MTS4000 and MTS4SA
MPEG Test System

Quick Start User Manual

Tektronix

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[W2 – 15AUG04]

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[W9b – 15AUG04]

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Table of Contents

MTS4000 and MTS4SA Quick Start User Manual

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

The inputs are not rated for connection to mains or Category II, III, or IV circuits.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do not operate without covers. Do not operate this product with covers or panels removed.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Wear eye protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

Provide proper ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in This Manual

These terms may appear in this manual:

⚠️ **_WARNING._** _Warning statements identify conditions or practices that could result in injury or loss of life._

⚠️ **_CAUTION._** _Caution statements identify conditions or practices that could result in damage to this product or other property._

Symbols and Terms on the Product

These terms may appear on the product:

- ■ DANGER indicates an injury hazard immediately accessible as you read the marking.

- ■ WARNING indicates an injury hazard not immediately accessible as you read the marking.

- ■ CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:

⚠️	⏚	○	I	⏻
CAUTION Refer to Manual	Protective Ground (Earth) Terminal	Mains Disconnected OFF (Power)	Mains Connected ON (Power)	Standby

Compliance Information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies.

EMC Compliance

EC Declaration of Conformity – EMC

Meets intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1:2006. EMC requirements for electrical equipment for measurement, control, and laboratory use. [1] [2] [3]

- CISPR 11:2003. Radiated and conducted emissions, Group 1, Class A

- IEC 61000-4-2:2001. Electrostatic discharge immunity

- IEC 61000-4-3:2002. RF electromagnetic field immunity [4]

- IEC 61000-4-4:2004. Electrical fast transient / burst immunity

- IEC 61000-4-5:2001. Power line surge immunity

- IEC 61000-4-6:2003. Conducted RF immunity

- IEC 61000-4-11:2004. Voltage dips and interruptions immunity

EN 61000-3-2:2006. AC power line harmonic emissions

EN 61000-3-3:1995. Voltage changes, fluctuations, and flicker

European Contact.
Tektronix UK, Ltd.
Western Peninsula
Western Road
Bracknell, RG12 1RF
United Kingdom

[1] This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

[2] Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.

[3] To ensure compliance with the EMC standards listed here, high quality shielded interface cables should be used.

[4] The MTS4000 meets the requirements of the harmonized standards listed above when configured with all interface cards except option QB2 (QAM Annex B). Specific conditions for RF electromagnetic field immunity apply to this option as follows. When demodulating QAM-256 constellation signals, the QAM Annex B card can be susceptible to radiated electromagnetic fields at levels below those in EN 61326-1 Table 1 for IEC 61000-4-3. This only occurs in a very narrow frequency band that is 44 MHz (the QAM tuner local oscillator frequency) higher than the tuned input frequency. Because of the high sensitivity of the QAM demodulator in this mode, RF lock may be lost, or stream errors may occur. For best performance, use only high quality well shielded cables to connect to the MTS4000, and avoid the use of cable adapters.

Australia / New Zealand Declaration of Conformity – EMC

Complies with the EMC provision of the Radiocommunications Act per the following standard, in accordance with ACMA:

■ CISPR 11:2003. Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN 61326-1:2006.

Australia / New Zealand contact.

Baker & McKenzie
Level 27, AMP Centre
50 Bridge Street
Sydney NSW 2000, Australia

Safety Compliance

EC Declaration of Conformity – Low Voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:

Low Voltage Directive 2006/95/EC.

■ EN 61010-1: 2001. Safety requirements for electrical equipment for measurement control and laboratory use.

U.S. Nationally Recognized Testing Laboratory Listing

■ UL 61010-1:2004, 2nd Edition. Standard for electrical measuring and test equipment.

Canadian Certification

■ CAN/CSA-C22.2 No. 61010-1:2004. Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1.

Additional Compliances

■ IEC 61010-1: 2001. Safety requirements for electrical equipment for measurement, control, and laboratory use.

Equipment Type

Test and measuring equipment.

Safety Class

Class 1 – grounded product.

Pollution Degree Description

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.

- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.

- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution Degree

Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor use only.

Installation (Overvoltage) Category Descriptions

Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:

- Measurement Category IV. For measurements performed at the source of low-voltage installation.

- Measurement Category III. For measurements performed in the building installation.

- Measurement Category II. For measurements performed on circuits directly connected to the low-voltage installation.

- Measurement Category I. For measurements performed on circuits not directly connected to MAINS.

Overvoltage Category

Overvoltage Category II (as defined in IEC 61010-1)

Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of

life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Mercury notification. This product uses an LCD backlight lamp that contains mercury. Disposal may be regulated due to environmental considerations. Please contact your local authorities or, within the United States, refer to the E-cycling Central Web page (www.eiae.org) for disposal or recycling information.

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive.

Preface

This manual describes the functions and use of the Tektronix MTS4000 MPEG Test Systems. The following naming conventions are used in this manual:

■ MTS4000 system – for information that applies to the MTS4000 and the MTS4SA

■ MTS4SA Stand-alone system – for information that applies to only the MTS4SA

Key Features

■ Supports a wide range of DTV standards, including MPEG, DVB, ATSC, and ISDB. Specific SI for Terrestrial, Cable and Satellite, and regional variations of these standards.

■ A range of interfaces and analysis capabilities provide the necessary connectivity to diagnose problems anywhere in the network environment, including RF or IP layer transmission links or transport stream content processing.

■ Connects to both IP version 4 and 6 networks, including those using IGMP and MLD multicast protocols.

■ Analysis of Constant Bit Rate Streams (CBR).

■ Integrated cross-layer fault analysis and logging provide a single box solution for fault diagnosis, reducing time to insight when troubleshooting.

■ The playout functionality provides stimulus with parametric capabilities and IP multisession replication to characterize behavior of a network or device under test.

■ CaptureVu™ technology captures and analyzes system events in real-time and deferred-time to debug intermittent and complex problems.

■ An innovative program-centric user interface brings expert power to the novice user.

■ H.264 buffer analysis, multiplexing and elementary stream compliance checking provide a powerful suite of tools for creation and analysis of transport streams containing H.264 content.

■ Video and audio quality analysis to help distinguish between impairments resulting from network distribution versus artifacts resulting from compression.

■ Multi input monitoring.

Documentation

This manual describes the installation and basic operation of the MTS4000 system. The following information is also available for this product:

Item	Purpose	Location
MTS4000 Quick Start User Manual (071-2970-xx English, 077-0665-xx Simplified Chinese, 077-0666-xx Japanese, 077-0657-xx Russian)	Describes how to install and get started using the test systems.	
MTS4000 Analyzer Applications User Manual (077-0622-xx)	Describes the operation of the following analyzer applications: TSCA, PES Analyzer, T-STD Buffer Analyzer, and ES Analyzer.	

Item	Purpose	Location
MTS4000 Generator Applications User Manual (077-0623-xx)	Describes the operation of the following generator applications: Multiplexer, MPEG Player, TS Editor, Make Seamless Wizard, Transport Stream Cutter, and Script Pad.	
MTS4000 Carousel Applications User Manual (077-0624-xx)	Describes the operation of the Carousel Analyzer and Carousel Generator applications.	
MTS4000 MPEG Test Systems Specifications and Performance Verification Technical Reference (077-0626-xx)	Provides a list of product specifications and verification procedures.	
MTS4000 Release Notes (077-0200-xx)	Describes known issues with the test systems.	
MTS4EA Compressed Video Elementary Stream Analyzer User Manual (071-1641-xx)	Describes the operation of the MTS4EA application software.	
MTS4CC Elementary Stream Compliance Checker User Manual (071-2075-xx)	Describes the operation of the MTS4CC application software.	
PQA600 Picture Quality Analyzer Quick Start User Manual (071-2775-xx)	Describes the operation of the PQA600 application software.	
VQS1000 Video Quality Software Quick Start User Manual (077-0489-xx)	Describes the operation of the VQS1000 application software.	

User documents can be downloaded from the Tektronix Web site: www.tektronix.com/manuals.

The following URLs access the Web sites for the standards organizations listed (the URLs listed were valid at the time of writing):

■ MPEG-2 standards (International Organization for Standards) – www.iso.org/

■ DVB standards (European Technical Standards Institute) – www.etsi.org/

■ ATSC standards (Advanced Television Systems Committee) – www.atsc.org/

Conventions Used in This Manual

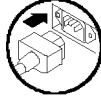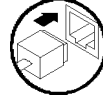The following icons may be used throughout this manual.
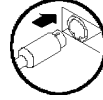
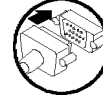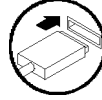| Sequence Step	Front panel power	Connect power	Network	PS2	SVGA	USB

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Installation

Before Installation

Perform the following product inspection procedure when you receive your instrument.

1. Inspect the shipping carton for external damage, which indicates possible damage to the instrument.

2. Remove the MTS4000 instrument from the shipping carton.

3. Check that the instrument has not been damaged in transit. The exterior should not have any scratches or impact marks. Before shipment, the instrument is thoroughly inspected for mechanical defects.

NOTE. Save the shipping carton and packaging materials for instrument repackaging in case shipment becomes necessary. (See page 69, Returning the Instrument for Service.)

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4. Verify whether you received the standard accessories and any optional accessories that you ordered. (See page 61, *Accessories*.)

Operating Considerations

The following table lists the electrical operating requirements for the MTS4000 systems. The complete electrical operating requirements of the MTS4000 instrument are listed in the *MTS4000 MPEG Test Systems Specifications and Performance Verification Technical Reference*.

Requirement	Specification
Operating temperature	+ 5 °C to + 40 °C
Operating altitude	0 to 2000 m (6562 ft)
Operating humidity	20% to 80% relative humidity, non-condensing
Source Voltage	100 to 240 V_{AC} ± 10% (90 to 264 V_{AC} RMS)
Frequency range	50/60 Hz
Maximum Power Consumption	220 Watts
Fuse	Not operator replaceable. Refer servicing to qualified service personnel
Overvoltage category	II (as defined in IEC 61010-1)
Pollution degree	2 (as defined in IEC 61010-1). Rated for indoor use only

Controls and Connectors

This section describes the MTS4000 system instrument controls and connectors. The analysis functions (if enabled) can be used with no installation other than providing power and making a transport stream available on the hard disk of the instrument. The monitoring and real-time analysis functions similarly require power, but also require connection to an external transport stream.

The MTS4000 system is configured with the software and hardware options that you ordered at the time of purchase. MTS4000 system options can be added using upgrade kits available from Tektronix.

CAUTION. *To prevent instrument damage from overheating, maintain at least two inches (5.1 cm) of clearance at the rear and sides of the instrument cabinet when locating the instrument on a bench.*

CAUTION. *Do not supply power to the instrument until all other connections have been made.*

Side Connectors

The following figure and table illustrates the MTS4000 system connectors.

2970-001
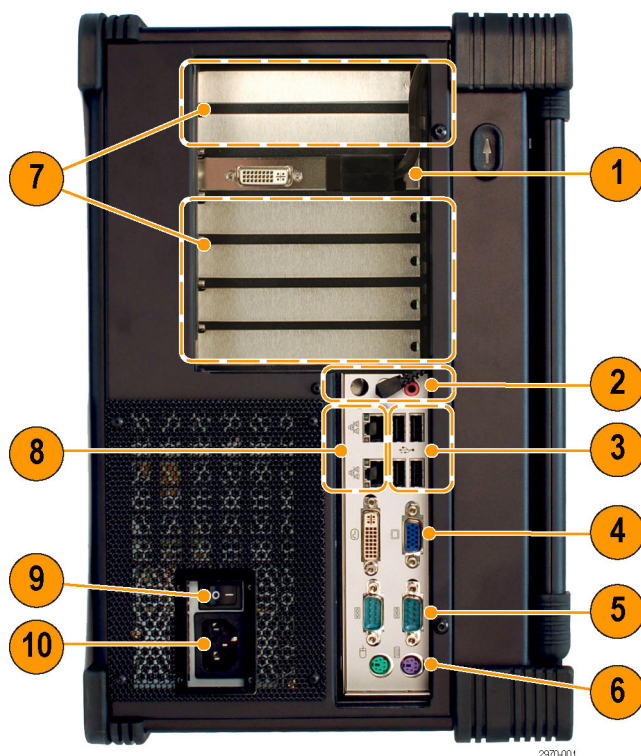
Figure reference	Description	Figure reference	Description
1	Main DVI display port (to mainframe LCD) Secondary DVI display port [1], [2]	6	PS/2 mouse and keyboard connectors [1]
2	Line Out — connected to the mainframe speaker Line In — not functional Mic [1]	7	Optional interface card bays
3	USB host ports	8	RJ-45 LAN connectors
4	DVI, VGA Video connectors — not functional	9	AC mains power switch
5	COM 1 and COM 2 serial ports	10	AC mains power plug Ensure that you use the proper power cord for your location.

[1] EMC performance is not tested with cables connected to this port.

[2] The secondary display port can be used to display or extend the MTS4000 display. The display must be connected during the instrument start up.

Front Panel Controls and Connectors

The following figure and table illustrates the MTS4000 front panel controls and connectors.

2970-003
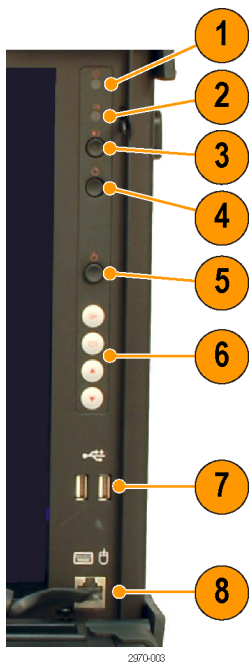
Figure reference	Description	Figure reference	Description
1	Power indicator. Flashes when in standby mode.	5	On/Standby button
2	Hard drive activity indicator	6	LCD controls
3	Display on/off button	7	USB host ports
4	Restart button (recessed)	8	Keyboard/mouse connector

Option Card Connectors

The MTS4000 System can be configured optional cards that support various transport streams, networks, and peripheral devices. This section describes each of the available option cards and their connectors.

See the *MTS4000 MPEG Test Systems Specifications and Performance Verification Technical Reference* for more detailed information about each connector and signal input and output formats for each of the option cards.

NOTE. Up to four option cards can be installed into the instrument, but only two of the following options: S2, VS, QB2, IPTV.

Ensure that the USB software key (dongle) is installed in one of the USB ports.

NOTE. The MTS4000 system applications and installed option cards require the software key.

If you return the test system to a Tektronix Service Center for upgrade or repair, include the software key.

Table 1: Option cards and connectors

Multiport ASI Interface (Option ASI)

Connectors: BNC, 75 Ω
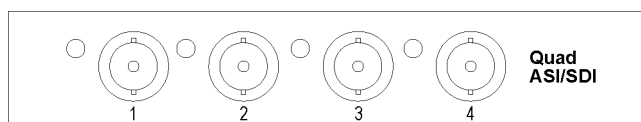
DVB-S/S2 Interface (Option S2)

DVB-S/S2 interface supporting QPSK, 8PSK, 16APSK and 32APSK demodulation (requires Option ASI)
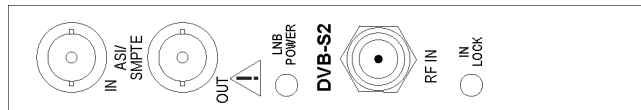
8VSB Interface (Option VS)

8VSB interface in accordance wit ATSC A/53B (requires Option ASI)
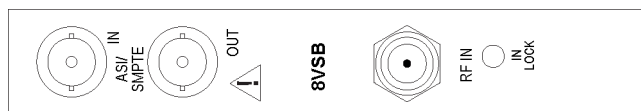
QAM B Interface (Option QB2)
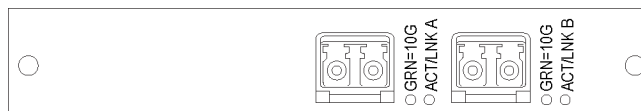
64QAM, 256QAM Interface (requires Option ASI)

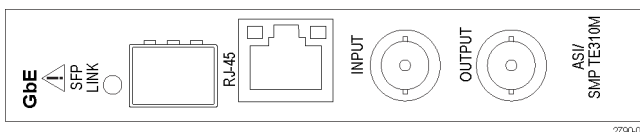**10GBase-SR Dual Optical Port 10GB/S NIC (Option 10GS)**

10GBase-SR Dual Optical Port 10 Gbps NIC. Includes Short Reach SFP+ and Modules (850 nm)

IP Video Interface (Option IPTV)

IPTV Gigabit Ethernet Interface with 10/100/1000 Base-T RJ45 Electrical Port (requires Option ASI)

SFP Modules (Options SX, LX, ZX)

1000 Base-SX Short Wavelength Optical Port with LC Connector for IPTV Ethernet Interface (Multi Mode 850 nm)

1000 Base-LX Long Wavelength Optical Port with LC Connector for IPTV Ethernet Interface (Single Mode 1310 nm)

1000 Base-ZX Optical Port with LC Connector for IPTV Ethernet Interface (Single Mode 1550 nm)

The optical port plug must be installed in the SFP module when no cable is connected.

To avoid exposure to hazardous laser radiation, use only Class 1 lasers as defined in the USA Federal Regulations CDRH 21 CFR 1040 and IEC/EN 60825/A2:2001.

MTS4SA Stand-Alone System Installation

The MTS4SA Stand-alone system makes the MTS4000 system applications available on a PC.

The MTS4SA includes a USB dongle. When installed on your PC, the USB dongle contains the keys to enable various MTS4000 software options. The keys stored on the USB dongle depends on which software options you purchased.

If the MTS4EA option (MTS4EA Compressed Video ES Analyzer) was purchased, use the installation procedure provided in the accompanying user manual (*MTS4EA Compressed Video ES Analyzer User Manual*, 071-1641-XX).

System Requirements

The following minimum PC configuration is recommended for installing the MTS4SA Stand-alone system:

- Microsoft Windows XP or Windows 7 operating system

- Processor speed >1.2 GHz

- Memory at least 1 GB RAM

- Screen resolution at least 1024 x 768

- 1 GB minimum hard disk space

NOTE. The MTS4EA MPEG Compressed Video ES Analyzer application will run satisfactorily on a PC with the preceding specifications. However, some of the more intensive operations will benefit from using a more powerful PC. Refer to the MPEG Compressed Video ES Analyzer User Manual for more details.

Installation Procedure

1. Ensure that the USB software key (dongle) supplied is inserted into a USB port on the PC.

2. Place the MTS4000 Application Software media in the DVD drive on your PC.

   The installation program will start and display a Welcome screen.

   Depending on your Windows setup and security settings, the MTS4000 installation autostart may not launch.

   If necessary, you can use Windows explorer to locate and run the file MTS4000_setup.exe on the MTS4000 Application Software media.

3. In the installation Welcome screen, select **Next**.

4. Read the End-User License Agreement. Accept the agreement and select **Next**.
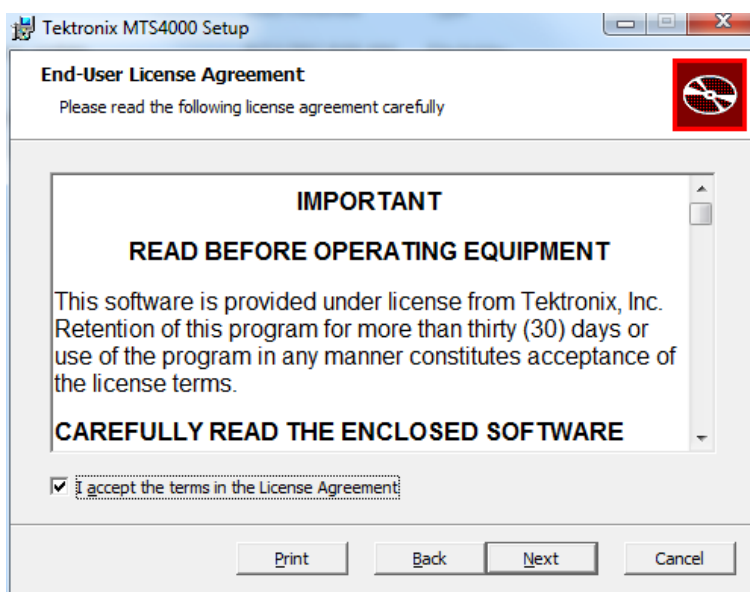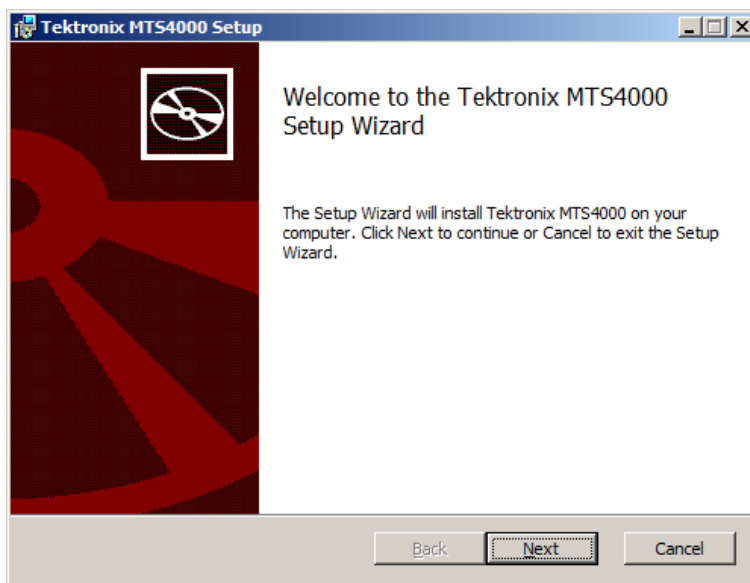
5. In the Setup Type screen, you need to indicate if this installation is for a PC or for the MTS4000 platform.

Installing on a PC:

Uncheck the *Install on MTS4000 Platform* check box.

Installing on the MTS4000 platform:

Check the *Install on MTS4000 Platform* check box.

