C-DOT DSS MAX

MAINTENANCE PROCEDURES

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(Updated w.r.t. Software Release 2_1_1_1)

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THIS C–DOT SYSTEM PRACTICE REFERS TO THE C–DOT DIGITAL SWITCHING SYSTEM MAIN AUTOMATIC EXCHANGE (ABBREVIATED AS C-DOT DSS MAX IN THE REST OF THIS PUBLICATION).

THE INFORMATION IN THIS SYSTEM PRACTICE IS FOR INFORMATION PURPOSES AND IS SUBJECT TO CHANGE WITHOUT NOTICE.

A COMMENT FORM HAS BEEN INCLUDED AT THE END OF THIS PUBLICATION FOR READER'S COMMENTS. IF THE FORM HAS BEEN USED, COMMENTS MAY BE ADDRESSED TO THE DIRECTOR (SYSTEMS), CENTRE FOR DEVELOPMENT OF TELEMATICS, 39, MAIN PUSA ROAD, NEW DELHI - 110 005

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Chapter 1.

Introduction

1.1. GENERAL

In C-DOT DSS MAX, two types of configurations are envisaged at Central Module level depending on the number of Base Modules connected to it. The first one is MAX-L (Main Automatic Exchange - Large) which supports a maximum of 16 Base Modules (BM) and the other is MAX-XL (Main Automatic Exchange - Extra Large) which supports a maximum of 32 Base Modules (BM-XL).

This document apprises maintenance personnel of their role in maintaining the C-DOT DSS family products for different configurations of SBM and MBM Exchanges. The maintenance procedure for SBM and MBM Exchanges are same except that

i) In SBM Exchanges, IOPs are connected to BP in BM-Rack and in MBM, it is connected to AP in CM-Rack.

ii) Additional maintenance procedure of CM-Rack which is used only in MBM Exchanges.

iii) Different ADPs for SBM and MBM Exchanges are connected to BP & AP respectively.

Wherever, the maintenance procedures differ for the specific configuration, the cross reference and special instructions in the form of "**Note**" has been incorporated.

The organisation of the document is as follows :

Chapter 2, provides all the information on system description and packaging.

Chapter 3 explains the hardware architecture of the system.

Chapter 4 describes the system initialisation including software loading and IOP boot up/shut down procedures.

Chapter 5 describes the routine maintenance philosophy for various modules.

Chapter 6 details preventive maintenance, trouble shooting and repair aspects of maintenance.

Chapter 7 describes the maintenance procedures of terminals as well as service circuits.

Chapter 8 describes the maintenance procedure for Network synchronization.

Chapter 9 gives some recommendations regarding precautions to be taken, logs to be maintained and feedback to be furnished to the 'repair centre'.

Chapter 10 indicates DOs and DON'Ts of the maintenance.

Appendix : Finally, as a quick reference to the test set numbers, audit set numbers, card IDs, test IDs etc., a complete list of these is provided in the appendices.

Pre-requistics : General familiarity with the maintenance capabilities of the system is assumed. Description of maintenance commands, detailed description of alarms and reports generated by the system do not come under purview of this document. Such aspects have been covered under respective maintenance related documents as "Maintenance Commands" and "Alarms & Reports".

Chapter 2.

The C-DOT DSS Family

2.1. GENERAL

C-DOT DSS MAX is a universal digital switch which can be configured for different applications as local, transit, or integrated local and transit switch. High traffic/load handling capacity upto 8,00,000 BHCA with termination capacity of 40,000 Lines as Local Exchange or 15,000 trunks as Trunk Automatic Exchange, the C-DOT DSS family is ideally placed to meet the different requirements of any integrated digital network.

The design of C-DOT DSS MAX has envisaged a family concept. The advantages of family concept are standardised components, commonality in hardware, documentation, training, installation and field support for all products and minimization of inventory of spares. Infact this modular design has been consciously achieved by appropriate hardware, practices.

The equipment practices provide modular packaging. Common cards and advanced components have been used in the system hardware in order to reduce the number and type of cards. Standard cards, racks, frames, cabinets and distribution frames are used which facilitate flexible system growth. Interconnection technology has been standardised at all levels of equipment packaging. All these features, together with ruggedised design, make C-DOT DSS MAX easy to maintain and highly reliable.

Another important feature of the design is the provision of both local and centralised operation and maintenance. Beginning with local operation and maintenance, with the installation of similar digital switches in the network, centralised operation and maintenance will provide maintenance and administration services very economically. All these services are provided through a simple, interactive man-machine interface.

2.2. FLEXIBLE ARCHITECTURE

C-DOT DSS is a modular and flexible digital switching system which provides economical means of serving metropolitan, urban, and rural environments. It incorporates all important features and mandatory services, required by the user with option of upgradation to add new features and services in future. The architecture for the C-DOT DSS is such that it is possible to upgrade a working

C-DOT SBM or MBM Exchange to provide ISDN service by adding minimum additional hardware modules while retaining existing hardware units. Another factor of the architecture is to support ISDN subscribers through Remote Switching Unit (RSU). This remote switching unit is able to provide switching facility locally even in case of failure of the communication path to the parent exchange. The system employs an open-ended architecture for flexibility of configuration and growth. The processor architecture is characterised by distributed control and message-based communication in order to achieve a loosely-coupled network for a flexible system architecture.

Software is written in high level language 'C' and distributed over various processors and is structured as a hierarchy of virtual machines. The software is packaged such that, depending upon the actual switch configuration, it can be distributed over appropriate controllers. The software features are implemented by communicating processes. The operating system provides message communication facilities such that the processes are transparent to their physical locations.

For inter-processor communication, messages are exchanged over HDLC links that are implemented either as direct links or switched network paths. This approach hides the physical details of processes from each other and provides a flexible communication network between the processors. New modules can be added and existing modules can be modified without affecting other modules in the system.

Resources are identified as 'global' or 'local' depending upon their distribution in the system. The resources which depend upon the number of terminals are provided within the basic growth unit, the Base Module. Base processors are provided for handling call processing locally. In a small system application, these processors independently support call processing, exchange operation and maintenance functions.

On the other hand, in order to avoid replication of large data and memory intensive functions, some features and facilities are provided centrally. Program backup, bulk data storage, man- machine interface and operations and maintenance facilities are therefore provided centrally in order to provide a means of separating the switch from the operations and maintenance interface.

2.3. TECHNOLOGY

The system employs a T-S-T switching configuration and is based on a 32-channel PCM structure. It uses a basic rate of 64Kbps and 2Mbps primary multiplexing rate. Control is distributed over the system by using 32-bit, 16-bit and 8-bit microprocessors. All the critical control circuitry has built-in redundancy.

System hardware utilises advanced concepts in micro electronics for a compact and optimum design. Basic memory unit has been implemented as a 16MB dynamic RAM board. Single-chip digital signal processors are used for implementing DTMF and MF receivers. A high performance, high density VLSI chip detects multiple

tones and simultaneously performs signal filtering on four channels. This approach reduces costs, power dissipation and saves space on the PCBs.

Analog to digital conversion on the line circuits has been achieved by using a per channel coder-decoder (CODEC) chip. Customisation based on ASICS/FPGAs has been used to optimize space utilisation and reduce the number of components on the line cards.

2.4. BASIC GROWTH/BUILDING MODULES

C-DOT DSS MAX exchanges can be configured using four basic modules (Fig. 2.1)

a. Base Module

b. Central Module

c. Administrative Module

d. Input Output Module

The Base Module (BM) is the basic growth unit of the system. It interfaces the external world to the switch. The interfaces may be subscriber lines, analog and digital trunks, CCM and PBX lines. Each Base Module can interface upto 2024 terminations. The number of Base Modules directly corresponds to the exchange size. It carries out majority of call processing functions and, in a small-exchange application, it also carries out operation and maintenance functions with the help of the Input Output Module.

In Single Base Module (SBM) exchange configuration, the Base Module acts as an independent switching system and provides connections to 1500 lines and 128 trunks. In such a configuration, the Base Module directly interfaces with the Input Output Module for bulk data storage, operations and maintenance functions. Clock and synchronisation is provided by a source within the Base Module. It is a very useful application for small urban and rural environments.

With minimum modifications in hardware through only one type of card, a Base Module can be remotely located as a Remote Switch Unit (RSU), parented to the main exchange using PCM links.

Central Module (CM) consists of a message switch and a space switch to provide inter-module communication and perform voice and data switching between Base Modules. It provides control message communication between any two Base Modules, and between Base Modules and Administrative Module for operation and maintenance functions. It also provides clock and synchronisation on a centralised basis.

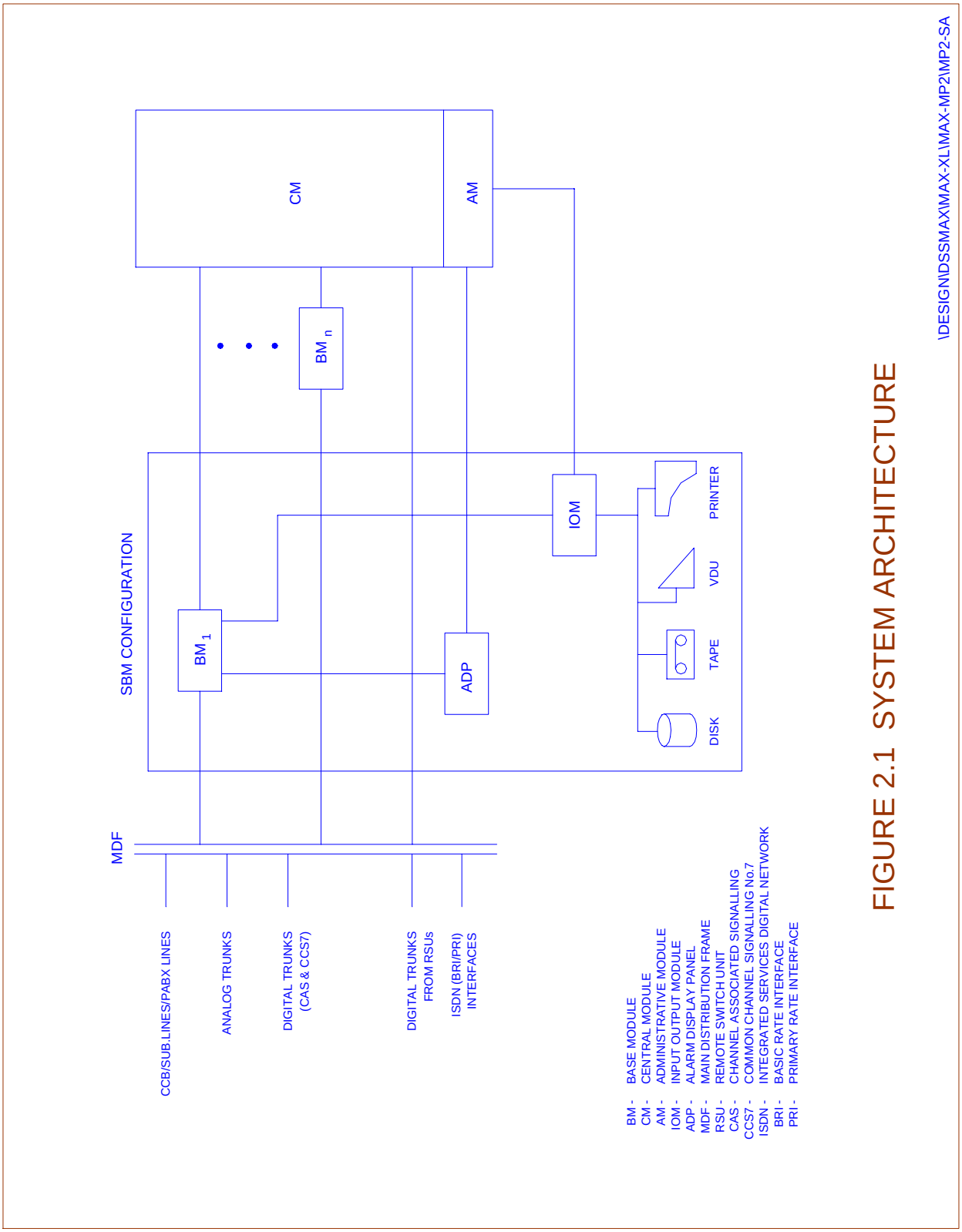


FIGURE 2.1 SYSTEM ARCHITECTURE

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-SA

Administrative Module (AM) performs system-level resource allocation and processing function on a centralised basis. It performs all the memory and time intensive call processing support functions and also administration and maintenance functions. It communicates with the Base Module via the Central Module. It supports the Input Output Module for providing man- machine interface. It also supports the Alarm Display Panel for the audio-visual indication of faults in the system.

Input Output Module (IOM) is a powerful duplex computer system that interfaces various secondary storage devices like disk drives, cartridge tape drive and floppy drive. It supports printers and upto 8 serial ports for video display units which are used for man- machine communication interface. All the bulk data processing and storage is done in this module.

Thus, a C-DOT DSS exchange, depending upon its size and application, consists of Base Modules (maximum 32), Central Module, Administrative Module, Input Output Module and Alarm Display Panel. The Base Modules can be remotely located or co-located depending on the requirement.

2.5. REMOTE SWITCH UNIT

Remote Switch Unit (RSU) is an integral part of C-DOT DSS architecture. In order to realise a RSU, the normal BM can be modified for remoting with the host exchange via 2 Mbps digital links. The number of 2 Mbps links between the Main Exchange and RSU is primarily determined by the traffic. A maximum 16 PCMs can be provided between a RSU & Main exchange. Analog and Digital trunk interfaces are also implemented in RSU to support direct parenting of small exchanges from RSU itself instead of parenting it to the main exchange which will ultimately save the media required from main exchange. As far as call processing is concerned, RSU is an autonomous exchange capable of local-call completion. Operation and maintenance functions are handled by the host exchange. In the event of failure of PCM links, RSU goes into standalone mode of operation. In case it is not possible to process a call request due to unavailability of links to the host, the subscriber is connected to appropriate tone or announcement.

During standalone mode of operation, the local and Incoming terminating calls in RSU are switched and the metering information of all the RSU subscribers is stored in the RSU. It is sent to the host whenever the PCM links are available again.

Only the even numbered BMs can be configured as RSU i.e. a maximum 16 RSUs are possible in C-DOT DSS MAX-XL and 8 RSUs in MAX-L.

2.6. COMMON CHANNEL SIGNALLING NO. 7 AND ISDN

Common Channel Signalling is pre-requisite to provide any value added service in the network e.g. Intelligent Network Services, ISDN services. Due to intelligent protocol implementation in conformance to ITU-T specifications and with the implementation of CCS7 signalling in C-DOT DSS, it has been made possible to provide the value added services. Also it is possible to configure the C-DOT DSS as TAX with multiple nodes, connected on CCS7 signalling.

ISDN Services are the most widely used carriers to transport bulk volume of data. With the increasing use of Internet Access, the use of ISDN interface is likely to go up as it provides the reliable access to the user at the rate of 64/128 Kbps. In addition to reliable data connection at higher rate, it integrates computer and Telephone on the single access.

In C-DOT DSS, the implementation is through add-on modules to provide the services in the beginning itself or retrofit as and when required. This facilitates the network administrator to upgrade the already commissioned exchanges in future.

2.7. REDUNDANCY

To meet the stringent availability requirements, C-DOT DSS employs 'hot standby' technique for all processor complexes so that in the event of the failure of any one security-block, not more than 8 subscribers will be affected.

Hardware cross-links between processors have been planned in such a way that even the failure of two dissimilar processors will not affect system performance. Also, wherever there is no duplication of hardware units, multiple units are provided to work in a load-sharing mode. In the event of failure of one of the units, other units will share its load preventing disruption of service. In case of certain service circuits, n+1 configuration is used for maintaining reliability.

2.8. COMMON HARDWARE UNITS

Various hardware units such as controller complexes and message switches have been standardised for multiple applications. This interchangeability is an important feature of the system hardware that helps in reducing inventories and increasing system availability. Some of these standardised units are -

- **Module Control Unit**

  Module Control Unit is a 16-bit or 32-bit microprocessor complex with associated memory unit. The same unit can be used as the Base Processor Unit in the Base Module or as the Space Switch Controller in the Central Module or as the Administrative Processor Unit in the Administrative Module.

- **Interface Controller**

  This is an 8-bit microprocessor based unit with a time-switching network that can be used to control either terminal interface in the Terminal Unit or service circuit interface in the Time Switch Unit. In both the cases, its function is to assign time-slots on the 128- channel link between the terminals (subscribers, trunks, etc.) and the module time switch.

- **Message Switch**

  Message Switch is implemented as a 32-bit message switch controller which provides upto 38 HDLC/ADLC links for message communication between controllers. In the Base Module, the message switch can also be implemented as a 16-bit message switch controller and a message switch device card. In such an implementation, the controller provides upto 22 HDLC/ADLC links with the help of the device card.

2.9. OPTIMISATION

In C-DOT DSS, distribution and centralisation of functions have been optimised. There are local functions which are entrusted to the growth units, i.e., the Base Modules, for local switching and interfacing. These functions use resources whose requirement is directly linked with the number of lines and trunks equipped.

These functions are -

- Terminal Interfacing - interfacing lines, analog and digital trunks, CCM, PBX and remote digital lines.
- Circuit Switching - switching within the Base Module.
- Call Processing - majority of call processing functions.
- Concentration - for providing upto 2024 subscribers on 512 time-slots.

On the other hand, the functions that are shared globally over the switch are provided by a central facility which may either be the Central Module or the Administrative Module. These functions are -

- **Inter-module Communication**

  Inter-BM and BM-AM communication via the Central Module.

- **Message Switching**

  Inter-BM and BM-AM control-message communication via the Central Message Switch in the Central Module.

- **Resource Allocation**

  Done by the Administrative Module.

- **Operations and Maintenance**

  Bulk data storage by the Input Output Module and man-machine interface provided by the Administrative Module via the Input Output Module.

- **Services**

  Announcements and conference circuits.

This approach is also followed while introducing new services and facilities in order to utilise them most optimally.

Chapter 3.

Hardware Architecture

3.1. GENERAL

The hardware architecture of C-DOT DSS MAX is mapped closely on the system overview described in the previous chapter. In the following sections, the hardware architecture of each constituent module is described.

3.2. BASE MODULE (BM)

Base Module (BM) is the basic building block of C-DOT DSS MAX. It interfaces the subscribers, trunks and special circuits. The subscribers may be individual or grouped PBX lines, analog or digital lines. The trunks may be Two Wire Physical, E&M Four Wire, E&M Two Wire, Digital CAS or CCS. The basic functions of a Base Module are -

- Analog to digital conversion of all signals on analog lines and trunks
- Interface to digital trunks and digital subscribers
- Switching the calls between terminals connected to the same Base Module
- Communication with the Administrative Module via the Central Module for administrative and maintenance functions and also for majority of inter-BM switching (i.e. call processing) functions
- Provision of special circuits for call processing support e.g. digital tones, announcements, MF/DTMF senders/receivers
- Provision for local switching and metering in stand alone mode of Remote Switch Unit as well as in case of Single Base Module Exchange (SBM-RAX)

For these functions, the Base Module hardware is spread over different types of units -

- ***Analog Terminal Unit*** - to interface analog lines/trunks, and providing special circuits as conference, announcements and terminal tester.
- ***Digital Terminal Unit*** - for interfacing digital trunks i.e. 2Mbps E-1/PCM links
- ***#7 Signalling Unit Module*** - to support SS7 protocol handlers and some call processing functions for CCS7 calls.

- ***ISDN Terminal Unit*** - to support termination of BRI/PRI interfaces and implementation of lower layers of DSS1 signalling protocol.
- ***Time Switch Unit*** - for voice and message switching and provision of service circuits.
- ***Base Processor Unit*** - for control message communication and call processing functions.

3.2.1. Analog Terminal Unit (ATU) *Figure 3.1*

The Analog Terminal Unit (ATU) is used for interfacing 128 analog terminations which may be lines or trunks. It consists of terminal cards which may be a combination of Line Circuit Cards (LCC), CCB with Metering (CCM) cards, Two Wire Trunk (TWT) cards, E&M Two wire (EMT) Trunk cards and E&M Four wire (EMF) trunk cards, depending upon the module configuration. Also, provision has been made to equip Conference (CNF) card to support “six party” conference, Announcement (ANN) to support 15 user friendly announcement messages, and Terminal Test Controller (TTC) for testing of analog terminations. Power Supply Unit (PSU-I) provides logical voltages and ringing current in the ATU.

Analog Subscriber Line Cards

Two variants of subscriber line cards as LCC or CCM with interfaces upto 8 subscribers, provide basic BORSCHT functions for each line. Analog to digital conversion is done by per-channel CODEC according to A-law of Pulse Code Modulation. Each CCM card has the provision of battery reversal for all the 8 lines with the last two lines having provision to generate 16 KHz metering pulses to be sent to subscriber's metering equipment.

The 8-bit digital (voice) output of four LCCs is multiplexed to form a 32-channel, 2 Mbps PCM link - also called a terminal group (TG). Since a Terminal Unit has a maximum of 16 terminal cards, there are four such terminal groups. The signalling information is separated by a scan/drive logic circuit and is sent to the signalling processor on four different scan/drive signals. The LCC/CCM also provides test access relay to isolate the exchange side and line side to test it separately by using the Terminal Test Controller (TTC).

Analog Trunk Cards

Analog trunk cards interface analog inter-exchange trunks which may be of three types as TWT, EMT and EMF. These interfaces are similar to Subscriber Line Card, with only difference that the interfaces are designed to scan/drive events on the trunks as per predefined signalling requirement.

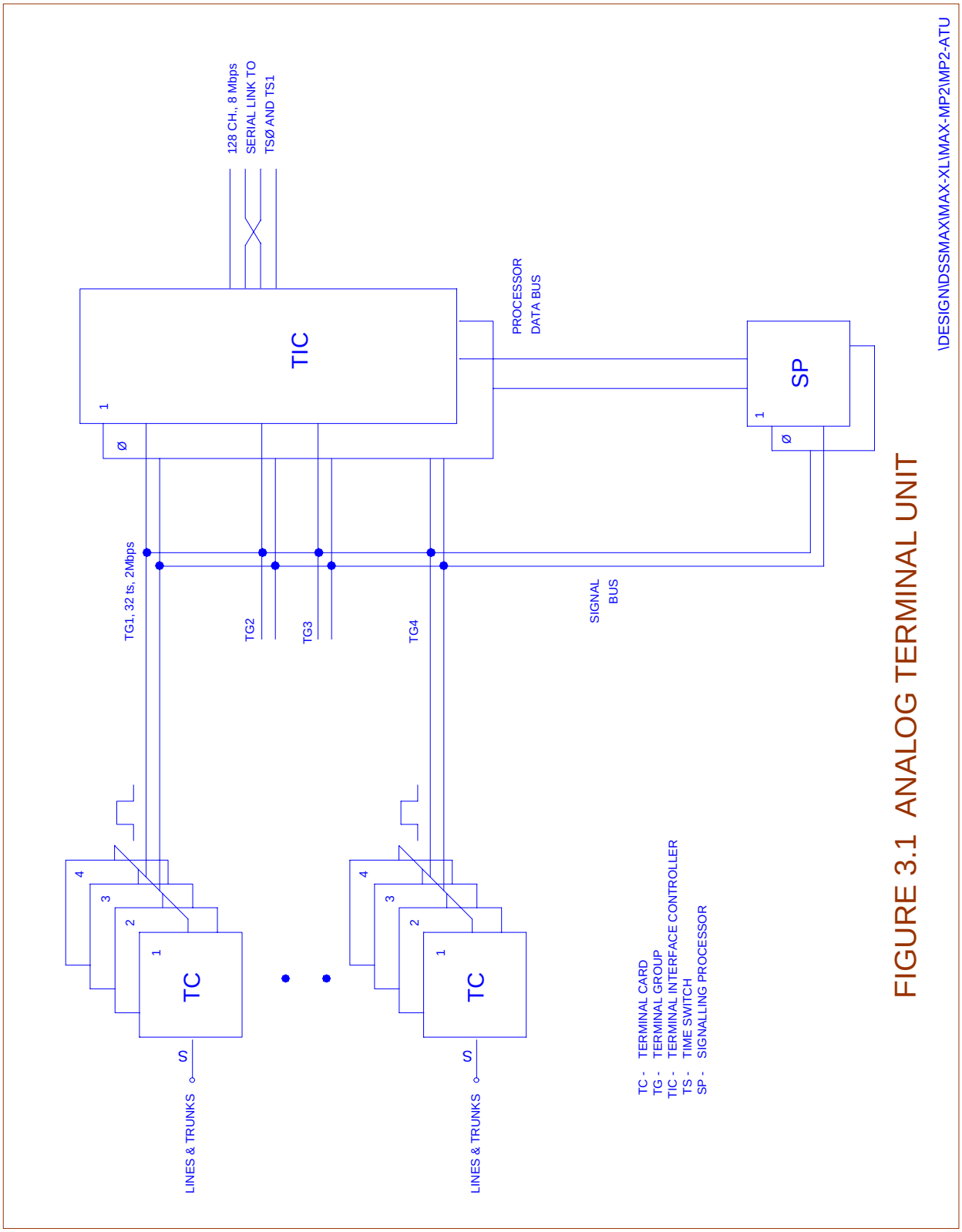


FIGURE 3.1 ANALOG TERMINAL UNIT

Signalling Processor (SP) Card

Signalling Processor (SP) processes the signalling information received from the terminal cards. This signalling information consists of scan/drive functions like origination detection, answer detection, digit reception, reversal detection, etc. The validated events are reported to Terminal Interface Controller for further processing to relieve itself from real-time intensive functions. Based on the information received from the Terminal Interface Controller, it also drives the event on the selected terminal through scan/drive signals.

Terminal Interface Controller (TIC) Card

Terminal Interface Controller (TIC) controls the four terminal groups (TG) of 32 channels, and multiplex them to form a duplicated 128-channel, 8 Mbps link towards the Time Switch (TS). For signalling information of 128-channels, it communicates with Signalling Processor (SP) to receive/send the signalling event on analog terminations. It also uses one of the 64 kbps channel out of 128 channels towards Time Switch, to communicate with Base Processor Unit (BPU). In concentration mode, three other Terminal Units share this 128-channel link towards the Time Switch to have 4:1 concentration.

Terminal Interface Controller is built around 8-bit microprocessor with associated memory and interface and it is duplicated for redundancy.

Special Service Cards

A Terminal Unit has some special service cards such as Conference (CNF) Card to provide six party conference. Speech samples from five parties are added by inbuilt logic and sent to the sixth party to achieve conferencing.

Terminal Test Controller (TTC) Card is used to test analog terminal interfaces via the test access relays on the terminal cards.

Announcement Controller (ANN) Card provides 15 announcements on broadcast basis. Only one service card of each type is equipped in a Base Module with provision of fixed slot for TTC and variable slots for CNF/ANNC.

Announcement and Conference Cards are equipped in Terminal Unit through S/W MMC command. Two slots are occupied by each card i.e. 16 channels for each card are used out of 128 channels available on a Bus between a TU & TS.

3.2.2. Digital Terminal Unit (DTU)

Digital Terminal Unit (DTU) is used exclusively to interface digital trunks. One set of Digital Trunk Synchronization (DTS) card alongwith the Digital Trunk Controller (DTC) card is used to provide one E-1 interface. Each

interface occupies one TG of 32 channels and four such interfaces share 4 TGs in a Digital Terminal Unit. The functions performed by TIC and SP in Analog Terminal Unit, are collectively performed by the Terminal Unit Controller (TUC) in the Digital Terminal Unit. The scan functions are - HDB3 to NRZ code conversion, frame alignment and reconstitution of the received frame. The drive functions include insertion of frame alignment pattern and alignment information. Each interface can be configured as CAS or CCS interface.

3.2.3. SS7 Signalling Unit Module (SUM)

Any one of the ATU or DTU in a BM can be replaced by SUM frame to support CCS7 signalling. Only one such unit is equipped in the exchange irrespective of its configuration or capacity. For details of SUM architecture, refer to chapter no.4 of "C-DOT DSS MAX General Description".

3.2.4. ISDN - Terminal Unit (ISTU)

One of the four ATUs/DTUs in a BM can be replaced by ISTU to provide BRI/PRI interfaces in C-DOT DSS. The only constraint is that ISTU has to be principal TU i.e. directly connected to TSU on 8 Mbps PCM link. The ATU/DTU cannot be used in concentration with ISTU. By equipping one ISTU in the exchange, a max. of 256 B channels are available to the administrator which can be configured as BRI, PRI or any mix as per site requirement. Depending on the requirement of number of ISDN-Interfaces, one or more ISTUs can be integrated in C-DOT DSS, either in one BM or distributed across different BMs. For details, refer chapter no. 4 of "C-DOT DSS MAX General Description".

3.2.5. Time Switch Unit (TSU)

Time Switch Unit (TSU) implements three basic functions as time switching within the Base Module, routing of control-messages within the Base Module and across Base Modules and support services like MF/DTMF circuits, answering circuits, tones, etc. These functions are performed by three different functional units, integrated as time switch unit in a single frame (refer Fig. 3.2).

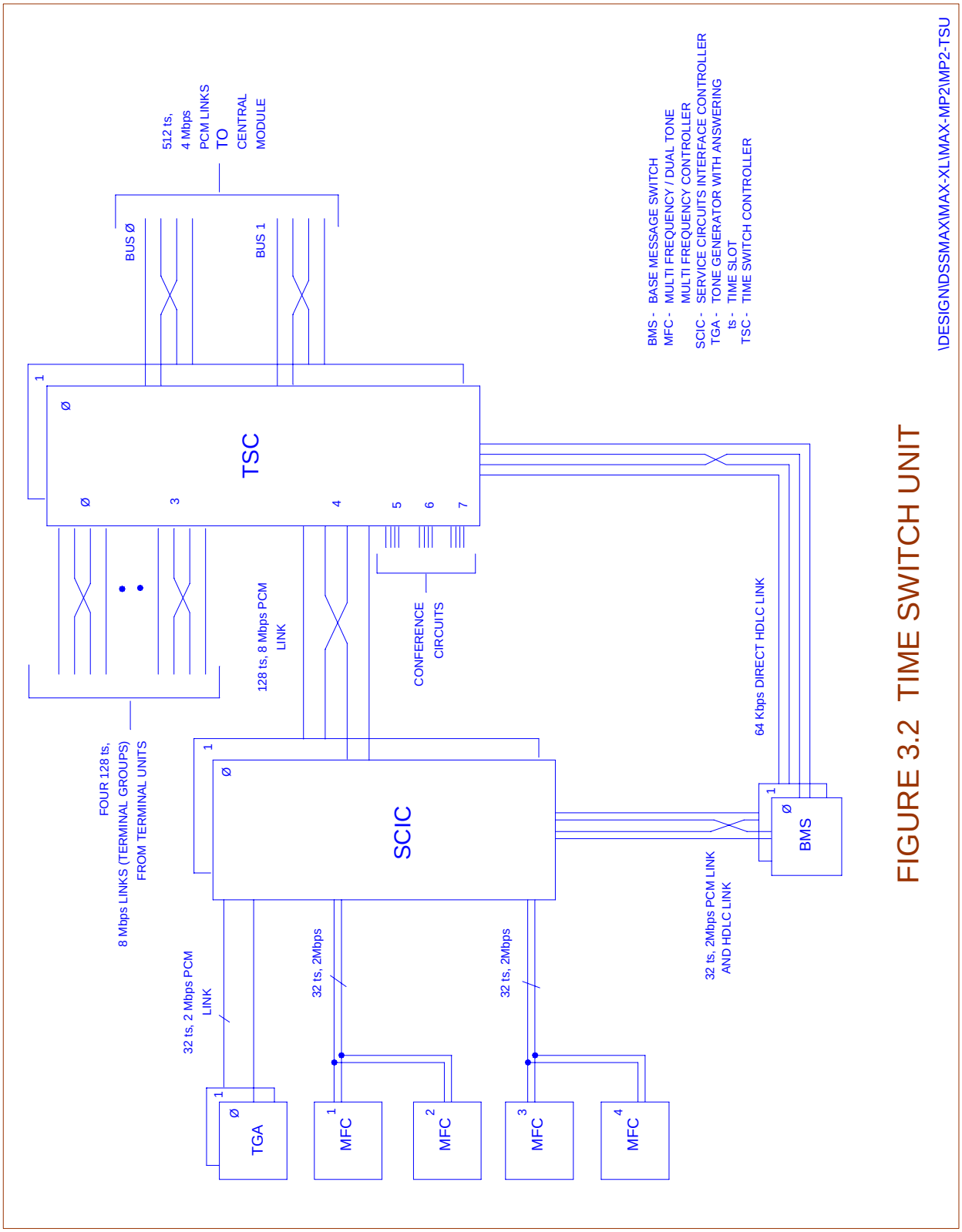


FIGURE 3.2 TIME SWITCH UNIT

Service Unit (SU)

Service Unit is integrated around three different cards as Tone Generator with Answering Circuit (TGA), Service Circuit Interface Controller (SCIC). and MF/DTMF Controller (MFC) Card. MF/DTMF circuits (senders/receivers) are implemented by using single-chip, 4-channel Digital Signal Processors (DSPs). Two MFC cards are grouped to form a terminal group. Upto four MFC Cards can be equipped. The TGA and two groups of MFCs, form three terminal groups towards the Service Circuits Interface (SCI). Service Circuit Interface multiplexes these three TGs together with another terminal group from the Base Message Switch (BMS) to form a 128-channel, 8Mbps link under the control of Service Circuits Interface Controller (SCIC) and sends it towards the Time Switch.

Base Message Switch (BMS)

Base Message Switch (BMS) routes the control messages within the Base Module, across different Base Modules, and also Administrative Module via the Central Module. It is implemented around two different cards as Message Switch Controller (MSC) with six direct HDLC-links and the Message Switch Device (MSD) Card implementing 16 switched HDLC links. As a unit, total 22 HDLC channels are implemented for communication with the Base Processor, Time Switch Controller, Service Circuits Interface Controller, Terminal Interface Controller within the BM and the four CMS complexes in CM. It acts as a message transfer point between the Base Processor and these controllers. It receives messages from the Base Processor and transmits them towards the appropriate controllers.

Note : *To support 8,00,000 BHCA, MSC and MSD cards are replaced by a High performance Message Switch (HMS) with high speed, 32 bit microprocessor (MC 68040). It implements 38 HDLC links with flexibility of programming individual link for a speed upto 750 kbps.*

Time Switch (TS)

The Time Switch complex is implemented using three different functional cards as multiplexer/demultiplexer (TSM), time switch (TSS) and time switch controller (TSC). The Time Switch complex receives the following PCM links and performs time- switching on them for switching within the Base Module :

- Four 128-channel multiplexed links from four different Terminal Units which may be any combination of. ATU, DTU, #7SU and ISTU.
- One 128-channel multiplexed BUS from the Service Circuits Interface Controller (SCIC) in the Time Switch Unit.
- Three 128-channel links to support onboard three party conference circuits (3 x 128).

It multiplexes above 128-channel links to form a dual 512-channel, 4 Mbps multiplexed bus towards the Central Module. The individual buses are called Bus0 and Bus1. Besides this, it also provides network switched path for message communication between Base Modules, between Base Module and Administrative Module, and between Base Module and Central Module.

3.2.6. Base Processor Unit (BPU)

Base Processor Unit (BPU) is the master controller in the Base Module. It is implemented as a duplicated controller with memory units. These duplicated sub-units are realised in the form of the following cards :

- Base Processor Controller (BPC) Card
- Base Memory Extender (BME) Card

BPC controls time-switching within the Base Module via the Base Message Switch and the Time Switch Controller. It communicates with the Administrative Processor via Base Message Switch for operations and maintenance functions. In a SBM configuration, BPC directly interfaces with the Alarm Display Panel and the Input Output Module.

To support 8,00,000 BHCA, the BPC card is replaced by High performance Processor Card (HPC). It is pin to pin compatible for hardware and also for software so that they are interchangeable at any site to meet specific traffic requirement.

Figure 3.3 summarises the various units and sub-units of the Base Module.

3.3. CENTRAL MODULE (CM)

Central Module (CM) is responsible for space switching of inter-Base Module calls, communication between Base Modules and the Administrative Module, clock distribution and network synchronisation. For these functions, Central Module has a Space Switch, Space Switch Controller and a Central Message Switch.

CM provides connectivity to 16 BMs if it is CM-L and 32 BMs if it is CM-XL. Each BM interfaces with CM via two 512-channel parallel buses as BUS-0 and BUS-1, each operating at 4 Mbps. These buses carry voice information of 512 terminations of the Base Module towards CM. In the reverse direction, after space switching has been done in the Space Switch under the control of Space Switch Controller (SSC), the same buses carry the switched voice information for 512 terminations towards BM. Thus, in a 32 Base Module configuration, there are 64 parallel buses carrying the voice information from Base Modules to the Central Module, and also the switched information in the reverse direction.

3.3.1. Space Switch (SS) and Space Switch Controller (SSC)

In order to take care of the large number of interface signals, the switch portion of CM is divided into three stages viz. MUX stage, Switch stage and

DEMUX stage. The MUX and DEMUX stages are implemented on single card to provide the Base Module to Central Module interface in each direction. Interfacing and switching are controlled by SSC which provides control signals for the MUX/DEMUX cards and the Space Switch Switch cards. Interconnection between MUX/DEMUX cards and the Space Switch is shown in Figure 3.4.

MUX/DEMUX Cards extract the information from time-slots 0 and 1 of Bus0 and Bus1 from the Base Modules. These time-slots carry control message from each Base Module and these messages are sent to the Central Message Switch (CMS). The CMS sends these messages to the Space Switch Controller (SSC) on a 128 kbps link to control space switching based upon this information.

Four 512-channel buses from four BMs are multiplexed to form a 2048-channel, 16 Mbps multiplexed BUS which is sent to both copies of the Space Switch Switch Card. Space switching of these 2048 channels is done based upon the switching information received by Space Switch Controller (SSC) from CMS.

Clock Distribution (Fig.3.5-*Please refer Fig 8.1****)***

CM provides the central clock for distribution to the Base Modules. The 8MHz clock may be locally generated at the Central Clock (CCK) card in case of CM-XL and of Space Switch Clock (SCK) card in case of CM-L by using high stability VCXO crystal or may be derived from an external reference clock using the Network Synchronisation Controller (NSC) card in case of CM-XL and Network Synchronisation Equipment (NSE) in case CM-L under the control of SSC. In the event of failure of external reference or duplex failure of the NSC cards/NSE, the local clock is fed in the holdover mode, synchronised to last reference value. In any arrangement, the local or external clock is distributed via Central Bus Extender (CBX) cards in case of CM-XL.

The CBX card provides an interface between SSC and SSU. SSC makes any switch card access through CBX. CBX also handles any power supply errors in SSU and BTU. Each CCK-CBX-NSC complex form a security block i.e. CBX0 cannot be used with CCK1. Thus there is a copy 0 complex and a copy 1 complex. The CBX also synchronises all SSC accesses to SSU with the 16 MHz clock as well as BTU.

