# 2MBPS PRIMARY DIGITAL MULTIPLEXING EQUIPMENT (PUNCOM)

## 1. Introduction

Digital communication is central nervous system of modern telecommunication. No other technology has had such a worldwide impact of putting people in touch around the world through voice, video, data etc. Fundamentally a digital message is nothing more than an ordered sequence of symbols provided by a discrete information source.

Most of the future expansions of telecommunication network are being planned around digital telephone exchanges linked with digital transmission system. Digital transmission system generally give superior performance over analog system as well as provide an ideal channel for data communication and compatibility with digital computing techniques.

The equipment used for multiplexing and de-multiplexing of digital signals can be defined as digital multiplexer equipment.

This handbook covers brief description of Pulse Code Modulation, Installation, Maintenance and trouble shooting of Primary Digital Multiplexing Equipment according to RDSO's Specification No.TC: 68/2004.

## 1.1 Pulse Code Modulation (PCM)

Primary Digital Multiplexer works on Pulse Code Modulation principles. Therefore it is beneficial to explain the PCM system in brief.

Pulse Code Modulation is adopted for digital multiplexing of channels. Analog signals are converted in to a digital signal and such output in a form of a number of channels are multiplexed by Time Division Multiplexing to form a digital base band.

Following stages are involved in Pulse Code Modulation:

### Filtering

The incoming analog VF signal is band limited to 300 Hz to 3400 Hz by a low pass filter.

### Sampling

The band-limited signal is sliced at regular intervals of time to generate pulses of the continuous analog wave.

The sampling theorem stipulates a minimum number of samples. According to Nyquest theorem the sampling rate should be equal to or higher than the double of the highest signal frequency present in the band limited analog signal i.e. $f_s \geq 2f_{max}$.

To allow a margin for filter performances the band limited frequency can be taken as 4 KHz. Thus the sampling frequency will be 8 KHz. Hence the time period of sampling would be equal to 1/8000 second

(i.e.125 microseconds). When a number of channels are to be sampled, all the channels are sampled sequentially on time division basis. If N channels are to be sampled then the time available for sampling one channel is equal to 125/N microseconds. Samples of various channels are transmitted in sequence on the common transmission path.

**Quantising**

The process of sampling generates PAM (Pulse Amplitude Modulation) signals. To convert the PAM signal in to Pulse Code Modulation signal, the discrete amplitude levels of the samples are first quantified with reference to a standard amplitude scale. This process is called quantisation. The practical PCM systems use 8-bit code with $2^8 = 256$ levels (128 levels each in the positive and negative swing). In this the signal to noise ratio for weaker signals will be poorer when compared with stronger signals. Hence this causes equal "Quantising error" for all channels.

**Encoding**

Conversion of analog samples into a binary signal is called 'encoding'. To represent 256 steps an 8-bit code is used.

## 1.2 30 Channel PCM System

Multiplexing of 30 channel PCM system consist of the Frame and Multiframe stages.

**Frame**

The duration of a frame is 125 microseconds. This frame has 32 time slots TS 0 to TS 31. Two additional time slots are inserted. One for signalling information (TS 16) and the other (TS 0) for synchronization information. Time slots TS 1 to TS 15 and TS 17 to TS 31 are for 30 speech channels.

**Multiframe**

It consists of 16 frames. Signalling information for two channels are inserted in TS 16 of each frame. The additional frame is used to carry the MFAW (Multiframe Alignment Word). The duration of multiframe is 2 milliseconds.

**Line Coding**

The binary signal with its DC component is unsuitable for its transmission on transformer and AC coupled transmission lines. Hence the binary code is modified to suit the characteristics of the line. One popular code called HDB 3 (High Density Bipolar) is employed.

**Bit Rate**

| | |
|---|---|
| Total numbers of bits/frame | = 32 X 8 = 256 |
| No. of frames/sec. | = 8000 |
| Total Number of bits/sec. | = 8000 X 256 |
| | = 2,048,000 |
| | = 2048 K Bits |
| | = 2.048 M Bits. |

## 2 Description

In Indian Railways, digital multiplexers of various Firms are being used which are working on same principal. In this handbook we will describe a typical digital multiplexer manufactured by M/s Punjab Communication limited VMX-0100 based on RDSO Specification No.TC 68/2004.

### 2.1 Primary Digital Multiplexer (VMX-0100)

The VMX-0100 is 2Mbps, 30 Channel E1, highly flexible Add-Drop multiplexer that provides full range of plain old telephone system (POTS) and digital data services to subscribers located at different locations, requiring to interconnect and establish a voice and data network over an E1 link.

The VMX-0100 offers an excellent flexibility on the 19-Inch Shelf & choice of transmission medium over which it may be deployed. The transmission medium can be either ordinary copper cable pairs or optical fibre cables or wireless, for deploying voice and data services. .

The system supports a full range of voice interfaces with user programmable speech output. These includes:

- 2 wire analog voice interface (FXO, FXS) for subscriber dial-up applications.
- 2 wire and 4 wire E&M interface(s) for connecting large PABX(s), or, for inter-connecting analog telephone switches.
- 2 wire Loop Incoming & Loop Outgoing for connecting large PABX(s), or, for inter-connecting analog telephone switches.

- Configuring any two voice (FXS - FXS) channels to provide Hotline facility.

  The design of VMX-0100 is modular and most user interfaces come with a modularity of four channels per card.

## 2.2 Salient Features

- Provides up to 40 Voice/Data ports with two E1 streams.
- Provides variety of Voice & Data Interfaces.
- Supports ISDN Digital Subscriber Line (IDSL).
- Supports Nx64 synchronous Data, with Nmax=30.
- Provision for 18 3/4 party conferencing, of which maximum 8 conferences can be 4-party.
- Fully programmable voice & data ports locally or remotely through Network Management System.
- Comprehensive test & diagnostics features.
- Loop protection feature for increased Network reliability.
- Standard 19" Rack Mountable unit.
- Powerful Network Management System for monitoring and network control
- Compliant with all relevant ITU-T (CCITT) recommendations
- Channel assignment independent of slot position in the sub-rack.
- Supports Software Download.
- Optional redundant DC-DC Converter.

## 2.3 Applications

The VMX-0100 can be used in various voice, data or mix applications. The application profile of VMX-0100 is shown in figures given below.

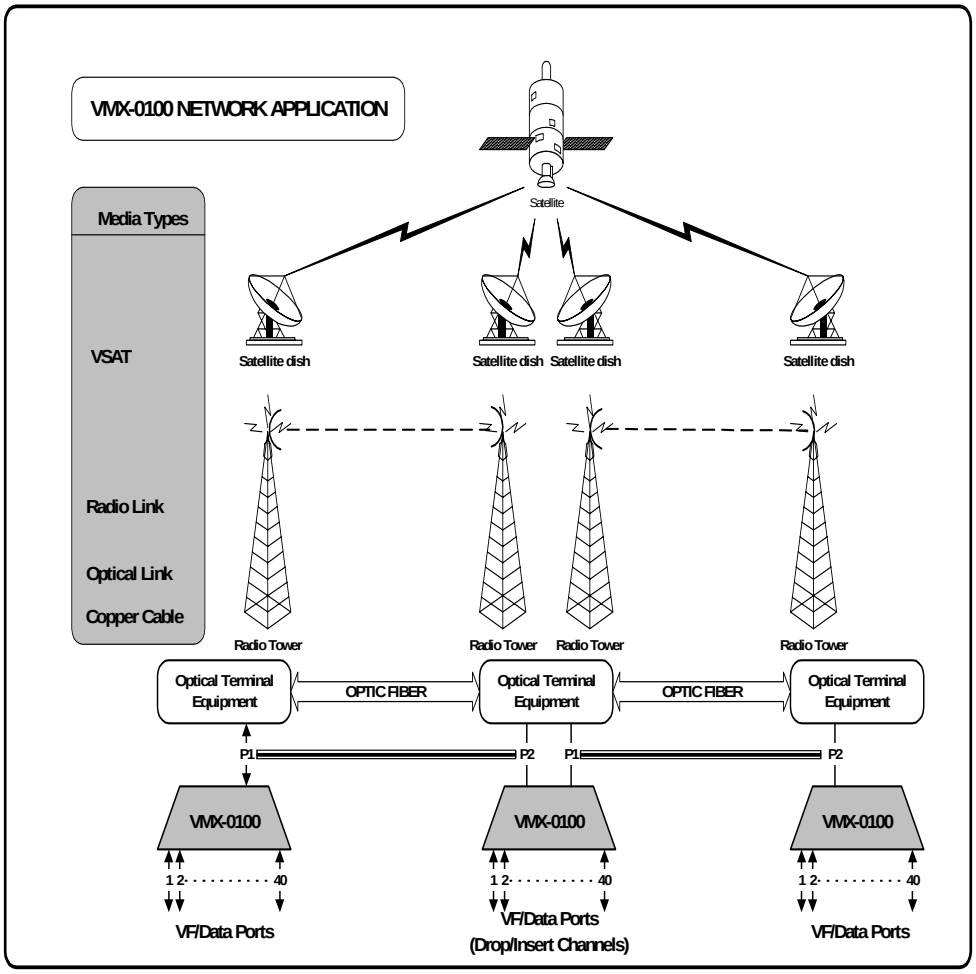



**Figure 1**

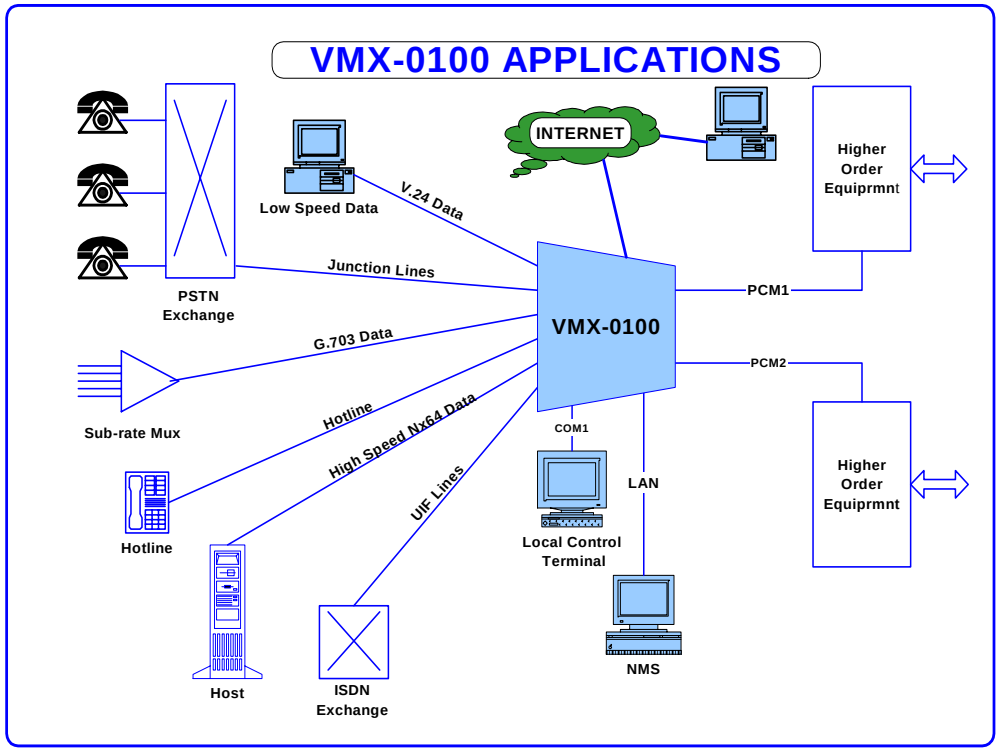



**Figure 2**

- As a point to point multiplexer for voice and data transmission on basic primary rate E1 trunk of 2.048 Mbps.
- As a tail end primary multiplexer in a digital transmission network.
- As an Add-Drop Multiplexer on a 2.048 Mbps PCM trunk.
- As a subscriber Multiplexer for a 2.048 Mbps primary rate user.

- As a customer premises PCM Multiplexer for 2.048 Mbps E1 trunk user for multiplexing a variety of voice, data and other traffic.
- Supervisory Control & Data Acquisition application.
- High-speed data ports for digital communication links providing Leased Lines access to Internet Service Provider (ISPs) with speeds ranging from 64Kbps upto 2048Kbps.
- Micro-Cellular infrastructure applications for providing cell-switch connectivity
- Wide area networking
- Internet Access over POTS lines.

## 3. Equipment Parts

VMX-0100 ADD/DROP MULTIPLEXER equipment comprises a sub-rack to accommodate various plug-in cards. The sub-rack is designed to fit in standard 19-inch frame with fixing on the front panel. The temperature limits to be observed for transport and storage are -5°C to 60°C. The following table shows the equipment components:

| **Equipment components** | **Quantity** |
|---|---|
| 6U sub-rack | 1 |
| Power Supply Unit Card | 2 |
| TME Card | 1 |
| Loop Protection Card | 1 ( Depends on user requirement) |
| Main Distribution Frame | 1 |
| Bay Top Panel | 1 |
| Heat-Vent | 1 |
| Line Cards | Max-10 (Number of Line cards depends on user requirement. |

## 4. Installation

VMX-0100 is housed in a standard **6U** sub-rack conforming to **DIN/19" Standard**. The only fastening and support points on these racks are situated on the front panel of the frame, on perforated brackets. The details of the sub-rack are given below.

Frame Height = 265mm
Width = 483mm
Depth = 260mm

### 4.1 Key Features

i) Made of aluminium extrusions. Side panels made of aluminium sheet of thickness 2.5mm.

ii) Centre supporting extruded stiffener bar in 6U sub-rack for supporting motherboard.

| CONSTITUENT | COLOUR |
|---|---|
| Frame | White Alodined |
| Mounting Bracket | Siemens's Grey Powder Coated Semi Gloss |
| Guide Rail | Made of glass filled nylon (GFN) / Noril FR Grade / Aluminium |

**Dimensions of Motherboard:**

Width : 426.72mm
Height : 261.85mm
Thickness : 1.6mm

**Dimensions of each card:**

| | | |
|---|---|---|
| Depth | : | 220mm |
| Height | : | 233.35mm |
| Thickness | : | 1.6mm |

## 4.2 Initial requirements and site considerations

There are initial requirements to be fulfilled before system installation as system operation depends on them. Proper Site selection is must for ease of system operation and fulfillment of other requirements. The following tasks must be completed in advance:

The rack where the equipment will be fixed must be properly grouted on the floor of the equipment room.

The Main Distribution Frame (MDF) must be placed properly.

The Bay Top Panel (BTP) must be placed at the top of rack, as it is convenient to connect supply lines (from runway) at the top of the rack.

Make sure that general condition of the equipment room is not damp.

## 4.3 Tools requirement:

The following tools are required to install the equipment:

Medium size screwdriver (Star head, Plain head etc.), Wire stripper, Cutter, Soldering Iron.

## 4.4. Power Supply Requirements

### Voltage Supply

**VMX-0100** is powered by a direct voltage supply. The equipment is guaranteed to work properly with a voltage supply that meets the following minimum technical specifications:

Nominal Voltage: **(-) 48V DC**
Nominal Voltage field: **(-) 36V DC to (-) 72V DC**

## 4.5 Power Consumption:

The current consumption of equipment fully fitted at nominal voltage of **–48V** is **60W** (typically).

## 4.6 Connections

### Ground Provision

The frame of VMX-0100 equipment must be connected to one of 2 ground strips that run down from rack's top to bottom. The wire used to connect equipment to ground strip must be at least 18 gauge wire. It is recommended that the ground screw on the system rear panel be used to ground the system directly to the equipment rack ground bus.

### Inter-connections

Following inter-connections must be ensured before initial powering up of VMX-0100 equipment:

(i) Connect power cable from Bay Top Panel to equipment using 4-Pin Power connectors provided on the rear panel (The mating plugs are pre installed on rear panel). The power input terminal is located on the right hand side of rear panel.

(ii) Connect alarm cable from Bay Top Panel to equipment using 6-Pin Wafer connectors provided on the rear panel.

(iii) Connect VF cables from Main Distribution Frame (MDF) to equipment using Dual 2 X 7 Round cable connector. The cables should be connected to corresponding slots on the MDF and equipment (Slot numbers are also written on VMX as well as MDF for identification purposes).

## 5. Card Installation

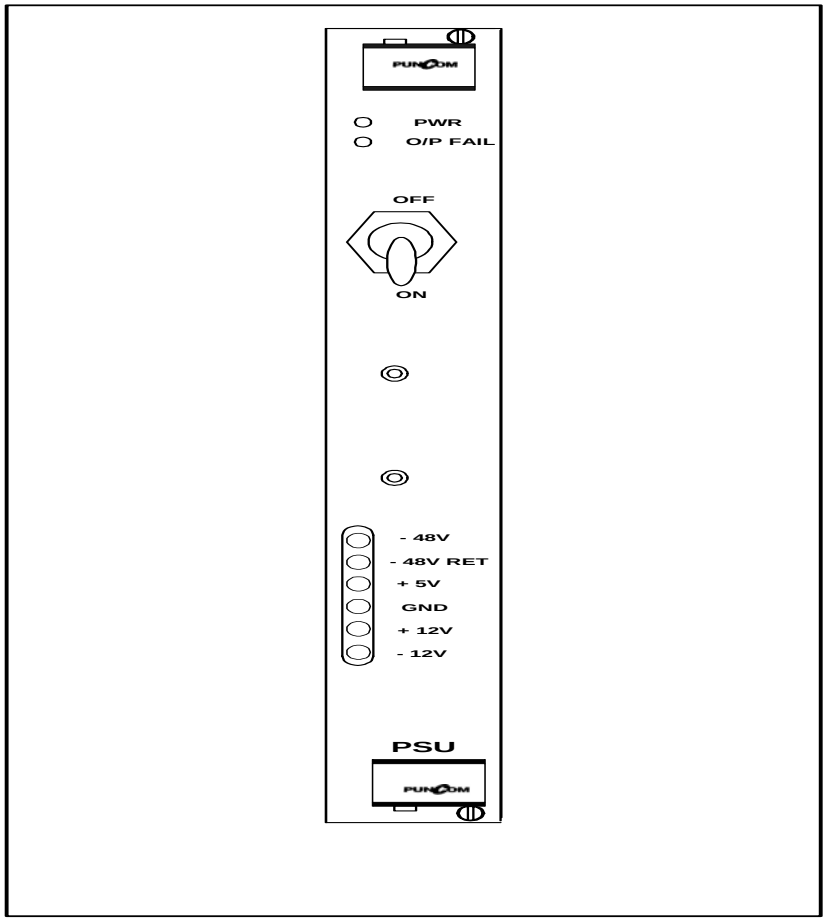
Various cards are installed before powering up VMX-0100 equipment. Initially, specific cards are installed in some slots. These cards are required for system power-up and are inserted in slots as shown below:

| Card type | Slot no. |
|---|---|
| Power Supply Card | 1 |
| Power Supply Card | 2 |
| TME | 3 |

Line cards are installed, as per requirements and maximum no of line cards that can be installed in VMX-0100 are 10.

