set materials	2 mounting angles, 600 mm long 4 x clamping sections 2 x clamping straps 4 x clamping brackets 4 x screws and nuts (M8) for mounting the set to the outdoor housing 1 x installation instruction

#### Temperature precautions

Pay some attention to the outside temperature influence on the Outdoor housing built-in base station (see specification table above). An additional warming-up (for example, self limiting warming tape or mat) can be needed in extreme low temperature areas. Opposite, a white or silvery paint on the outside of the Outdoor housing reflects much of the hot sunlight, if this housing is used in countries with high outside temperatures. Mount the housing under a sun protecting roof or on the shady side of a building to prevent the built-in base station from overheating.

### 5.11.3 MOUNTING OF THE OUTDOOR HOUSING

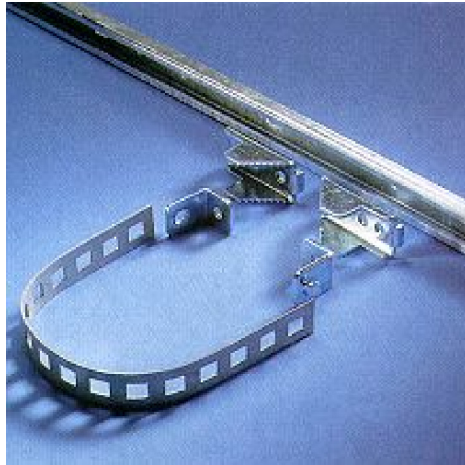
#### 5.11.3.1 *Mounting to a wall*

The Outdoor housing can be easily mounted to a wall using standard screws and plugs (not supplied, to be locally sourced). An installation instruction is delivered with the box

It is recommended to place matching washers for 6 mm (1/4") screws between the screw heads and the mounting flanges. For rough walls use longer screws and insert appropriate distance sleeves between the flanges and the wall to avoid damage of the Outdoor housing.

#### 5.11.3.2 *Mounting to a pole*

With the additional pole mounting set NTM 501 04 the case can also be fixed to a pole or mast with a circumference up to (OLD:750 mm (29 1/2 inches), equal to a 239 mm (9 3/8 inches) diameter post.)



**Figure 23: Pole mounting set for outdoor housing**

The set include twice of what is shown in the picture.

#### 5.11.4 BASE STATION CABLING INSIDE THE OUTDOOR HOUSING

The Outdoor housing has two glands (bushes), one for insertion of the data cable and the other for the connection cable to external antennas.

##### 5.11.4.1 *Cabling for the BS3xx*

These base stations are powered via the data/power cable from, for example, an ELU31 board. Because no separate power cable is used, the existing rubber disk used as air tightening for the power cable, can be kept.

The connection box (NEF 181 01/4) can also be placed inside the Outdoor housing. If this box is mounted inside the Outdoor housing fix it using double-sided self adhesive tape or hot-melt adhesive glue (to be sourced locally).

For the complete mounting of the BS3x0/BS3x2 base stations see chapter 5.9 Mounting of base station BS3x0 and BS3x2 on page 28.

#### 5.11.5 EXTERNAL ANTENNAS WITH THE OUTDOOR HOUSING

##### 5.11.5.1 *BS34X*

Instead of the provided standard antenna set, NTM/KRENB 101 116, two external non-standard antennas NTM/KRENB 101 119/1 can be used. See chapter 5.10 Non-standard antennas. on page 31

The external antennas cables lead through the gland for the data cable, while the data/power cable goes via the power cable gland directly to the Data/Power outlet (RJ45) or to the connection box NEF 181 01/4. If the connection box NEF 181 01/4 is used for cabling, it must fasten inside the Outdoor housing by double-sided self adhesive tape or hot-melt adhesive glue (to be sourced locally)

The Data/Power cable goes via the power gland to the Data/Power outlet (RJ45) or to the connection box NEF 181 01/4.

### 5.11.6 POST MOUNTING MEASURES

When the Outdoor housing is mounted in place with the connected base station and the connection box inside, then clean up the workplace. Remove all tools and all materials not included in the mounting of this Outdoor housing and base station.

Any front plates and other cabinet plates that have been removed, must be remounted with the sealing gasket in the right position.

After the installation of all other PBX equipment, test the functions according to the installation test instructions for CORDLESS PHONE.

## 5.12 INSTALLATION OF THE PORTABLES

### 5.12.1 INITIATION

For initiation of portables see operational directions for *CORDLESS EXTENSION*.

#### 5.12.1.1 *Unlocking of a portable part*

When the third attempt to unlock a PP with the PIN code has failed, the only way to unlock the PP is to use the IPEI code. See directions for use for relevant PP.

### 5.12.2 REGISTRATION (ON AIR-SUBSCRIPTION)

Follow the following procedures for the different portables for registration.

#### 5.12.2.1 *Mitel 5613 and 5614*

See the Configuration Guide and the User Guide fore the Mitel 5613 and 5614.

#### 5.12.2.2 *DT390, DT690 and DT692*

See direction for use. Configuration manual DT390/69X.

#### 5.12.2.3 *DT413, DT423 and DT433.*

See direction for use. Configuration manual DT4x3.

## 5.13 INSTALLATION OF CHARGING EQUIPMENT

### 5.13.1 MITEL 5613 AND 5614

See the Configuration Guide and the User Guide fore the Mitel 5613 and 5614.

### 5.13.2 DT390, DT690 AND DT692

See direction for use. Configuration manual DT390/69X.



### 5.13.3

DT413, DT423 AND DT433.

See direction for use. Configuration manual DT4x3.

## 6

## POWERING

## 6.1

## GENERAL

The ELU31 board is connected to +5 V and -48 V in the backplane of the MX-ONE and 48V is fed to the base stations. base station can be fed either from ELU31 or locally.

