



**MTSA-HW and MTSA-PC  
MPEG Test Systems  
Quick Start User Manual**







## **MTSA-HW and MTSA-PC MPEG Test Systems Quick Start User Manual**

### **Warning**

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

Supports MTSA firmware v3.3.1 and above.

[www.tek.com](http://www.tek.com)

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## **Contacting Tektronix**

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USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit [www.tek.com](http://www.tek.com) to find contacts in your area.

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# Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

To safely perform service on this product, see *Service safety summary*, which follows *General safety summary* in this manual.

## General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

This product shall be in accordance with local and national codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures, in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved must remove the cover for repair, maintenance, or adjustment. Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

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.

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of 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. Do not use the provided power cord for other products.

**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, make sure the product is properly grounded.

**Power disconnect.** The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.

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

**Do not operate without covers.** Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.

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

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

Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows. Examine the exterior of the product before you use it. Look for cracks or missing pieces. Use only specified replacement parts.

**Do not operate in wet/damp conditions.** Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

**Do not operate in an explosive atmosphere.**

**Keep product surfaces clean and dry.** Remove the input signals before you clean the product.

**Provide proper ventilation.** Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation. Slots and openings are provided for ventilation and must never be covered or otherwise obstructed. Do not push objects into any of the openings.

**Provide a safe working environment.** Always place the product in a location convenient for viewing the display and indicators. Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury. Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

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**NOTE.** Use only the Tektronix rackmount hardware specified for this product.

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## Service safety summary

The *Service safety summary* section contains additional information required to safely perform service on the product. Only qualified personnel should perform service procedures. Read this *Service safety summary* and the *General safety summary* before performing any service procedures.

**To avoid electric shock.** Do not touch exposed connections.

**Do not service alone.** Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

**Disconnect power.** To avoid electric shock, switch off the product power and disconnect the power cord from the mains power before removing any covers or panels, or opening the case for servicing.

**Use care when servicing with power on.** Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

**Verify safety after repair.** Always recheck ground continuity and mains dielectric strength after performing a repair.



## Terms in the manual

These terms may appear in this manual:




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**WARNING.** *Warning statements identify conditions or practices that could result in injury or loss of life.*

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

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## 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.

## Symbols on the product

When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)



When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

The following symbols may appear on the product:



CAUTION  
Refer to Manual



Protective Ground  
(Earth) Terminal



Standby



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# Compliance Information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies. This product is intended for use by professionals and trained personnel only; it is not designed for use in households or by children.

Questions about the following compliance information may be directed to the following address:

Tektronix, Inc

PO Box 500, MS 19-045

Beaverton, OR 97077, USA

<http://www.tek.com>

## EMC compliance

### EU EMC Directive

Meets intent of Directive 2014/30/EU for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

**EN 61326-1.** EMC requirements for electrical equipment for measurement, control, and laboratory use. <sup>1 2</sup>

**CISPR 11.** Radiated and conducted emissions, Group 1, Class A.

- IEC 61000-4-2. Electrostatic discharge immunity
- IEC 61000-4-3. RF electromagnetic field immunity
- IEC 61000-4-4. Electrical fast transient / burst immunity
- IEC 61000-4-5. Power line surge immunity
- IEC 61000-4-6. Conducted RF Immunity
- IEC 61000-4-8. Power frequency magnetic field immunity test
- IEC 61000-4-11. Voltage dips and interruptions immunity

**EN 61000-3-2.** AC power line harmonic emissions

**EN 61000-3-3.** Voltage changes, fluctuations, and flicker

### Australia/New Zealand EMC

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

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

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<sup>1</sup> This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

<sup>2</sup> For compliance with the EMC standards listed here, high quality shielded interface cables that incorporate low impedance connection between the cable shield and the connector shell should be used.

## Safety compliance

This section lists the safety standards with which the product complies and other safety compliance information.

### EU low voltage directive

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

Low Voltage Directive 2014/35/EU.

- **EN 61010-1.** Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

### U.S. nationally recognized testing laboratory listing

- **UL 61010-1.** Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

### Canadian certification

- **CAN/CSA-C22.2 No. 61010-1.** Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

### Additional compliances

- **IEC 61010-1.** Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

### Equipment type

Test and measuring equipment.

### Safety class

Class 1 - grounded product.

### Pollution degree descriptions

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 rating

Pollution Degree 2 (as defined in IEC 61010-1). Rated for indoor, dry location use only.

### IP rating

IP20 (as defined in IEC 60529).

### Measurement and overvoltage category descriptions

Measurement terminals on this product may be rated for measuring mains voltages from one or more of the following categories (see specific ratings marked on the product and in the manual).

- **Category II.** Circuits directly connected to the building wiring at utilization points (socket outlets and similar points).
- **Category III.** In the building wiring and distribution system.
- **Category IV.** At the source of the electrical supply to the building.

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**NOTE.** Only mains power supply circuits have an overvoltage category rating. Only measurement circuits have a measurement category rating. Other circuits within the product do not have either rating.

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### Mains overvoltage category rating

Overvoltage category II (as defined in IEC 61010-1).

## Environmental considerations

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

### Restriction of hazardous substances

Complies with RoHS2 Directive 2011/65/EU.

### 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. 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 2012/19/EU and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Tektronix Web site ([www.tek.com/productrecycling](http://www.tek.com/productrecycling)).

### **Battery recycling**

This product contains a small installed lithium metal button cell. Please properly dispose of or recycle the cell at its end of life according to local government regulations.

### **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](http://www.dtsc.ca.gov/hazardouswaste/perchlorate) for additional information.

### **Transporting batteries**

The small lithium primary button cell contained in this equipment does not exceed 1 gram of lithium metal content per cell, and the cell type has been shown by the manufacturer to comply with the applicable requirements of the UN Manual of Tests and Criteria Part III, Sub-section 38.3. Consult your carrier to determine which lithium battery transportation requirements are applicable to your configuration, including to its re-packaging and re-labeling, prior to reshipment of the product by any mode of transport.

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# Preface

This manual describes the functions and use of the Tektronix MTSA-HW and MTSA-PC MPEG Test Systems.

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**NOTE.** *The following naming conventions are used in this manual:*

- *MTSA-HW – for information that applies to only the MTSA-HW instrument*
  - *MTSA-PC – for information that applies to only the standalone software*
  - *MTSA – for information that applies to both the MTSA-HW and MTSA-PC products*
- 

The MTSA family of MPEG Test Systems provides comprehensive MPEG transport stream (TS) analysis and interoperability testing. Its deep analysis of the TS, PES (Packetized Elementary Stream), and elementary streams helps track down sources of picture anomalies and identify transport streams with syntax errors. Its ability to capture events for deep analysis is also critical to identifying the root cause of problems.

The MTSA can be delivered as a rack mountable 1RU full rack instrument (MTSA-HW) or as standalone software (MTSA-PC). The MTSA has a high-speed analysis engine that enables reduced time to insight, rapid development, evaluation, deployment, and diagnostics of next generation DTV and IPTV systems and services.

## Key features

- Perform analysis of key regional DTV standards - The MTSA supports the DVB, ATSC, ISDB, and ISDB-TB (Brazil) regional standards and the specific SI (Service Information) for terrestrial, cable, and satellite transmission
- Connect to the most important physical interfaces used for transmission - A range of RF and IP interfaces and analysis capabilities provide the necessary connectivity to diagnose problems anywhere in the network environment, whether that be transmission links (RF or IP layer) or content processing (TS layer)
- Analyze content using the common DTV compression technologies - the MTSA tools support H.265 (HEVC), H.264, VC1, MPEG 2 and MPEG 1 compression standards
- Test and analyze the structure of the TS and the content contained within that stream - A full range of tools enables QoS (Quality of Service) and QoE (Quality of Experience) with logging for fault diagnosis and reduced time to insight for both constant and variable bit rate streams (CBR and VBR). <sup>1</sup> Using CaptureVu® technology lets engineers capture and analyze system events in real time and deferred time to debug intermittent and complex problems that traditional analyzers miss
- Perform custom parametric testing and analysis - The MTSA options include a versatile Multiplexer and Generator that can be used to provide stimulus with parametric capabilities and IP multisession replication to characterize behavior of network or the Device Under Test (DUT)
- Perform in depth, repeatable, objective Picture Quality Analysis - the MTSA PQ software can be used to perform full reference Picture Quality Analysis based on the Human Vision Model allowing users to assess CODEC performance and troubleshoot picture issues in their content. The MTSA PQ option is the award winning PQA software

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<sup>1</sup> Some timing related measurements are not possible with VBR streams.

## Applications

### Equipment manufacturers - research and development

- CaptureVu® technology allows rapid isolation and debugging of equipment and system faults
- High-performance Gigabit Ethernet (GbE) IP connectivity and integrated cross-layer analysis enable diagnosis of complex timing problems in video over IP and IPTV network equipment
- Multiplexer/Remultiplexer allows flexible test stream creation and modification
- Rapid and in-depth analysis of selected elements of transport streams to confirm functionality and compliance to standards
- Set-top box buffer testing and verification
- Elementary stream analysis option for codec design and optimization High-accuracy picture quality analysis based upon the Human Vision Model for device design optimization and fault diagnosis

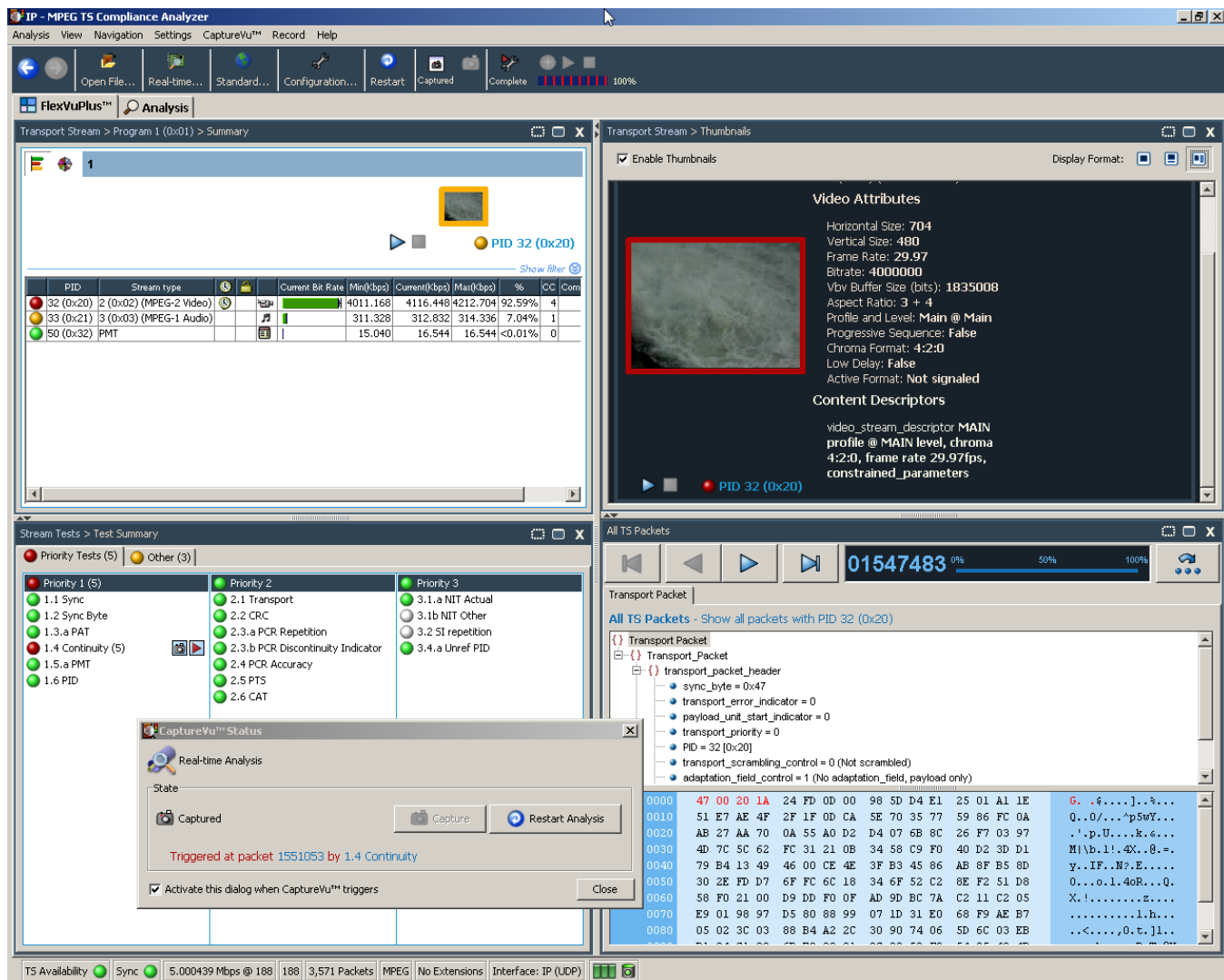


Figure 1: MTSA CaptureVu®



**Equipment manufacturers - manufacturing test**

- Tclips Test Streams together with the Multiplexer/Remultiplexer allow custom test stream creation and editing for fast and flexible equipment stress testing
- Stream playout and recording provide a repeatable test source with seamless looping and continuous time-stamping for test and alignment of STBs, IRDs, and modulators
- Multiport ASI and IP interfaces allow multiple devices to be tested simultaneously
- Duplex operation allows end-to-end testing of system network elements

**Broadcaster and network operator engineering**

- RF and IP connectivity and analysis provide a single-box solution for broadcast system troubleshooting at any point in the network
- Integrated cross-layer fault analysis and logging for network fault diagnosis reduces time to insight when troubleshooting and removes the need for additional IP- or RF-specific diagnostic equipment
- CaptureVu® technology allows for the isolation of intermittent network problems that other analyzers are not capable of isolating
- Video and audio quality analysis that help distinguish between impairments resulting from network distribution versus artifacts resulting from compression
- Elementary stream compliance option for evaluating different vendors' compression equipment and diagnosing faults



# Installation

The installation information is divided into sections for each of the installation types:

- **MTSA-HW system hardware.** This section describes how to install the MTSA-HW system hardware, how to use the controls and connectors, how to power-on and power-off the instrument, and how to connect the instrument to your local Ethernet network. See [MTSA-HW system hardware installation](#) on page 1.
- **Floating license system (Option FLT only).** This section describes how to install and configure Option FLT, which provides a floating license system for the MTSA software applications. See [Floating license system installation](#) on page 9.
- **MTSA-PC standalone system.** This section describes how to install the MTSA-PC standalone system software. See [MTSA-PC standalone system installation](#) on page 15. If you ordered Option FLT, you should install the floating license system before installing the MTSA-PC software.
- **VLC Media Player.** This section describes how to download and install the latest version of the VLC Media Player, which enables you to view video in the Transport Stream Compliance Analyzer (TSCA) application. See [VLC media player installation](#) on page 20.

## MTSA-HW system hardware installation

This section describes how to install the MTSA-HW system hardware and how to connect the system to your local network.

### 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 MTSA-HW 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.

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**NOTE.** Save the shipping carton and packaging materials for instrument repackaging in case shipment becomes necessary. See [Returning the instrument for service](#) on page 69.

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4. Verify whether you received the standard accessories and any optional accessories that you ordered. See [Accessories](#) on page 63.

### Operating requirements

This section provides the environmental and power operating requirements for the instrument. For additional information on product environmental and power specifications, see the *MTSA-HW MPEG Test System Specifications and Performance Verification Technical Reference*.

**Environmental operating requirements.** Check that the location of your installation has the proper operating environment as listed in the following table.



**CAUTION.** Damage to the instrument can occur if this instrument is powered on at temperatures outside the specified temperature range.


**Table 1: Environmental requirements**

Parameter		Specification
Temperature	Operating	0 °C to + 40 °C
	Non operating	–20 °C to + 60 °C
Cooling	Ventilation	Internal fans provide forced air circulation. Do not block ventilation openings
	Bare instrument	To ensure proper airflow, there must be at least 2 inches of clearance on both sides of the instrument, at least 2 inches of clearance from the rear of the instrument, and at least a 1/2 inch of clearance from the top of the instrument.
	Rackmount kit	Use only the Tektronix Rackmount Slides and Rails Kit (MTSA-HW RACK) to install this instrument in an equipment rack. To ensure proper airflow when installing the instrument in a closed rack with solid walls, there must be at least 2 inches of clearance from both sides of the instrument chassis to the rack side walls, at least 3 inches of clearance from the rear of the instrument to the rack's back wall, and at least a 1/2 inch of clearance from the top of the instrument to another installed instrument. The rack intake air to the side vents must not exceed 40 °C.

**Electrical power requirements.** The instrument operates from an AC power input. Check that your location provides the proper electrical power requirements as listed in the following table.

Use the proper power cord with the instrument. [Standard accessories](#) on page 63 The following table lists the power requirements for the instrument.

**Table 2: Electrical requirements**

Requirement	Specification
Line voltage range	100 to 240 V <sub>AC</sub>
	<b>CAUTION.</b> To reduce the risk of fire and shock, ensure that the mains supply voltage fluctuations do not exceed 10% of the operating voltage range.
Line frequency	50/60 Hz
Power consumption	100 W typical 200 W maximum



**WARNING.** In the instrument, only the line conductor is fused for over-current protection. The fuse is internal and not user replaceable. Do not attempt to replace the fuse. If you suspect the fuse has blown, return the unit to an authorized service center for repair.

## Controls and connectors

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

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




**CAUTION.** To prevent instrument damage from overheating, maintain at least two inches (5.1 cm) of clearance at the rear and sides of the instrument cabinet when locating the instrument on a bench. When the instrument is mounted in an equipment rack, maintain at least 3 inches (7.6 cm) of clearance from the back wall of the rack.



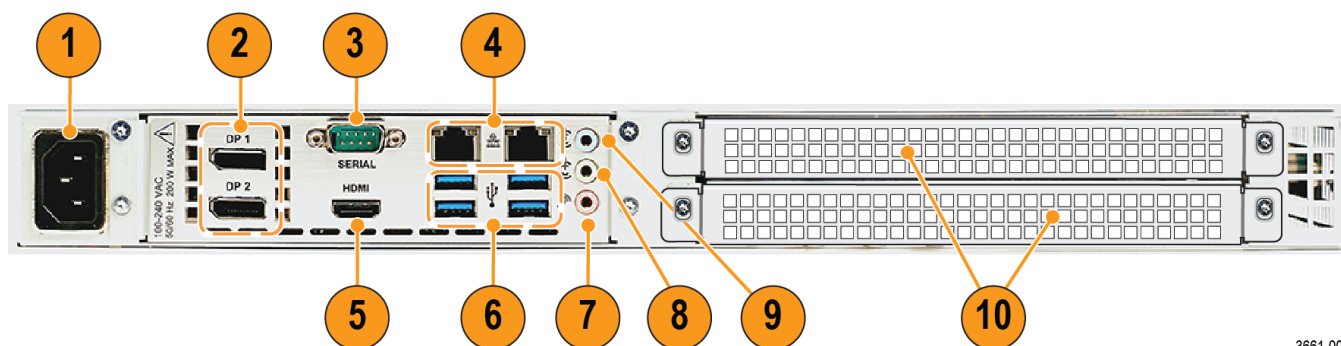
**CAUTION.** Do not supply power to the instrument until all other connections have been made.

**Front panel controls and connectors.** The following figure and table illustrates the MTSA-HW front panel controls and connectors.



Figure reference	Description
1	<p><b>Power / Standby button.</b> Press the button to turn the instrument on or off. To completely remove power from the instrument, remove the power cord.</p> <div></div> <p><b>CAUTION.</b> To prevent data loss, it is strongly recommended that you first shut down the instrument using the power button before disconnecting the power cord.</p>
2	<p><b>Headphone jack.</b> 1/4 inch headphone jack for listening to the selected video.</p>
3	<p><b>USB ports.</b> Two USB 3.0 ports for connecting a mouse and keyboard, upgrading the instrument firmware, or saving screen and stream captures.</p>

**Rear panel connectors.** The following figure and table illustrates the MTSA-HW system connectors.







3661-001

Figure reference	Description	Figure reference	Description
1	<b>AC power input.</b> Connector for AC power source. Ensure that you use the proper power cord for your location.	6	<b>USB ports.</b> Four USB 3.0 ports for connecting a mouse and keyboard, upgrading the instrument firmware, or saving screen and stream captures.
2	<b>DisplayPort (DP).</b> Two DisplayPort outputs for external monitors.	7	<b>Mic input.</b> This connector is for future use.
3	<b>SERIAL.</b> The Serial Interface 9-pin connector is not used.	8	<b>Audio output.</b> 3.5 mm line out port for using headphones to listen to the selected video.
4	<b>Ethernet ports.</b> Standard RJ-45 connector for 10/100/1000Base-T (GigE) Ethernet cable used for video input; identical port for control. It is recommended to use the left port for control and the right port for video.	9	<b>Audio input.</b> This connector is for future use.
5	<b>HDMI port.</b> HDMI port output for an external monitor.	10	<b>Interface card bays.</b> Two bays for the optional interface cards.

**Optional interface card connectors.** The MTSA-HW system can be configured with up to two optional cards that support various transport streams, networks, and peripheral devices. This section describes each of the available option cards and their connectors.

