

MTS400P
MPEG Test System
Quick Start User Manual



MTS400P
MPEG Test System
Quick Start User Manual

Copyright © Tektronix. All rights reserved. Licensed software products are owned by Tektronix or its subsidiaries or suppliers, and are protected by national copyright laws and international treaty provisions.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specifications and price change privileges reserved.

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.

Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

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

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

[W2 – 15AUG04]

Warranty

Tektronix warrants that the media on which this software product is furnished and the encoding of the programs on the media will be free from defects in materials and workmanship for a period of three (3) months from the date of shipment. If any such medium or encoding proves defective during the warranty period, Tektronix will provide a replacement in exchange for the defective medium. Except as to the media on which this software product is furnished, this software product is provided "as is" without warranty of any kind, either express or implied. Tektronix does not warrant that the functions contained in this software product will meet Customer's requirements or that the operation of the programs will be uninterrupted or error-free.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period. If Tektronix is unable to provide a replacement that is free from defects in materials and workmanship within a reasonable time thereafter, Customer may terminate the license for this software product and return this software product and any associated materials for credit or refund.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPLACE DEFECTIVE MEDIA OR REFUND CUSTOMER'S PAYMENT IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

[W9b – 15AUG04]

IMPORTANT

READ BEFORE OPERATING EQUIPMENT

This software is provided under license from Tektronix, Inc. Retention of this program for more than thirty (30) days or use of the program in any manner constitutes acceptance of the license terms.

CAREFULLY READ THE ENCLOSED SOFTWARE LICENSE AGREEMENT. If you cannot agree to the license terms, promptly contact the nearest Tektronix Field Office for return assistance.

TEKTRONIX SOFTWARE LICENSE AGREEMENT

THE PROGRAM, OR PROGRAMS, ENCODED OR INCORPORATED WITHIN EQUIPMENT, IS FURNISHED SUBJECT TO THE TERMS AND CONDITIONS OF THIS AGREEMENT. RETENTION OF THE PROGRAM FOR MORE THAN THIRTY DAYS OR USE OF THE PROGRAM IN ANY MANNER WILL BE CONSIDERED ACCEPTANCE OF THE AGREEMENT TERMS. IF THESE TERMS ARE NOT ACCEPTABLE, THE UNUSED PROGRAM AND ANY ACCOMPANYING DOCUMENTATION SHOULD BE RETURNED PROMPTLY TO TEKTRONIX FOR A FULL REFUND OF THE LICENSE FEE PAID. (FOR INFORMATION REGARDING THE RETURN OF PROGRAMS ENCODED OR INCORPORATED WITHIN EQUIPMENT, CONTACT THE NEAREST TEKTRONIX SALES OFFICE.)

DEFINITIONS. "Tektronix" means Tektronix, Inc., an Oregon corporation, or local Tektronix' legal entity that is supplying the equipment.

"Program" means the Tektronix software product (executable program and/or data) enclosed with this Agreement or included within the equipment with which this Agreement is packed.

"Customer" means the person or organization in whose name the Program was ordered.

LICENSE. Customer may:

- a. Use the Program on a single machine at any one time;
- b. If the Program is provided in connection with a floating-user license, the Program may be used on multiple machines provided that the user is authorized, and the total number of users at any one time does not exceed the total number of licensed concurrent users;
- c. Modify the Program or merge it with another for use on the single machine; and
- d. Copy the Program for archival or backup purposes, provided that no more than one (1) such copy is permitted to exist at any one time. If the Program is provided in connection with a floating-user license, the Program may be copied onto multiple machines for use by authorized users.

Each copy of the Program made by Customer must include a reproduction of any copyright notice or restrictive rights legend appearing in or on the copy of the Program as received from Tektronix.

Customer may not:

- a. Use the Program on more than one machine at any one time, unless covered by a floating-user license or separate site license;
- b. Transfer the Program to any person or organization outside of Customer or the corporation of which Customer is a part without the prior written consent of Tektronix, except in connection with the transfer of the equipment within which the programs are encoded or incorporated;
- c. Export or re-export, directly or indirectly, the program, any associated documentation, or the direct product thereof, to any country to which such export or re-export is restricted by law or regulation of the United States or any foreign government having jurisdiction without the prior authorization, if required, of the Office of Export Administration, Department of Commerce, Washington, D.C. and the corresponding agency of such foreign government;
- d. For object-code Programs only, reverse compile or disassemble the Program for any purpose; or
- e. Copy the documentation accompanying the Program.

For Programs designed to reside on a single-machine and support one or more additional machines, either locally or remotely, without permitting the Program to be transferred to an additional machine for local execution, the additional machines shall be considered within the definition of "single machine". For programs permitting the Program to be transferred to an additional machine for local execution, a separate license shall be required for each such machine with which the Program may be used, or each concurrent user authorized under a floating-user license.

Title to the Program and all copies thereof, but not the media on which the Program or copies may reside, shall be and remain with Tektronix or others for whom Tektronix has obtained a respective licensing right.