## 5.1 Power Supply Card

**(i) Front Panel** Front panel is shown in figure below:



The following table describes the front panel:

| **ITEM** | **DESCRIPTION** |
|---|---|
| ON/OFF SWITCH | Turns the power ON/OFF. UP Position OFF, Down position ON. |
| Power | Green LED glows when –48V input is present. |
| Output Fail LED | Red LED lights when any of the output voltages i.e. +5V, +12V or –12V fail. |
| Monitoring points | Monitoring points for input -48V, -48V return, +5V, Ground, +12V & -12V |
| **Monitoring points are un-protected. Thus monitored carefully** | |

**(ii)** **Header Settings :** There are no user installable headers in the Power Supply Card

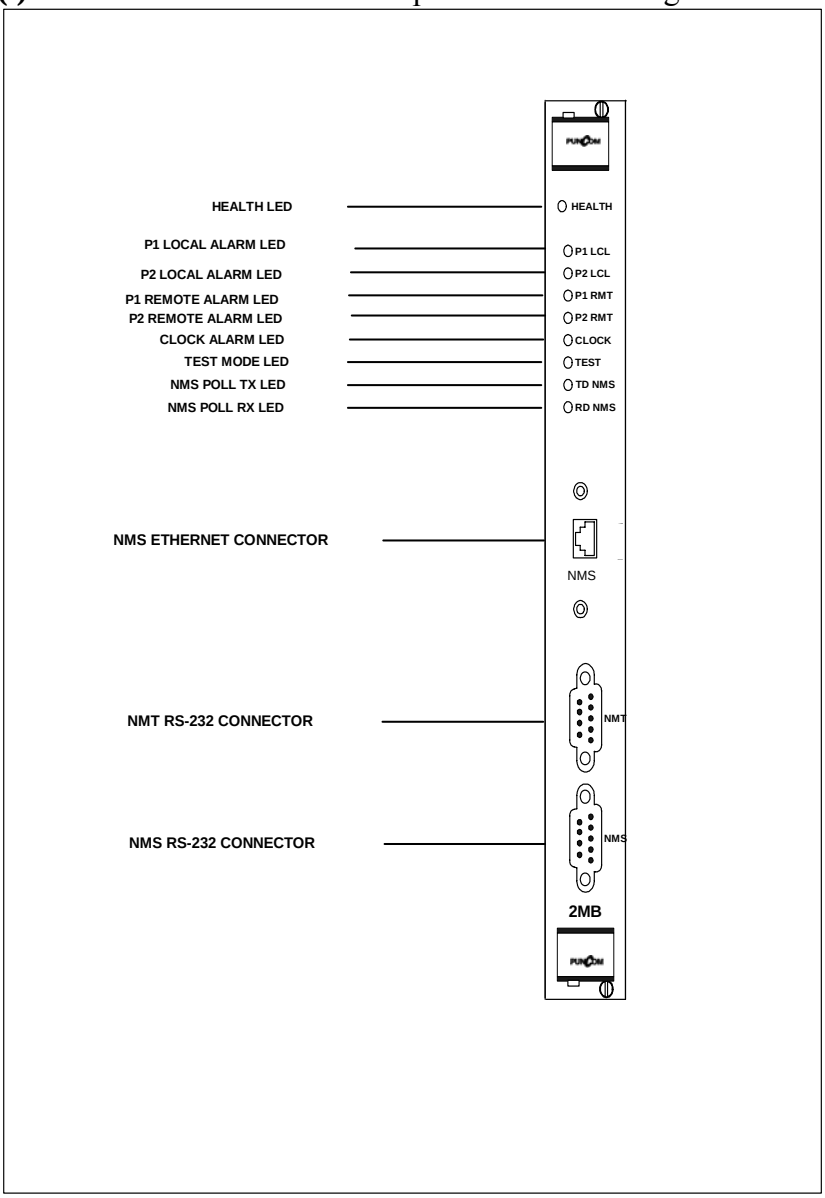
**(iii)** **Fuses :** The Power Supply Card includes one fuse, which is located near the Euro connector J1.

**(iv)** **Installation :** Set the ON/OFF Switch on the card to OFF position. Insert the card in slot no. 1 or 2 & lock it in position in the enclosure with the help of ejectors.

Make sure that ON/OFF switch on the Power Supply Card is in OFF position, before inserting/removing the card in slot. Also make sure that power switch on the PDP for the corresponding system is set to off for removing/inserting the power supply card. Inserting/removing the card in ON condition may damage the power supply connectors.

## 5.2 TME Card

**(i) Front Panel** The front panel is shown in figure below:



The following table describes the front panel:

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| HEALTH | Blinking (Green/Red)<br>Red ON | Card is working OK.<br>Card hardware has gone faulty. |
| P1 LCL | ON<br>Fast Blinking<br>Fast Blinking<br>Fast Blinking<br>Slow Blinking<br>Slow Blinking | PCM1 Loss of Signal<br>PCM1 Frame Sync. Loss<br>PCM1 Multiframe Sync. Loss<br>PCM1 CRC Frame Sync. Loss<br>PCM1 error rate > $E10^3$<br>PCM1 error rate > $E10^6$ |
| P2 LCL | ON<br>Fast Blinking<br>Fast Blinking<br>Fast Blinking<br>Slow Blinking<br>Slow Blinking | PCM2 Loss of Signal<br>PCM2 Frame Sync. Loss<br>PCM2 Multiframe Sync. Loss<br>PCM2 CRC Frame Sync. Loss<br>PCM2 error rate > $E10^3$<br>PCM2 error rate > $E10^6$ |
| P1 RMT | ON<br>Slow Blinking<br>Slow Blinking<br>Slow Blinking | PCM1 Receive AIS (All 1s)<br>PCM1 Receive Remote FSL<br>PCM1 Receive Remote MFSL<br>PCM1 Receive AIS in TS16 |
| P2 RMT | ON<br>Slow Blinking<br>Slow Blinking<br>Slow Blinking | PCM2 Receive AIS (All 1s)<br>PCM2 Receive Remote FSL<br>PCM2 Receive Remote MFSL<br>PCM2 Receive AIS in TS16 |
| CLOCK | Blinking<br>ON | Slips<br>Selected Clock Fail |

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| TEST | ON | Card in diagnostics or Loop back Mode |
| TD NMS | Blinking | NMS Polls Transmitted |
| RD NMS | Blinking | NMS Polls Received |
| NMS Ethernet Connector | RJ-45 Connector for connection to NMS on LAN. | |
| NMT Connector | DB9 female, for connection to NMT This port is configured as DCE. | |
| NMS RS-232 Connector | DB9 female, for connection to PC-Based NMS, This port is configured as DCE. | |

### ii) Header Settings

There are only five user selectable headers, rest all the headers are factory set. The settings of factory set headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

### (a) User Settable Headers

| **S.No.** | **Header Name** | **Position** | **Remarks** |
|---|---|---|---|
| 1. | H1 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM1 Output impedance selection. Default 120Ω. |
| 2. | H4 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM1 Input impedance selection. Default 120Ω. |
| 3. | H5 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM2 Output impedance selection. Default 120Ω. |
| 4. | H9 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM2 Input impedance selection. Default 120Ω. |

| S.No. | Header Name | Position | Remarks |
|---|---|---|---|
| 5. | H2 & H3 | 1-2<br>2-3 | PCM1 Output Connected<br>PCM1 Output Disconnected |
| 6. | H6 & H8 | 1-2<br>2-3 | PCM2 Output Connected<br>PCM2 Output Disconnected |
| 7. | H22 | 1-2 for 120Ω<br>2-3 for 75Ω | External clock impedance selection. Default 75Ω. |

**(b) Factory Set Headers**

| S. No | Header Name | Position | Remarks |
|---|---|---|---|
| 1. | H16 | 1-2 | Watchdog strobe selection |
| 2. | H7 | 1-2 TDM-FE2<br>2-3 TDM4 | Default setting is TDM4 |
| 3. | H10 | 1-2 TDM-FE2<br>2-3 TDM4 | Default setting is TDM4 |
| 4. | H19 | 1-2 | RS-485 Port Mode |
| 5. | H20 | 1-2 | RS-485 Port Mode |
| 6. | H24 | Short | Gain selection for clock |
| 7. | H25 | C16<br>2-3 C8 | Default setting is C8 |
| 8. | H26, H27 | Open | Unused |
| 9. | H11,H12,H14, H15, H17, H19, H20, H21 & H23 | Open | Testing |

**(iii) Terminations**

**(a) NMT DB9 Connector Details**

| PIN NO. | SIGNAL NAME | SOURCE |
|---|---|---|
| 1. | CD | NMT |
| 2. | RxD | NMT |
| 3. | TxD | VMX-0100 |
| 4. | DTR | VMX-0100 |
| 5. | GND | COMMON |
| 6. | DSR | NMT |
| 7. | RTS | VMX-0100 |
| 8. | CTS | NMT |
| 9. | RI | VMX-0100 |

**(b) NMS DB9 Connector Details**

| PIN NO. | SIGNAL NAME | SOURCE |
|---|---|---|
| 1. | NC | - |
| 2. | RxD | NMT |
| 3. | TxD | VMX-0100 |
| 4. | NC | - |
| 5. | GND | VMX-0100 |
| 6. | NC | - |
| 7. | NC | - |
| 8. | NC | - |
| 9. | NC | - |

**(c) Termination Signal Details**

When installed in designated slot (slot No 2), the terminations are available on the various connectors available on the rear of the motherboard. The signal detail of these connectors is as under:

**Connector Designation : J3**
**Connector Type : 64-pin Euro male**

| **PIN** | **A** | **C** | **PIN** |
|---|---|---|---|
| 1. | --- | --- | 1. |
| 2. | PCM1 IN (A) | PCM1 OUT (A) | 2. |
| 3. | GND | GND | 3. |
| 4. | PCM1 IN (B) | PCM1 OUT (B) | 4. |
| 5. | GND | GND | 5. |
| 6. | PCM2 IN (A) | PCM2 OUT (A) | 6. |
| 7. | GND | GND | 7. |
| 8. | PCM2 IN (B) | PCM2 OUT (B) | 8. |
| 9. | --- | --- | 9. |
| 10. | EXT. CLOCK IN (A) | EXT. CLOCK OUT (A) | 10. |
| 11. | GND | GND | 11. |
| 12. | EXT. CLOCK IN (B) | EXT. CLOCK OUT (B) | 12. |
| All other pins should not be used. | | | |

**Connector Designation : J34**
**Connector Name : Alarm Extension**
**Connector Type : DB 9F**

| PIN | Signal |
|---|---|
| 1. | -48V IN |
| 2. | MJR_NC |
| 3. | MJR_C |
| 4. | MJR_NO |
| 5. | GND |

| PIN | Signal |
|---|---|
| 6. | MIN_NC |
| 7. | MIN_C |
| 8. | MIN_NO |
| 9. | GND |

**Connector Designation : J32,J33**
**Connector Name : NMS**
**Connector Type : DB 15 F**

| PIN | Signal |
|---|---|
| 1. | GND |
| 2. | NMS_TXA |
| 3. | NMS_RXA |
| 4. | --- |
| 5. | --- |
| 6. | --- |
| 7. | GND |
| 8. | --- |

| PIN | Signal |
|---|---|
| 9. | NMS_TXB |
| 10. | NMS_RXB |
| 11. | --- |
| 12. | PP5V |
| 13. | --- |
| 14. | --- |
| 15. | --- |

**Connector Designation : J31 , J43**
**Connector Name : Power Input**
**Connector Type : 4-pin Male**

| PIN | Signal |
|---|---|
| 1. | -48V IN |
| 2. | -48V IN |

| PIN | Signal |
|---|---|
| 3. | -48V_RET |
| 4. | -48V_RET |

**Connector Designation : J42**
**Connector Name : -48V Input (SPEECH)**
**Connector Type : 4-pin Male**

| PIN | Signal |
|---|---|
| 1. | -48V IN |
| 2. | -48V IN |

| PIN | Signal |
|---|---|
| 3. | -48V_RET |
| 4. | -48V_RET |

**Connector Designation : J29**
**Connector Name : External Clock IN**
**Connector Type : BNC**

| PIN | Signal |
|---|---|
| 1. | EXTC_IN_A |

| PIN | Signal |
|---|---|
| 2. | EXTC_IN_B |

**Connector Designation : J30**
**Connector Name : 2Mb Clock Out**
**Connector Type : BNC**

| PIN | Signal |
|---|---|
| 1. | CLKOUT_A |

| PIN | Signal |
|---|---|
| 2. | CLKOUT_B |

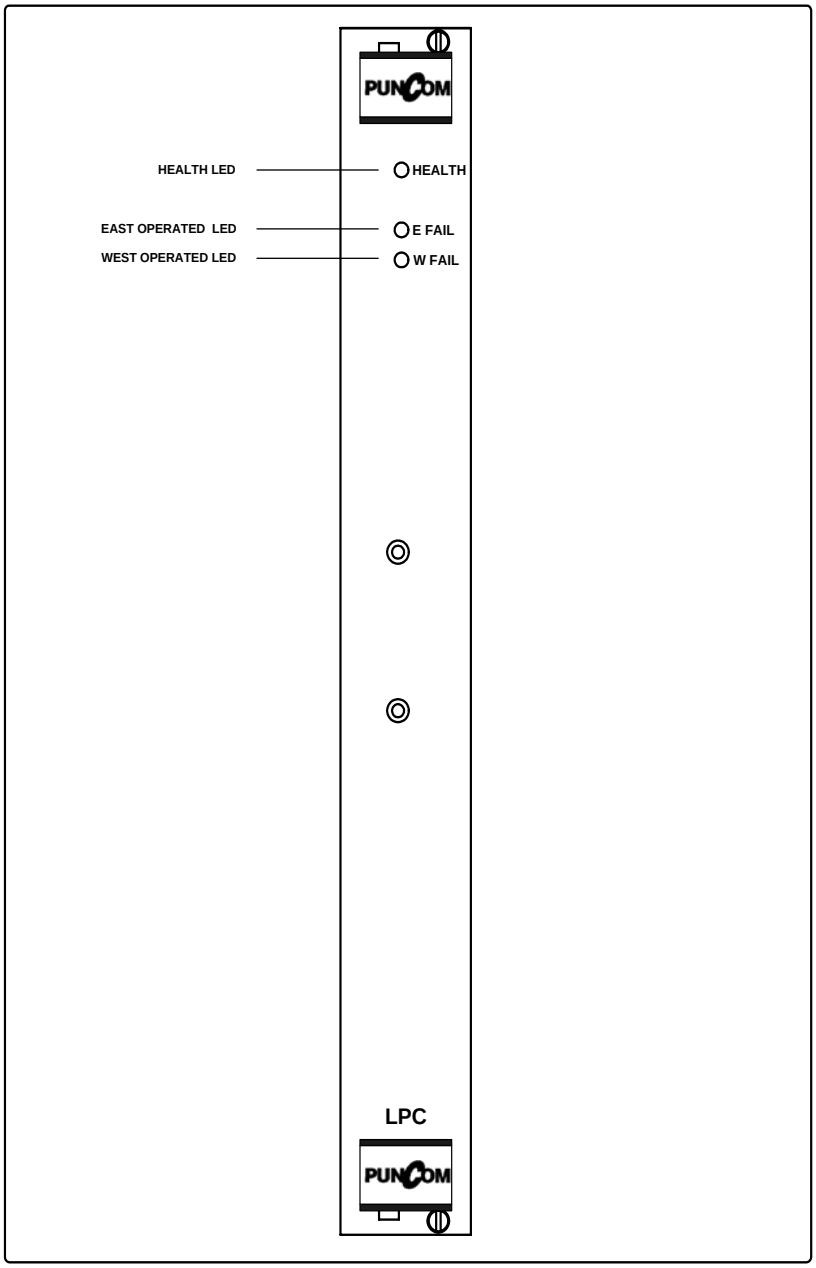
### (iv) Installation

- Switch off the Power Supply, if ON.
- Set the headers for 75 Ω or 120 Ω terminations as per the installation plan.
- Insert TME Card in Slot No. 3 & lock it with the help of ejectors.
- If PDP switch for this system is ON, then immediately Major Alarm will come ON and buzzer will sound.
- Press ACO switch to cut Audio Alarm. ACO indicator should glow in this case.
- If no audio alarm is generated check ON/OFF switch on PDP & wiring Alarm Extension Connector.

## 5.3 LPC Card

### (i) Front Panel

The front panel of LPC Card is shown in figure below:


PUNCOM
HEALTH LED
HEALTH
EAST OPERATED LED
E FAIL
WEST OPERATED LED
W FAIL
LPC
PUNCOM

The following table describes the front panel:

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| HEALTH | Green ON<br>Red ON | Card is working OK.<br>Card hardware has gone faulty. |
| E Fails | ON | East link connected to PCM1 is fail |
| W Fails | ON | West link connected to PCM1 is fail |

### (ii) Header Settings

There is no user settable header in this card. All the headers are factory set. The settings of these headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| **S.No.** | **Header** | **Position** | **Remarks** |
|---|---|---|---|
| 1. | H1 | 1-2 | Watchdog strobe selection. |
| 2. | H2 | --- | System resetting. |
| 3. | H3-6 | --- | For future use. |
| 4. | H7 | 1-2 | IP control. |
| 5. | H8 | Short | Grounds shorting. |

### (iii) Termination Signal Details

When installed in designated slot (slot No 4), the terminations are available on the various connectors available on the rear of the motherboard. The signal detail of these connectors is as under :

**Connector Designation : J5**
**Connector Type : 64-pin Euro male**

| PIN | A | C | PIN |
|---|---|---|---|
| 1. | --- | --- | 1. |
| 2. | PCM1 IN (A) | PCM1 OUT (A) | 2. |
| 3. | GND | GND | 3. |
| 4. | PCM1 IN (B) | PCM1 OUT (B) | 4. |
| 5. | GND | GND | 5. |
| 6. | PCM2 IN (A) | PCM2 OUT (A) | 6. |
| 7. | GND | GND | 7. |
| 8. | PCM2 IN (B) | PCM2 OUT (B) | 8. |
| 9. | --- | --- | 9. |
| 10. | PCM3 IN (A) | PCM3 OUT (A) | 10. |
| 11. | GND | GND | 11. |
| 12. | PCM3 IN (B) | PCM3 OUT (B) | 12. |
| 13. | GND | GND | 13. |
| 14. | PCM4 IN (A) | PCM4 OUT (A) | 14. |
| 15. | GND | GND | 15. |
| 16. | PCM4 IN (B) | PCM4 OUT (B) | 16. |
| 17. | --- | --- | 17. |
| 18. | PCM5 IN (A) | PCM5 OUT (A) | 18. |
| 19. | GND | GND | 19. |
| 20. | PCM5 IN (B) | PCM5 OUT (B) | 20. |
| 21. | GND | GND | 21. |
| 22. | PCM6 IN (A) | PCM6 OUT (A) | 22. |
| 23. | GND | GND | 23. |
| 24. | PCM6 IN (B) | PCM6 OUT (B) | 24. |
| 25. | --- | --- | 25. |
| All other pins are not connected. | | | |

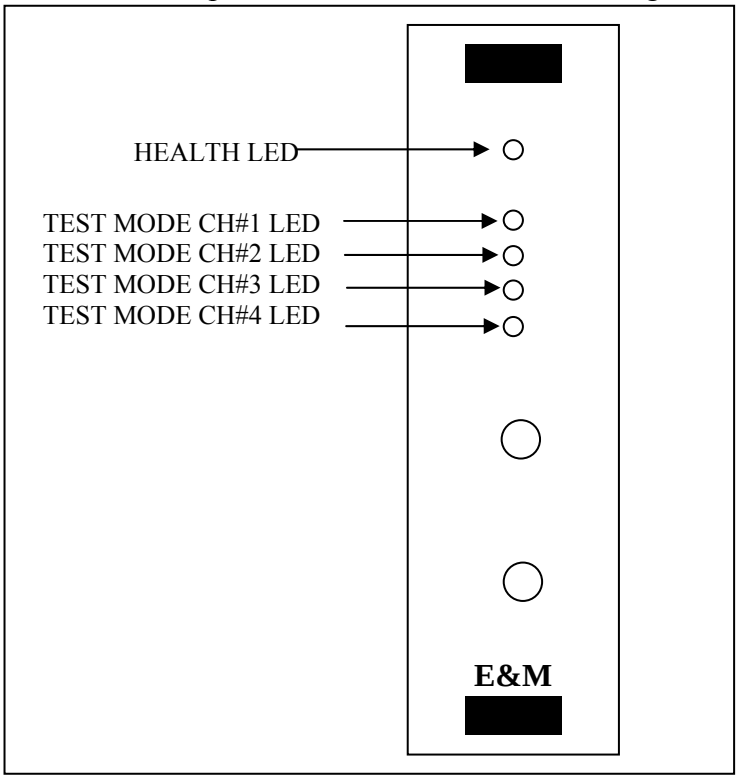
**(iv) Installation**

- Switch off the Power Supply, if ON.
- Ensure that TME card is already inserted in its designated slot.
- Insert LPC Card in Slot No. 4 & lock it with the help of ejectors.
- The health LED will glow green when system is switched ON.