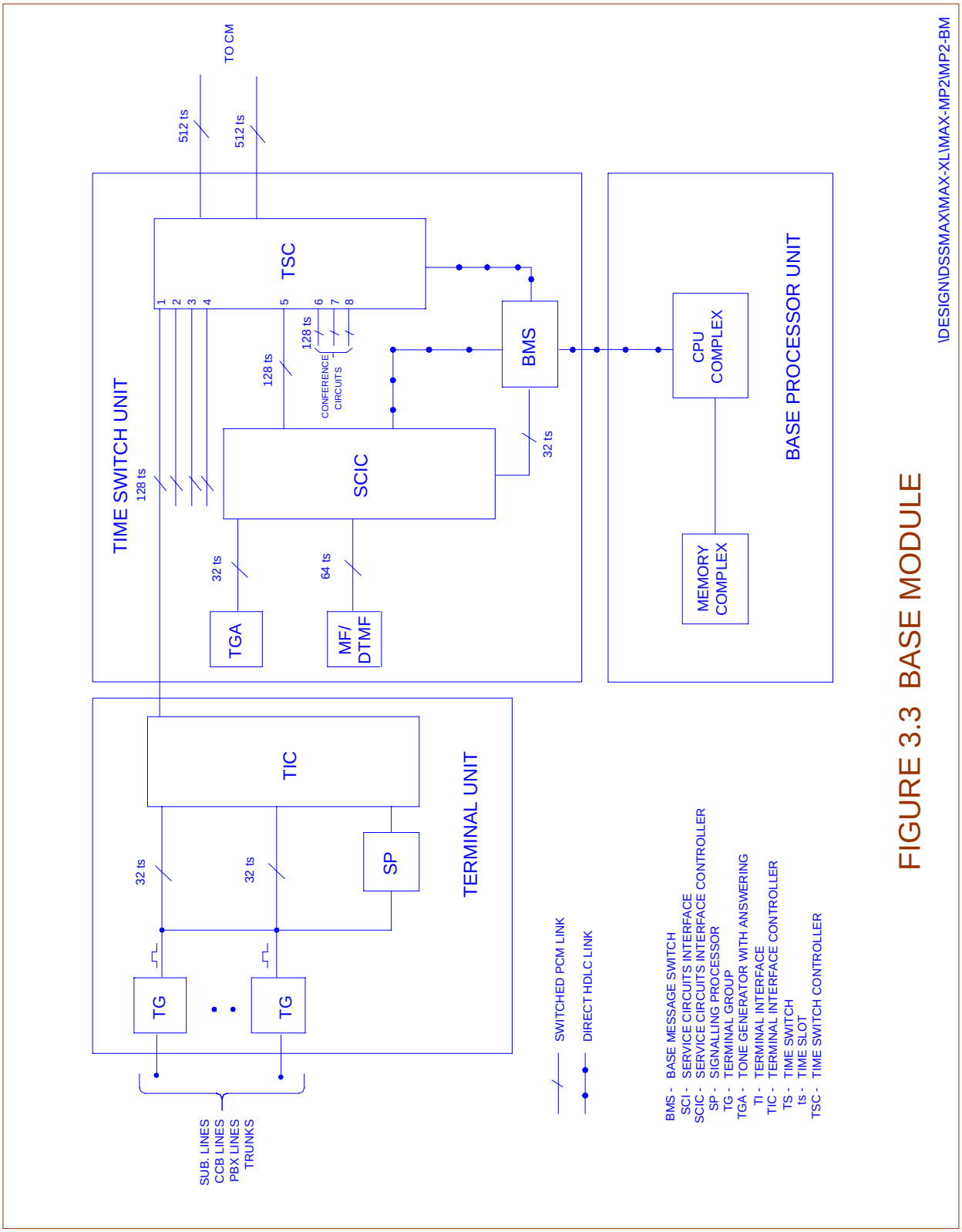


FIGURE 3.3 BASE MODULE

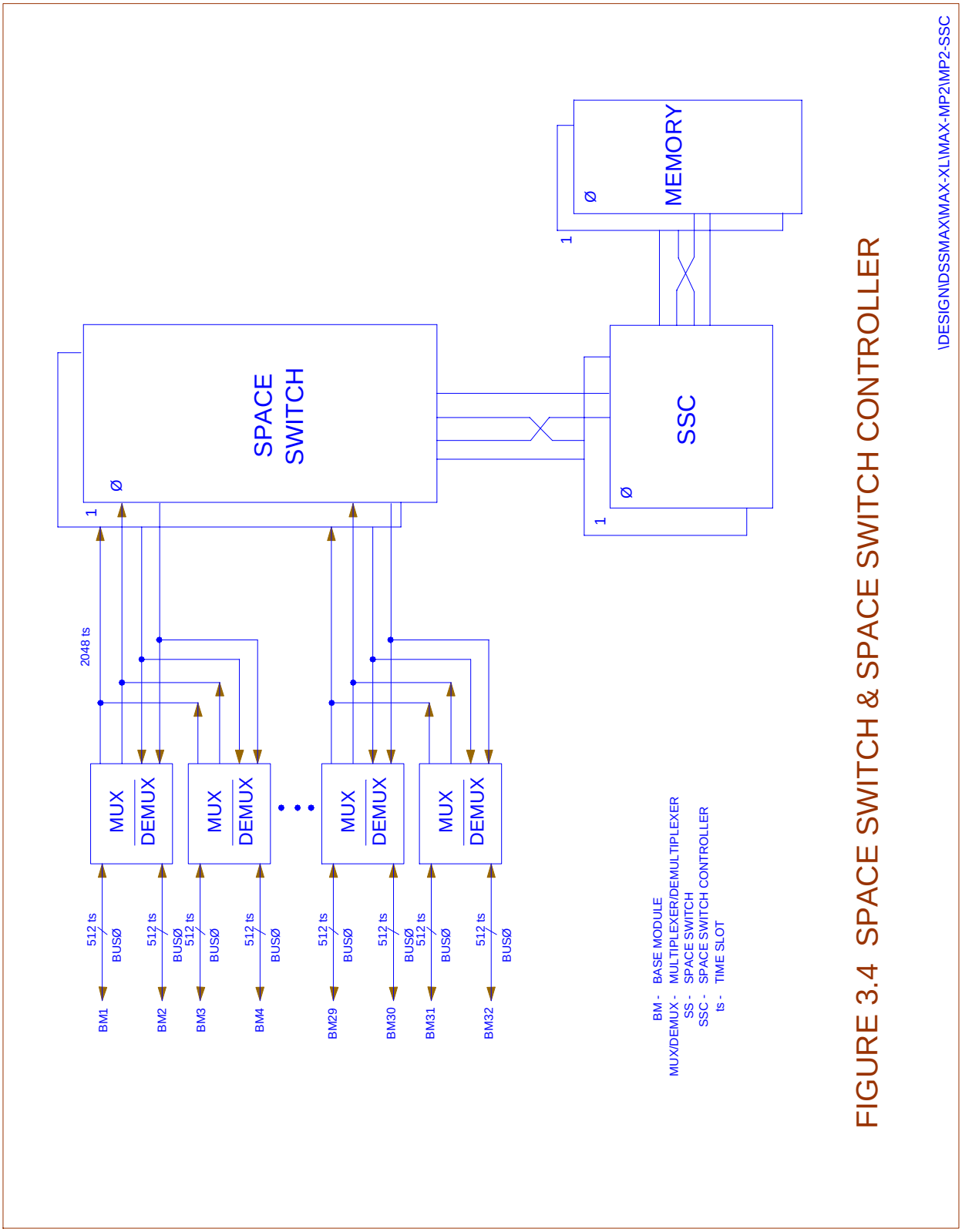


FIGURE 3.4 SPACE SWITCH & SPACE SWITCH CONTROLLER

3.3.2. Central Message Switch (CMS)

Central Message Switch (CMS) complex is the central message transfer point of the switch. It is implemented as four different message switches, working in load-sharing mode. Each message switch is a high performance message routing block, implemented by using high speed 32 bit microprocessor MC 68040 in case of CM-XL and 16 bit microprocessor MC 68000 in case of CM-L. This card supports 38 HDLC links in case of CM-XL with flexibility of programming individual HDLC links upto 750 kbps. All Central Message Switches (CMS1,2,3&4) are used for routing of messages across the Base Modules. On the other hand only CMS1 and CMS2 interface with the Administrative Module for routing control message between Base Processors and Administrative Processor. This communication is used to access office data for routing inter- module calls and administration and maintenance functions. Fig. 3.6 depicts the Central Message Switch in C-DOT DSS.

3.4. ADMINISTRATIVE MODULE (AM)

Administrative Module (AM) consists of a duplicated 16/32-bit controller called the Administrative Processor (APC). It communicates with Base Processors via the Central Message Switch for control messages and with the duplicated Input Output Processors in the Input Output Module for interfacing peripheral devices

Administrative processor is responsible for global routing, translation, resource allocation and all other functions that are provided centrally in C-DOT DSS MAX. The implementation of AM is similar to Base Processor Complex of BM, using the same hardware configuration. As explained earlier, HPC instead of BPC is used to support 8,00,000 BHCA.

3.5. INPUT OUTPUT MODULE (IOM)

Input Output Module (IOM) consists of duplicated Input Output Processor (IOP). The Input Output Processor (IOP) is a general purpose computer with UNIX Operating System. It is used as the front end processor in C-DOT DSS. It handles all the input and output functions in C-DOT DSS. The IOP is connected to AP/BP via HDLC links. During normal operation, two IOPs interconnected by a HDLC link, operate in a duplex configuration. Working as front end processor, it provides initial code down load to the subsystems, man machine interface and data storage for billing and other administrative information. Refer Fig. 3.7 for IOP connectivity in the system and IOP-VH architecture.

3.5.1. IOP-VH Hardware Architecture

The IOP-VH is value engineered high performance IOP, designed using a single card. The IOP CPU uses MC 68040 (25 MHz) processor on the VHC card. It has 16 MB (expandable to 32 MB) onboard DRAM and 512 KB

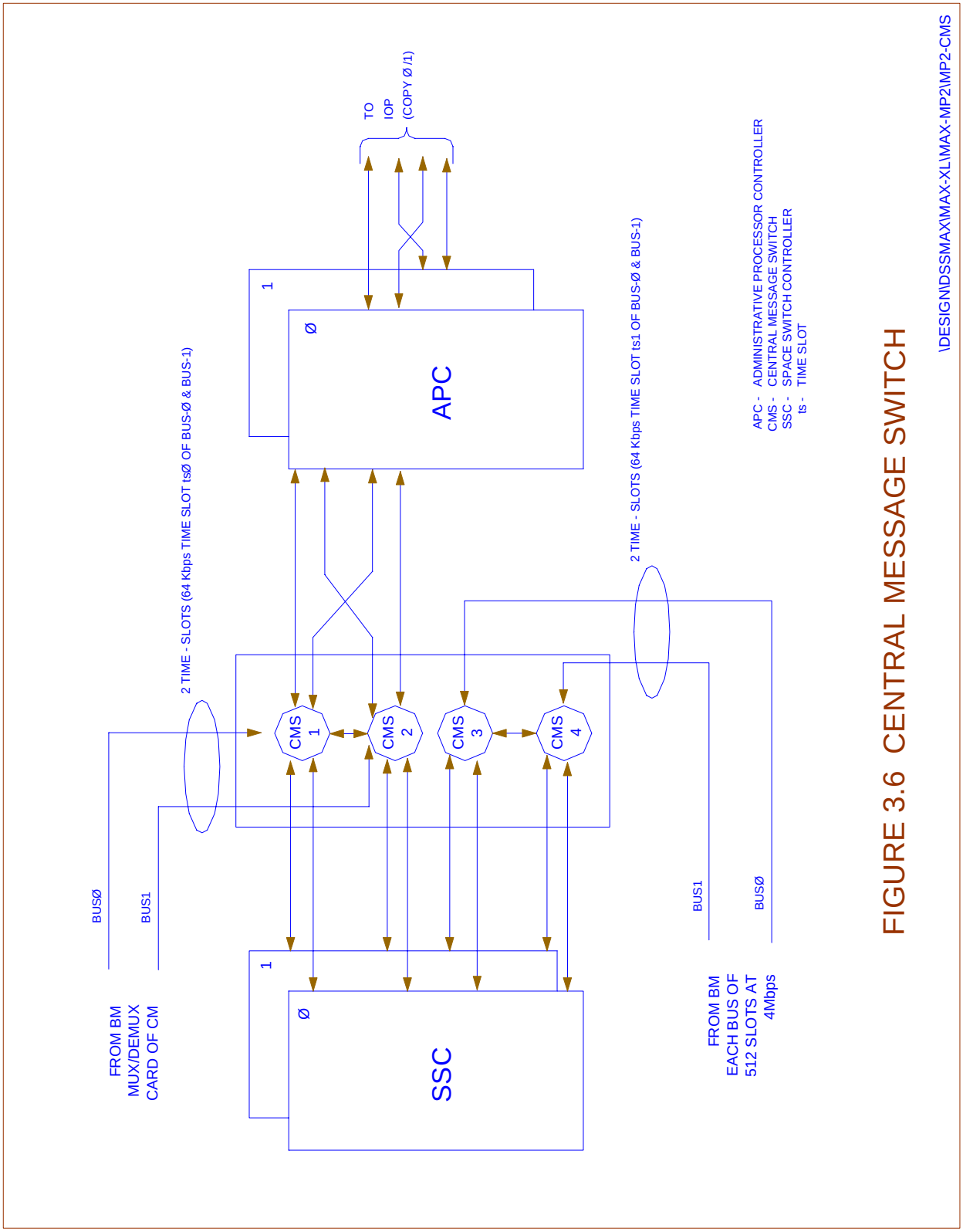


FIGURE 3.6 CENTRAL MESSAGE SWITCH

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-CMS

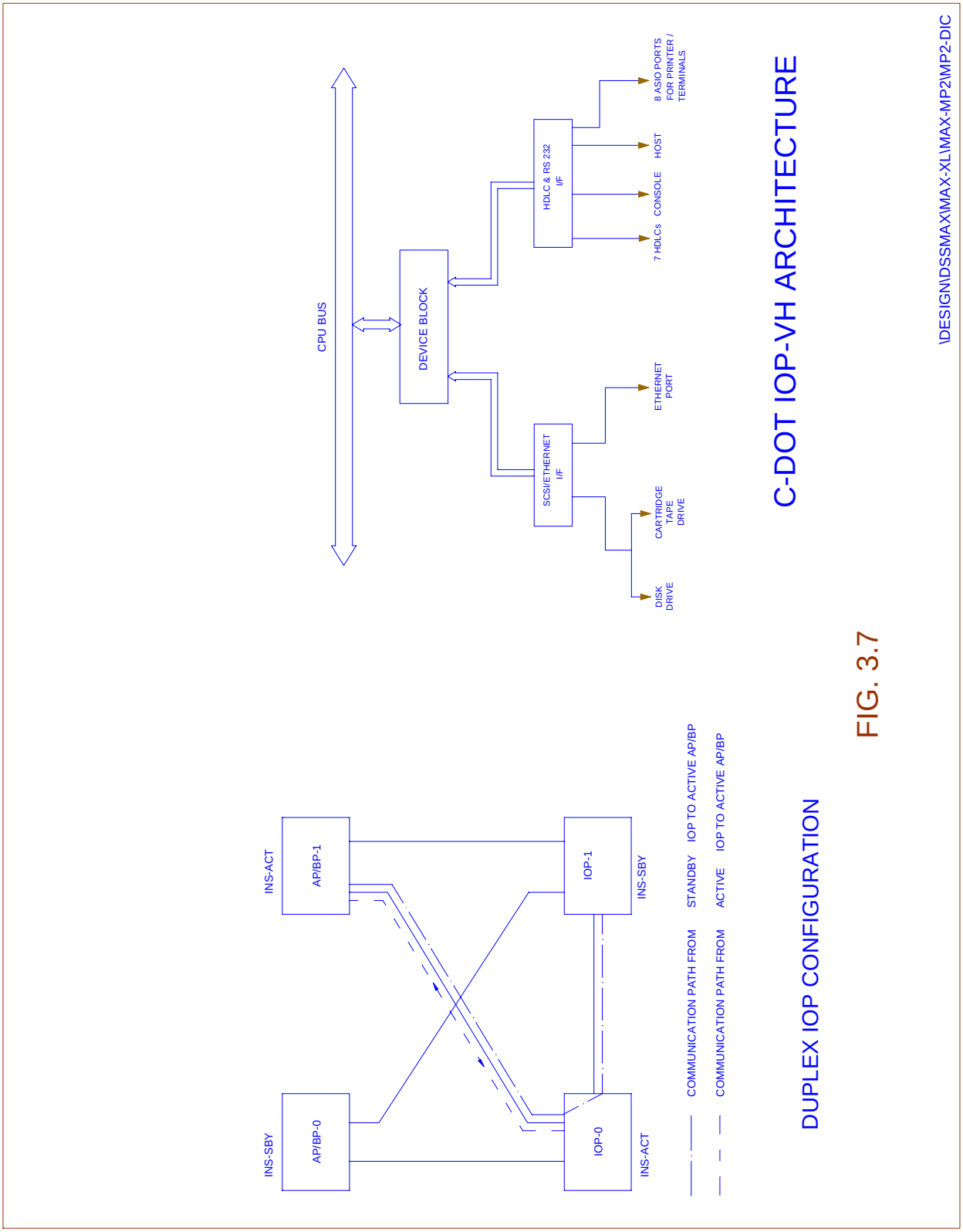

C-DOT IOP-VH ARCHITECTURE
\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-DIC
CPU BUS
DEVICE BLOCK
HDLC & RS 232 I/F
SCSI/ETHERNET I/F
7 HDLCs
CONSOLE
HOST
8 ASIO PORTS FOR PRINTER / TERMINALS
ETHERNET PORT
CARTRIDGE TAPE DRIVE
DISK DRIVE
DUPLEX IOP CONFIGURATION
INS-ACT
AP/BP-1
IOP-1
INS-SBY
INS-SBY
AP/BP-0
IOP-0
INS-ACT
COMMUNICATION PATH FROM STANDBY IOP TO ACTIVE AP/BP
COMMUNICATION PATH FROM ACTIVE IOP TO ACTIVE AP/BP

FIG. 3.7

EPROM. All active IOP processes reside in the dynamic RAM. Also the data being transferred through HDLC links, secondary storage devices and terminals, use the dynamic RAM. The IOP as a module is duplicated to provide rendundancy for cardridge and disk drives as well as serial communication terminals and printers.

The system has provision for 7 HDLC channels. Two of these are used to connect the IOP to both the copies of AP/BP. The third link is for connection with mate IOP when the two are working in synchronisation i.e. duplex IOP configuration. The rest four links are spare at present but may be used towards the four CMSs in future. Eight of RS-232C Serial Links (through ASIO ports) are also implemented for connecting operator terminals and printer to the IOP in addition to two ports as Console and Host.

The monitor based operations are performed only from the Console and the same is true in case of login to 'root' account. The operations like initial boot-up, software link loading etc. could be performed only from the Console. One X.25 port is implemented for 64Kbps full duplex link to communicate with Centralise Billing/Telecom Management Network Centre. In addition, one 10 Mbps Ethernet port is also implemented in the IOP-VH which has AUI or Co-axial interface support at physical level to allow networking of user terminals in future. A SCSI-2 controller with integrated DMA and SCSI cores is used for interfacing the disk drive and cartridge tape drive.

Note :

Presently the two ports, namely X.25 and ETHERNET are not supported in current UNIX release.

IOP-VH Peripherals

Input Output Processor (IOP-VH) supports three standard SCSI-2 interfaces, on VHC card, one each for Winchester Drive, Cartridge Tape Drive and one as spare. Here, it may be noted that only the peripherals with SCSI-2 interface can be used in IOP-VH.

Front Panel Display

The CPU 'Reset' and 'Abort' switches are provided alongwith lock and key, adjacent to the switches. 'Run' and 'Halt' LEDs for the CPU status indication is also extended on the front panel. A 'Reset' LED is provided alongwith RESET switch and glows when the CPU is reseted by pressing 'RESET' switch on the front panel. Power I/P LED is provided to indicate the presence of I/P power on the front panel.

3.6. NETWORK SYNCHRONIZATION IN C-DOT DSS

All the three modes of operation of Network Synchronization are implemented in C-DOT DSS. These are:

i) Locked Mode: When one or more primary reference clocks are available, NSC/ NSE enters into locked mode by selecting one of the available network clocks according to fixed priority and synchronises to it.

ii) Holdover Mode : When NSC/NSE loses the network clock to which it was locked and when no other network clocks are available, it enters the holdover mode in which it synchronises to the last reference value.

iii) Free Run Mode : When none of the network reference clocks are available and no locking to external reference has taken place before. In this mode system works on its local clock.

In C-DOT DSS MAX, Network Synchronisation Controller (NSC) Card synchronises the local clock of the exchange with the network clock. It gets input clocks from digital trunks connected to higher level or same level exchanges. It has an on-board clock source. It gives a network synchronised clock and SYNC signals to the duplicated Central Clock (CCK).

The CCK is controlled by the SSC through CBX. The clock card generates its own clock and can be configured to select between the local clock and two copies of NSC clock. Each clock card distributes 16 MHz clock and 8 kHz SYNC to self SSU and 16 MHz clock to all Bus Termination Units (BTUs) which receive switched data buses from all the BMs connected to CM.

In case of SBM-RAX and MAX-L exchanges, the function of NSC card is achieved by external add-on synchronization equipment C-DOT-NSE. In this mode of operation, the system works on external clock, received from C-DOT NSE instead of using its own clock. However in exceptional case of failure of both the clock sources from C-DOT-NSE, the system has provision to switch over to its own clock.

A brief description of implementation of Network Synchronization in C-DOT DSS using NSC card along with its functional block is explained below.

3.6.1. Function of NSC Card

- The NSC card forms the interface between DTS (Digital Trunk Sync.) and the CCKs (Central Clock Cards). It receives the 2.048 MHz reference input clock from DTS and converts it into a 16.384 MHz clock using a PLL (Phase Locked Loop). This clock is fed to both copies of CCKs. It also generates a sync signal (8 kHz) and feeds it to the CCKs for further distribution to all the BMs.
- There is a Time-of-Day (TOD) block which generates the real time clock for the system. It takes the input from DTS card (a one hertz clock) and embeds this in the 8 kHz sync.
- The NSC has an On Board Micro Processor (OBMP) to take care of the PLL functions, diagnostics, communication with SSC

3.6.2. Duplication and Security block

The NSC card is duplicated and its access is similar to CBX cards. The NSC and CBX form a security block as there is only one device enable for each NSC-CBX pair. The 2.048 MHz clock and 8 kHz sync signal are exchanged between the two copies of NSC. Clock selection is done before the PLL block. If all the inputs to the NSCs fail, it runs in the “holdover” mode. If the inputs are not restored till the end of the holdover period, (duration of the holdover period is defined in the Parameteric Specifications), the NSCs go into the "free-run" mode. The NSCs work in mutual synchronisation as the PLLs track each other.

3.7. REMOTE SWITCHING UNIT (RSU)

In case of a Remote Switch Unit (RSU) the Time Switch Switch (TSS) cards in BM are replaced by Enhanced Time Switch (ETS) cards. This card implements different functions like HDB3 to NRZ conversion, clock extraction, time-slot interchange on PCM links to/from the host exchange, digital trunk interface, fault handling on digital trunks etc.

In case of a remotely located BM (RSU), the corresponding MUX/DEMUX cards in BTU in CM in BUS-0 and BUS-1, are replaced by Enhanced Switch MUX (ESM) Cards in CM-XL and ESL cards in CM-L. The functions of the cards are HDB3 to NRZ conversion, digital trunk interface, multiplexing/ demultiplexing of 4 Mbps bit streams from/to a normal BM and a RSU. The interconnections between RSU and Central Module are shown in Figure 3.8.

3.8. ALARM DISPLAY PANEL

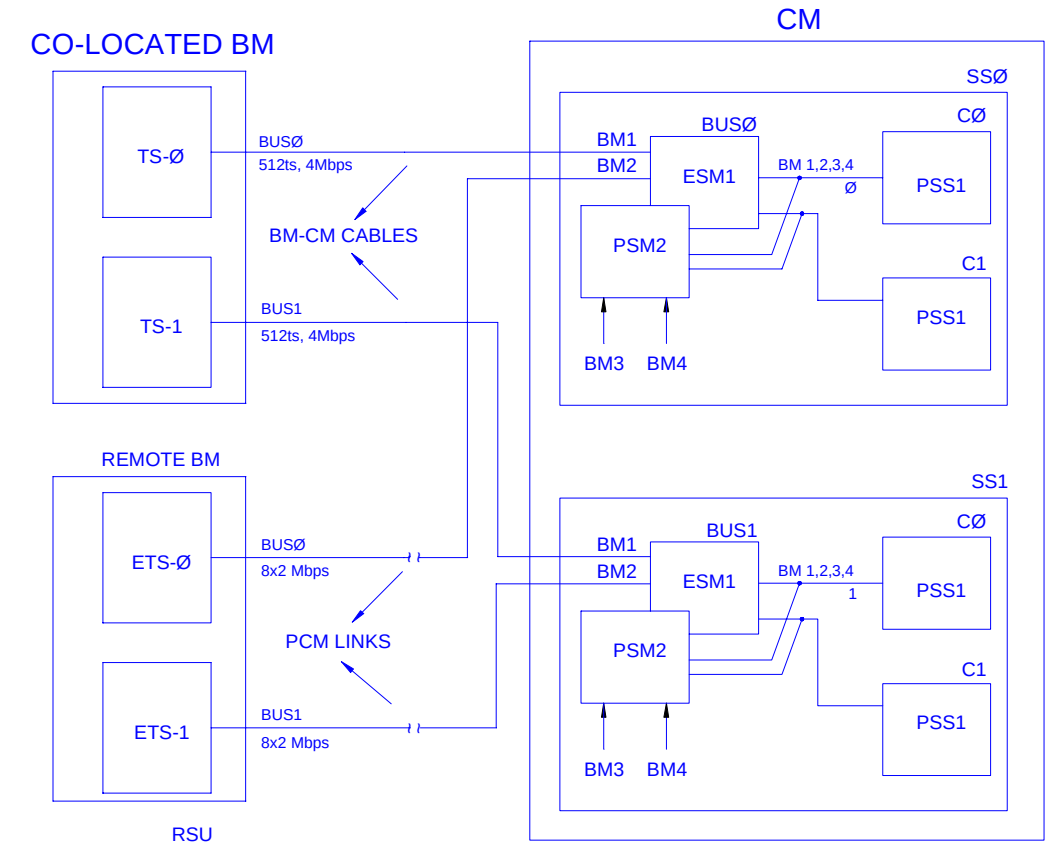
Alarm Display Panel (ADP) is a microprocessor based hardware unit which is attached to the BP (in SBM configuration) or AP (in MBM configuration) via HDLC links for providing audio-visual indication of system faults. It is a three card implementation. A matrix of LEDs is provided to indicate the maintenance status of the switch units and their level of initialisation. A seven-segment display shows the count of lines and trunks currently faulty. Keys are provided for manual acknowledgment, initiating self test and selective audio disable.

3.9. SYSTEM PACKAGING

For the O&M personnel, it is very important to know the details of actual positioning of each hardware so that the spares are replaced with ease without any major or catastrophic failure. This becomes more important when co-existance of multiple hardware configurations is supported. All the submodules packaging details are clearly explained in figures 3.9.1 to 3.9.14.

Note: *1. It is advised to follow the DO's and DONT's for spare cards handling, specially for controller cards, as explained in chapter 10 of this document.*

Note: 2. *In case of any confusion, refer to packaging details (Fig. 3.9.1 to 3.9.14) to identify the correct slot for spare replacement.*

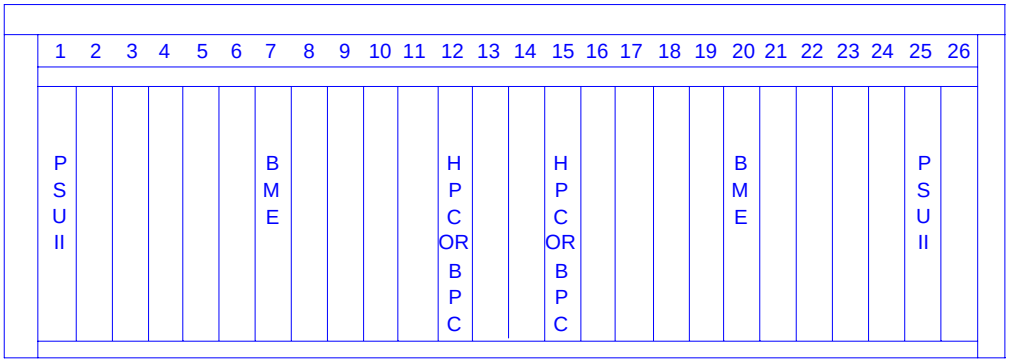


TS - TIME SWITCH
ETS - ENHANCED REMOTE TIME SWITCH
⊛ PSM - SPACE SWITCH MUX/DEMUX
⊛ ESM - ENHANCED REMOTE SWITCH MUX/DEMUX
SS1 - SPACE SWITCH
⊛ PSS - SPACE SWITCH-SWITCH
BM - BASE MODULE
CM - CONTROL MODULE

⊛ THE CARDS NAME ARE APPLICABLE TO CM-XL AND WILL BE DIFFERENT IN CM-L WITH THE SAME FUNCTIONALITY

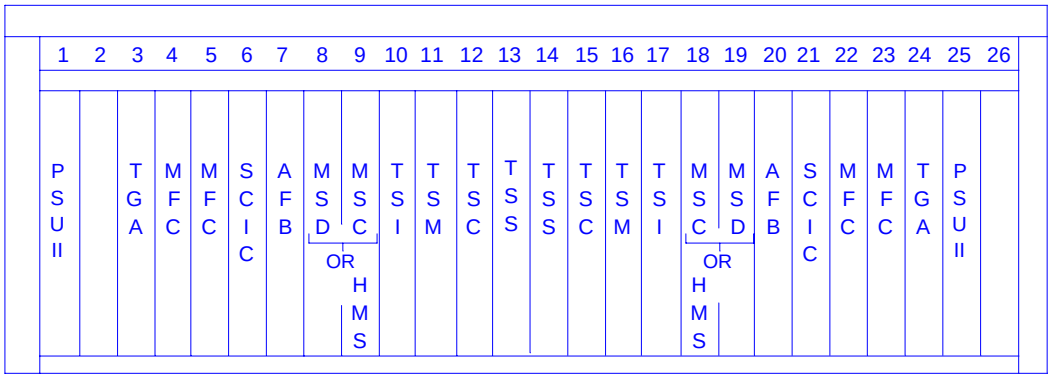
FIGURE 3.8
INTERCONNECTION BETWEEN RSU/LOCAL AND CENTRAL MODULE

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-CM



NOTE: HPC USED TO SUPPORT 800K BHCA

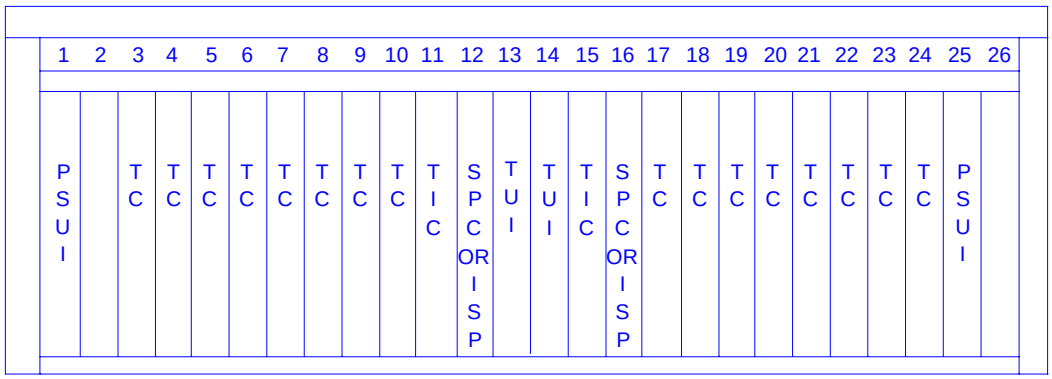
FIG. 3.9.1
BASE PROCESSOR UNIT (BPU) CONFIGURATION



NOTE : (i) REPLACE TSS CARDS BY ETS CARDS IN CASE OF REMOTE BASE MODULE (RSU)
(ii) MSC AND MSD ARE REPLACED BY HMS FOR 800K BHCA

FIG. 3.9.2
TIME SWITCH UNIT (TSU) CONFIGURATION

\DESIGN\DSSMAX\MAX-XL\MAX-XLMP\MXLMPTSC



NOTE: 1 TC MAY BE LCC, CCM, TWT OR E&M
2 IN CASE OF TU4 AS ATU IN BM, SLOT 24 WILL BE TTC.
3 IN CASE OF TUI AS ATU IN BM, SLOT3 WILL BE ANNC.

FIG. 3.9.3
ANALOG TERMINAL UNIT (ATU) CONFIGURATION

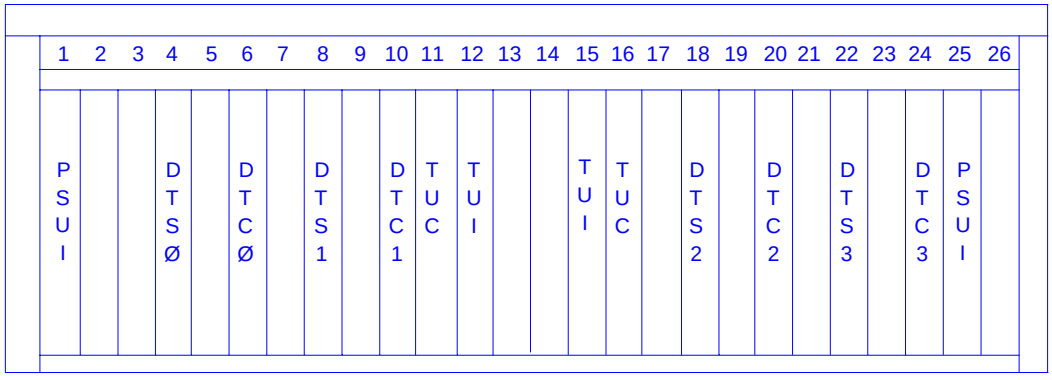
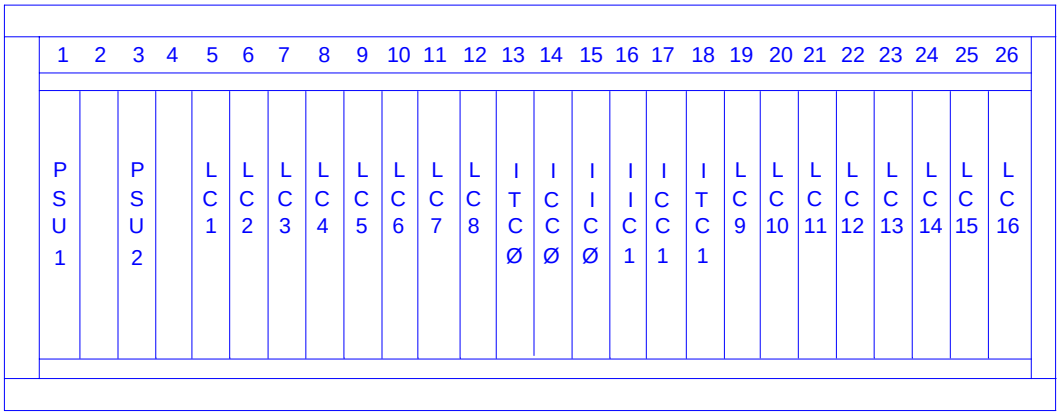


FIG. 3.9.4
DIGITAL TERMINAL UNIT (DTU) CONFIGURATION

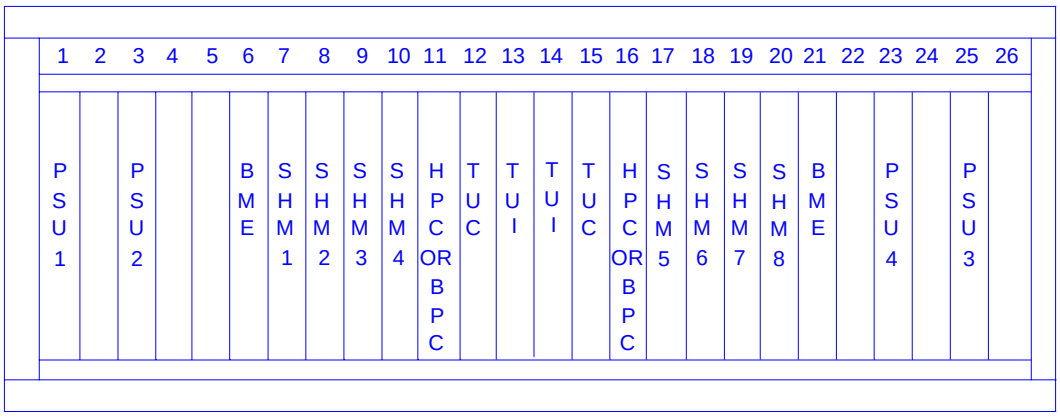
\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-DTC



LC ⟶ BRL OR PRL CARDS

NOTE : IIC CARDS ARE REQUIRED ONLY IN CASE OF CONCENTRATION OF ISTU

FIG. 3.9.5
ISTU CONFIGURATION

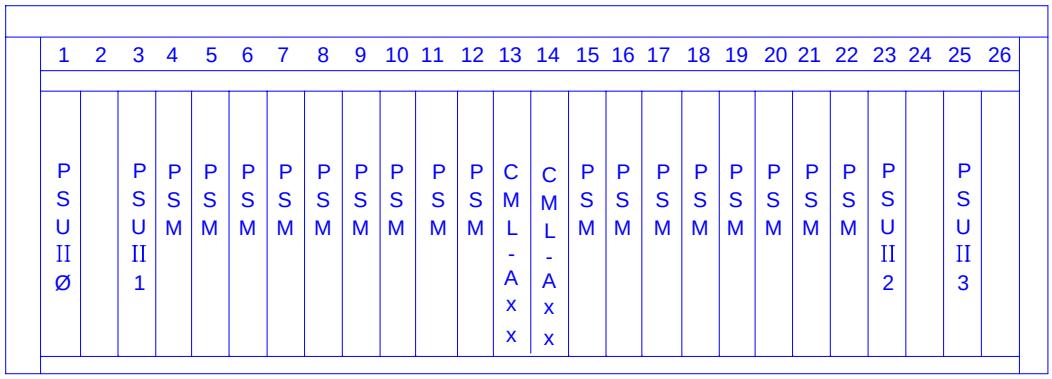


SHM ⟶ #7 PROTOCOL HANDLER CARD

NOTE: (i) WITH BPC, ONLY SHM1, 2, 3, AND 4 CAN BE EQUIPPED.
(ii) HPC IS USED TO SUPPORT SHM 1 TO 8 AND HIGHER MESSAGE PROCESSING CAPABILITY.