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

**Table 3: Optional interface cards and connectors**

<p><b>Multiport ASI Interface (Option ASI)</b> Four input/output connectors (BNC, 75 <math>\Omega</math>)</p>	
<p><b>Dual Input DVB-S/S2 Interface (Option DS2)</b> Two RF input connectors; two ASI output connectors (BNC, 75 <math>\Omega</math>). Supports DVB-S QPSK and DVB-S2 QPSK, 8PSK, 16APSK and 32APSK demodulation. Includes level, BER, MER, SNR, constellation points.</p>	
<p><b>Multifunction SDR RF Interface (Option SDR)</b> One RF input connector. Supports DVB-T, ISDB-T/Tb, QAM A/B/C and 8VSB. Includes level, BER, MER, constellation points.</p>	
<p><b>10GBase-SR Dual Optical Port 10Gb/s NIC (Option 10GS)</b> Includes Short Reach SFP+ Modules (850 nm).</p>	

## Power-on and power-off procedures

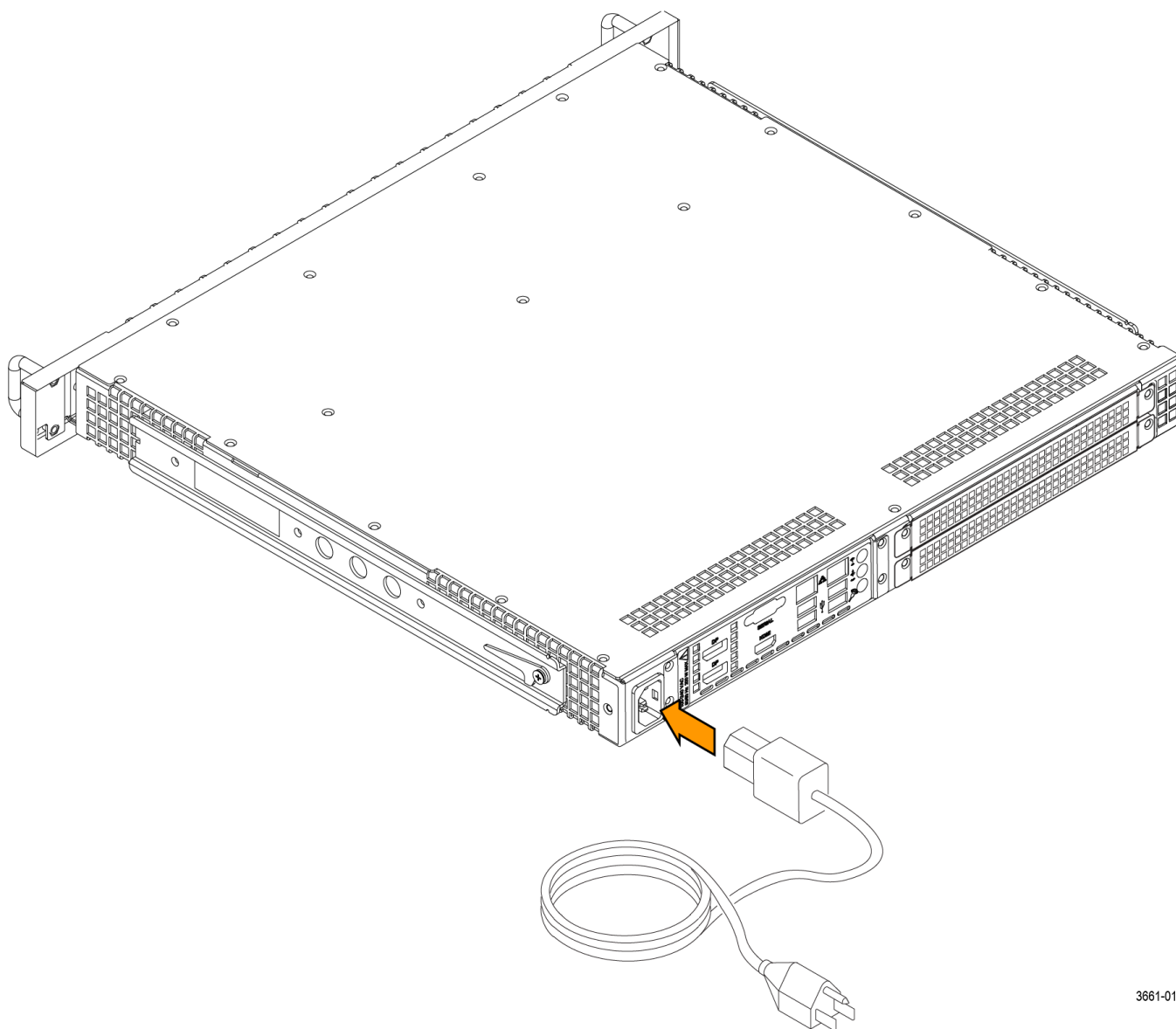
This section describes how to apply power to the instrument and how to power-on and power-off the instrument.



**Power cord installation.** This instrument is powered by an AC power source. Connect the power cord to the power connector on the rear panel of the instrument as shown below. The power connector is keyed to be directional, with the flat portion of the power cord housing facing the left of the instrument (as viewed from the rear). When fully inserted, the power cord housing latches onto the instrument power connector.



**CAUTION.** To minimize the risk of damage to the instrument, it is strongly recommended that the power cord be connected to the instrument before the power cord is connected to the AC power source.



3661-011

**Figure 2: Connecting the power cord to the instrument**

**Power-on procedure.**

1. Apply power to the instrument.

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**NOTE.** If the MTSA-HW instrument was previously powered off by a power interruption or by removing the power cord from the rear of the instrument, the instrument will power on when power is reapplied.

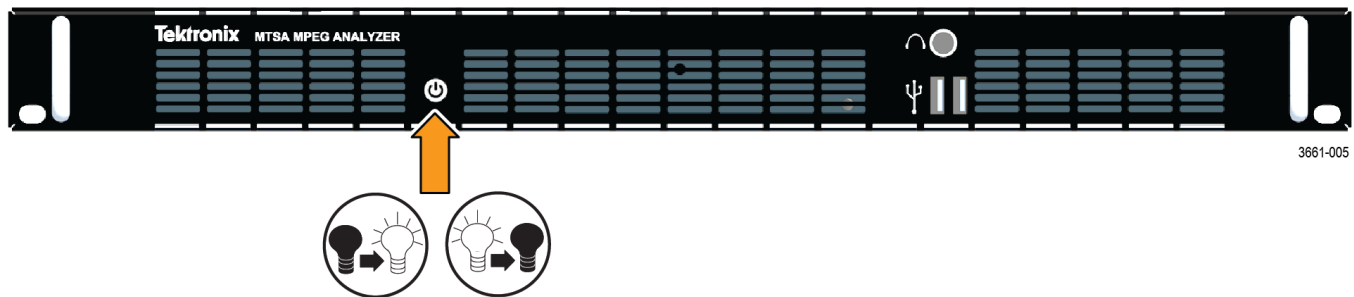
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2. Press the **Power/Standby** button on the instrument front panel to turn the instrument on.

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**NOTE.** The Power/Standby button illuminates during the power-on sequence and then turns off during normal instrument operation.

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**Power-off procedure.**

1. Press the **Power/Standby** button on the instrument front panel to put the instrument in standby mode. Power off the instrument using the Windows shutdown process (select **Start > Power > Shut down...**). The system (including applications) will shut down automatically.




---

**CAUTION.** To prevent data loss, it is strongly recommended that you first shut down the instrument before disconnecting the power cord.

---

2. To completely remove power from the MTSA-HW, disconnect the power cord from the instrument. The power cord has a locking mechanism to keep it attached to the instrument. Push the button on the cord housing to release the locking mechanism.

**Network installation**

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

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

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

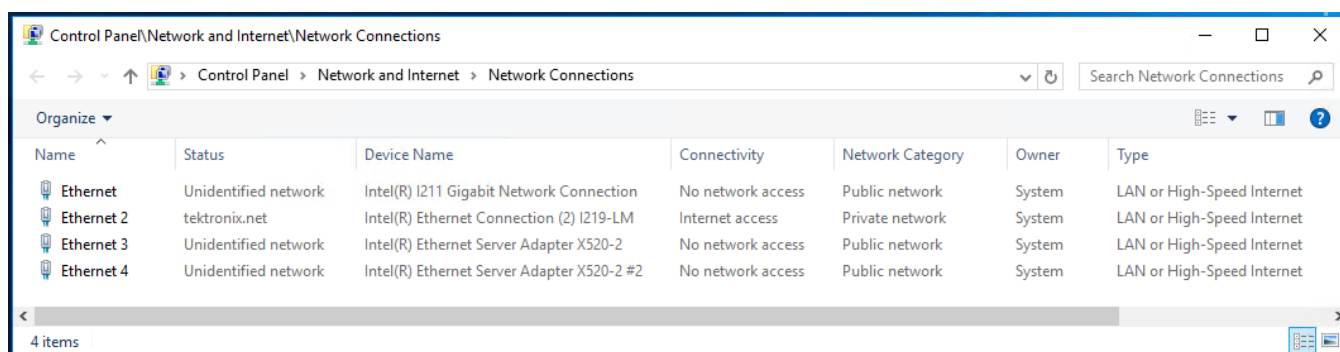
**Basic requirements.** Fulfill the following requirements before troubleshooting your host machines:

- Configure your system for use on your network. Contact your network administrator for details. The MTSA-HW NICs are set to DHCP for auto address setup.
- Ensure that any applications that you may have loaded on your test system since receiving it are not using the ports assigned to the test system components.

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

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

**NIC bandwidth limitations.** The MTSA-HW platform provides two CAT5 Network Interface Cards (NICs) for analyzing IP signals. See [Rear panel connectors](#) on page 5. As shown below, you can use the Control Panel > Network and Internet > Network Connections view to see the available network connections.



The I/O bandwidth limitations for both 1 Gbps NICs are:

- MPEG Player output of up to 250 Mbps
- TSCA IP input of up to 600 Mbps

**Option 10GS interface.** The Option 10GS (10 Gbps) interface card has a device name of Intel X520 and the I/O bandwidth limitations are:

- MPEG Player output of up to 300 Mbps
- TSCA IP input of up to 600 Mbps

## Floating license system installation

Option FLT adds a floating license that enables you to use the MTSA analysis software on multiple computers connected to your network. The floating licence mechanism requires that the license server software be installed on the MTSA-HW system or on a network machine.

---

**NOTE.** For MTSA-HW system users, you do not have to install the license server software on the MTSA-HW system. You can install the license server software on any machine on your network.

---

When you order Option FLT, the MTSA software is provided with a floating license, which uses a hardware key located on a license server or local machine to provide the license key. This means that in order to run the MTSA software, you must have the MTSA hardware key installed on the computer or server running the software.

---

**NOTE.** The hardware key is very important as it contains the MTSA license and therefore embodies the value of the MTSA product. If the hardware key is lost, you will have to purchase another hardware key, which may be at full list price of the software.

---

After you install Option FLT, your system will have a minimum of two floating licenses:

- One license from your original MTSA-HW or MTSA-PC system
- At least one license from Option FLT

If you ordered multiple Option FLT, then your system will have additional licenses.

### Floating license server requirements

Note the following system requirements for the floating license server:

- The hardware key will require a USB connection on the remote server or local machine.
- If installed on a remote server, a license server process must be run on the server machine (this process has modest requirements for CPU load).
- If installed on a remote server, clients require TCP/IP access to the server (this could be provided via VPN between remote sites).

### Floating license installation procedure

To install the floating license system, perform the following steps:

1. Install and configure the DK2 Network Server software on the server machine or the MTSA-HW system. See [Install and configure the floating license server software](#) on page 10.
2. Install the MTSA software and enter the software option key on all machines that will run the MTSA software. See [MTSA-PC standalone system installation](#) on page 15.

---

**NOTE.** For best system operation, all machines should run the same version of the MTSA software (version 3.3.1 or above).

---

3. Configure the DK2 Network Client software on all client machines. See [Configure the floating license client software](#) on page 12.

### Install and configure the floating license server software

The Option FLT license server hosts the hardware key, which contains one or more licenses. It is possible to have several license servers on the network, each with their own hardware key, forming a pool of licenses for the clients to use. It is also relatively easy to have a machine acting as both a server and a client.

---

**NOTE.** The license server software is not installed on the MTSA-HW system as shipped from the factory. However, the server software is included in the MTSA Application Software installation package and can be downloaded from the Tektronix website.

---

To allow a MTSA-HW system or a server machine to act as a floating license server, perform the following procedure:

1. Select a server machine and connect the hardware key (either via the USB port or parallel port depending on hardware key type) that contains one or more floating licenses.
2. If already installed, uninstall the existing DESkey software:

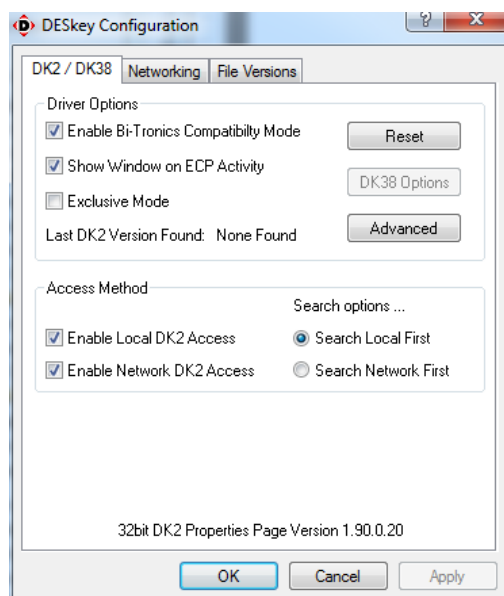
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**NOTE.** The DESkey software will already be installed if the MTSA software was previously installed on the server machine. It is recommended that you uninstall the older version of the DESkey software and install the new version.

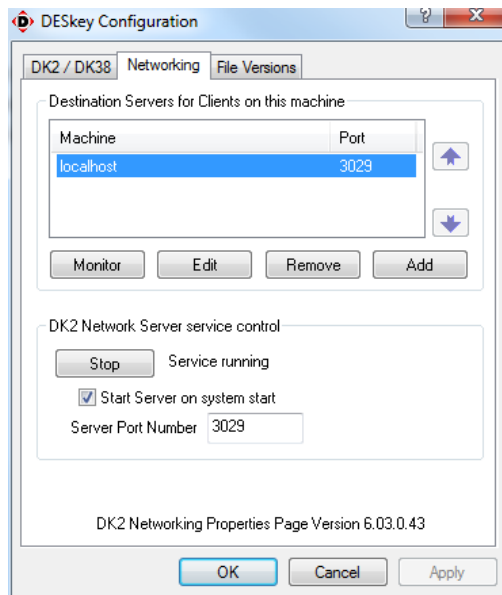
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- a. On the server machine, open the **Control Panel** and select the **Programs and Features** icon.
- b. Select **DK2 DESkey Drivers** and then click **Uninstall/Change**.
- c. Click **Uninstall** to proceed with the software removal.
- d. Close the Control Panel after the uninstall process is complete.
3. Install the new DESkey software:
  - a. Download the DESkey software from the Tektronix website to the server machine or MTSA-HW system or locate the DESkey software in the MTSA Application Software download package.
  - b. Using Windows Explorer, locate and open the **DES** directory in the DESkey software download.

- c. Run the program named **dnsv32.exe**. During the installation process, accept the default entries.
  - d. Run the program named **dk2wn32.exe**. During the installation process, accept the default entries.
  - e. Reboot the server machine if requested to do so at the end of the installation process.
4. Configure the DESkey license server settings:
  - a. On the server machine, open the **Control Panel**.
  - b. In the Control Panel, set **View by** to **Large Icons**. The default is by category.
  - c. Select the **DESkey** icon. This will show the DESkey Configuration dialog (the version numbers shown near the bottom may vary).
  - d. Select the **DK2 / DK38** tab. As shown below, make the following selections:
    - Check the box for **Enable Bi-Tronics Compatibility**.
    - Check the box for **Show Window on ECP Activity**.
    - Check the box for **Enable Local DK2 Access**.
    - Check the box for **Enable Network DK2 Access**.
    - Check the radio button for **Search Local First**.



- e. Select the **Networking** tab. The field at the bottom labeled Server Port Number shows the port to be used for communication with any clients; the default is 3029. Press the **OK** button to finish.



5. Make a note of the IP address of the floating license server machine. You will need the address when you configure the client machines.

**Port 3029 blockage.** Depending on the policy of your IT department, port 3029 may be blocked by the network firewall. In this case, you will need to consult your network administrator for another unrestricted port. After you obtain a valid port number, perform the following steps:

1. In the Networking tab, enter the new port number and click the **Apply** button.
2. If you get a prompt asking about restarting the server; select **Yes**. This will stop and restart the network server service using the new port.
3. When the port has been applied, press the **OK** button to finish.

---

**NOTE.** This does not cause the server to reboot; it only restarts the license server.

---

## Configure the floating license client software

For each client machine that will access the MTSA software, perform the following steps to configure the floating license client software:

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**NOTE.** The floating license client software is automatically installed when the MTSA software is installed.

You will need to enter the IP address of the MTSA floating license server machine in the steps below.

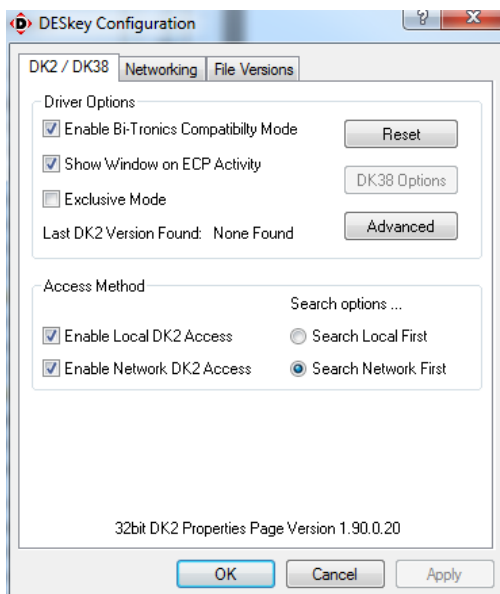
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Perform the following steps to configure the DESkey license client settings:

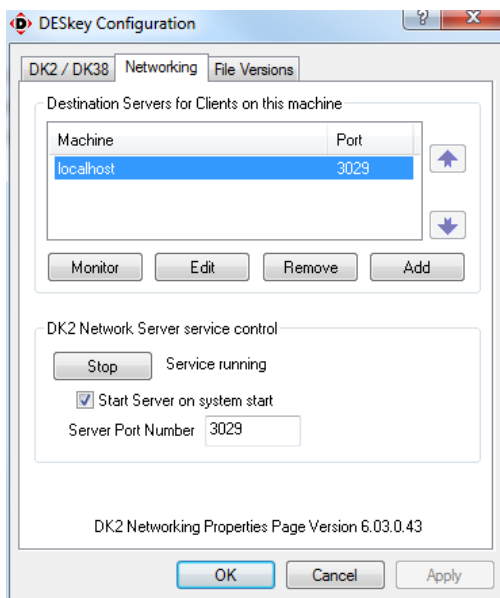
1. On the client machine, open the **Control Panel**.
2. In the Control Panel, set **View by** to **Large Icons**. The default is by category.
3. Select the **DESkey** icon. This will show the DESkey Configuration dialog (the version numbers shown near the bottom may vary).

4. Select the **DK2 / DK38** tab. As shown below, make the following selections:

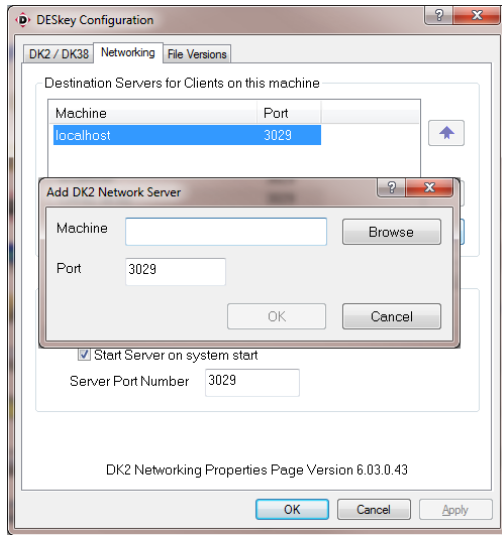
- Check the box for **Enable Bi-Tronics Compatibility**.
- Check the box for **Show Window on ECP Activity**.
- Check the box for **Enable Local DK2 Access**.
- Check the box for **Enable Network DK2 Access**.
- Check the radio button for **Search Network First**.



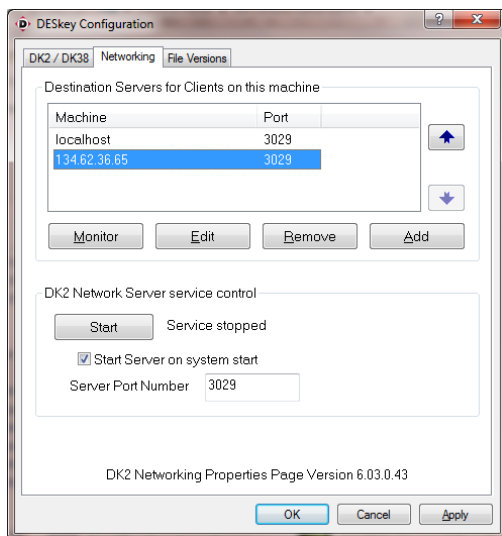
5. Select the **Networking** tab. The Destination Servers list should contain **localhost** as shown below.



6. Click the **Add** button to open the **Add DK2 Network Server** dialog.



7. Enter the IP address of the MTSA floating license server machine and click **OK**. The IP address you entered will appear in the Destination Servers list.
8. In the Destination Servers list, select the license server IP address as shown below (the IP address should be highlighted).



9. The field at the bottom of the Networking tab labeled Server Port Number shows the port to be used for communication with any clients; the default is 3029.
10. Press the **OK** button to finish.

---

**NOTE.** Depending on the policy of your IT department, port 3029 may be blocked by the network firewall. In this case, you will need to consult your network administrator for another unrestricted port. See [Port 3029 blockage](#) on page 12.

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## MTSA-PC standalone system installation

The MTSA-PC standalone system makes the MTSA-HW system applications available on a PC.

The MTSA-PC includes a USB dongle and option key. When installed on your PC, the USB dongle contains the option keys to enable various MTSA software options. The option keys stored on the USB dongle depends on which software options you purchased. Both the USB dongle and the option key are required for opening the MTSA-PC.

If you ordered Option ESA or ALZRPK (MTS4EAV7 HEVC / AVC Video and Compressed Audio Analyzer), use the installation procedure provided in the *MTS4EAV7 User Manual*.