## 5.4 E&M Card

**(i) Front Panel**

The front panel of E&M Card is shown in figure below:



The following table describes the front panel:

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| Health | Green ON<br>Red ON<br>Blinking | Card is working OK.<br>Card hardware has gone faulty.<br>Card's hardware is OK but it is not configured by main 2MB card. |
| Test1 | ON | Channel 1 is in test & diagnostics mode |
| Test2 | ON | Channel 2 is in test & diagnostics mode |
| Test3 | ON | Channel 3 is in test & diagnostics mode |
| Test4 | ON | Channel 4 is in test & diagnostics mode |

**(ii) Header Settings**

There are no user selectable headers; all the headers are factory set. The settings of factory set headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| **S.No** | **Header Name** | **Position** | **Remarks** |
|---|---|---|---|
| 1. | H1 | Short | SPROM program enable/disable |
| 2. | H2 | 1-2 | Watchdog strobe selection. |
| 3. | H3 | 1-2 | System resetting. |
| 4. | H4,6,8,10 | open | For future use. |
| 5. | H12 | 1-2 | IP control. |
| 6. | H14 | 1-2 | Programming supply selection |

**(iii) Signalling Codes**

(a) The signalling codes transmitted for various M lead conditions are as given below:-

| Signalling State | Transmitted Bits | | | |
|---|---|---|---|---|
| | a**r** | b**r** | c**r** | d**r** |
| M Lead Open | 1 | 0 | 0 | 1 |
| M Lead Gnd | 0 | 0 | 0 | 1 |

(b) The received signalling codes are interpreted in the following way.

| **Signalling State** | **Received Bits** | | | |
|---|---|---|---|---|
| | a**b** | b**b** | c**b** | d**b** |
| Open on E Lead | 1 | x | X | x |
| Gnd on E Lead | 0 | x | X | x |

**(iv) Termination Signal Details**

When installed in designated slot, the terminations are available on the various connectors available on the rear of the motherboard. The signal detail of these connectors is as under:

**Connector Designation : J7,9,11,13,15,17,19,21,23,39**
**Connector Type : 96-pin Euro male**

| **PIN** | **A** | **B** | **C** | **PIN** |
|---|---|---|---|---|
| 1. | --- | --- | --- | 1. |
| 2. | 2W/4W RX1 A (OUT) | NC | 2W/4W RX1 B (OUT) | 2. |

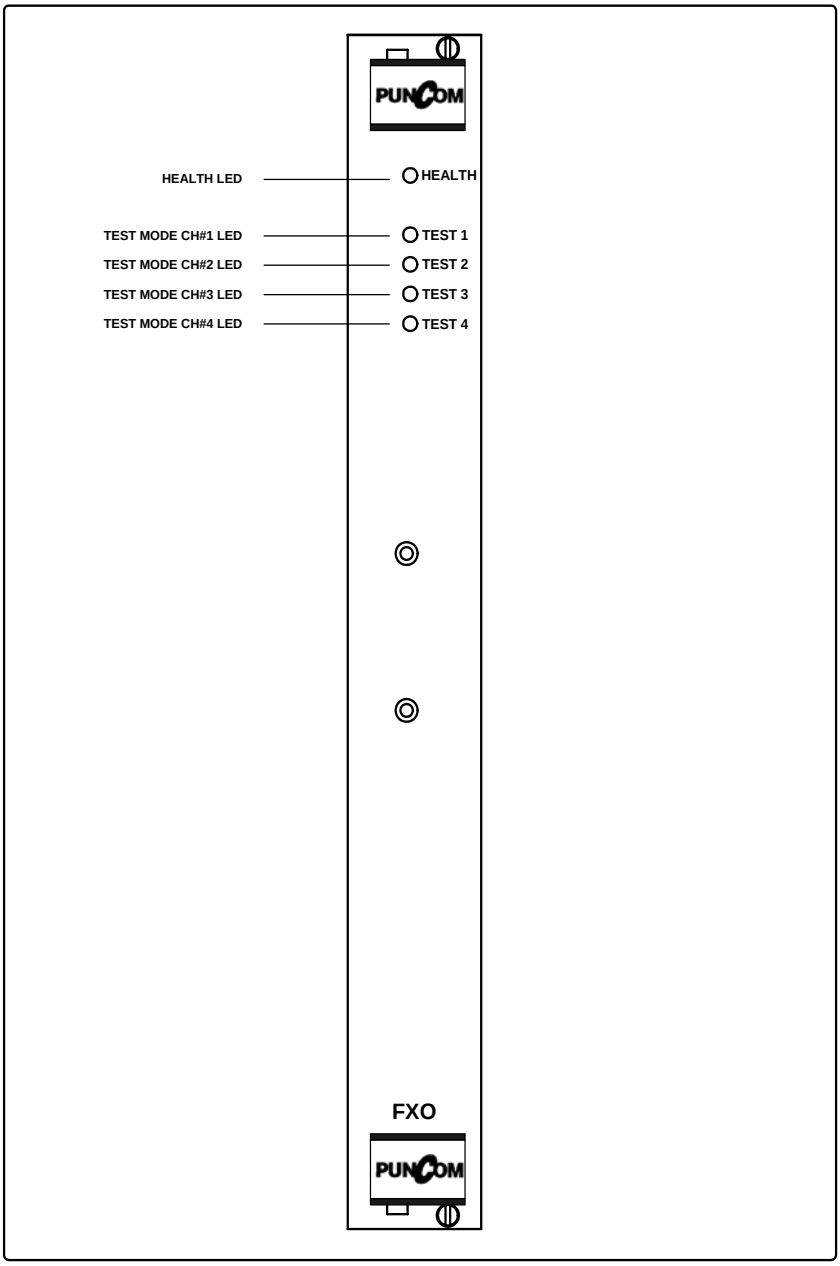
| PIN | A | B | C | PIN |
|---|---|---|---|---|
| 3. | 4W TX1 A (IN) | NC | 4W TX1 B (IN) | 3. |
| 4. | E1 | NC | M1 | 4. |
| 5. | 2W/4W RX2 A (OUT) | NC | 2W/4W RX2 B (OUT) | 5. |
| 6. | 4W TX2 A (IN) | NC | 4W TX2 B (IN) | 6. |
| 7. | E2 | NC | M2 | 7. |
| 8. | NC | NC | NC | 8. |
| 9. | --- | --- | --- | 9. |
| 10. | 2W/4W RX3 A (OUT) | NC | 2W/4W RX3 B (OUT) | 10. |
| 11. | 4W TX3 A (IN) | NC | 4W TX3 B (IN) | 11. |
| 12. | E3 | NC | M3 | 12. |
| 13. | 2W/4W RX4 A (OUT) | NC | 2W/4W RX4 B (OUT) | 13. |
| 14. | 4W TX4 A (IN) | NC | 4W TX4 B (IN) | 14. |
| 15. | E4 | NC | M4 | 15. |
| 16. | NC | NC | NC | 16. |
| All other pins are not connected | | | | |

**(v) Installation**

- Slide the card in required slot & lock in position with the help of ejectors.
- Configure the card and ports using either NMS or NMT, if already not configured.
- Route the ports, if already not routed.

## 5.5 FXO CARD

**(i) Front Panel** The front panel is shown in figure below:


PUNCOM
HEALTH LED
HEALTH
TEST MODE CH#1 LED
TEST 1
TEST MODE CH#2 LED
TEST 2
TEST MODE CH#3 LED
TEST 3
TEST MODE CH#4 LED
TEST 4
FXO
PUNCOM

The following table describes the front panel:

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| Health | Green ON<br>Red ON<br>Blinking | Card is working OK.<br>Card hardware has gone faulty.<br>Card's hardware is OK but it is not configured by main 2MB card. |
| Test1 | ON | Channel 1 is in test & diagnostics mode |
| Test2 | ON | Channel 2 is in test & diagnostics mode |
| Test3 | ON | Channel 3 is in test & diagnostics mode |
| Test4 | ON | Channel 4 is in test & diagnostics mode |

### (ii) Header Settings

There are no user selectable headers; all the headers are factory set. The settings of factory set headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| **S.No.** | **Header Name** | **Position** | **Remarks** |
|---|---|---|---|
| 1. | H2 | 2-3 | SPROM program enable/ disable |
| 2. | H1 | 1-2 | Watchdog strobe selection. |
| 3. | H3 | 1-2 | System resetting. |
| 4. | H4,5,6,7 | open | For future use. |
| 5. | H13 | 1-2 | IP control. |
| 6. | H15 | 1-2 | Programming supply selection |
| 7. | H12 | open | Power sequencing |

**(iii) Signalling Codes**

When FXO Card is set in FXO mode, for remote subscriber extension, the various signalling states and codes are as given below:

**(a) Call Originated by Subscriber**

| **Signalling Condition** | **Status of Exchange Port** | **Status of Exchange Interface Card** | **Transmitted Bits** | | | | **Received Bits** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **a** | **b** | **c** | **d** | **a** | **b** | **c** | **d** |
| Idle | Normal potential -ve on a limb +ve on b limb | High Resistance Loop | 1 | 1 | 0 | 1 | 1 | 1 | x | x |
| Seizure | -do- | Low Resistance Loop | 1 | 1 | 0 | 1 | 0 | 1 | x | x |
| Dialling | -do- | Loop Make Break | 1 | 1 | 0 | 1 | 0 | 1 | x | x |
| Answer by called subscriber | Reverse potential +ve on a limb -ve on b limb (only in case of CCB/PBX otherwise Normal potential) | Low Resistance Loop | 0 or 1 | 1 1 | 0 0 | 1 1 | 0 | 1 | x | x |
| Clear forward | Reverse or Normal potential | High Resistance Loop | 0 or 1 | 1 1 | 0 0 | 1 1 | 1 | 1 | x | x |

### (b) Call originated by exchange

| Signalling Condition | Status of Exchange Port | Status of Exchange Interface Card | Transmitted Bits | | | | Received Bits | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | a | B | c | d | a | b | c | d |
| Idle | Normal Potential | High Resistance Loop | 1 | 1 | 0 | 1 | 1 | 1 | x | x |
| Ring | Ringing Voltage 75V rms | High Resistance Loop | 1 | 1/ 0 | 0 | 1 | 1 | 1 | x | x |
| Ring Trip | Normal Potential | Low Resistance Loop | 1 | 1 | 0 | 1 | 0 | 1 | x | x |

### (iv) Termination Signal Details

When installed in designated slot, the terminations are available on the 96-pin Euro-connector on the rear of the motherboard. The signal detail of this connector is as under :

Connector Designation : **J7,9,11,13,15,17,19,21,23,39**
Connector Type : 96-pin Euro male

| PIN | A | B | C | PIN |
|---|---|---|---|---|
| 1. | --- | --- | --- | 1. |
| 2. | TIP1 | NC | RING1 | 2. |
| 3. | NC | NC | NC | 3. |
| 4. | NC | NC | NC | 4. |
| 5. | TIP2 | NC | RING2 | 5. |
| 6. | NC | NC | NC | 6. |

| PIN | A | B | C | PIN |
|---|---|---|---|---|
| 7. | NC | NC | NC | 7. |
| 8. | NC | NC | NC | 8. |
| 9. | --- | --- | --- | 9. |
| 10. | TIP3 | NC | RING3 | 10. |
| 11. | NC | NC | NC | 11. |
| 12. | NC | NC | NC | 12. |
| 13. | TIP4 | NC | RING4 | 13. |
| 14. | NC | NC | NC | 14. |
| 15. | NC | NC | NC | 15. |
| 16. | NC | NC | NC | 16. |
| All other pins are not connected | | | | |

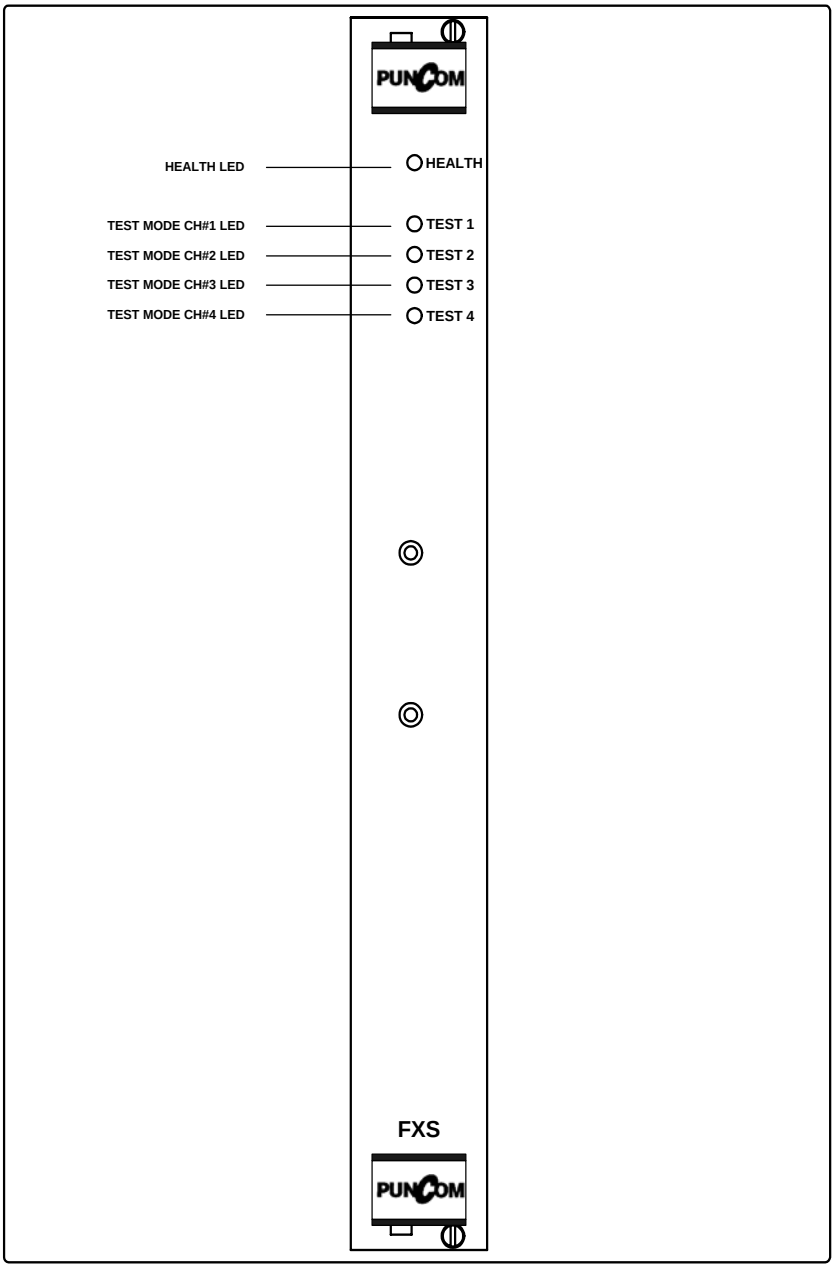
**(v) Installation**

- Slide the card in required slot & lock in position with the help of ejectors.
- Configure the card and ports using either NMS or NMT, if already not configured.
- Route the ports, if already not routed.

## 5.6 FXS Card

**(i) Front Panel**

The front panel of FXS Card is shown in figure below:


PUNCOM
HEALTH LED
HEALTH
TEST MODE CH#1 LED
TEST 1
TEST MODE CH#2 LED
TEST 2
TEST MODE CH#3 LED
TEST 3
TEST MODE CH#4 LED
TEST 4
FXS
PUNCOM

The following table describes the front panel:

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| Health | Green ON<br>Red ON<br>Blinking | Card is working OK.<br>Card hardware has gone faulty.<br>Card's hardware is OK but it is not configured by main 2MB card. |
| Test1 | ON | Channel 1 is in test & diagnostics mode |
| Test2 | ON | Channel 2 is in test & diagnostics mode |
| Test3 | ON | Channel 3 is in test & diagnostics mode |
| Test4 | ON | Channel 4 is in test & diagnostics mode |

### (ii) Header Settings

There are no user selectable headers; all the headers are factory set. The settings of factory set headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| **S. No** | **Header Name** | **Position** | **Remarks** |
|---|---|---|---|
| 1. | H3 | 2-3 | SPROM program enable/disable |
| 2. | H2 | 1-2 | Watchdog strobe selection. |
| 3. | H4 | 1-2 | System resetting. |
| 4. | H8,9,10,11 | open | For future use. |
| 5. | H7 | 1-2 | IP control. |
| 6. | H18 | 1-2 | Programming supply selection |
| 7. | H1 | 1-2 | Ringer mode Selection for CH#1 |
| 8. | H5 | 1-2 | Ringer mode Selection for CH#2 |
| 9. | H6 | 1-2 | Ringer mode Selection for CH#3 |
| 10. | H16 | 1-2 | Ringer mode Selection for CH#4 |

### (iii) Signalling Codes

The various signalling states and signalling codes for the FXS Card are as given below :

### a) Call Originated by Subscriber

| **Signalling Condition** | **Status of Subscriber** | **Status of Subscriber Interface Card** | **Transmitted Bits** | **Received Bits** |
|---|---|---|---|---|
| | | | **a b c d** | **a b c d** |
| Idle | High Resistance Loop | Normal potential<br>-ve on a limb<br>+ve on b limb | 1 1 0 1 | 1 1 x x |
| Seizure | Low Resistance Loop | - do - | 0 1 0 1 | 1 1 x x |
| Dialling | Loop Make Break | - do - | 0/ 1 0 1<br>1 | 1 1 x x |
| Answer by called subscriber | Low Resistance Loop | Reverse potential<br>+ve on a limb<br>-ve on b limb<br>(only in case of CCB/PBX otherwise Normal potential. | 0 1 0 1 | 1 1 x x<br>or<br>0 1 x x |
| Clear forward | High Resistance Loop | Reverse<br>or<br>Normal potential | 1 1 0 1 | 0 1 x x<br>or<br>1 1 x x |

**(b) Call originated by exchange**

| **Signalling Condition** | **Status of Subscriber** | **Status of Subscriber Interface Card** | **Transmitted Bits** | **Received Bits** |
|---|---|---|---|---|
| | | | **a b c d** | **a b c d** |
| Idle | High Resistance Loop | Normal potential | 1 1 0 1 | 1 1 x x |
| Ring | High Resistance Loop | Ringng Voltage 75V rms | 1 1 0 1 | 1 1/ x x 0 |
| Ring Trip | Low Resistance Loop | Normal potential | 0 1 0 1 | 1 1 x x |

**(iv) Termination Signal Details**

When installed in designated slot, the terminations are available on the 96-pin Euro-connector on the rear of the motherboard. The signal detail of this connector is as under :

**Connector Designation : J7,9,11,13,15,17,19,21,23,39**
**Connector Type : 96-pin Euro male**

| PIN | A | B | C | PIN |
|---|---|---|---|---|
| 1. | --- | --- | --- | 1. |
| 2. | TIP1 | NC | RING1 | 2. |
| 3. | NC | NC | NC | 3. |
| 4. | NC | NC | NC | 4. |
| 5. | TIP2 | NC | RING2 | 5. |

| | | | | |
|---|---|---|---|---|
| 6. | NC | NC | NC | 6. |
| 7. | NC | NC | NC | 7. |
| 8. | NC | NC | NC | 8. |
| 9. | --- | --- | --- | 9. |
| 10. | TIP3 | NC | RING3 | 10. |
| 11. | NC | NC | NC | 11. |
| 12. | NC | NC | NC | 12. |
| 13. | TIP4 | NC | RING4 | 13. |
| 14. | NC | NC | NC | 14. |
| 15. | NC | NC | NC | 15. |
| 16. | NC | NC | NC | 16. |
| All other pins are not connected | | | | |

