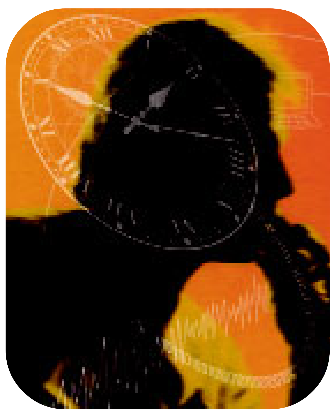

OmniBER XM network simulator

User Guide

Agilent Technologies

Agilent
OmniBER XM

Network Simulator

User Guide

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Notices

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In This Guide...

This User's Guide provides information in the following chapters on how to use your OmniBER XM.

Contents

11 Telecoms Concepts

1
Installation

OmniBER XM at-a-Glance

The OmniBER XM has been designed to address the requirements of system verification and test (SVT) for Next Generation SONET and SDH (i.e.Optical Cross Connect (OXCs), Bandwidth Managers and Optical Edge Devices (OEDs)). It also meets the needs of Q&V for Network Simulation and interoperability testing. This guide describes how to install and start up the network simulator. Please first check the Box Contents Lists to ensure that you have received all components.

To Contact us

Should you require technical assistance, contact the center in your region.

	Location	Telephone	E-mail
North America	9780 South Meridian Blvd. Englewood, Colorado USA 80112	1-800-452-4844	Americas_Support@agilent.com
		You may also call these local numbers:	
		Brazil 55-11-7297-3600	
		Mexico 01-800-506-4800	
Europe	Test & Measurement Startbaan 16 1187 XR Amstelveen The Netherlands	020 547 2111	customercare_benelux@agilent.com
		You may also call these local numbers:	
		France 0825 010 700	customer-care_tfo@agilent.com
		UK 07004 666666	tmo_assistance@aglient.com
		Ireland 01 890 924 204	
		Germany (01805) 24-6330* (*.24 DM/min)	messtechnik_support@agilent.com
		Austria +43-1-25125-7006	
		Switzerland 41-1-735 9300	
		Italy 3902 9260 8484	agilent_direct@agilent.com
Japan	Hachioji Business Center 9-1 Takakura-Cho, Hachioji Tokyo 192-8510 Japan	0120-421-345	mac_support@agilent.com
Asia Pacific	438B Alexandra Road Blk B, #05-08 Alexandra Point Singapore 119958	1-800-375-8100	TM_Asia@agilent.com

For faster service

We require the following information to troubleshoot problems. The more of this you provide, the faster we will be able to assist you.

- your name and contact details (phone or E-mail)
- your controller’s model and serial number
- your network simulator modules’ model number
- approximate purchase date
- software version (see the application’s splash screen or Help menu)
- software installed
- details of the problem

For support through the World Wide Web

You can also access technical support through the World Wide Web:

- www.Agilent.com/find/OmniBERXM.

This site provides general information about the tester: news, product information, data sheets, and brochures.

Specifications

Refer to the www.Agilent.com/find/OmniBERXM web site for detailed OmniBER XM specifications.

NOTE

Install an Antivirus application on system controller.

If your system controller is connected to a network, it is strongly recommended that you install an Antivirus application and keep the virus definition files up to date.

Safety Precautions for the Operator

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in the manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer’s failure to comply with these requirements.

WARNING

No operator serviceable parts inside. Refer servicing qualified personnel.

To prevent electrical shock do not remove covers.

To prevent possible electric shock hazard, disconnect power cord before removing covers.

Power disconnect device is the appliance coupler (mains input cord). Do not position the instrument such that access to the disconnect device is impaired.

When installing into a rack or system, access may be impaired and must be considered as part of the installation, in the form of an easily accessible rack isolation switch, or similar.

Unused slots must be filled with blanking covers to ensure correct operation and cooling. Warranty void if blanking covers are not fitted.

Do not stack more than 8 free-standing chassis.

The Chassis is a Safety Class 1 Product (provided with a protective earthing ground, incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact.

Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.

WARNING

If this instrument is not used as specified, the protection provided by the equipment could be impaired. This instrument must only be used in a normal condition (in which all means of protection are intact).

Modules may become hot during use. Do not touch any of the components on a card as you remove it from the chassis.

CAUTION

This instrument is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010 and 60664 respectively.

Before switching on this instrument, ensure the supply voltage is in the specified range.

This instrument has an autoranging line voltage input, ensure the supply voltage is within the specified range.

CLASS 1
LASER PRODUCT

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The laser classification label is located on the metallic top cover of each module adjacent to the serial number label.

Environmental Conditions

For indoor use only.

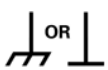
Safety Symbols

The following symbols on the instrument and in the user documentation indicate precautions you should take to maintain safe operation of the instrument.

The Instruction Documentation Symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the supplied documentation.

This indicates that part of the equipment may be hot. Please refer to accompanying documentation for specific information.

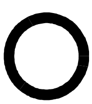
Indicates the field wiring terminal that must be connected to earth ground before operating the equipment - protects against electrical shock in case of fault.



Frame or chassis ground terminal - typically connects to the equipment's metal frame.

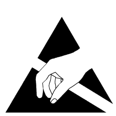
Alternating current (AC)

This symbol indicates the position of the operating switch for ‘On’ mode.



This symbol indicates the position of the operating switch for ‘Off’ mode.

Indicates hazardous voltages.



This symbol indicates that a device, or part of a device, may be susceptible to electrostatic discharges (ESD) which can result in damage to the product. Observe ESD precautions given on the product, or its user documentation, when handling equipment bearing this mark.

The CE mark shows that the product complies with all relevant European Legal Directives.

The C-Tick mark is a registered trademark of the Australian Communications Authority. This signifies compliance with the Australian EMC Framework Regulations under the terms of the Radio communications Act of 1992.

ISM 1-A

This is a symbol of an Industrial, Scientific, and Medical Group 1 Class A product.

ICES/NMB-001

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB-001 du Canada.

The CSA mark is a registered trademark of the Canadian Standards Association, and indicates compliance to the standards laid out by them.

Warranty and service

Standard warranty is one-year module exchange. Warranty and calibration plan extensions to 3 and 5 years can be provided.

Statement of Compliance

Electromagnetic Compatibility (EMC) Information

This product conforms with the protection requirements of European Council Directive 89/336/EEC for Electromagnetic Compatibility (EMC).

The conformity assessment requirements have been met using the technical Construction file route to compliance, using EMC test specifications EN 55011:1991 (Group 1, Class A) and EN 50082-1:1992.

In order to preserve the EMC performance of the product, any cable which becomes worn or damaged must be replaced with the same type and specification.

Safety Information

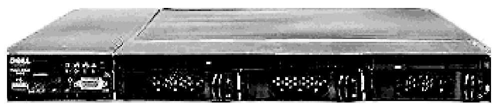
This instrument has been designed and tested in accordance with publication EN61010-1(1993) / IEC 61010-1(1990) +A1(1992) +A2(1995) / CSA C22.2 No. 1010.1(1993) Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

Overview: Network Simulator Components

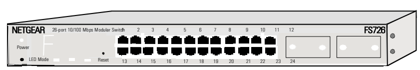
OmniBER XM Network Simulator consists of the following components:

- system controller which can be a laptop or a rackmount type as shown below.
- switch
- chassis and modules

System Controller



Switch



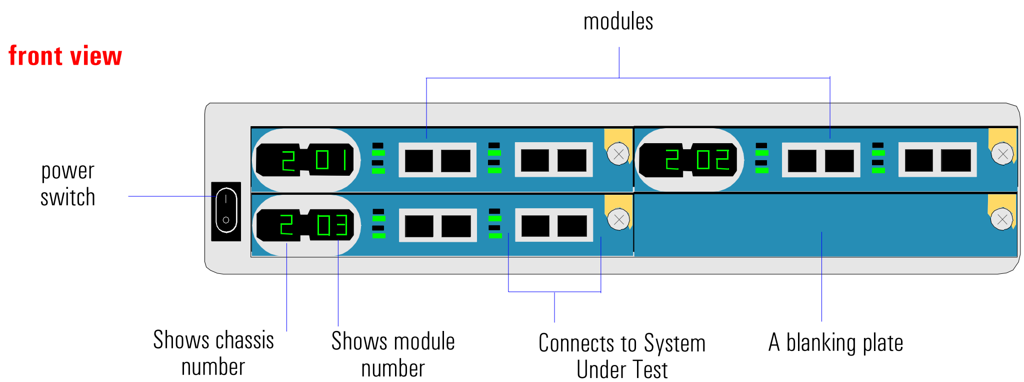
Used to connect chassis and modules to the System Controller PC.

Chassis and Modules

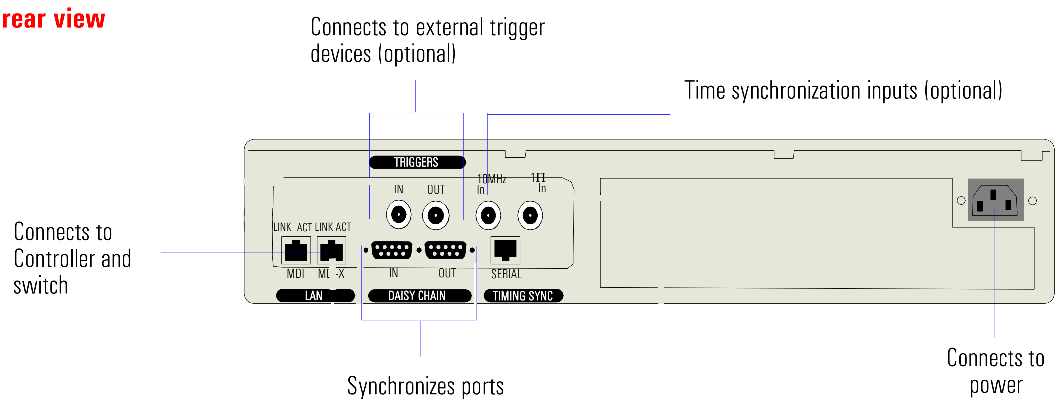
Two chassis are available the J7263A 4 slot chassis - holds up to four modules, and the E7192A 2 slot chassis - holds up to two modules. See “Chassis" on page 229 for further information.

Chassis and modules

front view



rear view



Modules are inserted into a chassis.

Modules differ from each other in the number of test ports they provide, the placement of test ports and the LEDs provided to indicate port status.

Hot Swappable

Modules are hot-swappable when not locked (in use) by a test session.

Module Removal

To avoid problems modules must only be removed from a chassis when that module is not allocated to a test session. Removal of a module from a currently active test session will result in a “script client abort” failure which will terminate the session.

Note that removal of a module from a chassis does not compromise the Clock/Event chain since this is handled entirely within the chassis.

CAUTION The OmniBER XM chassis should not be used with empty slots. Make sure that when removing a module or blanking plate that a replacement module or blanking plate is available nearby.

Module Insertion

A module can be hot inserted into an OmniBER XM chassis at any time. The module will go through it's boot process and identify itself to the Resource Manager. The Resource Manager will allocate the module a number according to the chassis in which it sits and it's position within the chassis. On completion of this process the module is available to be added to any pre-existing or new test session as far as the rules regarding Clock/Event lines allow.

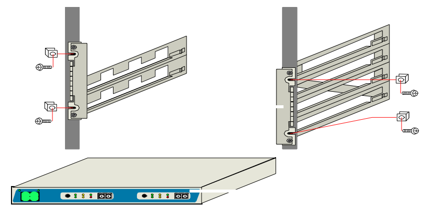
Note that a re-numbering operation requires that there are no test sessions running on the host controller.

Overview: Installation Process

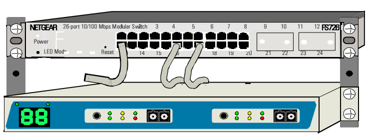
1 Plan your installation

- Do you need a switch?
- How many ports and user sessions?
- How many modules?
- What are the power requirements?
- Where to position test equipment?

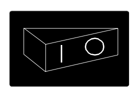
2 Install the test equipment



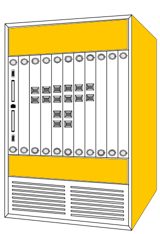
3 Connect the test equipment



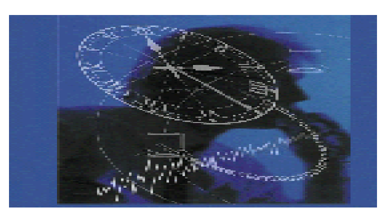
4 Power up the system



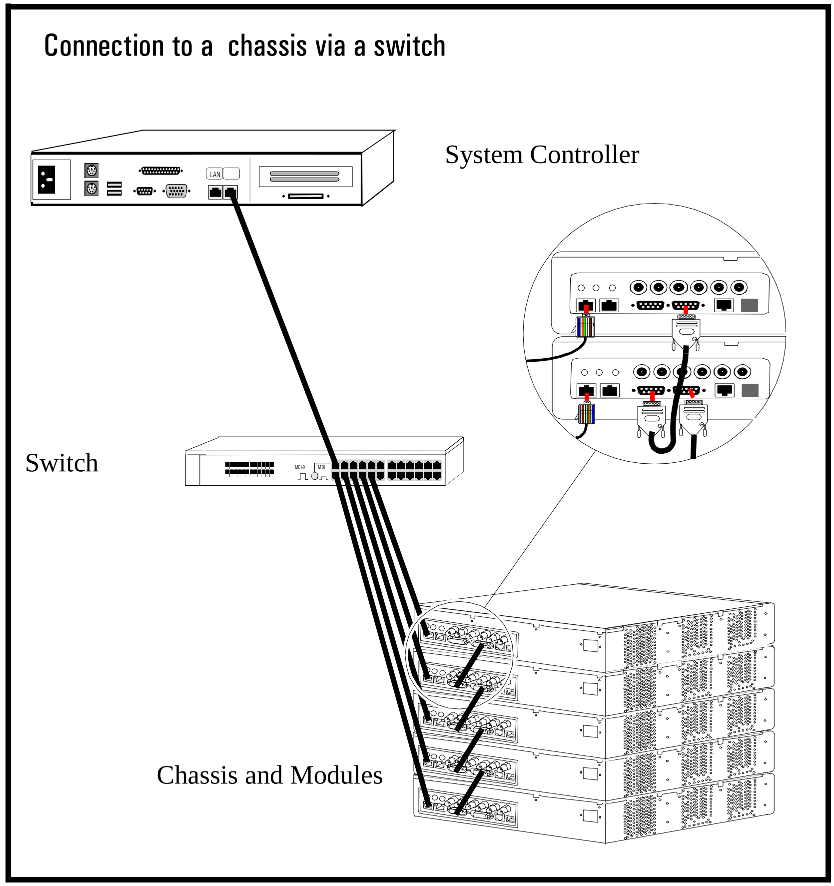
5 Connect to the System Under Test



6 Start the software.



Typical Configuration



Daisy chain together and connect to the controller using a LAN switch.

Step 1: Plan your installation

Do you need a switch?

When assembling your Network Simulator system you should use a switch if you have more than one piece of equipment in the configuration that you want to connect to the Controller.

It is recommended that you use a switch if your configuration has:

- one or more chassis

You will need a second switch if you are using:

- the Netgear FS108 switch and have more than 7 chassis, or
- the Netgear FS726 switch and have more than 23 chassis

The second switch can be daisy-chained off the first one. For information on how to daisy-chain switches, refer to Connecting the chassis or module to a switch.

How many ports and user sessions can your System Controller support?

The number of ports and user sessions (either local or remote through the Terminal Server) your Controller can support is determined by its available memory and CPU capacity.

The rules used to determine your system limitations are:

- 128 MB RAM if the Terminal Server is installed, plus
- 128 MB RAM for each user session, plus
- 4 MB RAM for each port (this may be the same memory reserved for user sessions, but do not include memory reserved for the Terminal Server)

Regardless of whether you have the Terminal Server installed, and regardless of the number of user sessions you run, make sure that:

- with up to 15 ports, you have a minimum of 128 MB RAM (recommended 256)
- with16 ports or more, you have a minimum of 256 MB RAM

System Controllers

Product	Description	Application	No of LAN ports	Included Ethernet Hub size
J7258A	High Performance system controller (rack mountable)	High port/channel count, multiple users	2	24-port
J7258A-AQ2	Flat panel monitor and keyboard (rack mountable)	High port/channel count, multiple users		
J7259A	System controller (rack mountable)	Medium port/channel count, multiple users	2	8-port
J7259A-AQ2	Flat panel monitor and keyboard (rack mountable)	Medium port/channel count, multiple users		
J7257A	Laptop System controller	Medium port/channel count, Single user	2	8-port

- Monitors are not included with rack-mountable controllers and can be ordered through option AQ2.
- Option AQ2 provides a flat panel monitor and keyboard in a 2U high rack-mountable drawer assembly.
- Rack-mount controllers are shipped with Windows 2000 Server Edition, and laptop controllers with Windows 2000 Professional.
- Each controller includes an Ethernet switch. One controller Ethernet port is required to connect to the chassis and/or switch. The other controller Ethernet port can be used to connect the controller to an external LAN to allow multi-user access.
- The laptop system controller has an Ethernet port to connect to the chassis and/or switch, but the second port is a PCMCIA LAN card which due to its limited bandwidth has poor performance for connection to a LAN. This port therefore is not recommended for remote control or multiple user applications. The PCMCIA LAN card does not provide enough bandwidth for direct connection to the chassis.

CAUTION

Install an Antivirus application on system controller PC
If your system controller is connected to a network, it is strongly recommended that you install an Antivirus application and keep the virus definition files up to date.

What are the power requirements of your configuration?

As part of the installation you must consider the power consumption of equipment. Avoid overloading a socket outlet by checking the combined power requirements of equipment on the same circuit.

CAUTION It is important to consult with equipment manufacturers to determine the equipment's power requirements. Check the rating plate on the equipment, or look in its documentation.

Below is a list of rated power for equipment typically used with OmniBER XM Network Simulator. It is given as a guide only.

Device	Model	Rated Power Requirements
J7259A	Dell PowerEdge	3.9 A (at 100V)
J7258A	Dell PowerEdge High Performance	2 A (at 240V)
J7257A	Laptop - AC Adaptor	1.7A (at 100V)
monitor	rackmount (includes keyboard, trackball)	3.5 A (at 100V)
	desktop	1.6 A (at 100V)
switch	Netgear FS108 (8 port) — universal AC adaptor	1 A (at 100V)
	Netgear FS726 (24-port)	1 A (at 100V)
4-slot chassis	with 4 cards (maximum)	6.3 A (at 100V) 3.2 A (at 240V)
2-slot chasis	with 2 cards (maximum)	3.3A (at 100V) 1.7A (at 240 V)

How should you position your test equipment?

Benchtop or rack

You may install chassis either on a benchtop or in a rack. Before mounting chassis in racks, verify that they work by testing them first on a benchtop.

Clock and event lines

The clock and event lines on chassis should be daisy-chained together.

The first chassis in the daisy chain is the one that has no input to its clock and event lines. It provides the master clock, and sends timing signals to the other chassis through the clock line.

The event line triggers chassis to start and stop traffic generation and measurements at precisely the same instant.

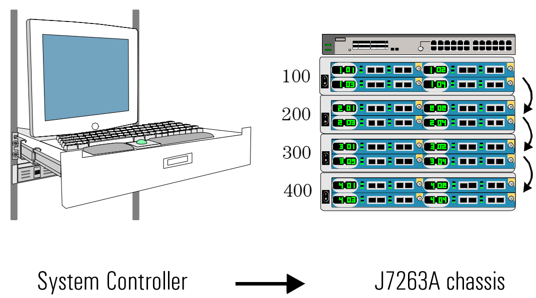
There are some limitations brought about by the clock and event synchronization described above that you should be aware of when positioning the test equipment:

- keep modules that will be used together, contiguous in the chassis
- to use a port in a session, you lock the entire module the port is on (you do not lock the entire chassis).
- to use modules in multiple chassis, you lock the daisy chain between the chassis.

Switches

If your configuration has more than one chassis, you need to connect each chassis to a switch to enable communication with the Controller.

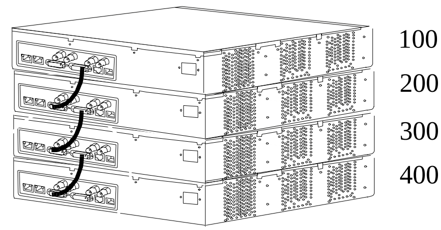
Cable the test equipment in your rack(s) in the order shown in this diagram:



Chassis numbering

Chassis are numbered in the order they are connected. The first chassis in the daisy-chain will be numbered 100 by the System Controller, the second 200, and so on. The first module in the daisy chain will be numbered 1, the second 2, and so on.

The following diagram shows the rear view of the clock and event line daisy-chain shown in the above diagram:



J7263A chassis

Primary Disconnect

CAUTION When a chassis is used by itself, the primary disconnect device is the chassis connector/power cord. However, once installed into a rack or system, there may be a different primary disconnect. When planning your installation, make sure you have clear access to the primary disconnect mechanism.

Step 2: Install the Test Equipment

To install the test equipment, you will need to set up (either on a benchtop or in a rack):

- the chassis and modules
- the switch
- the System Controller PC

When installing test equipment, be aware of the following:

Ventilation

CAUTION

Do not block the vent holes

Do not block the vent holes on the sides of chassis, or on the back of switches. This overheats and damages the devices. A gap of at least 2” (50mm) must be left around all vent holes. Also, orient all equipment correctly.

Racks

CAUTION

When you install the test equipment, beware of the safety hazards. Review and follow the guidelines of the rack manufacturer. Check web sites such as http://www.agilent.com/comms/racks.

Specifically:

- Avoid creating a top heavy rack. Install equipment from the bottom of the rack up. Install heavier equipment at the bottom. Deploy any anti-tip or anti-rolling mechanisms on the rack.
- Have two people secure equipment to the rack.

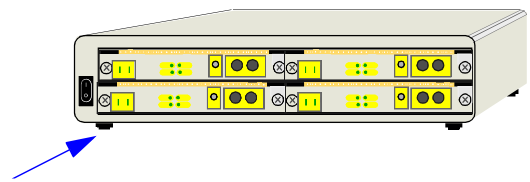
J7258A Controller 35 lbs (~16 kg).

A chassis weighs 22 lbs (10 kg).

Test modules weigh from 11 to 18 lbs (5 to 9 kg).

- Racks: Review and follow the rack manufacturer's guidelines. Check web sites such as http://www.agilent.com/comms/racks. The temperature inside the rack must remain below the operating temperature limits. Refer to the Environmental specifications on page 114.

To set up chassis on a Benchtop



Steps

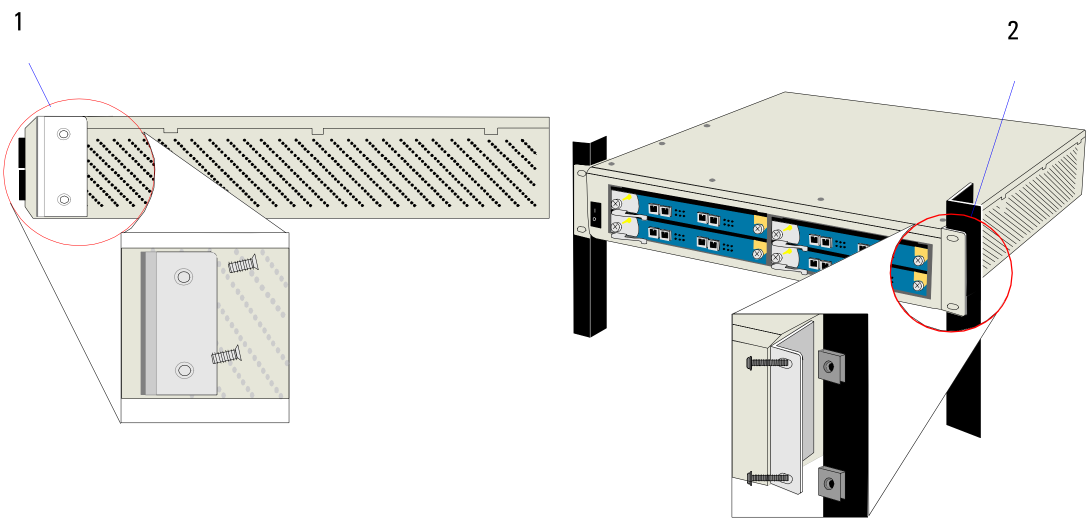
1. Stick 4 of the provided rubber feet to the indent marks on the bottom of each switch (24 port) and chassis. (The switches feet are in their accessories bag.)

   The rubber feet are to minimize slippage and scraping, not for air flow. Ventilation occurs through the sides of the chassis, and through the back of the switch. If you later mount chassis in a rack, you will need to remove the rubber feet.

2. Stack the controller, switch and chassis.

   The stack must not be more than 17U high, including the switch.

To rack mount a chassis



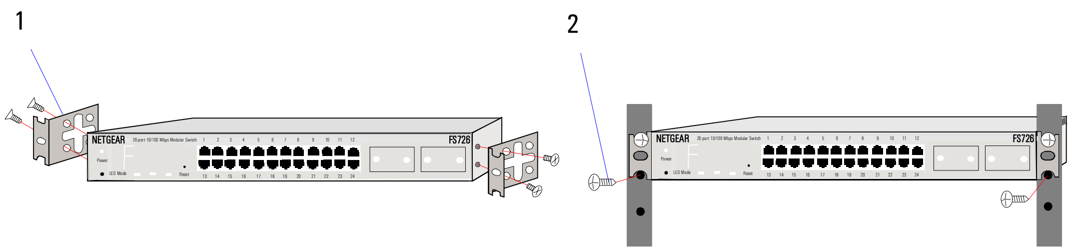
Steps

1. Attach the mounting ears to each side of the chassis.
2. Holding the chassis in place, clip 4 nuts to the rack and secure the mounting ears to the front two posts.

Notes: Use the ears provided to mount chassis in an EIA-standard 19” rack. The chassis is secured to 2 posts only (on 4-post racks, the chassis mounts to the front 2 posts).

Set up the switches

To rack mount switches



Steps 1 Secure two ears to each switch. The switches ears are in its accessories bag. There are 4 x 10mm M4 cross-head screws.

2 Secure the switch to the rack using the 4 screws (5/8” 12-24 cross-head screws). Leave a gap above or below the switch to run cables from the front of the switch to the back of the modules and chassis.

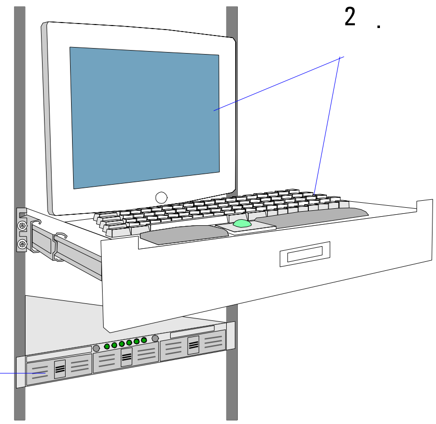
Notes: You may have either one of these switches:

- Netgear FS108 (8 port)
  This was supplied with the single processor Controller and Laptop.
- Netgear FS726 (24 port)
  This was supplied with the dual processor high performance Controller.

It may be possible to mount the switch facing backwards to make cabling easier.

The Netgear FS108 switch cannot be mounted in a rack, but can be placed on top of a chassis.

To set up a rack mount PC



Steps

1 Mount the Controller. For information on this see your Controller Systems Rack Installation Instructions: “Installing the system in the rack”.

2 (Optional) Mount the sliding, 2-slot, flip-up, flat-panel monitor. If you have a rackmount monitor and keyboard, see the Flat Panel Monitor/Keyboard Installation Guide Flat Panel Monitor/Keyboard Owner’s Manual.

Otherwise, connect your own monitor and keyboard to the Controller. The monitor should support a 1024 x 768 pixel area and 24-bit color. If you do not need a local console in the lab, use the monitor and keyboard only temporarily, to set up the controller for remote access (described in “Remote Access" on page 151 .

Controller See the Dell Systems Rack Installation Guide:

- Chapter 1-3: Four-Post Rack Installation
- Chapter 1-20: Two-Post Installation

Step 3: Connecting the test equipment

To connect the test equipment, you will need to:

- connect the chassis together
- install the modules in the chassis
- connect the chassis to a switch
- connect the chassis and switch to the System Controller

When installing test equipment, be aware of the following:

Static Electricity

CAUTION

Take anti-static precautions.

The connectors on the modules are sensitive to static electricity. To minimize electrostatic damage, please take the necessary anti-static precautions (for example, wear a wrist strap).

Power cables

WARNING

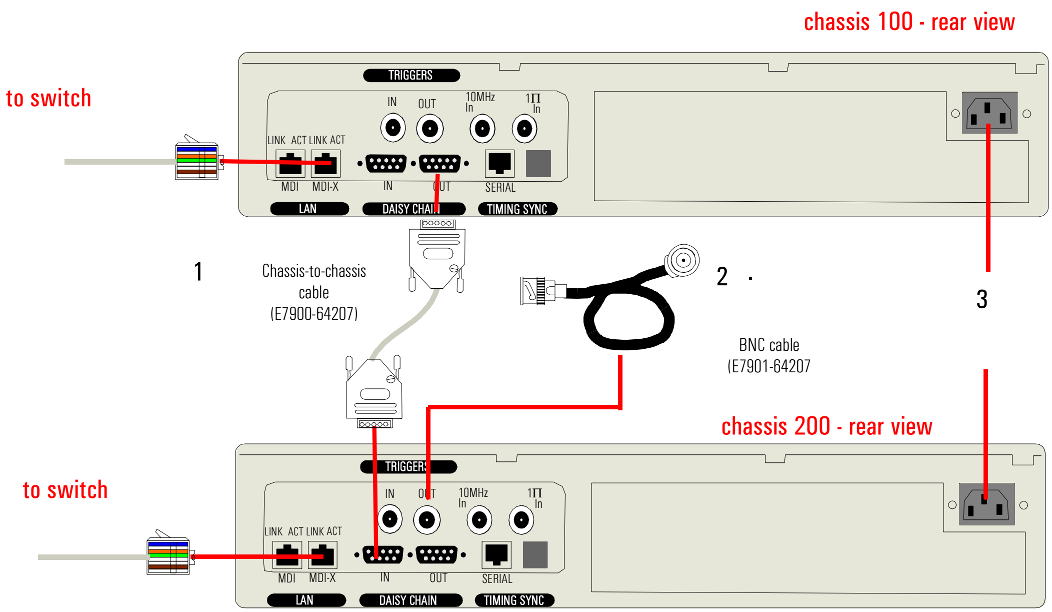
WARNING:

Use the supplied power cords. They manage the required loads, provide an earth ground, and protect you from electric shock. For additional or replacement power cords, contact us — see "To contact us" on page 17.

Only trained personnel who are aware of the hazards should install and disassemble the tester. Before disassembling the tester, turn off all power and unplug all power cords.

Do not block access to a power cord or switch, in case you need to disconnect power in an emergency.

Connecting chassis together



Steps

1 Daisy-chain the clock and event lines of the chassis by connecting the OUT port on the first chassis to the IN port on the next chassis. The first chassis in this daisy chain becomes chassis number 100, the second becomes chassis number 200, and so on.

2 (Optional) Connect an external trigger device (e.g., logic analyzer, oscilloscope).

3 Plug each chassis into a power source. For more information, refer to What are the power requirements of your configuration?

Installing and removing modules

CAUTION

Take anti-static precautions

The components on the modules are sensitive to static electricity. To minimize electrostatic damage, please take the necessary anti-static precautions (for example, wear a wrist strap).

Do not operate chassis with empty slots

Fill any empty slots in the OmniBER XM J7263A chassis with blanking plates (E7900-00001) to ensure correct operation of the chassis. When inserting the blanking plate always use the runners on the chassis otherwise you may damage the rear panel connectors.

WARNING

Modules may become hot during use

DO NOT touch any of the components on a module as you remove it from the chassis.

ESD Precautions

The network simulator contains components sensitive to electrostatic discharge. The smallest static voltage most people can feel is about 3500 volts. It takes less than one tenth of that (about 300 volts) to destroy or severely damage static sensitive circuits. Often, static damage does not immediately cause a malfunction but significantly reduces the component's life.

Adhering to the following precautions will reduce the risk of static discharge damage.

- Keep the module in its conductive storage bag and box when not installed in the OmniBER XM chassis. Save the box for future storage.
- Before handling the module, select a work area where potential static sources have been minimized. Avoid working in carpeted areas and using nonconductive chairs. Keep body movement to a minimum.

- Agilent Technologies recommends that you use a static controlled workstation.
- Handle the module by its front panel. Avoid touching any components or connectors. When about to install the module, keep one hand in contact with the protective bag and pick up the module with the other.
- Before installing the module, touch the metal surface of the OmniBER XM chassis with your free hand to ensure that you, the module and the chassis have the same static potential. This also applies whenever you connect/disconnect cables on the front panel.

Module Handling Requirements

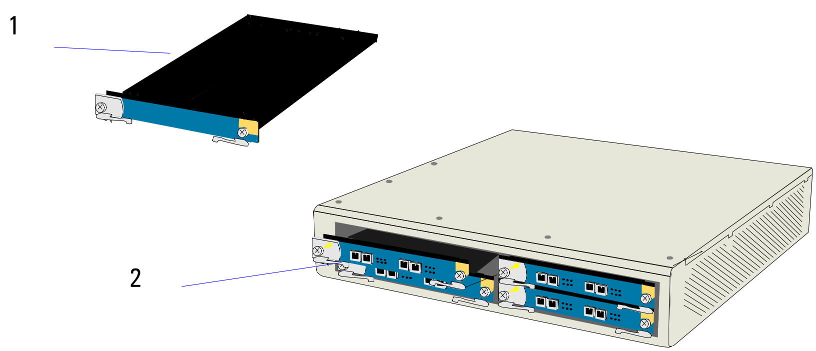
Care must be taken when fitting and removing modules into a chassis to avoid trapping cables between the module and the chassis.

When fitting or removing a module into a chassis, which is operating and contains any other modules, the following guidelines must be adhered to:

- Disconnect and move aside all cabling from the module to be removed.
- Ensure that the retaining screws have been released onto their retaining springs.
- Make sure that when removing a module/blanking plate that a replacement module or blanking plate is available nearby.
- Ensure that the time between first moving the fitted module and replacing it with another module or blanking plate is kept to a minimum.
- Never have a chassis operating without all module positions occupied by either a module or a blanking plate. Sufficient blanking plates are supplied with all chassis for this purpose.
- Always make sure that when fitting a module that the retaining screws are securely located before attaching any cables to the front panel.

Installing modules in a chassis

Be aware of the safety/handling information given in "Installing and removing modules" on page 43 before installing modules.



Steps

1. Remove the blanking plate from the slot you want to use (see instructions following for removing a module).
2. Line up the module with the slot, close the extractor levers and push the module firmly into place. Tighten the screwlocks until finger tight.

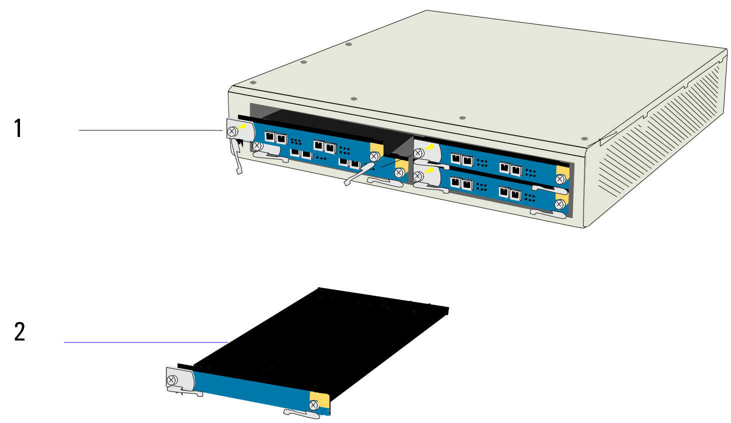
Notes: You can position the modules in any of the chassis slots, the order does not matter.

Be sure to fill any unused chassis slots with J7263A chassis blanking plate. When inserting the blanking plate always use the runners on the chassis otherwise you may damage the rear panel connectors.

Hot Swappable A module can be hot inserted into an OmniBER XM chassis at any time. The module will go through it's boot process and identify itself to the Resource Manager. The Resource Manager will allocate the module a number according to the chassis in which it sits and it's position within the chassis. On completion of this process the module is available to be added to any pre-existing or new test session as far as the rules regarding Clock/Event lines allow.

Note that a re-numbering operation requires that there are no test sessions running on the host controller.

Removing modules from chassis



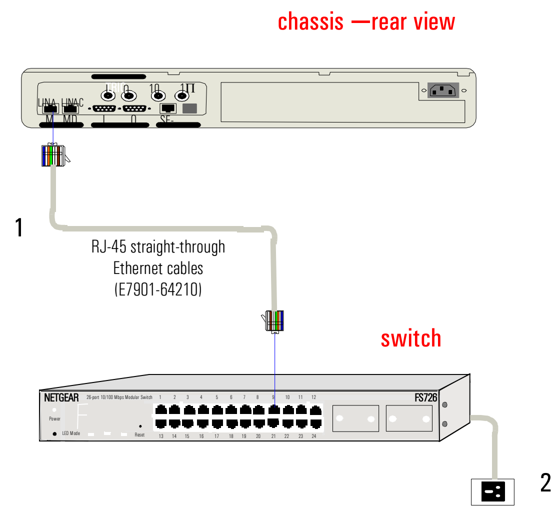
Steps

1. Unscrew the screwlocks. Pull the extractor levers outwards and pull them gently towards you. Remove the module, holding it only by the front panel and metal case. Be careful not to touch any of the components on the module. Place the module on a hard, flat surface. NEVER stack one module on top of another.
2. Replace the removed module with a blanking plate (see instructions above for installing a module). NEVER operate a chassis with an empty slot. ALWAYS replace the blanking plate to ensure correct cooling of the chassis. When inserting the blanking plate always use the runners on the chassis otherwise you may damage the rear panel connectors.

Note that removal of a module from a chassis does not compromise the Clock/Event chain since this is handled entirely within the chassis.

Hot Swappable To avoid problems modules must only be removed from a chassis when that module is not allocated to a test session. Removal of a module from a currently active test session will result in a “script client abort” failure which will terminate the session.

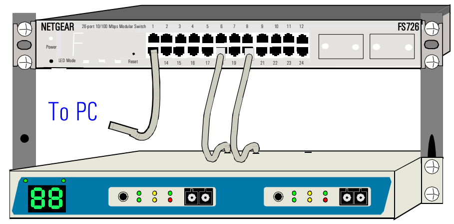
Connecting the chassis to a switch



Steps

1. Connect the ethernet cables from the back of each chassis to the front of the switch. When connecting a chassis, use a straight-through cable if you are connecting from the MDI port, and a cross-over cable if you are connecting from the MDI-X port.
2. Plug the switch into the power source. Switches have no ON switch, and power up once plugged in.

Notes: The supplied switches are auto-sensing and detect whether the cables attached to them are straight-through or cross-over. They will auto-switch, performing the cross-over correction of data when it is necessary.



Notes: If you stacked the chassis on a bench, connect the cables and run them over or to the side of the switch. If you installed the chassis in a rack, run cables over or under the switch.

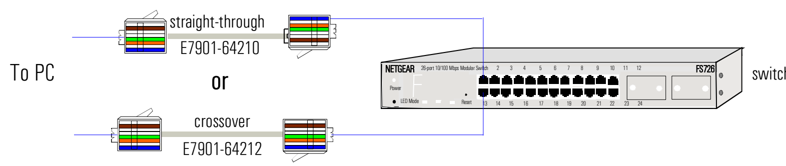
You will need a second switch if you are using:

- Netgear FS 108 switch (8 port) and have more than 7 chassis, or
- Netgear FS 726 (24 port) switch and have more than 23 chassis.

Daisy-chain the second switch off the first one by connecting any port on the first switch to any port on the second switch. See the switch’s Installation Guide for more information on daisy-chaining switches.

Connecting the System Controller

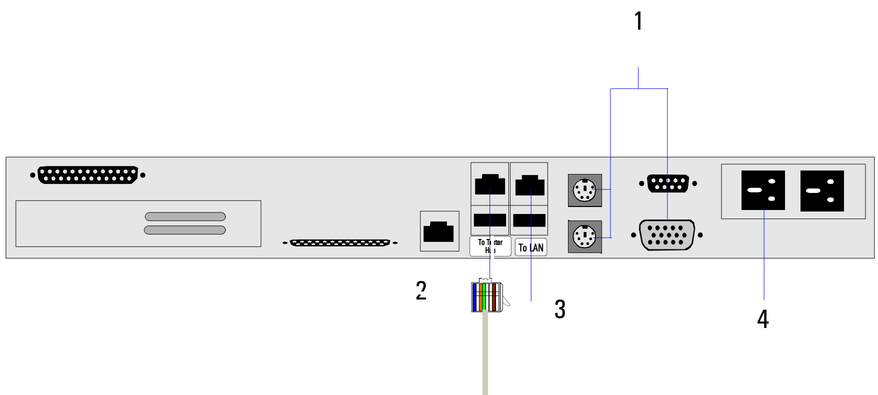
Controller to switch Connect the Controller to the switch with a straight-through LAN cable.



CAUTION Tester uses 10.x.x.x subnet addresses

The Ethernet port that connects the switch uses the IP address 10.0.0.1/8. A DHCP server on the Controller dynamically assigns each test port an IP address from this 10.x.x.x subnet range. If 10.x.x.x addresses are also used in your test lab/LAN, or by a software application (e.g., to connect to a VPN), change the switch and test port addresses to avoid conflicts. For complete details, see “To change the Tester’s subnet IP Addresses” on page 72.