### System requirements

The following minimum PC configuration is recommended for installing the MTSA standalone system:

Parameter	Requirement
Operating system	Microsoft Windows 10, 64 bit
Processor	Intel i7-7700T or better
Memory	At least 16 GB RAM
Screen resolution	1920×1080
Hard disk size	At least 256 GB SSD recommended

### Install the MTSA software

1. If installed, remove the MTSA USB hardware key (dongle) from the USB port on the PC or floating license server (Option FLT only).



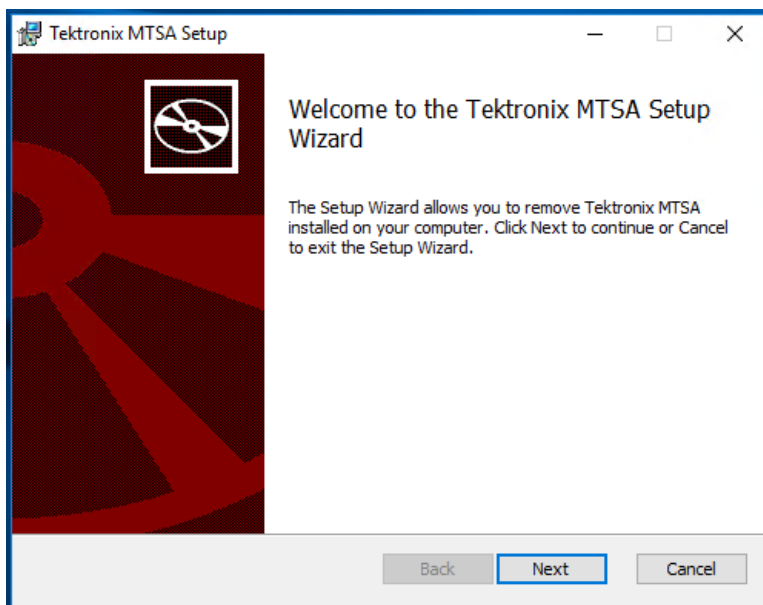
**CAUTION.** To prevent installation problems, it is recommended that you remove the hardware key (dongle) from the PC before you install the software.

2. Download the MTSA Application Software download package from the Tektronix website to your PC.

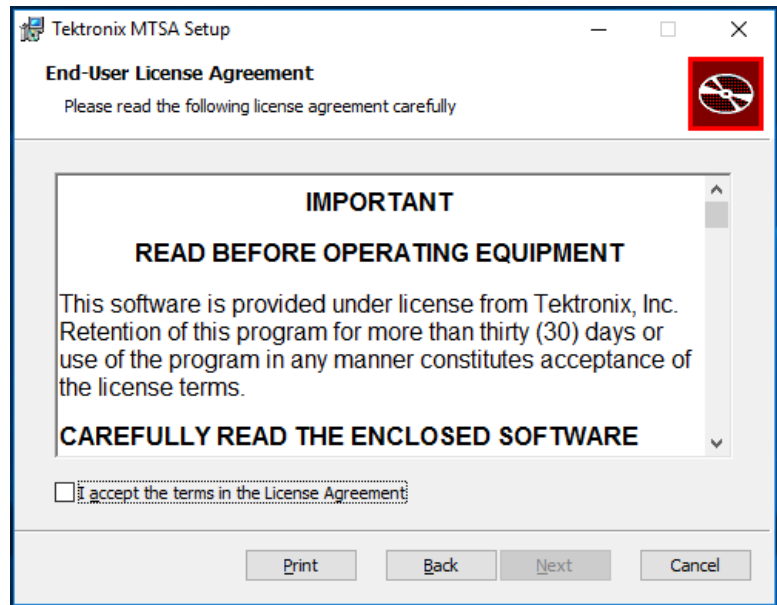
Locate the **MTSA\_Setup.exe** file in the download package. Be sure to right-click and select **Run as administrator**.

The installation program will start and display a Welcome screen.

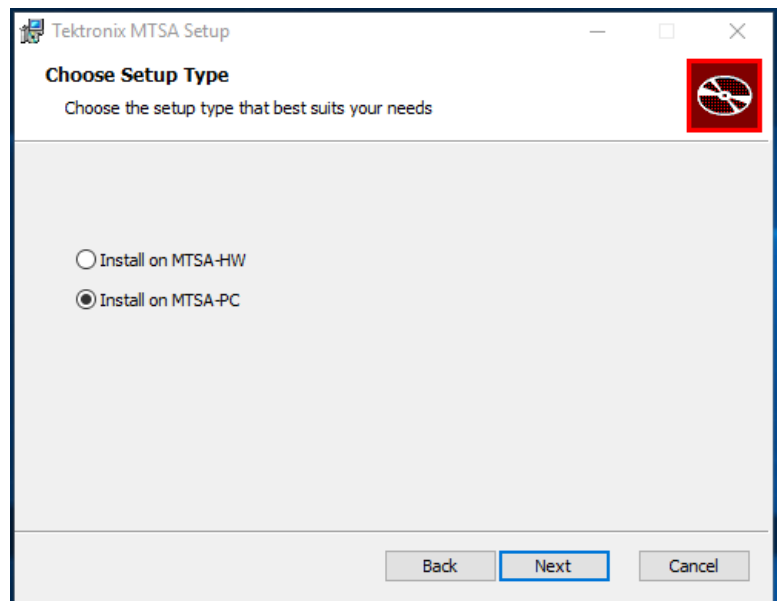
3. In the installation Welcome screen, select **Next**.



4. Read the End-User License Agreement. Accept the agreement and select **Next**.



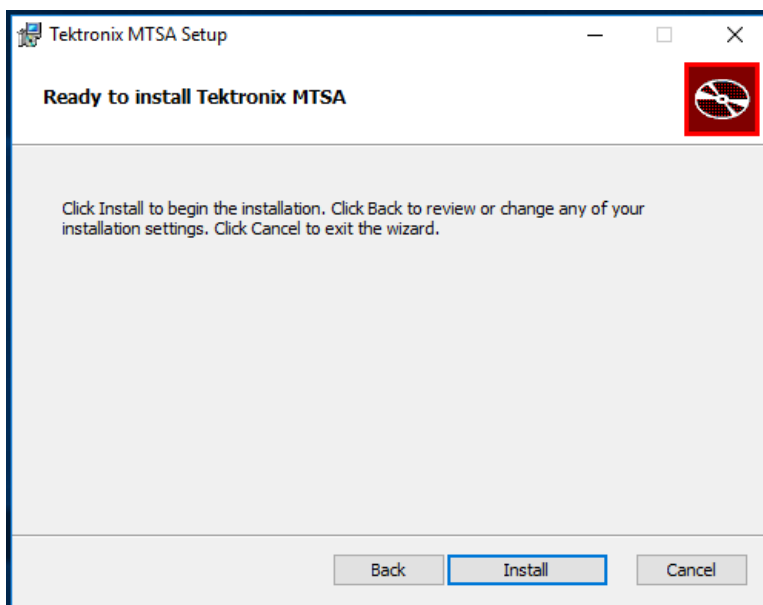
5. In the Choose Setup Type screen, select **Install on MTSA-PC** to install the MTSA software on your PC.
6. Select **Next**.



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

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

If the installation program detects an older version of the MTSA software, the software is automatically uninstalled.



8. Allow the installation to proceed.
9. When the DESkey installer displays, select **Next** to proceed with the DESkey installation process. Depending on the Windows security settings, you may see a Windows Security message to install device software. Select **Install**.

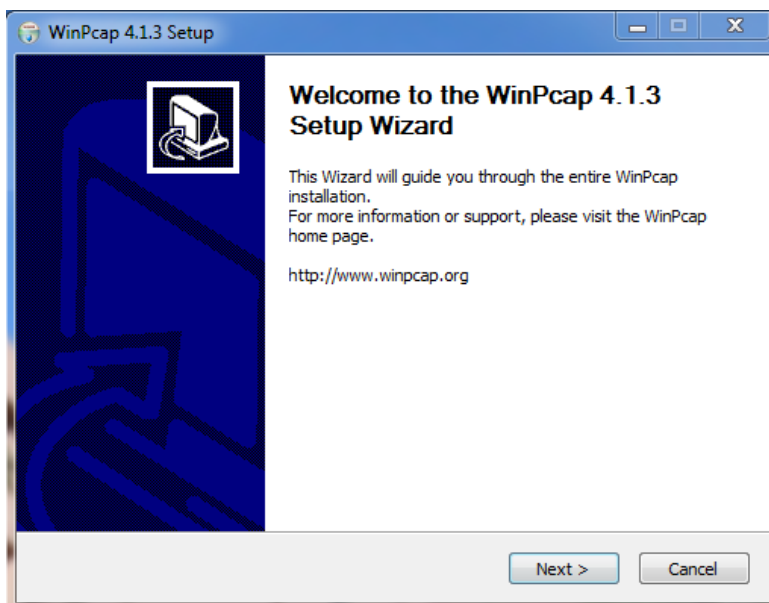
The DESkey installation is skipped if the MTSA installation process detects that the correct version of DESkey is already installed.



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

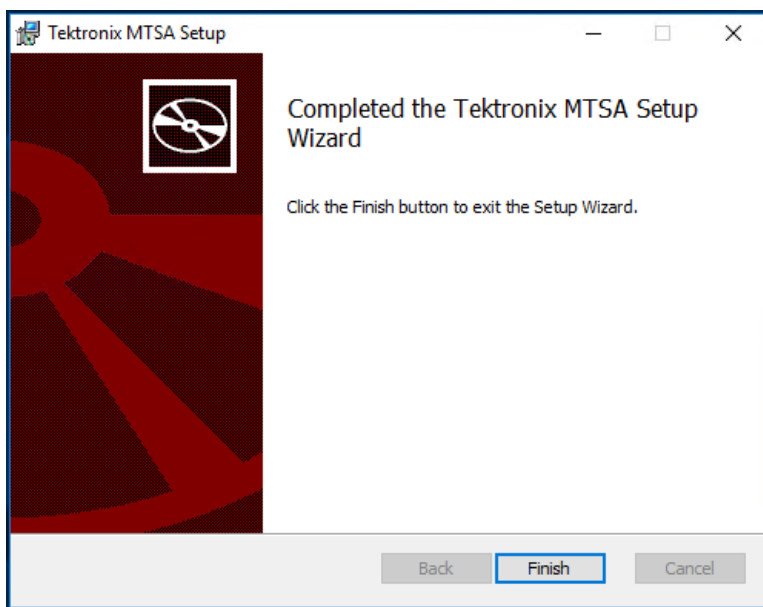
Proceed with the WinPcap installation process.

The WinPcap installation is skipped if the MTSA installation process detects that the correct version of WinPcap is already installed.



11. When installation completed screen displays, select **Finish**.

A reboot is necessary before entering the option key or using the applications.



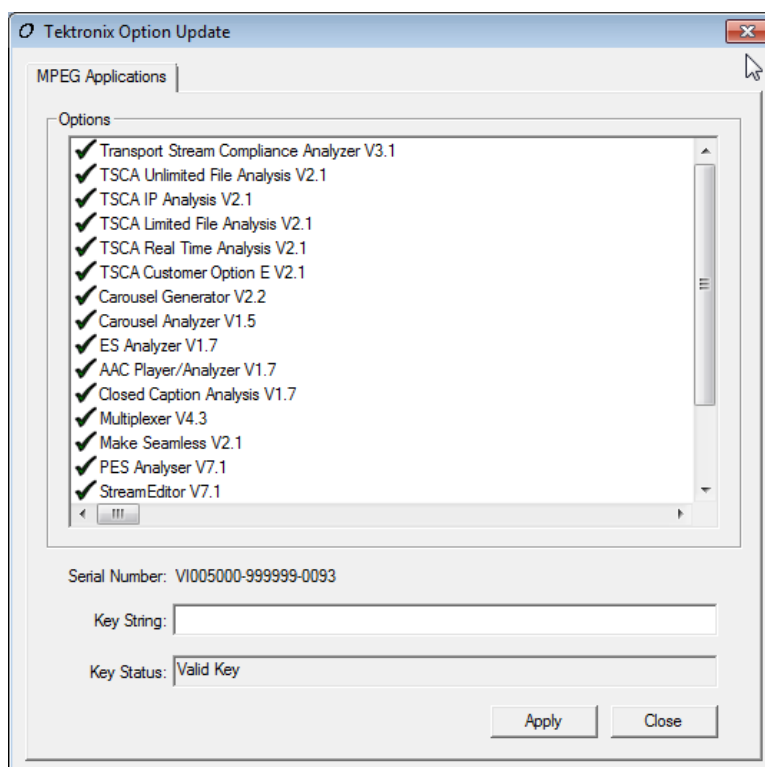
12. After the PC has restarted, install the MTSA USB hardware key (dongle) in the USB port of the local machine or confirm that the hardware key has been plugged in and detected by the remote dongle server (Option FLT only).
13. After the PC detects the hardware key dongle, open the MTSA Option Key Wizard by selecting **Tektronix MTSA > OptionKey Wizard**.
14. In the Tektronix Option Update dialog box, enter the Option Key String supplied with the installation documentation in the Key String field.
15. Click **Apply**.
16. Inspect and verify the list of licensed options.

---

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

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

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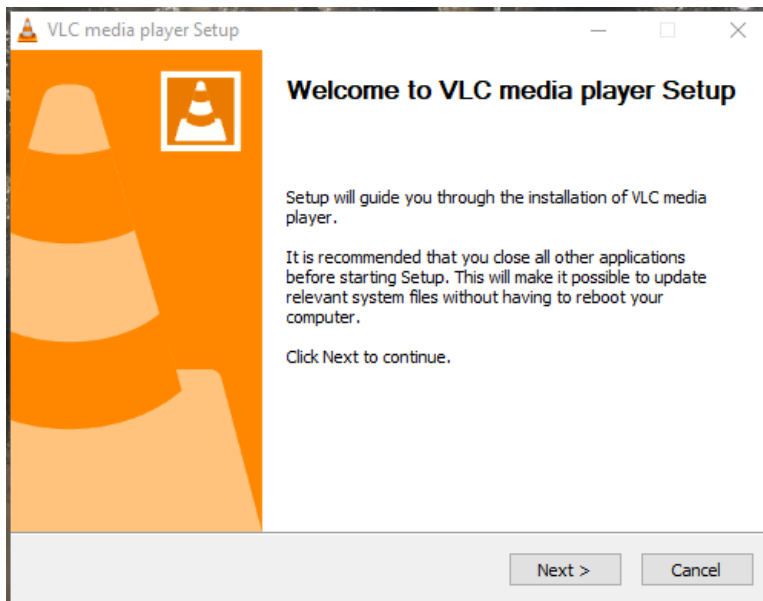


17. Close the Option Key Wizard.
18. The licensed MTSA-PC standalone applications can now be started from the Windows Start menu or from the shortcuts in the desktop folders (Real Time Analyzers, Deferred Time Analyzers, Generators, Player, or Utilities). See [Starting an application](#) on page 24.

## 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 MTSA-HW instrument or PC with access to the internet, navigate to the VideoLAN home page ([www.videolan.org](http://www.videolan.org)).
2. Locate and download the Windows self-extracting VLC Media Player installer to your PC hard disk. It is recommended that you use the 64-bit version.
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.



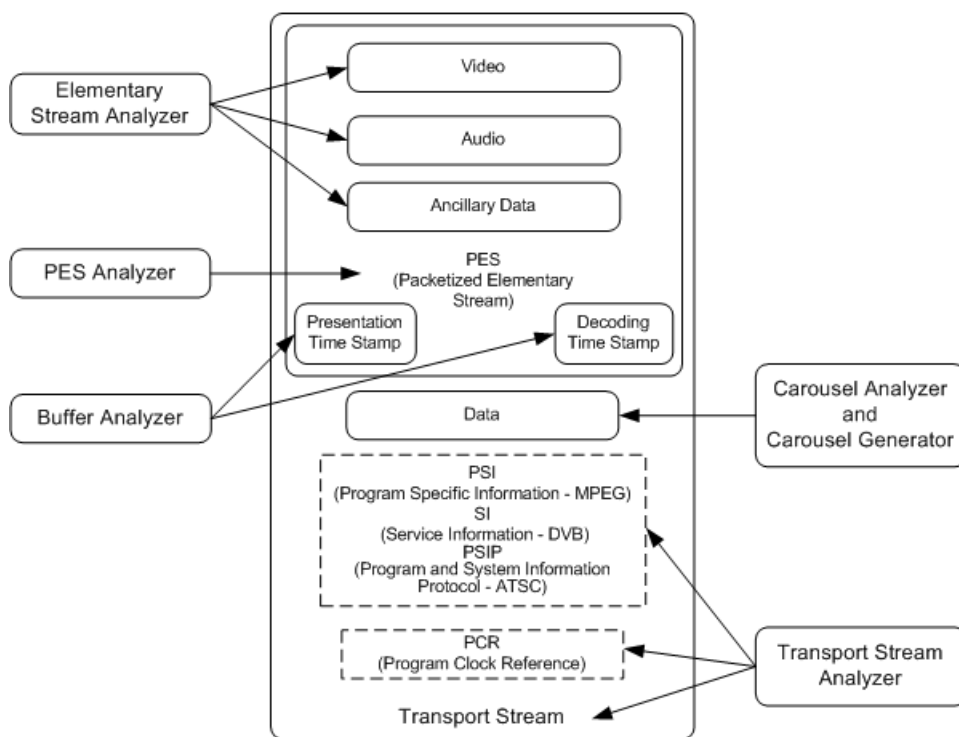
No further activity is required. The VLC Media Player will be used by the TSCA application as required.

# Operation

## Product description

The MTSA-HW and MTSA-PC 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.

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










The *Procedures* section tells you how to start the application, how to analyze a test stream, and what results are presented. The procedures do not tell you how to interpret the results.

Standards compliance is ensured through 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 MTSA MPEG Test Systems. Note that some options might not be enabled. Detailed descriptions of all applications can be found in the MTSA application user manuals.

Application		Icon <sup>1</sup>
<b>Analyzers</b>		
Transport Stream Compliance Analyzer (TSCA) – Real-time and Deferred time transport stream analysis with user-selectable MPEG-2, DVB, and ATSC conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing /transport rate graphs and error message logs.	The first RF/IP card installed in the MTSA-HW Test System is accessed using the TS Compliance Analyzer icon located in the Real Time Analyzers folder on the desktop and in the Start menu.	 TS Compliance Analyzer
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 Analyzer
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 Analyzer
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
<b>Generators</b>		
Carousel Generator – Provides in-depth, off-line generation of MPEG-2, DVB transport streams containing a range of data broadcast protocols.		 Carousel Generator
ISDB-T Remux – Remultiplexes an existing 188- or 204-byte transport stream file into an ISDB-T/Tb (ARIB STD-B31) compliant file (204 bytes per packet). The created file extension is .RMX and includes TMCC and IIP sections.		 ISDB-T Remux

<sup>1</sup> If installed and licensed.



Application	Icon <sup>1</sup>
<p>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.</p>	 Multiplexer
<p>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.</p>	 TS Editor
<b>Players</b>	
<p>MPEG Player – Plays MPEG-2 transport streams.</p>	 MPEG Player
<b>Utilities</b>	
<p>Make Seamless Wizard – Guides the user through the process of creating an MPEG-2 transport stream file for use by Stream Player in continuously looped operation.</p>	 Make Seamless Wizard
<p>Stream Cutter – Extracts sections of MPEG-2 transport stream files to new files.</p>	 Stream Cutter
<p>Script Pad – Enables users to create and modify System Information (SI) scripts.</p>	 ScriptPad

<sup>1</sup> If installed and licensed.

## Starting an application

All applications are started from Start > All Programs > Tektronix MTSA menus or from the shortcuts in the desktop folders (Real Time Analyzers, Deferred Time Analyzers, Generators, Player, or Utilities).

The MTSA application user manuals provide full descriptions of all applications. The following table shows the applications that display in the Windows 10 Start menu.

Start menu	Application	Function
Tektronix MTSA >	Option Key Wizard	Product licensing
	Buffer Analyzer	Analyzers
	Carousel Analyzer	
	ES Analyzer	
	PES Analyzer	
	TS Compliance Analyzer	
	TSCA with real time capabilities	
	Carousel Generator	Generators
	ISDB-T Remux	
	Multiplexer	
	TS Editor	
	MPEG Player	Player
	Make Seamless Wizard	Utilities
	ScriptPad	
	Stream Cutter	

**NOTE.** Applications appear in alphabetical order in the Start menu. All applications are shown in the Start menu, but you can only open those options that have been purchased and licensed.

## Duplex operation

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

## Setting up loopback

With loopback in operation you can:

- Use the MPEG Player to play out a stream
- Loop the instrument output back to the input (For example, with the ASI card, loop ASI-4 back to ASI-3. With the 10G card, loop the output back to the input using an LC multimode jumper cable.)
- Monitor/analyze the incoming stream using the TSCA

Before starting:

- Identify the stream to be played out (in this example, the sym1.mpg test stream is used).
- Choose the output/input interface (ASI) and make the necessary connections (loop between the connectors).

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

### MTSA-HW setup.

1. Connect a cable from the ASI-4 connector to the ASI-3 connector.

### MPEG player setup.

1. Open the MPEG Player: **Tektronix MTSA > MPEG Player**.
2. Open a stream: **File>Open...> Sym1.mpg**.

---

**NOTE.** The Sym1.mpg file is provided for use to help understand the MTSA applications. The file is available in several locations such as the hard drive of the MTSA-HW (C:\Streams\Tclips\MTS400 TestStreams) or the Tclips download from [www.tek.com](http://www.tek.com).

---

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

- Interface: ASI
- Packet size: 188
- Update: On
- Loop: On
- Other: Standard: DVB

4. Make the following settings in the **ASI** menu:

- ASI Out: ASI-4

### TSCA setup.

1. Open the TSCA: **Tektronix MTSA > 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-3** from the **Interfaces** drop-down list.
4. Select **OK**.

**Start the playback 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 playback 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 *MTSA-HW and MTSA-PC Generator Applications User Manual*.

## Interface card status LEDs

The rear panel on the optional ASI and DVB-S2 (Option DS2) interface cards have LEDs to indicate the status of the input and output signals. The following tables list the possible status conditions.