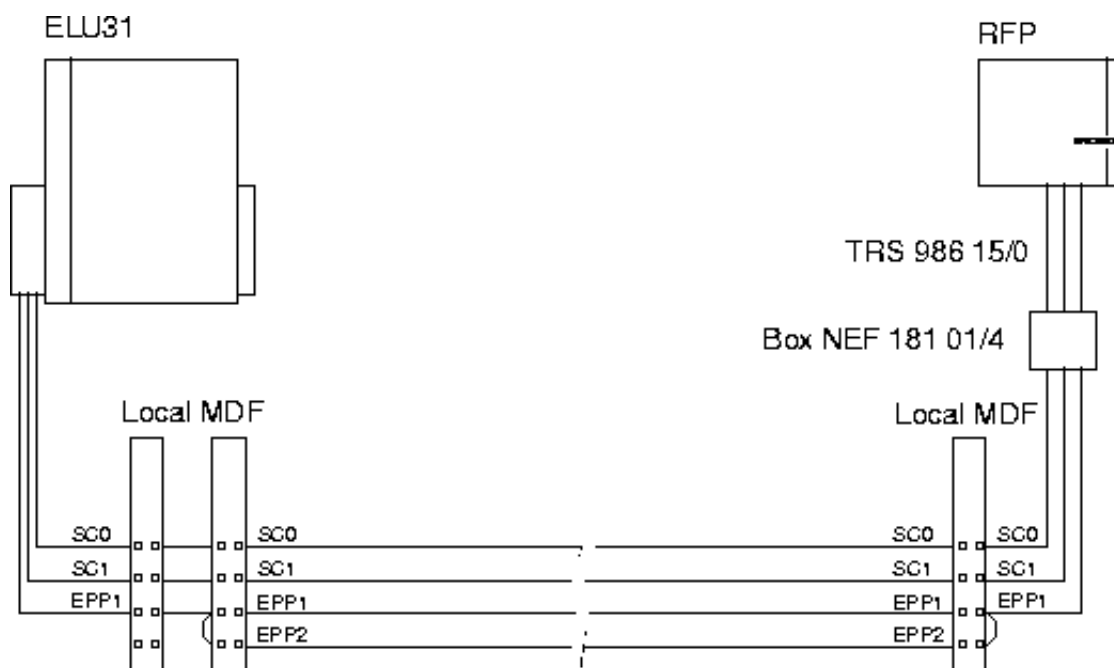
## 6.2

## DIMENSIONING

The tables in “Installation Guide Base Station”, Appendix A: RFP Power Consumption, indicate the power consumed by each base station interface with a BS33x base station and BS34x base station connected. The values in the power requirement tables are worst case figures.

When the express power feeding pair, EPP is used, the power loss will decrease less and the line length will increase. It is possible to get 2 EPP if the EPP pair from the ELU31 board is copied into two pairs in the MDF, see figure 24 Connections when using 2 EPP pairs on page 42 and also chapter 7.1 Introduction on page 45.

For backplanes with two -48 V pins (LBP22 and later), up to eight BS3x0 or BS3x2 base stations can be connected, to the ELU31, depending on power consumption see chapter “Appendix A:RFP Power Consumption” in “Installation Guide Base Station” document No. 32/1531-ANF90143.



**Figure 24: Connections when using 2 EPP pairs**

Maximum power available from one ELU31 board in an LBP22 magazine or later with two -48 V pins in the backplane is 109 W (42 x 1.3 x 2).

Using the backplane type, available power and the values in tables, see chapter “Appendix A:RFP Power Consumption” in “Installation Guide Base Station”, the number of base stations that can be connected to one ELU31 board can be deter-

mined. The power used by each ELU31 board and its base stations can then be added up to confirm that this is possible with the available power.

When using MX-ONE Classic with MGU, the practical and power limitation is 10 ELU31 boards, placed evenly between the magazines.

In a 3U box BFD 761 42/x or 87L 00039AAA-A the number of ELU31 boards is limited to 1 due to power consumption.

The individual signaling twisted cable pairs and the EPP pair follow an earlier recommendation, see chapter 7.2 Cable requirements on page 46.

**Table 7 Power dissipation**

ELU31/1 board	Maximum	5.0 W
	Typical	3.5 W
ELU31/2 board	Maximum	5.0 W
	Typical	2.8 W
ELU31/3 board	Maximum	5.0 W
	Typical	2.8 W
ELU31/4 board	Maximum	5.0 W
	Typical	2.8 W
BS3x2	Maximum	2.0 W
	Typical	1.3 W
BS330 base station, R4H and later. (figures without cable length)	Maximum	2.0 W
	Typical	1.3 W
BS340 base station, R4H and later. (figures without cable length)	Maximum	2.0 W
	Typical	1.3 W
BS330 base station, Prior R4H. (figures without cable length)	Maximum	5.0 W
	Typical	3.0 W
BS340 base station, Prior R4H. (figures without cable length)	Maximum	5.0 W
	Typical	3.0 W
BS370 base station (figures without cable length)	Maximum	5.0 W
	Typical	3.0 W
CORE base station (figures without cable length)	Maximum	7.5 W
	Typical	5.0 W

For information about RFP power consumption and cable length see chapter "Appendix A: RFP Power Consumption" in "Installation Guide Base Station".

**Table 8 Power consumption**

Maximum power consumption for an ELU31 board and connected base stations. Backplane LBP20 and later has two power pins.	+5 V	5.0 W
	-48 V	109 W (2 pins)

6.3 ASSEMBLING  
N/A

6.4 CONNECTION  
N/A

## 7

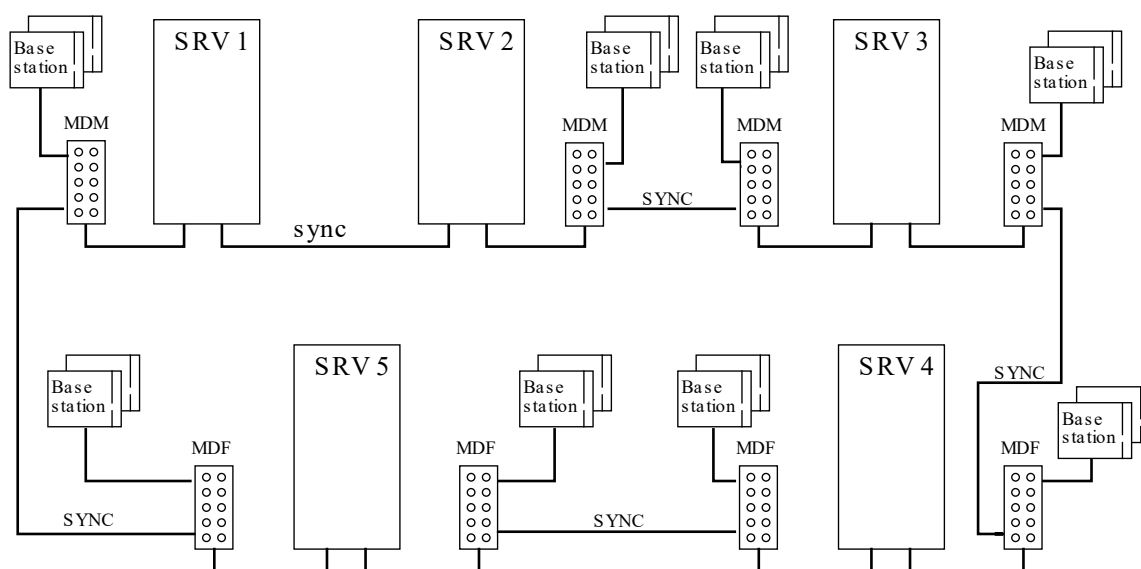
## CABLING

## 7.1

## INTRODUCTION

The cable quality is an important factor to achieve a successful INTEGRATED DECT installation, neglecting this causes unstable and troublesome systems. Standard Mitel cables that are referred to below fulfill these requirements. Cabling between MDF or MDM for base station connection and for synchronization must also follow these recommendations see chapter 7.2 Cable requirements on page 46.