FIG. 3.9.6
#7SU CONFIGURATION

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-7SU



NOTE : FOR SUPPORTING RBM-XL, CORRESPONDING PSM CARDS IN BOTH BUSES (i.e BTU Ø & 1)
ARE TO BE REPLACED BY ESM CARDS. MOREOVER,

FIG. 3.9.7
BTU Ø/1 CONFIGURATION

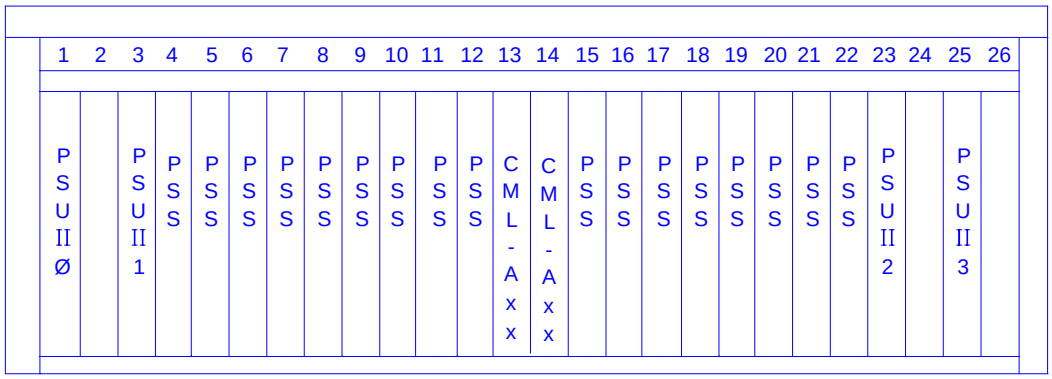


FIG. 3.9.8
SSU Ø/1 CONFIGURATION

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-SSU

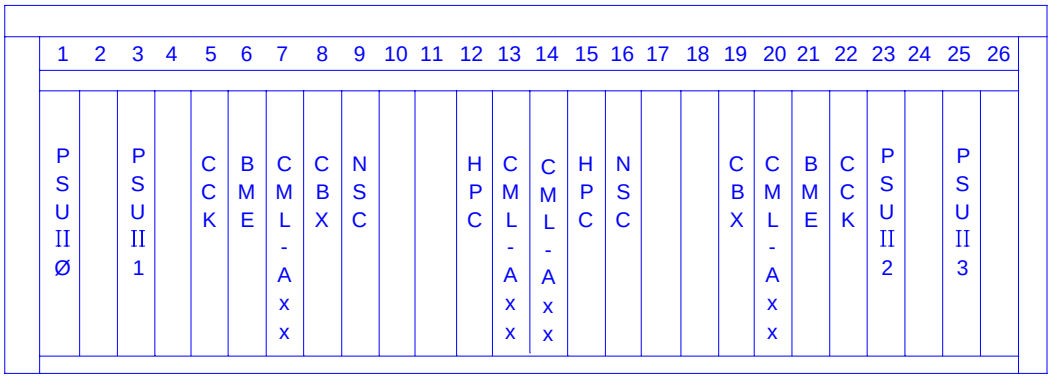


FIG. 3.9.9
SSCU CONFIGURATION

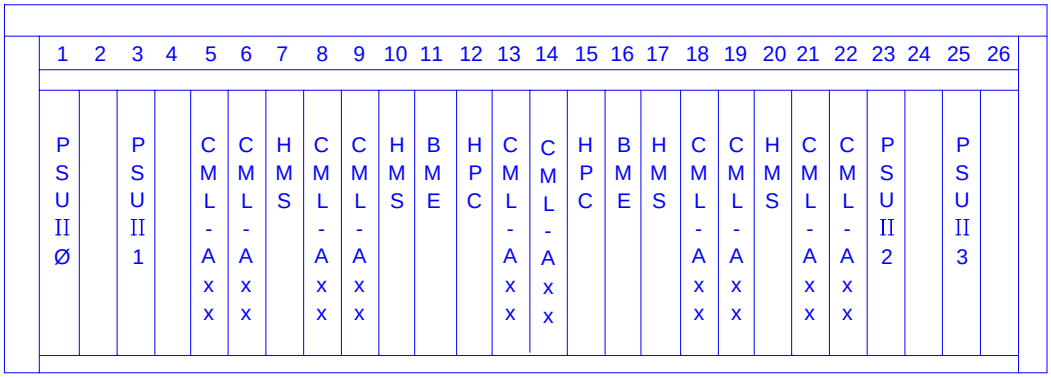


FIG. 3.9.10
HPU CONFIGURATION

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-HPU

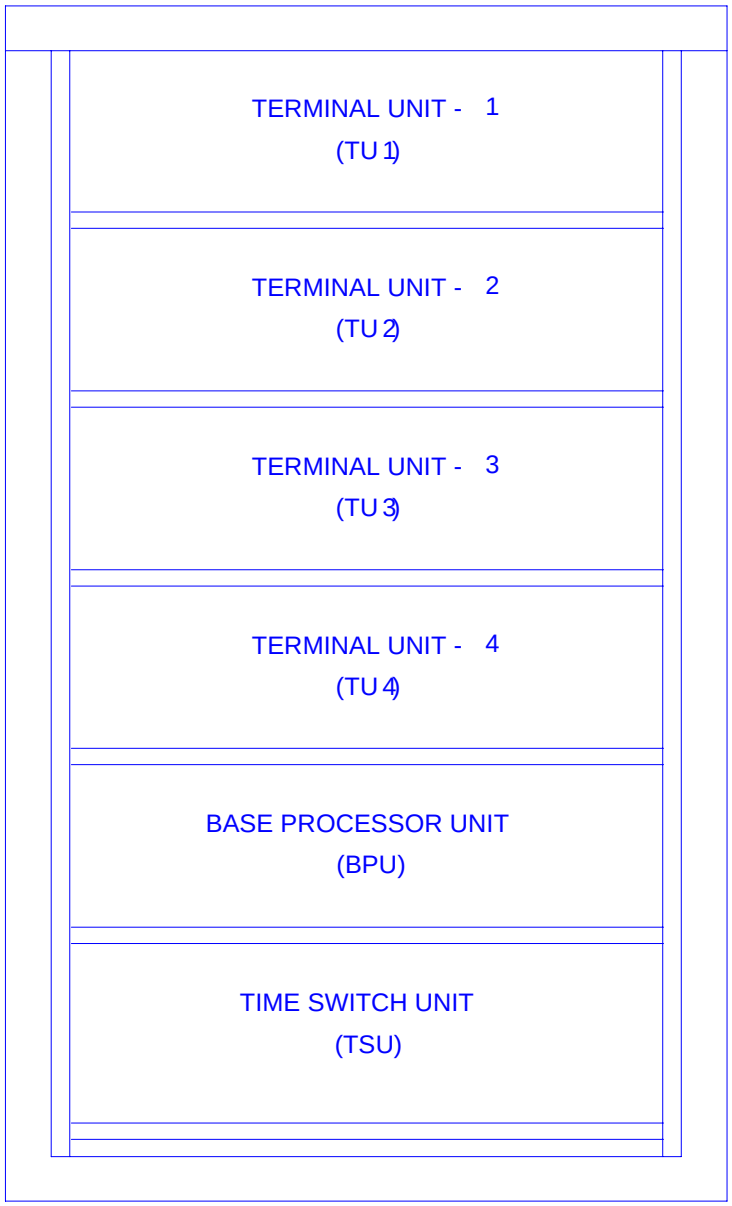


FIG. 3.9.11
BASE MODULE (BM-XL) CONFIGURATION

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-BMC

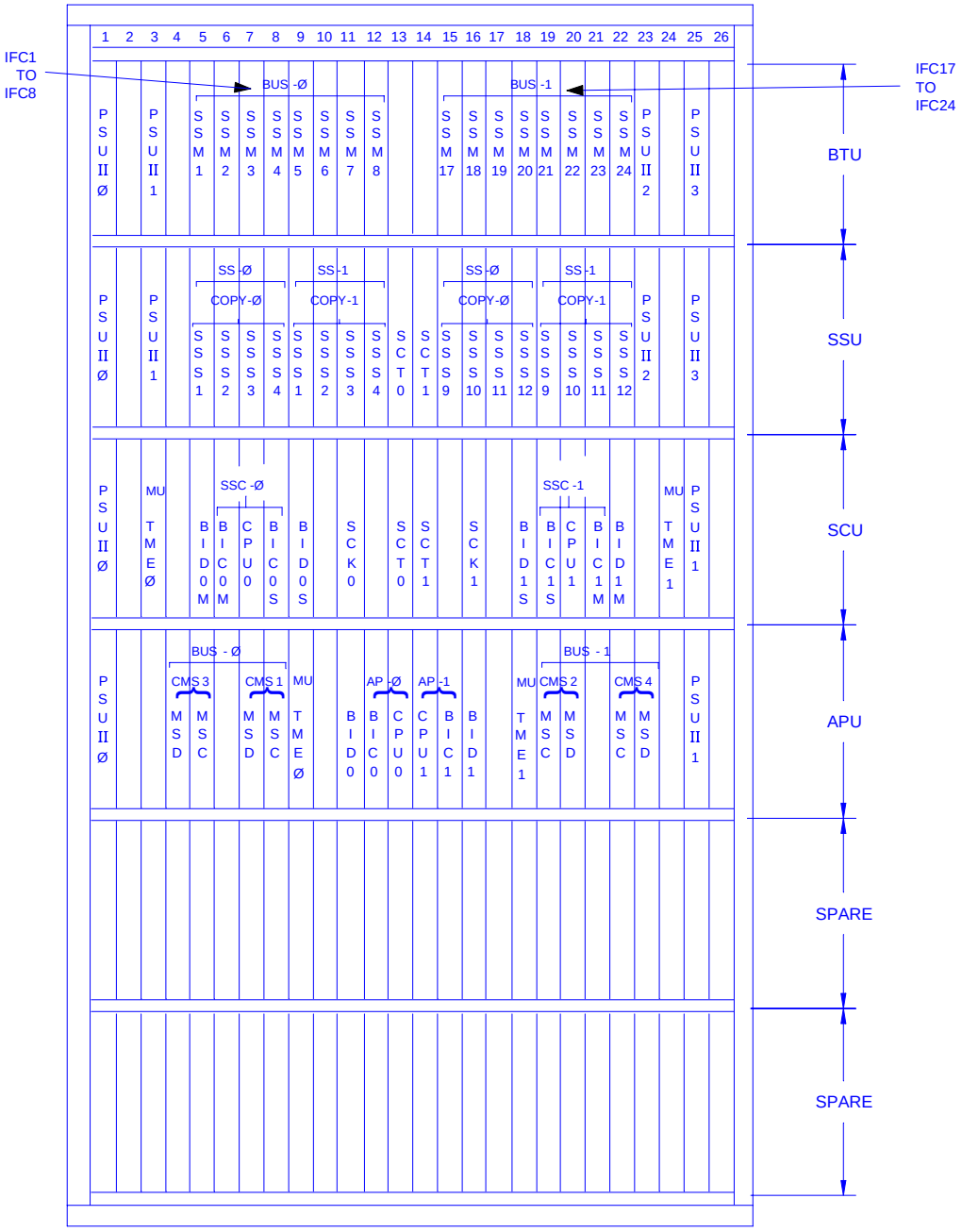


FIG. 3.9.12
CENTRAL MODULE - L (CONFIGURATION)

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-CMC

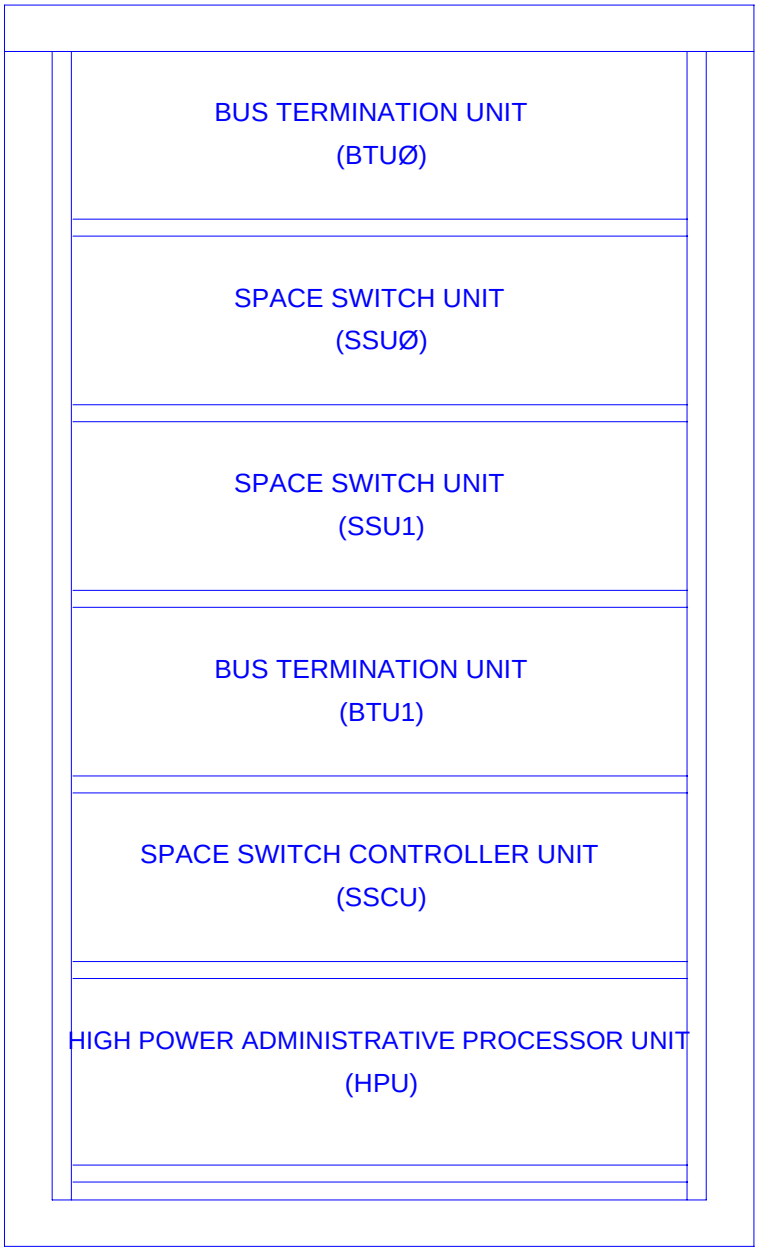
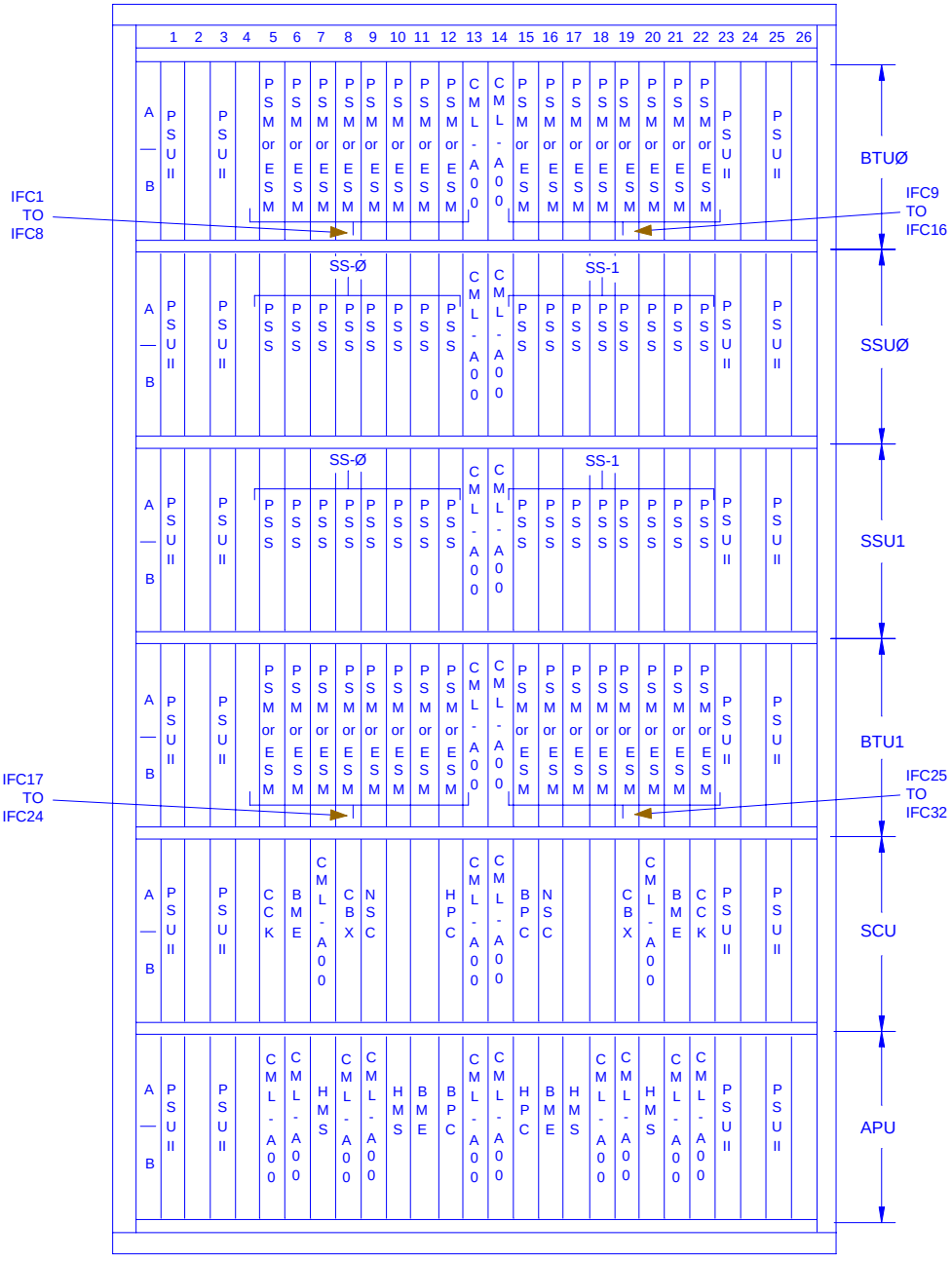


FIG. 3.9.13
CM-XL CONFIGURATION

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-CM1



NOTE :
- UNUSED PSM CARD SLOT SHOULD BE EQUIPPED WITH THE DUMMY LOAD CARD CML-S00
- UNUSED PSS CARD SLOT SHOULD BE EQUIPPED WITH THE DUMMY LOAD CARD CSL-S00
- HPC CAN BE USED IN PLACE OF BPC TO SUPPORT 800K BHCA

FIG. 3.9.14
CENTRAL MODULE-XL CONFIGURATION

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-CMX

3.10. NUMBERING SCHEME

In C-DOT DSS MAX, a common numbering scheme is employed for addressing functional modules, racks within a functional module, frames within a rack and card slots within a frame.

The system consists of four types of modules viz. Base Module (BM), Central Module (CM), Administrative Module (AM) and Input Output Module (IOM). The number of Base Modules in DSS MAX can vary from 1 to 32. In case of SBM exchange only one BM i.e. BM-1 is needed.

As shown in the Fig. 3.9.15, in 4:1 concentration, each BM can grow upto three racks. Each rack consists of 6 frames and each frame consists of 26 card slots. CM and AM are, however, housed in the same rack.

Thus a card slot is uniquely identified by a combination of the four fields :-

Field 1 : Base Module Number (1 to 32)

This field indicates BM Number in which the circuit is located.

Field 2 : Rack Number within a Base Module (1 to 3)

This field helps in identifying the particular rack of the specified BM in which circuit is located.

Field 3 : Frame Number within a rack (1 to 6)

This field helps in locating the relevant frame in the rack.

Field 4 : Card Slot Number within a frame (1 to 26)

This field helps in locating the card slot, in which the circuit resides.

Field 5 : Circuit No.

It identifies 1 out of 8 circuits for Lines/Analog trunks, 1 out of 16 service circuits of 1 out of 32 tone circuits or digital trunk channel.

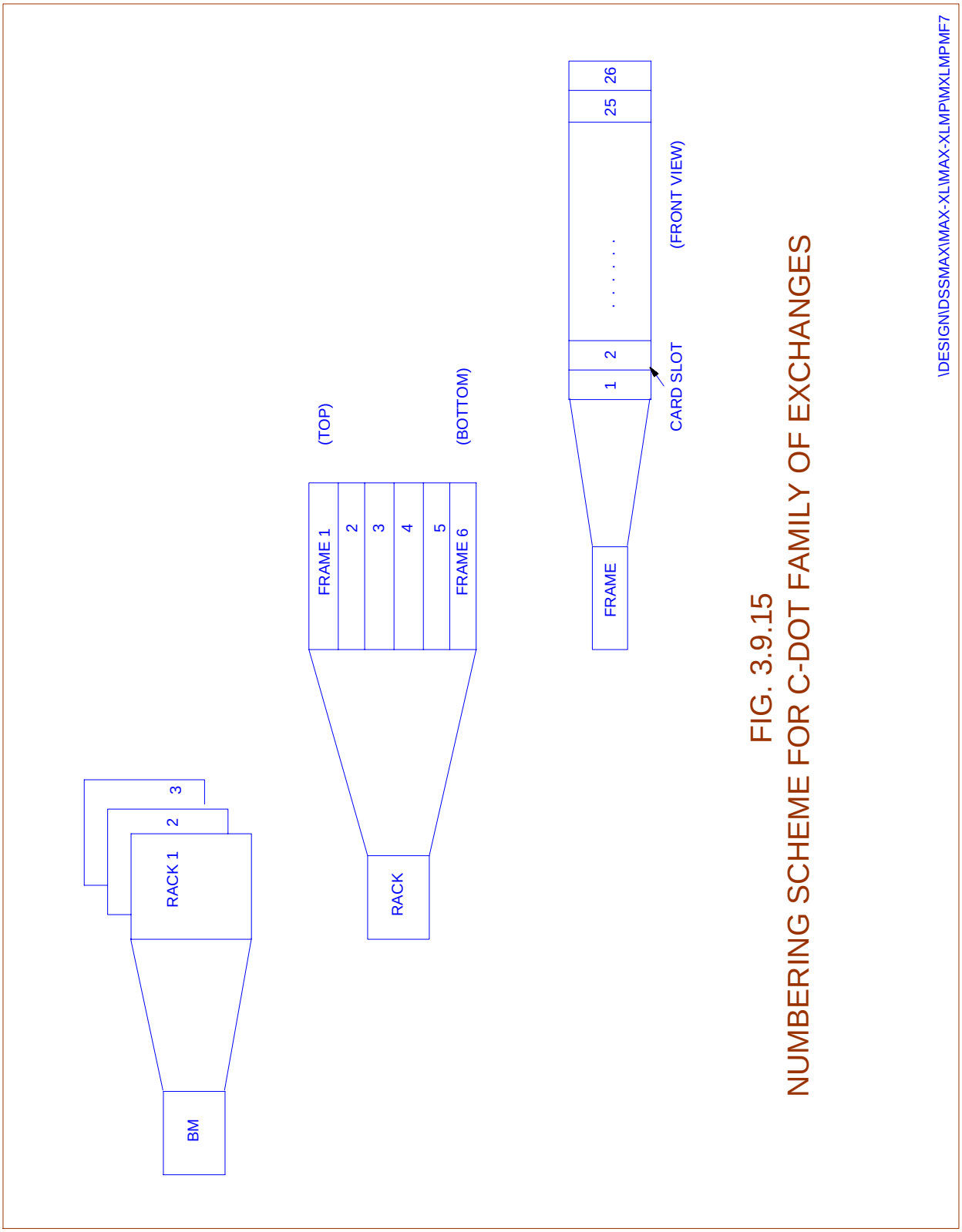


FIG. 3.9.15
NUMBERING SCHEME FOR C-DOT FAMILY OF EXCHANGES

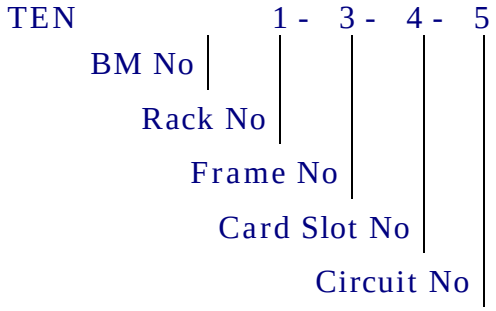
3.10.1. TERMINAL EQUIPMENT NUMBER (TEN) TO PHYSICAL LOCATION TRANSLATION

TEN uniquely identifies a subscriber port/trunk circuit/service circuit. TEN consists of five fields as follows (Refer Fig. 3.9.16):-

TEN : xx - x - x - xx - xx
Fields : 1 2 3 4 5

The first four fields uniquely identify the card slot number as explained above in sec. 2.5. The fifth field identifies the circuit number as explained below.

Fig. 3.9.17 below illustrates the translation process for a TEN :



In case of Line Module a typical TEN can be 1-2-6-22-1. The value 2 for the Rack No. signifies more than one rack, i.e. BM has been concentrated.

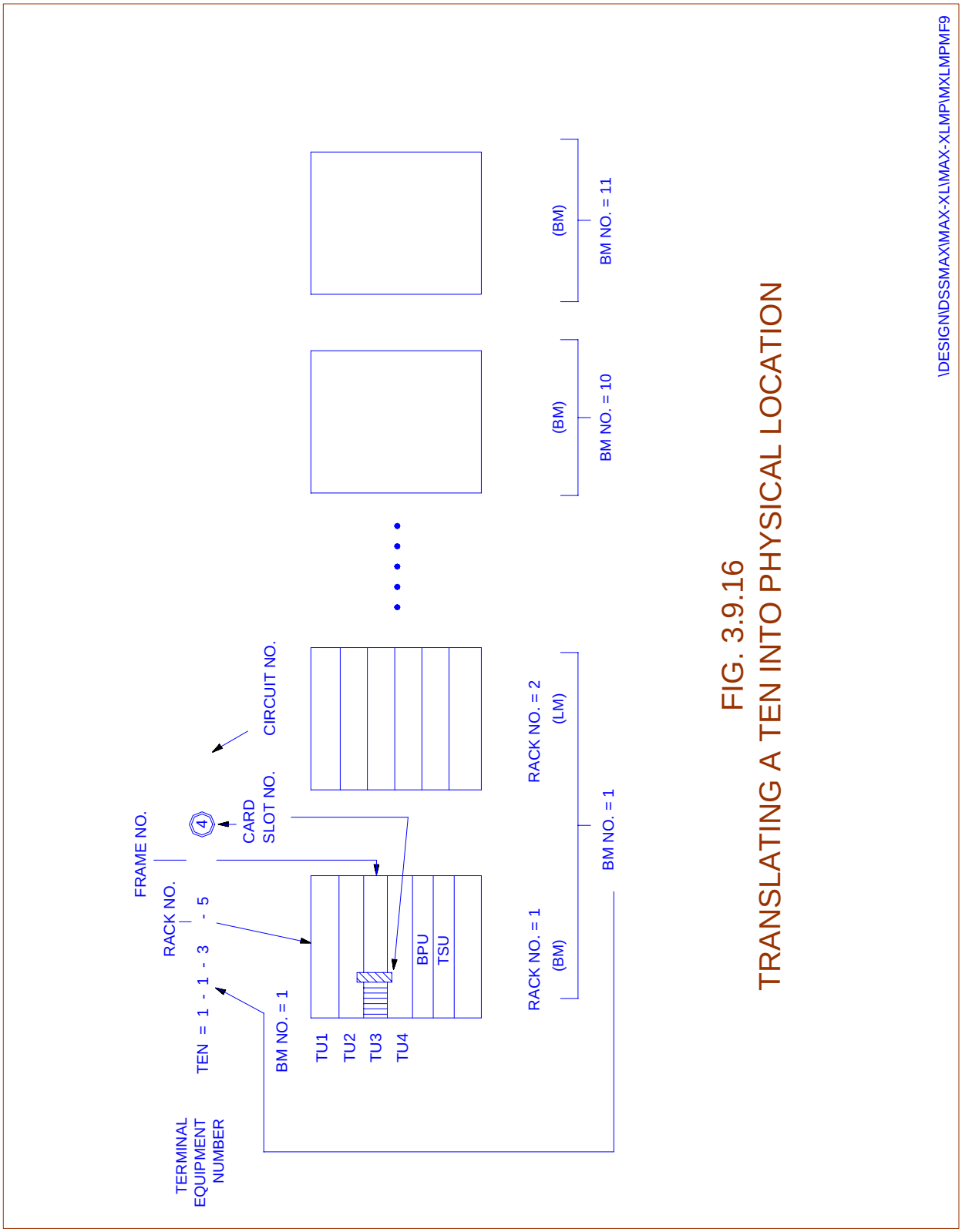


FIG. 3.9.16
TRANSLATING A TEN INTO PHYSICAL LOCATION

3.10.2. Fan Failure Detection Unit (Fig. 3.9.17)

Forced air cooling units are provided in CM-XL due to its relatively high dissipation of heat. A cooling unit is a set of 2 DC powered fans housed in a mechanical assembly alongwith a Fan Failure Detection (FFD) card. Three such units are equally spaced in a mother board in each plane on top hat of the CM-XL cabinet. These fans intake hot air raising through the CM frames and thereby providing additional cooling effect to CM-XL cards.

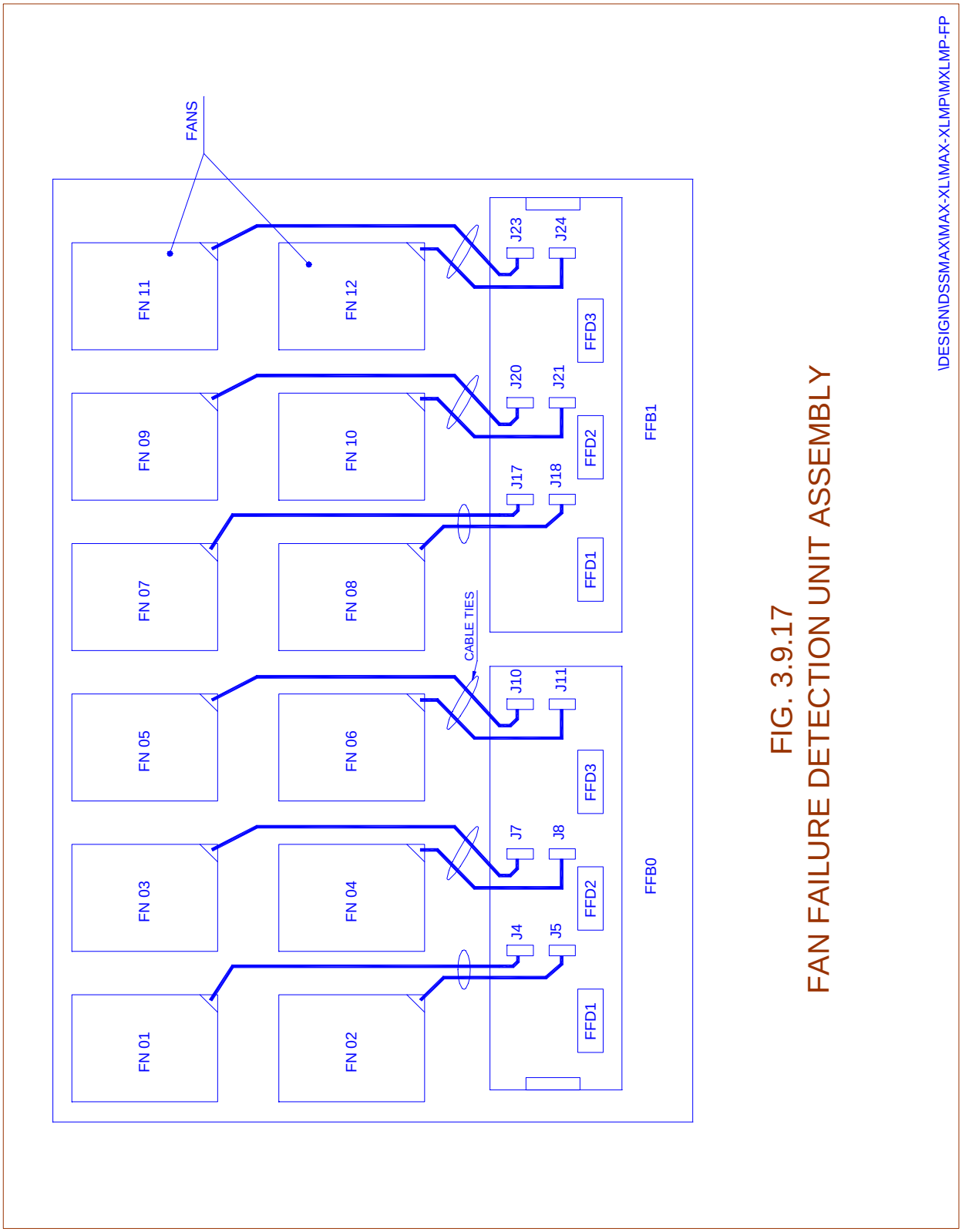


FIG. 3.9.17
FAN FAILURE DETECTION UNIT ASSEMBLY

Chapter 4.

System Initialisation & IOP Maintenance Procedure

4.1. GENERAL

The System Initialization is the process to bring up the system from 'cold' level, to provide the service. It loads the code, patches & data. It initializes the entire system to a level in which calls are processed to provide service. During initialisation, if at any time the system faces a unrecoverable software/hardware problems, it will try to solve the same by going for higher level recoveries.

4.2. LEVELS OF INITIALISATION FOR SYSTEM/MODULES

There are many levels of initialisation.

The different levels of initialization are described below :

Power On This will occur when the power to Administrative Processor (AP)/Base Processor (BP) is switched on. In this case BPs will go for power on tests. After the tests pass, it will try to communicate with the copy to find out whether it is active or not. If no reply comes from the copy it tries to become active by acquiring the memories. If the AP/BP is able to get at least one memory, it will become active with that memory..

Code Load This level is triggered by software recovery or by operator command.

Patch Init This level is triggered by software recovery or by operator command.

Part Init This level is triggered only by operator command.

Stable Clear This level is triggered by software recovery or by operator command.

Soft Start This level is triggered by software recovery or by operator command.

In all the above levels of initialisation, no new call is accepted by the module under initialisation. However, all the calls which were in progress are terminated forcibly at the end of initialisation.

4.2.1. Sequence of System Initialisation

The system initialization sequence is as follows.

AM --> CM -->BMs —>SUM

Only after the highest module has completed its initialization, the lower module/modules start their initialization. However, the levels of initialization for lower modules can be different. If AM gets initialised to any level, all other modules in initialised to stable clear (STBL-CLR). In case of power-ON/code loading, a maximum of 16 BMs can down load code/patch, at a time. Remaining BMs will wait for these BMs to finish the initialization. However during Part Init i.e. data down loading and other lower levels of initialization, a maximum of four BMs can initialise simultaneously. SUM initialization will take place only after initialization of the BM, also defined as "Home BM".

4.2.2. Conditions of Initialisation

The system can go for initialization in two ways -

1. System by itself as a result of in built recovery mechanism.
2. By operator command as decided by "Exchange Administrator".

4.2.2.1. System Initiated Levels of Initialisations

System on its own may decide to go for various levels of initialization to overcome to the fault conditions. This is a result of integrated/inbuilt recovery process to overcome the fault conditions without manual intervention.

Level of Initialisation	Reasons
Code load	• System power off/on or reset. • Unrecoverable error in code area in simplex memory condition. Data comparison error in code area.
Patch Init	• Switch over during data loading.
Part Init	• Data comparison error in Read Only Data (ROD) area. • Unrecoverable error in ROD area in simplex memory condition.
Stable Clear	• Data comparison error in Read- Write Data (RWD)

Level of Initialisation	Reasons
	area. • Unrecoverable error in RWD area in simplex memory condition. • Overflow of software recovery counters within certain time. • Failure of both time switches, message switches or SCICs
Soft Start	• Any exception when Operating System (OS) of static process is running.

4.2.2.2. Operator Initiated Levels of Initialisation

Operator can give INIT-MOD/INIT-SYS command to make the system go for any level of initialisation by giving a proper init option.

It is advised, not to use INIT-SYS command without consulting control rooms in DELHI or BANGALORE. However INIT-MOD can be used by the administrator to solve some problems.

4.3. IOP BOOT UP/SHUTDOWN PROCEDURE

4.3.1. Overview

In a working exchange, the need to shutdown and boot up IOP module may be felt due to various reasons. The need may arise due to faulty behaviour of one of the IOPs or due to link problems between IOPs or IOP and AP/BP. It may also be intentional, to make changes on only one IOP or for hardware modifications (ECN) or for routine maintenance of IOP. This section brings out the procedure for :

- How to put one of the IOPs out of service
- How to bring an out of service IOP into service

4.3.2. Terminology

Active IOP	The IOP whose status is shown as INS-ACT in DISPL-IOP-LEVEL command. All communication with the switch is possible from Active IOP.
Standby IOP	The IOP whose status is shown as INS-SBY in DISPL-IOP-LEVEL command. All communication between switch and standby IOP is through active IOP.

Inservice-Level IOP	The IOP whose level is shown INS- LEVEL in DISPL-IOP-LEVEL command. This may be either active IOP or standby IOP
OOS IOP	Out of Service IOP. No communication is possible from this IOP with the switch.

4.3.3. IOP Initialisation Levels

In DSS MAX, an IOP may be at different levels of initialisation. Depending upon the level of initialisation, IOP is able to perform certain activities allowed at that level of initialisation. An IOP run level is different from IOP status. An IOP may be in INS- ACT/INS-SBY but it may be running at different levels such as 'Inservice' or 'Disable Update All'.

The following IOP initialisation levels are possible:

- Power Off
- Cold Start
- Warm Start
- Disable Update All
- Disable Update Operator
- Inservice

a) **Power Off**

When power is switched off, IOP is in Power Off level. No activity is possible at this level in IOP.

b) **Cold Start**

This initialisation is done by just switching on power to the IOP. IOP performs some diagnostics and comes to monitor prompt and waits for the user to give instructions to go to next level of initialisation. At this level operator can choose to go to next level of Initialisation or can perform certain tests on IOP hardware. Refer IOP user manual for details of these tests.

c) **Warm Start**

This is the Initialisation level when the IOP is booted up by giving 'bo' command on monitor prompt. The IOP initialisation is done and DSS MAX software starts running. Login prompt comes on all terminals configured and operator is allowed to login. After login, CRP prompt comes and the operator can execute 'crp' at this level. Only certain commands are allowed at this level of initialisation in which AP/BP will not be able to communicate with IOP.

d) **Disable Update All (DIS-UPD-ALL)**

This level is in between INSERVICE and WARM START levels and can be reached either from an inservice level or warm start level by init-iop command. At this stage, IOP will have all eternal processes running in the system but no RCV commands are allowed from operator. No operator feature is allowed at this level. AP/BP is able to communicate with the IOP if this level is attained through INIT-IOP command on IOP which was running at 'Inservice' level.

e) **Disable Update Operator (DIS-UPD-OPR)**

INIT-IOP command can be used to bring IOP to this level. This is a level between 'Disable UPD All' and 'Inservice'. This level is reached from an 'Inservice' level or 'Disable UPD All' level. At this stage, operator features and subscriber initiated features are allowed but operators are not allowed to execute RCV commands. AP/BP is able to communicate with the IOP if this level is attained through Init-Iop command on IOP which was running at 'Inservice' level.

f) **Inservice (INS-ACT/INS-SBY)**

This initialisation is triggered by init-iop crp command for IOP. At this level, the IOP is inservice and is able to communicate with the switch.

4.3.4. IOP Shutdown Procedure

A. Whenever the IOP shutdown is intentional, the procedure given below should be followed :

Step 1

Login into 'admn' account on the IOP which you want to make OOS.

Step 2

Verify that the IOP on which you are logged on is the slave IOP, for example, if you are on IOP-1

< displ-iop-level

If the response indicates that the IOP-1 is INS-SBY then it can be put out of service and go to step 4. If the response says IOP-1 is INS-ACT then go to step 3.

Step 3

An INS-ACT IOP should not be put out of service or switched off, first it has to be made INS-SBY and then only it can be put out of service. To change its status, key in the command.

< intchg: mod-no=iom, unit-id=iop-1;

The interchange should be successful.

Step 4

Bring down the SBY IOP to warm-level by giving the command

< init-iop : 2, 1;

Step 5

Bring this IOP to cold-level by giving command.

<init-iop: 1, 1;

The following message will come:

"All the processes running in the system will now be killed and system will go to 'cold start' level".

Wait for console login :

Now the IOP can be switched off.

B. After loading the complete software, the IOP is to be shutdown. The IOP in this condition is in warm-level. At this stage give command.

cd /

shutdown 0

Now the system will ask for

Whether you want to continue (Y/N) ?

Give 'Y' and wait for INIT : SINGLE USER MODE and # prompt.

Now the IOP can be switched off.

4.3.5. IOP Boot Up Procedure

Power up the IOP. At the monitor prompt give the command, VHC x.x > bo

(where x.x is the current monitor version)

A file system check is automatically initiated. In case any error is found in the 'root' file system, the system will correct the inconsistency and displays,

/******** BOOT UNIX (NO SYNC) **********/

Press the 'reset' button and repeat the above procedure. After the system boot-up is completed.

The System will prompt for date

Enter date in the format MMDDHHmmYYYY (e.g. 102020301990 = Oct. 20, 8:30 PM, 1990)

Date :

If the date entered is not correct the system will reject it with a message "Bad Conversion". If the date is correct, then the operator will be asked to confirm it. Once the operator confirms the date, UNIX gets loaded.

Console Login : Prompt will be displayed on the console and the

Login : Prompt will be displayed on other configured terminals.

4.4. PROCEDURE TO BRING IOP INSERVICE FROM OOS STATE

The maintenance personnel may need to bring an Out of Service IOP in service in two distinct cases, namely

- When one IOP is active and other IOP is in warm-start level.
- When both the IOPs are out of service, and the DSS is functioning without an IOP.

Both cases will be discussed, in detail.

4.4.1. One IOP is INS-ACT

Before the OOS IOP is brought in as INS-SBY, the system needs to ensure that the data in the hard disk of this IOP is updated to reflect the latest status of the system. This data is already available in the disk of the INS-ACT IOP, and the HDLC RS-422 link between the two IOPs is used to transfer the data needed to bring about this objective. This procedure will henceforth be referred to as **IOP Synchronization**.

In the procedure described below it is assumed that **IOP-0** is **OOS-SYS** and **IOP-1** is **INS-ACT**. If the situation is the reverse, interchange **IOP-0** and **IOP-1** in the following description.

Step 1

If the Out of Service IOP is not in the WARM-START level, login to the 'admn' account, password is 'CDOTadmn' invoke 'crp', to bring it to this level.

Step 2

Perform the disk cleanup procedure to get rid of old data records that have already been backed up on to the cartridge. This should be done on both the IOPs.

- Clean up the data dump ($DUMPP) directory using the following commands < DEL-FGP-FILE for 'bc' and 'tf' file groups for old data.

Step 3

Now, the OOS IOP is to be made OOS-OPR in the system status map. For this, issue the following command from the INS-ACT, IOP

< PUT-SWU-OOS: IOM, IOP-0;

Step 4

Issue the following command from the INS-ACT IOP

< PUT-SWU-INS: IOM, IOP-0;

The console terminal will display the following activities one by one to indicate that synchronisation is going on.

SYNCHRONIZATION OF IOPs BEGIN

STEP 0 - PROCESS INIT DATA

STEP 1 - CURRENT DAY DUMPS

STEP 2 - SIF DATA

STEP 3 - GLOBAL DATA

STEP 4 - MIP DATA

IOPS ARE IN DUPLEX NOW

STEP 5 - PAST DAY DUMPS

SYNCHRONIZATION OF IOPs OVER

The OOD and printer will report the completion of the above stages of synchronization. When the synchronization begins, the INS-ACT IOP Level goes down to DIS-UPD-ALL. No data modification activity, by the operator through command, or by the subscriber through feature initiation, is allowed at this stage.

When 'STEP 2 - SIF DATA' is complete, the IOP-LEVEL goes up to allow subscriber initiated features, but operator data modification is still not allowed.

When 'STEP 5 - MIP DATA' is completed, and the OOD and Printer report 'IOPS ARE IN DUPLEX NOW', the operator data modifications are enabled.

The message 'SYNCHRONIZATION OF IOPs OVER' indicates that the entire synchronization procedure is complete, and the previously OOS IOP is now In Service and Standby (INS-SBY).

Errors and Solutions

If the procedure fails, try steps 1, 4 & 5 again. Before repeating, check the HDLC links between the two IOPs, and those between the OOS IOP and the AP (BP for SBM). If the failure persists, contact the design centre with this information.

