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STUDY OF FIBCOM STM-1 EQUIPMENT (Part – I)

INTRODUCTION

The FIBCOM FOCUS AC1 product family is part of the FIBCOM product range for access and regional telecommunication transmission networks based on the standards and recommendations on SDH under technical collaboration from TELLABS Denmark. The FIBCOM FOCUS AC1 is a product family where STM-1 and STM-4 Add/Drop Multiplexers (ADM) and Terminal Multiplexers (TM) are implemented on a single module giving VC-4, VC-3 and VC-12 connectivity. This provides a cost efficient solution especially in small nodes, where the requirement is to add/drop a limited number of 2Mbit/s signal. The number of tributary signals can be increased to full capacity by adding additional tributary modules. Management of the FIBCOM FOCUS AC1 can be performed from a local craft terminal, from a network element manager or from a network management system (FIBCOM FOCUS NM2100).

FEATURES:

- Add/drop, Terminal multiplexer and cross-connect family.
- VC-12, VC-3, VC-4 level connectivity.
- Up to 126 x 2 Mb/s or 6 x 34 Mb/s, 4 x 140 Mb/s or 4 x STM-1 tributaries in one sub-rack.
- Advanced Network and Element Management.
- Compact and ultra low power consumption.
- High reliability with extended temperature range (up to 55^0).
- Flexible architecture with a large suit of mechanical solutions.
- Integrated support of ATM and IP over SDH.
- Full Synchronization status messaging support with protection switch on synchronization sources.

MODULARITY:

- ADM/TM Module

Tributary Modules:

- 21 x 2 Mb/s interface board (TEX-1)
- 1 x 34 Mb/s interface board (TEX-31)
- 3 x 34 Mb/s interface board (TEX-33)
- 1 x 140 Mb/s interface board (TEX-4)
- 1 x STM-1 interface board (LI)
- 2 x STM-1 interface board (RI)
- 1 x STM-1 ATM interface board (ATEX)

The core of the transport system and of the AC1 in general, is the ADM/TM module. This one module holds a complete Add-Drop Multiplexer with 21 x 2 Mbit/s tributary interfaces. All the 21 E1s are normally terminated from the system connection field to DDF (Digital Distribution Frame) using 120-Ohm impedance cable. Depending on the selection of components for the module in the production phase, the module can appear in a number of variants. One group of these is the TM module, which is basically an ADM module with only one aggregate interface mounted. For ADM1/TM1 aggregate interfaces can be all optical, all electrical or one of each. For ADM4/TM4 the aggregate interfaces are Optical. If more than 21 tributaries are needed this can be obtained by connecting TEX-1 modules on the TISI interface of the ADM module. A TEX-1 module adds extra 21 tributaries. If 34 Mbit/s, 140 Mbit/s or STM-1 tributary interfaces are needed, this can be obtained by connecting TEX-3 or TEX-4 modules respectively to the ADM/TM module for STM-1 electrical /optical tributaries. Depending on the equipment practice, the TISI signals are cabled from ADM/TM module to TEX module or are routed in a motherboard.

MANAGEMENT SYSTEM

Management/supervision from an Operations System (OS) is possible via four types of interfaces:

F-interface (Craft terminal interface).
Ethernet

Embedded Communication Channel (ECC)

QD2 interface according to SISA specs. (Optional)

As to the ECC channels one channel per STM-1 interface is available. The ECC may be transferred in:

1. DCCR bytes (D1 –D3) of regenerator section overhead.
2. DCCM bytes (D4-D12) of multiplexer section overhead.
3. The payload of a selectable VC-12.

Internal Management:

Internally the AC1 system is managed by means of a master controller on the ADM/TM module and slave controllers on the TRIB modules. The master controller contains a non-volatile memory for the application SW of the network element. This memory can contain two complete versions of the SW and download of new SW while in service is possible. Internal management communication between modules takes place via the C-Bus. An exception is the power supply module, which is either controlled (monitored) via the Qecb channel or via the PS-fault interface.

POWER SYSTEM

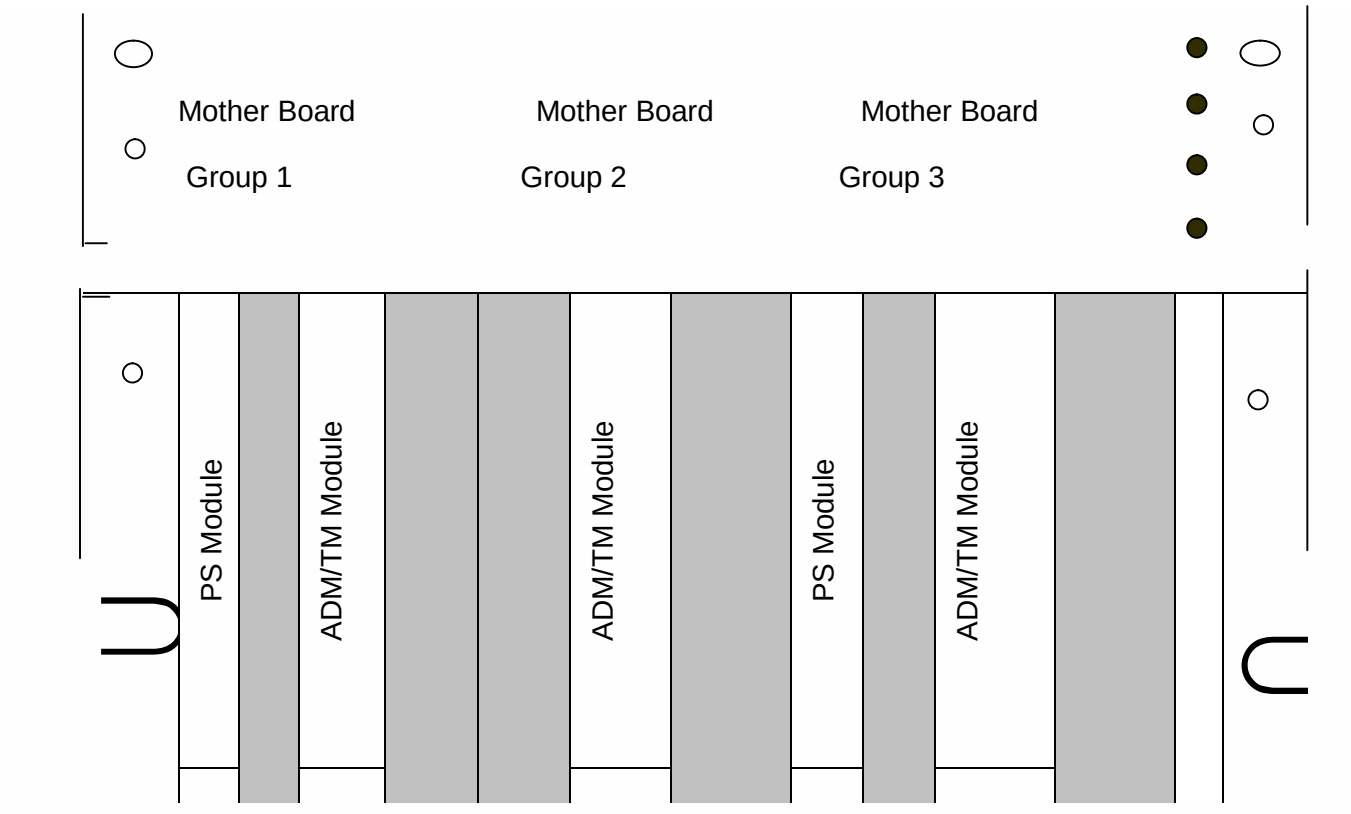
The customer can choose to use one of the two secondary inputs from the station or use one as main power supply and the other as protection supply in case the main supply fails. The power supply module converts secondary supplies to +5/0/-5 tertiary power. The power supply automatically switches from the main supply to the protection supply, if the main supply is below 36 V. The switching is completed within 500 m sec after the main supply has fallen below 36 V. The switching is revertive, that is, the input switch selects the main supply again if the voltage on the main supply increases to more than 40 V.

RACKS

The rack is designed according to ETSI specifications. The upper part of the rack is reserved for the RCF (Rack connection field). The racks are available in two sizes,. 600mm (W) 2200 mm (H) and 600 mm (W) 1600 mm (H). The rack can be equipped with up to four/five sub racks or two/three sub racks with rear cable access depending upon the amount of cables required. Safety earth connection is located at the top of the rack. On both left and right side, the rack is provided with connectors for antistatic bracelets. The rack is delivered with a rear plate.

SR1c Sub-rack Configurations

The SR1c consists of a mechanical frame, which can hold 1, 2 and 3 motherboard (MB) sections. Each motherboard section has a width, which is 1/3 of the total width. The sub rack can contain 1,2 or 3 network elements. A network element can consist of 1, 1.5, 2 and 3 motherboard sections. Cables perform interconnection of the motherboard sections. Each network element consists of an ADM/TM module and a number of tributary modules. The sub rack with motherboard groups 1, 2 and 3 is shown in the figure below.



Physically the modules can be inserted in the slots as indicated in the following table. The crosses indicate an allowed position.

Position Module	1	2	3+4	5+6	7	8	9+10	11+12	13	14	15+16	17+18	
TM/ADM											x		
LI1/RI1/TEX4			x	x			x	x					
TEX1, TEX1 resync.			x	x			x	x				x	S
TEX31			x	x			x	x				x	R
TEX33								x					C
PS	x	x			x	x			x	x			F

One NE in three Motherboard Groups

RACK CONNECTION FIELD

It provides the rack station alarm interface and distributes power to sub-racks. The RCF unit accommodates up to 4/3 AC1 sub-racks and one DTMF EOW.

RCF comprises two SECTIONS.

1. LED/ALARM section – CX –00007F.
2. Power supply section – CX – 00008F.

The function of the LED ALARM is to display the alarm generated by the system. Provision is made for display of alarms from 4 AC1 sub-racks at system connectors 02, 03, 04 and 05. The alarm signals are accessed from AC1 sub-racks through alarm cables. LED/ALARM section contains A, B and R alarm LEDs. The functions of A, B and R alarms are mentioned below.

Alarm	Colour	Function
A	Red	Critical alarm display
B	Yellow/Orange	Major alarm display
R	Green	Remind after acknowledgement of alarms

The function of the power supply section is to power the AC1 sub-racks and LED/ALARM section. The supply voltage is –48 V/60 V. Power supply section comprises of

A. Eight terminal points for power distribution to four AC1 sub-racks. Out of eight four are protection supply through power B. Supply for LED/ALARM section is through power C input.

B. Input. ON/OFF switch is provided to supply power to AC1sub-rack.

SUBRACK CONNECTION FIELD FOR THE SUBRACK SR1c

The sub rack is equipped with a connection field at the far right position where the power, local station alarms and Qecb from P-MUX are connected. Indication of rack alarms (LEDs), a battery power filter to protect against surge voltages and fuses for the battery voltages are placed in the sub rack connection field.

There is a switch for changing the upper LED between alarm indication function and power indication. The push button switch, accessible from the front, is used to reset the micro-controller system on all modules in the sub rack. Switches for setting Rack ID, sub rack ID and grounding option are located on the sub rack connection field (SRCF). –48 V DC power supply of protection and regular is terminated on the terminations field of sub rack connection field module. The ground terminal is terminated on the common terminal. If the protection supply is not available the negative terminal of protection and regular are looped to extinguish the alarm.

LEDs

LED Designation	LED colour	Function
P/S	Green	The LED indicates “Power on” .
R	Yellow	Default programmed to “Remind”
B	Red	Default programmed to “B-alarm, deferred”.
A	Red	Default programmed to “A-alarm, Prompt”.

LEDs on Modules.

All traffic /controller modules contains one red LED with the following states.

Red LED	State
Constantly Off	Normal condition (or no Power).
Slow flashing	The module performs a self-test or is in a state of hardware failure.
Fast flashing	The module is either booting or initializing Software.
Constantly On	The network element has a non-acknowledged A or B alarm, or hardware failure.

Slow flashing means approximately 1 Hz and fast flashing means approximately 4 Hz.
The master module contains a green LED.

Power Supply
The power supply is available in two configurations, one using red LED and one using green LED. The states of the power supply LEDs are shown in the following table.

Red LED	Green LED	State
Constantly Off	Constantly On	Normal condition
Slow flashing	Slow flashing	Service mode (alarm Off)
Fast flashing	Fast flashing	Malfunction in module detected during power-up or after system reset/power supply reset.
Constantly On	Constantly Off	Alarm condition (A or B)

Slow flashing means approximately 1 Hz and fast flashing means approximately 4 Hz.

REVIEW QUESTIONS

1). How many power supplies can be terminated at Rack connection field?

2). In one Sub rack how many motherboards can be accommodated?

3). In one Sub rack how many add/drop modules can be accommodated?

4). Draw a simple diagram by showing the 2 Mb electrical connections from system connection field to DDF.

Signature of the Candidate

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STUDY OF FIBCOM STM-1 EQUIPMENT (Part – II)

Wire Wrap Interface

The function of the wire wrap interface is to provide connection points to 4 sets of balanced 120 Ohm 2 Mbps bi-directional signals. This wire wrap interface is fixed on the rear motherboard of AC1 assembly at the tributary interface slots, 6-11 and 17-22. This interface is fitted in a one NE configuration. Refer figure below for slot identification. Slot 11 gives access to Sync. Interface at 2.048 Mb/s or2.048 MHz (T3 input and T4 output signals). Ethernet and C-Bus cables are connected to the connector ID No. 32 on the system connection field of the back plane of the motherboard.

Assumptions with reference to the diagram below:

1. The ADM/TM module (OEO, OE, EEE, EE etc) is mounted in position I as indicated on motherboard section 3.
2. Tributary extension module (TEX-1) is mounted in position II, III, IV, V, VI.

Connection details of wire wrap interface for clock

s2 Rx1, s2Rx/1 means SYNC 2 MHz-Rx1, Rx/1 which is Ext. Ref. Clock in 1

s2 Rx2, s2Rx/2 means SYNC 2 MHz-Rx2, Rx/2 which is Ext. Ref. Clock in 2

s2 Tx1, s2Tx/2 means SYNC 2 MHz-Tx1, Tx/2 which is T4 Clock out 1

s2 Tx2, s2Tx/2 means SYNC 2 MHz-Tx2, Tx/2 which is T4 Clock out 2

Connection details of wire wrap interface for Tributary

A 4 Nos. Trib input and output ports are available in each connector position 6-10 and 17-21 in MB-1, MB-2, MB-3 as shown in figure.

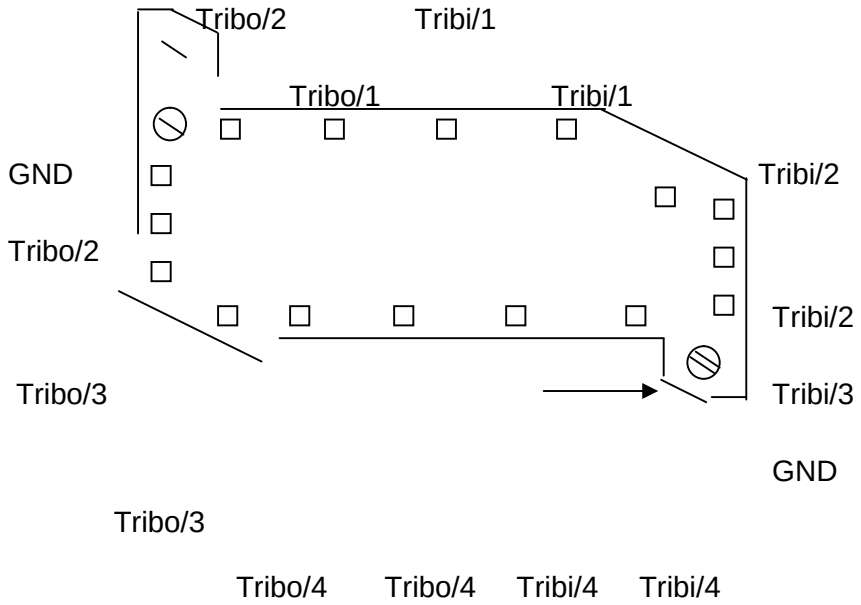
B Trib No. 21 from connector 22 of MB-3, Trib No. 63 from connector 22 of MB-2 and Trib No. 105 from connector 22 of MB-1 are available at Trib 1 input/output Wire Wrap pin positions as shown in figure.

C Trib No. 42 from connector 22 of MB-3, Trib No.84 from connector 22 of MB-2 and Trib No. 126 from connector 22 of Mb-1 are available at Trib 2 input/output Wire Wrap pin positions as shown in figure.

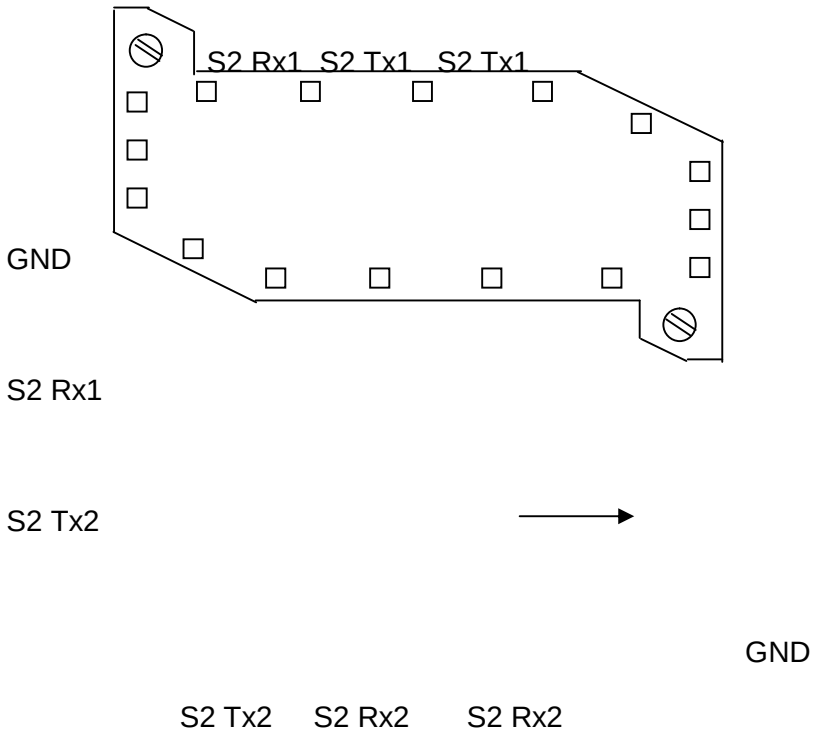
D Wire Wrap pin positions at output of Trib No. 1 is s2Tx1, at output of Trib No. 2 is s2Rx1, at output of Trib No. 3 is s2Tx2 and at output of Trib No. 4 is s2Rx2 in connector position 11 in MB-3, which are part of T3/T4 clock synchronization.

Connection of TISI Cable for 2 Mb/s wire wrap interface

From	To	For
MB-1 connector position 14	MB-3 connector position 4	TEX 1 slot No.3
MB-1 connector position 5	MB-3 connector position 14	TEX 1 slot No.5
MB-2 connector position 14	MB-3 connector position 15	TEX 1 slot No.9
MB-2 connector position 5	MB-3 connector position 3	TEX 1 slot No. 11



Connection diagram of Wire Wrap interface



Connection diagram for Clock

DTMF EOW MODULE

The DTMF EOW module provides network wide service phone functionality between telecommunication sites over a single (embedded) 64 Kbps channel. Special features like selective calling, group calling are provided in this system. In-band
DTMF is used for signaling. When the module is used in an SDH network the 64 kbps channel is normally placed in SDH section overhead byte E1 or E2. The DTMF module is a stand alone module housed in a separate cabinet to be mounted in a rack. The module contains a standard 2-wire phone interface for connecting an EOW phone handset. The figure below shows the DTMF EOW Module.

The following EOW interfaces are supported.

- 4 x Digital EOW channels, 126 Kbps propriety asynchronous channels.
- Two of the four channels can be configured as G.703 standard 64 Kb/S channels.
- 2 x Digital EOW channels 126 Kbps proprietary asynchronous channels for digital expansion. Physically located at the EOW EXP connector.
- 4-wire interface
- 2-wire EOW phone interface (POTS)
- 2-WIRE PSTN interface (optional)

The following management interfaces are supported.

- AUX alarm interface.

Three signals for control and monitoring the EOW module. When connected to the AUX signals the EOW module can be monitored and controlled by a NM2100 management system.

- F-interface.

A serial RS-232 interface for local SW download and testing. All normal set-up of phone number, ring protection etc is done from the F-interface.

The DTMF EOW module uses DTMF tones in the voice channel for call control. The call control protocol is proprietary. Phone numbers are five digits long in the range from 00000 to 99999.

Call Process

When the user lifts the phone off-hook on his DTMF EOW module, for example No. 12345, a dial tone is heard. The user only hears this dial tone. The voice line is not heard. The user is not on-line.

The user then enters the number to call, for example 56789, the dial tone is removed and the DTMF EOW module detects the entered number. The user is still not on-line.

The DTMF EOW module now sends a telegram in the voice channel. This telegram contains the number entered by the user, 56789, and the user's own number, 12345 as well as information that it is a normal call.

All DTMF-EOW modules always listen for DTMF –telegrams in the voice channel. The telegram sent will be ignored by all modules but the DTMF-EOW module with number 56789. This phone starts ringing and a telegram is sent back.

When No. 12345 receives this telegram it generates the ring back tone. If the called phone is lifted off-hook it will send another telegram and when the DTMF-EOW No. 12345 receives this telegram it will finally put the phone on-line.

Now the two DTMF-EOW modules are both on-line and may start their conversation.
There is only one voice channel in the DTMF-EOW system and any DTMF-EOW can access this voice channel. The DTMF-EOW network may have rings and branches but all voice signals are added to the single voice channel. The DTMF-EOW module connects to AC1thorugh the ADM module.

CABLING

Connect a cable WK-433X-02,5-11 between DTMF-EOW connector AUX and connector 13 on the AC1 as shown in the figure below.

Connect a cable WK-457Z-01,6-11 to DTMF EOW connector EOW1+2.

Connect the other end to connector 2 on the AC1 ADM.

Connect the open-end cable to –48 V on the RCF.

Signature of the Candidate

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EXPERIMENT: PROGRAMMING OF STM-1 SYSTEM

I. OBJECTIVE

To gain hands-on practice in programming STM-1 equipment using LCT (Local Craft Terminal)

II. Experimental Set-up

1. Equipment used in the experiment

i) Fibcom FOCUS AC1 STM-1 Equipment

ii) LCT (Local Craft Terminal) – Lap-top having the Software for configuring Fibcom's STM-1 equipment

2. Interconnection of equipment

STM equipment in SDH network are known as NEs (Network Elements). The NE connected to LCT locally is treated as 'Local NE'. All other NEs are treated as 'Remote NEs' .

The LCT is connected to 'Local NE' through F-interface of ADM card of the NE via RS 232 cable. LCT runs NM2100ct software, which is proprietary software of Fibcom to configure STM equipment.

3. Access method using LCT

Remote NEs can be accessed by LCT using 'NSAP (Network Service Access Point) address' of the NE. Once such access is established, the remote NE can be configured by transporting management information from the local NE.

Management information is transported between the NEs via a channel called the embedded control channel (ECC). The ECC can be contained in the DCC or DCM bytes of the SDH section overhead or a 2 Mb/s tributary unit (TU12) depending on how the NE is configured. It is important that the ECC of neighboring NEs are configured similarly.

Fibcom's Focus AC1 NEs are assigned the default NSAP address 490001< system/Node ID> 01 during production. The area address 490001 and the selector field part 01 of the NSAP address are always the same, only the system/node ID part is different. You need the Ethernet address to specify the NSAP address. Each Focus AC1 network element is assigned its own unique Ethernet address also known as Medium Access Control (MAC) address or LAN address during production. The Ethernet address is printed after the letters "EA" which stands for Ethernet address on the Main Board Label on the side of ADM/TM module. This can be noted and used appropriately in NSAP address.

III. Configuration of Local NE

1. Procedure to establish communication with a local NE using LCT

- Connect the Craft Terminal physically to the local NE.
- Start up the FOCUS NM 2100 ct.
- Select AC1 as the NE type. To do this
- Select File, choose NE type and specify AC1 in the type field of NE type window.
- Select the relevant embedded software version number. To do this
- Select File, NE type and select the version number in the version field of the NE type window.
- Connect to the local NE. To do this
- Select file, choose connect local NE.
- Enter the NE password in the Enter password field. Enter OK. AC1 Window appears. You can now communicate directly with the local NE.

2. Creating a model of the NE:

To be able to manage an NE, you have to create a model of the actual physical equipment. You can create the model automatically by transferring information directly from the actual equipment or you can create the model manually. The model is stored in the NE itself. Typically, you will create the initial model of a new NE automatically and then, when adding or removing equipment from the NE, make the changes to the model manually.

You can see a representation of the actual modules present in the NE as well as the corresponding model of the NE equipment in the equipment window in the Craft Terminal. It is in this window that you create the model automatically or manually. The representation of the actual NE equipment is in the Actual field, which scan only be read nut not edited. The NE model is created and displayed in the expected field. Selecting the menu item configuration – Equipment, opens the equipment window.

3. To create the initial NE model automatically:

Use this procedure only to create the initial NE model.

If the actual configuration is transferred to an existing model, all manual setting previously made in the model are reset.

Steps to follow:

- Select configuration – Equipment.
- The Equipment window appears, showing the physical equipment installed in the NE in the Actual field.
- In the Equipment window click the copy Actual to Expected button. The copy Actual to Expected process begins and the select sub rack Subtype window appears.
- Open the drop down list in the select sub rack subtype window and select the Sub rack subtype. The Sub rack subtype values describe the four different cablings possible for the sub rack type. For SR 1b, SR1c and SC1c sub racks the sub rack subtype shall be one full STM-1, full 2 Mb/s, LI-1 lower order to the right or LI1 lower order to the left before any module can be expected.
- Choose OK in the select sub rack subtype window. The contents of the Actual field are copied to the expected field. The NE model i.e the contents of the expected field, is stored in the NE.
- Select OK in the Equipment window. The Equipment window closes.

Sub rack Subtype.	Description
Full STM-1	The sub rack supports 2 X STM-1 signals with full lower order connectivity.
Full 2Mb/s	The sub rack supports up to 126 X 2 Mb/s signals.
LI-1 lower order to the right	The sub rack supports 1 X LI-1 module with lower connectivity. The LI-1 module is placed to the right of the master module.
LI-1 lower order to the left	The sub rack supports 1 X LI-1 module with lower connectivity. The LI-1 module is placed to the left of the master module.
None	The cabling is not determined yet. This is the default value for any sub rack subtype and the only legal sub rack subtype value for sub racks different from SR1b, Sc1b, SR1c or SC1c.

4. Specifying the way in which a Module can be used:

The ways in which a module can be used is determined by the module usage parameter. You set the module usage parameters according to the way in which you want the ports of the module to handle incoming or outgoing traffic. The procedure below describes how to configure the usage of a module.

- Select Configuration – Equipment. The equipment window appears.
- Select the module in question in the expected field. The module is highlighted and the Rack < no.> Sub rack <no.> Slot <no.> group box is active.
- Choose the value of the module usage attribute from the drop-down list. The value you choose is dependent on the network implementation of the module in question.
- Repeat the above steps for all the NE modules.
- Select OK. The progress window appears. When the NE is updated the progress window closes.

The table shows the possible values for the Module usage parameter, the modules for which the parameter applies and a corresponding description.

Module usage parameter Value.	Applies to	Description
None	All modules	The ports of the module cannot handle traffic.
STM-1 higher order	LI-1, TEX-4 and RI-1 modules	Higher order, connectivity on VC-4 level only.
STM-1 lower order	LI-1 and RI-1 modules	Lower order, connectivity on VC-4 and VC-3/VC12 levels.
STM-1 lower order Sub deployed	LI-1 and RI-1 modules.	Lower order connectivity on VC-4 and VC-3/VC12 levels. One TUG-3 Is used only.

IV. Creating Container mapping (configuration of termination points)

in Local NE

1. Purpose of container mapping (Configuration of Termination points)

The purpose of configuring the termination points is

- To specify which type of signal you wish the port to handle.
- To activate the monitoring capability of the individual ports.
- To specify the conditions for generating alarms in case a fault arises at the port.
- To specify the trail trace identifiers to check correct path setup during installation.

Incoming traffic to an NE is received on a physical port, like wise out going traffic is sent from a physical port. The interface between a link connection (the fiber optic cable or the electrical cable) and the ports (within the NE) are called termination points.