NOTE. When the Install on MTS4000 Platform is checked, all necessary drivers for the interface cards are installed.
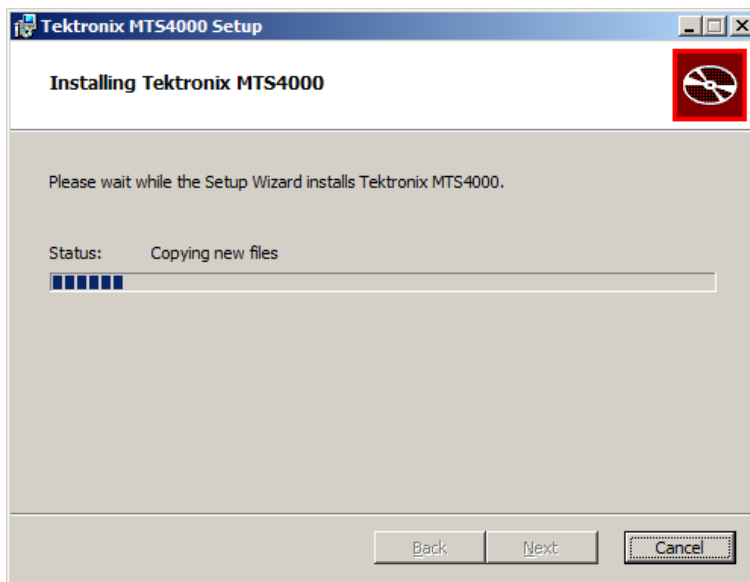
6. Select **Next**.

7. In the Ready to Install screen, select **Install**.

If the installation program detects an older version of the MTS4000 software, the software is automatically uninstalled.
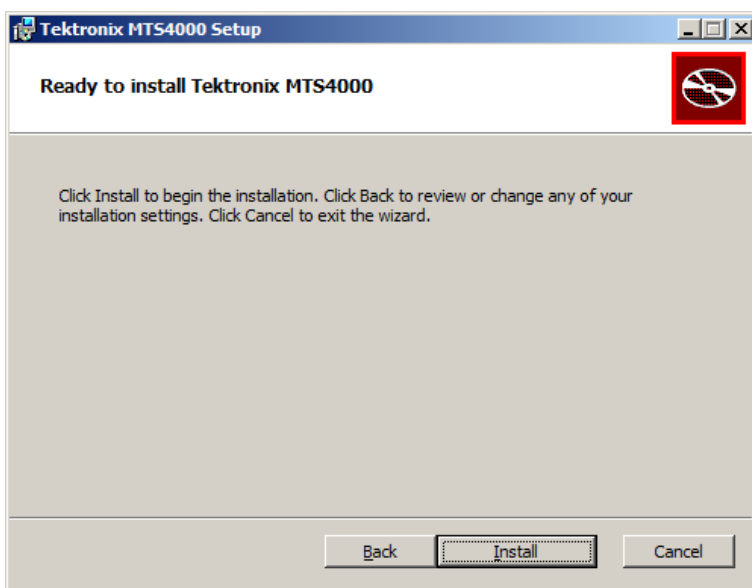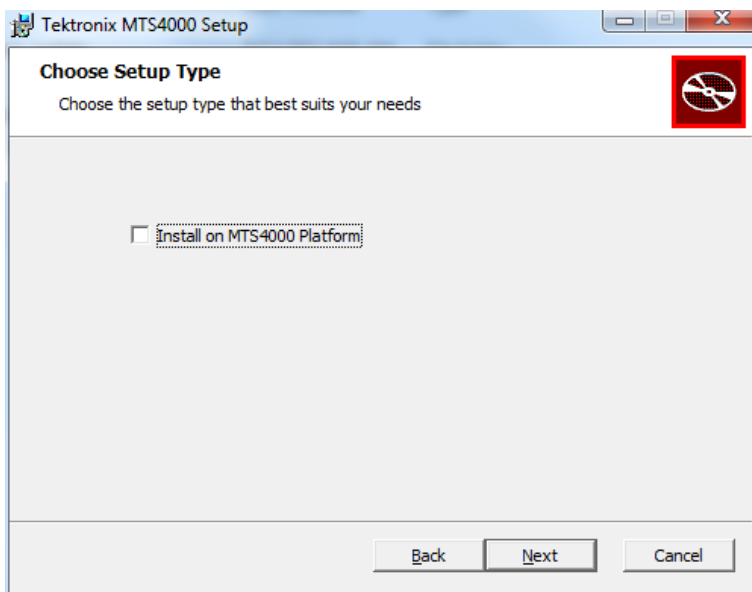
NOTE. A number of installation message boxes display during the installation process. Normally, no user intervention is required.

8. Allow the installation to proceed.

9. Depending on the Windows security settings, you may see a Windows Security message to install device software. Select **Install**.

This installation window does not display if DESkey software is installed.

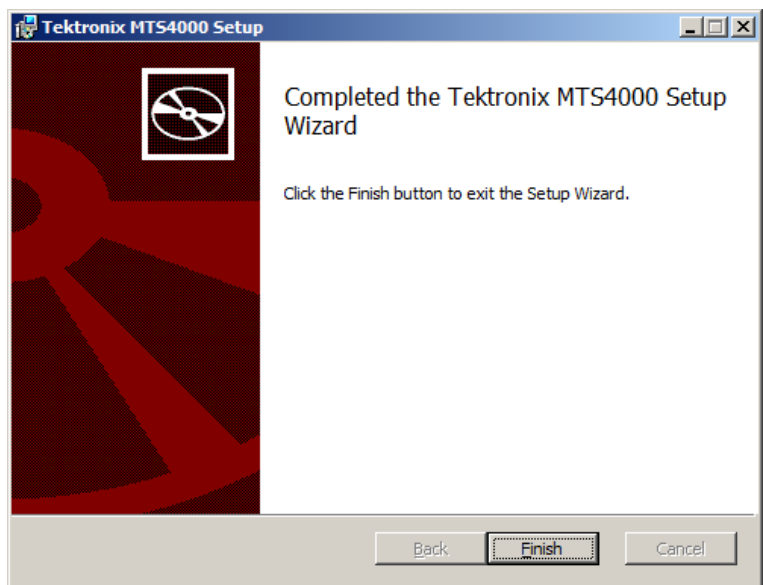**10.** When the WinPcap installer displays, select **Next**.

Proceed with the WinPcap installation process.

The WinPcap installation is skipped If the MTS4000 installation process detects that the correct version WinPcap is already installed.
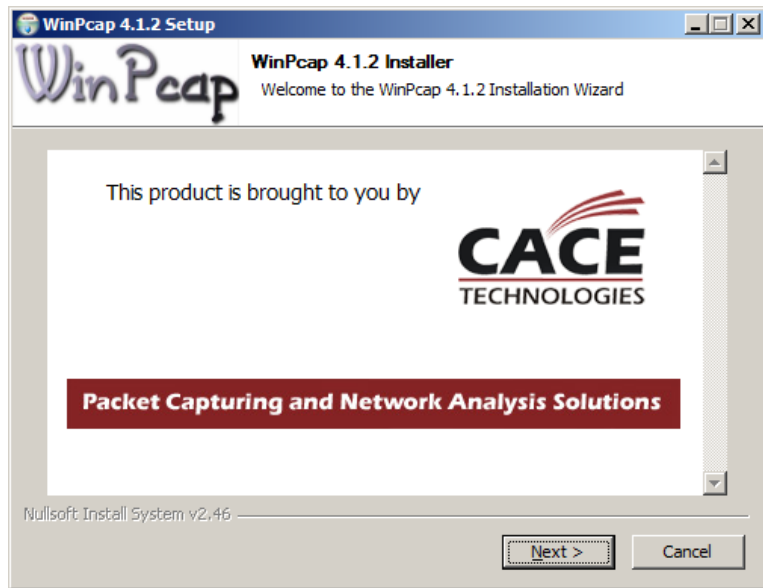
11. When installation completed screen displays, select **Finish**.

A reboot is necessary before using the applications.

12. When the PC has restarted, the MTS4000 Option Key Wizard must be started; select **Start > Programs > Tektronix MTS4000 > OptionKey Wizard**.

13. In the Tektronix Option Update dialog box, enter the Option Key String supplied with the installation documentation in the Key String field.

14. Click **Apply**.

15. Inspect and verify the list of licensed options.
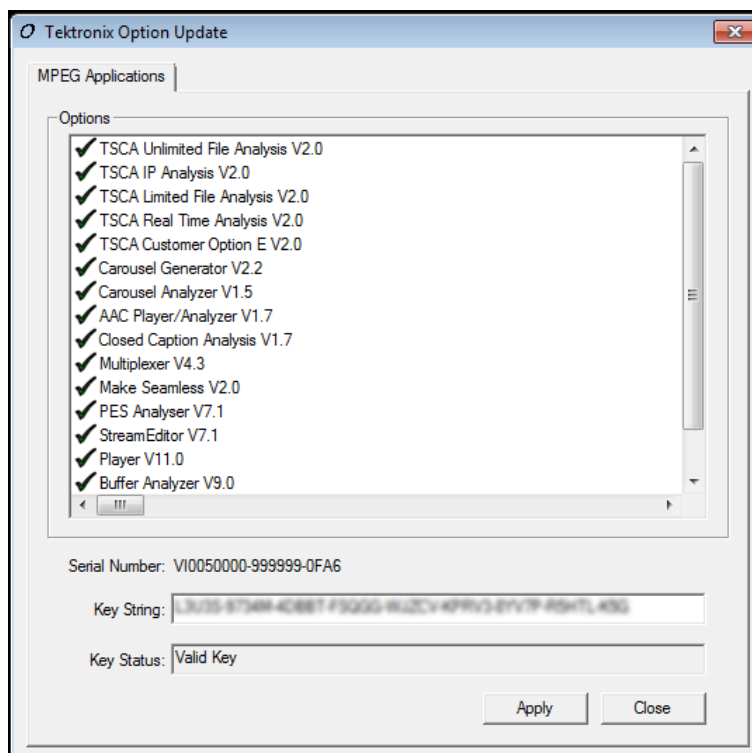
NOTE. Operational access to features is controlled by the licenses that are available on the software key. Applications and features can be installed, but will not be available unless the appropriate license has been obtained. Notification of these is provided when the product or additional licenses are purchased.

The MTS4EA and MTS4CC licensing is stored in the USB dongle. The VQS and PQA software require separate licensing.

16. Close the Option Key Wizard.

17. The licensed MTS4000 Stand-alone applications are now available in the Windows Start menu. (See page 24, *Starting an Application*.)

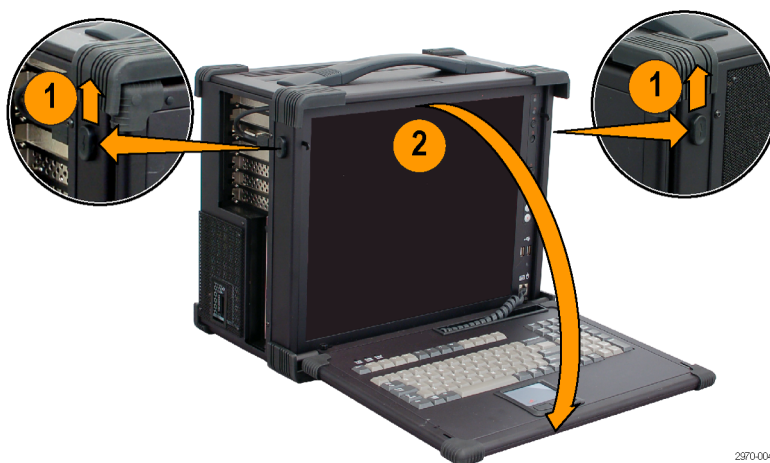# Powering On the Instrument

Supplying Power

The MTS4000 systems are designed to operate from a single-phase power source having one of its current carrying conductors at or near earth ground (the neutral conductor). Power sources that have both current carrying conductors live with respect to ground, such as phase-to-phase or multiphase systems, are not recommended. A protective ground connection, by way of the grounding conductor in the power cord, is essential for safe operation.

After you have installed the MTS4000 system and completed making the signal and peripheral connections, plug the power cord into the mains power supply.

Power On

Power on the test system as follows:

1. Slide the keyboard locks up.

2. Fold down the keyboard.

2970-004

3. Push the front-panel On/Standby switch to power on the instrument.

NOTE. Ensure the Mains switch on the rear panel is set to on.

Wait for the instrument to complete its power-on self-tests.

The default user name is MTS with the password mts.

NOTE. Refer to the Windows help documentation for setting up user accounts and passwords.

Detaching the Keyboard

1. Slide the keyboard pins towards the center.

2. Slide the keyboard out from the MTS4000 case.

2970-011

Powering Off the Instrument

Push the front panel On/Standby button and release. The system will shut down and power off automatically with no further intervention.

Alternately, power off the instrument using the Windows 7 shutdown process (select **Start** > **Shut down...**). The system (including applications) will shut down automatically.

If the instrument should become unresponsive, press and hold the On/Standby button for five seconds. This forces the instrument to shutdown, bypassing the Windows power down sequence.

VLC Media Player Installation

To be able to view video in the Transport Stream Compliance Analyzer (TSCA), the latest version of the VLC Media Player must be downloaded from the VideoLAN Web site and installed.

1. Using an MTS4000 instrument or PC with access to the internet, navigate to the VideoLan home page (http://www.videolan.org).

2. Locate and download the Windows self-extracting VLC Media Player installer to your PC hard disk.

3. Locate the downloaded VLC Media Player file on your instrument and run it.

4. Select your preferred language. The Welcome / Setup screen appears.

5. Follow the setup procedure and allow the VLC Media Player to be installed.
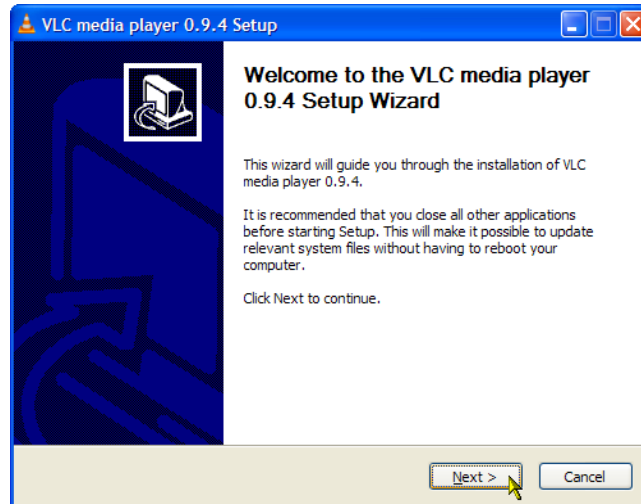
No further activity is required. The VLC Media Player will be used by the TSCA application as required.

Network Installation

The MTS4000 system can be attached to a computer network. Refer to your Network Administrator for details of the correct network configuration. For installation and operating instructions, refer to the documentation supplied with your network hardware and software.

Network Troubleshooting

Networks are based on standards; however, there are many unique characteristics of each network (LAN or WAN) that make it difficult to troubleshoot without a thorough knowledge of the specific network. Consequently, an expert who knows your network characteristics should perform in-depth network troubleshooting.

This section provides some basic procedures that can eliminate some of the more common sources of network errors. If you cannot resolve problems using these procedures, contact your network administrator.

Basic Requirements

Fulfill the following requirements before troubleshooting your host machines:

■ Configure your system for use on your network. Contact your network administrator for details. The MTS4000 NICs are set to DHCP for auto address setup.

■ Ensure that any applications that you may have loaded on your test system since receiving it are not using the ports assigned to the test system components.

IP Parameters

The illustrations in this section show how each IP parameter (IP address, subnet mask, and default gateway) can negatively affect network connectivity.

Incorrect IP address. If the IP address for your test system is incorrect (not unique), then you may not be able to communicate over the network. In the next figure, TVTest_1 uses the same IP address as Rennes. If Rennes is started first, TVTest_1 will recognize the IP address conflict and will not load TCP/IP; consequently, the system cannot be reached over the network.

If your IP address is incorrect, and the IP address does not exist on your subnet, you may be able to communicate from the device (system or monitoring station), but you may not be able to communicate to the device.
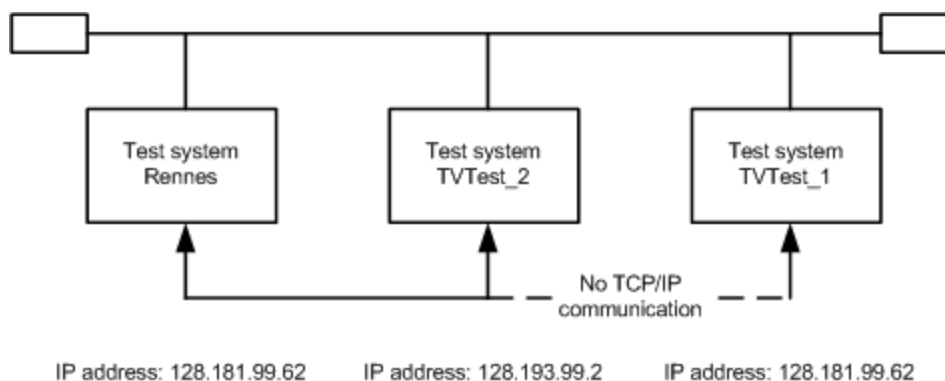
Incorrect subnet mask. Subnets and subnetting networks are complex and require a thorough understanding of IP addressing. Call your network administrator if you think your networking problem involves subnets. The next figure shows a simple (and fairly common) subnet mask problem.

In the figure, the subnet mask for TVTest_1 indicates that the network address is contained in the first two bytes of the IP address. In dotted decimal notation, the network address is 128.181. This information allows the device to communicate with any other device with the same network address without being routed through a default gateway.
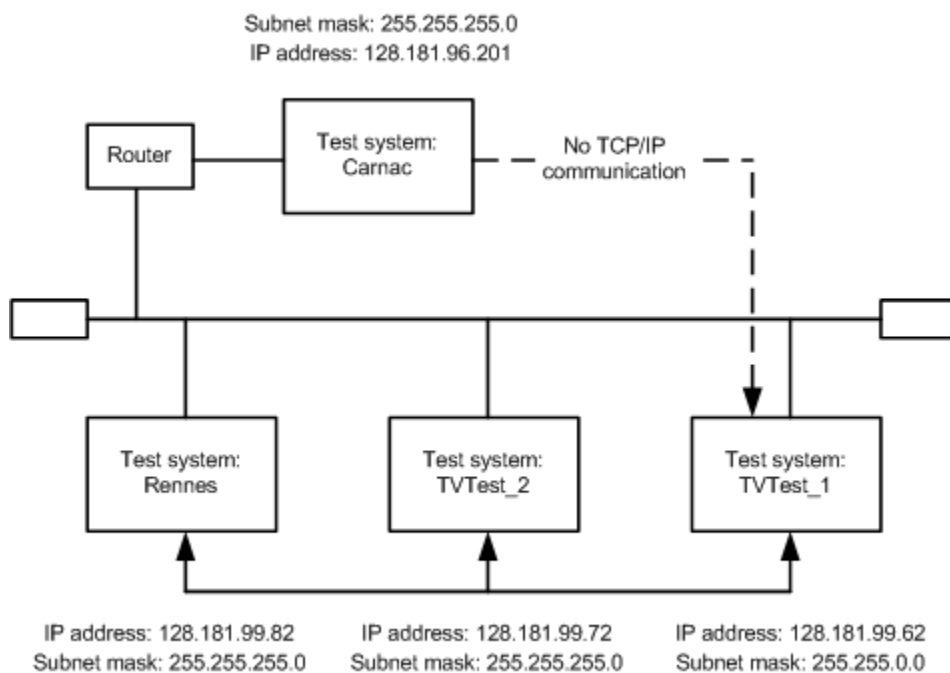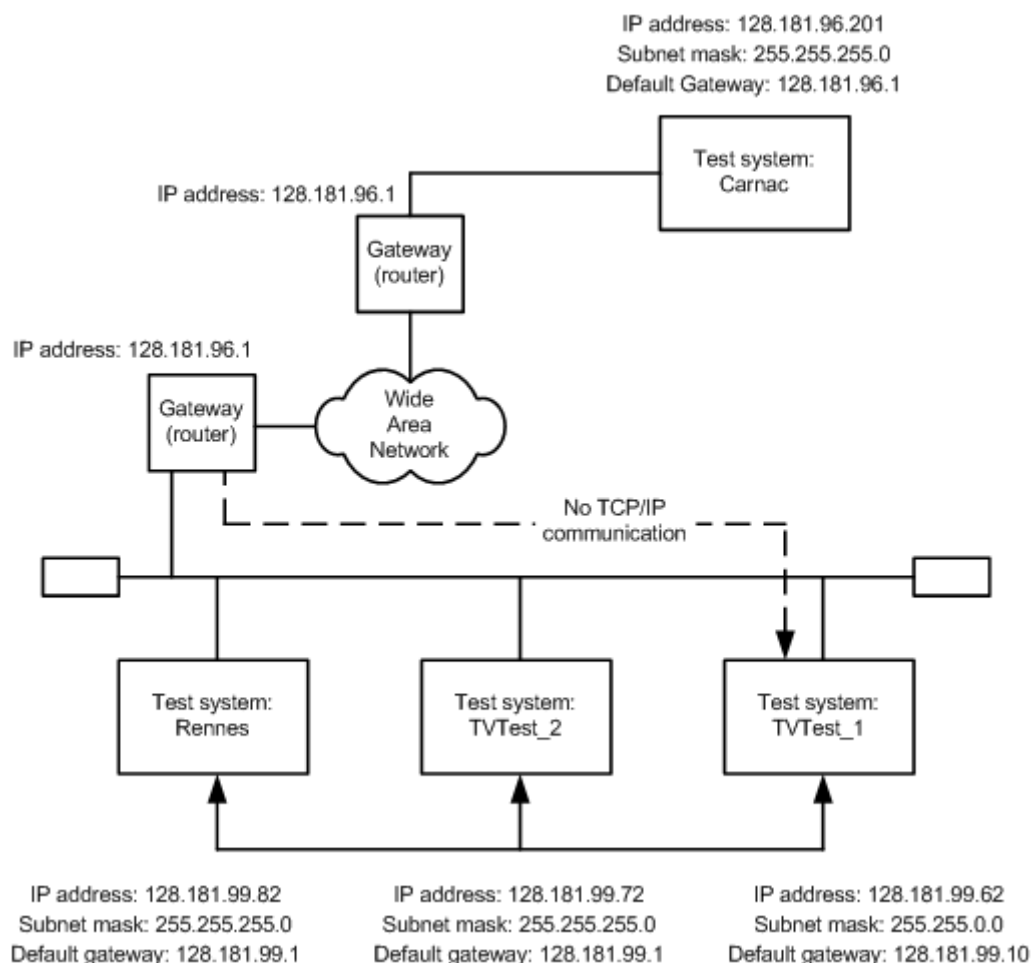

TVTest_1 cannot communicate with Carnac, because, according to the subnet mask on TVTest_1, Carnac and TVTest_1 are logically on the same network. Consequently, messages sent from TVTest_1 to Carnac are never routed. Because these two devices do not share a connection, TVTest_1 will never find the correct address for the network card on Carnac and will not be able to reach Carnac.

TVTest_1 can communicate with TVTest_2 and Rennes because these three devices share a connection, so messages from TVTest_1 do not need to be routed. TVTest_1 is therefore able to find the correct addresses for TVTest_2 and Rennes in spite of having an incorrect subnet mask.