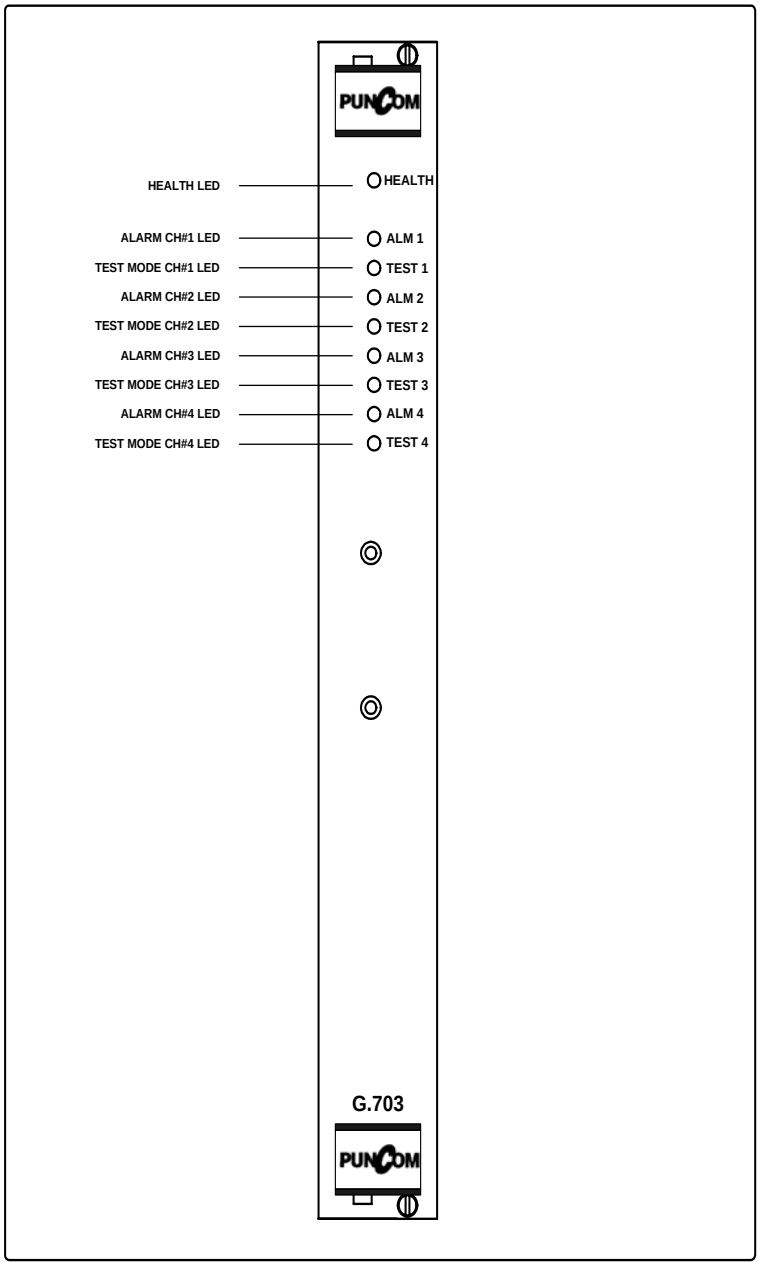
**(v) Installation**

- Slide the card in required slot & lock in position with the help of ejectors.
- Configure the card and ports using either NMS or NMT, if already not configured.
- Route the ports, if already not routed.

## 5.7 G703 Card

**(i) Front Panel**

The front panel of G703 Data Card is shown in figure below:


PUNCOM
HEALTH LED
HEALTH
ALARM CH#1 LED
ALM 1
TEST MODE CH#1 LED
TEST 1
ALARM CH#2 LED
ALM 2
TEST MODE CH#2 LED
TEST 2
ALARM CH#3 LED
ALM 3
TEST MODE CH#3 LED
TEST 3
ALARM CH#4 LED
ALM 4
TEST MODE CH#4 LED
TEST 4
G.703
PUNCOM

The following table describes the front panel:

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| Health | Green ON<br>Red ON<br>Blinking | Card is working OK.<br>Card hardware has gone faulty.<br>Card's hardware is OK but it is not configured by main 2MB card. |
| Alm1 | ON | LOS or Bipolar Violation on CH#1. |
| Test1 | ON | Channel 1 is in test & diagnostics mode. |
| Alm2 | ON | LOS or Bipolar Violation on CH#2. |
| Test2 | ON | Channel 2 is in test & diagnostics mode. |
| Alm3 | ON | LOS or Bipolar Violation on CH#3. |
| Test3 | ON | Channel 3 is in test & diagnostics mode. |
| Alm4 | ON | LOS or Bipolar Violation on CH#4. |
| Test4 | ON | Channel 4 is in test & diagnostics mode. |

### (ii) Header Settings

There is no user settable header in this card. All the headers are factory set. The settings of these headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| **S.No** | **Header Name** | **Position** | **Remarks** |
|---|---|---|---|
| 1. | H1 | 1-2 | IP control. |
| 2. | H2 | 2-3 | DCLK testing |
| 3. | H3 | 1-2 | System resetting. |
| 4. | H4 | 1-2 | Watchdog strobe selection. |

| | | | |
|---|---|---|---|
| 5. | H5 | 2-3 | SPROM program enable/disable |
| 6. | H8,9,10 ,11 | open | For future use. |
| 7. | H14 | 1-2 | Programming supply selection |

**(iii) Termination Signal Details**

When installed in designated slot, the terminations are available on the 96-pin Euro-connector on the rear of the motherboard. The signal detail of this connector is as under :

**Connector Designation : J7,9,11,13,15,17,19,21,23,39**
**Connector Type : 96-pin Euro male**

| PIN | A | B | C | PIN |
|---|---|---|---|---|
| 1. | --- | --- | --- | 1. |
| 2. | RX1_A (IN) | NC | RX1_B (IN) | 2. |
| 3. | TX1_A (OUT) | NC | TX1_B (OUT) | 3. |
| 4. | NC | NC | NC | 4. |
| 5. | RX2_A (IN) | NC | RX2_B (IN) | 5. |
| 6. | TX2_A (OUT) | NC | TX2_B (OUT) | 6. |
| 7. | NC | NC | NC | 7. |
| 8. | NC | NC | NC | 8. |
| 9. | --- | --- | --- | 9. |
| 10. | RX3_A (IN) | NC | RX3_B (IN) | 10. |
| 11. | TX3_A (OUT) | NC | TX3_B (OUT) | 11. |
| 12. | NC | NC | NC | 12. |
| 13. | RX4_A (IN) | NC | RX4_B (IN) | 13. |
| 14. | TX4_A (OUT) | NC | TX4_B (OUT) | 14. |
| 15. | NC | NC | NC | 15. |
| All other pins are unused | | | | |

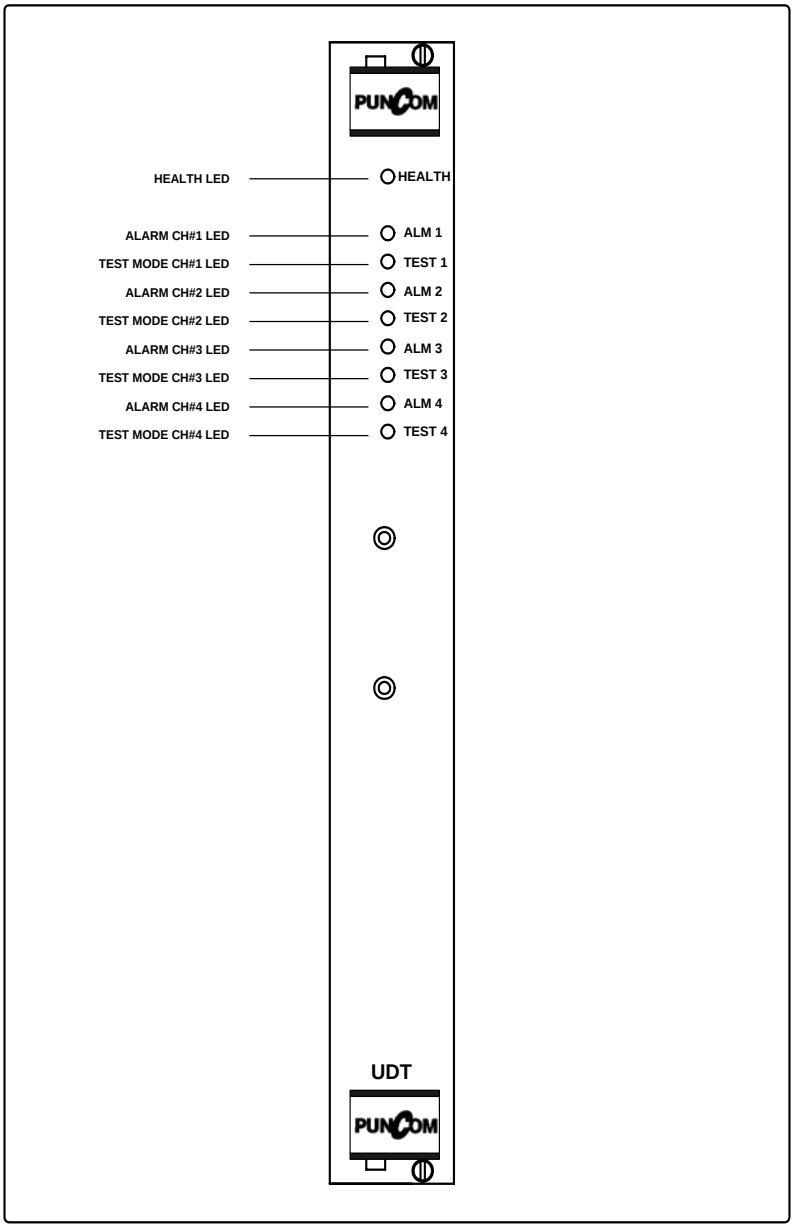
**(iv) Installation**

- Slide the card in required slot & lock in position with the help of ejectors.
- Configure the card and ports using either NMS or NMT, if already not configured.
- Route the ports, if already not routed.

## 5.8 UDT Card

### (i) Front Panel

The front panel of UDT Data Card is shown in figure below:




The following table describes the front panel:

| Item | LED Status | LED Function |
|---|---|---|
| Health | Green ON<br>Red ON<br>Blinking | Card is working OK.<br>Card hardware has gone faulty.<br>Card's hardware is OK but it is not configured by main 2MB card. |
| Alm1 | ON | LOS or excessive parity errors on CH#1. |
| Test1 | ON | Channel 1 is in test & diagnostics mode. |
| Alm2 | ON | LOS or excessive parity errors on CH#2. |
| Test2 | ON | Channel 2 is in test & diagnostics mode. |
| Alm3 | ON | LOS or excessive parity errors on CH#3. |
| Test3 | ON | Channel 3 is in test & diagnostics mode. |
| Alm4 | ON | LOS or excessive parity errors on CH#4. |
| Test4 | ON | Channel 4 is in test & diagnostics mode. |

### (ii) Header Settings

There is no user settable header in this card. All the headers are factory set. The settings of these headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| S.No. | Header Name | Position | Remarks |
|---|---|---|---|
| 1. | H2 | 2-3 | DCLK testing |
| 2. | H17 | 1-2 | IP control. |
| 3. | H18 | 1-2 | Watchdog strobe selection. |
| 4. | H19 | 1-2 | System resetting. |
| 5. | H5,8-10, 20-23 | 2-3 | For future use. |
| 6. | H13, H14 | 2-3 | Console/IP selection. |

| S.No. | Header Name | Position | Remarks |
|---|---|---|---|
| 7. | H15, H16 | Open | For future use. |
| 8. | H24 | 2-3 | SPROM program enable/disable |

**(iii) Signal Details**

Various signals supported by the UDT card interfaces are detailed below.

| | Signal Description | Abbr. | Dir. | V.24 | V.35 | V.11 | X.21 |
|---|---|---|---|---|---|---|---|
| Ground | Signal Ground | GND | --- | √ | √ | √ | √ |
| Data | Transmit Data | TD | ← | Unbal. | Bal. | Bal. | Bal. |
| | Receive Data | RD | → | Unbal. | Bal. | Bal. | Bal. |
| Control | Request to Send | RTS | ← | Unbal. | Unbal. | Bal. | Bal. |
| | Clear to Send | CTS | → | Unbal. | Unbal. | Bal. | --- |
| | Data Set Ready | DSR | → | Unbal. | Unbal. | Bal. | --- |
| | Data Terminal Ready | DTR | ← | Unbal. | Unbal. | Unbal. | --- |
| | Carrier Detect | CD | → | Unbal. | Unbal. | Bal. | Bal. |
| | Ring Indicator | RI | → | Unbal. | Unbal. | Unbal. | |
| Timing | Transmit Clock | TC | → | Unbal. | Bal. | Bal. | Bal. |
| | Receive Clock | RC | → | Unbal. | Bal. | Bal. | Bal. |
| | External Clock | XTC | ← | Unbal. | Bal. | Bal. | --- |

**Interface Signal Table**

### (iv) Termination Signal Details

When installed in designated slot, the terminations are available on the 96-pin Euro-connector on the rear of the motherboard. The signal detail of this connector is as under:

**Connector Designation : J7,9,11,13,15,17,19,21,23,39**
**Connector Type : 96-pin Euro male**

| PIN | A | B | C | PIN |
|---|---|---|---|---|
| 1. | --- | --- | --- | 1. |
| 2. | TD1A | RI1C | TD1B | 2. |
| 3. | RD1A | CD1A | RD1B | 3. |
| 4. | TC1A | CD1B | TC1B | 4. |
| 5. | RC1A | RTS1A | RC1B | 5. |
| 6. | XTC1A | RTSIB | XTC1B | 6. |
| 7. | DTR1A | CTS1A | GND | 7. |
| 8. | DSR1A | CTS1B | DSR1B | 8. |
| 9. | --- | --- | --- | 9. |
| 10. | TD2A | RI2C | TD2B | 10. |
| 11. | RD2A | CD2A | RD2B | 11. |
| 12. | TC2A | CD2B | TC2B | 12. |
| 13. | RC2A | RTS2A | RC2B | 13. |
| 14. | XTC2A | RTS2B | XTC2B | 14. |
| 15. | DTR2A | CTS2A | GND | 15. |
| 16. | DSR2A | CTS2B | DSR2B | 16. |
| 17. | --- | --- | --- | 17. |
| 18. | TD3A | RI3C | TD3B | 18. |
| 19. | RD3A | CD3A | RD3B | 19. |

| PIN | A | B | C | PIN |
|---|---|---|---|---|
| 20. | TC3A | CD3B | TC3B | 20. |
| 21. | RC3A | RTS3A | RC3B | 21. |
| 22. | XTC3A | RTS3B | XTC3B | 22. |
| 23. | DTR3A | CTS3A | GND | 23. |
| 24. | DSR3A | CTS3B | DSR3B | 24. |
| 25. | --- | --- | --- | 25. |
| 26. | TD4A | RI4C | TD4B | 26. |
| 27. | RD4A | CD4A | RD4B | 27. |
| 28. | TC4A | CD4B | TC4B | 28. |
| 29. | RC4A | RTS4A | RC4B | 29. |
| 30. | XTC4A | RTS4B | XTC4B | 30. |
| 31. | DTR4A | CTS4A | GND | 31. |
| 32. | DSR4A | CTS4B | DSR4B | 32. |

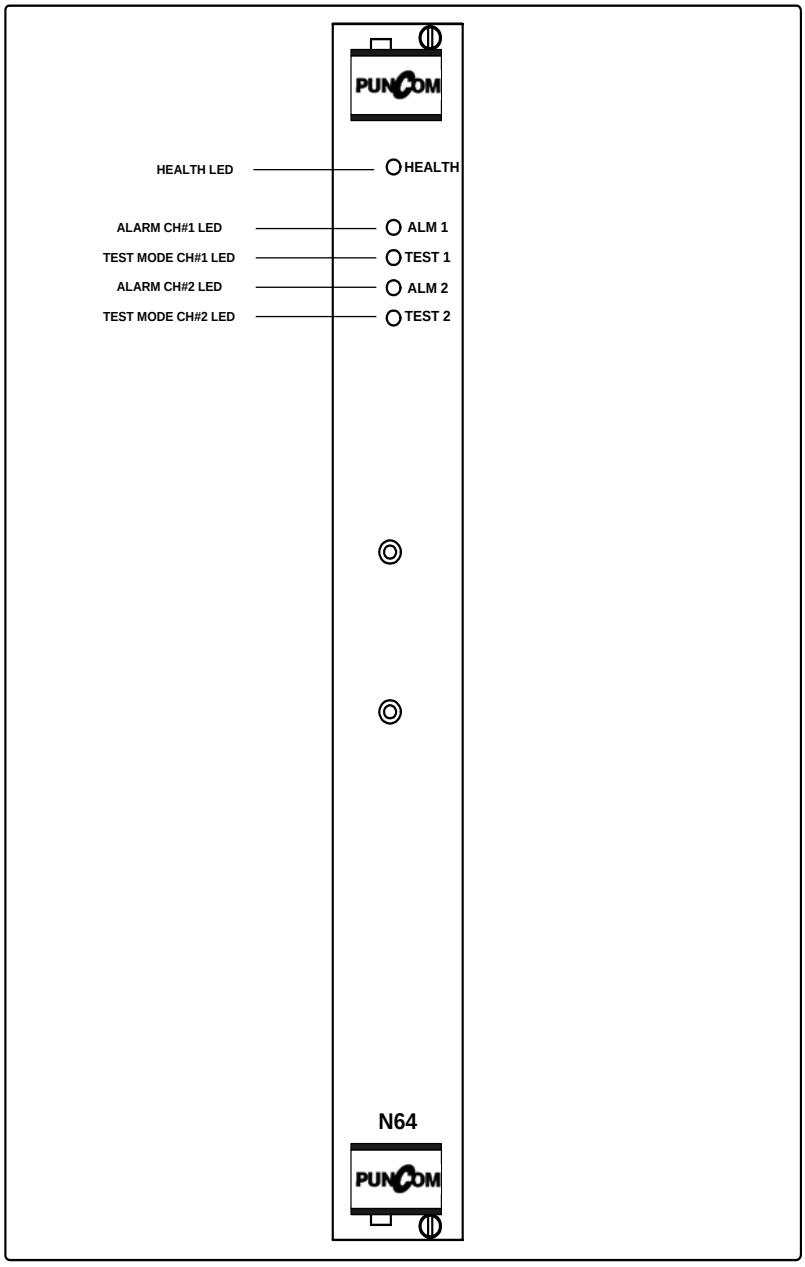
### (v) Installation

- Slide the card in required slot & lock in position with the help of ejectors.
- Configure the card and ports using either NMS or Local Port, if already not configured.
- Route the ports, if already not routed.