2. Steps in configuration of termination points

- Select configuration - Termination points. The termination points window appears. The ports field of the termination point's window shows all the ports for the NE in a tree structure. The types of ports available for monitoring are dependent on the modules installed in the NE. You will only see the ports whose modules are in the NE model and are enabled i.e the module usage parameters has been set.
- Select and expand the port of interest in the ports field by choosing the expand icon. The port expands and aggregate or tributary ports appear.
- Choose the tributary or aggregate port of interest in the ports tree. The port is high lighted and the parameters that you can set for the port are shown in the termination point's window. The parameters shown in the window change according to the type of port selected in the ports tree.
- Assign values to the parameters and check the required check boxes for the ports by opening the dropdown list for each parameter and selecting the required value.
- Repeat steps 2 to 4 until you have set the parameters for all the ports of interest.
- Click OK. The new data from this window is sent to the NE and the window closes.

V. Working with Cross Connections

1. Purpose of Cross Connections.

To enable the NE to handle traffic, it is necessary to setup the connections within the NE. Once the connections have been setup then you may need to make changes to them at a later date. The Cross Connection window provides a graphical illustration of the ports and the connections that currently exist within the selected network element (NE). The popup menus allow you to create and modify both higher order and lower order cross connections and to configure and view information about the ports. The cross connections window is split into three separate columns, each representing different parts of a traffic structure. The table below describes the three columns of the cross connections window.

The column	……. contains information about ……
Left	STM-n ports and AU4 termination points
Center	Cross Connection termination points within the NE
Right	Lower bandwidth PDH ports (140 Mbit/s, 34 Mbit/s and 2 Mbit/s

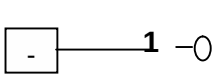
Connecting termination points in the left column with Cross Connection termination points in the center column makes Higher-order Cross Connections, whereas connecting Cross Connection termination points in the center column termination points in the right column makes lower-order Cross Connections. Icons are used to graphically represent containers, termination points and

cross connections.

  Icons representing parts of the SDH multiplexing structure.

 **Icon representing a termination point and a Cross Connection termination point.**

You can identify the rack, sub rack, slot, module and port handling each part of the SDH multiplexing structure by the numbers beside each icon in the Cross Connections window. You can observe an example of such an identifier in the following figure.

[0/0/01/2]  **1** **This part of the SDH multiplexing structure is handled by rack 0, sub rack 0, the module in slot 1 and port 2 of the module.**

2. Description of the connection Line Types & Colours

The connections between the nodes are represented by lines whose type and colour describe the type of connection as shown in the table below.

Line Color or Type	Description of connection
Solid lines (any colour except dark gray)	Indicates either an unprotected connection, or the protected part of a protected connection.
Dashed lines (any colour)	Indicates that the connection is the protecting part of a protected connection.
Solid, thin dark gray line	Indicates that one of the connection nodes of the connection are not visible in the window
Solid, thick dark gray line	Indicates that a connection is in the process of being made graphically.
Green colour	Indicates that the connection is currently active (that is, it will carry traffic when there is some), and that the traffic has been locked onto this part of the protected connection.
Dark green	Indicates that the connection is currently active (that is, it will carry traffic when there is some), and that the

	traffic has been locked onto this part of the protected connection.
Blue (dark = cobalt blue)	Indicates that the connection is currently on standby (that is, it will not carry traffic when there is some).
Red	Indicates that a “Server Signal Failure” (SSF) has been detected on the connection

3. Types of Cross Connection

You can make three types of Cross Connection.

- **Point-to-point bi-directional**
- **SNC protected point-to-point bi-directional**
- **Broadcast with Drop and Continue**

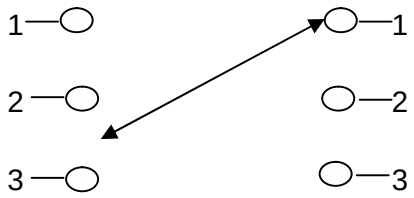
A point-to-point Cross Connection describes a connection where traffic flows from one termination point to another termination point. A bi-directional connection means that the traffic can flow in either direction. All single connections, which are created in the AC1 NE, are point-to-point bi-directional and are referred to as connections only.

Sub network connection protection (SNCP) means, that the traffic flow is protected by two possible routes being available to the signals (the working route and protecting route). An SNC protected point-to-point bi-directional Cross Connection inside an NE consists of a pair of connections with one shared termination point. All protected connections which are created in an AC1 NE are SNC protected point-to-point bi-directional connections and are referred to as protected connections only.

Broadcast with drop and continue is used to distribute a traffic signal at several points in a network. At each drop point the broadcast signal is both extracted from the network and transmitted onwards in the network. In AC1 NE, you can set up broadcast with drop and continue both at VC4 level, at the VC3level and at the VC12 level. All connections in a drop and continue connection group are unidirectional connections (that is, the traffic flows in only one direction).

4. Steps in creating a Cross Connection

- Select Configuration from the menu.
- The Cross Connection window appears.
- Place the mouse cursor anywhere in the cross connection window except over a termination point and open the pop-up menu.
- Select Expand all to view all termination points.
- Place the cursor over the termination point you wish to make a connection from, open the pop-up menu and select the item Connect and unprotected. A light green line appears between the termination point and the cursor.
- Move the cursor to the termination point you wish to make a connection to.
- The line is dragged along with the cursor and remains light green if the connection is possible. The line changes to red colour if the connection is not possible.
- Click on the termination point to verify the connection.
- A light green line, with an arrowhead on each end, is drawn between the two termination points to represent the connection.



Bulk Connections

Bulk connections are groups of connections, which you create for a whole part of the SDH multiplexing structure instead of a single termination point.

Steps in Creating Bulk Connections

- Place the cursor over the part of the SDH multiplexing structure you wish to make a connection from, open the pop-up menu and select the item Bulk connect. A thick light

green line appears between the part of the SDH multiplexing structure and the cursor.

- Move the cursor to the first of the termination points of the SDH multiplexing structure you wish to make connections to. The line is dragged along with the cursor and remains light green if the connection is possible. The line changes to red colour if the connection is not possible.
- Click on the termination point to verify the connection. Light green lines, with arrowheads on each end, are drawn between the termination points to represent connections.

Steps in creating Protected Connections

- Place the cursor over the termination point that you wish to protect, open the pop-up menu and select the item Connect, protected. A light green line appears between the termination point and the cursor.
- Move the cursor to the termination point you wish to make a connection to. The line is dragged along with the cursor and remains light green if the connection is possible. The line changes to red colour if the connection is not possible.
- Click on the termination point to verify the connection. A light green line, with an arrowhead on each end, is drawn between the two termination points to represent the protected connection. A second light green line appears between the termination point and the cursor.
- Move the cursor to the alternative termination point you wish to connect to and click on the termination point. A dotted blue line is now drawn between the protected termination point and the alternative termination point to represent the protecting connection. Both connection lines are shown with arrowheads at each end.

VI. Configuring the Termination point of a port

1. Purpose of configuring termination points.

Incoming traffic to an NE is received on a physical port, likewise outgoing traffic is sent from a physical port. The interface between the link connection and the ports are called termination point. The purpose of configuring the termination points is to activate the monitoring capability of the individual ports and to specify the conditions for generating alarms in case of fault arises at the port.

2. Steps in Configuring the Termination Points of a Port

- Place the cursor over the port that you wish to configure the termination points for, open the pop-up menu and select the item Termination Points. The termination points window appears.

- Assign values to parameters and select the required check boxes for the port.
- Repeat steps 1 and 2 until you have set the parameters for all the ports of interest.
- Click **OK.** The new data from this window is sent to the NE and the window closes.

VII. Changing a Cross Connection

1. Purpose of changing a Cross Connection

It is possible that you will want to make changes to existing connections within an NE. You may want to remove a connection, upgrade to a protected connection or you may want to change the configuration of a drop and continue connection group, which are amongst some of the changes you can make.

2. Steps in changing a Cross Connection

- Open the Cross Connection window.
- Place the cursor over either end point of the connection you wish to remove, open the pop-up menu and select the item Disconnect connection (s).
- A dialogue box appears asking you to confirm the action.
- Click **Yes** in the dialogue box. The connection is removed.

VIII. Testing a Network Element

1. Purpose of Testing

You have the possibility of performing test on an NE to isolate problems that may arise when commissioning the NE or when a fault arises with an individual laser of a module.

2. Loop-back Testing

Loop-back testing allows you to test the paths of a NE for through connection. A loop-back test is a test in which a signal is sent to a network destination that is returned as received to the originator. A discrepancy between what is sent and received may help diagnose a problem. Sending a loop-back test signal to each piece of equipment in succession, one at a time, is a technique for isolating a problem. You can make loop-back tests on the 2 Mb/s, 34 Mb/s or 140 Mb/s signal interfaces for a NE. For each interface you have the possibility of making the following types of loop-back test.

- Line loop-back
- Terminal loop-back

Loop-back test settings	Description
Off	No loop-back connection is associated with this setting
Line	The incoming signal is transmitted back but is also transmitted to the switching matrix. No signal enters the output port from the switching matrix. This setting is used typically for testing external cabling and DDFs.
Terminal	The signal from the switching matrix to the selected channel is transmitted back but is also transmitted to the output port. No signal enters the switching matrix from the input port. This setting is used typically for testing the internal cross connections of the NE.

3. Steps in Loop-back Testing

- Select Configuration, Termination Points. The termination points window appears.
- Select and expand the port of interest in the Ports field by clicking on the expand icon. The Port expands and the 2 Mb/s, 34 Mb/s or 140 Mb/s ports appear.
- Select the 2 Mb/s port in the Ports tree.
- Open the loop-back drop-down list in the Termination points window and select Loop-back test settings. A warning dialogue box appears asking you to confirm the action.
- Click Yes in the warning dialogue box. The warning dialogue box closes.
- Click OK in the Termination Points window. The termination points window closes.
- To remove a loop, carry out the procedure for making loop as described above and set the looping parameter to Off.
- **Remember to remove all loops when you have finished the test. Otherwise, the path will not function as expected.**

Hands On practice

1. Map two numbers of local 2 Mb/s signals on to VC4 of Port No.2 as unprotected. Write down the steps followed in performing the mapping.

2. Map two numbers of local 2 Mb/s signals on to VC4 of Port No.2 as protected. Write down the steps followed in performing the mapping.
3. Map three numbers of 2 Mb/s signals from VC4 of Port No.2 to VC4 of Port No.1. Write down the steps followed in performing the mapping.

Review Questions

1. What is the NSAP address of the NE on which you are working?
2. Which channel is used to transport management information between the NEs?
3. What is the purpose of container mapping?
4. What do you understand by Protected and unprotected connections?
5. Explain the concept of broadcast with drop and continue.
6. What is the purpose of configuring termination points?

नाम
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Instructor Initial :

STUDY OF TEJAS STM-1 SYSTEMS

INTRODUCTION

Tejas STM-1 systems are classified as

•TJ100MC-1

•TJ100CP

•TJ100LT

Depending on the tributary capacity requirement they are used. All are STM-1 capacity.

The TJ100MC-1 STM-1 Multi-service Provisioning Platform is a compact STM-1 SDH multiplexer equipment designed to manage bandwidth and derive services from the optical core to access. The system is based on Multi-card Chassis system that provides flexibility in terms of expansion to support additional client interfaces by adding new modules.

The TJ100MC-1 provides the following system features.

•The system has two STM-1 optical interfaces in the aggregate side implemented on LTC.
•The system allows for up to three tributary add-on cards.

The following interfaces are available as add-on cards in the chassis.

•28 port E1/T1 tributaries.

•1 port E3/DS3 tributary.

•8 port 10/100 Base-T Ethernet.

The system uses redundant Power supply units, which derive power from 48 V DC supply.

The key features of the system include

•Ethernet (NMS) interface and craft interface for management connectivity.

•Laser safety features.

•Order-wire interface, an extra modem interface for remote monitoring and management.

•Timing and synchronization features.

•Visual indication of alarms and status of the system.

•External alarm contacts etc.

TJ100MC-1 MODEL

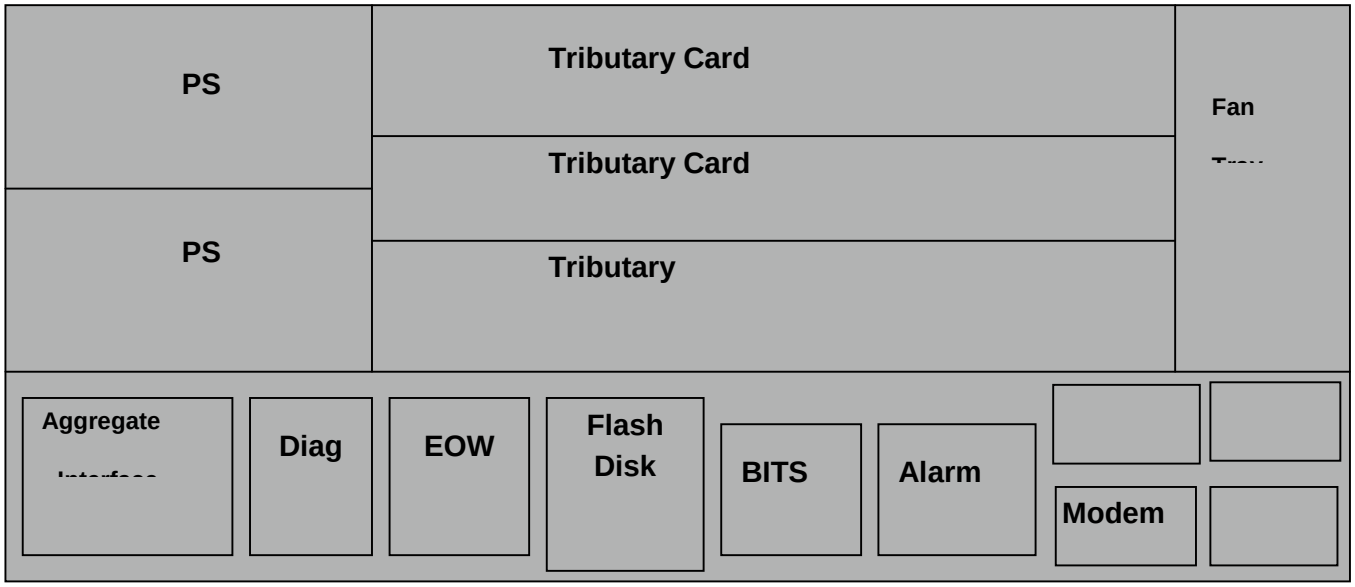
<table>
<tr><td rowspan="2">Slot-1</td><td>Slot-6</td></tr>
<tr><td rowspan="2">Slot-5</td></tr>
<tr><td rowspan="2">Slot-2</td></tr>
<tr><td>Slot-4</td></tr>
</table>

Slot-3

Slot View of MC-1

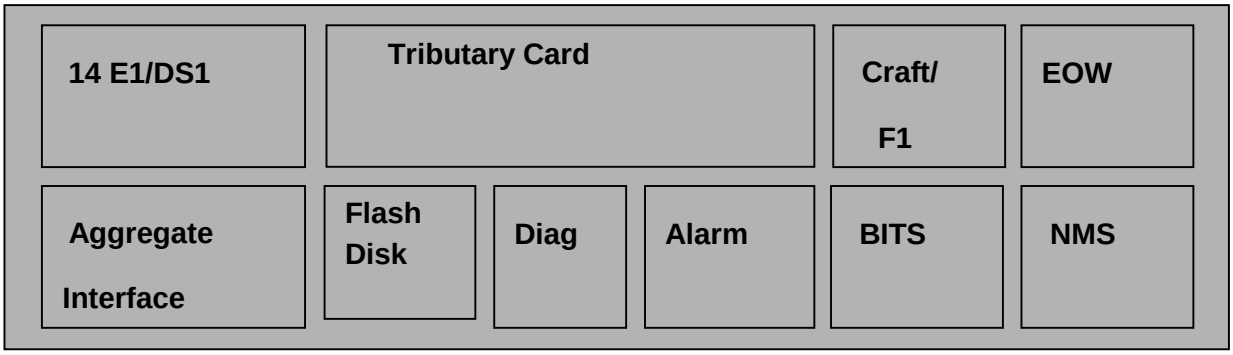
•The system consists of six slots for inserting the various cards.(MC-1)

<table>
<tr><td colspan="2" rowspan="2">PS</td><td colspan="5">TRIBUTARY CARD</td><td rowspan="3">FAN
TRY</td></tr>
<tr><td colspan="5">TRIBUTARY CARD</td></tr>
<tr><td colspan="2" rowspan="2">PS</td><td colspan="5">TRIBUTARY CARD</td></tr>
<tr><td>Aggregate Interface</td><td>Diag.</td><td>EOW</td><td>Flash Disk</td><td>BITS</td><td>Alarm</td><td>Craft</td><td>ETH</td></tr>
<tr><td colspan="6"></td><td>Modem</td><td>NMS</td></tr>
</table>



MC MODEL

TJ100CP MODEL



CP MODEL

TJ100MC-1 system has the following modules:

• PSU (Power Supply Unit)

• Lite Tributary Card (LTC)

• 1 E3/DS3 Tributary Card (TE31)

• E1 Tributary Cards (TET16, TET21, TET28)

• STM-1 Aggregate/Tributary Cards (A011)

• Ethernet Tributary Card (TP01)

• Ethernet Tributary Card (TP01FT)

Power Supply unit (PSU)

The power supply units (PSU) are part of the base TJ100MC-1. The PSU forms one part of a redundant, load-sharing (not true current sharing) supply and provides a stable DC power to other cards in the system. The power dissipation of fully loaded configuration of TJ100MC-1 system is around 120 watts. TJ100MC-1 has redundant power supplies in its 2 slots. The unit fits in Slot1 and Slot2 of the TJ100MC-1. The unit is fitted with a front panel that has a power connector, an ON/OFF switch and two LED indications. The 'power' LED turns green when the internal power converter is on and turns off if the converter is off. The 'Active' LED turns green when the outputs of the supply are working and within range. It turns red when an output voltage abnormality is detected.

Lite Tributary Card (LTC)

The system card (LTC) is the heart of the TJ100MC-1. It is the card that plugs into Slot 3 and provides the aggregate interfaces, clocks, processing and monitoring capability to the system.

The LTC provides the following interfaces:

•Processor bus for control path communication to the other cards in the sub rack (to the back plane)

•Two Telecom buses for the data path interface to the tributary cards

•System clocks and timing signal (to the back plane)

•Two STM-1 optical interfaces, SC-PC type

•Four STM-1 electrical interfaces, BNC type

•BITS clock and data inputs and outputs on 9 pin D connector

•External alarm inputs and alarm outputs on 15 pin D connector

•10/100BaseT Ethernet interface (RJ45) for communication with the network management system via a local area network (LAN)

•RS232C port for local craft terminal

•Diagnostic port (Diag)

•Modem port

•Engineering Order-wire (EOW) interface for 2-wire communication

STM –1 Optical Interfaces

The LTC has two SC-PC STM-1 optical interfaces on the front panel. The STM-1 transceivers are shipped with S1.1, L1.1 or L1.2 specifications. The type of the transceiver installed with the LTC will be indicated on the front panel and is also available via the web user interface.

Specifications	S1.1	L1.1	L1.2
Output Power			
Minimum	-15 dBm	-5dBm	-5dBm
Typical			
Maximum	-8 dBm	0 dBm	0 dBm
Receiver Sensitivity	-28 dBm	-34 dBm	-34 dBm
Receiver Overload	-8 dBm	-10dBm	-10dBm
Optical Path Penalty	1 dB	1 dB	1 dB
Section Loss	0 to 12 dB	10 to 28 dB	10 to 28 dB
Wavelength (nominal)	1310 nm	1310 nm	1550 nm
Spectral Range	1261-1360 nm	1263-1360 nm	1480-1580 nm
Connector Type	SC-PC	SC-PC	SC-PC
Fiber Type	Single mode	Single mode	Single mode

E1 Tributary Card (TET16, TET21, TET28)

•The E1 cards, TET16, TET21, and TET28 are generic tributary cards that can be used across all the Teja's STM-1/4 products. E1 tributary interface cards provide line interfaces to 16 E1, 21 E1, and 28 E1 channels respectively in both, add and drop directions. These cards map and de-map the E1 channels into SDH/SONET frame (at programmed slots) for the tributary card to make the cross connects

•This card can be plugged into any of the slots from 4 to 6 of the TJ100MC-1 chassis.

• The E1 Tributary cards use 2 Euro connectors to connect to the back plane of the sub-rack.

The TET28 provides the following interfaces:

•E1 interfaces on 120 ohm 62 way D-type connectors

•Processor bus for control path communication to the other cards in the sub-rack (to/from the back plane)

•System clocks and timing signals (to/from the back plane)

STM-1 Aggregate/Tributary Card (A011)

The STM1-Aggregate/Tributary card is generic tributary card that can be used across all the Teja's STM-1/4 products. The STM-1 Aggregate/Tributary card, A011 is designed to function as 1 port STM-1 tributary card.

Order wire Interface

•This is an operations communication channel that directly supports a 2-wire analog telephone. It has the full battery, over voltage, ringing, supervision, code, hybrid and test (BORSCHT) functions.

•Voice and signaling traffic is carried over E1 or E2 bytes of the SDH overhead. •2-wire analog interface is handled by hardware using a ringing SLIC and code. The line impedance can be set according to local conventions from the user interface. Two LEDs are used to indicate status on

Card State	OW LED	
	Green	Amber
Telephone On hook	ON	OFF
Telephone Ringing	Blink	OFF
Telephone Off hook	OFF	ON

the Order wire.

Network Management Interface

•The network management interface (NMS Interface) provides a CSMA/CD based LAN transceiver of an Ethernet link. This is available as an RJ45 connector on the LTC. The Ethernet address is available in the non-volatile memory on the LTC.

•Two LEDs are used on this connector to indicate link status, as given below :

Card State	NMS LED	
	Green	Amber
Link Speed 10 Mbps	OFF	NA
Link Speed 100Mbps	ON	NA
Receiver Activity	Na	Blink on packet received

Review Questions

1. What is the significance of S1.1, L1.1 and L1.2?
2. Explain the meaning of the term ‘receiver overload’.
3. In MC-1 system, TET 28 card can be inserted in which slots?
4. What is the input impedance of TET 28 card?
5. An STM-1 aggregate card is designated as A011, what is the meaning?
6. Identify the cards inserted in the MC-1 system provided in the Lab and write the name of the card used slot wise.
7. What type of connector is used on the optical port?

Signature of the Candidate

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Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

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STUDY OF TEJAS STM-4 SYSTEMS

1.0 INTRODUCTION

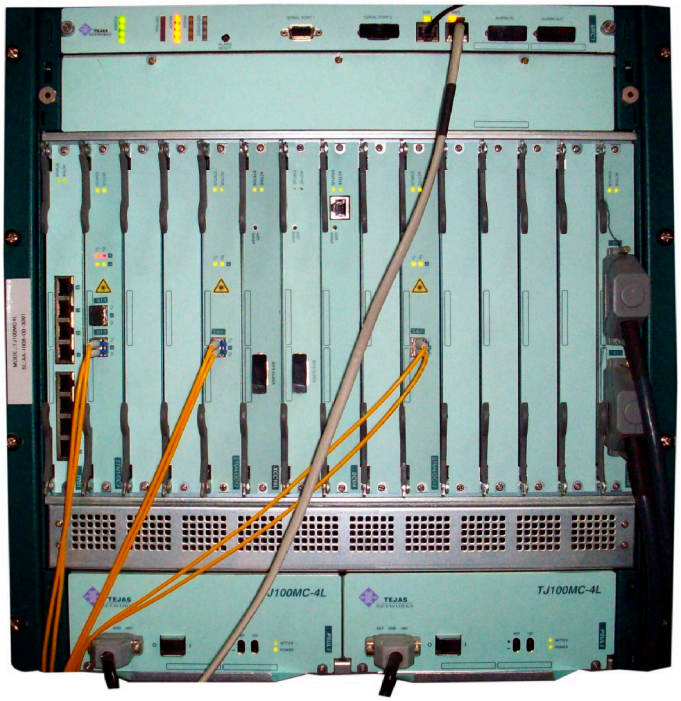
The TJ100MC-4L is a carrier class, cost effective and modular bandwidth provisioning equipment designed to manage and derive services from the optical core to the access. It supports end-to-end provisioning and management of services across all segments of the optical network. It combines innovative optical networking software with the resilience of SDH to deliver a flexible solution to today's service providers.

The TJ100MC-4L can be configured as a Terminal Multiplexer (TMUX), Add-Drop Multiplexer (ADM), Regenerator, In-Line Amplifier or as a standalone Cross-connect. A variety of service interfaces such as E1/DS1, E3/DS3, E4, STM-1e/o and 10/100 Mbps Ethernet tributary interfaces and trunk interfaces at STM-1/4 rates are supported. It features non-blocking cross-connect at VC-3, VC-4 and VC-12 granularity and supports drop and continue functionality.

1.1 FEATURES, ADVANTAGES & BENEFITS

- Multi slot chassis system.
- Flexibility, modularity and scalability in configurations
- Allows easy upgrade from STM-1 to STM-4 without service disruption.
- Capability enhancement in traffic drops can be achieved with expansion chassis.
- Compact size Half depth rack allows two TJ100MC-4Ls to be placed back-to-back on a standard rack
- Better utilization of available rack space
- Integrated multi-service delivery

- Provision of both voice and data services from the same
- Efficient use of transport bandwidth by supporting per-port rate adaptive Ethernet Services
- Redundant cards with hot insertion capability
- Guaranteed availability and superior network resilience
- Carrier-class redundancy and high network uptime with minimum loss of revenue
- Point-to-point, linear, ring & mesh topologies
- Diverse topology support to cater to all customer network scenarios
- Flexible and cost-effective network solutions
- Multi-level protection schemes MSP, SNCP
- Advanced protection schemes enable differing protection requirements
- Creation of differentiated services to enhance the portfolio of service offerings
- Advanced networking software with support for open standards such as GMPLS and OSPF
- Enables automatic topology discovery, shared mesh restoration and Point- and Click Provisioning (PNCP)
- User friendly GUI based Network Element Software for local and remote provisioning
- Reduction in operational costs and increase in efficiency through lower provisioning time and operator intervention
- 11 Traffic Slots 252 E1s from single chassis



1.3 The equipment view is shown below

TJ100MC4L

1.4 The MC-4L system of Tejas networks consists of the following units

1. Power supply unit (PSU)
2. Multifunction Card (MFC1)
3. Ethernet Tributary Card (TP01)
4. STM-1 Aggregate Card (A012)
5. STM-4 Aggregate card (A041)
6. Cross-connect Card (XCC16L)
7. System Control Unit (SCU4)
8. E1 Tributary Card (TET28)

1.5 Power Supply unit (PSU)

The power supply units (PSU) are part of the base TJ100MC-1. The PSU forms one part of a redundant, load-sharing (not true current sharing) supply and provides a stable DC power to other cards in the system. In general, the power supply units are required to provide independent power sources. Normally only one source of power supply is used. Each PSU delivers 150W power output with primary and secondary voltages being 48 V and 12 V respectively.

Operating parameters

- Input voltage, 48 V DC with either the positive or negative input earthed.
- Output voltage, +12 V DC at 12.5 A maximum.
- Output power 150 W.

A 6.3 A slow-blow glass fuse with maximum sustained dissipation of 1.6 W is used on the positive line of the input power. This card fits in the slots 16 and 17 of TJ 100 mc-4L chassis.

The front panel of this card includes:

- Power connector
- Power ON/OFF switch.
- Two LED indicators.
- Primary voltage monitoring port
- Secondary voltage monitoring port.

The two LEDs, Power and Active LEDs provide a visual indication of the input and the output voltages relative to the card.

LED	COLOUR	STATUS
POWER	GREEN	The DC-DC converter is active
	OFF	The DC-DC converter is in-active
ACTIVE	GREEN	The output voltage is within specified range
	RED	The output voltage is out of range

The PSU is protected against output short circuit, over voltage and under voltage. Input over voltage and under voltage protection is provided. The output over voltage protection is latched and the unit will not restart until power to the unit is removed and reconnected.

1.6 Multi Function Card (MFC1)

The MFC1 is used to implement miscellaneous interfaces. This card is plugged into the slot 18 of the TJ100MC-4L chassis. This card supports the following interfaces along with the visual alarm indicators.

- Order- wire interface
- 10/100 NMS Ethernet interface
- Two serial interfaces for modern and craft interfaces
- Alarm input and output interfaces.

MFC1 consumes a maximum power of 4 W, at 12 V DC.

The NMS interface is associated with two LEDs, Green and Amber. The possible LED status and their significance is given below.

Card Status	NMS LED	
	Amber	Green
Link speed 10 Mbps	OFF	NA
Link speed 100 Mbps	ON	NA
NMS port UP	NA	ON
Receiver Activity	NA	Blink on packet received

The Order-wire interface is associated with a single bicolour LED Green and Red. The possible LED status and their significance is given below.

Card State	OW LED
Telephone On hook	Green
Telephone Ringing	Green blinking
Telephone Off hook	Red

The MFC1 has visual indications for alarm and the power on the card. The following visual indications are available.