Incorrect default gateway IP address.

The default gateway you have specified in the TCP/IP Properties dialog box is the device that "knows about" your subnetwork and others on your network. When you send messages (for instance, traps from your system to a device on another subnet), the default gateway is able to route the message to the appropriate subnet. If the IP address specified in the TCP/IP Properties dialog box is incorrect, messages to devices on other subnets will not reach their destination (because they never made it to the default gateway).

IP address: 128.181.96.201
Subnet mask: 255.255.255.0
Default Gateway: 128.181.96.1

IP address: 128.181.96.1

Test system:
Carnac

Gateway
(router)

IP address: 128.181.96.1

Gateway
(router)

Wide
Area
Network

No TCP/IP
communication

Test system:
Rennes

Test system:
TVTest_2

Test system:
TVTest_1

IP address: 128.181.99.82
Subnet mask: 255.255.255.0
Default gateway: 128.181.99.1

IP address: 128.181.99.72
Subnet mask: 255.255.255.0
Default gateway: 128.181.99.1

IP address: 128.181.99.62
Subnet mask: 255.255.0.0
Default gateway: 128.181.99.10

Common Troubleshooting Procedures

Many of the procedures performed in the following sections are common tasks.

Pinging a host machine. One of the utilities provided with all TCP/IP installations is ping.exe. This utility allows you to send communication packets to and record the response from a host machine. This determines whether your packets arrived at the destination.

NOTE. The ping utility will not work with the MTS4000 unless the Windows firewall is disabled.

To run ping, use the following procedure:

1. Press these two keys simultaneously:

■ Windows key (⊞) + R

This displays the Run dialog screen.
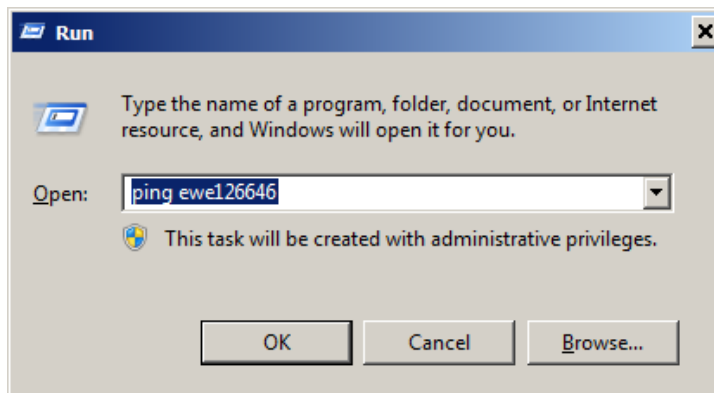
2. Type one of the following into the Run text box:

■ ping Machine_Name

■ ping IP_address

In the example, Machine_Name and IP_address represent the host machine name and IP address, respectively, of the networked device you are trying to ping.
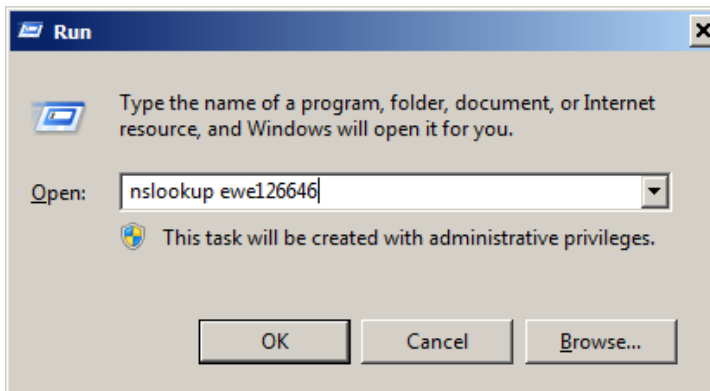
3. Click **OK**.

A DOS window indicates whether or not the machine is responding to the ping.

Ping only runs briefly and the DOS window closes when the process is complete.

Run ✕

Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.

Open: `ping ewe126646`

🛡 This task will be created with administrative privileges.

[OK] [Cancel] [Browse...]

C:\WINDOWS\system32\ping.exe

```
Pinging ewe126646.Central.tektronix.net [134.62.81.182] with 32 bytes of data:
Reply from 134.62.81.182: bytes=32 time<1ms TTL=125
Reply from 134.62.81.182: bytes=32 time<1ms TTL=125
Reply from 134.62.81.182: bytes=32 time<1ms TTL=125
```

Tracing the route of TCP/IP packets.

Sometimes it is helpful to know how far your packets made it on the way to a destination machine and which devices the packets pass through on the way. The utility that provides this functionality is tracert.exe. Tracert can also indicate a congested point in the network. To run tracert, use the following procedure:

1. Press these two keys simultaneously:

- Windows key ( ) + R

This displays the Run dialog screen.

2. Type one of the following into the Run text box:

- tracert Machine_Name

- tracert IP_address

  In the example, Machine_Name and IP_address represent the host machine name and IP address, respectively, of the networked device you are trying to reach.

3. Click **OK**.

  A DOS window indicates the progress of your packets. The far right column indicates the IP address of the nodes on the network that successfully pass your tracert packets. This information indicates the last good node on the path to the destination device.
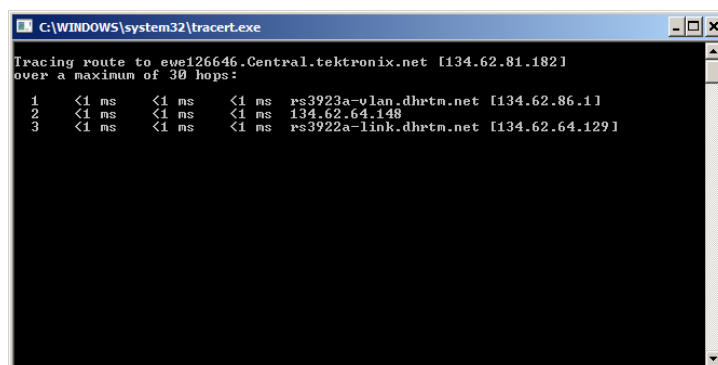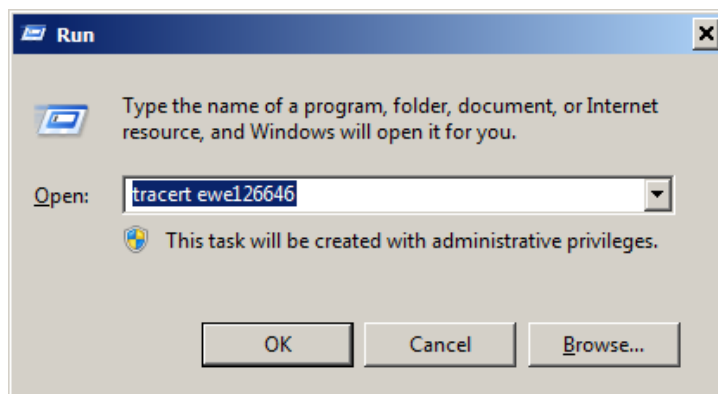
Finding IP addresses for devices on your network.

At times, you may need to find or confirm the IP address of a computer on your network (or find the network name if all you have is an IP address). You may want to find this information to ensure that IP addresses and network names you use in the Hosts file are correct. The utility nslookup.exe displays this information.

1. Press these two keys simultaneously:

■ Windows key (⊞) + R

This displays the Run dialog screen.

2. Type one of the following into the Run text box:

■ nslookup Machine_Name

■ nslookup IP_address

Machine_Name or IP_Address is the network name or IP address, respectively, of the device you are trying to look up.

3. Click **OK**.

The network name and IP address of the device you are trying to look up is displayed. If your network uses DNS, the IP address and network name of the DNS server is also displayed.
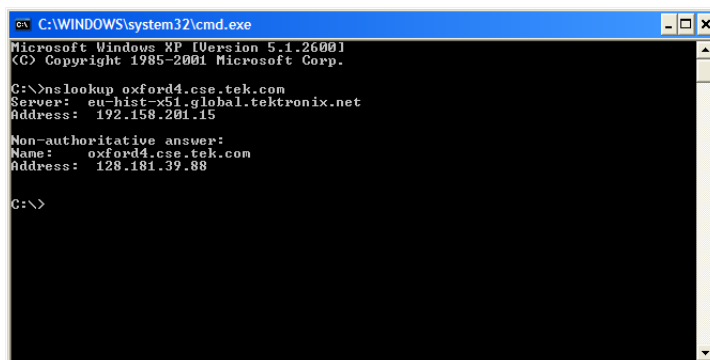
NOTE. Using nslookup from the Run command may not provide enough time to review the results. You may want to use a Command Prompt window from Start > All Programs > Accessories > Command Prompt.

Sources of Network Information

If you need more information about network troubleshooting, some potential resources are listed below.

■ Cisco Systems, Inc. – http://www.cisco.com/

This site is particularly useful for networks that use Cisco devices.

■ Dulaney, E; Lawrence, S; Scrimger, R; Tilke, A; White, J; Williams, R; Wolford, K. *MCSE Training Guide: TCP/IP*. Indianapolis, IN. New Riders, 1998

This is a training guide for Microsoft Certified Systems Engineer certification, and covers TCP/IP and network troubleshooting.

■ Taylor, E. *Network Troubleshooting Handbook.* New York, NY. McGraw-Hill, 1999

NOTE. These resources may provide you with more information. Most of this information is supplied as is, with no warranty as to its fitness, written or implied. The best source of network troubleshooting help is your network administrator.

Operation

Product Description

The MTS4000 MPEG Test System provides a comprehensive and integrated suite of real-time and deferred (offline) analysis tools. The tools include TS (transport stream) compliance, buffer, PES, MPEG2, and MPEG4 video and audio elementary stream analyzers. Also included are an editor and a multiplexer to create stream content, and test and error-stressing streams.

The applications in the MTS4000 analysis toolset are targeted at a specific aspect or layer of a transport stream. The following figure illustrates this principle in simplified form.
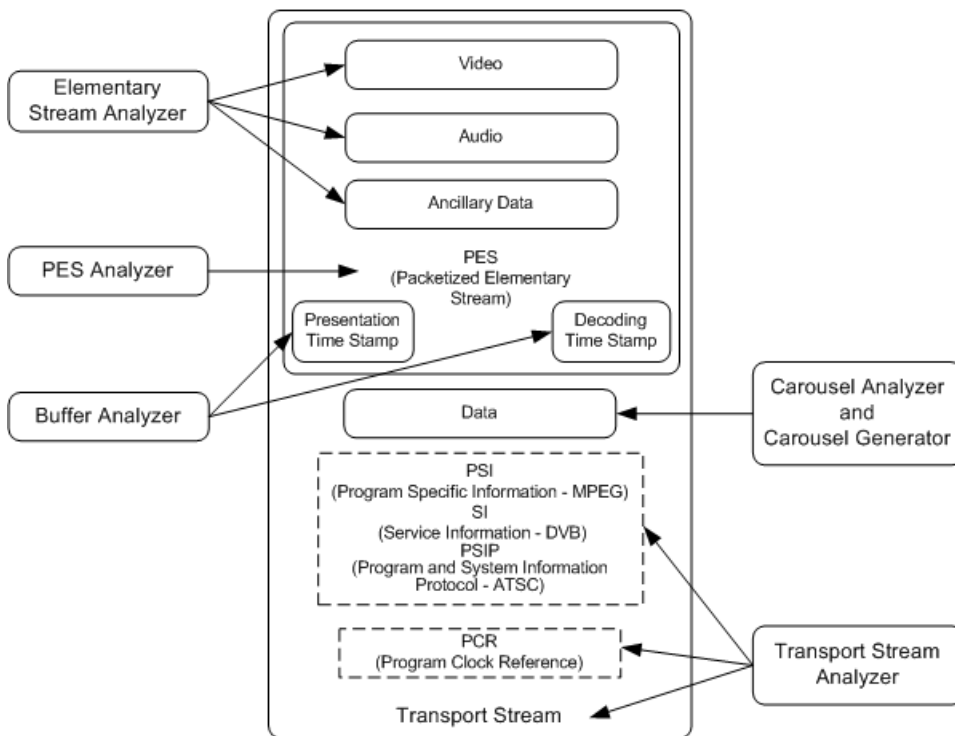
The Procedure section tells you how to start the application, how to analyze a test stream, and what results are presented. The procedures do not tell you how to interpret the results.

Standards compliance is ensured though built-in customizable scripting, which supports a broad range of ratified and evolving DTV standards. New standards and proprietary tables can easily be implemented by loading Tektronix supplied updates, or creating your own custom scripts.

Software Applications

This section provides an overview of the software applications that make up the MTS4000 MPEG Test Systems. Note that some options might not be enabled. Detailed descriptions of all applications can be found in the MTS4000 system MPEG Test System applications user manuals.

Application	Desktop Icon [1]
Analyzers	
Transport Stream Compliance Analyzer (TSCA) – Real-time and Deferred time transport stream analysis with user-selectable MPEG-2, DVB, and ATSC conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing /transport rate graphs and error message logs.	
The first RF/IP card installed in the MTS4000 Test System is installed above the ASI card. This RF/IP card is accessed using the TS Compliance Analyser icon located on the desktop and in the Start menu.	TS Compliance Analyser
The second RF/IP card installed in the MTS4000 Test System is installed below the ASI card. This RF/IP card accessed using the TS Compliance Analyser P1 icon located on the desktop. (There is not a TSCA P1 icon in the Start menu.)	TS Compliance Analyser P1
Packetized Elementary Stream (PES) Analyzer – PES analysis with selectable test options. Shows PES program structure, header contents, packet contents, PTS/DTS timing graphs and analysis reports.	PES Analyser
Transport Stream – System Target Decoder (T-STD) Buffer Analyzer analyzes program streams modeling their behavior in, and their conformance to, the MPEG-2 T-STD Buffer Model. Includes a trace facility.	Buffer Analyser
Elementary Stream – Analyzer Elementary Stream analysis at video picture and audio level. This includes vector graphs and macroblock picture quality.	ES Analyser
Carousel Analyzer – Data analysis showing structure, bit rate, repetition rate, syntax and semantics of data items.	Carousel Analyser

Application	Desktop Icon [1]
Generators	
Carousel Generator – Provides in-depth, off-line generation of MPEG-2, DVB transport streams containing a range of data broadcast protocols.	Carousel Generator
Multiplexer – Multiplexes table information and packetized elementary streams together to synthesize new transport streams. A fine level of control is provided to allow nonconformances and test cases to be specified for new transport streams.	Multiplexer
TS Editor – Viewing and editing of transport stream packets, using a hexadecimal view of the packet contents and semantic interpretation of the header. Provides facilities to remap PIDs, recalculate PCR values and introduce PCR inaccuracies.	TS Editor
Players	
MPEG Player – Plays MPEG-2 transport streams.	MPEG Player
Utilities	
Make Seamless Wizard – Guides the user through the process of creating an MPEG-2 transport stream file for use by Stream Player in continuously looped operation.	Make Seamless Wizard
Stream Cutter – Extracts sections of MPEG-2 transport stream files to new files.	Stream Cutter
Script Pad – Enables users to create and modify System Information (SI) scripts.	ScriptPad
TTS Utility – Converts time stamped transport streams to standard transport stream format.	TTS Utility

1   If installed and licensed.

Starting an Application

All applications are started from the desktop shortcuts or from Start > All Programs > Tektronix MTS4000 menus.

The MTS4000 system application user manuals provide full descriptions of all applications. The following table shows the hierarchy of applications in the Start menu.

Menu hierarchy

Tektronix MTS4000 >	OptionKey Wizard	
	Analyzers >	Buffer Analyzer
		Carousel Analyzer
		ES Analyzer
		PES Analyzer
		TS Compliance Analyzer
	Generators >	Carousel Generator
		Multiplexer
		TS Editor
	Player >	MPEG Player
	Utilities >	Make Seamless Wizard
		ScriptPad
		Stream Cutter
		TTS Utility

NOTE. Even though all applications are shown in the Start menu, you can only open those options that have been purchased and licensed.

Duplex Operation

The MTS4000 system can be operated in duplex mode (ASI or IP only). For example, while the Player is playing out a stream, the Transport Stream Compliance Analyzer (TSCA) can be analyzing a separate stream or, if the output is looped back to the input, the output of the Player can be monitored by the TSCA.

Setting Up Loopback

With loopback in operation you can:

■ Use the MPEG Player to play out a stream

■ Loop the instrument output back to the input (For example, with the ASI card, loop ASI-4 back to ASI-3. With the 10G card, loop the output back to the input using an LC multimode jumper cable.)

■ Monitor/analyze the incoming stream using the TSCA

Before starting:

■ Identify the stream to be played out (in this example, the sym1.mpg test stream is used).

■ Choose the output/input interface (ASI) and make the necessary connections (loop between the connectors).

In the following example, the stream is looped back using the ASI interface and the stream is looped in the player (to play continuously).

MPEG Player setup.

1. Open the MPEG Player: **Start** > **All Programs** > **Tektronix MTS4000** > **Player** > **MPEG Player**.

2. Open a stream: **File > Open... >** Sym1.mpg.

NOTE. The Sym1.mpg file is provided for use to help understand the MTS4000 applications. The file is available in several locations such as the hard drive of the MTS4000 (c:\TestStreams), the Tclips MPEG Test Streams DVD, and the Documentation Browser CD.

---

3. Make the following settings in the **Play** menu:

   Packet size: 188

   Update: On

   Sync: TS Packet

   Loop: On

   Other: Standard: DVB

TSCA setup.

1. Open the TSCA: **Start** > **All Programs** > **Tektronix MTS4000** > **Analyzers** > **TS Compliance Analyzer**.

2. In the start-up dialog box (**Open Transport Stream...**), select **Change...** in Stream Interpretation and select the DVB base standard with no extensions. Close the Stream Interpretation dialog box.

3. Select **Real-time Analysis** and select **ASI** from the **Interfaces** drop-down list.

4. Select **OK**.

Start the playout and analysis.

1. Return to the MPEG Player window and play the stream by selecting: **Play > Start/Stop** or use the toolbar button.

2. In the Player window, note that the status bar is now displayed and that playout has started.

3. Return to the TSCA window and note that analysis has started.

The MPEG Player is now playing out the sym1.mpg transport stream and, through the ASI input and output on the instrument connector panel, the TSCA is monitoring and analyzing the stream.

For detailed descriptions of the MPEG Player and the TSCA, refer to the *MTS4000 Analyzer Applications User Manual*.

Procedures

Using the Multiplexer

The following application example describes using the Multiplexer to create a new transport stream and add elementary streams to the transport stream.

The new transport stream created with this procedure (named TestMux.mpg) is used to complete some of the additional procedures in this manual.

Create a New Stream Using the Multiplexer

In this section of the application example, you will create a new transport stream using the MTS4000 Multiplexer application. You will introduce one error so that you will be able to observe it in a later section of the application example.

1. Open the Multiplexer application. **Start > All Programs > Tektronix MTS4000 > Generators > Multiplexer**.
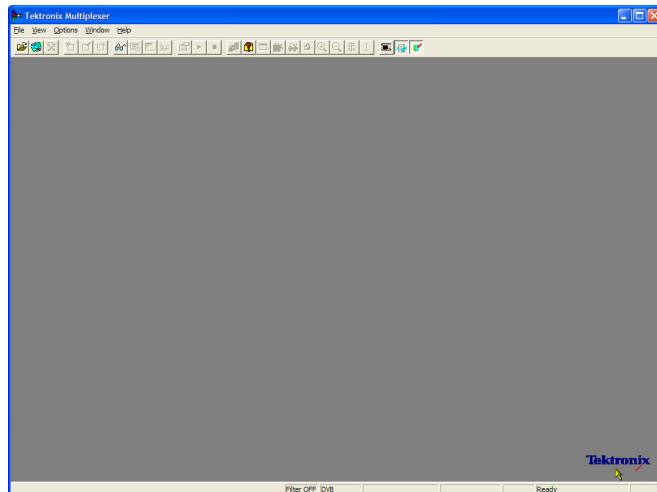
2. Select **View > Interpretation**.

3. In the Stream Interpretation dialog box, ensure that the selected Base Standard is DVB and that the Region is None.

4. Select **OK** to close the Stream Interpretation dialog box.
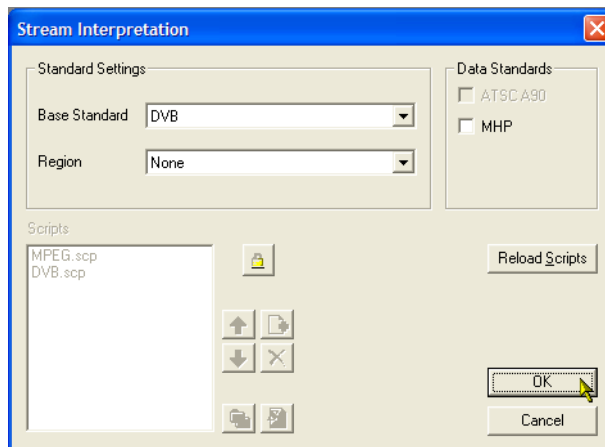
5. Select **File > New**.

6. In the Navigator window, highlight the Transport Stream node and select **Properties** from the context menu.
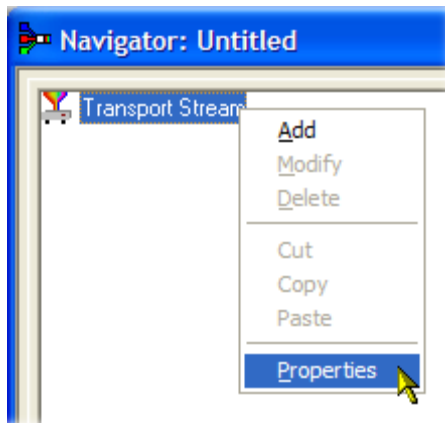

7. In the Stream Properties dialog box, enter a bit rate of 24.128 Mbit/s and a fixed duration of two minutes (120 seconds). Select OK.