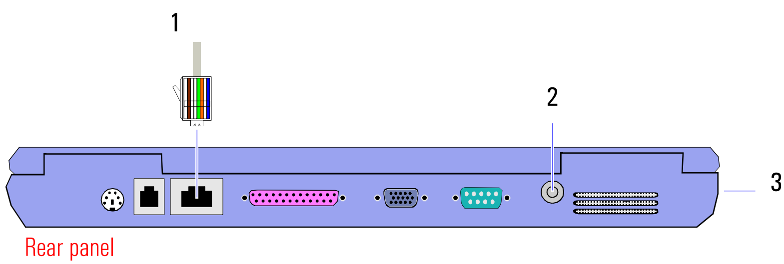
Connecting a rackmount Controller



Steps

1. Connect the mouse, keyboard, and monitor. Plug the cable connectors securely into the ports.
2. Connect this 10/100 Mb/s Ethernet port to a chassis or 10/100 Mb/s port on the switch.
3. (Optional) Connect this 10/100 Mb/s Ethernet port to your LAN. You can access the tester remotely and the tester can use shared network resources like file servers and printers. You must supply your own LAN cable for this connection.
4. Plug the controller and monitor into a power source.

To connect a laptop PC



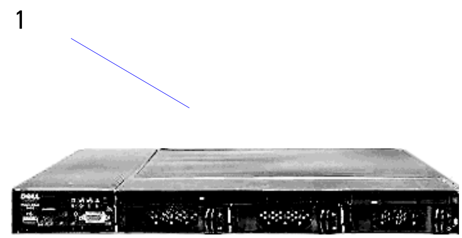
Steps.

1. Connect the laptop's 10/100/1000 Ethernet port to a chassis or 10/100 Mb/s port on the switch. Refer to “Connecting the system controller PC” on page 50 for cable information. If you connect the laptop to a single chassis you do not need to connect any other cables.
2. As needed, use the Universal AC adapter to plug the laptop into a power source.
3. (Optional) You can access a LAN using the Intel Wireless 2100 WLAN MiniPCI card installed in the PC card slot on the left side of the laptop. For details about the wireless adapter or other peripherals included with the PC, it is recommended that you read the accompanying printed or online documentation or see the manufacturer (Dell, Intel) web site.

10.x.x.x subnet used

The PC Ethernet port that connects the chassis, hub, or switch uses the IP address subnet 10.0.0.1/8. Specifically, a DHCP server on the PC dynamically assigns each test port an IP address from this 10.x.x.x subnet range. If 10.x.x.x addresses are also used in your test lab/LAN, or by a software application (for example, to connect a laptop to a VPN), change the subnet addresses used to avoid conflicts. For details, see “To change the IP address of the switch card” on page 160.

Step 4: Power Up the System



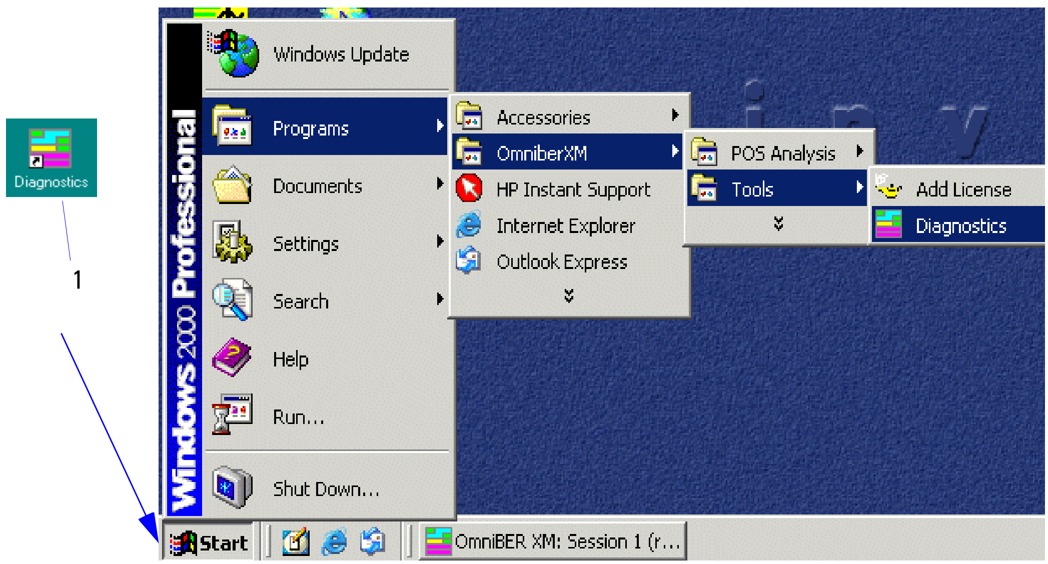
controller - front view

Steps

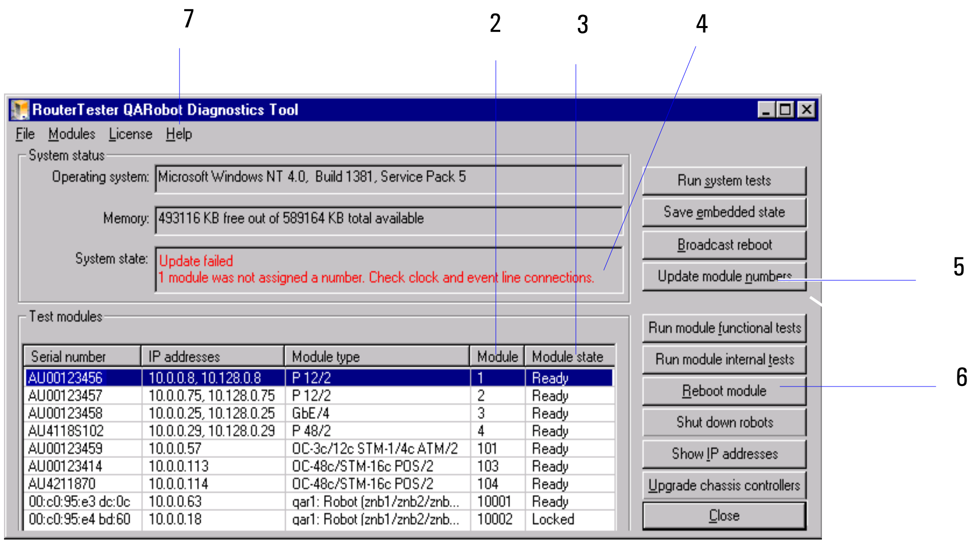
1. Power up the controller.
2. On the controller, log in as user **Administrator**. The password is preset in the factory to be blank but you might need to change it to conform to company conventions. See "To change the password" on page 93.
3. Power up each chassis using the power switch on the front of the chassis. Any modules in the chassis will boot up at this time.
   To avoid possible numbering problems, turn on the chassis in the order they are connected, leaving the chassis that is at the end of the event-line daisy-chain until last.

Using the Diagnostics tool

You can use the Diagnostics Tool to perform a system test once it has powered up.



Steps 1 Launch the Diagnostics Tool through the Windows desktop icon, or through the Start menu.



Steps

2 Check that each module has a unique number.

3 Check that each module appears in the “Ready” state.

4 Check the system state. If all modules are installed successfully, it will say “Ready”. If errors are reported, follow any actions recommended.

5 After fixing cabling problems, or adding or removing modules click this button.

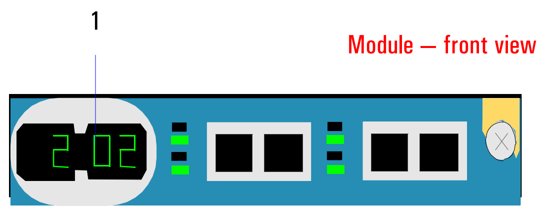
6 Click this button to reboot a module. This may clear a bad state.

Notes: For help with this tool and troubleshooting module problems, select Contents from the Diagnostic Tool’s Help menu (7). Follow the instructions in the displayed online help.

If the modules are installed successfully, close the Diagnostic Tool and review “To check module hardware indicators”. The hardware indicators will also indicate success but you should familiarize yourself with them in the event there are problems later.

To check module hardware indicators

Each time you power on or reboot a module, it runs through several self check stages. You should check that they display the correct indicators.



Steps **1** Check the module display. Each module should have a unique number based on the chassis number, and its position in the chassis. If the display shows an error message, see the next section for information on possible errors.

To check switch hardware indicators

To determine whether the switches in your configuration have powered up without error, refer to the Netgear Fast Ethernet Switch Installation Guide.

Module status indicators

When booting, the module LED indicators run through the following sequence of codes. If a problem occurs, the code shows what stage of the boot sequence was reached and a message may be scrolled across the display.

Following is a list of possible problems and recommended actions

Code	Diagnosis and Recommended Action
BHW1	The boot kernel cannot initialize its core devices. Please return the module to Agilent.
BHW2	The boot kernel cannot initialize the kernel services. Please return the module to Agilent.
BNET	The boot kernel cannot establish an Ethernet link with the module controller. Please return the chassis and module to Agilent.
BIP (Connect Ethernet and Enable DHCP)	The boot kernel cannot obtain an IP address from the controller. Check that all Ethernet cables are connected and all units in the network (including the switch) are powered up. Check that you are using the correct Ethernet ports on the chassis and controller. Check that the DHCP Server (dhcpdNT) is running on the controller. If it is not, start it. If it is, try restarting it.
BAPP	The boot kernel cannot load the main kernel image. Check that the FTP Publishing Service is running on the controller. If it is not, start it. If it is, check that the file E7900-64010/vxWorks.st exists on the controller in the FTP directory and restart the FTP Publishing Service.
KHW1	The main kernel cannot initialize its core devices. Please return the module to Agilent.
KHW2	The main kernel cannot initialize kernel services. Please return the module to Agilent.
KNET	The main kernel cannot establish an Ethernet link with the controller. Check that all Ethernet cables are connected and all units in the network (including the switch) are powered up. Check that you are using the correct Ethernet ports on the chassis and controller.
KIP	The main kernel cannot initialize the IP stack or required services. Please return the module to Agilent.
KAPP	The main kernel cannot initialize the application services. Please return the module to Agilent.
Empty display	The main kernel cannot establish a connection with the resource manager on the controller.
Display shows - - - -	The module cannot discover its number. Check the instrument cabling, then click the Diagnostics Tool’s “Update module numbers” button.
Two modules with the same chassis number	The daisy chain that connects the chassis is segmented. Check for a break in the chain immediately before the chassis with the duplicate module number.

When the module is downloading data, the display flickers to show this activity. When the module is ready for use, it displays its number and a ‘trail’ of pixels snakes round the perimeter of the display. When in use by a test session, the display is constant, showing only the number. It will also periodically scroll the session label.

Step 5: Connect to the System Under Test

Review the following safety information before connecting to the system under test.

WARNING

Do not look into a Transmit laser.

Lasers produce a very intense visible or invisible light that is harmful to human tissue and may cause eye damage. Never look into a Tx port to see if the laser is working. Before disconnecting or connecting a cable from or to a Tx port, ensure that the red LASER LED next to the port is off.

To avoid hazardous exposure to laser radiation, it is recommended that the following practices are observed during system operation:

- ALWAYS DEACTIVATE THE LASER BEFORE CONNECTING OR DISCONNECTING OPTICAL CABLES.
- When connecting or disconnecting optical cables between the network simulator and device-under-test, observe the connection sequences given below.

WARNING

Optical receivers can be permanently damaged by excessive Optical Power or Optical Transients. Ensure that any signal applied to the receiver is attenuated before connection so that the signal level applied is within the receiver operating range and also that the receiver is not subject to excessive optical transients.

Connecting: Connect the optical cable to the input of the device-under-test before connecting to any of the network simulators Optical Out connectors. When connecting to the Optical In ports ensure the power level never exceeds the maximum stated limit for that port. Also ensure that the power level of a signal applied to a receive port is within the recommended operating level for that port.

Disconnecting: Disconnect the optical cable from the Optical Out connector before disconnecting from the device-under-test. Always close the fiber optic connector dust caps over the laser aperture.

- NEVER examine or stare into the open end of a broken, severed, or disconnected optical cable when it is connected to one of the network simulator Optical Out connectors.
- Arrange for service-trained personnel, who are aware of the hazards involved, to repair optical cables.

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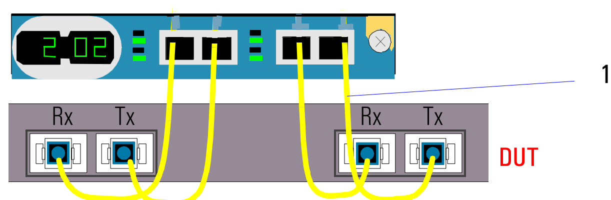
module — front view



Steps **1** Connect the transmit (Optical Out) and receive (Optical In) of each test port on the module, as a pair, to an interface on the Device Under Test (DUT). This allows port-based protocol exchanges.

Optical fibre cables

You must supply your own optical cables. Each test port has two separate, female SC ports — push cable connectors firmly into these ports. For the best results, use single mode fibers with single mode test ports, and multimode fibers with multimode test ports. The port types are as follows

J7241A/J7242A modules

Optical Out Port **Wavelength:** Tx 1550 nm (J7241A) or 1310 nm (J7242A), Rx 1280 to 1580 nm.

Fiber power output J7241A: Min –5 dBm, max –1 dBm.

Fiber power output J7242A: Min –6 dBm, max –1 dBm

Connectivity: Single mode

Optical In Port

Maximum input power: –0.5 dBm.

Maximum input power damage level: + 3 dBm.

Minimum sensitivity: –11 dBm (1310nm), -14dBm (1550 nm) .

Safety Classification: Class 1 laser product (60825-1:1993 + A1:1997 + A2:2001).

Connectivity: Single mode

J7244A/J7245A modules

Optical Out Port

Wavelength: Tx 1310 nm (J7244A) or 1550 nm (J7245A); Rx 1250 to 1660 nm.

Fiber power output: Min –5 dBm, max –0 dBm (1310 nm)
Min -2 dBm, max +3 dBm (1550 nm).

Connectivity: Single mode

Optical In Port

Maximum input power: –2.5 dBm.

Maximum input power damage level: + 4 dBm.

Minimum Sensitivity: OC-3 -24dBm; OC12 -24 dBm; OC-48 -20 dBm

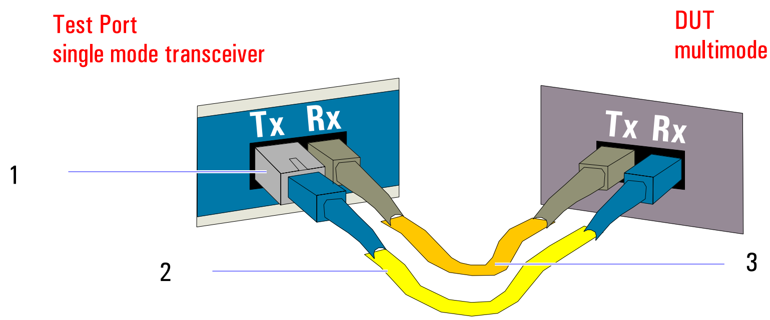
Safety Classification: Class 1 laser product (60825-1:1993 + A1:1997 + A2:2001).

Connectivity: Multi mode

WARNING **Do not exceed the stated maximum input power damage level when applying input signals.**

To attenuate single mode optical signals for a multimode optical interface

As indicated in the previous table, some single mode optical test ports provide connectivity with multimode interfaces.



Note: Tx = Optical Out; Rx = Optical In on module front panel

Steps

1 Use an attenuator to reduce the test port's transmitter output power to a level compatible with the Device under tests (DUT's) receiver.

2 Use a single mode fibre (yellow) to connect to the DUT's receiver.

3 Use a multimode fibre (may be orange, grey, green, or white) to connect to the test port's receiver.

Notes: You can order attenuators from manufacturers like AMP. The required attenuation depends on the DUT's receiver and the losses introduced by the optical fibers and connectors. For instance, assume the:

- single mode Tx output= S to T dBm— e.g., -15 to -8 dBm
- Rx input sensitivity= M to N dBm— e.g., -26 to -12 dBm
- fiber and connector loss— e.g., ~1 dB

You would require attenuation in this range:

- maximum= S - M - loss dB— e.g., (-15)–(-26)–(1) = 10 dB
- minimum= T - N dB— e.g., (-8)–(-12) = 4 dB

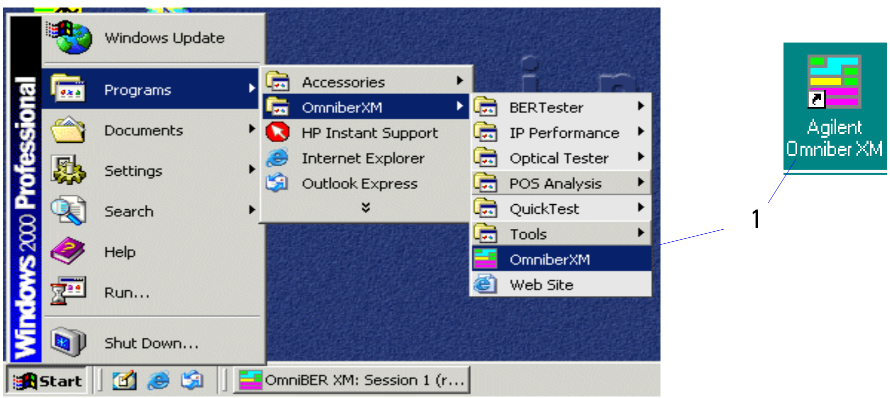
In this example, a 6 dB attenuator would work well, as it would reduce the output signal level to the range -21 to -14 dBm, well within the receiver’s sensitivity range.

About single mode fiber

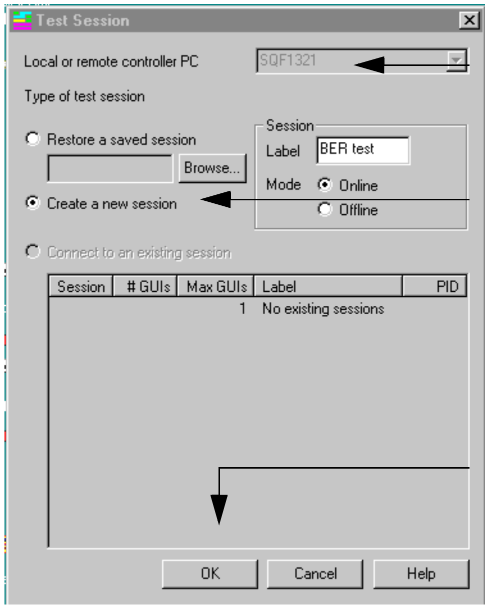
Single mode fiber has a narrower core and provides one possible path for an optical signal to follow. It is typically used in applications requiring a high degree of signal preservation, for example, SONET/SDH communications.

Step 6: Start the Software

Verify physical-layer connectivity between the tester and the DUT, by starting the Network simulator application and turning on transmissions.



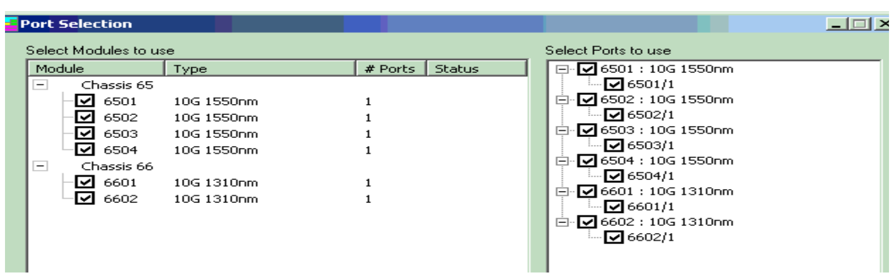
Steps 1 Launch the application through the Windows desktop icon, or through the Start menu.



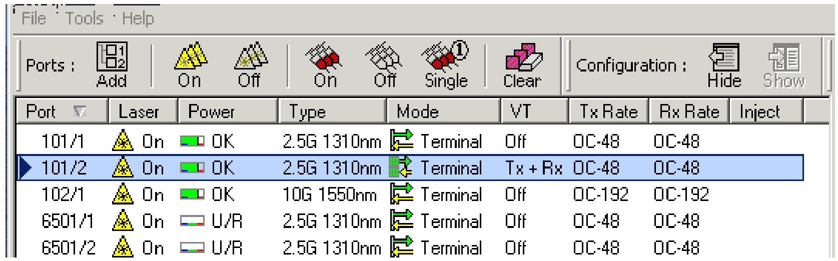
2 Choose the controller you are connecting to.

3 Create a new test session, restore a saved session or connect to an existing session.

4 Click **OK** to display the Port Selection dialog. It may take a few minutes for the Port Selection dialog to appear.



5 Select the test ports that are currently connected to the DUT. Click the **OK** button to display the OmniBER XM Network Simulator window.



To turn on the Lasers

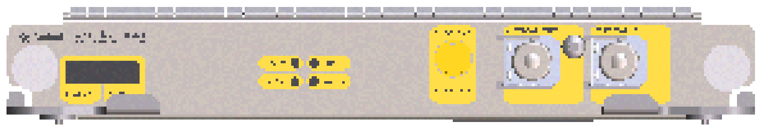
1 Click on the **Laser On** icon on the OmniBER XM Toolbar to turn all the lasers on.
The laser column should switch from off to on for each test port.

2 To turn all the lasers off, click **Laser Off**.

To check the Network Simulator modules hardware LEDs

The last step is to check the physical LEDs for the hardware modules.

10G Module



1 Check the LOF/LOP LED:

LOF/LOP (yellow) The test port detects a Loss of Frame alarm (A1/A2 framing errors for ~ 3 ms) or Loss of Pointer alarm (8-10 consecutive frames with invalid pointers). Possible causes:

- The tester and DUT clocks are not synchronized to the same master.
- Mismatched or incompatible SONET/SDH settings.

The LED turns off on receipt of valid frames.

2 Check the AIS/RDI LED:

AIS/RDI (yellow) The test port detects an Alarm Indication Signal or Remote Defect Indicator in received frames. Possible causes:

- You did not turn on this test port's laser.
- Faults in the DUT or DUT cabling.

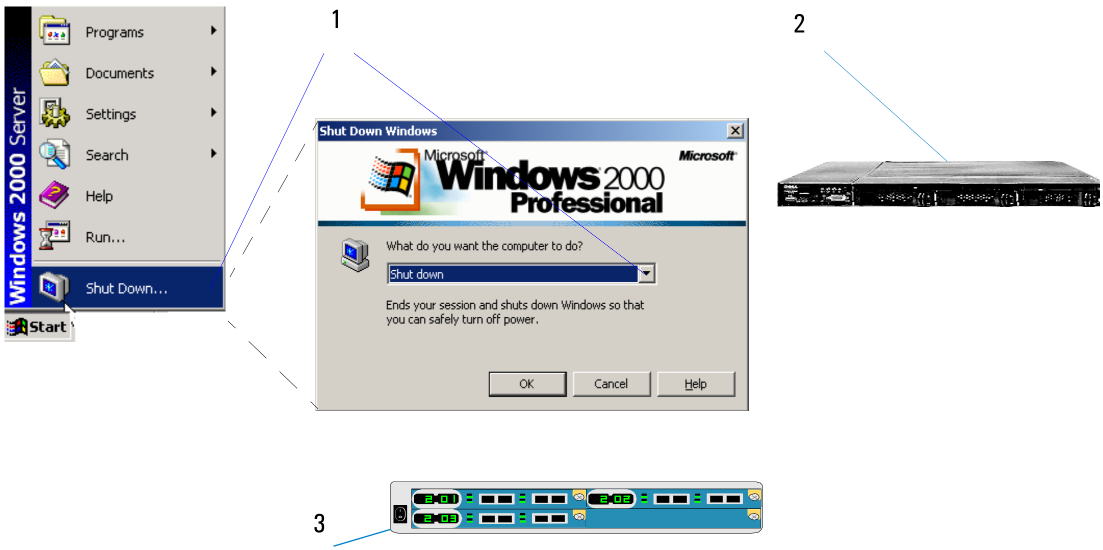
3 Check the signal LED:

SIGNAL (green) The test port is receiving a valid optical signal from the DUT.

4 Check the Laser LED:

LASER (red) The test port's laser is turned on.

To power down the system



Steps

1. Close all test sessions. Do this before you power down any of the test equipment. Select Shut Down from the Start menu, then select Shut Down from the pop-up window, and click OK.
2. Once Windows has shut down, switch off the System Controller.
3. Switch off the power to the test equipment. It does not matter in which order you switch off the test equipment. The power switches are at the front of the chassis.
4. Disconnect the power cord from the back of the switch after the chassis have been powered down.

Note It is not necessary to power down the system before removing or inserting modules. See Hot swapping modules, page 26

2
Using the Graphical User Interface (GUI)

This chapter provides information on how to use the Windows based graphical user interface of the OmniberXM Network Simulator.

The graphical user interface is Windows based and has the benefits of using components that are probably familiar to you, and uses many of the Windows shortcuts. The following list describes the shortcuts and quick selections available.

Shortcuts

Shortcut	Description
Tool Tips/Pop-up Windows	On the **Toolbar**, move the mouse over the graphic to display a short tool tip describing the action that will take place on selecting this item. On the **Channels, Pattern** or **POH** pages, move the mouse over a channel within the window to display a popup window containing information on the channel you are pointing to. On **E & A Inject** page, move the mouse over the mask to display information on the channel you are pointing to. On the **Overview** page, move the mouse over the mask to view a status summary.
Context menu	On the **Channels, Pattern, E&A Inject** tabs right click the mouse to display a context sensitive menu listing the selections available.
Column sort	You can click on some column headers to sort the column into ascending or descending order.
Mouse actions	In the **Channels** page double click the mouse in a channel to Select or Unselect it. Note you can also do this by pressing the spacebar see **Quick Selections** on next page. **Pattern** page: double click mouse or use the spacebar to cycle through pattern choices. **E+A Inject page**: double click mouse or use the spacebar to Add or Remove channels from the mask. **VT POH/LO-POH** page: No double click action **Overview** page: Double click mouse to go to the **E+A** page then select appropriate channel. **E+A** page: Double click mouse to go to **Counts** page and select required channel.

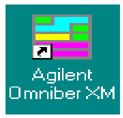
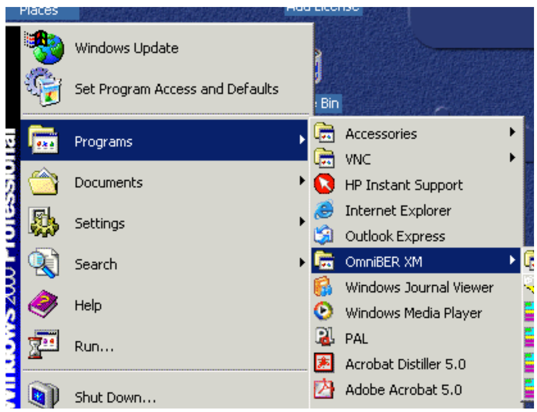
Quick Selections

Press	To perform this action:
Spacebar	To toggle the state of the highlighted item, for example (Un)Select.
UP / DOWN ARROW	To move highlight to previous or following line.
LEFT / RIGHT ARROW	To move highlight from left to right.
SHIFT+ UP/ DOWN ARROW	Highlights all the channels between the selection point and the row above or below.
SHIFT+LEFT / RIGHT ARROW	Highlights the channel to the left or right as well as the current selection.
Ctrl + A	Highlights all channels/paths/VTs/TUs.
Home	Highlights first channel/path/VT/TU.
End	Highlights last channel/path/VT/TU.
Shift left mouse click	Highlights all channels between the last selection and the current one.
Ctrl left mouse click	Invert the highlight on the selected channel.
Left mouse click	Highlight a single channel.

3
Getting Started

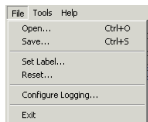
This chapter describes the basic tasks you need to complete in order to configure a test session.

To launch OmniBER XM

Windows Desktop		On the Windows desktop, double-click this icon to launch the Network Simulator application.
Start Menu		Or, from the Windows Start menu, select Programs, OmniBER XM.

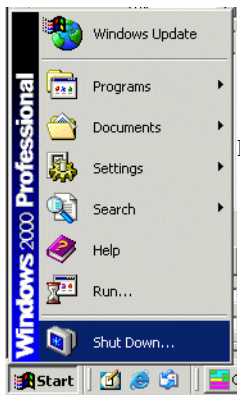
To exit and log out

Exit



From the application File menu, select Exit. Indicate whether you want to save your current test configuration. If you had detached the test session from your GUI, indicate whether to leave the test session running in the background. Note: You can close the GUI without ending your test session.

Log Out of Windows



From the Start menu, select Shut Down.

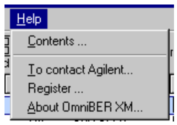
Confirm that you want to end your Windows session.

Before you turn off the controller, always log off Windows. Wait for the message indicating that it's safe to power down.There are two ways to power down:

- select Shut Down from the Start menu
- click Shut Down on the Windows Security dialog

To get online help

Help Menu



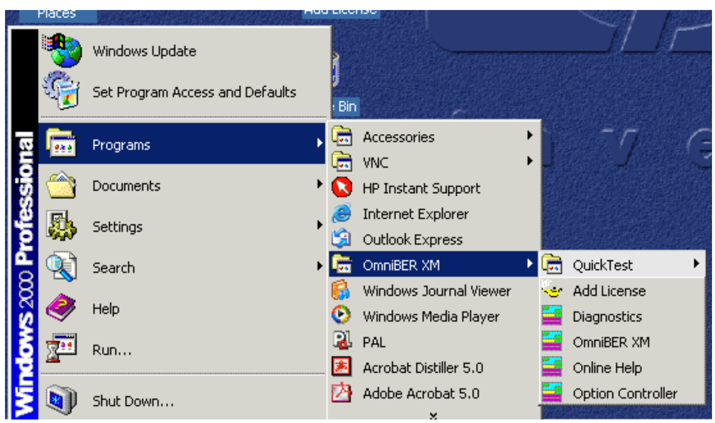
The OmniBER XM network simulator help includes:

- Introduction: Describes OmniBER XM and its help. Provides Acrobat/PDF versions of the paper guides.
- Using Network Simulator: Describes how to display and use the application's dialogs, with details about what to enter for each field.
- Provides troubleshooting help.
- Using the API: Describes how to use the Application Programming Interface.
- Using SCPI commands: provides a list of commands for controlling the OmniBER XM.
- Technology Reference: Provides white papers on testing and technologies; helpful web sites; and a glossary of terms.

Dialog Help Buttons

Provides context-sensitive details about the current dialog and what to enter for each field.

Start Menu



Provides access to the same help as that described above for the Help Menu.

The online help and paper guides are provided on both the

- OmniBER XM controller: C:\Program Files\Agilent\OmniBER XM\doc and the OmniBER XM CD: \doc

Launch OmniBERXM.chm to see the online help or the .pdf files to see the paper guides.

Tool Bar Explained

The functions you can access via the **File**, **Tools** and **Help** menus are explained here.

File Menu

Selections are: **Open**, **Save**, **Set label**, **Reset, Configure Logging** and **Exit**.

To open a session configuration from file

1 Select **File** then **Open** from the menu.

2 Select a file from the **Open** dialog window.

3 You can select which port to restore the saved settings on by clicking on the **Restore On** column.
You can restore a complete session or a partial session by clicking the appropriate radio button. If you select a partial session you can choose from the settings displayed in the bottom half of the dialog.

4 Select **Open**. This will apply the file settings to the current session.

To save session configuration to a file

Save a session configuration you wish to keep to a file. The file can then be restored on demand.

1 Select **File** then **Save** from the menu.

2 Enter a name in the **File name** field.

3 Set **Save as type** to **Configuration Files (*.xml)**.

4 Click on a Port and add a Comment if required.

5 Determine whether you wish to save a “Complete session” (all the settings for that session are retained) or a “Partial Session”. By

default, test configuration files are stored in: C:\Program Files\Agilent\OmniberXM\config\OmniberXm.

To set a label

1 Select **File** then **Set label**.

2 Enter a label for the current session in the **Session label** dialog window.

To Reset configuration to system default settings

1 Select **File** then **Reset**

Choosing reset will cause you to lose all selections and data.

2 Decide whether you wish to save the current configuration to a file before resetting. If not select **No**.

To Configure Logging: Please refer to "To log events to a file" on page 127.

To Exit

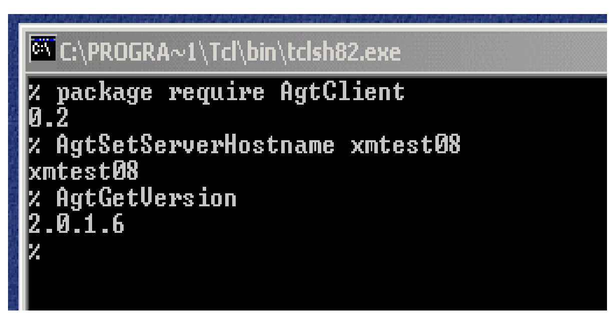
1 Select File then **Exit**. See "To close a session" on page 132 for a more detailed explanation.

Tools Menu

Selections are: **Tcl Shell** and **About the Tools Menu**.

Tcl Shell: A window similar to the one opposite is displayed allowing you enter Tcl commands.

About the Tools Menu: This provides help on how you can customize this menu and add other menus to launch your own software applications and scripts. Refer to the OmniBER XM online help provided with your system for more information on how to customize the menus.



Help Menu

Selections are: **Contents**, **To Contact Agilent**, and **About OmniBER XM**

Contents: Opens up the OmniBER XM online help.

To Contact Agilent: Provides information on how to contact Agilent.

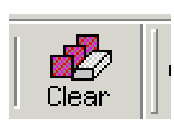
About OmniBER XM: States the current application software version build and date.

Configuration: Hide/Show

To Hide the Configuration part of the display

1 Click on the Configuration **Hide** icon to hide all the configuration part of the display and allocate all of the display to the Results window. Selecting **Show** will return to the normal display.

Clear History on all ports



1 Click on the Clear history icon to remove historical error indication (chassis/ports shown pink) from the instrument GUI.

Configure a session offline

With OmniBER XM you can configure a new session offline while there is an online session in progress. This saves you time as you don’t need to wait until the online session is finished before setting up a new configuration. You can then save the offline session to file and restore it later into a new future session.

▶ To configure a session offline

1. Double click on the **Agilent OmniBER XM** icon on your Controller display to start an OmniBER XM session.
2. When the **Test Session** dialog window opens set the **Session Mode** to **Offline**. Also enter a **Label** for your session.
3. Set the **Type of test session** to **Create a new session**.
4. Select **OK**.
5. In the **Port Selection** dialog window, select the ports you want to configure. Select **OK**.
6. Set up the Transmitter, Receiver and Results interface settings as required.
7. When you are finished setting up the OmniBER XM, select **File** then **Exit** from the OmniBER XM Toolbar.
8. In the **Exit** dialog window select **Close Session**, and then click on the **Save then exit** button.
9. In the **Save As** dialog enter a file name for your saved configuration. Also decide whether you wish to save a “Complete” or “Partial Session”. If you choose a Partial session you can then select which setting you wish to save.
10. Select the **Save** button. The Session will close down and your configuration will be saved with the file name you entered in step 9.

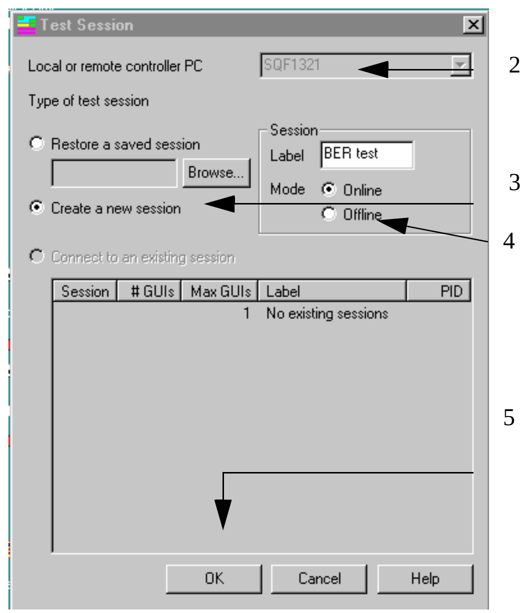
▶ To restore a saved session

1. Double click on the **Agilent OmniBER XM** icon on your Controller display to start an OmniBER XM session.
2. In the **Test Session** dialog select **Restore a saved session**, then click on **Browse**. From the **Open** dialog select the file required then **Open**. Click on **OK to** restore the saved file.

Example of OmniBER XM setup

To start a session and select modules and test ports

1 Double click on the OmniBER XM icon.

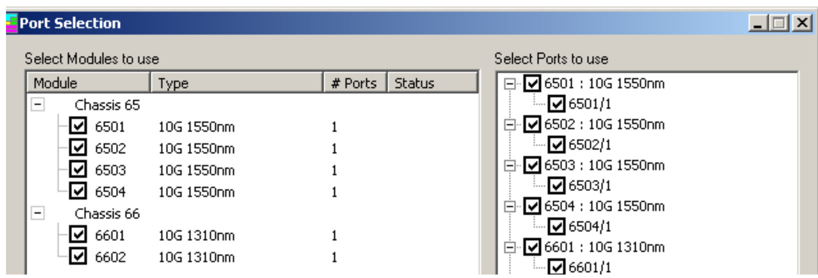


To Start a session

1. Launch OmniBER XM session by double clicking on the **Agilent OmniBER XM** icon on the Controller display.
2. Choose the Controller you are connecting to.
3. Determine whether you wish to “create a new test session”, “restore a saved session” or “connect to an existing session”.

4 Set the **Session Mode** to **Online**. Select **Offline** if you wish to configure a session offline - see Configure a session offline page 80. When you select Offline you are not connected to the chassis or modules hardware.

5 Click OK to display the **Port Selection** dialog.



6 Select the test modules to use in your test. Note any modules currently in use in a test session are shown blue on the display and are unable to be selected (the tic box is greyed out).

7 Select the ports to use in your test.

8 Click OK to display the **OmniBER XM: Session** window

NOTE

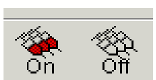
When selecting test ports on OmniBER XM test modules, select ports on consecutively numbered modules. Because of the event line used to synchronize these types of modules.

Thus if you select ports on chassis 1 and 3 in one session, you cannot select ports from chassis 2 and 4 in another session. You can select ports on chassis 2 or 4 but not them both together.

Ganged Port Operation

The ‘Ganged Port’ feature allows you to perform the same operation on all relevant ports on an OmniBER XM session. The timing of the events on each port is not synchronous, but is as close in time as internal processing allows. This feature is supported for all user interfaces. Ganged Port operation is only available for the following instrument features:

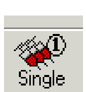
Laser On/Off All ports within a session can have their transmit lasers switched on and off by a single operation. Select the appropriate icon.



The **On Off** buttons on the Toolbar control both errors and alarms at the same time, see below.

Errors On/Off All relevant ports within a session can have their Errors ON and Errors OFF controls activated by a single operation. The specific error types on each port can be selected individually, allowing different error conditions to be generated on a port by port basis. The feature applies to all error generation modes - Continuous and Pulse Burst.

Alarm On/Off All relevant ports within a session can have their Alarm ON and Alarm OFF controls activated by a single operation. The specific alarms which apply to each port can be selected individually, allowing different alarm conditions to be generated on a port by port basis. The feature applies to all alarm generation modes - Continuous, Pulse Burst, and Timed Burst.

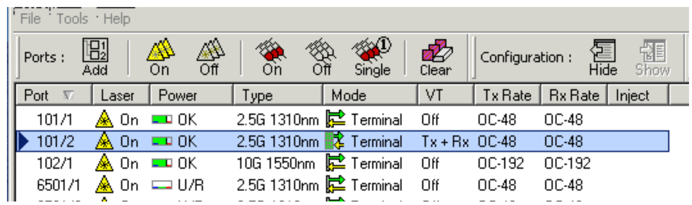


Single Selecting the Single icon adds a single error of the type you have configured for a port and/or transmits a SEF/OOF event for any port that has been configured to transmit a SEF or OOF event.

For example: if for a selected port you select the **E+A Inject** tab and set up **Add Errors** to add CV-S (B1) Transport Errors and **Add Alarms** to add RDI-P Path Errors, then when you select **Single** a single CV-S (B1) error is transmitted and also a single Path RDI-P event.

Turn on all Lasers and set up Physical parameters for each Port

You can switch all the lasers on or off for the selected ports (see below) or switch on or off individual lasers (see step 6 of "To set up the transmitter and receiver interface" on page 84).



To turn lasers on/off

1 Select **All Lasers On** from the Ports Toolbar to turn all the lasers on or select **All lasers Off** to turn them off.

Setting up the Transmitter and Receiver Interface

To set up the transmitter and receiver interface

1 Select the **Physical** tab.

2 Set the Transmitter and Receiver **Signal Standard** to **SONET** or **SDH** as required.

3 Set the **Signal Rate** (if applicable).

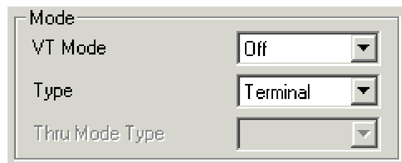
To set line rate offset

4 You can offset the Transmitter Line Rate by plus or minus 100 ppm. The resolution is 1ppm. Click on the **Edit** button then enter the value required and click on **OK**.

5 You can switch **off** or **on** the laser for the selected Port by clicking on the Laser button.

Select Terminal or Thru mode

The following procedures illustrates how to select Terminal or Thru mode. If your OmniBER XM has option 010 fitted you can also select VT/TU mode. However Thru mode and VT Mode are mutually exclusive. If Thru mode is selected VT Mode is disabled and vice-versa.



▶ **To select Terminal or Thru mode**

1 Select the **Physical** tab.

2 Click on the Mode required, **Terminal** or **Thru Mode**. Confirm in the dialog window that you wish to change mode for the selected port. Note that it takes approximately 5 seconds for a Mode change to be completed.

Terminal Mode: Multi-channel, mixed payload generation with pattern, error and alarm generation.

Thru Mode: Two types of Thru Mode are available - Transparent and Intrusive.

Transparent Thru Mode

In transparent thru mode, the signal on the receive port is routed unchanged, to the transmit port. The OmniBER XM operates as normal, monitoring errors and alarms in the received signal. No data is altered, and no BIP's re-calculated.

Intrusive Thru Mode

Re-transmits received payload, with ability to add errors or alarms to any or all channels as they pass. The following OmniBER XM Transmitter functionality is available in Thru Mode.