Customer shall pay when due all property taxes that may now or hereafter be imposed, levied or assessed with respect to the possession or use of the Program or this license and shall file all reports required in connection with such taxes.

Any portion of the Program modified by Customer or merged with another program shall remain subject to these terms and conditions.

If the Program is acquired by or for an agency of the U.S. Government, the Program shall be considered computer software developed at private expense and the license granted herein shall be interpreted as granting Customer restricted rights in the Program and related documentation as defined in the applicable acquisition regulation.

THE PROGRAM MAY NOT BE USED, COPIED, MODIFIED, MERGED, OR TRANSFERRED TO ANOTHER EXCEPT AS EXPRESSLY PERMITTED BY THESE TERMS AND CONDITIONS.

UPON TRANSFER OF ANY COPY, MODIFICATION, OR MERGED PORTION OF THE PROGRAM, THE LICENSE GRANTED HEREIN IS AUTOMATICALLY TERMINATED.

TERM. The license granted herein is effective upon acceptance by Customer, and shall remain in effect until terminated as provided herein. The license may be terminated by Customer at any time upon written notice to Tektronix. The license may be terminated by Tektronix or any third party from whom Tektronix may have obtained a respective licensing right if Customer fails to comply with any term or condition and such failure is not remedied within thirty (30) days after notice hereof from Tektronix or such third party. Upon termination by either party, Customer shall return to Tektronix or destroy, the Program and all associated documentation, together with all copies in any form.

LIMITED WARRANTY. Tektronix warrants that the media on which the Program is furnished and the encoding of the Program on the media will be free from defects in materials and workmanship for a period of three (3) months from the date of shipment. If any such medium or encoding proves defective during the warranty period, Tektronix will provide a replacement in exchange for the defective medium. Except as to the media on which the Program is furnished, the Program is provided "as is" without warranty of any kind, either express or implied. Tektronix does not warrant that the functions contained in the Program will meet Customer's requirements or that the operation of the Program will be uninterrupted or error-free.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period. If Tektronix is unable to provide a replacement that is free from defects in materials and workmanship within a reasonable time thereafter, Customer may terminate the license for the Program and return the Program and any associated materials for credit or refund.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PROGRAM IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPLACE DEFECTIVE MEDIA, OR REFUND CUSTOMER'S PAYMENT IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY.

LIMITATION OF LIABILITY, IN NO EVENT SHALL TEKTRONIX OR OTHERS FROM WHOM TEKTRONIX HAS OBTAINED A LICENSING RIGHT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR CONNECTED WITH CUSTOMER'S POSSESSION OR USE OF THE PROGRAM, EVEN IF TEKTRONIX OR SUCH OTHERS HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

THIRD-PARTY DISCLAIMER. Except as expressly agreed otherwise, third parties from whom Tektronix may have obtained a licensing right do not warrant the program, do not assume any liability with respect to its use, and do not undertake to furnish any support or information relating thereto.

GENERAL. This Agreement contains the entire agreement between the parties with respect to the use, reproduction, and transfer of the Program.

Neither this Agreement nor the license granted herein is assignable or transferable by Customer without the prior written consent of Tektronix.

This Agreement and the license granted herein shall be governed by the laws of the state of Oregon.

All questions regarding this Agreement or the license granted herein should be directed to the nearest Tektronix Sales Office.

ADDITIONAL LICENSE GRANT FOR VIDEO TEST SEQUENCES. The Software Product may include certain test patterns, video test sequences and video clips (together "Video Test Sequences"). If so, the following terms describe Your rights to the Video Test Sequences:

You may use, copy and modify the Video Test Sequences and display or distribute copies of individual Video Test Sequences in connection with Your video testing activity.

You are not licensed to do any of the following:

- You may not distribute the collection of Video Test Sequences, except in connection with the sale of original equipment containing the Video Test Sequences, without prior written permission from Tektronix.
- You may not permit third parties to distribute copies of the Video Test Sequences.
- You may not sell, license or distribute copies of the Video Test Sequences on a standalone basis or as part of any collection, product, or service where the primary value of the product or service is the Video Test Sequences.

You must indemnify, hold harmless, and defend Tektronix from and against any claims or lawsuits, including attorneys' fees, that arise from or result from the use or distribution of Video Test Sequences as modified by You.

You must include a valid copyright notice on Your products and services that include copies of the Video Test Sequences.