## 5.9 N64 CARD

### (i) Front Panel

The front panel of N64 Data Card is shown in figure below:


HEALTH LED
HEALTH
ALARM CH#1 LED
ALM 1
TEST MODE CH#1 LED
TEST 1
ALARM CH#2 LED
ALM 2
TEST MODE CH#2 LED
TEST 2
N64

**(i)** The following table describes the front panel:

| **Item** | **LED Status** | **LED Function** |
|---|---|---|
| HEALTH | Green ON<br>Red ON<br>Blinking | Card is working OK.<br>Card hardware has gone faulty.<br>Card's hardware is OK but it is not configured by main 2MB card. |
| Alm1 | ON | LOS on CH#1. |
| Test1 | ON | Channel 1 is in test & diagnostics mode. |
| Alm2 | ON | LOS on CH#2. |
| Test2 | ON | Channel 2 is in test & diagnostics mode. |

**(ii) Header Settings**

There is no user settable header in this card. All the headers are factory set. The settings of these headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| **S.No.** | **Header Name** | **Position** | **Remarks** |
|---|---|---|---|
| 1. | H5,H7 | open | For future use. |
| 2. | H6,H8 | 2-3 | For future use. |
| 3. | H9 | 1-2 | IP control. |
| 4. | H10 | 1-2 | Watchdog strobe selection. |
| 5. | H11 | 1-2 | System resetting. |

### (iii) Termination Signal Details

When installed in designated slot, the terminations are available on the 96-pin Euro-connector on the rear of the motherboard. The signal detail of this connector is as under :

Connector Designation : **J7,9,11,13,15,17,19,21,23,39**
Connector Type : 96-pin Euro male

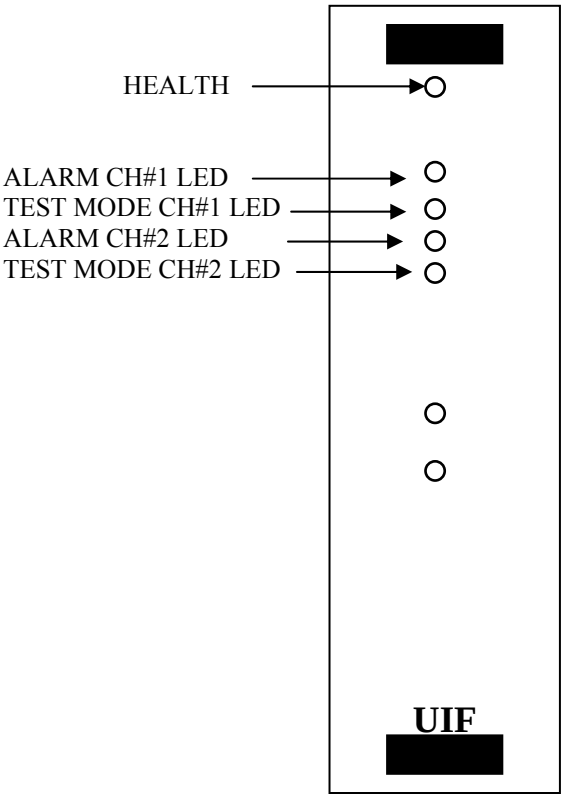
| **PIN** | **A** | **B** | **C** | **PIN** |
|---|---|---|---|---|
| 1. | --- | --- | --- | 1. |
| 2. | TD1A | RI1C | TD1B | 2. |
| 3. | RD1A | CD1A | RD1B | 3. |
| 4. | TC1A | CD1B | TC1B | 4. |
| 5. | RC1A | RTS1A | RC1B | 5. |
| 6. | XTC1A | RTSIB | XTC1B | 6. |
| 7. | DTR1A | CTS1A | GND | 7. |
| 8. | DSR1A | CTS1B | DSR1B | 8. |
| 9. | --- | --- | --- | 9. |
| 10. | TD2A | RI2C | TD2B | 10. |
| 11. | RD2A | CD2A | RD2B | 11. |
| 12. | TC2A | CD2B | TC2B | 12. |
| 13. | RC2A | RTS2A | RC2B | 13. |
| 14. | XTC2A | RTS2B | XTC2B | 14. |
| 15. | DTR2A | CTS2A | GND | 15. |
| 16. | DSR2A | CTS2B | DSR2B | 16. |
| All other pins are not connected | | | | |

**(iv) Installation**

- Slide the card in required slot & lock in position with the help of ejectors.
- Configure the card and ports using either NMS or Local Port, if already not configured.
- Route the ports, if already not routed.

## 5.10 UIF Card

**(i) Front Panel** The front panel of the Card is shown in fig below.



The following table describes the front panel:

| Item | LED Status | LED Function |
|---|---|---|
| Health | Green ON<br>Red ON<br>Blinking | Card is working OK.<br>Card hardware has gone faulty.<br>Card's hardware is OK but it is not configured by main 2MB card. |
| Alm1 | ON | CH#1 Alarm. |
| Test1 | ON | Channel 1 is in test & diagnostics mode. |
| Alm2 | ON | CH#2 Alarm. |
| Test2 | ON | Channel 2 is in test & diagnostics mode. |

**(ii) Header Settings**

There is no user settable header in this card. All the headers are factory set. The settings of these headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**Factory Set Headers**

| S. No. | Header Name | Position | Remarks |
|---|---|---|---|
| 1. | H1 | 2-3 | SPROM Program Enable/Disable |
| 2. | H2 | 1-2 | Watchdog strobe selection. |
| 3. | H3 | 1-2 | Programming supply selection |
| 4. | H4 | 1-2 | System resetting. |
| 5. | H5-8 | 1-2 | For future use. |
| 6. | H9 | 1-2 | IP control. |

### (iii) Termination Signal Details

When installed in designated slot, the terminations are available on the 96-pin Euro-connector on the rear of the motherboard. The signal detail of this connector is as under :

Connector Designation : **J5,7,9,11,13,15,17,19,21,23,39**
Connector Type : 64-pin Euro male

| PIN | A | C | PIN |
|---|---|---|---|
| 1. | --- | --- | 1. |
| 2. | TIP1 | RING1 | 2. |
| 3. | NC | NC | 3. |
| 4. | NC | NC | 4. |
| 5. | TIP2 | RING2 | 5. |
| 6. | NC | NC | 6. |
| 7. | NC | NC | 7. |
| 8. | NC | NC | 8. |
| 9. | --- | --- | 9. |
| 10. | NC | NC | 10. |
| 11. | NC | NC | 11. |
| 12. | NC | NC | 12. |
| 13. | NC | NC | 13. |
| 14. | NC | NC | 14. |
| 15. | NC | NC | 15. |
| 16. | NC | NC | 16. |
| 17. | --- | --- | 17. |
| 18. | NC | NC | 18. |
| 19. | NC | NC | 19. |
| 20. | NC | NC | 20. |

| PIN | A | C | PIN |
|---|---|---|---|
| 21. | NC | NC | 21. |
| 22. | NC | NC | 22. |
| 23. | NC | NC | 23. |
| 24. | NC | NC | 24. |
| 25. | --- | --- | 25. |
| 26. | -96V | -96V | 26. |
| 27. | NC | NC | 27. |
| 28. | NC | NC | 28. |
| 29. | GND | GND | 29. |
| 30. | NC | NC | 30. |
| 31. | NC | NC | 31. |
| 32. | -96V GND | -96V GND | 32. |

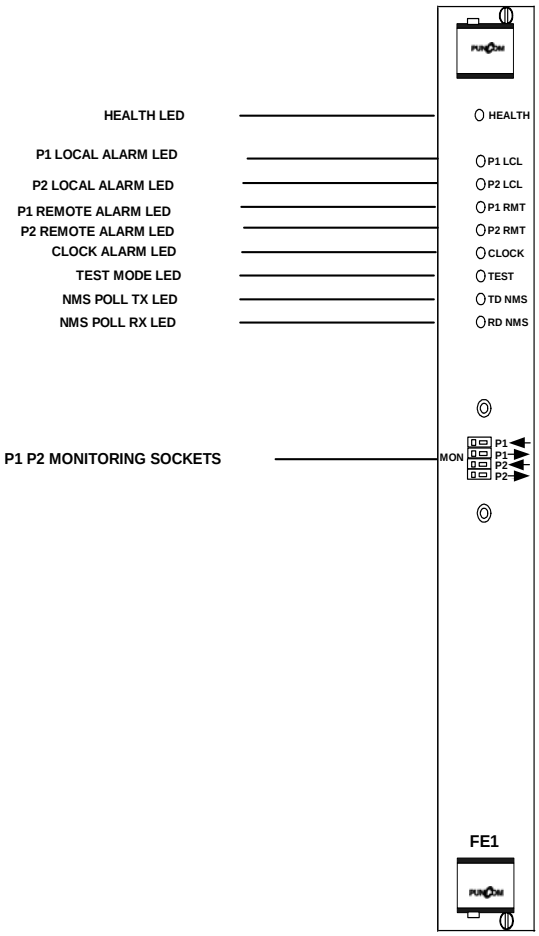
**(iv) Installation**

- Slide the card in required slot & lock in position with the help of ejectors.
- Configure the card and ports using either NMS or Local Port, if already not configured.
- Route the ports, if already not routed.

## 5.11 E1 Branching Module Card

**(i) Front Panel**

The front panel of E1 Branching module card is shown in figure below:


HEALTH LED
P1 LOCAL ALARM LED
P2 LOCAL ALARM LED
P1 REMOTE ALARM LED
P2 REMOTE ALARM LED
CLOCK ALARM LED
TEST MODE LED
NMS POLL TX LED
NMS POLL RX LED
P1 P2 MONITORING SOCKETS
HEALTH
P1 LCL
P2 LCL
P1 RMT
P2 RMT
CLOCK
TEST
TD NMS
RD NMS
MON
P1
P1
P2
P2
FE1

The following table describes the front panel:

| **ITEM** | **LED Status** | **LED Function** |
|---|---|---|
| Health | Green ON<br>Blinking | Card is configured.<br>Card is deconfigured. |
| P1 LCL | ON<br>Fast Blinking<br>Fast Blinking<br>Fast Blinking<br>Slow Blinking<br>Slow Blinking | PCM1 Loss of Signal<br>PCM1 Frame Sync. Loss<br>PCM1 Multiframe Sync. Loss<br>PCM1 CRC Frame Sync. Loss<br>PCM1 error rate > $E10^3$<br>PCM1 error rate > $E10^6$ |
| P2 LCL | ON<br>Fast Blinking<br>Fast Blinking<br>Fast Blinking<br>Slow Blinking<br>Slow Blinking | PCM2 Loss of Signal<br>PCM2 Frame Sync. Loss<br>PCM2 Multiframe Sync. Loss<br>PCM2 CRC Frame Sync. Loss<br>PCM2 error rate > $E10^3$<br>PCM2 error rate > $E10^6$ |
| P1 RMT | ON<br>Slow Blinking<br>Slow Blinking<br>Slow Blinking | PCM1 Receive AIS (All 1s)<br>PCM1 Receive Remote FSL<br>PCM1 Receive Remote MFSL<br>PCM1 Receive AIS in TS16 |
| P2 RMT | ON<br>Slow Blinking<br>Slow Blinking<br>Slow Blinking | PCM2 Receive AIS (All 1s)<br>PCM2 Receive Remote FSL<br>PCM2 Receive Remote MFSL<br>PCM2 Receive AIS in TS16 |
| CLOCK | Blinking | Slips |
| TEST | ON | Card in diagnostics or Loop back Mode |
| TD NMS | Blinking | NMS Polls Transmitted |
| RD NMS | Blinking | NMS Polls Received |

**(ii) Header Settings**

There are only four user selectable headers, rest all the headers are factory set. The settings of factory set headers should not be changed otherwise equipment may malfunction. The function of these headers is tabulated below:

**(a) User Settable Headers**

| S.No. | Header Name | Position | Remarks |
|---|---|---|---|
| 1. | H1 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM1 Output impedance selection. Default 120Ω. |
| 2. | H3 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM1 Input impedance selection. Default 120Ω. |
| 3. | H2 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM2 Output impedance selection. Default 120Ω. |
| 4. | H12 | 1-2 for 75Ω<br>2-3 for 120Ω | PCM2 Input impedance selection. Default 120Ω. |

**(b) Factory Set Headers**

| S.No. | Header Name | Position | Remarks |
|---|---|---|---|
| 1. | H4 | 1-2 | Watchdog strobe selection |
| 2. | H5 | 2-3 | System Resetting |
| 3. | H10 | Open | Interrupt Selection |
| 4. | H6 | Open | RS485 Rx data termination selection |
| 5. | H8 | Open | RS485 Tx data termination selection |
| 6. | H9 | Open | RS-485 Port Mode |
| 7. | H7 | Open | RS-485 Port Mode |

| S.No. | Header Name | Position | Remarks |
|---|---|---|---|
| 8. | H13 | Open | Testing |
| 9. | H16 | 1-2 | IP Control selection |
| 10. | H14, H15, H17, H18, H19, H20 | Open | For future use |

**(iii) <u>Terminations</u>**

**(a) Termination Signal Details**

When installed in designated slot, the terminations are available on the connectors available on the rear of the motherboard. The signal detail of these connectors is as under:

**Connector Designation : J1**
**Connector Type : 64-pin Euro female**

| PIN | A | C | PIN |
|---|---|---|---|
| 1. | --- | --- | 1. |
| 2. | PCM1 IN (A) | PCM1 OUT (A) | 2. |
| 3. | GND | GND | 3. |
| 4. | PCM1 IN (B) | PCM1 OUT (B) | 4. |
| 5. | GND | GND | 5. |
| 6. | PCM2 IN (A) | PCM2 OUT (A) | 6. |
| 7. | GND | GND | 7. |
| 8. | PCM2 IN (B) | PCM2 OUT (B) | 8. |
| 26. | TXA | RXA | 26. |
| 27. | TXB | RXB | 27. |
| All other pins are not connected. | | | |

**Connector Designation : S1**
**Connector Name : PCM1 IN**
**Connector Type : Stream Monitoring Socket**

| PIN | Signal | PIN | Signal |
|---|---|---|---|
| 1. | P1_IN_A | 2. | P1_IN_B |

**Connector Designation : S2**
**Connector Name : PCM1 OUT**
**Connector Type : Stream Monitoring Socket**

| PIN | Signal | PIN | Signal |
|---|---|---|---|
| 1. | P1_OUT_A | 2. | P1_OUT_B |

**Connector Designation : S3**
**Connector Name : PCM2 IN**
**Connector Type : Stream Monitoring Socket**

| PIN | Signal | PIN | Signal |
|---|---|---|---|
| 1. | P2_IN_A | 2. | P2_IN_B |

**Connector Designation : S4**
**Connector Name : PCM2 OUT**
**Connector Type : Stream Monitoring Socket**

| PIN | Signal | PIN | Signal |
|---|---|---|---|
| 1. | P2_OUT_A | 2. | P2_OUT_B |

**(iv) Installation**

- Set the headers for 75 Ω or 120 Ω terminations as per the installation plan.
- Insert E1 Branching Module card in desired slot & lock it with the help of ejectors.

- Configure the card and streams using either NMS or Local Port, if already not configured.
- Route the desired port or streams as require

## 5.12. Initial Power up

Before powering-up the system, we must check the following items:

- Ensure that nominal voltage –48V is coming at the Bay Top Panel terminals.
- Ensure that all the cards are fully inserted and in their respective slots.
- Ensure that system is properly grounded through ground strip or any other ground terminal.
- Ensure that all connections are tight.

Following procedure may be followed for general powering up of the system.

1. Insert the common cards viz. PSU & TME into the respective slots and power up to the system. See the normal functioning of the health LED on the 2MB Card. Connect the NMT to the Port marked 'NMT' and get the opening menu on the screen.

2. Insert the user Interface cards into desired slots (as wired) and display hardware to see that the same has been updated to show the enhanced configuration.
3. Finally insert the optional common cards (LPC), if required and again check up the display.
4. Configure the PCM trunks using hardware set-up screens for PCM trunks. Also configure the network clock as per

the desired priority. Now connect the PCM trunks and watch the PCM trunk status on the NMT display as well as from LEDs on TME Card.

5. Program now one Routing Table as per desired cross connect plan and make it active.
6. Program all the VF and data interface ports to desired settings.
7. Program the types of all alarms in the system as Major or Minor or None using screen.
8. VMX-0100 is now full configured for user ports. Check for correct flow of traffic between each of the user ports and its destination on the network.
9. Program alternate Routing tables if required and also the power on Routing Table as desired.
10. Set up and program the omni bus Conferencing channels. Configure the local E & M VF Conferencing ports. Connect the Conferencing phones through the adapter unit to the defined E&M Conferencing ports and test for the proper operation of omnibus channels.
11. Program the conditions under which bypass action is to be automatically activated (if required).
12. Finally delete the factory-defined password of level 2 and enter new password for level 1 and level 2.

## 6. Operation

The Block Diagram of the system is shown in figure 3.

## 6.1 Functional Description

- The two incoming PCM Streams P1 & P2, enters the 2MB Card via the Upper Card Connector, from the rear side of motherboard.
- 75Ω/120Ω operation is selected by one Jumper & programming through the NMT.
- The incoming streams are connected to the two separate Combined Line Interface Unit & Framer IC through line transformers, which give out two TTL level ST-Bus compatible VF & Signalling Streams.
- The Combined Line Interface Unit & Framer IC carries out the Line equalisation, HDB3 to binary conversion, deframing, clock extraction, extraction of information on spare bits, alarms monitoring etc.
- These TTL Level VF & Signalling Streams are further connected to VF & Signalling Cross-Connect Switches respectively. These switches perform the TSI function on these streams as programmed by the user in the routing tables.
- The Local add-drop channels are placed on the TDM1 & CAS streams, which are connected to various Line Cards through the system Bus. The other signals required for the operation of Line Cards are also generated in 2MB Card and are connected to Line Cards via the system Bus.

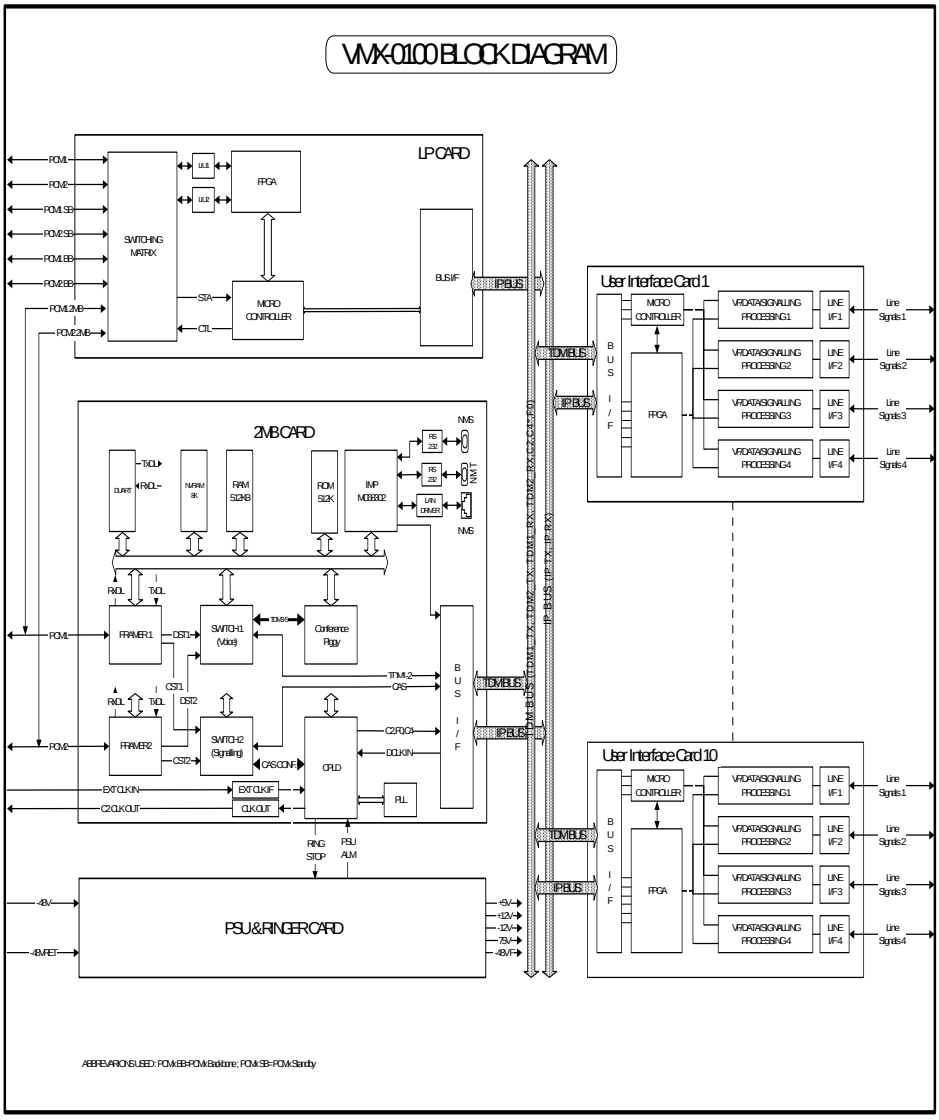

VMX-0100 BLOCK DIAGRAM
LP CARD
SWITCHING MATRIX
FPGA
MICRO CONTROLLER
BUS I/F
IP BUS
2MB CARD
FRAMER1
FRAMER2
SWITCH-1 (Voice)
SWITCH-2 (Signalling)
Conference Pkg
CPLD
PLL
EXT CLK I/F
CLK OUT
PSU&RINGER CARD
User Interface Card 1
User Interface Card 10
MICRO CONTROLLER
VF/DATA/SIGNALLING PROCESSING1
VF/DATA/SIGNALLING PROCESSING2
VF/DATA/SIGNALLING PROCESSING3
VF/DATA/SIGNALLING PROCESSING4
LINE I/F-1
LINE I/F-2
LINE I/F-3
LINE I/F-4
Line Signals1
Line Signals2
Line Signals3
Line Signals4
TDM BUS
IP BUS
ABBREVIATIONS USED: POWEB=POWerBackbone; POWSB=POWerStandby

**Figure 3**

- The 2MB Card Processor and the Line Card processors communicate with each other through IP Bus.
- The clock priorities can also be set through NMT. The selected clock is also extended to the connector on the motherboard.
- In the Line Cards the ST Bus compatible data & signalling information is suitably processed, according to the type of the User Interface Card.