Two types of front cabling are used on the ELU31 board, for connecting base stations and to make sure that all boards in the system are synchronized. The synchronization and communication within a magazine are distributed via the backplane when LBP22 or later. An illustration of how the synchronization ring can be connected is shown, see figure 25 An example of a multi Server system on page 45.



**Figure 25: An example of a multi Server system**

A system with only one ELU31 board still requires a RING cable TSR 901 1226/3000 for ELU31) running from the TX port to the RX port on the same board

The base stations are connected via a MDF or MDM with 2 communication pairs and if needed one express power pair. Connections for one express power pair (EPP) is provided both on the ELU31 board and on the base stations. It is possible to use 2 EPP pairs to lower the cable resistance and increase the line length to the base station even more, see chapter “Appendix A:RFP Power Consumption” in “Installation Guide Base Station”. This however requires some special arrangements when connecting the two EPP pairs in parallel, see figure 24 Connections when using 2 EPP pairs on page 42. Care should also be exercised not to short circuit the wires or swap polarity.

At the initial time when the system is installed and the ring is connected for the very first time it is a requirement that the ring cabling is complete. This is the first time the ring boards assume their roles and if the ring is not complete the roles cannot be decided. Until the synchronization ring is complete no base stations will start.

When the system is up and running and a Media Gateway is powered down and up or a ELU31 board is replaced or added, only base stations connected to these units will be affected.

**Note:** Too big or too fast alterations in the system may lead to that the synchronization ring gets disrupted. When this happens, the whole system will restart.

## 7.2

### CABLE REQUIREMENTS

All cables used for connecting base stations and for connecting the synchronization ring must be twisted pair. All cables delivered from Mitel for connection to the ELU31 board are shielded twisted pair cables. The shielded pair cables will be connected between the ELU31 and the MDF or MDM or between the first ELU31 board in all magazines for the synchronization ring. Cables from MDF or MDM to the base station or another MDF or MDM (for the synchronization ring) must also be of the twisted pair type.

It is essential that the requirements of the twisted pair cable are maintained throughout the entire connection from MDM or MDF to the base station and also for the synchronization connection. This is particularly important when using already installed cabling. Other types of cables will not work and can cause major problems for base station and ring synchronization communication. The two twisted pairs (SC0, SC1) to the base station must not be interchanged. For further details see chapter 5.3 Cables between ELU31 board and base stations on page 20.

It is good practice to avoid laying the above mentioned cables close to other cables carrying high currents and high frequencies. Examples of cables that should be avoided are power cables for elevators, welding equipment, heavy machinery and the like. If in doubt whether the environment is unsuitable for the ELU31 cabling, use shielded twisted pair cables. In new installations, it is recommended to use shielded twisted pair cables. All cable data used for base station communication and synchronization, throughout this document, can be found below, see table 9 Twisted pair cable data on page 46. Also calculations of power consumption and cable lengths are based on data below, see chapter 6.2 Dimensioning on page 42.

All pairs used for the synchronization cable must use the same path from point to point for ACDM to work correctly.

**Table 9 Twisted pair cable data**

Cable usage	Diameter mm	Resistance single wire /km	Capacitance	Impedance	Maximum superimposed noise
Base station/EPP	0.4	137 Ohm	<= 140 nF/km	120 Ohm	10 microV/Hz
	0.5	87.5 Ohm	<= 140 nF/km	120 Ohm	10 microV/Hz
	0.6	60.7 Ohm	<= 140 nF/km	120 Ohm	10 microV/Hz
Synchronization	0.4	137 Ohm	<= 140 nF/km	120 Ohm	-
	0.5	87.5 Ohm	<= 140 nF/km	120 Ohm	-
	0.6	60.7 Ohm	<= 140 nF/km	120 Ohm	-

## 7.3

### SYNCHRONIZATION RING CABLE

The synchronization port on the ELU31 board is used to distribute the synchronization pulses, to send Frame Counter Values (FCV) and to communicate the information used to establish each individual board roles, to all ELU31 boards in the synchronization ring. The port also provides the functionality of Automatic Cable Delay Measurement.

For single board system the synchronization ring cable has to be connected from the SYNC TX port to the SYNC RX port on the same ELU31 board.

**Note:** When ELU31 board are used in the ring, the mentioned cables must be used:

	Cables to be used with ELU31	
	TSR 901 1226/3000	Between ELU31 boards in the same stack
Cables used for the synchronization ring outside the cabinet	TSR 901 1226/5000	Between ELU31 boards in adjacent stacks
	TSR 901 1226/5000	Between first and last ELU31 board, or between ELU31 and MDM/MD
Cable used for the synchronization ring inside the cabinet	TSR 901 1235/2300	

## 7.4

### BASE STATION CABLE

Cable TSR 910 1054 can be used to connect base stations to the ELU31 front connectors. Independent if it is used as 16 or 32 individual board.