Table of Contents

General Safety Summary	iii
Compliance	v
EMC Compliance	v
Safety Compliance	vi
Environmental Considerations	vii
Preface	viii
Key Features	viii
Documentation	viii
Conventions Used in This Manual	ix
Installation	1
Before Installation	1
Operating Considerations	1
Hardware Installation	2
Connecting to the Instrument	6
Powering on the Instrument	9
Powering Off the Instrument	10
Licensing the Software	10
VLC Media Player Installation	12
Network Installation	13
Functional Check	18
Operation	19
Front Panel Controls and Connectors	19
Rear Panel Connectors	21
Software Applications	21
Starting an Application	23
Accessing Menu Commands	24
Entering Numeric Data	25
Duplex Operation	26
Procedures	28
Using the MTS400 Series Applications	28
Setting Ethernet Network Parameters	40
Application Examples	44
Creating, Viewing, and Analyzing a Transport Stream	44
IP Stress Test	64
Accessories	73
Standard Accessories	73
Optional Accessories	74
User Maintenance	75
General Care	75
Preventative Maintenance	75
In Case of Problems	76
Repackaging for Shipment	77

Index

General Safety Summary

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

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

Only qualified personnel should perform service procedures.

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

To Avoid Fire or Personal Injury

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

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

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

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

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

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

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

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

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

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

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

Terms in This Manual

These terms may appear in this manual:



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



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

Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

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



CAUTION
Refer to Manual



Protective Ground
(Earth) Terminal



Standby

Compliance

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

EMC Compliance

EC Declaration of Conformity – EMC

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

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

- CISPR 11:2003. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-2:2001. Electrostatic discharge immunity
- IEC 61000-4-3:2002. RF electromagnetic field immunity
- IEC 61000-4-4:2004. Electrical fast transient / burst immunity
- IEC 61000-4-5:2001. Power line surge immunity
- IEC 61000-4-6:2003. Conducted RF immunity
- IEC 61000-4-11:2004. Voltage dips and interruptions immunity

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

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

European Contact.

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

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

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

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

Australia / New Zealand Declaration of Conformity – EMC

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

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

Safety Compliance

EC Declaration of Conformity – Low Voltage

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

Low Voltage Directive 2006/95/EC.

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

U.S. Nationally Recognized Testing Laboratory Listing

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

Canadian Certification

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

Additional Compliances

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

Equipment Type

Test and measuring equipment.

Safety Class

Class 1 – grounded product.

Pollution Degree Description

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

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.

- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution Degree

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

Environmental Considerations

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

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



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

Restriction of Hazardous Substances

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

Preface

This manual describes the functions and use of the Tektronix MTS400P MPEG Test System. The following naming conventions are used in this manual:






- MTS400P system – for information that applies to only the MTS400P
- The operation of the MTS415, MTS430, and MTS4SA is not described in this manual, see the MTS400 Series Quick Start User Manual, Tektronix part number 071-2607-XX.
- MTS400 Series system – for information that applies to the MTS415, the MTS430, and the MTS4SA








Key Features

- Supports a wide range of DTV standards, including MPEG, DVB, ATSC, ISDB and ISDB-TB (Brazil). Specific SI for Terrestrial, Cable and Satellite, and regional variations of these standards.
- A range of interfaces and analysis capabilities provide the necessary connectivity to diagnose problems anywhere in the network environment, including RF or IP layer transmission links or transport stream content processing.
- Integrated cross-layer fault analysis and logging provide a single box solution for fault diagnosis, reducing time to insight when troubleshooting.
- The playout functionality can simulate IP multisession replication to characterize behavior of a network or device under test.
- CaptureVu™ technology captures and analyzes system events in real- and off-line time.
- An innovative program-centric user interface brings expert power to the novice user.
- H.264 Buffer Analysis, multiplexing and elementary stream compliance checking provide a powerful suite of tools for creation and analysis of transport streams containing H.264 content.

Documentation

This manual describes the installation and basic operation of the MTS400P MPEG Test System. The following information is also available for this product:

Item	Purpose	Location
MTS400P Quick Start User Manual (071-2610-XX English, 071-2611-XX Japanese)	Describes how to install and get started using the test system.	 +  +  www.Tektronix.com
MTS400 Series Analyzer Applications User Manual (077-0205-XX)	Describes the operation of the following analyzer applications: TSCA, PES Analyzer, T-STD Buffer Analyzer, and ES Analyzer.	 +  www.Tektronix.com

Item	Purpose	Location
MTS400 Series Generator Applications User Manual (077-0204-XX)	Describes the operation of the following generator applications: Multiplexer, MPEG Player, TS Editor, Make Seamless Wizard, Transport Stream Cutter, and Script Pad.	 +  www.Tektronix.com
MTS400 Series Carousel Applications User Manual (077-0203-XX)	Describes the operation of the Carousel Analyzer and Carousel Generator applications.	 +  www.Tektronix.com
MTS400 Series Programmer Manual (077-0206-XX)	Describes the programmer commands for controlling the MPEG Player application.	 +  www.Tektronix.com
MTS400 Series Release Notes (077-0200-XX)	Describes known issues with the test systems.	 www.Tektronix.com



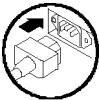
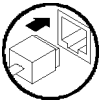
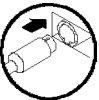
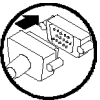
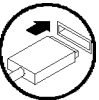
User documents can be downloaded from the Tektronix Web site: www.tektronix.com/manuals.