The Loop Protection function of the equipment can be achieved by using LPC Card (Optional). This Card is used to protect the P1 & P2 streams carrying the traffic in case of any major failure in the network. It provides the protection to the main 2Mb stream in a manner that all nodes on the chain remain connected to each other on the omnibus channels. It uses two 2Mb steams one spare & one backup for providing the protection.

## 6.2 Types Of User Interfaces With Vmx-0100

The following user interfaces are presently supported by VMX-0100:

### ( i ) VF Interfaces

- E & M (2W)
- E & M (4W)
- Loop Incoming Signalling
- Loop Outgoing Signalling
- Exchange Interface
- Subscriber Interface
- Hot Line Interface

### (ii) Data Interfaces

- G.703, co-directional, synchronous data interface @ 64Kbps.
- V.35/V.24/V.11/X.21, synchronous/ asynchronous data interface @ 1200-19200 baud.
- "N" x 64Kbps, V.35/V.24/V.11/X.21 user configurable, synchronous data interface with N=1 to 30.
- ISDN Digital Subscriber line (IDSL) supporting 64/128 Kbps.
- N * 64, G.703 / Fractional E1 Interface.
- Additional four channels for Teleprinter Data, 50/100 baud on the spare bits.
- 64Kbps support is available through GDT Card, which supports four 64Kbps G703 Co-directional Data.
- Low speed V.35/V.24/V.11/X.21 support is available through a UDT Card that provides four low speed sync./async. ports of 1200/ 2400/ 4800/ 9600/ 19200 bps in a card.

## 6.3 Programmable Time Slots

The operation of VMX-0100 is programmable or configurable from a VT 100 compatible Network Management Terminal (NMT) connected to it. Through this NMT the user interacts with VMX-0100 over multilevel user-friendly screens to display the existing configuration and / or to enter new configuration. Once entered, the configuration information is stored in a non-volatile RAM (NVRAM) and governs the operation of the Mux henceforth. This NVRAM has a battery life of several years.

The NVRAM comes programmed from the factory with a default configuration setting for all programmable parameters. This default setting can be viewed and altered at site using NMT. The default setting is generally good enough for the operation of VMX-0100 in a typical environment and can be supplied tailored to a specific user requirement.

## 6.4 Network Synchronization

VMX-0100 supports a variety of clock input options for network synchronization. These can be following:

- Extracted PCM1 Clock
- Extracted PCM2 Clock
- Extracted Synchronous Data Channel Clock
- External 2.048 MHz Clock
- Internal Oscillator Clock

The user can specify synchronizing clocks in order of priority. In case of failure of a higher priority clock, the next available lower priority clock is automatically brought into the circuit. In parallel, alarms are generated in case of failure of highest and next to highest priority synchronizing clock.

VMX-0100 also gives out a 120Ω / 75 Ω G.703 2.048 MHz network clock for synchronizing the next equipment in the chain.

## 6.5 Programmable Alarms And Thresholds

VMX-0100 detects a number of alarms conditions on PCM trunks, VF/Data user ports, clocks and other system status. The conditions are following:

### (i) On PCM Trunks:

- Loss of Signal
- Frame Sync Loss
- Multiframe Sync Loss
- Excessive FAS errors
- CRC Sync Loss
- Excessive Slips
- Remote Alarm
- AIS Received

### (ii) Others:

- Priority Clock Failure
- VF/Data Port Failure
- Configuration Mismatch

Each of these alarm conditions can be programmed by user to generate a Major, Minor or no alarm. The Major & Minor Alarms can also be extended to Bay Top Panel to generate the audio & visual indications.

The alarms once generated are also logged in a 100 entries deep alarm history file that can be displayed on the console. The alarm entries in this file include the alarm source, alarm type, alarm state, alarm generation and alarm clear time.

## 6.6 Omni Bus Conferencing

VMX-0100 has provision for 18 3/4 party conferencing, of which maximum 8 conferences can be 4-party. These conferencing channels can be set up in such a way that any one time slot each of PCM1 and PCM2 trunks and one/two local VF port (Depending on whether Conference is 3 party or 4 party) can participate in each conference.

## 6.7 NMT For Control Diagnostics

Apart from programming VMX-0100, NMT is also used for displaying Mux status, status of its various lines and ports, displaying alarm history, running diagnostics, initiating and displaying error statistics, etc.

## 6.8 Cross Connectivity Of PCM Trunks

VMX-0100 supports a full cross connect between both the PCM trunks and the 40 user ports. Any time slot on PCM trunks can be mapped to any user port. Also any time slot of PCM1 can be mapped to any time slot of PCM2 to bypass channels in Add/Drop configuration. Although 40 user ports have been provided to increase the modularity but only 30 of them can be configured at a time.

VMX-0100 can maintain up to four cross connect tables any of which can be activated by user action.

# 7. System Architecture

VMX-0100 is compact unit housed in a standard 6U sub-rack (265mm X 483mm X 260mm) conforming to DIN/19" Standard. The details of shelf arrangement and various card types are given below.

## 7.1 Shelf Arrangement

VMX-0100 shelf fitted with a motherboard has a provision for 13 slots. The slots are numbered 1 to 13 from left to right. The slot configuration is as under:

| | |
|---|---|
| Slot 1a | Power Supply (PSU) Card |
| Slot 1b | Redundant Power Supply (PSU) Card |
| Slot 2 | TME Card |
| Slot 3 | Loop Protection (LPC) Card (Optional) |
| Slot 4 | Teleprinter (TPC)/User Interface Card |
| Slot 5-13 | User Interface Cards |

The Teleprinter Card (TPC) can only be placed in slot 4, which can otherwise be used for user interface card if TPC Card is not used. Most user interface cards provide four VF/Data ports and therefore a maximum of 40 VF/Data ports can be accommodated in a VMX-0100 (without TPC Card). Out of which only 30 can be configured at a time (excluding TPC). The slots 4-13 can have any of the available user interface cards. VMX-0100 automatically detects the presence and type of the

interface card available in a particular slot. The front view of the VMX-0100 system is shown in the figure 4.

## 7.2 Cards

The design of VMX-0100 is modular and is based on multiple processors. Broadly VMX-0100 electronics can be partitioned as follows:

### ( i ) Common Cards

TME Card
Redundant PSU Card

### ( i i ) User Interface Cards

### ( a ) VF Cards

E & M Card : Required for E&M 2W & 4W interfaces.
FXO Card : Required for Loop I/C and Exchange Line interfaces.
FXS Card : Required for Subscriber, Loop O/G and Hot Line interfaces.

### ( b ) Data Cards

G703 Card : Required for 64Kbps G.703 Co-directional Data

UDT Card: Required for 1200/2400/4800/7200 /9600/19200 baud synchronous or asynchronous data.

N64 Card : Required for Nx64 data where $N_{max}$=30
TPC Card : Required for 50/100 baud Teleprinter Data on spare bits.
UIF Card : Required for 64/128K Data Extension to remote sites.
FE1 Card : Required for supporting two Fractional E1 streams

**( c ) Optional Cards**

LPC Card : Required to protect the 2Mb tributary carrying the omnibus channels in case of any major failure in the network.

DAC Card : Required for monitoring the voltages & other environmental parameters like Temperature, Pressure, Humidity, Battery Voltage, A.C. Voltage etc.

## 8. Cards Description

### 8.1 PSU Card

Power Supply in the VMX-0100 is DC-DC converter based on SMPS technology. VMX-0100 supports optional redundant PSU Card for higher availability. The two modules go in slot 1a & slot 1b of the motherboard. Apart from generating the output voltages required for the functioning of the system, it also generates the 75V rms, 25Hz. ring signal required for the FXS card. The input output specifications are as under:

**Input** : -36 V to -72V (-48V nominal)
**Output** :+5V/10 Amp, +12V/1.05 Amp & -12V/1.05 Amp

A filtered -48V is given to loop signalling VF Cards for powering the VF Loop interfaces.

## 8.2 TME Card

TME Card forms the heart of VMX-0100 system and is inserted in slot no. 2 of the VMX-0100 Shelf. This is a microprocessor-based card employing Motorola's MC68EN302 Microprocessor and functions as the overall controller of VMX-0100. It implements all programmable features of the mux, scans the mux for alarm conditions, maintains history files as well as takes the user defined action whenever the alarm condition is detected. It also scans the mux hardware for correct functioning and signals the user whenever any abnormality is seen. It also interacts with NMT user over a user-friendly menu based man machine dialogue for various actions requested by him. This implements full featured cross connect between PCM1, PCM2 trunks and the local user ports. It also functions as the signalling processor card for VMX-0100 and extracts the signalling information coming on time slots 16 of PCM 1 and 2 and sends them to the VF ports and vice versa. It houses the clock handing logic & PLL. It also interacts with the Network management System either through Rs-232 or Ethernet interface for providing Network Monitoring & Control.

## 8.3 User Interface Cards

All user interface cards implement the required specifications of the user interface port. They also sense

and drive the line, register signalling conditions on the line and pass them on to the 2MB card after processing.

All user interface cards support 4 interfaces per card except the N*64, UIF, FE1 Cards which provide 2 interfaces per card. All ports on a card however can be independently mapped to any time slot on PCM1 or PCM2.

## 8.4 LPC Card

This Card is used to protect the P1 & P2 streams carrying the traffic in case of any major failure in the network. It provides the protection to the main 2Mb stream in a manner that all nodes on the chain remain connected to each other on the omnibus channels. It uses two 2Mb steams one spare & one backup for providing the protection.

## 8.5 DAC Card

This Card has

- 8 auxiliary input ports, which can be used for getting status of events.
- 8 auxiliary dry contacts for controlling 8 tasks.
- 6 analog inputs for monitoring up to 6 environmental parameters.
- System voltages monitoring.

This card can go into any line card slot.

## 8.6 Equipment ID

An 8-position DIPswitch has been provided on the motherboard to set the equipment ID. With 8 positions maximum of 256 IDs can be set. This ID is required for the NMS operation & forms the address of the NMS basic frame.

## 8.7 Wiring & Terminations (Fig.5)

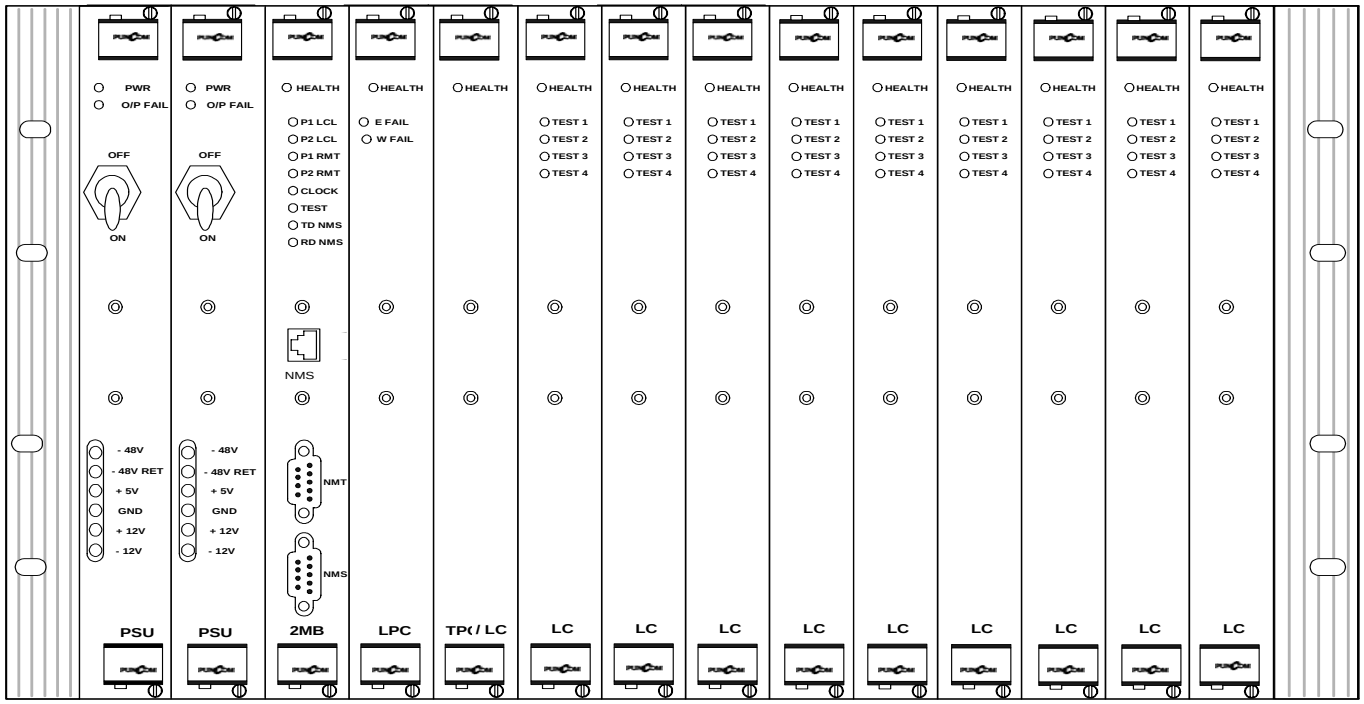
All the connections are terminated on the connectors on the rear side of the motherboard. VMX-0100 receives -48V power supply through a shrouded connector located on the rear of the motherboard. All user interfaces as well as 120Ω interfaces of PCM1 & PCM2, network clock-in, clock out have their terminations on the Euro-connectors on the rear side of the motherboard. The Euro Connectors used on the Motherboard provide the dual functionality. They provide the slots to accommodate upto 14 Cards on front side whereas these are used to connect the PCM Streams and Voice/Data Lines from the rear. 75 Ω interface terminations for Clock Input and Clock Output are also brought on to BNC connectors. Two DB15 connectors have been provided for the NMS. One DB9 connector has been provided to extend the Major & Minor Alarms to the Bay Top Panel.

The details of connectors & the signals are given below.

| **Conn. Desig.** | **Connector Type** | **Slot No.** | **Connector Function** | |
|---|---|---|---|---|
| | | | **Front Side** | **Rear Side** |
| J1 | Rev.Euro 64M | 1 | PSU Card 1 | --- |
| J2 | Rev.Euro 64M | 2 | PSU Card 2 | --- |
| J3 | Rev.Euro 64M | 3 | 2MB Card | P1,P2 Streams |

| Conn. Desig. | Connector Type | Slot No. | Connector Function | |
|---|---|---|---|---|
| | | | **Front Side** | **Rear Side** |
| | | | | & Clock in/out Interface |
| J4 | Rev.Euro 96M | 3 | 2MB Card | Termination Piggy(Right) |
| J5 | Rev.Euro 64M | 4 | LPC Card | P1,P2,P3,P4,P5 ,P6 Streams Interface |
| J6 | Rev.Euro 64M | 4 | LPC Card | --- |
| J7 | Rev.Euro 96M | 5 | VF/Data Line Card | VF/Data Line Interface |
| J8 | Rev.Euro 64M | 5 | VF/Data Line Card | --- |
| J9 | Rev.Euro 96M | 6 | VF/Data Line Card | VF/Data Line Interface |
| J10 | Rev.Euro 64M | 6 | VF/Data Line Card | --- |
| J11 | Rev.Euro 96M | 7 | VF/Data Line Card | VF/Data Line Interface |
| J12 | Rev.Euro 64M | 7 | VF/Data Line Card | --- |
| J13 | Rev.Euro 96M | 8 | VF/Data Line Card | VF/Data Line Interface |
| J14 | Rev.Euro 64M | 8 | VF/Data Line Card | --- |
| J15 | Rev.Euro 96M | 9 | VF/Data Line Card | VF/Data Line Interface |
| J16 | Rev.Euro 64M | 9 | VF/Data Line Card | --- |
| J17 | Rev.Euro 96M | 10 | VF/Data Line Card | VF/Data Line Interface |
| J18 | Rev.Euro 64M | 10 | VF/Data Line Card | --- |
| J19 | Rev.Euro 96M | 11 | VF/Data Line Card | VF/Data Line Interface |

| Conn. Desig. | Connector Type | Slot No. | Connector Function | |
|---|---|---|---|---|
| | | | **Front Side** | **Rear Side** |
| J20 | Rev.Euro 64M | 11 | VF/Data Line Card | --- |
| J21 | Rev.Euro 96M | 12 | VF/Data Line Card | VF/Data Line Interface |
| J22 | Rev.Euro 64M | 12 | VF/Data Line Card | --- |
| J23 | Rev.Euro 96M | 13 | VF/Data Line Card | VF/Data Line Interface |
| J24 | Rev.Euro 64M | 13 | VF/Data Line Card | --- |
| J39 | Rev.Euro 96M | 14 | VF/Data Line Card | VF/Data Line Interface |
| J40 | Rev.Euro 64M | 14 | VF/Data Line Card | Termination Piggy(Left) |
| J29 | BNC | -- | --- | External 2MHz Clock In |
| J30 | BNC | -- | --- | 2MHz Clock Out |
| J31 | 4-pin Male | -- | --- | Power Supply 1 (-48V) In |
| J43 | 4-pin Male | -- | --- | Power Supply 2 (-48V) In |
| J42 | 4-pin Male | -- | --- | Speech (-48V) In (Opt.) |
| J41 | 3 Pin Molex | -- | --- | Ring 75V rms In (Opt.) |
| J32 | DB15M | -- | --- | NMS I/F |
| J33 | DB15M | -- | --- | NMS I/F |
| J34 | DB9M | -- | --- | Alarm Extension |
| J36 | Fast-on Tab | -- | --- | -48V Return |
| J37 | Fast-on Tab | -- | --- | System Ground |
| J38 | Fast-on Tab | -- | --- | Chassis Ground |