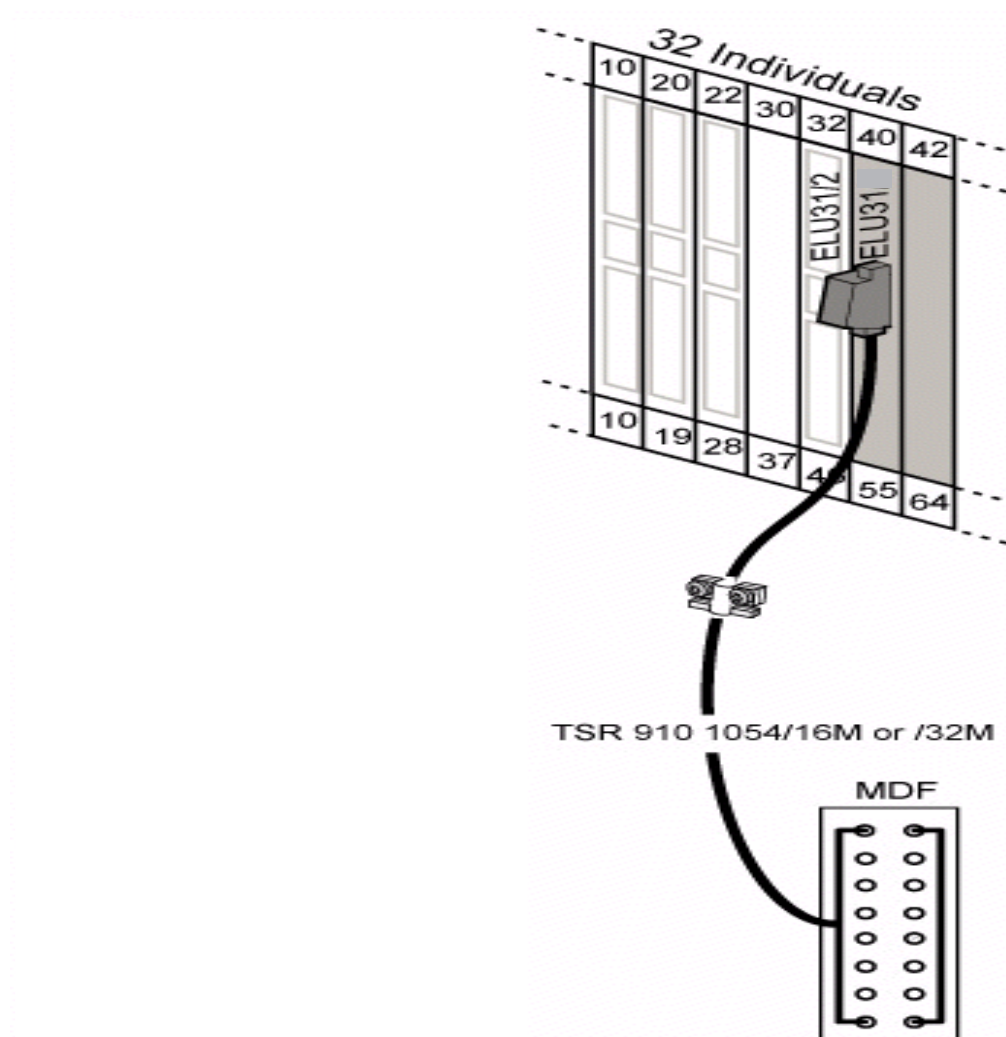


Figure 26: Base station cable ELU31.



## 8

## POST INSTALLATION MEASURES

See section 10 Appendix B on page 56

See installation instructions for *INSTALLING MIVOICE MX-ONE*.

Any front plates and other cabinet plates that have been removed are to be remounted and are to be left in the same state as prior to removal.

## 9

## APPENDIX A

## 9.1

## SPACE REQUIREMENTS

Each ELU31 can be defined to use 16 or 32 slots with unix style command **board\_-config** or will be allocated 16 or 32 slots depending on what is available with board\_-config -scan.

A BS332 and BS342 base station (w/o external antennas) measures 170 (w) x 170 (h) x 38 (d) mm.

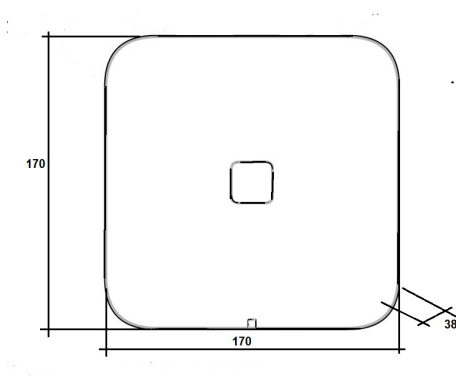
A BS330 base station measures 200 (w) x 165 (h) x 56 (d) mm.

A BS340 base station measures 200 (w) x 252 (h) x 56 (d) mm (with standard antenna). For space requirements for non-standard antennas see Table 5, Characteristics for recommended non-standard antennas on page 32.

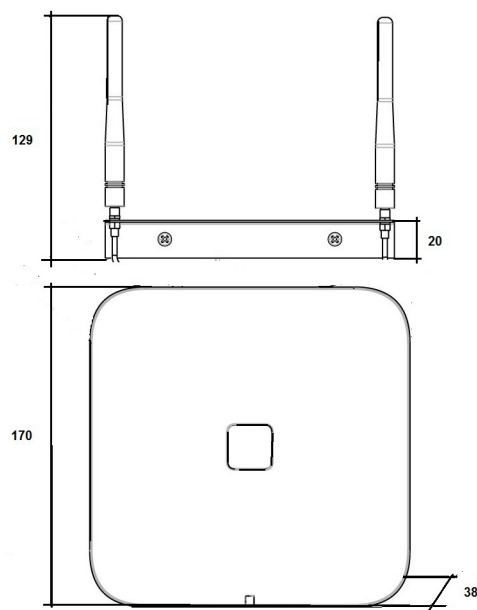
The size of the standard antennas for BS34x is 107 (l) x 8.5 (d) mm.

For space requirements for non-standard antennas see Table 5, Characteristics for recommended non-standard antennas on page 32.

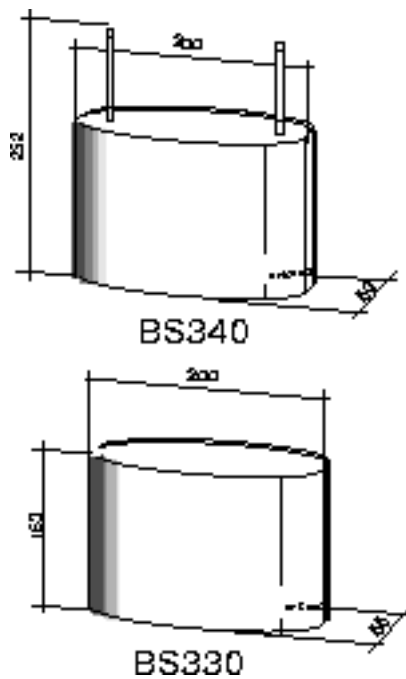
**Note:** More data regarding BS3x2, see document "Installation Guide Base Station". (32/1531-ANF 901 43)



**Figure 27: BS332 radio base stations**



**Figure 28: BS342 radio base stations with external antenna**



**Figure 29: BS330 and BS340 radio base stations**

## 9.2 TECHNICAL DATA

### 9.2.1 ELU31 BOARD

The building height of ELU31 board is 20 mm. When the front plate is removed from the ELU31 board and a support front is mounted it fits into the stackable cabinet.