Note that the two values are displayed in the status bar.
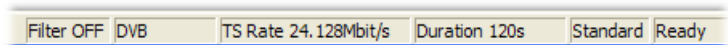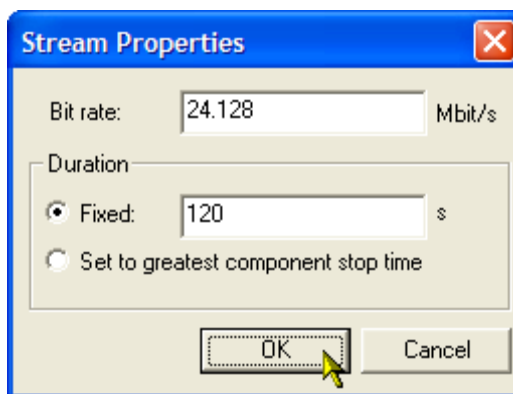
**8.** In the Navigator window, highlight the Transport Stream node and select **Add** from the context menu.
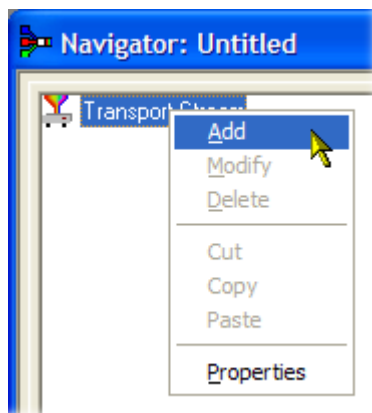
9. In the Transport Stream Settings dialog box, enter 1 as the Transport Stream identity.

10. Select the **PAT** (Program Allocation Table) folder icon button to open the PAT Timing dialog box.
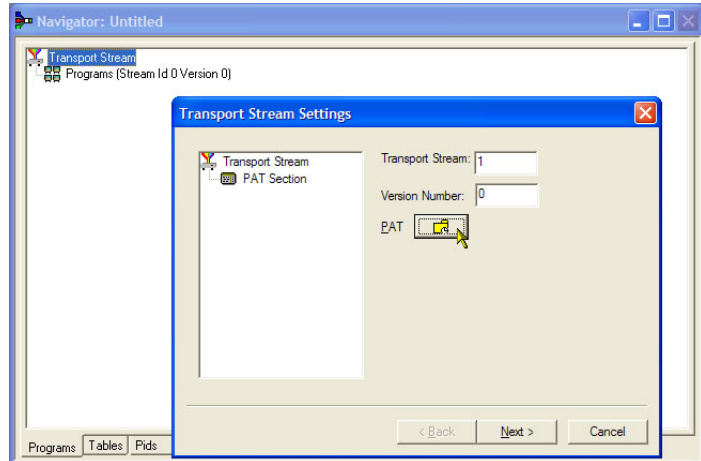
In the Version Timing tab window, note that the PAT timing Start time (0 s) and Stop time (120 s) mean that the PAT will be transmitted for the stream duration.

11. Select **OK** to close the PAT Timing dialog box.

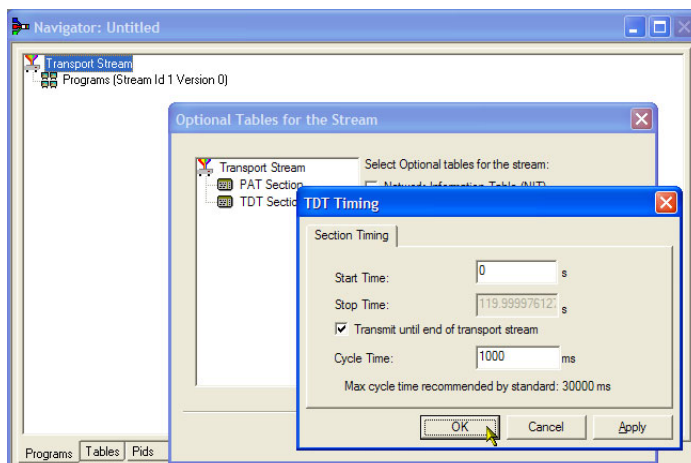**12.** In the Transport Stream Settings dialog box, select **Next**.
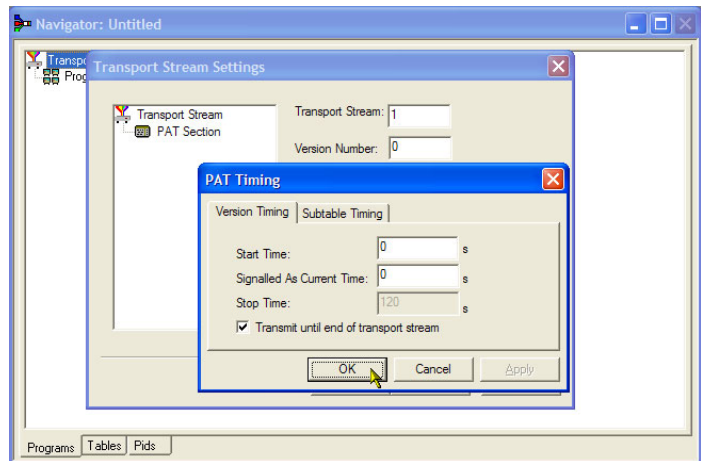
13. In the Optional Tables for the Stream dialog box, select the **TDT** (Time and Date Table) check box and select the **TDT** folder icon button.
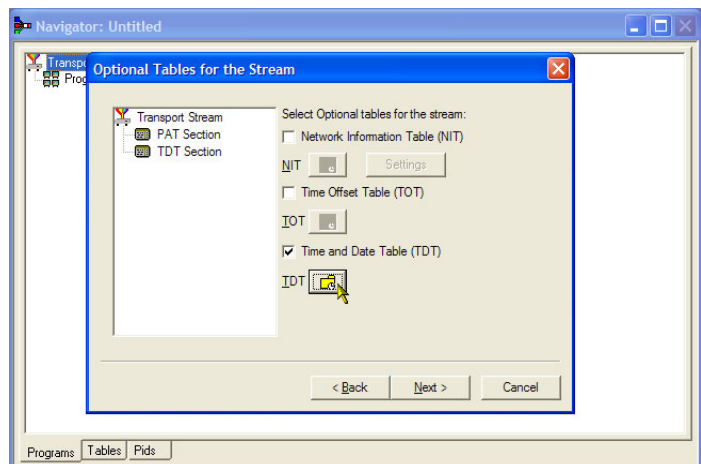
In the TDT Timing dialog box, confirm that the Start Time is zero and the Stop Time is the same as the duration previously set.

Note that the duration may have been adjusted by an insignificant amount. In this example, the set duration of 120 s is now displayed as 119.999976127.

14. Enter a Cycle Time of 1000 ms.

15. Select **OK** to close the TDT Timing dialog box.

16. In the Optional Tables for the Stream dialog box, select the **NIT** (Network Information Table) check box and select the **NIT** Settings button.
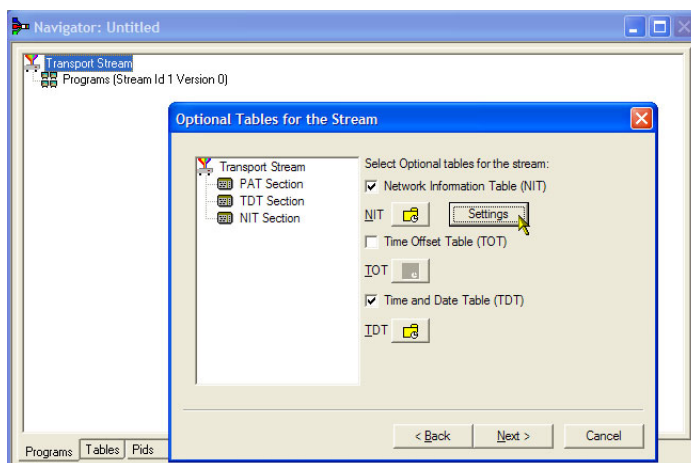
17. In the Set up the NIT dialog box, enter the Network Id 1234 and the Network Name Tek_test.

18. Set the Original Network identity to 2 and select **Terrestrial** from the Delivery System drop-down list.

19. Select the Delivery System Settings button.
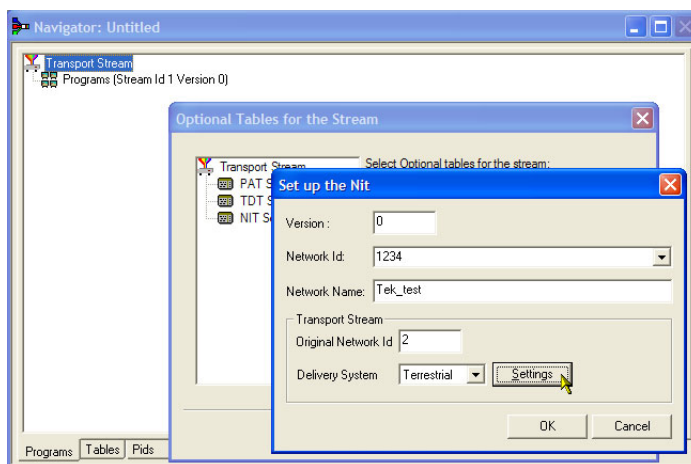
20. In the Terrestrial Settings dialog box, enter 0x123456 in the Centre Frequency field.

21. Select **2 (64-QAM)** from the Constellation drop-down list.

22. Select **4 (non-hierarchical, in-depth interleaver)** from the Hierarchy Information drop-down list.

23. Select **1 (8k mode)** from the Transmission Mode drop-down list.

24. Select **OK** to close the Terrestrial Settings dialog box.

25. Select **OK** to close the Set up the NIT dialog box.

26. In the Optional Tables for the Stream dialog box, select **Next** to display the Transport Wizard Complete dialog box.

The transport stream set up is complete. Now you need to add some content in the form of video and audio elementary streams.

Do not close the Transport Wizard Complete screen.
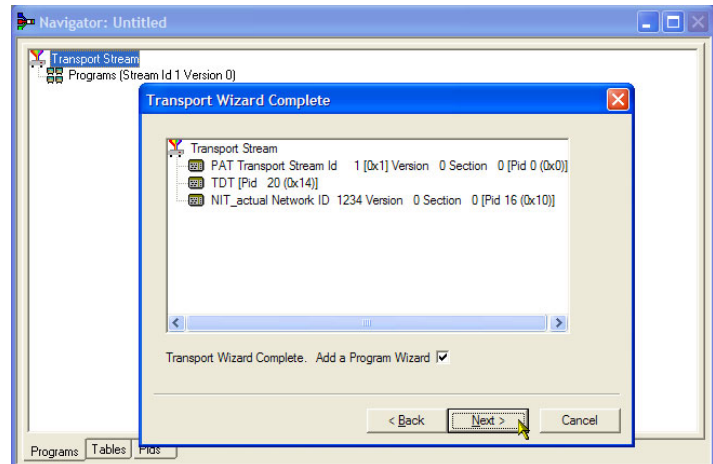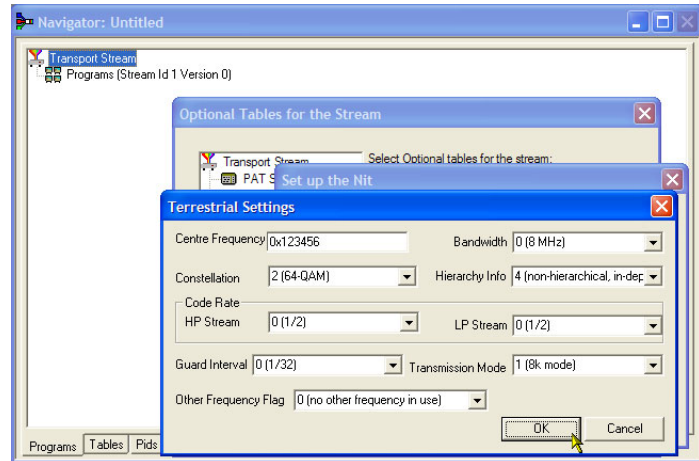
Elementary Stream Acquisition.

For this example, you need to add a video and an audio elementary stream to the transport stream that you have created. You can extract suitable streams from one of the sample transport streams supplied with the MTS4000 installation. The stream used in this example is Sym1.mpg. This file is available on the hard drive of the MTS4000, the Tclips MPEG Test Streams DVD, and the Documentation CD.

1. Open a second instance of the multiplexer. **Start > All Programs > Tektronix MTS4000 > Generators > Multiplexer**.

2. Select **File > Open**.

3. In the Set MPEG File to Edit dialog box, locate and open sym1.mpg.
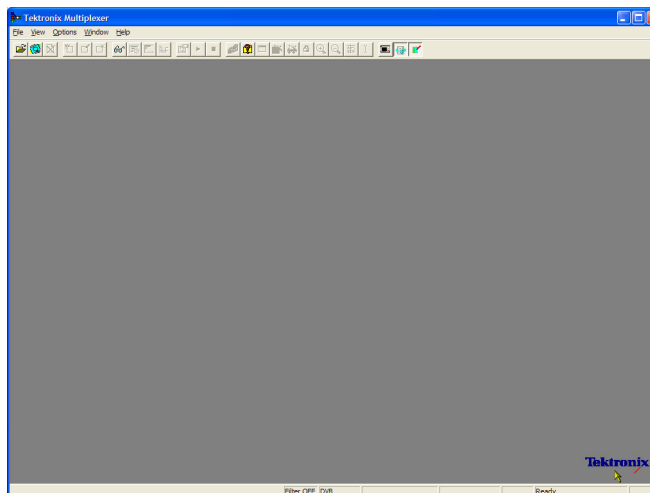
4. Expand the program 1 node and the dependent Elementary Streams node.

5. Highlight the PID 110 node. This PID is carrying an MPEG-2 video elementary stream.

6. Select **Export Elementary Stream** in the context menu.

7. In the Save As dialog box, enter a file name (Sym1pid110.es) and save the file to a suitable location.

8. Repeat the action for PID120. Name the file Sym1pid120.es.
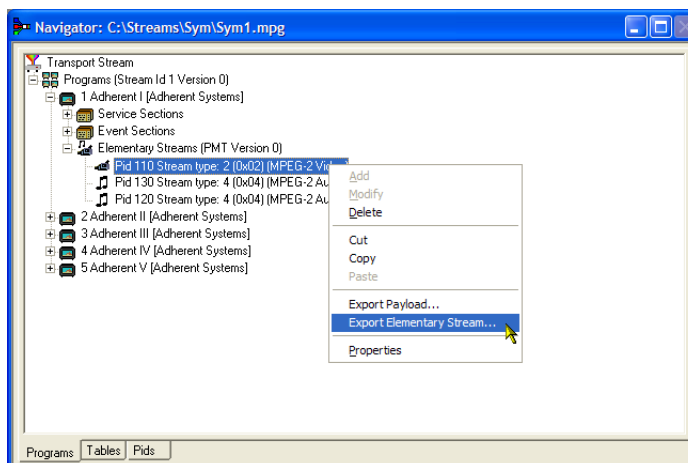
9. Select **File > Exit** to close this instance of the Multiplexer.

This completes the extraction of the video and audio elementary streams. You can continue with the multiplexing task.
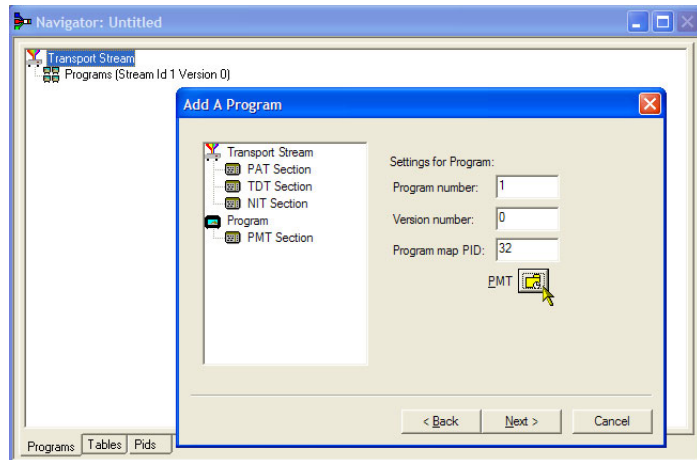
Add Elementary Streams.

Now you can return to the original multiplexer instance and add the elementary streams that you have just created.

1. Ensure that **Add a Program Wizard** is checked and select **Next**.
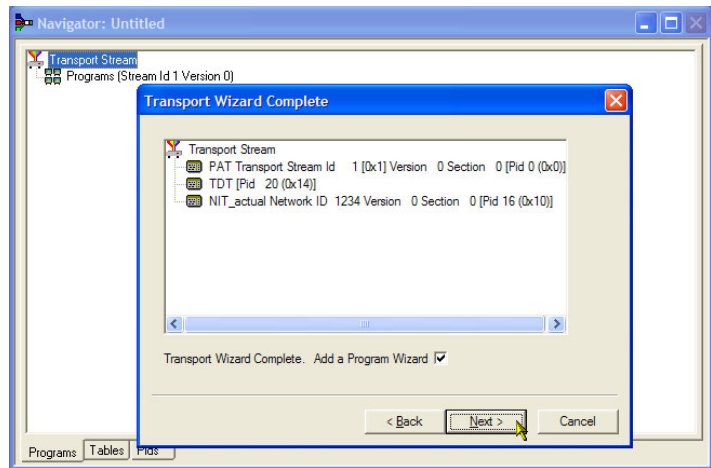
2. In the Add a Program dialog box, enter 1 as the program number.

3. Select the PMT folder icon.

4. In the PMT Timing dialog box, select the Subtable Timing tab.

   The subtable timing cycle time is the period over which a table is repeated in the stream. The maximum cycle time for the PMT in the DVB standard is 500 ms.

5. For this example stream, set the cycle time to 525 ms.

6. Select **OK** to close the PMT Timing dialog box.

7. In the Add a Program dialog box, select **Next**.
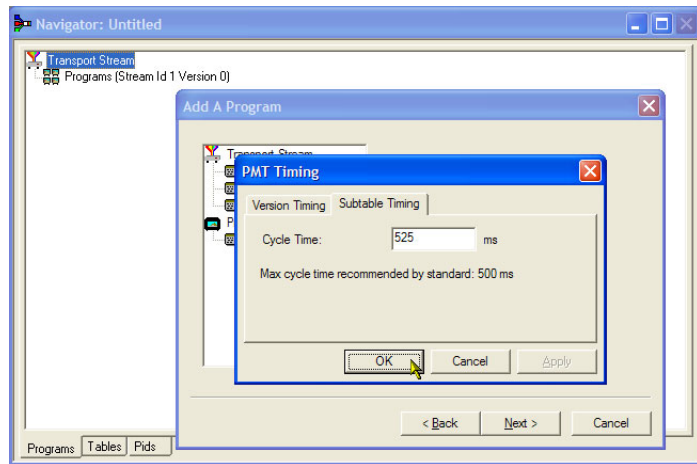
8. In the Add Service Description dialog box, select the **Add Service Description** check box.

9. Enter a **Service Provider Name**, for example, Tek Broadcasting.

10. Enter a **Service Name**, for example, Tek1.

11. Enter a **Service Type**, for example, 1 (0x1) (digital television service).
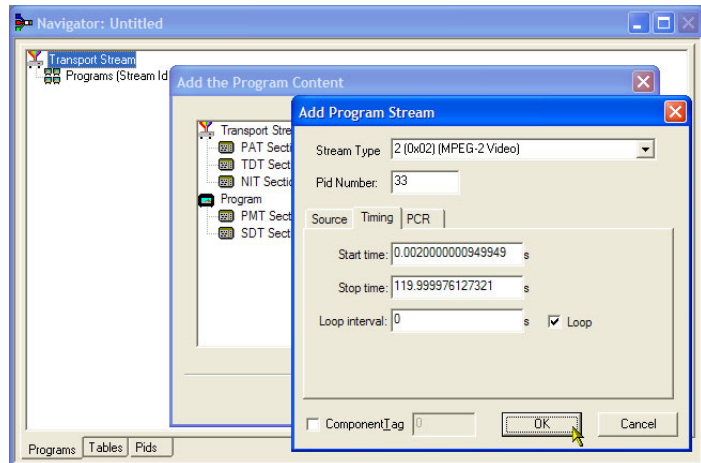
12. Select **Next**.
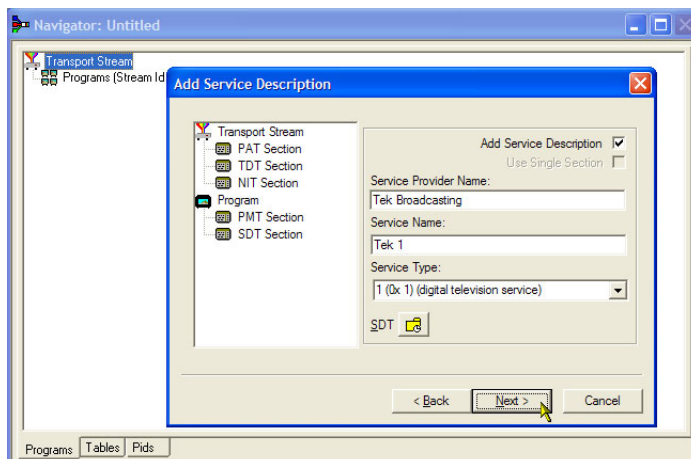
13. In the Add the Program Content dialog box, select **Add** to add a video elementary stream.
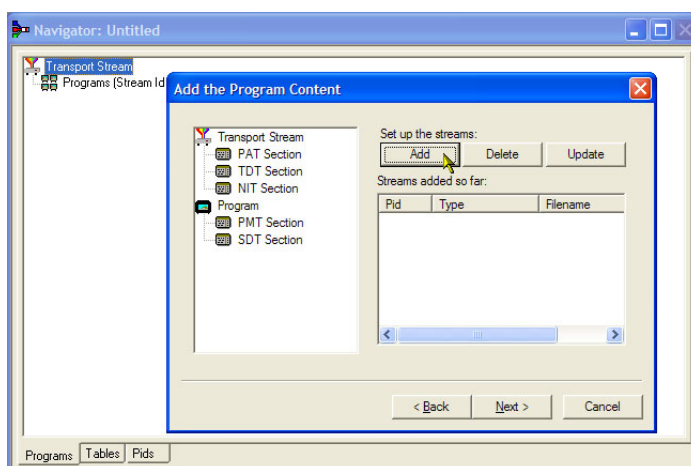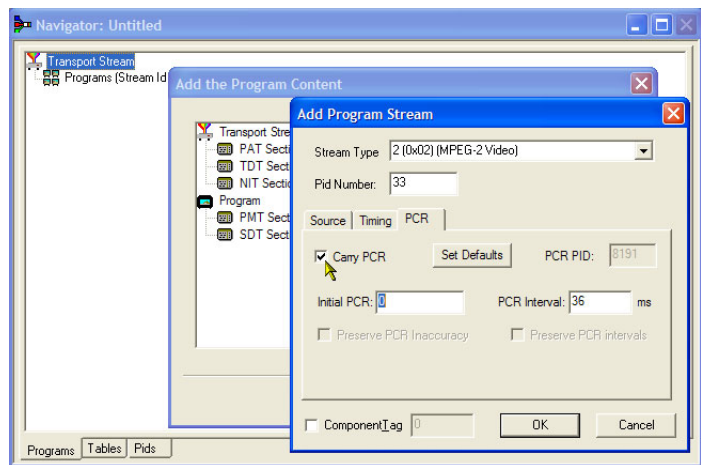
14. In the Add Program Stream dialog box, select 2 (0x02) (MPEG-2 Video) from the Stream Type drop-down list.