LED Name	LED Colour	Status
Power	Green	Card is powered-up
	OFF	Card is not powered-up
Critical Alarm	Red	Critical Alarm is present
	OFF	Critical Alarm is not present

Major Alarm	Orange	Major Alarm is present
	OFF	Major Alarm is not present
Minor Alarm	Yellow	Minor Alarm is present
	OFF	Minor Alarm is not present
Deferred Alarm	Blue	Deferred Alarm is present
	OFF	Deferred Alarm is not present

The MFC1 has a SLIC device to handle the two-wire analog Order Wire Interface. The SLIC device converts the analog voice data to PCM samples and vice-versa.

1.7 Ethernet Tributary Card (TP01)

TP01 tributary interface card provides line interfaces to eight 10/100 Mbps Rx and Tx port. This card maps and de-maps the Ethernet data into the virtual containers of different granularity (VC-12/VC-3/VC-4) of the SDH frame.

1.8 STM-1 Aggregate Card (A011, A012)

The STM-1 Aggregate cards are generic aggregate cards that can be used across all the Tejas's STM-1/4 products. The STM-1 aggregate cards, A011 and A012 are designed to function as one port STM-1 and Two port STM-1 aggregate cards respectively. This card can be plugged into any of the slots from 1 to 5 and 10 to 15 of the TJ100 MC-4L chassis. Visual Indicators are provided on the front panel of the STM-1 aggregate card. The visual indicators include the Active and the Status LEDs and an LED each for Tx and Rx for the STM interfaces.

The possible LED status and their significance is given below.

LED	COLOUR	STATUS
ACTIVE	Amber	On insertion/power ON
	Green	Initialization complete/In use
	Red	Card Inactive
STATUS	Amber	On insertion/Power ON
	Green	Initialization complete
	Red	Hardware error
TX	Green	Laser is ON and the corresponding port is transmitting
	Red	Laser is Off
RX	Green	The corresponding port is receiving a signal
	Red	The corresponding port is not receiving a signal

1.9 STM-4 Aggregate Card (A041)

The STM-4 tributary card is designed to function as one port STM-4 aggregate card. The A041 card has one optical Transreceiver operating at STM-4 rate for the aggregate interface. The optical Transreceiver mounted on the card can be of L/S4.1/4.2 types. The maximum span can that be achieved with L4.2 Tran receiver is 24 dB (80 Km). The front panel of STM-4 aggregate card is having visual indicators. They include the Active and the Status LEDs and an LED each for Tx and Rx for the STM interfaces. The possible LED status and their significance is given below.

LED	COLOUR	STATUS
ACTIVE	Amber	On insertion/power ON
	Green	Initialization complete/In use
	Red	Card inactive
STATUS	Amber	On insertion/power ON
	Green	Initialization complete
	Red	Hardware error
Tx	Green	Laser is ON and the corresponding port is transmitting
	Red	Laser is OFF
Rx	Green	The corresponding port is receiving a signal
	Red	The corresponding port is not receiving a signal

1.10 Cross-connect Card (XCC16L)

The XCC16L is the cross-connect card that occupies the slots 6 and 7 in the TJ100 MC4-L chassis. The card consists of the cross-connect sub-system and the timing sub-system. The system provides for redundancy on the XCC16L card. The cross connect subsystem consists of a non-blocking switch at VC-12 granularity. The timing subsystem has a stratum-3 timing module that generates the reference clocks for the entire equipment, including the SDH timing signals.

The front panel of the XCC16L consists of visual indicators. They include two LEDs, the Active and the Status LEDs. The possible LED status and their significance is given below.

LED	COLOUR	STATUS
ACTIVE	Amber	Card is booting-up
	Green	Card is active (Master)
	Off	Card is in standby mode (slave)
	Red	Card failure
STATUS	Amber	Card is booting-up
	Green	Card is active (Master)
	Off	Card is in standby mode (slave)
	Red	Card failure

Hot Swap switch

The master and slave card configuration of the redundant XCC16L cards can be forced using the hot swap switch. When the hot swap switch is activated, the respective card renders the peer card as the master and takes over as a slave. The switch is functional only on the card that is active provided another card is available in the standby configuration.

1.11System Control Unit (SCU4)

The SCU4 card initiates the configuration and control of the other cards on the TJ100MC-4L system at boot-up. The SCU4 card houses the processor sub-system (PSS) that handles the control path. The system provides for redundancy on the SCU4 cards. The SCU4 cards can be plugged into the slots 8 and 9 of the TJ100MC-4L chassis. The front panel supports visual indicators that reflect the status of the card, a diagnostic interface through an RJ-45 connector and two push button switches for soft reset and redundancy control. Visual indicators are provided on the front panel. The possible LED status and their significance is given below.

LED	COLOUR	STATUS
ACTIVE	Amber	Blinking. Card is booting
	Green	Booting process complete (Master)
	Off	Booting process complete (Slave)
STATUS	Amber	Blinking. Card is booting
	Green	Booting process complete
	Off	Card failure

The SCU4 consists of a 32 bit micro controller and an on board external memory to implement the required functions. The software residing in this block controls the overall management of the system.

Hot Swap Switch

The master and the slave card configuration of the redundant SCU4 cards can be forced using the hot swap switch. When the hot swap switch is activated, the respective card renders the peer card as master and takes over as slave. The switch is functional only on the card that is active provided another card is available in the stand-by configuration.

Reset switch

The reset switch, when activated provides a non-service disruptive reboot on the card.

1.12 E1 Tributary Card (TET16, TET21, TET28)

The E1 cards, TET16, TET21 and TET28 are generic tributary cards that can be used across all the Tejas STM1/4 products. E1 tributary interface cards provide line interfaces to 16 E1, 21E1 and 28 E1 channels respectively in both add and drop directions. These cards map and demap the E1 channels into SDH/SONET frame for the tributary card to make the cross-connects. This card can be plugged into any of the slots from 1 to 5 or 10 to 15 of the TJ100MC-4L chassis. The front panel of the tributary card is having visual indicators. They include two LEDs, the Active and Status LEDs. The possible LED status and their significance is given below.

LED	COLOUR	STATUS
ACTIVE	Amber	On insertion/power ON
	Green	Initialization complete/In use
	Red	Card inactive
STATUS	Amber	On insertion/power ON
	Green	Initialization complete
	Red	Hardware error

The E1 interface is provided through 62 way D-type connectors on 120 Ohms.

1.13 Review Questions

1. Identify the various cards available in the MC4L system available in the lab and write the card name and slot number.

2. Give the significance of A011, A012 and A041

3. Give the significance of S4.1, L4.1, S4.2 and L4.2

4. Give the significance of Active and Status LEDs on A041 aggregate card.

Signature of the Candidate

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Instructor Initial :

STUDY OF TEJAS NMS

Objective: To acquire familiarity with Tejas NMS operation

INTRODUCTION

Tejas Element Management System (TejEMS) is an integrated management of network elements across an intelligent optical network. TejEMS collects and represents management data from geographically dispersed network elements on to a centralized database in a network Operations Center (NOC). The GUI part of TejEMS forms a single NOC. EMS features are mainly based on Telecommunications Management Network (TMN) FCAPS functionality.

F- Fault Management: This functionality has the ability to identify, locate and repair problems.

C- Configuration Management: This functionality provides the service and resource provisioning.

A- Accounting Management: This functionality enables the collection of data to support billing and asset management.

P- Performance Management: This functionality enables gathering of statistics for planning,

troubleshooting and providing customer reports.

S- Security Management: This functionality enables the control of access to network resources to maintain reliability.

ARCHITECTURAL OVERVIEW

The TejEMS has a client server architecture. The server side of the TejEMS is actually a collection of multiple server processes, performing distinct functions. The server brings the network data into the EMS database and carries the EMS requests to the network elements. The client of TejEMS is a graphical user interface (GUI), which enables the operator or user to visualize the network and perform management operations. Using the GUI the operator can perform any of the FCAPS management operations. TejEMS enables the user to visualize the network in different views. The views show the actual physical topology of the network and logical data.

The different view supported by TejEMS are:

- Fiber View
- Management view
- Service View
- Partition View

GETTING STARTED

- Double click the TejEMS icon on the desktop. The login screen is displayed.
- Enter user name, password and the server IP of the machine where EMS is installed against the corresponding fields. The default user name is administrator and the password is tejas.
- Click Login.

MENU BAR

The menu bar has a set of options that are used to navigate through the application. The options are:

- File

- Layers
- Administration
- Maintenance
- Tools
- Help

1. File Menu

File menu consists of

- Print
- Exit

2. Layers Menu

Layers menu consists of

- Fiber view - Displays the network topology view with all nodes.
- Management view - Displays the connectivity details between the Tejas Nodes.
- Service view – Displays the information about the end-to-end circuit connectivity in the network.
- Partition view – Displays the entire network in parts that facilitates network management.

3. Administration menu consists of

- Customer settings – Displays the list of customers using the network. The can change the customer settings.
- Node Administration – Displays the node details. The user, IP address, Password and if the node is offline.
- Audit Log Search – Displays the Search Audit Log window to locate any changes done on the node.
- Security – Displays all the security details.
- Performance Details – Enables to configure and monitor the performance of the objects on the node.

4. Maintenance Menu consists of

- EMS Maintenance – Allows the user to take the backup and view the backup status.

5. Tools Menu consists of

- MS Springs – Displays the MS Spring details on the node that are through TejEMS.
- Switches – Displays all the switches in the network elements.
- Configure Alarms – Allow the user to configure the alarms.
- Filters – Allows the user to filter the search option.
- Inventory Reports – Allows the user to take various reports such as Node report, Card report Circuit report, Cross connect report etc.
- Alarm Reports – Allows the user to take alarm reports such as Network alarm report, Circuit alarm report, Card alarm report , Port alarm report etc.

6. Help Menu consists of

- License
- User Manual
- About Tejas

7. Standard Icons

Below the Menu Bar on the left side of the window seven standard icons are provided. You can directly enter into the items of layers menu on clicking on these icons. The standard icons are shortcuts to certain menu items and the alarms.

An alarm banner with different icons is also available on the window. There are six alarm icons with different colours. They are, in sequential order, classified as:

- Warning – Yellow Colour
- Minor – Amber Colour
- Major – Orange Colour
- Critical – Red Colour
- Environmental – Pink Colour
- Acknowledged – White Colour

The number on the alarm icons is the total number in the entire network. The number on the alarm icons is updated every time there is a new alarm based on the severity of alarm. The user can check the details of the alarms generated in the network by clicking on a particular icon.

8. Accessing a node in the network from Fiber view

- Log into the TejEMS client with the appropriate user access profile as stated earlier.
- Click on the fiber view icon. The fiber view window is displayed.

9. From the fiber view window right click on specific node. The following is displayed.

- Attributes
- Equipment view
- Capacity utilization
- Alarms
- Partitions
- Trunk
- DLC
- Set time
- Software download on NE
- Reboot
- Node Web page
- Upload

10. Select Node Web page. This opens a new browser window and you are prompted for the login details.

- Enter the appropriate User name and password as described earlier.
- The Node NES window is displayed. Here you can access the node and perform all the operations related to the node from the NES window. On the left side a menu is displayed. This menu consists of the following.

If the selected Node is a MC4L.

- Alarm Banner on the top of the menu.
- NE information
- Node slot view
- System time
- Inventory
- Protection
- Configuration
- Faults
- Profiles
- Performance
- Security
- Maintenance

If the selected node is a MC1 or CP then the following is displayed.

- Node view
- Slot view
- Node inventory
- Provisioning
- Performance
- Fault management
- Security
- Timing manager
- Maintenance operations

Below this menu also the following is displayed (for the Lab equipment only).

Slot	Type
0	Back plane
1	PSU
2	PSU
3	LTC4
4	TET 28

These menus will enable you to manage the Node according to your requirement. The details of Node management are dealt with in programming Lab sheet.

Review questions

1. Write in brief the steps followed to login to a particular Node.
2. What is the significance of Alarm banner? Give the significance of each icon on the alarm banner.

3. What is the significance of FCAPS functionality?

Signature of the Candidate

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PROGRAMMING OF TEJAS STM-1 & STM-4 SYSTEMS

1.0 INTRODUCTION

Tejas TJ100 MC-1 and MC-4L can be programmed for dropping, adding and cross-connecting the 2 Mbps signals i.e VC12s by using either the EMS connected at a centralized location or connecting a Laptop at the desired Node.

The navigation menu displayed is different for MC-1 and MC-4L systems.

The navigation menu for MC-1 is as follows.

- Node View
- Slot view
- Node inventory
- Provisioning
- Performance
- Fault management
- Security
- Timing Manager
- Maintenance operations

The navigation menu for MC-4L is as follows.

- NE information
- Node slot view
- System time
- Inventory
- Protection
- Configuration
- Faults
- Profiles
- Performance
- Security
- Maintenance

1.1 Significance of K, L and M while performing add/drop and cross connect functions.

While performing the operations of Add/Drop and cross connect functions you will find the letters K, L and M in the Add/Drop and Cross connect tables. The significance of these letters is as follows:

K specifies TUG 3 (supported values range from 1 to 3)

L specifies TUG 2 (supported values range from 1 to 7)

M specifies TU 12 number of the cross connect (supported values range from 1 to 3)

1.2 Configuring VC12s

Configuration of VC12s can be achieved either using NMS or Laptop. In both the cases the navigation menus will be same and the method adopted for configuration is also same. When you are using the Laptop the Router ID and Ethernet IP of the Nodes of the Network are required for logging into the Node.

The table below shows the Router ID and Ethernet IP of the various nodes available in the Lab.

NODE	ROUTER ID	ETHERNET IP
A	10.0.12.69	10.12.69.1
B	10.0.12.70	10.12.70.1
C	10.0.12.71	10.12.71.1
D	10.0.12.72	10.12.72.1
E	10.0.12.73	10.12.73.5

A. Using Laptop.

To use the Laptop for configuration, the first step is to configure the Laptop to access a Node of the network. For this follow the steps described below.

- Connect the Laptop with RJ45 cable to the NMS port of the Node under consideration. Ex. Node A
- Select setting in the programs.
- In the setting select Network connections.
- Select Local area connections (double click)
- Select properties.
- Click on continue.
- Select Internet protocol Ver.4 (TCP/IP)
- Select properties.
- Enter the values in the fields.
- IP address as 10.12.69.2
- Subnet mask as 255.255.255.0
- Default gateway as 10.12.69.1
- Select OK
- Select close
- Select close
- Select close
- Now open Internet explorer and enter the IP address of the local node where connected as http://10.12.69.1:20080.
- A Login screen is displayed.

- Log into the WUI with the following user name and password.
  User Name: tejas

  Password: j72e#05t

- Node A is logged in and a window is displayed giving the node view and its associated navigation menu as described earlier. Now the node can be managed.

B. Using NMS/EMS.

The Tejas EMS runs on Windows 2000 professional or Red Hat Linux 9.0/Fedora core and higher versions. TejEMS clients are of two types:

Installed client – The client installed on the machine.

Web client – The client launched through a web browser.

Now follow the following steps.

- Connect the EMS with RJ45 cable to the NMS port of the Node under consideration. Ex. Node A
- Double click the TejEMS icon on the desktop. The login screen is displayed.
- Enter the user name and password against the corresponding fields. The default user name is administration and the password is tejas.
- Click login.
- User interface window is displayed in which the network map is displayed.

The view window comprises of the title bar, which gives the name of the view being displayed. The tool bar, which contains the tools like download software, maximize, minimize size of the nodes, time, configuration and other options. The main window consists of a Main map of the network and displays all the node related information.

The views are made more user-friendly by displaying the node as a rectangle with its height being proportional to the actual height of the network element being displayed. The thickness of the trunks will be proportional to the bandwidth carried.

- To Login into a particular node, for example Node A, right click on the node rectangle. Navigation Menu is displayed.
- Click on the Node Web pages and select Node view.
- Log into the WUI with the following user name and password.
  User Name: tejas

  Password: j72e05t

- Now the Node A view window is displayed along with its Navigation menu as described earlier.
- Now it is possible to manage the node accordingly.

The following steps will be common for managing the node either with the Laptop or with the EMS.

When the selected Node is a MC-4L then select configuration from the menu. If it is MC-1 or CP model, then select provisioning.

1.3 Now follow the following steps for creating a cross connect, Add/Drop.

- Click Configuration/Provisioning in the navigation menu. The list of features that can be provisioned is displayed in the sub menu area.
- Click Cross-connect. The configuration Cross-connect page is displayed.
- Click Add Cross-connect link. The Add Cross-connect page is displayed. Enter/Select values as described in table below.
- Click submit. A confirmation page is displayed.
- Click Yes.
- Success message is displayed on confirmation.

The table below shows the parameters on the Add Cross-connect page, which are required to be filled by the user. The other parameters, which are displayed on the page, are not shown here.

Caution: Don't enter any other values, which are not mentioned here.

For Add/Drop

FIELD	DESCRIPTION
Cross-Connect parameters	
Capacity	Select the capacity of the cross-connect as VC12 from the drop down list
Circuit identifier	Enter the identity of the cross-connect as Tejas networks
Directionality	Set the directionality of the data flow as Bi-directional from the drop down list
Port (Source)	Select the port number of the cross-connect as E1-1-15-4
STM #	No need of giving the STM number
K, L, M	No need of giving K, L and M numbers
Port (Destination)	Select the interface number as STM1-1-2-1
STM#	Select STM number as 1
 K (TUG3) L (TUG2) M (TU12)	Select the STM time slot for the cross-connect. K specifies TUG3 (supported values range from 1 to 3) L specifies TUG2 (supported values range from 1 to 7) M specifies TU12 number of the cross-connect (supported values range from 1 to 3) (VC numbers)

1.4 For cross connect

For provisioning the Cross-connect the method is same as described in the above table. The only difference is that you have to specify the following values of the parameters as indicated below. Remaining parameter values will be same.

Port (Source)	Select the port number as STM1-1-2-1
STM #	Select STM number as 1
K, L, M	Give the K, L and M numbers as required
Port (Destination)	Select the interface number as STM1-1-2-2 or STM4-1-5-1 or STM4-1-10-1 according to requirement.

1.4 Review questions

1. In the cross-connect page click view cross-connects and note down the particulars displayed.

2. What is the significance of K, L and M in the above table?

3. What is the significance of STM number in the above table?

Signature of the Candidate

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STUDY OF PROTECTION SCHEMES IN TEJAS STM-4 SYSTEM

INTRODUCTION

Automatic Protection Switching

Automatic Protection Switching (APS) is the capability of a transmission system to detect a failure on a working facility and to switch to a standby facility to recover the traffic. This capability has a positive effect on the overall system availability.

Only the Multiplex Section in SDH is protected in this automatic fashion. The Multiplex Section protection mechanisms are coordinated by the K1 and K2 bytes in the Multiplex Section Overhead. Path protection is managed at a higher level by network management functions.

Various protection schemes are available in SDH systems. Protection switching comes into effect under any one of the following conditions.

- Signal failure
- Signal degradation
- User initiated request

The various protection schemes available are

- MS-SP RING (Multiplex Section Switched Protection ring)
- MSP RING (Multiplex Section Protection)
- SNCP (Sub-Network Connection Protection)

MS-SP ring

MS-SP ring is also known as BI-directional line switched ring (BLSR). MS-SP ring or BLSR is a protection scheme in which the total capacity in a multiplex section is divided equally between working and protection traffic.

This feature is supported only in STM-16 systems.

MSP ring

The protection against fiber cuts is provided using the well-known standardized SDH MSP protocol. The transmitted signal is split and permanently bridged to both the working and protection systems. The decision on which signal to use is made by the receiver end analyzing the signals at the receive terminal. The non-revertive single-ended protection switching is performed in the electrical domain. No transfer of extra information is required simplifying the procedure considerably.

The MSP implicates that every optical line interface is duplicated in the SDH ADMs. Working and protection signals are transmitted through the ADM in the opposite directions via the two fibers. Thus, a connection between two nodes uses two diverse routed fiber pairs of the ring.

SNCP

Sub network connection protection (SNCP) rings provide duplicate fiber paths around the ring. Working traffic flows in one direction while protection traffic flows in the opposite direction. If a problem occurs in the working traffic path, the receiving node switches to the path coming from the opposite direction.

To Create MSP Group

- Click Configuration in the main menu. The list of features that can be configured are displayed.
- Click MSP groups in the submenu. The View MSP groups page is displayed.
- Click Create MSP group link in the view MSP groups page. The provision port protection page is displayed.
- Select the values as described in Table below.
- Click Submit to create the MSP group.
- A confirmation page is displayed. Success message is displayed upon confirmation.

Parameters on the Create MSP groups page

FIELD	DESCRIPTION
Working Port	Select the port configured to carry the traffic under normal working conditions from the dropdown list.
Protection Port	Select the port configured to carry the traffic under failure of working port conditions from the dropdown list..
Protection Mode	Select either Non-revertive or revertive.
WTR Time	Specify the time from the dropdown list.
Protection switching Mode	Select either One-way or Two-way from the dropdown list.

Explanation for the protection mode

Revertive

This mode enables switching back to work path from protect path once the fault on work path is fixed.

Non-revertive

In this mode switching from protect to work path does not occur automatically. Until traffic is manually switched back to work path, traffic is carried on protect path as long as protect path is error free.

Explanation for WTR Time

WTR stands for Wait to Restore Time. Enables selection of a time interval (in minutes) after which the traffic must switch back to work channel on rectification of work channel, when reversion mode is set as revertive.

Explanation for Protection Switching mode

One-way

Only the Head end network element's receiver switches to the alternate receiver on receiving an alarm.

Two-way

Both, the head and tail end network element's receiver switches to the alternate receiver on receiving alarm.

To Create SNCP

During the provision of Cross-connects SNCP can be created. For creating SNCP connection the following steps may be followed.

- Click configuration/provisioning in the navigation menu. The list of features that can be provisioned is displayed in the sub-menu.
- Clock Cross-connect. The configure Cross-connect page is displayed.
- Click Add Cross-connect link. The Add Cross-connect page is displayed. Enter/Select values as described in the table below.
- Click Submit. A confirmation page is displayed. Success message is displayed on confirmation.

Cross-connect parameters

FIELD	DESCRIPTION
Cross-Connect parameters	
Capacity	Select the capacity of the cross-connect as VC12 from the drop down list
Circuit identifier	Enter the identity of the cross-connect as Tejas networks
Directionality	Set the directionality of the data flow as Bi-directional from the drop down list

Port (Source)	Select the port number of the cross-connect as E1-1-15-4
STM #	No need of giving the STM number
K, L, M	No need of giving K, L and M numbers
Port (Destination)	Select the interface number as STM1-1-2-1
STM#	Select STM number as 1
K (TUG3) L (TUG2) M (TU12)	Select the STM time slot for the cross-connect. K specifies TUG3 (supported values range from 1 to 3) L specifies TUG2 (supported values range from 1 to 7) M specifies TU12 number of the cross-connect (supported values range from 1 to 3) (VC numbers)
Source protection	Select disable
Destination protection	Select Enable to enable the protection path for destination
Protection Source Destination	 Port ----- Nothing to be selected Port ----- STM4-1-5-1 or STM1-1-2-2 as the case may be.
Source protection revertive	Nothing to be selected
Source WTR Time	Nothing to be selected
Destination protection revertive	Select revertive from the drop down list
Destination WTR Time	Select the desired time from the drop down list according to requirement. WTR values range from 1 to 12 minutes. Source WTR Time

Review Questions

1. What is the difference between MS-Spring, MSP and SNCP configurations?

2. What do you understand by the term WTR Time?

3. What is the difference between revertive and non-revertive protection modes?

Signature of the Candidate

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Ethernet over SDH

Objective:

To connect LANs over SDH network on Teja's STM nodes using Fast Ethernet Card, configure the ports of Fast Ethernet card and test

Brief description

LAN to LAN connection over SDH is possible due to ITU-T's G.7041 GFP (Generic Framing Procedure), which enables MAC frames of LAN (IEEE 802.3 or Ethernet) to be carried over STM frames.

GFP has two options :

1. GFP with FCS (where 4 byte frames check sequence is added along with 8-byte GFP overhead to IEEE 802.3 MAC frame)
2. GFP without FCS (where no FCS is added and only 8 byte GFP overhead is added to IEEE 802.3 MAC frame.)

We usually follow GFP without FCS since the inherent error check features of STM frame are sufficient. Fig.1 illustrates mapping IEEE 802.3 frame onto STM frame using GFP without FCS.

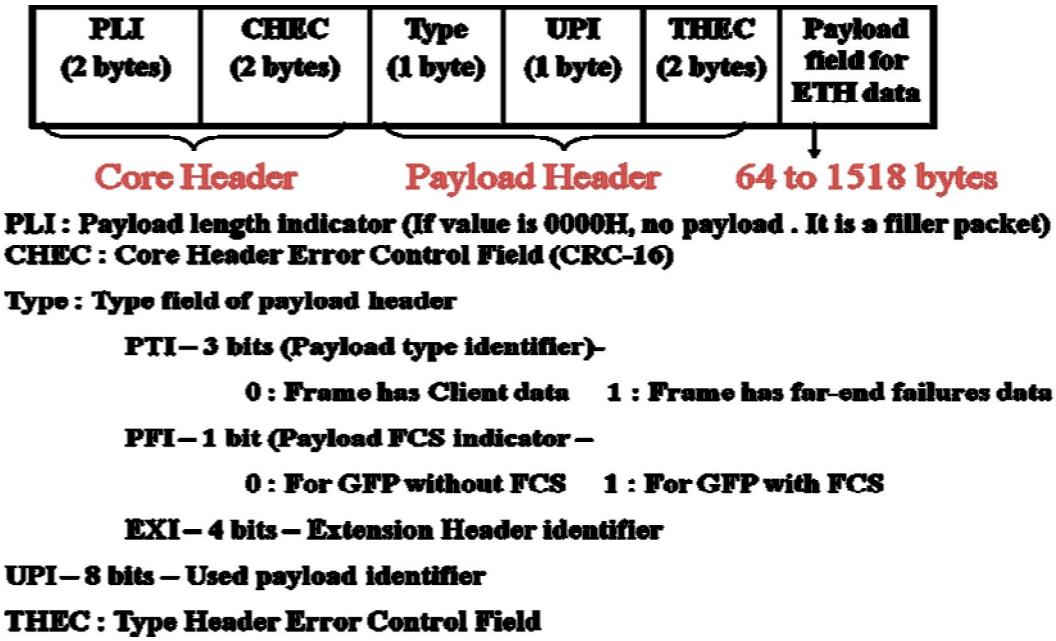

Fig.1 Mapping IEEE 802.3 frame using GFP without FCS

We also have extended GFP option where overhead need not be added for every 802.3 MAC frame, but GFP mapping of MAC frames can be continued with one-time overhead transmission till end of transmission is singnalled.

We have flow control options also while doing GFP mapping so that in case there is heavier traffic from LAN to the LAN at the other end, there is no loss of frames due to buffer over-flow. Flow control options are input flow control, output flow control.

Experimental set-up

1. Equip two interconnected STM-1 nodes (Tejas) with TP 01 or TP01 FT card (as per availability) . Make sure to use same type card at both the ends.TP01 is for 10 Mbps LAN and TP01FT is for 100 Mbps LAN.

2. Each card has 8 ports. (see fig. 2) Connect LAN switch to one of the ports on one node. At the other node also, use same numbered port for connection to LAN switch. Use CAT 5E cable with RJ45 connectors to make the connections.

3. In case LAN switches are not available, connect PCs' LAN interface ports to ETH ports of TP01/TP01FT card.

Fig.2 TP01 card illustration

4. To provision Ethernet ports using EMS of STM nodes:
    a. Click Ethernet Ports in the provisioning page. A list of all Ethernet ports available is displayed in the
    b. Click the desired port . Select the appropriate values against the fields. These are : choice of VC, flow control options and mapping options . (For mapping option, select GFP without FCS).
    c. Click Submit. Success message is displayed upon confirmation

5. Take peer to peer test

6. Select files of large size (10 MB and more) and observe transit time across LAN over SDH by using different bandwidth options for SDH pipe viz., VC-12, 2XVC-12, VC-3 and record observations.

Signature of the Candidate

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Instructor Initial :

Familiarization of SDH Analyzer ACTERNA Make

Objectives:

1. To know the functional capabilities of ACTERNA's SDH Analyzer
2. To become familiar with control panel, interfaces and display of ACTERNA's SDH Analyzer
3. To know about 'Laser Safety Precautions' while using ACTERNA
4. To understand the front-panel LED display
5. To power-up and start with default settings of ACTERNA's SDH Analyzer
6. To start programs with instant access buttons

Brief description of functional capabilities of ACTERNA's SDH Analyzer

The **A**dvanced **N**etwork **T**ester ANT-20SE is a high-end SDH Analyzer providing flexible and versatile measurement solutions for installing, maintaining and troubleshooting SDH networks elements as well as networks. With this analyzer, user can make measurements on all standard electrical and optical interfaces from 2 Mbit/s up to STM-4(622 Mbps).