The base station interface is a proprietary interface.

The ELU31 board supplies the base stations with -48 V. Power is fed through the communication interface and the EPP interface if applicable.

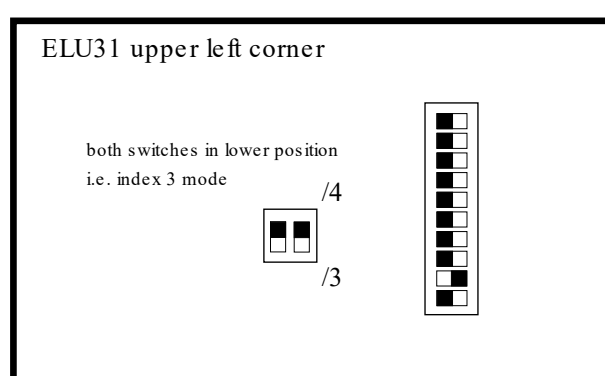
Power dissipation: See Table 7, Power dissipation on page 43

Power consumption: See Table 8, Power consumption on page 43

In some backplanes there are two -48 V feeding pins and there the power consumption can be higher.

ELU31/3, FW R7B and greater, and ELU31/4 has improved ring communication and ACDM function. Therefore it is recommended to use these boards in the ring.

ELU31/4 has an on-board switch. The switch can be set to "index\_3\_mode" or "index\_4\_mode". How to change mode on ELU31/4, see figure 30 ELU31/4 on-board switch setting. on page 52.



**Figure 30: ELU31/4 on-board switch setting.**

#### **ELU31/4 index 4 mode.**

When all ring boards are running index 4 mode can ring members act as synchronization source for the media gateway, like any primary rate interface (E1). Master board can not act as a synchronization source for the media gateway. Master board shall always have 'trsp\_synchronization --class no --prio no'. That is Master board shall never be able to give synchronization to its MGU.

In situation where the ring is broken, a ring member can temporarily become master, the new master will automatically be blocked as synchronization source. Old master, will now be temporarily a member board.

- ELU31/4 (index 4 mode) can have ELU31/3 as bus slaves.
- ELU31/4 (index 4 mode) can not be bus slaves to ELU31/3 ring.

#### **ELU31/4 index 3 mode.**

In this mode can both ELU31/3 and ELU31/4 exist in the system.

- ELU31/4 can replace all other ELU31 versions with some limitations (See 5/1531-ANF 901 14 section 2).
- ELU31/4 (index 3 mode) and ELU31/3 FW R7B and greater, can coexist on the ring.

## 9.2.2 BASE STATIONS

### 9.2.2.1 *BS3x2 and later base stations*

See document "Installation Guide Base Station". (See 32/1531-ANF 901 43)

### 9.2.2.2 *BS330*

**Table 10 Technical data for BS330 base station**

Parameter	Base station
Powering method	Centrally via 2 data pairs and optionally one extra pair only for powering.
Connector type	8 pin RJ45
Cable type	See chapter 6.2, Dimensioning on page 42
Operating voltage	21 to 56 V DC
Power dissipation	See Table 7, Power dissipation on page 43
Frequency band	1880 - 1900 MHz (Std) 1900 - 1920 MHz (China) 1910 - 1930 MHz (Latin America) 1920 - 1930 MHz (US and Canada)

### 9.2.2.3 *BS340*

**Table 11 Technical data for BS340 base station**

Parameter	Base station
Powering method	Centrally via 2 data pairs and optionally one extra pair only for powering.
Connector type	8 pin RJ45
Cable type	See chapter 6.2, Dimensioning on page 42
Operating voltage	21 to 56 V DC
Power dissipation	See Table 7, Power dissipation on page 43
Frequency band	1880 to 1900 MHz

## 9.2.3 PORTABLES

### 9.2.3.1 *Mitel 5613 and 5614*

See the Configuration Guide and the User Guide fore the Mitel 5613 and 5614.

### 9.2.3.2 *DT390, DT690 and DT692*

For technical data see direction for use. Configuration manual DT390/69X.

### 9.2.3.3 *DT413, DT423 and DT433.*

For technical data see direction for use. Configuration manual DT4x3.

## 9.3 ENVIRONMENTAL REQUIREMENTS

### 9.3.1 BASE STATIONS

#### 9.3.1.1 *BS3x2 and later base stations*

For further details please See document "Installation Guide Base Station".(32/1531-ANF 901 43)

**Table 12 Environment data BS332 and BS342.**

Operating temperature:	-10°C - +70°C
Storage temperature:	-25°C - +70°C
Relative humidity (operating):	15 - 90%, non-condensing
Relative humidity (storage):	5 - 95%, non-condensing

#### 9.3.1.2 *BS330*

NTM/KRCNB 301 03/1 with GAP SW for frequencies between 1880-1900 MHz and  
NTM/KRCNB 301 02/1 with GAP SW for frequencies between 1900-1920 MHz and  
NTM/KRCNB 301 04/1 with GAP SW for frequencies between 1910-1930 MHz.

**Table 13 Environment data BS330 and BS340.**

Operating temperature:	-10°C - +55°C
Storage temperature:	-40°C - +70°C
Relative humidity (operating):	15 - 90%, non-condensing
Relative humidity (storage):	5 - 95%, non-condensing

#### 9.3.1.3 *BS340*

NTM/KRCNB 302 01/1 with GAP SW.

Environment data see table 13 Environment data BS330 and BS340. on page 54

### 9.3.2 PORTABLE PARTS

#### 9.3.2.1 *Mitel 5613 and 5614*

See the Configuration Guide and the User Guide fore the Mitel 5613 and 5614.

9.3.2.2 *DT390, DT690 and DT692*

See direction for use. Configuration manual DT390/69X.

9.3.2.3 *DT413, DT423 and DT433.*

See direction for use. Configuration manual DT4x3.

# 10

# APPENDIX B

## 10.1

## INSTALLATION TEST INSTRUCTION

### 10.1.1

### GENERAL

The mobility installation is tested by “walk around test” that is walking a predetermined way while making call and receiving call and walking with a call connected, testing hand over, and walking with a PP that is idle, testing roaming).