**Table 4: ASI and DVB-S2 outputs**

LED pattern	Description
Short orange flashes	No output is generated
Long orange flashes	Null-packet stuffing only (no real data)
Solid orange	Generating live output

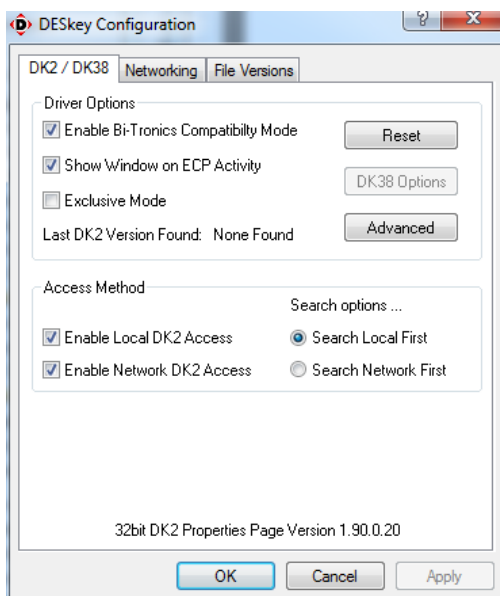
**Table 5: ASI and DVB-S2 inputs**

LED pattern	Description
Short green flashes	No carrier/signal detected
Long green flashes	Carrier detected but no data
Solid green	Valid signal detected
Solid red	Wrong signal connected
Five short red flashes quickly after each other	Code violations

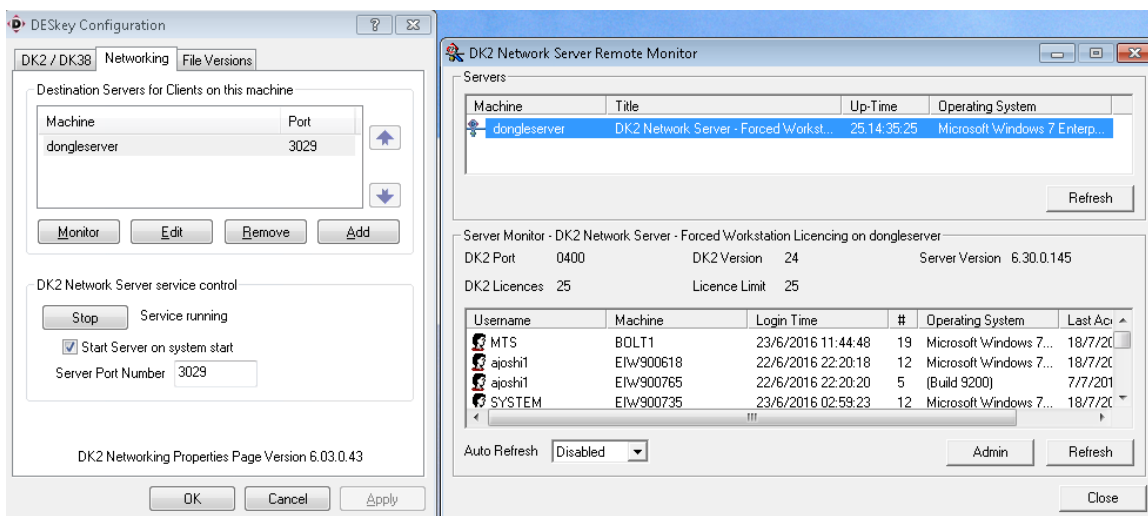
## Floating license operation

When your MTSA-HW or MTSA-PC system has Option FLT installed, there may be times when you are not able to run a MTSA application because all of the floating licenses are in use. Perform the following steps if you need to force-quit a remote session of the MTSA software in order to free up a license:

1. Login as **Administrator** on the floating license server machine.
2. Open the Control Panel (Settings > Control Panel) and select the **DESkey** icon. This will show the DESkey Configuration dialog (the version numbers shown near the bottom may vary).

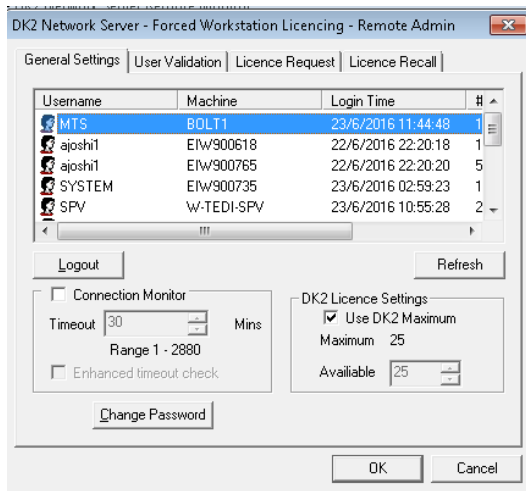


3. Select the **Networking** tab and click the **Monitor** button. This will show the DK2 Network Server Remote Monitor dialog.

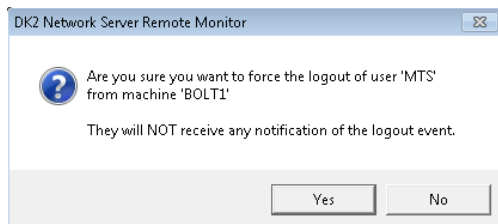


4. In the DK2 Network Server Remote Monitor dialog, click the **Admin** button.

5. Enter **deskey** as the password in the Password Required box, and then click **OK**. This will show the DK2 Network Server - Forced Workstation Licensing - Remote Admin dialog shown below.



6. In the DK2 Network Server - Forced Workstation Licensing - Remote Admin dialog, click the **General Settings** tab, and then select client machine that you would like to force out of the MTSA software license.
7. After you select the desired client machine, click the **Logout** button.
8. In the confirmation window, verify you have selected the correct client machine, and then click **Yes** to proceed with the force-quit operation.



9. After the force-quit operation is complete, the selected MTSA floating license is released to the pool of available licenses. Repeat this procedure as necessary to free up the desired number of licenses.
10. After you are done freeing up licenses, click **OK** to close the DK2 Network Server - Forced Workstation Licensing - Remote Admin dialog.

# Procedures

## Using the Multiplexer

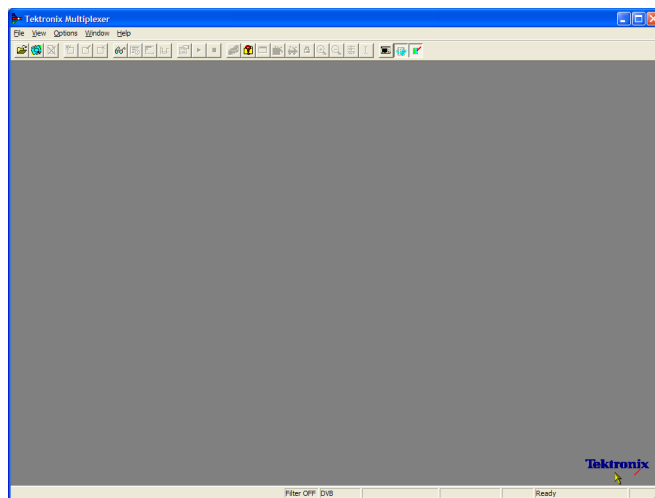
The following application example describes using the Multiplexer to create a new transport stream and add elementary streams to the transport stream.

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

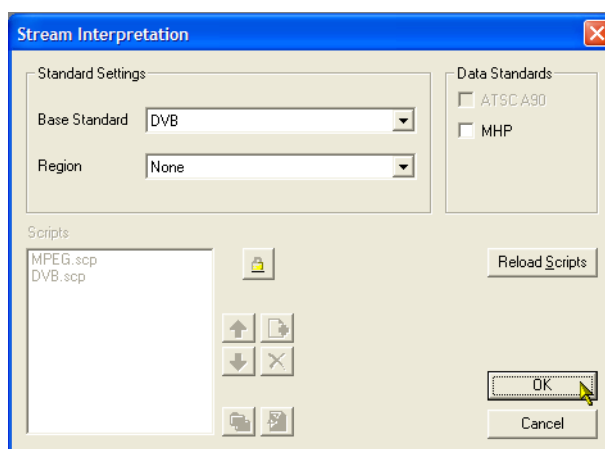
### Create a new stream using the Multiplexer

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

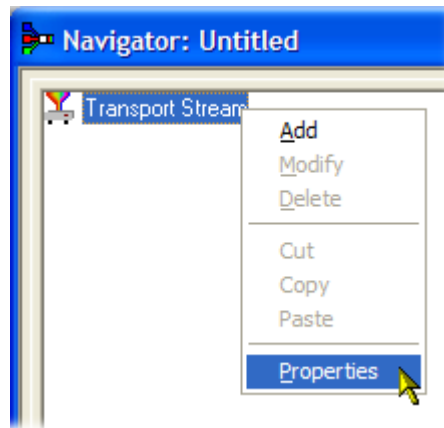
1. Open the Multiplexer application.  
**Tektronix MTSA > Multiplexer.**



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

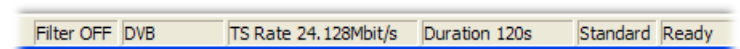
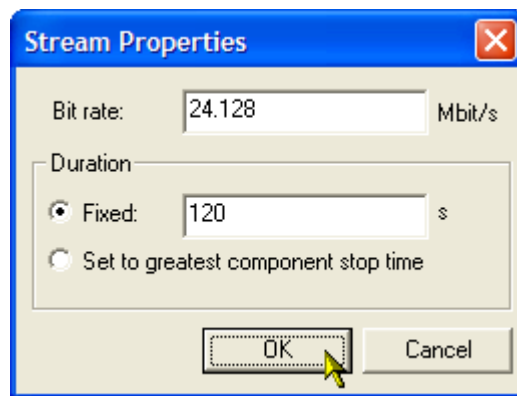


5. Select **File > New**.
6. In the Navigator window, highlight the Transport Stream node and select **Properties** from the context menu.

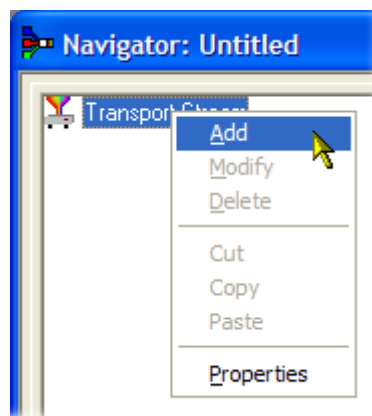


7. In the Stream Properties dialog box, enter a bit rate of 24.128 Mbit/s and a fixed duration of two minutes (120 seconds). Select OK.

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

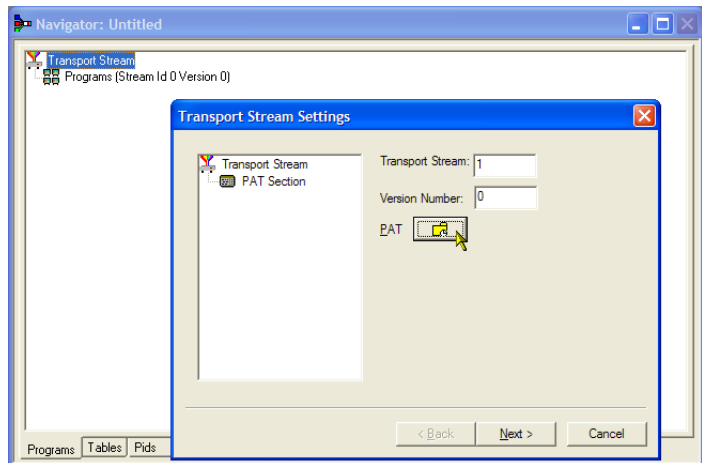


8. In the Navigator window, highlight the Transport Stream node and select **Add** from the context menu.



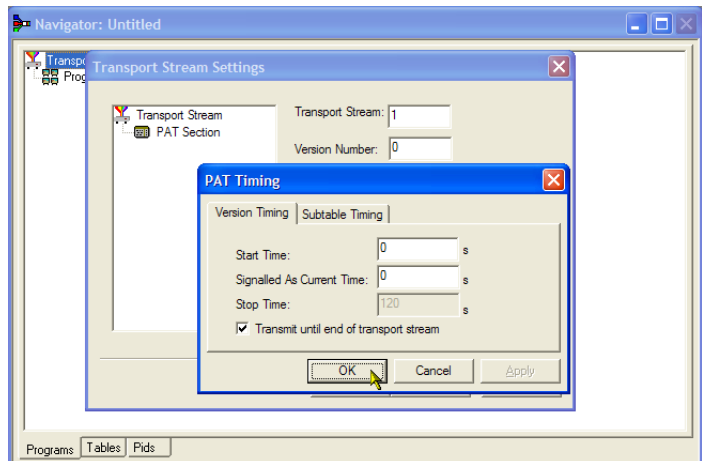


9. In the Transport Stream Settings dialog box, enter 1 as the Transport Stream identity.
10. Select the **PAT** (Program Allocation Table) folder icon button to open the PAT Timing dialog box.

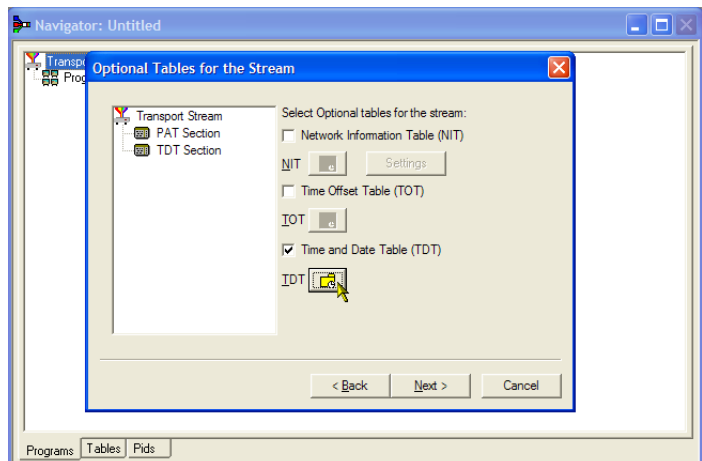


In the Version Timing tab window, note that the PAT timing Start time (0 s) and Stop time (120 s) mean that the PAT will be transmitted for the stream duration.

11. Select **OK** to close the PAT Timing dialog box.
12. In the Transport Stream Settings dialog box, select **Next**.



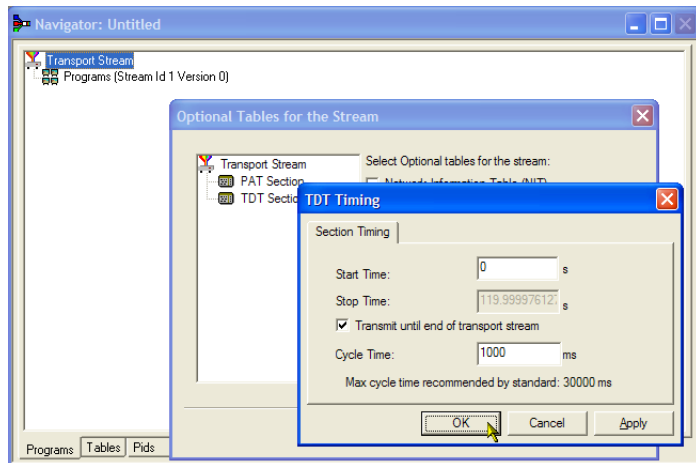
13. In the Optional Tables for the Stream dialog box, select the **TDT** (Time and Date Table) check box and select the **TDT** folder icon button.



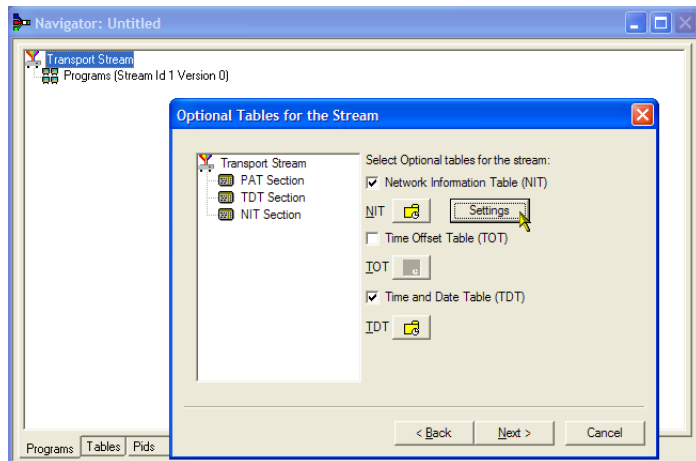
In the TDT Timing dialog box, confirm that the Start Time is zero and the Stop Time is the same as the duration previously set.

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

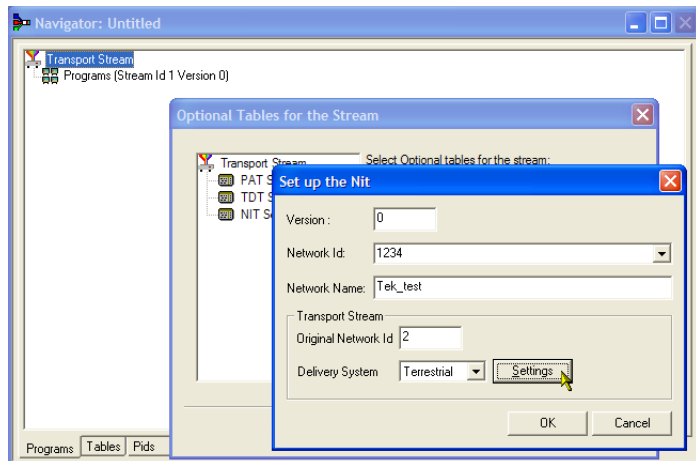
14. Enter a Cycle Time of 1000 ms.
15. Select **OK** to close the TDT Timing dialog box.



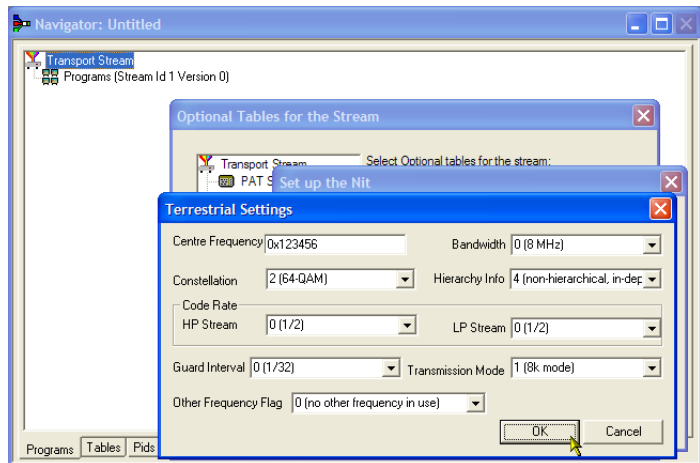
16. In the Optional Tables for the Stream dialog box, select the **NIT** (Network Information Table) check box and select the **NIT Settings** button.



17. In the Set up the NIT dialog box, enter the Network Id 1234 and the Network Name Tek\_test.
18. Set the Original Network identity to 2 and select **Terrestrial** from the Delivery System drop-down list.
19. Select the Delivery System Settings button.



20. In the Terrestrial Settings dialog box, enter 0x123456 in the Centre Frequency field.
21. Select **2 (64-QAM)** from the Constellation drop-down list.
22. Select **4 (non-hierarchical, in-depth interleaver)** from the Hierarchy Information drop-down list.
23. Select **1 (8k mode)** from the Transmission Mode drop-down list.
24. Select **OK** to close the Terrestrial Settings dialog box.

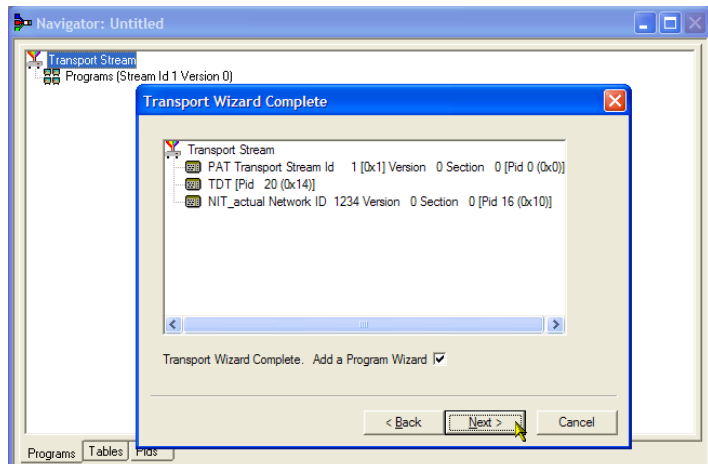


25. Select **OK** to close the Set up the NIT dialog box.

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

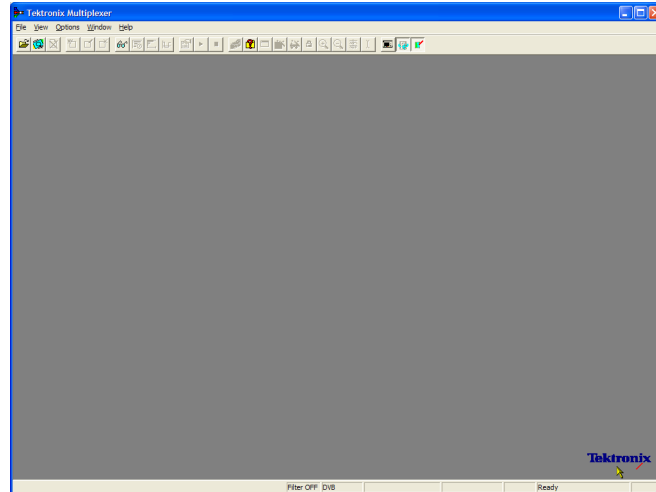
The transport stream set up is complete. Now you need to add some content in the form of video and audio elementary streams.

Do not close the Transport Wizard Complete screen.

