MTS400 Series
MPEG Test Systems

Quick Start User Manual

071-2607-01

Tektronix

MTS400 Series
MPEG Test Systems

Quick Start User Manual

www.tektronix.com
071-2607-01

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[W2 – 15AUG04]

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[W9b – 15AUG04]

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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.

Connect and disconnect properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

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.

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.

Replace batteries properly. Replace batteries only with the specified type and rating.

Use proper fuse. Use only the fuse type and rating specified for this product.

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.*

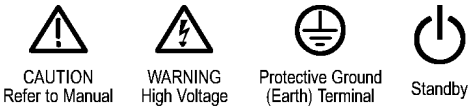
CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

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:



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, EN 61326-2-1:2006. 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
- 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 [4]

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 **Performance Criterion C applied at the 70%/25 cycle Voltage-Dip and the 0%/250 cycle Voltage-Interruption test levels (IEC 61000-4-11).**

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.

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

UL61010B-1:2003, First Edition, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.

Canadian Certification

- CAN/CSA C22.2 No. 1010.1-92 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.
- CAN/CSA C22.2 No. 1010.1B 97 - Amendment 2 to CAN/CSA C22.2 No. 1010.1-92 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.

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.

Overvoltage Category

Overvoltage Category (Mains Input)

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.

Perchlorate Materials. This product contains one or more type CR lithium batteries. According to the state of California, CR lithium batteries are classified as perchlorate materials and require special handling. See www.dtsc.ca.gov/hazardouswaste/perchlorate for additional 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 MTS400 Series MPEG Test Systems. The following naming conventions are used in this manual:

- MTS400 Series system – for information that applies to the MTS415, the MTS430, and the MTS4SA
- MTS415 system – for information that applies to only the MTS415
- MTS430 system – for information that applies to only the MTS430
- MTS4SA Stand-alone system – for information that applies to only the MTS4SA
- MTS400P system – for information that applies to only the MTS400P

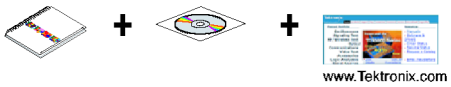
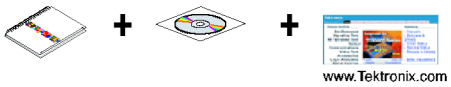
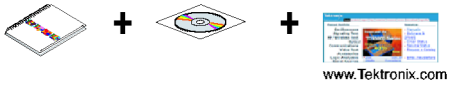
  The operation of the MTS400P is not described in this manual, see MTS400P Quick Start User Manual, Tektronix part number 071-2610-XX.
- MTX100B/RTX100B/RTX130B – for information that applies to only the MTX100B MPEG Recorder and Player, the RTX100B ISDB-T RF Signal Generator, and the RTX130B QAM and VSB RF Signal Generator.

Key Features

- Supports a wide range of DTV standards, including MPEG, DVB, ATSC, ISDB and ISDB-TB (Brazil). 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.
- Integrated cross-layer fault analysis and logging provide a single box solution for fault diagnosis, reducing time to insight when troubleshooting.
- The playout functionality can simulate IP multisession replication to characterize behavior of a network or device under test.
- CaptureVu™ technology captures and analyzes system events in real- and off-line time.
- 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.
- Tclips MPEG Test Streams

Documentation

This manual describes the installation and basic operation of the MTS400 Series systems. The following information is also available for this product:

Item	Purpose	Location
MTS400 Series Quick Start User Manual (071-2607-XX English, 071-2608-XX Japanese)	Describes how to install and get started using the test systems.	
MTS400 Series Analyzer Applications User Manual (077-0205-XX)	Describes the operation of the following analyzer applications: TSCA, PES Analyzer, T-STD Buffer Analyzer, and ES Analyzer.	
MTS400 Series Generator Applications User Manual (077-0204-XX)	Describes the operation of the following generator applications: Multiplexer, MPEG Player, TS Editor, Make Seamless Wizard, Transport Stream Cutter, and Script Pad.	
MTS400 Series Carousel Applications User Manual (077-0203-XX)	Describes the operation of the Carousel Analyzer and Carousel Generator applications.	
MTS400 Series Programmer Manual (077-0206-XX)	Describes the programmer commands for controlling the MPEG Player application.	
MTS400 Series 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.	

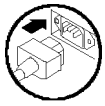
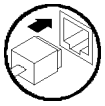
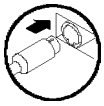
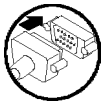
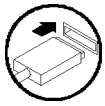
User documents can be downloaded from the Tektronix Web site: www.tektronix.com/manuals.

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
						

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 MTS400 Series 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 70, Repackaging for Shipment.)*

4. Verify whether you received the standard accessories and any optional accessories that you ordered. (See page 66, *Accessories*.)
5. Perform the functional check procedure after installing the instrument. The functional check procedure is located in the *MTS400 Series MPEG Test Systems Specifications and Performance Verification Technical Reference* document.

Operating Considerations

The following table lists the electrical operating requirements for the MTS400 Series systems. The complete electrical operating requirements of the MTS400 Series instruments are listed in the *MTS400 Series MPEG Test Systems Specifications and Performance Verification Technical Reference*.

Table 1: Electrical operating requirements

Requirement	Specification
Operating temperature	+ 5 °C to + 40 °C
Operating altitude	0 to 3000 m (9800 ft)
Source Voltage	100 to 240 VAC ≥ 10% (90 to 264 VAC RMS)
Frequency range	50/60 Hz
Maximum Power Consumption	4 Amps
Inrush Surge Current	13 A at 240 VAC, 50 Hz 4.8 A peak at 100 VAC, 60 Hz
Fuse rating	T6.3AH, 250 V, Fast; 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

Connecting to the Instrument

This section describes how to install the MTS400 Series systems instruments. 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 MTS400 Series system and the MTX100B/RTX100B/RTX130B instruments are configured with the software and hardware options that you ordered at the time of purchase. MTS400 Series system options can be added using upgrade kits available from Tektronix.

CAUTION. *Do not operate the MTS400 Series system instrument in the vertical position. Using it in the vertical position does not allow sufficient ventilation or clearance for cables at the rear of the unit.*

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.

Rear Panel Connectors

This section lists the standard electrical, signal, and network connections.

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

The following figure illustrates the MTS400 Series system rear-panel connectors.

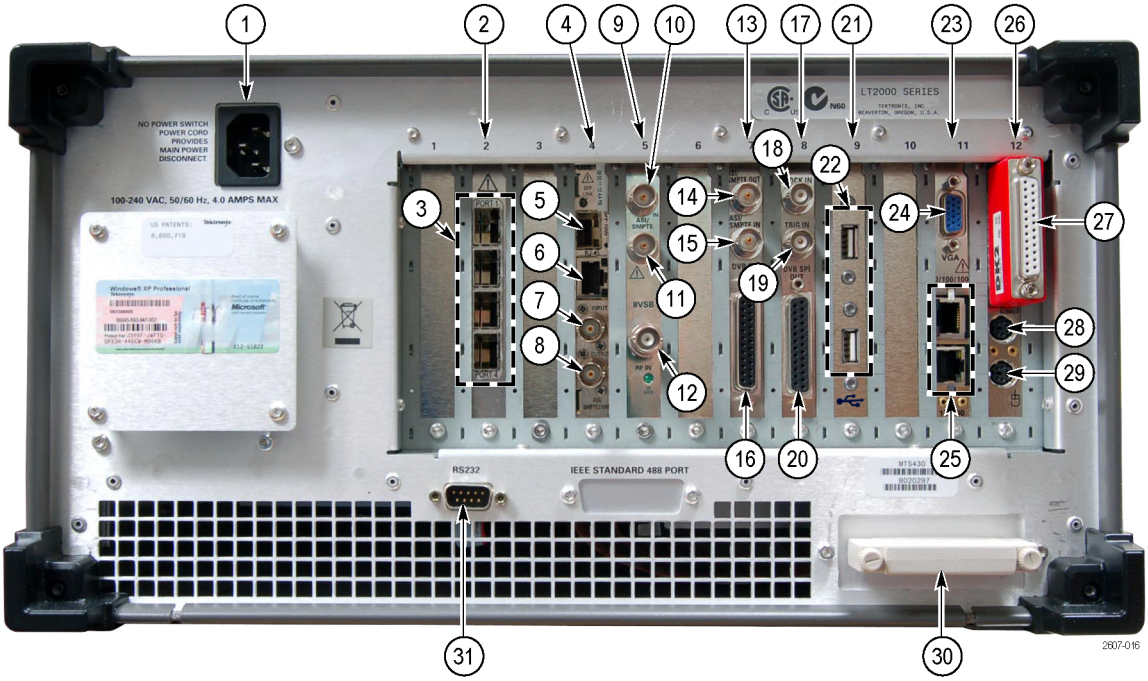


Figure 1: MTS400 Series rear panel

The following table describes the transport stream, network, and peripheral device connectors. See the *MTS400 Series MPEG Test Systems Specifications and Performance Verification Technical Reference* for more detailed information about each connector and signal input and output formats.

CAUTION. *The rear panel illustration is for information only. The following notes apply:*

- Where present, the GbE Video over IP interface card must be installed in slot 2

- Where present, the IP Video over IP interface card or RF interface card should be installed in slot 4

- Only one of the above two types of IP interface cards can be installed at a time

Table 2: MTS400 Series system rear panel connectors

Figure reference	Description	Connector type
1	AC mains power	-
2	Gigabit Ethernet (GbE) Video over IP interface card (optional)	-
3	SFP (small format pluggable) ports 1 to 4	-
4	IP Video GbE interface card (optional)	-
5	SFP (small format pluggable)	
6	Ethernet	RJ45
7	ASI/SMPTE input	75 Ω BNC
8	ASI/SMPTE output	75 Ω BNC
9	RF interface card (Optional, 8VSB shown)	-
10	ASI/SMPTE input	75 Ω BNC
11	ASI/SMPTE output	75 Ω BNC
12	RF in	-
13	LVDS/ASI/SMPTE310 (A170 card)	-
14	ASI/SMPTE output	75 Ω BNC
15	ASI/SMPTE input	75 Ω BNC
16	DVB/SPI Out	25-way, D-type connector
17	Main input/output (A12 card)	
18	Reference clock input	50 Ω BNC connector
19	External trigger	50 Ω BNC connector
20	DVB/SPI	25-way, D-type
21	USB connector panel	-
22	USB 2.0; software key (USB option) location	2 x USB 2.0 Standard-A sockets
23	Input/output card	-
24	Video Out	15-way, D-type
25	Ethernet	■ 10 Base-T/100 Base-T, RJ45 connector ■ Gigabit
26	SBC (Single Board Computer)	9-way, D-type
27	Parallel port; software key (parallel option) location	25-way, D-type
28	Keyboard	Six-pin mini-DIN (for PS2 compatible keyboard)
29	Mouse	Six-pin mini-DIN (for PS2 compatible mouse)
30	SCSI (including factory fitted terminator)	Terminates the SCSI bus
31	RS-232 COM (serial) Port 1	9-way, D-type

Plug the keyboard into the proper rear panel connectors. Note that the keyboard has two connectors at the end of the cable; one connector for the keyboard and one connector for the track pad. Refer to rear-panel illustration. (See Figure 1.)

Ensure that the software key is in place. If you are using the parallel port software key, ensure that the securing screws are tightened to 4 inch-pounds of torque (45 Newton centimeters).

CAUTION. *To prevent instrument damage from electrostatic discharge, ensure that the parallel port software key securing screws are properly tightened before operating the instrument.*

NOTE. *The MTS400 Series system applications will not run without the software key installed. Do not remove the software key.*

To use the parallel port with the software key installed, attach any parallel port cables (such as a printer cables) directly to the software key. The software key does not interfere with parallel communications.

NOTE. *If you return the test system to a Tektronix Service Center for upgrade or repair, do not remove the software key.*

RF Interface Card Connectors

The MTS400 Series systems can have optional RF interface cards installed in slot 5. (See Figure 1.)

Connector	Connector	Description
COFDM RF Interface		
ASI/SMPTE In/Out	75 Ω BNC	Standard ASI / SMPTE310M compliant
RF In	F-type	RF input
8PSK RF Interface [1]		
ASI/SMPTE In/Out	75 Ω BNC	Standard ASI / SMPTE310M compliant
RF In	F-type	RF input
QAM (Annex B) RF Interface		
ASI/SMPTE In/Out	75 Ω BNC	Standard ASI / SMPTE310M compliant
RF In	F-type	RF input
8VSB RF Interface		
ASI/SMPTE In/Out	75 Ω BNC	Standard ASI / SMPTE310M compliant
RF In	F-type	RF input

1 The 8PSK RF interface card has a LNB (Low Noise Block) LED indicator. The LED is lit when the LNB is active.

The **In Lock** LED on each RF card indicates that full lock has been acquired onto the channel and the signal is being received correctly.

On each RF card, the ASI/SMPTE In connector is looped through to the ASI/SMPTE Out connector. When the RF card is to be used, the RF card ASI/SMPTE Out must be connected to the A170 (LVDS/ASI/SMPTE310) card ASI/SMPTE In. This allows the full range of measurements to be made.

When using the RF input, for example a satellite feed, connect it to the RF In connector on the RF card. If an ASI/SMPTE input is also available, it can be connected to the RF card ASI Input. Which input is monitored and analyzed will depend on the input selection made when opening the Transport Stream Compliance Analyzer. Refer to the *MTS400 Series Analyzer Applications User Manual*.

GbE Interface Card Connectors

Two IP interface options are available: the IP Video Gigabit Ethernet Interface (IP Video Interface) and the GigE Video over IP Interface (GigE Interface). Generically they are referred to as GbE interface cards. The IP Video Interface card must be installed in slot four. The GigE Interface card must be installed in slot two. (See Figure 1.)

The GbE interface cards provide up to four SFP (Small Format Pluggable) modules, which can be used to facilitate the Ethernet Optical and copper interconnections. SFP modules are used to facilitate different wavelengths for the Ethernet Optical interconnection feature. The SFP ports are numbered from one to four (from the top of the card).

The following figure shows an SFP module and optical port plug. The options tables list the SFP module options available. (See page 66, *Standard Accessories*.)

The GbE interface cards have been tested with SFP module(s) ordered from Tektronix. SFP modules purchased from a supplier other than Tektronix are not warranted to work.

WARNING. *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.*

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

MTS4USB Installation

If you ordered option MTS4USB with your MTS415 or MTS430 system, then you received a USB dongle with your instrument. When installed on your PC, the USB dongle enables various MTS400 Series software options. Which options are enabled depends on which USB software option you purchased, ES or TS. The ES option enables the MTS4CC software application (MTS415 systems) or enables the MTS4EA software application (MTS430 systems). The TS option enables the MTS400 Series software applications such as the TSCA, Multiplexer, and Buffer Analyzer.

To install the MTS4USB option, perform the procedure described in *MTS4SA Stand-Alone System Installation* using the MTS4USB dongle. (See page 6.)

MTS4SA Stand-Alone System Installation

The MTS4SA Stand-alone system makes the MTS400 Series system applications (except the real-time features) available on a PC. The full specification is given in the *MTS400 Series system Technical Reference*.

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™ 2000 or Windows XP operating system
- Processor speed >1.0 GHz
- Memory at least 256 MB RAM
- Screen resolution at least 1024 x 768
- 120 MB 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.*

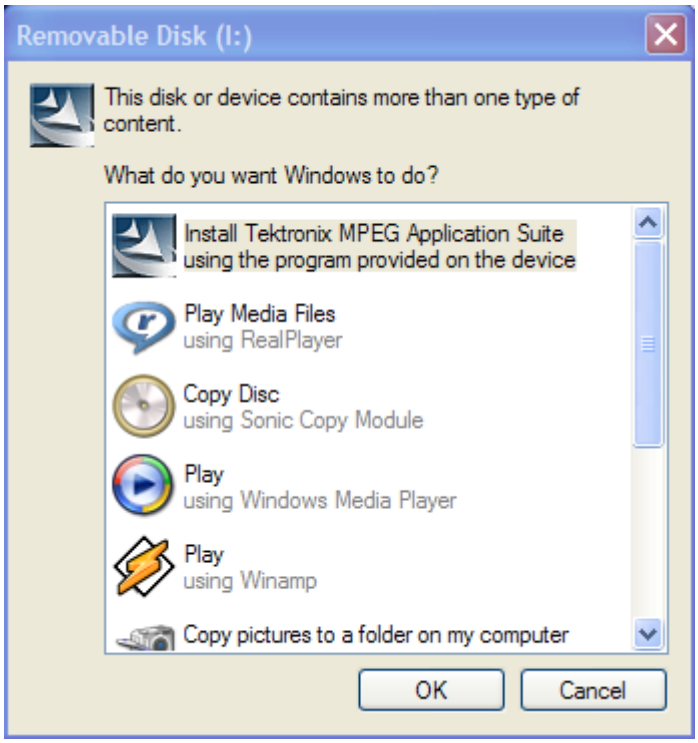
Installation Procedure

1. Ensure that the PC is switched on and has completed the start-up process.
2. Ensure that the software key (dongle) supplied is attached to your PC.
3. Place the MTS400 Series Application Software Media (CD-ROM or USB flash drive) in the appropriate drive slot on your PC.

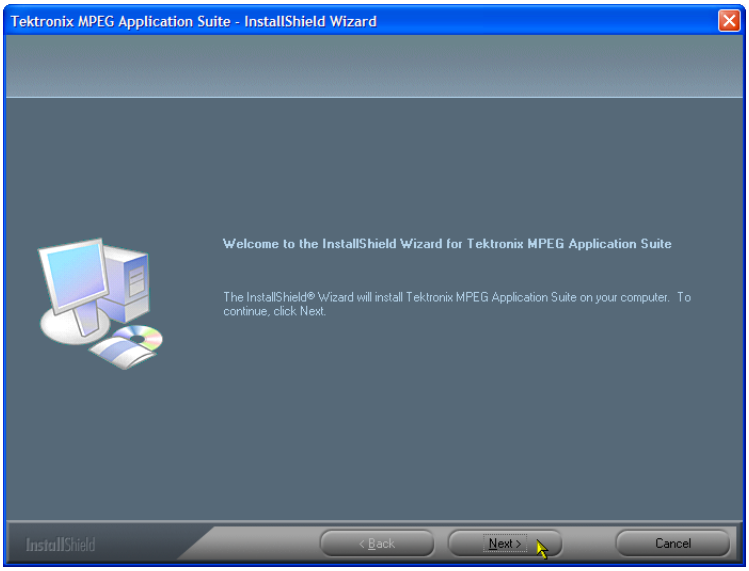
   The **Removable Disk** dialog box is displayed.
4. Highlight the **Install Tektronix MPEG Application Suite** entry and select **OK**.

   The installation program will start and display a Welcome screen.