You can add the following errors and alarms in Thru mode:

- B1, B2 and B3 errors.
- LOS, LOF, LOP, AIS-L/MS-AIS, AIS-P/AU-AIS alarms.

Refer to Chapter 4 “Instrument Setup and Use - VT/TU mode” for detailed information on VT/TU operation.

Setting up the Transmit Clock source

You can reference the transmitters timing to an internal or recovered clock source.

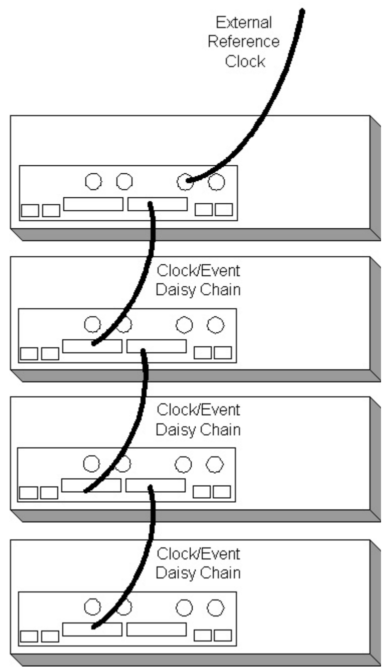
▶ To set up the transmitter clock source

1 Select the **Physical** tab.

2 Set the **Clock Source** to **Internal (Global)**, (10 MHz, see External Clock Reference) or **Recovered** (clock recovered from received data) as required. In **Thru** mode the Transmitter clock is locked to the Recovered clock.
When in Internal mode an external clock source can be used as a reference source. This external reference signal is applied via one of the clock input ports on the J7263A Chassis rear panel (see External Clock Reference).

External Clock Reference

An OmniBER XM system can comprise of multiple chassis, populated with multiple modules (four per chassis). By connecting the chassis together via the event system cabling you can synchronize the transmit clock on all modules to a common source. The choice for the clocks is always set up and connected to the first chassis in the system.



Only one external reference clock source should be applied to the chassis rear panel at any given time. If more than one clock source is applied during operation the chassis will lock to the first valid signal present. If more than one clock signal is present at re-boot the chassis will lock using the following order of preference:

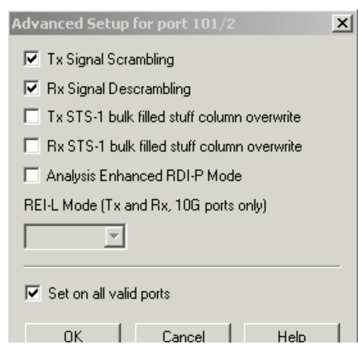
Clock Input Port	Clock Signal
50 Ohm BNC	10 MHz reference clock
100 Ohm Bantam	1.544 Mbs BITS

Clock Input Port	Clock Signal
75 Ohm BNC	2.048 Mbs MTS
75 Ohm BNC	2.048 MHz reference clock
Siemens 3-pin	2.048 Mbs MTS

Selecting Signal Scrambling

▶ To set signal scrambling for selected port

1 Select the **Advanced Setup** button.



2 Click on the respective boxes to select or deselect **Tx** or **Rx Signal Scrambling**. The SONET/SDH signal can be scrambled/de scrambled according to G707/GR253 network specifications.

3 **Set on all valid ports:** If this box is checked the OmniBER XM attempts to apply the features selected to all valid ports in the current session.

Selecting STS-1 Bulk Filled Stuff Column Overwrite

▶ **To select STS-1 bulk filled stuff column overwrite**

1 Select the **Advanced Setup** button.

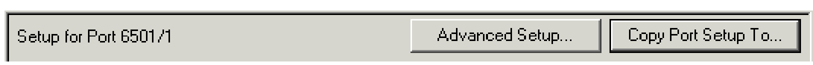
2 Select **Tx** or **Rx** overwrite as required.

For STS-1 only: 'Stuff column overwrite mode' can be enabled. In this mode the payload overwrites the Fixed Stuff columns in the SPE/VC.

For AU3, stuff columns cannot be overwritten.

NOTE If you are using OmniBER XM with an OmniBER 718 and experience Bit errors or B3 errors on STS-1 operation. Set Tx and Rx STS-1 bulk filled stuff column overwrite to ON.

To Copy Port Settings to other Ports



▶ **To copy a ports setup to another port**

1 Click on the **Copy Port Setup To** button.

The **Copy Port Setup To** dialog window displays the Current Port Setup and ports to which you can copy settings.

2 If you wish to copy the settings of the currently selected port to all the other ports listed in the dialog window choose **Select All,** otherwise click on the box for each individual port as required.

3 Click on the **Advanced button** to see a list of modes and settings that can be copied from port to port.

4 If you have a mix of different rate modules/ports to which you may wish to copy settings, you are restricted to copying those of a similar rate (i.e. all 2.5 Gb/s or all 10 Gb/s). To change this select the **Advanced** button and switch off **Rate**

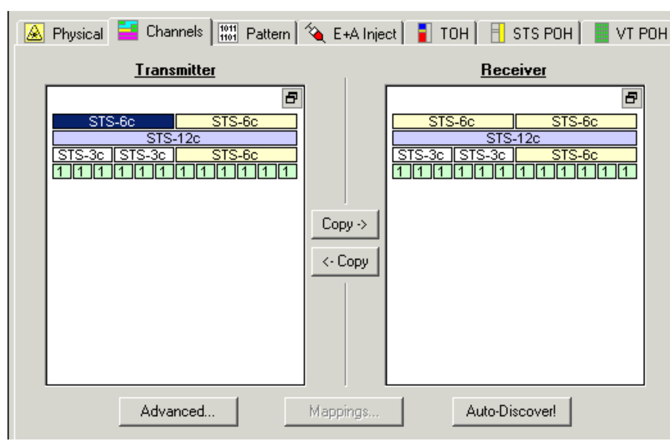
Transmitter and Receiver Channels Setup

The OmniBER XM user interface allows to quickly setup individual channels within the transmitter and receiver channel mask (see "To set up individual channels ") or re-configure all of the channels (see "Advanced Channel Configuration" on page 92).

To Set up Transmitter channels

Up to 192 channels can be defined for the 10GHz ports (48 for 2.5GHz). Each channel can be defined as 'selected' or 'unselected'. Any unselected channels are set to 'Unequipped' (that is all payload and path overhead bytes are set to 00h, but the pointer is set as per selected channels. Selected channels contain a full Path Overhead (POH) and BER pattern.

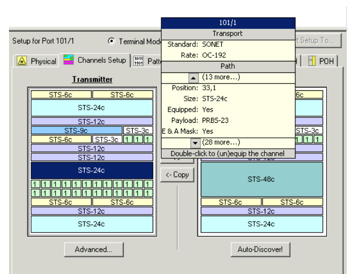
Any change to the Transmitter structure will take effect with no 'intermediate' states, that is, it is hitless to the structure of channels that are unchanged. This applies to SPE/VC structure, not to payloads.



To set up individual channels

1 Click on the **Channels Setup** tab.

2 Position the display cursor on the desired channel then click the right mouse key, and select from the choices given in the menu. The choices offered are ones that are valid for the selected channel. When you position the cursor over a channel a ToolTip box appears giving Transport and Path interface settings for the selected channel, an example is given below.



To set a channel to unselected

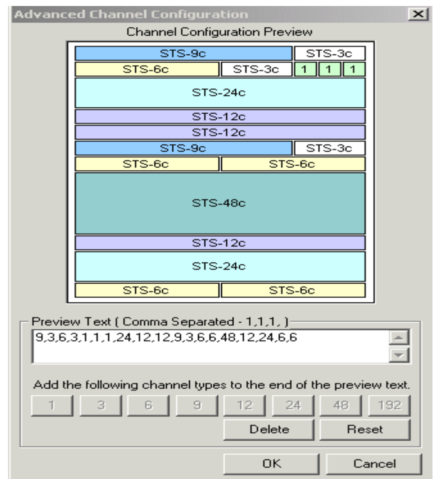
3 To toggle between a channels current payload setting and Unselected, position the cursor on the channel of interest and double click the left mouse key. The display will change to show **Unselected** or just **U** (for an STS-3c or STS-1). Double **c**licking the left mouse key again returns to the original setting. You can also select and unselect a channel from the right-click menu

To copy channel setup from Tx to Rx - or - Rx to Tx

4 Use the **Copy** → button to copy the Transmitter settings to the Receiver, and the ← **Copy** button to copy the Receiver settings to the Transmitter.

Advanced Channel Configuration

The advanced channel configuration window allows you to quickly set up the desired transmitter or receiver, channel configuration.



For fast channel setup

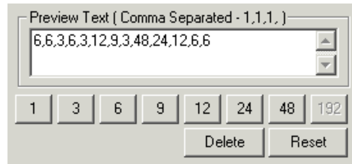
1 Select the **Channels Setup** tab.

2 Click on **Advanced** button to display the **Advanced Channel Configuration** dialog.

3 Use the channel buttons (1, 3, 6, 9, 12, 24 and 48) to set your channel configuration, or type in your selection using the controller keyboard. Or use a combination of both keyboard and buttons.

4 If your system has option 010 fitted and you have selected VT/TU operation a VT/TU Preview Text dialog window is displayed enabling you to select VT/TU types.

Delete last channel selection



5 If you make a mistake while inputting a channel type into the Comma Separated list use the **Delete** button to delete the last entry in the list.
Note: The Delete function deletes the last entry from the Comma Separated list fills the deleted channel with STS-1's or AU-3's (SDH).

Reset channel configuration to all STS-1s

6 Clicking on the **Reset** button will reset all channels to STS-1's/AU-3's.

To cancel advanced channel configuration edits

7 Click on the **Cancel** button to cancel all edits, close the **Advanced Channel Configuration** window and return to your original transmitter settings.

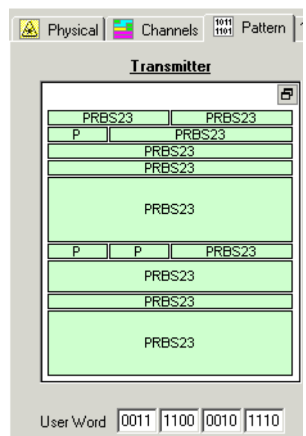
NOTE The Advanced Channel Configuration dialog will only apply the new structure to the port when the dialog is OK'd

Set Up Transmitter Payload Pattern

The pattern-type can be selected on a per-channel basis, each channel can be set to one of the following:

User Word: User defined 16-bit word. The same word value is used for all channels set to User Word.

PRBS23 or PRBS23 inverted: The pattern is byte-aligned to the SONET/SDH frame (but has no specified alignment to the frame). The pattern can be inverted or non-inverted. This is selectable on a per-channel basis.



▶ To set up the transmitter pattern

1 Click on the **Pattern** tab.

2 Position the display cursor on the channel of interest and click the right mouse key to display the pattern selection menu, or hit the spacebar to toggle round the available options. Set the **Transmitter** pattern selection to one of the following:

- PRBS 23 (shown on display as **PRBS23** or **P**)
- PRBS 23 Inverted (shown on display as **PRBS23-INV** or **I**).

- User Word (user definable 16-bit user-word shown on display as **User** or **W**)

3 If you selected **User Word** type the required 16 bit word in the **User Word** fields at the bottom of the Transmitter display.

Copy Tx Pattern to Rx

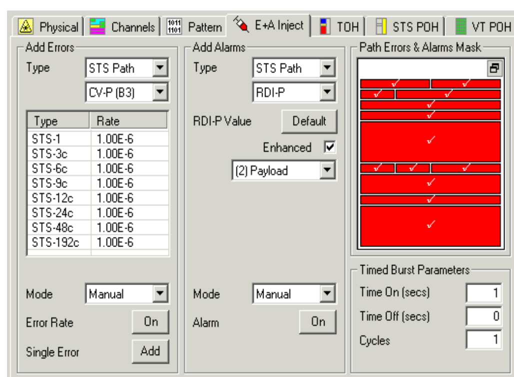
You can copy the current Transmitter Pattern selections to the Receiver, this includes User Word setup. Set up the Transmitter Payload Pattern selection for each channel, then select the **Copy**→ button.

Add Errors or Alarms to the test pattern

You can add errors and alarms to a SONET or SDH signal during testing while in Terminal or Intrusive Thru Mode. See "Ganged Port Operation" on page 83.

To add errors and/or alarms

1 Click on the **E+A Inject** tab.



Add Errors

2 Select the **Errors Type** required.

3 If you select Path or Pattern errors, set up the **Rate** for each Payload.

4 Set the Add Error **Mode** field to **Manual** or **Timed Burst** (refer to "Burst Mode Generation" on page 102 for information on Timed Burst operation).

Add Alarms

5 Select the **Alarm Type**, then Alarm **Mode**.

6 Click on the Error Rate and /or Alarm **On** buttons to transmit the selected errors or alarms.

NOTE You can add errors and alarms at the same time.

Adding Errors and Alarms

You can add the following error and alarm types for SONET and SDH.

Only one error type at a time can be injected.

SONET Transport/SDH Section Errors

SONET errors	SDH errors
CV-S (B1)	B1
CV-L (B2)	B2
REI-L	MS-REI

SONET Transport/SDH Section Alarms

SONET/SDH Alarm	Continuous	Timed Burst	Pulse
LOS (Physical)	yes	no	no
SEF/OOF*	*see Note below	yes	yes
LOF	yes	yes	yes
AIS-L/MS-AIS	yes	yes	yes
RDI-L/MS-RDI	yes	yes	yes

*Note: SEF/OOF are one-shot alarms that are transmitted using the **Transmit** button. All other alarms are transmitted continuously until turned off.

Error rates

- Errors can be added singly on demand (via the **Single Error Add** button), or at user defined rates.
- **Error rates**: Errors can be added at a rate of w.xyE-z where w.xy is 1.00 to 9.99, and z is 3 to 7. For example 1E-3 will give a result of 1.000E-3 on the Receiver.
- **Error Distribution**: For B1 and B2 errors, the bit selected for error is ‘rotated’, for example for B1 (a single byte), the first error is added to bit 1, and the second to bit 2 and so on.

Refer to the Specifications, available on the CD-ROM (supplied with your system) for a full list of errors and alarms.

Adding Pattern Bit Errors

You can add pattern bit errors to both SONET and SDH payloads. The errors can be added singly, at a fixed rate or in timed burst mode.

Adding Path Errors/Alarms

The following STS Path and HO Path errors are available for SONET and SDH. The errors can be added to any combination of the selected transmitter channels via the user-defined Path Errors & Alarms Mask. Only one error type at a time can be injected.
The following table lists the errors and error add modes available.

SONET	SDH	Single	Timed Burst
CV-P (B3)	B3	yes	yes
REI-P	HP-REI	yes	yes

M1 only mode for REI-L/MS-REI errors

The **M1 Only** mode is for Tx and Rx, 10G ports only and is provided for backwards compatibility with old network equipment. It uses M1 only, and saturates at 255 errors. Normally at 10G two bytes **M0 and M1** are used which is sufficient to indicate up to 1536 errors.

M1 only mode can be selected independently for each port in a session. The mode applies to both transmit and receive properties of the port. On the transmit side, it determines the overhead byte(s) in which REI-L errors are generated and on the receive side it will determine in which byte(s) REI-L/MS-REI errors are detected.

To select M1 only mode

1 Select the **Advanced Setup** button.
2 Set the **REI-L/MS-REI mode** field to **M1 Only** or **M0 and M1** as required.

Path Alarms

The following Path alarms can be generated.

SONET	SDH
AIS-P	AU-AIS
LOP-P	AU-LOP
RDI-P	HP-RDI
UNEQ-P	HP-UNEQ
PDI-P	HP-PDI

You can select enhanced RDI-P/HP-RDI alarms by selecting one of three user definable modes (payload, server and connectivity). You can also set the PDI-P alarm (set C2 POH byte) to any user definable value.

▶ To generate enhanced RDI-P/HP-RDI path alarms

1 Select the **E+A Inject** tab and set the Add Alarms **Type** field to **STS Path/HO Path** and then select **RDI-P/HP-RDI** as required.

2 Click in the **Enhanced** box, if appropriate.

3 Select a value from the drop down menu (payload, server or connectivity). The following table illustrates the value of bits 5-7 of the POH G1 byte for the options available.

Alarm On	Alarm Off	Non-enhanced	Enhanced	G1 Bits 5-7
	•	•		000
	•		•	001
•		•		100
•			Payload •	010
			Server •	101
			Connectivity •	110

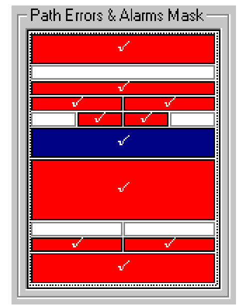
Selecting which channels to insert Path errors/alarms

You can add errors/alarms to all channels or just a chosen few. This is achieved using the Path Errors & Alarms Mask.

Channels shown in white will not be errored or alarmed.

Channels shown in red and with a tick are selected and can be errored/alarmed.

The currently selected channel is shown in the system highlight color.



Right click on the mask to display a menu of options enabling you to select **All** or **None** for Error/Alarm Inject, or select the channel under the mouse for error/alarm inject enable/disable.

To set up the path errors & alarms mask

1 Use the **Path Errors & Alarms Mask** to select which channels you wish to add errors or alarms.

2 Position the display cursor on the channel of interest and then double click the left mouse key. Channels with a tick will be errored/alarmed when the OmniBER XM error add/alarm function is enabled. You can also use the Controller keyboard up/down arrows to select channels and the spacebar to toggle the add error/alarm function.

Path error add modes

Path errors can be added singly on demand, at a user-defined rate or as a timed burst. **To add single errors:** Click on the **Single Error Add** button.

Note that each channel is errored completely independently of all the other channels. When a single error is added, it is added to all of the selected channels in the mask. The error will be added to each channel at the next valid point in time. For example if you are adding a single CV-P(B3) error, then the error will be added to each channel on the next occurrence of its B3 byte within the POH.

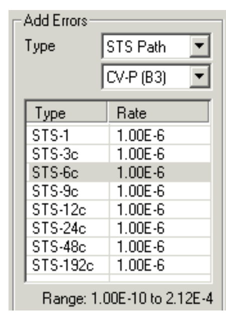
Error Rates

Errors can be added at a rate of w.xyE-z where w.xy is 1.00 to 9.99, and z is 3 to 7. For example 1E-3 will give a result of 1.000E-3 on the Receiver.

Error Distribution

In multi-channel mode, when an error is added to B3 or to the pattern, the same bit positions are always errored.

Error Rate Mappings



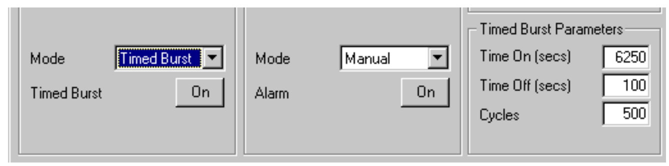
▶ To set error rate mappings

1. You can set the error-add rate for each mapping independently. For example STS1/AU3 channels can be set independently of the rate for STS3/AU4 channels. All selected channels with the same mapping-type will be errored at the same rate.
2. Click on a Payload Rate cell that you wish to edit and use the drop down menu to enter a new value, or use the keyboard to enter your own value The range for the selected mapping is shown at the bottom of the list.

Burst Mode Generation

Two types of burst generation are provided for alarms and errors, they are:

- Timed error/alarm burst generation and
- Pulse mode alarm burst generation



Timed error burst generation

1 Select the **E+A Inject** tab.

2 Select the **Type** of errors you wish to generate.

3 Set the **Mode** field to **Timed Burst**.

With Timed Burst you can set a burst of errors or alarms to be:

- ON for X seconds or OFF for Y seconds, where X and Y are between 1 and 10,000.
  X: 1 to 10,000; Y: 0 to 10,000; Z: 1 to 10,000.
- Repeat the ON/OFF cycle Z times, where Z is 0 to 10,000.
  Note: When Y is 0, there is no OFF time, just a one-shot burst of X seconds.

The Timed Burst mode is applied to the currently selected error or alarm types.

4 Use the **Timed Burst Parameters** edit fields to enter **On**, **Off** and **Cycle** values for a timed burst.

5 Click on the **Timed Burst** button to start the burst of error.

Note: Stopping the burst will reset it so that it will start from the beginning if restarted. Also the Timed Burst Parameters fields are greyed out (disabled) when there is a timed burst in progress.

Pulse mode alarm burst generation

You can generates alarms bursts of SONET/SDH frames. Pulse Mode bursts are applied to the currently selected alarm type.

The pulse mode alarm burst sequence is as follows:

- burst starts **OFF** -> then goes to **ON** for **X** frames -> then **OFF**.

Where X is 1 to 64. Frames are SONET/SDH frames or SPE/VC frames depending upon the currently selected alarm type. Pulse mode bursts are applied to the currently selected alarm type.

1. Select the **E+A Inject** tab.
2. Select the **Type** of alarm you wish to generate.
3. Set the **Mode** to **Pulse Burst**.
4. Enter a **Burst Length** value (1 to 64).
5. Click on the **Pulsed Burst Start** button to start the burst of Alarms. There is no stop control for pulse mode as the burst terminates after a maximum of 8 milliseconds (64 frames).

Set up Transmitter TOH/SOH

Select the **TOH/SOH** tab.

Within the **TOH/SOH** tab you can set up the following:

- K1, K2 Automatic Protection Switching
- S1 Synchronization Status Message
- Configure the Section Overhead bytes
- Increment/decrement Pointer value
- J0 Section Trace Message
- Overhead Sequence Capture

Generating K1, K2 Automatic Protection Switching (APS) Messages

You can check network equipment ability to switch to a standby line (to maintain service when a failure is detected). Switching is controlled by Automatic Protection Switching (APS) messages controlled by the K1 and K2 bytes.

APS occurs when there is a signal failure, signal degradation, or in response to commands from a local terminal or remote network manager.

You can view the K1/K2 bytes as either Linear or Ring.

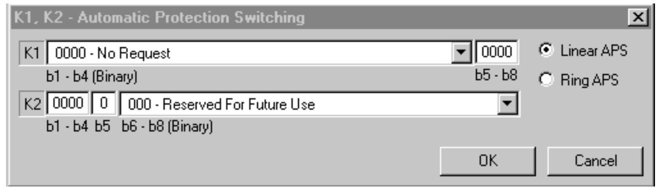
Note that the modules error add test function interacts with the setting of the K2 overhead byte. If the RDI-L and AIS-L alarms are active, any byte values generated by those features will override the value previously assigned to K2.

For more information refer to “Telecomm Concepts” page 304.

▶ **To generate an APS message**

1 Select the **TOH/SOH** tab.

2 Click on the **Edit K1, K2** button.



3 Set the **Protocol** to **Ring** or **Linear APS**.

4 Set **K1 b1-b4** and **b5-b8** as required.

5 Set **K2 b1-b4, b5 and b6-b8** as required.

6 Select **OK** or **Cancel** to undo your selections.

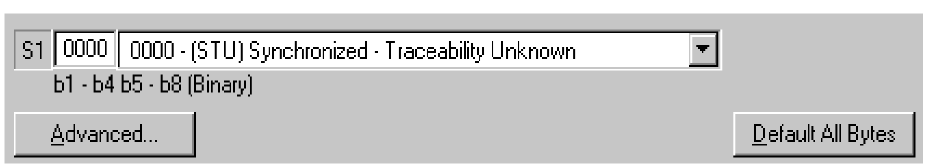
Generating Synchronization Status Messages

You can transmit synchronization status messages in bits 5 to 8 of the S1 byte.

For more information, see “Synchronization Status Messages (S1 bits 5 to 8)” on page 273.

To generate a S1 synchronization status message

1 Select the **TOH/SOH** tab.



2 **S1 (b5-b8)** indicate the levels of synchronization being used at the transmit end of a line span. Set the **Synchronization Status Message** bits as required from the drop down menu. When you select a message, its binary value is automatically displayed. Unused bits (b1-b4) are set to 0000.

Editing Transmitter Section Overhead Bytes

You can assign values to the transmitter Section Overhead bytes using the **Advanced**, **Configure Overhead** window. All bytes in any STS-3 position can be selected to be individually set with the following exceptions:

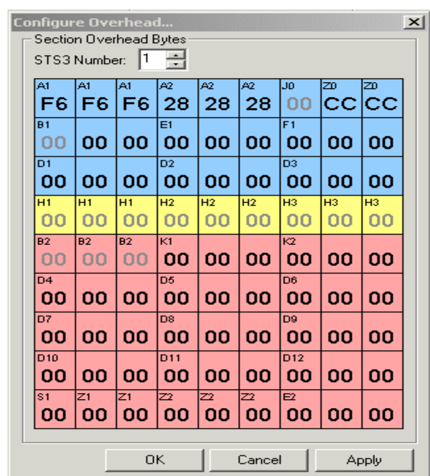
- B1, B2, J0 and H1, H2 and H3 in STS-3 #1
- B2, H1, H2, H3 in all other STS-3's

Any settable byte can be set to a value in the range 00-FF hex.

To edit section overhead bytes

1 Select the **TOH/SOH** tab.

2 Click on the **Advanced** button (at bottom of display under the S1 byte) to open the **Configure Overhead** window.



3 Select the Nth STS3's worth of Overhead you wish to edit in the **STS3 Number** field.

4 To edit a byte, position your controller cursor on the byte of interest, click, and then enter a new byte value using the keyboard, or use the 'Tab' key on your keyboard to access a byte and then enter a new

value. **Note:** You can only edit the bytes shown red or blue in color. Editable bytes are shown black, non editable bytes are greyed out.

5. Use the **Apply** button to implement your edits before choosing another STS3 Number
6. Select **OK** when finished editing bytes to close the Dialog window, or **Cancel** to undo your edits.
7. Click on the **Default All Bytes** button if you wish to set the bytes to there default values.

Adjusting SPE or AU Pointer Values

You can check your systems ability to handle adjustments to SPE or AU pointer values.

A single pointer value is transmitted in all channels.

You can increment or decrement any pointer value, or enter a new value (via the **Set New Pointer Value** dialog) with or without a New Data Flag. When the pointer value is moved, it moves simultaneously in all channels.

The transmitter Pointer **SS** bits are set to the following:

SONET: 00
SDH: 01

▶ **To adjust pointer values and/or set a new data flag**

1. Select the **TOH/SOH** tab.
2. Use the P**ointer Control +1** or **-1** buttons to increment or decrement the Pointer value, or select the **Edit Pointer** button and enter a new Pointer Value.
3. Select the **New Data Flag** checkbox if required.
4. Select **OK** to close the **Set New Pointer Value** dialog window.

Generating a J0 Section Trace Message

You can insert trace messages to verify signal routing through your system. The message format can be 16-byte CRC-7 (to G707) or 64 byte format (ending in <CR><LF>).

The trace message can be set to a default value or user defined.

The default trace message identifies the originating port (i.e. ‘ppp’ [001-999]). The default values are:

16 byte mode

“Agt ppp<padding><CRC-7>”

64 byte mode

Agilent OmniBER XM JxxxxxPort ppp<padding><CR><LF>

Instrument number Jxxxxx will match the current instrument. Padding is NULL characters.

User defined string.

They can be up to (and including) 15 or 62 bytes long depending on the current selected setting of trace mode. The appropriate terminator will be added. The strings are:

- <inst> - Instrument number (6 characters, taken from configured name).
- <port> - Port number (6 characters in the format nnnn/n, which is made up of the rack position, module number and the physical port within the module).
- <c> - Channel number (3 digits, leading 0 added if needed).

To generate a J0 trace message

1 Select the **TOH/SOH** tab.

2 Select a **16 byte** or **64 byte** message and enter the required message using the keyboard.

Overhead Byte Group Capture

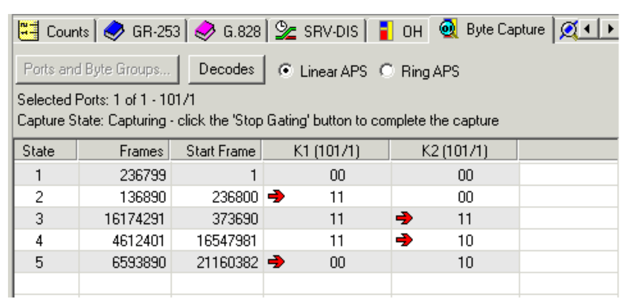
Overhead channels available for capture are:

- K1 K2 byte-pair
- K1 K2 K2-2 byte-triplet

No other overhead byte groups are selectable for sequence capture.

Result Presentation

The results are correlated for all ports configured for byte capture as shown:



State	Frames	Start Frame	K1 (101/1)	K2 (101/1)
1	236799	1	00	00
2	136890	236800	11	00
3	16174291	373690	11	11
4	4612401	16547981	11	10
5	6593890	21160382	00	10

The captured byte values are displayed in hexadecimal or text form (selectable with the **Decodes** button) alongside the following:

State • Position in sequence

Frames • The number of frames for which that value persisted.

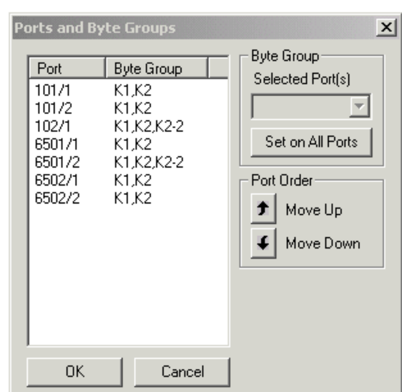
Start Frame • The Frame Number at which the transition to this value took place, where the first frame captured is numbered '1'. This enables easy correlation of captured events across multiple ports.

Note that two events with the same 'Frame Number' on different ports cannot be said to be 'the same frame'. Frames are terminated at each node in the network, and also there can be significant delays through network elements. It is, however, true to say that the events happened within 125 microseconds of each other (due to capture being started synchronously across all ports) so cause and effect can be deduced.

To Configure Sequence Capture

1 Select the **Byte Capture** tab.

2 Select the **Ports and Byte Groups** button.



3 Select the **Byte Group** (K1,K2 or K1,K2,K2-2).
Click on the **Set on All Ports** button if you wish to capture the same set of bytes for all the selected ports.

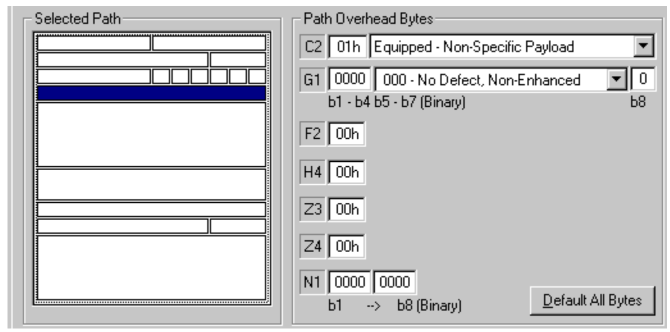
4 Clock on **OK** when finished selecting the required Port and Byte Groups.

To Start or Stop Byte Capture

5 Capture is initiated by selecting the **Gating Start** button and stopped by selecting the **Gating Stop** button.

Edit Transmitter Path Overhead Bytes

You can set up the path overhead bytes for an individual channel or a number of selected channels. A unique J1 message can also be defined for each of the defined channels. Refer to the Telecoms Concepts chapter at the rear of this manual for descriptions of the STS Path Overhead bytes.



To edit the path overhead bytes

1 Select the **STS POH/HO-POH** tab. Select a channel or channels for editing as follows:

To select a channel:

- position your mouse cursor on the channel of interest and single click (either left or right mouse key works).

Add/remove a channel from current selection:

- control+click adds the channel under the mouse to the selection (or removes it, if it is already in the selection)

Select a block of channels

- shift+click selects all the channels between the last selected channel and the one currently under the mouse.

2 Set up the **Path Overhead Bytes** once you have selected the channels of interest.

Default All Bytes Select the **Default All Bytes** button to set all bytes to their default value.

Generating a J1 Path Trace Message

You can check for continuity between the transmitting and receiving ends of a path by transmitting a message in the J1 byte.

The message format can be 16 byte CRC-7 or 64 byte non-CRC. You can set the trace message to a default value or define your own message. The default trace message identifies the originating port and channel. The Port and Channel Numbering scheme is as follows:

- Port: ‘ppp’ [001-999].
- Channel number: ‘ccc’ [001-192] indicates the starting STS-1 number where the channel starts.

User defined string.

They can be up to (and including) 15 or 62 bytes long depending on the current selected setting of trace mode. The appropriate terminator will be added. The strings are:

- <inst> - Instrument number (6 characters, taken from configured name).
- <port> - Port number (6 characters in the format nnnn/n, which is made up of the rack position, module number and the physical port within the module).
- <c> - Channel number (3 digits, leading 0 added if needed).

To generate a J1 trace message

1 Select the **STS-POH/HO-POH** tab.

2 Select a **16 byte** or **64 byte** message and enter the required message.

User Message 16 Byte mode: You can enter up to 15 characters. The system will pad up to 15 with NULL, and add the CRC-7 header.

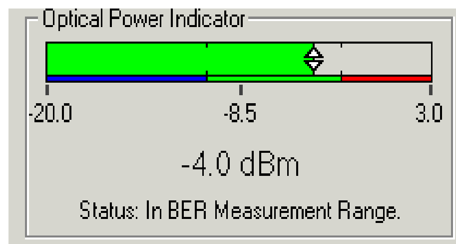
User Message 64 Byte mode: You can enter up to 62 characters. The system will pad up to 62 with NULL, and add the <CR><LF>.

Setting up the Receiver

Optical Connector Safety Information

Please be aware of the optical connector safety information before making connections to the receiver - refer to “Step 5: Connect to the System Under Test" on page 59.

Optical Power Indicator



Indicates the level of power being received in relation to that required for a BER measurement. There are three colored regions on the optical power indicator to indicate power level status for a BER measurement.

- Blue region - low power
- Green region - correct power
- Red - high power

There is also an indication of received Port optical power in the Port Selection window, adjacent to the yellow Laser icon. You can quickly check the received power for a port by selecting the port and viewing the legend in the Power field (it will be U/R under range, OK, high or damage).

To set up the Receiver interface

▶ **To set up the receiver interface**

1 Select the **Physical** tab.

2 Set the **Signal Standard** and **Rate** as required.

3 If your system has option 010 fitted you can switch VT/TU Mode operation on, see “Instrument Setup and Use - VT/TU mode" on page 133 for more detailed information.

To Set up Receiver channels

Up to 192 channels can be defined for the 10GHz ports (48 for the 2.5 GHz).

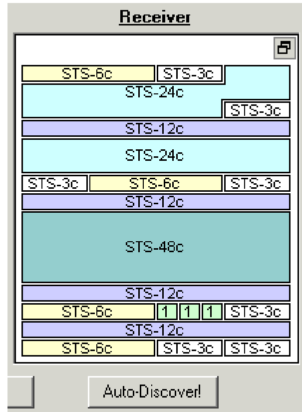
Each channel can be defined as ‘selected’ or ‘unselected’. Measurements are only made on selected channels; any unselected channels are ignored by the Receiver.

Receiver Auto Discovery

The OmniBER XM receiver Auto Discover feature automatically detects the mixture of payload types at its input and configures its channel structure to match the incoming signal.

Configure transmitter channels

You can also quickly set up the OmniBER XM transmitter channels settings by doing an auto discover on the input signal (perhaps from equipment under test), and then copying the receiver settings to the transmitter.



To perform an auto discovery on a receiver input signal

1 Connect a suitable optical input signal to the OmniBER XM receiver **OPTICAL IN** port.

2 Select the **Channels Setup** tab.

3 Select the **Auto Discover** button. The receiver will quickly align its channels structure to that of the received input signal.

4 If required you can now copy the receiver setup to the transmitter; select the ← **Copy** button.

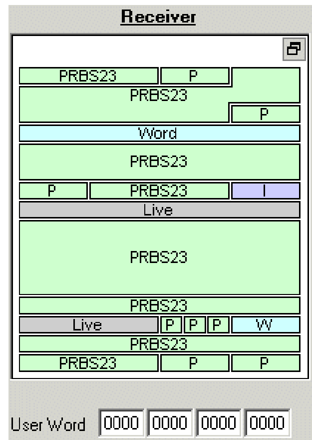
Set Up Receiver Payload Pattern

The pattern-type can be selected on a per-channel basis, each channel can be set to one of the following:

User Word: The 16-bit word value is the same for all channels that contain a word pattern. The Receiver 16 bit User word specification is identical to the Transmitter.

PRBS23/PRBS23 inverted: The pattern is byte-aligned to the SONET/SDH frame (but has no specified alignment to the frame). The Receiver pattern can be inverted or non-inverted. This is selectable on a per-channel basis.

Live mode When the pattern is set to '**Live**', no pattern measurements (Pattern Sync Loss and bit errors) are attempted for this channel.



To set up the receiver pattern

1 Click on the **Pattern** tab to display the **Pattern** dialog.

2 Position the display cursor on the Receiver channel whose pattern you wish to select and right click the mouse key. Choose a pattern from the choices offered in the popup menu. They are:

- PRBS 23 (shown on display as **PRBS23** or **P**)
- PRBS 23 Inverted (shown on display as **PRBS23-INV** or **I**)
- User Word (user definable 16-bit user-word shown on display as **User** or **U**)
- Live (shown on display as **Live** or **L**)

3 If you selected **User Word** type the required 16 bit word in the **User Word** fields at the bottom of the Receiver display.

4 **Multi-channel selection:** To select a range of channels (click on a channel, then shift click on another channel) and press the spacebar to toggle through the available choices.

To Monitor Ports for Errors or Alarms

Use the **Overview** window to quickly check all the chassis/ports in your current session for errors or alarms. Any errored ports are shown red in color.

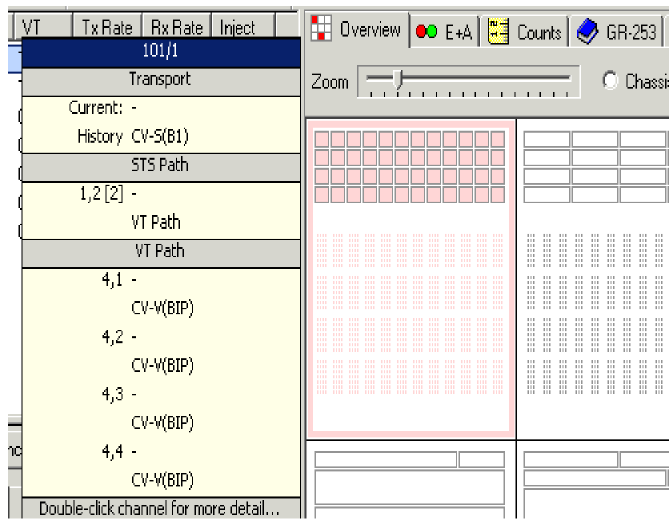
Overview

The chassis and port view are exactly the same except for the layout of ports. The two views both show the status of all channels on all ports in the session

The Overview window enables you to quickly check for errored or alarmed channels/ports. The current and historical error/alarm events for an individual port/channel is displayed via a popup window when you position your controller cursor over a port/channel. If you find an errored or alarmed channel simply double click the left mouse key to display the **E+A** window. This allows you to check the full set of alarm and error events for the selected channel.

Both port and channel measurements can be logged to a file on a per-second basis along with a timestamp. See “To log events to a file" on page 127.

Overview Tool Tip Window explained



If you move the cursor onto a channel a ToolTip window gives a display of current and historical errors. It also gives the position of the channel currently selected (the one your cursor is sitting over). In VT mode the whole VT/TUG group is also shown.

▶ How to quickly find and identify errors

1 Select the **Overview** window.

2 Determine whether you wish to view the **chassis** in the current session (select **Chassis View**) or view the **ports** (select **Port View**). Chassis view represents physical position, port view allows more ports to be seen at a higher detail.

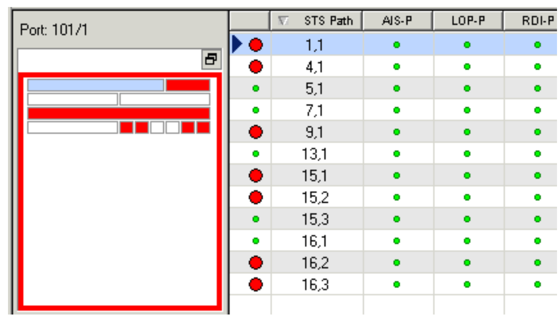
3 If you have a large number of chassis/ports in your current session you can use the slider control to adjust the resolution of the display for better viewing. For an extra large display of the **Overview**, **Chassis** or **Port** view set the **Configuration** (on top Tool bar) to **Hide**. This hides all the Configuration window settings and allocates the whole display to the Overview window. To return to showing the full configuration window select **Show**.

4 If there are any Transport or Path errors present on a port, there will be a RED border around the port channel mask. If there are Path errors then the errored channels will also be shown RED. To investigate an errored channel further position the controller cursor on the channel of interest and double click the left mouse key. This will close the **Overview** window and open the **E+A** window.

5 You can now view the errors and alarms for the selected port and/or channel.

Port Error/Alarm Mask.

Channels shown red are errored. Pink channels indicate historical errors. Blue channel is currently selected channel.



Clear History

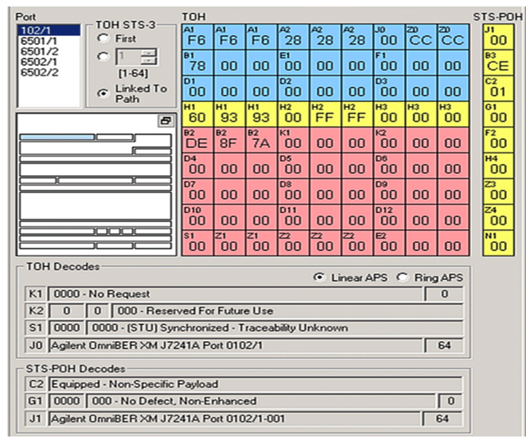
Select the **Clear History** button to clear all the historical error/alarm events.

On selected port only

Select this function to only clear historical errors from a user definable port. The order in which channels are displayed is automatically sorted such that those with errors/alarms appear at the top of the list.