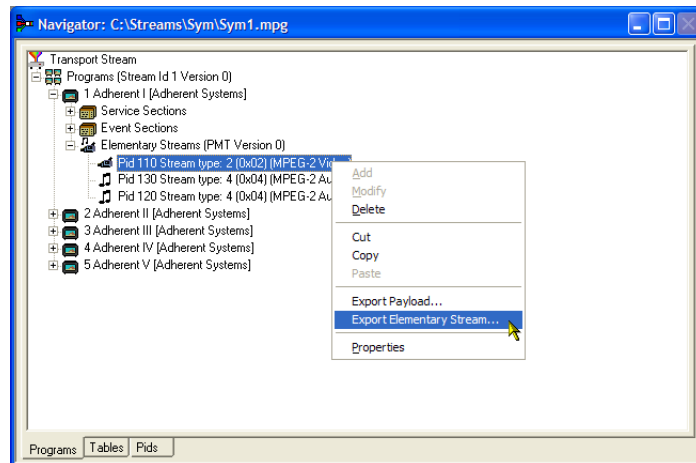


**Elementary stream acquisition.** For this example, you need to add a video and an audio elementary stream to the transport stream that you have created. You can extract suitable streams from one of the sample transport streams supplied with the MTSA installation. The stream used in this example is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

1. Open a second instance of the multiplexer. **Tektronix MTSA > Multiplexer.**
2. Select **File > Open.**
3. In the Set MPEG File to Edit dialog box, locate and open sym1.mpg.



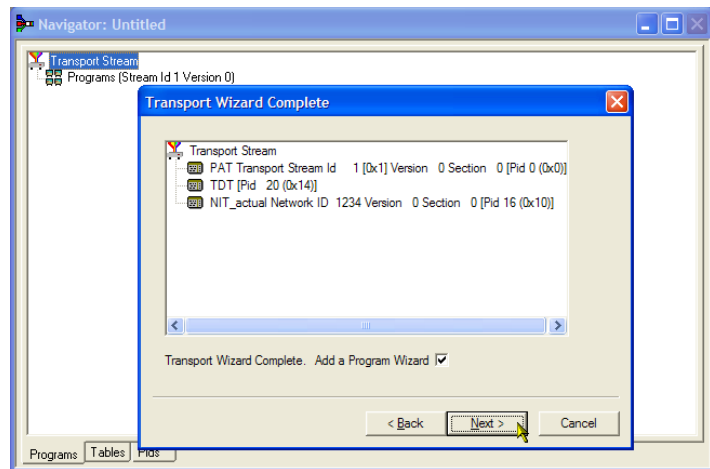
4. Expand the program 1 node and the dependent Elementary Streams node.
5. Highlight the PID 110 node. This PID is carrying an MPEG-2 video elementary stream.
6. Select **Export Elementary Stream** in the context menu.
7. In the Save As dialog box, enter a file name (Sym1pid110.es) and save the file to a suitable location.
8. Repeat the action for PID120. Name the file Sym1pid120.es.
9. Select **File > Exit** to close this instance of the Multiplexer.



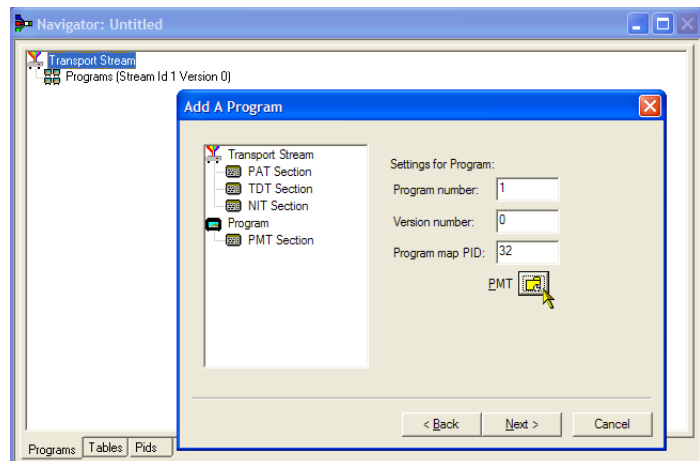
This completes the extraction of the video and audio elementary streams. You can continue with the multiplexing task.

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

1. Ensure that **Add a Program Wizard** is checked and select **Next**.



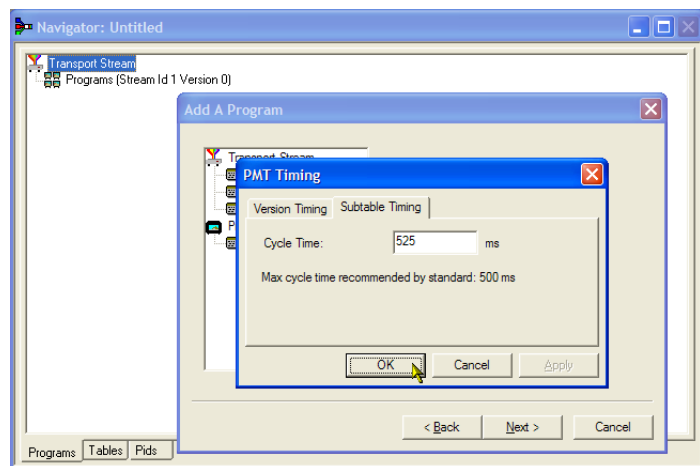
2. In the Add a Program dialog box, enter 1 as the program number.
3. Select the PMT folder icon.



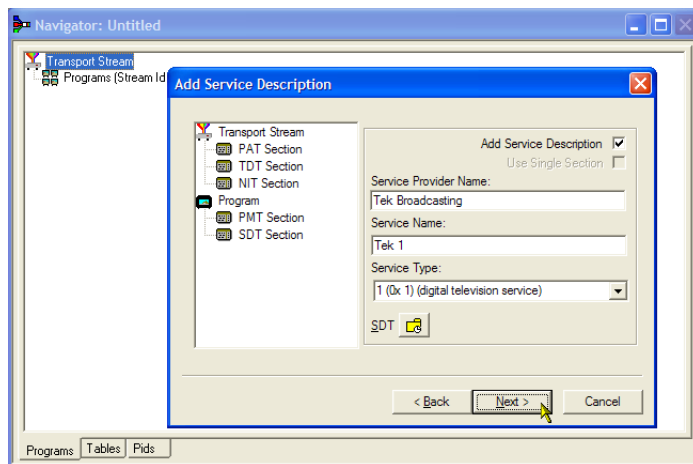
4. In the PMT Timing dialog box, select the Subtable Timing tab.

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

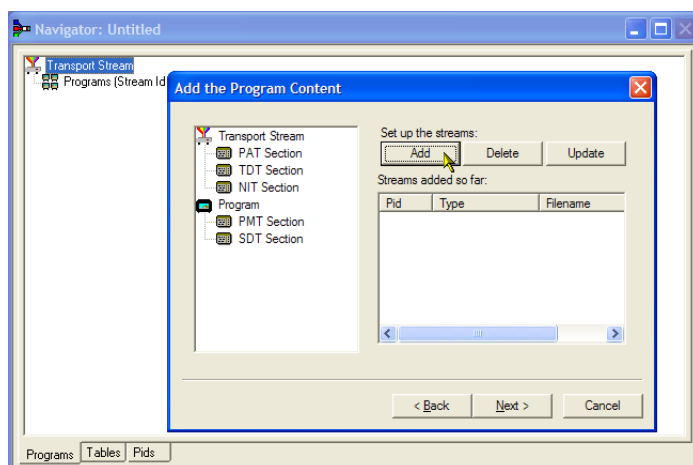
5. For this example stream, set the cycle time to 525 ms.
6. Select **OK** to close the PMT Timing dialog box.
7. In the Add a Program dialog box, select **Next**.



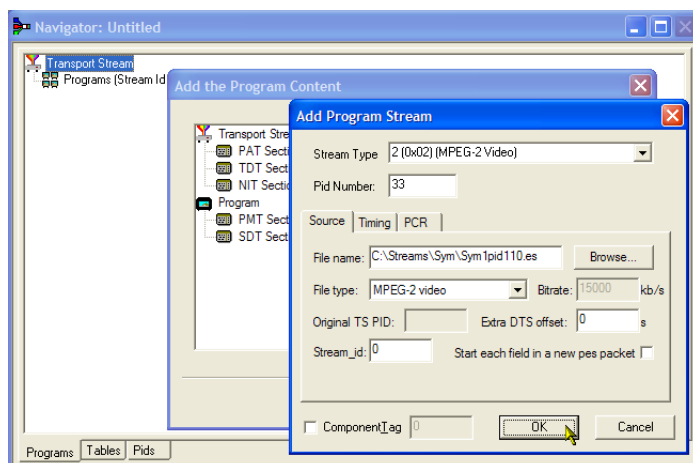
8. In the Add Service Description dialog box, select the **Add Service Description** check box.
9. Enter a **Service Provider Name**, for example, Tek Broadcasting.
10. Enter a **Service Name**, for example, Tek1.
11. Enter a **Service Type**, for example, 1 (0x1) (digital television service).
12. Select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



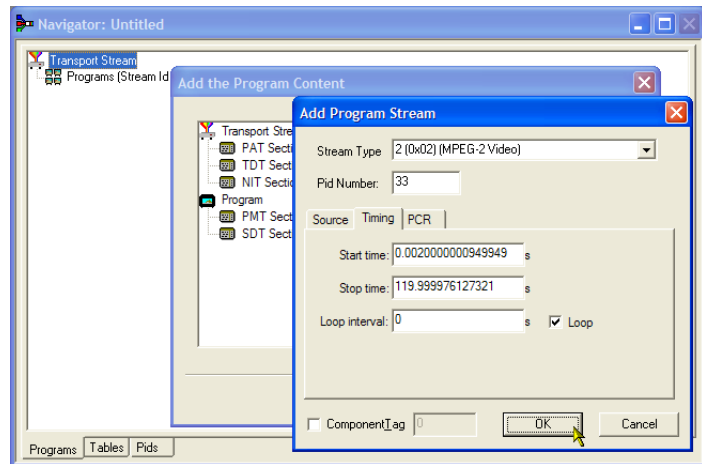
13. In the Add the Program Content dialog box, select **Add** to add a video elementary stream.



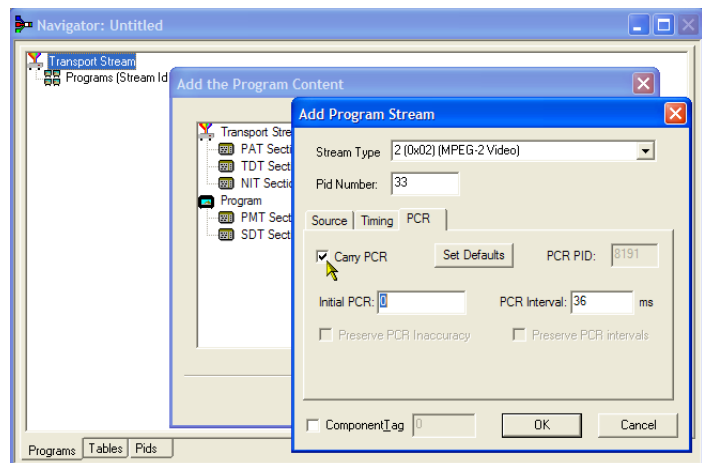
14. In the Add Program Stream dialog box, select 2 (0x02) (MPEG-2 Video) from the Stream Type drop-down list.
15. Ensure that the Source tab is selected.
16. Enter a File Name, or use **Browse** to locate the video elementary stream previously set up (Sym1pid110.es).
17. Select MPEG-2 video from the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



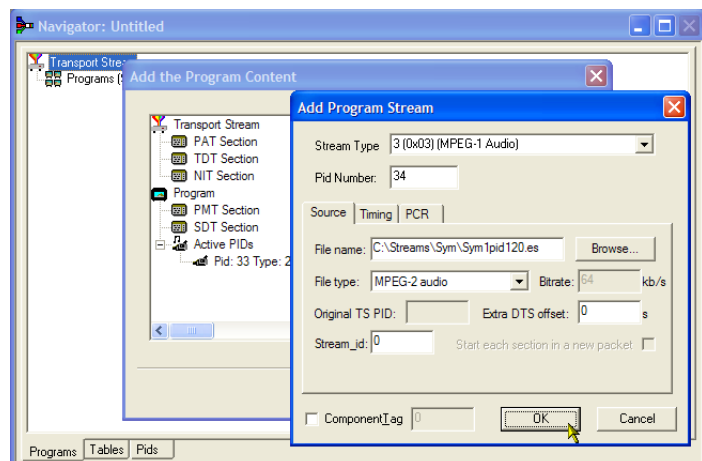
Select the Timing tab. Note that the elementary stream is going to run for the length of the stream previously set, that is, 120 s.



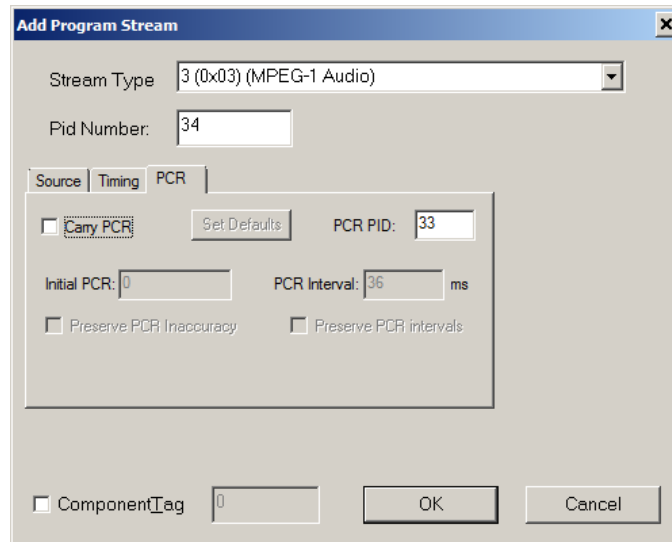
18. Select the PCR tab. Ensure that the **Carry PCR** check box is selected.



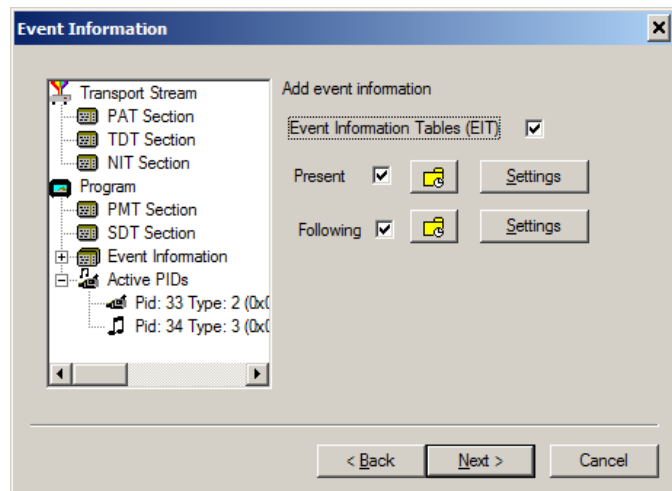
19. Select **OK** to close the Add Program Stream dialog box.
20. In the Add the Program Content dialog box, select **Add** again to add an audio elementary stream.
21. Select **3 (0x03) (MPEG-1 Audio)** from the Stream Type drop-down list.
22. In the Add Program Stream dialog box, ensure that the Source tab is selected.
23. Enter a File Name, or use the Browse button to locate the audio elementary stream previously set up (Sym1pid120.es).
24. Select **MPEG-2 audio** from the File type drop-down list. Note that the file bit rate has been entered automatically.



25. Select the **Timing** tab. Note that the elementary stream is going to run for the length of the stream previously set, that is, 120 s.
26. Select the **PCR** tab. Ensure that the Carry PCR check box is cleared.
27. Enter 33 in the PCR PID field. This is the PID that will carry the PCR information – also the video es, Carry PCR.
28. Select **OK** to close the Add Program Stream dialog box.
29. Select **Next**.



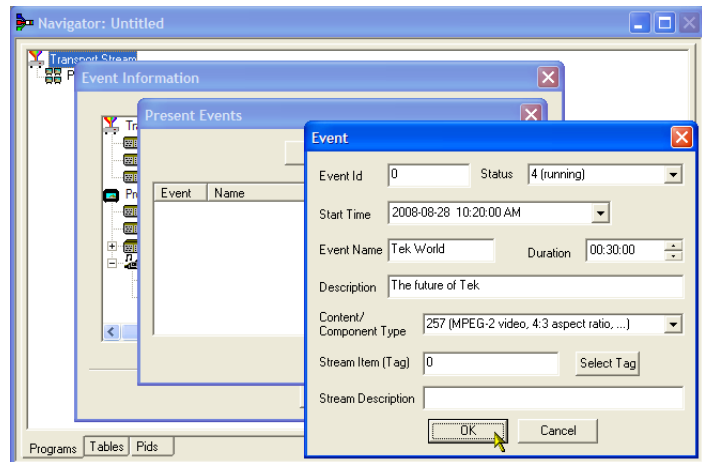
30. In the Event Information dialog box, select the Event Information Tables (EIT) check box.
31. Ensure that the Present check box is selected.
32. Select **Present Settings**.





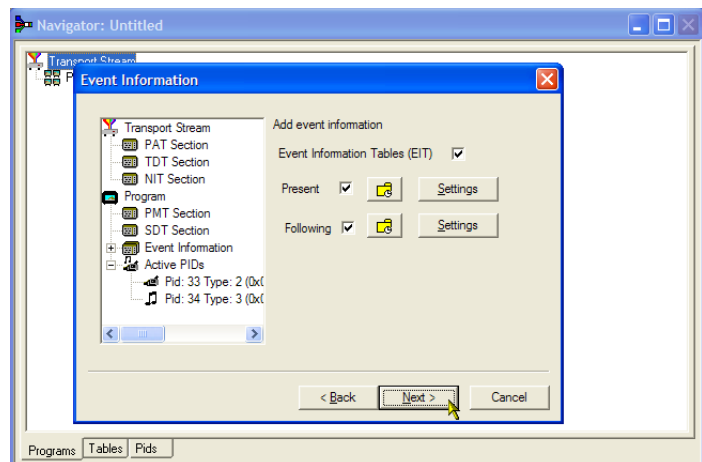
33. In the Present Events dialog box, select **Add** to set up the present event information, that is, the time of this broadcast. In the Event dialog box, select 4 (running) from the Status drop-down list.
34. Set the Start Time to 2008-08-28 10:20:00 AM.

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

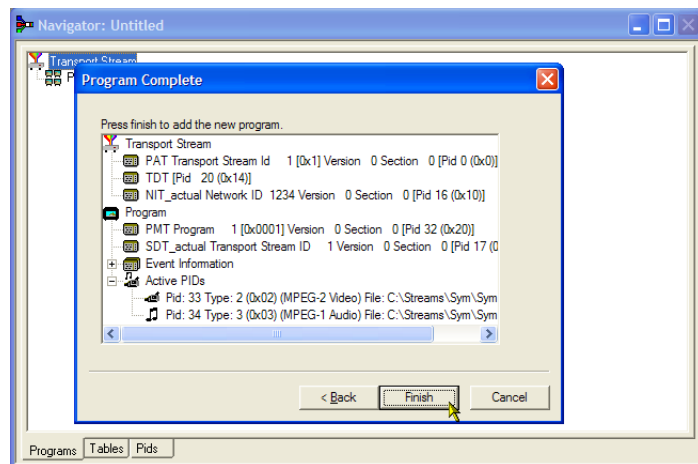


35. Enter an **Event Name**, for example, Tek World.
36. Enter a **Description**, for example, The future of Tek.
37. Enter a **Duration**, for example, 30m (00:30:00).
38. Select **257 (MPEG-2 video, 4:3 aspect ratio, ...)** from the Content/Component Type drop-down list.
39. Select **OK** to close the Event dialog box.
40. Select **OK** to close the Present Events dialog box.
41. Ensure that the **Following** check box is selected.

42. Select **Following Settings**.
43. Select **Add** to set up the following event information, that is, the event following the present event.
44. In the Event dialog box, enter 1 in the Event Id field.
45. Select **1 (not running)** from the Status drop-down list.
46. Set the Start Time to 2008-08-28 10:50:00 AM.
47. Enter an **Event Name**, for example, Tek News.



48. Enter a **Description** of the event, for example, All the latest news from Tek.
49. Enter a **Duration**, for example, 30 m (01:00:00).
50. Select **257 (MPEG-2 video, 4:3 aspect ratio, ...)** from the Content/Component Type drop-down list.
51. Select **OK** to close the Event dialog box.
52. Select **OK** to close the Following Events dialog box.
53. Select **Next** in the Event Information dialog screen.
54. In the Program Complete dialog box, select **Finish**.



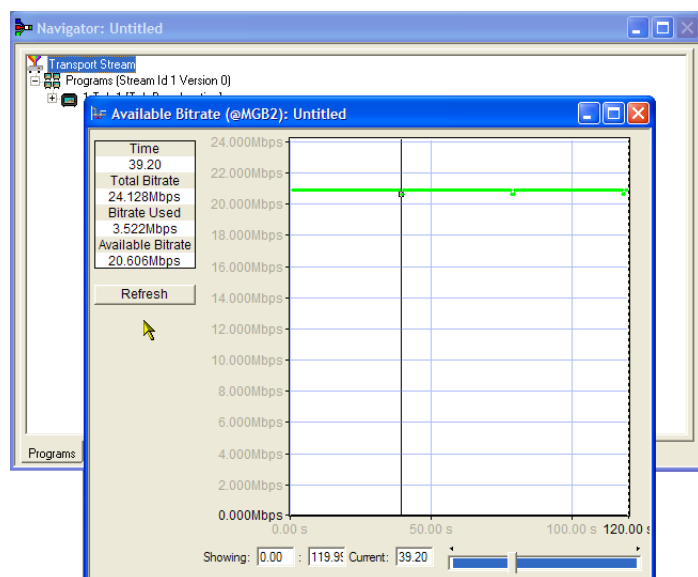
You have finished creating the structure and content of the proposed transport stream. You can now make a couple of checks to ensure that the stream will compile successfully.