4.4.1.1. Both IOPs Out of Service

The DSS MAX has the capability to provide service for a limited period in a situation where both the IOPs are Out of Service (and presumably Out of Order). In this condition, the system functions at a reduced efficiency with some of the features not operational as password change for Dynamic Locking, no traffic and billing dumps etc. However, as the system software cannot resort to various levels of system initialisation in case of irrecoverable errors, there is a major risk of indefinite exchange or group downtime.

It is therefore essential that whenever such a condition arises, the maintenance personnel, who will be notified by a Critical IOP Alarm Indication on the Alarm Display Panel (ADP), take immediate action to rectify the situation, and attempt to bring atleast one IOP in service.

To describe a situation when both IOPs have gone OOS, the following terminology will be used

IOP-X is the IOP that was the last IOP to be in service

IOP-Y is the IOP that had gone out of service before IOP-X.

In this respect, the operator may face one of the two situations:

- IOP-X is in order, and can be brought in service.
- IOP-X is not recoverable, but IOP-Y is functional, and can be brought in service.

Case I (IOP-X is in order, and can be brought in service)

Follow the steps described below:

i. Bring IOP-X to WARM-START level, if it was not already so. The procedure for doing so has already been discussed in previous sections.

ii. Check that all HDLC cables from IOP-X to the AP (BP for SBM) are in proper order.

iii. From the CRP prompt on IOP-X, issue the command

< INIT-IOP: INS-LEVEL, FORCED;

This will bring IOP-X in service. Now, if IOP-Y is also in order

iv. Follow procedure 4.4.1 to bring IOP-Y INS-SBY.

Case II (IOP-X is not recoverable, but IOP-Y is functional, and can be brought in service.)

This condition is more serious than the previous one. Some amount of data will probably be lost. Follow the steps outlined below -

Copy out Exchange Data, Billing Data, Traffic Data from IOP-X and COPY-IN into IOP-Y, if it is possible to copy data from the unrecoverable IOP-X.

If it is not possible to copy data from IOP-X, then do the following -

1. Bring IOP-Y up to WARM-START Level.

   If IOP-Y had gone OOS before the last data backups were taken, perform the following step (Step 2). Otherwise, skip this step.

2. Restore the latest Exchange Data, Billing Data and Traffic Data, backup on to IOP-Y.

3. From the CRP prompt on IOP-Y, issue the command

   < INIT-IOP: INS-LEVEL, FORCED;

   This will bring IOP-Y in service.

4. Wait for next billing dump to come on this IOP from memory (BP). Maximum wait time is twice the billing dump periodicity.

5. Initialise the system with part-init option using "INIT-SYS" command.

6. Rectify the IOP-X and bring this as INS-SBY using the procedure given in 4.4.1.

4.4.2. Printer Procedure

The Line Printer (LP) subsystem in IOP provides the facility to the operator to have multiple printers connected to IOP and choose any of these printers to take printouts. This section describes how to configure the LP subsystem.

Logical Printer :

Each IOP has eight logical printers. They are to be named as 'prX' where X varies from 1 to 8. The requests from CRP/OOD and ORP (Operator Recognition Process) are issued for these logical printers and it is assumed that all eight are always there. These logical printers are mapped to some IOP ports to which the printers are connected. This logical printer to port (and hence physical printer) mapping is changeable through the LP subsystem commands. More than one logical printer may be mapped to one physical printer and more than one physical printer may be attached with one logical printer. The figure below gives configuration which is present in the system by default. This configuration need not be changed.

Logical Printer	Physical Printer
pr1	
pr2	--> prn1 (/dev/icc_0)
pr3	
pr4	

The system is configured as

i. Four logical printers 'pr1' to 'pr4'.

ii. Physical printer prn1.

iii. All logical and physical printers accepting the requests.

iv. Physical printer prn1 is 'enabled'.

v. Logical printer prn1 is the default destination printer.

The LP subsystem configuration is done using following LP subsystem commands. All commands need to be given from 'LP' account which is LP administrator. Login as 'lp' and password as 'DSSlp'

LP subsystem commands :

i. Changing of the device for physical printer prn1 to /dev/icc_x

```
IOP5x> /usr/lib/lpadmin -pprn1 -v/dev/icc_x
```

ii. Creation of a new physical printer 'prn1' on port '/dev/icc_0'

```
IOP5x>/ usr/lib/lpadmin -pprn1 -v/dev/icc_0 -mcdot
```

iii. Deletion of a physical printer

```
IOP5x>/ usr/lib/lpadmin -xprn1
```

iv. Creation of logical printer 'pr1' having physical printer 'prn1'. If pr1 does not exist, it is created. If pr1 already exists, prn1 is added as an additional printer for that logical printer.

```
IOP5x>/ usr/lib/lpadmin -pprn1 -cpr1
```

v. Deletion of logical printer 'pr1' or removal of physical printer 'prn1' association to logical printer. If it is the only physical printer associated with the logical printer, the logical printer is deleted.

```
IOP5x>/ usr/lib/lpadmin -pprn1 - cpr1
```

vi. Make a logical printer default system destination

```
IOP5x> /usr/lib/lpadmin -dpr1
```

vii. Deleting the system default destination for print requests

```
IOP5x> /usr/lib/lpadmin -d
```

viii. Display of LP subsystem configuration

```
IOP5x> lpstat -t
```

ix. Making a printer 'pr1' 'accept' request

```
IOP5x> accept pr1
```

x. Making a printer reject new requests

```
IOP5x> reject pr1
```

xi. Enabling a physical printer to print

```
IOP5x> enable prn1
```

xii. Disabling a physical printer from printing

```
IOP5x> disable prn1
```

Procedures :

Before any reconfiguration is done for printers, one need to follow some procedure. LP subsystem needs to be shutdown before reconfiguration and should be restarted after reconfiguration.

These procedures are listed below :

- Shutdown for LP subsystem

    a) login into 'lp' or 'root' account

    b) /usr/lib/lpctl1

- Restart for LP subsystem

    a) login into 'lp' account

    b) /usr/cdot/lpctl0

All the print requests in queue will be cancelled by shutdown and restart of LP subsystem as given above.

To start the printer subsystem by removing all input requests in the queue.

Login to lp account or root account

#> /usr/lib/lpctl1

#> /usr/lib/lpctl0

Check that all logical printers are accepting requests and physical printer prn1 is enabled, if not, make the printers accept requests by giving the command.

#> /usr/lib/accept prx

where prx is the printer which was not accepting the print requests. Enable the printer prn1 by

#> enable prn1.

4.4.3. Handling of Cartridge Tapes

- Whenever you are using a cartridge for the first time, the first thing to be done is to write a null on the cartridge. It is done as follows:

    a) Check that the cartridge is not write protected.

    b) iop 5x> >$TAPE

    c) Now the cartridge may be brought into regular use.

- For dumping /u on a cartridge:-
    a) Check that the cartridge is not write protected
    b) Insert cartridge in drive
    c) iop5x >find /u -print | cpio -ocv > $TAPE
- For dumping any directory on a cartridge:
    a) Check that the cartridge is not write protected
    b) Insert cartridge in drive
    c) IOP5x> cd (<dir-name> is the required directory)
    d) IOP5x> ls | cpio -ocv > $TAPE
- Normally, any cartridge should be kept write protected. Only when you want to write onto it, remove the write protection.

Chapter 5.

Routine Maintenance

5.1. GENERAL

Initiatives to be taken by maintenance personnel in the best interest of the system's health are highlighted in this chapter. However Chapter 6 and 7 should be referred to for remedial action in case of faults.

Routine maintenance philosophy, as applicable to the system as a whole, is described first. What needs to be done for the maintenance of switch hardware, terminal hardware, PSU cards and IOPs are covered later.

5.2. ROLE OF MAINTENANCE PERSONNEL

Keeping a watch on the system's health, trouble fixing and programming periodic routining strategy in advance form the major functions to be performed by the maintenance personnel.

In addition to above, following functions also require human attention:

1. Co-ordination with remote exchanges for trunk testing.
2. Providing the necessary feedback to the support centre.
3. Day to day logging of important observations and maintenance actions.

Some of the above functions are briefly described in the following paragraphs :-

5.2.1. Watch on System's Health

This involves ensuring periodic dump of desired informations, scanning reports generated by the system and verifying systems integrity with a view to uncover any abnormalities in system's behavior, and being vigilant towards the audio-visual alarms raised by the system.

Moreover, when a new card is brought to service, vigilance towards system's behavior is needed to uncover any malfunctions which can be attributed to the new card.

5.2.1.1. Ensuring Periodic Dump of Desired Information

System, on its own initiative, keeps generating various reports regarding system's health as and when significant events take place. Maintenance personnel too can programme the system in advance, for generating various periodic reports including the following. Such reports are to be scanned daily to enable them to track system's health on a day-to-day basis.

i. List of all switch units and terminals having OOS- OPR status.

ii. List of all switch units found faulty by the system (OOS-SYS).

iii. List of all terminals found faulty by the system (OOS-SE/ OOS-SO/ INS-LLO)

iv. List of service circuits and trunks found faulty by the system or by operator.

v. List of trunks having status as BLOCKED or as OOS- TRANS.

Above reports can be generated by storing appropriate commands alongwith the execution time and interval in the system's calendar, through command ADD-CAL.

5.2.1.2. Scanning Spontaneously Generated Reports

All reports, periodic or otherwise, should be scanned daily keeping following objectives in view:

i. To identify fresh repair needs.

ii. To verify the repair activity done earlier is successful or not.

iii. To verify that no. of lines and trunks having Out of Service (OOS) status is within acceptable limits.

iv. To detect any abnormality in system's behaviour. Example : Suddenly, system might declare all lines faulty. This could be due to a fault in the tester i.e., TTC itself.

v. To verify that no unit or link of the system remains untested or in passive service, for a long duration.

vi. To identify important observations, reports, which are of interest to the support centre.

5.2.1.3. Verifying System's Integrity

It is worthwhile to keep verifying system's integrity manually from time to time. This can help in uncovering those faults which might have remained undetected so far.

Verifying sanity of TTC, running audits, dialling tones, announcements, and trunks by equipment no., making a test call after TIC switchover fall into this category.

5.2.2. Trouble-Fixing

The need for this phase arises either on external complaints or observation of abnormal situations or when the system itself finds one or more units faulty.

Fault isolation involves interpretation of Alarm and associated Report and if applicable, use of on-demand tests and reference to system trouble fixing procedures'.

Repair action such as card replacement, if not critical, can be deferred to convenient hours as the system (in most of the cases) can automatically recover from faults through reconfiguration.

5.2.3. Periodic Routining

This involves exercising those parts of the system hardware elements which are not normally in use so as to bring out the latent faults much before they adversely affect user services and to reduce the chances of an active unit going faulty in case of duplex units. This can be done manually by issuing diagnostic commands by the operators.

System has however, the capability to periodically routine entire hardware and generate routining reports. Maintenance personnel have to dictate the time of day at which routining should be done, the sequence in which units be tested, and the periodicity of routining. The strategy regarding assignment of active or passive role to a duplex unit found fault-free after routining is to be chosen and communicated to the system in advance.

Following steps are needed for periodic testing :-

a) Deciding a schedule for routine testing.

b) Conveying the schedule to the system.

c) Analysing routining reports.

Each one of the above steps is described below.

5.2.3.1. Deciding a Schedule

This involves the following :-

i. To choose the time of testing/routining in such a way that subscriber services are least affected.

ii. To choose appropriate interval for routining giving due weightage to the fact that faults should not remain hidden for "too long".

iii. To choose a sequence in which units are to be tested.

iv. To ensure that various units and links of the system do not remain in "non-active" service for too long.

A typical schedule could be as follows :-

Periodic testing is performed daily at low traffic hours, say at 00-30 hrs at night. Higher level unit, say BP is tested before a lower level circuit, say a terminal circuit, gets tested. After a duplex unit is found fault free, it is assigned ACTIVE state and its mate standby state. Care is also taken that "links" which have been unused earlier become (under use) active now.

5.2.3.2. Conveying the Schedule to System

This involves preparing a file of commands needed for periodic testing and specifying in the system's calendar the time of day and the periodicity for executing the command file.

Once this is done, at specified time interval, System automatically keeps routining exchange hardware and generates reports.

In case of manual testing, the operator needs to initiate the tests manually as per the schedule drawn.

5.2.3.3. Scanning Routining Reports

Routining reports convey the test results to maintenance personnel. It is essential to scan the said reports daily so as to confirm the following :-

i. Periodic testing/routining schedule is actually being done.

ii. No unit or link remains in passive role for a long period.

iii. No unit or termination remains un-tested for a long period.

iv. Routining was not abandoned in-between.

v. Units or terminations are generally found in good health after routining.

vi. Routining failures also result in generation of diagnostic reports, alarm reports and appropriate alarms on the ADP.

In case above is not true, further investigations are initiated.

5.3. ROUTINE MAINTENANCE OF BASE MODULE (BM)

This involves maintenance of Switch hardware, Terminal hardware and service circuit hardware. These aspects are described below:

5.3.1. Switch Hardware Routine Maintenance

Routine maintenance for the switch hardware should be taken up only in the low traffic hours typically in the night.

5.3.1.1. General Procedure for Testing of all Duplex Units

i. Note down the current status of all the switch units through DISPL-SYS-ALL command. It is assumed that all the units are in duplex mode either active or standby state. If any unit is OOS first attend to that fault using the procedure given in chapter 6 on the system trouble fixing procedures.

ii. The order for routining should be such that a hierarchically higher up unit should be tested first and then the subsequent units. The desired order for routining is BP-MU-BMS-SCIC-TS-TIC.

iii. First the standby unit (say BP-1) should be made OOS-OPR using PUT-SWU-OOS command. Note this action will lead to a switch alarm getting raised on ADP and OOD and report on the printer. Next diagnose this unit using DGN-SWU command. If the diagnostics passes, bring the unit into service using PUT-SWU-INS or FRC- SWU-INS command.

iv. If the diagnostics fail, follow the procedure given in the chapter 6 on 'system trouble fixing procedures'.

v. After the unit has come as inservice standby, issue the INTCHG command to make it active.

vi. If the switchover is successful then repeat steps iii) and iv) on the other copy also (say BP-0).

vii. On the other hand during switchover, if one of the adjacent unit becomes OOS-SUS then the cross links from the unit (BP-1) to that unit (say IOP or ADC or BMS) should be suspected. Wait for the system to complete the diagnostics and see if it declares some unit faulty. If it does, refer chapter 6 on Trouble Fixing Procedures. If it does not, refer section on Transient Faults Handling.

viii. If the routining of both the copies of a unit is completed, then leave the unit in a configuration such that the copy which was earlier active is now the standby. Proceed onto the next duplex unit and repeat the process. Note that in case of MU, both the copies are active. So the procedure for MU is slightly different in the sense that after successfully diagnosing one of the copies and bringing it into service the copies need not be switched over. The other copy can be made OOS-OPR and diagnostics can be started on it.

ix. It is desirable that the entire switch hardware be routined at least once in a week. Ensure the following four configurations of Switch H/W during a 4 day cycle after performing tests :-

a)	Active BP0-BMS0-SCIC0-TS0-TIC0	(All TICs)
	Standby BP1-BMS1-SCIC1-TS1-TIC1	"
b)	Active BP0-BMS1-SCIC0-TS1-TIC0	"
	Standby BP1-BMS0-SCIC1-TS0-TIC1	"
c)	Active BP1-BMS0-SCIC1-TS0-TIC1	"
	Standby BP0-BMS1-SCIC0-TS1-TIC0	"
d)	Active BP1-BMS0-SCIC1-TS1-TIC1	"
	Standby BP0-BMS1-SCIC0-TS0-TIC0	"

In the above schemes all units get checked as active as well as standby within 4 days and no link remains unused beyond 4 days. Each unit gets exhaustively tested at least once within 48 hours for all it's functions.

x. When a switch unit, previously not in active service, is brought into active service, it is worth while to "watch" system's behaviour for any possible abnormality. This is most essential in case the unit happens to be repaired recently. For example, make a call to and from a TIC which has just been switched into active service.

Note:

The entire procedure of periodic routining of switch units can be fully made automatic by entering the entire schedule into the calendar. At the appropriate time, the calendar will invoke the desired test and if the test fails the operator will be informed through alarms and other maintenance reports.

5.3.2. Terminal Hardware Routine Maintenance

For tracking the fault count for lines and trunks ADP displays the number of faulty trunks and line circuits. A watch should be kept on such counts on day to day basis. Progress of the repair activity should be monitored and a periodic report can also be generated.

In case number of faulty lines or trunks happens to cause an alarm of proper intensity, it should be verified and initiation of repair action ensured.

As part of routine maintenance procedure, make at least one call via each trunk group once every 24 hours.

Testing of terminal H/W viz., lines and trunks should be scheduled after the same is over for the corresponding switch units. Terminal Maintenance can be divided into five parts i.e. maintenance for Analog Lines, Analog trunks, Digital trunks, PHC circuits and Digital lines (ISDN).

5.3.2.1. Procedure for Testing of Analog Lines

i. Each terminal circuit should get tested once in two weeks. First of all the status of all the lines should be checked to see that system itself has declared any lines INS-LLO or OOS-SE. This can be seen through DISPL-TRM-ALL and DISPL-LSCNT-OOS.

ii. If there are already some lines OOS, the operator should first test the line by TST-TRM command and attend to the specified fault in the TST-TRM report.

iii. After attending to the already detected faults the following test sets can be scheduled at low traffic hours using the TST-TRM command for a range of lines.

Open loop outside plant tests : Test set no. 102

Exchange side line circuit tests : Test set no. 103

It is to be ensured that at least a few lines are tested in each frame every day.

Note :

For proper outside plant side tests for lines (open loop and closed loop), the line category for the subscriber line is to be assigned based on line characteristics. The tests will be declared passed or failed depending on the category of the lines. The various values for the test parameters corresponding to different categories are given in Appendix-F and details of test sets are given in Appendix-'A'.

5.3.2.2. Procedure for Testing of Analog Trunks

i. Each terminal circuit should get tested at least once in 24 hours. First of all ensure that all trunks are in inservice using DISPL-TRM-ALL or DISPL-TGP-STATUS or DISPL-TRCNT-OOS command.

ii. If there are some trunks OOS, the operator should first test it by TST-TRM and attend to the fault reported in TST-TRM report.

iii. The following test sets can be scheduled at low traffic hours using the TST-TRM for a range of trunks or TST-TGP for one trunk group at a time.

- Exchange side trunk circuit tests (OG/IC) : Test set no. 202
- O/G trunk answering circuit tests : Test set no. 203

iv. Answering circuit test can be performed on outgoing trunks only.

5.3.2.3. Procedure for Testing of PHC Terminals

i) Each PHC terminal should get tested atleast once in 24 hours. First of all the status of all the PHC terminals should be checked to see if any of the PHC terminal is in faulty condition. This can be seen through DISPL-TRM-ALL & DISPL-LSCNT-OOS command.

ii) If there are some PHC terminals which are faulty the operator should first test it with the help of TST-TRM command and fix the problem or replace the card.

The following test set can be used to test the PHC terminal with the help of TST-TRM command after making it to OOS-OPR status.

Test set no 502 : To test the successful working of PHC terminal.

5.3.2.4. Testing of Digital Trunk (CCS or CAS) Cards

Testing of digital trunk cards equipped as DTK-CAS/DTK-CCS can be done with the help of command TST-TRML-CARD with parameters as :

CARD-TYPE = DTK-CAS/DTK-CCS
TEST-SET = 401 to 406

where

Test set 401 : Tests on DTS card for card type as DTK-CCS /DTK-CAS
Test set 402 : Tests on DTC card, only for DTK-CAS
403 : Tests on DTC+DTS cards, only for DTK-CAS

Note : **There is no command as TST-DTK in the Software Release 2-1-1-1 Release.**

5.3.2.5. Test Procedures for Digital Line ISDN Interface

The CRP command **TST-TRM** is used to perform the tests on the U-Interface in C-DOT DSS.

The valid value for the test sets are 607 , 608, 609 & 610. The details of the test sets are listed in ANNEX 'A'. The test set 607 is used to test the exchange side i.e. (LT) and test set 608 is used to verify the customer end up to S-Interface.

The test set 609 is used to evaluate the characteristics of cable pair. The parameters are measured and absolute values are displayed. The test is executed subject to the condition that the TTC Card is INS .

The test set 610 is comprehensive complete test combining tests from 607 to 609.

For PRI CARD only test sets 607 & 610 are valid.

5.3.2.5.1. HOW TO OBSERVE THE STATUS OF DIGITAL LINE / ISDN-INTERFACE ?

DISPL-TRM-STATUS (to monitor the status of interface)

STAT-TRM :

TML-TYP :

TEN :

DIRNO :

On execution of the above command , the current status of the U-Interface is displayed which may be :

OOS-SO	:	Fault may be in LT, DLL or NT
OOS-SE	:	Fault is confirmed in LT
INS-FREE or	:	The interface is activated up to NT and free to provide service.
INSF-FREE		
CP-BUSY	:	The interface is busy and providing service.

5.3.2.5.2. ACTIVATION / DEACTIVATION FROM LT

It is possible to activate or deactivate the interface from the exchange side.

FRC-TRM-OOS (to deactivate the interface from LT)

TML-TYP :

TEN :

DIRNO :

The command can be executed after defining the parameter values. The successful execution of the command confirms that the interface has been deactivated.

FRC-TRM-INS (to activate the interface from LT without tests)

TML-TYP :

TEN :

DIRNO :

The command can be executed after defining the parameter values. The successful execution of the command will result in activation attempt , being

initiated from the LT. However , in case of fault in LT or NT, the interface will be deactivated with its status, marked as OOS-SO .

PUT-TRM-INS (to activate the interface from LT after successful testing)

TML-TYP :

TEN :

DIRNO :

The command can be executed after defining the parameter values subject to the condition that the TLC is already created . The successful execution of the command confirms that there is no fault in LT. The line status is marked as INS-FREE . In case of fault in DLL (Digital Line loop) or NT, the interface will be deactivated with its status, marked as OOS-SO .

General Guidelines for O&M Personnel

On receipt of complaint from the user , related to non availability of service , the following sequence of operations are desired.

1. Verify the status of the interface using command DISPL-TRM-STATUS . Its status may be OOS-SO indicating that the fault may be in LT , DLL or NT. In such cases , the interface is tested using command TST-TRM command. It the test set 607 fails , the fault is confirmed to LT . In such cases , any of the two options as “Changing the Card “ or “Shifting the port to another free TEN “ may be used as it is being followed for PSTN interface.

2. It the interface status is INS-FREE , the fault probability is on S-interface. The interface is tested using command TST-TRM with TST-SET=608 . The result will indicate the test failure related to ACT/DEACT of S- interface.

5.3.2.5.3. CREATING A REFERENCE TEST CIRCUITS (TLC) IN C-DOT DSS.

The TLC is created to simulate the functions of LT when test set 608 is executed to verify the functioning of NT up to S-Interface. Similarly, it simulates the functions of NT to test the LT in the exchange. This helps in integration of all the functional requirements of testing of ISDN-Interface in C-DOT DSS as the tests are simulated in conformance to actual functional requirement. This avoids the use of any additional test equipment to isolate and locate the fault.

Sufficient checks are also incorporated to verify the sanity of TLC, time to time. This is possible by testing the TLC at the time of creation itself. The TLC is functionally tested in totality before making it available for testing of other ISDN-Interfaces in C-DOT DSS.

The TLC is created by using CRP Command **CRE-TST-CKT** with parameters as :

TLC-TEN :

TST-TEN :

The basic requirements are :

1. The TLC-TEN should be the first free circuit (i.e. not associated with DIRNO) of any BRL card .
2. The status of the BRL card should be INS-NRM . This can be ensured by executing the command TST-TRML-CARD with test set = 605.
3. The TST-TEN should be any free circuit (i.e. not associated with DIRNO) of the same BRL card or any other BRL card in the ISTU.

After executing the command, the TLC is created and subjected to functional tests by using the TST-TEN as reference circuit. Once the functional tests are executed and passed, the status of the circuit is marked as INS-FREE which can be verified using command DISPL-TRM-STAUS. In case of failure, the status of the circuit is marked as OOS-SE. In such cases, it is advised to delete the TLC and recreate it after changing the BRL Card. Alternatively, it is possible to create the TLC on any alternative BRL-Card.

5.3.2.5.4. PROCEDURE TO DELETE A TLC

The TLC can be deleted using CRP Command **DEL-TST-CKT** with parameters as :

TLC-TEN :

The mandatory requirement for deleting the test circuit is that the BRL Card should be made OOS-OPR using CRP Command FRC-TRML-CARD-OOS.

5.3.2.5.5. PROCEDURE FOR TESTING OF ISDN TERMINATION CARD

In case, more than 50 % interfaces corresponding to a Interface Card is reported as faulty , it is advised to perform the tests on the BRL/PRL Card . The card can be tested using CRP Command **TST-TRML-CARD** with parameters as :

RTN-COD : G

RPT-FMT : B

REPEAT : NO

TML-CRD-TYP : BRI/PRI

TST-SET : 605 or 606

CARD-SLOT :

The status of the BRL Card can be displayed by using CRP Command **DISPL-TRML-CARD-STATUS** with parameter as :

TML-CRD-TYP : BRI/PRI

CARD-SLT :

The status of the card can be displayed as INS-NRM , INS-FRC or OOS-SE.

INS-NRM : Card has been brought INSERVICE after performing the complete tests , successfully .

INS-FRC : The Card has been made INSERVICE , forcibly.

OOS-SE : The Card is faulty

The status of a BRL Card can be modified to "Out of Service" by using CRP Command **FRC-TRML-CARD-OOS** . Similarly , its status can be modified to "In service " by using CRP Command **FRC-TRML-CARD-INS** without testing or **PUT-TRML-CARD-INS** after successful testing.

5.3.2.6. Testing of Analog/Digital Trunk Groups

Analog (TWT, E&M) and Digital (DTK) trunk groups can be tested with the help of TST-TGP command with the input parameters TGP-NO Test set.

where Test set = 403 for DTK-CAS/Test Set = 401 for DTK-CCS and test set = 202 for Analog TGP.

5.3.3. Service Circuit Hardware Routine Maintenance

Service circuits MFC, TOGC, ANNC and TTC should get tested at least once in 24 hours. First of all check the status of all these service circuits through DISPL-SRV-STATUS command. If there are already some service circuits OOS, the operator should first attend to these according to the procedures given in Chapter 6.

5.3.3.1. Procedure for Testing of MFC

i. The following test sets can be scheduled at low traffic hours using the TST-SRV with test set 301 for testing the MFC.

ii. If the test passes on all circuits, then perform the same test on the next MFC and so on for all the equipped MFCs.

iii. If the test fails, then refer chapter 6.

5.3.3.2. Procedure for Testing of TOGC

i. For testing the active tone generator give TST- SRV command with test set 304. If the test fails, make the TOGC OOS-OPR and refer Chapter 6.

ii. If the test is successful then give INTCHG command for TOGC to make the other copy of tone generator active. If the switchover is successful repeat the same test on the other copy of TOGC also. Leave the TOGCs in this configuration.

iii. If the switchover of Tone Generators is unsuccessful then one of the links from TOGC to SCIC must have gone faulty. If after switchover one of the TOGCs is declared OOS-SYS follow the procedure in chapter on Trouble Fixing Procedures. If the switchover failed but no unit is declared OOS-SYS then follow the procedure given in section on transient faults.

5.3.3.3. Procedure for Testing of ANNC

There is no command based testing possible for Announcement Controller. It has to be done manually.

From a subscriber with DBE facility (Dialling By Equipment Number), dial to all the announcements one after another. It is recommended that at least all the announcements are checked once in a day. The procedure is as follows:

i) LH DT 1683 TEN

ii) Confirm that announcement fed is the dialled one

iii) Disconnect

Note:

LH - Lift Hand-set

DT - Dial Tone

TEN - Terminal Equipment No. of the announcement circuit dialled (e.g. if 1-1-1- 3 is the card slot number of ANNC, then corresponding announcements are numbered 01110301 to 01110308)

1683 - Service code for DBE

iv) In case of DTMF telephone, *683 TEN# can also be used in place of 1683 TEN for faster response.

v) For further information on DBE feature, refer to document "C-DOT DSS MAX Subscriber Features & Supplementary Service"

5.3.3.4. Procedure for Testing of TTC

i. Check the sanity of TTC against a good line in the switch room. Give TST-TRM with test-set 103 and check that it passes. Conduct test-set 102 with the detailed parameter options and check that values measured are appropriate. Refer Appendix - D for limits of TTC measurements

5.4. ROUTINE MAINTENANCE OF CENTRAL MODULE (CM) AND ADMINISTRATIVE MODULE (AM)

This involves maintenance of APU hardware, SSCU hardware, SSU hardware and BTU hardware.

5.4.1. Routine Maintenance of AP Complex

The general procedure to be followed for routine maintenance of duplex units (5.3.1.1) can be followed.

5.4.2. Routine Maintenance of CMSs

CMSs have to be diagnosed one by one during lean hour. Before making any CMS out of service, it should be ensured that TSC in all BMs are in duplex, all other CMSs are in service and all IFCs are in service. For diagnosing a CMS, make the unit OOS-OPR, then diagnose and put/force it inservice if it passes.

5.4.3. Routine Maintenance of IFC cards in BTU 0/1

All Switch Multiplexer cards have to be diagnosed at least once ina week. IFCs should be made OOS one at a time and diagnosed and made inservice. Before making any IFC OOS, ensure that all BMs are in duplex. The diagnosis should be carried out only during lean hours.

5.4.4. Routine Maintenance of SSU 0/1 & SSCU Hardware

The general procedure for routine maintenance of duplex units given in sec. 5.3.1.1 can be followed. Here duplex units to be considered are SSC-0/1, MU-0/1, and SS-0/1. Each Space Switch (SS) plane consists of all switch cards (SWC1 to SWC16), SSBID and CLK and diagnosis of SS includes diagnosis of all these cards of the copy. If NSC card is equipped, card-id of CLK indicates to NSC. If it is not equipped, then card id of CLK indicates to CCK.

5.4.5. Routine Maintenance of Alarm Display Panel (ADP-SM/ADP-MM)

Once in a day run the LED test on ADP by pressing the LED Test button mounted on its front panel.

5.4.6. Routine Maintenance of Fan Failure Detection Unit

Fan failure detection unit mounted on top hat of the CM-XL cabinet for cooling purposes is to be monitored every day for proper functioning of all fans. Generally, alarm on FBI mounted on corresponding suite where CM-XL is installed, is raised in case of blown fuse on any Filter Box mounted in CM-XL cabinet or blown fuse in FFD cards or any fan being stuck on top hat or the CM-XL cabinet.

5.5. ROUTINE MAINTENANCE OF POWER SUPPLY UNITS

Here, we shall concentrate on PSU cards installed in the switch rack.

i.) Check of all the LEDs on PSU cards once in a day.

ii.) Check whether there are any pending Power Alarms by issuing DISPL-ARM-LIST command. If there are some, attend to them first.

5.6. PERIODIC AUDITS

i) Most of the system integrity checks are performed by the system as idle time audits. However, terminal count audit (Audit set 12) can be run once in every day by the operator.

ii) Audit can be automatically run by making use of the Calendar feature.

Refer Appendix-B and also the "C-DOT DSS MAX Maintenance Commands" document for more information on audits.

5.7. ROUTINE MAINTENANCE OF IOPs

This involves maintaining both the IOPs and their peripherals. Back up devices such as cartridge drive require special attention as their read/write heads need cleaning at regular intervals. Refer to the IOP user manual for details.

5.8. ROUTINE MAINTENANCE OF POWER PLANT

Routine maintenance of power plant is beyond the scope of this manual. However, it is necessary to be mentioned here that input DC supply to switch from power plant is to be monitored regularly. Typical input voltage required is -50V DC.

Chapter 6.

Maintenance of Switch Units

6.1. GENERAL

This chapter offers a set of detailed procedures which guide maintenance personnel in fixing various kinds of problems occurring in the system.

Conceptual aspects of trouble fixing are covered in first two sections. A section is devoted to various phases of trouble fixing. Detection of fault symptoms, their analysis and corrective actions are discussed here. Importance of information field viz., fault code, fault probability, action code existing in the reports output by the system, is emphasised.

Detailed procedures for fixing troubles are, however, presented in the last section. This section is structured according to the fault symptom which could be alarm on ADP, user complaint, failure of a confidence check or some observation pointing towards system's misbehavior.

6.2. TROUBLE FIXING

Trouble fixing involves the following three phases:-

i.) Knowing symptoms

ii.) Analysis of symptoms

iii.) Corrective action

Each of the above phase is described below.

6.2.1. Knowing Symptoms

This involves collecting the desired information which when analysed, points towards the type of corrective actions to be taken. The information can be acquired from the Alarm Display Panel (ADP), cyclic alarm display on Output Outside Dialogue (OOD) terminal, diagnostic reports output by the system and routine maintenance checks.

The above aspects are briefly described below :

i.) **Alarm Display Panel (ADP)**

Alarms are indicated through audio visual means on this panel and examination of ADP reveals the following aspects :

a) All pending alarms.

b) Severity of the alarm, which can be critical, urgent or non-urgent.

c) Type or category of alarm, which could be due to switch fault or due to threshold crossover of faulty terminals/service circuits.

d) Identity of the switch unit, suspected to be faulty in case of SBM configuration.

e) Faulty trunk group numbers and total number of faulty trunks. Trunk groups are divided into small, medium and large depending on the trunks present in them. The alarms will be raised for these trunk groups depending on the thresholds as given in the system parameters.

f) Number of faulty lines in case the number is large.

g) Alarms will be raised for units which are in OOS-SUS state and for terminals in LLO/OOS-SE/BLK-CNF/OOS-SO status.

h) Severity of the alarm can be known from the color of the LED that glows. Latest alarm attracts the attention of maintenance personnel through blinking of visual display as well as sounding of a hooter. Blinking and audio indication stops as soon as the alarm is locally acknowledged by pressing a push button on the ADP. ADP, however, continues to display the alarm condition till such time real cause is removed. In case of MBM, only the most severe alarm in a module will be indicated by the LED in ADP.

ii) **Cyclic Alarm Display on the OOD/VDU Terminal**

a) A portion of the screen on OOD terminal is reserved for scrolling the 10 most serious alarms. When a new alarm is raised, it remains on the screen for 20 seconds and then "scrolling" takes over. An alarm can be removed from the cyclic display on OOD through use of RTR-ARM command without affecting the corresponding indication on ADP. System also continues to remember the alarm till such time real cause is removed.

b) In order to read a particular alarm report from the cyclic display, one has to wait till such time the report appears on the

screen. The desired information then, can be quickly noted down.

c) Information consists of the following aspects :

Type of alarm		**Likely cause for the alarm (not shown on OOD)**
★ Switch alarm	-	due to switch unit faults
★ Threshold alarm	-	due to threshold crossover of terminal or service circuit faults
★ Overload alarm	-	due to overload condition
★ Battery alarm	-	due to battery low
★ Power alarm	-	due to PSU faults

d) Severity of alarm which indicates urgency of corrective action

★ Critical, urgent or non-urgent alarms

e) Identity of module responsible for alarm

★ BM, IOM, CM, AM

f) Identity of the faulty unit within the module

★ Unit identity for switch alarms

★ Circuit type for threshold crossover alarm (Trunk/Service Circuit/Line)

★ PSU identity for power alarm

g) Trunk Group No., in case of threshold crossover alarm due to many trunks being faulty.

iii) **Diagnostics Failure Report for Faulty Switch Units**

a) In case of switch faults, diagnostic report throws more light on the reason for the alarm. It indicates the type of fault encountered and the identity of the card or cards, which are most likely to be faulty.

b) Alarm sequence number helps in correlating the report with the alarm on OOD terminal.

c) An index on switch units required for diagnosis of a particular unit is given in Appendix-E.

iv) **User Complaints**

User complaints such as "no dial tone on off hook" etc. point towards some fault either in the system or in external plant.

v) **Specific Observations**

Abnormality in system's behaviour can sometimes be inferred from routine observations. Following examples illustrate this aspect :

a) One fine day, it is observed that system declare almost all the lines of the exchange faulty

Hint: This could be due to TTC being faulty.

b) Quality of voice from subscribers belonging to a particular TU deteriorates on alternate days.

Hint: This could be due to a new TIC card, which has been recently introduced into the system.

vi) **Reports**

Scanning of various reports output by the system might reveal some abnormalities in system.

Typical findings could be as follows:

a) Periodic routining of few switch units could not be completed.

b) Too many audit failures within a given period.

c) Too many terminals faulty in a single BM.

d) A particular process recovers too often.

e) Overload conditions occurring frequently.

Reports output by the system are described in a separate manual titled "C-DOT DSS MAX Maintenance Alarms and Reports". However, the reports are summarised below :

★ Switch-unit-diagnostics abandoned report

★ Switch-unit-diagnostics failed report

★ Overload report

★ Answering circuit test failure report

★ Process recovery report

★ Load pass report

★ Status change report for terminals to OOS (without test details)

- ★ Detailed report on routining done
- ★ Brief report on routining abandoned for terminals
- ★ Brief test-passed report for terminals
- ★ Switch alarm report
- ★ Overload alarm report
- ★ Threshold crossover alarm report
- ★ Power or battery alarms
- ★ IOP synchronization report
- ★ Killer trunks and service circuits report

vii) **Remote Alarms Monitoring**

The operator can find out the severity of the alarms in the system by this remote alarms features. In alarm monitoring feature the operator can dial a number which is DIR-TYP alarm-monitoring (ALM-MON) and find out the alarm type in the system. The tone fed is as follows:

Alarm type	***Tone Fed***
Non- urgent	Very slow interrupted tone
Urgent	Slow interrupted tone
Critical	Fast interrupted tone
Normal	Continuous tone

6.2.2. Corrective Action

Corrective action could be one or more than one of the following activities:

a) Replacing a circuit board.

b) Correcting a human mistake such as a switch unit made OOS-OPR and left in that state.

c) Manually resetting a microprocessor based controller.

d) Tracing and repairing a faulty cable in the external plant.

e) Initializing the system partially or fully.

f) Taking help of the support centre.

6.3. GENERAL FAULTS

There are broadly two kinds of faults in the system :

Type 1 : Faults as indicated by the diagnostics or routining through commands :

e.g: DGN-SWU
TST-TRM
TST-SRV
TST-TRML-CARD
PUT-SWU-INS

Type 2 : Spontaneous faults in the system, which may or may not be recreatable.

As a result of these faults, the particular unit may go OOS-SUS, OOS-SYS, INS-ACT or INS-SBY. If it goes OOS-SYS then the diagnostics of the particular switch unit may pass or fail. If it fails, then the problem is of type 1. If it passes and the problem is not isolatable by diagnostics but appears spontaneously, then the problem is of type 2.

In case of system detected faults, information which is of interest to maintenance personnel for trouble fixing purposes can be extracted from the alarms and associated reports. The information helps in following:-

i. locating the suspected unit
ii. knowing urgency of repair or corrective action
iii. knowing type of corrective action required
iv. nature of fault detected by the system
v. identities of the card/cards suspected to be faulty

6.4. PROCEDURE FOR HANDLING ALARMS

Any fault in the system which is affecting or is likely to affect the service appreciably gets reported on ADP in the form of alarm to the operator. The alarm indications in the form of a flashing LED accompanied by an audio alarm. The same alarm gets displayed as an alarm report on OOD and also gets printed on the printer. Depending upon the severity, the alarm can be :

i.) Non-urgent

ii.) Urgent

iii.) Critical

Non-urgent alarm is indicated on the ADP via a green LED, Urgent by an orange LED and Critical by a red LED.

The alarm of greater priority should be attended to first before other alarm. Switch alarms will be raised for units in OOS-SUS, OOS-SYS and OOS-OPR states.

6.4.1. Procedure for Handling Switch Alarms in Base Module

Indication:

Flashing LED against the module in which the fault has occurred accompanied by an audio alarm on ADP, alarm report on OOD and a printout of the alarm on the printer. The unit ID in the module can be known from OOD or printer. In case of SBM-RAX, ADP itself indicates the faulty unit.

PROCEDURE FOR HANDLING URGENT/NON-URGENT SWITCH UNIT FAULTS **(Refer Fig. 6.1)**

For non-critical faults the LED on ADP will either be green (for non-urgent) or orange (for urgent alarm).

i) Check the alarm on ADP and printer.

ii) Study the Diagnostics Failure Report on printer for cards declared faulty and the test that has failed. Depending on the reason for the failure corrective actions mentioned in specific sections for the unit can be taken.

iii) Check the status of all the switch units.

iv) Confirm the fault i.e. diagnose all the units made OOS-SYS as a result of the fault

Note:

Before DGN-SWU command can be issued for any unit, the status of the unit should be made OOS-OPR.

v) If now the diagnosis passes, refer section on transient faults.

vi) Reset the controller card, if involved, and repeat step (iv). If the diagnosis passes now, log this observation and report to design centre, if diagnosis fails, proceed to next step.

vii) Jack out/Jack in all cards which are in OOS-SYS state. Repeat step (iv). If the diagnosis passes now, log this observation as momentary hardware problem in the card/card slot at the appropriate place. Otherwise, replace the card having highest fault probability with a healthy card. If there are more than one card with same probability, start with the unit higher up in hierarchy.

viii) Repeat step iv (diagnose again) to check whether the fault is removed or not.