PWR
O/P FAIL
OFF
ON
- 48V
- 48V RET
+ 5V
GND
+ 12V
- 12V
PSU
PWR
O/P FAIL
OFF
ON
- 48V
- 48V RET
+ 5V
GND
+ 12V
- 12V
PSU
HEALTH
P1 LCL
P2 LCL
P1 RMT
P2 RMT
CLOCK
TEST
TD NMS
RD NMS
NMS
NMT
NMS
2MB
HEALTH
E FAIL
W FAIL
LPC
HEALTH
TP( / LC
HEALTH
TEST 1
TEST 2
TEST 3
TEST 4
LC
HEALTH
TEST 1
TEST 2
TEST 3
TEST 4
LC
HEALTH
TEST 1
TEST 2
TEST 3
TEST 4
LC
HEALTH
TEST 1
TEST 2
TEST 3
TEST 4
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HEALTH
TEST 1
TEST 2
TEST 3
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HEALTH
TEST 1
TEST 2
TEST 3
TEST 4
LC
HEALTH
TEST 1
TEST 2
TEST 3
TEST 4
LC
HEALTH
TEST 1
TEST 2
TEST 3
TEST 4
LC

**Figure - 4**

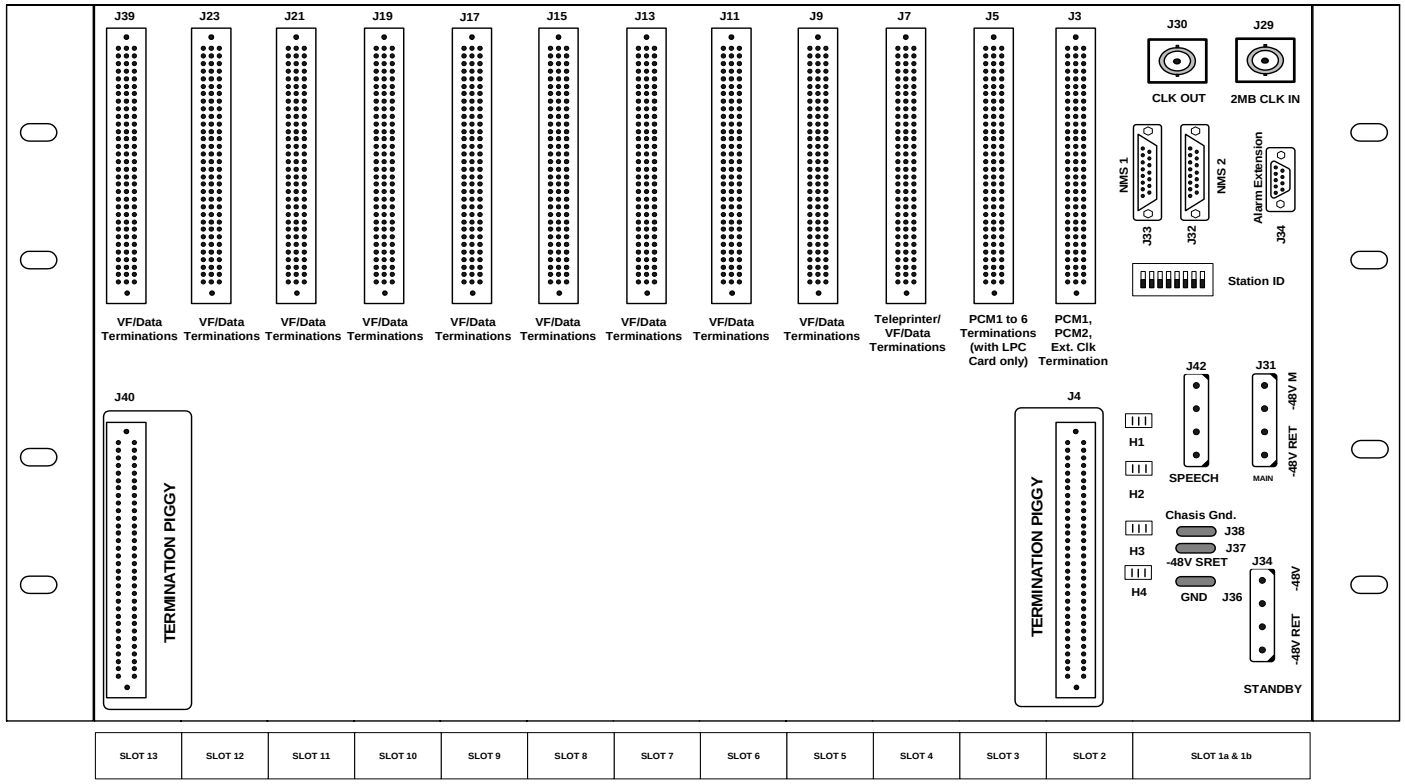

J39
J23
J21
J19
J17
J15
J13
J11
J9
J7
J5
J3
J30
J29
CLK OUT
2MB CLK IN
NMS 1
NMS 2
Alarm Extension
J33
J32
J34
Station ID
VF/Data Terminations
VF/Data Terminations
VF/Data Terminations
VF/Data Terminations
VF/Data Terminations
VF/Data Terminations
VF/Data Terminations
VF/Data Terminations
VF/Data Terminations
Teleprinter/ VF/Data Terminations
PCM1 to 6 Terminations (with LPC Card only)
PCM1, PCM2, Ext. Clk Termination
J40
TERMINATION PIGGY
J4
TERMINATION PIGGY
J42
J31
-48V M
-48V RET
SPEECH
MAIN
H1
H2
H3
H4
Chasis Gnd.
J38
J37
-48V SRET
GND
J36
J34
-48V
-48V RET
STANDBY
SLOT 13
SLOT 12
SLOT 11
SLOT 10
SLOT 9
SLOT 8
SLOT 7
SLOT 6
SLOT 5
SLOT 4
SLOT 3
SLOT 2
SLOT 1a & 1b

**Figure – 5**

# 9. System Specifications

## 9.1 General

| | | |
|---|---|---|
| Number of PCM Trunks | : | 2 |
| Number of user ports | : | 40 max., modularity of 4 in most cases. |
| Number of configurable user ports | : | 30 max., excluding Teleprinter data |
| Types of VF interfaces supported: | | E&M 2W and 4W<br>Loop Incoming<br>Loop Outgoing<br>Subscriber Interface<br>Exchange Interface<br>Hot Line |
| Types of data interfaces supported: | | 64 Kbps G.703 codirectional<br>1200 to 19200 baud sync<br>1200 to 19200 baud async<br>Nx64 Kbps Sync.<br>U Interface (64/128 Kbps)<br>N*64,G.703/Fractional E1 |
| Basic Shelf dimensions for one: VMX-0100 terminal | | 265 x 483 x 260 (H x W x D in mm) |
| Power Supply | : | -36V to -72V, -48(Nom.) |
| Network Clock Synchronisation | : | Selected from<br>Extracted PCM1 Clock<br>Extracted PCM2 Clock<br>Data Interface Clock<br>2.048 MHz External Clock<br>2.048 MHz Internal Clock |
| Other Synchronising features | : | 2.048 MHz network clock out available |

| | | |
|---|---|---|
| Omnibus Conferencing | : | 18 3/4 party conferencing, of which maximum 8 conferences can be 4-party. |
| Alarms | : | All alarms user programmable for threshold and type as Major / Minor/None. All alarms logged in history file |
| Network Management | : | A PC based Application available for network control and management. |

## 9.2 PCM Trunk Interface Specifications

| | |
|---|---|
| Multiplexing | :As per recommendations G.732 |
| Framing Structure | :As per recommendations G.706 |
| Interface | :As per recommendations G.703 |
| Clock Rate | :2048 Kbps $\pm$ 50 ppm |
| Output impedance | :75Ω unbalanced/120Ω Balanced |
| Input impedance | :75Ω unbalanced/120Ω balanced |

## 9.3 VF Interfaces Specifications

### (i) E & M (4W)

| | | |
|---|---|---|
| Coding | : | A-law, rec. G.711 |
| Nominal impedance | : | 600Ω at input and output Ports |
| Return Loss | : | Better than 20dB in range 300-3400Hz |
| Quantization distortion: | | Meets rec. G.712 |

| | | |
|---|---|---|
| Linearity | : | Meets rec. G.712 |
| Frequency distortion | : | Meets rec. G.712 |
| Rx Level | : | -11dBr to + 4dBr adjustable in steps of 0.1 dB |
| Tx level | : | -14dBr to 1dBr adjustable in steps of 0.1dB |

**(ii) E & M (2W)**

| | | |
|---|---|---|
| Coding | : | A-law, rec. G.711 |
| Nominal impedance | : | 600Ω |
| Return Loss | : | 12dB, 300-600Hz<br>15dB, 600-3400Hz |
| Quantization distortion: Meets rec. G.712 | | |
| Linearity | : | Meets rec. G.712 |
| Frequency distortion | : | Meets rec. G.712 |
| Rx Level | : | -14dBr to + 1 dBr adjustable in steps of 0.1dB |
| Tx Level | : | -11dBr to +4dBr adjustable in steps of 0.1dB |

**(iii) Loop Incoming**

Open Loop resistance: More than 10KΩ
Closed Loop resistance: 1200 Ohm max.
Line reversal detection: Provided
Line potential disconnection: Provided detection

| | | |
|---|---|---|
| Trunk Offering | : | Provided |
| Dial Plus speed | : | 8-12 pps |
| VF specs | : | Same as for 2W, E & M |

**(iv) Loop Outgoing**

| | | |
|---|---|---|
| Max. Loop resistance | : | 800Ω |
| Battery reversal capability | : | Provided |
| Trunk Offering Detection | : | Provided |
| Blocking | : | Provided (Reverse potential applied on limbs) |
| Dial Pulse Speed | : | 8 - 12 pps |
| VF specs | : | Same as for 2W, E & M |

**(v) FXS Interface**

| | | |
|---|---|---|
| Max. Loop Resistance: | | 1200Ω |
| Battery reversal capability | : | Provided |
| Ring Voltage : | | 75 V rms $\pm$ 5V |
| Ring Frequency | : | 17-25 Hz |
| Dial Pulse Speed | : | 8-12pps |
| VF Specs : | | Same as for 2W, E & M |

**(vi) FXO Interface**

| | |
|---|---|
| Open Loop resistance : | More than 10KΩ |
| Closed Loop resistance: | 1200 ohm max. |
| Minimum ring voltage : | 15V rms detection |
| Dial Pulse Speed | : 8-12pps |
| VF Specs : | Same as for 2W, E & M |

**(viii) Hot Line**

| | | |
|---|---|---|
| Max. Loop resistance | : | 1200Ω |
| Ring Voltage | : | 75V rms. |
| Ring Frequency | : | 17-25Hz |
| VF Specs | : | Same as for 2W,E& M |

## 9.4 Data Interface Specifications

### ( i ) 64 Kbps G.703 Data Interface

| | | |
|---|---|---|
| Interface | : | Codirectional as per rec. G.703 |
| Nominal Output impedance | : | 120Ω |
| Nominal Input impedance | : | 120Ω |
| Return Loss at Input ports | : | 12dB for 4 KHz - 13 KHz 18dB for 13 KHz - 256 KHz 14dB for 256 KHz - 384 KHz |

**(ii) <u>Low Speed Data Interface</u>**

| | | |
|---|---|---|
| Interface | : | V.24/V.35/V.11/X.21 |
| Modes | : | Sync./Async |
| Rates Supported | : | 1200, 2400, 4800, 9600 and 19200 Kbps |
| Signals supported | : | Tx Data, RX Data, RTS, CTS, DSR/DCD |
| | : | TxC, RxC, XTC (for Sync Modes only) |

**(iii) High Speed Synchronous Data Interface "N X 64"**

Conformity : To (CCITT) Rec. G.703

Mode : Synchronous
Bit Rate : 64 Kbps
Maximum Value of N : 30

**ISDN Digital Subscriber Line (IDSL)**

Interface : 2B1Q/ U interface as per ITU-T G.961
Bit Rate : 64 / 128 Kbps
Features : Optional remote Power Feed

**N*64, G.703/ Fractional E1 interface**

Conformity (Electrical): ITU -T G.703
Frame Structure : As per ITU –T G.704, CRC4
Bit Rate : 2048 Kbps ± 50 ppm
Value of N : 1 - 30

## 9.5 Clock Interfaces Specifications

### ( i ) 2.048 MHz Clock Input

Termination : 75Ω unbalanced/120Ω balanced
Rate : 2048 KHz ± 50ppm
Signal Wave Shape: As per figure 21/G.703(Bluebook) modified by interconnecting line.
Maximum Line Attenuation : 6dB

### (ii) 2.048 MHz Clock Output

Nominal Impedance : 75Ω unbalanced/120Ω balanced
Rate : Synchronised to system clock
Wave Shape : As per G.703
Other specs : As per § 10/G.70

# 10. Commissioning

## 10.1 System Configuration

VMX-0100 configuration requires two distinct steps of setting up & programming Mux for the desired environment and of monitoring its operation for status of trunks, user lines and other network parameters. The latter may also involve reacting to certain alarm conditions by activating alternate configurations etc.

VMX-0100 comes with a Non-Volatile RAM (NVRAM) which holds at all times the running configuration or programming of VMX-0100. This NVRAM comes pre-programmed from the factory to a default typical configuration. This default programming can be viewed on the NMT/ NMS and can be altered to meet installation specific requirements.

## 10.2 Programming Of Vmx-0100

The user interacts with the system from Network Management Terminal / NMS connected to TME Card. Well designed user friendly menus display to user the existing parameters as already programmed and allow user to edit and modify them. The system also checks the new values entered for consistency.

The Mux configuration can be viewed for display and/or modified at any time of the Mux operation.

Once properly programmed, NMT is not required for day to day operation of Mux as the Mux automatically scans the hardware and network lines for alarm and abnormal

conditions and takes appropriate alternate actions defined by the user. A number of LED indicators on the VMX-0100 cards as well as on the bay also continuously display the Mux status at all times. NMT can however be used to display detailed network status, to run diagnostics and to make further changes to the Mux programming if required.

VMX-0100 does not require constant attendance on NMT or otherwise for its normal operation. The configuration and features once programmed and saved in NVRAM guide its operation during normal as well as during alarm conditions, by automatically activating alternate configurations and/or taking other actions as programmed by the user. Several indicators on the VMX-0100 are available however to indicate the status of the Mux and of its various interfaces to the operator. In addition, the NMT can be used to display the network and line status in detail, as well as to initiate local and remote diagnostics to isolate the network problem.

Among the diagnostic aids that can be activated from NMT include local or remote loop back of an entire trunk or of an individual VF/Data time slot.

All alarms in the VMX-0100 are categorised by the system (redefinable by user) as either MAJOR or MINOR or NONE. All major alarms light a alarm LEDs on the 2MB card and also close major alarm audio and visual dry loops. All such major alarm dry loops are connected in parallel and brought to the top of the bay where a major alarm indicator and audio annunciator for the bay is installed. A similar audio/visual annunciator for minor

alarm is also available. The major & minor alarm annunciators are reset upon operator acknowledgement.

## 10.3 Parameters Programmable In VMX-0100

The following major parameters are programmable in VMX-0100 and may be modified from NMT / NMS.

### (i) Parameters related to PCM Trunks

- Framing format CRC 4/Standard
- Enable / Disable trunk
- Time slot cross connection
- 75 / 120 Ohm Line Impedance

### (ii) Parameters related to VF

- VF Port type: E&M 4W / E&M 2W /Loop IC /Loop OG/ FXS / FXO / Hotline
- Trans gain
- Receive gain
- Time slot mapping

### (iii) Parameters related to Data

**When data card is G703** : Time slot mapping

**When Data Card is UDT**

- Baud Rate
- Sync/Async
- Point to Point / Multidrop
- Handshaking
- Time slot mapping

- Interface selection

**When Data Card is N64**

- Time slot mapping
- Value of 'N'

**When Data Card is UIF**

- Time Slot Mapping
- Value of 'N' (1-2)
- Interface Selection

**When Data Card is FE1**

- Time Slot Mapping
- Interface Enable / Disable
- NMS Enable / Disable

**(iv) Parameters related to Network Clocks**

- Programming of network clocks sources in order of priority.

**(v) Miscellaneous parameters**

- Defining all alarms in Mux as Major/Minor/None
- Setting up omnibus Conferencing channels
- Defining conditions for activating Mux bypass
- Defining alarm thresholds for BER, CRC errors, slip counts
- Setting up and defining alternate route configurations in case of major network failures.

## 10.4 Remote Programming Of VMX-0100

NMS can be used to implement the remote programming of other VMX-0100 in a network from a single Mux.

## 10.5 Factory / Default Settings

### 10.5.1 Factory / Default Settings For User Interface Cards

**(i) For VF Interfaces**

| Card Type | Port Type | Tx dBr | Rx dBr (dB) |
|---|---|---|---|
| E&M | 4W E & M | -3.5 | -3.5 |
| FXO | FXO | 0 | -2.0 |
| FXS | FXS | 0 | -2.0 |

**64 Kbps G.703 Data Interface**

| Card Type | Port Type |
|---|---|
| G703 Card | 64 Kbps G.703 Co-directional I/F |

**(ii) Low Bit Rate Data Interface**

| Card Type | Port Type |
|---|---|
| UDT Card | 9600 baud V.24, async Data |

**Other Settings:**

- No. of Data bits: 8
- No. of stop bits: 1
- Parity: Disabled
- Handshaking: Disabled

**(iii) N * 64 High Speed Synchronous Data Interface**

| **Card Type** | **Port Type** |
|---|---|
| N * 64 Kbps Card | N = 1 to 30, V.11/ V.35, Synchronous |

**Other Settings:**

- Handshaking: Disabled
- Clock Mode: Sync Internal

(iv) **ISDN Digital Subscriber Line Interface**

| **Card Type** | **Port Type** |
|---|---|
| UIF Card | LT |

**Other Settings:**

- Line rate: 64 / 128 Kbps

(v) **N*64, G.703 / Fractional E1 interface**

| **Card Type** | **Port Type** |
|---|---|
| FE1 Card | N = 1 to 30, Bit rate of 2048± 50 ppm |

**Other Settings:**

- Termination Impedance : 75 Ohm
- NMS Working : Disable

### 10.5.2 Factory / Default Settings For Clocks

| | |
|---|---|
| Priority 1 | PCM1 |
| Priority 2 | PCM2 |
| Priority 3 | DCLK |
| Priority 4 | EXT. 2M |
| Priority 5 | INT. 2M |

### 10.5.3 Factory / Default Settings Miscellaneous

**(i) Passwords:**

Level 0 (User) : No Password
Level 1 (Supervisory) : 123
Level 2 (Administrative) : 1234

**(ii) Time of Day event:** None Selected

**(iii) PCM Trunk Settings**

| | |
|---|---|
| PCM 1 | Framing Format - Standard |
| | Signalling Format - CAS |
| | CRC4 Enabled |
| PCM2 | Framing Format - Standard |
| | Signalling Format - CAS |
| | CRC4 Enabled |

## 10.6 Configuration Menu

### 10.6.1 General

VMX-0100 is a highly versatile and programmable PCM multiplexer based on multiple microprocessors. The Mux comes with a Network Management Terminal (NMT) through which all the programming and control features of VMX-0100 are accessible.

VMX-0100 comes with a non-volatile NVRAM whose contents define the running configuration of the Mux as well as control its operating behaviour during its run time. The NVRAM comes pre-configured to certain default settings from the factory, which configures it to a typical operating environment. From the NMT the user can see these values as well as alter them to suit the specific requirements of the Mux at site.

### 10.6.2 Setting Up NMT

Opening screen displays PUNCOM Versatile Multiplexer, VMX-0100 & the current software version. After pressing the 'Enter' main menu screen is displayed which is as follows.

1. Status
2. Routing Tables
3. Conference Set up
4. Hardware Set up
5. User Options
6. Maintenance
7. Administrative Login

8. Administrative Logout
9. Diagnostics

**Enter your selection (1 to 9)**

After the user enters his selection other menus are displayed to the user to solicit further selections from him and/or display him the information.