Monitoring Receiver Overhead Bytes

You can view a snapshot of all the Transport/Section Overhead bytes for a selected STS-3/STM-1 channel. This includes TOH/SOH Decodes values for K1,K2, S1 and J0 bytes, and STS-POH C2, G1 and J1 values. For SDH the HO-POH decodes values for C2, G1 and J1 are given.



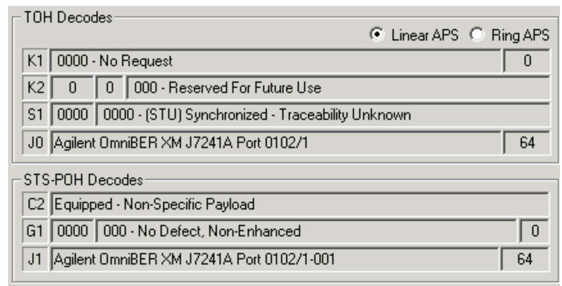
▶ To Monitor Received Overhead bytes

1. Select the **OH** tab from the Results display area.
2. Select the required STS3 or STM channel. There are three methods available for quick selection of a channel.

- **First** - selects the first STS or STM channel.
- User selectable - up/down keys allow you to select the required channel number, or you can type the number in the box.
- **Linked to Path** - When you select this option the STS3 position selected is linked to the channel currently selected in the **Selected Path** mask (selected channel is shown blue).

Monitoring J0, J1 Trace Messages

You can check for continuity between the transmitting and receiving end of a section, STS or VT path by monitoring a message in the J0 or J1 byte. The message format can be 16-byte CRC-7 or 64 byte



To monitor J0 and J1 overhead bytes

1 Select the **OH** tab from the Results display area.

2 The J0 Section trace message and J1 Path trace message are displayed as shown above along with the other bytes.

Viewing Measurement Results

How are Results presented?

Measurements are performed during a measurement period (Gating period) set by the user, see “Setting a Measurement Gating Period" on page 130. When a gating period has ended, the final results for each measurement remain available to the user. When a new gating period is started, all results are cleared. Results from previous gating periods are now unavailable.

Section and Line level results are displayed for all receiver ports in a test session. Path level results are displayed for all selected channels within a specified receiver port.

Results Format

All results are displayed as follows:

Count: Displays as an integer for counts up to 999,999, then changes to X.XXX E+nn where $6 \leq nn \leq 15$.

Ratios: Displays as X.XXX E-nn where $0 \leq nn \leq 15$.

Total (Cumulative) Results

All results listed for SONET/SDH error results are cumulative totals over the entire measurement period.

Basic SONET/SDH Error Measurements

Error Counts

Number of errors over the measurement (gating) period.

Error Ratio

Ratio of counted errors to the number of error opportunities in the measurement period.

Alarms stopping error counting

The following table defines, for each error source which alarms prevent error counting.

Error Type	Alarms that inhibit error counting
CV-S (B1)/RS-BIP	LOS, LOF
CV-L (B2)/MS-BIP	LOS, LOF, AIS-L/MS-AIS
CV-LFE/MS-REI	LOS, LOF, AIS-L/MS-AIS, AIS-P/AU-AIS, LOP-P/AU-LOP
CV-P (B3)/Path BIP	LOS, LOF, AIS-L/MS-AIS, AIS-P/AU-AIS, LOP-P/AU-LOP
REI-P/HP-REI	LOS, LOF, AIS-L/MS-AIS, AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI
Bit	LOS, LOF,AIS-L/MS-AIS, AIS-P/AU-AIS, LOP-P/AU-LOP, PSL

Pointer Activity Measurements

Pointer Activity Seconds The number of seconds during which a pointer movement occurred.

Pointer Increment Count The number of pointer increment adjustments in the measurement period.

Pointer Decrement Count The number of pointer decrement adjustments in the measurement period.

Pointer Measurement Inhibition

Measurement Type	Alarms that Inhibit Counting
Pointer Increment/Decrement Count	LOS, LOF, AIS-L/MS-AIS, AIS-P/AU-AIS, LOP-P/AU-LOP

To View Pointer Results

1 Select the **Counts** tab.

2 Select the **Select Statistics** button.

3 In the **Select Basics Statistics** dialog window select the **STS Path** tab and Pointer Activity. Add PTR-ACT, PTR-INC, PTR-DEC to the **Selected** list.

Viewing Port and Channel Statistics

▶ **To select port and channel statistics for viewing**

1 Select the **Counts** tab.

2 Select the **Select Statistics** button.

3 Use the **Select Basic Statistics** dialog window edit functions to add or remove Alarm Seconds, Ratios or Count results to the Transport, STS Path or VT Path selected list. Click on **Alarm Seconds** and **Error Counts and Ratios** to view the statistics available.
The up/down arrows enable you to sort the order in which statistics appear on the measurements display. For example, the statistics at the top of the list will appear at the extreme left of the display, next to the Port column.

Analysis Enhanced RDI-P Mode

The default for this mode is Off. When set to On it affects how B3 errors are counted. Refer to the Enhanced Remote Defect (RDI) alarm function (as specified in Telecordia GR-253 CORE issue 3 and ITU-T G.707) for more details.

▶ **To enable analysis enhanced RDI-P mode**

1 Select the **Advanced Setup** button (next to Copy Port Setup To button).

2 Click in the **Analysis Enhanced HP-RDI Mode** box.

Viewing the Analysis of SONET/SDH Errors and Alarms

The OmniBER XM provides the following types of error analysis.

- G.826 and G.828.
- GR-253.

You can select one of these standards per port for analysis but not both. The choice is independent of the SONET/SDH Signal Standard setting in the OmniBER XM Receiver.

Results Presentation

Analysis measurements are made during a measurement period (gating period). When a measurement period has ended, the final results for each statistic are available either via the GR-253 and G.828 tabs on the results display, or via the system API. When a new measurement period is started, all results are cleared. Results from previous measurement period are now unavailable.

Analysis results are updated once per second. Section/Regenerator and Line/Multiplex path level results are displayed for all Receiver ports in a test session. STS-Path/HO-Path level results are displayed for all selected channels within the currently selected port.

To view the analysis of results

1. Select the **GR-253** or **G.828** tab as required.
2. To set the analysis mode click on the **All Ports GR-253** or **All Port G.828** buttons to set all ports to the mode selected **or** click on the **Analysis Mode** button and set selected ports as required.
3. Click on the **Select Statistics** button and choose the **Section** and **HO Path** Statistics to be displayed. Use the Add/Remove keys to move statistics within the **Selected** list.
4. Click **OK** when finished.
5. Click on the **Start** gating button to obtain Analysis results.

To log events to a file

You can log error results, alarms and statistics which have occurred during a measurement period to a file. Logging is only enabled during a measurement (gating) period. Results are logged to a file in text format (.csv).

Types of Logging

The following items are logged

- Alarm Second Events
- Error Events
- Reports (Statistics)

The OmniBER XM system controller logs each of these items in separate files.

Alarm Second Event Logs and **Error Second Event Logs** are created/written as they happen in real time. You can choose to log either or both.

Statistic Reports are produced and logged at pre-determined intervals during gating, and also at the end of a period. The interval between reports is set by the user. The minimum configurable interval is 10 minutes and the maximum 1 hour (in seconds). All results are cumulative over the entire measurement (gating) period.

Alarm Events

These events are recorded along with a time stamp indicating when they occurred. Minimum resolution for event reporting is one second. Both the start and end of an event is logged. The start is logged as a SET event and the end as a CLEAR event.

Error Second Events

These events are also recorded along with a time stamp indicating when they occurred. Minimum resolution for event reporting is one second. These events are logged on a per second basis. That is every second in which there was at least one occurrence of that event is logged. A count of the number of each event in that second is also logged.

What is not logged

Any unselected port, and any channels within a Receiver port which are unselected (unequipped) are not included in the logging process.

To log errors, alarms and statistics results to a file

Result events are logged during and at the end of a measurement period. Set up and enable logging before you run a test.
You must first set up logging to log the type of results events (errors, alarms or statistics) for your current measurement. Then choose a log event file name, and destination where you wish to save the logged file of results.The final step is to select from which ports to log results and the type of result events to be logged.

▶ To set up logging

1 From the Toolbar select **File** then **Configure Logging**.
In the **Logging Configuration** window determine whether you wish to enable:

- Error Event Logging
- Alarm Event Logging or
- Statistics Report Logging

Click in the appropriate boxes as required. When you enable a logging event the ports selected for logging are those that were selected the last time you configured that event.

Select which events to log

2 Click on the **Options** button for each event you wish to log, and choose from the menu of events listed. If you choose to log statistics you can set up to log events at pre-determined intervals during gating, and also at the end of a period. Use the **Interval (secs)** spin control or type a value to set up a time interval (600 to 3600 seconds).

Save events to a file

3 You can save the logged results of error, alarm or statistics events to a file. With the **Logging Configuration** dialog still open click on the **File** button for any events logging that you wish to save to a file.

4 Choose a **File name** (files are saved in .csv format which can be viewed in Microsoft Excel).

5 Choose where you wish to save the file. The default is to save the file in C:/Programs/Agilent/OmniberXM/data. The file path you choose is displayed in the Logging Configuration window.
Note: If the file already exists, any previous log data will be overwritten

Port Selection

You can choose the type of events to be logged for each port.

Select results to be logged

6 In the **Port Selection** window click on the **All** button for a logging event (errors, alarms or statistics) to configure all the ports in your current session to log that event. Select **None** to disable logging for all ports for the chosen event. You can also configure events for individual ports by clicking in the event columns for the required port.

7 Logging only occurs during a measurement (Gating) period. Configure your system to perform a measurement, start gating and then view the results in your chosen log file at the end of the measurement.

Setting a Measurement Gating Period

Measurement Gating System

Measurements are made on a per port basis but controlled on a per session basis. That is, for every port in a session, individual measurements are gathered and maintained. However, every port allocated to a session will make those measurements simultaneously.

Measurement Period

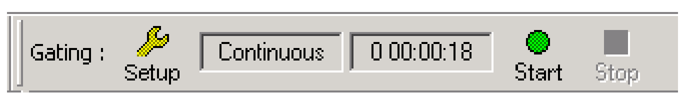
The measurement period (gating duration) is the block of time over which a measurement is made. There are two methods for setting this time - Single Measurement Mode and Continuous Measurement Mode.

Single Measurement Mode (Once)

Allows you to set the time over which a measurement is made. Once a gating period is started it will automatically terminate when the time you defined has elapsed.

Continuous Measurement Mode

In this mode a gating period is controlled manually via the **Gating, Start** and **Stop** buttons



To set up and control a gating period

1 On the OmniBER XM ToolBar select the **Gating Setup** button.

2 Select **Continuous** or **Once** as required. If you select **Once** also set the **Test Duration**.

3 To start a measurement select the **Start** button, to stop select **Stop**.

Viewing Service Disruption Time

Definition

Service Disruption is the time from the first error in a burst to the last error. The last error is considered to have happened after an error-free 'Guard Time' has elapsed. For a more detailed description of Service Disruption and the testing methods refer to the Telecoms Chapter in this guide.

Service Disruption with PRBS or User Word payloads

When a PRBS payload is used, the service disruption time can be measured in all selected channels simultaneously. Service disruption measurements are also available with 16-bit word payloads but it is not advisable to use an all-ones pattern because most network equipment will send all-ones when a switchover is in progress, and this will emulate a good payload.

Result Updates

Results are available on a per-second basis. A result is reported in the 1 second interval during which the service disruption ends. The OmniBER XM display gives results for each channel of Last Time and Max Time.

Last Time The duration of the last error burst detected in each 1-second interval during the test.

Count Displays the number of disruptions measured since the start of gating.

Max Time The duration of the longest error burst detected in the current measurement (gating) period.

▶ **To view service disruption time**

1 Select the **SRV-DIS** tab.
2 Refer to "APS Measurements" on page 203 for detailed instructions on how to perform a measurement.

To close a session

The OmniBER XM allows you to **close a session** or **leave the session active**. Before you exit the session you can also save the current session configuration to a file (.xml).

Closing a session

If you choose the **Close a session** option both the GUI and the session close down completely. If you have not saved the configuration for the session in a file the configuration is lost.

Leaving the session active

If you choose to **Leave the session active** the GUI closes down but the session stays active. When you next start up the GUI and a Test Session you can select the **Connect to an existing session** option and return to the active session.

▶ To close a session

1 On the OmniBER XM Toolbar select **File** then **Exit**.

2 Determine whether you wish to **close the session** or **leave the session active**. Select the required option.

3 Decide whether you wish to save the current test configuration in a file before exiting. If **No** select **Exit**, if **Yes** select **Save then exit**.

▶ To save a Session's configuration in a file

1 Select **File**, **Save** or if closing a session and you wish to save, select the **Save then exit** button.

2 Enter a name for your file in the **File name** field.

3 To add a comment click on the **Port** field then on the **Comment** field (under **Comment**), and enter the required text.

4 Determine whether you wish to save a **Complete** or **Partial Session.** If you select a **Partial Session** also select from the list of Settings those that you wish to save.

4
Instrument Setup and Use - VT/TU mode

This chapter describes how to set up the OmniBER XM (J7244A/45A Option 010) for VT/TU operation.

Port and Channel Numbering Scheme

SONET LO Channel Numbering

On the instrument GUI, LO channels will be numbered according to the GR.253 VT numbering scheme. This scheme numbers the constituent channels of an SONET STS signal based on VT-groups.

There are 7 VT-groups in an STS-1, and the VT channels within a VT-group are numbered with a 2-digit scheme, B, A where B represents the VT-group number and A represents the VT number within the group:

- VT1.5 channels in an STS-1 are numbered 1,1 through 7,4
- VT2 channels in an STS-1 are numbered 1,1 through 7,3
- VT3 channels in an STS-1 are numbered 1,1 through 7,2
- VT6 channels in an STS-1 are numbered 1,1 through 7,1

SDH LO Channel Numbering

On the instrument GUI, LO channels will be numbered according to the G.707 TUG numbering scheme. This scheme numbers the constituent channels of an SDH VC signal based on TUG positions.

For a VC4 signal, there is a 3 digit scheme C, B, A where C represents the TUG3 number within the VC4, B represents the TUG-2 number within the TUG-3, and C represents the TU11 or TU12 number within the TUG-2. For a TU channel that occupies whole TU group, its number within that group is designated '0'. For example:

- TU11 channels in a VC4 are numbered 1,1,1 through 3,7,4.
- TU12 channels in a VC4 are numbered 1,1,1 through 3,7,3.
- TU3 channels in a VC4 are numbered 1,0,0 through 3,0,0

For a VC3 signal, there is a 2 digit scheme B, A where B represents the TUG-2 number within the VC3, and C represents the TU11 or TU12 number within the TUG-2. For TU channels that occupy whole TU groups, their number within that group is designated '0'. For example:

- TU11 channels in a VC3 are numbered 1,1 through 7,4.
- TU12 channels in a VC3 are numbered 1,1 through 7,3.

Setting up the VT/TU/PDH Transmit/Receive Interface

To set up the transmitter/receiver interface for VT/TU operation

1 Select the **Port** you wish to set up for VT/TU operation (see "To Start a session" on page 81 for advice on starting a session and selecting ports).

2 Select the **Physical** tab.

3 Set the Transmitter and Receiver **Signal Standard** to **SONET** or **SDH** as required.

4 Set the **Signal Rate** as required.

To set Line Rate Offset

5 You can offset the Transmitter Line Rate by plus or minus 100 ppm. The resolution is 1ppm. Click on the **Edit** button then enter the value required and click on **OK**.

To set transmitter/receiver for VT/TU operation

6 On the transmitter set the **Mode Type** to **Terminal** and **VT/TU Mode** to **On**.

7 On the receiver set **VT/TU Mode** to **On**.

Port Laser Control

8 You can switch **off** or **on** the laser for the selected Port by clicking on the Laser button, or the Laser **On** icon on the Toolbar.

To set Clock Source

9 Set the Clock Source to Internal (Global) or Recovered as required.

To set up VT/TU mappings within individual channels

1 Click on the **Channels** setup tab.

2 Position the display cursor on the desired channel then click the right mouse key, and select from the choices given in the menu. The choices offered are ones that are valid for the selected channel.
When you position the cursor over a channel a ToolTip box appears giving interface settings for the selected channel.
For SDH, AU3 and AU4 are selectable:
AU3 - You can select a TU-11, TU-12 or Direct Mapping

AU-4 - you can select a TU-11, TU-12 or TU-3.
For SONET VT1.5 and VT2 are selectable.
You can also set up VT/TU channels using the Advanced Channel Configuration dialog - select the **Advanced** button in the **Channels** dialog window and use the VT/TU Preview Text dialog to set up the channels.
Note Direct mapping is where non VT/TU structured DS3/E3 PDH signals are mapped into STS-1/AU-3 signals.

Selected and Unselected Channels

Each LO channel can be defined as **Selected** or **Unselected**. Any unselected channels are set to VT/TU Unequipped (that is all payload and LO path overhead bytes are set to 00h, but the VT/TU pointer is the same as that in the selected channels). Selected channels contain a full LO POH and payload. All channels can be selected (up to 1344 VT1.5/TU11 in an OC48/STM16 for example).

Any changes to the transmitter channel configuration will take effect with no intermediate states.

▶ To select/unselect VT/TU channels

1 Click on the **Channels** setup tab.

2 To toggle a channel between Selected and Unselected, click on the channel of interest, and then double click the left mouse key to change the selection. You can also select and unselect a channel using the spacebar. To select a block of channels click on the first channel, then shift click on the last channel. If you view the Tooltip window for the selected channel you will see the “Selected” field change from No to Yes or Yes to No.

Set up Transmitter/Receiver Payload Mapping

▶ To select transmitter and receiver VT/TU payload mapping

1 Check you have set VT/TU Mode to **On** in the **Physical** tab window.

2 Select the **Channels** tab and then the **Mappings** button.

3 Double click on the **Tx Mapping** or **Rx Mapping** field for the VT/TU Type you wish to set up, and select from the drop down menu. The options available are given in the following Table.

VT/TU	Tx Mapping	Rx Mapping
VT1.5/TU11	DS1ASYNC SF, DS1 ASYNC ESF, DS1 ASYNC UNFRAMED, Bulk Filled	DS1 ASYNC SF, DS1 ASYNC ESF, DS1 ASYNC UNFRAMED, Bulk Filled
VT2/TU12	E1 ASYNC UNFRAMED, E1 ASYNC CRC ON, E1 ASYNC CRC OFF, Bulk Filled	E1 ASYNC UNFRAMED, E1 ASYNC CRC ON, E1 ASYNC CRC OFF, Bulk Filled
TU3	E3 ASYNC UNFRAMED, DS3 ASYNC UNFRAMED, DS3 ASYNC M23, DS3 ASYNC CBP Bulk Filled	E3 ASYNC UNFRAMED, DS3 ASYNC UNFRAMED, DS3 ASYNC M23, DS3 ASYNC CBP Bulk Filled
AU-3/STS-1	E3 ASYNC UNFRAMED, DS3 ASYNC UNFRAMED, DS3 ASYNC M23, DS3 ASYNC CBP	E3 ASYNC UNFRAMED, DS3 ASYNC UNFRAMED, DS3 ASYNC M23, DS3 ASYNC CBP

Adding VT/TU LO Path Errors to the transmitted signal

Errors can be added to any combination of the selected transmitter channels. Only one error type at a time can be injected. The following VT/TU errors can be added to the transmitted signal:

Sonet VT Path Errors	
Mapping	**Error**
VT1.5, VT2, TU-3	CV-V (BIP), REI-V

SDH LO Path Errors	
Mapping	**Errors**
TU-11, TU-12, TU-3	TU-BIP, LP-REI

To add VT/LO path errors

1. Ensure that you have switched on **VT/TU Mode** on the **Physical** tab for the selected port.
2. Click on the **E+A Inject** tab.
3. Select **LO Path** (SDH) or **VT Path** (Sonet) and choose the **Type** of error.
4. Select a **Rate** for each Payload.
5. If you wish to error selected channels only, use the **Path Errors and Alarms Mask** to select the required channels (see “Selecting which channels to insert Path errors/alarms" on page 100).
6. Click on the **Error Rate On** button to transmit the selected errors, or the **Single Error Add** button to inject single errors.

Adding Alarms to the transmitted signal

Only one alarm type can be enabled at a time. The alarms can be added to any combination of the selected channels using the **Path Errors and Alarms Mask**. You can add the following VT/LO Path Alarms, **H4-LOM** is also added to the list of alarms for the Sonet 'STS Path' and the SDH 'HO Path'.

SDH	
LO Path	TU-AIS, TU-LOP, LP-RDI, LP-UNEQ, LP-RFI
PDH	AIS, LOF

SONET	
VT Path	AIS-V, LOP-V, RDI-V, UNEQ-V, RFI-V
PDH	AIS, LOF

▶ To add alarms to a DSn/PDH signal

1 Ensure that you have switched on **VT/TU Mode** on the **Physical** tab for the selected port.

2 Click on the **E+A Inject** tab.

3 Select **LO Path** (SDH) or **VT Path** (Sonet) or **PDH** and choose the type of alarm.

4 If you wish to alarm selected channels only, use the **Path Errors and Alarms Mask** to select the required channels (see "Selecting which channels to insert Path errors/alarms" on page 100).

5 Click on the **Add Alarms**, **Alarm** button to transmit the selected alarm

Setting VT/TU Pointer Bytes

VT/TU pointer occupy the V1V2 bytes for all mappings except TU3, which occupy H1,H2 bytes in a fixed location within the TUG3. In both cases the pointer bytes are treated as a single 16-bit word whose function is very similar to that of the AU pointer. The pointer bits are numbered as follows:

Pointer Bits (numbered 1-16)	Use
bits 1-4	New data flag
bits 5-6	SS (pointer size) bits
bits 7-16	10-bit pointer value

Transmitter Pointer

A single pointer value is transmitted in all VT/TU channels of a given VT/TU type (that is there is one value for VT1.5/TU11, another value for VT2/TU12, and another for TU3). The following operations are available, independently on each pointer type.

- Increment
- Decrement
- New Pointer Value with or without NDF

When the pointer value for a given pointer type is moved. It moves simultaneously in all channels of that type at once.

Pointer SS Bits

The SS (pointer size) bits indicate VT/TU type as follows:

SS Bits	Size
00	(VT6/TU2)
10	VT2/TU12
11	VT1.5/TU11

The SS bits for TU3 are not used and are transmitted as 10.

Pointer Range

The VT/TU pointer range for each supported channel type is:

- VT1.5/TU11: 0 - 103
- VT2/TU12: 0 - 139
- TU3: 0 - 764

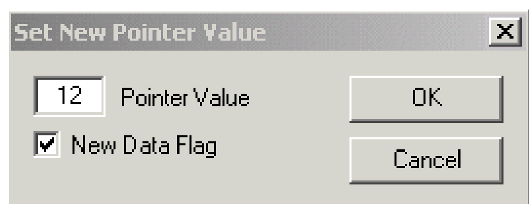
To adjust VT/TU pointer values

1 Ensure you have **VT/TU Mode** selected in the **Physical** tab window.

2 Select the **TOH/SOH** tab.

3 In the **VT/LO Pointer Control** dialog window click on the drop down menu arrow and select the required VT/TU.

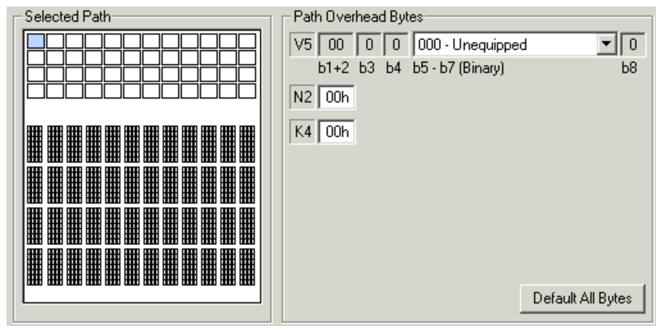
4 Use the **VT/LO Pointer Control -1** or **+1** buttons to increment or decrement the pointer value, or select the **Edit Pointer** button and enter a new value.



Edit VT /LO Path Overhead Bytes

Path Overhead Byte Access

You can set up the VT/TU path overhead bytes for an individual channel or a number of selected channels. Every POH byte in every channel can be set to a unique value.



VT1.5/TU11/VT2/TU12 POH settings

For any chosen channel, any POH byte except V5 and J2 can be individually set. The selected byte can be set to a value in the range 00 - FF hex.

▶ To edit the VT/TU path overhead bytes

1 Select the **VT POH/LO POH** tab.

2 Use the '**Selected Path**' mask to select a channel or channels for editing as follows:

To select a channel

Use the zoom feature - click on **x** at corner of mask for a larger display.

- position your mouse cursor on the channel of interest and single click (either left or right mouse key works).

Select a block of channels

- shift+click selects all the channels between the last selected channel and the one currently under the mouse.

- Ctrl A highlights all the channels.
- You can also use the keyboard arrow keys and the **home** and **end** buttons to navigate around the channels.

3 Set up the following **Path Overhead Bytes** once you have selected the channels of interest.
SONET: V5, Z6, Z7 and J2 (see “Generating a J2 Path Trace Message" on page 144).
SDH: V5, J2, N2 and K4.

Default All Bytes

Select the **Default All Bytes** button to set all bytes to their default value.

Generating a J2 Path Trace Message

You can check for path routing faults, following for example a protection switching event by monitoring the content of the J2 byte. Refer to “To monitor J2 path routing" on page 148 for instructions on how to capture and monitor the J2 byte.

▶ To generate a J2 path trace message

1 Select the **VT POH/LO POH** tab.

2 Enter the required 16 byte message for each low order path or select a preset default message. Selecting the Default Message button calls up a default message which identifies the originating port and HO and LO channel.

3 If you set the transmitter to SDH mode with TU Mode enabled and then select an AU4 and TU3 channels, when you select the LO-POH tab and select a TU3, the number of bytes displayed changes to 9 with a 16 byte or 64 byte J1 Path Trace Message offered.

Viewing VT/TU Measurement Results

Viewing VT/LO/PDH Path Errors

Use the following procedure to view low order path errors.

▶ To view VT/LO path errors

1 Ensure **VT/TU Mode** is set to **On** in both transmitter and receiver (selectable via the **Physical** tab).

2 Select the **E+A** tab and view which Ports or Channels are errored (errors are shown red in color).

3 Click on an errored port or channel, or select the **Counts** tab and then select a port.

4 Use the **Port** mask to select individual channels for viewing.
For an enlarged Port mask display making it easier to select channels click on the zoom icon at the top right corner of the **Port** mask.
For SONET - STS Path and VT Path errors are displayed.
For SDH - HO Path and LO Path errors are displayed.
PDH-LOF and PDH-AIS results are given at the extreme right of the VT Path/LO Path display.

Viewing VT/LO/PDH Alarms

You can view the time alarms are active as follows:

▶ To view VT/LO/PDH alarms

1 Select the **E+A** tab in the Results part of the display.

2 Select the port you which to check for alarms.

3 View the alarms present in the VT/LO path results display.

4 Use the Port mask to select individual channels.

Monitoring Received VT/TU Path overhead bytes

You can view a snapshot of all nine of the STS POH bytes for any chosen channel, and also the VT/LO POH bytes (V5, Z6, Z7, J2 for SONET and V5, N2, K4, J2 for SDH) for any chosen channel.

To monitor received VT/LO POH bytes

1 In the Measurements/Results window, select the **OH** tab.

2 Select the required Port.

3 Select the required SOH/TOH. There are three methods as follows:

- **First** - selects the first STS-3 or STM-1.
- **User selectable** - up/down keys allow you to select the required STS-3/STM-1 (1-16), or you can type the number in the box.
- **Linked to Path** - When you select this option the position selected is linked to the STS-3/STM-1 currently selected in the **Selected Path** mask (selected channel is shown blue).

4 Click on the required VT/TU channel to observe the VT/LO POH bytes for the selected channel. For easier selection of individual VT/TU channels - use the zoom feature to give an enlarged Port Mask. Click on the icon at the top right corner of the mask.

Measuring Service Disruption in a PDH system

You can measure the time it takes (service disruption time) for the automatic protection switch (APS) circuit to detect and activate the standby equipment when a fault occurs.

▶ To view service disruption time

1 Select the **SRV-DIS** tab.

Set up Guard Time

2 The guard time which is used to define the end of an error burst can be set between 100ms and 1600ms in 1ms steps. You can define it **for All Ports** in a session or for a **Selected port only (**select the **On selected port only** box).

3 Select the Guard Time **Edit** button and enter the required value.

Set Warning Threshold

You can set a Warning Threshold - any channels which have a service disruption time equal to or above your pre-set threshold will be displayed red in color in the Port mask and in the VT/LO Path Max Time and Last Time columns.

4 If required set a **Warning Threshold** value.

5 Start a measurement - select the **Gating: Start** button.

6 Verify error-free reception of the PRBS test pattern (select the **Overview** tab - Chassis View and check for a red border or channels indicating errors).

7 Invoke a protection switch on a working section of the equipment under test that is transporting the PRBS.

8 Select the **SRV-DIS** tab, view the list of ports in your session and check if the **Max Time** field gives a value for any port.

9 Select any port that has **SRV-DIS** flagged and view the **Max Time**, **Last Time and Count** and results in the channel list window. You can use the Port channel mask to quickly examine the results for a particular channel.

10 Select **Gating: Stop** when you wish to end the measurement.

Detecting Path Routing Faults

You can use the J2 byte to check for continuity between the transmitting and receiving ends of a VT/LO path.

You must first configure a set of reference Expected J2 path trace messages. When you start a J2 test the OmniBER XM compares the expected J2 path trace messages with the captured (current) measured J2 path trace messages and produces a result indicating whether there are any received J2's in error (mismatched).

Set up Expected J2 Path Trace messages

You can set up the expected J2 Path Trace messages either by entering a message manually, or by copying the message from the Tx of another port or the Rx input for the currently selected port. See "Generating a J2 Path Trace Message" on page 144.

▶ To monitor J2 path routing

1 Select the **Connectivity** tab (click on the **>** arrow at the extreme right of the Tool bar) if this tab is not visible.

Note: to make it easier to see the full width of the Connectivity display, try selecting the **Configuration**, **Hide** icon on the OmniBER XM Toolbar. Select **Configuration**, **Show** to return to the normal display.

2 If you wish to perform a test on only one port, select the port, then click in the **On selected port only** box. Otherwise all ports in the current session will be tested for a J2 mismatch.

3 Determine the **Expected Path Trace** message from one of the following methods:

From the **Copy Expected Messages** window select either:

- **From: Tx on** (current port, or select a port from the drop down menu if there are other ports with the same channel configuration).
- **From: Current Rx**.

If you select the **All Ports** box then the Path Trace messages for all ports in the current session are copied as Expected Path Traces messages.

- you can also enter a Path Trace message manually, by clicking on the **VT Path**, **Expected Path Trace** field for a chosen channel and then editing the message via the keyboard.

4 If you chose to copy J2 Path Trace messages from the signals at the Tx or Rx ports, select the **Copy Now** button.

Compare J2’s

5 Click on the **Start Test** button. The expected J2 Path Trace messages are compared with the measured J2 Path Trace messages and the results given as the number of VT Mismatches for each Port and also a Pass or fail for each Channel.

View the number of Mismatches for each Port and also the Pass or Fail result for each Channel. The Port mask highlights in red any channels which have a J2 mismatch between the expected and measured J2’s. If you click on an errored (red) VT/TU channel, the channel is highlighted in the VT Path Results display.

5
Remote Access

This chapter provides information on how to configure the network simulator for remote operation and access.

NOTE It is recommended that you consult your system administrator to ensure correct configuration of the network simulator on your network, and to determine any security restrictions to networking the tester.

Remote Access

The network simulator software provides both a Windows-based Graphical User Interface (GUI), as well as an Application Programming Interface (API) that allows you to automate tests, for example, to:

- run tests that would be too tedious or imprecise to do manually or repeatedly through the Graphical User Interface (GUI)
- integrate tests with larger test suites that access other test equipment and Systems Under Test
- repeat tests for subsequent product builds
- regression test new versions or releases of products

You might want remote access if:

- the tester is in a lab and you want to access it from your desk or home
- you want to use a UNIX workstation to run tests
- several users want to run tests at the same time
- you want to run test scripts remotely

The network simulator rack-mount controller comes with two 10/100 Mb/s Ethernet ports:

- Port #1: Connects to your company LAN.
- Port #2: Connects to the tester switch, which in turn connects to the network simulator modules.

The Ethernet port configured for your LAN is labelled “To LAN”. If you have not already, connect this port to your LAN.

This chapter describes:

- different methods of remote access
- how to use the different methods for desk or home access
- how to set up the tester and remote computers for remote access

CAUTION

Consult with your system administrator to ensure correct configuration of the network simulator on your network and to determine any security restrictions to networking the tester. You will need to obtain for the tester:

a network IP address

domain or workgroup

unique host/computer name

Please note that when setting up a DCOM server and client you must ensure that both the tester and remote computers are on the same network and belong to the same domain or workgroup.

When using the API remotely ensure that the tester and remote computer are both in the same network.

Types of Remote Access

API access

To accommodate different customer preferences, two API syntax styles are available within the single command set:

• SCPI based syntax

• TCL syntax

The tester's API allows *several* remote users to launch *separate test sessions* from remote PCs or UNIX workstations. The GUI is not used.

You must install SCPI, Tcl/Tk and the tester's Tcl package on the remote computer — see "To use the API remotely" on page 171.

GUI access

VNC — remote GUI

Virtual Network Computing (VNC) is a freely available product from AT&T Research. VNC allows a single user to access the controller PC's Windows desktop from a remote PC, UNIX workstation, Linux workstation, or Macintosh. VNC also supports remote control through web browsers. VNC is suitable if only one user wants to control the tester at any given time. If several users try to access the tester at the same time, they will all see the same desktop and be competing for control of the mouse and keyboard.

You must install VNC software on the tester's controller PC and remote computer — see "To set up a VNC server" on page 162 (for the tester) and "To set up a VNC client" on page 172 (for remote computers).

DCOM — remote GUI

The Distributed Component Object Model (DCOM) is a built-in Windows capability that allows PCs to control COM-based applications on other PCs. DCOM allows *several* remote users to launch *separate, remote instances of the tester GUI*. Each launches a separate test session on the tester and can select a different set of test port interfaces. Thus, users do not interfere with others' sessions. Note that, unlike VNC, DCOM does not allow remote access to non-COM applications like the Diagnostics Tool.

You must install and use the tester software on the remote PC and thus, the remote PC must be running Windows 2000 — see "To set up a DCOM server" on page 162 (for the tester) and "To set up a DCOM client" on page 172 (for remote computers).

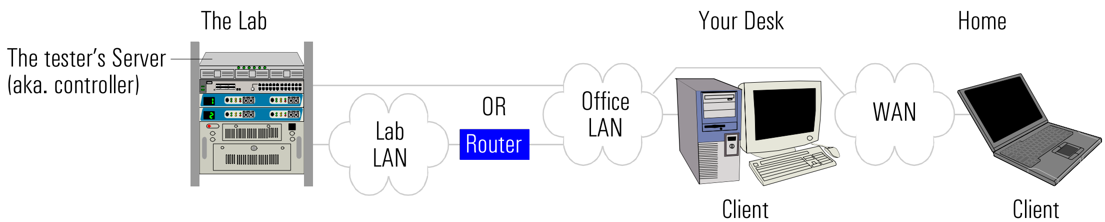
Terminal Services -remote GUI

Terminal Services (TS) is a Microsoft Windows 2000 utility that allows several users to log in from remote computers and establish *separate desktop instances on the TS computer* to control its software. Remote desktops are provided through thin terminal-emulator clients.

Controllers shipped with OmniBER XM software installed have the TS software pre-installed (it does however have to be enabled by the user). If you want to use TS on a controller that does not have the software, you must install the TS software. Note: TS is not supported on OmniBER XM laptop controllers. For more information see “To set up the TS server" on page 167 and “To set up a TS client" on page 175.

Desk and Home Access

You may access OmniBER XM network simulator from your desk or home. The tester may be connected to your office LAN directly or through a lab LAN. The office LAN in turn may be connected via a WAN (Internet, VPN) to your home:



You may use the different methods of remote access as follows:

Desk Access

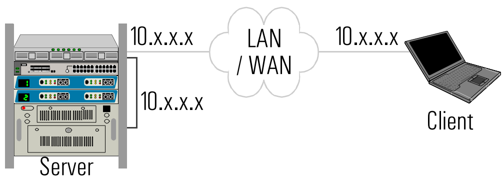
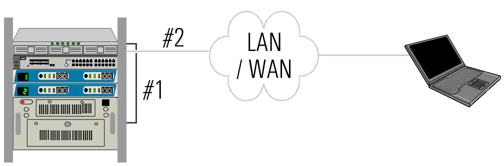
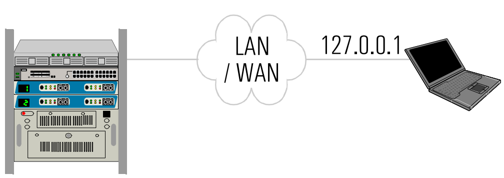
API	Advantages:Multiple concurrent users, cross-platform support, programmable
VNC	Advantages: Control of all tester software, cross-platform support. Limitation: One user at a time, performance
DCOM	Advantage: Multiple concurrent users. Limitations: Control of network simulator GUI only, PCs running Windows 2000 only.

Home Access

API	Advantages: Multiple concurrent users, cross-platform support
VNC	Limitations: One user at a time, works only if the WAN can access the tester connecting the lab LAN, performance
DCOM + VNC	You set up a DCOM session from the desktop PC, then use VNC from home to control the desktop PC. Advantages: Works even if the WAN cannot access the Lab Router, faster than using only VNC, allows multiple concurrent users (each uses their own desktop PC).

Troubleshooting Remote Access

Before setting up remote access, beware of these potential problems::

<table>
<tr><th>Potential Problem ...</th><th>Troubleshooting ...</th></tr>
<tr><td>Duplicate 10.x.x.x IP addresses.

</td><td>The tester uses IP addresses in the subnet 10.x.x.x/8 to control its test interfaces. A DHCP server on the tester PC dynamically assigns each network simulator test port an IP address from this subnet. If you are also using 10.x.x.x addresses in your test lab/LAN or to connect remote clients through a VPN, you must avoid addressing conflicts by changing the subnet addresses used by the tester.
See “To change the IP address of the switch card” on page 160.</td></tr>
<tr><td>Reversed binding order of LAN ports.

</td><td>The tester’s DCOM software is sensitive to the order of LAN interfaces. The LAN interface that connects your test lab/LAN (which in turn connects remote clients) must be first in the tester’s network binding order. The LAN interface that connects the test interfaces must be second. Otherwise, remote clients will not be able to connect to the tester software. The order is configured properly on controllers from Agilent.
See “To change the binding order of network ports” on page 192.</td></tr>
<tr><td>DHCP client uses incorrect LAN IP address

</td><td>A known problem with Windows 2000 causes the DHCP client to ignore the address assigned by DHCP when interacting with DCOM on a Windows 2000 client PC. Instead, the client PC uses the default address, 127.0.0.1, which prevents the controller PC from connecting to the Windows 2000 client PC.
There are two possible fixes:
Use a static IP address on the Windows 2000 client PC instead of DHCP.
Install the Microsoft’s hotfix Q299407 on the Windows 2000 client PC.
To install the hotfix: download and install Windows 2000 Service Pack 2, if you have not already and then execute Q299407_W2K_SP3_x86_en.exe.</td></tr>
</table>

Step 1: Configure the Tester

A summary of the tasks:

- “To configure the tester for network access” on page 158
- “To change the IP address of the switch card” on page 160
- “To set up a VNC server” on page 162
- “To set up a DCOM server” on page 163
- “To set up the TS server" on page 167

To configure the tester for network access

Log into the tester using the Administrator account, which has the required administrator privileges. You must set up the tester with the following:

IP address

If your lab is set up to use:

- DHCP: Set up the tester to use its DHCP client software to obtain an IP address dynamically from your LAN’s DHCP server. Then, determine the IP address that was allocated.
- hardcoded IP addresses: Manually enter a unique IP address.

The procedure for setting up IP addresses varies depending on whether your controller has Windows 2000. If you need help doing this, see “To set a PC’s IP addresses" on page 190. To see which addresses are allocated by DHCP servers, see “To list a PC’s IP addresses" on page 193.

Host name and domain

The tester’s controller PC has a factory-preset host computer name but you may change it to something that:

- is more appropriate for your installation
- is unique
- conforms to your company or lab’s conventions for host names

Again, the procedure for setting up host names varies depending on whether your controller has Windows 2000. If you need help doing this, see “To set a PC’s host name and domain" on page 189.