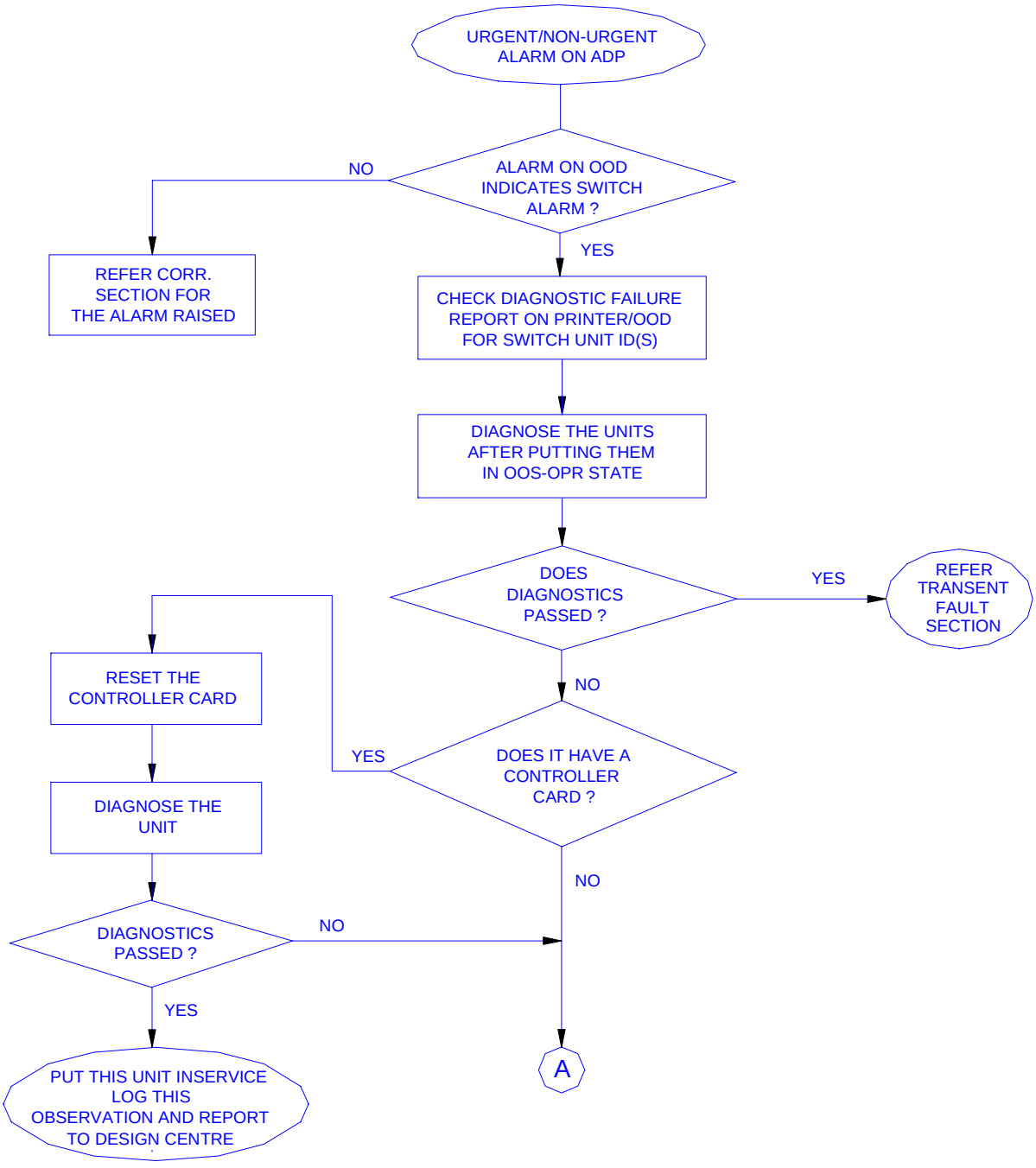


FIG. 6.1
FLOWCHART FOR URGENT/NON-URGENT SWITCH UNIT FAULTS

\DESIGN\DSSMAX\MAX-XL\MAX-XLMP\MXLMPUF

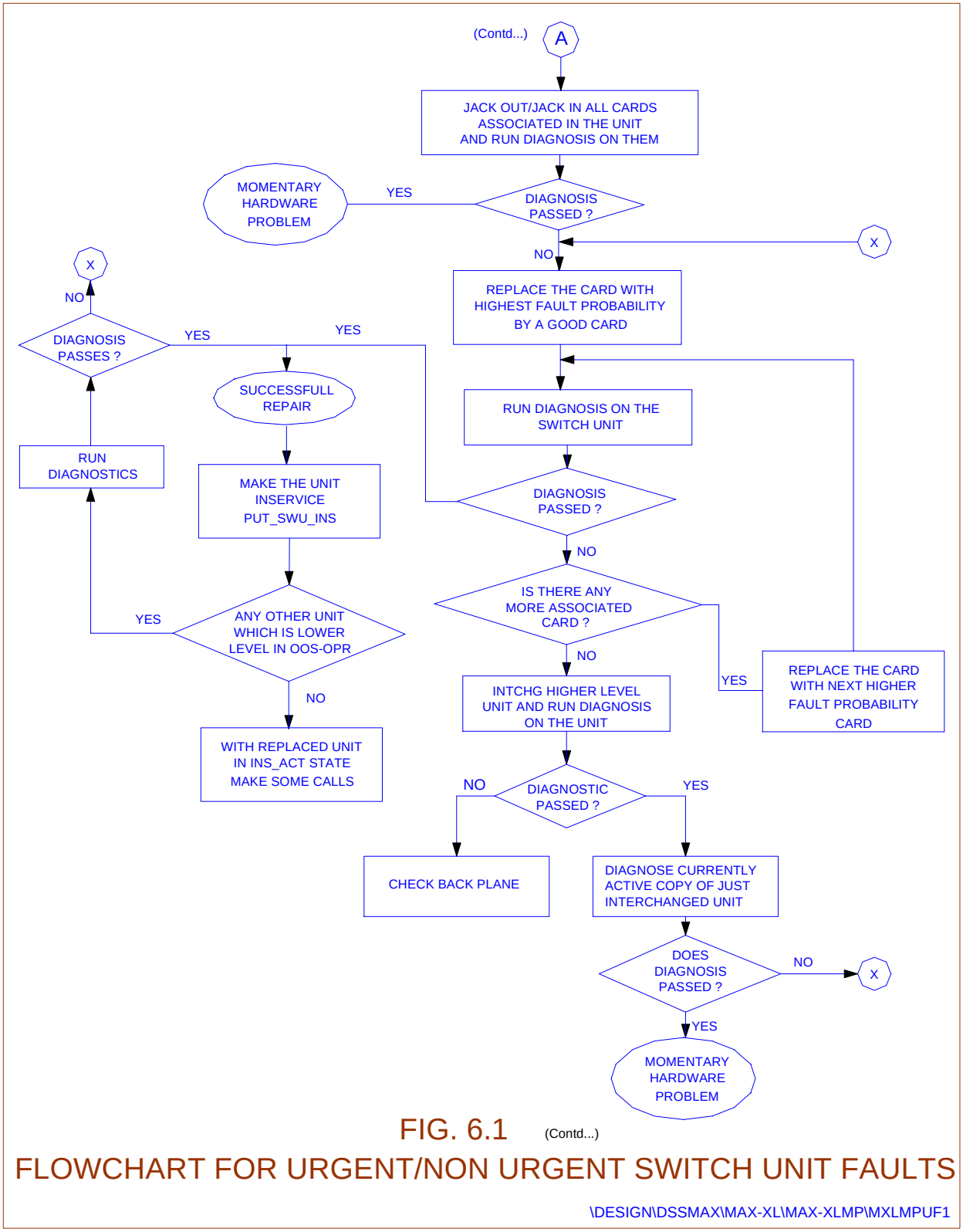


FIG. 6.1 (Contd...)

FLOWCHART FOR URGENT/NON URGENT SWITCH UNIT FAULTS

\DESIGN\DSSMAX\MAX-XL\MAX-XLMP\MXLMPUF1

ix) If diagnosis passes on all the units, then repair is successful. Make the unit inservice through PUT-SWU-INS command. Bring the replaced unit INS-ACT and make a few calls.

x) If the diagnosis failed again in step (vii), then repeat step (vi) on card having next highest fault probability. If again the problem persists, go for the next card and so on.

xi) If even after changing all the suspected cards, the fault persists, then check the backplane. The common kinds of faults in the back plane are:

- Bent connector pins on the front side or the pins on the back side shorting with one another.
- Connector pulled out not making a proper connection.
- Rupture of wire insulation leading to a short between wires/connector pins. If the fault is identified in the backplane, replace the original cards and repeat step (viii).

The above mentioned steps should be strictly followed for handling switch unit faults unless mentioned otherwise. Henceforth, only the additional steps helpful in the particular case being discussed will be listed, which can be tried before suspecting the backplane if the general procedure fails.

PROCEDURE FOR HANDLING CRITICAL SWITCH UNIT FAULTS

Refer Fig. (6.2)

If for some reason both copies of TS or SCIC or BMS go faulty then follow the procedure given below. For such critical faults there will be a red LED on ADP flashing against the module in which both copies are faulty. Also if the fault does not get rectified immediately the BM will start going for repeated boots. In such, conditions we will have alternately critical alarm against MLF and the faulty unit in SBM-RAX. In MBM exchanges, alarm will be reported to corresponding module.

i.) Give reset to both copies of the faulty unit and wait.

ii.) If the fault get rectified the System will make one of the copies inservice and recover on its own.

iii.) If system fails to recover, try a jack out and jack in of one copy and then the other if necessary.

iv.) If the problem continues, then jack out both copies, and replace all the cards of one copy with a good set of spare cards. If system does not recover contact the control room.

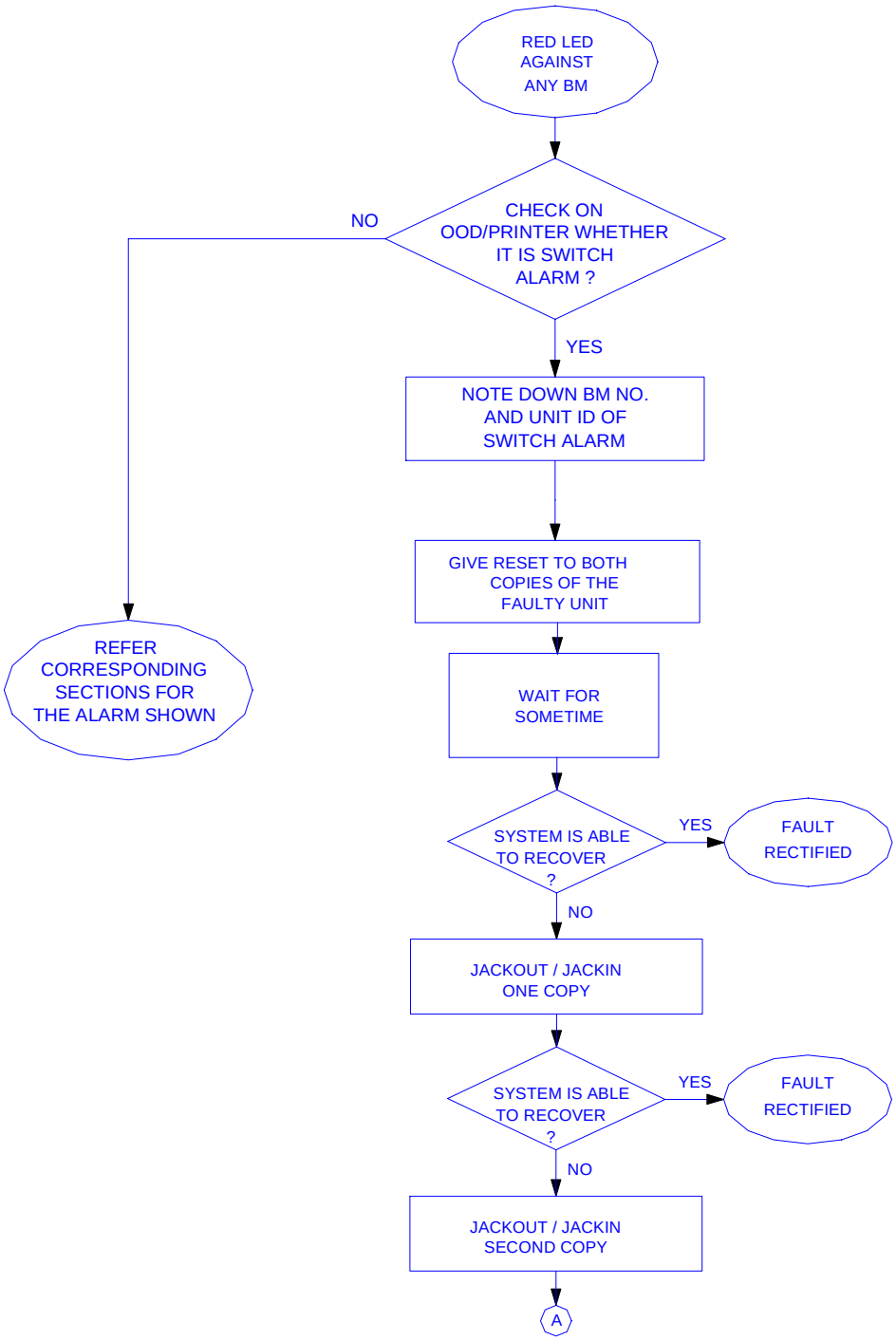


FIG. 6.2
FLOWCHART FOR CRITICAL SWITCH UNIT FAULTS

\DESIGN\DSSMAX\MAX-XL\MAX-XLMP\MXLMPUF2

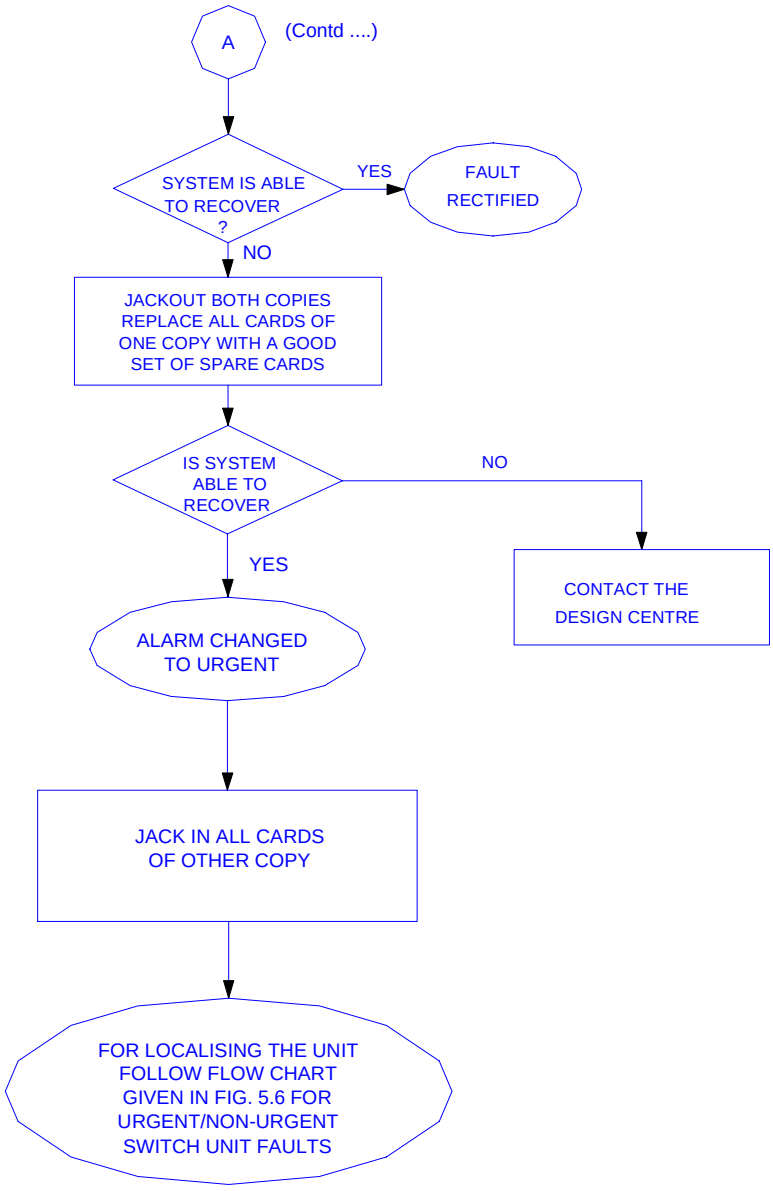


FIG. 6.2 (Contd.)

FLOWCHART FOR CRITICAL SWITCH UNIT FAULTS

\DESIGN\DSSMAX\MAX-XL\MAX-XLMP\MXLMPUF3

If the system recovers, check that normal service is restored. Diagnose the standby copy to localise the fault and follow the normal procedure given for non-critical faults.

In all the cases given below follow the general procedure given for handling switch alarm.

6.4.1.1. Alarm Raised for TIC

6.4.1.1.1. CASE : FAILED TO CONTACT TIC

FAILED TO CONTACT TIC VIA ALTERNATE PATH

Explanation

- Card is faulty -
- TSC to TIC link faulty

Note :

Active TSC communicates with active TIC

Standby TSC communicates with standby TIC.

Action

- Change the TIC card after ensuring that it fails even after reset.
- Interchange the TSC copy and repeat diagnostics. If it passes, then one of the links is bad. In such a case, the situation may be as follows :

  Faulty : TSM0-TSI0 - Cable1 - TUI0-TIC

  Good : TSM1-TSI1 - Cable2 - TUI0-TIC

  The problem could be either in TSM or TSI or the cable. It could also be in TUI or TIC because there are separate buffers for TSC0 interface and TSC1 interface.

  Then the decision of changing the faulty card needs to be taken after more observations.

  If all the TICs are failing similarly then the problem will be due to TSM or TSI. In TSM card, the PCM signals are checked in the TSC diagnostics. In case of successfull TSC diagnostics, TSI could be faulty. This can happen only if the -5.2V generation on TSI card not OK. Check fuse on TSI card. If this is ok, then the problem could be due to the corresponding PSU which is giving -9V input to TSI card through backplane. In such a case, the corresponding PSU is faulty and it needs to be replaced.

  If only few of the TICs are failing with the above message, then either the TIC, TUI, SPC/ISP. In exceptional fault may be with individual channels in TSM/TSI or the corresponding cable is faulty. Normally cable faults do

not occur in the field. Instead the cable may not be making proper contact with the connectors because of improper harnessing. Latches and latch frames should be used for locking the cable onto the shroud.

Change TIC or TUI and SPC/ISP

Check Cable position and harnessing (desired only during installation).

Change TSM or TSI of TSU frame

If problem does not get solved by any of the above, then it is possible that the corresponding ADLC in BMS could be faulty. If so, BMS diagnostics should fail. If BMS diagnostics fails, then attend to the BMS problems first. Refer the section of BMS faults.

If the test passes with one BMS active and fails with another (DGN-SWU for TIC) BMS active, then also the problem can be isolated to the BMS and the MSD card can be changed.

6.4.1.1.2. CASE : TIC-SP TESTS FAILED

Explanation

- SP could be faulty
- TIC could be faulty in the SP interface logic.

Action

- Change the ISP card if problem persists
- Change the TIC card

Even if the diagnostic report declares only SP card faulty replacing TIC card could be tried on failure of the general procedure to rectify the problem. If this rectifies the problem then log the faulty card to TIC and restore SP card.

6.4.1.1.3. CASE : TIC INFORMATION MEMORY FAILURE

Explanation

- TIC Card is faulty - switching logic ckt is bad.
- TSC - TIC links is bad.
- TSC itself is bad.

Actions

- Replace the TIC if only one TIC is shown faulty
- Replace TSM, TS I or PSU-II if all TICs are failing in same test.
- Check cable between TSC-TICs.

In this test the TSC inserts a pattern in all the 128 channels towards that TIC and loops back at the TIC end and extract the pattern at TSC and compares. If this test fails on all the TICs, then TSC could be suspected and a diagnosis of TSC is required to be done. If the diagnosis passes, then TSM or TSI or PSU could be indirectly contributing to the noise at the output of the TSI or all the PCM links.

6.4.1.1.4. IN CASE OF TICS BEING CONCENTRATED (Refer Fig. 6.3)

a) **CASE : FAULT PROB. FOR MORE THAN ONE TIC IN THE SAME PLANE IN A CHAIN**

i. Following points are to be considered during concentration TIC trouble-shooting :

- When all the members of TIC concentration chains are O.K then the chain can remain 'INS-ACT' or 'INS-SBY' mode. Criss-cross configuration is not possible. If all the members of the chain are not O.K, then the units which are O.K, will be 'INS- ACT' or 'INS-SBY' mode. Also, the plane with more no. of good units in the chain will be INS-ACT and the other will be INS-SBY.

- Whenever any unit in a chain is OOS-OPR the other units of that copy will become OOS-EXT. This does not hold good if it is thrown out by the system i.e. the unit is OOS-SYS.

For analysis purpose we are taking one chain say for example chain 3 which consists of TI09, TI10, TI11 and TI12. Copy-0 of these 4 TICs will be noted as copy-0 chain and copy-1 of these 4 TICs will be called as copy-1 chain of TICs. Now, suppose a problem creeped in any part of copy-0 chain, which we have to appendix. As soon as problem occurred in copy-0 chain all the members of the TICs in copy-1 chain will be instantly changed to 'INS-ACT' status. Due to the fault, one or more than one TIC of the copy- 0 chain will go to the 'OOS-SUS' (out of service suspect) status of which one or more TIC unit may go to 'OOS-SYS' status, depending upon the fault. Although an experienced maintenance person can locate the fault easily by elimination method but to facilitate steady and methodical approach for pinpointing the fault location following step-by-step approach is suggested.

Only one observation, we have taken for reference is that due to some problem copy-0 chain of TICs consisting of TI09-0, TI10-0, TI11-0 and TI12-0 are not coming in service.

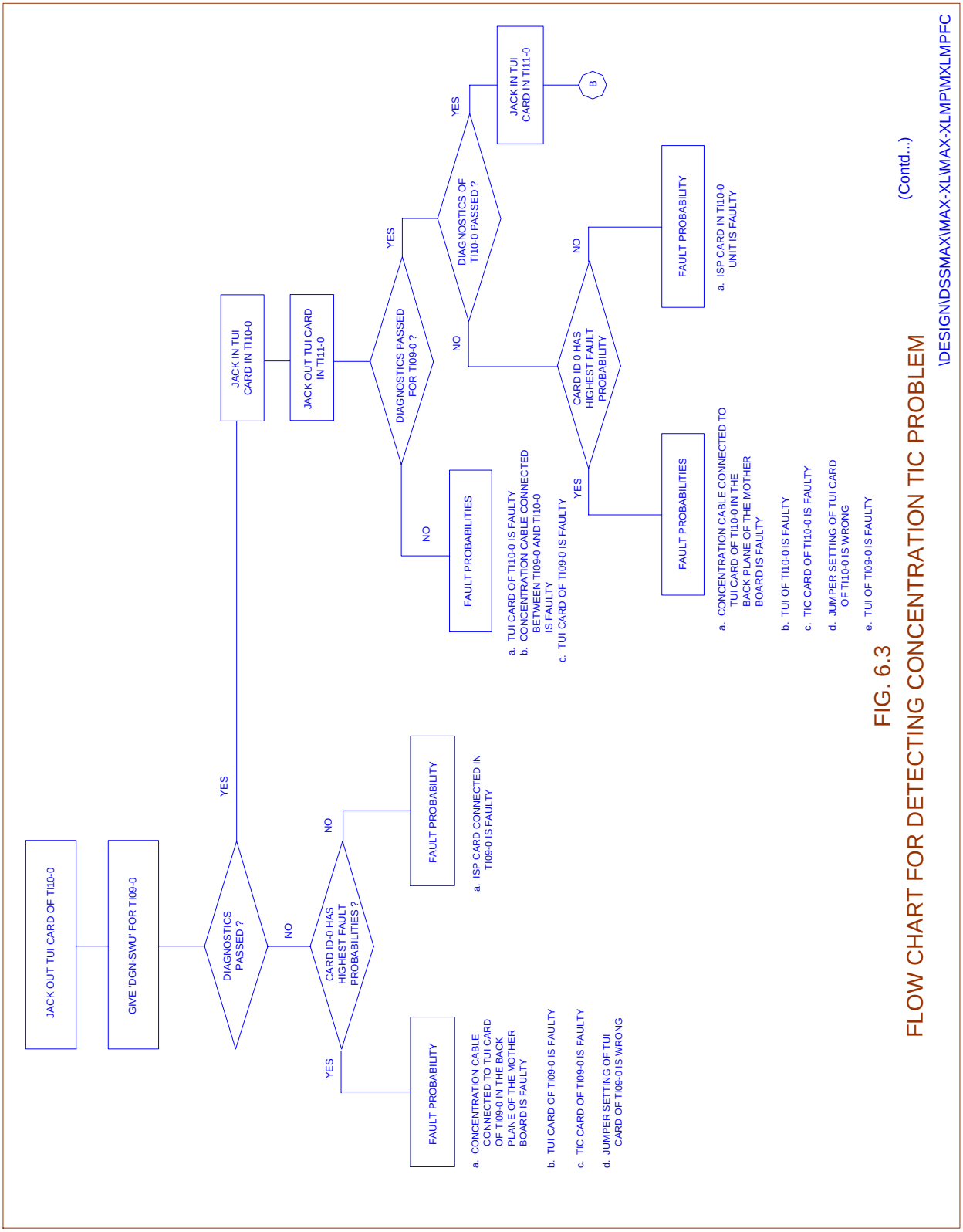


FIG. 6.3

FLOW CHART FOR DETECTING CONCENTRATION TIC PROBLEM (Contd...)

\DESIGN\DSSMAX\MAX-XL\MAX-XLMP\MXLMPFC

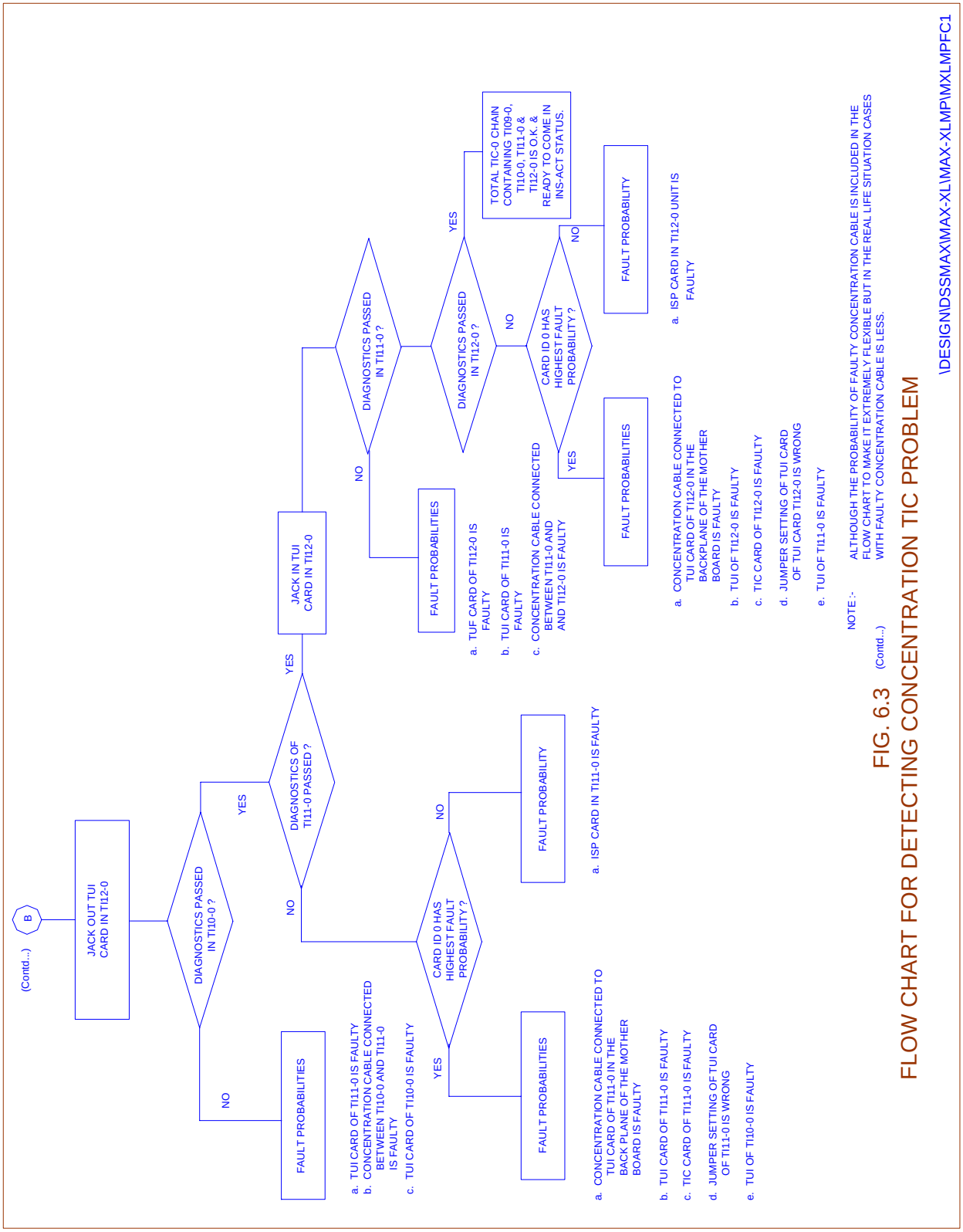


FIG. 6.3 FLOW CHART FOR DETECTING CONCENTRATION TIC PROBLEM

\DESIGN\DSSMAX\MAX-XL\MAX-XLMP\MXLMPFC1

ii. If the problem persists, make the standby copy of TS/SCIC/BMS out of service-operator one by one and perform diagnostics. After diagnosing the unit, bring it back in service if diagnostics pass. If diagnostics on any of these units fail, refer to the section on TS/SCIC/BMS faults.

iii. If diagnostics pass, try changing the TSI card.

b) **CASE : ALARM RAISED FOR MORE THAN ONE TIC IN DIFFERENT PLANES IN A CHAIN.**

In this case, even though the procedure is similar to the above case, the problem needs urgent attention since some of the concentration TUs may be down completely. Determine which plane is the standby plane and fix the problem in that plane as described in the previous section.

When the problem is fixed on one plane, the switching over of the planes will take place immediately. After this, follow the procedures described in the previous section to fix the problem in the new standby plane also.

6.4.1.2. Alarm Raised for TS

6.4.1.2.1. CASE : FAILED TO CONTACT TSC

Explanations

- TSC card monitor is faulty
- BMS to TSC card link is bad (standby)

Action

Give a reset to TSC and repeat test again. If it fails,

- Change TSC card :
- If problem persists, interchange BMS, repeat commands or interchange SCIC, repeat commands.

a) **FAULT PROB. ONLY FOR TSS CARD (ETS Card in case of RBM)**

i. If replacing TSS (ETS in case of RBM) card does not solve the problem, then replacing TSC and finally TSM should be tried.

Reset the TSC after replacing any of the cards.

b) **FAULT PROB. ONLY FOR TSM CARD**

i. If replacing TSM card does not solve the problem, then replacing TSC and finally TSS (ETS in case of RBM) should be tried.

Reset the TSC after replacing any of the cards.

c) **FAULT PROB. FOR TSC & TSM CARD**

i. Follow the general procedure except that while replacing the cards, first TSM card should be changed. If that fails to solve the problem, then TSC and finally TSS (ETS in case of RBM) can be changed in that order. Reset the TSC after replacing any of the cards.

d) **FAULT PROB. FOR BOTH COPIES OF TSC**

i. Assume TSC-0 is OOS-SYS/OOS-OPR and TSC-1 is INS- ACT.

ii. If the fault persists after replacing the TSC card of the TSC-0 restore the original card, force it in service and make it INS-ACT. Ensure that the service is not affected.

iii. Now make TSC-1 OOS-OPR and replace its controller card by a healthy card. Put this TS in service and make it INS-ACT.

iv. Diagnose TSC-0 again and if the diagnosis passes, log TSC-1 as the faulty card. Make it INS-ACT and observe the service.

e) **FAULT PROB. FOR TSM AND ONE OR MORE THAN ONE TIC**

i. While following the general procedure, replace TSM card first and diagnose the TS. If the diagnosis passes, diagnose the TIC cards and bring them in service.

ii. Try replacing TSI card next.

iii. If the diagnosis fails above, replace TSS (ETS in case of RBM) and TSC card, in that order, and diagnose the TS.

iv. Replace the individual TICs one by one and repeat diagnostics.

6.4.1.2.2. CASE : TSC INFORMATION MEMORY TEST FAILED

Explanations

In the information memory test, a pattern such as "55" or "AA" is inserted into a time slot and a one-to-one or one- to-all switching is done and then the pattern is extracted from the corresponding time slot. If the pattern matches, then the test is declared passed :

Pattern insertion register and -
Pattern extraction register

Switching logic	-	Present in TSS (ETS in case of RBM) card
Control signals to TSS, TSM	-	

Hence any one of the cards could be contributing to the diagnostic failure.

Action

Change TSS card (ETS Card in case of RBM) or

Change TSC card or

Change TSM card in same order of priority.

- Follow the general procedure except that while replacing the cards, first TSS (ETS in case of RBM) card should be changed. If that fails to solve the problem, then TSC and finally TSM can be changed in that order. Reset the TSC after replacing any of the cards.
- If diagnostics fails randomly, then it is likely that there is some noise in the system, or the space switch clock selected by the TSC is bad.

  In such a case, more observations are required, so as to give the exact nature of the fault to the repair center. However, the above problem should get removed by changing one of these 3 cards except in the case of SSW clock bad. In such a case, the test is to be repeated with only clock cable in the system at any time.

Note :

This is dangerous exercise and needs to be done with caution.

6.4.1.2.3. CASE : BOTH SSW CLOCK ABSENT IN SYSTEM

Action

Check the 2 BM-CM clock cables coming from CM to the BM. At the BM end, the clock cable which is housed in a 7x2 connector with a single module cover should be put on the first of the four positions of TSC card "B" connector.

At the CM end, the clock cable which is connectorised similarly should be put on the last of the four positions of the corresponding IFC card slot "B" connector.

Note :

The above fault message can appear even if the Bus0 sync. and Bus1 sync. are not coming to the TSU. These signals come through the BM-CM data cable which also needs to be checked.

"**This type of fault is effected only at the time of installation and capacity expansion**".

6.4.1.2.4. CASE : MATE WATCHDOG TEST FAILED

Explanation

i. The software indicates to the active TSC to stop punching its watchdog. As a result of this the WD output line of active TSC will go high. This will be sensed at the input of the OOS-OPR TSC and reported to the BP.

ii. The same is repeated by stopping the punching of watchdog in the OOS-OPR TSC and detecting at active TSC and reporting to BP.

Action

TSC which fails in diagnostics could be faulty or the active TSC could be faulty with the same probability.

Hence TSC which is OOS-OPR should be changed first. If problem persists force this TSC in-service and replace the copy TSC.

Note :

This should be done only after ensuring that the card which fails in diagnostics has no other problem except WD problem. Else, this procedure could be dangerous.

6.4.1.2.5. CASE : TSC-TIC LINK TEST FAILED

Explanation

This kind of message appears usually when TSC is OOS-OPR and is getting diagnosed and all the TICs which are tuned to this TSC are in OOS-EXT state. In such a case, the TSC sends a message towards all the 4 TICs and expects a reply.

In the above case, TSC0 sent a message to all the 4 links but TU2 copy-1 TIC did not respond, because either the card was not there or because the card was faulty or because the link was faulty. So even if the TSC is fine in all respects, because one of the TICs was faulty, the diagnostics will fail. Replacement of TSC card will not help.

Action

PUT-SWU-OOS for TI05-1. Then give diagnosis for TSC. If the test passed Put the TSC inservice, the problem of TI05-1 can be looked into.

6.4.1.2.6. CASE : SCIC-TSC LINK TEST FAILED

a) **FAULT PROB. For TSM (which is made OOS-SYS) and SCIC which is standby.**

i. If TS is made OOS-SYS, replace the TSM card first. Diagnose and on passing, bring it in service. Interchange TS and SCIC and make

them INS-ACT. Observe the service for some time.

ii. If diagnosis fails in the above step, restore the original TSM card. Make the SCIC OOS-OPR and diagnose. If diagnosis fails refer section on SCIC faults. Otherwise try replacing SCIC by a healthy card. Diagnose SCIC and TS and on passing, bring them into service. Interchange TS and SCIC to make them INS-ACT. Observe the service for some time.

iii. If SCIC is made OOS-SYS, refer to section 6.4.1.3

b) **FAULT PROB. TSM CARD (which is OOS-SYS TS) and SCIC (which is INS-ACT)**

i. Replace the TSM card of the OOS-SYS TS and diagnose. On passing, interchange and make the TS INS-ACT. Observe the service for some time.

ii. If TS diagnosis fails in the above step, restore the original TSM card. Make the SCIC which is active OOS-OPR and diagnose it. If diagnosis fails, replace by a healthy card.

iii. Diagnose again, both SCIC and TS and on passing bring them in service. Make them INS-ACT and observe the service for some time.

iv. If SCIC is made OOS-SYS, refer to section 6.4.1.3

6.4.1.2.7. CASE: BMS-TSC DIRECT LINK TEST FAILED

i. If replacing TSC card does not rectify the fault, replacing the TSS (ETS in case of RBM) and TSM cards, in the mentioned order, can be tried before replacing BMS controller card.

ii. If step (i) fails, restore the original TS complex cards. Make the BMS OOS-OPR and diagnose it. If it fails, follow section on BMS faults. Otherwise replace the BMS controller card. Diagnose, both BMS and TS, and on passing bring them in service. Make them INS-ACT and observe the service for some time.

6.4.1.3. Alarm Raised for SCIC

6.4.1.3.1. CASE: FAILED TO CONTACT SCIC

a) **FAULT PROB. ONLY FOR SCIC CARD**

i. Refer to the general procedure given in sec. 6.4.1.

6.4.1.3.2. CASE: SCIC-TSC LINK TEST FAILED

a) **FAULT PROB. FOR SCIC CARD, TSM CARD**

i. If even after replacing the SCIC card diagnostics fail, then make the standby TS OOS-OPR and diagnose it.

ii. If diagnostics fail restore the original card & refer section on TS. If diagnostics passes change the TSM card try diagnostics on SCIC.

iii. If the problem persists change the SCIC card also.

6.4.1.3.3. CASE: BMS-SCIC LINK TEST FAILED

a) **FAULT PROB. FOR SCIC CARD AND MSC (STANDBY COPY)**

i. If the problem persists after replacing the SCIC card, restore the original card. Make BMS OOS-OPR and diagnose. If the diagnosis fails on the BMS, refer to section 6.4.1.4.

ii. Diagnose both SCIC and BMS. If diagnosis passes, make them INS-ACT and observe the service for some time.

iii. If diagnosis fails in the above step, replace MSD card of the BMS complex.

b) **FAULT PROB. FOR BOTH COPIES OF SCICs**

i. Assume SCIC-0 is OOS-SYS/OOS-OPR and SCIC-1 is INS-ACT.

ii. If the fault persists after replacing SCIC-0 restore the original card, force it in service and make it INS-ACT. Ensure that the service is not affected.

iii. Now make SCIC-1 OOS-OPR and replace it by a healthy card. Bring this SCIC in service and make it INS-ACT.

iv. Diagnose SCIC-0 again and if the diagnosis passes, log SCIC-1 as the faulty card. Make it INS-ACT and observe the service.

6.4.1.4. Alarm Raised for BMS

6.4.1.4.1. CASE: FAILED TO CONTACT BMS

a) **FAULT PROB. FOR MSC CARD ALONE**

i. Refer the general procedure given in sec. 6.4.1.

b) **FAULT PROB. FOR BOTH COPIES OF MSC CARDS**

i. Assume BMS-0 is OOS-SYS/OOS-OPR and BMS-1 is INS- ACT.

ii. If the fault persists after replacing MSC of BMS-0 card restore the original card, force it in service and make it INS-ACT. Ensure that the service is not affected.

iii. Now make BMS-1 OOS-OPR and replace its controller card by a healthy card. Bring this BMS in service and make it INS-ACT.

iv. Diagnose BMS-0 again and if the diagnosis passes, log BMS-1 as the faulty card. Make it INS-ACT and observe the service.