It can resolve signal structures up to the 10 Gbit/s level and analyze them down to the lowest level. Access to all standardized mappings is available both for different transmission methods (SDH, SONET, ATM) and for mixed structures (e.g. DS1 in STM-1).

The ANT-20SE can measure synchronous functions at high bit rates and also jitter simultaneously. The measurement capabilities can be extended to STM-16 (2.5 Gbps) and

STM-64 also (10 Gbps) by add-on modules and software up-gradation. Hence, the instrument is also referred as ANT-20SE/10Gig.

Use of SDH analyzer eliminates the complicated and time consuming methods of using several different test instruments during network installation or troubleshooting.

The analyzer can handle ATM test functions , performance quality analysis on ATM links, ATM
frame structures on PDH and SDH interfaces which make it useful on ATM networks.

ANT-20SE/10Gig has the following features making it user-friendly:

1. Pentium processor with 32 MB RAM to match normal PC work environment
2. Use of the Windows operating system
3. Standard software ensures future viability
4. Easy access to PCMCIA interface without additional software
5. The PC concept and standard color display screen of the ANT-20SE/ANT-10Gig make it easily understandable and usable without the need to learn new operating procedures.

Exercise-1 : Observation of front panel

Observe the front-panel of ANT-20SE and label the areas marked I to VI in figure 1 below:

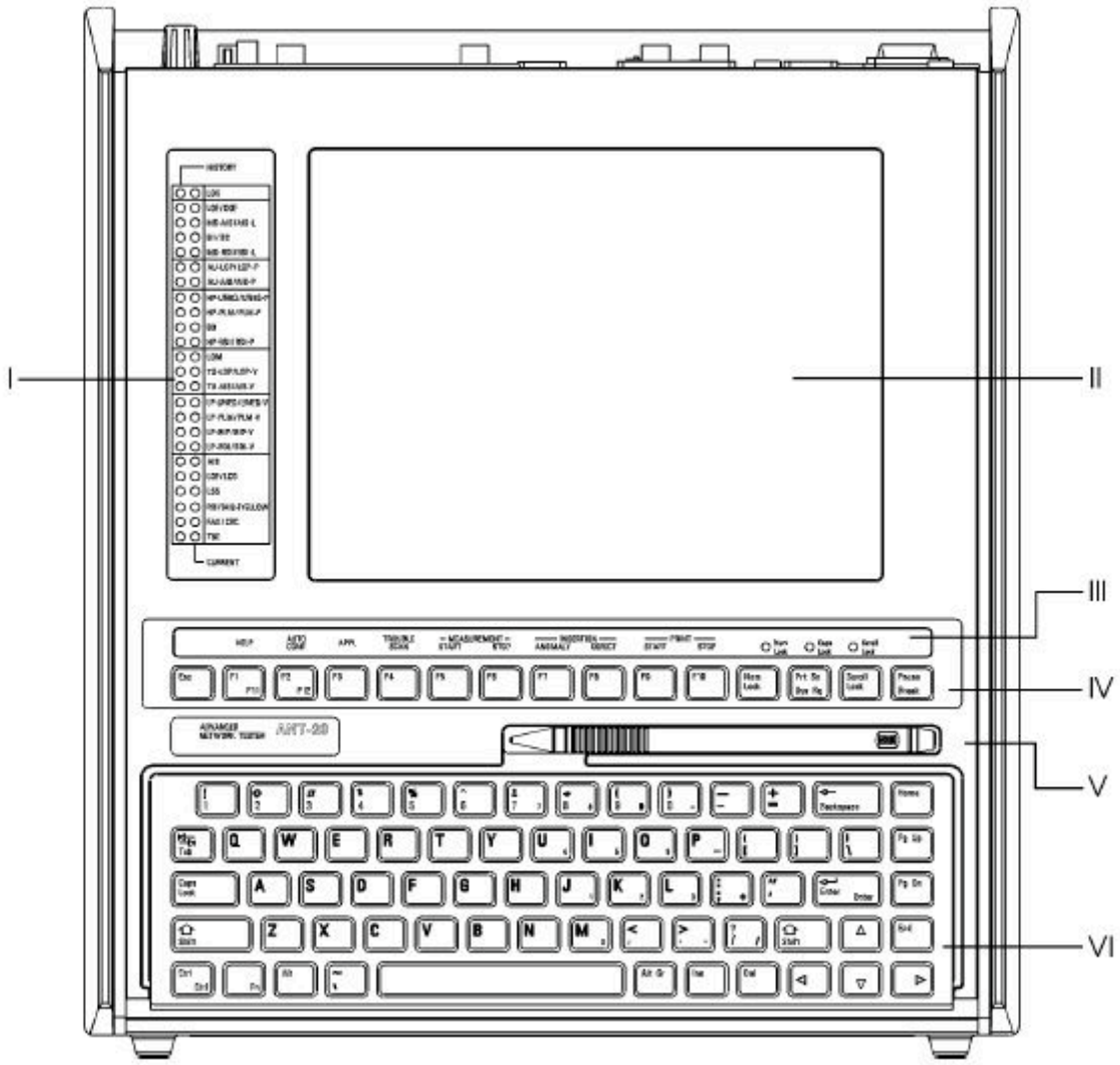


Figure-1

I :

II :

III :

IV :

V :

VI :

Exercise-2 : Observation of connector panel

Observe the connector panel and label the numbers shown in figure 2 below:

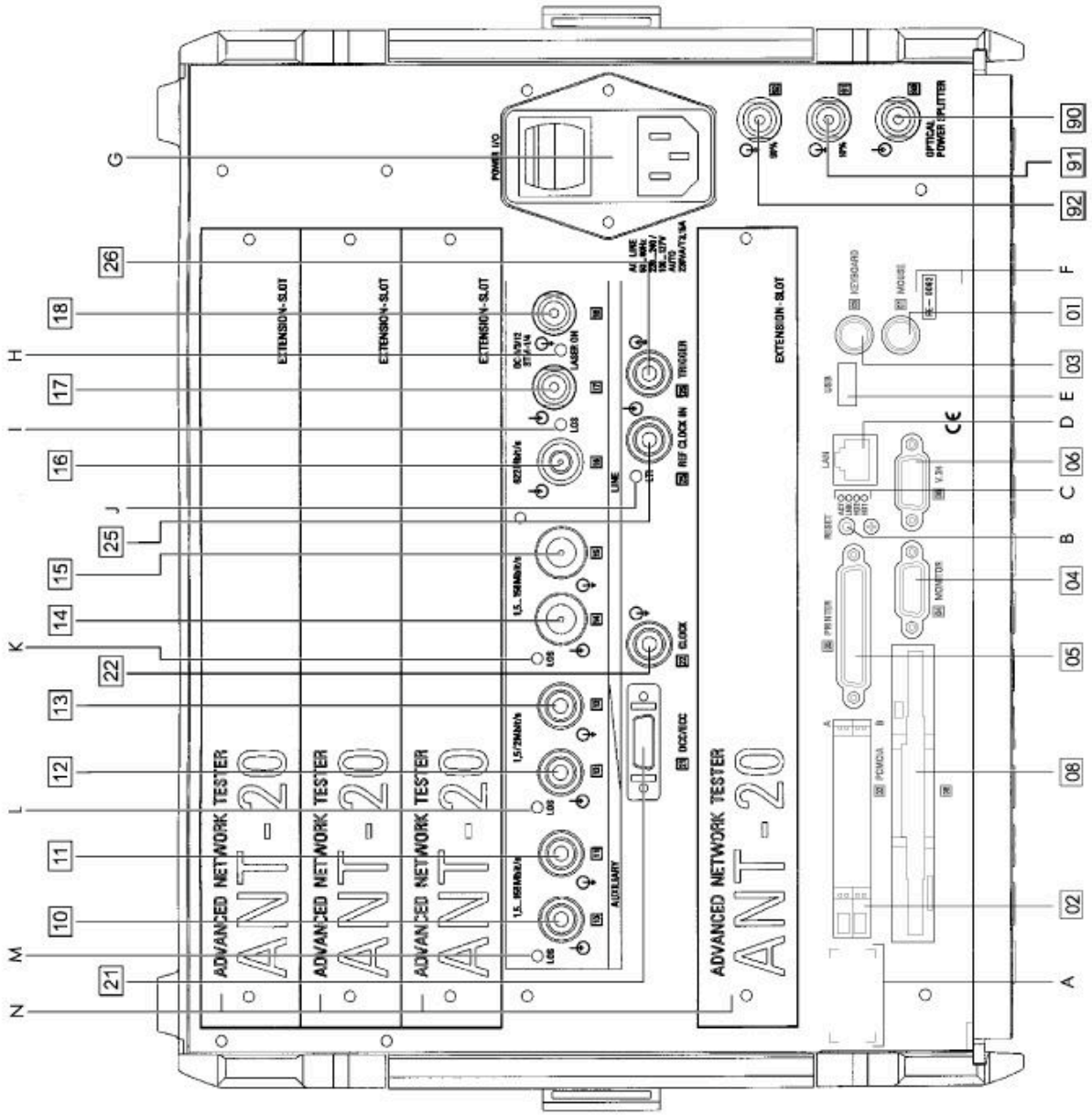


Figure-2

Interfaces / Connectors

Position	Interface / Connector designation
[01]	
[02]	
[03]	
[04]	
[05]	
[06]	
[08]	
[10]	
[11]	
[12]	
[13]	
[14]	
[15]	
[16]	
[17]	
[18]	
[21]	
[22]	
[25]	
[26]	
[90]	
[91]	
[93]	

Other labels/buttons

Position	Purpose / Nomenclature
A	
B	
C	
D	
E	
F	
G	
H	
I,K,L,M	
J	
N	

Exercise-3 : To know about 'Laser Safety Precautions' while using SDH Analyzer

The following options for the ANT-20SE are fitted with laser output devices:

- BN 3035/90.40 through BN 3035/90.59
- BN 3035/91.45
- BN 3035/91.53 through BN 3035/91.59

Optical radiation with wavelengths in the range 1300 to 1600 nm is present at sockets [18], [47]
and [103].

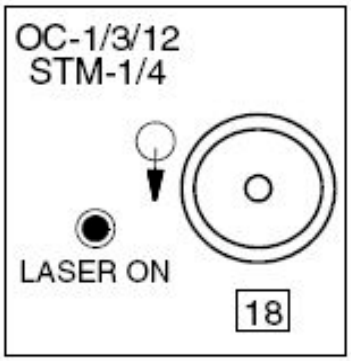
Maintenance and repair work on the laser sources should only be carried out by qualified service operatives familiar with the risks involved.

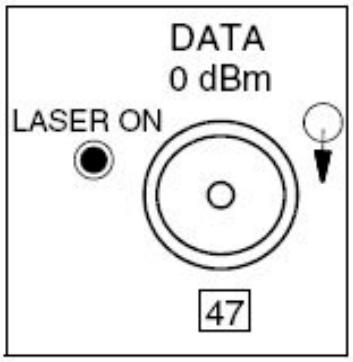
The laser source is active if the yellow LED next to the connector is on.

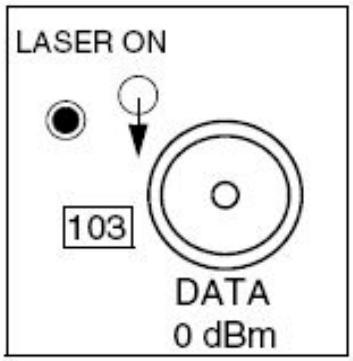
The output power at socket [18] of the STM-4/OC-12 module is within the limits for a CLASS 1 LASER PRODUCT.

The output power at socket [47] or [103] of the STM-16/OC-48 module or STM-64/OC-192 is also within the limits for a CLASS 1 LASER PRODUCT (IEC 825-1: 1993) during normal operation. Under fault conditions, the output power level may exceed these limits and the output

is then a CLASS 3A LASER PRODUCT (IEC 825-1: 1993).

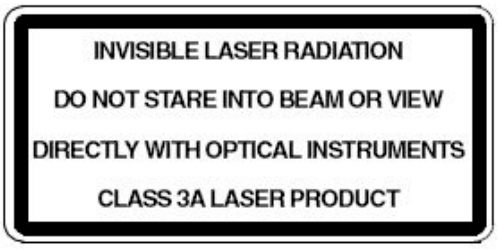






Check for 'Laser safety warning labels'

A laser safety warning label in the local language indicating the laser class must be affixed to the outside of the ANT-20SE/ANT-10Gig in such a position that it is clearly visible to the user.



List of precautions

Laser light can cause irreparable damage to the eyes, particularly to the retina.

1. Never look directly into the generator outputs [18], [47] and [103] or the connector end surfaces of the connected cables (free ends) if the laser sources are activated.
2. Never use a microscope to check the generator outputs if the laser sources are activated.
3. Do not activate the laser sources until all measurement connections have been made.

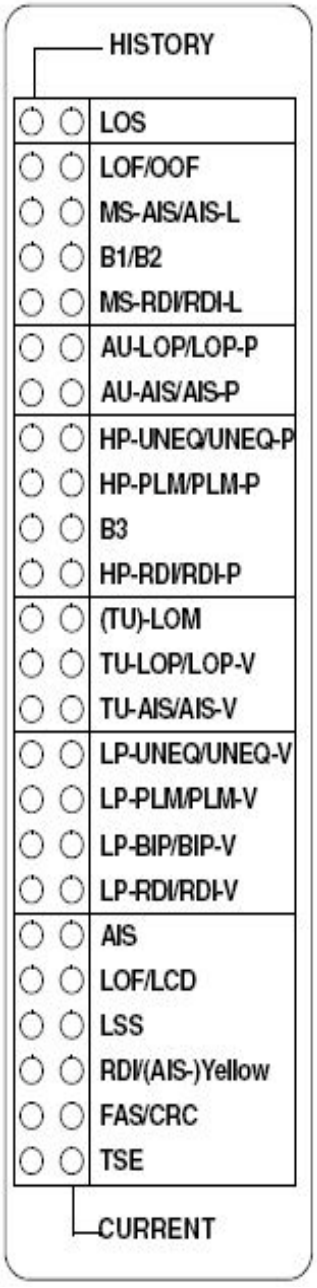
Exercise-4 : Observation of front LED panel

Observe the labeling on front LED panel and record the same, giving purpose of each indication Front LED panel is shown in figure-3

Question: What do you understand by the terms 'Current' and 'History'?

Answer :

Please note that the following events apply to SONET only and not to SDH :
AIS-L, LOP-P,UNEQ-P, RDI-P, AIS-V,PLM-V,RDI-L, AIS-P, PLM-P, LOP-V,UNEQ-V,BIP-V, (AIS-)YELLOW

Front LED panel	Explanation of indication
	

Exercise 5 : Getting started

5.1 Precautions MUST be observed before switch-on

Before switching the instrument on, observe the following precautions:

1. The instrument must not be damaged in any way that would affect safe operation.
2. The instrument must not be switched on if condensation is present.
3. The local a.c. line voltage and frequency must match the a.c. line voltage and frequency ranges of the ANT-20SE/ANT-10Gig.
4. The protective ground conductor must be properly connected.

5.2 Connecting up

1. Connect the ANT-20SE/ANT-10Gig a.c. line input to the local a.c. power supply using the line cord supplied with the instrument.
2. Connect the signal output [14] and signal input [15] together with a screened coaxial cable.

5.3 Switching on

Switch on the ANT-20SE/ANT-10Gig by setting the POWER switch to the "**I**" position.

5.4 After switching on

The ANT-20SE/ANT-10Gig is factory-configured to perform the following actions when it is switched on:

• Windows starts.
• All necessary windows drivers are loaded.
• The ANT-20 software is loaded and started

5.5 Switching on with function key "F3" APPL pressed

If the user wants to start the ANT-20SE with the default settings and ignore the last application that was saved

OR

If problems occur with a previously-saved application during boot-up of the ANT-20 software :

1. Press function key F3 "APPL" when the welcome screen is displayed. A dialog window opens after a few seconds.
2. Click on the "Yes" button in the dialog window.

5.6 Display when switched on with default settings or first time

Display when switched on with default settings or first time is shown in fig.4. It comprises of two windows or virtual instruments, namely:

1. ANT20 - <Application Title>
2. Signal Structure

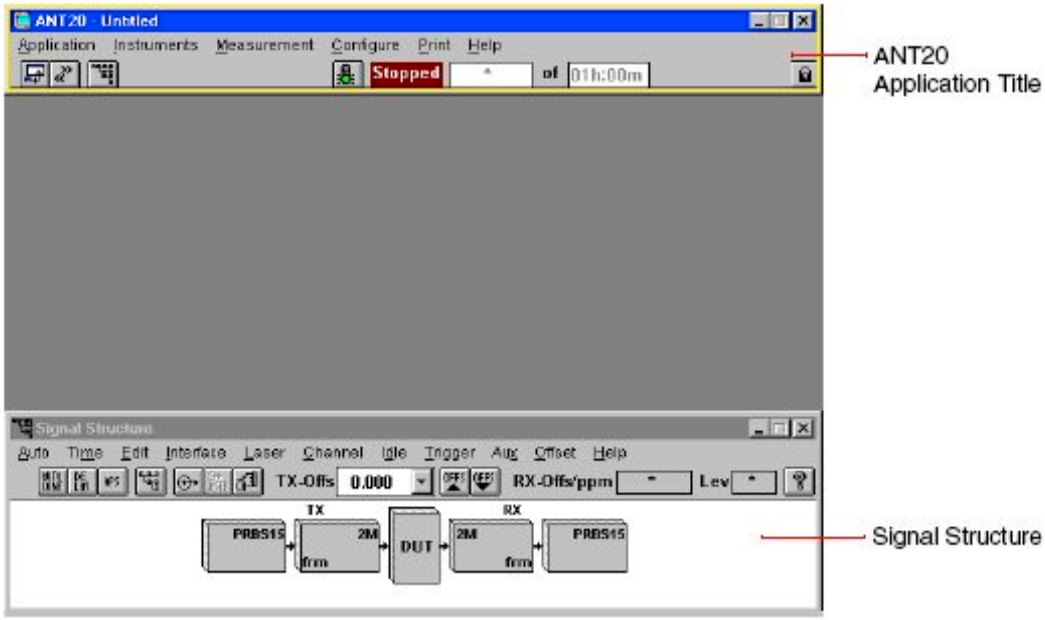


Figure-4

Exercise-6 : Starting programs with the "Instant Access Buttons"

As already explained in the previous exercise, when the user switches on the ANT-20SE, Windows starts by default and the ANT-20SE software will be loaded.

Other programs are available (included in the installed software on ANT-20SE. These programs can be started with the "Instant Access Buttons" or using icons (shortcuts). Proceed as follows to invoke them:

1. Click on "Exit" in the "Application" menu of the "ANT-20SE <Application Title>" (Application Manager) window.

The ANT-20SE/ANT-10Gig program terminates.

Note: Programs that do not utilize the ANT-20SE hardware, such as "Notepad",

"Acrobat Reader" or other Windows applications, can be run at the same time as the ANT-20 program.

2. Double click on the icon on the desktop. 

The "Instant Access Buttons" application will be activated. The desk-top looks as shown in fig.5

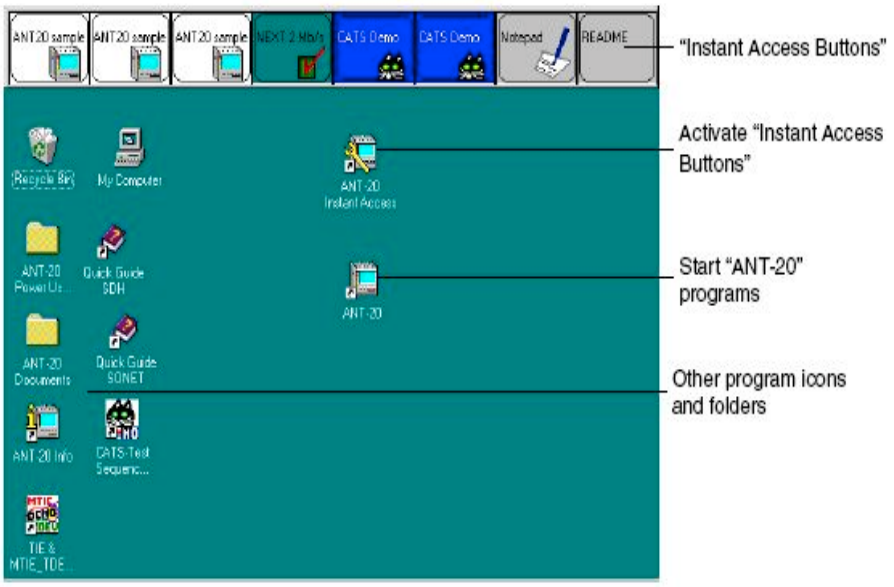


Figure-5 ANT-20SE desktop after activating the "Instant Access Buttons"

3. Click on the "Instant Access Button" or on the icon for the program that you want to start. The program will start.

Start the programs listed in the tables 1,2,3 as part of Exercise-5 of this experiment

Instant Access Button	Program / File	Explanation
	ANT-20	Starts the ANT-20 program with a pre-defined application.
	ANT-20 NEXT BN 3035/95.40	Starts the demo version[1] of the "ANT-20 NEXT" (ANT-20 Network Expert Test) software.
	ANT-20 CATS BN 3035/95.90	Starts the demo version[1] of the "ANT-20 CATS" software with a pre-defined application.
	NOTEPAD.EXE	Starts the Window Notepad program (text editor).
	NOTEPAD.EXE	Opens the readme file about the "Instant Access Buttons".

Table 1 : Instant access buttons and programs started by them (Set-1)

Icon	Program / File	Explanation
	ANT-20	Starts the ANT-20 program with the last application that was loaded.
	Shortcut	Activates the "Instant Access Buttons".
	MTIE/TDEV Analysis BN 3035/95.21	Starts the demo version[1] of the "MTIE/TDEV Analysis" software.
	CATS Test Sequencer BN 3035/95.90	Starts the demo version[1] of the "CATS Test Sequencer" software.
	Acrobat Reader	Opens the "Quick Guide SDH" pdf file.

Table 2 : Instant access buttons and programs started by them (Set-2)

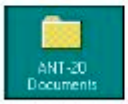
Icon	Program / File	Explanation
	Acrobat Reader	Opens the "Quick Guide SONET" pdf file.
	Shortcut	Opens a folder with pdf files that can be read using the Acrobat Reader.
	Shortcut	Opens a folder with pdf files that can be read using the Acrobat Reader.
	Shortcut	For service purposes only.

Table 3 : Instant access buttons and programs started by them (Set-2)

Notes on the use of the "Instant Access Buttons"

1. If you often use the "Instant Access Buttons" or you work with other applications, remove the shortcut for starting the ANT-20SE/ANT-10Gig program from the "Startup" group.
2. The "ANT-20", "CATS" or "ANT-20 NEXT" programs cannot be run simultaneously. If one of these programs has been started, you cannot start another of these applications using the "Instant Access Buttons".
3. If you remove the ANT-20 program shortcut from the "Startup" group, long-term measurements will not be resumed if they are interrupted by an AC power failure. Copy the "ANT-20" icon back into the "Startup" group or use an uninterruptible power supply if you want to make long term measurements.
4. Each of the "Instant Access Buttons" can be customized to the user requirements. User can change the labelling or link a button to a different application

How to remove "Instant Access Buttons" application

1. Press the "Shift" key.
2. Click on one of the "Instant Access Buttons" at the same time. A context menu opens.
3. Click on "Exit".

The "Instant Access Buttons" are removed.

OR

Press the "Alt" + "F4" keys simultaneously when the "Instant Access Buttons" are activated.
The "Instant Access Buttons" are removed.

Signature of the Candidate

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

अनुदेशक का अधाक्षर
Instructor Initial :

Familiarization of Signal Structure Virtual Instruments and all dialogs

Objectives:

1. To become familiar with the concept of 'Virtual Instruments' in SDH Analyzer
2. To become familiar with 'Signal Structure' VI and all the associated dialogs

Concept of 'Virtual Instruments'

To allow simple and logical operation of SDH Analyzer despite the large number of functions, user interfaces are available for ANT-20SE instrument , known as 'Virtual Instruments'. These are instruments (virtual) within instrument, hence the name. Virtual Instrument is denoted by VI

These VIs are designed so that each VI is assigned to a clearly defined task. By selecting specific VIs, customized applications (or tools) can be generated which are tailor-made for each particular measurement task.

The "ANT20 - <Application Title>" VI, also known as the Application Manager is the central control panel for the ANT-20SE. This VI has overall control of

• Measurement applications
• Measurement results generated using the applications
• Measurement sequence.

All the VIs that are available in SDH Analyzer ANT-20SE are listed in table-1.

Virtual instrument		Function
Icon	Name	
	**Application Manager**	Control and management of measurement applications
	**Signal Structure**	Configures the physical layer.
	**Anomaly/Defect Insertion**	Generates anomalies and defects for the physical layer including the "Transmission Convergence Sublayer".
	**Anomaly/Defect Analyzer**	Analyzes anomalies and defects for the physical layer including the "Transmission Convergence Sublayer".
	**Overhead Generator**	Edit physical frame overhead information. Used with SDH, SONET and PDH/ATM frames to G.832 (34 Mbit/s and 140 Mbit/s).
	**Overhead Analyzer**	Analyzes physical frame overhead information. Used with SDH, SONET and PDH/ATM frames to G.832 (34 Mbit/s and 140 Mbit/s).
	**Pointer Generator**	Generates SDH/SONET pointers.
	**Pointer Analyzer**	Analyzes SDH/SONET pointers.
	**PDH Generator/ Analyzer**	Set and display physical frame overhead. Used with PDH frames.
	**Performance Analysis**	Performance analysis to G.821, G.826, M.2100, M.2101 and Bellcore/ANSI.

Table 1 Vis available in SDH Analyzer ANT-20SE

Exercise-1 : Signal Structure VI

The “Signal Structure” VI is used to match your ANT-20SE/ANT-10Gig to the measurement interface of the device under test and to generate appropriate signal structures for the generator and receiver. The VI has the following functions:

• Entering the signal structure

• Selecting the Tx/Rx interfaces

• Automatic functions: Auto Config, Search, Trouble Scan, Delay, APS measurement

After the VI is booted up, the main window, “Signal Structure”, as shown in fig.1 is displayed.