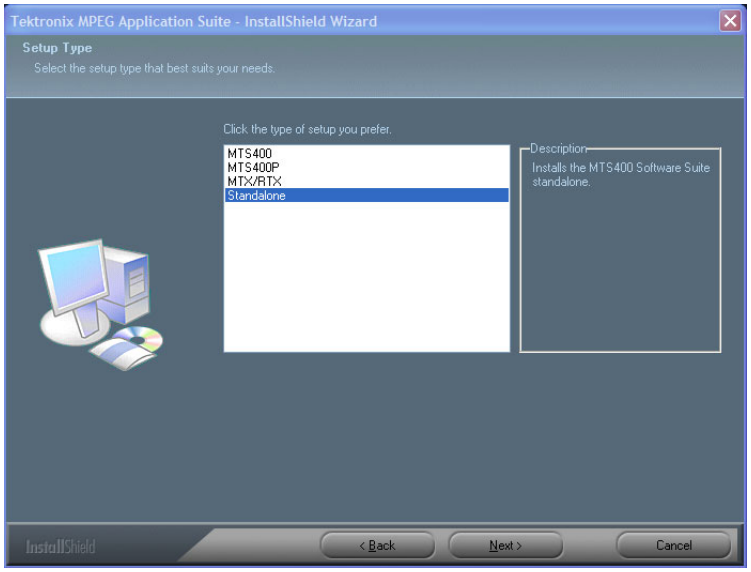
   (If the installation program does not autostart, use Windows explorer to locate and run the file setup.exe on the MTS400 Series Application Software media.)



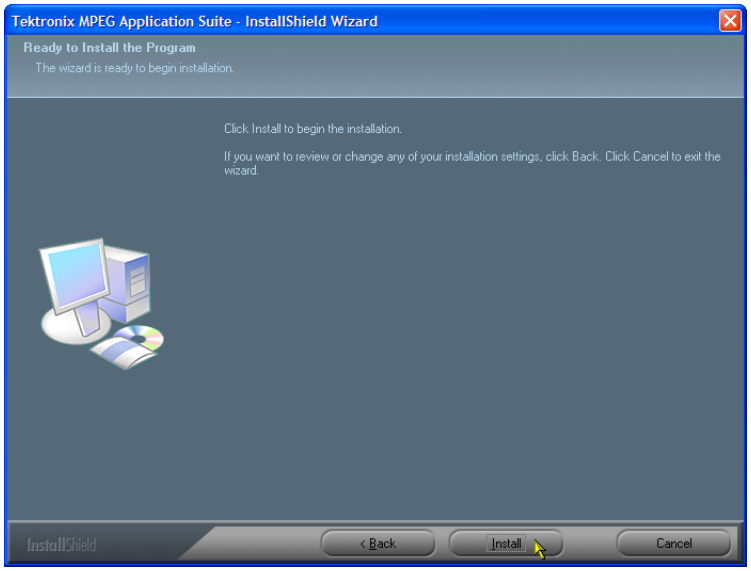
5. In the installation Welcome screen, select **Next**.



6. In the Setup Type screen, highlight **Standalone** and select **Next**.



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

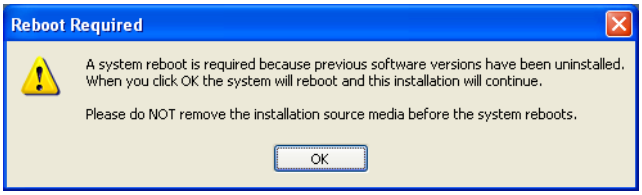


NOTE. *A number of message boxes are displayed during the installation process. Normally, no user intervention is required.*

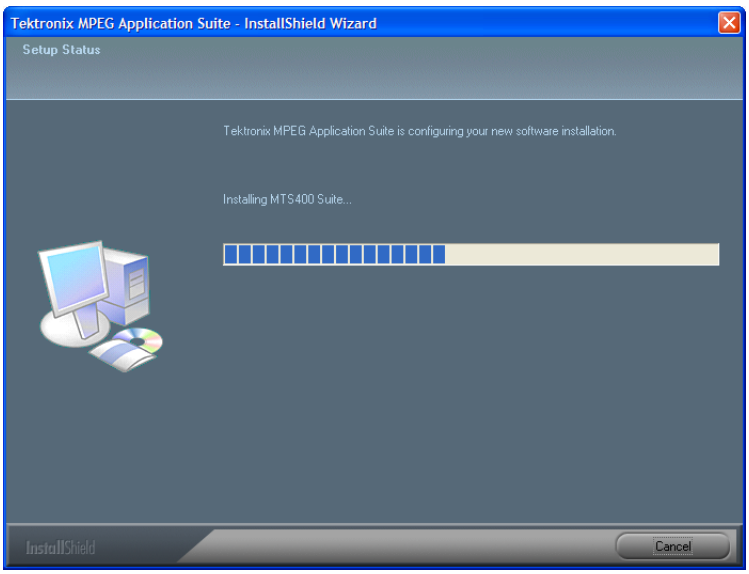
8. If the installation program detects an older version of the MTS400 Series software, the software will be automatically uninstalled.

   For some versions of older MTS400 software, a reboot is required. The Application Software media should not be removed at this stage.

   If a reboot is required, on completion, the Ready to Install screen is redisplayed.



9. Allow the installation to proceed.

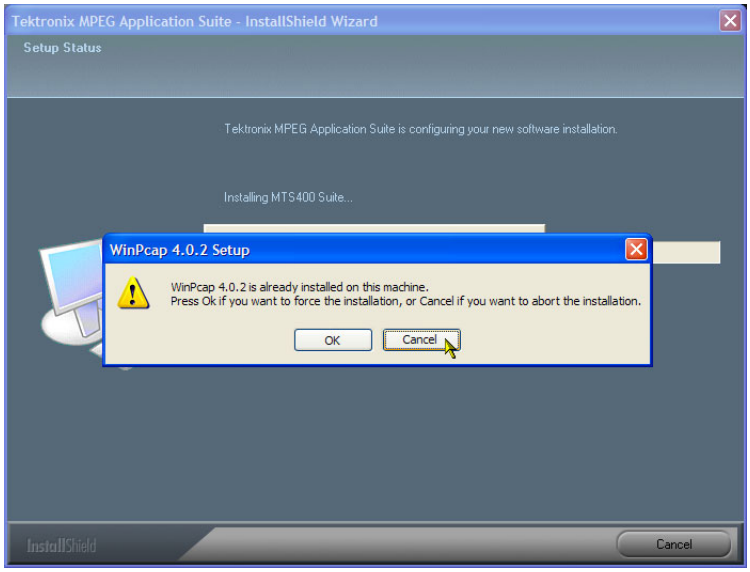


10. If WinPcap has not been installed previously, select OK in the message box and proceed through the WinPcap installation process.

    If the installation process detects that the correct version WinPcap is already installed, you will be offered an opportunity to force reinstallation of WinPcap or to proceed with the MTS400 Series installation.

11. Select Cancel to abort the reinstallation of WinPcap and proceed with the MTS400 Series software installation.

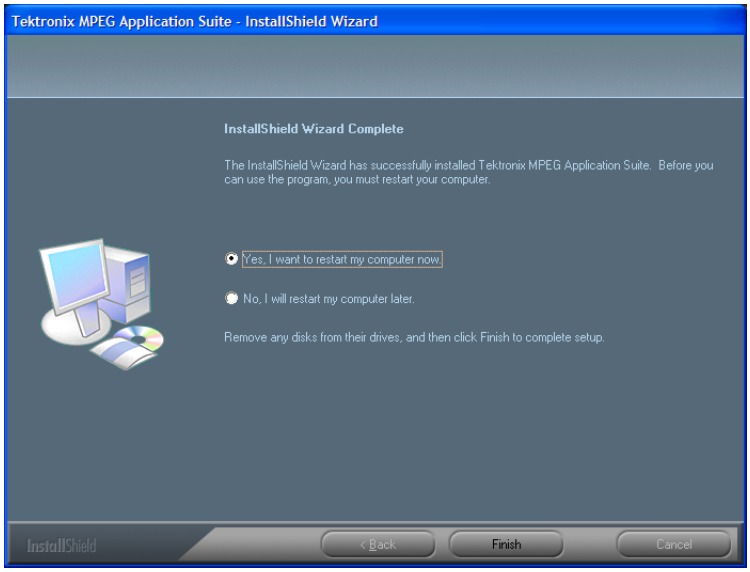
If you select OK, the WinPcap program will simply be overwritten and the installation will proceed.



NOTE. *The average installation time for the MTS4SA Stand-alone system is approximately five minutes.*

12. When installation is complete, the InstallShield Wizard Complete screen is displayed.

13. Choose the option to restart the PC, and then select **Finish**. The PC will shut down and restart.

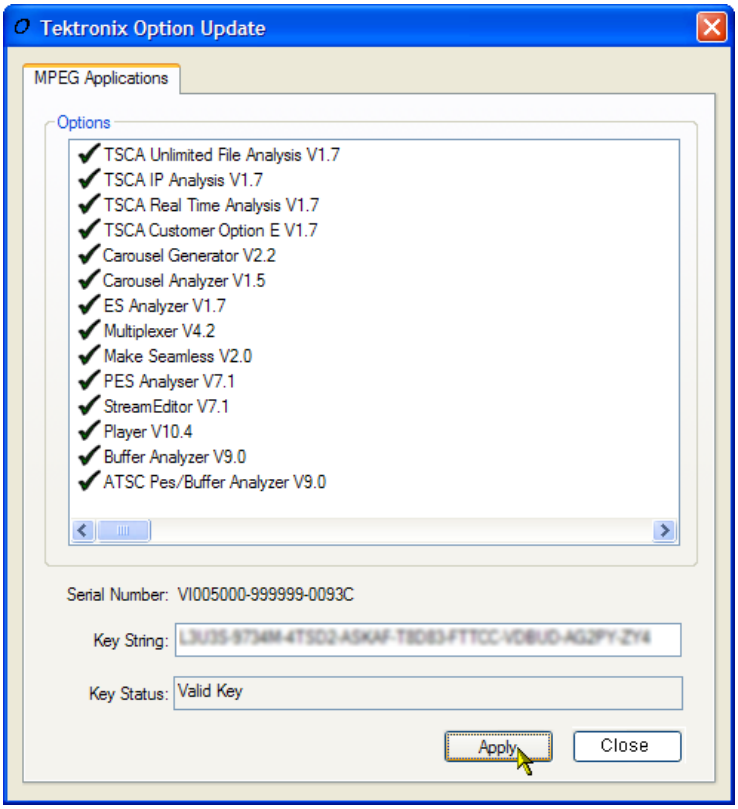


14. When the PC has restarted, the MTS400 Series Option Key Wizard must be started; select **Start > Programs > Tektronix MTS400 > OptionKey Wizard**.

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

16. Click **Apply**.

17. 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.*

18. Close the Option Key Wizard.

19. The licensed MTS400 Series Stand-alone applications is now available in the Windows Start menu. (See page 23, *Starting an Application*.)

Powering On the Instrument

Supplying Power

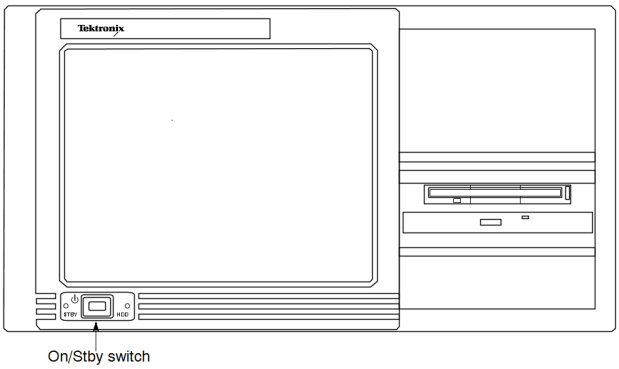
The MTS400 Series system and MTS430 units are designed to operate from a single-phase power source having one of its current carrying conductors at or near earth ground (the neutral conductor). Power sources that have both current carrying conductors live with respect to ground, such as phase-to-phase 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 MTS400 Series system and completed making the signal and peripheral connections, plug the power cord into the mains power supply. (See Figure 1.)

First Time Power On

Power on the test system as follows:

1. Push the front-panel On/Standby switch to power on the instrument.
2. Wait for the instrument to complete its power-on self-tests.
3. On startup, the system will prompt you to set up Windows XP. Follow the on-screen procedure, accepting defaults where necessary.
4. Allow the system to restart when prompted.



NOTE. *If you later want to set a password, refer to your Windows documentation.*

Powering Off the Instrument

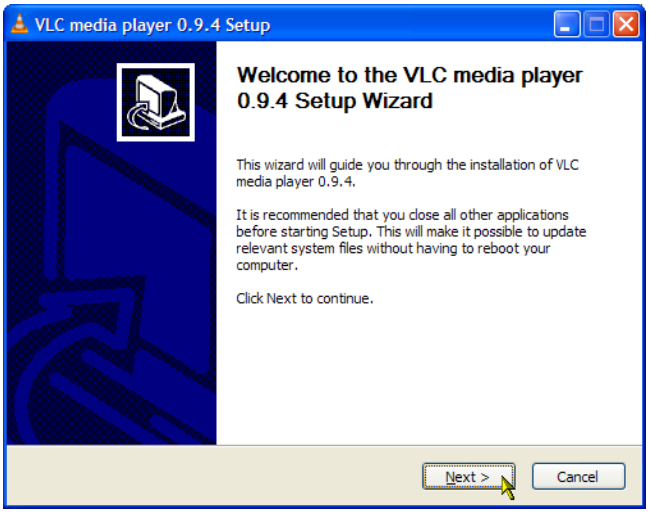
Always power off the instrument using the Windows XP shutdown process (select **Start** > **Shut down**… or **Start > Turn off computer**). The system (including applications) will shut down automatically. When prompted, push the front panel On/Standby switch to remove power from the unit.

Alternatively, push the front panel On/Standby switch for two seconds and release. The system will shut down and power off automatically with no further intervention.

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 MTS400 Series 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.

MTX100B/RTX100B/RTX130B and VLC Media Player

If the VLC Media Player is installed on the MTS400P or the MTX100B/RTX100B/RTX130B, the audio feature in the media player must be disabled.

In the VLC Media Player, perform the following steps to disable the audio feature:

1. Select Settings > Preferences.
2. Select Audio from the list on the left hand side of the Preferences dialog box.
3. Under General audio settings, clear the Enable audio check box.
4. Click the Save button to accept the changes and close the Preferences dialog box.

Network Installation

The MTS400P 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 that is supplied with the 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:

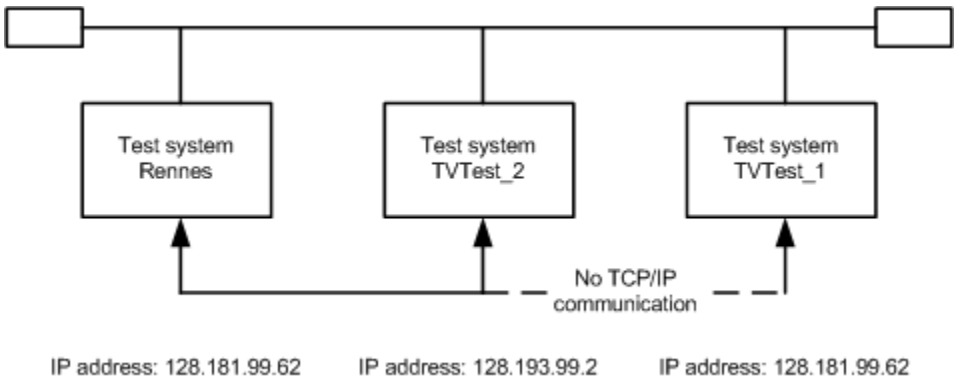
- Configure your system for use on the network as described in the documentation that is supplied with the Network Adapter card. Contact your network administrator for details.
- Ensure that any applications that you may have loaded on your test system since receiving it are not using the ports assigned 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.

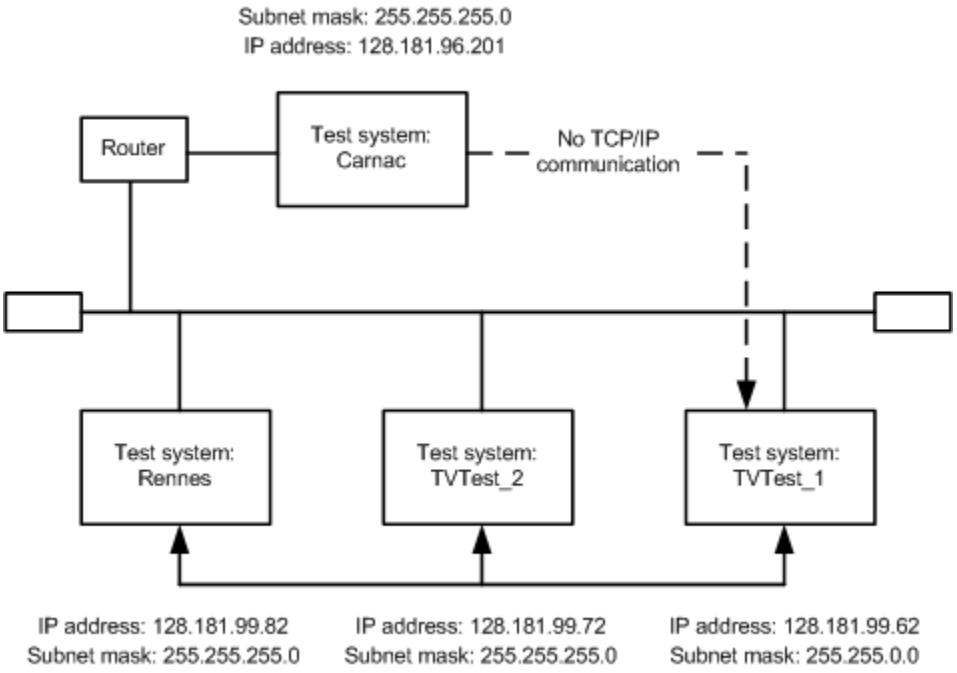
Incorrect IP address. If the IP address for your test system is incorrect (not unique), then you may not be able to communicate over the network. In the next figure, TVTest_1 uses the same IP address as Rennes. If Rennes is started first, TVTest_1 will recognize the IP address conflict and will not load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