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

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

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

56. Close the Available Bitrate graph.



57. Select **Multiplex > Start** to start the multiplex.
58. In the Set TS Output File... dialog box, enter the name TestMux.mpg for the new multiplexed transport stream. (This new transport stream is used in other procedures.)

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

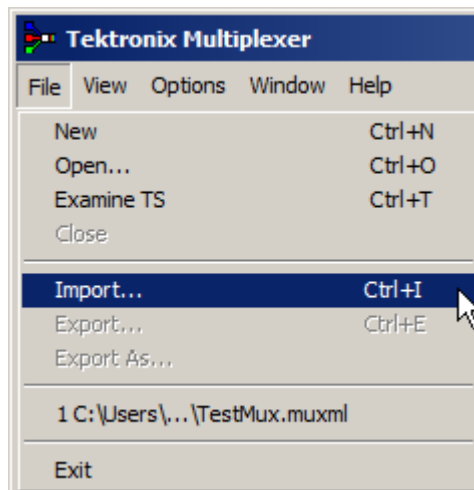
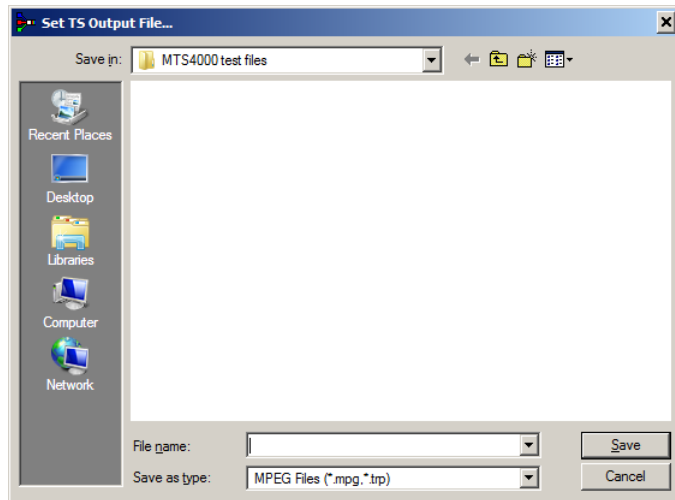
The elementary streams and structural information have now been multiplexed together to form the transport stream, TestMux.mpg.

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

60. Select **File > Export....**

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

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



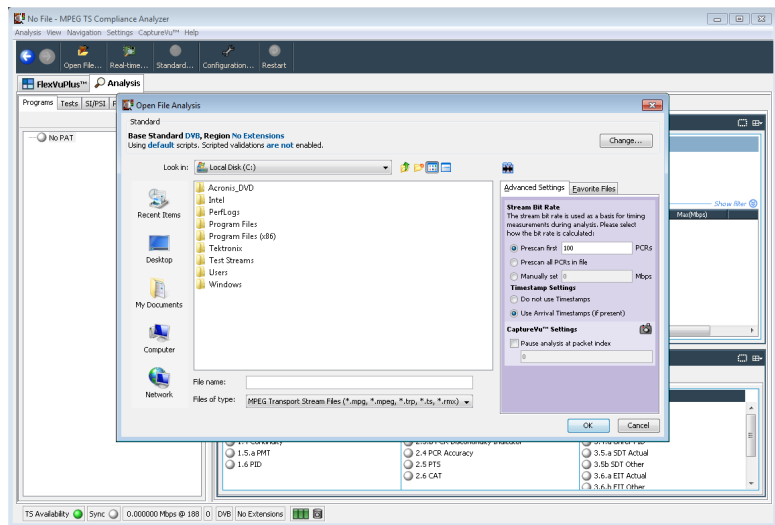
## Using the Transport Stream Compliance Analyzer

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

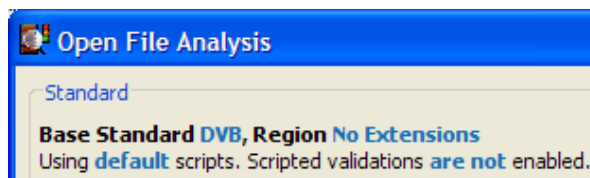
Use the Real-time Analysis to analyze live data. [Multiple input monitoring](#) on page 61

1. Open Transport Stream Compliance Analyzer. **Tektronix MTSA > TS Compliance Analyzer.**

The Open File Analysis dialog box displays automatically. If not, select **File Analysis** in the TSCA Analysis toolbar.

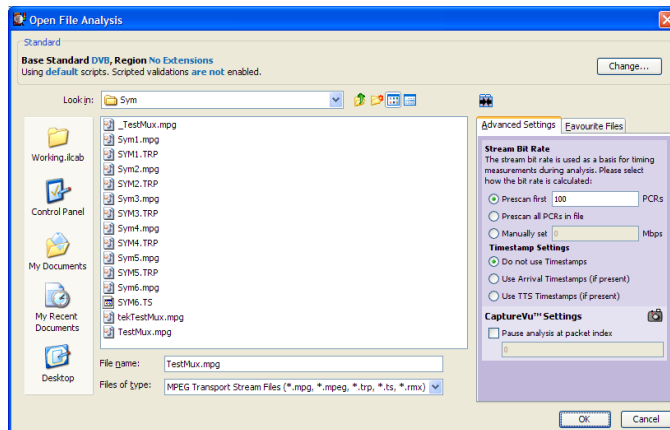


In the Open File Analysis dialog box, ensure that the Base Standard is DVB and the Region is No Extensions.

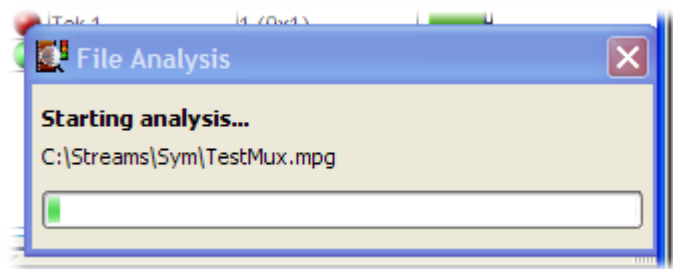


2. Locate and select the example stream, **TestMux.mpg**.

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



- The analysis will take a moment to complete.

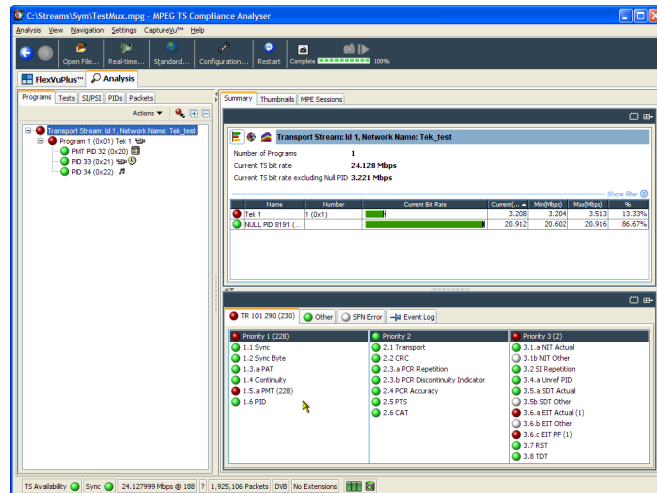


- Select the **Analysis** tab to display the navigation and related views.
- Select the **Programs** tab and expand the nodes in the navigation view by clicking the plus symbols.

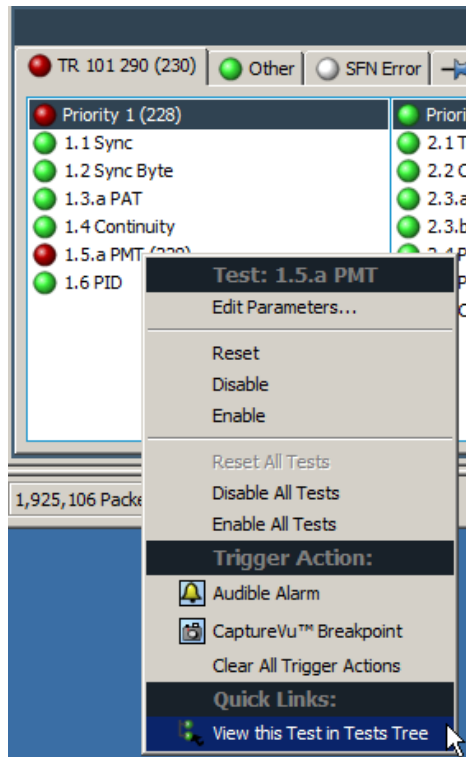
In the detail views, ensure that the Summary view and the Tests view are displayed.

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.

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

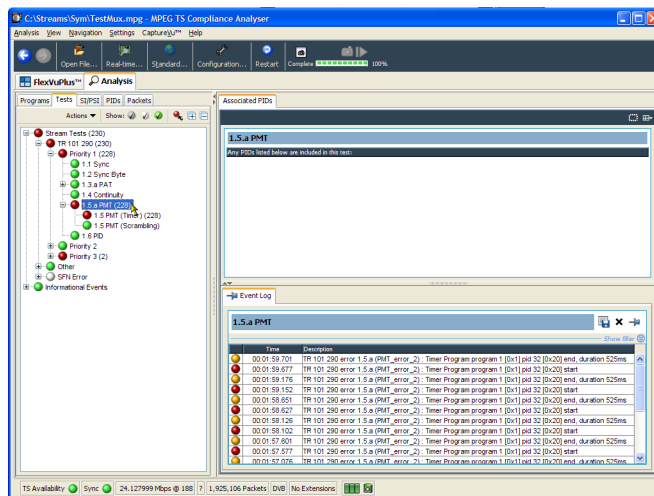


7. Highlight test 1.5.a PMT and select **View this test** in the Tests tree from the context menu.

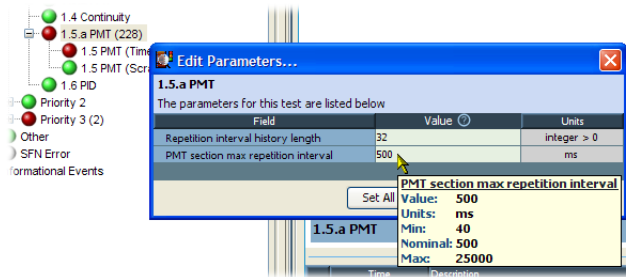


The Tests tab views are displayed. The navigation view is expanded to show the failed test. The detail view shows any PIDs associated with the highlighted test (none in this example) and the event log filtered to show only events for the highlighted test.

Examine the log entries for error information. Note that the error reports refer to a duration of 525 ms. This is the PMT section repetition rate; 525 ms was the value set in the example stream created earlier.



8. In the navigation view, highlight the 1.5 PMT (Timer) test and select **Edit Parameters** from the context menu.
9. In the Edit Parameters dialog box, note that for this stream the PMT section maximum repetition interval is set to 500 ms. Since the repetition rate found in this stream exceeds this value (525 ms), it is being reported as an error. However, by examining the maximum and minimum repetition rates shown in the Edit Parameters dialog box (hover the mouse pointer over the value field and refer to the tool tip), you can see that the rate of 525 ms is within the range recommended by the DVB standard, 40 ms to 25000 ms.

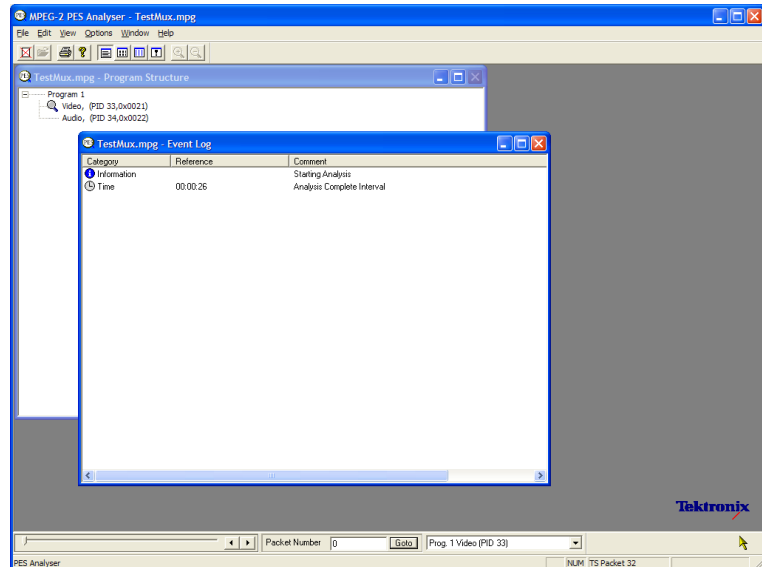


## Using the PES Analyzer

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

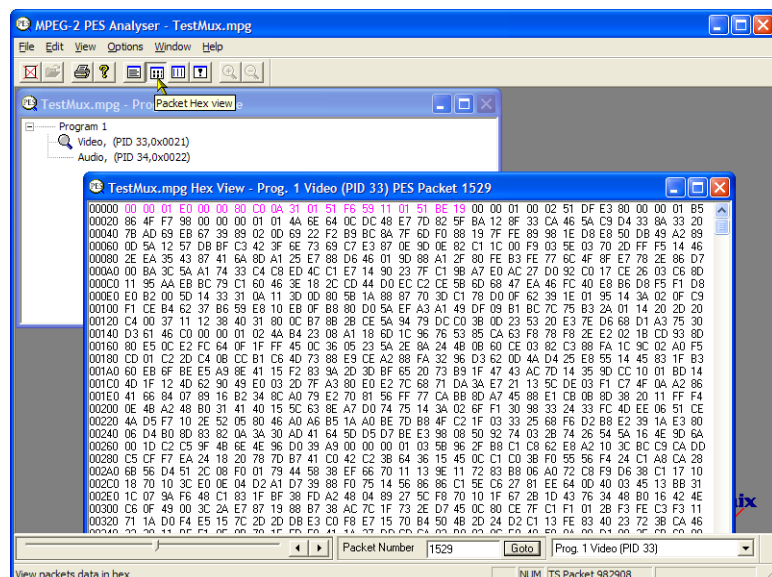
1. Open the PES Analyzer. **Tektronix MTSA > PES Analyzer**.
2. Select **File > Open**. Locate and open a transport stream. For example, the TestMux.mpg file created in the *Using the Multiplexer* procedure.

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



3. Select the video stream in the Program Structure view; the magnifying glass icon will indicate that it has been selected.
4. Open each view option in the View menu, that is, Event Log, Hex, Interpretation, and PTS/DTS Timing. Each action opens a new view in the PES Analyzer window. It may be useful to tile the views in the window using the **Window > Tile** option.

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

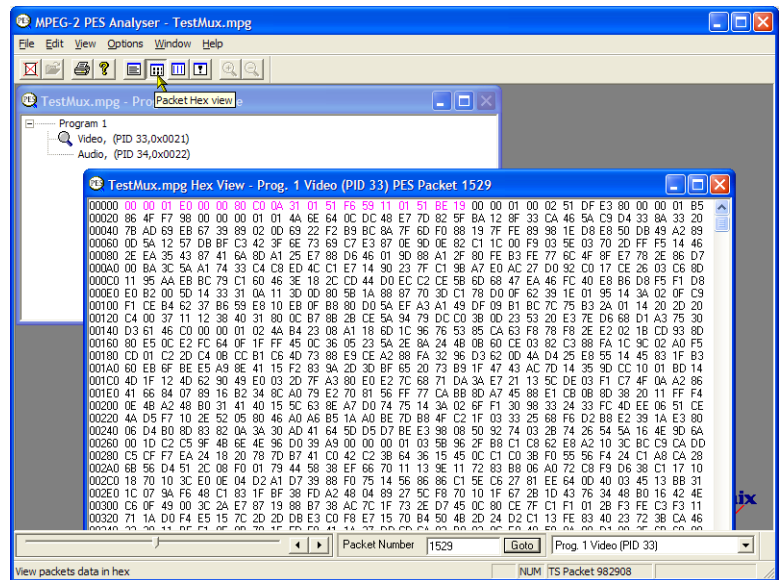




### Packet Hex View:

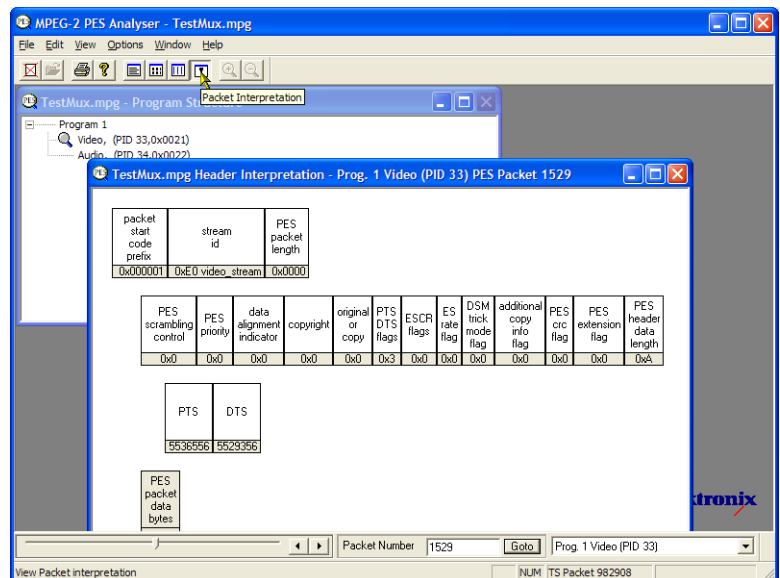
In this view, you can examine every byte in the PES.

- The four digit numbers in the left column are the addresses of the first byte in the row.
- The bytes displayed in magenta represent the PES packet header. You can view this as a graphical representation in the Packet Interpretation view.



### Packet Interpretation View:

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

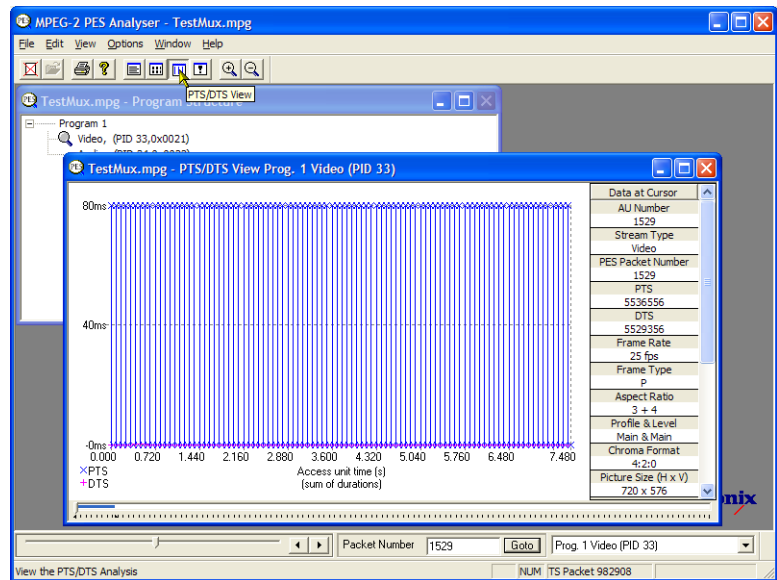


**PTS/DTS View:**

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

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

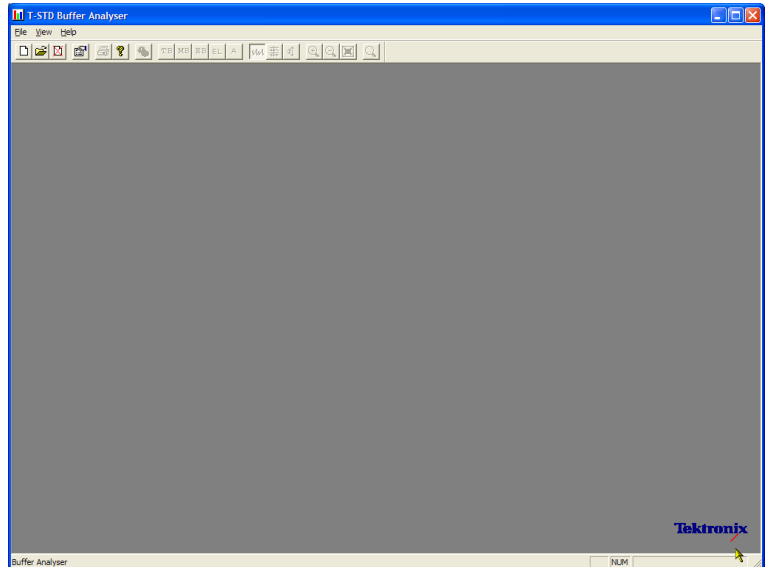
Select the toolbar magnifying glass and click on the view to zoom in and out of the graph. The slider at the bottom of this window indicates where the displayed packets are in relation to the rest of the file.