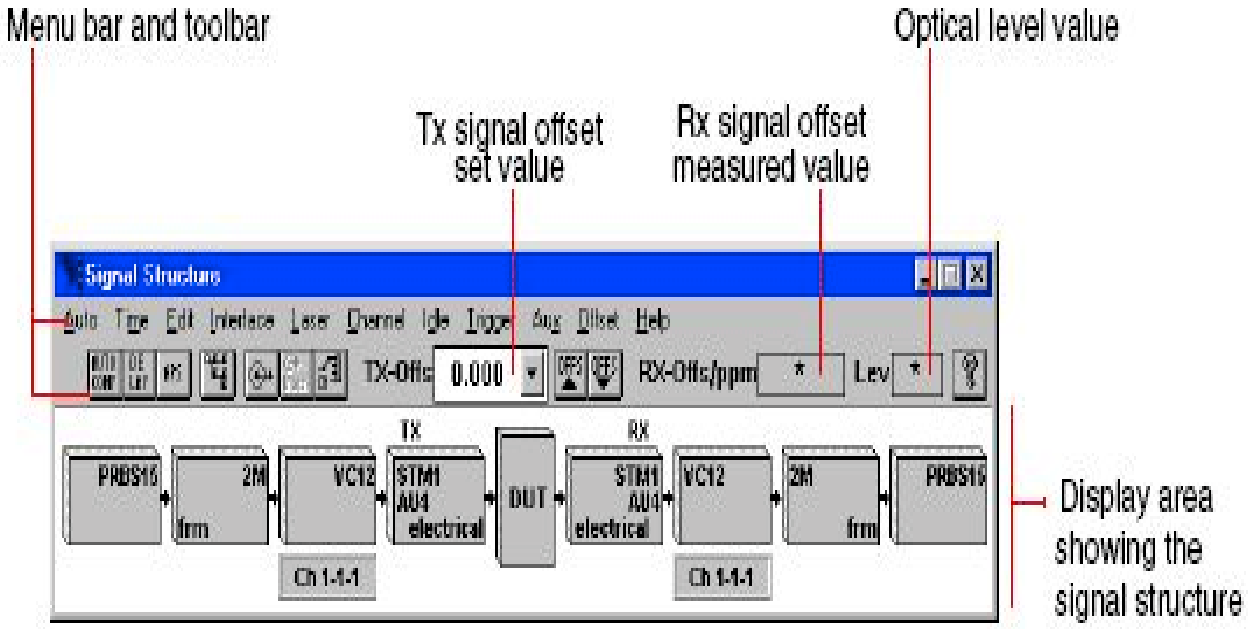


Fig.1 Elements in Signal Structure VI Main Menu

Menu bar items, icon buttons and their functions are tabulated in table-2 below

The following dialogs are possible with Signal Structure VI

1. Edit
2. Interface
3. Channel
4. Auto-configuration
5. Delay measurement

6. APS time measurement

Menu	Icon button	Function
Auto	AUTO CONF	Automatic functions, e.g. receiver configuration
Time	DE LAY, APS	Delay / APS measurements
Edit		Edit signal structur
Interface		Enter interface parameters
Laser	LASER	Switch laser on / off
Channel	CH	Select tributary channels
Idle		Set fill pattern for idle channals
Trigger		Set trigger signals
Aux		Select interface for Drop&Insert function
Offset	OFFS, OFFS	Set Tx signal (clock frequency) offset
Help		On-line help

Table-2 Signal structure Main Menu , Icon buttons and functions

Exercise 2 Dialog : Edit

This dialog is used to set the structures of PDH, SDH signals using corresponding buttons in the columns shown in fig.2

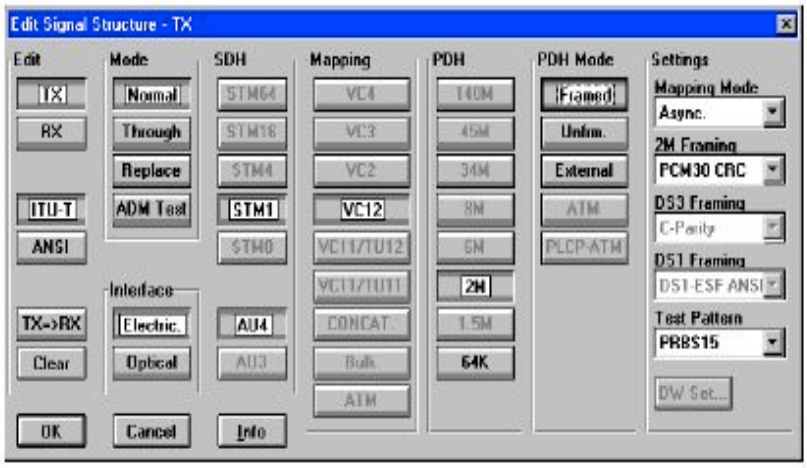


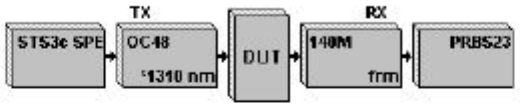
Fig.2 Display and settings for 'Edit dialog' of Signal Structure VI

Purpose of various buttons in 'Edit' column is explained below:

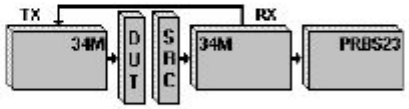
Edit	**"TX"/"RX"**	Select Tx or Rx signal structure to be edited.
	"ITU-T"	Select signal structure to ITU-T (SDH).
	"ANSI"	Select signal structure to ANSI (SONET).
	"TX => RX"	Copy Tx signal structure settings to Rx.
	"RX => TX"	Copy Rx signal structure settings to Tx.
	"Clear"	Clear Tx or Rx signal structure settings.

Purpose of various buttons in 'Mode' column is explained below:

"Normal" Normal mode: Tx and Rx signal structures are independent. Example:



"Through" Through mode: The Rx signal is looped through to the generator and transmitted. Tx and Rx clocks are identical. Example:

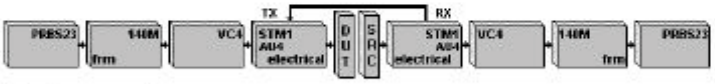


Basic procedure:

1. Set Rx signal structure.
2. Click the "Tx" button.
3. Click the "Through" button.

"Replace" Block&Replace: (only possible with SDH C4 and C3 mapping) Generator and receiver are coupled. The received signal is looped through from the receiver to the generator. The ANT-20SE/ ANT-10Gig is used on the receive side as a measurement channel monitor. The AU of the measurement channel is re-formed on the transmit side.

Example:

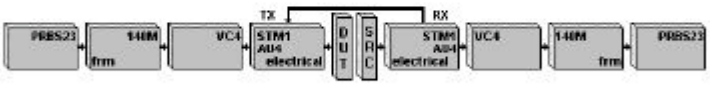


Basic procedure:

1. Set Rx signal structure.
2. Click the "TX" button.
3. Click the "Replace" button.

"Replace" Block&Replace: (only possible with SDH C4 and C3 mapping) Generator and receiver are coupled. The received signal is looped through from the receiver to the generator. The ANT-20SE/ ANT-10Gig is used on the receive side as a measurement channel monitor. The AU of the measurement channel is re-formed on the transmit side.

Example:

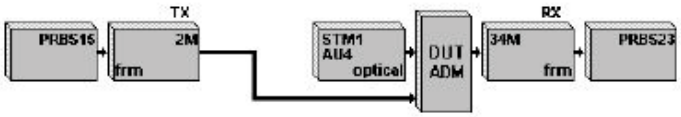


Basic procedure:

1. Set Rx signal structure.
2. Click the "TX" button.
3. Click the "Replace" button.

"ADM Test" Add/drop multiplexer test: ADMs require a valid optical signal, even for measurements on tributaries. The instrument provides an optical signal in addition to the electrical signal.

Example:



Basic procedure:

1. Set Rx signal structure.
2. Click the "Tx" button.
3. Click the "ADM Test" button.
4. Select the optical signal in the "SDH" column.
   When the signal is ready, the "PDH" column is enabled.
5. Set the Tx signal structure in the "PDH" column.

Under SDH column, we have options to choose STM rate viz., STM-1, STM-4, STM-16, STM-64.

Purpose of various buttons under interface column is explained below:

Interface	**"Electric."**	Electrical interfaces	Tx: [13] or [15]	Rx: [12] or [14]
	"Optical"	Optical interfaces	Tx: [18]	Rx: [17]
		for STM-16/OC-48	Tx: [47]	Rx: [44]
		for STM-64/OC-192	Tx: [103]	Rx: [113]

Purpose of various buttons under mapping column is explained below:

Mapping	**"CONCAT."**	Operating mode selection: Contiguous Concatenation or Virtual Concatenation Selection between Contiguous and Virtual modes is made under "Settings"/"Concat. Mode".
	"Bulk"	Fills the entire synchronous signal container with the O.181 (ITU-T) test pattern.
	"ATM"	Generates an ATM cell stream in the selected mapping (ATM mapping in SDH and SONET signals). For further signal definitions, see "ATM Signal Structure" VI.

Purpose of various buttons under PDH column is explained below:

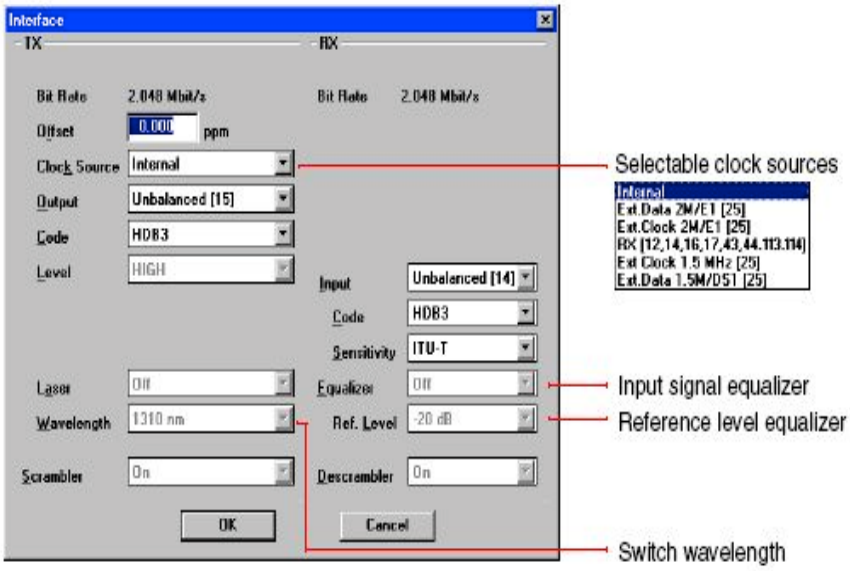
PDH Mode	**"External"**	Tx: An externally-applied PDH signal is multiplexed into the selected PDH signal from socket "Aux" [10]. Rx: A PDH tributary is demultiplexed from the PDH signal and output to socket "Aux" [11].
	"ATM"	Generates an ATM cell stream in the selected PDH signal (ATM mapping in PDH signals). For further signal definitions, see "ATM Signal Structure" VI.

Note : If 'Info' button is pressed, SDH signal structure corresponding to relevant ITU-T standard is displayed.

Exercise 3 Dialog : Interface

The "Interface" dialog is used to configure the parameters for the Tx and Rx interfaces. Dialog box for 'Interface dialog is shown in fig. 3

We have to select clock source, wavelength of operation, line-code and output (balanced / unbalanced, dependent on the case) using this dialog box.



Exercise 4 Dialog : Channel

The “Channel” dialog is used to set the measurement channel in all hierarchy levels of the tributary structure for the generator and receiver.

The channel numbering can be selected in the channel menu either as timeslot (acc. to ITU-T G.707) or as tributary. Dialog box for Chanel menu is shown in fig.4

At STM interface, we select TUGs and at PDH interface, we select time-slot / tributary through this dialog box.

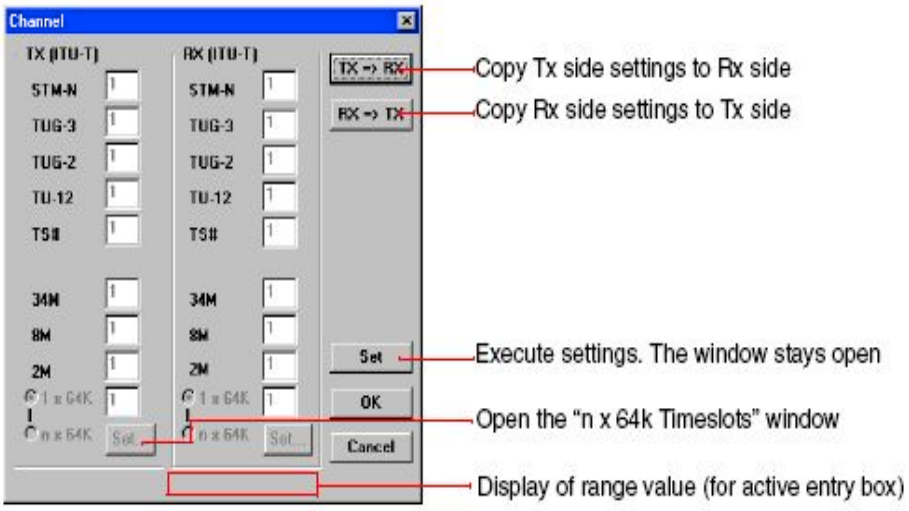


Fig.4 Dialog box for Channel setting

Exercise 5 Dialog : Auto-configuration

Dialog auto-configuration is for automatic setting of receiver to one of the options listed in the search menu. The result i.e. signal identified and to which receiver is set is displayed in the ‘Result’ box. Fig.5 gives dialog box for auto-configuration with protocol search options and result-box.

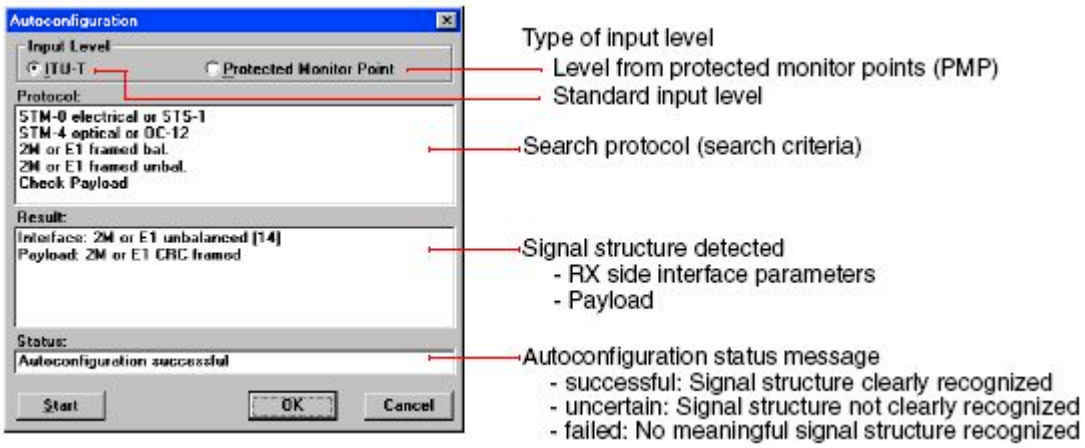


Fig.5 Dialog box for auto-configuration with protocol search options and result-box

Basic procedure

1. Select the type of input level (ITU-T or PMP)
2. Click the “Start” button to start the search
3. The Rx signal is checked for its system bit rate, line code, pattern and signal level. If the search is successful, the “Result” will display the signal structure that was detected.
4. To configure the receiver to the detected signal structure, click the “OK” button.

Only one channel is considered in the signal structure hierarchy in each case.
Status message “Autoconfiguration uncertain”
1. Click the “Start” button.
The search is triggered again.
2. If the search is successful, click the “OK” button.
– or –
If the search result is again uncertain, click the “Cancel” button.
The previous signal structure settings will be reinstated, which was selected before beginning Auto-configuration.

Search criteria

The signal structure is determined according to the following search criteria:
1. Check Interface

Matching to the physical parameters (bit rate / line code)

2. Check mapping

Searches for the mapping structure using the signal label and pointer bytes (distinction between AU-4 / AU-3). The search is always made in channel #1. If the signal is STM-16 / OC-48, the search is made for an AU-4 structure only in “ITU-T” mode or for an AU-3 structure only in “ANSI” mode.

If an UNEQuipped signal is detected, the previously selected mapping setting will be reinstated or a default mapping will be set.Autoconfiguration recognizes “C-11 via TU-12” mapping as “C-12” mapping.

3. Check payload

The search only takes account of the test patterns recommended in the standards.

Exercise 6 Dialog : Delay Measurement

The “Delay Measurement” is used to measure the signal delay times between the Tx and Rx sides using characteristic patterns included in the pseudo-random sequences. The delay measurement is an automatic measurement made by repeating single measurements continuously. It can be made using practically all the available ANT-20SE signal structures.

Exceptions are:
• ATM signal structures
• Measurements in the overhead
• Through mode
• ADM test
• Virtual concatenation

The measurement range and measurement time depend on the pattern bit rate and the pattern selected. The maximum possible measured value is determined by the length of the pseudorandom sequence. This maximum is calculated and displayed; it can be influenced by selecting a shorter or a longer test pattern.

Dialog box for ‘Delay measurement’ is shown in fig.6

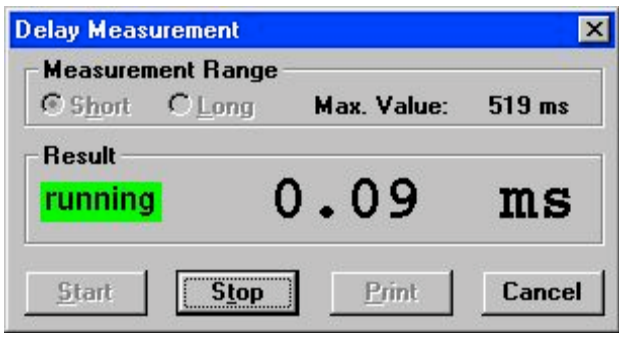


Fig.6 Dialog box for Delay-measurement

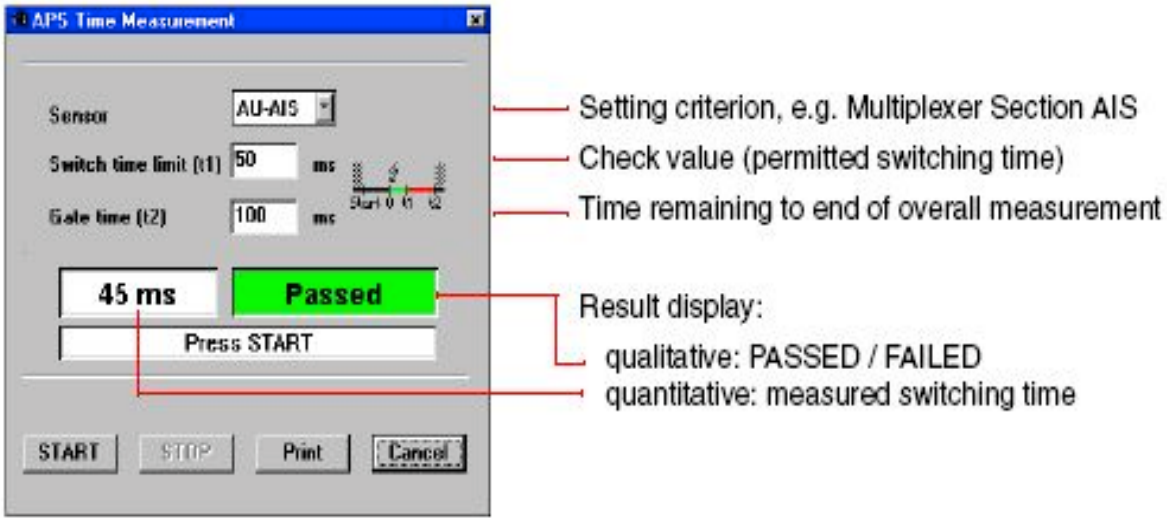
Exercise 7 Dialog: APS Time Measurement

The “APS Time Measurement” dialog is used for measuring the switching times of automatic protection switching (APS) to demonstrate that the permitted maximum drop-out times for a connection are not exceeded. The dialog is only available if the “Extended Overhead Analysis” option is fitted.

Using a selected criterion such as AIS or bit error burst, the drop-out times of tributary connections are measured and compared with a pre-set check value. The selectable criteria are:

MS-AIS, AU-AIS, TU-AIS and TSE (ITU-T)
AIS-L, AIS-P, AIS-V, TSE (ANSI)

The result is a simple “Passed” or “Failed” message.
Dialog box for ‘APS time measurement is shown in fig.1.7



Sensor: Selecting the setting criterion

"Sensor" specifies which event is to be evaluated and measured as the switching event. For example :

• MS-AIS measures the duration of a Multiplexer Section Alarm

• TSE measures the time for which the test pattern (PRBS) dropped out.

Switch time limit (t1): Setting the check value

The measured switching time is compared with the 'Switch Time Limit' value at the end of the measurement time. If the measured value is less than or equal to this value, the result is a PASSED message, otherwise a FAILED message is displayed.

Gate time (t2): Setting the measurement time

The measurement begins as soon as the sensor event first occurs. It ends after the set measurement time has elapsed. This ensures that multiple switching is also detected.

Result and status display

After the measurement the following are displayed:

• The switching time required

• A status message

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

अनुदेशक का अधाक्षर
Instructor Initial :

Use of Virtual Instruments

Objective :

To become familiar with the following Virtual Instruments, options available thereof :

1. Anomaly /Defect insertion VI
2. Anomaly / Defect analyzer VI
3. Overhead generator VI
4. Overhead analyzer VI
5. Pointer generator VI
6. Pointer analyzer VI

Brief description

To allow the instrument to be operated simply and logically despite the large number of functions, a user interface was developed for the SDH analyzer (ANT-20SE) makes use of “Virtual instruments” or VIs. These VIs are designed so that each VI is assigned to a clearly defined task. By selecting specific VIs, customized applications (or tools) can be generated which are tailor-made for each particular measurement task.

The common VI used in all tests and applications is “Signal Structure VI”, which was practiced under lab-sheet SDH-12. Now, use of other VIs shall be practiced.

Exercise 1 : Familiarization with Anomaly / Defect insertion VI

The “Anomaly/Defect Insertion” VI is used to insert anomalies (errors) and defects (alarms) into
signals of synchronous (SDH/SONET), plesiochronous (PDH) and asynchronous (ATM) communications systems. In our context, it is for SDH signal.

Set signal structure VI to STM-1 . Add ‘Anomal / Defect insertion VI to application manager. Click on “Anomaly/Defect Insertion VI” to activate. After the VI boots up, the “Anomaly/Defect Insertion” window appears, as shown in fig.1-A

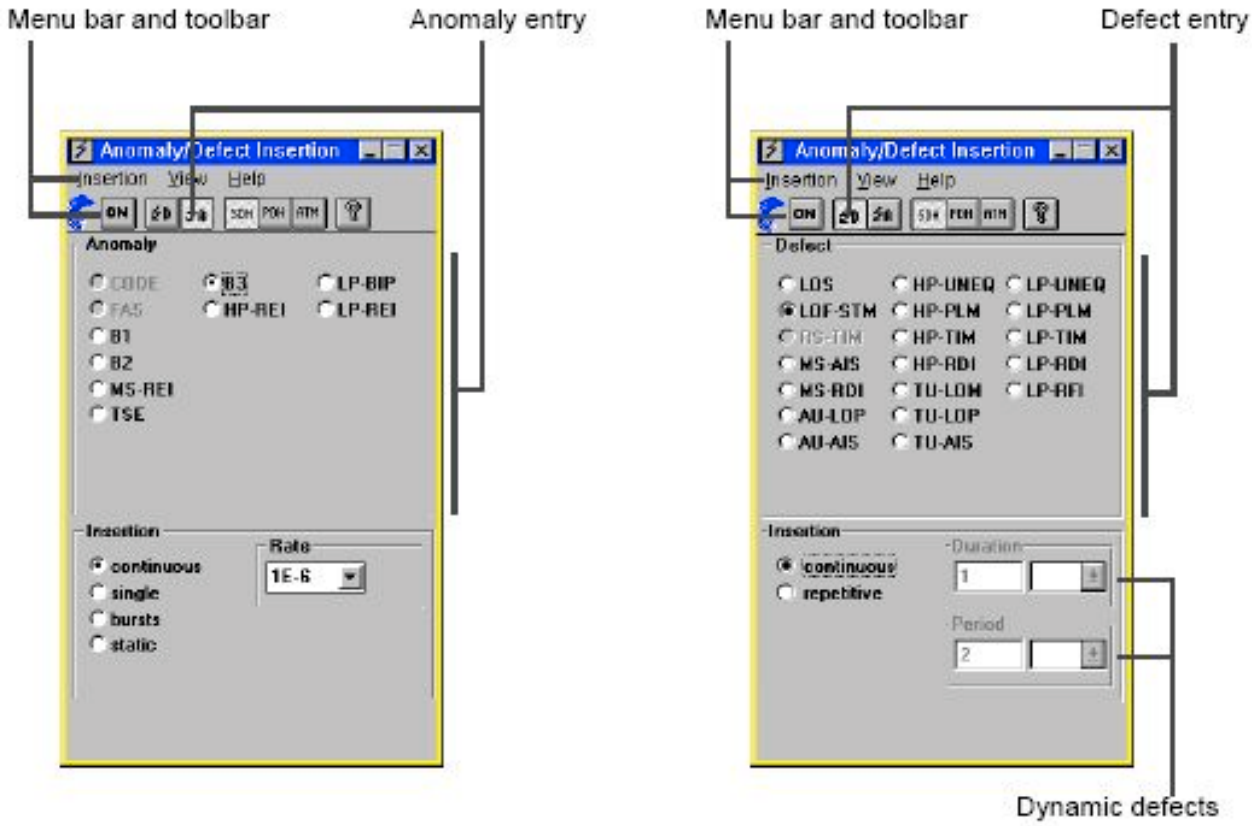


Fig.1 Anomaly / Defect Insertion VI window

Icon(button) wise functions are listed below, in fig.1-B :

Menu - Command	Icon button	Function
Insertion - ON		Inserts anomalies or defects (A/D)
View - Defects		Display and entry of defects
View - Anomalies		Display and entry of anomalies
View - SDH		Anomalies or defects for SDH technology
View - PDH		Anomalies or defects for PDH technology
View - ATM		Anomalies or defects for ATM technology
View - RDI		Select Remote Defect Indication options
View - Pointer Options		Select AISx/LOPx for Concatenation
Help		On-line help

Fig. 1-B Icon(button) wise functions in Anomaly / Defect Insertion VI window

1.1 Procedure for inserting anomalies

Procedure for inserting continuous anomalies is given below:

1. The “continuous” option is to be selected.
2. Click the “A” (Anomaly) button. The anomaly insertion entry box is activated.
3. Select the technology type (SDH in our case)
4. Select the anomaly required in the “Anomaly” entry box. The corresponding check box will be marked.
5. Enter the anomaly rate in the “Rate” list box
6. Click the “ON” button.

The anomaly will be inserted continuously.

Procedure for inserting single anomaly is given below :

1. Select single option
2. Steps 2 to 5 same as above

The anomaly is inserted each time the (ON) button is clicked.

1.2 Procedure for inserting defects

Procedure for continuous insertion of defects :

1. The “D” (Defect) button is to be clicked.
2. The “continuous” option has been selected.
3. Select the technology type (SDH in our case).
4. Select the defect required using the “Defect” entry box. The corresponding check box will be marked.
5. Click the “ON” button.

The defect will be inserted continuously.

Procedure for Repetitive insertion of defects

1. Select the ‘repetitive’ option
   a. The “Duration” and “Period” list boxes can now be accessed.
   b. Enter the duration of defect insertion (in frames or seconds) in the “Duration” box
   c. Enter the repetition period (in frames or seconds) in the “Period” box.

2. Steps 2 to 5 same as above.

Defects can be inserted or removed and the type of defect changed even while a measurement is running.

Exercise-2 : Familiarization with Anomaly / Defect Analyzer VI

This VI enables display of anomalies and defects as a histogram (View - Graph).

Procedure :

1. Set signal structure VI to STM-1 .
2. Add ‘Anomaly / Defect insertion and Anomaly / Defect Analyzer VI to application manager.
3. Click on “Anomaly/Defect Insertion VI” to activate. Carry-out anomaly / defect insertion as in exercise-1

4. Click on ‘Anomaly / Defect Analyzer VI’ . After the VI boots up, the “Anomaly/Defect analyzer ” window appears, as shown in fig.2-A

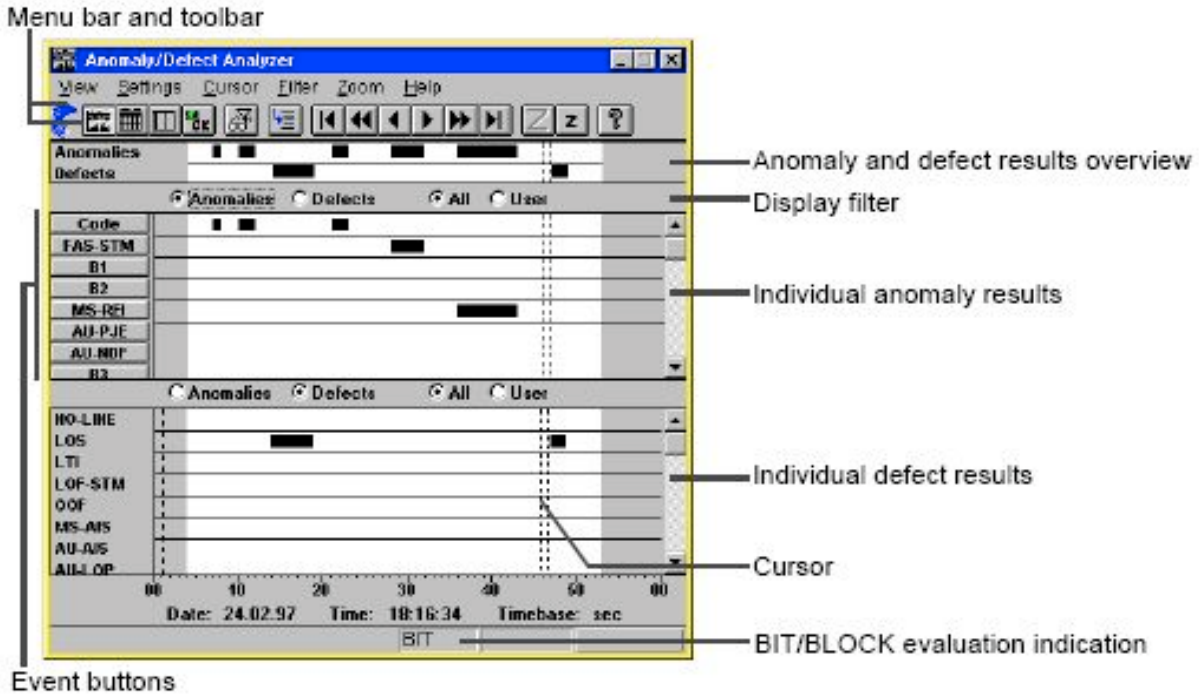


Fig.2-A Anomaly / Defect Analyzer window

Icon (button) wise functions are listed in fig.2-B

‘Filter’ button is of importance in the experiment. This enables display of selected results, as per

selection criteria are provided in the “User Filter” dialog.