15. Ensure that the Source tab is selected.

16. Enter a File Name, or use **Browse** to locate the video elementary stream previously set up (Sym1pid110.es).

17. Select MPEG-2 video from the File type drop-down list. Note that the file bit rate has been entered automatically.
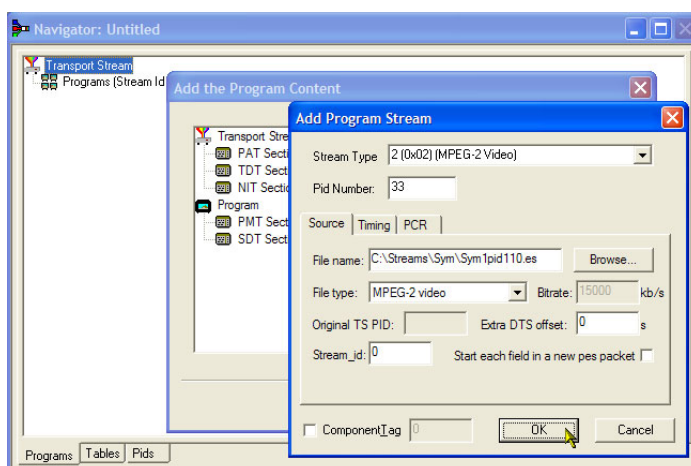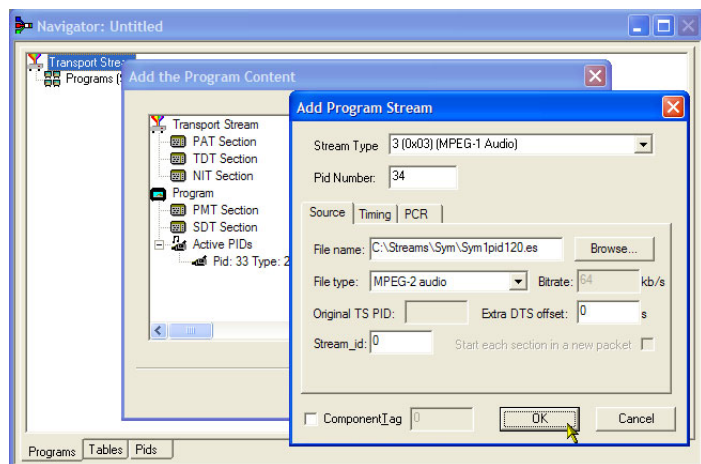
Select the Timing tab. Note that the elementary stream is going to run for the length of the stream previously set, that is, 120 s.

18. Select the PCR tab. Ensure that the **Carry PCR** check box is selected.

19. Select **OK** to close the Add Program Stream dialog box.

20. In the Add the Program Content dialog box, select **Add** again to add an audio elementary stream.

21. Select **3 (0x03) (MPEG-1 Audio)** from the Stream Type drop-down list.

22. In the Add Program Stream dialog box, ensure that the Source tab is selected.

23. Enter a File Name, or use the Browse button to locate the audio elementary stream previously set up (Sym1pid120.es).

24. Select **MPEG-2 audio** from the File type drop-down list. Note that the file bit rate has been entered automatically.

25. Select the **Timing** tab. Note that the elementary stream is going to run for the length of the stream previously set, that is, 120 s.
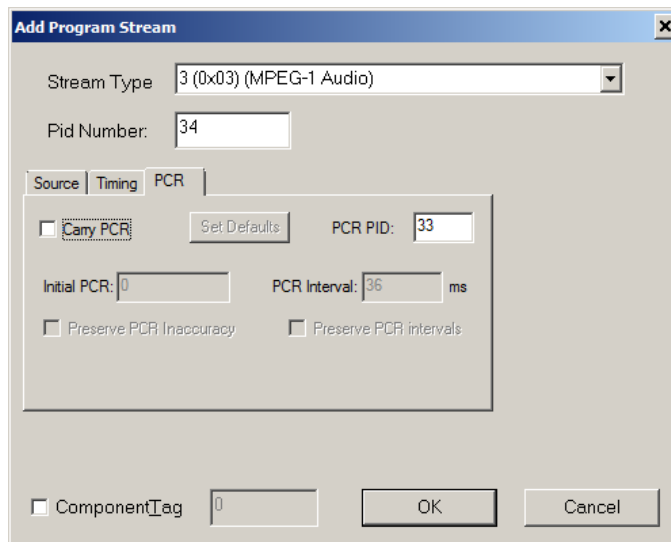
**26.** Select the **PCR** tab. Ensure that the Carry PCR check box is cleared.

27. Enter 33 in the PCR PID field. This is the PID that will carry the PCR information – also the video es, Carry PCR.

28. Select **OK** to close the Add Program Stream dialog box.

29. Select **Next**.

30. In the Event Information dialog box, select the Event Information Tables (EIT) check box.

31. Ensure that the Present check box is selected.

32. Select **Present Settings**.
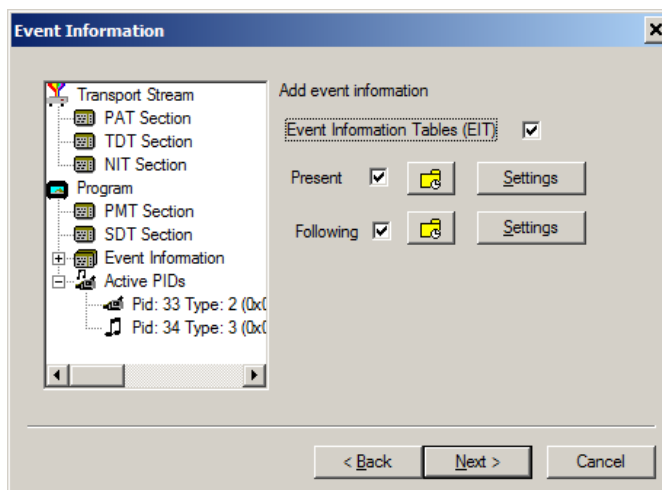
33. In the Present Events dialog box, select **Add** to set up the present event information, that is, the time of this broadcast. In the Event dialog box, select 4 (running) from the Status drop-down list.

34. Set the Start Time to 2008-08-28 10:20:00 AM.

You can change the time and date by highlighting the individual field and entering the required value.
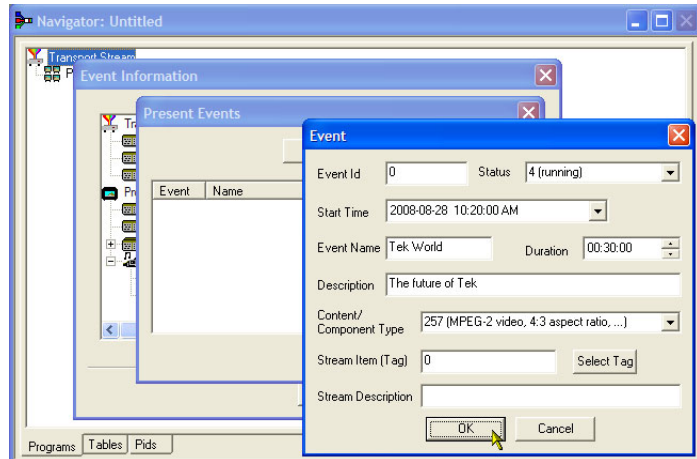
35. Enter an **Event Name**, for example, Tek World.

36. Enter a **Description**, for example, The future of Tek.

37. Enter a **Duration**, for example, 30m (00:30:00).

38. Select **257 (MPEG-2 video, 4:3 aspect ratio, ...)** from the Content/Component Type drop-down list.

39. Select **OK** to close the Event dialog box.

40. Select **OK** to close the Present Events dialog box.

41. Ensure that the **Following** check box is selected.

42. Select **Following Settings**.

43. Select **Add** to set up the following event information, that is, the event following the present event.

44. In the Event dialog box, enter 1 in the Event Id field.

45. Select **1 (not running)** from the Status drop-down list.

46. Set the Start Time to 2008-08-28 10:50:00 AM.
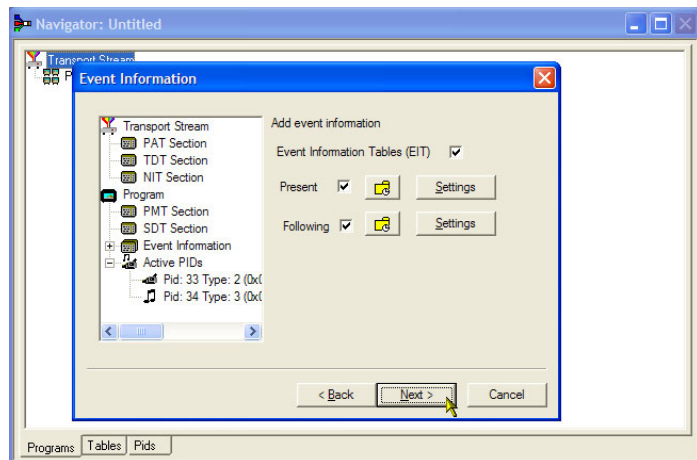
47. Enter an **Event Name**, for example, Tek News.

48. Enter a **Description** of the event, for example, All the latest news from Tek.

49. Enter a **Duration**, for example, 30 m (01:00:00).

50. Select **257 (MPEG-2 video, 4:3 aspect ratio, ...)** from the Content/Component Type drop-down list.

51. Select **OK** to close the Event dialog box.

52. Select **OK** to close the Following Events dialog box.

53. Select **Next** in the Event Information dialog screen.

**54.** In the Program Complete dialog box, select **Finish**.
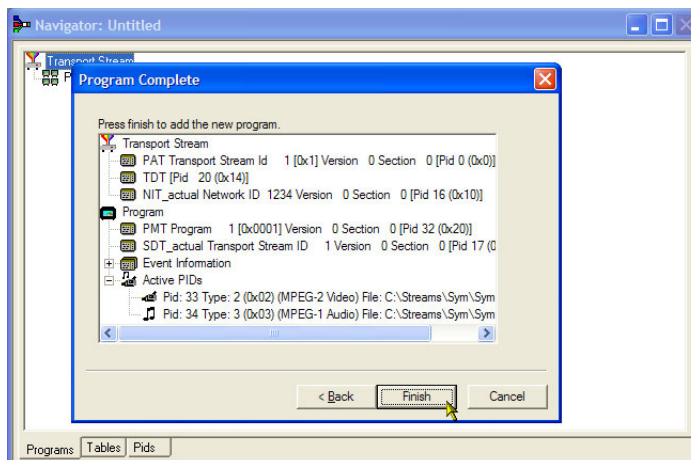
You have finished creating the structure and content of the proposed transport stream. You can now make a couple of checks to ensure that the stream will compile successfully.

55. Select **View > Available Bitrate**.

In the Available Bitrate graph, note that the bit rate remains within the required bitrate, that is, 124.128 Mbps.

You can examine the bit rate at any point on the graph, by clicking a point and reading the values from the adjacent table.

**56.** Close the Available Bitrate graph.
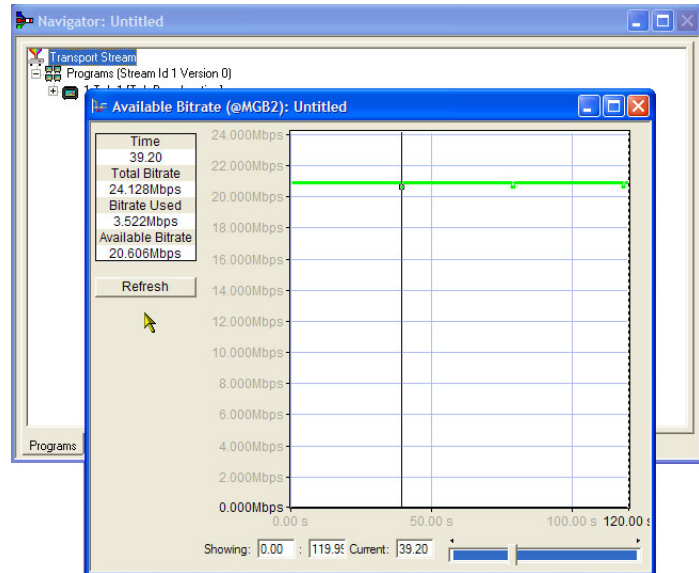
57. Select **Multiplex > Start** to start the multiplex.

58. In the Set TS Output File... dialog box, enter the name TestMux.mpg for the new multiplexed transport stream. (This new transport stream is used in other procedures.)

Watch the right side of the Status bar for the multiplexing progress; the progress bar may be hidden if the window is too small horizontally.

The elementary streams and structural information have now been multiplexed together to form the transport stream, TestMux.mpg.

59. It is a good idea to save the structure of the multiplex, so that it can be recalled and more information added to it as required.
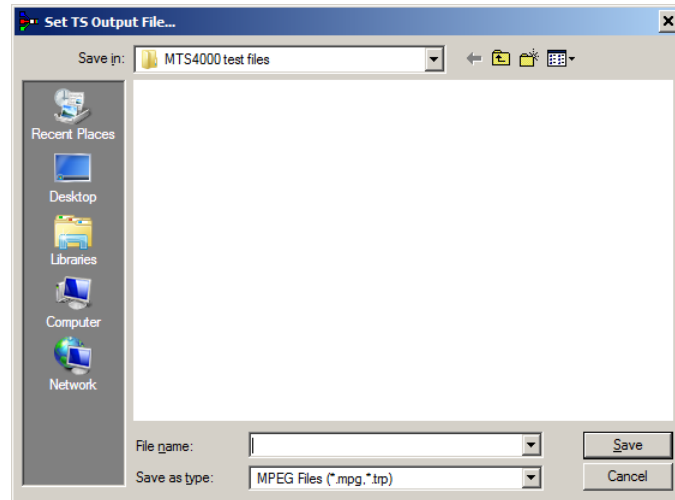
60. Select **File > Export...**.

61. In the Export File dialog box, enter a name for the multiplex structure file, for example, TestMux.muxml and select a location to save the file. Note the muxml extension.

62. Using **File > Import**, the multiplex structure file can be reopened at any time to add elementary streams or structural information.
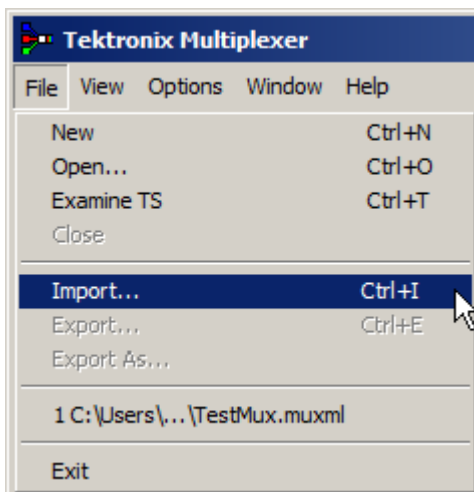
Using the Transport Stream Compliance Analyzer

The following procedure examines a transport stream off-line using the File Analysis mode of the Transport Stream Compliance Analyzer (TSCA). The procedure uses the transport stream (TestMux.mpg) created in the *Using the Multiplexer* procedure.

Use the Real-time Analysis to analyze live data. (See page 59, *Multiple Input Monitoring*.)

1. Open Transport Stream Compliance Analyzer. **File > Program > Tektronix MTS4000 > Analyzers > TS Compliance Analyzer**.

The Open File Analysis dialog box displays automatically. If not, select **File Analysis** in the TSCA Analysis toolbar.
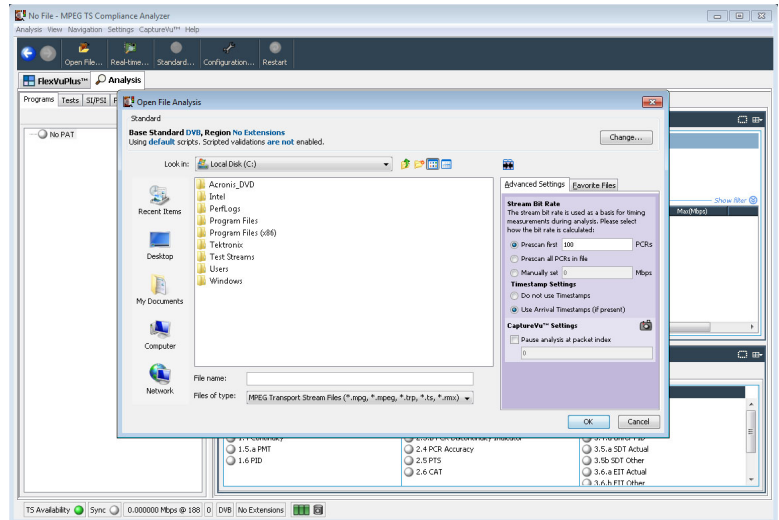
In the Open File Analysis dialog box, ensure that the Base Standard is DVB and the Region is No Extensions.
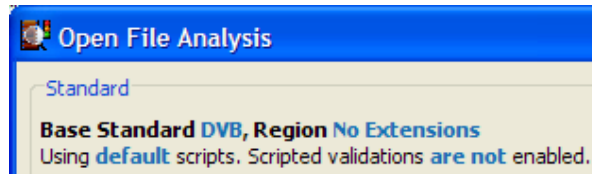
2. Locate and select the example stream, **TestMux.mpg**.

Ensure that in the Advanced Settings pane, the Stream Bit Rate and the Timestamp Settings are as shown.

3. The analysis will take a moment to complete.
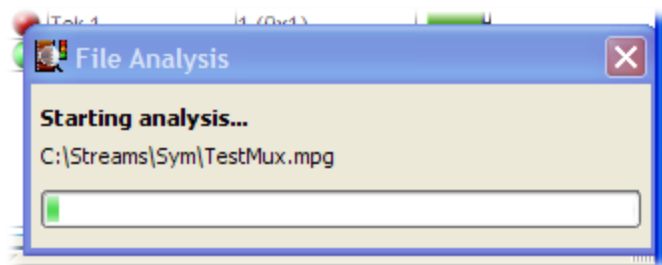
4. Select the **Analysis** tab to display the navigation and related views.
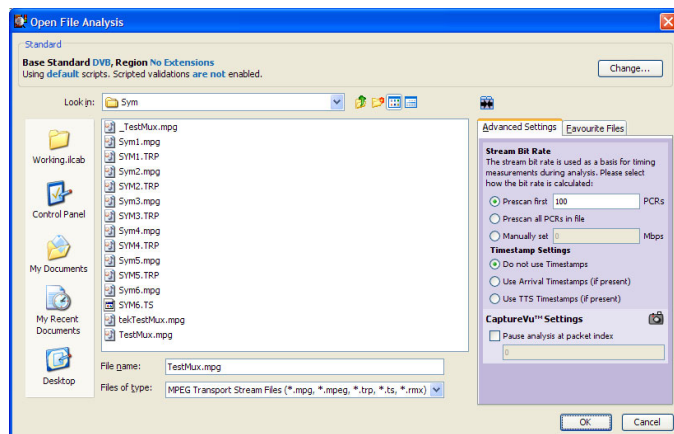
5. Select the **Programs** tab and expand the nodes in the navigation view by clicking the plus symbols.

In the detail views, ensure that the Summary view and the Tests view are displayed.

The Transport Stream node and the Program node are both red. This shows that an error has occurred in the stream and is still active.

6. Highlight the Transport Stream node. In the Tests Summary detail view, TR 101 290 tab, note that test 1.5.a PMT is indicating an error, that is, the associated LED is red.
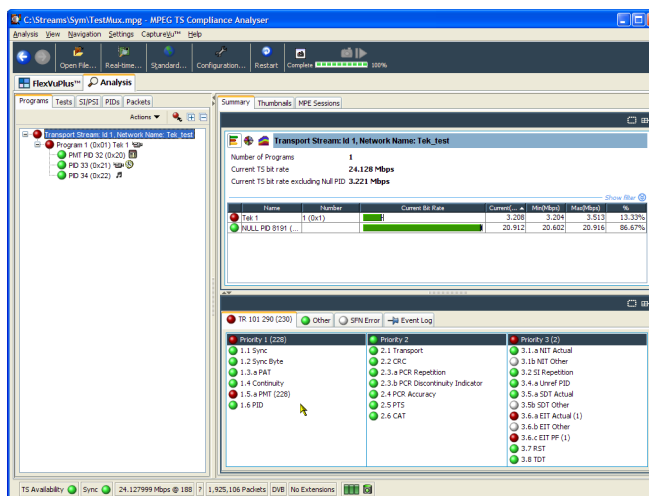
7. Highlight test 1.5.a PMT and select
View this test in the Tests tree from the
context menu.
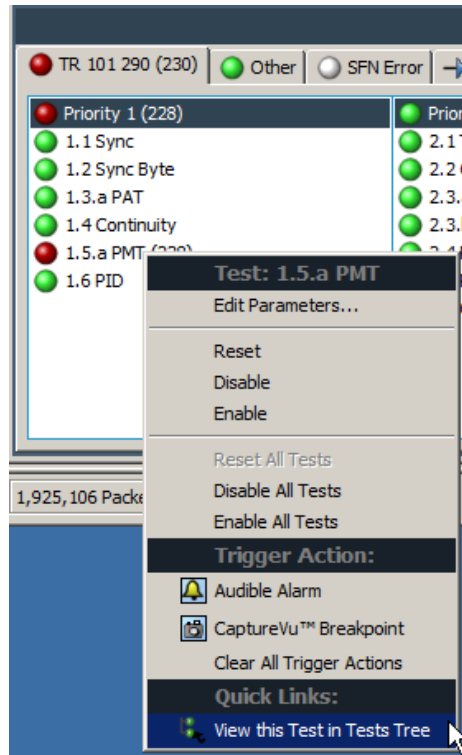
The Tests tab views are displayed. The
navigation view is expanded to show the
failed test. The detail view shows any
PIDs associated with the highlighted test
(none in this example) and the event
log filtered to show only events for the
highlighted test.