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

- MPEG-2 standards (International Organization for Standards) – www.iso.org/
- DVB standards (European Technical Standards Institute) – www.etsi.org/
- ATSC standards (Advanced Television Systems Committee) – www.atsc.org/

Conventions Used in This Manual

The following icons may be used throughout this manual.

Sequence Step	Front panel power	Connect power	Network	PS2	SVGA	USB
						

Installation

Before Installation

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

1. Inspect the shipping carton for external damage, which indicates possible damage to the instrument.
2. Remove the MTS400P MPEG Test System from the shipping carton.
3. Check that the instrument has not been damaged in transit. The exterior should not have any scratches or impact marks. Before shipment, the instrument is thoroughly inspected for mechanical defects.

NOTE. Save the shipping carton and packaging materials for instrument repackaging in case shipment becomes necessary. (See page 77, *Repackaging for Shipment*.)

4. Verify whether you received the standard accessories and any optional accessories that you ordered. (See page 73, *Accessories*.)
5. Perform the functional check procedure after installing the instrument. (See page 18.)

Operating Considerations

Before you install the instrument, refer to the General Safety Summary section at the front of this manual for power source, grounding, and other safety information.

Environment Operating Requirements

Verify that the location of your installation has the proper operating environment as listed in the following table. The complete operating requirements are listed in the *MTS400P Specifications and Performance Verification Technical Reference*.



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

Table 1: Environmental operating requirements

Characteristics	Specifications
MTS400P ambient temperatures	From +5 °C to +40 °C (+41 °F to +104 °F)
Maximum Operating Altitude	3000 m (9842 ft)
MTS400P relative humidity	From 20% to 80%
Clearance on top	5.0 cm (2 in)
Clearance on left side	5.0 cm (2 in)

Table 1: Environmental operating requirements (cont.)

Characteristics	Specifications
Clearance on right side	5.0 cm (2 in)
Clearance in rear (from the fan guard)	5.0 cm (2 in)

NOTE. If you are installing the instrument in a dedicated rack, refer to the instruction sheet that comes with the rackmount kit for proper installation procedures.

When the MTS400P system is mounted in a 19-inch rack, verify that there is at least one unit of clearance above the MTS400P system.

AC Line Voltage Requirement

Check that your location provides the proper electrical power requirements. Refer to Table 2.

Table 2: AC line power requirement

Parameter	Description
Line voltage range	100 to 240 V
Line frequency	50/60 Hz
Maximum power	180 VA



CAUTION. The instrument does not have a power switch, but does have an On/Standby switch. When you connect the power cable to the AC line connector, power is applied to the power supply standby circuit of the instrument. Read the power application instructions before plugging the power cable into a power source. (See page 9, Powering on the Instrument.)

Power Cord Requirement

Ensure that you are using the proper power cord for your location. Connect the power cord from the rear-panel power connector to the power system. (See page 73, Accessories.)



CAUTION. The instrument is shipped with a power cord appropriate for use with your power system (normal 115 V power system or 230 V power system). If the instrument is to be used with a power system other than that specified in the order, the power cord must be replaced with one appropriate for the power source used.

Hardware Installation

The MTS400P system is designed to be portable. 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 MTS400P system is configured with the software and hardware options that you ordered at the time of purchase. MTS400P system options can be added using upgrade kits available from Tektronix.

To install the instrument, plug the keyboard and mouse into one of the front-panel USB connectors. Ensure that the parallel port software key is in place and that the securing screws are tightened to 4 inch-pounds of torque (45 Newton centimeters).



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

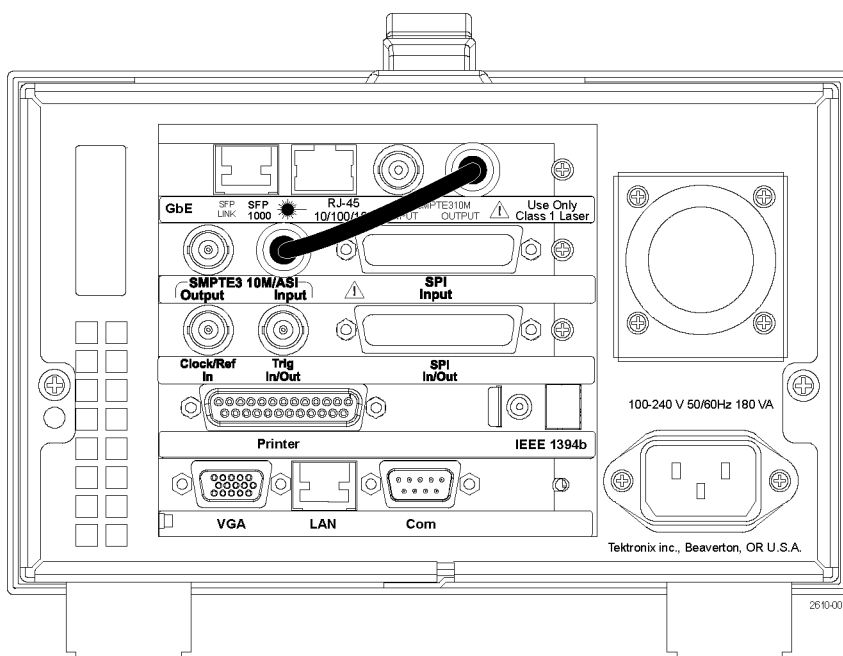
NOTE. The MTS400P system applications will not run without the software key installed. Do not remove the software key from the instrument.