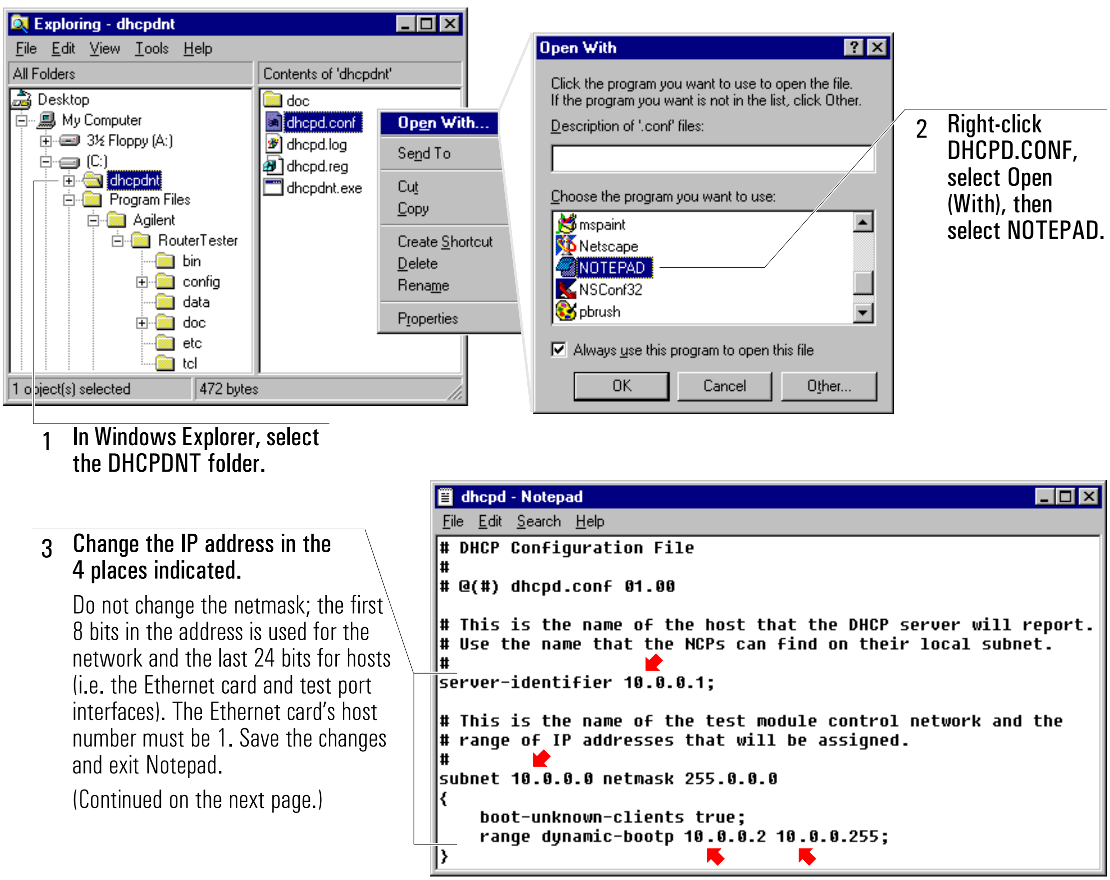
To change the IP address of the switch card

Important

This may be required. As described on page 157, the tester uses addresses from the subnet 10.x.x.x/8 for its test interfaces. If 10.x.x.x addresses are also used in your test lab/LAN, or by a remote client (e.g., connecting via a VPN), you must change the addresses used by the tester's subnet.

Modify the controller's DHCP configuration file and system registry

:

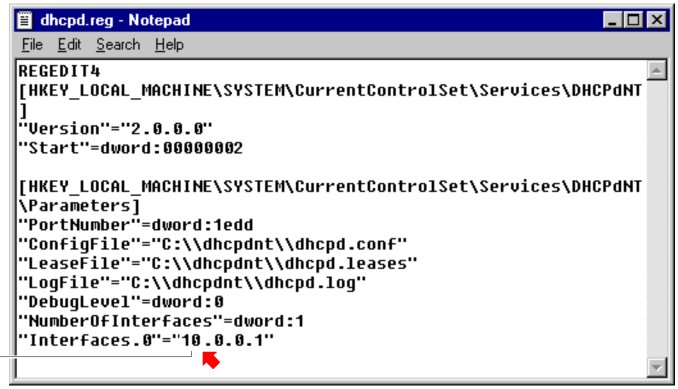


4 Back in Windows Explorer, right-click the file DHCPD.REG, then select Edit to display the file in NOTEPAD.

5 Change the IP address here.

You must use the same number as before (e.g., 11). Save the changes and exit Notepad.

6 Back in Windows Explorer, double-click the dhcpd.reg file you changed to update the system



Next, modify an environment variable, set the switch port's IP address, and restart the test system:

1 Reset the environment variable CM_ADDRESS to the new address. This procedure varies depending on whether you have Windows 2000 — for details, see "To set up an environment variable" on page 195.

2 Reset the IP address of the Ethernet port connecting the switch and test interfaces so that it uses the new IP address. This procedure also varies depending on the operating system — for details, see "To set a PC's IP addresses" on page 190. You will be prompted to restart the PC.

3 Restart the PC. This is when the Resource Manager obtains a new IP address for the interface connecting the controller to the switch.

4 Reboot each test module. Do not use the Diagnostics Tool's Broadcast Reboot — instead, power each module down, then up again. Each device will obtain a new IP address in the new subnet range.

Use the Diagnostics Tool to verify that the new IP addresses are being used.

To set up a VNC server

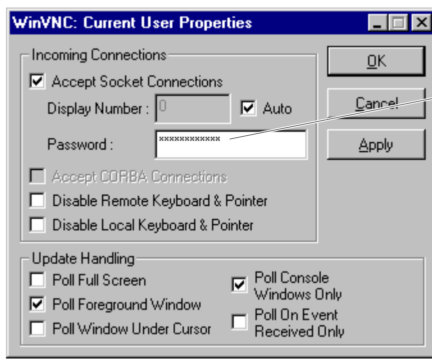
To install VNC

VNC is now installed as an optional component along with the network simulator software. If it is not currently installed on the tester PC, install it the same way you would install network simulator software. See “To install/upgrade software" on page 182. Simply select VNC from the list of optionally installed software.

For complete documentation on VNC, see the AT&T Research web site: http://www.uk.research.att.com/vnc/

To enable remote access

On the tester PC, log in with administrators’ privileges. Then select Start menu > Programs > VNC > Run WinVNC (App Mode)



Enter a password that remote users must enter to control the tester desktop.

Change the default settings for the other parameters as needed. Then click OK.

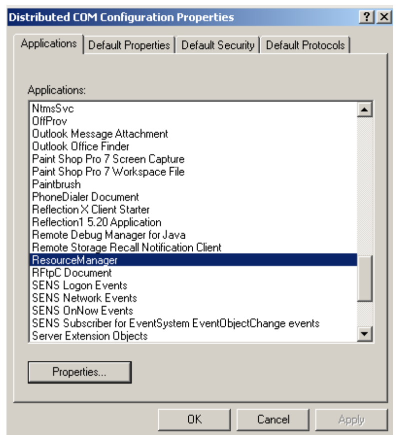
This displays an icon in the lower right corner of the tester PC’s desktop.

When you are ready to disable remote access, right-click the icon and select Close VNC.

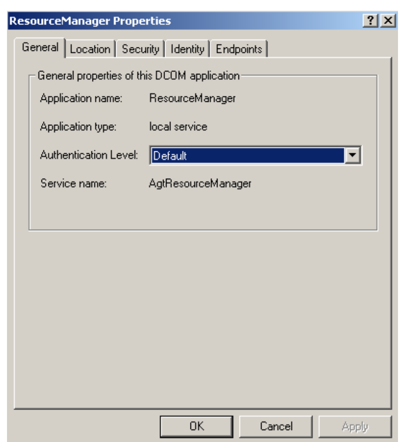
To set up a DCOM server

You must configure the tester PC's DCOM security to allow remote computers to access ResourceManager and sessionexec.

1 Select Start menu > Run to display the Run dialog. Then type dcomcnfg to display the Distributed COM Configuration Properties dialog.



2 On the Applications tab, select ResourceManager and click Properties to display the ResourceManager Properties dialog.



3 On the Security tab, set the access permission to “Use custom”. Click Edit to display the Registry Value Permissions dialog. Click Add to display the Add Users and Groups dialog. Select Everyone and click Add to give everyone access. Click OK to close the Add Users and Groups dialog and the Registry value permissions dialog.

4 On the Security tab of the ResourceManager Properties dialog, set the launch permission to “Use default”. Then click OK to close the dialog.

5 On the Applications tab of the Distributed COM Configuration Properties dialog, select sessionexec and click Properties to display the sessionexec Properties dialog. Repeat Step 3 to give everyone access permission.

6 On the Security tab of the sessionexec Properties dialog, set the launch permission to “Use custom“. Click Edit and repeat Step 3 to allow everyone to launch test sessions.

7 Click OK to close the sessionexec Properties dialog and the Distributed COM Configuration Properties dialog.

To set up a Terminal Services (TS) server

About TS

TS is installed along with the OmniBER XM software. If your controller does not have Terminal Services installed, use the OmniBER XM Operating System Recovery CD supplied with your system to install all required TS software. To see if you have TS installed on your controller, select Start menu > Administrative Tools. You should see Terminal Services menu items (Client Creator, Configuration, Manager, Licensing).

If you do not have TS installed, see:

1 To install the TS software, page 166

2 To set up the TS server, page 166

3 To set up a TS client, page 175

If you do have TS installed, see:

1 To set up the TS server, page 167

2 To set up a TS client, page 175

For complete documentation on TS, see the Microsoft web site:

www.microsoft.com/windows2000/technologies/terminal/

System requirements

A system controller requires extra resources (CPU, memory, disk space) to run as a TS Server. To review the system requirements, see “How many ports and sessions can your system support?” on page 29.

About licensing

When you install TS from the OmniBER XM Recovery CD, it is installed in Application Server mode. This mode is licensed, and requires a license server installed in the domain (usually the server itself). There is no hard limit to the number of licenses that can be installed, so the real limit is the resources available. To use TS, you need three licenses:

- Server license—Conformance is met by installing a legal version of the Windows 2000 Server operating system.

- Client Access License (CAL)—A CAL is used for each remote connection that uses a Microsoft service (e.g. Terminal Services, file/printer sharing). The version of Windows 2000 Server shipped with OmniBER XM comes with 5 built-in CALs.
- Terminal Services — Client Access License (TS-CAL): Each remote connection must also have a TS-CAL. Windows 2000 Server comes with an unlimited number of “built-in” Windows 2000 Pro and Windows XP Pro TS-CALs. Other clients running operating systems like Windows NT, XP Home, ME, 98, and 95 get a temporary license for 90 days after first connecting to a server. When this 90-day temporary license expires, you need to obtain your own permanent TS-CAL licenses through Microsoft. You could also enquire whether your corporate IT group has or can more easily obtain TS-CAL licenses.

Normally, a multi-user system allows concurrent or per-server licensing. Instead, TS-CAL licensing uses per-seat licensing and licenses are permanently assigned to computers. This means a user connecting from both home and office uses two licenses. OmniBER XM controllers use a hotfix that allows a license to time expire and be reclaimed if a connection from a given computer is not repeated within 52 to 89 days.

To install the TS software

CAUTION

When you install TS from the OmniBER XM Recovery CD, it completely replaces the hard disk image on your OmniBER XM controller with a new image containing the latest operating system and OmniBER XM software.

Any third-party software applications and data files you have installed or saved on the controller will not be preserved.

---

1. Save all your data and configuration files before you install the hard disk image, so that you can restore these files to the controller at a later stage. For help on saving these files, contact your system administrator.
2. Insert the OmniBER XM Recovery CD into the CD-ROM drive.
3. Power up the controller.

4 Follow the instructions provided with the OmniBER XM Recovery CD and install the hard disk image.

5 Use the third party software CDs to re-install any additional software you require.

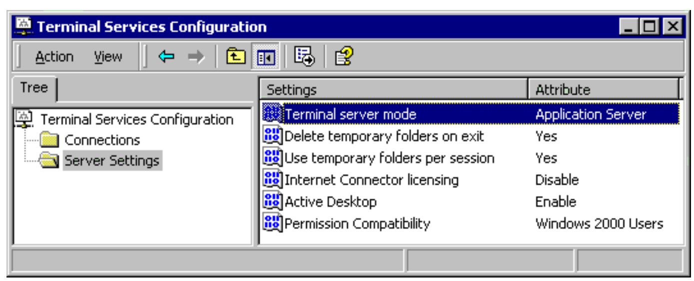
6 Restore any data and configuration files you backed up previously.

To set up the TS server

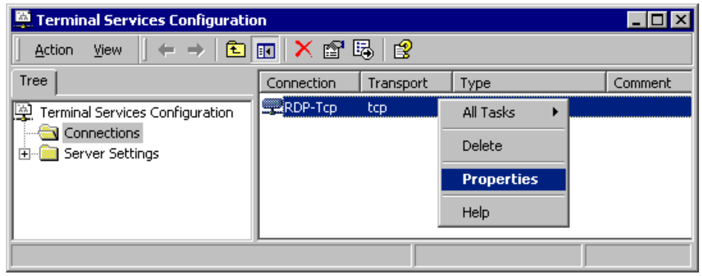
To review the default remote connection options

1 Select Start menu > Administrative Tools > Terminal Services Configuration to display the Terminal Services Configuration window.

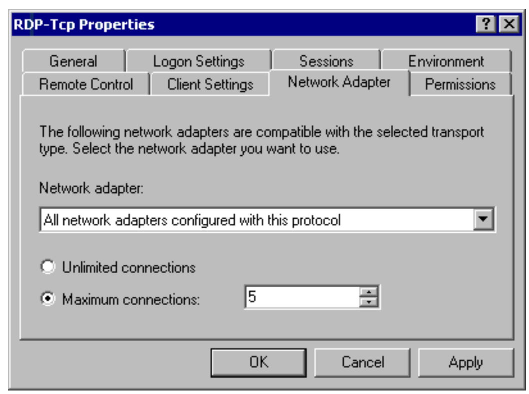
2 Review the default server settings.



3 In the left-hand pane, select Connections. In the right-hand pane, right click RDP-Tcp; then select Properties.



4 On the RDP-Tcp dialog, select the Network Adapter tab; then enter the maximum number of remote clients allowed.



The default is 0. This is a security precaution, to prevent unauthorized remote access until you have configured the server to your requirements. Through the Remote Control tab, you can deselect the Require user’s permission check box, so that you can access from home a session you initiate at the office.

To activate the License Server and obtain a license

1 Select Start menu > Administrative Tools > Terminal Services Licensing. The Terminal Services Licensing window is displayed.

From this window, you will be able to review who is currently using permanent and temporary licenses, and install additional licenses.

2 The servers listed under All servers are computers in the network which have been set up as Terminal Services license servers. Right-click the current controller name and select Activate Server. The Licensing Wizard is displayed.

3 Specify how you want to contact Microsoft to obtain a license (Internet/E-mail, web, phone, fax), or activate your license manager. The wizard displays your Product ID to relay to Microsoft. Depending on the method of contact you choose, you may need to identify:

- an Install Option (select Activate a license server)
- the Purchase Method (select Other)
- user info, address, country

Microsoft generates a TS Server License ID based on the Product ID. You enter this license into the wizard. (The format of the license varies depending on the method used to obtain the license.)

4 Deselect Install licenses now, unless you need to install additional license key packs for TS clients.

To review the manager options

1 Select Start menu > Administrative Tools > Terminal Services Manager. The Terminal Services Manager window is displayed.

2 Review the available options. From this window, you can:

- view the active processes running on each server and client
- connect to a client session (you may use Remote Control)
- send messages to clients
- forcefully disconnect or log off clients

Step 2: Configure the Remote Computer

Remote API access

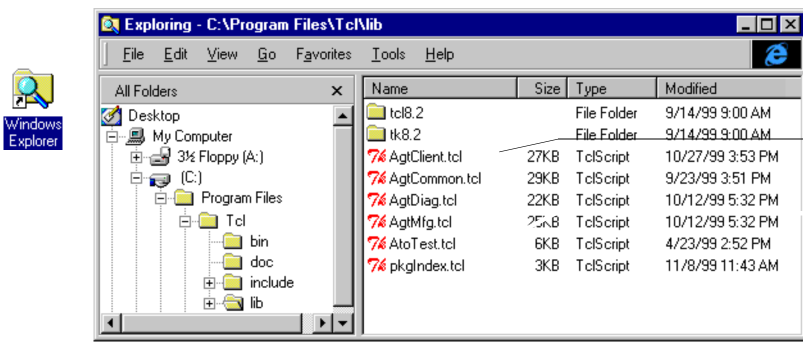
- “To use the API remotely" on page 171
- “To access the online help remotely" on page 177

Remote GUI access

- “To set up a VNC client" on page 172
- “To set up a DCOM client" on page 174
- “To set up a TS client" on page 175
- “To access the online help remotely" on page 177

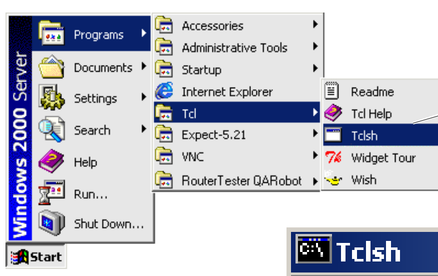
To use the API remotely

The tester’s API allows several remote users to launch separate test sessions from remote PCs or UNIX workstations. You must first install Tcl/Tk Version 8.0 or later on the remote computer. The tester CD provides Tcl/Tk 8.2 for Win32 computers. If installing onto a UNIX system, download the software from http://tcl.sourceforge.net/ or http://www.tcl.tk/. Build (i.e. compile) the Tcl source code as described at the web site.



1 **On the tester PC, copy the file AgtClient.tcl.**

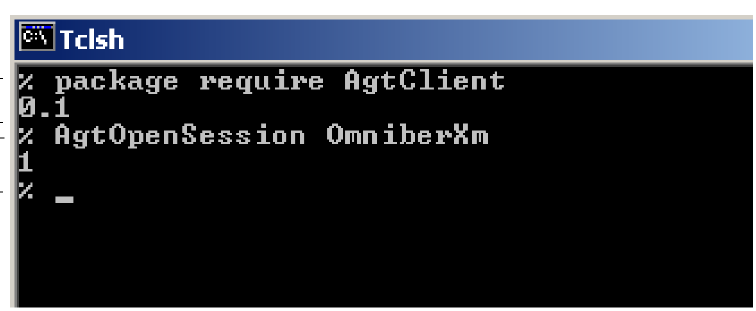
Copy this Tcl package to the remote computer’s Tcl /lib directory.



2 On the remote computer, launch Tcl.

3 Include the tester’s Tcl package.

4 Connect to a running test session or open a new one.



To set up a VNC client

To install VNC

If the remote computer is a Win32-based PC (i.e., Windows 95, 98, 2000, NT4), follow the same steps outlined for the tester PC under “To install VNC" on page 162.

If the remote computer is another type of computer, download the appropriate VNC package from the AT&T Research web site.

http://www.realvnc.com/

For details, please see the documentation at the above web site. If you encounter problems, please see the FAQ web page:

http://www.realvnc.com/faq.html

To control the tester remotely

1 On the remote computer, launch the VNC viewer. On a PC, select Start > Programs > VNC > Run VNC Viewer.

2 When prompted, enter the tester PC’s IP address or host name, then the password you set up in “To enable remote access" on page 162.

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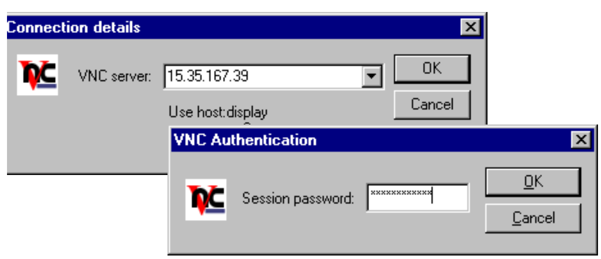

3 When the tester PC’s desktop appears, launch and use the tester software as normal. If you need to refresh the display, right-click the VNC title bar and select “Request Screen Refresh“.

To control the tester via a web browser

1 On the remote computer, launch a web browser.

2 For the URL address, enter “http://” followed by the tester PC’s IP address followed by the port number “:5800”; for example, http://10.1.1.1:5800.

3 When prompted, enter the password you set up under “To enable remote access" on page 162.

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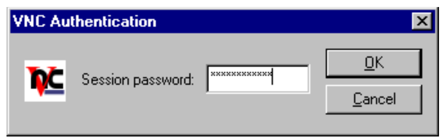


4 When the tester PC’s desktop appears, launch and use the tester software as normal

To set up a DCOM client

To install the tester software

Install the tester software on the remote computer, as described fully in Chapter 4, “Software Installation/Upgrades”. Select:

- GUI Installation: If you do not plan to use Demo mode. This installation requires less disk space, as described under “System Requirements" on page 180.
- Full Installation: If you plan to use Demo mode to simulate network simulator test modules and interfaces (e.g., to see what you can do with test interfaces you do not currently have connected).

To control the tester remotely

1 Launch the application as shown on page 64.

2 On the Test Session dialog, enter the IP address or host name of the tester PC as defined in “To configure the tester for network access" on page 158.

This connects your remote instance of a GUI to a test session running on the controller PC.

To update old desktop icons

If you previously set up desktop shortcut icons on your remote PC to connect to the tester, check the following: Right-click the icon and select Properties. In the Target field, any command such as:

C:\PROGRA~1\Tcl\bin\wish82.exe “C:\Program Files\Agilent \ OmniberXM\etc\LicCheck.tcl” -server <n>

must be changed to ...

“C:\Program Files\Agilent\Omniberxm\bin\XmLauncher.exe” -server <n>

where <n> is used to specify a default tester host name or IP address.

To set up a TS client

About TS client licensing

Each remote connection must have a Terminal Services - Client Access License (TS-CAL). Windows 2000 Server comes with an unlimited number of built-in Windows 2000 Pro and Windows XP Pro TS-CALs. Other clients running operating systems like Windows NT, XP Home, ME, 98, and 95 get a temporary license for 90 days after first connecting to a server. When this 90 day temporary license expires, you need to obtain your own TS-CAL licenses through Microsoft. You could easily enquire whether your corporate IT group has, or can more easily obtain TS-CAL licenses.

To install the client software

You can find this software on the:

- controller hard disk:

C:\WINNT\system32\clients\tsclients\msrdpcli.exe

- OmniBER XM Operating System Recovery software CD: at the top level

\msrdpcli.exe

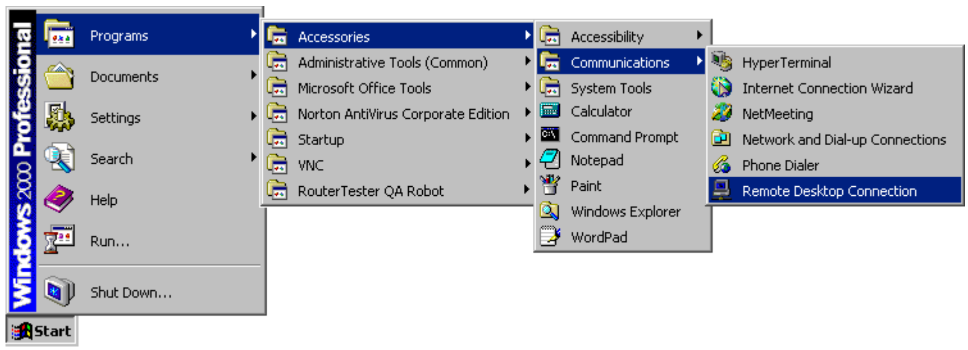
- web site:

www.microsoft.com/windowsxp/pro/downloads/rdcliental.asp

1. Navigate to the required .exe file listed above, and double-click.
2. Accept the license and install the application for anyone who uses the client PC. It takes less than one minute to install the files.

To configure connection options

1 From the Start menu, launch the Remote Desktop Connection.



2 In the Computer field, select the OmniBER XM controller to which you want to connect.
Note: If you want to configure the display, resource, and performance options, click the Options button. Click the Help button for full details.

3 Click the Connect button. The Log On to Windows dialog is displayed.

4 Log on to the OmniBER XM controller. Use the OmniBER XM application as normal.

To disconnect or log off the server

If you want to:

- leave active processes running in the background and reconnect later—click the X icon on the server taskbar. Alternatively, select Start menu > Shutdown; then select Disconnect from the Shut Down Windows dialog.
- log off and terminate all active processes—shut down your PC as normal by selecting Start menu > Shutdown; then select Log off from the Shut Down Windows dialog.

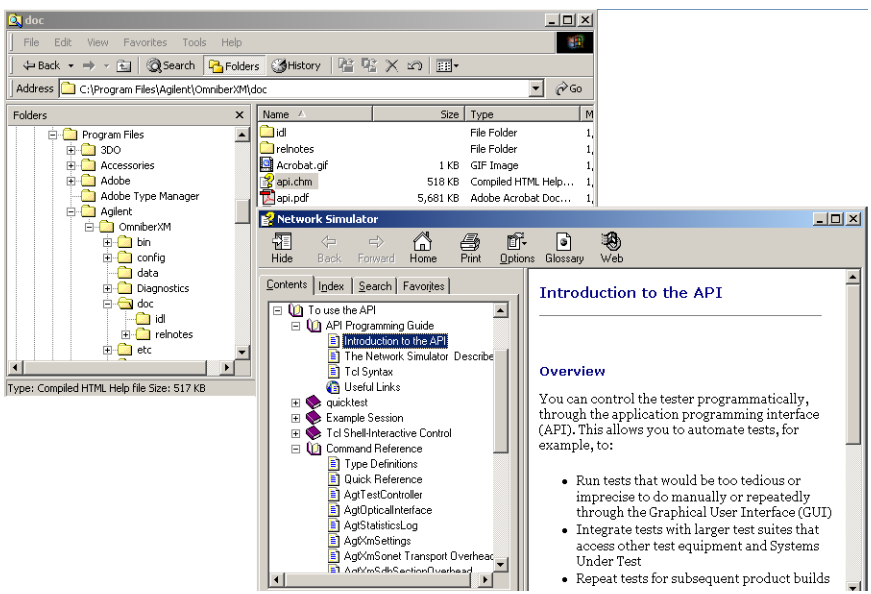
To access the online help remotely

If you are using VNC or DCOM, you simply display the online help as normal: from the Windows Start menu, tester application’s Help menu, or dialog Help buttons. If you are using the API, you have these options:

If your remote computer is a PC with IE3 or later

You can view the same help files displayed on the tester PC. These help files are Compiled HTML Help (.CHM) files. They are viewable on any Windows PC that has Internet Explorer 3.0 or later. (The HTML Help uses DLLs supplied with IE.) The .CHM help files are provided on the:

- tester PC: C:\Program Files\Agilent\Omniberxm\doc
- tester CD: \doc



If it is not

Use Acrobat to read the PDF files which are also on the PC and CD:

- user_guide.pdf— OmniBER XM network simulator User Guide.
- installation_guide.pdf - OmniBER XM network simulator Installation Guide.
- api_programming_guide.pdf— OmniBER XM network simulator API Programming Guide.
- rem_cntrl_mnl.pdf - OmniBER XM network simulator SCPI Programming Guide.

6
Software Install/Upgrade

CAUTION

Caution: Support for modified or non-Agilent hardware and software

Disregard any instructions in the PC User's Guide directing you to check or install components inside your PC. We cannot guarantee that the network simulator is compatible with other hardware, peripherals, operating systems, or software applications not purchased through Agilent. Consequently, we do not provide warranty for or support problems associated with modified or non-Agilent systems or systems with altered operating system configuration or initialization files.

Software Installation Upgrades

The tester software is factory-installed on each controller PC shipped. You may however be:

- upgrading software on the controller
- installing or upgrading software on a computer that will remotely access the controller through DCOM, as described in “To set up a DCOM client" on page 174

Please review the System Requirements before starting the installation.

System Requirements

To install and run the software, a PC minimally requires the following:

	Controller PC (Full Installation)	**Remote Client PC (GUI Installation)**
Operating System	Windows 2000 Version 5.0, Service Pack 1	Windows 2000 Version 5.0, Service Pack 1
RAM	256 MB for medium-sized systems of 5 to 20 network simulator modules 512 MB for large systems of 21 to 32 network simulator modules	128 MB
Disk Space	Total: 500 MB On the C: drive: 300 MB to install the software 500 MB to run the software	Total: 300 MB On the C: drive: 200 - 250 MB

The actual software occupies less space. The extra space is required during installation to unpack software and during operation for virtual memory usage.

Software Installed

The following software is installed:

- OmniBER XM network simulator software
- PDF's of manuals, online help, release notes
- Tcl/Tk 8.2: Tcl Widgets, BLT, Expect: scripting tools, extensions to Tcl and Tk
- Acrobat Reader 4.0: displays electronic versions of guides and papers
- HTML Help: displays the online help
- vi, emacs: Windows versions of UNIX editors
- VNC: enables remote access (see "Types of Remote Access" on page 153)

NOTE

Install anti-virus software on system controller PCs

If your system controller PC is connected to a network, it is strongly recommended that you install an anti-virus program and keep the virus definition files up to date.

To install/upgrade software

Before you begin

- You need the OmniBER XM network simulator CD-ROM.
- If you are installing to a new remote computer, you must ensure IIS FTP is installed and enabled. For details, see “To install and enable IIS FTP" on page 183
- If you are upgrading software, you must uninstall the previous version. For details, see “To uninstall a previous version" on page 183.

To install/upgrade software

1. Insert the CD-ROM into the CD-ROM drive. The CD-ROM should autostart and display the ‘Home’ page.
2. Double-click on OmniberXM Software.
3. Double–click the file Setup.exe. This launches the InstallShield wizard.
4. Follow the prompts and accept the defaults in the installation. Select a:
   - **Full Installation:** If you are installing the software on a controller PC or a remote PC that will run Demo Mode (i.e., to simulate connected test interfaces).
   - **GUI Installation:** If you are installing on a remote PC that will not run Demo Mode.
5. When the installation has finished copying files, it restarts the PC.
6. To verify that the installation was successful, log in and launch the Diagnostics Tool as described in “Step 4: Power up the System” in the Installation chapter. On the Diagnostic Tool, click Run system tests to verify that all files were installed.

To install and enable IIS FTP

File Transfer Protocol (FTP), a component of Internet Information Services (IIS), is required to download firmware to the test modules. The IIS software is factory-installed on system controllers but is not distributed on the tester CD and must be installed on your own PCs before you can do a Full Installation of the tester software.

The software might already be installed on your PC. In this case, you simply enable it — follow the procedures below to do this. If the software is not on your PC, you need the Windows CD to install it.

Windows 2000

Install IIS from the Control Panel:

1 Choose Start, Settings, Control Panel and double-click the Add/Remove Programs icon.

2 Select the Add/Remove Windows Components button, on the left hand side, to open the Windows Components Wizard dialog.

3 Select Internet Information Services (IIS) from the list. Click the Details button.

4 In the IIS dialog, select File Transfer Protocol (FTP) Server and click OK.

5 The Common Files and IIS Snap-In components will be auto-selected. Click the Next button to complete the installation.

To uninstall a previous version

1 From the **Settings** menu, select **Control Panel**.

2 Double-click the **Add/Remove Programs** icon.

3 Select **OmniBER XM**.

4 Click **Remove** or **Add/Remove** (depends on your version of Windows).

5 Repeat steps 3 and 4 for other Agilent network simulator products.

To install on remote computers

You must:

- install omniBER XM network simulator software
- enter product licenses (simply double-click the Add License desktop icon and enter your licenses)

Shortcut

If you need to install software onto multiple remote PCs, you can:

- copy all files from the CD into a temporary folder on the controller
- set up that folder for sharing (right-click the folder in Windows Explorer and click Sharing)
- remotely install the software from the controller’s hard drive (double-click Network Neighborhood or My Network Places; the tester PC; then the folder containing the unpacked software; then double-click the Setup.exe for the software)

7
System Administration

CAUTION

Network Configuration: It is recommended that you consult your network system administrator to ensure correct configuration of the network simulator on your network, and to determine any security restrictions to networking the tester.

Caution: Support for modified or non-Agilent hardware and software

Disregard any instructions in the PC User's Guide directing you to check or install components inside your PC. We cannot guarantee that the tester is compatible with other hardware, peripherals, operating systems, or software applications not purchased through Agilent. Consequently, we do not provide warranty for or support problems associated with modified or non-Agilent systems or systems with altered operating system configuration or initialization files.

Windows 2000: Different vendors provide slight variations of Windows 2000 — the instructions provided here apply to the Windows 2000 included with PCs purchased through Agilent.

System Administration

This chapter describes tasks required to configure the tester PC and is designed for those without a lot of PC administration experience and those migrating from Windows NT or FreeBSD to Windows 2000. Please also consult the Windows guide for tasks not covered here. This appendix describes how:

System Recovery

This chapter also provides basic system recovery information.

Problem	Recovery
Windows or the tester software has somehow been corrupted	If you have an existing Windows NT controller from Agilent, you may be able to use a backup partition on the PC hard disk — see "To recover from system problems" on page 198. To install the latest tester software on this partition, see Chapter 4, "Software Installation/Upgrades"
The PC hard disk has been corrupted	If you need assistance, contact Technical Support — see "To contact us" in the Installation chapter

To change the password

First, log on as Administrator. The password is preset in the factory to be blank but you might need to change it to conform to company conventions.

1 Press **Ctrl-Alt-Delete** to display the **Windows Security** dialog.

2 Click on the **Change Password** button to display the **Change Password** dialog.

3 Enter the **Old Password** (blank), then the **New Password** in both fields.

To create a user account

To install and use the OmniBER XM software a new user account must be given administrators' privileges. These are needed to, for example, set up TCP sockets. Thus, log in using the Administrator account to give new accounts the required access. Initially, there is no password for this account but if one has been set up, enter it. The rest of the procedure depends on the Windows system:

Windows 2000

1 Select Start menu -> Settings -> **Control Panel**. Double-click **Users and Passwords**. (On some Windows 2000 systems, you must double-click **Administrative Tools**, then **Computer Management**, and select the **Local Users and Groups** from the left-hand panel).

2 Select the **Advanced** tab, then click the **Advanced** button.

3 In the left-hand pane of the Local Users and Groups dialog, right-click the Users folder and select **New User**.

4 In the New User dialog, use these account values:

- User name: **<abbreviated login name>**
- Full name: **<more descriptive name for account>**
- Description: <blank>
- Password & Confirm password: **<Password>**
- Disable: User must change password at next logon
- Enable: Password never expires

5 Click the **Create** button, then click the Close button. Back on the Local Users and Groups dialog, you should see the new user in the right-hand pane. Double-click this new user entry.

6 In the Properties dialog, select the **Member Of** tab, then click the Add button.

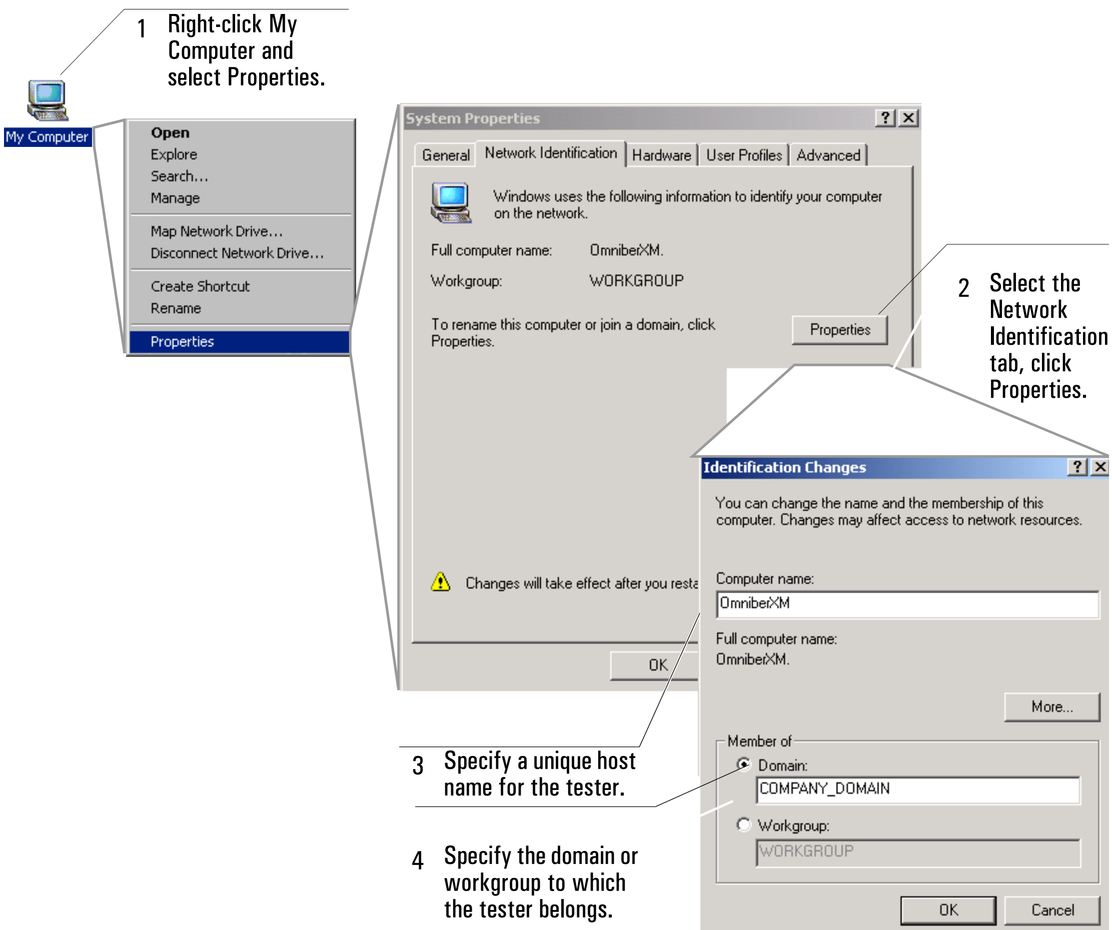
7 In the Select Groups dialog, select **Administrators** from the list at top then click the Add button.

8 Click OK twice to dismiss the two most recent dialogs.Then close the Local Users and Groups and Users and Passwords dialogs.

Log off, then log in as the new user to verify.

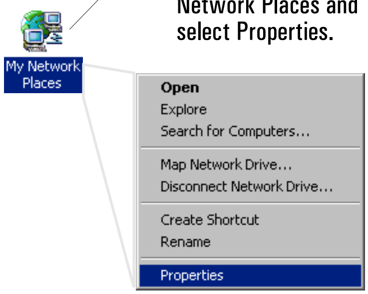
To set a PC's host name and domain

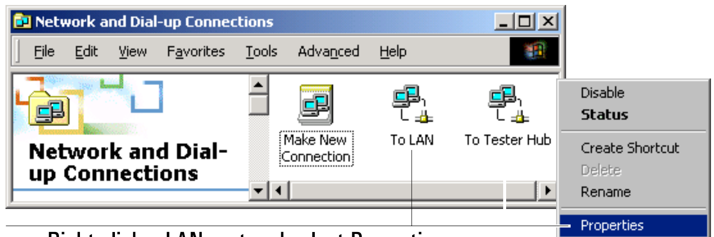
The tester's controller PC has a factory-preset host computer name but you may change it to something that is more meaningful, unique, or conforms to your company or lab's conventions for host names.



To set a PC’s IP addresses

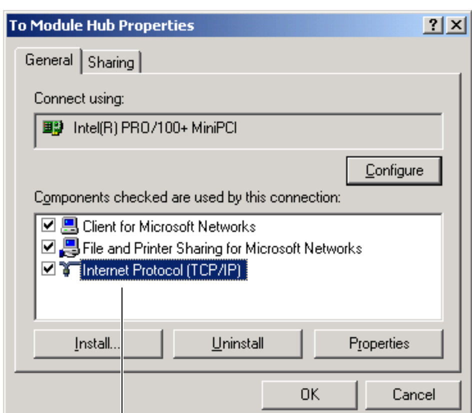
1 Right-click My Network Places and select Properties.

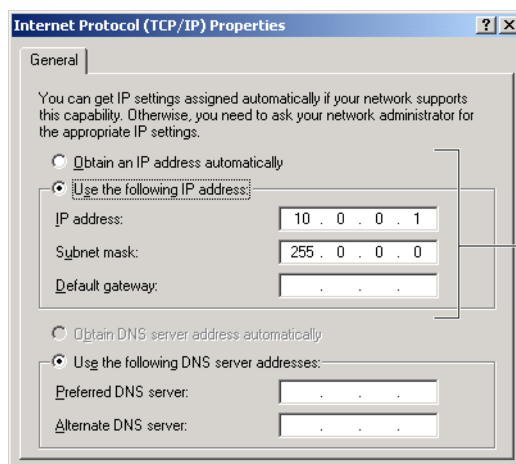




2 Right-click a LAN port and select Properties.

Important: LAN Port #1 must connect to your company LAN and Port #2 must connect to the tester switch/modules. Otherwise, you will experience communication problems.





3 Select TCP/IP, click Properties.

4 Identify the IP address the LAN port is to use.

If your network uses a DHCP server to auto-assign IP addresses, simply select Obtain an IP address automatically.

If your network does not, ask your system administrator for an IP address, subnet mask, and default gateway. Select Use the following IP address and enter them.

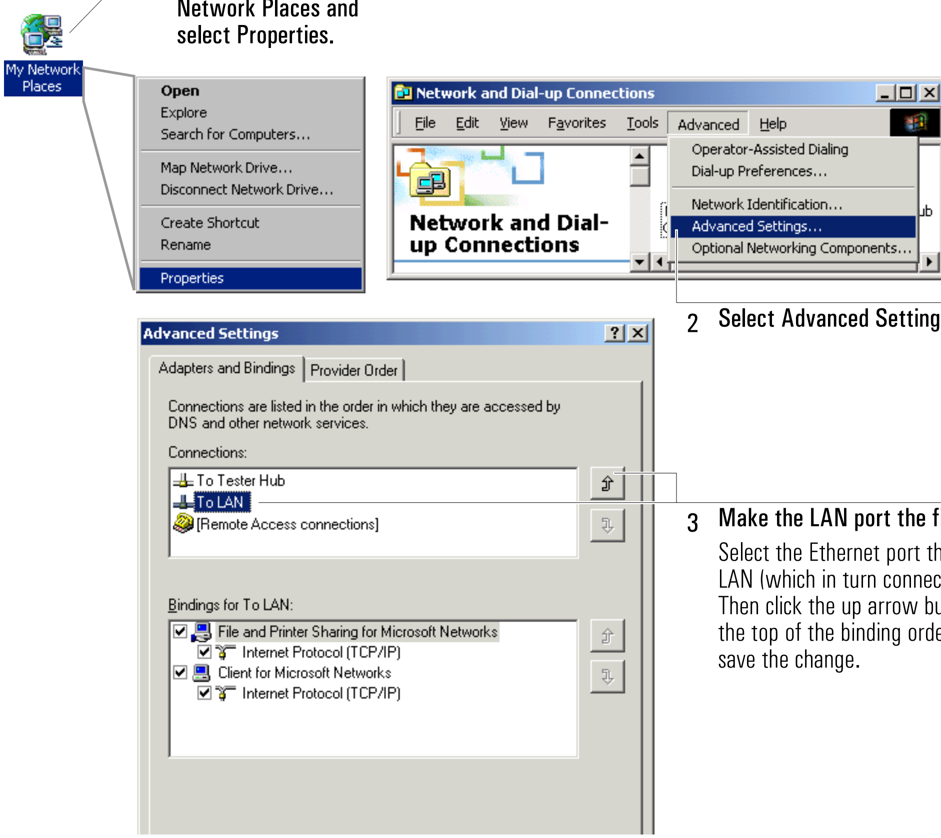
CAUTION

To enable remote clients to set up connections with the tester PC's software, the Ethernet port that connects to the LAN must be first in the network binding order. If you have set up your own PC to be a tester PC, please see the next section "To change the binding order of network ports" on page 192.