Examine the log entries for error
information. Note that the error reports
refer to a duration of 525 ms. This is
the PMT section repetition rate; 525 ms
was the value set in the example stream
created earlier.
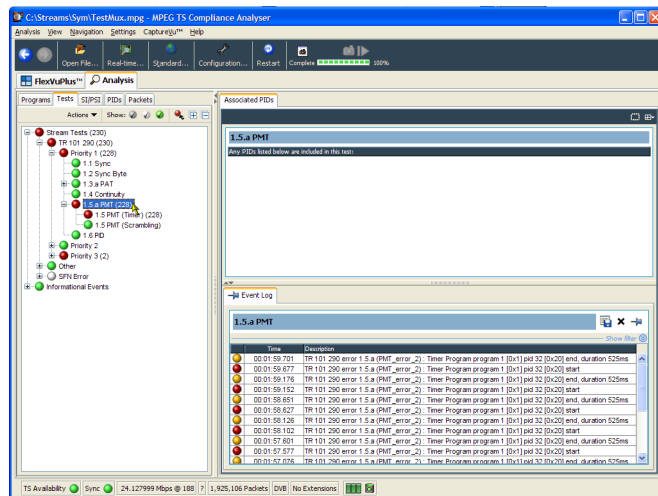
8. In the navigation view, highlight the 1.5 PMT (Timer) test and select **Edit Parameters** from the context menu.

9. In the Edit Parameters dialog box, note that for this stream the PMT section maximum repetition interval is set to 500 ms. Since the repetition rate found in this stream exceeds this value (525 ms), it is being reported as an error. However, by examining the maximum and minimum repetition rates shown in the Edit Parameters dialog box (hover the mouse pointer over the value field and refer to the tool tip), you can see that the rate of 525 ms is within the range recommended by the DVB standard, 40 ms to 25000 ms.
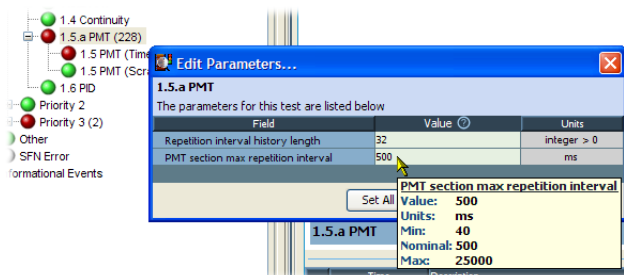
Using the PES Analyzer

The elementary streams (including video, audio, and ancillary data) are combined into a packetized elementary stream (PES). The header associated with each PES packet in a transport stream is of particular interest, as it contains the decode and presentation timestamps (DTS and PTS) for the contained elementary streams. Errors in these timestamps may cause resets or picture freeze problems at the receiver in extreme cases.

1. Open the PES Analyzer. **Start > All Programs > Tektronix MTS4000 > Analyzers > PES Analyzer**.

2. Select **File > Open**. Locate and open a transport stream. For example, the TestMux.mpg file created in the *Using the Multiplexer* procedure.

The analysis progress is displayed in the status bar and the Event Log. The Program Structure view is displayed when analysis is complete. In this example you can see that the stream carries a single program, which contains one video and one audio elementary stream on PIDs 33 and 34 respectively.
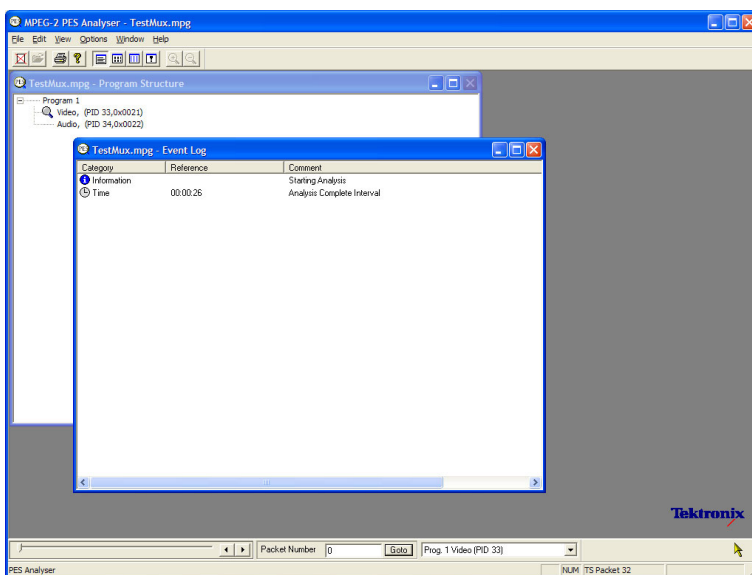
3. Select the video stream in the Program Structure view; the magnifying glass icon will indicate that it has been selected.

4. Open each view option in the View menu, that is, Event Log, Hex, Interpretation, and PTS/DTS Timing. Each action opens a new view in the PES Analyzer window. It may be useful to tile the views in the window using the **Window > Tile** option.

You can use the slider bar, above the status bar, to navigate to any packet in the PES stream. Packets are numbered within a PID, according to their position in the file. The slider bar displays the packet number and the PID for the current packet.
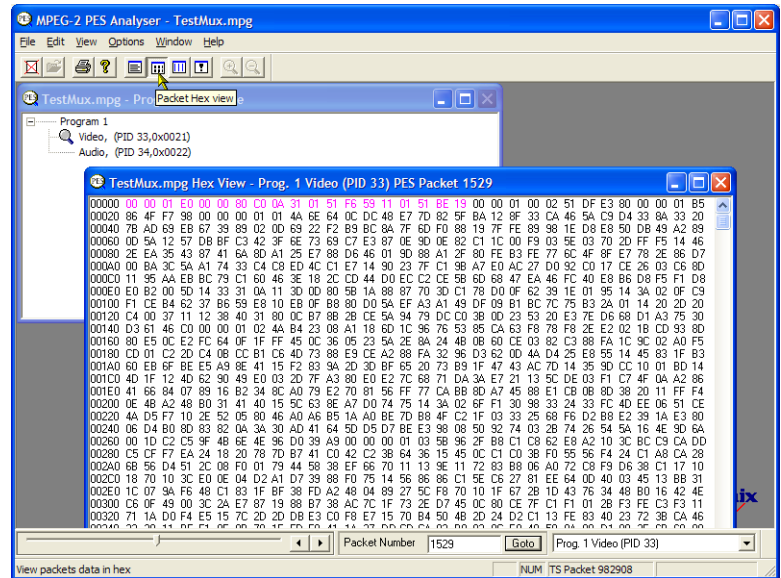
Packet Hex View:

In this view, you can examine every byte in the PES.

▪ The four digit numbers in the left column are the addresses of the first byte in the row.

▪ The bytes displayed in magenta represent the PES packet header. You can view this as a graphical representation in the Packet Interpretation view.
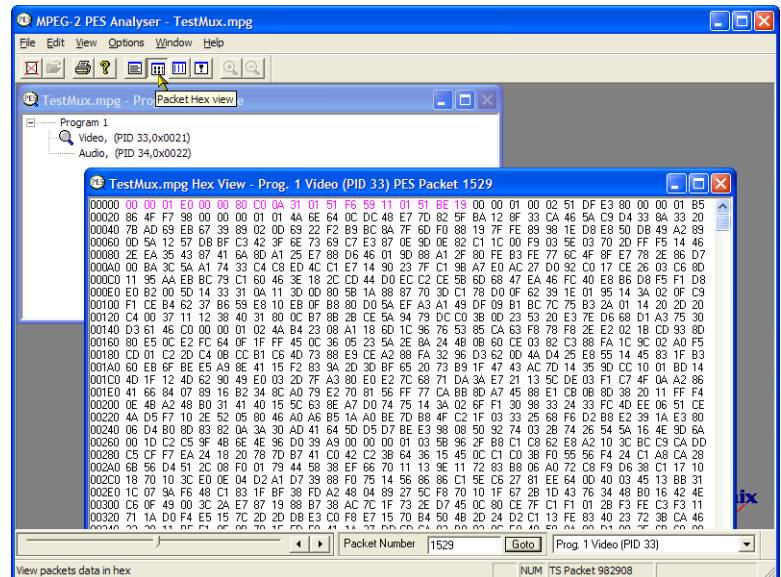
Packet Interpretation View:

This window interprets and displays a graphical representation of the header of the currently selected packet. The size of the header will vary depending on the packet content.
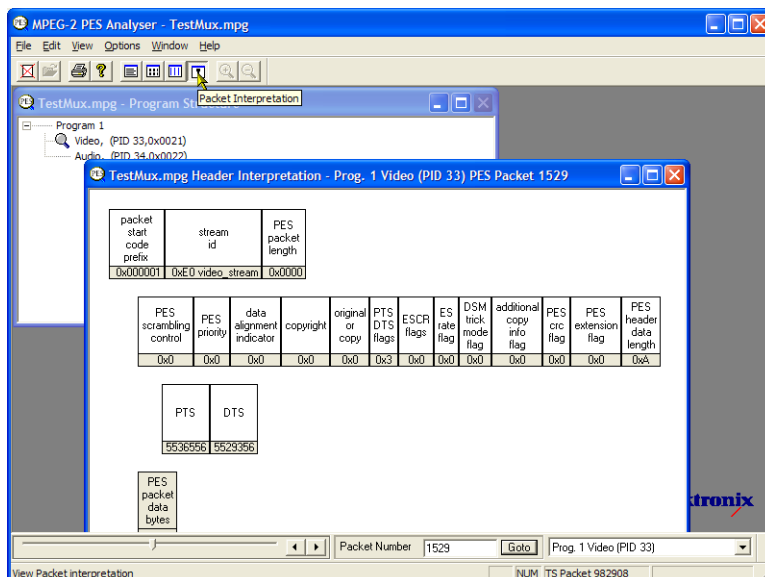
PTS/DTS View:

This view shows a timing analysis of the selected stream. The X-axis shows the duration of the stream in seconds. The Y-axis shows the differences between the expected and actual DTS values. Vertical blue lines show the difference between the PTS and DTS for each access unit. Additional access unit information is shown in the side panel.

A compliant stream will show each DTS on the 0 ms Y-axis; streams with errors usually show a stepped graphical effect.

Select the toolbar magnifying glass and click on the view to zoom in and out of the graph. The slider at the bottom of this window indicates where the displayed packets are in relation to the rest of the file.

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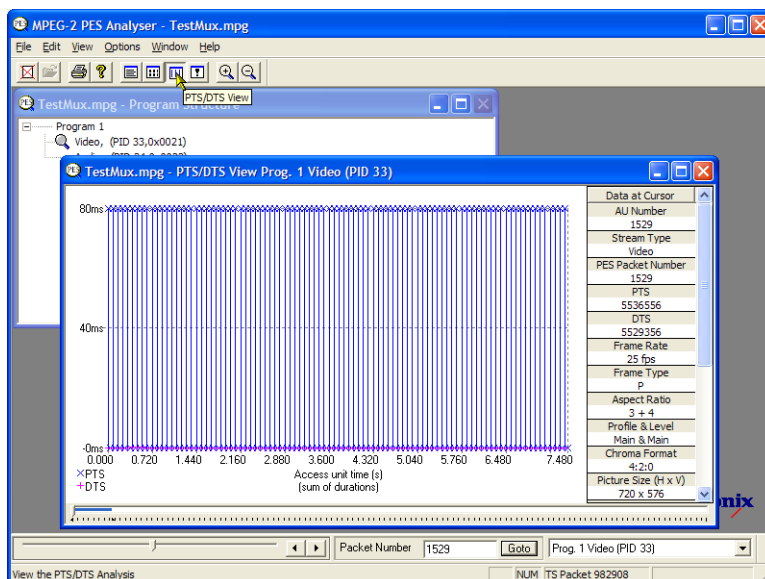
Using the T-STD Buffer Analyzer

The T-STD Buffer Analyzer models the behavior of the buffers in the hypothetical Transport Stream System Target Decoder, as specified in ISO/IEC 13818-1. It can process video, audio, and system control streams. The results of the analysis are displayed as graphs of the buffer capacity over time and a log of exceptions and noteworthy events. The consequences of non-conformance to the buffer model can include freeze frames and receiver resets.

1. Open the T-STD Buffer Analyzer. **Start > Program > Tektronix MTS4000 > Analyzers > Buffer Analyzer**.
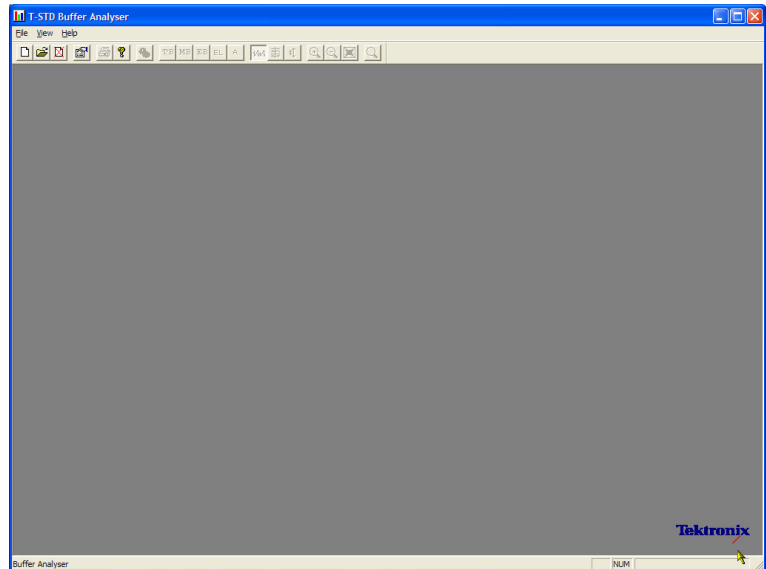
2. Review the configuration settings. **View > Settings**.

   In the System tab of the Settings dialog box, select **MPEG2 Packet Interpretation** and select **Pre-Scan Packets All Packets**.
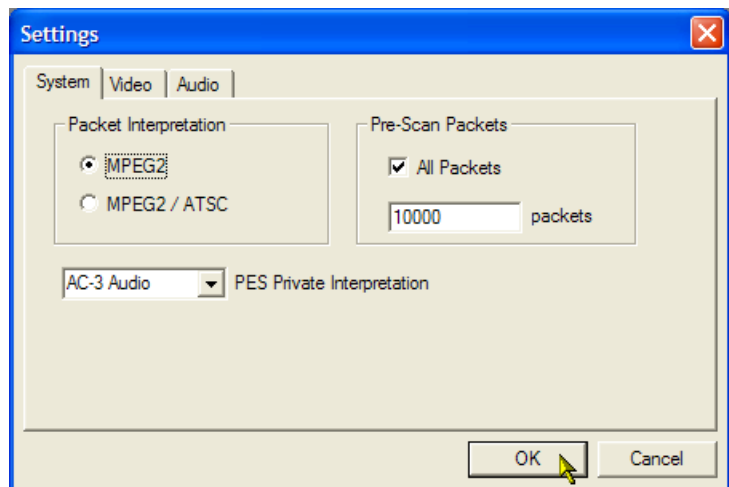
3. In the **Video** tab, select **Buffer Sizes**, **Automatic** and **Data Transfer**, **Automatic**.
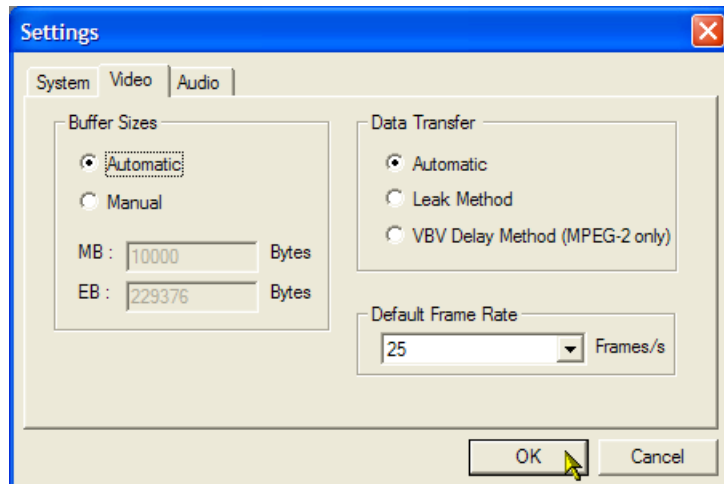
4. In the **Audio** tab, select **Buffer Size**, **Automatic**.

5. Close the **Settings** dialog box.
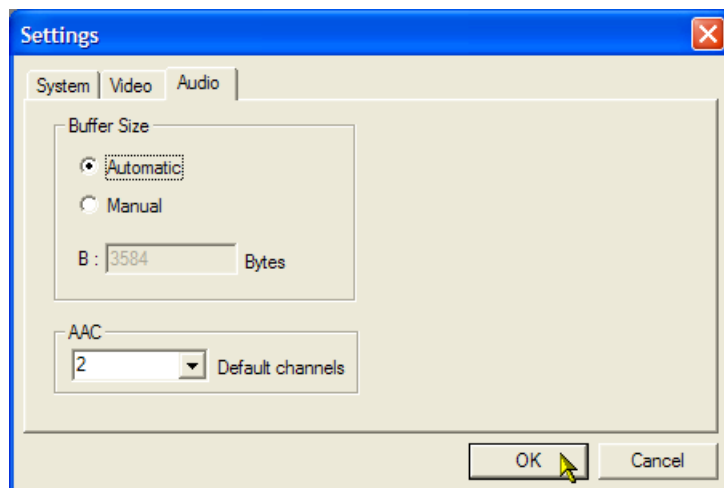
6. Select a file for analysis. **File > New**.

7. Locate and open an MPEG file. For example, the TestMux.mpg file created in the *Using the Multiplexer* procedure.

   Another file selection dialog box is opened immediately. This is for you to name and open a buffer model results (BMR) file, which will hold the results of subsequent analysis.

   Accept the default name and open the file.

   The program performs initial analysis to form a Stream List and calculate the mean transport rate. The stream list displays all of the programs and elementary streams in the file. All streams in the list are marked as Unprocessed, because no analysis has been performed on them in this session.
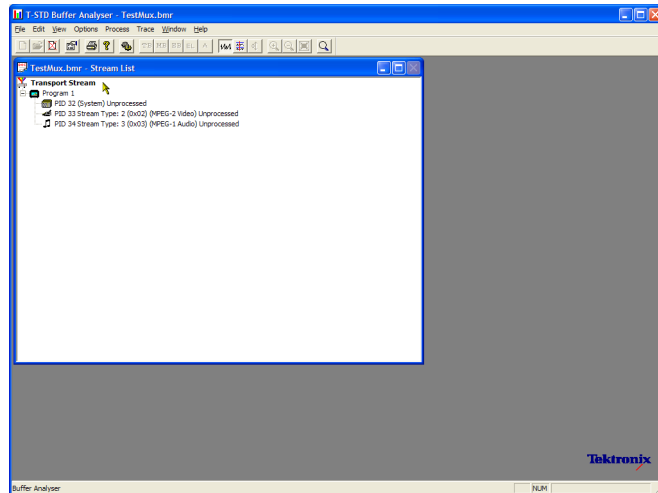
8. Select **Process Streams** from the transport stream context menu to start processing the stream.

   Analysis progress is displayed in the status bar.
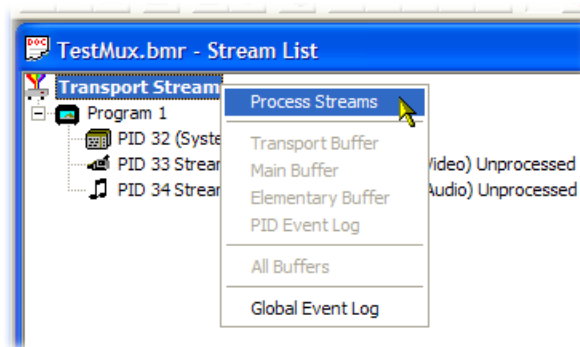
9. Highlight PID 33 and select **All Buffers** from the context menu.

The following windows will be displayed for a video elementary stream: PID Event Log, Video Transport Buffer, Video Multiplex Buffer, and Video Elementary Buffer. (The Stream List window has been minimized.)

10. Tile the resulting windows: **Window > Tile**.

PID Event Log:

You can open two event logs: a global event log (**View > Global Event Log**) that displays high level events occurring in the initial analysis process and a PID event log (**View > PID Event Log**) that displays events for each processed PID.
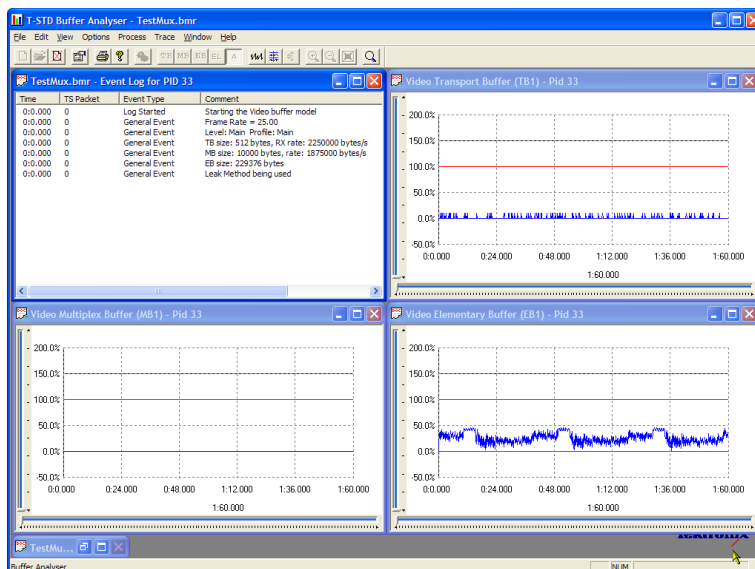
In the following buffer graph views:

- Use the toolbar magnifying glass icons to zoom in and out of the selected graph. Zoom value can be reset using the Reset Zoom toolbar button.

- All open graphs can be viewed and manipulated separately. Use the Options > Synchronize Views to synchronize all views with the currently selected view.

- Red y-axis lines indicate the 0% and 100% limits.

Video Multiplex / Main Buffer:

In this view, for video streams, you can see the results of modeling a multiplex buffer. For audio and system control streams, you can see the results for the main buffer. The title bar shows the stream type.

Video Transport Buffer:

This view shows results of modeling the transport buffer for video, audio, or system control streams.

Video Elementary Buffer:

This view shows only applicable video elementary streams.