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

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

Installing the BNC Cable (GbE Interface Only)

Connect the BNC cable provided with Option IPTVP as shown in the following figure.



The optional IP Video Gigabit Ethernet (GbE) interface card allows you to remotely monitor and measure the quality of video-over-copper and optical IP networks. The SFP (Small Format Pluggable) modules are available to facilitate different optical wavelengths.



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



CAUTION. To prevent static discharge damage, service the product only in a static-free environment. Observe standard handling precautions for static-sensitive devices while installing this module. Always wear a grounded wrist strap, grounded foot strap, and static resistant apparel while installing this module.

The following figure shows an SFP module with the optical port plug removed. Use the plug to protect the optical interface when no cable is connected or the module is not in use.

NOTE. The optical port plug must be in place when no cable is connected.

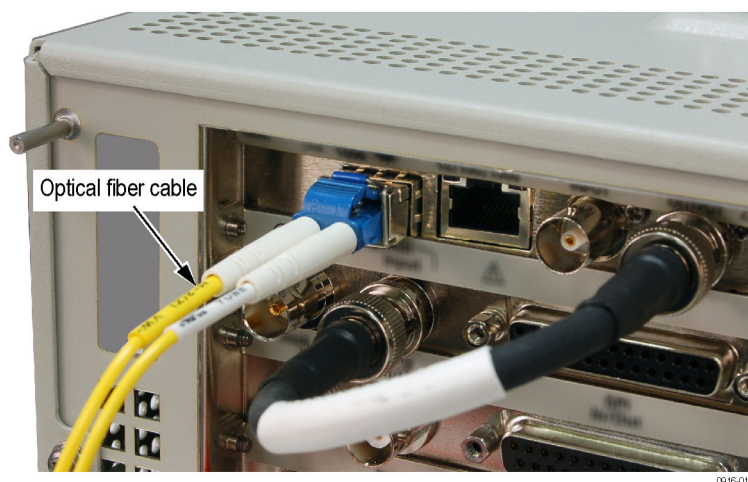


Installing an SFP module. Perform the following steps to install an SFP module into the Option IPTVP interface module:



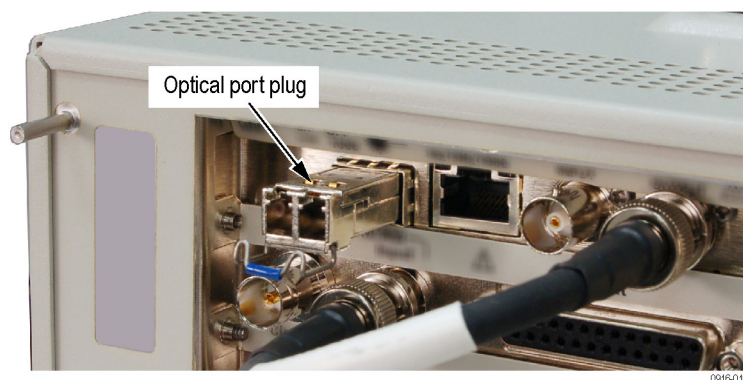
CAUTION. To avoid damage to the SFP module, remove power from the MTS400P system before removing or inserting an SFP module.

1. Disconnect the power cord from the instrument.
2. Insert the SFP module into the connector labeled SFP 1000 on the rear panel of the Option IPTVP module. When pushed in fully, the module latches into position.
3. Remove the optical port plug and insert the optical fiber cable into the SFP module as shown in the following figure. When pushed in fully, the cable connector latches into position. Retain the optical port plug for later use when you need to remove the SFP module from the instrument.
4. Reconnect the power cord to the instrument.



Removing an SFP module. Perform the following steps to remove an SFP module from the Option PTV interface module:

1. Disconnect the power cord from the instrument.
2. Press the top of the SFP module connector to unlatch the optical fiber cable, and then disconnect and withdraw the cable from the SFP module.
3. Flip down the SFP module retaining latch, and then remove the module from the instrument as shown in the following figure.



4. Install an optical port plug into the removed SFP module to protect the optical port interface.
5. Reconnect the power cord to the instrument.

Connecting to the Instrument

Front Panel Connectors

The front panel provides two USB 2.0 ports that you can use to connect the keyboard and mouse and other USB devices.