## Using the T-STD Buffer Analyzer

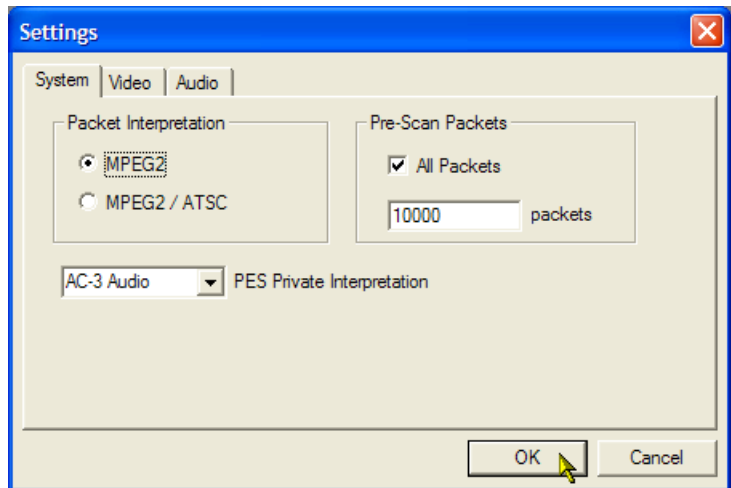
The T-STD Buffer Analyzer application models the behavior of the buffers in the hypothetical Transport Stream System Target Decoder, as specified in ISO/IEC 13818-1. It can process video, audio, and system control streams. The results of the analysis are displayed as graphs of the buffer capacity over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

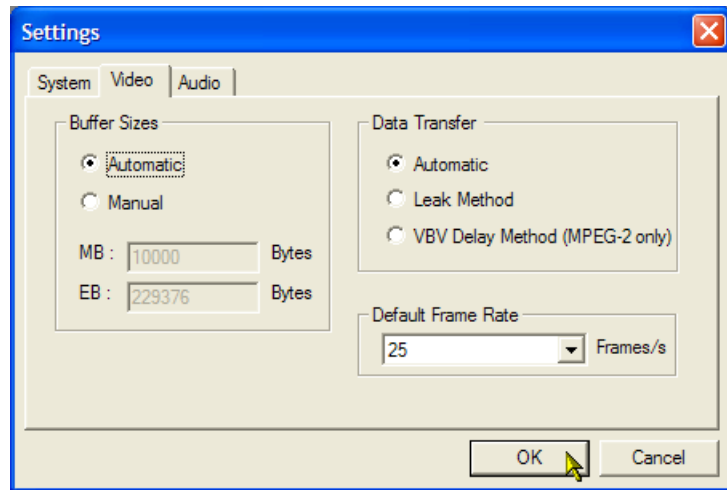


2. Review the configuration settings. **View > Settings.**

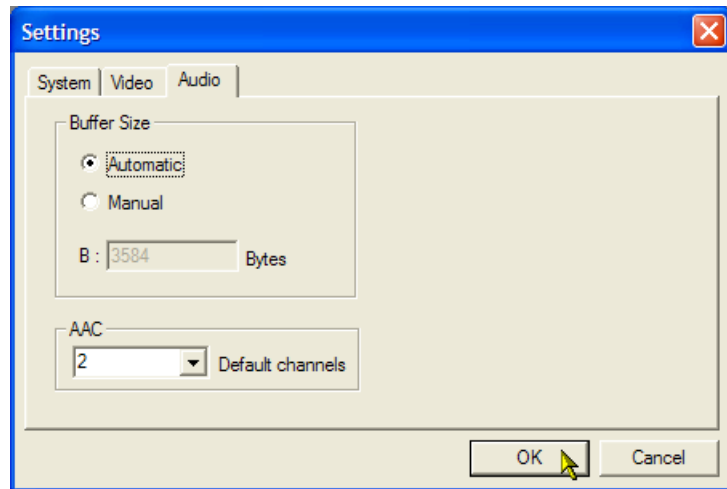
In the System tab of the Settings dialog box, select **MPEG2 Packet Interpretation** and select **Pre-Scan Packets All Packets**.



3. In the **Video** tab, select **Buffer Sizes**, **Automatic** and **Data Transfer**, **Automatic**.



4. In the **Audio** tab, select **Buffer Size**, **Automatic**.
5. Close the **Settings** dialog box.

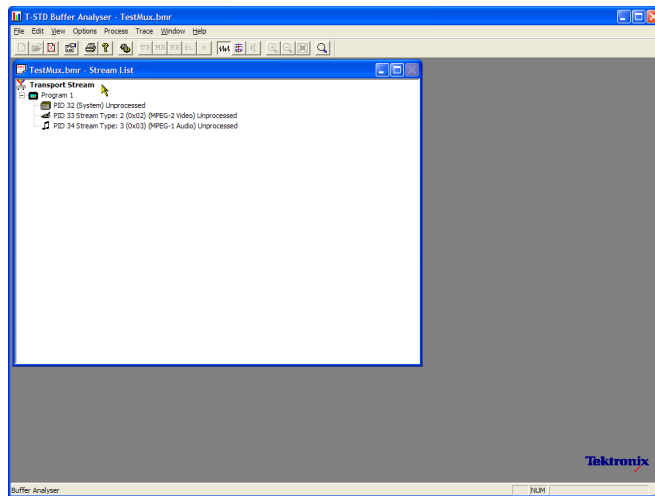


6. Select a file for analysis. **File > New.**
7. Locate and open an MPEG file. For example, the TestMux.mpg file created in the *Using the Multiplexer* procedure.

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

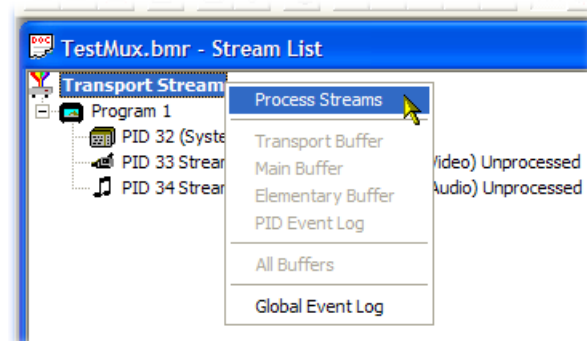
Accept the default name and open the file.

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



8. Select **Process Streams** from the transport stream context menu to start processing the stream.

Analysis progress is displayed in the status bar.



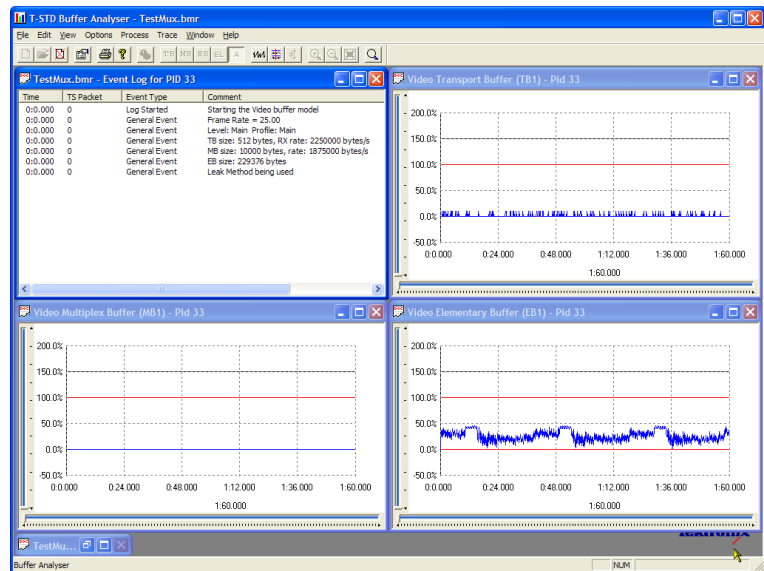
9. Highlight PID 33 and select **All Buffers** from the context menu.

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

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

#### PID Event Log:

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



In the following buffer graph views:

- Use the toolbar magnifying glass icons to zoom in and out of the selected graph. Zoom value can be reset using the Reset Zoom toolbar button.
- All open graphs can be viewed and manipulated separately. Use the Options > Synchronize Views to synchronize all views with the currently selected view.
- Red y-axis lines indicate the 0% and 100% limits.

#### Video Multiplex / Main Buffer:

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

#### Video Transport Buffer:

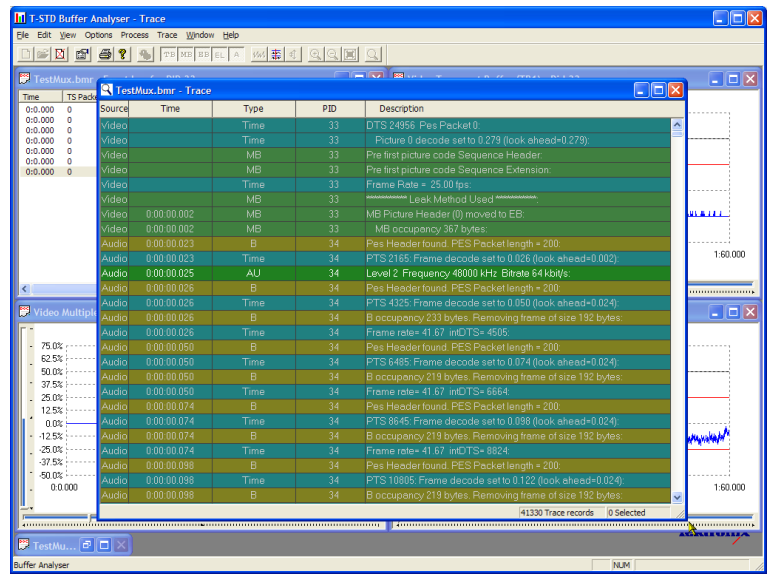
This view shows results of modeling the transport buffer for video, audio, or system control streams.

#### Video Elementary Buffer:

This view shows only applicable video elementary streams.

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

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



## Using the ES Analyzer

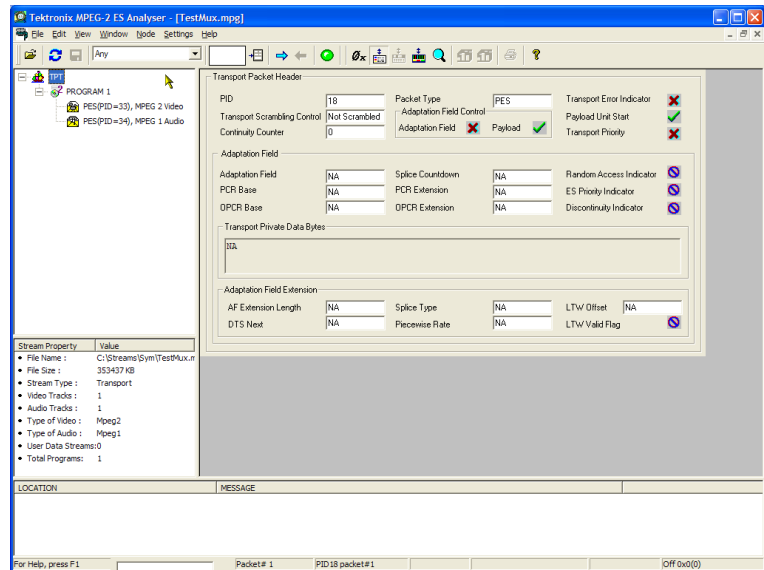
The ES (Elementary Stream) Analyzer application checks for compliance of CODECs to MPEG-2 and H.263 standards. Audio decode and waveform display of MPEG-2 audio (ISO/IEC 13818 parts 3 and 7), AC-3 and MPEG-4 AAC are also supported.

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

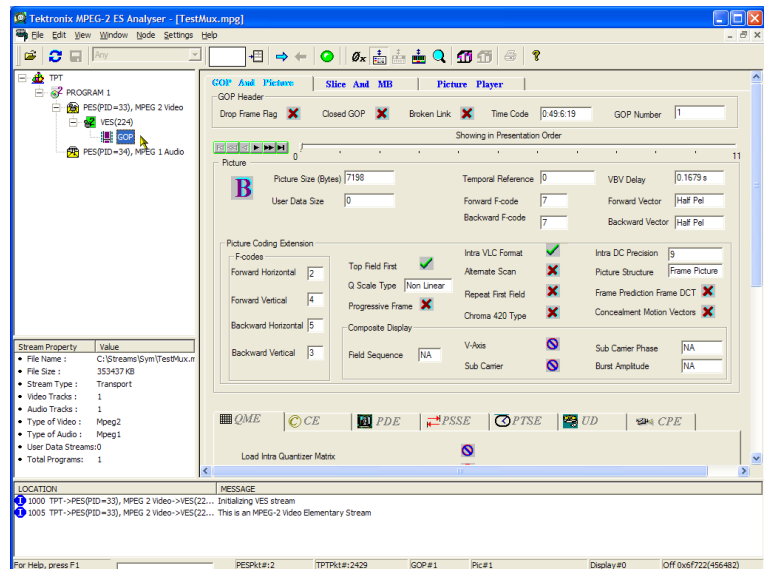
1. Open the ES Analyzer. **Tektronix MTSA > ES Analyzer.**

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

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

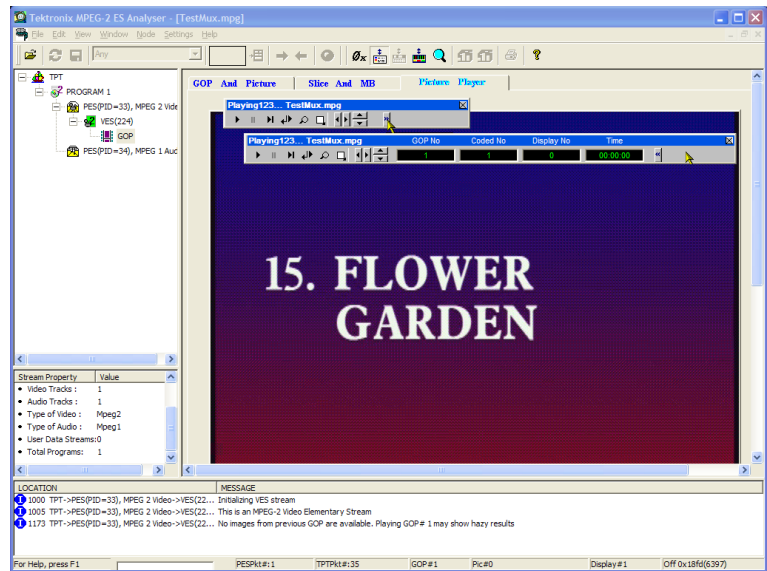


3. Click on each successive node in the navigation window until the GOP (Group of Pictures) is highlighted in the Program 1 / PES (PID 33), MPEG 2 Video branch.



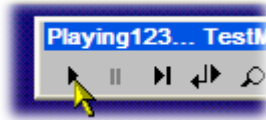


4. Select the Picture Player tab. Note that the Picture Player remote control is displayed.
5. Click the Show Information button to expand the control bar. The extra information shows the position in the file of the displayed picture; more information is shown in the status bar.

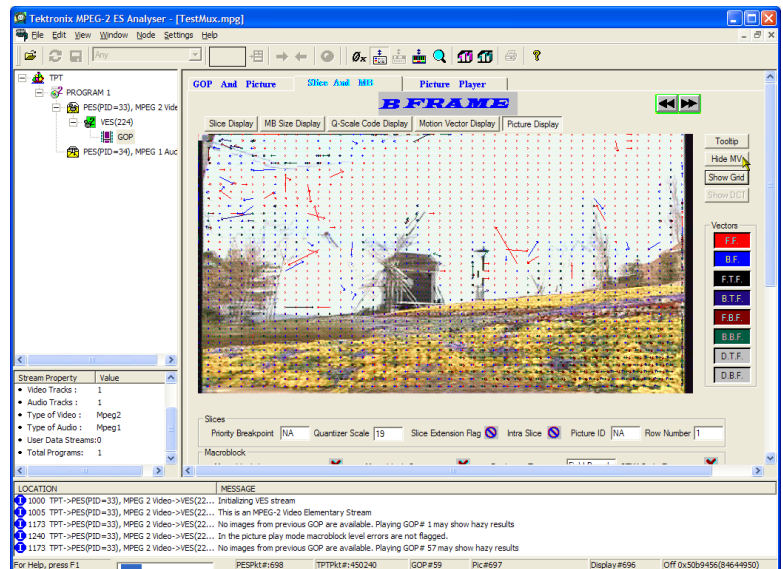


6. Start playing the stream by clicking the play button on the control bar.

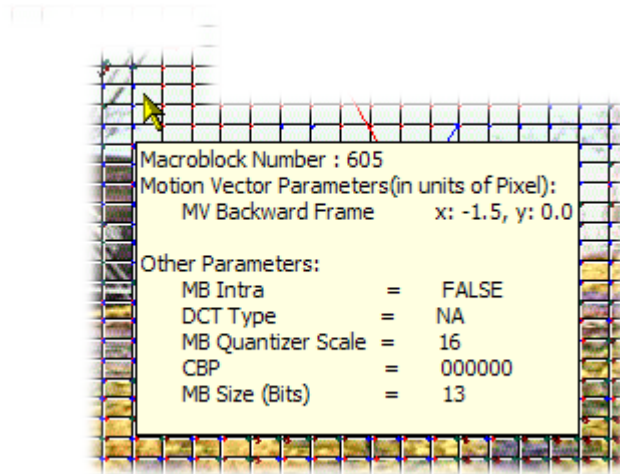
If you stop the payout, you can select the other GOP tabs (GOP and Picture, Slice and MB), and examine the characteristics of that frame.



7. For example, select the **Picture Display** on the **Slice and MB** tab. The picture will correspond to the picture in the Picture Player.
8. Click **Show MV** (motion vectors) on the right of the picture display. For B and P frames, the motion vectors will be displayed as colored arrows overlaying the picture.



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



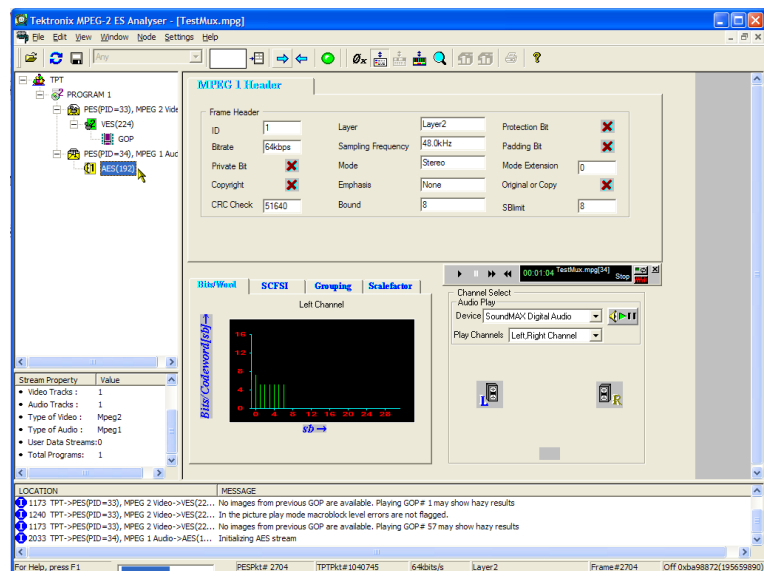
9. Use the Previous Frame and Next Frame buttons to move backward and forwards in the stream and compare the motion vectors.



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

10. Click on each successive node in the navigation window until the GOP (Group of Pictures) is highlighted in the Program 1/PES (PID 34), MPEG 1 Audio branch.

Use the audio control bar to review the audio track. You will need to use headphones to hear the output.

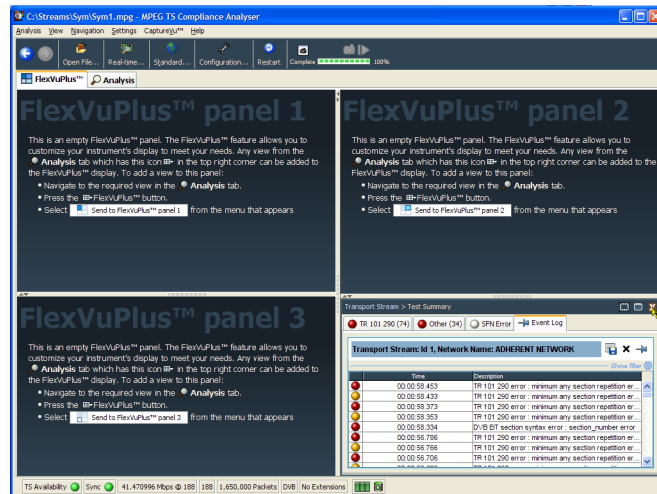


## TSCA FlexVuPlus display

In the Transport Stream Compliance Analyzer (TSCA), you can use the FlexVuPlus™ display to select up to four views from the analysis detail views to be displayed together to facilitate basic transport stream monitoring or more detailed diagnostic monitoring.

For this exercise, close each of the currently displayed FlexVuPlus 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 FlexVuPlus panels is numbered.



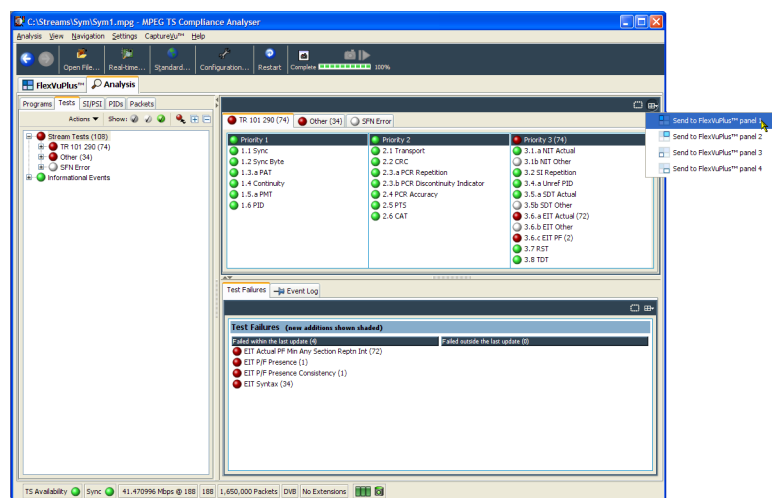
### Set up panel 1

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

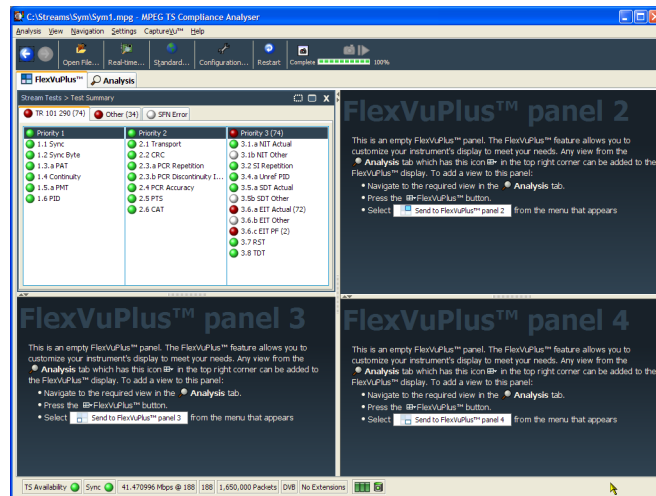


In the top right corner of all detail views is a FlexVuPlus panel select button. You can use this button to display a replica of the detail view in the selected FlexVuPlus panel.