**Note:** It is good to know roughly where the different location areas overlap. That where “hand over” and “roaming” is performed. Can be seen in the DCA menu.

**Note:** When moving from ELU31 connected to server “A” to another ELU31 connected to server “B”. Depending when called to PP starts and when PP starts roaming can PP not be reached.

### 10.1.2

### PREREQUISITES

Make sure that the ELU31 boards, all the required cables between the boards and the base stations have been properly installed see chapter 5 Mounting & Installation on page 20

Make sure that the correct R-state of the SW in the system as well as FW on the ELU31 boards and base stations are installed. SW may be verified by the pu\_info command while FW R-state for the ELU31 board and base stations are printed out with the board\_sw command.

Check also that all portables have the right firmware loaded and that they are initiated and registered in the exchange.

Check that the number of system the phone is registered to are correct. See Direction for Use Cordless phones. Normally only one. Having only one working site and having more then one registration can cause seriously problem for other DECT phones. All invalid subscription shall be removed.

See section DCA service and operational directions for Cordless extension.

Check that a floor plan is drawn up. On the floor plan all base stations shall be marked out with their RFP numbers and belonging PARI values.

### 10.1.3

### REFERENCES

In this appendix references are made to following documents

Operational Direction	Cordless extension
Command Description	Cordless extension
Parameter Description	Cordless extension
Feature Description	Cordless phone
Fault location directions	Synchronization fault for DECT fixed part Synchronization disturbance for DECT fixed part Faulty RFP for DECT fixed part



Installation Planning	Mobility
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## 10.1.4

## PROCEDURE

The following procedure shall be used when testing Mobility:

- Verify initiation of the Mobility equipment.
- Verify HW and FW revision of installed equipment, including PP.
- Test the radio coverage.
- In areas with high call rate check that wanted b-channel capacity are available.

## 10.1.5

## EXECUTION

## 10.1.5.1

*Verify the initiation of Mobility equipment***Preparation**

Initiate all relevant Mobility equipment necessary for the installation or check that all Mobility equipment already is initiated. ELU31 boards, base station and PP are initiated by command. See operational direction for Cordless extension.

**Synchronization ring**

When all the synchronization cables are inserted, both TX and RX connectors, and all ELU31 boards are inserted and initiated, the synchronization ring should complete and the ELU31 boards should have a defined role.

Following steps needs to be checked/controlled/executed.

- All components has the latest FW loaded.
- All ring boards have switch set to 'index\_4\_mode'.
- That correct ring board is Ring Master. Preferably assigned by command `dect_cfp -i --ring-prio on --fpi x --allow-sync no`.
- That Ring Master is not allowed to provide PCM synchronization, `dect_cfp -p -v`.
- That all ring boards has ACDM set to yes.
- Confirm with command `dect_cfp -p -s ring` that all ring boards are correct and connected in correct order.
- That the accumulated delay value does not exceed 2000 ns, `diagnostic_print -unit CTLP -lim 'master' -request x`. If it does compensation needs to be added manually. `dect_cfp --fpi x -c --compensation y`
- That the delay value are reasonable. The typical delay across a 1 km copper cable is 5.35 micro seconds (approx 40 steps), this value will change with different cable types. 500 m copper cable is approx 23 steps.
- If ELU31 shall provide PCM synchronization. That all ring members, excluding the RING MASTER, are allowed to provide PCM synchronization, `dect_cfp -p -v`.
- That each media gateway receives the PCM synchronization from the correct source. Command `trsp_synchronization -p`
- That clock quality with command `diagnostic_print -unit CTLP -lim all -request 'clock quality snapshot'`. Dect synch adjustment shall be 0 or close to 0, this is a percent value of how often an adjustment has been made to the DECT synchro-

nization, 100 adjusted every time possible. Pcm clock should be stable and preferably less than 50.

- Use command `diagnostic_print -unit CTLP -lim all -request 'clock quality history view'` to see that Dect synchronization adjustment and Pcm clock jitter is stable.

### Synchronization role

If boards still have an undefined status in the `dect_cfp` printout there is one or several faults in the cabling of the synchronization ring. Verify that the correct cables are used. Verify that a TX outlet is always connected to an RX inlet. As long as there is one single fault in the ring, no board will respond properly.

**Note:** If RING MASTER is missing in the printout but the other boards have indication of RING MEMBER or BUS SLAVE and there is no synchronization alarm the explanation is probably that a board that was previously MASTER has been removed by command `dect_cfp -e`, but is still in the magazine with the synchronization cables untouched.

#### 10.1.5.2

#### *ACDM, time delay values*

Verify the automatic cable delay values are within reason. Print the data with command `dect_cfp`. To get a rough estimate calculate  $\text{delay} = 5.35 \text{ ns/metre}$  can be used. Check also the board compensation need due to the delay by the board it self. 1 km copper cable is approx 40 steps, 500 m copper cable is approx 23 steps.

Use `diagnostic_print -unit CTLP -lim all -request 'Accumulated Dect sync difference on master'`. Ring master board will print accumulated delay in nano seconds. If delay is larger than 2000 nano seconds action to compensate the ring needs to be taken. `dect_cfp --compensation x` to add compensation for tex. delay caused by the board it self.

#### 10.1.5.3

#### *Verify that the ELU31 and all the base stations are working*

Print the status of all base stations in the system by keying command `dect_rfp -p`. If any of the base stations is in NOT OPERABLE state, then check ADD INFO for fault code 349.

For visual indications see chapter 5.9 Mounting of base station BS3x0 and BS3x2 on page 28 and chapter 5.2 Base stations on page 20

#### 10.1.5.4

#### *Tracing through V.24 port.*

The ELU31 board has a V.24 port which is available in the front connector X5. Any standard I/O cable can be used to connect this V.24 port to a computer. Defining the what shall be trace can now be assignee by command `diagnostic_print -unit CTLP -lim x -request 'activate slmode'`. Also `diagnostic_print -unit CTLP -lim x -request 'slspont on'` to start the spontaneous print out. And `diagnostic_print -unit CTLP -lim x -request 'slspont off'` to stop. Still is PC needed to capture the actual data.

To start tracing on ELU31 follow the below steps:

- Go to Winfiol and open a new channel. Give it an appropriate name and click on Properties button.
- A new window will pop up. Select Protocol as RS-232
- Next click on Setup option under Protocol. Select Baud rate as 38400, Flow control as none, Parity as none, Data bits as 8, Stop bits 1 and select the DTR enabled and RTS enabled under Control signal. Now press OK. Then click Open.