11. Select **View > Trace** to display the trace log.

The trace log can help you analyze the message logs produced by the Buffer Analyzer. These logs may be useful for in-depth analysis of the internal processing, particularly for the video stream type. The trace view has filtering capabilities that allow you to focus on message types of particular interest.
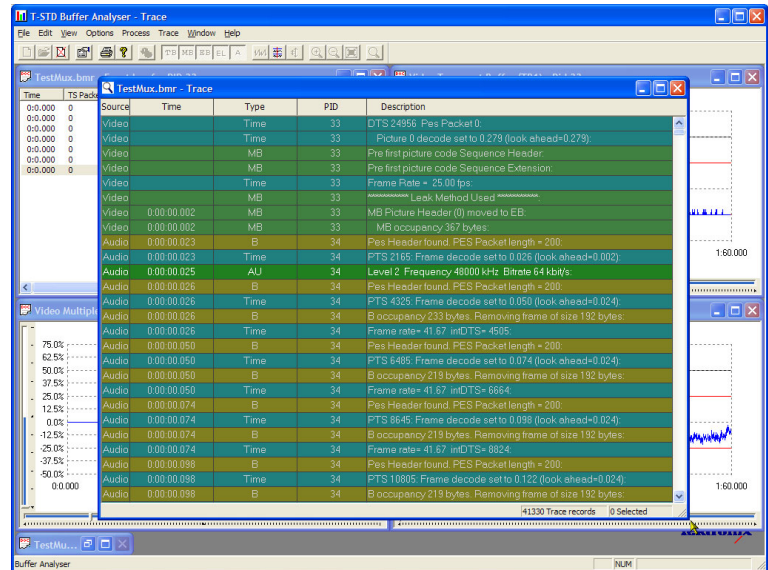
Using the Elementary Stream Analyzer

The ES Analyzer checks for compliance of CODECs to MPEG-2 and H.263 standards. Audio decode and waveform display of MPEG-2 audio (ISO/IEC 13818 parts 3 and 7), AC-3 and MPEG-4 AAC are also supported.

ES Analyzer is a complex application which you can use to analyze many aspects of video and audio streams. For this reason, the following procedure shows you how to access some of the analysis screens; detailed explanation of their content and meaning can be found in the *MTS4000 Analyzer Application User Manual*.

1. Open the ES Analyzer. **Start > All Programs > Tektronix MTS4000 > Analyzers > ES Analyzer**.

2. Select a file for analysis. **File > Open**.

   Locate and open an MPEG file. For example, the TestMux.mpg file created in the *Using the Multiplexer* procedure.
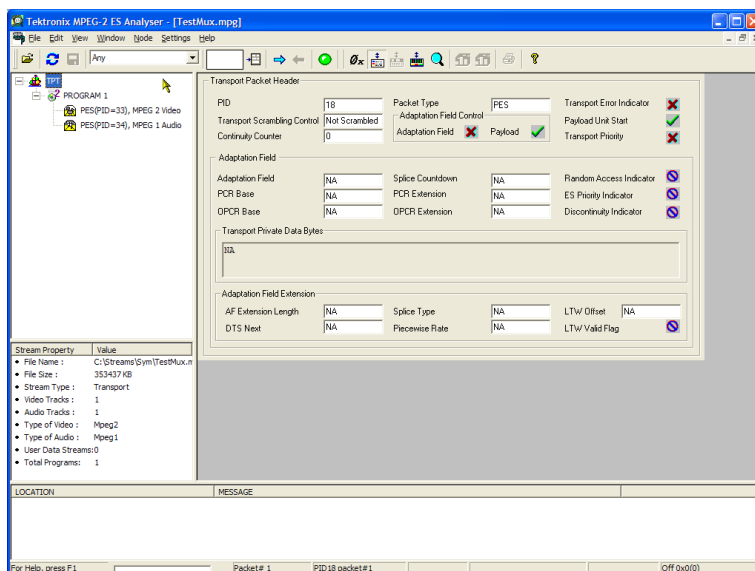
3. Click on each successive node in the navigation window until the GOP (Group of Pictures) is highlighted in the Program 1 / PES (PID 33), MPEG 2 Video branch.
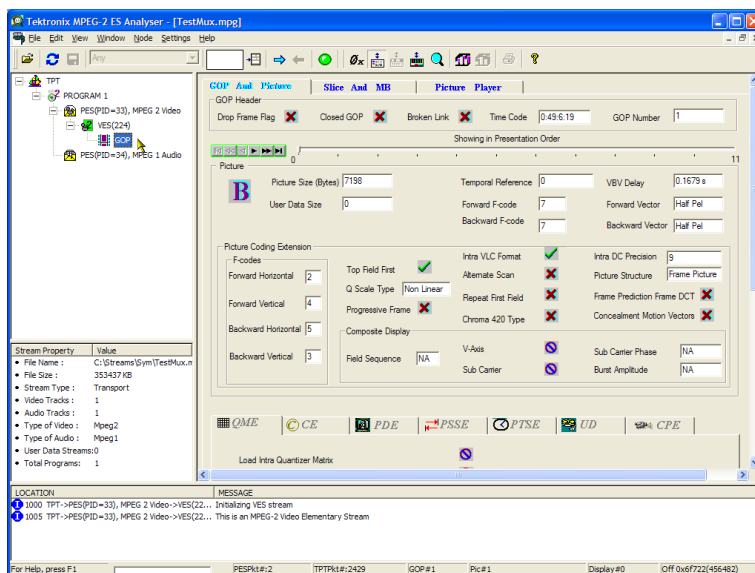
4. Select the Picture Player tab. Note that the Picture Player remote control is displayed.

5. Click the Show Information button to expand the control bar. The extra information shows the position in the file of the displayed picture; more information is shown in the status bar.
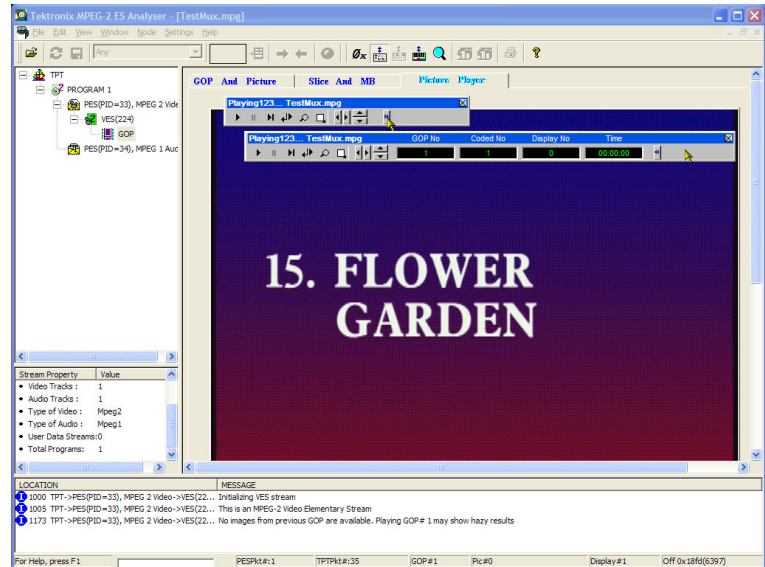
6. Start playing the stream by clicking the play button on the control bar.

If you stop the playout, you can select the other GOP tabs (GOP and Picture, Slice and MB), and examine the characteristics of that frame.
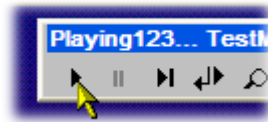
7. For example, select the **Picture Display** on the **Slice and MB** tab. The picture will correspond to the picture in the Picture Player.

8. Click **Show MV** (motion vectors) on the right of the picture display. For B and P frames, the motion vectors will be displayed as colored arrows overlaying the picture.

Additionally, you can see the characteristics of any of the macroblocks that make up the picture by hovering the mouse over a picture macroblock.

Macroblock Number : 605
Motion Vector Parameters(in units of Pixel):
    MV Backward Frame   x: -1.5, y: 0.0

Other Parameters:
    MB Intra   =   FALSE
    DCT Type   =   NA
    MB Quantizer Scale   =   16
    CBP   =   000000
    MB Size (Bits)   =   13
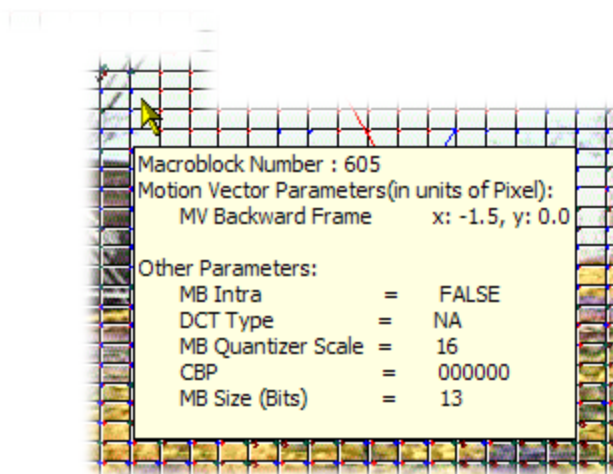
9. Use the Previous Frame and Next Frame buttons to move backward and forwards in the stream and compare the motion vectors.

You can examine the characteristics of the audio stream in a similar manner.

10. Click on each successive node in the navigation window until the GOP (Group of Pictures) is highlighted in the Program 1/PES (PID 34), MPEG 1 Audio branch.
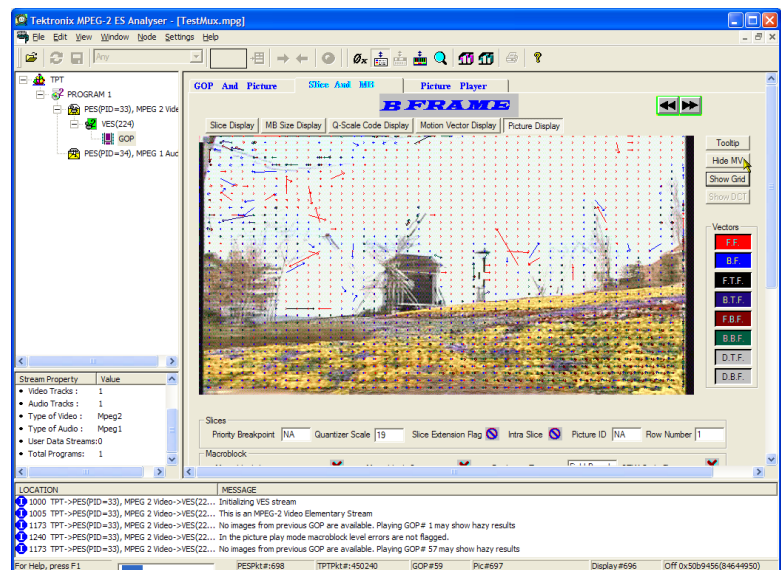
Use the audio control bar to review the audio track. You will need to use headphones to hear the output.
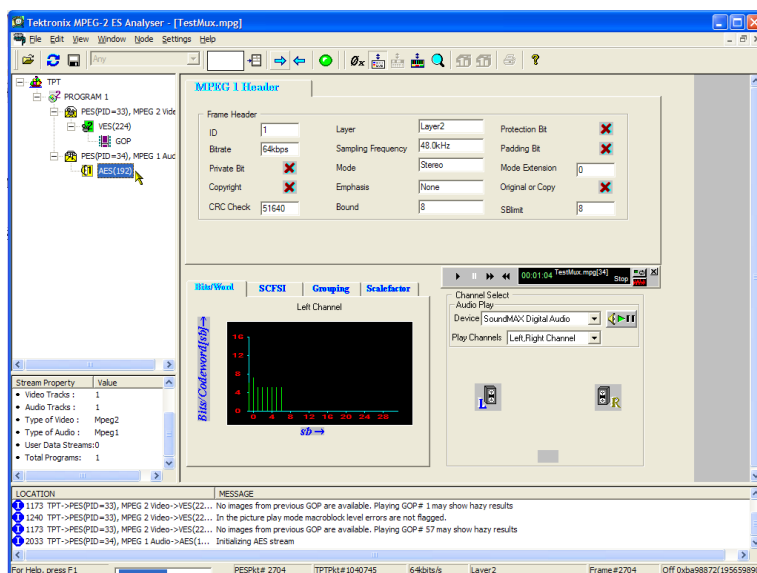
TSCA *FlexVu*Plus™ Display

In the Transport Stream Compliance Analyzer, you can use the *FlexVu*Plus, to select up to four views from the analysis detail views to be displayed together to facilitate basic transport stream monitoring or more detailed diagnostic monitoring.

For this exercise, close each of the currently displayed *FlexVu*Plus panels by clicking the **X** in the top right corner of each panel.

This is not necessary, but it may help you visualize the following procedure more easily as each panel is populated. Note that each of the four *FlexVu*Plus panels are numbered.
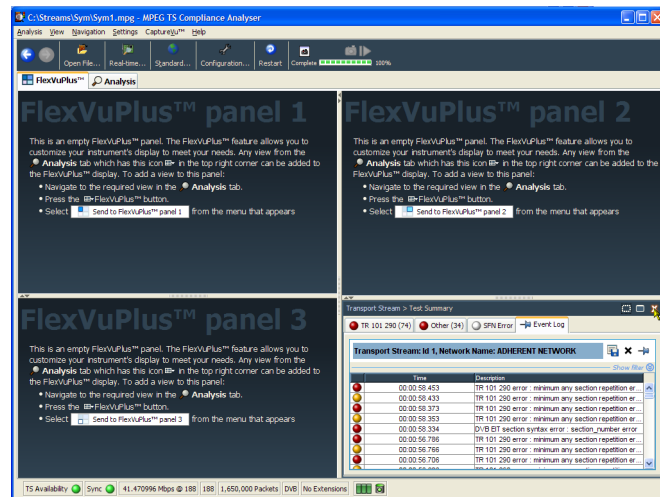
Set up panel 1

1. Select the **Analysis** tab and then the **Tests** tab.

   In the top right corner of all detail views is a *FlexVu*Plus panel select button. You can use this button to display a replica of the detail view in the selected *FlexVu*Plus panel.

2. In the Test Summary view, use the *FlexVu*Plus panel select button to replicate the view in panel 1.
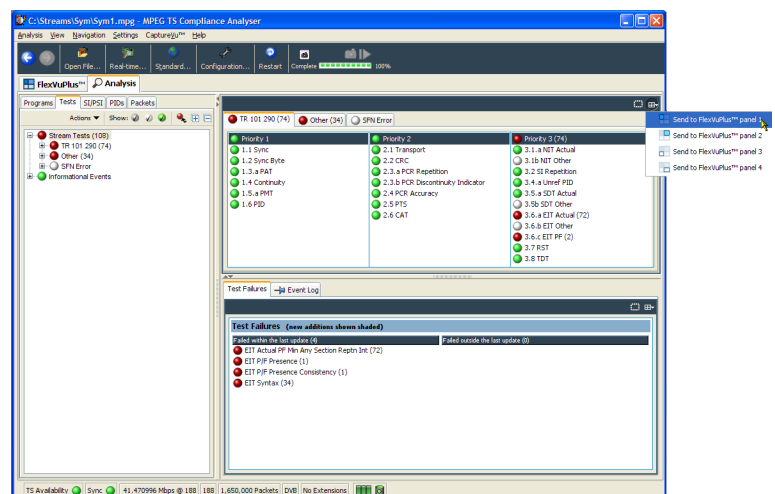
3. The *FlexVu*Plus display now contains the Test Summary view in panel 1.
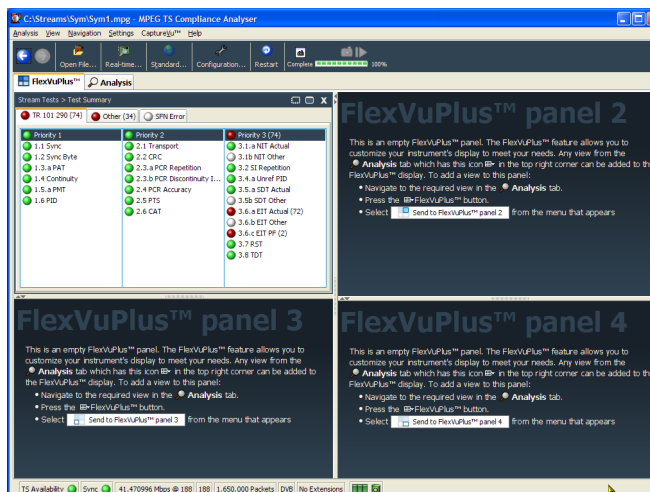
Set up panel 2.

4. Select the **Analysis** tab and then the **Programs** tab.

5. In the **Thumbnails** view, use the *FlexVu*Plus panel select button to replicate the view in panel 2.
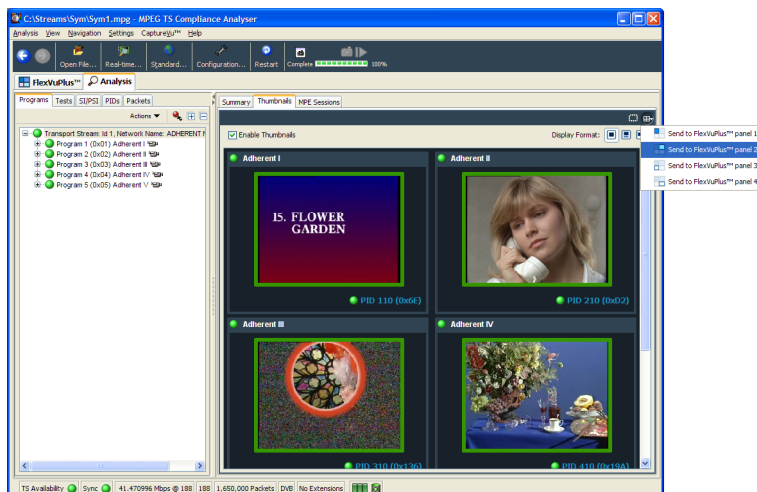
6. The *FlexVu*Plus display now contains the Thumbnail view in panel 2.
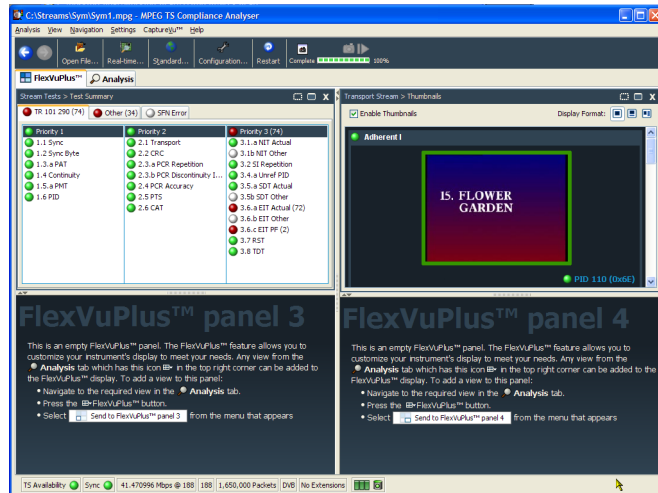
Set up panel 3.

7. Select the **Analysis** tab and then the **Tests** tab.

8. In the **Test Failures** view, use the *FlexVu*Plus panel select button to replicate the view in panel 3.
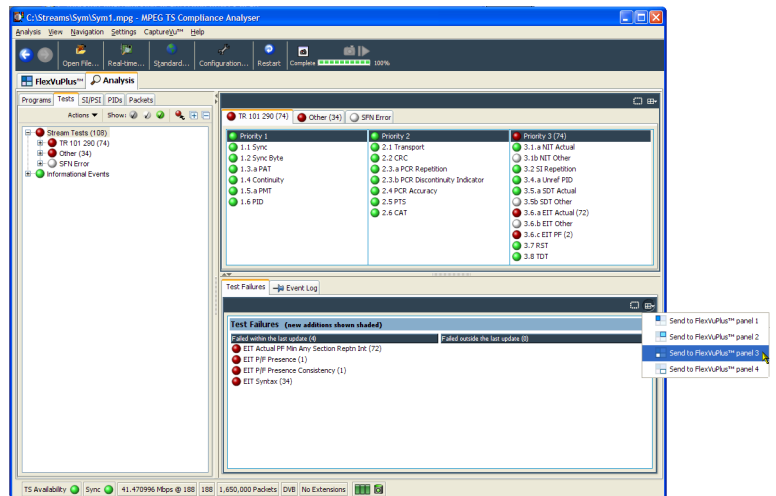
9. The *FlexVu*Plus display now contains the Test Failures view in panel 3.
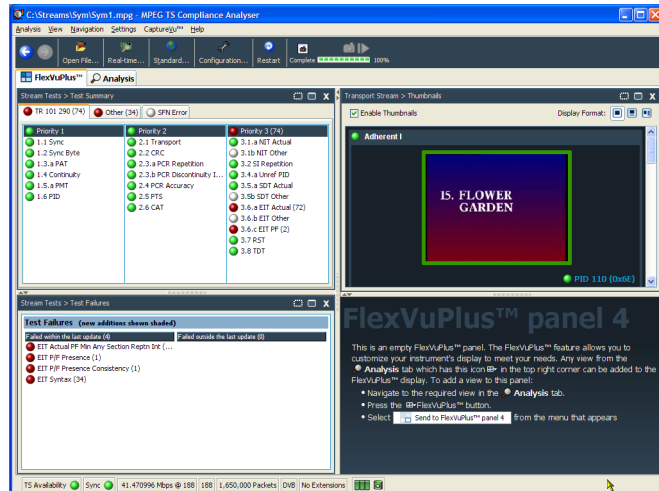
Since only three panels are used in this example, you can expand the thumbnails view to fill the right side of *FlexVu*Plus™.

You can expand panel 2 vertically by selecting the panel expand button.

(Similarly, you can expand panels horizontally using the horizontal panel expand button.)
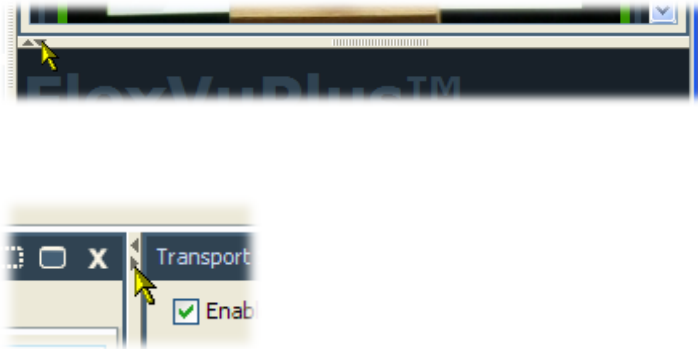
10. Expand panel 2 to display the complete *FlexVu*Plus basic monitoring view.
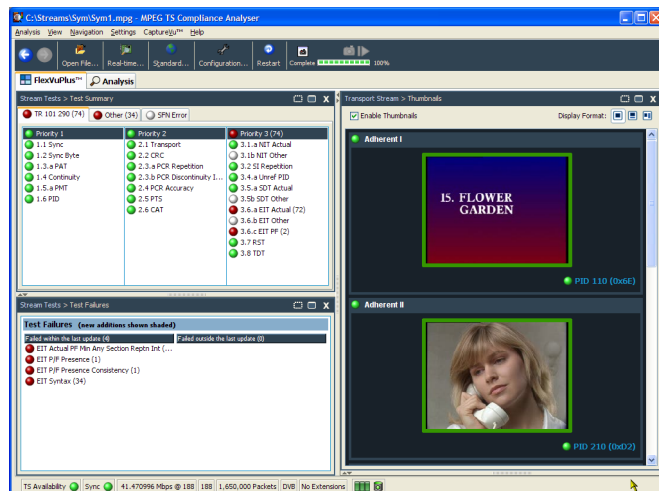
To summarize, in this view you can immediately see the following:

■ In the Tests Summary view (*FlexVu*Plus panel 1), which tests have failed.