6.4.1.4.2. CASE: BMS-SCIC DIRECT LINK TEST FAILED

a) **FAULT PROB. FOR MSD AND SCIC (ACTIVE OR STANDBY) CARD**

i. Make the BMS OOS-OPR and diagnose.

ii. If the diagnosis fails, replace the MSC/MSD card by a healthy card. Diagnose BMS again and on passing bring it in service. Make it INS-ACT and observe the service for some time.

iii. If BMS diagnosis fails, restore the original card. Make SCIC OOS-OPR and diagnose. If SCIC diagnosis fails, refer to section 6.4.1.3.

iv. Diagnose both BMS and SCIC and on passing bring them in service. Make them INS-ACT and observe the service for some time.

6.4.1.4.3. CASE: BMS-TSC DIRECT LINK TEST FAILED

a) **FAULT PROB. FOR MSC AND TSC (ACTIVE OR STANDBY) CARD**

i. Make the BMS OOS-OPR and diagnose.

ii. If the diagnosis fails, replace the MSC card by a healthy card. Diagnose BMS again and on passing bring it in service. Make it INS-ACT and observe the service for some time.

iii. If BMS diagnosis fails, restore the original card. Make TS OOS-OPR and diagnose. If TS diagnosis fails, refer to section 6.4.1.2.

iv. Diagnose both BMS and TS and on passing bring them in service. Make them INS-ACT and observe the service for some time.

6.4.1.4.4. CASE: BMS LINK TEST FAILED

a) **MSC AND BP (ACTIVE OR STANDBY) CARD**

i. Make the BMS OOS-OPR and diagnose.

ii. If the diagnosis fails, replace the MSC card by a healthy card. Diagnose BMS again and on passing bring it in service. Make it INS-ACT and observe the service for some time.

iii. If BMS diagnosis fails, restore the original card. Make BP OOS-OPR and diagnose. If BP diagnosis fails, refer to section 6.4.1.5.

iv. If BP diagnosis passes in the above step, replace BPC card. Diagnose both BMS and BP and on passing bring them in service. Make them INS-ACT and observe the service for some time.

6.4.1.4.5. CASE: 32 CHANNEL PCM LOOPBACK TEST FAILED ON BMS

Explanation

32 channel PCM loopback test failure indicates that whatever data sent to the 32 ADLCs (16 ADLCs in BMS mode because of one MSD card), when loopbacked back in the MSD card is not being received faithfully. Some of the ADLCs on MSD card could be faulty.

Action

- Change the MSD card
- Check if all the jumper position is with the BMS mode and not CMS mode.

Note :

There are 3 sets of jumper in the card (for BMS/CMS)

- MSC card also could be faulty, but less probable.

6.4.1.4.6. CASE : DMA-ADLC TEST FAILED ON BMS

Explanation

There are totally 22 ADLCs in the MSW complex on BMS mode. The 6 direct link ADLCs are in MSC card, while the remaining 16 PCM link ADLCs are in the MSD card. Depending on which of the ADLCs the test has failed, either MSC or MSD has to be changed.

Action

Change MSC card (OR)

Change MSD card

- If problem still persists, check if the 2 MHz clock coming from SCIC is reaching MSD properly i.e., problem could be at the SCIC end.
- Interchange SCIC and repeat diagnostics.
- Change SCIC card if test is found to fail with only one SCIC.

6.4.1.5. Alarm Raised for BP

6.4.1.5.1. CASE: FAILED TO CONTACT BP

If indicated the possible faults could be as listed below :

- Card is faulty
- BP to BP link is not O.K.

Action

- Reset the out of service BP card and perform diagnosis. If passes, put the BP inservice. If fails, replace the BPC card. Ensure correct EPROMs in the new card. Follow the general procedure.

6.4.1.5.2. CASE: MATE WATCHDOG TEST FAILS

Explanation

The possible faults could be as listed below

- Card watchdog output circuit may be faulty,
- Card watchdog input circuit may be faulty
- Interrupt generation may be faulty
- Other copy BP may be faulty.

Action

- Change the BPC card
- If problem persists, force this BPC in service. (FRC- SWU-INS). Ensure that there is no other problem in this card. Do an interchange of BP (INTCHG). Ensure that system is stable. Then put the other copy BP out of service (PUT- SWU-OOS). Change the copy BP.

Note :

This is to be done only after ensuring that the card which failed in diagnostics has no other problem other than watchdog circuit fault.

6.4.1.6. Alarm Raised for MU

6.4.1.6.1. FAULT PROB. FOR BME AND BPC CARDS

i) Follow the general procedure.

ii) Replace the corresponding BME card and do diagnosis.

iii) If it passes, interchange BP and do diagnosis again.

iv) If it passes again, bring this inservice.

vi) If it fails, replace current standby BPC make it active and do diagnostic.

6.4.1.7. Alarm Raised for ADP

i. First give a reset to ADP and perform the LED test on ADP.

ii. If LED test has failed, then ADC is faulty and it has to be replaced.

iii. Otherwise, if LED test passes try bringing the ADC inservice.

iv. If it still fails, check the link between the ADP and AP/BP. Check that the connectors at the ADP are properly connected.

v. If there is no problem in the cable, perform a switchover of AP/BP, and try to bring ADC into service.

vi. If ADC comes inservice now, then the link from ADC to one copy of AP/BP is faulty. Try replacing the BPC card of standby AP/BP. Make it active and see whether the ADC remains inservice.

vii. If the ADC goes OOS again, then the fault is in ADC. Replace back the old BPC in AP/BP. Now fault is in ADC.

6.4.1.8. Alarm Raised for IOP

i. Refer section 4.3.4, 4.3.5 & 4.3.6 on IOP shutdown, boot-up & synchronisation procedure etc. Refer to IOP-VH user manual for further details.

6.4.1.9. Alarm Raised for TOGC

6.4.1.9.1. CASE : FAILED TO CONTACT TOGC

Explanation

TGA card could be faulty

SCIC-TGA link is faulty

Action

i. Follow the general procedure.

ii. If the problem continues, interchange the SCICs and try to bring the TOGC inservice. If now the TOGC comes inservice, then it is the SCIC (current standby) which may be faulty. Replace the SCIC and make it the active copy and check that the TOGC remains inservice.

iii. If on the other hand even after interchanging the SCICs, the TOGC does not come inservice, then interchange the BMS and try bringing it inservice. If it comes inservice, then it may be the BMS (current standby), which is faulty.

iv. Put the BMS out-of-service and diagnose it. If diagnostics fail, refer section on BMS faults.

6.4.1.10. Alarm Raised for TTC

6.4.1.10.1. CASE : FAILED TO CONTACT TOGC

i. Follow the general procedure.

ii. If the problem continues, interchange the TICs in that TU and try to bring the TTC inservice. If now the TTC comes inservice, then it is the TIC (current standby) which may be faulty. Replace the TIC and make it the active copy and check that the TTC remains inservice.

In exceptional cases :

iii. If the problem is not solved, then interchange SCIC and then try to bring TTC inservice. If it comes in service, then it is the standby SCIC which is faulty.

iv. If on the other hand even after interchanging the TICs, TTC does not come inservice, then interchange the BMS and try bringing it inservice. If it comes inservice, then it may be the BMS (current standby), which is faulty.

v. Put the BMS out-of-service and diagnose it. If diagnostics fail, refer section on BMS faults.

6.4.1.10.2. CASE: HEALTH LOG NOT PROPER

i. Check the fuses in TTC card if they are intact go to step ii. If not, replace the blown fuse, jack in the card and put in service. (use fuses of correct rating (100 mA)).

ii. Replace the card with a good spare card and diagnose. If the diagnosis passes mark the original card as faulty and put the new card in service. If the diagnosis still fails, restore the original card and go to next step.

iii. This error can also be due to one of the Test Access (TA) relay getting stuck in one of the TUs. First the TU in which the relay is stuck is to be identified. Remove the TA bus cable from the back plane connector of 4th TU.

(3rd and 4th blocks in B connector of 2nd slot). Perform the diagnosis if the diagnosis passes, the problem is not present in 4th TU. If it is failed, the problem may be identified in 4th TU and go to step (v).

iv. To isolate other TUs, put back the TA bus cable of only main TU of 3rd TU and repeat the diagnosis.

If it fails, the problem is present in that TU. Repeat the procedure with all other frames till a condition is obtained when putting the TA bus cable of a particular frame causes the diagnosis to fail. That frame is identified as faulty frame.

v. After the faulty frame is identified put back the TA bus cable of that TU. Jack out the termination cards in that frame one by one and repeat the diagnosis till it passes after the jackout of a particular card. Mark that card put TTC in service. Connect TA bus cables of all frames, and make

all lines/trunks which had gone out of service due to jack out of cards in service.

6.4.1.11. Alarm Raised for ANNC

6.4.1.11.1. CASE : FAILED TO CONTACT TO TOGC

i. Follow the general procedure.

ii. If the problem continues, interchange the TICs in that TU and try to bring the ANNC inservice. If now the ANNC comes inservice, then it is the now standby TIC that is faulty.

iii. Replace the TIC and make it the active copy and check that the ANNC remains inservice.

iv. If on the other hand even after interchanging the TICs, the ANNC does not come inservice, then interchange the BMS and try bringing it inservice. If it comes inservice, then it may be the BMS (current standby), which is faulty. Inter change of SCIC can also be tried in case of problem persisting.

v. Put the BMS out-of-service and diagnose it. If diagnostics fail, refer section on BMS faults.

vi. Test all the announcements on ANNC card using DBE facility.

6.4.2. Procedure for Handling Alarms in Central Module

6.4.2.1. Alarm Raised For CM

6.4.2.1.1. CASE : ACCESS OF CLOCK OR SWITCH CARD FAILED

i. This error may be displayed because of fault in clock card or switch card. The corresponding CBX (SSBID) card may also be faulty. To isolate, first interchange SSC and repeat the diagnosis. If the diagnosis fails, continue with next step.

ii. If fault probability is shown for all switch cards, replace the CBX card. Otherwise replace the switch/clock card for which the fault probability is shown and repeat the diagnosis.

6.4.2.1.2. CASE: TDRA TEST FAILED

This error is displayed during the diagnosis of IFC. This test may fail due to IFC card being faulty, or HMS card of one of the CMSs being faulty or BM-CM link being faulty. Replace the IFC card for which the diagnosis has failed and repeat the diagnosis. If the diagnosis passes, mark the IFC card as faulty. If it fails, make the TSC of the BMs corresponding to the IFC card, TSC-0 for bus-0 (IFC1 to IFC16) and TSC-1 for bus-1 (IFC17 to IFC32) out of service and repeat the diagnosis. If the diagnosis passes, the BM-CM link

may be suspected. Replace the TSS (ETS in case of RBM) card of the BM, make the TSC in service and repeat the diagnosis. If the diagnosis still fails, make one CMS of the corresponding bus (CMS1 and CMS3 for bus-0 and CMS2 and CMS4 for bus-1) OOS. Repeat the diagnosis of IFC. If it passes, replace the HMS as faulty. If it still fails, make the other CMS in the bus OOS and repeat the above.

Note:

Check the jumper setting in the PSM card before jacking in the new card.

6.4.2.1.3. CASE : FAILED TO CONTACT CMS

a) **Fault Prob. for HMS card.**

Replace the HMS card and repeat the diagnosis. If it passes, mark the HMS card as faulty. If it fails, interchange SSC and repeat the diagnosis. If it passes, the link between SSC (now standby) and HMS may be faulty. Make SBY SSC OOS and replace the BPC card, make it inservice and repeat the diagnosis. If the diagnosis passes now, mark BPC card as faulty.

b) **Fault Probability for HMS card and some IFC cards**

In this case, replace the HMS card and repeat the diagnosis. If it passes, mark the HMS card as faulty. If the diagnosis still fails, make the IFC for which the fault probability is shown OOS, replace the PSM card, put in service and repeat the CMS diagnosis. If it passes, mark the PSM card as faulty.

6.4.2.1.4. CASE : MATE WATCHDOG TEST FAILED (CMS DIAGNOSIS)

If this error is displayed, replace the HMS card and repeat the diagnosis. If the diagnosis passes, mark the HMS card as faulty. This test can also fail due to fault in the other CMS. For isolating this, the HMS of the mate CMS has to be replaced. For CMS1 the mate CMS is CMS2 and vice versa. Similarly for CMS3 mate CMS is CMS4 and vice versa.

6.4.2.1.5. CASE : SPACE SWITCH DIAGNOSIS FAILED

In this case, follow the procedure given in Section 6.4.2.1.1.

6.4.2.1.6. CASE : SSC DIAGNOSIS FAILED

i. Replace the BPC card and repeat the diagnosis. If it passes, mark the BPC card as faulty.

ii. If mate watchdog test is failing, force the SSC in service, put the other SSC OOS, replace the BPC card and put in service. Now make the other SSC OOS and do diagnosis. If the diagnosis passes now, mark the BPC card as faulty.

6.4.2.1.7. CASE : MEMORY DIAGNOSIS FAILED IN SSC

This case is similar to BP memory diagnosis failing. Refer Section 6.4.1.6.

6.4.2.2. Alarm Raised for AM

6.4.2.2.1. CASE: FAILED TO CONTACT AP

This case is similar to BP diagnosis failing, follow the same procedure given in 6.4.1.6.

6.4.2.2.2. CASE: MEMORY DIAGNOSIS FAILED IN AP

Follow the same procedure as indicated for BP memory diagnosis failure. (Refer Section 6.4.1.6).

6.4.2.3. Digital Trunk Links Going OOS for RSU

This problem may arise due to a problem in the transmission media between RBM and parent exchange or due to fault in ESM card or ETS card. First replace the ETS card, (ETS-0 for DTK1 to DTK8, ETS-1 for DTK17 to DTK24) and put the TSC in service. If the digital links come in service, mark the ETS card as faulty. If the links still do not come in service, replace the corresponding ESM card, (Bus-0 for DTK1 to DTK8, Bus-1 for DTK17 to DTK24) make the ESM in service. If the DTKs come in service, mark the ESM card as faulty. Otherwise check the transmission equipment.

Note:

Wait for two minutes before making the ESM card in service after jacking it in.

6.4.2.4. MLF Alarm in ADP

If MLF (main link failure) alarm LED is glowing in ADP. Check whether alarm is raised for ADC in OOD and printer. If alarm is present follow the procedure given in 6.4.17. (Alarm raised for ADP) if alarm is not present, check whether dial tone is present in the system. If there is no dial tone, the system would have gone for some recovery (stable clear etc.). Check whether the message for data loading, patch loading or code loading is present is present on IOP console. If it is present, wait for some time and system will recover on its own. if there is no such message and there is no dial tone in the system, contact the support centre immediately.

6.4.3. Procedure for Handling Power Alarms

LED flashing against the BM accompanied by an audio alarm. Note that there will not be any LED flashing against any switch unit. On VDU (OOD) power alarm would be raised and there will be print out of Power Alarm on the printer.

6.4.3.1. Non-urgent Power Supply Alarm for TU

i. The LED corresponding to the module in which power alarm is present will be blinking on ADP. Check the power alarm report on OOD, printer and alarm list on IOP and find out the identity of the TU in which the PSU has gone faulty and also its copy id. In multimodule.

ii. Check the status of the TICs in that TU.

iii. Check the LEDs on the suspected PSU.

iv. Power off and on or jack out and jack in the PSU card. Check whether the PSU alarm gets removed.

v. If the fault gets repaired then log it as a transient hardware problem and keep the card under observation.

vi. Otherwise replace the PSU card. Check whether the PSU alarm on ADP, OOD and alarm list gets removed.

vii. If the alarm is removed, then the fault is repaired.

viii. Even after replacing the PSU if the fault persists, then check the backplane. The common kinds of faults in the back plane are - bent connector pins on the front side or the pins on the back side shorting with one another, some connector coming out, wire rupturing and shorting with the pins etc. If the fault got identified on the backplane, restore back the original PSU card.

Note :

The chances of faults mentioned in viii) occurring in a working exchange are very less.

6.4.3.2. Urgent Power Supply Alarm for TSU

i. Check the alarm on ADP, printer and alarm list on IOP. From the power alarm report or using DISPL-ARM-LIST find out the identity of the copy of PSU in TSU which has gone faulty.

Note:

The PSU id is denoted by the copy of BMS to which that PSU is supplying power to. Refer appendix - C for PSU ids in power alarms.

ii. Check the status of all the units in the BM. All the units of one plane of TSU for which the PSU is faulty will be marked OOS-SUS. All the units in other plane of TSU should be active.

iii. Check the LEDs on the suspected PSU. One or more of the LEDs would be off under fault conditions.

iv. Power off and on or jack out and jack in back the same card. Check whether the PSU alarm gets removed.

v. If the fault got repaired then log it as a transient hardware problem and keep the card under observation.

vi. Otherwise replace the PSU card. Check whether PSU error LED goes off and the alarm on ADP, OOD and alarm list gets removed.

vii. If the alarm is removed, then check the status of all the units in that plane of TSU. All the OOS-SUS units should get diagnosed and automatically brought into service. If some unit fails to come in service, then give reset and bring it in service. If it fails, then refer section switch faults.

viii. Even after replacing the PSU if the fault persists, then check the backplane. The common kinds of faults in the back plane are - bent connector pins on the front side or the pins on the back side shorting with one another, a connector coming out, wire rupturing and shorting with the pins etc. If the fault gets identified on the backplane, restore back the original cards.

Note :

Note given in 6.4.3.1 is applicable here also.

6.4.3.3. Urgent Power Supply Alarm for BPU

Follow the procedure given in 6.4.3.2 and read BPU and BP in place of TSU & BMS respectively.

6.4.3.4. Power Alarms in BTU0/1 of CM-XL

Power alarms in BTUs will be generated for IFC units. Refer appendix C for MAX-XL for Unit Ids of IFCs for which power alarm is reported. The two power supplies in left side of BTU are in load sharing mode and power supplies in right side of BTU are also in load sharing mode. Under any circumstances both power supplies should not be switched off in any side of BTU. If power supply alarm is displayed, change the corresponding power

supply and check whether power alarm gets removed. In case the power alarm still persists, interchange switch planes and check whether power alarm gets removed. In case the power alarm gets removed, make the now standby switch plane OOS, replace the clock card, make in service and make it INS-ACT. If the power alarm does not reappear, mark the clock card as faulty. (The power supply errors for BTU and SSU are routed through the clock card.)

6.4.3.5. Power Alarms in SSU0/1 of CM-XL

Here the power alarms will be generated for switch cards. The power supply units' operation in case of CM-XL is similar to that of BTU0/1. Refer appendix C(b) for power alarms and their corresponding unit ids for MAX-XL. Replace the PSU for which the alarm is generated and check. If the power alarm vanishes, mark the PSU as faulty. Otherwise, interchange switch planes and check whether power alarm gets removed. In case the power alarm gets removed, make the now standby switch plane OOS, replace the clock card, make in service and make it INS-ACT. If the power alarm does not reappear, mark the clock card as faulty. (The power supply errors for BTU and SSU are routed through the clock card.)

6.4.3.6. Power Alarm for SSCU in CM-XL

In SSCU frame two PSUs per plane one as active and the other as slave are used. Replace the power supply for which the alarm is generated and check that the power alarm goes off. If it does not go off, check that all LEDs are glowing in the PSU and then force the corresponding SSC in service. Interchange SSC and make the, now standby SSC OOS. Replace the BPC card, make it INS and interchange. If the power alarm does not reappear, mark the BPC card as faulty. However there won't be any alarm for slave PSU failure: Refer appendix - C also for MAX-XL on PSU ids.

6.4.3.7. Power Alarm for HPU in CM-XL

In HPU frame, both power supplies in one plane work in load sharing mode like BTUs. Refer appendix C also for MAX-XL for PSU ids.

6.4.3.8. Procedure for Handling Battery Alarm

Check the power plant and verify that the battery is charged properly.

6.4.4. Procedure for Handling Overload Alarm

Overload alarm and overload control report on VDU (OOD) and printer.

6.4.4.1. CPU Overload

CPU overload normally occurs due to abnormally high traffic. System has it's own built-in mechanisms to control CPU overload and there is no need for operator to do anything other than logging down the problem occurrence and the corrective action taken by the system.

Only way the operator can help is stop all activities on the system that are not critical at that time.

i. Stop periodic routining of switch units, lines, trunks if they are going on at that time; do not issue any man-machine commands other than that which is absolutely necessary; stop any repair action other than that which is very essential (like both copies of a duplex unit has become OOS etc.).

ii. Check if too many status change reports are coming for any set of terminals repeatedly on OOD. If they are, then make those terminals OOS-OPR.

iii. Check the status of switch units. If any unit is repeatedly going OOS and coming inservice, then make it OOS-OPR.

iv. Check whether too many entities (subscriber, trunk group etc.) are put under observation. If they are, then remove them from observation.

v. Check whether some of the MF circuits have gone faulty, causing repeated call attempts.

6.4.4.1.1. Overload of Memory Resources (Buffers, Stack etc.)

This kind of overload normally occurs due to some abnormality in the behaviour of the system under some specific conditions. The system has its own built- in mechanisms to control this type of overload, but following actions are recommended.

i. Stop periodic routining of switch units, lines, trunks if they are going on at that time; do not issue any man-machine commands other than that which is absolutely necessary; stop any repair action other than that which is very essential (like both copies of a duplex unit has become OOS etc.). Abort IOP Synchronisation procedure if it was under progress at the time of overload.

ii. Run audit for the resource that is overloaded (viz. message buffer audit if message buffers are overloaded, ordinary buffer audit if ordinary buffers are overloaded etc.). Buffer size is also displayed in the report. If the overload persists then proceed as follows.

iii. Check if too many status change reports are coming for any set of terminals repeatedly on OOD. If they are, then make those terminals OOS-OPR.

iv. Check whether too many entities (subscribers, trunk group etc.) are put under observation. If they are, then remove them from observation.

v. If this overload persists for a long time (>10 minutes), contact the design centre and then the system should be rebooted (softstart) if necessary.

6.5. PROCEDURE FOR HANDLING SYSTEMS REPORTS

This sections deals with spontaneously generated system reports other than the alarm reports or those which come in conjugation with the alarm reports which has been separately dealt with in the previous section.

6.5.1. Procedure for Handling Switch Maintenance Reports

6.5.1.1. Diagnostics Fail Report

This has been already dealt with in the chapter for handling alarms.

6.5.1.2. Diagnostics Abandoned Report

This report is normally output by the system when diagnostics gets aborted in between due to some higher priority task coming up or the configuration of the system at the instance diagnostics was invoked does not permit the diagnostics on the unit specified.

6.5.1.2.1. DIAGNOSTICS ABANDONED REPORT: DIAGNOSTICS NOT POSSIBLE/ INVALID REQUEST

This report is output by the system, when a diagnostics request for a unit goes, typically from calendar for periodic routining, when the configuration of the system at that instance does not permit the diagnostics on the unit specified.

Procedure:

i. Check the status of the unit for which the diagnosing command was issued. It's status should be OOS-OPR. If it is not, put it OOS-OPR and conduct diagnostics, check for success. Appropriately make the corrections in the calendar as it has been wrongly programmed.

ii. If the status of the unit was OOS-OPR, then check the status of other units required for diagnostics. Diagnostics of TIC - requires that all TSU units are duplex, Diagnostics of SCIC - requires duplex BMS, Diagnostics of MU - requires duplex BP.

iii. Check PSU which is supplying power to the unit under test.

6.5.1.2.2. DIAGNOSTICS ABANDONED REPORT: DIAGNOSTICS JOB ABORTED

This report is output by the system, when diagnostics is going on in an unit, some higher priority task arises. Typically this can be spontaneous fault report from some of the in service units which necessitates immediate

attention (i.e. one of the switch units might have gone OOS-SUS status. This might have happened coincidentally, in which case it will not be of repetitive nature, and will not need any special attention.

On the other hand this fault might be due to exercising of some part of the system by diagnostics, which is not normally exercised. In such case the problem will be of repetitive nature. Under such cases, note the configuration of the system under which the problem is occurring. Try to recreate the problem by bringing the system to the same configuration and issuing the diagnose command from the operator position. Repeat a few times. Report the observation to the support centre.

6.5.1.3. Switch Unit Interchange Report

This report is outputted by the system whenever switchover request is given for unit.

6.5.1.3.1. SWITCH UNIT INTERCHANGE REPORT: RESULT = NOT-RECONFIGURABLE

This report is output by the system whenever switchover request is rejected for a unit because of the configuration of the system at the time the command was issued. The operator needs to do the following -

i. Check whether the unit was in duplex operation.

ii. For successful switchover for SCIC, besides SCIC, TOGC should also be in duplex.

6.5.1.3.2. SWITCH UNIT INTERCHANGE REPORT: RESULT = FAIL

This report is outputted by the system whenever switchover request is

a) the command got executed, but because of the switchover some other unit has becomes OOS-SUS;

b) totally rejected for a unit because in the new configuration the system is unable to provide service.

6.5.1.3.2.1. INTERCHANGE HAS TAKEN PLACE BUT ADJACENT UNIT GONE SUSPECT

i. In this case, most likely the OOS-SUS unit will be declared OOS-SYS in which the operator has to follow the procedure given in for System Alarms.

ii. However, in certain cases like for example after BP switchover, one MU might go OOS-SUS, come into service and go OOS-SUS again, and this keeps happening indefinitely. Under such circumstances, perform a BP switchover again, make the memory that is suspected OOS-OPR and diagnose it. In this configuration the diagnostics will

catch the fault. Follow the procedure given for handling BP-MU faults. In order to change status of MU from OOS-SUS to OOS-OPR, give frc-swu-oos for that MU and then give reset to an inservice SBY TIC.

iii. If after BP switchover one BMS keeps going OOS and then being in service then the fault might be in that BMS or the currently active BP. Try replacing the MSC of BMS first and see if the problem goes off. Otherwise replace the BPC card of BP which is currently active.

6.5.1.3.2.2. INTERCHANGE DOES NOT TAKE PLACE

i. This happens because in the new configuration the system is unable to come up altogether. For example, the interchange command for BP might get rejected altogether because, the standby BP is not able to access either of the memories when made active and hence the original BP is retained as the active copy and the standby copy is made suspect.

ii. Now in the above case if diagnosis on BP fails and is declared OOS-SYS, then follow the same procedure as when BP alarm is raised.

iii. If on the other hand, diagnosis passes, then make one of the MU OOS-OPR and diagnose it. Thus the interface between the suspected BP and MU gets tested and the fault will come out. Follow the procedure given for handling Alarms and Diagnostics Failed Report.

6.5.2. Procedure for Handling System Integrity Reports

6.5.2.1. Audit Failure Report

i. If an audit fail report has come in isolation, then just repeat the same audit manually and check whether it passes now. If it passes then whatever inconsistency that was present is now cleared. Check for reoccurrence of the audit failure and report to support centre if it repeats.

ii. If the audit fails again, it means that the audit is detecting some inconsistency in the system but is unable to clear it by itself. Try running the associated audits and then the same audit again. Check whether it passes now. If it does not, check how the service is getting affected because of this problem. If it is seriously getting affected, then reboot the system (INIT-SYS: STABLE CLEAR). Otherwise inform the support centre and await instructions.

iii. If many of audit failures occur simultaneously, check the quality of the service like DT delay etc. If the service quality is bad, then reboot the system (INIT-SYS: STABLE CLEAR).

Note:

Audit No. 12 will fail in SBM as well as MBM even though it corrects the inconsistency. Refer Appendix - 'B' for various audit sets.

6.5.2.2. Loading Complete Report

This report gives the information that the system has booted at such and such time. The action is same as that described in the section for handling "MLF" alarm on ADP. This report will also contain the level of initialisation and the reason for the initialisation.

6.6. TRANSIENT FAULT HANDLING

6.6.1. Repeated Raising and Clearing of Switch Unit Alarms

Repeatedly some unit is becoming OOS-SUS and then coming back into service. However, there will be no alarm raised for the peripheral processor units like TIC, TSC etc. and other units like ADC, CMS etc. except BP/AP/SSC complexes including memory. Only if the operator is vigilant this type of fault can be detected. Another indication may be large number of unsuccessful calls (as seen by traffic reports) or overload getting declared although the BHCA is low.

Actions

i. Confirm that the unit is repeatedly going out-of- service, by repeatedly issuing display command to check its status.

ii. Make the unit OOS-OPR.

iii. Diagnose the unit repeatedly for 3 times. If it fails consistently or otherwise, refer the section on switch unit alarms and follow that procedure for rectifying the fault.

iv. If the diagnostics passes consistently then interchange the active/standby status of the unit immediately higher up (eg. for SCIC, interchange BMS etc.) in hierarchy. Repeat the diagnostics.

v. Now if the diagnostics fails, refer section on switch unit alarms.

vi. If still the diagnostics passes then contact Control Room.

6.6.2. Repeated Raising and Clearing of BPU/TSU Power Alarm

i. Try replacing the PSU for which the alarm is raised.

ii. If the problem continues, then interchange the copies of BP using 'intchg' command.

iii. If now the problem gets cleared, then it is the BP card (which is currently standby) which is faulty.

6.6.3. Repeated Raising and Clearing of TU PSU Alarms

i. Follow 6.6.2 except that instead of BP interchange the TICs in step ii) and it will be the standby TIC that is faulty in step iii).

Chapter 7.

Maintenance of Lines/Trunks & Service Circuits

7.1. THRESHOLD ALARMS & ROUTINE MAINTENANCE COMPLAINTS

7.1.1. Threshold Alarms

7.1.1.1. Threshold Alarm for Service Circuits (MF/DTMF)

LED flashing against service circuits accompanied by an audio alarm. On VDU (OOD) threshold alarm would be raised and there will be print out of threshold alarm for MF-SENDER, MF-RECEIVER or DTMF RECEIVER on the printer. The same alarm will be available in the alarm list also.

7.1.1.1.1. CASE : FAILED TO CONTACT MFC

a) **MF CONTROLLER GONE FAULTY**

i. Check the status of units in the BM.

ii. If a MF controller is marked OOS-SYS, then give a reset to that MFC and try to bring it into service.

iii. If MFC still fails to come inservice, then jack out the MFC, jack it back in, give MFC a reset and try to bring it into service.

iv. If the MFC comes inservice now, note it as a transient hardware problem in that MFC or that card slot position. Keep it under observation for a few days.

v. If MFC still fails to come inservice, then replace the MFC with a new MFC card. Try to bring it into service.

vi. If the MFC comes inservice now then log that the old MFC had actually gone faulty. Also perform a loopback test (test set = 301) on the MFC after bringing the MFC inservice. If the test passes the repair is successful. Otherwise replace with a new card.

vii. If the new card also fails to come inservice, then revert back to the old MFC card. Give a command to switchover the active-passive status of SCICs. Try to bring the MFC into service.

viii. If now the MFC comes into service, then it is SCIC that might have gone faulty. Put the standby SCIC OOS-OPR, and replace it with a new card. Bring the SCIC into service and make it the active copy.

ix. If now all the units including MFC remain inservice then it is SCIC that was faulty and the repair is successful.

If the problem persists inspite of all this, check the backplane of the MFC and SCIC. However, this is not recommended in case of a functional BM and should be attempted only in BMs being installed.

b) **SOME MF CIRCUITS HAVE GONE FAULTY IN THE SYSTEM**

i. Check the alarm on the ADP, VDU and Printer. Identify the entity (DTMF/MF-SENDER/MF-RECEIVER) for which the alarm is raised.

ii. Check the status of all the MFCs using DISPL- SWU-ALL command and verify that all the MFCs that are equipped are inservice. If one of the MFCs is OOS then refer procedure as explained for previous case 'a'.

iii. Using DISPL-SRV-STATUS command check the status of the MFC on which routining had failed on some or all circuits. The status of those circuits will be OOS-SE.

iv. Repeat test on the MFC (TST- SRV : test-set=301) after giving reset and confirm the fault.

v. Put the MFC out-of-service, jack out the card, jack it back in again, give it a reset and bring it inservice again. Repeat the test on it again.

vi. If now the test passes on all the circuit then problem is of transient nature. Keep the MFC under observation for few days.

7.1.1.2. Threshold Alarm for Lines

Indication:

LED flashing on ADP accompanied by an audio alarm. The total no. of lines faulty will also be indicated on the ADP. Depending on the no. of lines faulty, the alarm will be Non-urgent, Urgent or Critical. The same alarm would be available on VDU (OOD) and Printer also. Threshold values for lines can be seen from system parameters.

Procedure:

Threshold alarm for lines get raised when a large number of lines go OOS or This section gives the procedure for handling conditions wherein suddenly lots of lines go faulty in a short period of time. If on the other hand if individual lines go out-of-service, one after another and this leads to a threshold alarm for lines, then refer the procedure given under section for handling subscriber complaints or System reports. If the lines have all gone OOS-SE then follow procedure 7.1.1.2.1.

7.1.1.2.1. CASE: LOT OF LINES HAVE GONE OOS-SE SUDDENLY

Procedure:

i. Look for some "Line Status Change" reports on printer or in OOD-LOG just prior to alarm for lines. From the reports check that several lines have gone OOS-SE suddenly.

ii. Cross check the status of some of these lines through MMC commands.

iii. Try to bring some of these lines into service through put inservice or force inservice commands. If they come inservice, then make calls on these lines and check that everything is proper.

iv. On the other hand if the lines, fail to come inservice do as follows. Check whether all the lines belong to same TU or they are distributed over different TUs.

v. If they are belonging to the same TU, the fault should in the active TIC/SP path. Interchange the TICs and force the lines into service. If they come inservice, then make calls on these lines and check that everything is OK.

vi. If service gets restored, then wait for low traffic hour and then only start on the repair action. But on the other hand if the service does not get restored via the other copy of TIC also proceed with the repair action immediately.

vii. Put the standby TIC OOS and replace the SP card. Bring the TIC inservice. And make it the active copy (Do this only in low traffic hour when there is very little traffic on this TU). If the terminals remain inservice, then make calls on few terminals and confirm that everything is OK. Log the problem as H/W fault in SP.

viii. If on other hand, the terminals start going OOS, then interchange the TICs and again force the terminals which have gone OOS into service. Put the standby TIC OOS again and replace the TIC card also. Bring the TIC inservice. And make it the active copy. If the terminals remain inservice, then make calls on few terminals and confirm that everything is OK. Log the problem as H/W fault in TIC.

ix. If on other hand, the terminals start going OOS, then interchange the TICs and again force the terminals which have gone OOS into service. Put the standby TIC OOS again and restore the old TIC & SP card back. Bring it into service. Make it the active copy. Jack out all the line cards. Start jacking in one line card at a time and simultaneously start bring them into service.

x. If the first line card itself fails to come into service, then suspect the line card or the backplane as faulty.

xi. Otherwise keep jacking in cards and bring them into service until a point where not only one of the cards that is jack in fails come into service, but also other inservice lines go OOS when this particular card is jacked in. Replace the card with a good spare. Bring all the lines back into service.

7.1.1.2.2. CASE: ROUTINING FAILED ON SEVERAL LINES

i. Suspect the sanity of TTC. Perform the same test which had failed in some good lines within the switch room.

ii. If the tests fail, then either the TTC or the test bus is faulty.

iii. Force all the lines that have gone OOS into service. Check that calls go through on these lines.

iv. Replace the TTC with a good spare. Again test some of the lines in the switch room. If the tests pass now, then log that it was TTC that was faulty.

v. If still the tests fail, then it must be the test bus that has gone faulty. (The common type of fault is TA relay on any line or Trunk card getting permanently operated). To identify which is the faulty card, follow the procedure given under the heading alarm raised for TTC.

7.1.1.3. Threshold Alarm for a Trunk Group

Indication:

LED flashing on ADP accompanied by an audio alarm. The total number of trunks faulty in the system will also be indicated on the ADP. Depending on the number of trunks faulty in the trunk group, the alarm will be Non-urgent, Urgent or Critical. The threshold values for small, medium and large trunk groups can be seen from the system parameters.

The same alarm would be available on VDU (OOD) and printer also.

Procedure:

Threshold alarm for trunks get raised when a large number of lines go OOS. This section gives the procedure for handling conditions wherein suddenly lots of trunks go faulty in a short period of time. If, on the other hand, individual trunks go out-of-service, one after another and this leads to a threshold alarm for trunks in that TGP, then refer the procedure given under section for handling System reports. If the trunks have all gone OOS-SE suddenly then follow the same procedure 7.1.1.2 given for lines. If trunks have gone OOS-SE during periodic routining then follow same procedure 5.4.2.2 as for lines. If the trunks gone OOS-SO, then follow 7.1.1.3.

7.1.2. Procedure for Handling Terminals Maintenance Reports

7.1.2.1. Line Status Change Report

7.1.2.1.1. STATUS OF LINE BECOMING INS-LLO (FAULT IN THE OUTSIDE PLANT)

i. This indicates ground fault developing on the line. If several lines go faulty simultaneously, the likelihood of a cable going faulty is very high.

ii. If the report comes for a single line, do the following. Check the status of the line. It's status might be INS-LLO. Perform an outside plant test (102) on that line. The insulation test will fail. Inform the result of the test to the outside plant personnel.

Note: In cae of fault in the outdoor plant, the line may be INS-LLO if the telephone set is not placed properly.

7.1.2.1.2. STATUS OF LINES BECOMING OOS-SE (FAULT IN THE EXCHANGE)

In this case, the fault is confirmed to Exchange Side and the corrective active has to be taken as explained.

7.1.2.2. Trunk Status Change Report (Digital Trunk)

7.1.2.2.1. STATUS OF TRUNK BECOMING OOS-SE (EXCHANGE FAULT)

For analog trunks, the procedure is same as that for lines which is explained in section 7.1.2.2.1. For digital trunks, perform TST-TRML-CARD (test-set number 403) and proceed as in "Trunk Routining Failed" (section 7.1.2.4).

7.1.2.2.2. STATUS OF TRUNK BECOMING OOS-SO (FAULT IN OUTSIDE PLANT)

i. In case of Digital Trunks, it can be due to absence of voltage or due to an actual ground fault. First, the voltage should be checked at the MDF.

ii. If voltage exists upto MDF, and then upto connector on exchange, fault should be in the trunk card. The trunk card should be replaced with a good spare.

iii. If on the other hand, there is no voltage at MDF, first check with the distant end. If everything is proper at the distant end, then cable should be faulty. Inform the outside plant personnel.

If the trunks is digital, go to the next section (7.1.2.2.3) - "STATUS OF DTK BECOMING OOS-SO/TRANS"

7.1.2.2.3. STATUS OF TRUNKS BECOMING OOS-TRANS

i. Perform TST-TRML-CARD (test-set-403) and proceed as in "Digital Trunk Routining Failed".

7.1.2.2.4. STATUS OF TRUNKS BECOMING BLK-CNF

7.1.2.3. Line Routining Failed Report Analog/Digital Lines

This report is generated when periodic calendar based routining of lines fail. Depending upon the test that was being conducted the fault can be on exchange side (test sets = 103, 104, or 105) or outside plant (test set = 102). Similar tests can be done for digital line (ISDN lines) with the help of TST-set 607 for Exchange side & 608 for outside plant test.

7.1.2.3.1. EXCHANGE SIDE ROUTINING FAILED REPORT FOR LINES

i. This report is displayed, when exchange side signalling or voice path tests has failed. The Test- set no. will be 103, 104 or 105 for Analog Line & 607 for digital line.

ii. Check whether this report has come for only this line or it has come for a large no. of lines in the BM.

iii. If large number of lines have gone faulty, then perform the same test on some of the lines to confirm the fault. If the fault persists, then follow the same procedure as given in section 7.1.1.2.1 or 7.1.1.2.2.

iv. If the fault is not large numbers of lines, then repeat test that has failed on the line and confirm the fault. From the test number find out the nature of the fault (eg. ringing test failure etc.). Confirm the fault manually.

v. If the nature of the fault is serious enough, then allot a new spare TEN to the subscriber if available (use MOD-SUB-TEN). Note if more then one TEN is faulty in the line card, then replace the line card itself with a good spare.

vi. Test the new line/line card for all its exchange side functions and if it passes bring the line into service.

7.1.2.3.2. ROUTINING FAILED REPORT FOR LINES (OUTSIDE PLANT TESTS)

i. This report is displayed, when outside plant tests (Test-set 102) for Analog Line & 608 for digital line.

ii. Check whether this report has come for only this line or it has come for a large number of lines in the BM.

iii. If the report has come for only this line, then do the following. Issue the command TST-TRM for that line with detailed report option and check the measured values.

iv. If the measured values are definitely bad, then inform the outdoor plant personnel.

v. If the measured values are marginal then call the subscriber and enquire about the quality of the service. Only if the subscriber has some complaint, inform the outdoor personnel.

vi. If large number of lines have gone faulty, then perform the same test on some of the lines to confirm the fault. If the fault persists, then verify the sanity of TTC by testing it against a good switch room no.

vii. If the TTC declares the switch room number also as faulty, then it must be the TTC which is faulty. Replace it with a good spare.

7.1.2.4. Trunk Routining Failed Report Analog/Digital Trunk

This report is generated when periodic calendar based routining of trunks fail. Depending upon the test that was being conducted the fault can be exchange side (test sets = 201, or 202) or outside plant (test set = 203).