- Now a new window will open. If enter key is pressed, ELU31>> prompt will appear.
- To start capturing the traces, go to File menu and select Log output. Give an appropriate name for the trace file and click on create. In order to stop the traces, go to file menu, select Log output and click on close. The desired trace file is created.
- Type slmode to view the states of various modes. The state of one or more modes can be changed according to the requirement. For example, 'sl sys all' is typed for enabling the trace taking of the SYSTEM and 'sl sys off' for disabling the same. Similar procedure can be adopted for enabling or disabling the trace taking of other modes as well. For further guidance of the above, help should be typed.
- After the appropriate states of modes are selected, slspon on should be keyed to start the actual trace taking

### Example

To view the actual type of data that are going to be traced type slmode.

SYSTEM means signals between ELU31 and CTLP.

DSP means signals between DSP and DP.

RFP means signals between ELU31 and base station.

STRING means the strings saved by sprintf command in the code.

EVENT means the software event: FCV means the Frame counter value.

To change selected mode. If, for example, the user wants to enable the STRING also, the following command must be keyed: 'sl str all'. to stop tracing on STRING key: 'sl str off'.

To get more information key help.

It is recommended to key command elustat in the beginning of the trace and in the end of the trace. Typical trace sequence.

- Open log file.
- select what to trace on
- slmode (to verify)
- elustat
- do your action, or wait until fault occurs.
- elustat

#### 10.1.5.5

#### *Additional diagnostic print commands*

It is possible to read out the two 'error' logs on the ELU31 with command diagnostic\_print -request 'get alarm logs' or 'get sw alarm logs' the alarm logs can be cleared with -request 'clear alarm logs'

#### 10.1.5.6

#### *Test of radio coverage*

To be able to carry out a careful test of the radio coverage it is recommended that at least the following aids are available.

- A floor plan with all the base stations marked out and numbered and with belonging PARI values.

- Site specific document showing e.g. specific places (hot spots) and if this document is missing, contact the site planning responsible.
- A dect\_cfp printout to identify all ELU31 boards (each PARI number in the printout corresponds to an ELU31 board.)
- A dect\_rfp printout to identify all base stations (each RPN number in the printout corresponds to a base station.)
- The base station is, in contrast to the dect\_rfp printout, identified as the two last numbers in the PARI number or under the RFPI header in the DCA-Service menu in portables

### **Base station identification**

Check all base stations by walking up underneath them one by one and identify their PARI and RPN in the DCA-Service menu in the portable. There are at least two methods of identifying a base station by using the DCA-Service menu.

The easiest and most reliable method when there is no other traffic on the base station is to stand close to the base station and at the same time go off-hook/on-hook several times. The BS330 and BS340 base stations have two LEDs, one LED is indicating power and the other LED is indicating traffic. The LED indicating traffic should be switched ON and OFF when the portable is going off-hook/on-hook. The LED can switch ON after several seconds or within 1 second. It is only if the LED switches ON within 1 second at off-hook that the PP is locked to the base station. This means that if the LED is switched ON several seconds after off-hook then the PARI and RPN that are seen in the DCA-Service menu are not corresponding to the actual base station. If the latter is the case then it usually helps by switching the portable OFF and ON while standing close to the base station at the same time.

The second method of identifying a base station by using the DCA-Service menu is used during traffic. The base station LED is, more or less, continuously ON due to traffic making it almost impossible to use the method above. This second, less reliable, method is to scan through all the PARI numbers and check their signal strength (SS). The PARI list is found in the DCA-Service FP-Info menu. The PARI in the list indicating the strongest signal strength should then represent the closest base station. This method is not so reliable since it is impossible to be 100% sure.

Verify that all the base stations are placed according to the floor plan and, if possible, label the actual mounted base station. The RPN and the BPOS for an ELU31 board does not change if re initiating the ELU31 board (dect\_cfp -e/-i), but the PARI for the ELU31 board will always change.

In order to test the radio coverage it is recommended to use a portable which is set in the DCA service mode. See section DCA service. This portable can be used to verify that all base stations are operable and connected to the right ELU31.

Verify also that it is possible to carry out a location registration at every base station. Sometimes it is necessary to go off-hook in order to force the portable to move to the next base station.

#### **10.1.5.7**

#### ***Walk around test***

After finalized installation of the DECT system or when configuration changes are done i.e. adding base stations a “structured walk around test” will help out to secure that the system behaves as expected. Prerequisite DECT terminals, a floor plan with the location area of each ELU31 board and its base stations. Mobility logging active in the system. Knowledge about how to use the terminals in admin mode with DECT info and as site survey tool. The intention with the “walk around test” is to validate that the DECT system planning marry up with the actually installation when it comes to radio

coverage, roaming and hand over behavior. Procedure: walk through the installation with a terminal using the DECT info service and "HO roaming beep" enabled, indicating which ELU31 board and base station that the terminal is currently connected to. Monitor that the terminal change base stations and ELU31 boards as expected. The roaming behavior shall correspond to the planning, i.e. no unexpected roaming between boards. Confirm the sequence with the Mobility logging. Repeat the action with a terminal in speech to check the hand over behavior. In addition "Range beep" and "Error rate beep" could be used to sort out possible weak areas. Verify that the test result correspond to the customer expectation.

The number of people participating in the test will probably vary from case to case depending on the site configuration. Describe and record any faulty sound/speech.

**Note:** Walk around test can also be performed when faults have been reported in the system. Result of that walk around test is then compared with the result from last "OK" walk around test. This to check if any general disturbance has occurred.

**Table 14 Walk around test form**

Type of fault	Number of faults	Fault area
Blocked call immediately		
Blocked call after 1-2 seconds		
Dropped call immediately		
Dropped call after bad speech		
Not received call		
Faulty sound/speech		
No speech		
One way speech		
Display message No system		
Display message No access		
Any other comment:		

#### 10.1.5.8

#### *DCA service*

By the aid of a portable verify that the base stations are all working and having the expected coverage. The portables have a visual indication of signal field strength when turned ON, as well as detailed information about the air interface when set in DCA service mode or Admin menu.