### 10.6.3 Hardware Set Up (User Selection 4)

A further user screen 4.0 is displayed in response to user selection 4. Under this selection following options are available:

**( i ) Configure Trunk (User Screen 4.1)**

This screen allows enabling/disabling of the selected PCM trunk, framing format, CRC enable/disable & line impedance etc.

**(ii) Configure Slot (User Screen 4.2)**

This screen allows the user to configure a particular slot for a required user interface. If auto-learn mode is executed, the system automatically configures itself for the given card. User can keep maximum 40 physical ports configured as either VF or Data. During run time the system detects the type of card actually present in the system and activates the required programming.

**(iii) Channel Configuration (User Screen 4.3)**

This screen allows user to configure a particular channel for specific type. In this screen the specific parameters of a particular channel of already configured slot, can be selected.

**(iv) Erase Hardware Set up (User Screen 4.4)**

This option can only be activated by administrative user and initialises the entire hardware to default configuration.

### 10.6.4 Routing Table (User Selection 2)

**General**

Routing Tables are used to program and define the cross connections between time slots of PCM1 and PCM2 and VF/Data ports. Upto four routing tables can be programmed and kept in readiness. However at any time only one routing table can be active. Power On Routing Table shall become active at power. There after other routing tables can be activated by user on manual intervention from NMT.

**Editing Routing Tables**

Selecting Routing Table entry on the main menu further displays routing table screen 2.0 with following selections:

**(i) Enter Routing Table No. To Edit (User Screen 2.1)**

Enter Routing Table No. option selects the one routing table out of four that will be used in options 2 to 8.

**(ii) Modify Connection(User Screen 2.2)**

Modify connection selection in user screen 2.2 further displays another screen 2.2.1 to the user. The user enters the source and the destination time slots to be routed.

**(iii) Delete Connection(User Screen 2.3)**

Delete connection allows the user to disconnect a specific port or TS of any trunk (PCM1, PCM2) in a routing table.

**(iv) Display Routing Table(User Screen 2.4)**

Display routing table displays the entries of a routing table. Through this option the user can know the exact routing details of the system. The format of this screen is given below:

| PCM1 TS | CONNECTED TO | PCM2 TS | CONNCTED TO | PORT NO. | CONNECTED TO |
|---|---|---|---|---|---|
| 1 | | 1 | | 1 | |
| 2 | | 2 | | 2 | |
| -- | | -- | | -- | |
| 32 | | 32 | | 40 | |

**(v) Activate Routing Table (User Screen 2.5)**

Activate routing table displays the currently active routing table number and allows the user to activate another routing table.

**(vi) Erase Routing Table (User Screen 2.6)**

Erase routing table erases all relevant entries in a routing table. This routing table if made active shall disconnect all time slots in PCM1, PCM2 and VF from all other time slots.

**(vii) Copy Routing Table (User Screen 2.7)**

Copy routing table command is used to copy an entire routing table to another table so that only alterations need be edited in that. This saves the operator from the tedium of entering an entire routing table when it is only slightly different from another existing table.

**(viii) Specific Card Routing (User Screen 2.8)**

Specific Card routing is used to perform routing of UDT, N*64, IDSL & FE1 Cards. This option further includes sub option for Add routing, Delete routing & Display routing of these cards.

**Default Settings For Routing Tables**

Power up Routing Table: No. 1

| PCM1 TS | CONNECTED TO | PCM2 TS | CONNECTED TO | PORT NO | CONNECTED TO |
|---|---|---|---|---|---|
| 1 | Port 1 | 1 | No Connection | 1 | PCM1 1 |
| 2 | Port 2 | 2 | No Connection | 2 | PCM1 2 |
| 3 | Port 3 | 3 | No Connection | 3 | PCM1 3 |
| 4 | Port 4 | 4 | No Connection | 4 | PCM1 4 |
| 5 | Port 5 | 5 | No Connection | 5 | PCM1 5 |
| 6 | Port 6 | 6 | No Connection | 6 | PCM1 6 |
| 7 | Port 7 | 7 | No Connection | 7 | PCM1 7 |
| 8 | Port 8 | 8 | No Connection | 8 | PCM1 8 |
| 9 | Port 9 | 9 | No Connection | 9 | PCM1 9 |

| PCM1 TS | CONNECTED TO | PCM2 TS | CONNECTED TO | PORT NO | CONNECTED TO |
|---|---|---|---|---|---|
| 10 | Port 10 | 10 | No Connection | 10 | PCM1 10 |
| 11 | Port 11 | 11 | No Connection | 11 | PCM1 11 |
| 12 | Port 12 | 12 | No Connection | 12 | PCM1 12 |
| 13 | Port 13 | 13 | No Connection | 13 | PCM1 13 |
| 14 | Port 14 | 14 | No Connection | 14 | PCM1 14 |
| 15 | Port 15 | 15 | No Connection | 15 | PCM1 15 |
| 16 | No Connection | 16 | No Connection | 16 | PCM1 17 |
| 17 | Port 16 | 17 | No Connection | 17 | PCM1 18 |
| 18 | Port 17 | 18 | No Connection | 18 | PCM1 19 |
| 19 | Port 18 | 19 | No Connection | 19 | PCM1 20 |
| 20 | Port 19 | 20 | No Connection | 20 | PCM1 21 |
| 21 | Port 20 | 21 | No Connection | 21 | PCM1 22 |
| 22 | Port 21 | 22 | No Connection | 22 | PCM1 23 |
| 23 | Port 22 | 23 | No Connection | 23 | PCM1 24 |
| 24 | Port 23 | 24 | No Connection | 24 | PCM1 25 |
| 25 | Port 24 | 25 | No Connection | 25 | PCM1 26 |
| 26 | Port 25 | 26 | No Connection | 26 | PCM1 27 |
| 27 | Port 26 | 27 | No Connection | 27 | PCM1 28 |
| 28 | Port 27 | 28 | No Connection | 28 | PCM1 29 |
| 29 | Port 28 | 29 | No Connection | 29 | PCM1 30 |
| 30 | Port 29 | 30 | No Connection | 30 | PCM1 31 |
| 31 | Port 30 | 31 | No Connection | 31 | No Connection |
| 32 | No Connection | 32 | No Connection | 32 | No Connection |
| 33 | No Connection | 33 | No Connection | 33 | No Connection |
| 34 | No Connection | 34 | No Connection | 34 | No Connection |
| 35 | No Connection | 35 | No Connection | 35 | No Connection |
| 36 | No Connection | 36 | No Connection | 36 | No Connection |
| 37 | No Connection | 37 | No Connection | 37 | No Connection |
| 38 | No Connection | 38 | No Connection | 38 | No Connection |
| 39 | No Connection | 39 | No Connection | 39 | No Connection |
| 40 | No Connection | 40 | No Connection | 40 | No Connection |

### 10.6.5 Conference Setup (User Selection 3)

The set-up allows selection of 1 or 2 local VF ports and one time slot each on PCM1 and PCM2 to be put in each Conferencing. The system has provision for 18, 3 / 4 party Conferencing, of which maximum 8 conferences can be 4-party. The various options available under this selection are given below:

**(i) Enter Routing Table No. To Edit (User Screen 3.1)**

Enter Routing Table No. option selects the one routing table out of four that will be used in options 2 to 4.

**(ii) Add Conference (User Screen 3.2)**

A new conference can be made using one time slot each from PCM1, PCM2 and 1 or 2 local VF ports. Add Conference selection in screen 3.2 further displays another screen 3.2.1 to the user. The user enters the source and the destination time slots to be routed.

**(iii) Delete Conference (User Screen 3.3)**

Delete Conference allows the user to delete the existing conference.

**(iv) Display Conferences (User Screen 3.4)**

Display routing table displays the existing conferences and the time slots & ports involved. The format of this screen is given below:

| CONF. NO. | TYPE | PCM1 TS | PCM2 TS | PORT NO. 1 | PORT NO. 2 |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| -- | | | | | |
| 18 | | | | | |

**Default Settings For Conferences**

No VF channel in conference. Conferencing Disabled

## 11. Maintenance

### 11.1. Maintenance Guidelines

Various maintenance aids have been provided in VMX equipment. Following is brief introduction to these:

a) **Alarms and Indications**

Alarm and indications LED's are provided on various modules of equipment. Their OK & faulty states are mentioned in previous Chapter under Cards Installation section.

b) **Test and measurement points**

Power supply measurements points are provided on T ME card to check supply input.

c) **Maintenance through NMS software**

NMS (Network Management Software) is provided which maintains all VMX equipment connected in a network. Operator can refer to NMS user manual for details. However, maintenance procedures possible through NMS are described in section Maintenance Action Procedures.

VMX equipment has been designed in a modular way to assist troubleshooting and fault detection. The equipment has visual alarm indicators on various cards that allow identifying faulty cards as well as determining fault type.

Maintenance team consists of two lines of staff:

a) The 1st line maintenance staffs shall identify faulty cards and replace them. They also carry out periodic checks of various system parameters to ensure satisfactory system operation and to restore the communication link at the earliest in case of system failure.

b) The 2nd line maintenance staffs shall undertake repair of faulty cards, assembly adjustments, testing and debugging etc.

## 11.2 Routine Maintenance

Routine maintenance is carried out while the system is in operation and consists of checking the important system parameters at the monitoring sockets provided. This process helps to identify faults if present and correct the fault at the earliest

The routine check may be carried out weekly, monthly or yearly depending upon the importance of parameters and strength of manpower. Use of NMS software allows remote maintenance of the equipment. The following schedule is suggested for efficient maintenance:

**a) Weekly check**

- Check –48V input terminal
- Check alarm LED's on various cards and compare them with ideal states.
- Check whether all electrical cables and connections are properly secured and the cables are not stretched.
- Check alarm history to record occurrence of any alarm type.

**b) Monthly check**

- During monthly check, error performance of individual equipment and monitoring voltages are considered.

**c) Yearly check**

- Various tests of 2MB PCM stream and individual cards are performed using testing equipments like Oscilloscope, Digital Multimeter and PCM terminal test set etc.

## 12. Fault Management

VMX-0100 provides visual alarm indicators on the front panel of every card for fault determination and isolation in event of system failure.

Faults are split into three types:

**Major Faults:**

A major fault is a fault whose appearance inhibits normal operation of the equipment or entails risk to operation.

**Minor Faults:**

A minor fault is a fault whose appearance causes no risk to equipment operation. In this case normal operation of equipment is guaranteed.

**None:**

This class includes faults which operator desires to ignore on their appearances. Normal operation of equipment is guaranteed when they appear.

Faults are split into three categories:

Powering-Up Faults
Hardware Faults
Communication Faults

| **FAULTS** | **CLASS** |
|---|---|
| **Powering-up Faults** | |
| Conference Piggy Absent | MAJOR / MINOR / NONE * |
| NVRAM Fail | MAJOR / MINOR / NONE * |
| | |
| **Hardware Faults** | |
| Power Supply1 Failure | MAJOR / MINOR / NONE * |
| Power Supply2 Failure | MAJOR / MINOR / NONE * |
| Slot Fail / Absent | MAJOR / MINOR / NONE * |
| Port Failure | MAJOR / MINOR / NONE * |
| | |
| **Communication Faults** | |
| Priority-1 Clock Failure | MAJOR / MINOR / NONE * |
| Priority-2 Clock Failure | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): LOS | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): FSYNC | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): MFSYNC | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): CRCSYNC | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): AIS | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): BIT3 | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): BIT6 | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): AIS16 | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): EXX_BER3 | MAJOR / MINOR / NONE * |
| Trunk (PCM1/PCM2): EXX_BER6 | MAJOR / MINOR / NONE * |

* Depends on operator/user requirements

## 13. Maintenance Action Procedures

The following maintenance options have been provided in the Versatile Mux, which can be used to identify network or Mux faults as well as to activate network reconfigurations.

### ( i ) Loop backs

VMX-0100 provides local and remote loop backs at both trunk and channel level which can be activated from NMT.

### (ii) MUX Bypass

In case of critical hardware failure, the Mux automatically bypasses itself by physically shorting PCM1 trunk to PCM2 trunk through bypass relays. This bypass can also be activated from NMT.

### (iii) Statistics Collection

Mux can be programmed to collect error and slip statistics on the PCM1 and PCM2 trunks. The statistics collections can be started/stopped for a specified period or can be done on continuous basis. In latter case, thresholds can be specified for error performance and major/minor alarms can be raised in case error performance deteriorates.

### (iv) Alarm History

The VMX-0100 maintains a 100 deep alarm history file that contains at all times the most recent 100 past and present alarms including their generation and clear time.

This display can be used to see in one place, a chronological sequence of last 100 alarms. In case the history file overflows with new alarms, older, minor and major alarms, in order, are deleted from display.

## 14. Maintenance Menu

### 14.1 Maintenance

Through this menu the user is provided with several options, which can be used for the fault finding or the routine maintenance. Under user options, the user programs following items:

#### (i) Display Hardware

This screen displays all the configured & the actually present cards in the system.

#### (ii) Loopbacks

This user option further provides the option for:

- System Bypass
- Loopback Trunk
- Loopback Channel

The various loopbacks can be initiated for the desired period of the time.

**(iii) Display Alarm History**

User can see the 100 entries deep alarm log file, which provides the Alarm, Alarm Type, Alarm Generation Time, Alarm Clearing Time etc.

**(iv) Erase Alarm log**

This option can only be activated by administrative user and initialises the entire alarm log.

**(v) G821 Statistics**

This option allows the user to see the G.821 Statistics for past 24 Hrs. & current Hr. for both the trunks. It also provides the option to restart G.821 statistics.

## 15 Human Machine Interface

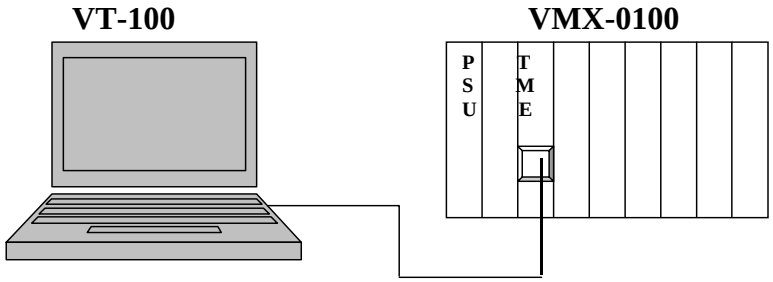
### 15.1. Interface Types

The human-machine interface forms an inevitable feature of VMX-0100. Various interface types have been incorporated in the equipment that allow operator to operate VMX-0100 not only from field site but also from remote location. Choice of interface type depends on the location of the operator as well as the flexibility desired by the operator. A brief introduction to interface types is given below:

**NMT (Network Management Terminal)**

This method consists of a connecting VT-100 monitor to VMX equipment using RS-232 serial interface. VMX has

serial port provided on TME card for this purpose. VT-100 is further connected to keyboard that allows operator to select menus and give input to VMX equipment. The connection is shown below:




**OPERATION OF VMX-0100 with NMT**

**( i ) With NMT disconnected**

The NMT can be disconnected from the VMX-0100 after it has been installed and made operational.

Even if no NMT is connected, the VMX-0100 continues to function, displaying their own and network status on different LED and on bay major and minor alarm indicators. Major & Minor alarms once raised remain raised until the alarm condition is cleared.

**(ii ) With NMT connected**

NMT when connected to VMX-0100 can be used to the following advantages:

1. The detailed status of system can be displayed.

2. Conditions causing major and minor alarms can e seen.
3. Active MUX diagnostics can be activated.
4. The alarm log file can be viewed, which is a history file of the latest 100 alarms.

Screens 1.1 to 1.3 display the detailed network status for the Mux. Screen 1.1 gives the summary nodal communications status of the Mux and gives the total number of major and minor alarms in the node, the current clock source running and its defined priority level.

Screen 1.2 gives detailed status of the trunks (PCM1 & PCM2). Screen 1.3 gives the channel status for channels 1 to 40.

## 15.2 NMS (Network Management System)

For remote monitoring and configuration of VMX equipment, NMS interface type has been incorporated. Under this method, an operator is provided with Network Management System software application compatible with Microsoft Windows 2000, Windows XP. The NMS data is sent over 2MB stream i.e. 2 bits of NMS data are transferred in every PCM30 frame. An Ethernet port is provided on TME card for this purpose.

### Web Server

This interface type is additional feature provided for operators who demand remote operation of VMX using WWW (World Wide Web). The operator accesses the various menus by entering IP of VMX equipment in Internet Explorer of Microsoft Windows Operating

system. The Ethernet port provided on TME card is used for this interface type. HTTP 1.0 version is supported by VMX equipment. Various menus accessible from NMT except Diagnosis are also accessible using this method. However, the operator must check web browser version before using this method.

## 15.3. Menu Description

### 15.3.1 Status (User Selection 1)

This menu further displays the following options:

**(i) System Status:**

This user option displays the system status, which includes bypass status, no. of major alarms, no. of minor alarms & sync. Source etc.

**(ii) Trunk Status:**

This screen displays trunk enable/disable status, loopback status, major/minor alarms present.

**(iii) Channel status:**

This screen displays each channel's status, its settings & alarm status pertaining to the channel.

### 15.3.2 Routing Tables (User Selection 2)

This user option is discussed in para 10.

### 15.3.3 Conference Setup (User Selection 3)

This user option is discussed in para 10.

### 15.3.4 Hardware Setup (User Selection-4)

This user option is discussed in para 10.

### 15.3.5 User Options (User Selection 5)

Under user options, the user programs following items:

**(i) Set Time (User Screen 5.1)**

In this screen the user can change current Time, Date & Day.

**(ii) Edit Password (User Screen 5.2)**

Password editing is however allowed only if user gives his level's password.

**(iii) Power-up Routing Table (User Screen 5.3)**

VMX-0100 maintains upto 4 routing tables any of which can be active at a time. This entry defines the routing table number, which shall be activated at power on. It is also possible to activate the last active routing table at power on.

**(iv) Time of Day reconfiguration (user screen 5.4)**

Through this screen upto five events (time of day and date) can be specified at which specified routing table numbers shall be brought into activation.

**(v)Select sync source Priorities (User Screen 5.5)**

Through this screen the network sync clocks and their priorities are defined. The highest priority clock is automatically selected.

**(vi)Major/Minor alarm Settings (User Screen 5.6)**

This screen allows the user to define each possible alarm in the system as either major / minor / none. It also allows user to define thresholds for the alarms.

### 15.3.6 Maintenance (User Selection 6)

This user option is discussed in para 11.

### 15.3.7 Administrative Login (User Selection 7)

There are three different levels of login, which provides different privileges to the users. These levels are:

- **Level 0 (User Mode):** The system automatically logs in the user mode, when VT-100 is connected to it. In this mode the user can view the settings along-with the system status. In this mode the user is not allowed to change the programming.
- **Level 1 (Supervisory Mode):** To modify/update settings, user has to login in supervisory mode. The entry to supervisor mode is protected by passwords, which the user must enter correctly to be able to login in supervisor mode. In supervisory mode only those settings can be changed which do not disturb the traffic. These include VF gains etc. The default

password is 123 and can be changed to other codes by the user.

- **Level 2 (Administrative Mode):** The administrative level password gives access to modification of all operational parameters and settings. The default setting of the password is 1234 and can be changed to other codes by the user.

Once changed, the new passwords can only be used and must be remembered by the user. In case of accidental loss of level 2-password code, only way to get back to 1234 code is by loading default settings wherein the entire hardware is re-initialised.

### 15.3.8 Administrative Log Off (User Selection 8)

Log off command is used to log off from the supervisory/administrative mode. The system also automatically logs off if no Keyboard entry from NMT is received for five minutes. This is to safeguard against the supervisor accidentally leaving the terminal logged in supervisor mode.