2. In the Test Summary view, use the FlexVuPlus panel select button to replicate the view in panel 1.

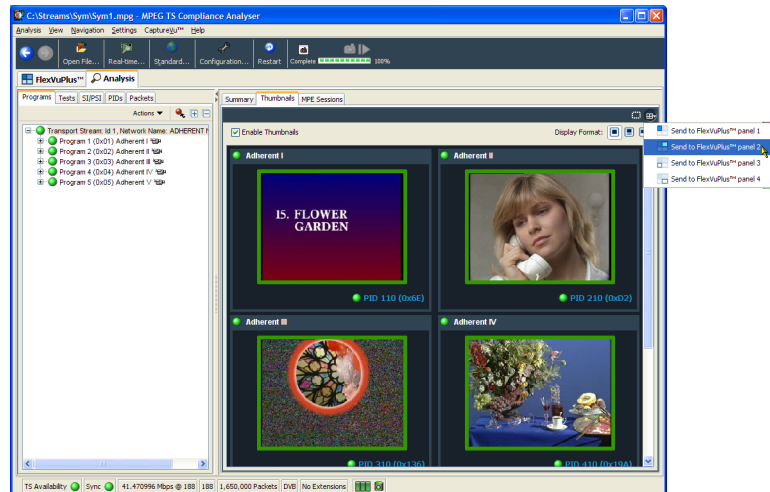


- The FlexVuPlus display now contains the Test Summary view in panel 1.

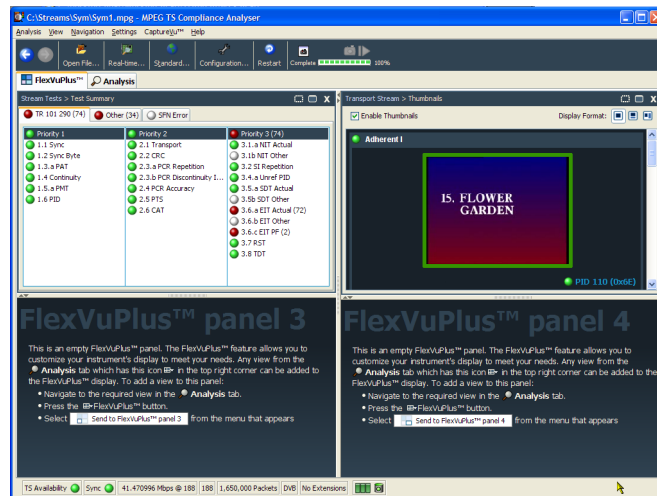


### Set up panel 2.

- Select the **Analysis** tab and then the **Programs** tab.
- In the **Thumbnails** view, use the FlexVuPlus panel select button to replicate the view in panel 2.

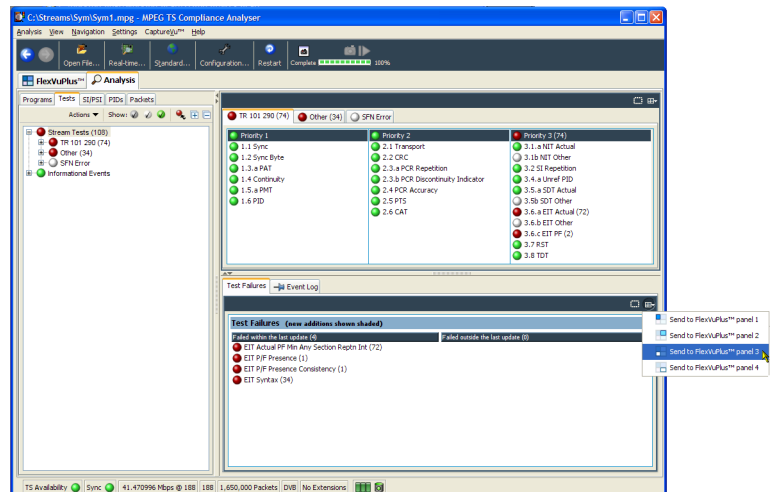


6. The FlexVuPlus display now contains the Thumbnail view in panel 2.

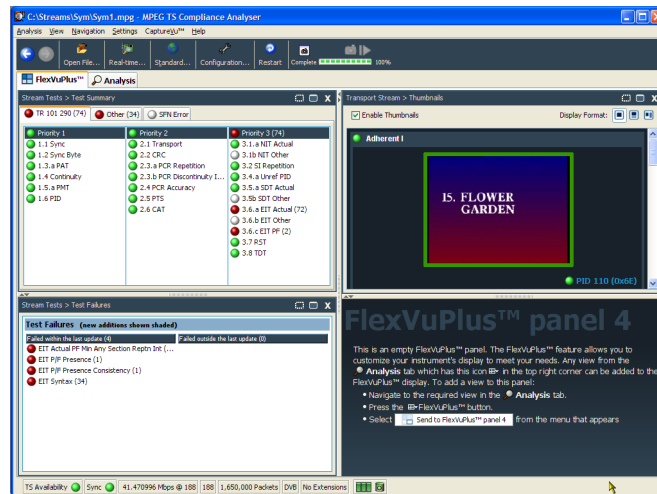


### Set up panel 3.

7. Select the **Analysis** tab and then the **Tests** tab.
8. In the **Test Failures** view, use the FlexVuPlus panel select button to replicate the view in panel 3.



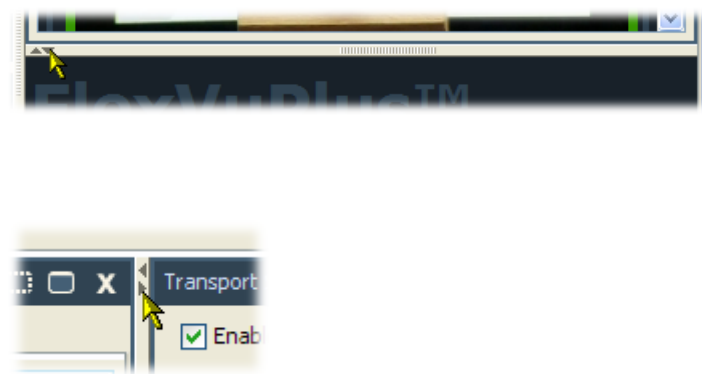
9. The FlexVuPlus display now contains the Test Failures view in panel 3.



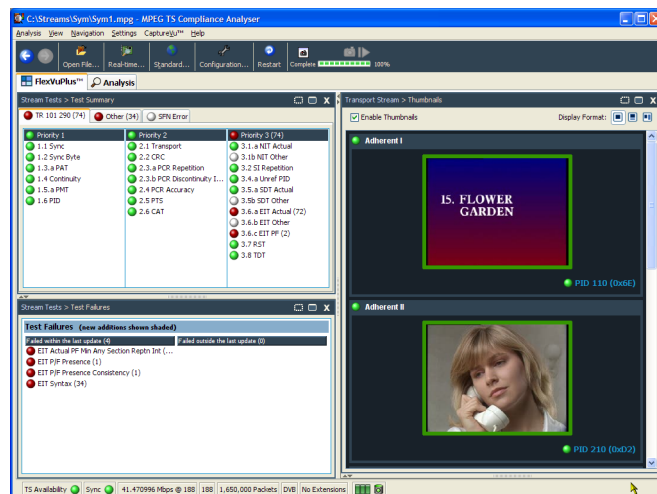
Since only three panels are used in this example, you can expand the thumbnails view to fill the right side of FlexVuPlus™.

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 FlexVuPlus basic monitoring view.



To summarize, in this view you can immediately see the following:

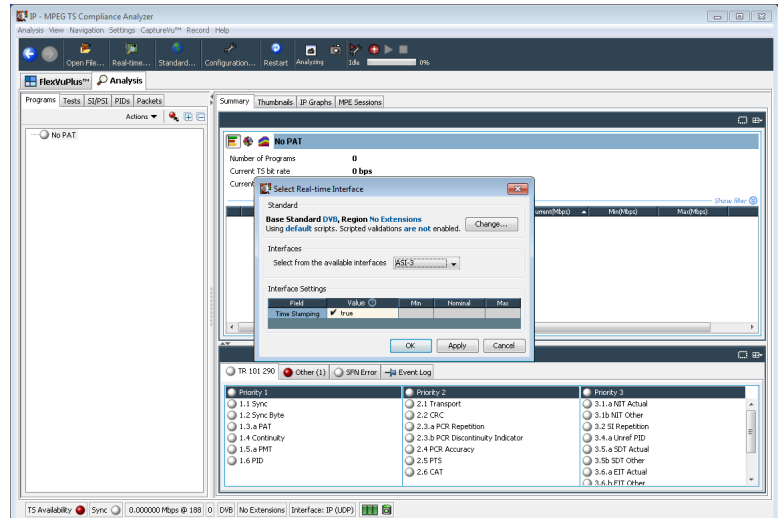
- In the Tests Summary view (FlexVuPlus panel 1), which tests have failed.
- In the Test Failures view (FlexVuPlus panel 3), which tests have failed most recently.
- In the Thumbnails view (FlexVuPlus panel 2), which elementary streams are currently carrying video content.

## Multiple input monitoring

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

1. Open Transport Stream Compliance Analyzer. **Tektronix MTSA > TS Compliance Analyzer.**

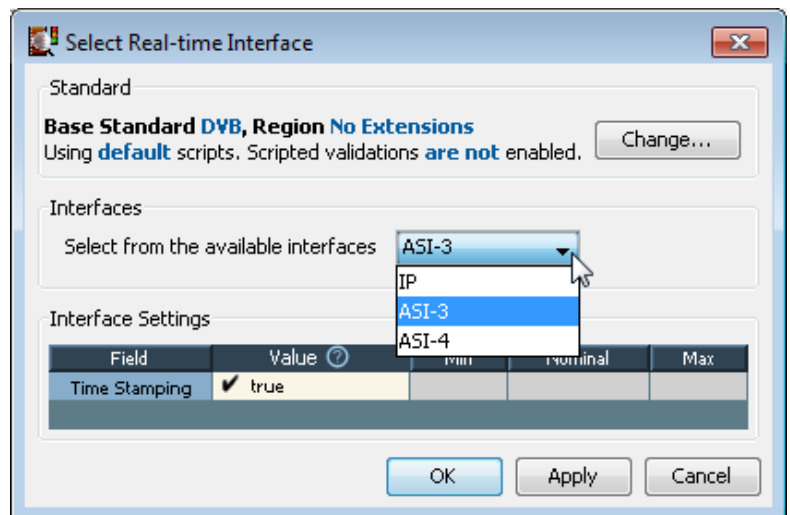
Select **Real-time Analysis...** in the TSCA Analysis toolbar.



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

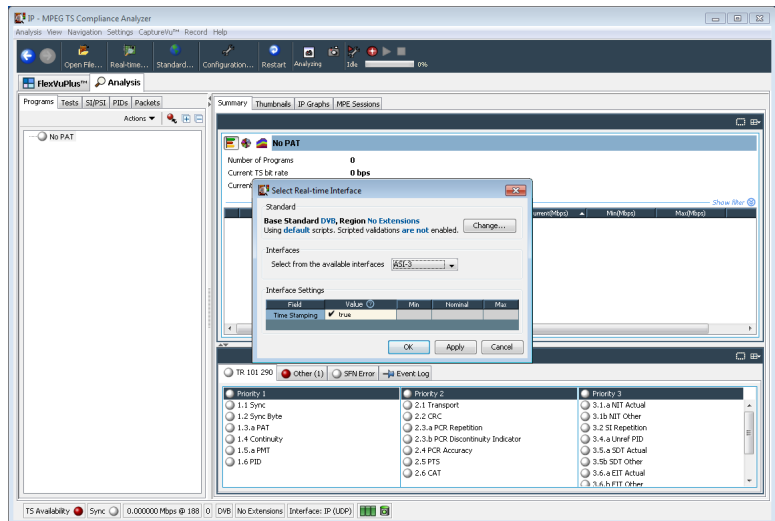
In the example the, ASI-3 input is selected to monitor for this instance of the TS Compliance Analyzer application.

The choices available are dependent on the available optional inputs.



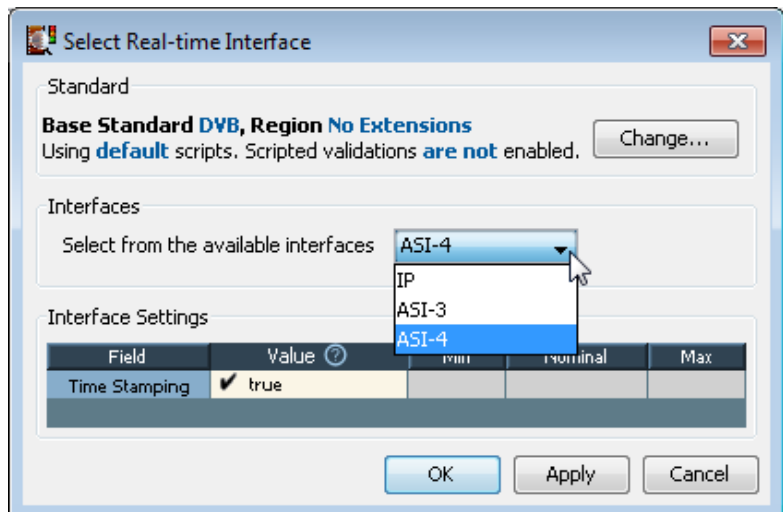
- Open a second instance of the Transport Stream Compliance Analyzer. **Tektronix MTSA > TS Compliance Analyzer.**

Select **Real-time Analysis...** in the TSCA Analysis toolbar.



- In the Select Real-time Interface dialog screen, select an available input from the Interfaces pull-down menu.

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





# Accessories

## Standard accessories

The following table lists the standard accessories that are shipped with the MTSA-HW instrument and MTSA-PC software:

Description	Part number	MTSA-HW	MTSA-PC
Compliance certificate	001-1180-XX	■	■
MTSA-HW and MTSA-PC Quick Start User Manual	071-3661-XX	■	■
Supplemental information sheet; China ROHS	071-2185-XX	■	■
Hardware key (dongle), USB	NA		■
Power Cord (one of the following options) <ul style="list-style-type: none"><li>■ Option A0 – North America</li><li>■ Option A1 – Universal Euro</li><li>■ Option A2 – United Kingdom</li><li>■ Option A3 – Australia</li><li>■ Option A4 – North America 240 V</li><li>■ Option A5 – Switzerland</li><li>■ Option A6 – Japan</li><li>■ Option A10 – China</li><li>■ Option A11 – India</li><li>■ Option A99 – No power cord</li></ul>	NA	■	

## Options and upgrades

### Options

The following table lists the available hardware and software options that you can order with the MTSA-HW and MTSA-PC systems. Accessories included with the options are also listed.

Option		Description
Hardware options	MTSA-HW ASI	Add multiport ASI interface.
	MTSA-HW 10GS	Add 10 Gbase-SR dual optical port 10 Gb/s NIC. Includes short reach SFP+ modules (850 nm).
	MTSA-HW SDR	Add multifunction SDR RF interface with support for DVB-T, ISDB-T/Tb, QAM A/B/ C and 8VSB. Includes level, BER, MER, constellation points.
	MTSA-HW DS2	Add dual input DVB-S/S2 interface. Card supports dual port QPSK/8PSK or single port 16APSK/32APSK demodulation. Includes level, BER, MER, SNR, constellation points.
	MTSA-HW RACK	Add MTSA rackmount kit. Includes the rackmount slides and rails
Software Options	MTSA-HW TSCA MTSA-PC TSCA	Add real and deferred time Transport Stream Compliance Analyzer. Includes real and deferred time TSCA for MPEG-2, ATSC1.0, DVB, ISDB-S, ISDB-T, ISDB-TB. Carousel analysis and compliance for MPEG-2, DSM-CC, DVB (INC. MHP), DTT (MHEG-5), ARIB. Closed Caption analysis, rendering and alignment to CEA608, CEA708 and SCTE20/21 control commands.
	MTSA-HW MUX MTSA-PC MUX	Add Stream Multiplexer and Generator. Includes TS and ISDB-T/Tb Multiplexer, ISDB-T Remux, TS Editor, Make Seamless, Carousel Generator, and Tclips Test Streams; also includes HEVC stream generation capabilities.
	MTSA-HW ESA MTSA-PC ESA	Add elementary stream analyzer. Includes support for VC1, AVC/H.264, MPEG-4, MPEG-2, H.263, HEVC/H.265. Closed Caption analysis, rendering and alignment to CEA608, CEA708 and SCTE20/21 control commands.
	MTSA-HW PBUFFA MTSA-PC PBUFFA	Add PES and T-STD Buffer Analyzers. Includes HEVC buffer analysis and PES with AVC, HEVC and AC-3 codec analysis.
	MTSA-HW PQ MTSA-PC PQ	Add Picture Quality Analysis Software, Single and Double Ended. Includes the PQA software with Option ESA to enable conversion of VC1, AVC/H.264, HEVC/H.265 source files to YUV for PQ Analysis.
	MTSA-HW ALZRPK MTSA-PC ALZRPK	Add Analyzer Software Bundle. Includes TSCA, ESA, MUX and PBUFFA.
	MTSA-HW FLT MTSA-PC FLT	Add floating license (all floating licenses include the same capabilities as purchased); for multiple licenses, order multiple Option FLT.

## MTSA-UP upgrade kits

The MTSA-UP upgrade kits are available to enhance the capabilities of the instrument and software after you purchase an MTSA-HW or MTSA-PC system. Kits may contain software, hardware, or both.

Option		Description
MTSA-UP hardware upgrades	MTSA-UP ASI	Add multiport ASI interface.
	MTSA-UP 10GS	Add 10Gbase-SR dual optical port 10Gb/s NIC. Includes short reach SFP+ modules (850 nm).
	MTSA-UP SDR	Add multifunction SDR RF interface with support for DVB-T, ISDB-T/Tb, QAM A/B/ C and 8VSB. Includes level, BER, MER, constellation points.
	MTSA-UP DS2	Add dual input DVB-S/S2 interface. Card supports dual port QPSK/8PSK or single port 16APSK/32APSK demodulation. Includes level, BER, MER, SNR, constellation points.
	MTSA-UP RACK	Add MTSA rackmount kit. Includes rackmount slides and rails

Option		Description
MTSA-UP software upgrades	MTSA-UP TSCA	Add real and deferred time Transport Stream Compliance Analyzer. Includes real and deferred time TSCA for MPEG-2, ATSC1.0, DVB, ISDB-S, ISDB-T, ISDB-TB. Carousel analysis and compliance for MPEG-2, DSM-CC, DVB (INC. MHP), DTT (MHEG-5), ARIB. Closed Caption analysis, rendering and alignment to CEA608, CEA708 and SCTE20/21 control commands.
	MTSA-UP MUX	Add Stream Multiplexer and Generator. Includes TS and ISDB-T/Tb Multiplexer, ISDB-T Remux, TS Editor, Make Seamless, Carousel Generator, and Tclips Test Streams; also includes HEVC stream generation capabilities.
	MTSA-UP ESA	Add elementary stream analyzer. Includes support for VC1, AVC/H.264, MPEG-4, MPEG-2, H.263, HEVC/H.265. Closed Caption analysis, rendering and alignment to CEA608, CEA708 and SCTE20/21 control commands.
	MTSA-UP PBUFFA	Add PES and T-STD Buffer Analyzers. Includes HEVC buffer analysis and PES with AVC, HEVC and AC-3 codec analysis.
	MTSA-UP PQ	Add Picture Quality Analysis Software, Single and Double Ended. Includes the PQA software with Option ESA to enable conversion of VC1, AVC/H.264, HEVC/H.265 source files to YUV for PQ Analysis.
	MTSA-UP ALZRPK	Add Analyzer Software Bundle. Includes TSCA, ESA, MUX and PBUFFA.
	MTSA-UP FLT	Add floating license (all floating licenses include the same capabilities as purchased); for multiple licenses, order multiple Option FLT.



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# User maintenance

This section describes general care and service procedures for the MTSA-HW instrument.

- *Preventive maintenance* provides cleaning instructions
- *In case of problems* provides some hints for troubleshooting startup errors
- *Returning the instrument for service* gives instructions for repacking and shipping the instrument

## General care

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



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

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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.



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**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.*

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

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## 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 MTSA-HW system provided in this section can help you isolate problems. For a performance verification procedure, refer to the *MTSA-HW Specifications and Performance Verification Technical Reference*.

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 MTSA-HW system software from starting.

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

Symptom	Possible causes and recommended actions
Instrument does not power on	Verify that the power cord is connected to the instrument and to the power source. Check that the instrument receives power when you push the On/Standby switch; check that fan starts. Check that power is available at the power source. Contact your local Tektronix service center.
Instrument powers on but does not complete the power-on sequence	Make sure instrument boots from the hard disk drive.
Power-on diagnostics fail	Contact your local Tektronix service center.
Instrument does not recognize accessories such as external monitor, printer, or keyboard	Check that accessories are properly connected or installed. Contact your local Tektronix service center.
Instrument will not power off with On/Standby switch	Try powering off the instrument using the Windows 10 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 MTSA-HW instrument 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 [GUID-78BED516-B6F8-4C93-8038-172CF5428567#GUID-78BED516-B6F8-4C93-8038-172CF5428567](#).

If you suspect networking problems, see [Network troubleshooting](#) on page 8.

## 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 MTSA-HW system, so you should contact your local Tektronix Service representative if you have a hardware problem.

## Returning the instrument for service

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

1. Seal the shipping carton with an industrial stapler or strapping tape. Before returning the instrument for service, contact the Service Center to get an RMA (return material authorization) number, and any return or shipping information you may need.
2. If the instrument is being shipped to a Tektronix Service Center, enclose the following information:
  - The RMA number.
  - The owner's address.
  - Name and phone number of a contact person.
  - Type and serial number of the instrument.
  - Reason for returning.
  - A complete description of the required service.
3. Mark the address of the Tektronix Service Center and the return address on the shipping carton in two prominent locations.





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