Rear Panel Connectors

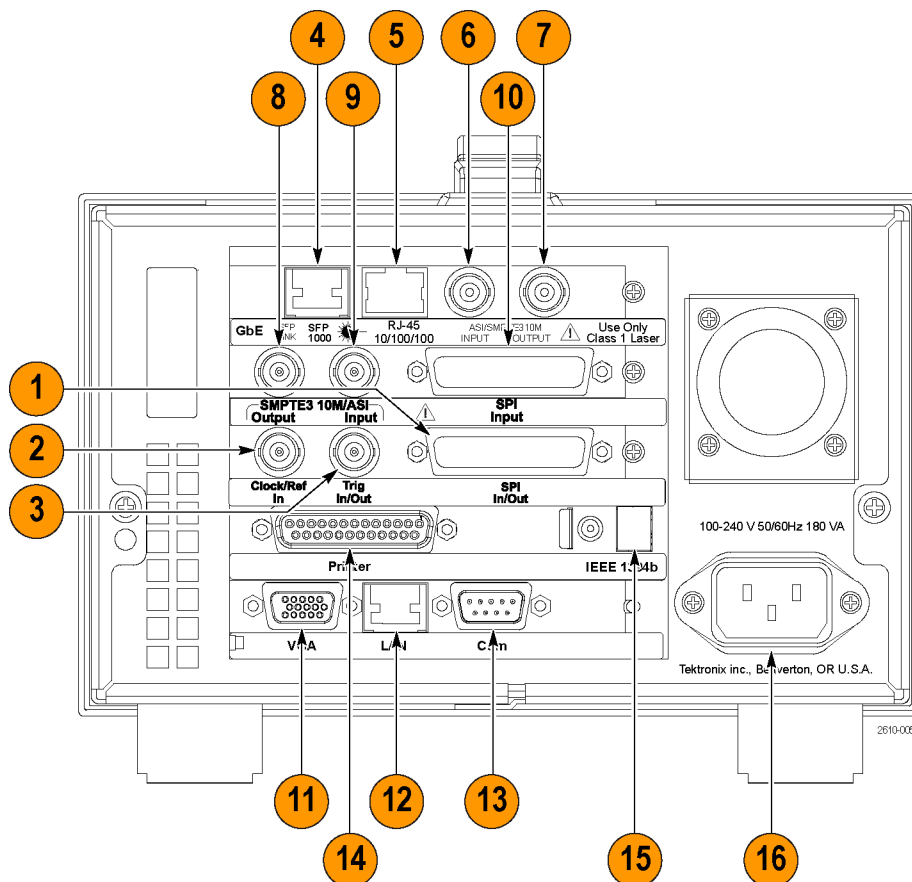


Table 3: Rear panel connectors

Figure reference	Control	Function
1	SPI In/Out	Use this 25-pin D-sub connector to input or output an SPI (Synchronous Parallel Interface) signal.
2	Clock/Ref In	Use this BNC connector to input an external reference signal or clock signal. Refer to the <i>MTS400P Specifications & Performance Verification Technical Reference</i> for detailed information about the signal specification. NOTE. Use a continuous signal for an external reference or clock signal.

Table 3: Rear panel connectors (cont.)


Figure reference	Control	Function
3	Trig In/Out	Use this BNC connector to input an external trigger event for stream recording or output a 27 MHz reference clock signal or an ISDB-T frame pulse signal. You can change the configuration from the Play menu. Refer to the <i>MTS400P Specifications and Performance Verification Technical Reference</i> manual for detailed information about Trig In/Out signals.
4	SFP (small format pluggable) port	Use this connector to install an SFP optical port.
5	Ethernet	Use this connector to connect the instrument to the Ethernet.
6	ASI/SMPTE Input	Use this BNC connector to input an ASI/SMPTE signal.
7	ASI/SMPTE Output	Use this BNC connector to output an ASI/SMPTE signal.
8	SMPTE310M/ASI Output	Use this BNC connector to output a SMPTE310M or an ASI (Asynchronous Serial Interface) signal in Play mode of the Player. You can select the output signal format from the 310M/ASI/SPI menu. NOTE. The SMPTE310M interface supports data rates of 19.392658 Mbps (8 VSB, 188 bytes packet size).
9	SMPTE310M/ASI Input	Use this BNC connector to input a SMPTE310M signal or an ASI (Asynchronous Serial Interface) signal in Record Mode of the Player. You can select the input signal format from the 310M/ASI/SPI menu.
10	SPI Input	Use this 25-pin D-sub connector to input an SPI (Synchronous Parallel Interface) signal. You can select the source format as SPI/ASI/310M and input port from the 310M/ASI/SPI menu. NOTE. The SPI Input connector can only be used to input a signal. Selecting SPI as a source, will enable the SPI on the SPI In/Out interface on the base card.
11	VGA	Use this 9-pin D-sub connector to display the instrument screen to an external monitor. The VGA output is automatically enabled only when you power on the instrument with an external monitor connected. If you want to enable the VGA output after powering on the instrument, perform the following steps: 1. Minimize the Play screen to display the Windows XP desktop. 2. Click the Intel(R) Extreme Graphics 2M icon at the right side of the taskbar.  3. Select Graphic Options > Output To > Intel(R) Dual Display Clone > Monitor+Notebook from the displayed menu.
12	LAN (10/100/1000 Base-T)	Use this connector to connect the MTS400P system to your local Ethernet network.
13	Com	This 9-pin D-sub connector provides a serial interface for instrument control.
14	Printer	Use this 25-pin D-sub connector to connect a printer. This interface supports the IEEE 1284 parallel port standard.