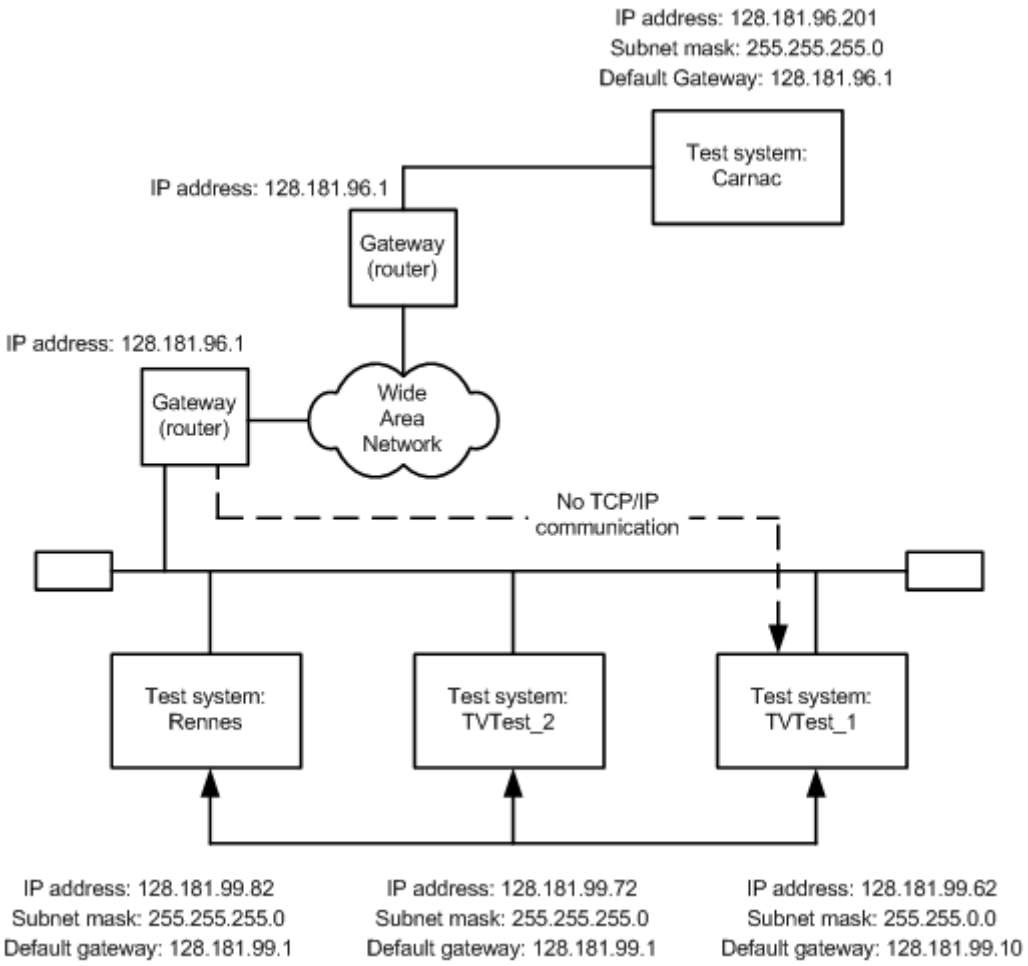


TVTest_1 cannot communicate with Carnac, because, according to the subnet mask on TVTest_1, Carnac and TVTest_1 are logically on the same network. Consequently, messages sent from TVTest_1 to Carnac are never routed. Because these two devices do not share a connection, TVTest_1 will never find the correct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



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. (Look in the C:\windows\system32\ directory.) 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. To run ping, use the following procedure:

1. Select **Run** from the Start menu. The Run dialog box appears.
2. Type one of the following into the Run text box:

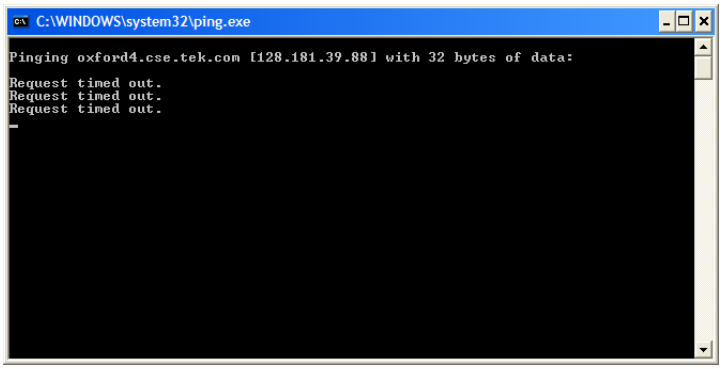
   ping machineName

   ping IPaddress

   In the examples, machineName and IPaddress 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. In the figure, the destination machine (Oxford4) is not responding.

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



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:

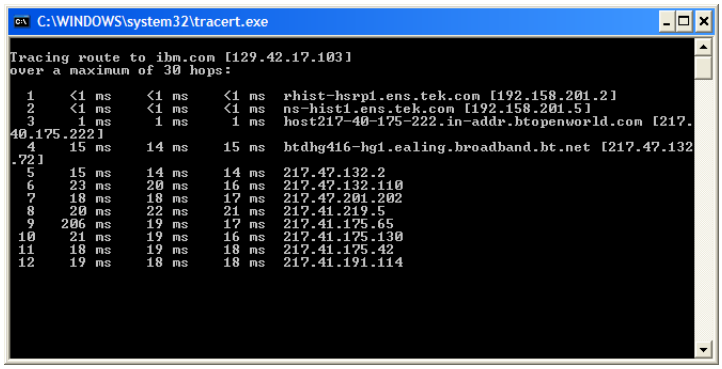
1. Select **Run** from the Start menu. The Run dialog box appears.
2. Type one of the following into the Run text box:

   tracert machineName

   tracert IPaddress

   In the examples, machineName and IPaddress 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.

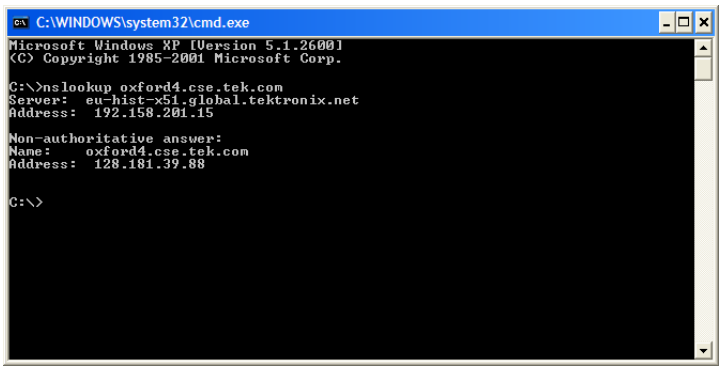
At times, you may need to find or confirm the IP address of a computer on your network (or find the network name if all you have is an IP address). You may want to find this information to ensure that IP addresses and network names you use in the Hosts file are correct. The utility that will display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

1. Select **Run** from the Start menu. The Run dialog box appears.
2. Enter one of the following and push Enter, where machineName or IPaddress is the network name or IP address, respectively, of the device you are trying to look up.

   nslookup machineName

   nslookup IPaddress

   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.



Sources of Network Information

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

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.*

- 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

Operation

Product Description

The MTS400 Series MPEG Test Systems provide 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.

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 MTS400 Series MPEG Test Systems. Note that some options might not be enabled. Detailed descriptions of all applications can be found in the MTS400 Series system MPEG Test System applications user manuals.

The MTS4EA Compressed Video ES Analyzer options are described in the MTS4EA User Manual, Tektronix part number 071-1641-XX. Similarly, the MTS4CC Elementary Stream Compliance Checker options are described in the *MTS4CC User Manual*, Tektronix part number 071-2075-XX.

Application	Desktop Icon [1]
Analyzers	
Transport Stream Compliance Analyzer (TSCA) – Real-time transport stream analysis with user-selectable MPEG-2, DVB, ATSC and ISDB conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing /transport rate graphs and error message logs.	TS Compliance Analyser
Transport Stream Compliance Analyzer (TSCA) – Deferred transport stream analysis with user-selectable MPEG-2, DVB, ATSC and ISDB conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing/transport rate graphs and error message logs.	TS Compliance Analyser
Transport Stream Compliance Analyzer Lite (TSCA) – Same as for the TS Analyzer except that the file size of transport streams to be analyzed is limited to 192 MB.	TS Compliance Analyser
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

Application	Desktop Icon [1]
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
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 – Records and plays MPEG-2 streams. (The MTX100B/RTX100B/RTX130B players are described in their respective user manuals: MTX100B User Manual, Tektronix part number 071-1927-XX, RTX100B User Manual, Tektronix part number 071-1930-XX, and RTX130B User Manual, Tektronix part number 071-1933-XX.)	MPEG Player
Utilities	
Make Seamless Wizard – Guides the user through the process of creating an MPEG-2 file for use by Stream Player in continuously looped operation.	Make Seamless Wizard

Application	Desktop Icon [1]
Stream Cutter – Extracts sections of MPEG-2 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.	

1 If installed

Starting an Application

All applications are started from the Start > All Programs > Tektronix MTS400 menus.

The MTS400 Series 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 MTS400 >	Analyzers >	Buffer Analyzer
		Carousel Analyzer
		ES Analyzer
		PES Analyzer
		TS Compliance Analyzer
	Generators >	Carousel Generator
		Multiplexer
		TS Editor
	Player >	MPEG Player [1]
	Utilities >	Make Seamless Wizard
		ScriptPad
		Stream Cutter
		TTS Utility
	OptionKey Wizard	

1 MTX100B/RTX100B/RTX130B MPEG Player – Start > Programs > Tektronix > MPEG Player

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 MTS400 Series system (including the MTS400P) can be operated in duplex mode (ASI/SMPTE/DVB Parallel (SPI) only). For example, while the Player is playing out a stream, the TS Compliance Analyzer 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 TS Compliance Analyzer (TSCA).

NOTE. *Duplex operation is unavailable on the MTX100B/RTX100B/RTX130B.*

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
- 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/SMPTE310 or DVB SPI) and make the necessary connections (loop between the connectors) at the rear of the instrument.

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

NOTE. *You can choose either ASI or SPMTE310 to be supplied through the BNC connectors. The DVB SPI output will always be available, whatever the settings are in the player. IP is unavailable.*

MPEG Player setup.

1. Open the MPEG Player: **Start** > **Programs** > **Tektronix MTS400** > **Player** > **MPEG Player**.
2. Open a stream: **File > Open**… **>** sym1.mpg.
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** > **Programs** > **Tektronix MTS400** > **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.

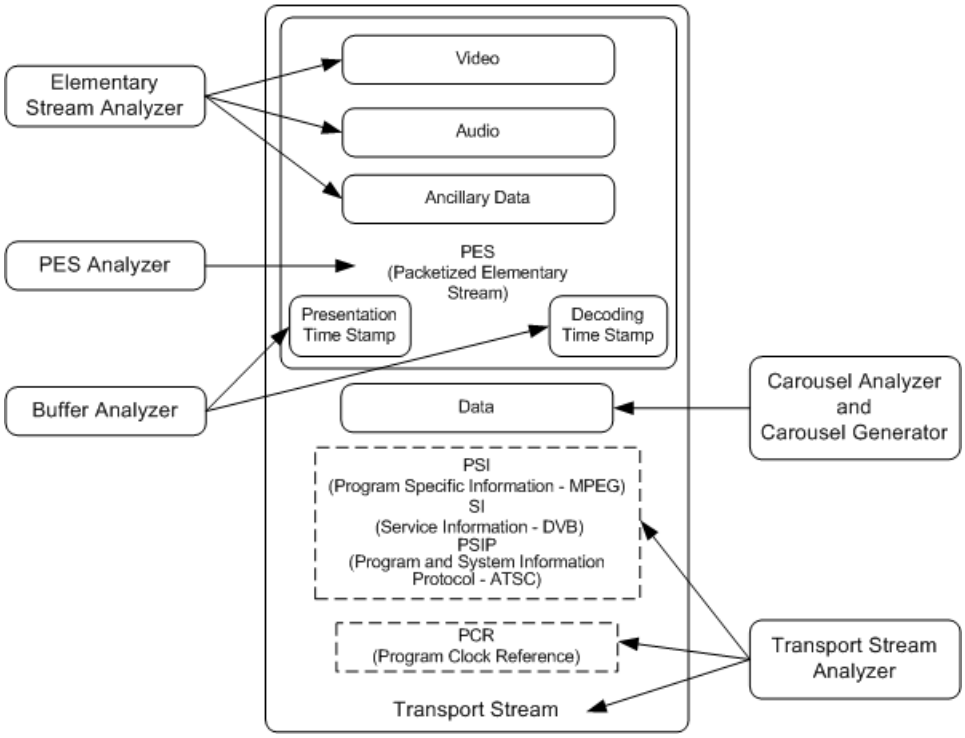
The MPEG Player is now playing out the sym1.mpg transport stream and, through the ASI input and output on the instrument connector panel, the TSCA is monitoring and analyzing the stream.

For detailed descriptions of the MPEG Player and the TSCA, refer to the *MTS400 Series Analyzer Applications User Manual*.

Procedures

Using the MTS400 Series Applications

The applications in the MTS400 Series analysis toolset are targeted at a specific aspect or layer of a transport stream. The following figure illustrates this principle in simplified form.



This tutorial will tell you how to open the application, how to analyse the test stream created earlier (testmux.mpg) and what results will be presented. It will not tell you how to interpret the results.

Transport Stream Compliance Analyzer

The TSCA provides real-time and off-line analysis of transport streams to check for compliance with a range of DTV standards. Streams can be received through a range of RF and IPTV interfaces. A practical application of the TSCA is described in Examine Stream Content with TSCA section. (See page 63, *Examining Stream Content with the TSCA*.)

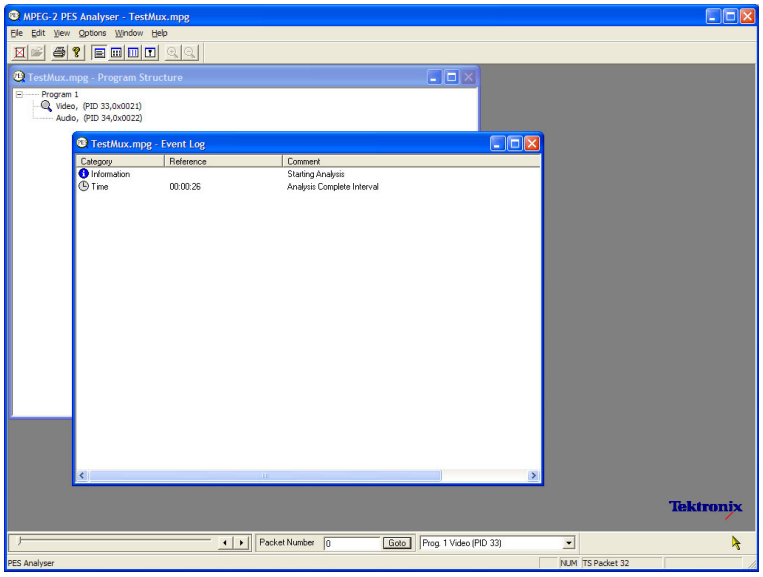
PES Analyzer

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 > Program > Tektronix MTS400 > Analyzers > PES Analyzer**.

2. Select **File > New**. Locate and open a transport stream, for example, the stream created earlier, testmux.mpg.

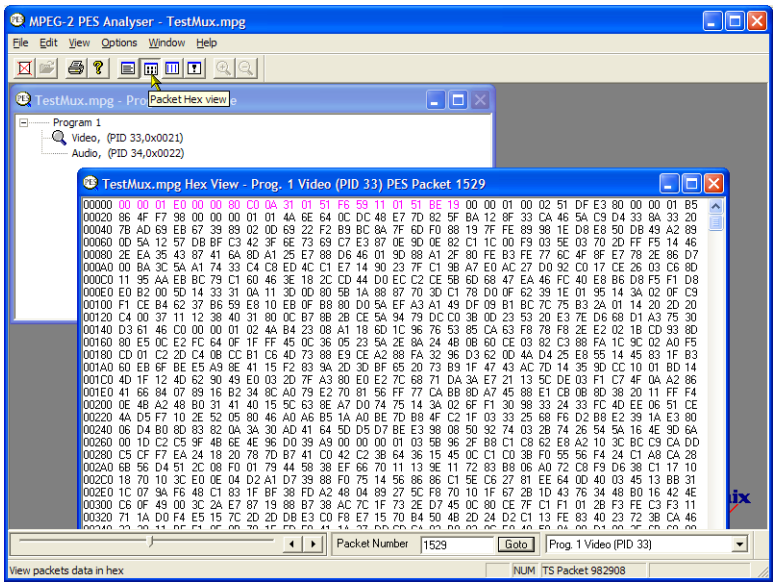
   The analysis progress is displayed in the status bar and the Event Log. The Program Structure view is displayed when analysis is complete. In this example you can see that the stream carries a single program, which contains one video and one audio elementary stream on PIDs 33 and 34 respectively.



3. Select the video stream in the Program Structure view; the maginifying 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.

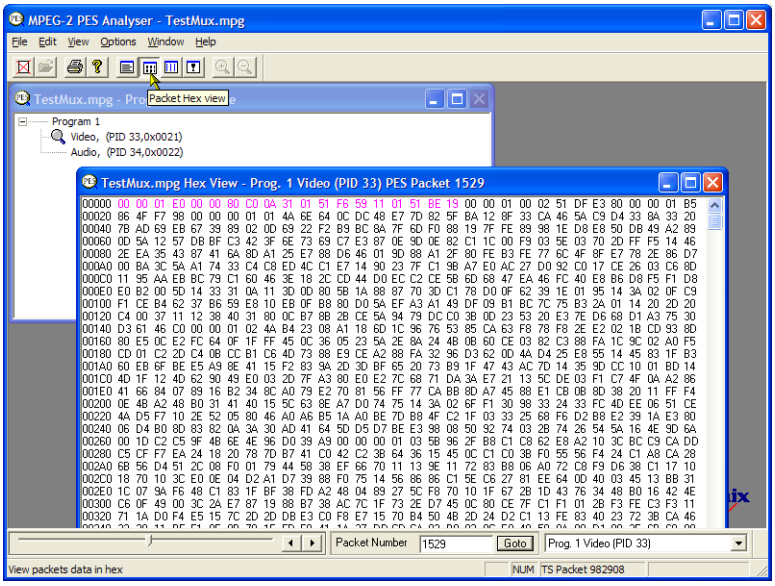
   You can use the slider bar, above the status bar, to navigate to any packet in the PES stream. Packets are numbered within a PID, according to their position in the file. The slider bar displays the packet number and the PID for the current packet.



Packet Hex View:

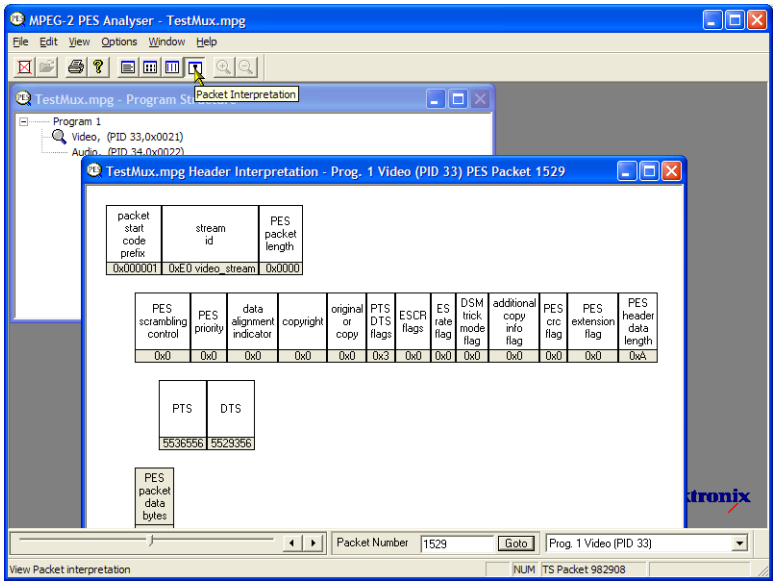
In this view, you can examine every byte in the PES.