The second Ethernet port, used to connect the switch and test interfaces uses the subnet 10.0.0.1/8. You must reset this if an address in this range is already being used in your LAN. For details, please see "To change the IP address of the switch card" on page 160.

To change the binding order of network ports

On the tester PC, the Ethernet port that connects the LAN (which in turn connects remote clients) must be first in the PC's network binding order. Otherwise, remote clients will not be able to connect to the tester software. The order is configured properly on PCs from Agilent but may not be on PCs you set up as tester PCs.



1 Right-click My Network Places and select Properties.

2 Select Advanced Settings.

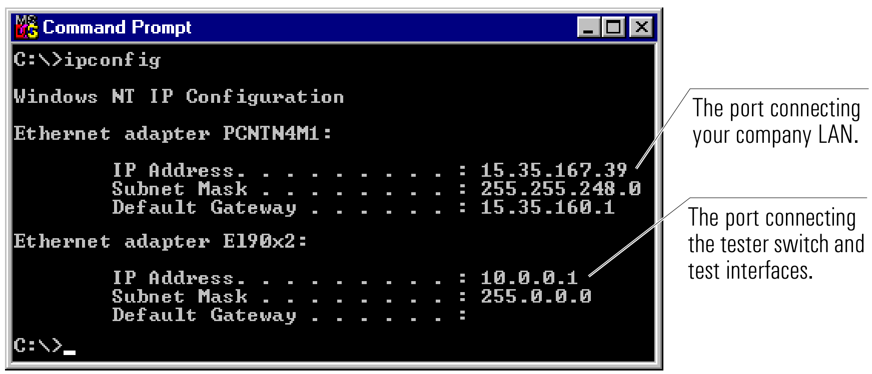
3 **Make the LAN port the first connection.**
Select the Ethernet port that connects the LAN (which in turn connects remote clients). Then click the up arrow button to move it to the top of the binding order list. Click OK to save the change.

To list a PC’s IP addresses

The fastest way to list the IP addresses currently being used by a PC’s LAN ports is through a DOS command. First launch a DOS shell:

1 Select Start > Programs > Accessories > Command Prompt.

2 Enter the command “ipconfig”:



To use the Demo mode

If you do not have test modules connected to your PC but want to simulate traffic generation and see sample statistics, you can do so operating in Demo mode. To set up the Demo mode, you must set certain environment variables.

NOTE

To use the Demo mode on a PC other than the Controller PC, you must do a Full (not GUI only) Installation of the software.

To create dummy modules:

Create the variable **AGT_DUMMY_MODULE_LIST**. This variable allows you to specify the network simulator modules the program displays.

Choose from the following module types:

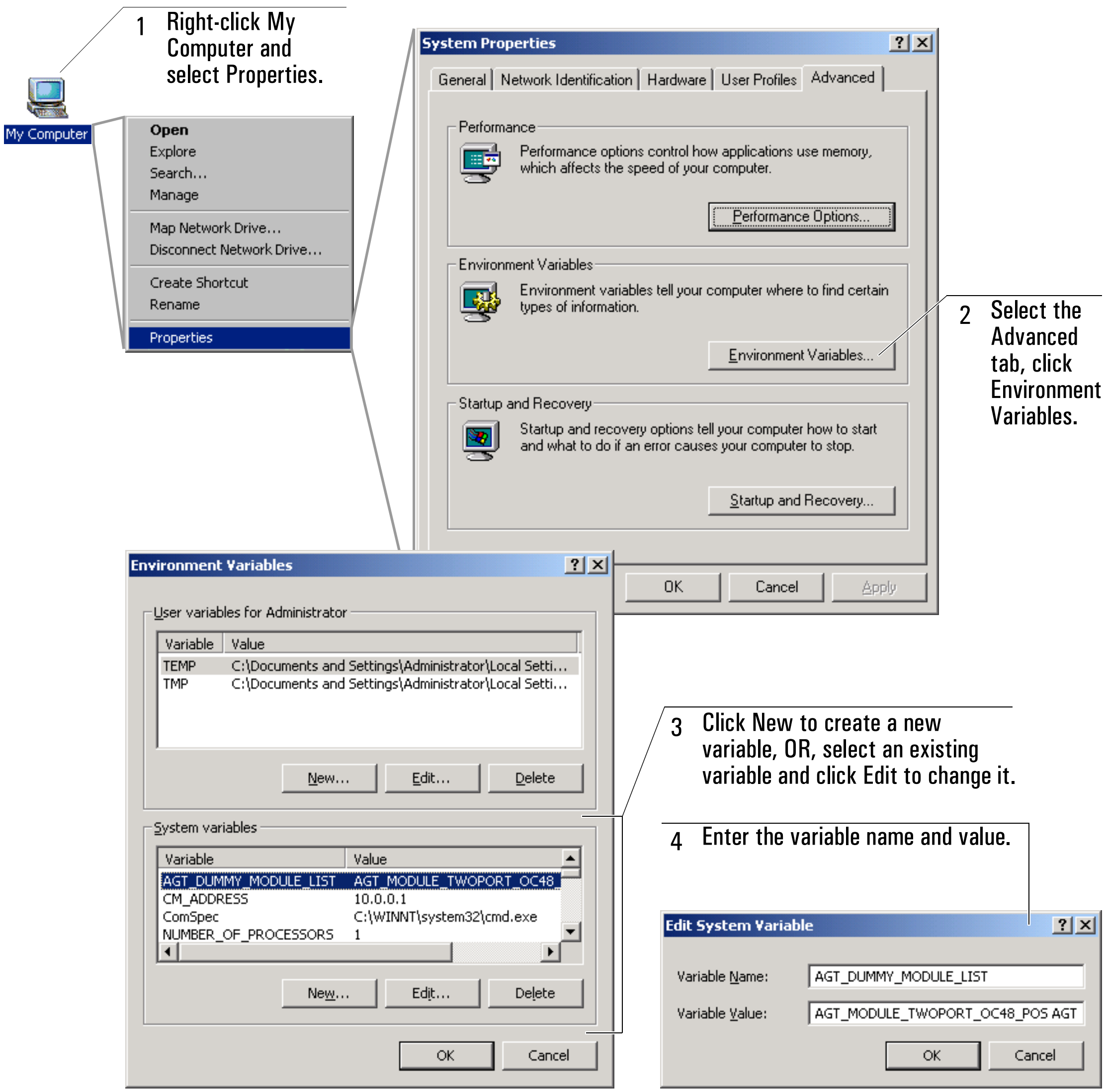
AGT_CARD_ONEPORT_OMNIBERXM_10G_SONET_1550

AGT_CARD_ONEPORT_OMNIBERXM_10G_SONET_1310

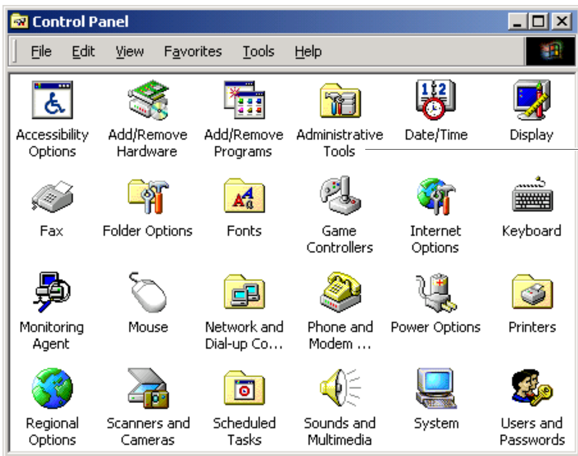
AGT_CARD_TWOPORT_OMNIBERXM_2G5_SONET_1310

AGT_CARD_TWOPORT_OMNIBERXM_2G5_SONET_1550

To set up an environment variable

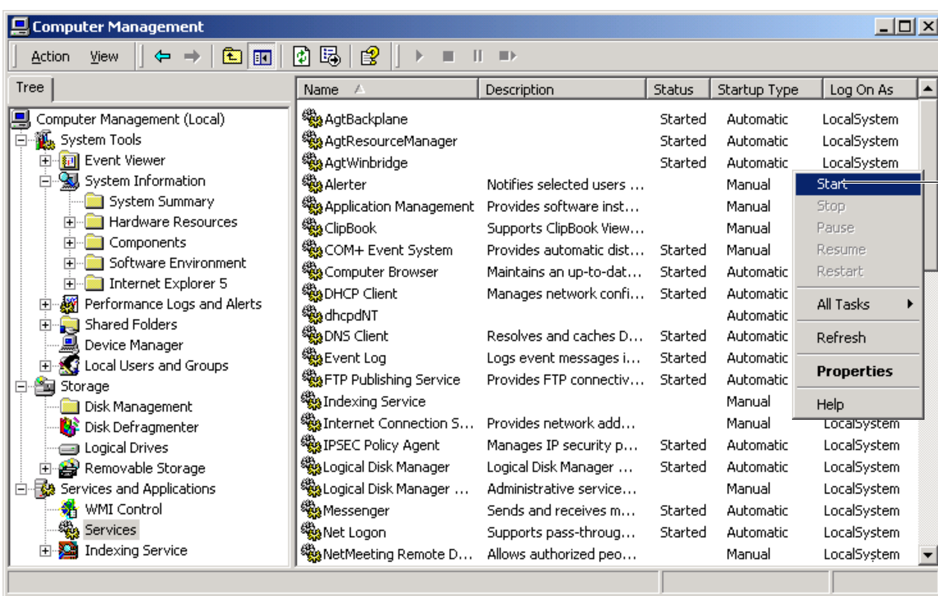


To start and stop services



1 From the Start Menu, select Settings, then Control Panel.

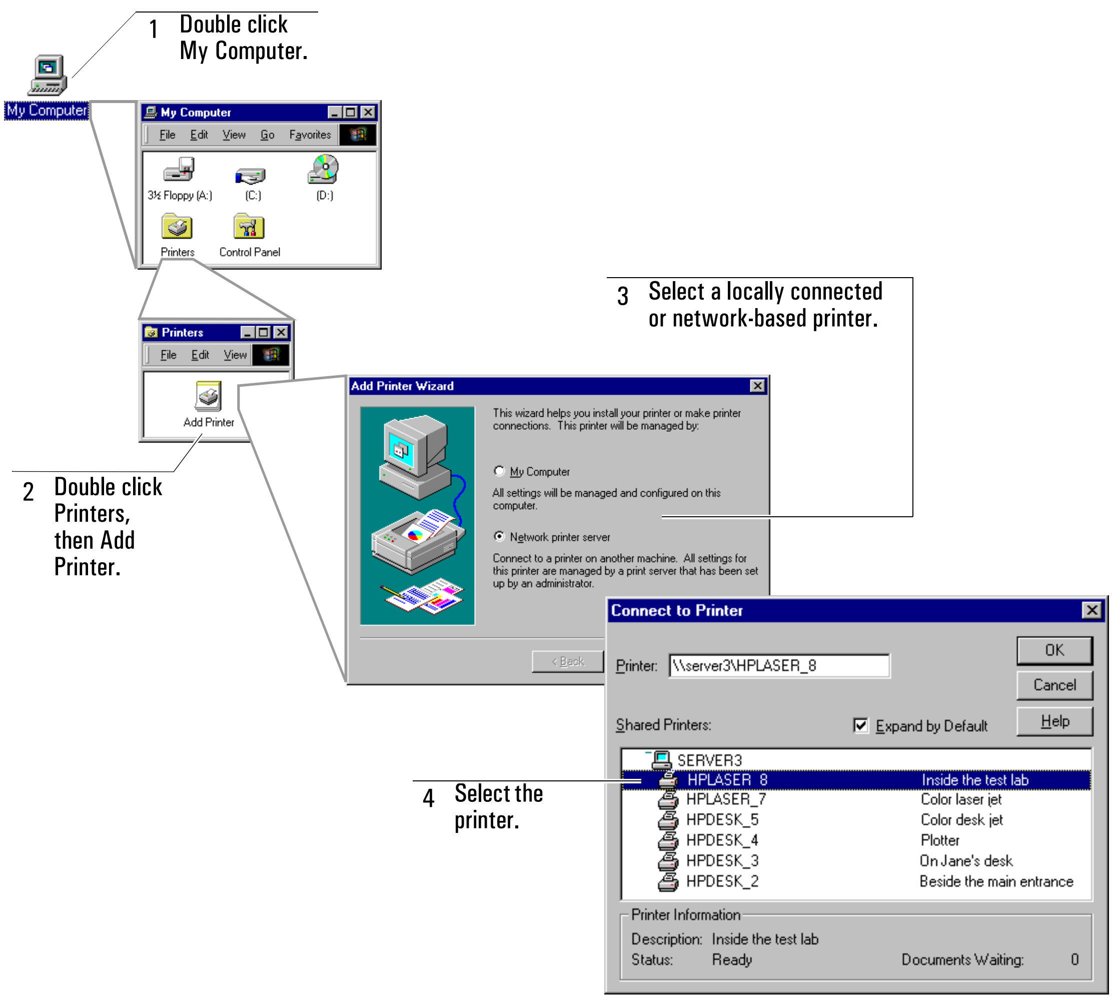
2 Double-click Administrative Tools, then Computer Management.



3 **Right-click the service and select Start/Stop.** The available selections on the menu depend on whether the service is running.

To configure the tester for printing

You might want to print and analyze test results or help information offline. You can connect a parallel printer directly to the tester or use a printer on your company LAN. Ask your system administrator about printer names.



To recover from system problems

WARNING **All data will be erased when this process begins. Back up any data before beginning recovery.**

If the Windows 2000 operating system or tester software becomes corrupted you can recover it using the OmniBER XM network simulator Recovery CD and Application CD. This will restore the network simulator system controller to the Agilent factory default state. You will have to repeat any configuration changes you have made to the controller such as IP address changes.

To use the Operating System recovery disk

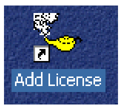
- Make sure the controller can boot from the CD-ROM drive. To do this, restart the controller and interrupt the boot process to enter ‘setup’ or ‘boot devices’. In the boot order settings, make sure the CD-ROM drive is listed before the hard disk drive. If it is not, change the order and exit setup, saving changes. If the order is correct, exit setup, discarding changes.
- Insert the CD-ROM into the drive.
- Restart the controller.
- Follow the instructions on the screen.

To install OmniBER XM Application

- Insert the OmniBER XM application CD (part number J7241-90003) into your controller. If the application does not auto-run select the drive containing the application CD, and select the file start.htm.
- To load the application select the OmniBER XM Software link.
- Follow the on screen instructions.

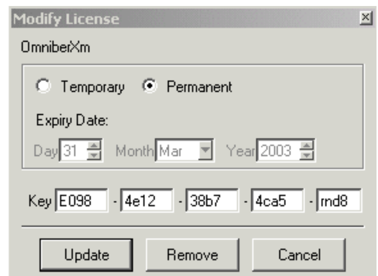
Add a License

Before you next run an OmniBER XM test session you will need to add a license. This requires entering a special license key provided by Agilent.



1 Click on the **Add License** icon on your desktop and select **OmniberXm**.

2 Select **Modify License** and choose **Permanent**.



- Enter the license key provided with your OmniBER XM system. The key shown in the figure above is for example only, it is not a valid key.
- Click on Update when finished. You can now click on the **OmniBER XM** icon on your desktop and start a new session.

8
Measurements

Avoiding Problems When Making Measurements

Bit errors can occur due to network defects (such as faulty network elements, damaged optical fiber or dust/dirt particles in the fiber connections) or problems with the test environment/setup. Follow the steps below to avoid problems when making measurements.

To avoid introducing errors when performing tests:

1. Ensure that optical fibers connecting the instrument to the network are not damaged - check that fibers have not been crimped.
2. Avoid acute bends in the fiber. Ensure that fibers only have gentle arcs.
3. If the system is left unattended for a long term test, ensure that the equipment is not in a position where people will disturb the connecting fibers.
4. Ensure that all fiber connections are clean and dirt-free. Use a fiberscope to measure the cleanliness of an (unpowered) fiber. A poorly cleaned fiber results in a drop in power. Alternatively, use a power meter (e.g. the instrument’s internal power meter) to measure the power at the end of a fiber, the other end of which is connected to the network.
5. Before connection is made, always clean the connector ferrule tip with acetone or alcohol using a cotton swab. Dry the connector with compressed air. Failure to maintain cleanliness of connectors is liable to cause excessive insertion loss.

APS Measurements

Definition

In the XM it is the time from the first error in a burst to the last error. The last error is considered to have happened after an error-free 'Guard Time' has elapsed. For a more detailed description of Service Disruption and the testing methods refer to the Telecoms Chapter in this guide.

Service Disruption with PRBS or Word payloads

When a PRBS payload is used, the service disruption time can be measured in all selected channels simultaneously. Service disruption measurements are also available with 16-bit word payloads but it is not advisable to use an all-ones pattern because most network equipment will send all-ones when a switchover is in progress, and this will emulate a good payload.

Result Updates

Results are available on a per-second basis. A result is reported in the 1 second interval during which the service disruption ends. The XM display gives results for each channel of Last Time and Max Time.

Last Time The duration of the longest error burst detected in each 1-second interval during the test.

Count Displays the number of disruptions measured since the start of gating.

Max Time The duration of the longest error burst detected in the current measurement (gating) period.

To check switching thresholds by injecting errors and alarms

The following procedure assumes that you have already set up the network simulator to run a test session.

1 Connect the XM **OPTICAL OUT** port via a suitable optical cable and attenuator to the device under test (DUT). Connect the output of the DUT to the XM **OPTICAL IN** port. Be aware of the safety factors involved before connecting/disconnecting optical cables, see “Do not look into a Transmit laser." on page 59.

2 Select the **Add Ports** button on the Toolbar and select the modules and ports you intend to use for this measurement in the **Port Selection** window.

3 Switch **ON** the lasers for the ports you are using.

4 Select the **Physical** tab and set up the transmitter and receiver **Signal Standard** and **Rate**.

5 Set the transmitter **Mode Type** to **Terminal**.

6 Select a **Clock Source**.

7 Select the **Channels Setup** tab. You can do one of the following:

- If you have already setup a structured signal in the device under test, you can select **Auto-Discover.** This configures the XM receiver channel setup to that of the received signal from the DUT. Now copy the Receiver Channel Setup to the Transmitter (select **<-Copy**).
  OR
- Select the Transmitter **Advanced** button and use the **Advanced Channel Configuration** edit buttons to set up channels as required. Select **OK** when finished. Now copy the Transmitter channel setup to the Receiver (select **Copy ->**).

8 Select the **Pattern** tab and set the transmitter to generate a PRBS.

9 Select the **Gating Setup** button on the Toolbar and select **Continuous**, then OK.

To view service disruption time

10 Select the **SRV-DIS** tab.

Set up Guard Time

11 The guard time which is used to define the end of an error burst can be set between 100ms and 1600ms in 1ms steps. You can define it **for All Ports** in a session or for a **Selected port only (**select the **On selected port only** box).

12 Select the Guard Time **Edit** button and enter the required value.

Set Warning Threshold

You can set a Warning Threshold - any service disruption times equal to or above your pre-set threshold will be flagged and displayed red in color in the Port and STS Path/HO Path Max Time and Last Time columns.

13 If required set a **Warning Threshold** value.

14 Start a measurement - select the **Gating: Start** button.

15 Verify error-free reception of the PRBS test pattern (select the **Overview** tab - Chassis View and check for a red border or channels indicating errors).

16 Invoke a protection switch on a working section of the equipment under test that is transporting the PRBS.

17 Select the **SRV-DIS** tab, view the list of ports in your session and check if the **Max Time** field gives a value for any port.

18 Select any port that has **SRV-DIS** flagged and view the **Max Time**, **Last Time and Count** and results in the channel list window. You can use the Port channel mask to quickly examine the results for a particular channel.

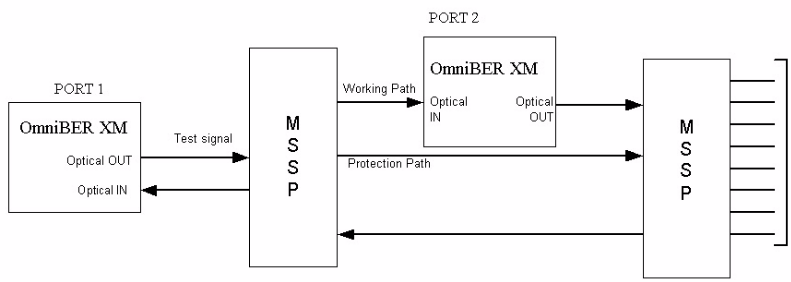
19 Select **Gating: Stop** when you wish to end the measurement.

NOTE

You can deliberately invoke a protection switch in equipment under test carrying a PRBS by generating a burst of errors. You can simulate a node failure by removing the Laser power from the transmission element.

APS Measurements on multiple STS/AU channels (J7244A/45A Option 010)

This test involves using one pair of ports to stimulate the system under test with a test pattern and monitor the system output. An other set of ports is used to inject errors/alarms in Thru Mode to force Path Protection Switch Events.



To check switching thresholds by injecting STS/HO path errors

1 Connect **Port** 1 and **Port 2** of the XM as shown in the diagram above. Be aware of the safety factors involved before connecting/disconnecting optical cables. See “Do not look into a Transmit laser." on page 59.

2 Select the **Add Port** button on the Toolbar and select the modules and ports you intend to use for this measurement.

3 Switch **ON** the laser for the ports you are using.

Port 1 set up.

4 Select the **Port** you are connecting as per **Port 1** in the diagram.

5 Select the **Physical** tab and set up the Transmitter **Signal Standard** and **Rate**. Set the **Mode Type** to **Terminal** and **VT Mode** to **On**.

6 Set the Receiver Interface **Signal Standard** and **Rate** as per the transmitter settings, and set **VT Mode** to **On**.

7 Select the **Channels** tab. Check on the **Transmitter** channels display that all VT channels are set to VT1.5 (they are brown in color, VT2 channels are color coded purple). If necessary right click on a channel to change selection. For SDH operation set TUs to TU-11.

8 Select the **Mappings** button and set the **VT1.5/TU-11** Tx and Rx Mapping as required for your test. Click on the Tx and Rx Mapping fields to enable the drop down menu's. Click on **OK** when finished.

Port 2 set up

9 Ensure the working path of the system under test is connected to the Receiver **Optical IN** port of the Port configured as per **Port 2** in the diagram.

10 In the Port display (top left) select the **Port** you are connecting as shown for **Port 2** in the hook-up diagram.

11 Select the **Physical** tab and set the Transmitter to **Thru** Mode and the **Thru Mode Type** to **Intrusive**.

12 Set the Receiver **Signal Standard** and **Rate** to those you set previously in Step 6 for Port 1. Ensure **VT Mode** is set to **On**.

13 Select the **Channels** tab and click on the **Auto-Discover** button to configure the Receiver to the incoming signal.

14 Select the **Gating Setup** button on the Toolbar and select **Continuous**.

▶ To view service disruption time

15 Select the **SRV-DIS** tab.

Set up Guard Time

16 The guard time which is used to define the end of an error burst can be set between 100ms and 1600ms in 1ms steps. You can define it **for All Ports** in a session or for a **Selected port only (**select the **On selected port only** box).

17 Select the Port you configured as per Port 1 in the hook-up diagram.

18 Select the Guard Time **Edit** button and enter the required value.

Set Warning Threshold

You can set a Warning Threshold - any channels which have a service disruption time equal to or above your pre-set threshold will be displayed red in color in the Port mask and in the VT/LO Path Max Time and Last Time columns.

19 Enter a **Warning Threshold** for port 1 if required.

20 Start a measurement - select the **Gating: Start** button.

21 Verify error-free reception of the PRBS test pattern (select the **Overview** tab - Chassis View and check for a red border or channels indicating errors).

Add Errors/Alarms

- Invoke a protection switch on a working section of the equipment under test that is transporting the PRBS or use the XM to inject errors/alarms to the DUT as follows:

22 Select the Port you have configured for **Thru Mode** operation.

23 Select the **E+A Inject** tab.

24 Add Pattern Bit errors at a high enough rate to invoke a path protection switch event. Use the Path Errors and Alarms Mask to select the channels to be errored.

25 Select the **SRV-DIS** tab and view the list of ports in your session and check if the **SRV-DIS** field indicates **Yes** for any port.

26 Select any port that has **SRV-DIS** flagged and view the **Max Time**, **Last Time** and **Count** results in the channel list window. You can use the Port channel mask to quickly examine the results for a particular channel.

27 Select **Gating: Stop** when you wish to end the measurement.

Detecting Path Routing Faults

The **J1 Connectivity Test** detects path routing faults, e.g. following a protection switch event.

The user must first configure a set of reference "**Expected**" J1 trace messages, then capture the received "**Measured**" J1 Trace Messages. The XM then compares the **Expected J1** messages with the captured (**Measured**) messages and produces a result indicating whether there are any received J1's in error (mismatched). Use the following procedure to monitor J1 Path routing.

To monitor J1 path routing

The following procedure assumes that you have already set up the network simulator to run a test session.

1. Connect the XM **OPTICAL OUT** port via a suitable optical cable and attenuator to the device under test (DUT). Connect the output of the DUT to the XM **OPTICAL IN** port. Be aware of the safety factors involved before connecting/disconnecting optical cables, see "Do not look into a Transmit laser." on page 59.
2. Select the **Add Port**s button on the Toolbar and select the modules and ports you intend to use for this measurement.
3. Switch **ON** the laser for the modules you are using.
4. Select the **Connectivity** tab (click the → button at the top right of the Results window if J1 Trace is not visible).
5. The default condition is that all ports in your current session are included in the J1 Path Trace test. If you wish to perform the test on only one port, select the port, then click in the **On selected port only** box.

Set up expected J1's

6. You can set up the expected J1 trace messages either by manually entering a value, by copying the values from the signal transmitted from a port, or by copying the values from the signal at the receiver input. Use the **Copy Expected Messages From** options to copy from a selected **Tx** port or from the **Current Rx**.
7. If you choose to copy values from the signals at the transmit or receive ports, select the **Copy Now** button.

8 If you wish to enter a trace message manually, select a **Channel** then the **Expected J1 Path Trace** field and enter your message. To change the length of the J1 byte double click in the **Length** field for the required channel and select from the drop down menu.

Compare J1's

9 Check you have selected the ports to be included in the test (see step 2).

10 Select the **Start Test** button. The **J1 Path Trace** test runs through a compare test and displays in the Port **STS Mismatches** column the number of mismatches found for each port, and also gives channel results for (pass or fail) for the currently selected port.
Expected and **Measured** J1 values for the currently selected port are displayed.
The **Port** mask highlights in red any channels which have a J1 mismatch between the expected and received J1's.
If you click on an errored (red) channel, the channel list changes to highlight that channel allowing you to quickly view results.

Detecting VT/LO Path Routing Faults (J7244A/45A Option 010)

The **J2** byte **c**onnectivity test detects Sonet VT path trace routing faults, while both **J1** and **J2** can be used to detect SDH LO path trace routing faults, e.g. following a protection switch event.

The procedure is to first configure a set of reference “**Expected**” Path Trace messages, then capture the received “**Measured**” Trace Messages. The XM then compares the **Expected** messages with the captured (**Measured**) messages and produces a result indicating whether there are any received messages in error (mismatched). Use the following procedure to monitor path trace routing.

To monitor VT/LO path trace routing

The following procedure assumes that you have already set up the XM to run a test session.

1 Connect the XM **OPTICAL OUT** port via a suitable optical cable and attenuator to the device under test (DUT). Connect the output of the DUT to the XM **OPTICAL IN** port. Be aware of the safety factors involved before connecting/disconnecting optical cables, see “Do not look into a Transmit laser." on page 59.

2 Select the **Add Port** button on the Toolbar and select the modules and ports you intend to use for this measurement.

3 Switch **ON** the laser for the modules you are using.

4 Select the **Physical** tab and ensure the Transmitter and Receiver **VT/TU Mode** selection is set to **On**.

5 Select the **VT-POH/LO-POH** tab and view the current Transmitter J2 Path Trace Message, edit the message if required.

Monitor J2 Path Trace Message

6 Select the **Connectivity** tab (click the → button at the top right of the display if you cannot see the Connectivity tab).

7 The default condition is that all ports in your current session are included in the Path Trace test. If you wish to perform the test on only one port, select the port, then click in the **On selected port only** box.

Set up expected Path Trace Message’s

8 You can set up the expected path trace message's either by manually entering a value, by copying the values from the signal transmitted from a port, or by copying the values from the signal at the receiver input. Use the **Copy Expected Messages From** options to copy from a selected **Tx** port or from the **Current Rx**.

9 If you choose to copy values from the signals at the transmit or receive ports, select the **Copy Now** button.

10 If you wish to enter a trace message manually, select a **VT Path** then the **Expected Path Trace** field and enter your message.
Note: If you have configured the XM Tx/Rx interface to SDH with a TU-3 within an AU-4 the byte used for path trace routing is J1 which can be set to 16 or 64 byte length. To change the length of the J1 byte double click in the **Length** field for the required channel and select from the drop down menu.

Compare Path Trace Message's

11 Check you have selected the ports to be included in the test (see step 7). Select the **Start Test** button. The **Path Trace** test runs through a compare test and displays in the Port **Mismatches** column the number of mismatches found for each port, and also gives channel results for (pass or fail for the currently selected port). Expected and Measured J1/J2 values for the currently selected port are displayed.
The **Port** mask highlights in red any channels which have a mismatch between the expected and received J1/J2 byte's.
If you click on an errored (red) channel, the channel list changes to highlight that channel allowing you to quickly view results.

Connectivity Port Mask Color Scheme

If there have been no connectivity tests performed (the **Result** column reads **Not Tested**) the Port mask is light grey in color. This changes to a darker grey when a test is performed. Any errored channels are shown red - use the mask zoom facility to better view channels.

Making a BER Measurement

The procedure given here describes how to start a session, set up the Transmitter and Receiver interface and channel configuration; set up a measurement period; add errors/alarms to the transmitted signal and view the results.

▶ To start a session

1. Connect the XM **OPTICAL OUT** port(s) via attenuator(s) to the device under test (DUT). Connect the output from the DUT to the XM **OPTICAL IN** port(s).
2. Start a session by double clicking on the **Agilent XM** icon (if not already in a session) on your Controller display.
3. Select **Create a new session** and click on **OK**.
4. In the Port Selection window (top left) click on the **Add Ports** icon and select the ports required for the test session.
5. Click on **OK**.

▶ To configure the Transmitter interface

6. On the XM **Setup for Port** window select the **Physical** tab.
7. Set the **Signal Standard** to **SONET** or **SDH** and select a **Signal Rate** (if applicable).
8. Set the **Mode Type** to **Terminal**.
9. Switch the **Laser** to **On**.
10. Set the **Clock Source** to **Internal (Global)**.

▶ To Configure the Receiver interface

11. Set the Receiver **Signal Standard** as per the Transmitter selection. Also set the **Signal Rate** if applicable.
12. Check that the Optical Power Indicator displays a received power level within the operable BER measurement range.

Channels Set up

13 Select the **Channels** tab.

14 Click on the **Advanced** button and use the **Advanced Channel Configuration** dialog edit keys to set up the transmitter channels. Note that the **Delete** button deletes the channel type at the end of the list and substitutes it with STS-1's (SONET) or AU-3's (SDH).

15 Click **OK** when finished channel setup.

16 Double clicking on a channel will set it to **Selected** or **Unselected** depending on its current setting. Measurements are not made on channels that are set to Unselected (the channel(s) that will be changed are shown in the system highlight color (which is blue).

17 Click on the **Copy ->** button to copy the Transmitter channel settings to the Receiver.

To set up payload pattern

18 Select the **Pattern** tab.

19 Set the payload pattern for each of the Transmitter channels. Right click on your mouse to display the pattern menu. Double clicking on a selected channel alternates the pattern selection between:
For Tx - PRBS23, PRBS23-INV and Word, and for Rx -PRBS23, PRBS23-INV, Word and Live.

20 Set up the Receiver channels to have identical payloads to the Transmitter. Any differences will result in errors - visible if you select the **Overview** or **E+A** tabs on the Results window (top right of display). Click on the Pattern **Copy ->** button to copy the Transmitter pattern settings to the Receiver.
Note: The **Copy** buttons on the **Channels** setup and **Pattern** tabs copy both the structure and the pattern (i.e. both buttons perform the same task).

Switch off any pre-configured errors and alarms

21 Select the **E+A Inject** tab.

22 Ensure the **Error Rate** and **Alarm** buttons are switched off. If any Errors/Alarms are being generated they can be seen by selecting the **E+A** tab in the Results display, or checking the **Port** status bar for an error or alarm indication in the **Inject** column.

Set Section Overhead Bytes and J0 Trace Message

23 Select the **TOH/SOH** tab.

24 You can set all the bytes to a their default condition by selecting **Default All Bytes** or select the **Edit K1K2** button to set up K1,K2 bytes, and the **Advanced** button to set up Section Overhead bytes.

25 Select a **16** or **64 byte J0-Section Trace Message**. Set to a default message by clicking on the **Default Message** button or enter your own message.

Set POH bytes and J1 Section Trace Message

26 Click the **STS-POH/HO-POH** tab.

27 Set up the Path Overhead bytes and J1 Section Trace message as required or select **Default All Bytes** and **Default Message** to set all bytes to their default condition.

Set up Gating period

28 Click on the **Gating Setup** button (on Toolbar at top of display).

29 Set the measurement **Run** period to **Once**, also set the **Test Duration**.

30 Click **OK** when finished.

Check Results window for any errors present

Select the **E+A** results tab. The channel setup for the selected port will be shown in the Port mask.
White is a correct signal, pink is a historical error and red is a current error. In the Port and Channel results display green bullets indicate a correct state, red an error and pink historical errors.
Note: White is the system window default color.
Selecting the **Overview** tab will also give you an indication of the presence of results.

31 Click on the **Clear** icon on the Toolbar to clear any historical errors. If there are any channels still shown red determine the cause. Check the errors and alarms being received and reconfigure the XM or DUT appropriately.

Configure XM to generate errors

32 In the **Setup for Port** window (bottom left) select the **E+A Inject** tab.

33 Select the **Type** of errors you wish to add and also the **Rate**. You can use the **Path Errors and Alarms Mask** to select which Channels you wish to error. Double click on a Channel to turn it off or on (if already off). Channels not selected for error/alarm inject are shown white in color.

34 Select the **Add Errors Mode - Timed Burst** or **Manual**. If you selected **Timed Burst** also set up the **Timed Burst Parameters**.

Select Statistics to be displayed

35 On the XM Results window select the **Counts** tab. The **Port** mask will indicate the presence of errors. If only Transport errors are present only the outside border of the Port mask is shown red. If Path errors are present then both the outside border and the errored channels are shown red.

36 Click on the **Select Statistics** button.

37 Under **Transport** Statistics and **STS Path/HO Path** Statistics click on **Error Counts and Ratios** and **Alarm Seconds** and select the type of measurements you wish displayed in the Results window.

38 Click **OK** when finished.

Start a measurement period

39 Check that there are no errors present - the Port mask should be completely white (no red areas).

40 **Add errors:** In the Setup for Port window (bottom left), select the **E+E Inject** tab and set the **Error Rate** button to **On** to inject the type of errors already setup in steps 32-34 of this procedure.

41 Click on the **Gating Start** button.

42 Observe the error results accumulating for the errored channels in the **Counts** results display.

43 Click on the **Gating Stop** button to end the measurement or wait until the end of any preset gating period.

NOTE Error results are Cumulative over the entire measurement period. Use a timed gating period (Once) to ensure that a known fixed transmitted error rate is measured correctly in the XM receiver.

Making a BER measurement on VT/TU channels (J7244A/45A Option 010)

The procedure given here describes how to start a session, set up the Transmitter and Receiver interface and channel configuration; set up a measurement period; add errors/alarms to the transmitted signal and view the results.

To start a session

1 Connect the XM **OPTICAL OUT** port(s) via attenuator(s) to the device under test (DUT). Connect the output from the DUT to the XM **OPTICAL IN** port(s).

2 Start a session by double clicking on the **OmniBER XM** icon (if not already in a session) on your Controller display.

3 Select **Create a new session** and click on **OK**.

4 In the Port Selection window (top left) click on the **Add Ports** icon and select the modules and ports required for the test session.

5 Click on **OK**.

To configure the Transmitter interface

6 From the list of ports you have chosen select a port to configure.

7 On the XM **Setup for Port** window select the **Physical** tab.

8 Set the **Signal Standard** to **SONET** or **SDH** and select a **Signal Rate** (if applicable).

9 Switch the **Laser** to **On**.

10 Set the **Mode** to **Terminal**.

VT/TU Mode Operation

If your XM supports VT/TU operation set the Transmitter **VT/TU Mode** selection to **On**.

11 Set the **Clock Source** to **Internal (Global)**.

To Configure the Receiver interface

12 Set the Receiver **Signal Standard** as per the Transmitter selection. Also set the **Signal Rate** if applicable. Set **VT/TU Mode** to **On**.

13 Check that the Optical Power Indicator displays a received power level within the operable BER measurement range.

Channels Set up

14 Select the **Channels** tab.

15 Click on the **Advanced** button and use the **Advanced Channel Configuration** dialog edit keys to set up the VT/TU channels -or- position the cursor over a channel, right click your mouse, then choose from the options given in the pop-up menu.

16 Double clicking on a channel will set it to **Selected** or **Unselected** depending on its current setting. Measurements are not made on channels that are set to Unselected (they are shown white in color). TU-12/VT 2’s are colored purple and TU-11/VT1.5’s a shade of Brown, TU-3’s are shown in a solid orange color.

17 Click on the **Copy** → button to copy the Transmitter channel settings to the Receiver.

To set up payload pattern

18 Select the **Pattern** tab.

19 Set the payload pattern for each of the Transmitter channels. Right click on your mouse to display the pattern menu. Double clicking on a selected channel alternates the pattern selection between:
For Tx - PRBS23, PRBS23-INV and Word, and for Rx -PRBS23, PRBS23-INV, Word and Live. Selecting the zoom icon at the top right corner of the Transmitter Pattern display gives a larger display, making it easier to select/set channels. You can also use the keyboard spacebar to toggle pattern selections when you position the cursor over the selected channel.

20 Set up the Receiver channels to have identical payloads to the Transmitter. Any differences will result in errors - visible if you select the **Overview** or **E+A** tabs on the Results window (top right of display). Click on the **Copy ->** button to copy the Transmitter pattern settings to the Receiver.

Note: The Copy buttons on the **Channels** and **Pattern** tabs copy both the structure and the pattern (i.e. both buttons perform the same task).

Switch off any pre-configured errors and alarms

21 Select the **E+A Inject** tab.

22 Ensure the **Error Rate** and **Alarm** buttons are switched off. If any Errors/Alarms are being generated the port concerned will have an **E** inject icon (syringe with red tip) in the **Inject** column.

Set Section Overhead Bytes and J0 Trace Message

23 Select the **SOH/TOH** tab.

24 You can set all the bytes to a their default condition by selecting **Default All Bytes** or select the **Edit K1K2** button to set up K1,K2 bytes, or the **Advanced** button to set up Section Overhead bytes.

25 Select a **16** or **64 byte** J0 Section Trace Message. Set to a default message by clicking on the **Default Message** button or enter your own message.

Set POH bytes and J1 Section Trace Message

26 Select the **STS POH/HO POH** tab.

27 Set up the Path Overhead bytes and J1 Path Trace Message as required or select **Default All Bytes** and **Default Message** to set all bytes to their default condition.

Set up Gating period

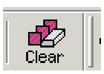
28 Click on the **Gating Setup** button (on Toolbar at top of display).

29 Set the measurement **Run** period to **Once**, also set the **Test Duration**.

30 Click **OK** when finished.

▶ Check Results window for any errors present

31 Select the **E+A** results tab and check for any results present. The channel setup for the selected module will be shown in the port mask. Note that in the mask, channels shown white indicate a correct signal, pink is a historical error and red is a current error. In the Port and Channel results display green bullets indicate a correct state, red an error and pink historical errors. Note white is the system window default color.



32 Click on the **Clear** icon on the Toolbar to clear any historical errors. If there are any channels still shown red determine the cause. Check the errors and alarms being received and reconfigure the XM or DUT appropriately.

▶ Configure XM to generate errors

33 In the **Setup for Port** window select the **E+A Inject** tab.

34 Select the **Type** of errors you wish to add and also the **Rate**. You can use the **Path Errors and Alarms Mask** to select which Channels/Paths you wish to error. Double click on a Channel/Path to turn it off (channels/paths are shown white when off).

▶ Select Statistics to be displayed

35 On the XM Results window select the **Counts** tab. The **Port** mask will indicate the presence of errors. If only Transport errors are present only the outside border of the Port mask is shown red. If Path errors are present then both the outside border and the errored channels are shown red.

36 Click on the **Select Statistics** button.

37 Click on the **VT Path** tab and select the type of measurements you wish displayed in the Results window. You can also display Transport or STS Path results.

38 Click **OK** when finished.

▶ Start a measurement period

39 Check that there are no errors present - the Port mask should be completely white (no red areas).

40 Add errors: Select the **E+E Inject** tab and set the **Error Rate** button to **On** to inject the type of errors already setup.

41 Click on the **Gating Start** button.

42 Observe the error results accumulating for the errored channels in the **Counts** results display.

43 Click on the **Gating Stop** button to end the measurement or wait until the end of any preset gating period.

NOTE Error results are Cumulative over the entire measurement period. Use a timed gating period (Once) to ensure that a known fixed transmitted error rate is measured correctly in the XM receiver.