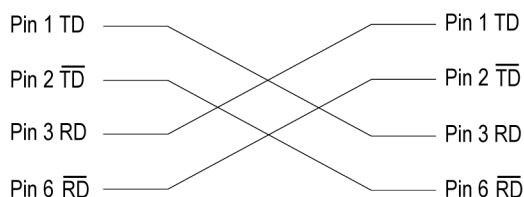
Table 3: Rear panel connectors (cont.)

Figure reference	Control	Function
15	IEEE 1394b	Use this connector to connect an IEEE 1394b device such as an external hard disk drive.
16	Power	Use this connector to apply power to the instrument using the supplied power cord.

Connecting the MTS400P System to a PC

Use one of the following two methods to connect the MTS400P system to your PC(s):

1. If you are connecting the MTS400P system directly to a single PC, use a crossover Ethernet cable to connect between the LAN port on the MTS400P system and the Ethernet port on the PC. If you need to construct your own crossover cable, change the pin connections on a straight cable as shown in the figure to produce a crossover cable.

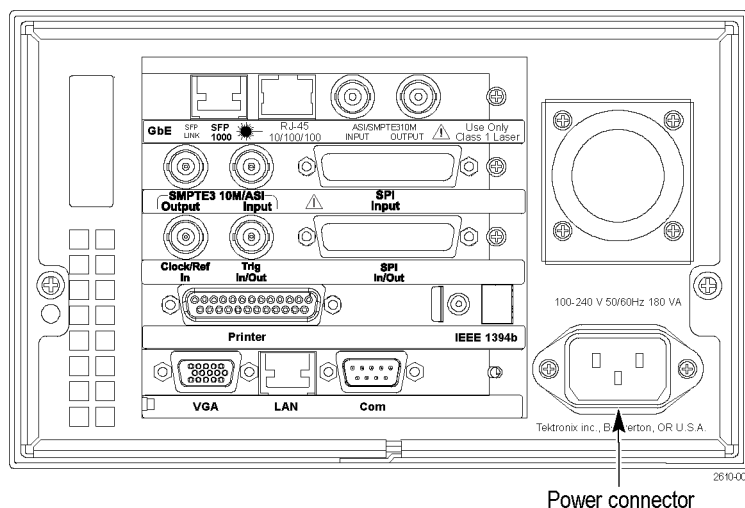


2. If you are connecting the MTS400P system to your local Ethernet network, use a straight Ethernet cable to connect between the LAN port on the MTS400P system and the Ethernet hub port of your local network. By connecting to an Ethernet network, you can access the MTS400P system using any PC on the network.

Refer to *Network Installation* for more information about installing the MTS400P system on your local Ethernet network. (See page 13.)

Powering on the Instrument

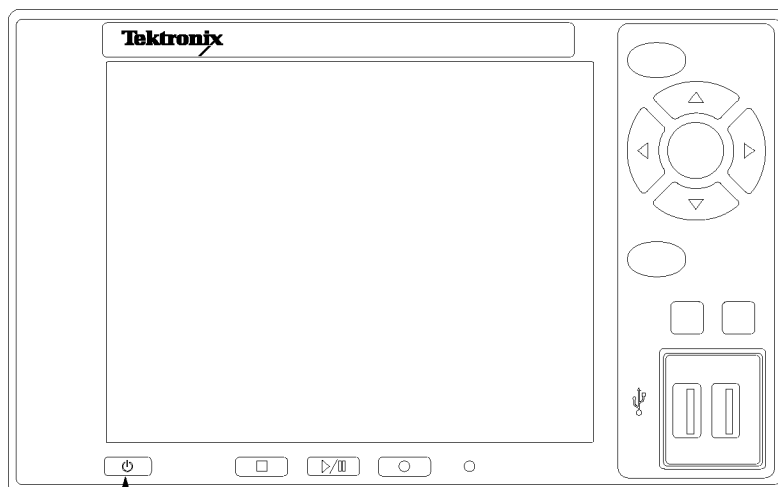
1. After you have verified the operating environment, AC line, and power cord requirements, plug the power cord into the power connector on the rear panel, and then plug the power cord into the local power source.



2. Press the **On/Standby** switch to power on the instrument. After you power on the instrument, verify that the fan on the rear panel is operating. To verify whether the fan is operating, place your hand behind the right side of the instrument. You should be able to feel the fan's air flow.



CAUTION. Do not operate the instrument if the cooling fan does not operate when you turn on the instrument. Serious damage can occur to your instrument from overheating and if the cooling fan is not operating.