- 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.

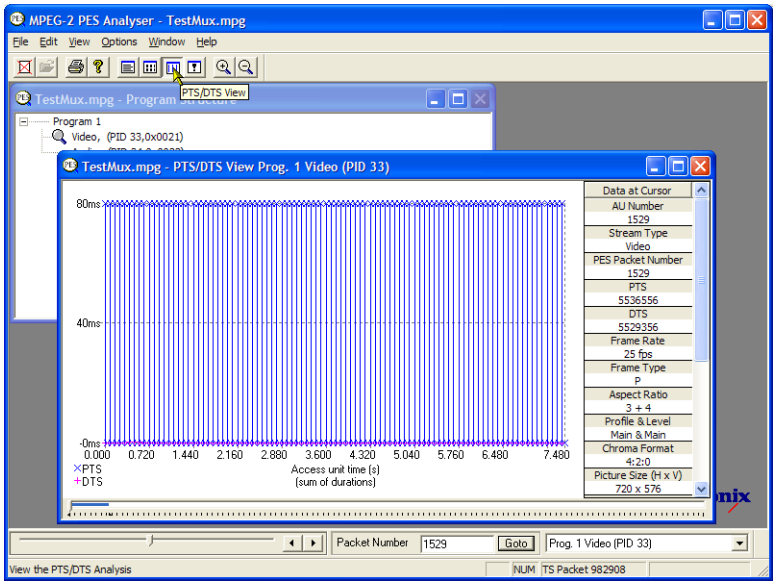


PTS/DTS View:

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.

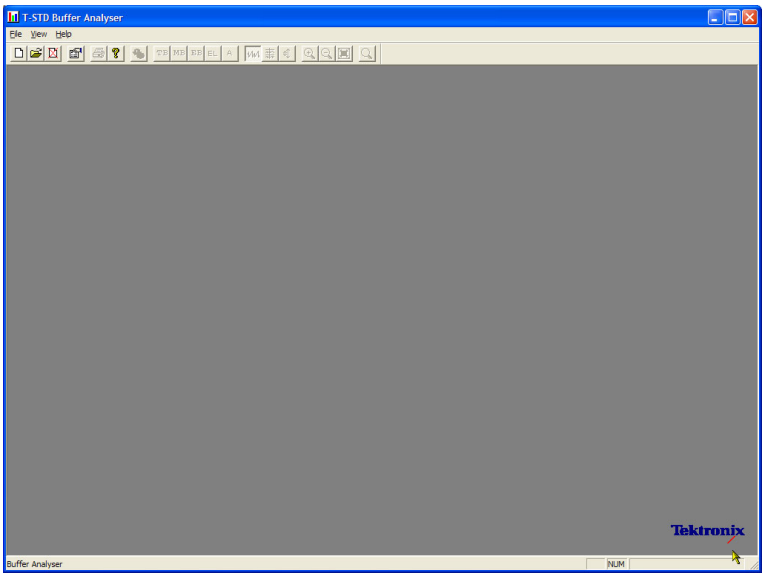
Select the toolbar magnifying glass and click on the view to zoom in and out of the graph. The slider at the bottom of this window indicates where the displayed packets are in relation to the rest of the file.



T-STD Buffer Analyzer

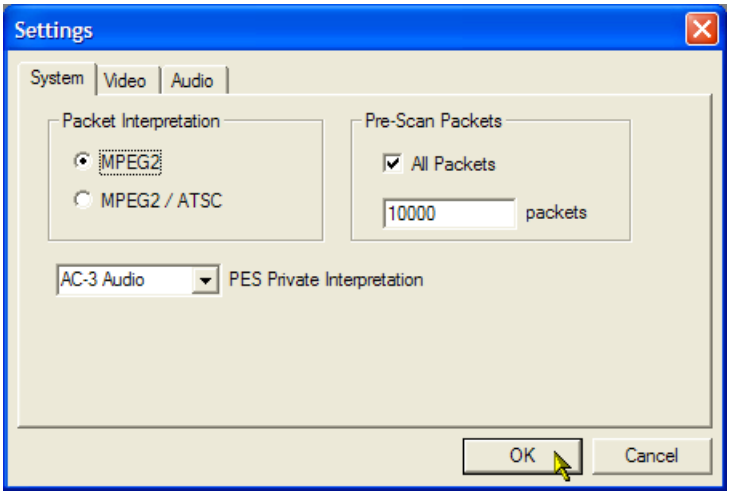
The T-STD Buffer Analyzer models the behavior of the buffers in the hypothetical Transport Stream System Target Decoder, as specified in ISO/IEC 13818-1. It can process video, audio, and system control streams. The results of the analysis are displayed as graphs of the buffer capacity over time and a 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 MTS400 > Analyzers > Buffer Analyzer**.

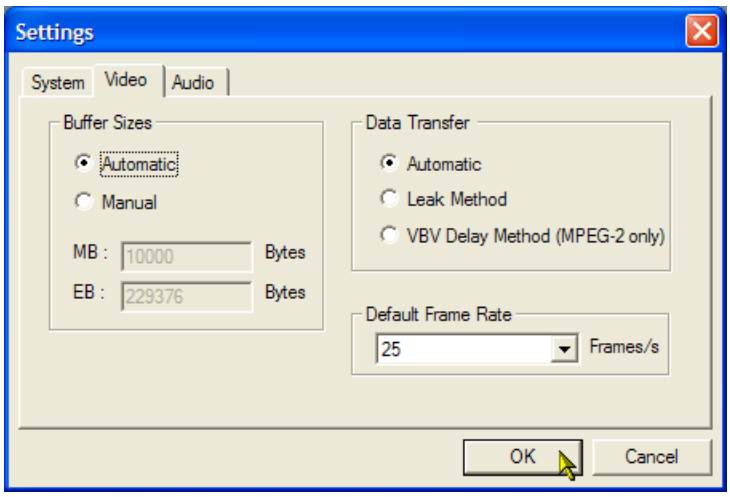


2. Review the configuration settings. **View > Settings**.

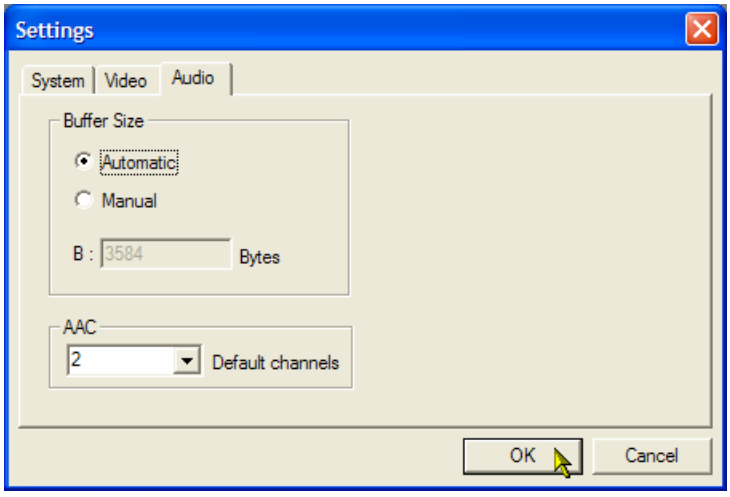
   In the System tab of the Settings dialog box, select **MPEG2 Packet Interpretation** and select **Pre-Scan Packets All Packets**.



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.



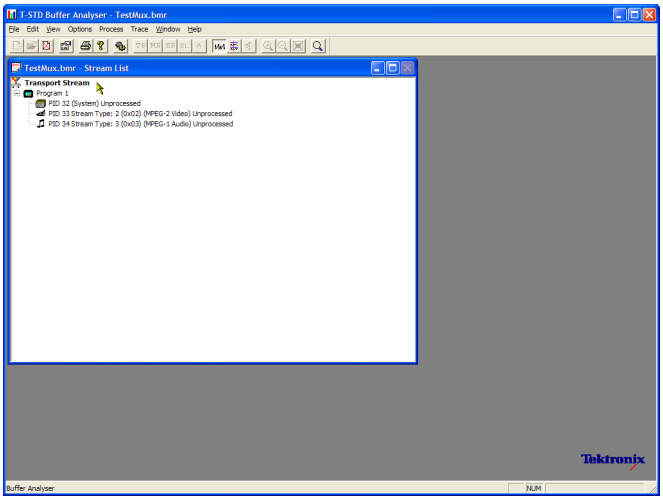
6. Select a file for analysis. **File > New**.

7. Locate and open an MPEG file. For example, testmux.mpg, created in earlier application examples.

   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.

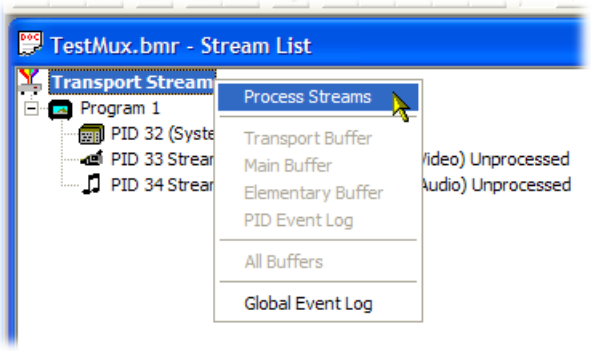
   Accept the default name and open the file.

   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 tranpsort stream context menu to start processing the stream.

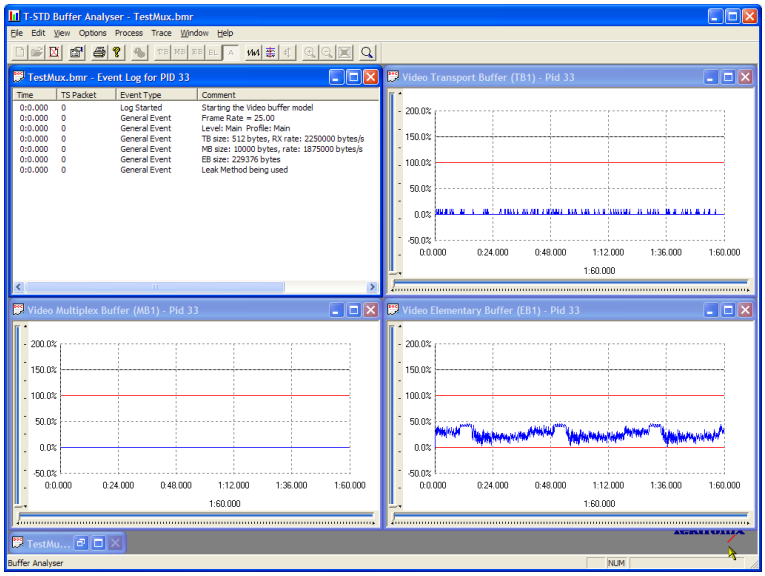
   Analysis progress is displayed in the status bar.



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:

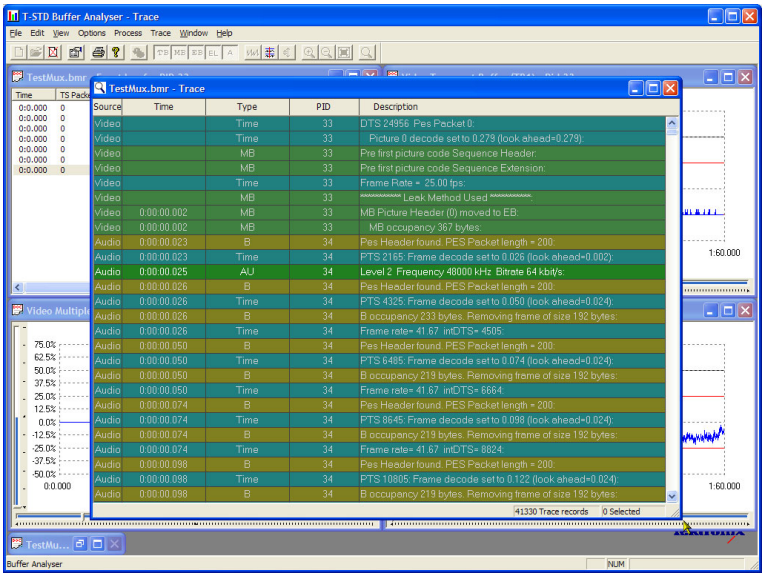
This view shows results of modeling the transport buffer for video, audio, or system control streams.

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.



Elementary Stream Analyzer

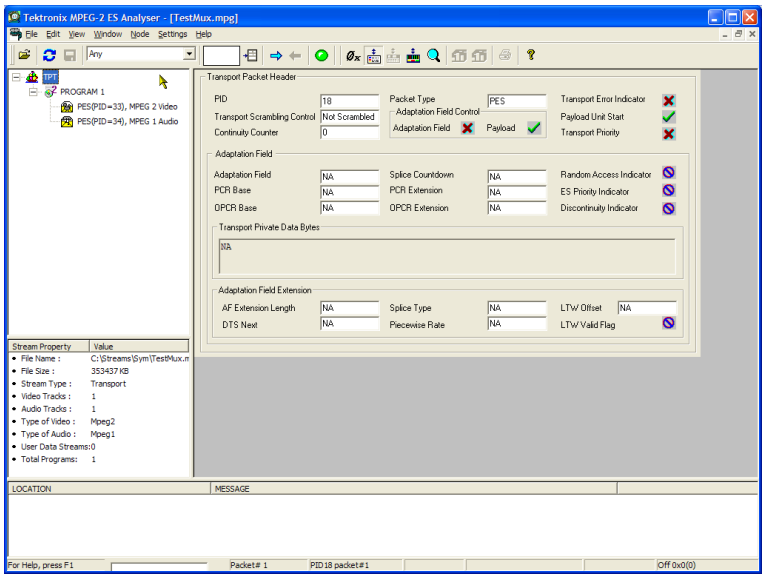
The ES Analyzer checks for compliance of CODECs to either next generation VC-1, AVC/H.264 and MPEG-4 standards or legacy MPEG-2 and H.263. Audio decode and waveform display of MPEG-2 audio (ISO/IEC 13818 parts 3 and 7), AC-3 and MPEG-4 AAC are also supported.

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 *MTS400 Series Analyzer Application User Manual*.

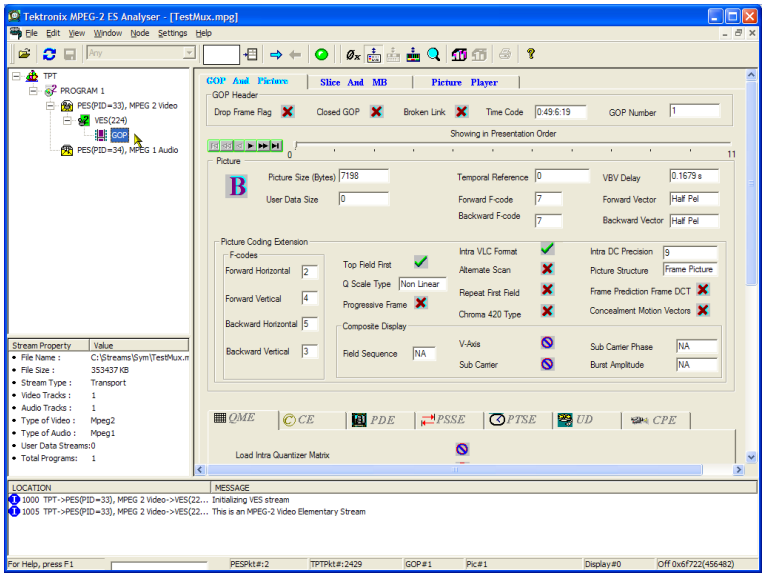
1. Open the ES Analyzer. **Start > Program > Tektronix MTS400 > Analyzers > ES Analyzer**.

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

   Locate and open an MPEG file. For example, testmux.mpg, created in earlier application examples.

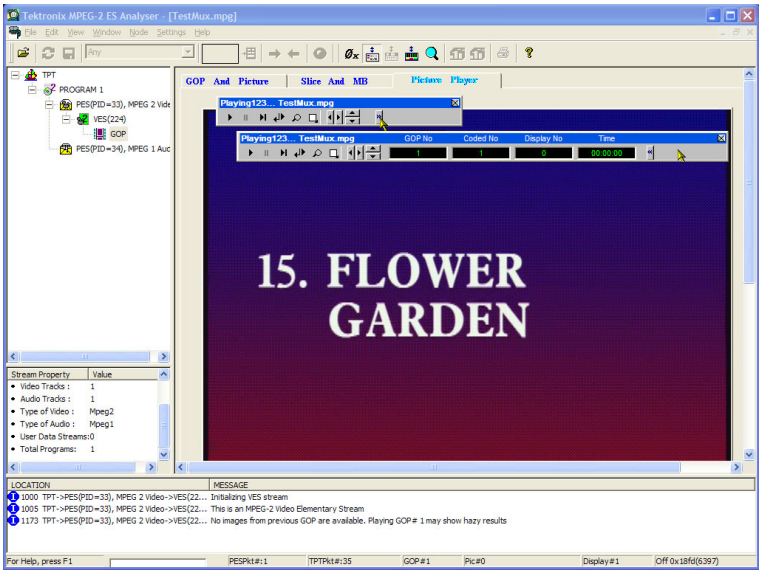


3. Click on each successive node in the navigation window until the GOP (Group of Pictures) is highlighted in the Program 1 / PES (PID 33), MPEG 2 Video branch.



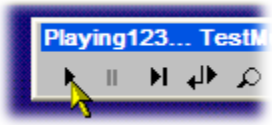
4. Select the Picture Player tab. Note that the Picture Player remote control is displayed.

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.



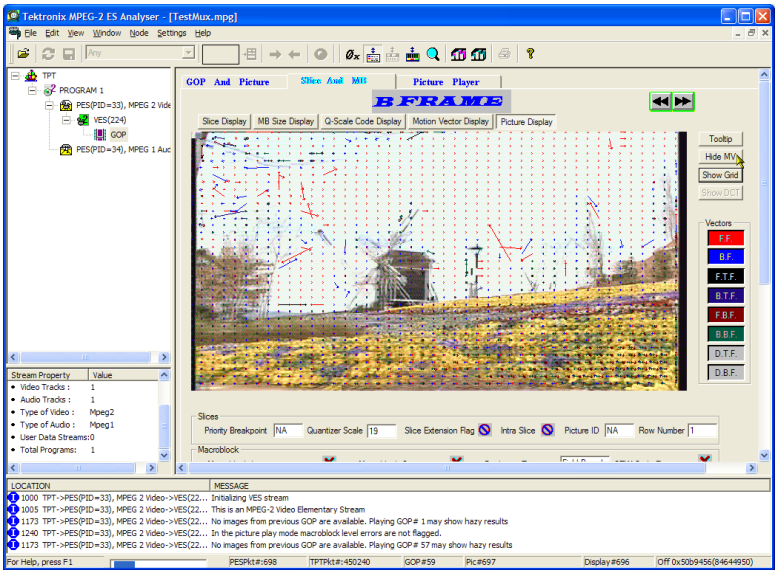
6. Start playing the stream by clicking the play button on the control bar.