9
Specifications

Specifications

The specifications listed here are only a subset of the full OmniBER XM specifications. Please refer to the OmniBER XM web site for a list of complete specifications given in the J7241A/42A and J7244A/45A Technical Datasheets at:

www.Agilent.com/find/OmniBERXM

Modules

10 Gb/s Transceiver Modules

Product	Description
J7241A	OC-192/STM-64 Transceiver module: single port (1 x Tx/Rx); 1550nm.
J7242A	OC-192/STM-64 Transceiver module: single port (1 x Tx/Rx); 1310nm.

2.5 Gb/s (and below) Multi-Rate Transceiver Modules

Product	Description
J7244A-002	OC-48/STM-16 multi-rate transceiver module: includes OC-12/STM-4 and OC-3/STM-1 capability; dual port (2 x Tx/Rx); 1550nm.
J7244A-010	Adds multi-channel VT/TU calability.
J7245A-002	OC-48/STM-16 multi-rate transceiver module: includes OC-12/STM-4 and OC-3/STM-1 capability; dual port (2 x Tx/Rx); 1310nm.
J7245A-010	Adds multi-channel VT/TU calability

Calibration

We recommend a 2 year calibration cycle. Contact Agilent Technologies for assistance. See “To Contact us" on page 17.

Electrical

Power Requirements	AC Voltage	100 - 120V 200 - 240V	nominal
	Frequency	50/ 60 Hz	
	Power	230W typical	630W per chassis maximum

LASER

For your protection, review all laser information given in this manual before installing or using the instrument.

CLASS 1
LASER PRODUCT

This marking indicates that the radiant energy present in the instrument is non-hazardous. The product is a Class 1 laser product in Europe and complies with the standard IEC 60825-1:1993 + A1:1997 + A2:2001 / EN 60825-1:1993/A2:2001. Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001.

WARNING To prevent exposure to hazardous laser radiation, this product should not be disassembled. Service personnel should not attempt to disassemble or repair the laser device incorporated within this product.

WARNING Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Mechanical

J7241A and J7242A

Size	Width	187mm
	Height	29 mm
	Length	287 mm
Weight		1.7 kg

J7244A and J7245A

Size	Width	187mm
	Height	29 mm
	Length	287 mm
Weight		1.44 kg

J7263A

Size	Width	454 mm
	Height	889 mm
	Length	490 mm
Weight		9.1 kg

E7912A

Size	Width	300 mm
	Height	110 mm
	Length	490 mm
Weight		5.1 kg

Environmental

Note: For indoor use only.

Use Conditions	Operating Temperature	5° to 40°C
	Humidity	Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.
	Installation Category	II
	Pollution Degree	2
	Altitude	Up to 2000 m.

German Noise Declaration

LpA<70dB
am Arbeitsplatz (operator position)
normaler Betrieb (normal position)
nach DIN 45635 pt.19 (per ISO 7779)

Cleaning

To clean the OmniBER XM, use a soft, dry cloth to clean the front-panel and side covers.

Connectors

J7241/42A Modules

Optical Out

Wavelength: Tx 1550 nm or 1310 nm, Rx 1280 to 1580 nm.

Fiber power output: 1550nm - Min -5 dBm, max -1 dBm (single mode)
1310nm - Min -6dBm, max -1dBm (single mode).

Tx spectral width: < 3 nm.

Extinction ratio (min): 6dB at 1310nm, 8.2dB at 1550nm.

Min sensitivity: –11dBm at 1310nm, -14dBm at 1550nm.

Tx clock sync: Tx clock can be synchronized to either BITS, MTS, or internal 10 M through the XM chassis, or to recovered clock.

Tx clock performance: Frequency: ± 0.2 ppm;

Stability: ± 1.0 ppm/year max.

Tx Eye clock The eye clock frequency is set to the line rate divided by 16 (e.g. 622.08 MHz for 9.95 GHz SONET/SDH line rates).

Optical In Max input power: -1dBm.

Max input power damage level: + 3 dBm.

Optical pulse mask: SDH - S-64.2, S64.3 (ITU-T G.691)
SONET - OC-192 (reach to VSR-1)

J7244A/45A Modules

Optical Out Wavelength: Tx 1550 nm or 1310 nm, Rx 1250 to 1600 nm.

Fiber power output: 1310nm - Min -5 dBm, max 0 dBm (single mode)
1550nm - Min -2 dBm, max +3dBm (single mode).

Tx spectral width: <1 nm at -20dB.

Extinction ratio (min): 8.2 dB.

Optical eye mask: Complient with Telecordia GR-253 and ITU-T G.957

Tx clock sync: Tx clock can be synchronized to either BITS, MTS, or internal 10 M through the XM chassis, or to recovered clock.

Tx clock performance: Frequency: ± 0.1 ppm;

Stability: ± 1.0 ppm/year max.

Tx Eye clock The eye clock frequency is set to a quarter of the line rate (e.g. 622.08 MHz for 2.48832GHz SONET/SDH line rates).

Optical In Min sensitivity: OC-3 -24 dBm; OC-12 -24 dBm; OC-48 -20 dBm.

Max input power: -2.5 dBm.

Max input power damage level: + 4 dBm.

Chassis

Two chassis are available, the J7263A and the E7912A. Each module uses one slot in a chassis.

J7263A Chassis

4 slot chassis - holds up to four modules. Comes complete with:

- external 10M/BITS/2M clock reference input.
- four blanking plates.
- a chassis-to-chassis cable for interconnecting chassis.

J7263A chassis connectors

External BITS (DS1) 1.544 Mb/s

A DS1 reference signal as specified in GR-378-CORE (Issue 2, February 1999).

Connector: 100 Ohm balanced Bantam socket.

Signal Level: As per T1.102-1993, 3V pp nominal.

Vpp max = 3.6V

Vpp min = 2.4V

Format: Framed all 1s, Ternary, Return to zero.

External Balanced MTS Clock 2.048 Mb/s

2.048 Mb/s reference as per ITU-T G.703 (11/2001) section 9.

Connector: 120 Ohm balanced Siemens 3-pin socket.

Level: Mark, 3.0 Vpeak , Space, 0 +/- 0.3 Vpeak

Data Format: Data format framed all ones as per ITU-T G.703 (11/2001) section 9

External Un-balanced MTS Clock 2.048 Mb/s

2.048 Mb/s reference as per ITU-T G.703 (11/2001) section 9.

Connector: 75 Ohm BNC female.

Level: Mark, 2.37 Vpeak; Space, 0 +/- 0.237 Vpeak

Data Format: Data format framed all ones as per ITU-T G.703 (11/2001) section 9.

External 2.048 MHz synchronization clock

2.048 MHz reference as per ITU-T G.703 (11/2001) section 13.

Connector: 75 Ohm BNC female.

Level: Vpeak max = 1.5V; Vpeak min = 0.75V

External 10.0MHz synchronization clock

The chassis will retain the existing 10 MHz external clock reference function.

Connector: 50 Ohm BNC female.

Level: Vpp min = 0.5V; Vpp max = 3.6V

Reference Output to Module control PCA

Rate: The BITS PCA will output a 10 MHz signal to the chassis.

Other Chassis Connectors

Power: Male AC power receptacle.

MDI: RJ-45. 100 Mb/s Ethernet (to PC controller).

MDI-X: RJ-45. 100 Mb/s Ethernet (to next chassis).

Daisy-chain Out: Male D-shell Event/ clock connections to next chassis.

Daisy-chain In: Male D-shell. Event/ clock connections from previous chassis.

E7912A Portable Chassis - 2 Slot

The E7912A chassis holds up to 2 modules. Each module uses one slot in the chassis.
The E7912A chassis includes the following:

- A chassis to chassis connecting cable
- 2 Blanking plates (a blanking plate must be fitted to any unused slot to ensure correct operating temperature range).

NOTE The E7912A portable chassis supports a 10 Mhz reference input, with no support for an external BITS/2M reference.

E7912A Other Chassis Connectors

Power: Male AC power receptacle.

MDI: RJ-45, 100 Mb/s Ethernet (to PC Controller).

MDI-X: RJ-45, 100 Mb/s Ethernet (to next chassis)

Daisy-chain Out: Male D-shell, Event/clock connections to next chassis.

Daisy-chain In: Male D-shell, Event/clock connections from previous chassis.

External Trigger In: Female BNC, Trigger input from external device.

External Trigger Out: Female BNC, Trigger output to external device.

1 pps In: Female BNC, 1 pulse-per-second input from GPS module

Serial: RJ-45, Serial input from GPS module

Option 010 -Multi-channel VT/TU mode

Adds multi-channel VT/Low Order Path BER, VT/Low Order Path APS switching times and J2 path connectivity testing for verification of multi-service provisioning platforms. Full bandwidth simultaneous measurement of up to 1344 VT1.5s or 1008 TU-12s is supported within each OC-48. In addition, framed/unframed DS-3/DS-1/E1 mapped payloads are supported, as well as unframed E3 mapped payloads.

Option 010 enable

Normally option 010 is factory enabled when you place an order for option 010, however if need to switch on Option 010 in a module use the following procedure.

1 On your OmniBER XM controller select: **Start**, **Programs**, **OmniBER XM** and **Option Controller**.
2 In the Module Option Controller dialog window enter the module **Serial Number**, **Enabled Option** and in the **Key** box the codeword provided by Agilent to enable VT/TU operation in the chosen module.

Exchangeable optical connectors

One option must be ordered per module.

- FC/PC connector - option 609
- SC connector - option 610
- ST connector - option 611
- UK calibration certificate - option UK6

Accessories

Part number	Product name	Description
E7900-64207	J7263 chassis-to-chassis cable	Interconnects J7263A chassis (included with J7263A)
E7900-64208	Rack-to-rack cable across 19-inch racks	Interconnects J7263A chassis
J7283A	Optical connector	One exchangeable optical FC/PC connector
J7284A	Optical connector	One exchangeable optical SC connector
J7285A	Optical connector	One exchangeable optical ST connector
J7287A	XM product CD	Software and user manual CD

Performance Tests

Performance tests are provided in the XM Verification manual, a copy of which (in .pdf format) can be found at the following web site:

www.Agilent.com/find/OmniBERXM

10
Operator Maintenance

This chapter provides information on cleaning optical connectors and module storage and shipment.

Operator Maintenance

WARNING WARNING NO OPERATOR SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL. TO PREVENT ELECTRICAL SHOCK DO NOT REMOVE COVERS.

Maintenance that can be done by operators:

- Optical connector cleaning.

Optical Connector Cleaning

Fibre optic connectors must be cleaned prior to making every optical connection. This chapter details the equipment and the techniques to be used.

Equipment required

Isopropyl Alcohol

Lint-free cloth: Typically SWI400 from Automation Facilities

Cleaning stick: Typically Cletop NTT-ME/2.5mm

Compressed Air: Typically Ambersil ARD 400

(Alternative: Cleaning cassette reel Cletop-S, Type-A)

CAUTION Isopropyl alcohol (IPA) should be stored in a pump action solvent container (designed to allow a small amount of alcohol to be dispensed on demand) with a cap to prevent evaporation of the alcohol.

IPA should be stored and used only in a clean, cool and ventilated area.

Inhalation of vapors and repeated or prolonged contact of the liquid with skin or clothing should be avoided.

Hands should be washed after use of IPA.

Do not touch the area of lint-free cloth to be used for cleaning.

Optical Patch-cord connectors

Wet/Dry Cleaning

- Remove connector dust cap.
- Moisten a small section of a lint free cloth with IPA and place the cloth on a clean, dry flat surface. Hold the connector vertically and using light downward pressure, inscribe several figure 8 motions on the cloth.
- Using a dry portion of the cloth dry the ferrule immediately. Failure to do this will result in a residue on the ferrule and/or fibre end-face.
- Dispose of the cloth immediately after use - do not use it to clean another connector.
- A compressed air spray may be used as a final operation to remove any residual particles.
- Replace the dust cap on the connector, taking care not to touch the ferrule/fibre end-face.

Dry Cleaning (alternative method)

This method addresses the potential to use a cassette-style cleaner e.g. NTT-ME 'Cletop' range.

- Clean the connector end using the cassette cleaner by advancing the tape belt, exposing a fresh tape section and sliding the ferrule/fibre end-face along the exposed tape section with a light downward pressure. The Cletop cassette has two adjacent "slots" thus exposing two sections of tape. Hence two separate cleaning operations should be employed per connector.
- Replace the dust cap on the connector, taking care not to touch the ferrule/fibre end-face.

Inspection

Either of the above methods should produce acceptable results, however connector inspection is the only way to guarantee that a cleaning operation was successful.

Module Front Panel Optical Connectors

- Remove the dust cap and optical adaptor.
- Moisten a small section of a lint free cloth with IPA. Bring the cloth into contact with the exposed end of the ferrule and using light pressure, inscribe several figure 8 motions with the cloth.
- Using a dry portion of the cloth dry the ferrule immediately. Failure to do this will result in a residue on the ferrule.
- Dispose of the cloth immediately after use - do not use it to clean another connector.
- A compressed air spray may be used as a final operation to remove any residual particles.
- Replace the optical adaptor after cleaning (see below) then replace the dust cap, taking care not to touch the ferrule end-face.

Module Front Panel Optical Adapters (FC/PC and SC)

- Carefully remove the optical adaptor from the instrument.
- Moisten a new stick cleaner with isopropyl alcohol.
- Clean the adapter by pushing and pulling the cleaner within the alignment sleeve. Rotate the cleaner slowly during the push/pull operation.
- Using a new, dry cleaner, remove the alcohol.
- Dispose of the stick cleaners - do not re-use.
- Replace the optical adaptor, taking care not to touch the ferrule end-face.

Storage and Shipment

Storage

The module may be stored in or shipped to environments that meet the following conditions:

- **Temperature:** -20 °C to +60 °C
- **Altitude:** Up to 15,200 meters (50,000 feet)

- **Humidity:** Up to 90% relative humidity to 60 °C.

The module should also be protected from extreme temperatures that could cause interior condensation.

Shipment

Repackaging for Shipment

Original Packaging Containers and materials identical to those used in factory packaging are available from Agilent Technologies offices. If the module is being returned to Agilent Technologies for servicing, attach a tag indicating the type of service required; return address, model number, and full serial number.

Mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the module by its model number and full serial number.

Other Packaging

The following general instructions should be followed when repackaging with commercially available materials:

- Always use a static bag and then wrap module in paper or plastic. If the module is being shipped to Agilent Technologies, attach a tag indicating the type of service required; return address, model number and full serial number.
- Use a strong shipping container. A double-walled carton made of 350-pound test material is adequate.
- Use a layer of shock absorbing material 70 to 100 mm (3 to 4 inches) thick, around all sides of the module to provide firm cushioning and prevent movement inside the container.
- Seal shipping container securely.
- Mark shipping container FRAGILE to ensure careful handling.
- In any correspondence, refer to the module using its model number and full serial number.

11
Telecoms Concepts

This chapter provides useful reference material, including a summary of the ITU standards, explanations of telecoms terms and lists of overhead bytes, signal rates and errors/alarm.

Glossary

Numerics

10BASE-2	10 Mb/s Ethernet on 200-meter segments of thin copper - standard 75 ohm coax. (“Cheapernet” or “Thinlan”.)
10BASE-5	10 Mb/s Ethernet on 500-meter segments of coaxial cable - “fat” 75 ohm coax. (The original Ethernet.)
10BASE-FL	10 Mb/s Ethernet on 2-km multimode fiber-optic cables at 850 nm.
10BASE-T	10 Mb/s Ethernet on 200-meter loops of unshielded twisted pair copper - UTP Cat 3.
100BASE-FX	100 Mb/s Ethernet on 2-km multimode or 10-km single-mode fiber-optic cables at 1310 nm.
100BASE-SX	100 Mb/s Ethernet on 2-km multimode fiber-optic cables at 850 nm.
100BASE-T	100 Mb/s Ethernet on 200-meter loops of unshielded twisted pair copper.
100BASE-TX	100 Mb/s Ethernet on 200-meter loops of unshielded twisted pair copper - UTP Cat 5.
1000BASE-LX	1 Gb Ethernet on 2-km multimode or 10-km single-mode fiber-optic cables at 1310 nm.
1000BASE-SX	1 Gb Ethernet on 2-km multimode fiber-optic cables at 850 nm.
1000BASE-T	1 Gb Ethernet on 30-meter loops of unshielded twisted pair copper - UTP Cat 5.
802.3ae	The IEEE standard for 10 Gb Ethernet.
802.3z	The IEEE standard for 1 Gb Ethernet.

A

AAL	ATM Adaption Layer.
ABR	Available Bit Rate.
ADM	Add and Drop Multiplexer.
ADPCM	Adaptive Coded Differential Pulse Coded Modulation.
AIS	Alarm Indication Signal.
AIS-P	Synchronous Transport Signal Path Alarm Indication Signal.
AIS-L	Line Alarm Indication Signal.
AIS-V	Virtual Tributary Path Alarm Indication Signal.
AIS-C	Concatenated Signal Alarm Indication Signal.
AMI	Alternate Mark Inversion.
ANSI	American National Standards Institute.
APS	Automatic Protection Switch.
ASCII	American Standard Code for Information Exchange.
ATM	Asynchronous Transfer Mode.
AU	Administrative Unit.
AU-AIS	Administrative Unit Alarm Indication Signal.
AU-LOP	Administrative Unit Loss Of Pointer.
AU-NDF	Administrative Unit New Data Flag.

B

BBE	Background Block Error.
BBER	Background Block Error Ratio.
BC	Background Channel.

BCD	Binary Coded Decimal.
BER	Bit Error Rate.
BERT	Bit Error Rate Test.
BIP	Bit Interleaved Parity.
BPS	Bits Per Second.
BPV	Bipolar Violation.
B3ZS	Bipolar with 3 Zero Substitution.
B8ZS	Bipolar with 8 Zero Substitution.

C

CAN	Campus Area Network.
CAS	Channel Associated Signaling.
Cat 5	Category 5 unshielded twisted pair copper.
CATV	Cable Television.
CBR	Constant Bit Rate.
CCITT	Consultative Committee for International Telephony and Telegraphy.
CCS	Common Channel Signaling.
CDT	Cell Delay Tolerance.
CDV	Cell Delay Variation.
CEPT	Committee of European PTTs.
CMI	Coded Mark Inversion.
CO	Central Office.
CoS	Class of Service.
CRC	Cyclic Redundancy Check.

CSES	Consecutive Severely Errored Seconds.
CSMA/CD	Carrier Sense, Multiple Access with Collision Detection.
CV-L	Line Code Violation, also L-BIP.
CV-LFE	Line Far End Code Violation, also REI-L.
CV-P	Synchronous Transport Signal Path Code Violation, also P-BIP.
CV-PFE	Synchronous Transport Signal Path Far End Code Violation, also REI-P.
CV-S	Section Code Violation, also S-BIP.
CV-V	Virtual Tributary Path Code Violation, also V-BIP.
CV-VFE	Virtual Tributary Far End Code Violation, also REI-V.

D

D/I	Drop and Insert.
DACS	Digital Access and Cross-connect Switch.
dB	Decibel.
DCC	Data Communications Channel.
DCS	Digital Cross-connect Switch.
DDF	Digital Distribution Frame.
DDN	Digital Data Network.
DSn	Digital Signal Hierarchy.
DTMF	Dual Tone Multi-Frequency signaling.
DUT	Device Under Test.
DWDM	Dense Wave Division Multiplexing.
DXC	Digital Cross-connect Switch.

E

EB	Errored Block.
EBCDIC	Extended Binary Coded Decimal Interchange Code.
EOW	Engineering Order Wire.
ES	Errored Second.
ESF	Extended SuperFrame format.
ESR	Errored Second Ratio.
ETSI	European Telecommunications Standards Institute.

F

FAS	Frame Alignment Signal.
FC	Foreground Channel.
FCS	Frame Check Sequence.
FDDI	Fiber Distributed Data Interface.
FDM	Frequency Division Multiplexing.
FEAC	Far End Alarm Channel.
FEBE	Far End Block Error.
FEC	Forward Error Correction.
FERF	Far End Receive Failure.

G

GBIC	Gigabit Interface Converter.
GP-IB	General Purpose Interface Bus.
GUI	Graphical User Interface.

H

HDB3	High Density Bipolar 3.
HDLC	High-level Data Link Control.
HEC	Header Error Control.
HO	High Order.
HO PTE	High Order Path Terminating Equipment.
HP-BIP	High Path Bit Interleaved Parity error.
HP-PLM	High Path Payload Label Mismatch.
HP-RDI	High Path Remote Defect Indication.
HP-REI	High Path Remote Error Indication.
HP-TIM	High Path Trace Identifier Mismatch.
HP-UNEQ	High Path Unequipped.
Hz	Hertz.

I

ICMP	Internet Control Message Protocol.
IEC	Incoming Error Count.
IHL	Internet Header Length.
IP	Internet Protocol.
ISDN	Integrated Services Digital Network.
ISO	International Organization for Standardization.
ITU	International Telecommunications Union - Telecommunications.
IXC	Inter eXchange Carrier.

J

K

K-bytes	K1 and K2.

L

LAN	Local Area Network.
LCD	Loss of Cell Delineation.
LEC	Local Exchange Carrier.
L-BIP	Line Bit Interleaved Parity error, also CV-L.
LCP	Link Control Protocol.
LLC	Logical Link Control.
LO	Low Order.
LOF	Loss of Frame.
LOM/LOMF	Loss of Multiframe.
LOP	Loss of Pointer.
LOP-C	Loss of Concatenation.
LOP-P	Synchronous Transport Signal Path Loss Of Pointer.
LOP-V	Virtual Tributary Path Loss Of Pointer.
LOS	Loss of Signal.
LP-BIP	Low Path Bit Interleaved Parity error.
LP-PLM	Low Path Payload Label Mismatch.
LP-RDI	Low Path Remote Defect Indication.
LP-REI	Low Path Remote Error Indication.
LP-RFI	Low Path Remote Failure Indication.
LP-TIM	Low Path Trace Identifier Mismatch.
LP-UNEQ	Low Path Unequipped.

LSB	Least Significant Bit.
LTM	Line Terminal Multiplexer.

M

MAC	Media Access Control.
MAN	Metropolitan Area Network.
M/F LOSS	Loss of Multiframe (PDH).
MMF	Multi Mode Fiber.
MS	Multiplexer Section.
MS-AIS	Multiplexer Section Alarm Indication Signal.
MS-BIP	Multiplexer Section Bit Interleaved Parity error.
MSOH	Multiplexer Section OverHead.
MSP	Multiplexer Section Protection.
MS-RDI	Multiplexer Section Remote Defect Indication.
MS-REI	Multiplexer Section Remote Error Indication.
MSTE	Multiplexer Section Terminal Equipment.
MTBF	Mean Time Between Failures.
MTJ	Maximum Tolerance Input Jitter.
MUX	Multiplexer.

N

NDF	New Data Flag.
NE	Network Element.
NFAS	Non Frame Alignment Signal.

O

OAM	Operations, Administration and Management.
OC	Optical Carrier.
OCh	Optical Channel.
ODI	Outgoing Defect Indication.
ODU	Optical channel Data Unit.
OEI	Outgoing Error Indication.
OH	Overhead.
OLTU	Optical LIne Terminal Unit.
ONNI	Optical transport Network Node Interface.
OOF	Out Of Frame.
OOM	Out Of Frame.
OPU	Optical channel Payload Unit.
OS	Operating System.
OSC	Optical Supervisory Channel.
OSI	Open Systems Interconnection.
OTM	Optical Transport Module.
OTN	Optical Transport Network.
OTU	Optical channel Transport Unit.

P

P/AR	Peak to Average Ratio.
P-BIP	Synchronous Transport Signal Path Bit Interleaved Parity error, also CV-P.
PBX	Private Branch Exchange.

PC	Personal Computer.
PCM	Pulse Code Modulation.
PCS	Physical Coding Sublayer.
PCR	Peak Cell Rate.
PDH	Plesiochronous Digital Hierarchy.
PES	Percentage Errored Seconds.
PHY	Physical layer device.
PLM	Payload Label Mismatch.
PLM-P	Synchronous Transport Signal Path Payload Label Mismatch.
PLM-V	Virtual Tributary Path Payload Label Mismatch.
PMD	Physical Media Dependent.
POH	Path OverHead.
PoP	Point of Presence.
POS	Packet Over SONET.
PPP	Point-to-Point Protocol.
PRBS	Pseudo-Random Bit Sequence.
PSN	Packet Switched Network.
PSTN	Public Switched Telephone Network.
PTE	Path Terminating Equipment.
PUAS	Path UnAvailable Seconds.

Q

QoS	Quality of Service.

R

RAI	Remote Alarm Indication.
RAI (M/F)	Loss of Multiframe Remote Alarm Indication.
RDI	Remote Defect Indication.
RDI-L	Line Remote Defect Indication.
RDI-P	Synchronous Transport Signal Path Remote Defect Indication.
RDI-V	Virtual Tributary Path Remote Defect Indication.
REBE	Remote End Block Error.
REI	Remote Error Indication.
REI-L	Line Remote Error Indication, also CV-LFE.
REI-P	Synchronous Transport Signal Path Remote Error Indication, also CV-PFE.
REI-V	Virtual Tributary Path Remote Error Indication, also CV-VFE.
RFI-V	Virtual Tributary Path Remote Failure Indication.
RS	Regenerator Section.
RS-BIP	Regenerator Section Bit Interleaved Parity error.
RSOH	Regenerator Section OverHead.
RSTE	Regenerator Section Terminating Equipment.
RS-TIM	Regenerator Section Trace Identifier Mismatch.
RX	Receiver

S

S/N	Signal to Noise Ratio.
S-BIP	Section Bit Interleaved Parity error, also CV-S.

SCPI	Standard Commands for Programmable Instrumentation.
SDH	Synchronous Digital Hierarchy.
SEF	Severely Errored Frame.
SEP	Severely Errored Period.
SEPI	Severely Errored Period Intensity.
SES	Severely Errored Seconds.
SESR	Severely Errored Seconds Ratio.
SF	Super Frame.
SFD	Start Frame Delimiter.
SLA	Service Level Agreement.
SMF	Single Mode Fiber.
SNMP	Simple Network Management Protocol.
SOH	Section OverHead.
SONET	Synchronous Optical Network.
SPE	Synchronous Payload Envelope.
STM	Synchronous Transport Module.
STS	Synchronous Transport Signal.

T

TC	Tandem Connection.
TC-APId	Tandem Connection Access Point Identifier.
TC-BIP	Tandem Connection Bit Interleaved Parity error.
TC-IAIS or TC-INCAIS	Tandem Connection Incoming Alarm Indication Signal.
TC-IEC	Tandem Connection Incoming Error Count.

TC-OOM	Tandem Connection Out of Multiframe.
TCI	Tag Control Information.
TCP/IP	Transmission Control Protocol/Internet Protocol.
TC-RDI	Tandem Connection Remote Defect Indication.
TC-REI	Tandem Connection Remote Error Indication.
TC-UNEQ	Tandem Connection Unequipped.
TDM	Time Division Multiplexing.
TDMA	Time Division Multiple Access.
TE	Terminal Equipment.
TIM	Trace Identifier Mismatch.
TIM-P	Synchronous Transport Signal Path Trace Identifier Mismatch.
TIM-V	Virtual Tributary Path Trace Identifier Mismatch.
TM	Terminal Multiplexer
TMN	Telecommunications Management Network.
TOH	Transport OverHead.
TPID	Tag Protocol Identifier.
TU	Tributary Unit.
TU-AIS	Tributary Unit Alarm Indication Signal.
TUG	Tributary Unit Group.
TU-LOM	Tributary Unit Loss Of Multiframe.
TU-LOP	Tributary Unit Loss Of Pointer.
TU-NDF	Tributary Unit Pointer New Data Flag.
TX	Transmitter.

U

UAS	UnAvailable Second.
UI	Unit Interval.
UNEQ	Unequipped.
UNEQ-P	Synchronous Transport Signal Path Unequipped.
UNEQ-V	Virtual Tributary Path Unequipped.
UTP	Unshielded Twisted Pair.
UUT	Unit Under Test.

V

V-BIP	Virtual Tributary Path Bit Interleaved Parity error, also CV-V.
VBR	Variable Bit Rate.
VC	Virtual Channel (ATM).
VC-AIS	Virtual Container Alarm Indication Signal.
VC-n	Virtual Container.
VID	VLAN Identifier.
VLAN	Virtual Local Area Network.
VP	Virtual Path (ATM).
VT	Virtual Tributary.
VT PTE	Virtual Tributary Path Terminating Equipment.

W

WAN	Wide Area Network.
WDM	Wave Division Multiplexing.

WIS	WAN Interface Sublayer.
WWDM	Wide Wave Division Multiplexing.

X

X-Connect	Cross-Connect.
X-bits	DS3 bits, X1 and X2.

Y/Z

Yellow	Yellow Alarm.

Signal Rates

Rate (Mb/s)	Optical Carrier	SONET STS	SDH STM
51.84	OC-1	STS-1	STM-0
155.52	OC-3	STS-3	STM-1
466.56	OC-9	STS-9	STM-3
622.08	OC-12	STS-12	STM-4
933.12	OC-18	STS-18	STM-6
1244.16	OC-24	STS-24	STM-8
1866.24	OC-36	STS-36	STM-12
2488.32	OC-48	STS-48	STM-16
2 666.06	OTU-1		
4976.64	OC-96	STS-96	STM-32
9953.28	OC-192	STS-192	STM-64
10709.23	OTU-2		
39 813.12	OC-768	STS-768	STM-256
43 018.41	OTU-3		

Summary of Errors and Alarms

Acronym	Error/Alarm
AIS	Alarm Indication Signal
BIP	Bit Interleaved Parity
IEC	Incoming Error Count
LOF	Loss of Frame
LOM/LOMF	Loss of Multiframe
LOP	Loss of Pointer
LOP-C/AU-LOP-C	Loss of Concatenation
LOS	Loss of Signal
ODI	Outgoing Defect Indication
OEI	Outgoing Error Indication
OOF	Out of Frame
PLM	Payload Label Mismatch
RAI	Remote Alarm Indication
RDI	Remote Defect Indication
REI	Remote Error Indication
RFI	Remote Failure Indication
SEF	Severely Errored Frame
TIM	Trace Identifier Mismatch
UNEQ	Unequipped

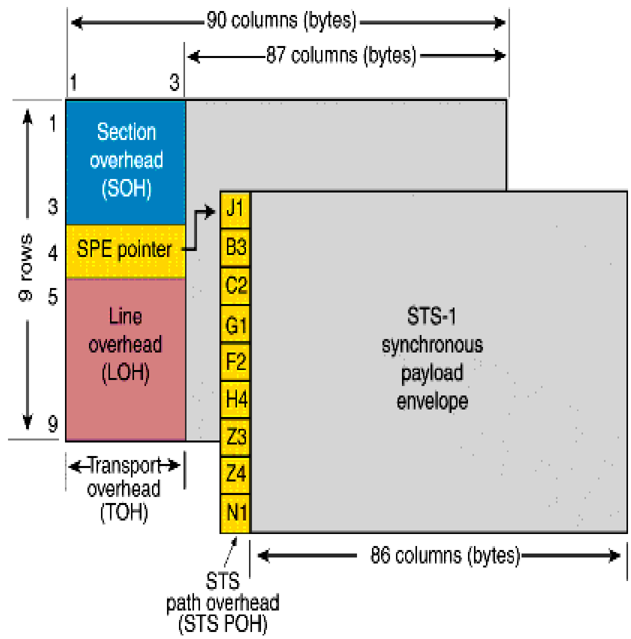
SONET Concepts

For SONET reference information, see:

- "SONET STS-1 Frame Structure" on page 263
- "SONET Payload Structure" on page 264
- "SONET Overhead Bytes" on page 265

SONET STS-1 Frame Structure

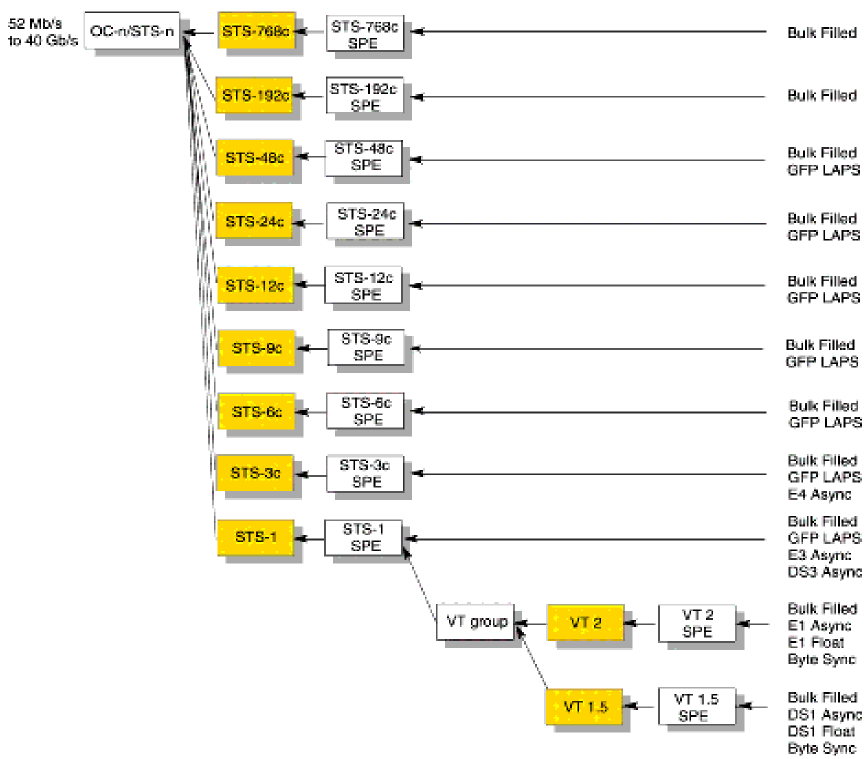
The relationship between the various elements that make up a SONET STS-1 signal is shown in the following diagram.



SONET Payload Structure

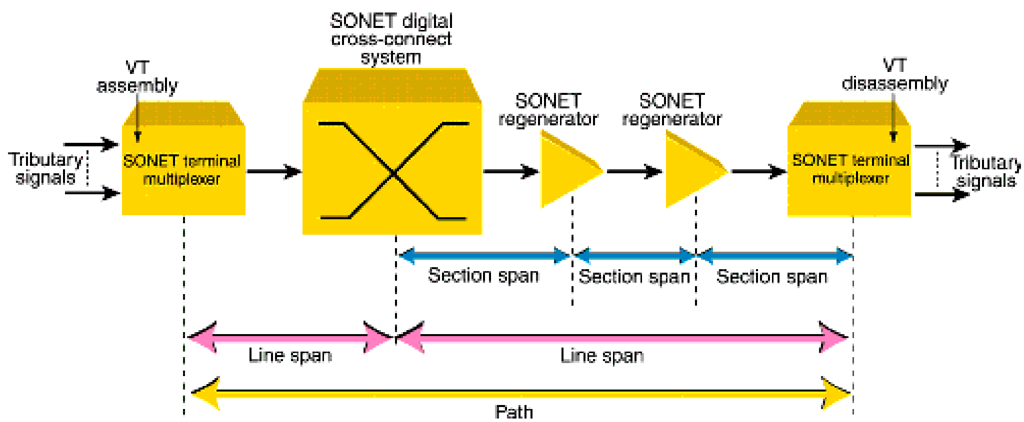
The payloads that can be carried in a SONET signal are outlined below.

- You can asynchronously map a framed/unframed DS3 (44 Mb/s) or E3 (34 Mb/s) signal into a full STS-1 SPE, or you can bulk fill the STS-1 SPE.
- You can transmit 28 VT1.5s, 21 VT2s or 7 VT6s in a STS-1 SPE. The VTs are structured into 7 virtual tributary groups (VT Groups) within a STS-1 SPE. Each VT-group can contain 4 VT1.5s, 3 VT-2s or 1 VT-6.
- You can transmit concatenated payloads in SONET signals. These types of payload reduce test times by testing the entire bandwidth in one go.



SONET Overhead Bytes

Four overheads are used to transport SONET signals across the spans of a network.



For more information, see:

- "Section Overhead (SOH)" on page 266
- "Line Overhead (LOH)" on page 267
- "STS Path Overhead (STS POH)" on page 274
- "VT Path Overhead (VT POH for VT-1.5, VT-2 or VT-6)" on page 278

Section Overhead (SOH)

The Section overhead (SOH) supports the transmission of SONET signals across the section span of a network.

Byte	Label	Description
A1, A2	Framing	Provides a frame alignment pattern (A1=F6 Hex, A2=28 Hex), The frame alignment word of an STS-n frame is n A1 bytes followed by n A2 bytes.
J0	Section Trace	Supports continuity testing between the transmitting and receiving device on each section span.
Z0		Reserved for future international standardization.
B1	Section Code Violation (CV-S)	Provides section error monitoring. The section BIP-8 provides end-to-end error performance monitoring across an individual section. The BIP-8 is calculated over all bits of the previous STS-n frame after scrambling. The computed value is placed in the B1 byte of the current STS-n before scrambling.
E1	Orderwire	Provides local orderwire channel for voice communication between regenerators, hubs and remote terminal locations.
F1	User Channel	Provides a 64 kb/s proprietary data communications channel for the user. It is terminated at each section terminating equipment.
D1 to D3	Data Comm. Channel	Provides a 192 kb/s message-based data communications channel (DCC) for administration, monitor, alarm and maintenance functions between section terminating equipment.

Line Overhead (LOH)

The LOH carries SONET signals over the line span of a network.

Byte	Label	Description
B2	Line Code Violation (CV-L)	Provides line error monitoring. The BIP-8 is calculated over all bits of the line overhead and envelope capacity of the previous STS-n frame before scrambling and is placed in the B2 byte of the current STS-n frame before scrambling.
K1, K2	APS Channel	Line automatic protection switching (APS) is controlled by the K1K2 bytes. Two APS message types are used: Linear APS messages Ring APS messages For more information, see “Linear APS Messages (Telecordia GR-253-CORE Issue 3)" on page 269 and “Ring APS Messages (Telecordia GR-1230)" on page 271.
D4 to D1 2	Data Comm. Channel	Provides a 576 kb/s data communications channel (DCC) between line terminating equipment. Used for network administration/maintenance information.
S1	Sync Status	S1 bits 5 to 8 show which levels of synchronization are being used at the transmit end of a line span. For more information, see “Synchronization Status Messages (S1 bits 5 to 8)" on page 273.
Z1, Z2		Allocated for future growth.
M0	REI-L	STS-1 line remote error indication (defined only for STS-1) conveys the B2 errors detected by the downstream line terminating equipment.
M1	REI-L	STS-n line remote error indication (defined for n>3) conveys the B2 errors detected by the downstream line terminating equipment.
E2	Orderwir e	Provides express orderwire channel for voice communication between line terminating equipment.

Byte	Label	Description
H1 to H3		The payload pointer contained in the H1 and H2 bytes of the line overhead designates the location of the byte where the STS SPE begins. The last ten bits (bits 7 to 16) of H1H2 carry the pointer value (0 to 782). The H1 and H2 bytes are also used to indicate a concatenated payload by transmitting the pointer word “1001XX1111111111” in the second to Nth STS-1 in an STS-Nc.The H3 bytes is allocated for SPE frequency justification purposes and can carry “live” information from a STS SPE when a negative pointer adjustment occurs.

Linear APS Messages (Telecordia GR-253-CORE Issue 3)

Protection Switching Protocol	
K1	**Condition**
Bits 1 to 4	
1111	Locked out of protection
1110	Forced switch
1101	Signal fail high priority
1100	Signal fail low priority
1011	Signal degrade high priority
1010	Signal degrade low priority
1001	Unused
1000	Manual switch
0111	Unused
0110	Wait-to-restore
0101	Unused
0100	Exercise
0011	Unused
0010	Reverse request
0001	Do not revert
0000	No request
Bits 5 to 8	Selects channel used by APS messages

Protection Switching Protocol	
K2	**Condition**
Bits 1 to 4	Selects bridged channel used
Bit 5	Determines APS architecture 0 - 1:1 Architecture - short path 1 - 1:N Architecture - long path
Bits 6 to 8	
100	Provisional mode is unidirectional
101	Provisional mode is bidirectional
110	RDI-L
111	AIS-L
	All other combinations of bits 6 to 8 not used.

Ring APS Messages (Telecordia GR-1230)

Protection Switching Protocol	
K1	**Condition**
Bits 1 to 4	
1111	Locked out of protection (span) or signal fail (protection)
1110	Forced switch (span)
1101	Forced switch (ring)
1100	Signal fail (span)
1011	Signal fail (ring)
1010	Signal degrade (protection)
1001	Signal degrade (span)
1000	Signal degrade (ring)
0111	Manual switch (span)
0110	Manual switch (ring)
0101	Wait-to-restore
0100	Exercise (span)
0011	Exercise (ring)
0010	Reverse request (span)
0001	Reverse request (ring)
0000	No request
Bits 5 to 8	Destination node ID

Protection Switching Protocol	
K2	**Condition**
Bits 1 to 4	Source node ID
Bit 5	Path code: 0 = short path request, 1 = long path request
Bits 6 to 8	
000	Idle
001	Bridged
010	Bridged and switched
011	Extra traffic (ET) on protection channels
100	Note used
101	Not used
110	RDI-L
111	AIS-L

Synchronization Status Messages (S1 bits 5 to 8)

S1 (Bits 5 to 8)	Quality level	SONET synchronization quality level description
0001	1	Stratum 1 traceable
0000	2	Synchronized-traceable
0111	3	Stratum 2 traceable
1010	4	Stratum 3 traceable
1100	5	SONET minimum clock traceable
n/a	6	Stratum 4 traceable
1111	7	Do not use for synchronization
0111	User-assignable	Reserved for network synchronization use

STS Path Overhead (STS POH)

The STS Path overhead (STS POH) support the transmission of SONET signals across the path of a network.