7.1.2.4.1. EXCHANGE SIDE ROUTINING FAILED REPORT FOR TRUNKS

i. This report is for exchange-side failure. In case of digital trunks (test-sets 401, 402,403) go to section 7.1.2.4.3. Test set 40x is used with command TST-TRML-CARD.

For analog trunk test-set will be 201 or 202, with TST-TRM command and the following description applies.

ii. Check whether this report has come for only this trunk or it has come for a large number of trunks in the BM.

iii. If large number of trunks have gone faulty, then perform the same test on some of the trunks to confirm the fault. If the fault persists, then follow the same procedure as given in section 7.1.1.3.

iv. If the fault is not reported for large number of trunks, then repeat the test that has failed on that trunk and confirm the fault. From the test number find out the nature of the fault (eg. seizure test failure etc.). Confirm the

fault manually, if possible, by using DBEN facility to dial that specific trunk.

v. Replace the trunk card with a good spare.

vi. Test the new trunk card for all its exchange side functions and if it passes bring all the trunks into service.

7.1.2.4.2. ROUTINING FAILED REPORT FOR TRUNKS (ANSWERING CIRCUIT TESTS)

i. This report is displayed, when answering circuit test (Test-set 203) fails on some outgoing trunk. Answering circuit is created using the command MOD-SPL-NUM.

ii. Check whether this report has come for only this trunk or it has come for a large number of trunks in the BM.

iii. If the report has come for only this trunk, then repeat this test a couple of times and confirm the fault.

iv. If the fault is persistent then put the trunk out-of-service. Perform the exchange side tests (test set = 202) to check if the fault is on the exchange side.

v. If the test fail, replace the trunk card.

vi. If the test passes, then manually make a call to that trunk using the DBEN facility. If the call fails, check if the problem is with distant end. If not inform the outside plant personnel.

vii. If large number of trunks had gone faulty, then verify the exchange side function on some of the suspected trunks. If they pass, then verify the sanity of the answering circuit. Perform the same test on some trunks in a different trunk group.

viii. If the tests fail, there is possibility that the answering circuit might have gone faulty. Test the tone generator which is currently active (TST-SRV: TST-SET = 304). If the test fails, replace the TOGC with a good spare, and then repeat the test on the answering circuit test on the trunks.

ix. If the answering circuit test passes on the other trunk groups, but is failing only on the trunks in a trunk group, then check whether calls are otherwise successful in that TGP. If they are, then the answering circuit tone sender at the distant end can be suspected.

x. If the calls are also not going through on the TGP, then cable might have gone faulty. Inform the outdoor personnel.

7.1.2.4.3. "EXCHANGE SIDE ROUTINING FAILED FOR DIGITAL TRUNKS"

i. This section applies for failure in routining for digital trunks (test-sets 401 to 404).

ii. If test fails again, run TST-TRML-CARD (test-set 401), and if it fails replace DTS card.

iii. Run TST-TRML-CARD (test-set 402), and if it fails, replace DTC card.

iv. If the above steps do not solve the problem, interchange TUC and try again. Thus, a possibly faulty TUC can be sensed.

v. When bringing in service any new digital trunk (DTS/DTC Card), perform TST-TRML-CARD/PUT-TRML-CARD-INS first with one TUC active, and then with the other.

7.1.2.5. Procedure for Handling Line Routining Abandoned Report

In the routining abandoned report the reason for abandoning the routining is given. If the reason for abandoning the routining is -

i. TERMINAL_BUSY - then there is no need for any action to be taken by the operator.

ii. This error message can come, when TTC is out-of- service for any reason. In such case, there will be alarm raised for TTC. The operator needs to first attend the TTC alarm. After the TTC is repaired the routining can be resumed.

iii. TST-BUS-BUSY - this is similar to the above case. Only difference is that the test bus was busy due to line or trunk testing being conducted at that time. Operator need not take any action on this report. Only thing is that periodic routining of lines should be normally performed at night when there is) no other load on TTC.

iv. TST-BUS-FAULTY - this error message comes when TTC finds some voltage on the test bus. This can happen if TA bus of any termination is permanently operated.

v. TSTCKT-NOTOK - Before conducting test on any terminal the TTC does a self test on itself. If this fail, then the above message is flashed. Operator needs repeat the test to check whether the problem is persistent in which case the TTC needs to be replaced.

vi. SYS-RECOVERY/MSG-PARAM-ERROR/DEF-CHK-FAIL - this normally indicates some software problem. Confirm whether the problem is still persisting. If it is, report to support centre.

7.1.2.6. Procedure for Handling Trunk Routining Abandoned Report

The same error messages as that for lines can come for trunks also. Besides the above error conditions some more error conditions are possible for trunks.

i. TRK-NOTAVBL - This message is flashed if TST-TRM is given for conducting any exchange side tests on trunks and at that time there was no free trunk of the required type available in the system (TST-TRM for an ICT requires a free OGT and vice versa). As such this condition can occur only in a very remote circumstances. If it happens frequently, report to support centre.

ii. ANSCKT-NOTSZD - This message is displayed when then there is no answering circuit receiver available for conducting the answering circuit test for OGTs.

7.1.3. Procedure for Handling Problems Detected by Traffic Reports

Traffic can be a good means for detecting problems in the system that could not be caught by other fault detection mechanisms

7.1.3.1. Too many Call Failures in all Trunk Groups with MF Signalling

i. This can be due to some MF sender/receivers going faulty. The system either has not yet detected the problem or the system has detected the fault but number of circuits that have gone faulty is not large enough to raise an alarm. Under such conditions operator is required to check the status of all MF circuits, conduct loopback test (TST-SRV: TST-SET=301) on all the MFCs and replace the faulty MFC if any.

7.1.3.2. Too Many Call Failures in One TGP

i. Under such conditions the operator is required to test all the trunks in that trunk group. For outgoing trunk group, the answering circuit should be performed.

ii. If the failures are in the Incoming side, then perform the exchange side test on that trunk group (TST-TGP: TST-SET = 202).

iii. If the test passes, then ask the exchange personnel at the distant end to test their outgoing end and take the necessary action-

7.1.3.3. Outgoing Line Report : Too Many Calls Failed due to Congestion

i. Check the status of all the trunks in those trunk groups where excessive congestion was reported.

ii. If most of the trunks are inservice and still there is too much congestion report then there is a possibility that some of the calls on the trunk are

hanging (i.e. the trunk circuit is marked busy although there is no call established on it). Perform audit (AUDIT: AUD-SET = 20).

iii. If either of the audits failed then inconsistency in the status must have got cleared and problem should have got solved.

7.1.3.4. Too Many Lines in INS-LLO Status

A report is displayed on OOD if number of terminals having LLO status exceeds the threshold limit. A report is also displayed if number of terminals having OOS status exceeds the limit.

Check whether these lines belong to the same cable. In that case suspect the cable. Perform TST-TRM with test set 102 on few of these lines. If the tests, fail, inform the outside plant personnel.

7.1.3.5. Too Many Trunks in INS-LLO Status

If these trunks belong to an incoming trunk group, suspect the outside plant cable. Perform TST-TGP with test set 201 and verify that the exchange side test pass.

In case the concerned trunks belong to a bothway trunk group. Contact the distant end and check whether they have put the trunks out of service. (Note: in case of CDOT exchanges when a bothway trunk is made out of service by operator, a permanent loop is extended on the trunk which can lead to distant end trunk going to LLO). If the trunks in distant end are all right, suspect the cable. Perform TST- TGP with test-set 201 and verify that exchange side tests pass.

7.1.4. DTK Repeatedly Goes OOS-SO and INS

i. Run TST-TRML-CARD, (Test-set 403 for DTK-CAS and Test-set=401 for DTK-CCS and try to locate the fault.

ii. If this does not succeed, inform the distant end.

iii. Even then problem is not solved, switch OFF and ON both PSUs of DTU and bring Digital Trunks inservice after TUCs come in service.

7.2. PROCEDURE FOR HANDLING SUBSCRIBER COMPLAINTS

7.2.1. Telephone Dead

Case-I Problem concerns a particular subscriber

i. Perform both exchange side tests and outside plant open loop test on the terminal.

ii. If the outside plant open loop tests fail, the fault lies in the outside plant. Most likely there will be disconnection in the telephone line. Capacitance test will fail with '00' uf as measured value in this case.

iii. If the exchange side tests fail, then the concerned line card is to be replaced.

Case-II Quite a few number of telephones reported dead

i. In this case confirm from the external plant records whether the subscribers belong to the same distribution cable.

ii. In such a situation, the fault can be due to a problem in cable plant itself which is to be corrected. Otherwise each line has to be treated separately as in Case-I.

7.2.2. Telephone Held-Up (No Dial Tone)

i. In case subscriber complains of the telephone being held-up, then the likelihood is that speech battery is present but some ground fault is there.

ii. To ensure this, check the status of the subscriber on BM. If the status indicates INS-LLO for the line, then confirm the fault by conducting outside plant open loop tests on the subscriber.

iii. If the outside plant test passes then perform exchange side tests and confirm that there is no fault at the exchange side. If there is fault at the exchange side, the concerned line card should be replaced.

7.2.3. Permanent Ring

i. Check the status of the terminal.

ii. Perform exchange side tests on the concerned subscriber. If the exchange side tests fail, the line card is to be replaced.

iii. Perform closed loop tests on the line. If closed loop tests fail, most likely the fault will be in telephone instrument which has to be replaced.

iv. Perform outside plant open loop test on the subscriber and confirm that there is no fault at outside plant.

v. Make check on other lines in the same TU.

7.2.4. Permanent Dial Tone

i. Check the status of the terminal.

ii. Perform closed loop tests on the line. If closed loop tests indicate fault in the telephone instrument, then telephone has to be replaced.

iii. Perform exchange side tests and confirm that there is no fault at the exchange side. If there is fault at the exchange side, then the concerned line card should be replaced.

iv. If the subscriber has changed his instrument recently, check whether he is now using the DTMF phone. Check the data for proper instrument type and modify the instrument type if necessary.

7.2.5. Speech Quality Poor

i. Presence of foreign potential and low insulation may be the causes of poor speech quality.

ii. Perform outside plant open loop tests on the subscriber. If the tests indicate fault in the cabling, it has to be traced and rectified.

iii. Conduct exchange side tests also and confirm that there is no fault at the exchange side. If there is fault at the exchange side, then the concerned line card should be replaced.

iv. Make check on other lines in the same TU.

7.2.6. Feeble Speech

i. The likely cause of this complaint is lower values of loop current. This can be confirmed by conducting closed loop tests on the line.

ii. Conduct exchange side tests also and confirm that there is no fault at the exchange side. If there is fault at the exchange side, then the concerned line card should be replaced.

7.2.7. Call, Being Routed To Wrong Numbers

i. In this case most likely the fault will be in the telephone instrument.

ii. Perform closed loop tests on the line. If closed loop tests indicate fault in the telephone instrument, then telephone has to be replaced.

7.2.8. One Way Speech

i. Perform exchange side tests and confirm that there is no fault at the exchange side. If there is fault at the exchange side, then the concerned line card should be replaced.

ii. Perform closed loop tests on the line. If closed loop tests indicate fault in the telephone instrument, then telephone has to be replaced.

7.2.9. Ringer Cadence not O.K

i. If the problem is occurring on all the lines of that TU, replace PSUI which is towards the active copy of TIC. Check that the problem is rectified.

ii. If the problem is not occurring on all lines of that TU, then the telephone instrument must be faulty.

Chapter 8.

Maintenance Procedure for Network Synchronization

8.1. INTRODUCTION

The Space Switch Controller Unit (SCU) in the CM-XL cabinet, has duplicated SSCs, 16 MB memory cards (Base Memory Card - BME), CBX, CCK and duplicated NSC cards. The SSC checks the health status of all these cards and reconfigures the system in case of any faults.

There two duplicated devices are : NSC (Network Synchronisation Card) and CBX (Central Bus Extender Card). NSC synchronises the local clock of the exchange with the network clock. It gets input clocks from digital trunks connected to higher level and peer level exchanges. It has an on-board clock source also. It gives a network synchronised clock and sync signals to the duplicated Central Clock cards (CCK).

The CCK is controlled by the SSC through CBX. The clock card generates its own clock and can be configured to select between the local clock and two copies of NSC clock. Each clock card distributes 16 MHz clock and 8 kHz sync to self SSU and 16 MHz clock to all Bus Termination Units (BTUs) which receive buses from all the BMs connected to CM..

The CBX card provides an interface between SSC and SSU. SSC makes any switch card access through CBX. CBX also handles any power supply errors in SSU and BTU. Each CCK-CBX-NSC complex form a security block i.e. CBX0 cannot be used with CCK1. Thus there is a copy 0 complex and a copy 1 complex.

Fig. 8.1 depicts the clock distribution in MAX-XL.

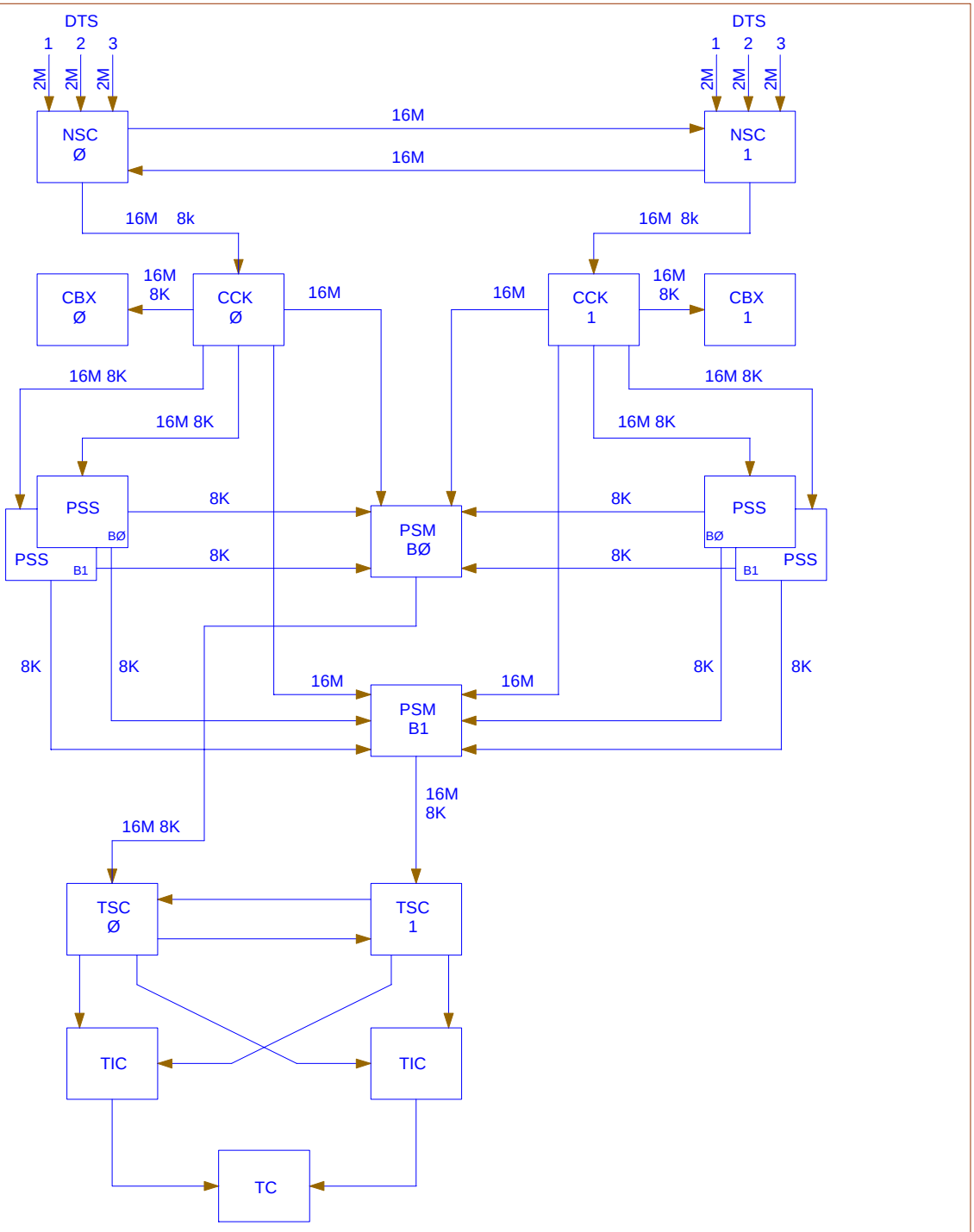


FIG.8.1
CLOCK DISTRIBUTION

\DESIGN\DSSMAX\MAX-XL\MAX-MP2\MP2-CD1

8.1.1. position of nsc card in the system

The NSC card sits in the SCU (Space Switch Controller Unit) frame of the CM-XL cabinet. It interfaces on the CPU bus of SSC (Space Switch Controller) and shares the bus with CBX (CPU Bus Extender Card) and memory card. It acts as a device to the SSC.

8.2. FUNCTION OF THE CARD

- The NSC card forms the interface between the USRN/DTS (Digital Trunk System) and the CCKs (Central Clock Cards).
- It receives the 2.048 MHz reference input clock from either USRN or DTS and converts it into a 16.384 MHz clock using a digital PLL (Phase Locked Loop) and feed this clock to both copies of CCKs.
- It also generates a sync signal (8 kHz) and feeds it to the CCKs for further distribution to all the BMs.
- There is a Time-of-Day (TOD) block which generates the real time clock for the system. It takes an input from DTS cards in future (a one hertz clock) and embeds this in the 8 kHz sync.
- The NSC has an On Board Micro Processor (OBMP) to take care of the PLL functions, diagnostics, communication with SSC

8.3. DUPLICATION AND SECURITY BLOCK

- The NSC card is duplicated and its access is similar to CBX cards.
- The NSC and CBX form a security block as there is only one device enable for each NSC-CBX pair.
- The 2.048 MHz clock and 8 kHz sync signal are exchanged between the two copies of NSC. Clock selection is done before the PLL block. If all the inputs to the NSCs fail, it runs in the “holdover” mode. If the inputs are not restored till the end of the holdover period, (duration of the holdover period is defined in the Parameteric Specifications), the NSCs go into the "free-run" mode. The NSCs work in mutual synchronisation as the PLLs track each other.

8.4. DIAGNOSTIC FEATURES

The following diagnostic features are provided on the NSC Cards.

- Beat circuits to detect frequency drifts between the input clock pairs and input and output of PLL.
- Selected clock monitoring for frequency failures and stuck-at faults.
- Sync failure detection logic to check for the presence of-first frequency submultiples and multiples of 8kHz, stuck-at fault of sync. signal and load pulse failure.

- USRN interface failure detection by making use of alarm signals.
- Lock detection between the copies of NSCs and input and output of PLL.
- All the signals like address, data and control in the CPU-NSC interface are provided with parity bits.
- TOD (one Hz) signal failure detection.

8.5. ERROR REPORTING

- All error signals described in 8.5 above latch the error in the OBMP Status Register and generate an interrupt to the OBMP.
- It is possible to separately enable and disable the interrupt signals using control information present in the OBMP Control Register.
- In the normal mode, the control information is written into the control register by the OBMP and based on the status of various signals. However, it is possible for the CPU to exercise overriding control through communication with OBMP.
- Error like APE (Address Parity Error), DPE (Data Parity Error) and MVE (Mode Violation Error) on the CPU bus interface are combined and given as DERR to CPU. The APE is given to the mate NSC.

8.6. OPERATOR COMMAND SHEETS

8.6.1. MOD-CLKSRC-EQPAG : Modify Clock Source Equipage

Function - To equip/unequip a particular network clock source for both the copies of NSC.

Input parameters -

1. OPR-TYP

Possible values - 1 - EQUIP

2 - UNEQUIP

2. CLOCK

Possible values - 1 - RCLK0

2 - RCLK1

3 - RCLK2

4 - USRN

Note :

For the Equip option, the status of that particular clock source should be UNEQUIPPED for both the NSC copies. For the Unequip option, the status of that particular clock source should be OOS_OPR for both the NSC copies.

Output -

The report displays the result of the command as a SUCCESS or FAILURE.

Sample report

CLK SOURCE EQUIPPAGE MODIFICATION SUCCESS REPORT		
Operation Type	=	Equip
Clock source	=	Rclk2

8.6.1.1. DGN-NSC-CLK : Diagnose NSC Clock

Function -To let the operator diagnose a particular clock source of an NSC copy.

Input parameters -

1. NSC-ID

Possible values - 1 - NSC_0

2 - NSC_1

2. CLOCK

Possible values - 1 - RCLK0

2 - RCLK1

3 - RCLK2

4 - USRN

5 - DUP-CLK

Note :

The clock source status for the requested NSC copy should be OOS_OPR.

Output -

The report displays the result of the command as a SUCCESS if the diagnostics were successful.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT					
RESULT	=	PASS	REPORT OPTION	=	N
UNIT ID	=	NSC-0	CLOCK SOURCE	=	RCLK2

The report displays the result as FAILURE if any of the diagnostic test has failed.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT					
RESULT	=	FAIL	REPORT OPTION	=	N
UNIT ID	=	NSC-0	CLOCK SOURCE	=	RCLK2

8.6.1.2. PUT-NSC-CLK-INS : Put NSC Clock In Service

Function - To let the operator bring in a particular clock source of an NSC copy after running diagnostics on it.

Input parameters -

1. NSC-ID

Possible values 1 - NSC_0

2 - NSC_1

2. CLOCK

Possible values - 1 - RCLK0

2 - RCLK1

3 - RCLK2

4 - USRN

5 - DUP-CLK

Note :

The status of the particular clock source for the specified NSC copy should be OOS_OPR.

The specified NSC copy should be INS itself.

If the DUP-clock of an NSC is attempted to be brought IN when the mate Switch plane is OOS, the request is rejected with reason CONFIG_NOT_SUITABLE.

When the first network clock has to be brought INS, the "SEL-CLK-SRC" command should be used. If "PUT-NSC-CLK-INS" is used, it will be rejected with result CONFIG_NOT_SUITABLE.

Output

The report displays the result of the command as SUCCESS if the clock source could be brought INS successfully. The status awarded could be INS_TOBE/INS_COLD as outlined in the design document.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT

RESULT = PASS

UNIT ID = NSC-1 CLOCK SOURCE = RCLK2

NEW STATUS = INS_TOBE

OLD STATUS = OOS_OPR

If the diagnostics of the clock source fail then the result displayed is FAILURE.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT

RESULT = FAIL

UNIT ID = NSC-1 CLOCK SOURCE = RCLK2

NEW STATUS = OOS_OPR

OLD STATUS = OOS_OPR

If the execution of command itself fails, the result shown is JOB ABORTED, and in some specific cases (like mate SSC not INS) it is displayed as CONFIG_NOT_SUITABLE.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT

RESULT = JOB_ABORTED

UNIT ID = NSC-1 CLOCK SOURCE = RCLK2

NEW STATUS = OOS_SYS

OLD STATUS = OOS_SYS

8.6.1.3. FRC-NSC-CLK-INS : Force NSC Clock In Service

Function - To let the operator bring in a particular clock source of NSC without running any diagnostics.

Possible values -

1. NSC-ID

   Possible values - 1 - NSC_0
   2 - NSC_1

2. CLOCK

   Possible values - 1 - RCLK0
   2 - RCLK1
   3 - RCLK2
   4 - USRN
   5 - DUP-CLK

Note :

1. The status of the clock source should be OOS.
2. The specified NSC copy should be INS itself.
3. If the DUP-clock of an NSC is attempted to be brought INS when the mate Switch plane is OOS, the request is rejected with reason CONFIG_NOT_SUITABLE.
4. When the first network clock has to be brought INS, the "SEL-CLK-SRC" command should be used. If "FRC-NSC-CLK-INS" is used, it will be rejected with result CONFIG_NOT_SUITABLE.

Output -

The result of the command is shown as SUCCESS if the clock source could be brought INS. The status awarded could be INS_TOBE/ INS_COLD also.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT

RESULT = PASS

UNIT ID = NSC-1 CLOCK SOURCE = RCLK2

NEW STATUS = INS_TOBE

OLD STATUS = OOS_OPR

If the clock source is not available to the NSC, then the result displayed is FAILURE.

Sample report

CLOCK SOURCE STATUS CHANGE REPORT		
UNIT ID	=	NSC-1
CLOCK SOURCE	=	RCLK2
RESULT	=	FAIL
NEW STATUS	=	OOS_SUS
OLD STATUS	=	OOS_OPR

If the execution of command itself fails, the result shown is INVALID_CHANGE / CONFIG_NOT_SUITABLE.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT		
UNIT ID	=	NSC-1
CLOCK SOURCE	=	RCLK2
RESULT	=	INVALID_CHANGE
NEW STATUS	=	INS_TOBE
OLD STATUS		INS_TOBE

8.6.1.4. PUT-NSC-CLK-OOS : Put NSC Clock Out Of Service

Function -To let the operator throw out a particular clock source of NSC which is not the selected clock source.

Input parameters -

1. NSC-ID

Possible values - 1 - NSC_0
2 - NSC_1

2. CLOCK

Possible values - 1 - RCLK0
2 - RCLK1
3 - RCLK2
4 - USRN
5 - DUP-CLK

Note :

That particular clock source should be equipped and its status should not be already OOS_OPR. Further, it should not be the clock source selected by the active NSC copy.

Output -

The report displays the result of the command as SUCCESS if the status of the clock source could be successfully changed to OOS_OPR.

Sample report

CLOCK SOURCE DIAGNOSIS REPORT		
UNIT ID	=	NSC-1
CLOCK SOURCE	=	RCLK2
RESULT	=	PASS
NEW STATUS	=	OOS_OPR
OLD STATUS		INS_TOBE

Sample report

CLOCK SOURCE DIAGNOSIS REPORT		
UNIT ID	=	NSC-1
CLOCK SOURCE	=	RCLK2
RESULT	=	INVALID_CHANGE
NEW STATUS	=	INS_ACT
OLD STATUS		INS_ACT

8.6.1.5. FRC-NSC-CLK-OOS : Force NSC Clock Out of Service

Function - To let the operator throw out any clock source of NSC.

Input parameters -

1. NSC-ID

Possible values - 1 - NSC_0
2 - NSC_1

2. CLOCK

Possible values - 1 - RCLK0
2 - RCLK1
3 - RCLK2
4 - USRN

5 - DUP-CLK

Note : The status of the clock source should not be UNEQUIPPED or OOS_OPR.

Output - The result of the command is shown as SUCCESS if the clock source status could be made OOS_OPR successfully.

Sample report

CLOCK SOURCE STATUS CHANGE REPORT		
UNIT ID	=	NSC-1
CLOCK SOURCE	=	RCLK2
RESULT	=	PASS
NEW STATUS	=	OOS_OPR
OLD STATUS		INS_ACT

If the excution of command itself fails, the result shown is INVALID_CHANGE.

Sample report

CLOCK SOURCE STATUS CHANGE REPORT		
UNIT ID	=	NSC-1
CLOCK SOURCE	=	RCLK2
RESULT	=	INVALID_CHANGE
NEW STATUS	=	OOS_OPR
OLD STATUS		OOS_OPR

8.6.1.6. SEL-CLK-SRC : Select Clock Source

Function - Through this command, the operator can make both the NSC copies select a particular clock source. This command is particularly useful when the first network clock source is being brought INS.

Input parameter -

1. CLK

Possible values (already existing) - 1 - NSE_0

2 - NSE_1

3 - TSC_0

Possible values (added for NSC) - 4 - TSC_1
5 - RCLK0
6 - RCLK1
7 - RCLK2
8 - USRN
9 - DUP-CLK.

Note : The clock source should not be UNEQUIPPED. Also, the requested clock source should not be the one to which the two NSC cards are already tuned.

Output -The result of the command is displayed as PASS if both the NSC copies could select the clock source successfully.

Sample report

CLOCK SELECTION PASS/FAIL REPORT		
RESULT	=	PASS
REQUESTED CLOCK	=	RCLK2
TUNED CLOCK	=	RCLK2

If the excution of command fails, the result displayed is INVALID_CHANGE.

If the clock source is not available to one of the two NSC copies, the same is indicated in the report. In this case, the TUNED CLOCK is the clock to which active NSC is tuned.

Sample report

CLOCK SELECTION PASS/FAIL REPORT		
RESULT	=	FAILURE_AS_REQUESTED_CLOCK_NOT_AVAIL_TO_NSC1
REQUESTED CLOCK	=	RCLK2
TUNED CLOCK	=	RCLK2

8.6.1.7. DISPL-CRNT-CLK-SRC : Display Current Clock Source

Function -To let the operator display the status of the various clock sources of both copies of NSC as well as the clock source selected by the active copy of NSC.

Input parameter - None.

Output - The status of all the clock sources is displayed along with the clock source selected by the active NSC.

Sample report (assuming NSC_0 as active) :

NSC CLOCK STATUS REPORT

NSC_0 CLOCK STATII

DUP-CLK	RCLK2	RCLK1	RCLK0	USRN
INS_TOBE	OOS_OPR	INS_TOBE	OOS_OPR	UNEQP

NSC_1 CLOCK STATII

DUP-CLK	RCLK2	RCLK1	RCLK0	USRN
INS_COLD	OOS_OPR	INS_ACT	OOS_OPR	UNEQP

SELECTED CLOCK = RCLK1

***Note* :** All the existing commands e.g. PUT-SWU-INS, PUT-SWU-OOS, DGN-SWU, FRC-SWU-INS, FRC-SWU-OOS etc. will work for NSC when the unit id chosen is that of CLK.

8.7. DO'S AND DON'TS FOR NSC CARD

1. The default status of all the three network clock sources is UNEQUIPPED.
2. Since it is always the active, copy that is providing clock to the system, the SELECTED CLOCK shown by the "DISPL-CRNT-CLOCK-SRC" command is the clock to which the ACTIVE NSC is tuned. The active NSC never tunes to the DUP-CLK, and its is maintained as INS_COLD as long as the dup clock is available to it, and mate switch plane is INS.
3. When no network clock is equipped, the active NSC will provide self clock to the system and the standby NSC will tune to the DUP-CLK. The SELECTED CLOCK displayed by the "DISPL-CRNT-CLK-SRC" command will be NO_CLK_SELECTED. If the standby NSC loses the dup clock also, it will immediately be thrown OOS (Out of Service).

4. When the first network clock is to be brought INS, first equip that particular clock source using the command "MOD-CLK-SRC-EQPAG". The status of the clock source will become OOS_OPR from UNEQUIPPED, in both the NSC copies. Now, give "SEL-CLK-SRC" command for that clock source. Both the NSC copies shall tune to this clock source. In case of any failure, the operator will be intimated appropriately and he can take corrective action.

5. Whenever any copy of NSC is thrown OOS, the status of all its clock sources which are INS, will be marked OOS_SYS. Also, the dup clock of the MATE NSC will also be marked OOS_SYS. Now, when the OOS NSC is brought INS, only those clock sources are considered for selection whose status is OOS_SYS (OOS_OPR/UNEQUIPPED clock sources are not considered for selection). The NSC will select the most stable (in hierarchy) clock available to it which will consequently be marked INS_ACT. Other clock sources available to the NSC will be marked INS_TOBE. Thus, for any OOS NSC to be able to come INS, it should select a clock source (this clock source can be DUP-clock if Active NSC is providing self clock to the system, but it has to be a network clock if active NSC is tuned to a network clock source), the status of which should be OOS_SYS.

Note:

When CM is initialised NSC comes up in 2 hrs. after warm up as level 2 oscillator is used. However the status of NSC becomes inservice immediately but during warm up period proper operation is not guranteed.

8.8. ALARM STRATEGY FOR NSC

Following section gives the alarm strategy use for displaying NSC alarms in various conditons.

1. If not all clock sources but at least one clock source of an NSC copy is out of service, a non-urgent alarm is raised for this NSC.

2. If all the clock sources of an NSC copy are out of service, then an URGENT ALARM is raised for this NSC copy.

3. If all the clock sources of both the NSC copies are OOS, an URGENT ALARM is raised for both the NSC copies, individually under clocksource alarm.

It may be noted that INS_COLD and UNEQUIPPED status are not not considered for calculating the alarm level. This implies that for the active NSC, if all the four equipped network clock sources are out of service, an urgent alarm will be raised even if he dup clock is marked INS_COLD.

Separate alarms for any of individual clock sources of NSC are raised under CLKSOURCE ALARMS. The NSC switch alarm will be raised separately. On the ADP, NSC CLOCKSOURCE ALARM is reflected on SYSTEM CLOCK LED.

SAMPLE REPORT ON OOD FOR NSC CLOCKSOURCE ALARM

SWITCH ALARM					
CATEGORY	RAISE	CLASS	URGENT	ALM SEQ NO	8273
MOD NO		CM	UNIT ID		CLK-0

The status change of any clock source is reported on the OOD indicating both the old and new status of the NSC clock source.

SAMPLE REPORT ON OOD FOR CLOCK SOURCE STATUS CHANGE

CLOCK SOURCE STATUS CHANGE REPORT			
UNIT-ID	CLOCK SOURCE	OLD STATUS	NEW STATUS
NSC-1	RCLK2	INS-ACT	OOS-OPR

8.9. MAN-MACHINE INTERFACE

Man machine commands have been provided as part of the exchange software for supporting NSC functionality in the MAX-XL system. The commands are listed below:

- PUT-NSC-CLK-INS : To put in service a clock source in any copy of NSC after diagnostics.
- FRC-NSC-CLK-INS : To force in service a clock source in any copy of NSC.
- PUT-NSC-CLK-OOS : To put out of service a clock source in any copy of NSC.
- FRC-NSC-CLK-OOS : To force out of service a clock source in any copy of NSC.
- DGN-NSC-CLK : To diagnose the clock source in a copy of NSC.
- SEL-CLK-SRC : To select a clock source in both NSC copes.
- DISPL-CRNT-CLK-SRC:To display the currently selected clock source in active NSC copy.
- MOD-CLKSRC-EQPAG:To modify the equipage status of a clock source for NSC.

8.10. MODES OF OPERATION

- Free Run Mode : When none of the network reference clocks are available and no locking to external reference has taken place before.
- Locked Mode: When one or more primary reference clocks are available, NSC enters into locked mode by selecting one of the available network clocks according to fixed priority and synchronises to it.
- Holdover Mode : When NSC loses the network clock to which it was locked and when no other network clocks are available, NSC enters the holdover mode.

Note :

Each mode of operation is shown in the response of DISPL-CRNT-CLK-SRC command.

Chapter 9.

Logs To Maintain

9.1. GENERAL

All observations and maintenance actions are to be logged in a sequential manner. From this log, a daily report can then be prepared which provides useful information in a structured manner. Daily reports help in compiling information regarding system's performance which is of interest to external agencies such as the support centre.

Following logs have to be maintained:

9.2. REGISTERS

i) **History Register**

This register keeps track of all the TENs of the BM. Each page represents a TEN, against which following information is maintained :

Directory Number, Line-Type-PCO, Ordinary Subs or PABX, Facility provided to subscriber; Date of Opening, Date of Closing if any, Address, Access Barring, etc. Suppose some facility of subscriber is changed, then entry is made in this register with date of changing the facility.

ii) **Deliverable Register**

This register contains the details of all the changes made in the system during a patch installation. The details of checksum of EPROMs changed after patch installation in TICs, SCIC and other cards is entered here.

iii) **System Log Book**

In this log book, faults description of every type is written. Any activity related to exchange is to be noted down in log book.

iv) **MDF Log Book**

This important book contains the details of MDF locations for all subscriber lines, outgoing and incoming trunks. The register contains the following description :

Trunking diagram, MAX MDF layout, cable layout at line side and exchange side, outgoing and incoming trunks details of different exchanges, incoming junctions traffic details. outgoing junctions traffic details, colour coding of cables used, answering circuit numbers of all the exchanges in the network.

v) **Complaint Book**

Complaints from subscribers are noted in this register under the following headings :

Docket number, telephone number, date and time of booking, fault reported, action taken, remarks, sign, date and time of clearance.

vi) **Directory Number Record Book**

This register contains the record of all subscribers under following headings :

Dir. No., subs. .address, locations of exch-TEN, line side, tie and pair and remarks (line type whether STD is barred or not, and is it a member of hunt group).

The directory numbers are arranged in ascending order. The telephone number of complaint booking centres are also written at beginning of register.

vii) **Outgoing Junctions Complaint Register**

In this register, faulty outgoing junctions are booked to distant exchanges. In the beginning, the telephone number where the fault is booked is written. The complaint is registered with following details :

S.no., exchange code, junction no., date and time of booking, complaint no., fault booked, sign of person booking, fault reported back from distant exchange, date and time of reporting back, checked whether ok or not at our end, Remarks for further action if not ok at our end.

viii) **Incoming Junctions Complaint Book**

In this register, fault of incoming junctions, reported by distant exchanges are booked. The fault is booked with following details :

S.no., complaint no., junction no. booked, fault reported, date and time of booking, signature of person booking, TEN of junctions booked, action taken, time of reporting back to respective Exchange. Here we have to give complaint no. to distant exchange and after checking one junctions, give the report to the exchange.

ix) **Billing Record Register**

A register should be maintained to keep a record of the cartridge sent for detail bill record and bulk counter reading.

x) **Generator Record Registers**

A register is kept to record the time for which the generator has been run in case of AC power failure.

xi) **Backup Register**

A register to record the billing traffic and data backup is maintained. This contains the date, expiry date, signature of person taking the backup, cartridge no. used for backup.

xii) **Power Plant & Environment Register**

Note down the voltage and current reading of the power plant after every hour. Similarly log the temperature of the switch room every hour. Input 3 phase voltage should also be logged.

xiii) **Spare Card inventory Register**

This contains the details of spare cards available in the exchange. One page can be reserved for each type of card (LCC, TIC, ISP etc.). Details on spare cards available, sent for repair etc. are entered in this book.

The following details should be available - card serial no., on date on which card sent for repair, date on which card received (after repair), date on which card is put in the system (after it is put as a replacement), slot in which the card is put in the system, Remarks.

9.3. FILES

Correspondence Files

i) **Subscriber Feedback File**

This file contains the feedback form duly filled by the subscribers.

ii) **PCO Meter Reading Record**

This file contains the record of meter reading of PCOs given to J.E.s from time to time.

iii) **Correspondence with Other Exchange**

This file contains all the letters issued or received from or to other exchanges.

iv) **OCR File**

The record of opening and closing of subscribers is kept in this file. The letters received for opening/closing of subscribers is kept in this file.

v) **FDT Installation**

The forms sent with FDTs are kept in this file.

vi) **MRC File**

This file contains all the letters issued or received regarding meter reading of subscribers to operating company. The exchange billing letters are also kept in the same file.

vii) **Manuals/Equipment File**

A file containing the list of manuals/documents available at the exchange, and also the test equipments available at the exchange.

9.4. REPORTS

Following maintenance reports have to be generated from the exchange.

- Weekly and monthly exchange performance report.
- A monthly report on H/W (cards faulty) and S/W (downtime) failure.
- Faulty junction report (monthly)
- Subscriber complaint analysis report (monthly)

9.5. MANUALS REQUIRED

The following manuals are at least needed in the exchange :

i. Power plant manual {FR, SWC, inverters}

ii. Backplane wiring details of all mother boards & cards of the system

iii. Administration and maintenance commands manual

iv. System general description manual

v. Printer manual

vi. System error codes manual

vii. Exchange operations manual

viii.Maintenance Procedure Manual

ix. Installation manual

x. SW release document corresponding to the current SW installed in the exchange.

Chapter 10.

Do's and Don'ts of Maintenance

10.1. GENERAL

This software release has been generated and being released to field after field trails are successfully completed. The release supports most of the requirements, raised from time to time. This has resulted in restructuring of some of the user commands and precautions should be taken in day to day operations of the exchange.

10.2. DO'S AND DON'TS

A number of basic operation and maintenance guidelines are listed which should be carefully studied followed during day to day operations.

10.2.1. Restoration of BMDC

The BMDC cartridge should never be restored in day to day operation. Restoration of BMDC is required only when complete software is being loaded in the exchange. The restoration of "ed" backup does not require restoration of "BMDC". In case of data corruption when restoration of old exchange data is required, only "ed" backup restoration using command “COPY-IN” is sufficient. As and when BMDC has been restored in working exchange, "ed" as well "bd" must be copied. Get around is given in Annexure-D to recover the exchange in case of failure.

10.2.2. Programming Trunk Groups in C-DOT DSS

Keeping in view the complexity of the network and multiple features being supported in the common software release for different configurations/applications of C-DOT DSS, the following requirements should be met at the time of creating a trunk group :

- All the incoming trunk groups from TAX or ILT should be programmed as TTAX.
- All the incoming trunk groups from the parented exchanges should be defined as ORD.

- If C-DOT DSS is configured as TAX/ILT, all the O/G trunks should be defined as ORD.

10.2.3. Calender Programming in C-DOT DSS

To maintain consistency of alarms and reports for lines, trunks and service circuits. AUDIT with AUDIT-SET=12 should be programmed in the calender with daily triggers for all the days in the current year. This programming is required to be done only once in a year every time, a software is loaded in the exchange.