   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.

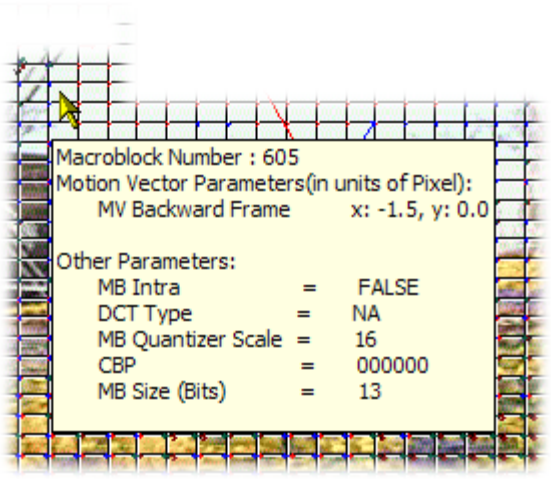


7. For example, select the **Picture Display** on the **Slice and MB** tab. The picture will correspond to the picture in the Picture Player.

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 coloured 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.

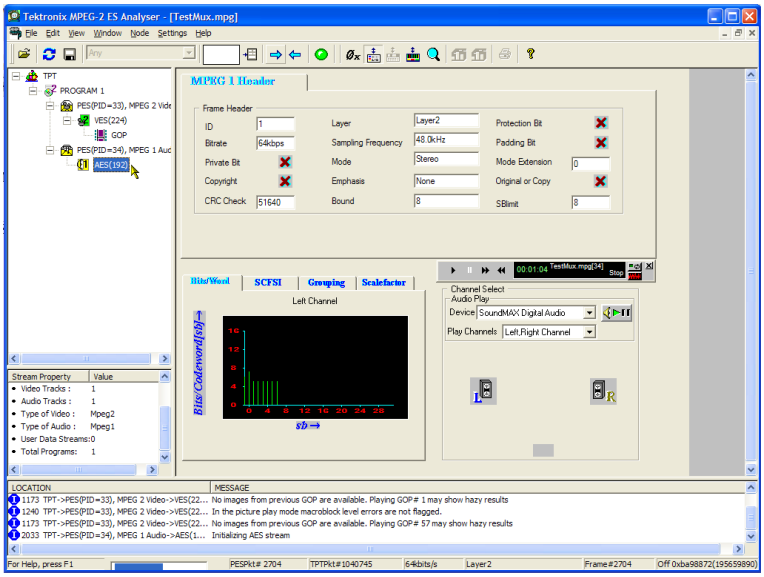


9. Use the Previous Frame and Next Frame buttons to move backward and forwards in the stream and compare the motion vectors.

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.



MTS400 Series System Recovery

If you have problems with the MTS400 Series system software, use the procedures in this section to restore the system to factory default installation and configuration.

CAUTION. *If your MTS400 Series instrument has an 80 GB hard disk, you must use the version 1.7 restore disk; Tektronix part number 063-4220-00.*

If your MTS400 Series instrument has a 250 GB hard disk, you must use the version 1.9 restore disk; Tektronix part number 063-4220-01.

Failure to use the correct recovery disk may result in the hard disk being incorrectly formatted.

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

NOTE. *The procedures described in this section are not applicable to the MTS400P or the MTX100B/RTX100B/RTX130B.*

Overview

These procedures require the MTS400 Series system Recovery media, which were shipped with your system. See following table.

Quantity	Description	Tektronix part number
1 ea	Software package: MTS400 MPEG Test System Installation CD-ROM	063-4196-XX
1 ea	MTS400 Series Version 1.7 only: Software package: Operating System Restore DVD, MTS400 MPEG Test System	063-4220-00
1 ea	MTS400 Series Version 1.9 only: Software package: Operating System Restore DVD, MTS400 MPEG Test System	063-4220-01

CAUTION. *Only a qualified technician who is familiar with installing drivers and configuring systems for networking should perform this recovery procedure.*

These tips apply to the procedures in this section:

- Use default settings unless otherwise indicated in the following procedures.
- These procedures use drive “D:” as the CD-ROM drive.
- At the end of some steps, you are instructed to restart the system. To do this, if you are prompted to restart, select **Yes**. If not prompted, select **Shutdown** from the Start menu and then select **Restart the computer**.

The procedures in this appendix tell you how to:

- Restore the operating system to factory default
- Reinstate the SCSI drives (if required)
- Install MTS400 Series system applications
- Reinstate the software license option key
- Reformat the SCSI drives (if required)

The complete system includes:

- Microsoft Windows XP Professional with Service Pack 3
- Internet Explorer 6.0 SP2
- SigmaTel C-Major Sound Driver
- Mobility Radeon 7500 Display Driver (ATI)
- Tektronix Soft Power Down Driver & Shutdown Service
- Intel EtherExpress PRO/100B and PRO/1000 PCI Adapter Driver
- Symbios SCSI Driver
- Nero CD/DVD recording software
- Intel Application Accelerator
- Intel INF Update
- Media Player 11
- Tektronix MTS400 Series system MPEG Test Systems application software

Restoring the Operating System

In some situations, such as when the power is interrupted or files are mistakenly deleted, the system might fail to boot from the hard drive. If this happens, use the *MTS400 Series System* Recovery media to restore the hard drive to factory default installation status.

CAUTION. *To avoid losing access to your licensed applications, you must use the MTS400 Series system Recovery media supplied with the unit (or subsequent upgrade).*

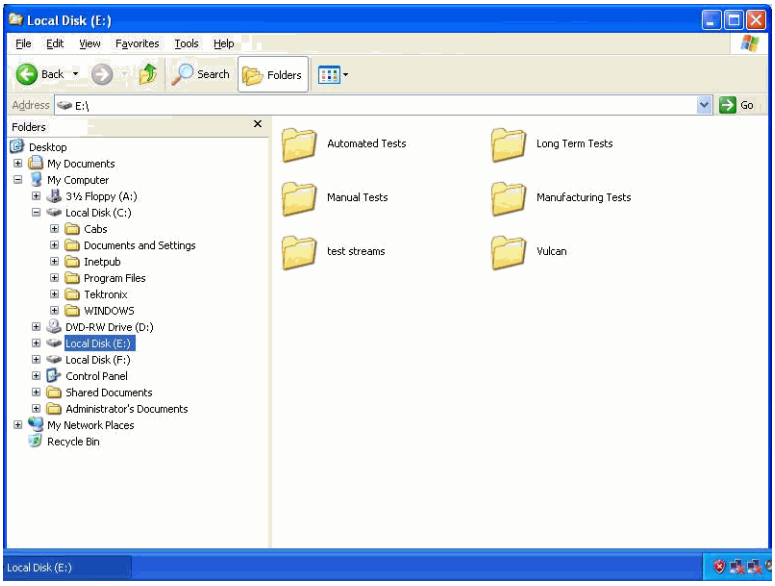
MTS400 Series System Operating System Restore. To restore the MTS400 Series system operating system, use the following steps. This restore process is effective only if the hard disk drive is still good. The process will restore the operations system and the application software. (The process should take less than 30 minutes.)

CAUTION. *To prevent data loss, back up your hard drive before you restore the MTS400 Series system. All data on the hard drive will be destroyed during the system restore process.*

Ensure that you are using the correct operating system restore disk. Refer to the caution at the beginning of this section; (See page 38, MTS400 Series System Recovery.)

- Start the MTS400 Series system with the MTS400 Series System Operating System Restore DVD in the CD-ROM drive. The system will autostart the recovery application.
- Push the “1” key to begin the system restore process. The Acquiring Device dialog box will appear briefly and display a progress bar.
- When the system restore is complete, remove the DVD from the CD-ROM drive, push any key and then push the "4" key.
- When prompted, push the “Y” key to reboot the instrument.

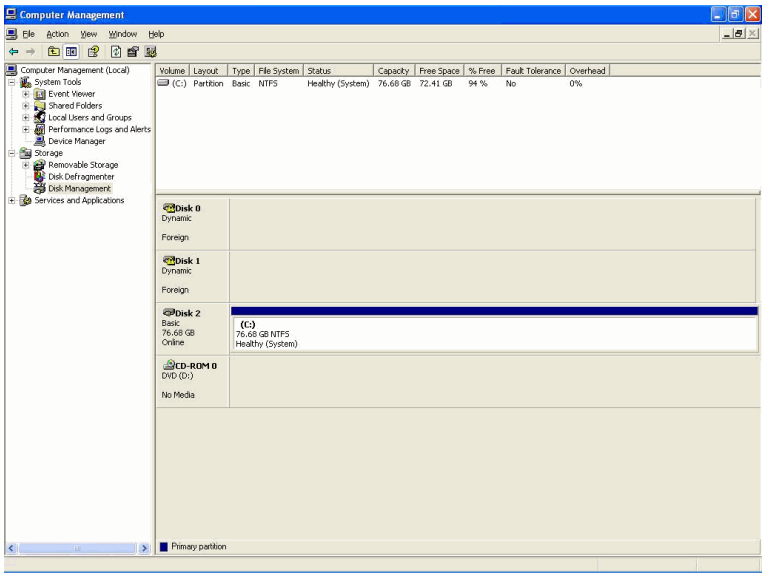
Reinstate the SCSI drives. After restoring the operating system, confirm that the SCSI drives (drives E and F) have been recognized by the system. shows the drives in the Windows Explorer.



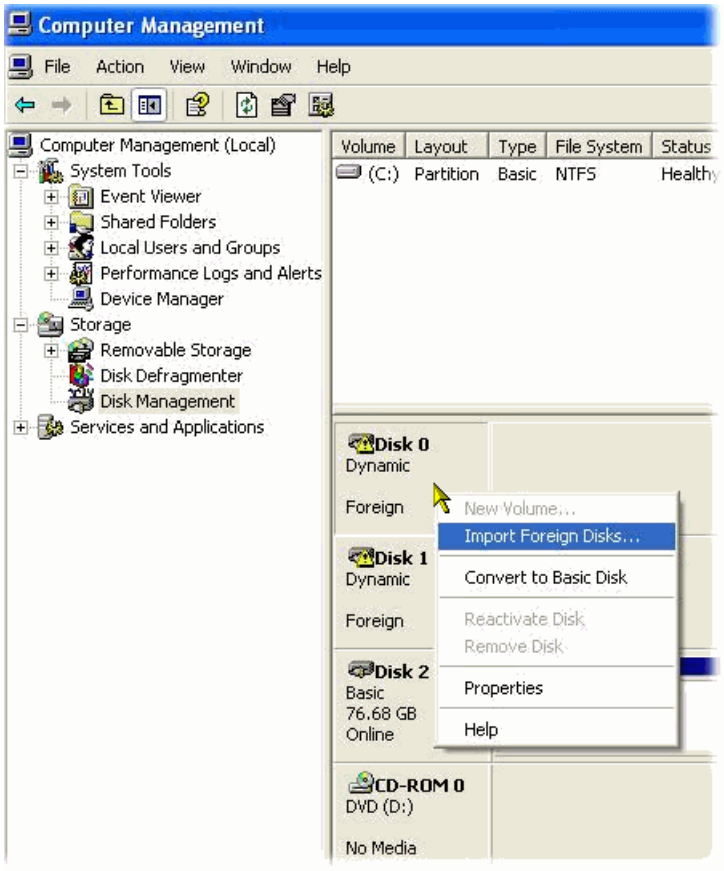
If the drives (E and F) are not listed in Windows Explorer, complete the following procedure to allow them to be recognized by the system.

1. Open the Windows Disk Management window (**Start > Control Panel > Performance and Maintenance > Administrative Tools > Computer Management > Storage > Disk management**).

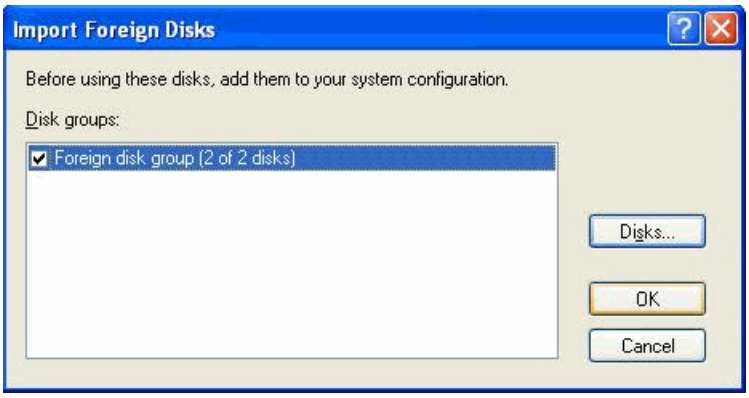
   Note that Disk 0 and Disk 1 are described as Foreign.



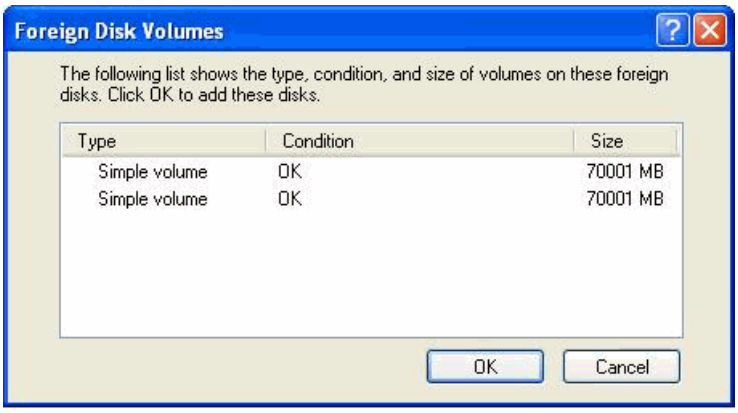
2. Right-click on Disk 0 or Disk 1 and select **Import Foreign Disks** from the context menu.



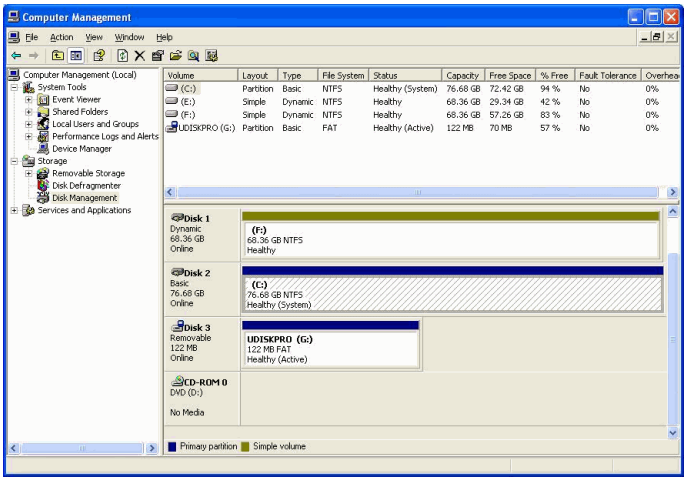
3. In the Import Foreign Disks dialog box, ensure that the disk group is checked and select **OK**.



4. In the Foreign Disk Volumes dialog box, select **OK**.



5. The disk display should now be as shown.

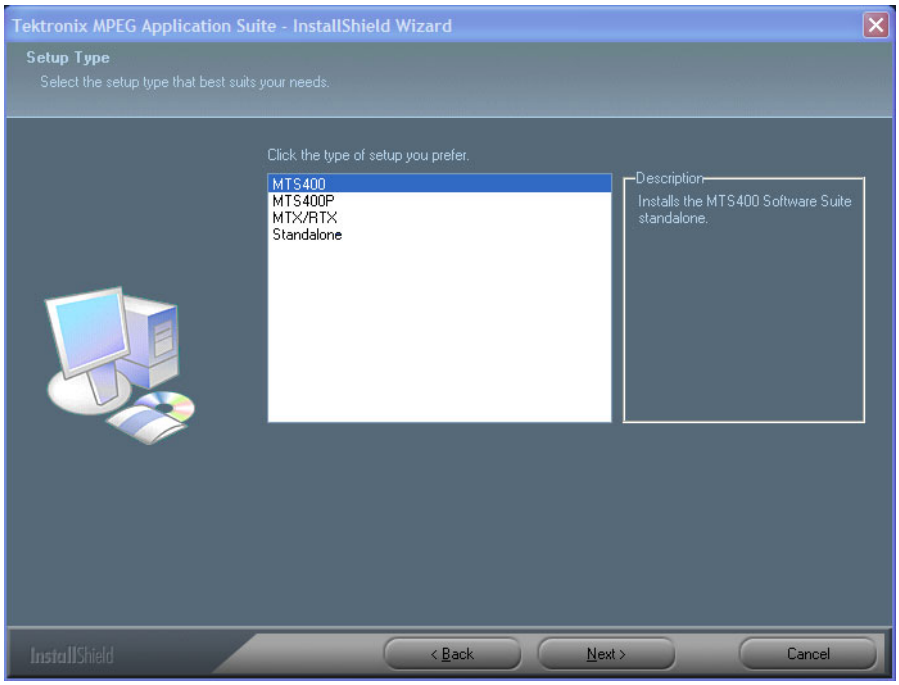


This completes the *MTS400 Series Operating System Restore Procedure*.

Installing the MTS400 Series System Applications

The procedure for installing the MTS400 Series system applications on either an MTS415 or an MTS430 is similar to the procedure for stand-alone installations.

In the MTS4SA stand-alone system section of the stand-alone installation procedure, select MTS400 Platform and continue with the installation.



Note that after installing the MTS400 applications, the software license key must be reinstated – this is also described in the stand-alone installation procedure. (See page 6, *MTS4SA Stand-Alone System Installation*.)

Reformatting the SCSI Drives

CAUTION. *All data stored on the SCSI drives will be lost when they are reset. Ensure that any important data is backed up.*

Two SCSI (small computer system interface) hard drives are used for MPEG file storage. If the drives have become corrupted, they should be reset using the following procedure:

1. Insert the *MTS400 Series system Operating System Restore DVD* in the CD-ROM drive. Locate the *SCSI_DRV* folder.
2. Copy the whole *SCSI_DRV* folder to the C: drive. The folder contains the following files:
   - drives.bat
   - readme.doc
   - complete.txt
   - complete2.txt
3. Remove the MTS400 Series system *Operating System Restore DVD*.
4. In the *SCSI_DRV* folder, run the file *drives.bat* (double-click on the file name).
5. When the process is complete, restart the instrument.