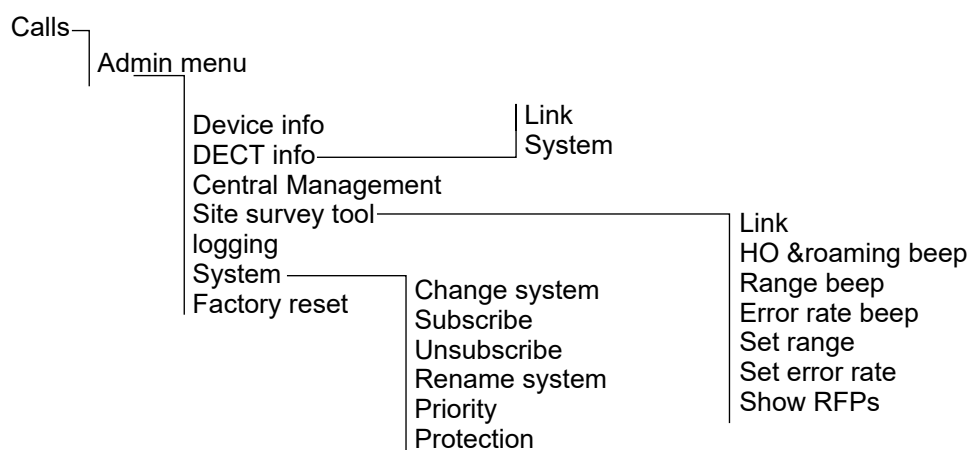
#### **Mitel 5614, DT690/DT692**

Selecting Admin menu on an idle portable

Go into DCA service menu as follows.

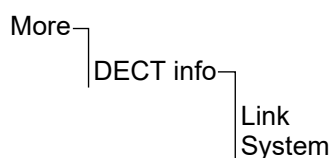
- Select Calls in the Mitel 5614, DT690/DT692 menu and press Yes.
- Select Call time and press Yes.
- Scroll right then press \*
- Scroll left twice then press \*
- Scroll left
- Admin menu appears

The DT690 is now in service mode.



To use DCA service during speech.

First must the DCA mode be activated in idle. Then do as follows to use DCA service in speech.



### Link information

This menu will show information about the current link.

C	Carrier number (A-J)
S	Time slot number (0-B)
Rp	RFP number (RPN)
Ss	Signal strength (dBm)
Error rate	Signal quality (values between 00-20)
PARI	DECT FP identifier
PARK	Octal presentation of PARI

### Fixed part information

Shows all RFPs will show information about visible FPs seen by the portable. Belonging to own system and other system.

Nr	Entry number in the RFP list. Lowest number = highest signal strength
dBm	Signal strength
RFPI	PARI + RFP number (RPN), two last digits 01-08 = RPN

**DT413, DT423**

In order to be able to use test functions, the test-func box has to be checked in the special menu entered by pressing 40022 in the Calls menu/Call time (DT413, DT 423). Remember to deactivate the test function after testing. A test function is activated by holding the 0..9 hot key for some time. This prints the test information on the display. The information will go off after timeout.

Press and hold key 1. This displays some variables used when roaming and doing hand-over. The values indicated are:

RFL	MARM roaming flag
HFL	MARQUA hand over flag
EHOS	External hand over status
HD	External hand over domain received

Press and hold key 2. This displays PARK for the subscriptions. For more than one subscription, press the key 2 more than once to display the next subscription info. The values indicated are:

line 1	8 digit PARI code
line 2	12 digit PARK code

**Measuring point.**

Mark on the map the location of the measuring point and not it in table Measuring point data. Preferably use two portable. Of the same type used on site. Fill in the data. Alternative is to take a picture of the map with the point marked and another picture of the two displays.

**Table 15 Measuring point data**

Link info				
Floor map	CS stable?	Rp	SS	Error rate

**Table 16 Enter data about seen PARIs**

		Link info		
		SS	nRFP	Status
0:pari				
1:pari				
2:pari				

3:pari				
4:pari				
5:pari				
6:pari				
7:pari				
8:pari				
9:pari				
10:pari				
11:pari				
12:pari				

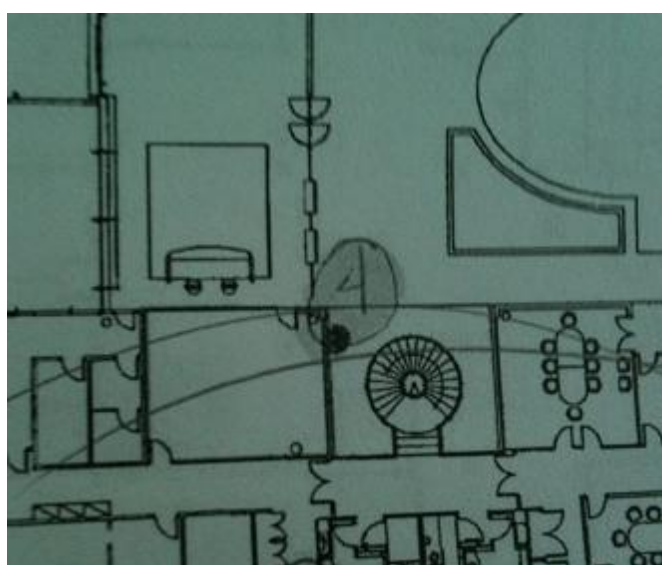


Figure 31: Marked position on the map.

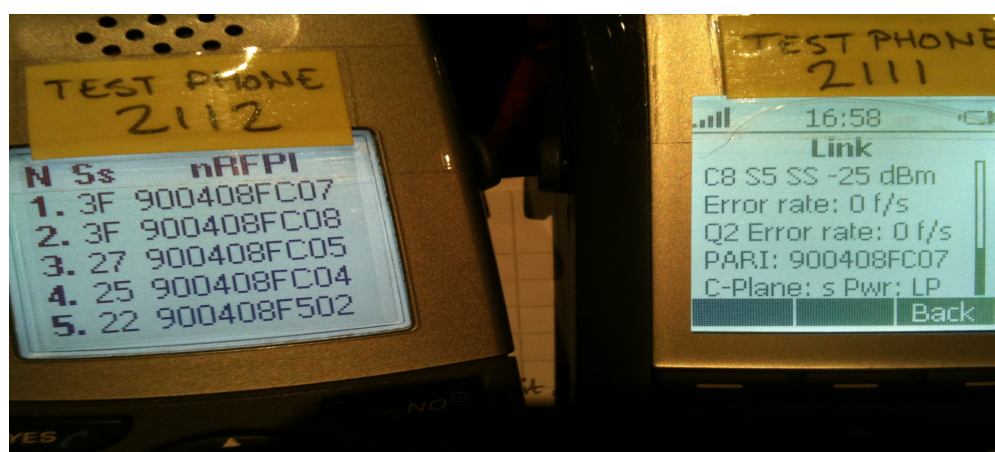


Figure 32: Measuring data