■ In the Test Failures view (*FlexVu*Plus panel 3), which tests have failed most recently.

■ In the Thumbnails view (*FlexVu*Plus panel 2), which elementary streams are currently carrying video content.

Multiple Input Monitoring

The MTS4000 system is capable of monitoring multiple transport streams (on separate 10 G or PC NIC ports) using multiple instances of the Transport Stream Compliance Analyzer.

1. Open Transport Stream Compliance Analyzer. **File > Program > Tektronix MTS4000 > Analyzers > TS Compliance Analyzer**.

Select **Real-time Analysis...** in the TSCA Analysis toolbar.
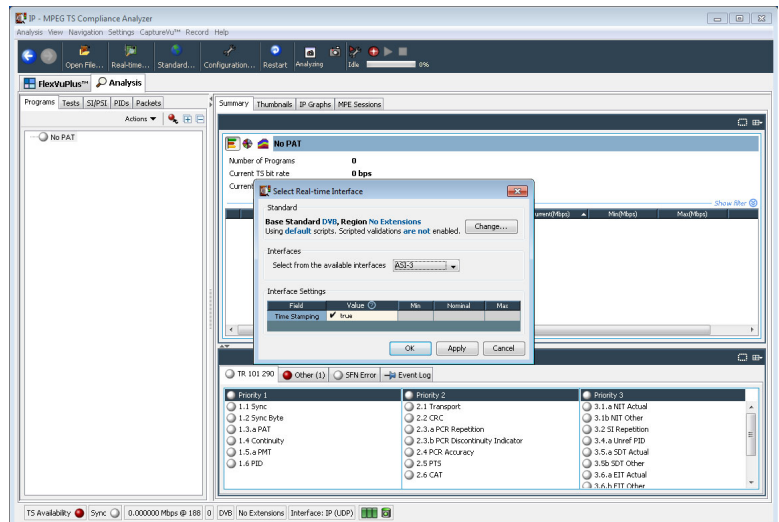
2. In the Select Real-time Interface dialog screen, select an available input from the Interfaces pull-down menu.

In the example the, ASI-3 input is selected to monitor for this instance of the TS Compliance Analyzer application.

The choices available are dependent on the available optional inputs.
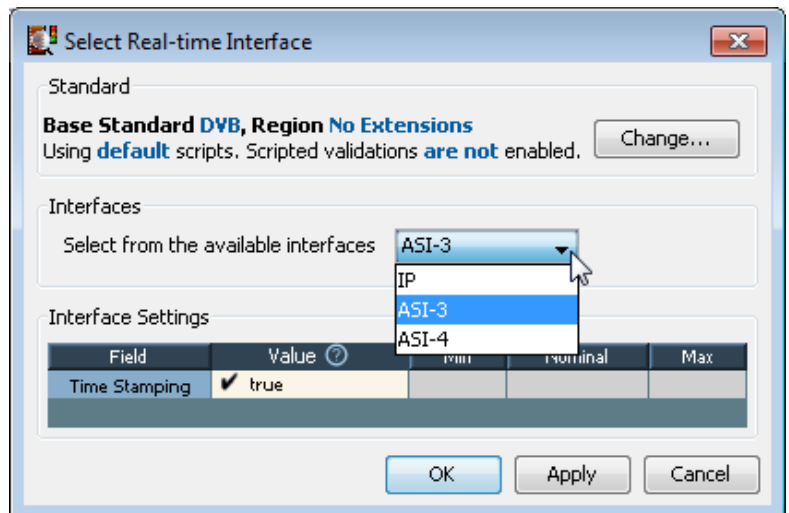
3. Open a second instance of the Transport Stream Compliance Analyzer. **File > Program > Tektronix MTS4000 > Analyzers > TS Compliance Analyzer**.

Select **Real-time Analysis...** in the TSCA Analysis toolbar.
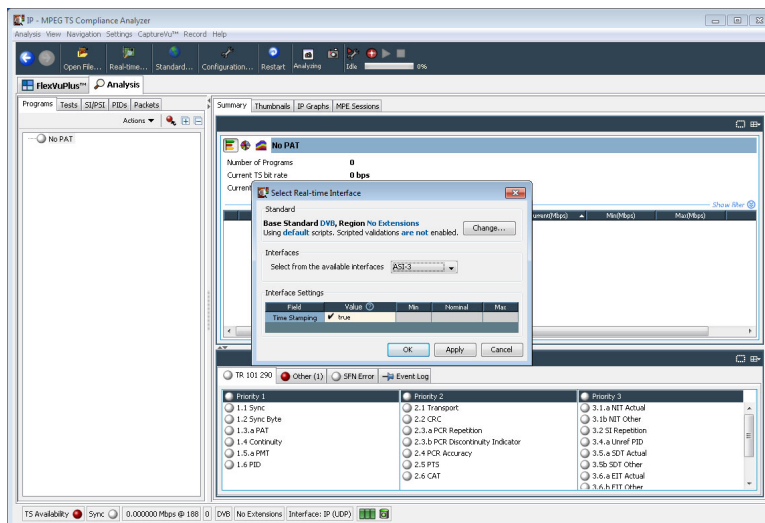
4. In the Select Real-time Interface dialog screen, select an available input from the Interfaces pull-down menu.

For this instance of the TS Compliance Analyzer, ASI-4 input has been selected to monitor.
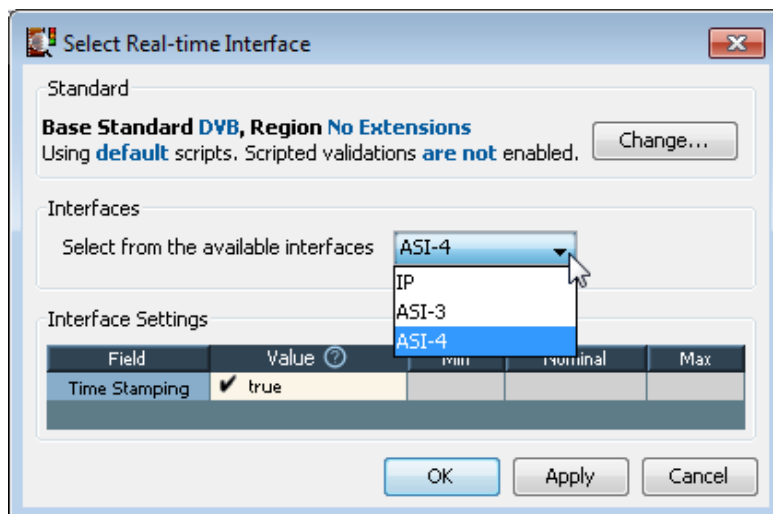
Accessories

Standard Accessories

The following table lists the standard accessories that are shipped with the MTS4000 instrument:

Description	Part number	MTS4000	MTS4SA
Compliance certificate	001-1180-XX	▪	▪
Software CD-ROM: MTS4000 Application Software Media	063-4385-XX	▪	▪
Certificate Of Authenticity: Microsoft Windows 7	NA	▪	
Software DVD: MTS4000 Operating System Restore DVD	063-4387-XX	▪	
MTS4000 Product Documentation CD-ROM	063-4386-XX	▪	▪
The CD contains all documents supporting the MTS4000 and its software applications.			
MTS4000 and MTS4SA Quick Start User Manual	071-2970-XX	▪	▪
Supplemental information sheet; China ROHS	071-2185-XX	▪	▪
Hardware key (dongle), USB	NA	▪	▪
Power Cord (one of the following)	NA	▪	
North America (Option A0)			
Universal Euro (Option A1)			
United Kingdom (Option A2)			
Australia (Option A3)			
North America 240 V (Option A4)			
Switzerland (Option A5)			
Japan (Option A6)			
China (Option A10)			
India (Option A11)			
No power cord or AC adapter (Option A99)			

Options and Upgrades

Options

The following table lists the available hardware and software options that you can order with the MTS4000. Accessories included with the options are also listed.

Option	Description
Hardware options	
ASI	Multiport ASI Interface.
	Up to four output ports. Ports 1 and 2 reserved for RF and IP cards. Ports 3 and 4 are available to receive.
S2	DVB-S/S2 Interface supporting QPSK, 8PSK, 16APSK, and 32APSK Demodulation (requires Option ASI).
	Includes BNC to BNC 75 Ω cable (Tektronix part number 174-5135-xx).
VS	8VSB Interface (requires Option ASI).
	Includes BNC to BNC 75 Ω cable (Tektronix part number 174-5135-xx).
QB2	QAM B Interface (requires Option ASI).
	Includes BNC to BNC 75 Ω cable (Tektronix part number 174-5135-xx).
IPTV	IPTV Gb Ethernet Interface with 10/100/1000BASE-T RJ45 Electrical Port (requires Option ASI).
	Includes BNC to BNC 75 Ω cable (Tektronix part number 174-5135-xx).
SX	1000BASE-SX Short Wavelength SFP Optical Port with LC Connector for IPTV Ethernet Interface (Multi mode 850 nm).
LX	1000BASE-LX Long Wavelength SFP Optical Port with LC Connector for IPTV Ethernet Interface (Single mode 1310 nm).
ZX	1000BASE-ZX SFP Optical Port with LC Connector for IPTV Ethernet Interface (Single mode 1550 nm).
10GS	10GBASE-SR Dual Optical Port 10 Gb/s NIC. Includes Short Reach SFP+ Modules (850 nm).
Software Options	
GEN	Multiplexer, MPEG Player, Transport Stream Editor, Make Seamless Wizard, Transport Stream Cutter, and Script Pad.
	Includes Tclips MPEG Test Stream software media.
ESS	Standard ES Analysis. Includes MTS4CC with all options plus MPEG-2 ES Analyzer.
ESE	Enhanced ES Analysis. Includes MTS4EAB with all options plus MPEG-2 ES Analyzer.
VQ	Video Quality Software, Single Ended. Includes VQS1000 with all options.
PQ	Picture Quality Analysis Software, Single and Double Ended. Includes PQASW with Option IP.
PB	PES and T-STD Buffer Analyzers.
Package Option	
430	Includes: Player, Multiplexer and Tclips Test Streams, PES and Buffer Analyzers, MTS4EAB with all options, MPEG-2 ES Analyzer.

Upgrade Kits

Upgrade kits are available to enhance the capabilities of the instrument after you purchase the MTS4000 test system. Kits may contain software, hardware, or both.

A qualified technician is required to install hardware to the instrument.

Option	Description
MTS4KUP	
GEN	Multiplexer, MPEG Player, Transport Stream Editor, Make Seamless Wizard, Transport Stream Cutter, and Script Pad.
	Includes Tclips test streams media.
ESS	Standard ES analysis. Includes MTS4CC with all options plus MPEG-2 ES Analyzer.
ESE	Enhanced ES analysis. Includes MTS4EAB with all options plus MPEG-2 ES Analyzer.
VQ	Video quality software, single ended. Includes VQS1000 with all options.
PQ	Picture quality analysis software, single and double ended. Includes PQASW with IP option.
PB	PES and T-STD Buffer Analyzers.
ASI	Multiport ASI interface (four ports)
S2	DVB-S/S2 interface supporting QPSK, 8PSK, 16APSK AND 32APSK demodulation.
VS	8VSB interface.
QB2	QAM B interface.
IPTV	IPTV GIGABIT Ethernet interface with 10/100/1000 BASE-T RJ45 electrical port.
10GS	10GBASE-SR dual optical port 10Gb/s NIC. Includes short reach SFP+ modules (850 nm).
SX	1000BASE-SX short wavelength optical port with LC connector for IPTV Ethernet interface (multi mode 850 nm).
LX	1000BASE-LX long wavelength optical port with LC connector for IPTV Ethernet interface (single mode 1310 nm).
ZX	1000BASE-ZX optical port with LC connector for IPTV Ethernet interface (single mode 1550 nm).

MTS4000 System Recovery

If you have problems with the MTS4000 system software, use the procedures in this section to restore the system to the factory default installation and configuration.

A complete system recovery involves restoring the Windows Operating System and reinstalling the MTS4000 MPEG Test System software.

A system recovery affects the primary hard drive (C:). The secondary hard drive (D:) is not affected by these procedures.

NOTE. *If you are restoring software after replacing the primary hard drive with one that you ordered from Tektronix, follow the instructions provided with the hard drive replacement kit.*

Restore the Operating System

You can restore the instrument operating system from either a file on the instrument hard disk drive or from the instrument restore DVDs. The preferred restore method is to use the hard disk restore file.

⚠ *CAUTION.* *To avoid data loss, back up any important user files stored on the hard drive. This operating system restoration process reformats the primary hard drive (C: drive), which erases any user-installed files and applications. The secondary hard drive (D: drive) is not affected.*

If Windows does not boot, you may be able to start the computer from the Last Known Good configuration.

To avoid malfunction, do not install any version of Windows that is not specifically provided by Tektronix for use with your instrument. The version of Windows is specially configured for the instrument. Other available versions of Windows will not operate properly.

Restoring the Operating System from the Instrument Hard Disk

The instrument contains an operating system restore file on a separate partition of the hard drive.

1. Restart the instrument. During the boot-up process you will see the following message at the top of the screen:

   Starting Acronis Loader... press F5 for Acronis Startup Recovery Manager

2. Repeatedly press the F5 key until the Acronis True Image Tool opens. There is a 5-second time period from when the message appears until the instrument proceeds with the normal instrument startup. If the instrument does not open the Acronis application, power off the instrument, then power on the instrument and try again.

3. Click Recover.

4. In the Confirmation dialog box, click Yes to restore the instrument operating system, or No to exit the restore process. The restore process takes approximately 30 minutes; the actual time depends on the instrument configuration.

5. When prompted, either shutdown or restart the instrument.

6. Install the MTS4000 System Applications.

Restoring the Operating System Using the OS Restore DVDs

The procedure to restore the instrument system software requires the MTS4000 MPEG Test System Operating System Restore DVDs (063-4387-XX), supplied with the MTS4000 instrument.

1. Insert disk 1 of the Operating System Recovery media into the DVD drive of the instrument, and close the drive door.

2. Reboot the instrument.

   If the instrument does not reboot from the DVD, reboot again:

   - Repeatedly press the F11 function key during the boot process, until a boot drive menu is displayed.

   - Select the CD/DVD as the boot device, and press Enter. The instrument should now boot from the DVD.

   NOTE. If necessary, use the keyboard arrow keys to select the required restore option.

3. When prompted, select Recover the original system installation, and then press **Enter**.

4. Press Enter to proceed with the installation. The restore process begins.

   NOTE. Please be patient. For the first 10 minutes while files are being copied, the progress bar will not show any activity.

   NOTE. Follow the displayed instructions. You will need to swap disks during the procedure.

   Each time you insert a DVD, wait for the DVD activity light to stop blinking before checking OK or Retry. Failure to wait for the blinking to stop generates a popup that pauses the install until you select OK.

5. When the Acronis restore process is completed, remove the restore disc.

6. When prompted, select either restart or shutdown to complete the OS restore process and either restart or power off the instrument.

7. When prompted by Windows, select Restart Now to restart the instrument and finish installing all device drivers.

8. Install the MTS4000 System Applications.

Installing the MTS4000 System Applications

The procedure for installing the MTS4000 system applications is similar to the procedure for stand-alone installation.

When installing the MTS4000 applications on the MTS4000 platform, select the **Install on MTS4000 Platform** during the installation procedure and continue with the installation.
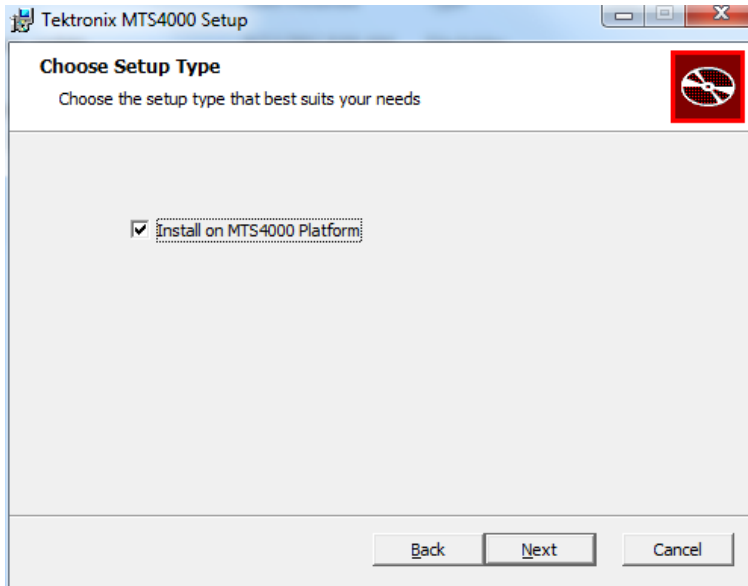
After installing the MTS4000 applications, the software license key must be reinstated – this is described in the stand-alone installation procedure. (See page 6, *MTS4SA Stand-Alone System Installation*.)

User Maintenance

This section describes general care and service procedures for the MPEG Test System.

■ *Preventive Maintenance* provides cleaning instructions

■ *In Case of Problems* provides some hints for troubleshooting startup errors

■ *Repackaging for Shipment* gives instructions for packing and shipping the instrument

General Care

Protect the instrument from adverse weather conditions. The instrument is not waterproof.

⚠ *CAUTION. To avoid damage to the instrument, do not expose it to sprays, liquids, or solvents.*

Do not use chemical cleaning agents; they may damage the instrument. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Preventative Maintenance

Check the electrical performance and verify that the instrument accuracy is certified (calibrated) once a year.

Preventive maintenance mainly consists of periodic cleaning. Periodic cleaning reduces instrument breakdown and increases reliability. You should clean the instrument as needed, based on the operating environment. Dirty conditions may require more frequent cleaning than computer room conditions.

Cleaning the Exterior

Clean the exterior surfaces of the instrument with a dry, lint-free cloth or a soft-bristle brush. If dirt remains, use a cloth or swab dampened with a 75% isopropyl alcohol solution. A swab is useful for cleaning in narrow spaces around the controls and connectors. Do not use abrasive compounds on any part of the instrument.

⚠ *CAUTION. Avoid getting moisture inside the instrument during external cleaning and use only enough solution to dampen the cloth or swab. Use a 75% isopropyl alcohol solution as a cleanser and rinse with deionized water.*

Do not wash the front-panel On/Standby switch. Cover the switch while cleaning the instrument.

Cleaning the Keyboard

Clean the exterior surfaces of the keyboard and integrated tracking device with a dry, lint-free cloth or a soft-bristle brush. A swab is useful for cleaning in narrow spaces around the controls and connectors. Do not use abrasive compounds on any part of the instrument.

⚠️ **CAUTION.** *Avoid getting moisture inside the keyboard and integrated tracking device during external cleaning and use only enough solution to dampen the cloth or swab. Use a 75% isopropyl alcohol solution as a cleanser and rinse with deionized water.*

In Case of Problems

This section addresses problems that you may encounter while using the test system. This section does not identify specific problems related to performance verification or adjustments. The diagnostic procedures for the MTS4000 system provided in this section can help you isolate problems. For a performance verification procedure, refer to the *MTS4000 Specifications and Performance Verification Technical Reference*, supplied as a PDF file on the *MTS4000 Product Documentation* CD-ROM.

Power-on diagnostics run when you first power on the instrument to start the test system application. These diagnostics check the operating system and hardware for correct operation. If error messages occur during the power-on diagnostics, there may be a system error that prevents the MTS4000 system software from starting.

The following table lists some of the symptoms of hardware problems (related to the operating system and peripheral devices) and possible solutions.

Symptom	Possible causes and recommended actions
Instrument does not power on	Verify that the power cord is connected to the instrument and to the power source.
	Check that the instrument receives power when you push the On/Standby switch; check that fan starts.
	Check that power is available at the power source.
	Contact your local Tektronix service center.
Instrument powers on but does not complete the power-on sequence	Make sure instrument boots from the hard disk drive.
Power-on diagnostics fail	Contact your local Tektronix service center.
Instrument does not recognize accessories such as external monitor, printer, or keyboard	Check that accessories are properly connected or installed.
	Contact your local Tektronix service center.
Instrument will not power off with On/Standby switch	Try powering off the instrument using the Windows 7 shutdown procedure. If the instrument still does not power off, use the task manager to close down tasks. Finally, try the hard shutdown procedure; push and hold the On/Standby switch for five seconds to power off the instrument.

Software Problems

Your MPEG Test System comes with software already installed. For any suspected software problems, try to isolate the problem to the test system application software or to other installed software.

Many software problems are due to corrupt or missing software files. In most cases, the easiest way to solve software problems is to reinstall the software. (See page 64, *MTS4000 System Recovery*.)

If you suspect networking problems, see *Network Troubleshooting*. (See page 14, *Network Troubleshooting*.)

Hardware Problems

Hardware problems can have several causes. Review the installation instructions in this manual to verify that you have properly installed the instrument. There are no user serviceable parts in the MTS4000 system, so you should contact your local Tektronix Service representative if you have a hardware problem.

Restoring the TS Compliance Analyser P1 Icon

If the TS Compliance Analyser P1 icon has been inadvertently deleted from the desktop, you can restore it by following these steps.

1. Copy the TS Compliance Analyser icon from either the desktop or the Start menu.

2. Select the icon, right-click, and select Properties.

3. Select the Shortcut tab.

4. In the Target field, add /p1 to the end of the target string.
   The target string should be:
   `"C:\Program Files (x86)\Tektronix\mpeg\MTS4000\Apps\TSCA\bin\TSCA.exe" /p1`

NOTE. Make sure to include a space between the " and /p1.

5. Rename the shortcut icon, adding P1 to the end of the name.

Returning the Instrument for Service

When repacking the instrument for shipment, use the original packaging. If the packaging is unavailable or unfit for use, contact your local Tektronix representative to obtain new packaging.

1. Seal the shipping carton with an industrial stapler or strapping tape. Before returning the instrument for service, contact the Service Center to get an RMA (return material authorization) number, and any return or shipping information you may need.

2. If the instrument is being shipped to a Tektronix Service Center, enclose the following information:
   - The RMA number.
   - The owner's address.
   - Name and phone number of a contact person.
   - Type and serial number of the instrument.
   - Reason for returning.
   - A complete description of the required service.

3. Mark the address of the Tektronix Service Center and the return address on the shipping carton in two prominent locations.

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