Application Examples

This section provides the following application examples:

- Creating, viewing, and analyzing a transport stream, including:
  - Using the Multiplexer application to create a new transport stream
  - Setting up *FlexVu*Plus™ in the Transport Stream Compliance Analyzer (TSCA) application
  - Examining the content of the created stream using the TSCA application
- Inspecting the created stream using the PES Analyzer, T-STD Buffer Analyzer, and ES Analyzer applications

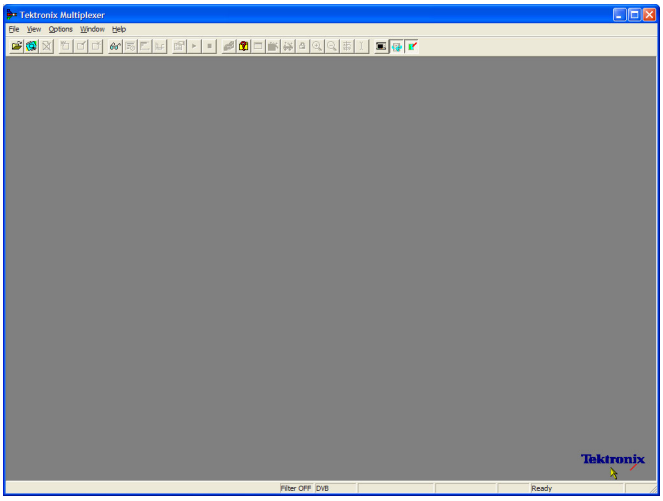
Creating, Viewing, and Analyzing a Transport Stream

The following application example describes how you can create a new transport stream and examine it for errors.

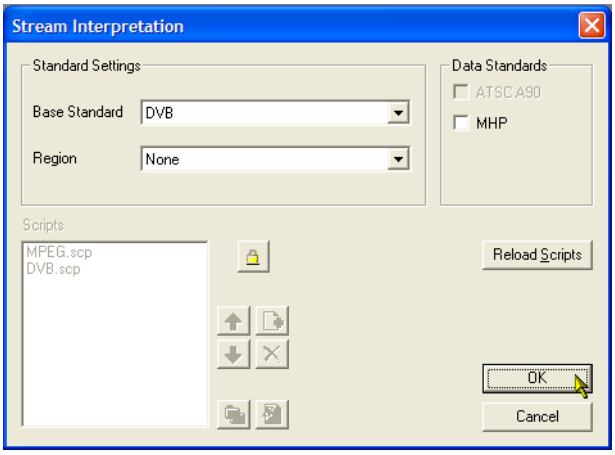
Create a New Stream using the Multiplexer

In this section of the application example, you will create a new transport stream using the MTS400 Series 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 > Programs > Tektronix MTS400 > Generators > Multiplexer**.

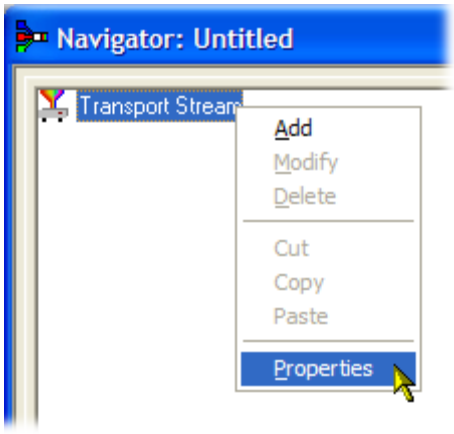


2. Select **View > Interpretation**.
3. In the Stream Interpretation dialog box, ensure that the selected Base Standard is DVB and that the Region is None.
4. Select **OK** to close the Stream Interpretation dialog box.



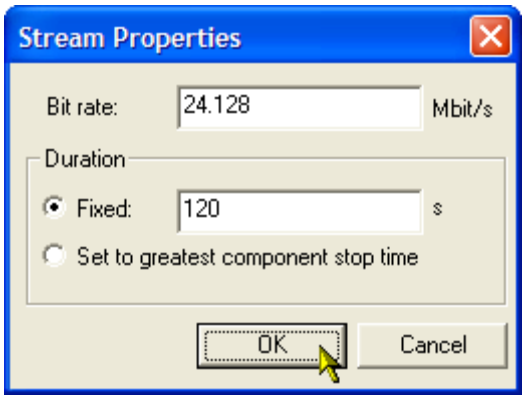
5. Select **File > New**.

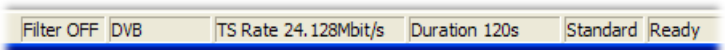
6. In the Navigator window, highlight the Transport Stream node and select **Properties** from the context menu.



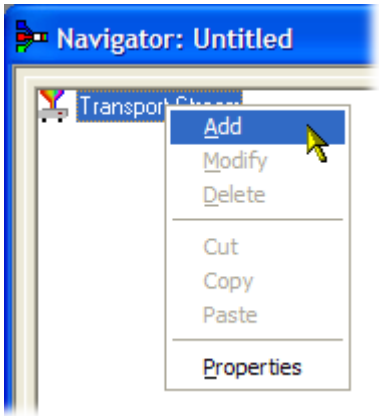
7. In the Stream Properties dialog box, enter a bit rate of 24.128 Mbit/s and a fixed duration of two minutes (120 seconds). Select OK.

   Note that the two values are displayed in the status bar.



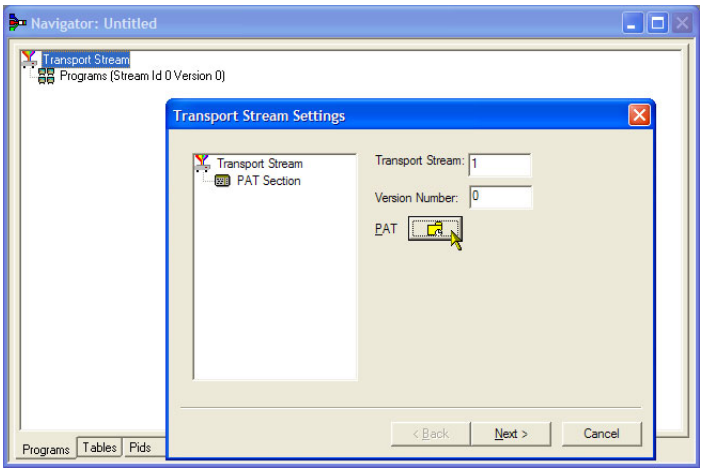


8. In the Navigator window, highlight the Transport Stream node and select **Add** from the context menu.



9. In the Transport Stream Settings dialog box, enter 1 as the Transport Stream identity.

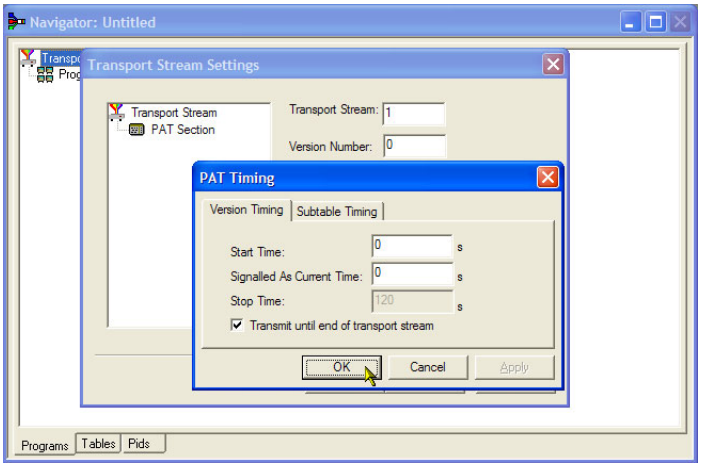
10. Select the **PAT** (Program Allocation Table) folder icon button to open the PAT Timing dialog box.



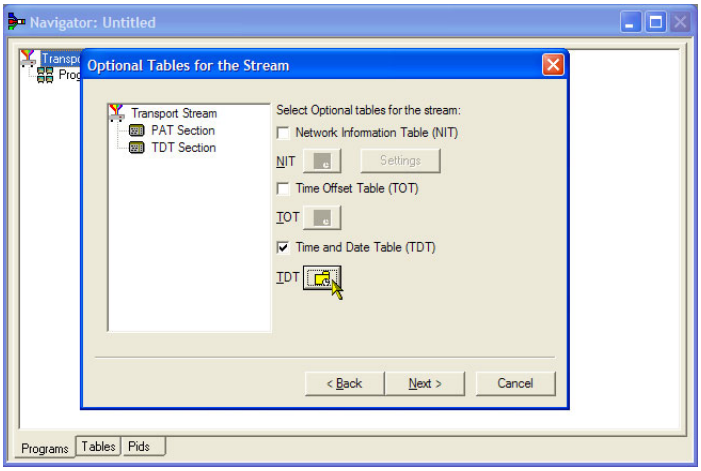
In the Version Timing tab window, note that the PAT timing Start time (0 s) and Stop time (120 s) mean that the PAT will be transmitted for the stream duration.

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

12. In the Transport Stream Settings dialog box, select **Next**.

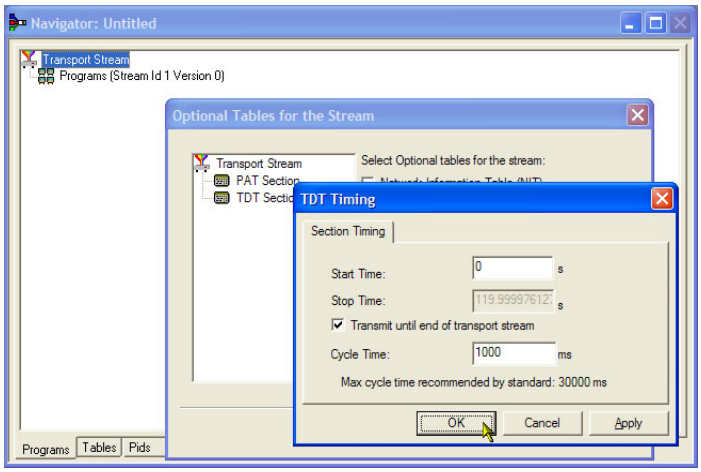


13. In the Optional Tables for the Stream dialog box, select the **TDT** (Time and Date Table) check box and select the **TDT** folder icon button.



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.

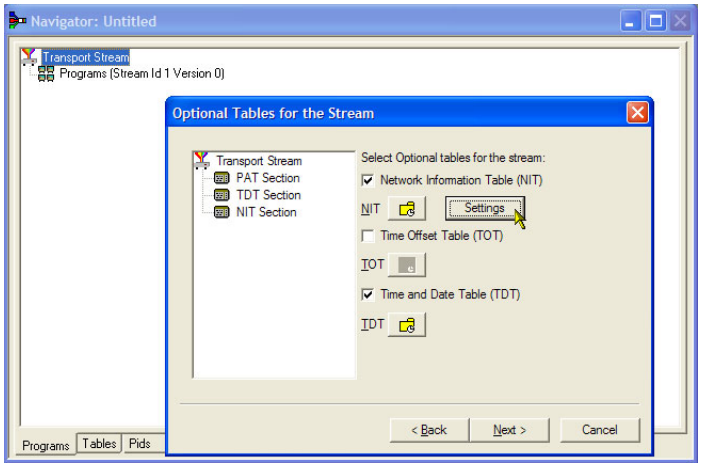
Note that the duration may have been adjusted by an insignificant amount. In this example, the set duration of 120 s is now displayed as 119.99999049.



14. Enter a Cycle Time of 1000 ms.

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

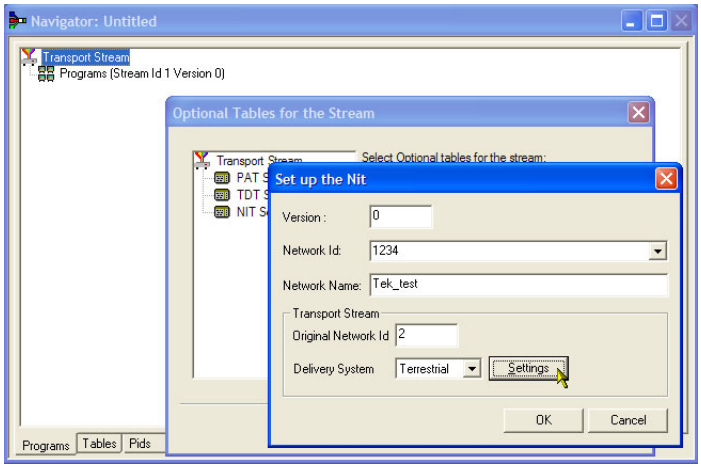
16. In the Optional Tables for the Stream dialog box, select the **NIT** (Network Information Table) check box and select the **NIT** Settings button.



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.

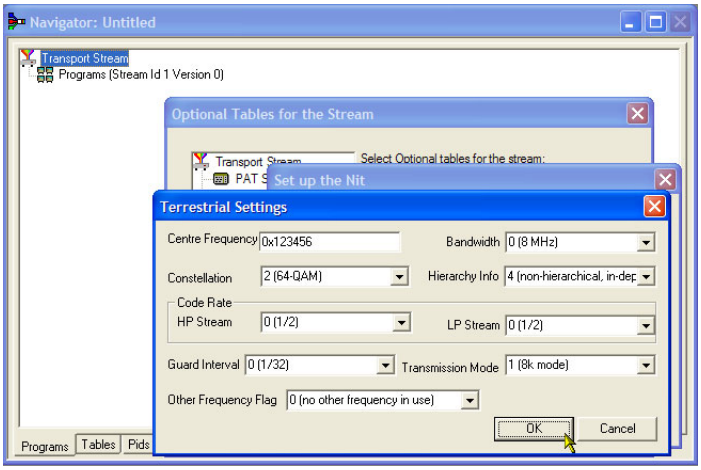


20. In the Terrestrial Settings dialog box, enter 0x123456 in the Centre Frequency field.

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.

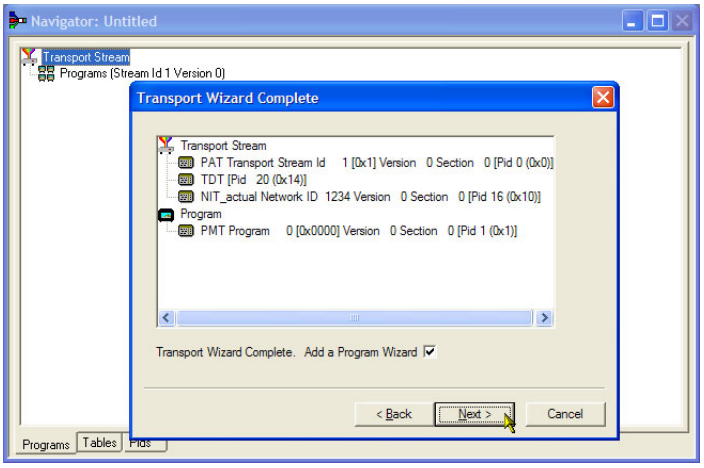


24. Select **OK** to close the Terrestrial Settings dialog box.

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

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

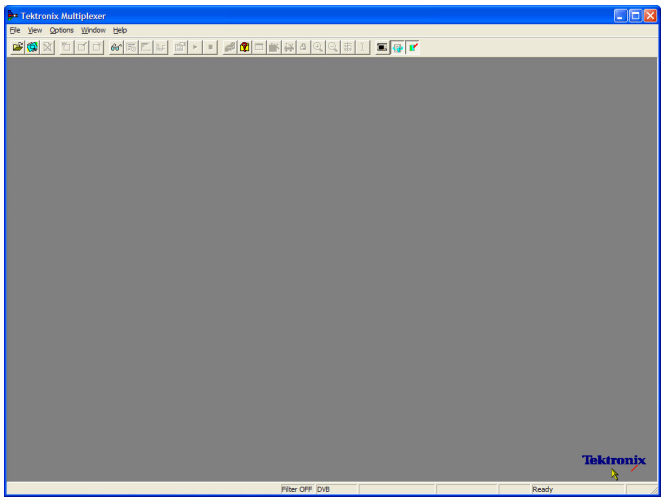
    The transport stream set up is complete. Now you need to add some content in the form of video and audio elementary streams.



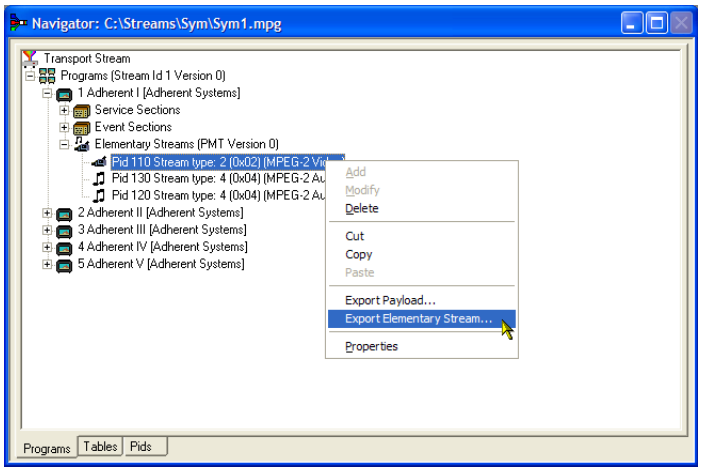
Elementary Stream Acquisition.

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 MTS400 installation. The stream suggested is Sym1.mpg; this is available on the E: drive of your MTS400.

1. Open a second instance of the multiplexer. **Start > Programs > Tektronix MTS400 > 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. The es file extension will be added automatically.
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 Mux.



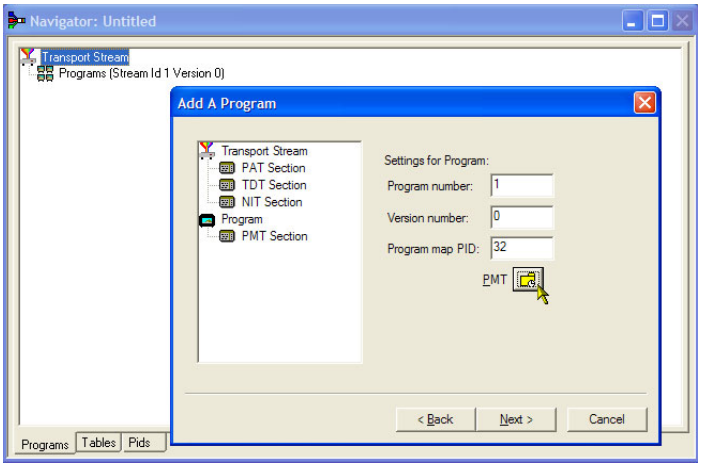
This completes the extraction of the video and audio elementary streams. You can continue with the multiplexing task.

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**. See step 26.