Byte	Label	Description
J1	Path Trace	The first byte in the STS SPE. Its location is indicated by the pointer (H1H2). Provides an STS path trail trace identifier (64-byte free format string or 16 frame including CRC7). Supports end-to-end monitoring of an STS path.
B3	Path Code Violation (CV-P)	Provides STS path error monitoring. The BIP-8 is calculated over all bits of the previous STS SPE. The computed value is placed in the B3 byte before scrambling.
C2	Signal Label	STS path signal label indicates the content of the STS SPE, including the status of the mapped payloads. For more information, see “C2 Byte Mapping" on page 276.
G1	Path Status	STS path status contains status and performance monitoring information from the receiving path terminating equipment to the originating equipment. Allows status and performance of the complete duplex path to be monitored at either end.For more information, see “G1 (Bits 5 to 7) Coding and Interpretation" on page 277. Bits 1 to 4 of this byte indicate the count of interleaved-bit block errors, based on the B3 count, to the upstream path terminating equipment.
F2	User Channel	STS path user channel. Allocated for network operator communication between STS path terminating equipment.
H4	Position Indicator	This byte provides multiframe phase indication for VT structured payloads.

Byte	Label	Description
Z3, Z4		Allocated for future use.
N1		Allocated for tandem connection maintenance and the path data channels. Bits 1 to 4 are used to provide tandem connection incoming error count (IEC). Bits 5 to 8 ar used to provide the path data channel. For more information, refer to ANSI T1.105.05.

C2 Byte Mapping

Bits 1 to 4	Bits 5 to 8	Hex Code	Description
0000	0000	00	Unequipped
0000	0001	01	Equipped - non-specific
0000	0010	02	VT-structured STS-1 SPE
0000	0011	03	Locked VT mode
0000	0100	04	Asynchronous mapping for DS3
0001	0010	12	Asynchronous mapping for DS4NA
0001	0011	13	ATM mapping
0001	0100	14	Mapping DQDB
0001	0101	15	Asynchronous mapping for FDDI

G1 (Bits 5 to 7) Coding and Interpretation

Bits 5 to 7	Description	Triggers
000	No remote defect	No defect
001	No remote defect	No defect
010	Remote payload defect	LCD-P, PLM-P
011	No remote defect	No defect
100	Remote defect (RDI-P, ERDI-P)	AIS-P, LOP-P
101	Remote server defect (ERDI-P-S)	AIS-P, LOP-P
110	Remote connectivity defect (ERDI-P-C)	TIM-P, UNEQ-P
111	Remote defect (ERDI-P-P)	AIS-P, LOP-P

VT Path Overhead (VT POH for VT-1.5, VT-2 or VT-6)

The VT Path Overhead (VT POH) support the transmission of SONET signals across the tributary path of a network.

Byte	Label	Description
V5	CV-V, Signal Label and Path Status	This byte contains error analysis, signal label and path status information. Bits 1 and 2 contain lower order path error analysis (BIP-2). Bits 5, 6 and 7 contain signal label. For more information, see “V5 (bits 5 to 7) Signal Label" on page 279. Bit 3 contains the Remote Error Indication (REI-V). Bit 4 contains the Remote Failure Indication (RFI-V). Bit 8 contains the Remote Defect Indication (RDI-V).
Number of data bytes separating fields: VT-1.5 = 25, VT-2 = 34 and VT-6 = 106		
J2	VT Path Trace Identifier	Supports the end-to-end monitoring of a path.
Number of data bytes separating fields: VT-1.5 = 25, VT-2 = 34 and VT-6 = 106		
Z6		Reserved for future use.
Number of data bytes separating fields: VT-1.5 = 25, VT-2 = 34 and VT-6 = 106		
Z7		Bits 5 to 7 of Z7 provide enhanced RDI-V. Bits 5 to 7 of Z7 together with bit 8 of V5 provide codes to indicate both the old version and enhanced version of RDI-V. For more information, see “Z7 (bits 5 to 7) Coding and Interpretation" on page 280.
Number of data bytes separating fields: VT-1.5 = 25, VT-2 = 34 and VT-6 = 106		

V5 (bits 5 to 7) Signal Label

Bits 5 to 7	Description
000	Unequipped
001	Equipped - non-specific
010	Asynchronous mapping
011	Bit synchronous mapping (no longer valid for DS1)
100	Byte synchronous mapping
101	Unassigned
110	Unassigned
111	Unassigned

Z7 (bits 5 to 7) Coding and Interpretation

V5 bit 8 Z7 bit5	Z7 bit 6	Z7 bit 7	Interpretation	Triggers
0	0	0	No remote defect	No defect
0	0	1	No remote defect	No defect
0	1	0	Remote payload defect	PLM-V
0	1	1	No remote defect	No defect
1	0	0	Remote defect	AIS-V, LOP-V
1	0	1	Remote server defect	AIS-V, LOP-V
1	1	0	Remote connectivity defect	UNEQ-V
1	1	1	Remote defect	AIS-V, LOP-V

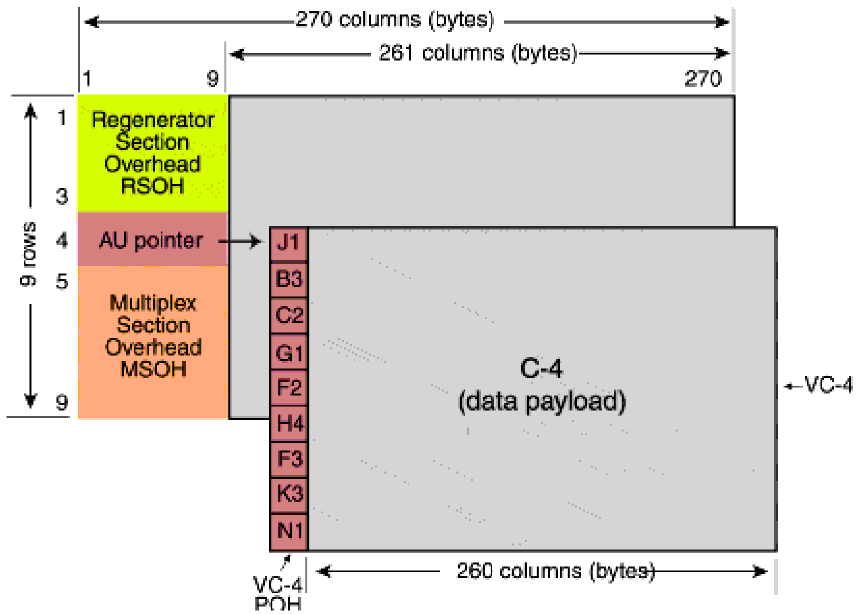
SDH Concepts

For SDH reference information, see:

- “SDH Frame Structure" on page 282
- “SDH Payload Structure" on page 283
- “SDH Overhead Bytes" on page 284

SDH Frame Structure

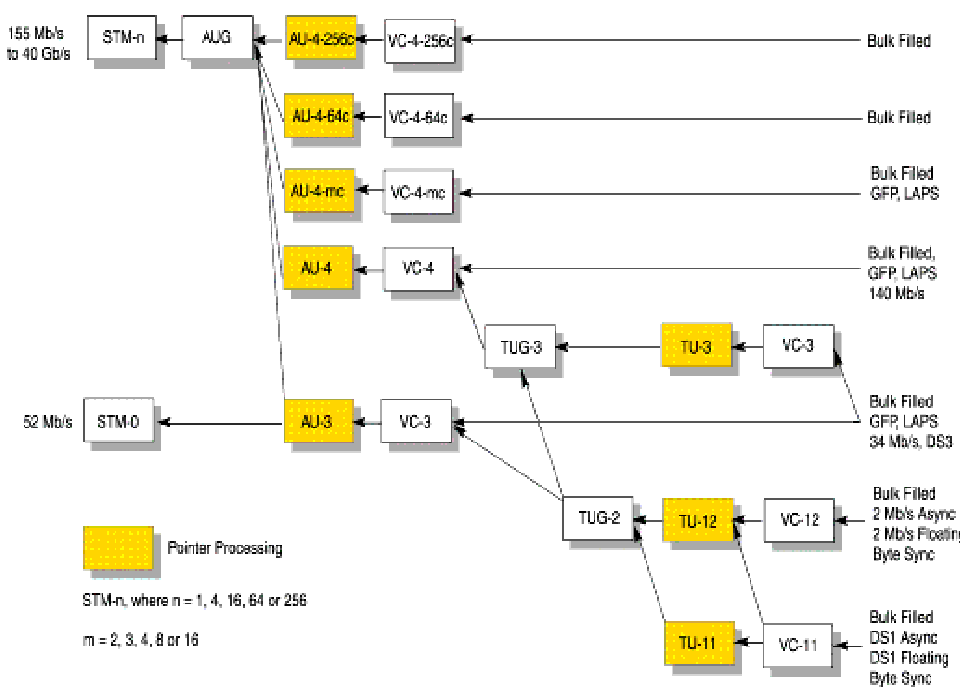
The relationship between the various elements that make up an SDH signal is shown in the following diagram.



SDH Payload Structure

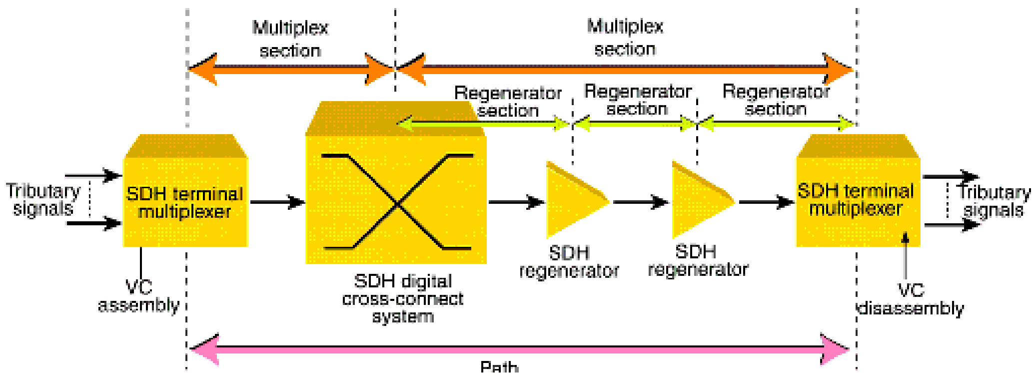
The payloads that can be carried in a SDH signal are outlined below.

- You can asynchronously map a framed/unframed DS3 (44 Mb/s) or E3 (34 Mb/s) signal into a full VC-3/4, or you can bulk fill the VC-3/4.
- You can transmit 28 TU-11s, 21 VT12s or 7 TU-2s in a VC-3, or 84 TU-11s, 63 TU-12s or 3 TU-3s in a VC-4. The TUs are structured into tributary unit groups (TUG) within the VC-3/4. A VC-3 contains 7 TUG-2s, each TUG-2 can contain 4 TU-11s, 3 TU-12s or 1 TU-2. A VC-4 contains 3 TUG-3s, each TUG-3 contains 7 TUG-2s or 1 TU-3.
- You can transmit concatenated payloads in SDH signals. These types of payload reduce test times by testing the entire bandwidth in one go.



SDH Overhead Bytes

Four overheads are used to transport SDH signals across the spans of a network.



For more information, see:

- “Regenerator Section Overhead (RSOH)" on page 285
- “Multiplex Section Overhead (MSOH)" on page 286
- “Higher Order Path Overhead (HO POH)" on page 293
- “Lower Order VC-n Path Overhead (LO POH for VC-11, VC-12 or VC-2)" on page 298

Regenerator Section Overhead (RSOH)

The regenerator section overhead (RSOH) bytes support the transmission of an SDH signal across the regenerator section span of a network.

Byte	Label	Description
A1, A2	Framing	Provides a frame alignment pattern (A1=F6 Hex, A2=28 Hex), The frame alignment word of an STM-n frame is 3 x n A1 bytes followed by 3 x n A2 bytes.
J0	Regenerator Section Trace	Regenerator section trace (16-byte frame including CRC) supports continuity testing between the transmitting and receiving device on each regenerator section span.
Z0		Spare. Reserved for future international standardization.
B1	RS-BIP	Provides regenerator section error monitoring. The regenerator section BIP-8 provides end-to-end error performance monitoring across an individual regenerator section. The BIP-8 is calculated over all bits of the previous STM-n frame after scrambling. The computed value is placed in the B1 byte of the current STM-n frame before scrambling.
E1	Orderwire	Provides local orderwire channel for voice communication between regenerators, hubs and remote terminal locations.
F1	User Channel	Provides a 64 kb/s proprietary data communications channel for the user. It is terminated at each regenerator section terminating equipment.
D1 to D3	Data Comm. Channel	Provides a 192 kb/s message-based data communications channel (DCC) for administration, monitor, alarm and maintenance functions between regenerator section terminating equipment.

Multiplex Section Overhead (MSOH)

The multiplex section overhead (MSOH) bytes support the transmission of an SDH signal across the multiplexer section span of a network.

Byte	Label	Description
B2	MS-BIP	Provides multiplex section error monitoring. The BIP-n x 24, of an STM-n frame, provides end-to end performance monitoring across an individual multiplexer section and is calculated over all bits of the previous STM-n frame except for the first three rows of the current STM-n frame before scrambling.
K1, K2	MS-APS	Multiplexer section automatic protection switching (APS) is controlled by the K1K2 bytes. Two APS message types are used: Linear APS messages Ring APS messages Bits 6 to 8 of the K2 byte contain MS-RDI and MS-AIS. This byte is defined only for STM-1#1a of a SDH frame. For more information, see “Linear APS Messages" on page 288 and “Ring APS Messages" on page 290.
D4 to D1 2	Data Comm. Channel	Provides a 576 kb/s data communications channel (DCC) between multiplex section terminating equipment. Used to carry network administration and maintenance information.
S1	Sync Status	S1 bits 5 to 8 indicate which of the four levels of synchronization is being used at the transmit end of a multiplexer section span.
M1	MS-REI	Multiplexer section remote error indication conveys the B2 errors detected by downstream equipment.

Byte	Label	Description
E2	Orderwire	Provides express orderwire channel for voice communication between Multiplex Section terminating equipment.
H1 to H3	AU Pointer	The payload pointer contained in the H1 and H2 bytes of the multiplex section overhead designates the location of the byte where the VC-n begins. The last ten bits (bits 7 to 16) of H1H2 carry the pointer value (0 to 782). The H3 bytes is allocated for VC frequency justification purposes and can carry “live” information from a VC-4 when a negative pointer adjustment occurs.

Linear APS Messages

ITU-T G.783 Protection Switching Protocol	
K1	**Condition**
Bits 1 to 4	
1111	Locked out of protection
1110	Forced switch
1101	Signal fail high priority
1100	Signal fail low priority
1011	Signal degrade high priority
1010	Signal degrade low priority
1001	Unused
1000	Manual switch
0111	Unused
0110	Wait-to-restore
0101	Unused
0100	Exercise
0011	Unused
0010	Reverse request
0001	Do not revert

ITU-T G.783 Protection Switching Protocol	
0000	No request
Bits 5 to 8	Selects channel used by APS messages
K2	**Condition**
Bits 1 to 4	Selects bridged channel used
Bit 5	Determines APS architecture
Bits 6 to 8 110 111	MS-RDI MS-AIS All other combinations of bits 6 to 8 not used.

Ring APS Messages

ITU-T G.741 Protection Switching Protocol	
K1	**Condition**
Bits 1 to 4	
1111	Locked out of protection (span) or signal fail (protection)
1110	Forced switch (span)
1101	Forced switch (ring)
1100	Signal fail (span)
1011	Signal fail (ring)
1010	Signal degrade (protection)
1001	Signal degrade (span)
1000	Signal degrade (ring)
0111	Manual switch (span)
0110	Manual switch (ring)
0101	Wait-to-restore
0100	Exercise (span)
0011	Exercise (ring)
0010	Reverse request (span)
0001	Reverse request (ring)
0000	No request
Bits 5 to 8	Destination node ID

ITU-T G.741 Protection Switching Protocol	
K2	**Condition**
Bits 1to 4	Source node ID
Bit 5	Path code: 0 = short path, 1 = long path
Bits 6 to 8	
000	Idle
001	Bridged
010	Bridged and switched
011	Not used
100	Note used
101	Not used
110	MS-RDI
111	MS-AIS

Synchronization Status Messages (S1 bits 5 to 8)

S1 (Bits 5 to 8)	SDH synchronization quality level description
0000	Quality unknown
0001	Reserved
0010	G.811
0011	Reserved
0100	G.812 transit
0101	Reserved
0110	Reserved
0111	Reserved
1000	G.812 local
1001	Reserved
1010	Reserved
1011	Synchronous equipment timing source (SETS)
1100	Reserved
1101	Reserved
1110	Reserved
1111	Do not use for synchronization

Higher Order Path Overhead (HO POH)

The higher order path overhead (HO POH) bytes support the transmission of an SDH signal across the high order path of a network.

Byte	Label	Description
J1	Path Trace	The first byte in the virtual container (VC). Its location is indicated by the AU pointer (H1H2). Provides a higher order trail trace identifier (64-byte free format string or 16 frame including CRC7). Supports end-to-end monitoring of a higher order path.
B3	HP-BIP	Provides higher order path error monitoring. The BIP-8 is calculated over all bits of the previous VC-n. The computed value is placed in the B3 byte before scrambling.
C2	Signal Label	Higher order signal label indicates the content of the VC, including the status of the mapped payloads. For more information, see "C2 Byte Mapping" on page 295.
G1	Path Status	Higher order path status contains status and performance monitoring information from the receiving path terminating equipment to the originating equipment. For more information, see "G1 (Bits 5 to 7) Coding and Interpretation" on page 296. Allows status and performance of the duplex path to be monitored at either end. Bits 1 to 4 of this byte contain the Path REI count. Bits 5 to 7 contain Path RDI.
F2	User Channel	Higher order path user channel. Allocated for network operator communication between path terminating equipment.
H4	Position Indicator	This byte provides multiframe phase indication for TU structured payloads.
F3	User Channel	Higher order path user channel. Allocated for network operator communication between path terminating equipment.

Byte	Label	Description
K3	HO-APS	Higher order automatic protection switching (bits 1 to 4). Bits 5 to 8 are currently not used.
N1		Higher order tandem connection monitoring. There are two possible implementations described in Annex C and Annex D of ITU-T G.707. In Annex C, the N1 byte provides a tandem connection incoming error count (TC- IEC) and the remaining four bits provide an end-to-end data link. For more information, see “N1 (Bits 7 and 8) Multiframe Structure" on page 297. The Annex D option contains an incoming error count (IOC), tandem connection REI (TC-REI), outgoing error indication (OEI) and a 76-byte multiframe containing a tandem connection access point identifier (TC-APId)

C2 Byte Mapping

Bits 1 to 4	Bits 5 to 8	Hex Code	Description
0000	0000	00	Unequipped or supervisory-unequipped
0000	0001	01	Equipped - non-specific
0000	0010	02	TUG-structure
0000	0011	03	Locked TU
0000	0100	04	Asynchronous mapping of 34 Mb/s or 45 Mb/s into the container C-3
0001	0010	12	Asynchronous mapping of 140 Mb/s into the container C-4
0001	0011	13	ATM mapping
0001	0100	14	MAN (DQDB) mapping
0001	0101	15	FDDI mapping
1111	1110	FE	O.181 test signal (TSS1 to TSS3) mapping
1111	1111	FF	VC-AIS

G1 (Bits 5 to 7) Coding and Interpretation

Bits 5 to 7	Description	Triggers
000	No remote defect	No remote defect
001	No remote defect	No remote defect
010	Remote payload defect	LCD
011	No remote defect	No remote defect
100	Remote defect (RDI-P, ERDI-P)	AIS, LOP, TIM, UNEQ (or PLM, LCD)
101	Remote server defect (ERDI-P-S)	AIS, LOP
110	Remote connectivity defect (ERDI-P-C)	TIM, UNEQ
111	Remote defect (ERDI-P-P)	AIS, LOP, TIM, UNEQ (or PLM, LCD)

N1 (Bits 7 and 8) Multiframe Structure

Frame Number	N1 Bits 7 and 8 Description	
1 to 8	Frame alignment signal: 1111 1111 1111 1110	
9 to 12	TC-APId byte # 1 [1 C1 C2 C3 C4 C5 C6 C7]	
13 to 16	TC-APId byte # 2 [0XXXXXXX]	
17 to 20	TC-APId byte # 3 [0XXXXXXX]	
. .	. .	
65 to 68	TC-APId byte # 15 [0XXXXXXX]	
69 to 72	TC-APId byte # 16 [0XXXXXXX]	
73 to 76	TC-RDI, ODI and reserved (see below)	
	N1 bit 7 Description	**N1 Bit 8 Description**
73	Reserved (default = 0)	TC-RDI
74	ODI	Reserved (default = 0)
74	Reserved (default = 0)	Reserved (default = 0)
76	Reserved (default = 0)	Reserved (default = 0)

Lower Order VC-n Path Overhead (LO POH for VC-11, VC-12 or VC-2)

The lower order path overhead (LO POH) bytes support the transmission of an SDH signal across the low order path of a network.

Byte	Label	Description
V5	LP BIP, Signal Label and Path Status	This byte contains error analysis, signal label and path status information. Bits 1 and 2 contain lower order path error analysis (BIP-2). Bits 5, 6 and 7 contain signal label. For more information, see “V5 (bits 5 to 7) Signal Label" on page 300. Bit 3 contains the Remote Error Indication (LP-REI). Bit 4 contains the Remote Failure Indication (LP-RFI). Bit 8 contains the Remote Defect Indication (LP-RDI).
Number of data bytes separating fields: VC-11 = 25, VC-12 = 34 and VC-2 = 106		
J2	Trail Trace Identifier	The lower order trail trace identifier (16-byte frame including CRC7) supports the end-to-end monitoring of a lower order path.
Number of data bytes separating fields: VC-11 = 25, VC-12 = 34 and VC-2 = 106		
N2	LO TCM	The lower order tandem connection monitoring byte contains the following information: Bits 1 and 2 contains BIP-2 error analysis. Bit 3 is set to “1”. Bit 4 contains incoming AIS. Bit 5 contains Tandem Connection Remote Error Indication (TC-REI). Bit 6 contains Outgoing Error Indication (OEI). Bits 7 and 8 contain a 76-byte multiframe containing a tandem connection access point identifier (TC-APId), TC-RDI, ODI or reserved. For more information, see “N2 (bits 7 and 8) Multiframe Structure" on page 301.
Number of data bytes separating fields: VC-11 = 25, VC-12 = 34 and VC-2 = 106		

Byte	Label	Description
K4	LO APS	The lower order automatic protection switching (APS) and enhanced RDI. Bits 1 to 4 contain the APS. Bits 5 to 7 contain the enhance RDI. For more information, see “K4 (bits 5 to 7) Coding and Interpretation" on page 302.

Number of data bytes separating fields: VC-11 = 25, VC-12 = 34 and VC-2 = 106

V5 (bits 5 to 7) Signal Label

Bits 5 to 7	Description
000	Unequipped or supervisory unequipped
001	Equipped - non-specific
010	Asynchronous
011	Bit synchronous
100	Byte synchronous
101	Reserved for future use
110	O.181 test signal (TSS4)
111	VC-AIS

N2 (bits 7 and 8) Multiframe Structure

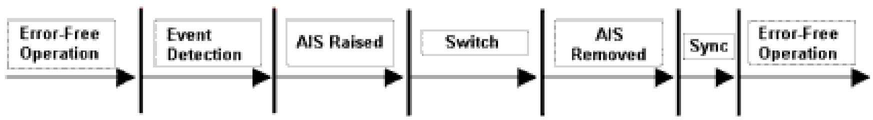
Frame Number	N2 Bits 7 and 8 Description	
1 to 8	Frame alignment signal: 1111 1111 1111 1110	
9 to 12	TC-APId byte # 1 [1 C1 C2 C3 C4 C5 C6 C7]	
13 to 16	TC-APId byte # 2 [0XXXXXXX]	
17 to 20	TC-APId byte # 3 [0XXXXXXX]	
. .	. .	
65 to 68	TC-APId byte # 15 [0XXXXXXX]	
69 to 72	TC-APId byte # 16 [0XXXXXXX]	
73 to 76	TC-RDI, ODI and reserved (see below)	
	N2 bit 7 Description	**N2 Bit 8 Description**
73	Reserved (default = 0)	TC-RDI
74	ODI	Reserved (default = 0)
74	Reserved (default = 0)	Reserved (default = 0)
76	Reserved (default = 0)	Reserved (default = 0)

K4 (bits 5 to 7) Coding and Interpretation

Bits 5 to 7	Description	Triggers
000		
001	No remote defect	No remote defect
010	Remote payload defect	LCD, PLM
011		
100		
101	Remote server defect	AIS, LOP
110	Remote connectivity defect	TIM, UNEQ
111		

Service Disruption

Service disruption is the time it takes for a transmission system to perform an automatic protection switch following the detection of a transmission defect. Events occurring during protection switching are shown:



If a fiber break causes protection switching in a network element, an Alarm Indication Signal may be initiated by the network element. Once switching takes place, the AIS is removed. After a period of synchronization on the protection signal path, error-free operation is resumed.

ITU-T recommend that protection switching should take 50 milliseconds or less. While this is a difficult standard to meet, a large part of the problem is in actually initiating the protection switch. There are two methods to achieve this effectively:

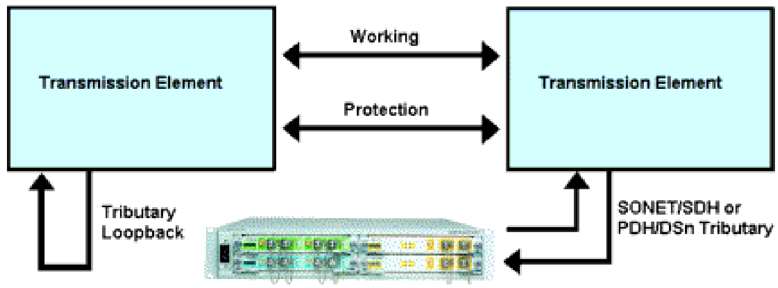
- Create a LOS failure, which will typically be detected in under 100 microseconds.
- Generate control parity errors on the protected system.

Each method has its own advantages and is ideal for particular test scenarios.

For more information, see:

- “Test Configuration for Measuring Service Disruption Time" on page 305
- “Contributors to Protection Switching Time" on page 306
- “Protection Switching Time Test Methods" on page 308
- “Measuring Protection Switch Time" on page 309
- “Understanding Service Disruption Test Results" on page 315

Test Configuration for Measuring Service Disruption Time

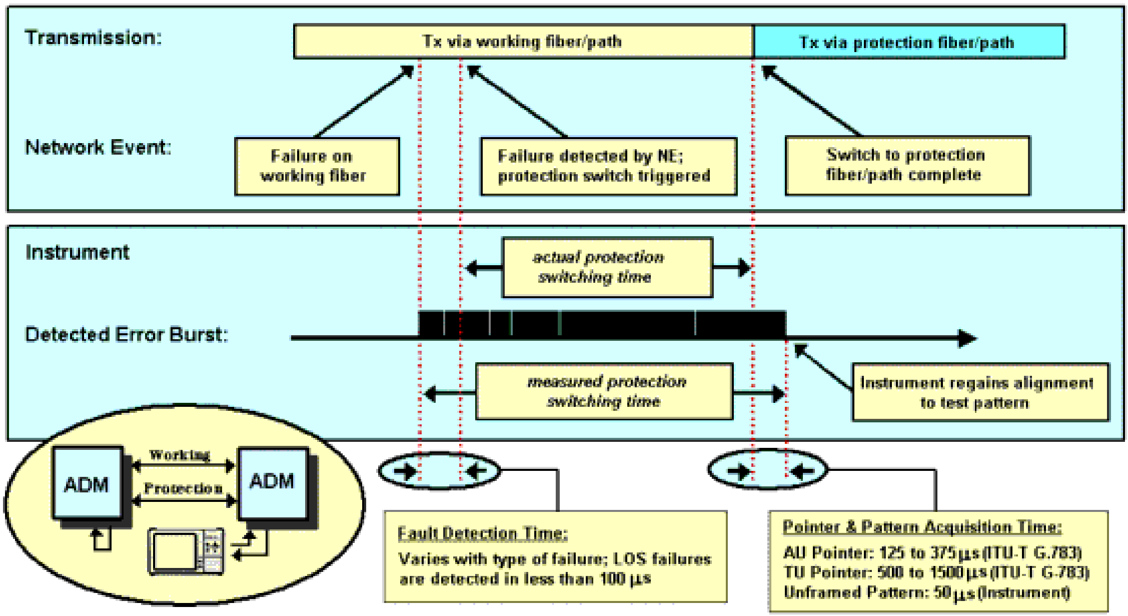


To measure service disruption time, insert a PRBS pattern at the tributary side of the device-under-test, looping it back on itself on the corresponding drop-side tributary. Monitor the received PRBS for errors as a switch occurs.

Result accuracy and reliability are based on the instrument’s ability to measure the duration of error bursts associated with a protection switch event.

By measuring service disruption time from the tributary-side of the system-under-test, the measurement will be independent of the protection switching architecture. This setup supports all protection switching architectures. The performance of the system-under-test cannot be affected by the instrument since results are obtained through passive monitoring of the PRBS for errors.

Contributors to Protection Switching Time



When a protection switch is triggered (a fiber break can trigger a protection switch), it results in the PRBS test pattern being corrupted for a short period. The duration of this corruption is controlled by the following factors:

- The system’s fault detection time
- The system’s protection-switching time
- The time taken by the instrument to re-align to the pointers (SONET/SDH tributary only) and test pattern

System Fault Detection Time

For fault detection time, this is achieved by triggering the protection switch using a failure that results in a LOS defect. Although ITU-T G.783 (2000) defines LOS detection time as being “in the province of regional standards”, it provides an example based on a value of less than 100 microseconds (less than 0.2% of the maximum acceptable protection-switching time). In the case of pointer and pattern acquisition, the required times are 125 to 375 microseconds for STS/AU pointers, and 500 to 1500 microseconds for VT/TU pointers.

System Protection Switching Time

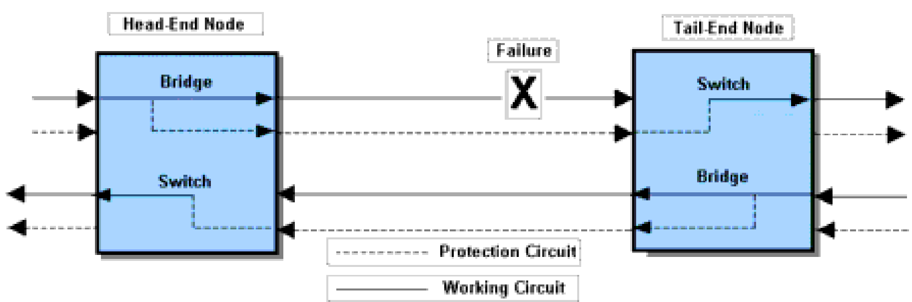
When measuring a system’s protection-switching time, the total systematic error associated with the instrument’s service disruption measurement can be restricted to between +0.3% to +4.05% of the maximum acceptable switching time. Consequently, it can be relied on to accurately evaluate this important system specification.

Protection Switching Time Test Methods

Many SONET/SDH linear and ring networks have built-in fault restoration known as Automatic Protection Switching (APS). However, the basic principles behind the instrument's Service Disruption measurement, and its application in verifying a transmission system's protection switching time, remain valid.

Following a failure, full service is not restored until all the Bridge and Switch operations are completed. A key goal for Network Equipment Manufacturers (NEMs) is to keep service disruption as short as possible, as their customers (Network Operators) will demand that all systems deployed in the network meet or exceed the specification published by the governing standards body (Telcordia or ITU-T). This section deals with the challenge of making meaningful and repeatable measurements of Protection Switch Time.

Protection Switching Summary



The diagram shows the state of the nodes after a switch has taken place. A typical sequence of events is listed below:

1. The Tail-End node detects the failure and signals the Head-End to request a Protection Switch.
2. The Head-End node performs a Bridge or Bridge and Switch operation, and sends back an acknowledgement.
3. The Tail-End node receives the acknowledgement and performs a Bridge and Switch operation, then finishes by sending a status message to the Head-End.

4 The Head-End node finishes by performing a Switch operation if necessary.

Measuring Protection Switch Time

The Protection Switch Time of a transmission system should be equal to or less than 50 milliseconds. The switching process is dominated by the protocol processing time at each node on the Protection Circuit. The ITU-T standards specifies Protection Switch Time and the ‘detection times’ for various SF and SD conditions.

Protection switching can be initiated by the following events:

1 Signal Fail (SF): usually loss of signal, loss of framing, or a very high error ratio such as 10E-03 or greater.

2 Signal Degrade (SD): a persistent background error rate that exceeds a provisioned threshold in the range 10E-05 to 10E-09. Note that, at the Multiplex Section level, ITU-T G.806 (October 2000 draft) specifies the ‘detection time’ for these errors as 10E-09.

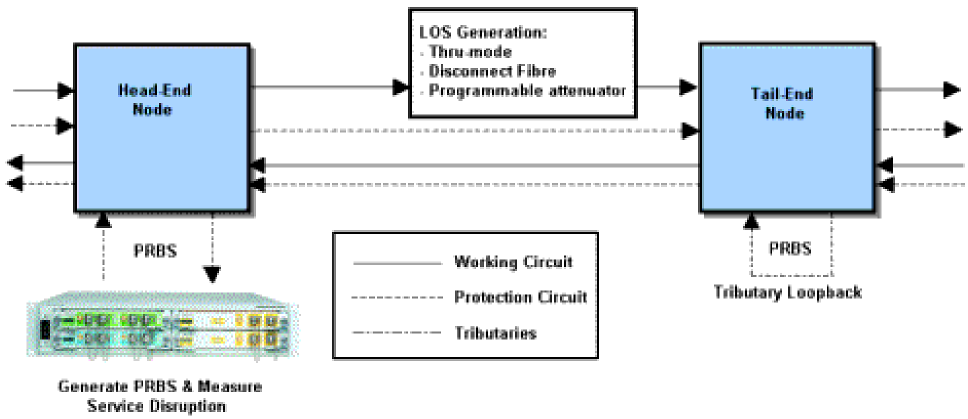
To reliably measure protection switching time, you need to measure the service disruption time associated with a SF/SD condition that either minimizes the ‘detection time’ (create a LOS failure – typically detected in less than 100 ms), or eliminates the ‘detection time’ (generate control Parity Errors (B2 and B3) on the entity being protected). Dividing service disruption time into its component parts is necessary due to the wide variation in detection times for different SF/SD conditions.

Detection Times

These range from 100 microseconds for a LOS failure to 10,000 seconds for a Signal Degrade that has a provisioned threshold of 10E-09 error rate. Also, the nature of some faults can be very unpredictable. For example, when a fiber is damaged during construction work it may not break cleanly. Instead, the optical signal may fade over several tens of milliseconds or vary erratically before finally disappearing. So the ITU-T standards require that, once SF/SD is detected, a Protection Switch event must be completed in 50 milliseconds or less. This is a tough requirement, but if it is met, end-users will not normally notice a Protection Switch event even allowing for a realistic SF/SD detection time.

Generating LOS Failure

This diagram shows three ways to generate a LOS failure.



If you use **Thru mode**, the LOS condition is induced by either switching off the instrument's laser transmitter or using its alarm generation controls to transmit LOS. Both of these controls produce a predictable and instantaneous LOS condition, and consequently enable repeatable and accurate protection switching time measurements to be performed.

The only source of measurement error associated with this method will be due to the LOS detection time being included in the service disruption time result. This is the recommended method for generating a LOS failure when measuring protection switch times.

If you **manually disconnect** an optical fiber, you will generate the LOS (but it is not an instantaneous LOS). The power level will roll-off over the time taken to perform the disconnect. Consequently, variation in the 'speed' of manual disconnection can lead to poor result repeatability.

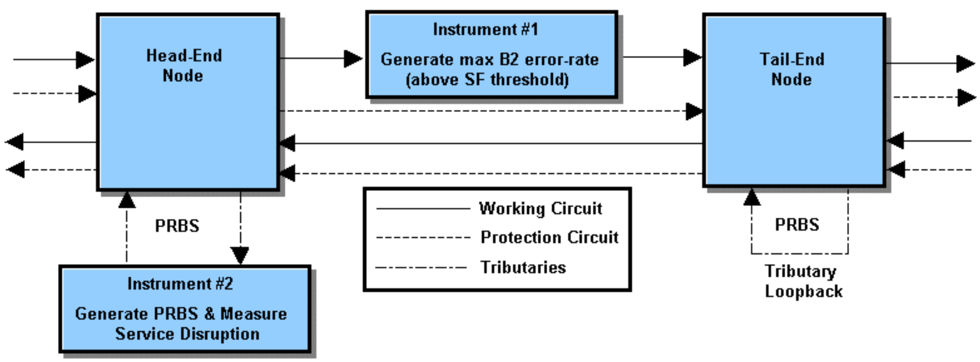
WARNING Exercise extreme caution when disconnecting an optical fiber – follow your organization's standard safety procedures.

If you insert a **programmable optical attenuator** in to the working circuit, you have a more predictable method of inducing LOS. However, it may not fully address the issue of 'measurement error' due to the optical power level rolling-off over a finite period of time. Most programmable optical attenuators have a specified response time.

Generating Excessive Errors (SF Trigger)

With the instrument in Thru mode, inject a high-rate of errors into the parity-check byte(s) associated with the protection system under test. In a Multiplex Section/Line protected system, B2 parity errors are used, while HP-B3 and LP-B3/BIP-2 parity errors are used for High-order Path and Low-order Path protected system respectively.

In the following example, the system-under-test is protected at the Multiplex Section/Line level.



To generate excessive errors and create a Signal Fail condition in the system-under-test, inject B2 errors at rate that exceeds the receiving NE’s provisioned threshold for the Excessive Error condition.

To always exceed the provisioned error threshold, inject the maximum error rate supported by the parity-check bytes (in this case – continuously error all bits of all B2 bytes).

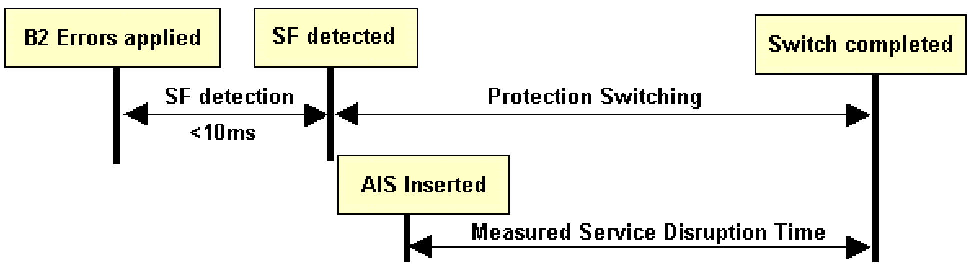
Since errors are only injected into the B2 parity bytes they will not affect the traffic being carried. Consequently, no errors will be added to the PRBS test pattern.

This method will produce accurate and repeatable protection switching time results.

Signal Fail (SF) Triggering a Protection Switch Sequence

Within 10 ms of injecting the B2 errors, the Tail-End node (the NE receiving the B2 errors) will detect the Excessive Error condition. This causes the NE to declare a SF and to initiate a protection switch sequence.

In addition, the Tail-End node is required to insert an AIS alarm in all down-stream traffic channels within 250 microseconds of declaring SF. And since this AIS will overwrite the PRBS test pattern that is transmitted and monitored by test set#2, it causes the service disruption measurement to be triggered (started).



For standards compliant network elements, this method will produce accurate and repeatable protection switching time results. Its main advantage over the ‘LOS methods’ discussed earlier is that it eliminates the ‘SF detection time’ error from the measured result. The only technical drawback is that its results slightly under-estimate a system’s protection switching time – but only by up to 250 microseconds (assuming that the Tail-End node inserts the downstream AIS within the 250 microseconds period specified in ITU-T G.783). Possibly the most serious ‘drawback’ associated with this measurement method is a commercial one – it requires two transmission test sets (one covering the required tributary rates, the other covering required line rates).

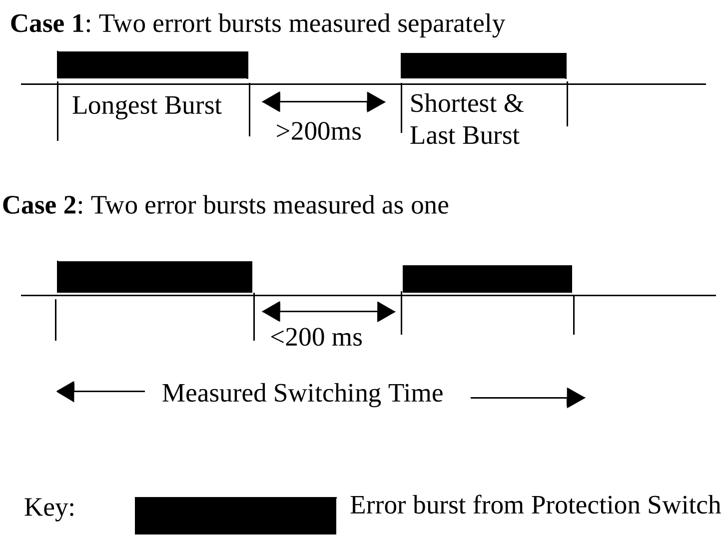
Understanding Service Disruption Test Results

To interpret service disruption results you must understand the rules associated with the analysis of error-burst duration.

The service disruption test measures the elapsed time between the first and last error in an error-burst that consists of one or more errors. The error-burst is taken as having ended when no errors are detected for a period of greater than the Guard Time following the last error.

“Illustrating Service Disruption Results" on page 316 shows the affect these simple rules have on measurement results when different error distributions are present in the received test pattern.

Illustrating Service Disruption Results



In Cases 1 and 2 the system-under-test generates two error-bursts when a protection switch is made. The results will be affected by the separation of these two error-bursts. In Case 1 a result for each error-burst will be reported (since they are more than the Guard Time apart), while in Case 2 only a single high value will be reported (since they are less than the Guard Time apart). In both cases the reported results will indicate that a problem exists in the system-under-test.

Index

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

V

W

Z

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