The scrollbar lets the user display all the registered results within the display window. Clicking on an event button causes the rate per time for that event to be displayed.

Menu - command	Icon button	Function
View - Graph/Table/Num/ Summary		Switch display modes
Settings		Select various detection and measurement modes
Cursor - Go to		Moves cursor position to date and time entered
Cursor - First/Last		Sets cursor to start / end of the measuring interval
Cursor - Prev/Next		Moves cursor page by page to the left / right
Cursor		Moves cursor in intervals (single step) to the left / right
Filter		Display selected results only (user filter)
Zoom - In/Out		Increase / decrease resolution of time axis

Fig.2-B Icon(button) wise functions in Anomaly / Defect Analyzer window

Try-out 'Table-view' as an exercise. The result looks similar to fig.2-C. (Other modes can be tried as per availability of time) :

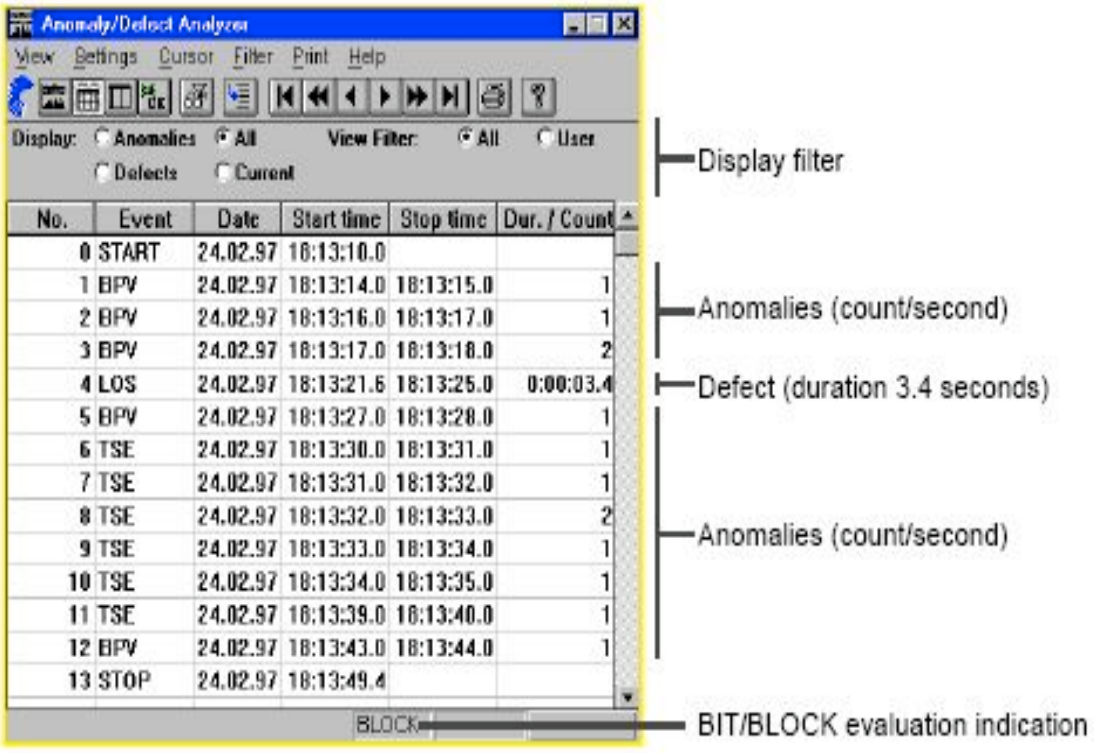


Fig.2-C Table-view of Anomaly / Defect Analyzer results' display

Exercise-3 : Familiarization with Overhead generator VI

The “Overhead Generator” VI is used to edit the bytes in the RSOH/MSOH/POH of the selected channel. The dynamic bytes (B1, B2, B3) and the pointer line cannot be edited.

Procedure

1. Set signal structure VI to STM-1 .
2. Add ‘Overhead generator VI’ to application manager
3. Click on ‘Overhead generator VI’ to activate. The VI boots up and the window shown in fig.3-A appears

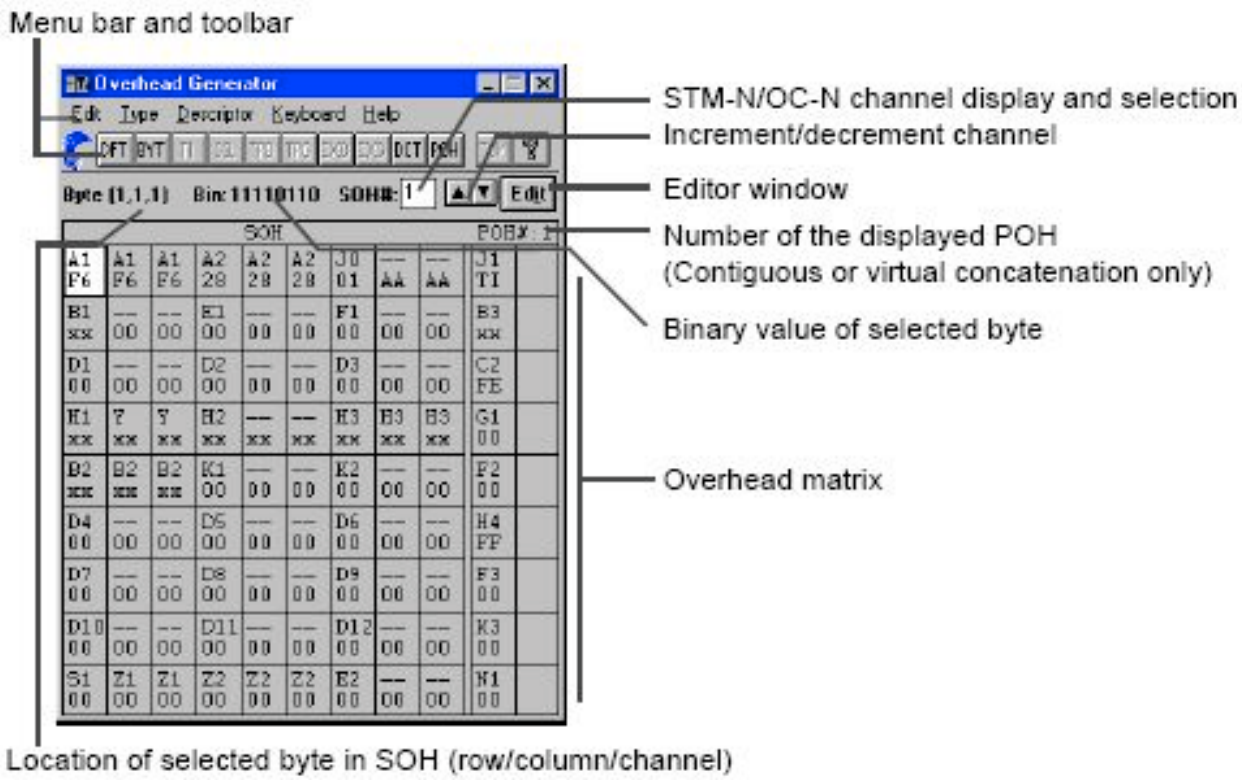


Fig. 3-A Overhead Generator VI

Icon(button) wise functions in the above window are given in fig.3-B

Menu	Icon button	Function
Edit	DFT	Default: Set overhead bytes to default values
Type	BYT	Byte: Enter static value
	TI	Trace Identifier: Enter J0, J1, J2 bytes (ASCII string)
	SQ	Sequence: Select standard H4 sequence (4, 48, off)
	TPB	Test Pattern: Fill byte with test pattern
	TPG	Test Pattern Group: Fill byte group with test pattern
	EJB	External Byte: Insert externally-generated signal from socket [21] in selected byte
	EJG	External Byte Group: Insert externally-generated signal from socket [21] in selected byte group
Descriptor	DCT	Bytes for APS (ring and linear), synchronization and path label
Edit	POH	Selection of the background POH
Type	TCM	Opens the "TCM Sequence" dialog for editing the TCM sequence

Fig.3-B Icon-wise functions in Overhead Generator VI main-window

Procedure (continued)

4. Click on the RSOH/MSOH/POH byte in the main window, which has to be edited
5. Select desired function in the toolbar.
6. Press "Edit" button.
7. Depending on the byte type selected, one of the following windows will open:
   – "Edit Overhead Byte"
   – "Trace Identifier Editor" (when J0, J1, J2 or TR selected)
   – "H4 sequence editor" (for C-12/C3 mapping)
8. The selected byte is edited in this window.
9. Please note that the button has no function for E1, E2, F1, F2 and D1 to D12 and K1 to K2 if the selected byte is set to TP (test pattern) or EX (external).

Exercise-4 : Overhead analyzer

The "Overhead Analyzer" VI is used to display the contents of the RSOH/MSOH/POH bytes of the received channel.

Procedure

1. Set signal structure VI to STM-1 .
2. Add 'Overhead analyzer VI' to application manager

3. Click on ‘Overhead analyzer VI’ to activate. Main window as in fig.4-A appears:

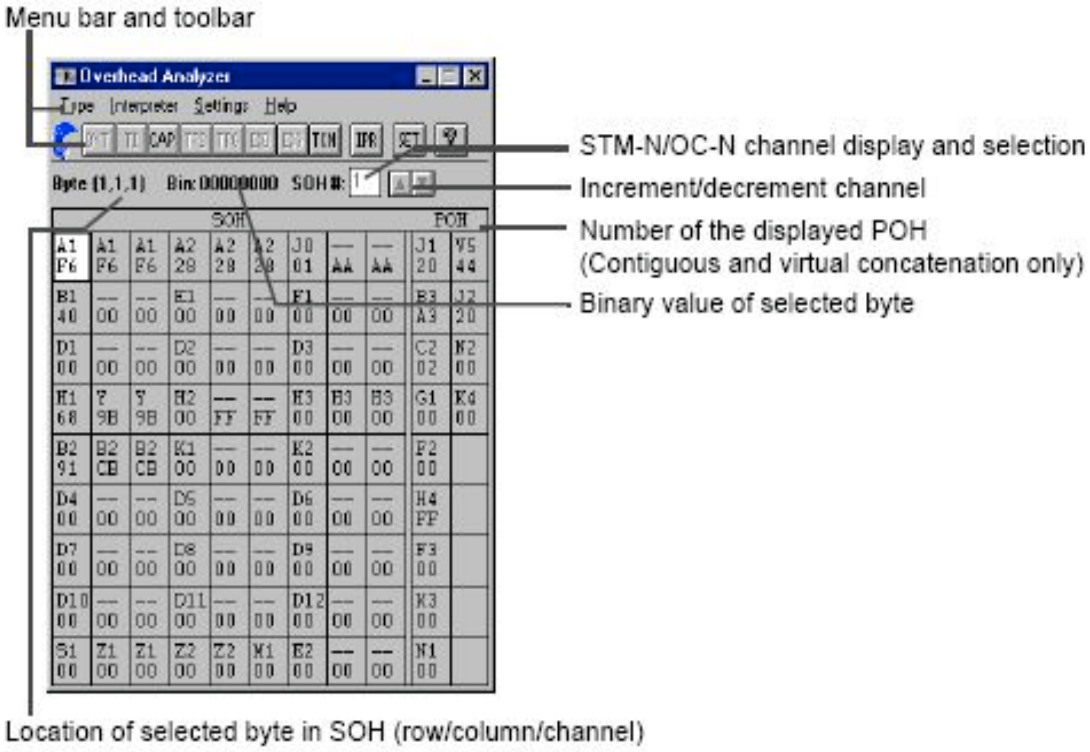


Fig.4-A Overhead analyzer main window

Icon (button) wise functions of this menu or window are listed in fig.4-B

Menu	Icon button	Function
Type	BYT	Byte: Select individual byte analysis
	TI	Trace Identifier: Display of bytes J0, J1, J2
	CAP	Capture function for recording selected bytes
	TPB	Test Pattern Byte: Display test pattern in individual bytes
	TPG	Test Pattern Group: Display test pattern in byte groups (e.g.. D1 to D4)
	EJB	External Byte: Outputs a byte to socket [21]
	EJG	External Group: Outputs a byte group to socket [21]
	TCM	Switch on TCM evaluation (Tandem Connection Monitoring). Only possible, if one of the bytes N1 or N2 (Z6) is marked.
Interpreter	IPR	On-line interpretation of APS, sync. and path label
Settings	SET	Select expected values for trace identifier, path label and H1 byte

Fig.4-B Icon (button) wise functions in main window of Overhead Analyzer

Procedure (contd.)

4. The “Type” menu is used to set the various evaluation modes for the individual bytes. Details are in fig.4-C.

J0, J1, J2:	Byte and Sequence evaluation
D1 to D4:	Byte, Test Pattern Byte and Test Pattern Group
D5 to D12:	Ext. Byte and Ext. Group
E1, E2, F1, F2:	Test Pattern Byte and Ext. Byte
K1, K2:	Ext. Group
K3, K4:	Ext. Byte
N1, N2 (Z6)	TCM evaluation

Fig.4-C Type menu – Options for setting evaluation mode

5. The procedure for using ‘type’ menu is as follows :
   a. Select the byte of interest in the overhead matrix.
   b. The field color changes from gray to white.
   c. Select the evaluation mode from the “Type” menu or using the corresponding icon buttons.

6. Interpreter window is used window is used to display the actual content of the various bytes in plain text. User can also select whether the evaluation is to be performed according to “Ring APS (G. 841)” or “Linear APS (G. 783)”. Interpreter window is shown in fig.4-D

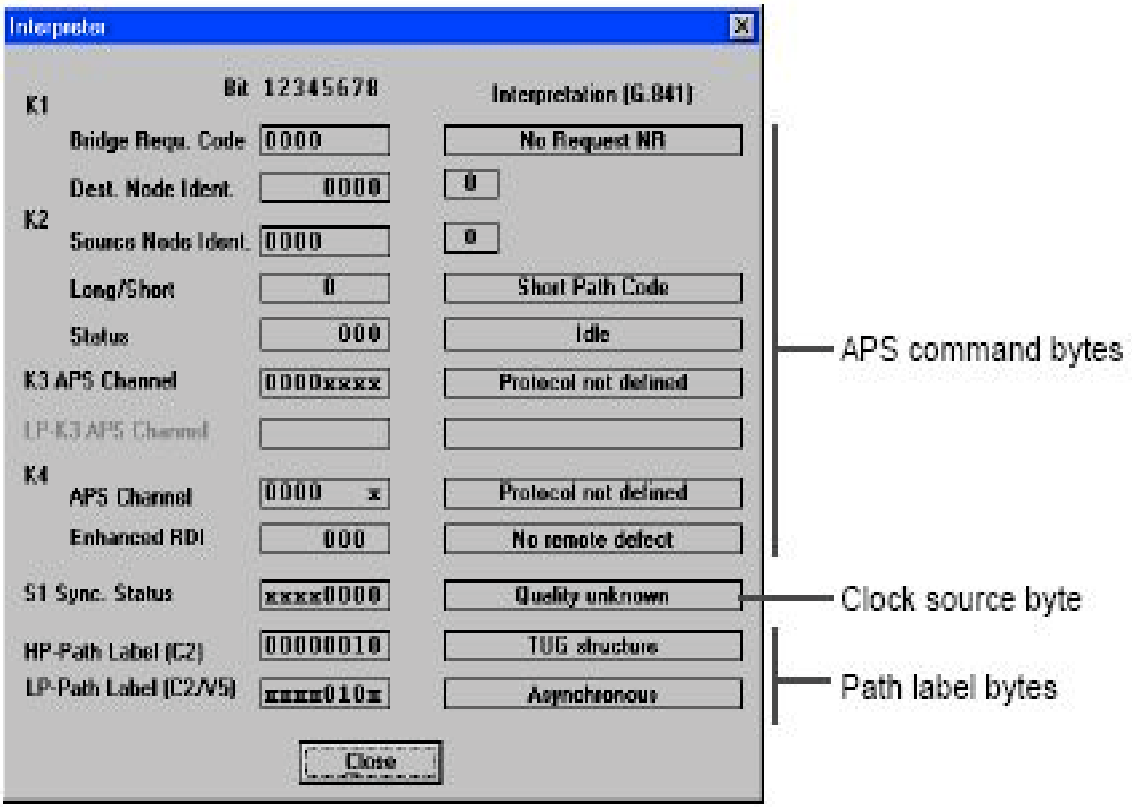


Fig.4-D Options in interpreter window

Exercise-5 : Familiarization with Pointer Generator VI

The “Pointer Generator” VI is used to generate individual pointer actions and pointer sequences
according to the ITU-T standards.

Procedure:

1. Set signal structure VI to STM-1
2. Add pointer generator VI to application manager
3. Click on the VI icon. Pointer generator window appears as in fig.5-A

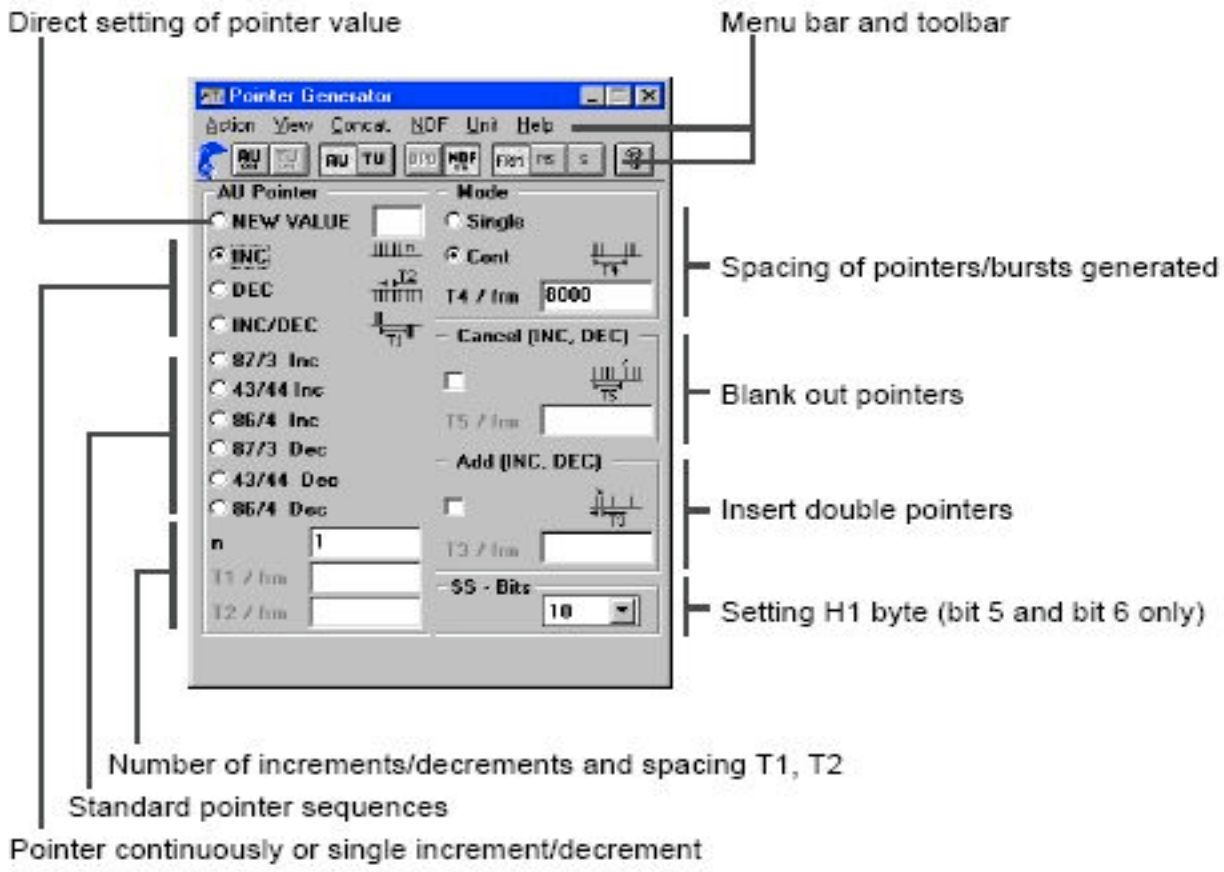


Fig.5-A Pointer generator VI main window

Icon(button) wise interpretation is given in fig.5-B

Menu - command	Icon button	Function
Action	AU ON TU ON	Trigger AU or TU pointer action
View	AU TU	Select AU or TU pointer layer
Concat.	DPO	Delta Pointer Offset
NDF	NDF ON	Set pointer value with NDF on / off
Unit - Frame	FRM	Units for the time parameters (T1 to T5) in frames
Unit - Millisecond	MS	Units for the time parameters (T1 to T5) in milliseconds
Unit - Second	S	Units for the time parameters (T1 to T5) in seconds
Help	?	On-line help

Fig.5-B Icon-wise interpretation of pointer generator VI main window

The Pointer Generator allows simultaneous generation of AU and TU pointers using independent parameters.

Periodic pointers and pointer bursts

· Periodic (single / multiple) pointers of identical polarity
("INC" or "DEC" pointer actions)
· Periodic (single / multiple) pointers of different polarity
("INC/DEC" pointer action)
· Periodic pointers with one double pointer
("INC" or "DEC" pointer actions with "Add" function, T4 = n x T2)
· Periodic pointers with one missing pointer
("INC" or "DEC" pointer actions with "Cancel" function, T4 = n x T2)
· Pointer burst with missing pointers
("INC" or "DEC" pointer actions with "Cancel" function, T4 >> n x T2)

Standard sequences

All the standard sequences to ITU-T G.783 can be used directly or can be edited for special applications.
· "87-3" sequence
· "43-44" sequence with double pointer
· "86-4" sequence with double pointer

Above pointer actions and sequences are used in lab-sheet SDH-18 while carrying out pointer stress tests.

Exercise-6 : Familiarization with pointer analyzer VI

The "Pointer Analyzer" VI is used to display the pointer values (addresses) and to show the number of pointer actions graphically

Procedure:

1. Set signal structure to STM-1
2. Add pointer generator and pointer analyzer VIs to Application manager.
3. Click on pointer analyzer VI. The main window appears as shown in fig.6-A

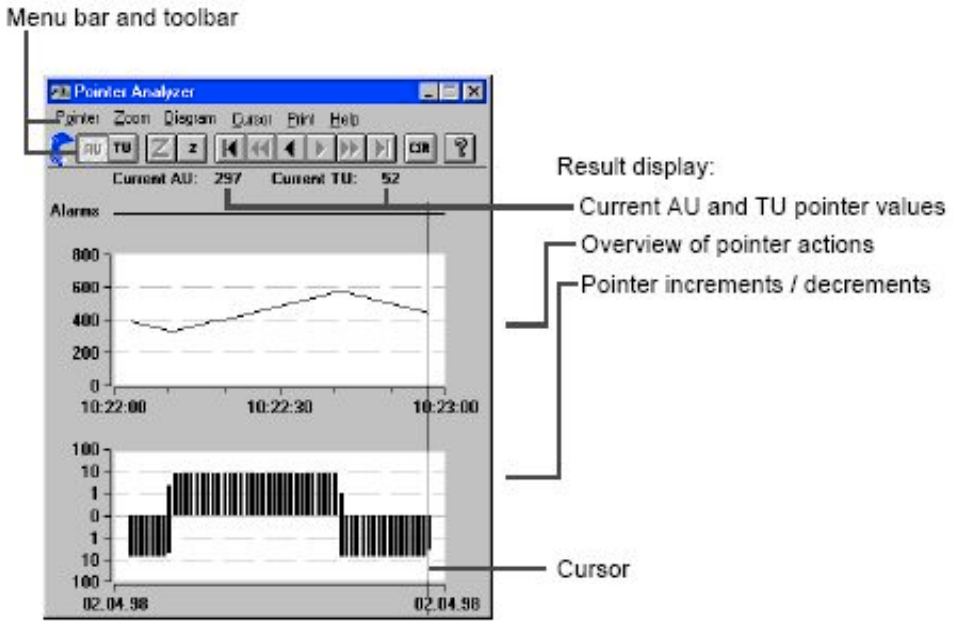


Fig.6-A Pointer Analyzer main window

Icon (button) wise interpretation is given in fig.6-B

Menu - command	Icon button	Function
Pointer	AU TU	Selects the pointer layer
Zoom - In/Out	Z z	Increase / decrease time axis resolution
Diagram		Select the diagram display (for Virtual Concatenation only)
Cursor - First/Last	⏮ ⏭	Set the cursor to the start / end of the record
Cursor - Prev/Next Page	⏪ ⏩	Move back / forwards by half a display width
Cursor - Prev/Next Value	◀ ▶	Move back / forwards by one pointer address
Cursor - Position	CSR	Numerical display of pointer value at cursor position
Print		Print and export results
Help	?	On-line help

Fig.6-B Icon (button) wise interpretation of pointer analyzer VI main window

Test to be performed

Connect four STM nodes in a ring with SDH analyzer with pointer analyzer VI enabled for on-line monitoring of one of the nodes. Change clock reference of adjacent node and observe pointer activity i.e. display of fig.6-A.

Signature of the Candidate

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

अनुदेशक का अधाक्षर
Instructor Initial :

RSOH, MSOH & POH Analysis using SDH Analyzer

Objectives :

To display the contents of RSOH, MSOH & POH bytes of STM frame using Overhead Virtual Instrument (OH-VI) of ACTERNA's SDH analyzer and check the trace-identifiers

Brief description

STM frame has the following overhead bytes to facilitate configuration & maintenance of SDH

Network elements:

Regenerator Section Overhead (RSOH)	:	Information exchanged between two adjacent RGs (Regenerators)
Multiplexer Section Overhead (MSOH)	:	Informaiton exchanged between two adjacent MUXes
Path Overhead (POH)	:	Information exchanged between two TMs (Terminal MUXes) on a path

STM-1 frame structure & location of RSOH, MSOH ,POH in STM-1 frame are shown in fig. 1

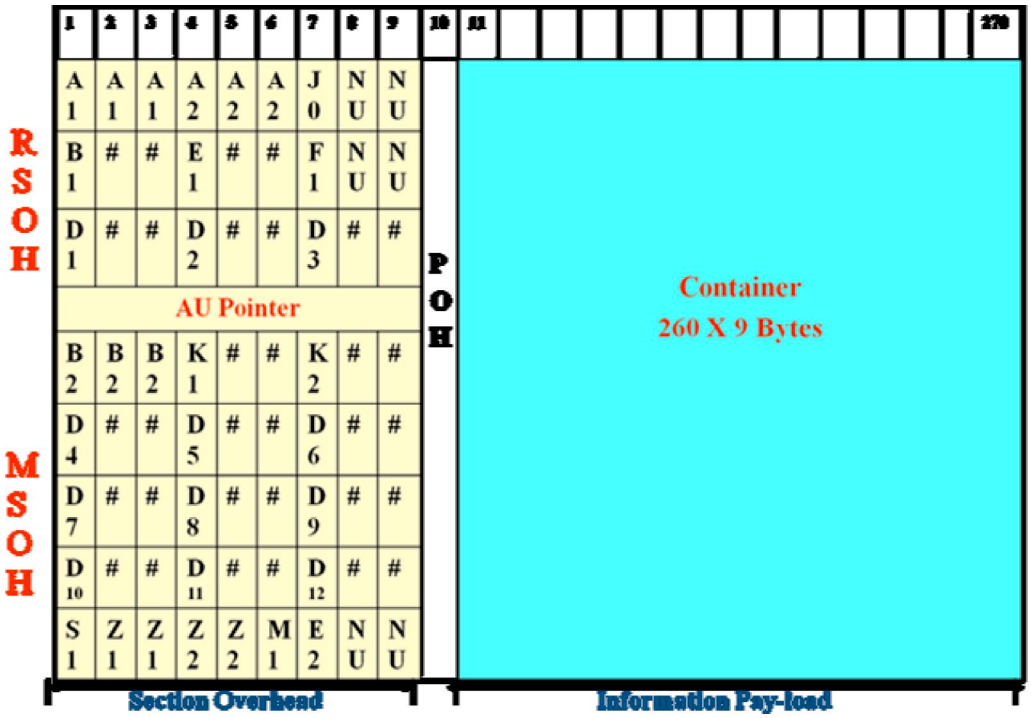


Fig.1 STM-1 frame structure & location of RSOH,MSOH,POH

Interpretation of RSOH bytes is given in table 1

RSOH Byte	Description
Framing Bytes A1, A2	Each STM-1 frame begins with A1=11110110, A2 = 00101000 Framing algorithm helps in locating
Section trace J0	To identify section through a code
BIP-8 (B1)	Even parity checksum for all bytes of previous STM frame
Order-wire (E1)	Voice channel for user order-wire
Service provider Order-wire (F1)	64kbps channel for network provider
Data comm.(D1/2/3) (DCCr)	192 kbps channel for alarms, mntc., control, monitoring, admn.