2. In the Add a Program dialog box, enter 1 as the program number.



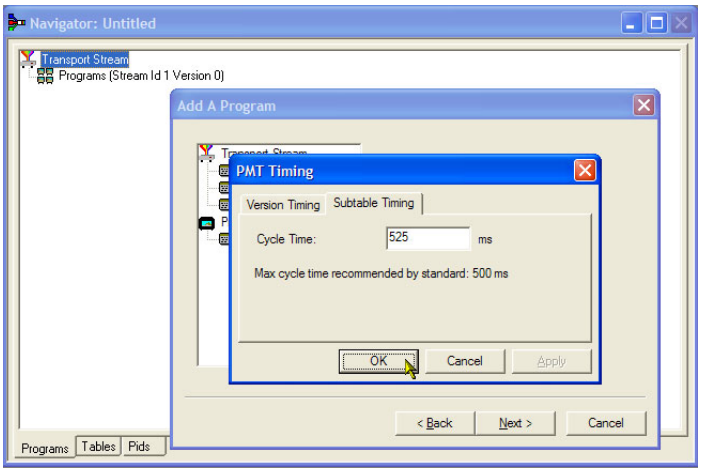
3. In the PMT Timing dialog box, select the Subtable Timing tab.

   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.

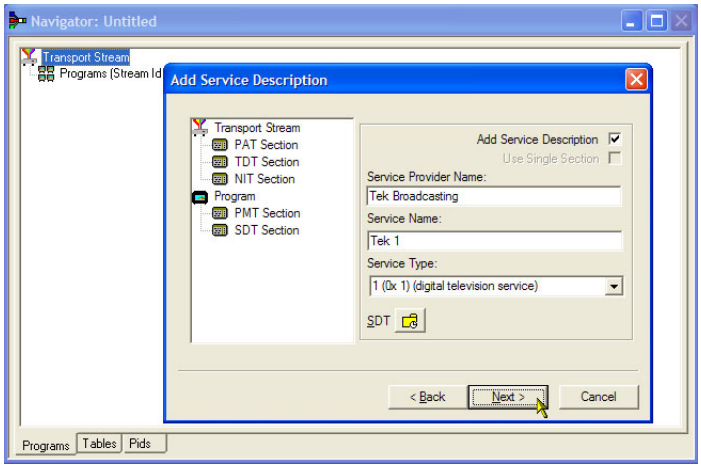
4. For this example stream, set the cycle time to 525 ms.

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

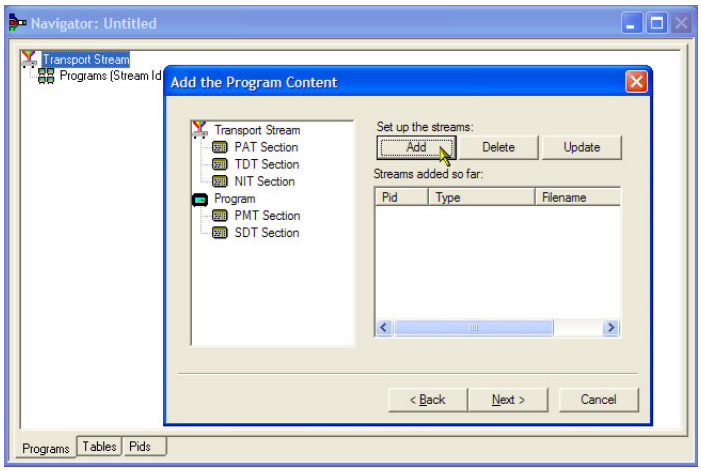
6. In the Add a Program dialog box, select **Next**.



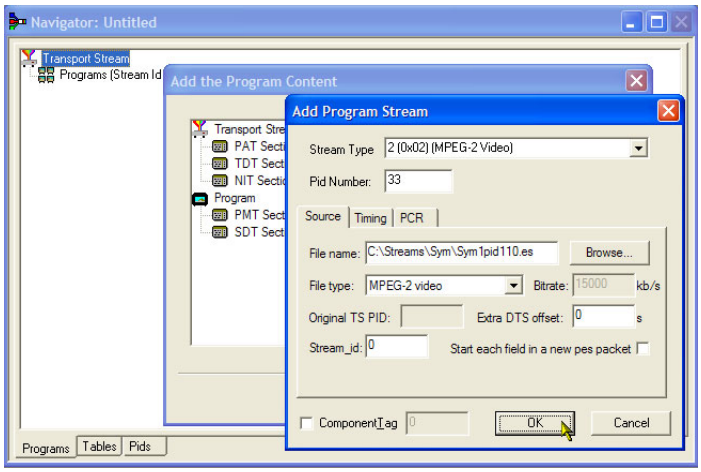
7. In the Add Service Description dialog box, select the **Add Service Description** check box.
8. Enter a **Service Provider Name**, for example, Tek Broadcasting.
9. Enter a **Service Name**, for example, Tek1.
10. Enter a **Service Type**, for example, 1 (0x1) (digital television service).
11. Select **Next**.



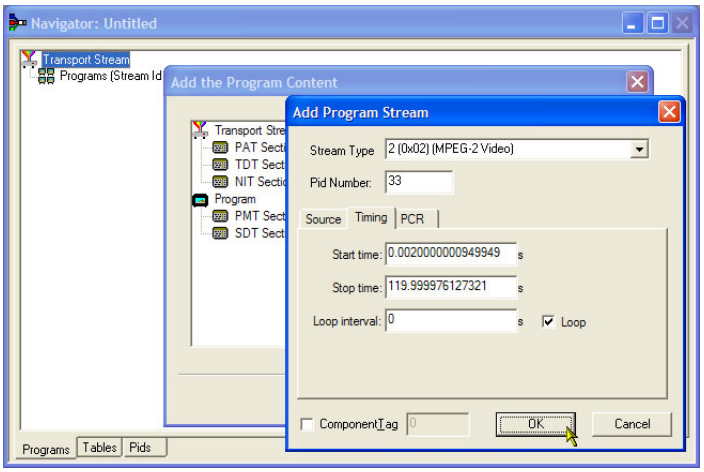
12. In the Add the Program Content dialog box, select **Add** to add a video elementary stream.



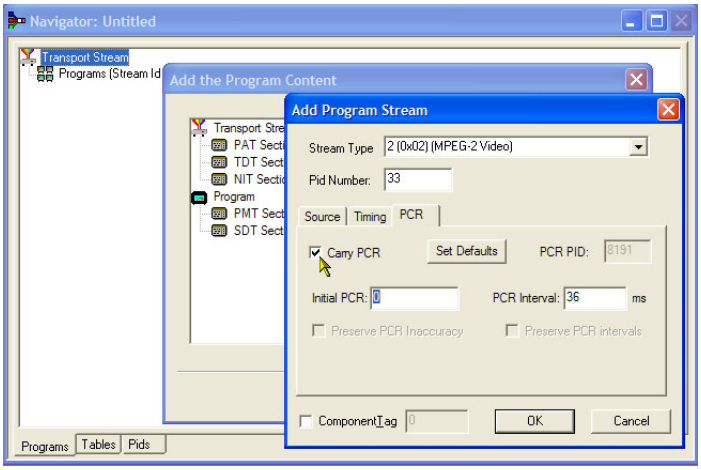
13. In the Add Program Stream dialog box, select 2 (0x02) (MPEG-2 Video) from the Stream Type drop-down list.
14. Ensure that the Source tab is selected.
15. Enter a File Name, or use **Browse** to locate the video elementary stream previously set up (Sym1pid110.es).
16. Select MPEG-2 video from the 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.



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



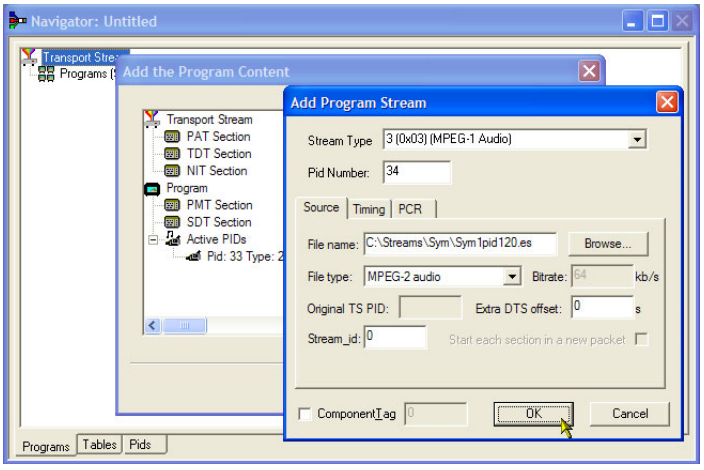
18. Select **OK** to close the Add Program Stream dialog box.

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

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

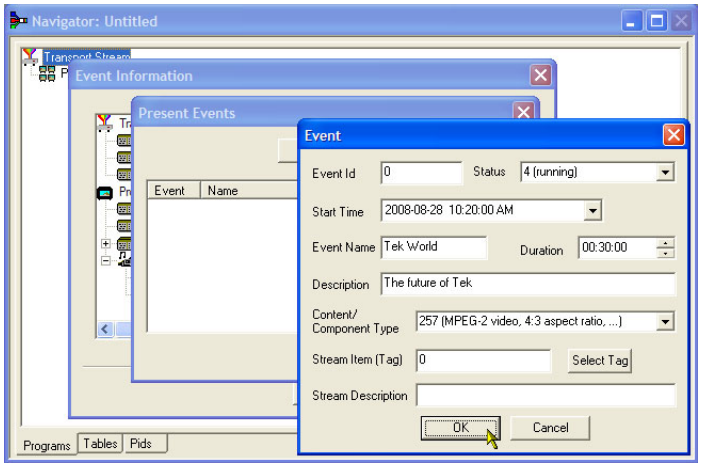
21. In the Add Program Stream dialog box, ensure that the Source tab is selected.

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

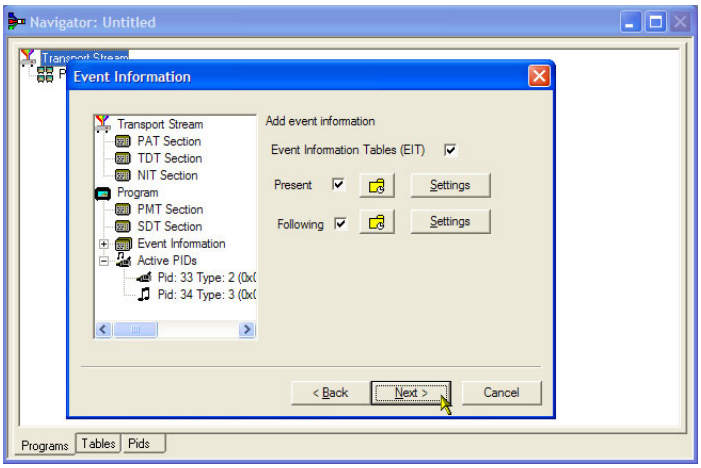


23. Select **MPEG-2 audio** from the File type drop-down list. Note that the file bit rate has been entered automatically.
24. Select the **Timing** tab. Note that the elementary stream is going to run for the length of the stream previously set, that is, 120 s.
25. Select the **PCR** tab. Ensure that the Carry PCR check box is cleared.
26. Enter 33 in the PCR PID field. This is the PID that will carry the PCR information – also the video es, Carry PCR.
27. Select **OK** to close the Add Program Stream dialog box.
28. Select **Next**.
29. In the Event Information dialog box, select the Event Information Tables (EIT) check box.
30. Ensure that the Present check box is selected.
31. Select **Present Settings**.
32. 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.
33. Set the Start Time to 2008-08-28 10:20:00 AM.

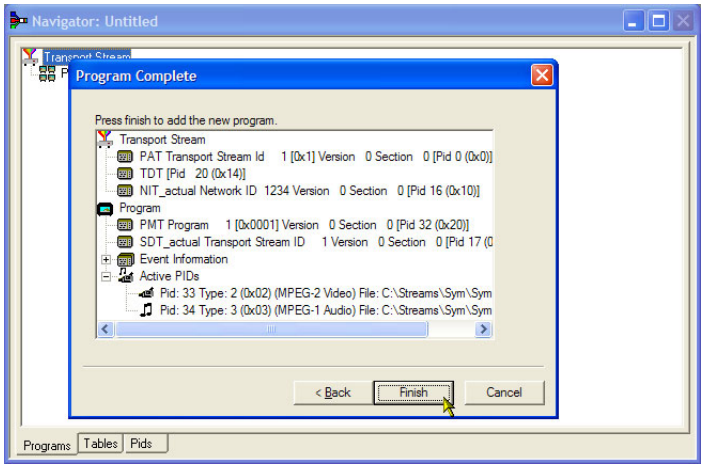
    You can change the time and date by highlighting the individual field and entering the required value.



34. Enter an **Event Name**, for example, Tek World.
35. Enter a **Description**, for example, The future of Tek.
36. Enter a **Duration**, for example, 30m (00:30:00).
37. Select **257 (MPEG-2 video, 4:3 aspect ratio, ...)** from the Content/Component Type drop-down list.
38. Select **OK** to close the Event dialog box.
39. Select **OK** to close the Present Events dialog box.
40. Ensure that the **Following** check box is selected.
41. Select **Following Settings**.
42. Select **Add** to set up the following event information, that is, the event following the present event.
43. In the Event dialog box, enter 1 in the Event Id field.
44. Select **1 (not running)** from the Status drop-down list.
45. Set the Start Time to 2008-08-28 10:50:00 AM.
46. Enter an **Event Name**, for example, Tek News.
47. Enter a **Description** of the event, for example, All the latest news from Tek.
48. Enter a **Duration**, for example, 30 m (01:00:00).
49. Select **257 (MPEG-2 video, 4:3 aspect ratio, ...)** from the Content/Component Type drop-down list.
50. Select **OK** to close the Event dialog box.
51. Select **OK** to close the Following Events dialog box.
52. Select **Next**.



53. In the Program Complete dialog box, select **Finish**.



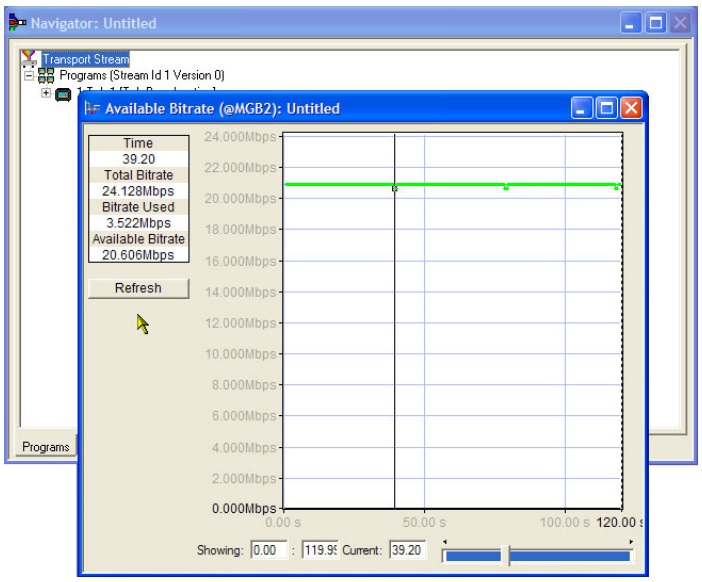
You have finished creating the structure and content of the proposed transport stream. You can now make a couple of checks to ensure that the stream will compile successfully.

54. 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 ans reading the values from the adjacent table.

55. Close the Available Bitrate graph.



56. Select **Multiplex > Start** to start the multiplex.

57. In the Set TS Output File dialog box, enter a name for the new multiplexed transport stream, for example, TestMux.mpg.

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.

58. 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.

59. Select **File > Export**.

60. In the Export File dialog box, enter a name for the multiplex structure file, for example, TestMux.muxml. Note the muxml extension.

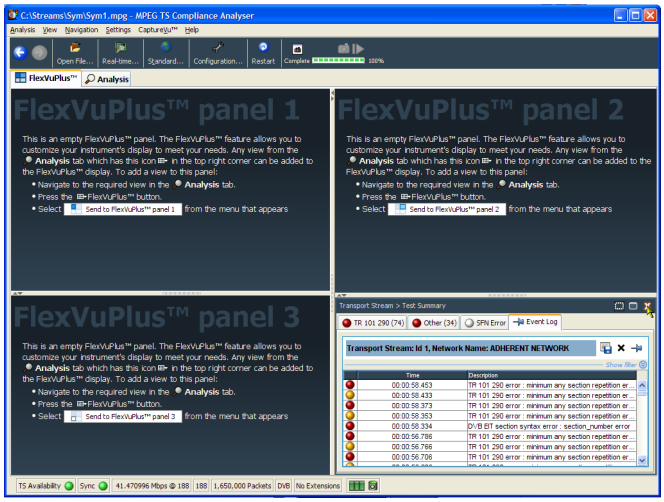
61. Using **File > Import**, the multiplex structure file can be reopened at any time to add elementary streams or structural information.

Setting up the *FlexVu*Plus™ display

Using *FlexVu*Plus, you can 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.

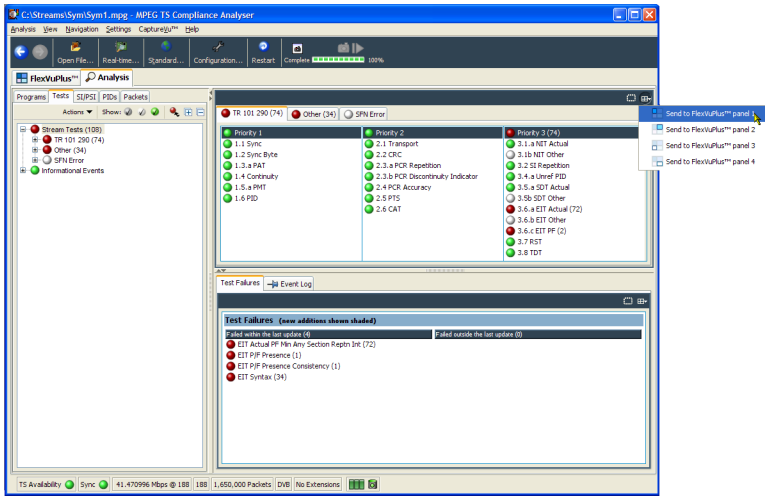


Set up panel 1

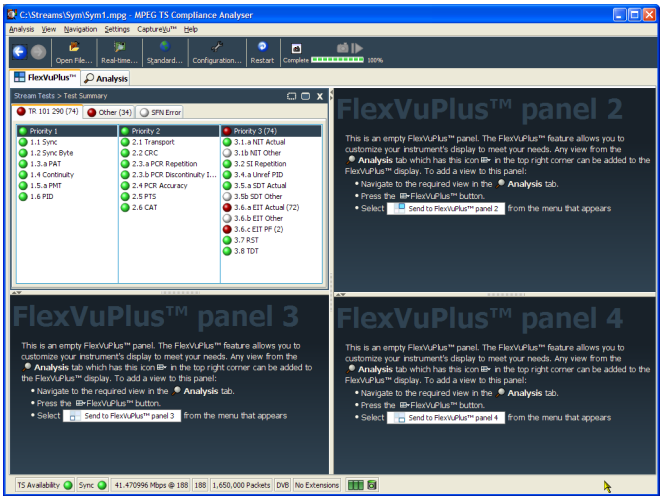
1. Select the **Analysis** tab and then the **Tests** tab.