10.2.4. Use of TSC PROM s in Different Exchange Configurations

When BMs of MAX-L are being integrated with MAX-XL or BM-XL are being integrated with MAX-L, then following care should be taken for use of TSC PROM.

★ The checksum for TSC PROM will be same for BM-L as well as for BM-XL if used as SBM-RAX or as colocated BM/RSU of MAX-L.

★ The checksum for TSC PROM will be same for BM-L as well as for BM-XL if used as colocated BM or RSU of MAX-XL.

Precisely, we can conclude from the above that the PROMs on TSC will depend on the type of CM i.e. CM-L or CM-XL and it is independent of BM-type.

10.2.5. TIC Cards with Compatible Software EPROMs

The C-DOT DSS supports distinctive ringing in all the new exchanges with retrofit option for existing sites. The software has been designed to take care of compatibility related problems. The exchange is defined to support “Distinctive Ringing” by setting the system parameter “SPL-RNG“ to 1. At these sites, all the PSUs should be updated for ECNs. Also the TIC cards should be updated for compatible software EPROM. The TIC unit will not become INS unless compatible software EPROM is not used.

10.2.6. Mandatory Execution of MOD-DAY-TYP

It should be ensured that in 1st week of January & July of every year, the command is executed to define the day type.

10.2.7. Programming for Routing of Priority Subscriber's Call

In all the routes, priority 2 should be allowed by defining the trunk group choice against priority 2.

10.3. ROUTINE OPERATIONAL AND MAINTENANCE PRECAUTIONS

In addition to critical DO's and DON'T's, some more precautions are to be taken to avoid any problem during O & M functions.

10.3.1. Precautions to be Taken While Handling Various Hardware Cards

i) With the introduction of "Distinctive Ringing" in C-DOT DSS, there are two different versions of PSU used in Analog Terminal Unit. One with blinking ringler LED to indicate the ringing cadence which is used at the existing sites. The modified PSU is identified with continuous ringer LED and used only at the sites where "Distinctive Ringing" feature is offered. The two PSUs can not be used interchangeably. Also in one exchange, only one version of Power Supply can be used i.e. with distinctive ringers or without distinctive ringing.

ii) The SHM cards cannot be used interchangeably with BPC and HPC in SUM. To use SHM cards at the sites where HPC has been used as processor in SUM, ECN in the form of firmware changes is mandatory on SHM cards.

iii) For 32 signalling links, BPC is used as processor in CCS7 Signalling Unit. For more than 32 signalling links but upto 64 signalling links, only HPC is to be used as processor.

iv) In case of 800K BHCA configurations, HMS is used in all the BMs. HMS and MSC/MSD are not pin to pin compatible and can not be used interchangeably.

v) While changing any TUI card, proper jumper settings as mentioned in **"Installation Document"** should be ensured. The same is valid for BME cards used in CCS7 signalling unit (SUM) with HPC. Otherwise, it is same for BM, AM, CM and SUM with BPC.

vi) While changing any Processor Card in BM, CM & AM, the jumper settings and EPROM status should be ensured.

vii) At the time of changing any controller card from some other site, PROMs of correct software version should be ensured before jacking the card into the system.

10.3.2. Known O&M Changes as a Result of Feature Enhancements

(i) A subscriber data can be modified only after making it OOS-OPR.

(ii) It is not possible to delete the subscriber in growth mode.

(iii) All the **"Hunt Group"** related CRP commands are possible only when IOP is ONLINE.

(iv) Due to enhanced disk partitioning, to utilise the full capacity of the disk, the boot up time for IOP has been increased to 30 minutes or even more depending upon the IOP and disk types, used.

(v) It is not possible to go to growth mode, when IOPs are in DUPLEX. This has been done to avoid data inconsistencies.

(vi) In case of TAX or ILT, the system has to be defined for TAX functioning by setting the parameters XCHG-TYPE = 4 and CLI-INFO = 1. If it is not so, the exchange will not support CLI for TAX functions in case of R2-R2 and R2-ISUP transit calls. In addition to exchange configurations, the incoming R2 trunk groups from parented stations should have CAMA=YES with TGP-TYP=ORD.

(vii) For ISDN subscribers, even if the subscriber has subscribed for CW facility, "Call-Hold" should also be subscribed as the facility works through "HOLD" and "RETRIEVE" messages.

10.3.3. Other Precautions to be taken during Operation & Maintenance of the Exchange

i) When it is required to make IOP out of service, INIT-IOP:2,1; should be used. It is advised not to make the IOP out using command PUT/FRC-SWU-OOS unless IOP is being synchronised.

ii) Check the status of the system daily by using CRP command DISPL-SYS-ALL; take corrective action for the faulty units.

iii) Do not give TST-TRM for different type of trunks (OG,IC & BW) at the same time in the same command..

iv) For incoming calls (Terminating as well as Transit), the charge rate number should have initial charge as '0'.

v) Take ed & bd backups daily and tf & bc back up by weekly.

vi) The system parameter MIN-SUBS-DIALS should have value greater than or equal to the length of exchange code. e.g., if the exchange code is 7262, the parameter value should be at least '4'.

vii) While displaying traffic reports related to hunt groups, trunks & routes, the entry against 'MOD-NO' parameter in "DISPL-TRF-RPT" command should be 'AM'.

10.3.4. Known Constraints and Possible Alternatives

i) While creating a trunk group, more than 40 trunks should not be given at a time. If more than 40 trunks are required in a trunk group, trunks can be added using ADD-TRK commands in the existing trunk group.

ii) The status of more than 40 trunks cannot be displayed at a time in the same command. The range of terminals given in DISPL-TRM-STATUS should not be more than 40. Alternatively, the command DISPL-TRCNT-OOS can be used to know the breakup of more than 40 trunks. After that, DISPL-TRM-ALL can be used to find out the listing of trunks with a specific status.

iii) In case of more than 100 trunks, MOD-TGP-CHAR does not work. Command is rejected with suitable error message. To modify the characteristics, the no. of trunks should be reduced to ≤100. After modification, the deleted trunks should be added.

iv) In few cases, modification commands for subscriber or Trunk Group Characteristics may fail with suitable error message, prompting the user for corrective measures. In such cases, the subscriber or trunks should be attempted once again to make them out of service.

Appendix - A

Test-Sets

I. TEST SET NUMBER

Test-Set Numbers are used for performing various maintenance tests on the system. Test-Set Numbers determine the type of tests to be performed

Test-Set Numbers have been divided as follows :

1. Test-Set Numbers 100 to 199 for Lines. Used in TST-TRM command.
2. Test-Set Numbers 200 to 299 for Trunks. Used in TST-TRM and TST-TGP commands.
3. Test-Set Numbers 300 to 399 for Service Circuits. Used in TST-SRV command.
4. Test-Set Numbers 400 to 499 for Digital Trunks. Used in TST-DTK command.
5. Test Set Numbers 500 to 599 for PHC terminals. Used in TST-TRM command.
6. Test Set Numbers 600 to 699 for BRI/PRI links. Used in TST-TRM command.
7. Test-Set Numbers 1000 to 2000 for routining Switch Units. Used in TST-SWU command.**

** Not available presently.

Trunk Offer test for trunks and reversal check for lines is done only for terminations configured as operator trunks or CCBs or PBX with reversal facility.

II. LIST OF TEST-SETS

A. List of test sets for Analog lines (TST-TRM)

1. *Test-Set No.102 : Outside Plant Open Loop Tests on Lines.*

    1. Interference Voltage Test
    2. Insulation Resistance Test
    3. Capacitance Test (including instrument capacitance)

    Time Estimate : 120 secs.

2. *Test-Set No. 103 : Exchange Side Tests on Lines (Signalling + Codec)*

1. Line Circuit Current Limiting Circuitry Check (test 1)
2. Line Circuit Current Limiting Circuitry Check (test 2)
3. Origination Test
4. Digit Reception Test
5. Flash Test
6. Disconnection Test
7. Answer Test
8. Ringing Test
9. Ring Trip Test
10. Reversal Detection
11. Codec Analog to Digital Test
12. Codec Digital to Analog Test

Time Estimate : 40 secs.

3. *Test-Set No. 104 : Exchange Side Tests on Lines (Signalling)*

1. Line Circuit Current Limiting Circuitry Check (test 1)
2. Line Circuit Current Limiting Circuitry Check (test 2)
3. Origination Test
4. Digit Reception Test
5. Flash Test
6. Disconnection Test
7. Answer Test
8. Ringing Test
9. Ring Trip Test
10. Reversal Detection

Time Estimate : 30 secs.

4. *Test-Set No. 105 : Exchange Side Tests on Lines (Codec)*

1. Codec Analog to Digital Test
2. Codec Digital to Analog Test

Time Estimate : 10 secs.

5. *Test-Set No. 106 : Outside Plant Open Loop + Exchange Side Tests on Lines (Signalling + Codec)*

1. Interference Voltage Test
2. Insulation Resistance Test
3. Capacitance Test (including instrument capacitance)
4. Line circuit current limiting circuitry check (test 1)
5. Line circuit current limiting circuitry check (test 2)
6. Origination Test
7. Digit Reception Test
8. Flash Test
9. Disconnection Test
10. Answer Test
11. Ringing Test
12. Ring Trip Test
13. Reversal Check
14. Codec Analog to Digital Test
15. Codec Digital to Analog Test

Time Estimate : 160 secs.

6. *Test Set No 107 : Closed loop Tests on lines.*

1. Dial Characteristic Test
2. Loop Current Test
3. Loop Resistance Test

Time Estimate : Can't be estimated.

B. **List of test-sets for Analog trunks (TST-TRM)**

1. *Test-Set No. 201 : Exchange Side Tests on Trunks. (Signalling)*

1. Line circuit current limiting circuitry check (test 1)
2. Line circuit current limiting circuitry check (test 2)
3. Seizure Test
4. Digit Outpulsing or Reception Test
5. Answer Test

6. Metering Pulse Test
7. Trunk Offer Test
8. Clear Forward Test
9. Clear Back Test

Time Estimate : 10 secs.

2. *Test-Set No. 202 : Exchange Side Tests on Trunks. (Signalling + Codec)*

1. Line circuit current limiting circuitry check (test 1)
2. Line circuit current limiting circuitry check (test 2)
3. Seizure Test
4. Digit Outpulsing or Reception Test
5. Answer Test
6. Metering Pulse Test
7. Trunk Offer Test
8. Clear Forward Test
9. Clear Back Test
10. Codec Analog to Digital Test
11. Codec Digital to Analog Test

Time Estimate : 15 secs.

3. *Test-Set No. 203 : Answering Circuit Tests on Outgoing Trunks.*

1. Connection to Answering Circuit.
2. Tone Detection.
3. Noise Check. (4 wire trunks)

4. *Test-Set No. 204 : Codec Tests on Trunks*

1. A to D Conversion
2. D to A Conversion

C. **List of test-sets for service circuits (TST-SRV)**

1. *Test-Set No. 301 : Loop Back Test on MF/DTMF Receivers.*
    1. Loop Back at Time Switch
    2. Test for All Frequencies

    Time Estimate : 4 secs
2. *Test Set No 302 : Loop Back Test on MF/DTMF Receivers.*
    1. Loop Back at Time Switch
    2. Test for One Frequency
3. *Test-Set No. 303 : Loop Back Test on Tones.*
    1. Loop Back at Time Switch
    2. Test for One Tone
4. *Test-Set No. 304 : Loop Back Test on Tones.*
    1. Loop Back at Time Switch
    2. Test for All Tones

D. **List of test-sets for digital trunks (TST-TRML-CARD)**

1. *Test-Set No. 401 : Tests on DTS Card*
    1. Interface Signal Test (TUC-DTS)
    2. Pattern Insertion Extraction Test (TUC Front-End loopback)
    3. Pattern Insertion Extraction Test (HDB3 loopback)
    4. FAS Logic Test
    5. FAS Alarm Logic Test
2. *Test-Set No. 402 : Tests on DTC Card*
    1. Return Direction Signalling Test
    2. Go Direction Signalling Test (type1)
    3. Go Direction Signalling Test (type2)
    4. MFAS Logic Test
    5. MFAS Alarm Logic Test
    6. FIFO Test

3. *Test-Set No. 403 : Tests on DTS+DTC (All) Card*
    1. Interface Signal Test (TUC-DTS)
    2. Pattern Insertion Extraction Test (TUC Front End Loopback)
    3. Pattern Insertion Extraction Test (HDB3 Loopback)
    4. FAS Logic Test
    5. FAS Alarm Logic Test
    6. Return Direction Signalling Test
    7. Go Direction Signalling Test (Type1)
    8. Go Direction Signalling Test (Type2)
    9. MFAS Logic Test
    10. MFAS Alarm Logic Test
    11. FIFO Test
4. *Test-Set No. 404 : Tests on DTS+DTC (PIE) Card*
    1. Pattern Insertion Extraction Test (TUC Front End Loopback)
    2. Pattern Insertion Extraction Test (HDB3 Loopback)
5. *Test-Set No. 405 : Tests on DTS+DTC (FAS & MFAS) Card*
    1. FAS Logic test
    2. FAS Alarm Logic test
    3. MFAS Logic Test
    4. MFAS Alarm Logic Test
    5. FIFO Test
6. *Test-Set No. 406 : Tests on DTC (Signalling) Card*
    1. Return Direction Signalling Test
    2. Go Direction Signalling Test (type1)
    3. Go Direction Signalling Test (type2)

E. List of test set for PHC terminal (SHM)

The following test is carried out with command TST-TRM (Test set 502)

TEST SET = 502

S.No.	Test Name	Test No.	
1.	NDP_PSU_DRV	9	To check if the PSUs in the plane of the faulty unit are down. If both PSUs are down, diagnostics are not carried out.
2.	NDP_TRMLS_CNTCT	11	To try and access the PHC card's shared RAM to check that the PHCis accessible.
3.	NDP_SANITY_DRV	10	Dummy test, always a SUCCESS is returned.
4.	NDP_POWON_TRMLS	7	A message is sent to PHC, to make the PHC boot
5.	NDP_TRMLS_CNTCT	11	The PHC is contacted again to ensure that it has successfully completed the boot up process
6.	NDP_INIT_ALIGN_DRV	3	A loopback is created at TUC between the PHC trml under diagnostics & another healthy #7 terminal, and then level 2 alignment is tried on the loopback. If there is no free #7 terminal available or the nailup at TUC is unsuccessful, the test is still considered successful. Only if the level 2 alignment fails, the test fails.

F. Test details on digital cards (BRL/PRL)

The following test sets are carried out with command TST-TRML-CARD & TST-TRM.

S.No.	Test Set	Test No.	Test Details
1.	**605**	**16**	**Power on test on the BRL/PRL**
2.	606		**Test on interface on the exchange site/LT of BRL/PRL**
		1	B-Channel loopback test at LT end
		2	D-Channel loopback test at LT end
		3	Line activation/deactivation test
		7	IDEC functionality tet
		9	NT activation and deactivation test using TLC
		10	CRC generation recognition test using TLC
		12	TLC indication bit test or UID event detection test
		13	TLC-line loopback test
		16	Power-on test on the terminal card

S.No.	Test Set	Test No.	Test Details
3.	**607**		**Interface test towards exchange side(LT) of BRL/PRL**
		1	B-Channel loopback test at LT end
		2	D-Channel loopback test at LT end
		3	Line activation/deactivation test
		7	IDEC functionality test
		9	NT activation and deactivation test using TLC
		10	CRC generation recognition test using TLC
		12	TLC indication bit test or UID event detection test
		13	TLC-line loopback test
4.	**608**		**Test on U-S interface towards user**
		4	B-Channel loopback test with NT
		5	B and D-Channel loopback test with NT
		6	S-interface activation/deactivation test
5.	**609**		**External network condition test**
		19	Interface voltage (foreign potential test)
		20	Insulation resistance
		21	Insulation capacitance
6.	**610**		**Complete test on U/S interface**
		4	B-Channel loopback test with NT
		5	B and D-Channel loopback test with NT
		6	S-interface activation/deactivation test
		19	Interface voltage (foreign potential test)
		20	Insulation resistance
		21	Insulation capacitance

Note : *1. The TLC (Test Line Circuit) is a BRI interface in C-DOT DSS, which is free and configured as TLC. The circuit is used to simulate NT conditions to test the BRI interface.*

2. For PRI, only test sets 607 & 610 are valid.

3. TST-TRML-CARD command is used for Test sets 605 & 606 and valid for both BRL & PRL.

Appendix - B

Audit Sets

The audit sets and audits constituting them currently available in C-DOT DSS MAX are summarised in the table bnelow followed by a brief description of each

Audit #	Audit Name	MBM Config.			SBM Config.
		AM	CM	BM	SBM
1	AUD-OBFR-HANG	Y	Y	Y	Y
2	AUD-MBFR-HANG	Y	Y	Y	Y
4	AUD-MBFR-LINK	Y	Y	Y	Y
5	AUD-OBFR-ADDR	Y	Y	Y	Y
6	AUD-MBFR-ADDR	Y	Y	Y	Y
7	AUD-PCD-PDT	Y	Y	Y	Y
8	AUD-PCB-LINK	Y	Y	Y	Y
9	AUD-TMB-LINK	Y	Y	Y	Y
10	AUD-LOCK	Y	Y	Y	Y
11	AUD-CLEAR	Y	Y	Y	Y
12	AUD-TM	Y	N	N	Y
13	AUD-UNIT-STATUS	Y	N	Y	Y
14	AUD-ETRNL	N	N	Y	Y
15	AUD-STALONE-CCM-STATUS	N	N	N	Y
16	AUD-SANITY	Y	Y	Y	Y
17	AUD-COUP	N	N	Y	Y
18	AUD-HANG	N	N	Y	Y

Audit #	Audit Name	MBM Config.			SBM Config.
		AM	CM	BM	SBM
19	AUD-TIC-SWOVR	N	N	Y	Y
20	AUD-REF-MEM	N	N	Y	Y
21	AUD-FRETS	N	N	Y	Y
22	AUD-RMS-ROUTE	N	N	Y	Y
23	AUD-FIX-LINK	N	N	Y	Y
24	AUD-RES-COUNT	N	N	Y	Y
25	AUD-RES-STATUS	N	N	Y	Y
26	AUD-LOGIN	N	N	Y	Y
27	AUD-OVL	N	N	Y	Y
33	AUD-FILE-ALM	Y	N	N	Y
34	AUD-ADP-ALM	Y	N	N	Y
35	AUD-CCM-STATUS	Y	N	N	Y
37	AUD-CCM-MODSTAT	Y	N	N	Y
38	AUD-CMCM-MOD	Y	N	N	Y
39	AUD-WPROT	Y	Y	Y	Y
41	AUD-SS-HANG	N	Y	N	N
42	AUD-CHNL-HANG	N	N	Y	N
43	AUD-TERM-BLK	Y	N	N	N
44	AUD-ALM	Y	N	N	Y

Audits Description

1. AUD-OBFR-HANG

The ordinary buffer hanging audit goes through the list of all ordinary buffers. It finds out the owner of those buffers which are busy. After determining the owner of the buffer it determines if the owner exists in the system. If the owner doesn't exist it de-allocates the buffer.

2. **AUD-MBFR-HANG**

The hanging message buffer audit determines the owner of every buffer that is found busy in the pool of message buffers and then determines whether the owner is still present in the system. It the owner is found to have been terminated it releases the buffer, making it available to the system.

10. **AUD-LOCK**

This audit checks that the area that should be locked is locked. If it is not then it is locked.

11. **AUD-CLEAR**

This audit involves sending to all the eternal processes, a Maintenance Clear message so that they recreate themselves and in the process release all resources inadvertently held by them.

12. **AUD-TM**

The terminal maintenance audit has been designed to maintain consistency of various counts maintained by GFRH.

The audit runs for all entities (trunks, lines etc.) except when invoked by roll back/rec-routine, in which case it runs on the particular entity on which GFRH encountered an error.

The audit is triggered by :

1. AP Boot
2. GFRH roll back/rec-routine
3. Operator
4. Idle time

13. **AUD-UNIT-STATUS**

This audit involves comparing the status map of all the units of the BM as maintained by BMCM against that maintained by the units. In case of a discrepancy or wrong status being present at either end, it tries to correct it. If it is unable to correct it, it sends a message to BMCM to this effect.

14. **AUD-ETRNL**

Involves getting the eternal process identities from the peripheral units (including BMs), which were supplied to it at the time of initialisation. If some unit sends a wrong eternal process identity, it is supplied with the correct identity.

15. **AUD-STALONE-CCM-STATUS**

This involves comparing the unit status map maintained by BMCM with the one maintained by CCM. If there is a discrepancy between them the data structure with a valid status is believed and the other is corrected. If both the data structures have valid values the BMCM data structure is believed and CCM data structure is corrected.

In this case to ensure that the right decision has been taken, the AUD-UNIT-STATUS audit is initiated.

The audit however, avoids auditing the status of the units whose present status in mbc-bm-unit is CCS-EXT-RECENTLY.

16. **AUD-SANITY**

The audit of the sanity map (MSM-MODULE-SANITY-MAP) is for validating the list of units from which a sanity punch is expected, and the list of units from which the sanity punch is not expected. It involves consulting the status map maintained by BMCM (mbc-bm-unit). If there is a conflict between an entry in the status map and one in the sanity map, the status map is believed to be correct and the sanity map is corrected accordingly.

17. **AUD-COUP**

This audit involves determining whether a TP or a CMR, existing in the BP, has a right to be present in the system. If it shouldn't be present in the system, it is sent a maintenance clear. (It involves determining that in the particular phase of the call it is in communication with the processes that it should be and that it has not been in that phase of the call for a duration greater than the allowed duration.) and it is present it is sent a maintenance clear or deleted straight- away depending on the situation

If a process is not supposed to be present in the system involved.

18. **AUD-HANG**

This audit involves determining whether a call processing dynamic process has the right to exist in the system. It is different from AUD-COUP, in the sense that the only thing it takes into account is the time since the process has been last scheduled for if it hasn't been scheduled than the time interval since the time of it's creation). If this period happens to be greater than the allowed period the process is deleted. However, it is ensured that the process is not in the SLEEP state (in which case the process is allowed to exist for an indefinite period of time). The audit also tries in release the resources that were allocated by the process which is deleted.

19. **AUD-TIC-SWOVR**

At the time of TIC switch over, quite a few discrepancies relating to the status of the terminal and the phase of the call are expected. This audit tries to remove these discrepancies. These discrepancies arise because the two TICs run a synchronously. As a result of this during TIC switch over there is a possibility of some events/messages being missed (or duplicated), which might lead to a mismatch in the status of a terminal as perceived by TIC vis-a-vis that maintained in reference memory. It is the endeavour of this audit to correct some discrepancies. This audit corrects only those discrepancies which can occur as a result of TIC switch over. If it finds a mismatch in the status of the terminal which can't occur as a result of tic switch over it is left to the reference memory audit to correct.

20. **AUD-REF-MEM**

This audit involves validating the status of the terminal found in the Reference Memory. It validates the busy status, llo status and the blocked status of the terminal maintained in reference memory. It ignores the login bit in the busy status which it leaves for the AUD-LOGIN audit to validate.

21. **AUD-FRETS**

This audit is used for validating the status of the time-slots. It involves auditing a data structure of list of free time-slots versus another data structure which contains the status of all the time-slots.

Time-slot here refers to intra-BM time-slots.

23. **AUD-FIX-LINK**

This audit involves validating the linked lists of free global and local telephony resources. This audit detects and corrects broken links of the doubly linked list maintained by data base. After this audit has been run AUD-RES-COUNT should be run to correct the count of free available resources.

24. **AUD-RES-COUNT**

This audit validates the count of free resources. It first validates the linked list of free resources and then determines the number of free resources.

25. **AUD-RES-STATUS**

This audit validates the status of the resources present in the data base data structures. It should be run only after the audit. AUD-FIX-LINK has been run and should be followed by the audit AUD-RES-COUNT.

26. **AUD-LOGIN**

The login audit validates the status of the login bit in the terminal status field of reference memory. The audit determines whether the terminal whose login status is being audited is an operator line.

If it is not an operator line it checks that the login bit of the status field for that terminal should not be set. If it is set it resets it.

If it is an operator line it interacts with ORP and uses the data base (to determine whether it is free/busy in the resource list) to audit the login status of the operator line.

27. **AUD-OVL**

The audit on overload checks and corrects the consistency of the internal data structures of OCP, and ensures that the control actions taken by OCP are appropriate. Particularly, the possibility of the system remaining under overload control without ant actual overload is eliminate.

Check consistency of the scheduler - in overload state, OCP should have a timer running and the task-wise data should be consistent. Any discrepancy is non-recoverable and hence OCP is rolled back.

From scheduler data, the control level table is reconstructed and checked against the one maintained by OCP. If inconsistent, the OCP table is corrected.

The current control actions are corrected by mailing new messages to TICs and SCP.

34. **AUD-ADP-ALM**

Alarm audit audits the list of switch alarms, power alarms and module alarms against the actual status and corrects the list on IOP and ADP.

41. **AUD-SS-HANG**

This audits the space slots on the CM to BM Bus. Space slots hanging even after completion of calls are released by this audit at SSC after checking for the existence of Call Manager (CMR) in the originating/terminating BM.

42. **AUD-CHNL-HANG**

This audits the channels on DTKs connecting remote BM to the host exchange. Channels which may not get released even after completion of the call are released by checking for the existence of the process which got the channel allocated.

43. **AUD-TERM-BLK**

This audit audits the blocking ratio for the terminating calls for a BM against the actual overload level of the BM.

44. **AUD-ALM**

The objective of having Alarm Audits is to that the alarms in the system are consistent with the actual System Status.

The following are the audits available as Alarm Audits -

Alarm Status Map in AP vs Alarm Status Map in IOP

Unit Status in AP vs Alarms in AP

Audits for counts in AP vs Alarms in AP

Audits for Overload in Modules Vs Alarms in AP

Audits for Power Supply Status in various Modules vs Alarms in AP

Module Status in AP vs Alarms in AP

Battery Status in AP vs Alarms in AP

Alarms in ADP vs Alarms in AP

Appendix - C

List of Card IDs in Switch Alarms & Power Alarms for MAX-XL

(a) LIST OF CARD IDS AND THEIR ASSOCIATED CARD SLOTS

Number in brackets under physical frame indicate frame number from top in the same module cabinet.

BASE MODULE (BM-XL)

Sl. No.	Switch unit or Unit-ID in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in BM Cabinet	Card Slot
1.	BP-0	BPC/HPC*	0	BPU(5)	12
2.	BP-1	BPC /HPC	0	BPU(5)	15
3.	MU-0	BME	0	BPU(5)	7
4.	MU-1	BME	0	BPU(5)	20
5.	BMS-0	MSC or HMS MSD AFB	0 1	TSU(6)	9 8 7
6.	BMS-1	MSC or HMS MSD AFB	0 1	TSU(6)	18 19 20
7.	TSC-0	TSC TSS TSM TSI	0 1 2 -	TSU(6)	12 13 11 10
8.	TSC-1	TSC TSS TSM	0 1 2	TSU(6)	15 14 16

Sl. No.	Switch unit or Unit-ID in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in BM Cabinet	Card Slot
		TSI	-		17
9.	SCIC-0	SCIC(TIC)	0	TSU(6)	6
10.	SCIC-1	SCIC(TIC)	0	TSU(6)	21
11.	MFC1	MFC	0	TSU(6)	5
12.	MFC2	MFC	0	TSU(6)	4
13.	MFC3	MFC	0	TSU(6)	22
14.	MFC4	MFC	0	TSU(6)	23
15.	TOGC-0	TGA	0	TSU(6)	3
16.	TOGC-1	TGA	0	TSU(6)	24
17.	ANNC	ANN	0	TU(1)	3
18.	TTC	TTC	0	TU(4)	24
19.	TI01-0	TIC ISP/SPC TUI	0 1 -	TU(1)	11 12 13
20.	TI01-1	TIC ISP/SPC TUI	0 1 -	TU(1)	15 16 14
21.	TI05-0	TIC ISP/SPC TUI	0 1 -	TU(2)	11 12 13
22.	TI05-1	TIC ISP/SPC TUI	0 1 -	TU(2)	15 16 14
23.	TI09-0	TIC ISP/SPC TUI	0 1 -	TU(3)	11 12 13
24.	TI09-1	TIC ISP/SPC	0 1	TU(3)	15 16

Sl. No.	Switch unit or Unit-ID in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in BM Cabinet	Card Slot
		TUI	-		14
25.	TI13-0	TIC ISP/SPC TUI	0 1 -	TU(4)	11 12 13
26.	TI13-1	TIC ISP/SPC TUI	0 1 -	TU(4)	15 16 14
27.*	ADC	SMC	0	ADP (Not in BM cabinet)	SMC card of ADP
28.**	TI05-0	TUC TUI	0 -	DTU(2)	11 12
29.**	TI05-1	TUC TUI	0 -	DTU(2)	16 15

* Applicable in case of Single Base Module (SBM-XL) configuration only.

** Applicable if Digital Trunk Unit is equipped in the 2nd frame.

Note :

A maximum of 16 terminal unit frames including digital trunk frames can be equipped in a Base Module and the Line Modules associated with it. Their unit-ids vary from TI01-0/1 to TI16-0/1. However only TI01- 0/1, TI05-0/1, TI09-0/1 & TI13-0/1 which are normally equipped in a BM are shown in the chart. For concentration TICs i.e. TI02 to TI04, TI06 to TI08, TI10 to TI12 and TI14 to TI16 equipped in the Line Modules, information on rack no. and physical frame no. of any TI may be taken using 'displ-mod-info' command. Cards involved in these Switch Modules, their card IDs and card slots in that frame are exactly same as that of any TU frame equipped in a BM.

ADMINISTRATION MODULE AM (AM-XL)

Sl. No.	Switch unit or Unit-ID in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in CM Cabinet	Card Slot
1.	ADC	SMC	0	ADP (not in CM cabinet)	SMC Card of ADP
2.	AP-0	BPC/ HPC *	0	APU (6)	12
3.	AP-1	BPC/ HPC *	0	APU (6)	15
4.	MU-0	BME	0	APU (6)	11
5.	MU-1	BME	0	APU (6)	16

***** **if used**

CENTRAL MODULE CM (CM-XL)

Sl. No.	Switch unit or Unit-id in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in CM Cabinet	Card Slot
1.	CMS1	HMS	0	APU (6)	10
2.	CMS2	HMS	0	APU (6)	17
3.	CMS3	HMS	0	APU (6)	7
4.	CMS4	HMS	0	APU (6)	20
5.	SSC-0	BPC/HPC	0	SCU (5)	12
6.	SSC-1	BPC/HPC	0	SCU (5)	15
7.	MU-0	BME	0	SCU (5)	6
8.	MU-1	BME	0	SCU (5)	21
9.	SSBID-0	CBX	0	SCU (5)	8
10.	SSBID-1	CBX	0	SCU (5)	19
11.	CLK-0	NSC/CCK	0	SCU (5)	9/5
12.	CLK-1	NSC/CCK	0	SCU (5)	16/22

Sl. No.	Switch unit or Unit-id in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in CM Cabinet	Card Slot	
13.	SWC1-0	PSS	0	SSU0 (2)	5	
	SWC2-0	PSS	0	"	6	
	SWC3-0	PSS	0	"	7	
	SWC4-0	PSS	0	"	8	BUS-0
	SWC5-0	PSS	0	"	9	COPY0
	SWC6-0	PSS	0	"	10	
	SWC7-0	PSS	0	"	11	
	SWC8-0	PSS	0	"	12	
	SWC1-1	PSS	0	"	15	
	SWC2-1	PSS	0	"	16	
	SWC3-1	PSS	0	"	17	
	SWC4-1	PSS	0	"	18	BUS-0
	SWC5-1	PSS	0	"	19	COPY1
	SWC6-1	PSS	0	"	20	
	SWC7-1	PSS	0	"	21	
	SWC8-1	PSS	0	"	22	
	SWC9-0	PSS	0	SSU1(3)	5	
	SWC10-0	PSS	0	"	6	
	SWC11-0	PSS	0	"	7	
	SWC12-0	PSS	0	"	8	BUS-1
	SWC13-0	PSS	0	"	9	COPY0
	SWC14-0	PSS	0	"	10	
	SWC15-0	PSS	0	"	11	
	SWC16-0	PSS	0	"	12	

Sl. No.	Switch unit or Unit-id in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in CM Cabinet	Card Slot	
	SWC9-1	PSS	0	"	15	
	SWC10-1	PSS	0	"	16	
	SWC11-1	PSS	0	"	17	
	SWC12-1	PSS	0	"	18	BUS-1
	SWC13-1	PSS	0	"	19	COPY1
	SWC14-1	PSS	0	"	20	
	SWC15-1	PSS	0	"	21	
	SWC16-1	PSS	0	"	22	
14.	IFC1	PSM/ESM	0	BTU0 (1)	5	
	IFC2	PSM/ESM	0	"	6	
	IFC3	PSM/ESM	0	"	7	
	IFC4	PSM/ESM	0	"	8	
	IFC5	PSM/ESM	0	"	9	
	IFC6	PSM/ESM	0	"	10	
	IFC7	PSM/ESM	0	"	11	BUS-0
	IFC8	PSM/ESM	0	"	12	
	IFC9	PSM/ESM	0	"	15	
	IFC10	PSM/ESM	0	"	16	
	IFC11	PSM/ESM	0	"	17	
	IFC12	PSM/ESM	0	"	18	
	IFC13	PSM/ESM	0	"	19	
	IFC14	PSM/ESM	0	"	20	
	IFC15	PSM/ESM	0	"	21	
	IFC16	PSM/ESM	0	"	22	
	IFC17	PSM/ESM	0	BTU1(4)	5	

Sl. No.	Switch unit or Unit-id in CRP	Cards Involved	Card IDs in Diagnosis Reports	Physical Frame in CM Cabinet	Card Slot	
	IFC18	PSM/ESM	0	"	6	
	IFC19	PSM/ESM	0	"	7	
	IFC20	PSM/ESM	0	"	8	
	IFC21	PSM/ESM	0	"	9	
	IFC22	PSM/ESM	0	"	10	
	IFC23	PSM/ESM	0	"	11	
	IFC24	PSM/ESM	0	"	12	
	IFC25	PSM/ESM	0	"	15	
	IFC26	PSM/ESM	0	"	16	
	IFC27	PSM/ESM	0	"	17	
	IFC28	PSM/ESM	0	"	18	
	IFC29	PSM/ESM	0	"	19	
	IFC30	PSM/ESM	0	"	20	
	IFC31	PSM/ESM	0	"	21	
	IFC32	PSM/ESM	0	"	22	

Note :

i.) Space Switch Plane SS-0/1 consists of the following switch units (UNIT IDs) and if DGN-SWU on SS-0/1 is conducted, then all the units involved in the switch plane will be tested.

1) SSBID-0/1
2) CLK-0/1
3) SWC1-0/1
4) SWC2-0/1
5) SWC3-0/1
6) SWC4-0/1
7) SWC5-0/1
8) SWC6-0/1
9) SWC7-0/1
10) SWC8-0/1

For physical slots, refer to corresponding switch units in the chart.

11)	SWC9-0/1
12)	SWC10-0/1
13)	SWC11-0/1
14)	SWC12-0/1
15)	SWC13-0/1
16)	SWC14-0/1
17)	SWC15-0/1
18)	SWC16-0/1

(b) **POWER SUPPLY UNITS FOR DIFFERENT FRAMES**

If any Power Supply Unit is failed in BM, LM or CM, the UNIT ID for which power alarm raised is reported in OOD and printer. Following chart gives power supply units and corresponding unit IDs for which power alarm is reported. The UNIT ID for which power alarm raised/changed will be referred here as PSU ID of the power supply unit involved in the alarm.

BASE MODULE BM-XL

Sl. No.	PSU ID in OOD/Printer	PSU Type	Physical Frame	Card Slot
1	BP-0	PSU II	BPU(5)	1
2	BP-1	PSU II	BPU(5)	25
3	BMS-0	PSU II	TSU(6)	1
4	BMS-1	PSU II	TSU(6)	25
5	TI01-0	PSU I	TU(1)	1
6	TI01-1	PSU I	TU(1)	25
7	TI05-0	PSU I	TU(2)	1
8	TI05-1	PSU I	TU(2)	25
9	TI09-0	PSU I	TU(3)	1
10	TI09-1	PSU I	TU(3)	25
11	TI13-0	PSU I	TU(4)	1
12	TI13-1	PSU I	TU(4)	25

In case of Line Modules, PSU IDs reported depend upon the corresponding TIC-id equipped in the frame.

CENTRAL MODULE INCLUDING AM Administrative Module

Sl. No.	PSU ID in OOD/Printer	PSU Type	Physical Frame	Card Slot
1.	AP-0	PSU II-K05	APU(6 of CM)	1
2.	AP-0	PSU II-K05	APU(6 of CM)	3
3.	AP-1	PSU II-K05	APU(6 of CM)	23
4.	AP-1	PSU II-K05	APU(6 of CM)	25
5.	SSC-0	PSU II-K05	SSCU(5 of CM)	1
6.	SSC-1	PSU II-K05	SSCU(5 of CM)	25
7.	SWC1-0	PSU II-K05	SSU0(2 of CM)	1
8.	SWC2-0	PSU II-K05	SSU0(2 of CM)	3
9.	SWC1-1	PSU II-K05	SSU0(2 of CM)	23
10.	SWC2-1	PSU II-K05	SSU0(2 of CM)	25
11.	SWC9-0	PSU II-K05	SSU1(3 of CM)	1
12.	SWC10-0	PSU II-K05	SSU1(3 of CM)	3
13.	SWC9-1	PSU II-K05	SSU1(3 of CM)	23
14.	SWC10-1	PSU II-K05	SSU1(3 of CM)	25
15.	IFC1	PSU II-K05	BTU0(1 of CM)	1
16.	IFC2	PSU II-K05	BTU0(1 of CM)	3
17.	IFC9	PSU II-K05	BTU0(1 of CM)	23
18.	IFC10	PSU II-K05	BTU0(1 of CM)	25
19.	IFC17	PSU II-K05	BTU1(4 of CM)	1
20.	IFC18	PSU II-K05	BTU1(4 of CM)	3
21.	IFC25	PSU II-K05	BTU1(4 of CM)	23
22.	IFC26	PSU II-K05	BTU1(4 of CM)	25

In case of power supplies in slots 3 & 23 (slave PSU) of SSCU frame, no alarm will be reported.

Appendix - D

Limits for TTC Measurements

The limits of insulation resistance, loop resistance and capacitance for different line categories of subscribers.

The line category of the subscriber has to be assigned depending on the values of insulation resistance capacitance and loop resistance. These may vary depending on the instrument connected. Normally category 2 can be used for DTMF instruments. The limiting values for different categories are listed below.

Category	Insulation Resistance (Low) in kohms			Insulation Resistance (High) in kohms		
	a & gnd	b & gnd	a & b	a & gnd	b & gnd	a & b
1	20.0	20.0	20.0	20000	20000	20000
2	20.0	20.0	20.0	20000	20000	20000
3	20.0	20.0	20.0	20000	20000	20000
4	20.0	20.0	20.0	20000	20000	20000
5	20.0	20.0	20.0	20000	20000	20000
6	20.0	20.0	20.0	20000	20000	20000
7	20.0	20.0	20.0	20000	20000	20000

Category	Capacitance (micro farade)		Loop Current (milli Amps)		Loop Resistance (ohms)	
	LOW	HIGH	LOW	HIGH	LOW	HIGH
1	1.5	3.0	20.0	36.0	100.0	2400
2	0.15	3.0	15.0	36.0	100.0	3200
3	1.5	3.0	20.0	36.0	75.0	2400
4	0.15	3.0	15.0	36.0	75.0	3200
5	1.5	4.0	15.0	36.0	100.0	3200
6	0.15	4.0	13.0	36.0	100.0	3600
7	1.5	8.0	20.0	36.0	100.0	2400

Note

If external voltage on the line is more than 5.99 volts. no other tests will be conducted.

Limits for Dial Tests

5th closing high	60 msec
5th closing low	16 msec
5th opening high	100 msec
5th opening low	42 msec
Dial Ratio high	4
Dial Ratio low	1
Dial Speed high	12 IPS
Dial Speed low	8 IPS

Appendix - E

Switch Units Required for Diagnostics of an Unit

Unit to be diagnosed	Switch units required for diagnosis
TIC with mate active	All units in TSU in duplex
TIC with mate faulty	At least one copy of all units in TSU active
SCIC	Duplex BMS
TSC	BMS and SCIC in duplex
Duplex TOGC	BMS, SCIC, TSC in duplex
Simplex TOGC	At least one unit of BMS, SCIC and TSC active
MFC	At least one copy of all units in TSU active
TTC	At least one copy of TIC in concerned TU
ANN	At least one copy of TIC in concerned TU
SWC (SS)	Standby SSC
MU in BP/AP/SSC	Standby BP/AP/SSC respectively

सी-डॉट C-DOT **System Practices**	**COMMENTS**

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