Table 1 Interpretation of RSOH bytes

Interpretation of MSOH is shown in table 2

MSOH Byte	Description
Pointer bytes H1,H2	Pay-load pointers, concatenation indicators All 1s in H1 & H2 indicate Failure Alarm
Pointer action byte H3	H3 carries Extra SPE byte when Negative Justification occurs
B2	Parity Checksum for LOH & SPE bytes
APS Bytes K1,K2	Signalling bits for line level Automatic protection switching
D4-D12	576 kbps data channel for alarms, Mntc., Control, Admn. needs between Line Term. Eqpt.
Sync. Status S1	Bits 5-8 convey synchronous status Life byte of SDH network
M1 (FEBE)	To convey Far-end block error
Order-wire E2	Express Order-wire
Z1,Z2	Spare

Table 2 Interpretation of MSOH

Interpretation of POH is given in Table 3

POH Byte	Nomenclature	Purpose
J1	Path Trace	Enables receiver to verify connection with TX
B3	Path BIP 8	Check-sum of previous VC4
C2	Signal Label	E4/T6 (European/American)
G1	Path Status	Path status & performance conveyed back to VC-4 source terminal. Complete duplex trail can be monitored
F2	Path User Channel	Data channel for path user
H4	Position Indicator	Generalized position indicator for payloads Can be payload specific
F3	Path User Channel	Data channel for path user
K3	APS	Automatic protection switching at VC-4 path level
N1	NW Operator Byte	Monitoring NW

Table 3 Interpretation of POH bytes

Procedure to check RSOH, MSOH, POH and Trace identifiers in them

1. The “Overhead Analyzer VI(Virtual Instrument)” is used to display the contents of the RSOH, MSOH, POH bytes of the received channel. Menu buttons in the Overhead-VI and the options under each are summarized in table 4.

Menu	Icon button	Function
Type	BYT	Byte: Select individual byte analysis
	TI	Trace Identifier: Display of bytes J0, J1, J2
	CAP	Capture function for recording selected bytes
	TPB	Test Pattern Byte: Display test pattern in individual bytes
	TPG	Test Pattern Group: Display test pattern in byte groups (e.g.. D1 to D4)
	EJB	External Byte: Outputs a byte to socket [21]
	EJG	External Group: Outputs a byte group to socket [21]
	TCM	Switch on TCM evaluation (Tandem Connection Monitoring). Only possible, if one of the bytes N1 or N2 (Z6) is marked.
Interpreter	IPR	On-line interpretation of APS, sync. and path label
Settings	SET	Select expected values for trace identifier, path label and H1 byte

Table 4 Menu buttons and options in Overhead Analyzer Virtual Instrument

2. Activate the “Settings” dialog w.r.t. receiver for checking the Trace Identifier or the Path Label. To do this, specify expected values for the Trace Identifier (J0, J1, J2) or Path Label HPPLM, LP-PLM).

3. The device under test is operating correctly if the receive signal meets the expected values. If the receive signal does not match the expected values, the “Trace Identifier Mismatch” or “Path Label Mismatch” alarm messages can be generated. These defects are indicated in the “Anomaly/Defect Analyzer” VI.

4. Also set the expected values for the SS bits in the H1 byte in the “Settings” dialog. The “AU-LOP” alarm is generated if the SS bits received do not correspond to the expected SS bits. SS bits will not be evaluated if you set the expected value of the SS bits to “Don’t care” (xx).

5. Steps in checking trace identifiers are given below :

   a. Select the desired Trace Identifier byte (check box).
   b. Enter the corresponding expected values (hexadecimal value or plain text messages).
   c. Select the desired defect for a “Path Label Mismatch” (check box).
   d. Select the corresponding expected values (“Expected Value” list box; Path Label Mismatch).
   e. Select the expected values for the SS-Bits (“Expected Value” list box; H1-Byte).
   f. Click the “OK” button.

The expected values will be checked and a message output if there is a mismatch.

A. Record of RSOH & trace identifier J0

RSOH Byte	Observation
Framing Bytes A1, A2	
Section trace J0	
BIP-8 (B1)	
Order-wire (E1)	
Service provider Order-wire (F1)	
Data comm.(D1/2/3) (DCCr)	

Error message observed : Yes/No

B. Record of MSOH

MSOH Byte	Observation
Pointer bytes H1,H2	
Pointer action byte H3	
B2	
APS Bytes K1,K2	
D4-D12	
Sync. Status S1	
M1 (FEBE)	
Order-wire E2	
Z1,Z2	

Error message observed : Yes/No

C. Record of POH & trace identifier J1

POH Byte	Nomenclature	Observation
J1	Path Trace	
B3	Path BIP 8	
C2	Signal Label	
G1	Path Status	
F2	Path User Channel	
H4	Position Indicator	
F3	Path User Channel	
K3	APS	
N1	NW Operator Byte	

Error message observed : Yes / No

Signature of the Candidate

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुदेशक का अधाक्षर
Instructor Initial :

BER Test & Performance Analysis Test using SDH Analyzer

Exercise-1 : BER Test

Objective:

1. To measure BER on STM-1 signal
2. To test the reaction of the DUT(Device under Test) to artificially-induced defects and error messages.

Test set-up : BER Test set-up is shown in fig.1

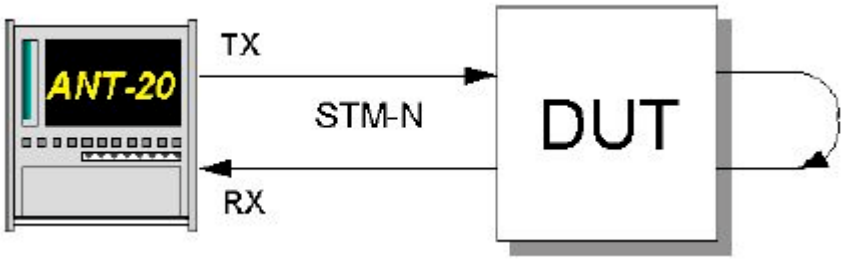


Fig.1 BER Test set-up

Interfaces to be used with connector/terminal number in brackets are mentioned below:

Interfaces

• electrical balanced	Rx : [12]	Tx : [13]
• electrical unbalanced	Rx : [14]	Tx : [15]
• optical 52, 155, 622 Mbit/s	Rx : [17]	Tx : [18]
• optical 2.5 Gbit/s	Rx : [44]	Tx : [47] (1550 nm)
		Tx : [48] (1310 nm)
• optical 10 Gbit/s	Rx : [113]	Tx : [103]

(Note : Test can be done on optical 10Gbps is available but not used in our lab)

Procedure:

1. VIs required for BER test are :
   - Signal Structure
   - Anomaly/Defect Analyzer
   - Anomaly/Defect Insertion

2. After the 'Signal structure VI' has been set, connect the ANT-20SE to the DUT. Make sure that you select the corresponding interface when you set the signal structure.

3. Add the VIs required to the list of VIs used in the Application Manager. The Application Manager tool-bar shall look like as shown in fig. 2

Fig.2 Application Manager tool bar after selection of Vis

4. Click first on the "Anomaly and Defect Analyzer" button and then on the "Anomaly and Defect Insertion" button in the Application Manager. This activates both these aplications. To monitor a signal, only the "Anomaly/Defect Analyzer" is needed.

5. Result can be viewed in 4 ways :
   a. Histogram
   b. Table
   c. Count
   d. Summary

Histogram display

Histogram display is shown in 'Anamolies box' by clicking on B2 button. Resultant screen is shown in fig.3

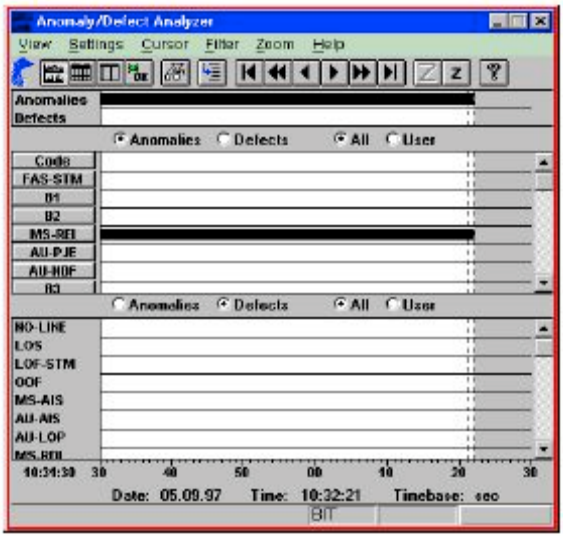


Fig.3 Histogram mode display of BER test result

Table mode display

This display window is useful if user wants to determine when and for how long a particular event occurred. Errors are shown as a count per second and alarm durations are shown with a resolution of 100 millisecond. Table mode display is illustrated in fig.4.

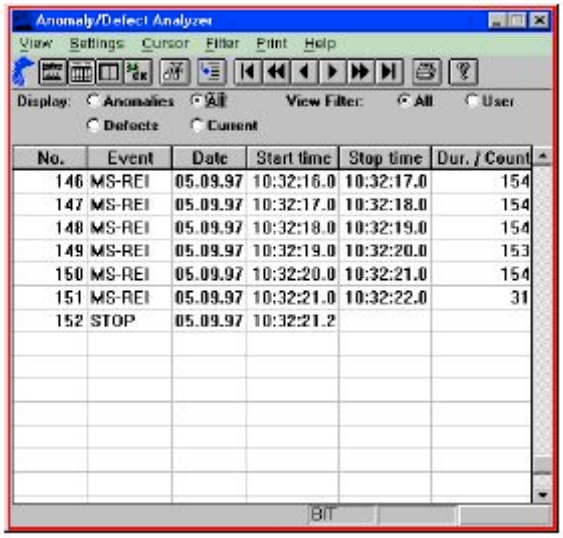


Fig.4 Table mode display of BER test result

Count mode display

The “total” and “intermediate” results are displayed in this mode. The measurement parameters can be set under “Measurement Settings...” in the Application Manager. The number of alarms displayed can be reduced by selection using appropriate filters.

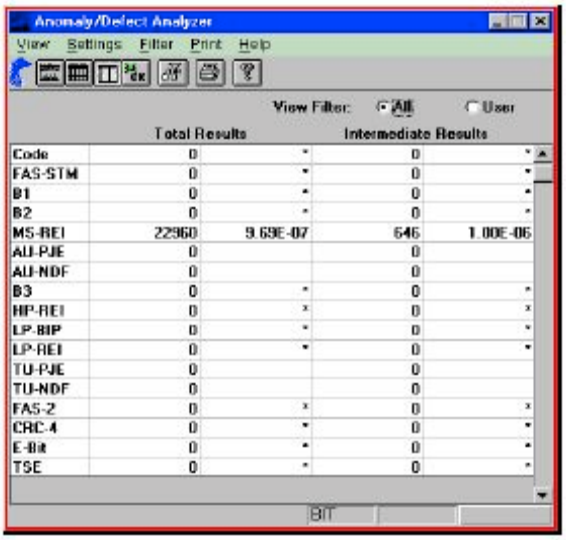


Fig.5 Count mode display of BER Test result

Summary

The “Summary” view allows user to see at a glance whether anomalies or defects occurred during the measurement. The filter function allows user to exclude certain anomalies and defects from the Summary evaluation. If the Performance Analyzer is loaded and an evaluation has been selected, the results of this evaluation will also be displayed. Summary mode display of BER test result is shown in fig.6

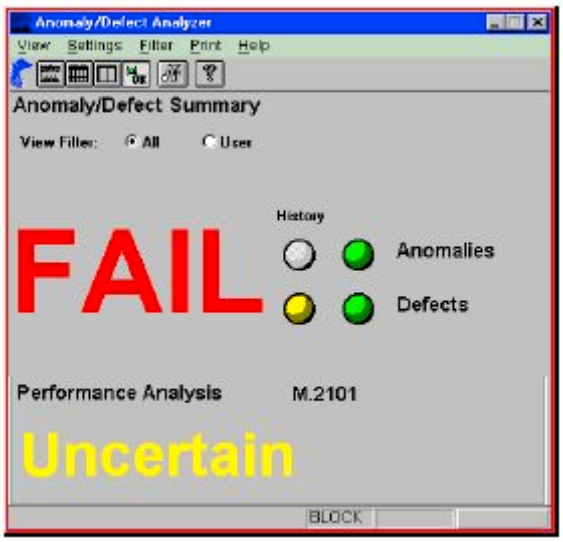


Fig.6 Summary display of BER Test result

Observations

Record BER Test result display in different modes :

Exercise-2 : Performance Analysis Test to G.826

Objectives : To conduct ITU-T Rec. G.826 Analysis in-service & out-of service

Test set-up : Test set-up for in-service & out-of service is shown in Fig.7 & 8

In 'In-service' mode, measurements are taken while system is operational. In out-of service mode, measurements are done on newly set-up equipment using unframed test signals and counting block errors.

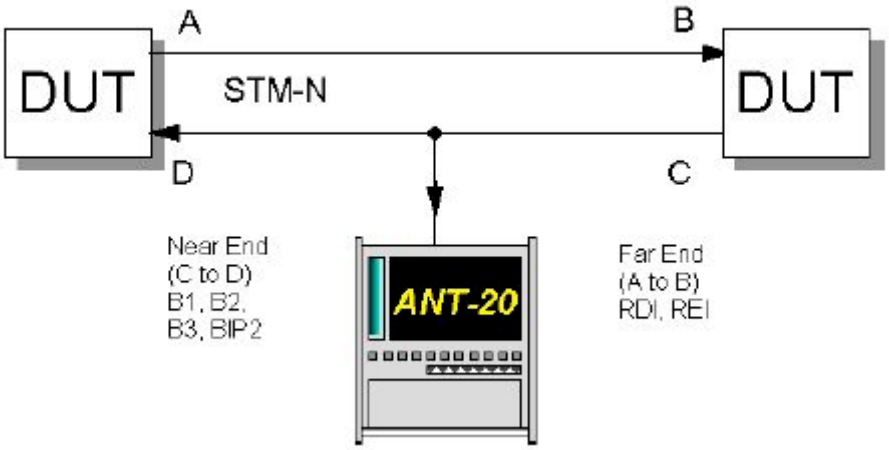


Fig.7 In-service test set-up

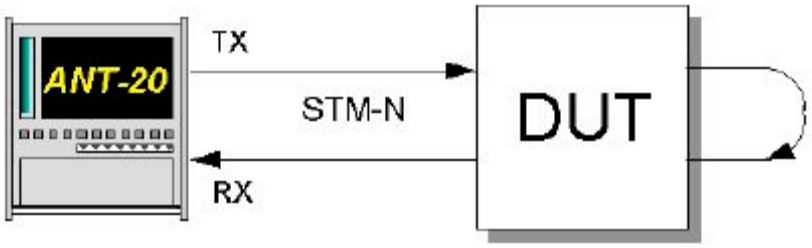


Fig.8 Out-of service test set-up

Interfaces used and terminal/connector numbers are listed below :

• electrical balanced	Rx : [12]	Tx : [13]
• electrical unbalanced	Rx : [14]	Tx : [15]
• optical 52, 155, 622 Mbit/s	Rx : [17]	Tx : [18]
• optical 2.5 Gbit/s	Rx : [44]	Tx : [47] (1550 nm) Tx : [48] (1310 nm)
• optical 10 Gbit/s	Rx : [113]	Tx : [103]

(Note : Test can be done on optical 10Gbps is available but not used in our lab)

Procedure :

1. Following VIs are required for this test :
   - · Signal Structure
   - · Performance Analysis

2. Add the VIs required to the list of VIs used in the Application Manager. The Application Manager should include at least the instruments shown in fig.9 :

Fig.9 Vis included in Application Manager tool-bar for G.826 Test

3. Click on the “Performance Analysis” button to activate the VI.

4. **Settings :** The G.826 ISM analysis window is shown in fig.10 as an example for the various measurement options available. Select the option by clicking on the appropriate button in the toolbar.

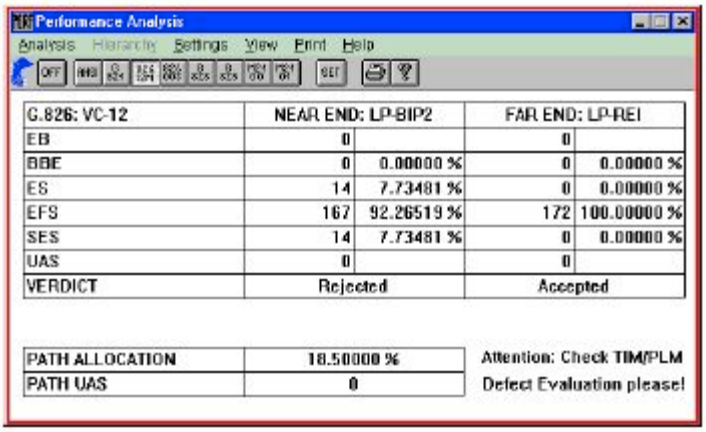


Fig.10 G.826 In-service mode test options

5. Before starting the measurement, the path allocation (Allocation), the SES threshold and the UAS threshold can be set under the “Settings” menu item.

6. **Results :** The analysis provides separate results for the “NEAR END” and the “FAR END”. This means that errors occurring directly in the path are analyzed as well as errors occurring in the return path which are indicated by a REI message. This allows both directions to be monitored without actually connecting to both.

7. The “Verdict” box gives direct indication as to whether the communications path meets the requirements of the Recommendation or not.

Signature of the Candidate

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुदेशक का अधाक्षर
Instructor Initial :

Maximum Tolerable Jitter (MTJ) Test and Jitter Transfer Function (JTF) Test

Objective:

1. To check the maximum tolerable jitter (MTJ) of the electrical and optical line and tributary inputs of STM Equipment
2. To demonstrate that the jitter transfer function (JTF) or jitter gain of a regenerative repeater is within ITU-T prescribed limits.

Experiment-1: MTJ Test

Brief description

When a sine-wave modulation signal is used with a pseudorandom sequence as the test pattern, at a given frequency, the amplitude of the jitter signals is increased using a half-interval progression until errors occur at the output of the device under test.

Experimental set-up

Experimental set-up for MTJ test is shown in fig.1

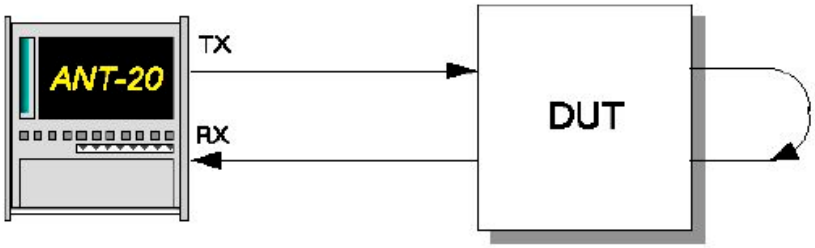


Fig.1 Experimental set-up for MTJ Test

Interfaces used

Interfaces used are listed below (port numbers given in brackets) :

Interfaces

• electrical balanced	Rx : [12]	Tx : [13]
• electrical unbalanced	Rx : [14]	Tx : [15]
• optical 52, 155, 622 Mbit/s	Rx : [17]	Tx : [18]
• optical 2.5 Gbit/s	Rx : [44]	Tx : [47]
• optical 10 Gbit/s	Rx : [113]	Tx : [103]

(It may please be noted that STM equipment with optical 52 Mbps, 2.5 Gbps, 10 Gbps are not available in IRISET lab)

Procedure

1. Add the following VIS on Application Manager

- Signal Structure
- O.172 Jitter Generator/Analyzer

After this, Application Manager tool-bar is as shown in fig.2

Fig.2 Application Manager tool-bar after adding VIs

2. General settings

a. Click on the “JIT” button to open the window for the O.172 Jitter Generator/Analyzer.
b. In the opened O.172 Jitter Generator/Analyzer window, Select the “MTJ” command in the “Mode” menu.
   – or –
   Click on the corresponding button in the toolbar.
c. Select the error source (e.g. TSE, Test Sequence Error) in the “Error Source” list field (currently only bit errors are available).
d. Enter the error threshold in the “Error Threshold” field. The error threshold provides a decision criterion for the search algorithm.
e. In the “Settling Time” field, enter a delay for each measurement that allows the DUT to settle before the measurement is made.
f. Enter the gate time in the “Gate Time” box.

3. “MTJ Settings” dialog

a. In the “Settings” menu, choose the selection “MTJ...”.
– or – Click on the “SET” icon.

b. The “MTJ Settings” dialog will open.

The “MTJ Settings” dialog box is shown in fig.3

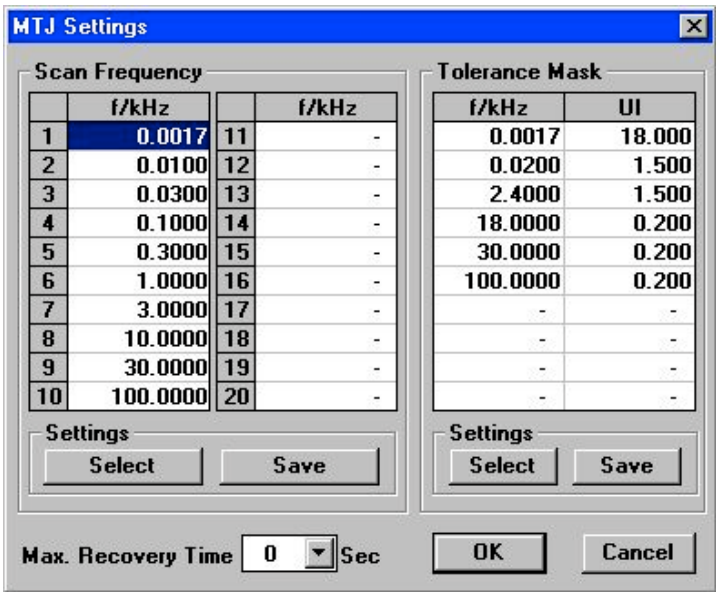


Fig.3 MTJ Settings dialog box

c. The “MTJ Settings” dialog contains the most recent settings of the scan frequencies for the MTJ measurement and the specifications for the tolerance mask. (**Note:** In case of a bit rate change, the scan frequencies and the specifications for the tolerance mask are set to their default values.)

d. **If required: Change/Save scan frequencies**

i. Click on the “Select” button in the “Scan Frequency” area. The “Select MTJ Freq” dialog will open. The “Select MTJ Freq” dialog contains standards settings and user-defined data sets (available if any)

ii. Select a data set with scan frequencies for use in making the measurement.

iii. Click “OK” to confirm. The “Select MTJ Freq” dialog will close.

iv. If necessary, edit the scan frequencies.

v. If the user (tester) wants to save the current scan frequencies under a separate name, click on the “Save” button in the “Scan Frequency/Amplitude” area. The “Save MTJ Freq” dialog will open. **[Under this option, user (tester)** can save a maximum of five user defined data sets.]

vi. Select a name or enter a new name. Confirm the selection/entry with “OK”.

vii. The “Save MTJ Freq” window will close.

e. If required: Change/Save the tolerance mask using similar procedure

f. Confirm the settings in the “MTJ Settings” dialog with OK. The “Settings” dialog will close.

g. **Start the measurement with “Start”.** The measurement stops automatically, but can be halted at any time by clicking on “Stop”.

Analysis of results

When an MTJ measurement is made, the default values for the scan frequencies and the tolerance mask are set in the “MTJ Settings” window according to the bit rate. The default values are changed automatically when the bit rate is changed. There are two windows for displaying results :

1. Table format (Refer fig. 4)

- Measurement results are displayed in the table under “UI”.
- Measurement results where the tolerable jitter of the DUT is greater than the maximum amplitude that can be set on the jitter generator, are indicated by a “>” (e.g. >64 UI).
- Measurement results which are below the tolerance mask are marked with an “!” in the table.

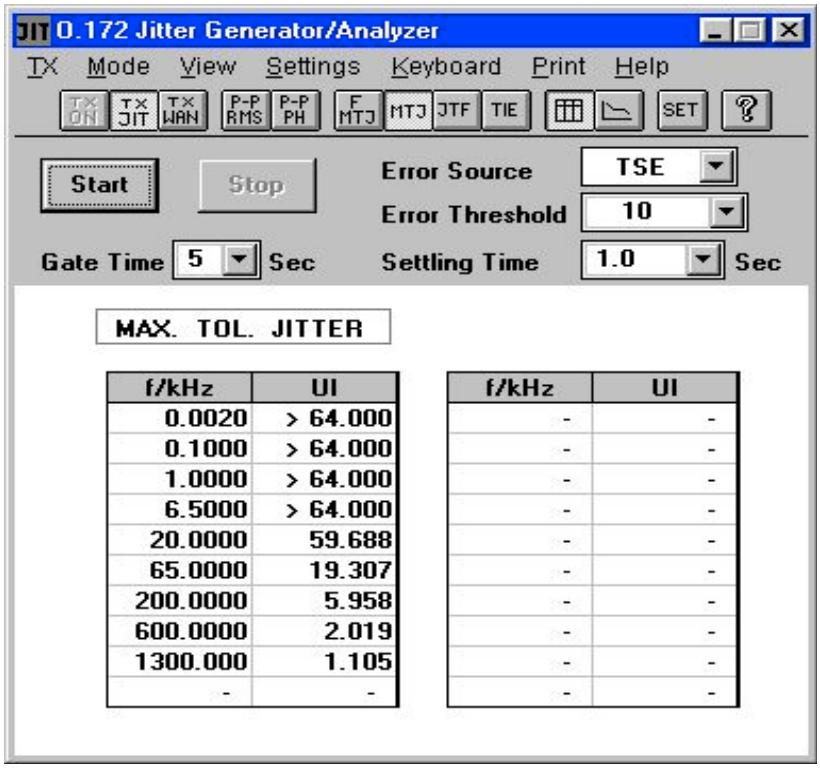


Fig.4 Display of MTJ Test results in Table Format

2. Graphics format (Refer fig.5)

• Measurement results are marked with a “+” on the graphics.

• Measurement results where the tolerable jitter of the DUT is greater than the maximum amplitude that can be set on the jitter generator are marked with “Δ” on the graphics (instead of the “+”).

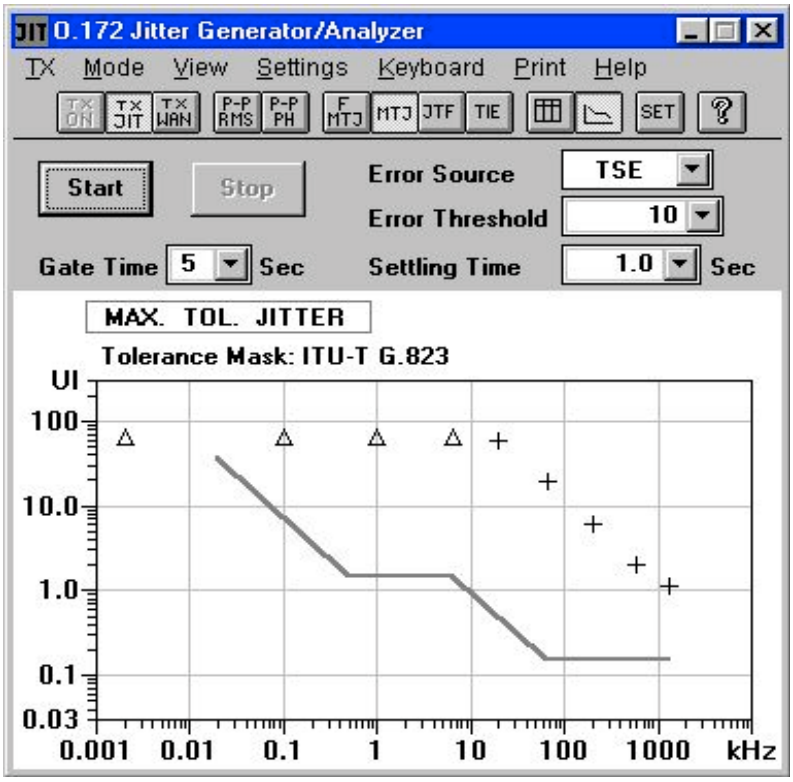


Fig.5 Display of MTJ Test results in Graphics Format

Do the test for STM-1, STM-4 interfaces and record observations

Exercise-2: Jitter Transfer Function (JTF) Test

Brief description

Jitter transfer function measurements are of particular importance when dealing with regenerative repeaters. Checks are carried out to demonstrate that the jitter gain of a regenerative repeater is below a predefined value. If this is not the case, “jitter runaway” occurs after several regenerative repeaters.

The jitter transfer function (JTF) is measured by applying a signal whose jitter is constant over frequency to the DUT. The jitter amplitude is selected so that the DUT can handle it at high frequencies.

The Jitter Analyzer measures the resulting jitter amplitude at the output of the DUT at various TX jitter frequencies. The log of the ratio gives the jitter gain or attenuation.