   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.



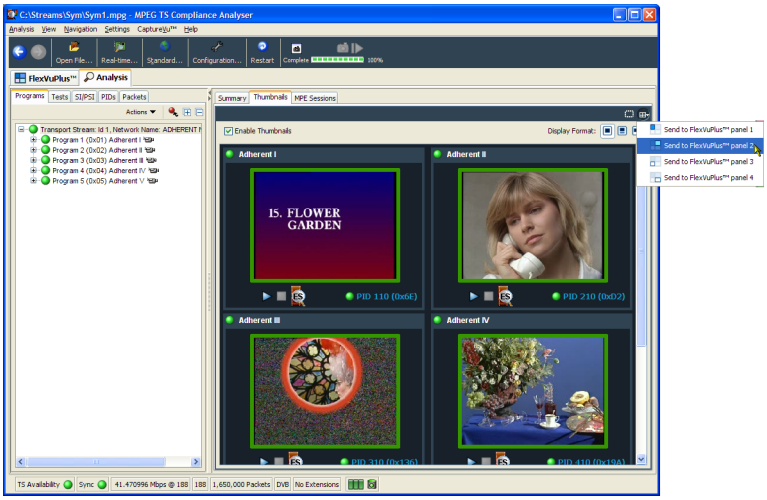
3. The *FlexVu*Plus display now contains the Test Summary view in panel 1.



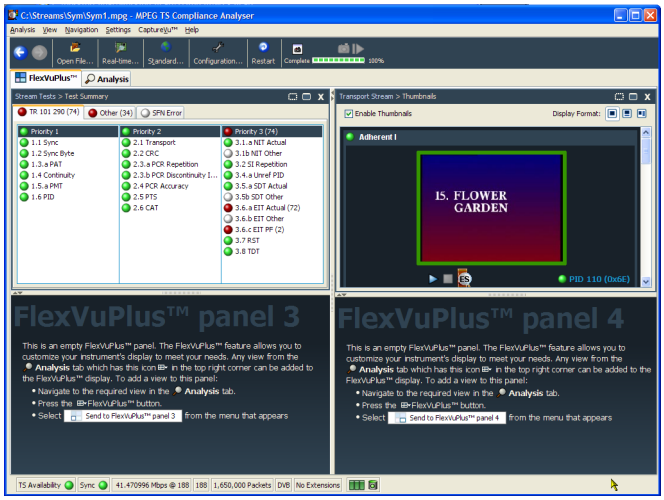
Set up panel 2.

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.



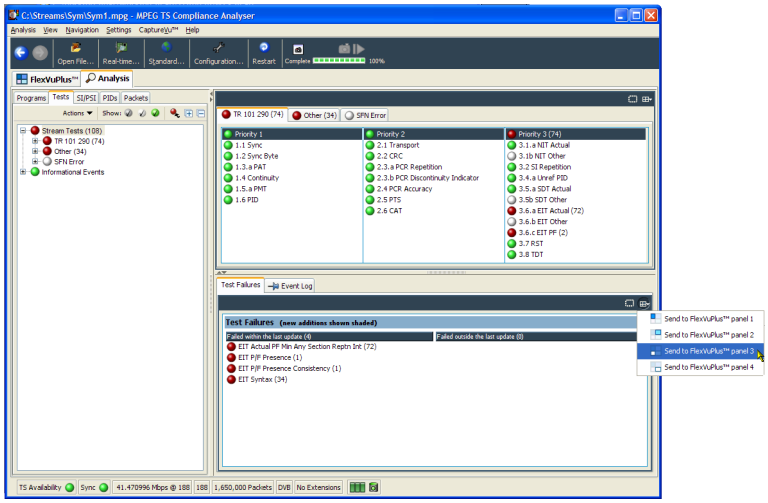
6. The *FlexVu*Plus display now contains the Thumbnail view in panel 2.



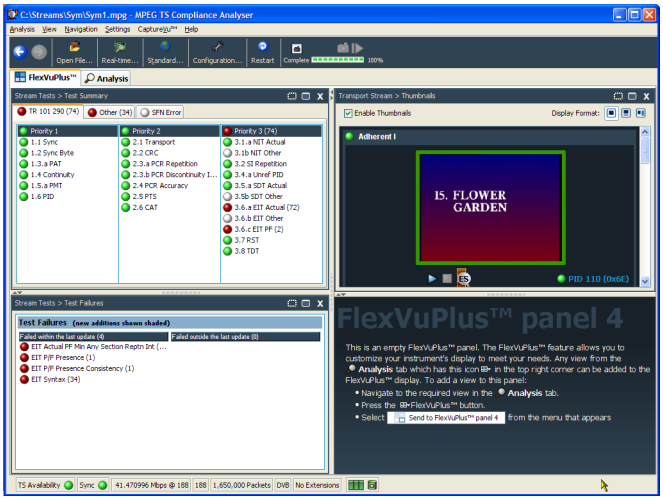
Set up panel 3.

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.



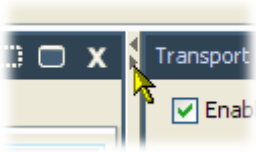
9. The *FlexVu*Plus display now contains the Test Failures view in panel 3.



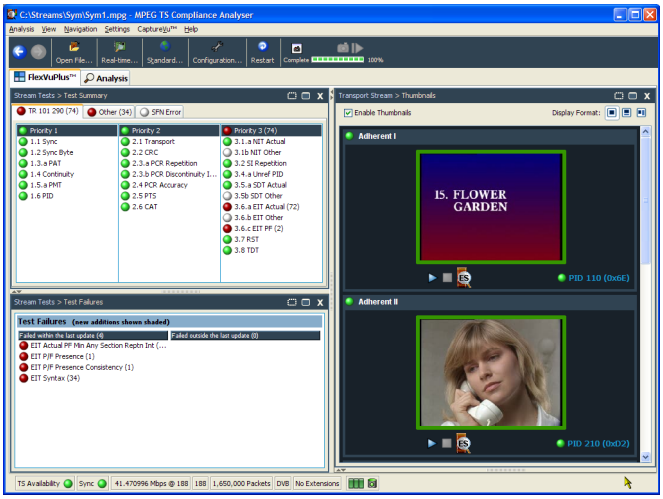
Since only three panels are used in this example, you can expand the thumbnails view to fill the right side of *FlexVu*Plus™.

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.

Examining Stream Content with the TSCA

The example transport stream created in the previous applications, testmux.mpg, will be examined off-line using the Transport Stream Compliance Analyzer.

1. Open Transport Stream Compliance Analyzer. **File > Program > Tektronix MTS400 > Analyzers > TS Compliance Analyzer**.

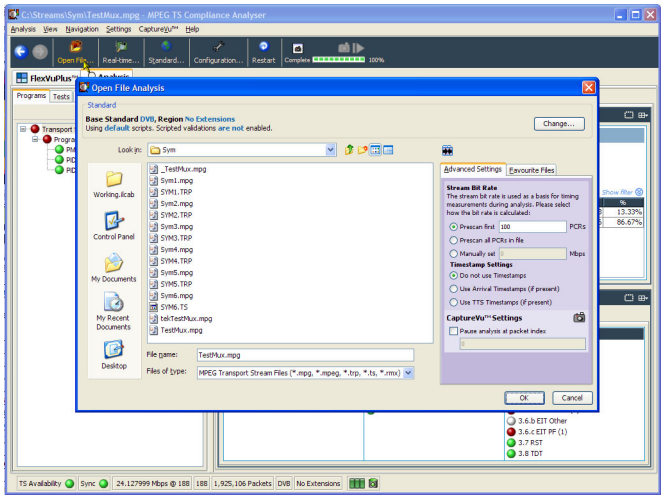
   In the TSCA toolbar, select **Open File**.

   You may need to close the Select Real-time Interface dialog box, before you can select the off-line analysis set up.

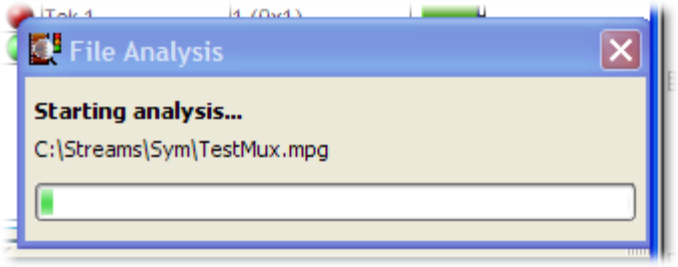
   In the Open File Analysis dialog box, ensure that the Base Standard is DVB and the Region is No Extensions.

   Locate and select the example stream, **tetsmux.mpg**.

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



   The analysis will take a moment to complete.



2. Select the **Analysis** tab to display the navigation and related views.

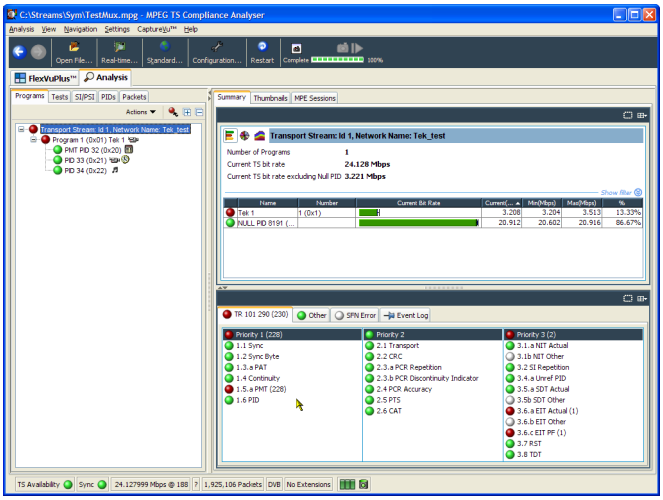
3. Select the **Programs** tab and expand the nodes in the navigation view by clicking the plus symbols.

   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.

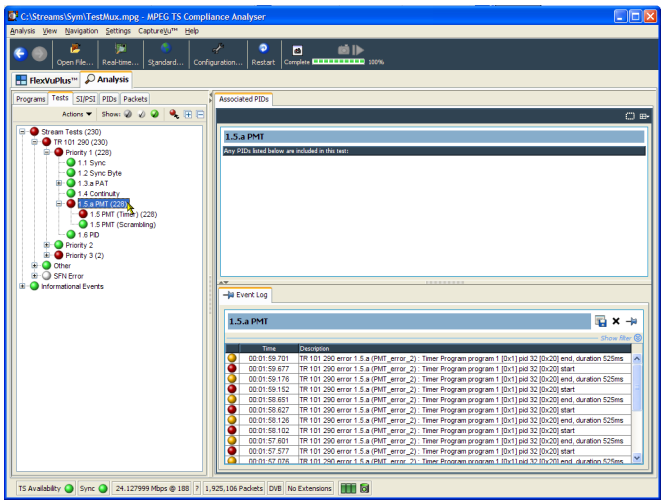
4. Highlight the Transport Stream node. In the Tests Summary detail view, TR 101 290 tab, note that test 1.5.a PMT is indicating an error, that is, the associated LED is red.

5. Highlight test 1.5.a PMT and select **View this test** in the Tests tree from the context menu.



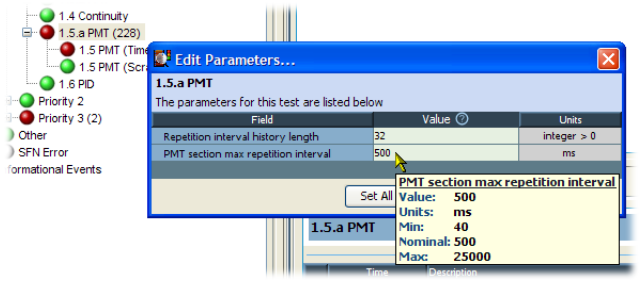
The Tests tab views are displayed. The navigation view is expanded to show the failed test. The detail view shows any PIDs associated with the highlighted test (none in this example) and the event log filtered to show only events for the highlighted test.

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.



6. In the navigation view, highlight the 1.5 PMT (Timer) test and select **Edit Parameters** from the context menu.

7. 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 tootip), you can see that the rate of 525 ms is within the range recommended by the DVB standard, 40 ms to 25000 ms.



Accessories

Standard Accessories

The following table lists the standard accessories that are shipped with the MTS400 Series products:

Quantity	Description	Part number	MTS4 15	MTS4 30	MTS4 SA	MTS4 USB
1 each	Compliance certificate	001-1180-XX	■	■	■	
1 each	Software package: Tclips MPEG Test Stream Software Media	020-2965-XX	■	■	■	
1 each	Software package: MTS400 Series Application Software Media	020-2994-XX	■	■	■	
1 each	TekRestore License	063-3906-XX	■	■		
1 each	Certificate Of Authenticity: Microsoft Windows XP	NA	■	■		
1 each	Software package: MTS400 Series Operating System Restore DVD	063-4220-XX	■	■		
1 each	Software package: MTS400 Series Product Documentation CD-ROM	063-4197-XX	■	■	■	
1 each	Software package: MTS4CC Software CD-ROM	063-3991-XX	■			
1 each	Software package: MTS4EA Software CD-ROM	063-3824-XX		■		
1 each	Nero CD-ROM burning Software; OEM suite 8.3	063-3781-XX	■	■		
1 each	MTS400 Series Quick Start User Manual					
	Option L0 (English)	071-2607-XX	■	■	■	
	Option L5 (Japanese)	071-2608-XX				
1 each	Supplemental information sheet; China ROHS	071-2185-XX	■	■	■	
1 each	Software key, parallel port MTS4SA with option MTS4USB substitutes parallel port key with a USB software key.	NA	■	■	■	
1 each	Software key, USB port	NA				■
1 each	Keyboard, 105 key layout	119-6989-XX	■	■		
2 each	Cable assembly; RF, BNC to BNC; 75 Ω	174-4954-XX	■	■		
2 each	Cable assembly: DB25	174-4955-XX	■	■		

Optional Accessories

MTS400 Series Optional Accessories

The following items are optional accessories:

Quantity	Description	Part number
COFDM RF Interface only		
1 each	Adapter, RF; BNC to F type	015-0688-XX
1 each	Cable assembly; RF, BNC to BNC; 75 Ω	174-5135-XX
QPSK/8PSK RF Interface only		
1 each	Cable assembly; RF, BNC to BNC; 75 Ω	174-5135-XX
QAM B RF Interface only		
1 each	Cable assembly; RF, BNC to BNC; 75 Ω	174-5135-XX
8VSB RF Interface only		
1 each	Adapter, RF; BNC to F type	015-0668-XX
1 each	Cable assembly; RF, BNC to BNC; 75 Ω	174-5135-XX
GigE Ethernet interface with 10/100/1000Base-T RJ-45 electrical port		
1 each	Cable assembly, RF, BNC to BNC, 75 Ω	174-5135-XX
IPTVD Gigabit Ethernet interface with 10/100/1000 Base-T R-J45 electrical port		
1 each	Cable assembly, RF, BNC to BNC, 75 Ω	174-5135-XX

User Maintenance

This appendix 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 Compact Disc Drive

The compact disc drive requires routine maintenance to operate at maximum efficiency. The compact discs can be damaged if dirt and dust accumulate on the surface of the discs. Store any discs in their protective containers to keep them from being exposed to dust or dirt.

CAUTION. *Electrostatic discharge (ESD) can damage components in the CD-ROM drive. Do not touch lens or exposed metallic parts on the platter, with the exception of the center hub.*

Clean the face of the CD-ROM drive monthly with a cloth dampened with deionized water.

CAUTION. *Do not allow moisture to enter the disc drive. When power is applied, the internal components might be damaged.*

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 MTS400 Series system provided in this section can help you isolate problems. For a performance verification procedure, refer to the *MTS400 Series Specifications and Performance Verification Technical Reference*, supplied as a PDF file on the *MTS400 Series 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 MTS400 Series 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 fans start. 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	Check for and remove any disk in the floppy disk drive; make sure instrument boots from the hard disk drive.
Power-on diagnostics fail	Contact your local Tektronix service center.

Symptom	Possible causes and recommended actions
Instrument does not recognize accessories such as 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 XP 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 38, *MTS400 Series 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 MTS400 Series systems, so you should contact your local Tektronix Service representative if you have a hardware problem.

Repackaging for Shipment

Your instrument was originally shipped by Tektronix in a carton with packaging components designed to protect the instrument from damage during shipment. If you need to ship the instrument to another location, it is strongly recommended that you use the original shipping carton and packaging components to provide adequate protection during shipment.

CAUTION. *To prevent the invalidation of your instrument's warranties, Tektronix strongly recommends that you use your original shipping carton (one that is in good condition) when you ship the instrument to another location or when you return the instrument to a Tektronix service center for repair.*

Tektronix cannot honor the instrument's warranties if the instrument arrives at the service center damaged and it was not shipped in its original carton or in a replacement carton (and its supporting packaging material) purchased from Tektronix. If you lose your original packaging material, contact your Tektronix representative to obtain replacement packaging.

Packaging Inspection

When preparing to ship your instrument to another location, it is important to inspect your packaging materials for condition and missing components.

If the condition of your packaging materials is poor, or if you are missing some of the components, it is strongly recommended that you order a new packaging kit.

Replacement Packaging Materials

New packaging materials are available from Tektronix. To obtain these items, contact your Tektronix representative. The replacement packaging kit includes all the material required to properly package the instrument for shipment.

Repackaging Procedure

When the instrument is shipped, it is important to package it well to protect the instrument. It is not necessary to return the accessories received with the instrument when returning the instrument for repair.

NOTE. *If you return the test system to a Tektronix Service Center for upgrade or repair, do not remove the software key.*

1. If the instrument is to be shipped to a Tektronix field office for repair, attach a tag to the instrument showing the following:
   - Owner's name and address
   - Instrument serial number
   - Description of the problem(s) encountered and/or service required.
2. Place the protective front cover on the front of the instrument.
3. Place the instrument in the protective bag. The bag prevents dust, moisture, and other debris from entering the cabinet.
4. Fold the top of the bag neatly over the top of the instrument to make it as flat as possible and seal with packing tape.
5. Place the front cushion over the front of the instrument.
6. Place the rear cushion over the rear of the instrument.
7. Carefully lift the instrument with front and rear cushions attached and lower it into the shipping box.
8. Position the cardboard tray into the top of the box, pressing the tray down until it rests on the tops of the front and rear cushions.

NOTE. *To ensure packaging integrity and product safety, the tray must be installed regardless of whether accessories are being included in the package.*

9. If you are shipping the accessories, arrange the accessories in the tray.
10. Close and tape the shipping box.
11. Attach the appropriate shipping documents needed to ship the instrument to its destination.

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