Experimental set-up

Experimental set-up for JTF test is shown in fig.6

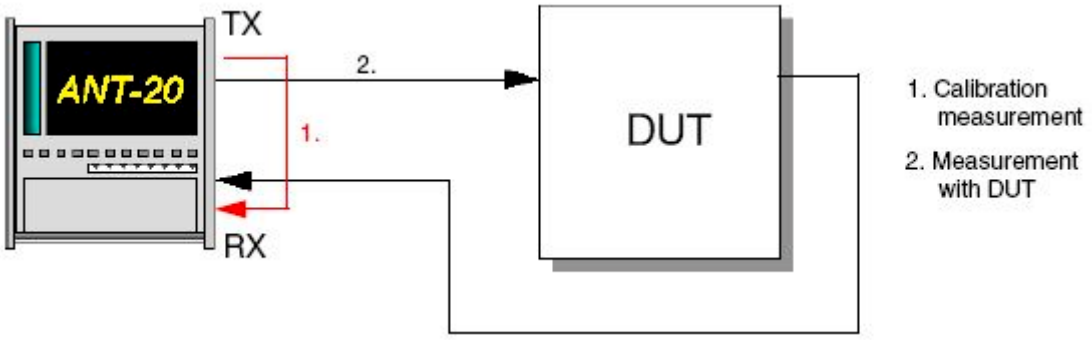


Fig.6 Experimental set-up for JTF Test

Interfaces used

Interfaces used are listed below:

Interfaces

• electrical balanced	Rx : [12]	Tx : [13]
• electrical unbalanced	Rx : [14]	Tx : [15]
• optical 52, 155, 622 Mbit/s	Rx : [17]	Tx : [18]
• optical 2.5 Gbit/s	Rx : [44]	Tx : [47]
• optical 10 Gbit/s	Rx : [113]	Tx : [103]

(It may please be noted that STM equipment with optical 52 Mbps, 2.5 Gbps, 10 Gbps are not available in IRISET lab)

Procedure

1. Add the following VIs to Application Manager
   - Signal Structure
   - O.172 Jitter Generator/Analyzer

After this, Application Manager tool-bar appears as shown in fig.7

Fig.7 Application Manager tool-bar after addition of VIs for JTF Test

2. General settings
   a. Select JIT on tool-bar to open O.172 Jitter Generator/Analyzer window, which appears as in fig.8

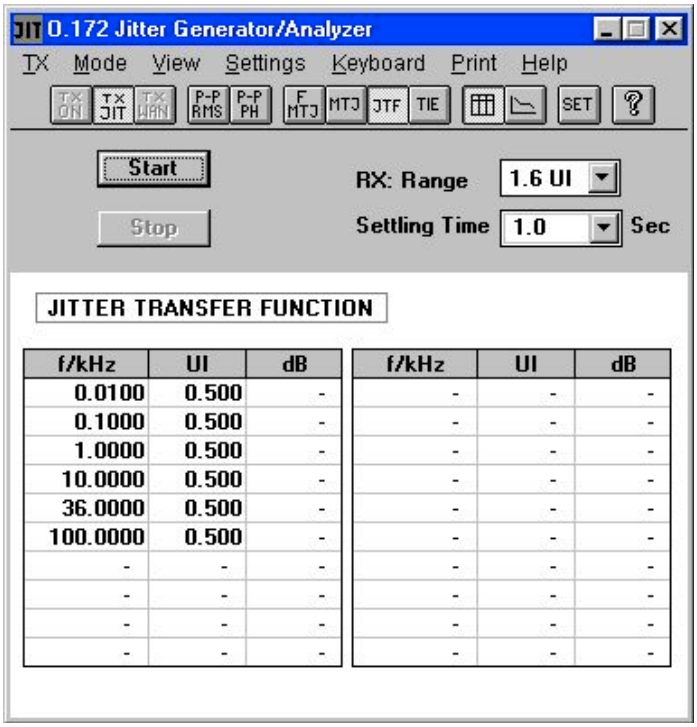


Fig.8 O.172 Jitter Generator/Analyzer window for JTF test

   b. In the “Mode” menu, select the “JTF” command.

   – or –

   Click on the corresponding button in the tool bar.

   c. Select the appropriate range (1.6 UI or 20 UI; the range is pre-set for STM-16/OC-48 and for STM-64/OC-192) in the “RX: Range” box.

d. Enter an appropriate delay time for the various measurements in the “Settling Time” field, so that the measurement starts after the DUT has settled.

3. JTF Settings dialog

The measurement frequencies for the JTF measurement and the specifications for the tolerance mask are found in JTF settings dialog.

a. In the “Settings” menu, choose the selection “JTF...”.

– or – Click on the “SET” icon.

The “JTF Settings” dialog will open. It appears as shown in fig.9

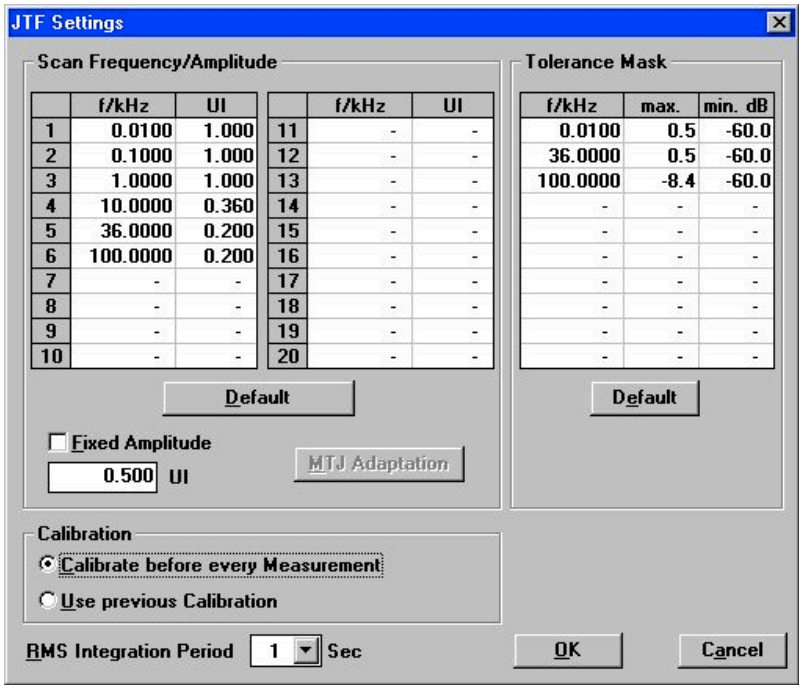


Fig.9 JTF Settings window for JTF test

b. If required, select individual scan frequencies and amplitudes, as well as altered tolerance mask values.

c. If user/tester wants the measurement to be performed using a constant amplitude for all scan frequencies, check the “Fixed Amplitude” check box and enter the required amplitude in the box below it.

d. If user/tester wants to use the results of a previous MTJ measurement for the scan frequencies and amplitudes, click on the “MTJ Adaptation” button. The MTJ results are then automatically matched to the permissible ranges (measurement and frequency) of the jitter meter. If there are no MTJ results available, the button is grayed out.

e. Select whether to perform a calibration measurement before every JTF measurement or to use a single calibration measurement (stored internally). For maximum measurement

accuracy, it is a good idea to make a calibration measurement before every JTF measurement

f. Click “Start” to start the measurement. The measurement stops automatically when finished or when “Stop” is clicked

Results & Analysis

The measurement results are displayed in three different windows :

1. Table form
2. Graphics form with normal resolution
3. Graphics form with high resolution

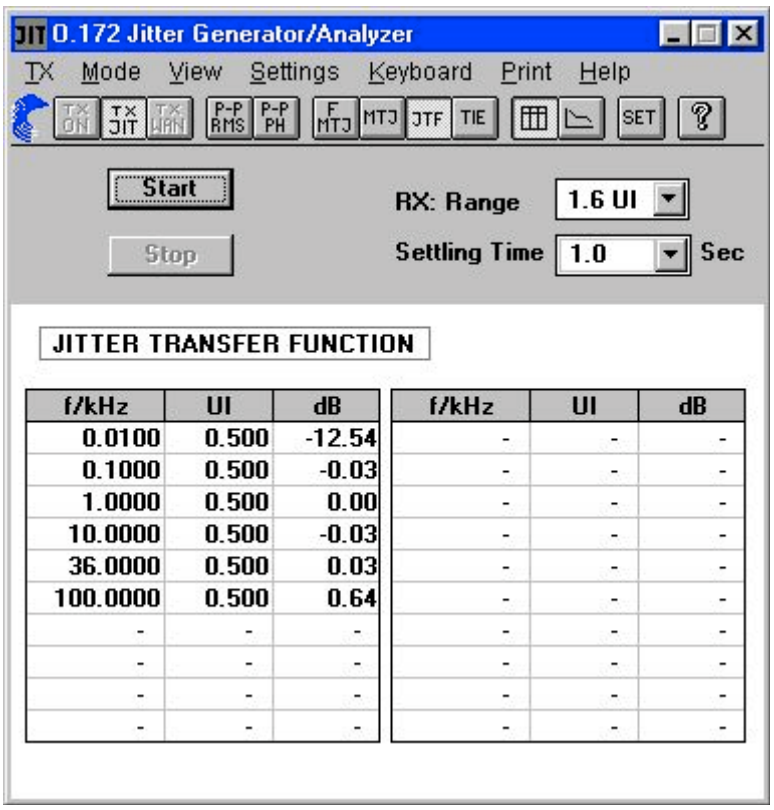
Table form

The default values for the scan frequencies and the tolerance masks in the “JTF-Settings” window are set in the window with the table display (refer fig.10).

The default values depend on the bit rate and change automatically when the bit rate is changed.

· Measurement results are displayed in the table under “dB”.

· Measurement results in the table that are outside the tolerance mask(s) are marked with an “!”.



f/kHz	UI	dB	f/kHz	UI	dB
0.0100	0.500	-12.54	-	-	-
0.1000	0.500	-0.03	-	-	-
1.0000	0.500	0.00	-	-	-
10.0000	0.500	-0.03	-	-	-
36.0000	0.500	0.03	-	-	-
100.0000	0.500	0.64	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Fig.10 JTF Measurements: Display of results in table form

Graphic form with normal resolution

Please refer fig.11 Resolution on y-axis is 10 dB per unit. On the graph, the measurement values are marked with a “+”.

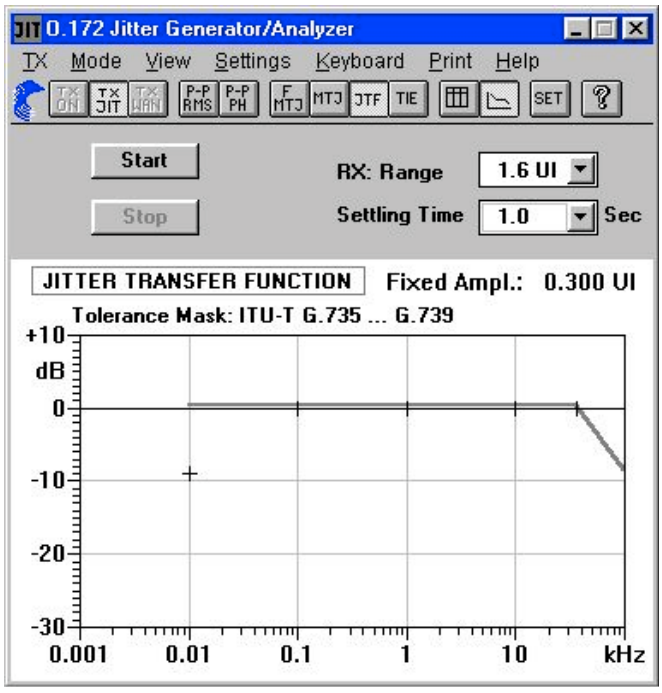


Fig.11 JTF Test results display : Graphic form with normal resolution

Graphic form with normal resolution

Please refer fig.12. Resolution on y-axis is 1 dB per unit. On the graph, the measurement values are marked with a “+”.

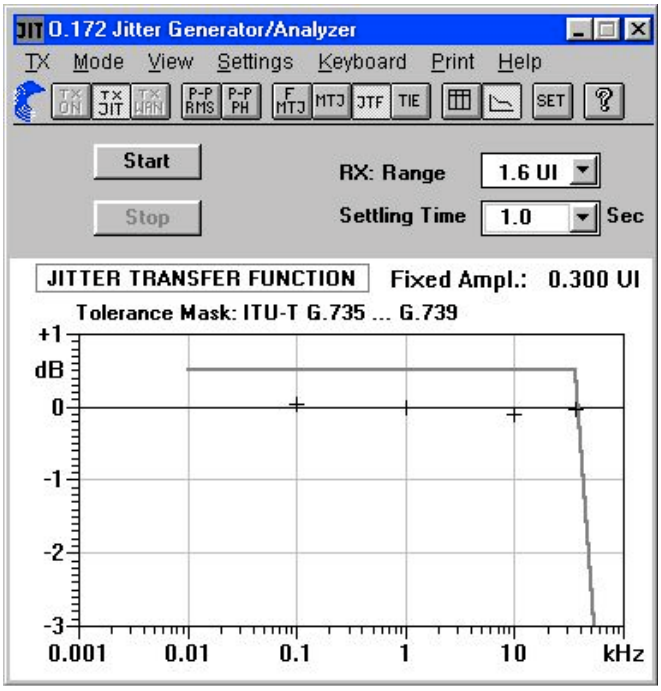


Fig.12 JTF Test results display : Graphic form with high resolution

Exercise

JTF test to be performed on STM-1 & STM-4 ADMs of different makes. Results to be seen in all the three forms and observations to be recorded.

Signature of the Candidate

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुदेशक का अधाक्षर
Instructor Initial :

APS related tests & Delay Measurement test using SDH Analyzer

Objective :

To measure switching time using SDH analyzer in case of 'Automatic Protection Switching' on SDH network experiencing failure on working fiber

Brief description :

APS stands for Automatic Protection Switching. This is a function of SDH networks that prevents connections from being interrupted for a long period if a working line fails. If a problem occurs with the working line, the system automatically switches to a back-up line. The time taken to switch circuits must conform to certain requirements.

To check that the network meets these requirements, the ANT-20SE/ANT-10Gig measures how long a particular event (e.g. AIS or loss of test pattern) remains present after APS has been triggered. The measured time is compared with a previously set threshold. This provides a simple PASSED/FAILED assessment of the APS switching time.

Experimental set-up

Experimental set-up is shown in fig.1

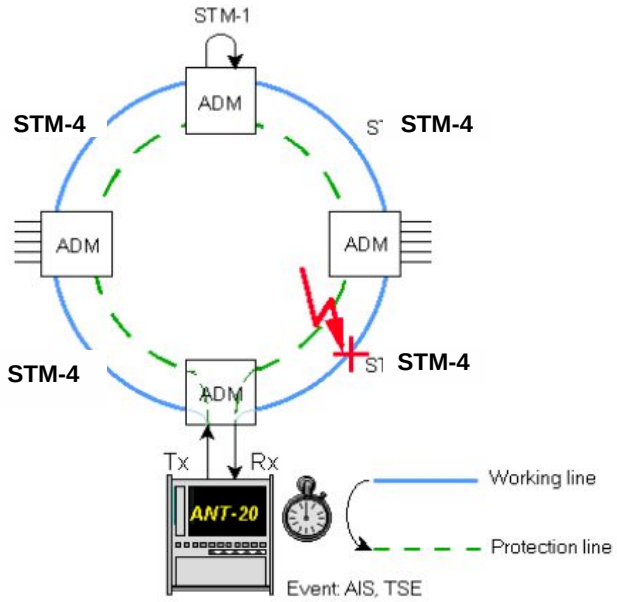


Fig.1 Experimental set-up to measure APS switching time

Interfaces used on SDH analyzer are given below:

Interfaces

- electrical balanced Rx : [12] Tx : [13]
- electrical unbalanced Rx : [14] Tx : [15]
- optical 52, 155, 622 Mbit/s Rx : [17] Tx : [18]

Procedure :

1. Make the experimental set-up involving four STM-1/4 nodes in MS-SPRing/2 (MUX Section Shared Protection Ring on 2 fibers) as shown in fig.1
2. Add signal structure VI in Application Manager. After this addition, 'Application Manager' tool bar shall be as shown in fig.2

Fig.2 Application Manager tool-bar after addition of signal structure VI

3. Click on the APS icon button in the "Signal Structure" VI toolbar.
4. Select an event for triggering the switch process from the "Sensor" list box in APS time measurement window (shown in fig.3)

5. Set the maximum permitted switching time threshold value in the “Switch time limit (t1)” box.
6. Enter the required duration for the complete measurement in the “Gate time (t2)” box. This time should be more than the threshold value in order to detect multiple switching.
7. Start the measurement by clicking the “START” button.
8. Trigger the switching process by e.g. interrupting the working line. The measurement stops automatically when completed.
9. Result is displayed in APS measurement window (again refer fig.3)

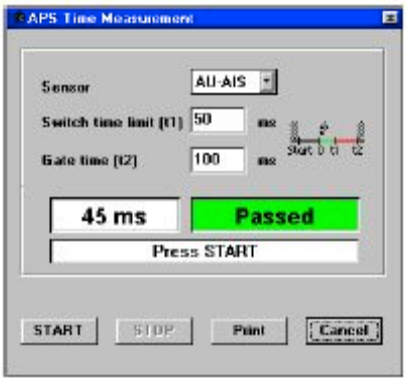


Fig.3 APS Time Measurement Window

Analysis of results

As can be seen in fig.3, two results are displayed once the measurement is completed :

1. The total duration of the event pre-set in the sensor list box
2. An interpretation of the measured value.

Interpretation of measured value is summarized in Table below:

Display	Meaning
PASSED	Measured value $\leq$ Switch time limit
FAILED (Time)	Measured value >Switch time limit
FAILED (Signal)	A non-permitted defect occurred during the measurement that blocked the sensor (for example, LOS or LOF if sensor is set to MS-AIS)

Repeat the experiment setting switching time as 30 m sec. and 60 m sec. and record observations

Signature of the Candidate

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्त अंक
Marks Awarded :

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुदेशक का अधाक्षर
Instructor Initial :

Pointer Activity Test and Pointer Stress Test on SDH Network

Objective :

To demonstrate the resilience of SDH network under pointer stress i.e. pointer sequences specified in ITU-T Rec.G.783 using SDH analyzer

Brief description

Pointer adjustment takes place in SDH Network element in case of clock reference changes. To check the resilience of SDH Network element or MUX section or path of SDH network to such pointer operations, ITU-T prescribed certain pointer stress sequences in Recommendations G.783. These sequences are to be used in evaluating the performance of DUT (Device under test i.e. SDH Network element or MUX section or path). These pointer stress sequences pre-defined in ITU-T Rec.G.783 are:

1. Single pointer with reversed polarity
2. Pointer sequences with one double pointer 43/44 sequence:
   43 pointers - 1 double pointer - 44 pointers
3. Pointer sequences with missing pointers :
   87/3 sequence: 87 pointers - 3 missing pointers
   86/4 sequence: 86 pointers - 4 missing pointers
4. Double pointer with reversed polarity

Experimental set-up

Experimental set-up for pointer stress test is shown in fig.1

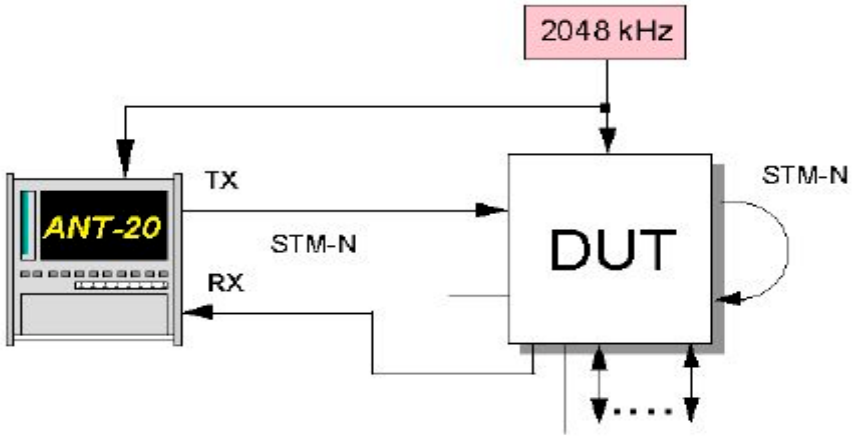


Fig.1 Experimental set-up of pointer stress test

Interfaces used

Interfaces used are listed below:

Interfaces

• electrical unbalanced	Rx : [14]	Tx : [15]
• optical 52, 155, 622 Mbit/s	Rx : [17]	Tx : [18]
• optical 2.5 Gbit/s	Rx : [44]	Tx : [47] (1550 nm)
		Tx : [48] (1310 nm)
• optical 10 Gbit/s	Rx : [113]	Tx : [103]
• reference clock	Rx : [25]	

(Note: Optical 10 Gbps interface can be used but such NE not available in IRISET lab)

Procedure

1. **Add the following Virtual Instruments to Application Manager tool-bar :**

a. Signal Structure

b. Pointer Generator

c. Pointer Analyzer

After this the 'Application Manager Tool-bar should be as shown in fig.2

Fig. 2 Application Manager Tool-bar after selection of required Vis

2. Synchronizing the ANT-20SE/ANT-10Gig to an external clock signal:

   a. Click on “Settings...” in the “Interface” menu in the “Signal Structure” VI.
   b. Select “Ext. Clock 2M/E1 [25]” from the “Clock Source” box and click “OK” to confirm.

The interface window snap-shot for this setting is shown in fig.3

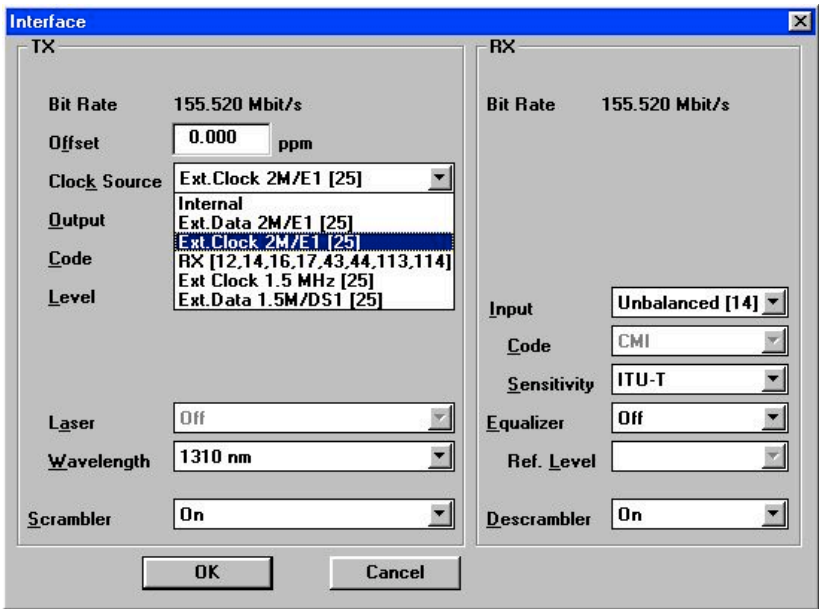


Fig.3 Snap-shot of Interface window after the setting for External Synchronization

3. Details of the test for 86/4 Stress sequence are given below :

a. Open the “Pointer Generator” window by clicking on the VI in Application Manager. Pointer Generator window appears as shown in fig.4

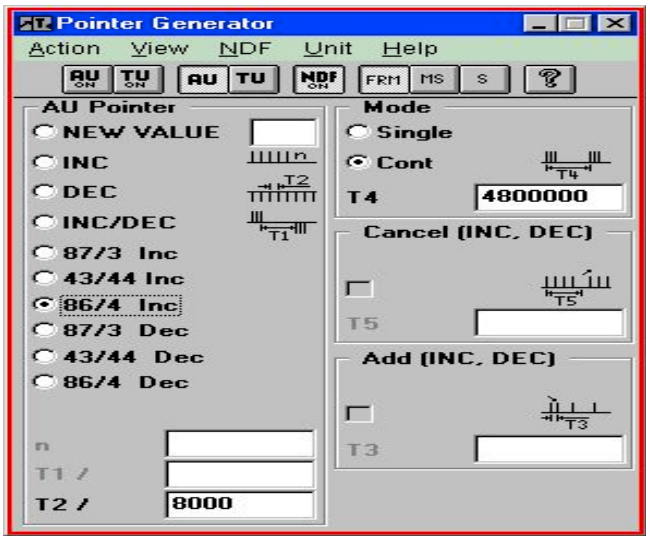


Fig.4 Pointer Generator Window

b. Click the “AU” button in the toolbar.
c. Select “86/4 Inc.” from the “AU Pointer” box.86 pointer jumps are generated, followed by 4 missing pointers.
d. Set the distance between two pointer actions in the “T2” entry box.
e. Set the desired sequence length in the “Mode” box.
f. Select between a single sequence or continuous repetition.
g. Click on the “AUON” button to activate the pointer sequence.
h. Start the measurement by pressing function key F5.
– or – Click on the “green traffic signal” icon in the Application Manager.

4. Analysis

Click on “Pointer Analyzer VI” in Application Manager. The “Pointer Analyzer” has two windows for the two types of pointer, just like the “Pointer Generator”. The measurement record starts once function key F5 has been pressed. The results are shown as a display of pointer address versus time and as an absolute value of increment/decrement (INC/DEC) versus time.

The graphic display makes it easy to see if the system is running synchronously or if wander is present. Display of “Pointer Analyzer” window is shown in fig.5

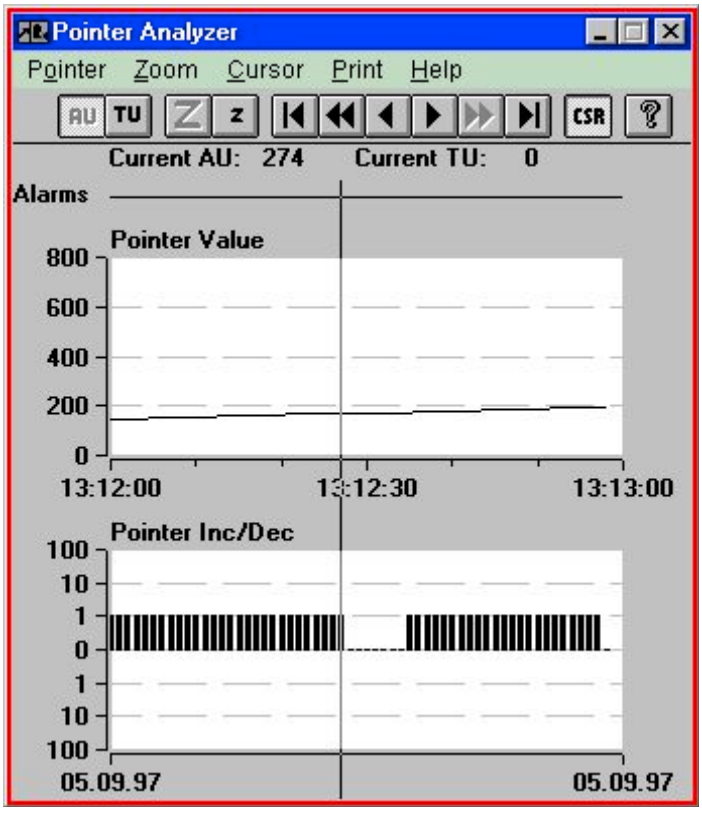


Fig.5 Pointer Analyzer Window

If the user(tester) clicks on the “CSR” button, the “Cursor” window opens. This shows the actual pointer value and the increment or decrement of the pointer per unit time. The corresponding clock deviation is indicated under the heading “Deviation”.

Display of cursor pop-up is shown in fig.6

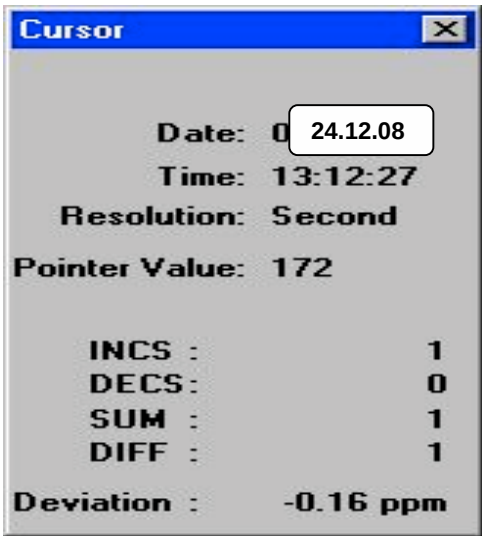


Fig.6 Display of cursor pop-up (when ‘cursor’ option is clicked in Pointer Analyzer tool-bar)

5. Repeat the test for other sequences in Pointer Generator window i.e. single pointer operations, 43/44 sequence, 83/84 sequence and record observations

Signature of the Candidate