On/Standby switch

Powering Off the Instrument

Always power off the instrument using the Windows XP shutdown process (select **Start > Shut down...** or **Start > Turn off computer**). The system (including applications) will shut down automatically. When prompted, push the front panel On/Standby switch to remove power from the unit. Alternatively, push the front panel On/Standby switch for two seconds and release. The system will shut down and power off automatically with no further intervention.

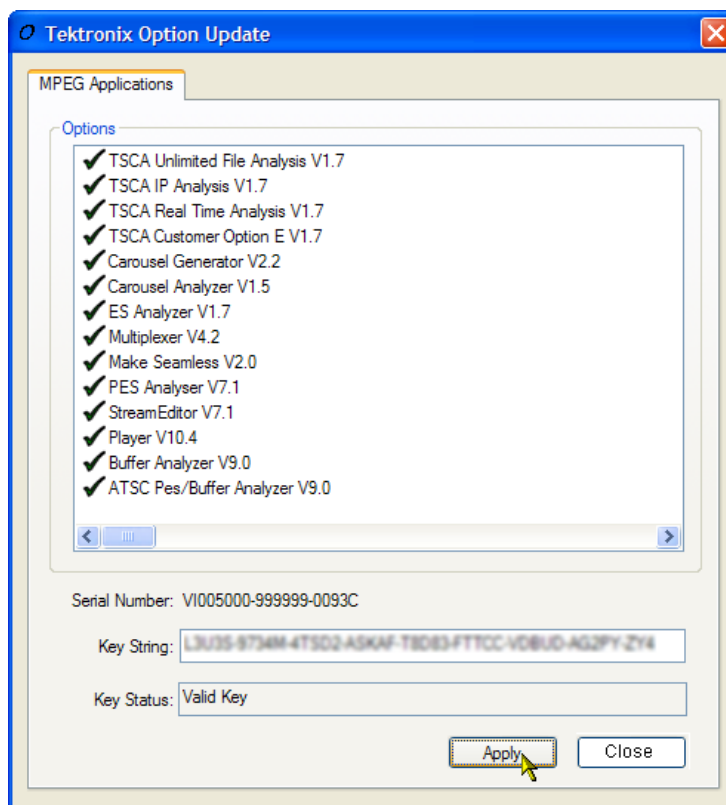
Licensing the Software

During first-time power on, you need to license the software by entering the option key that was shipped with the instrument as described in the following procedure.

NOTE. *The instrument is shipped with a parallel security key dongle. You must connect the dongle to the printer port before starting the instrument in order for the instrument software to be enabled.*

1. Attach the software key dongle to the printer port on the rear panel of the instrument. (See page 6, *Rear Panel Connectors*.)
2. Power on the instrument.
3. When the instrument is started, the Option Key Wizard must be started, select **Start > Programs > Tektronix MTS400 > Option Key Wizard**.

4. In the Tektronix Option Update dialog box, enter the Option Key String supplied with the installation documentation in the Key String field.
5. Click **Apply**.



6. Inspect and verify the list of licensed options.

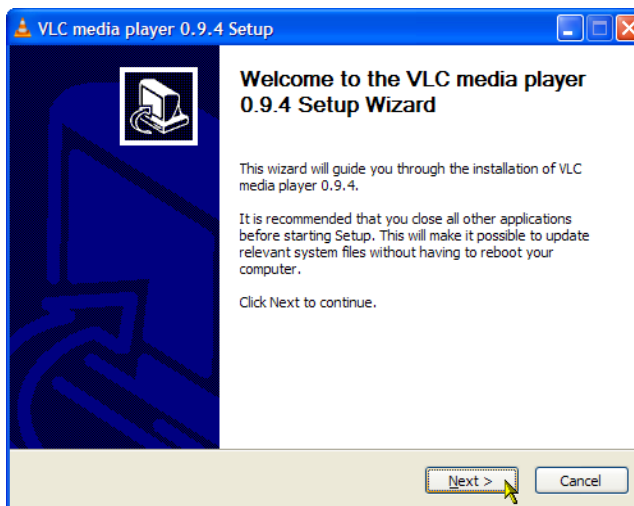
NOTE. Operational access to features is controlled by the licenses that are available on the software key. Applications and features can be installed, but will not be available unless the appropriate license has been obtained. Notification of these is provided when the product or additional licenses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

7. Close the Option Key Wizard. The licensed instrument is now available in the Windows Start menu.

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 MTS400P instrument or PC with access to the internet, navigate to the VideoLAN home page (<http://www.videolan.org>).
2. Locate and download the Windows self-extracting VLC Media Player installer to your PC hard disk.
3. Locate the downloaded VLC Media Player file on your instrument and run it.
4. Select your preferred language. The Welcome / Setup screen appears.
5. Follow the setup procedure and allow the VLC Media Player to be installed.



NOTE. When the VLC Media Player is installed on the MTS400P, the audio feature in the media player must be disabled.

To disable the audio feature:

6. In the VLC Media Player, select Settings > Preferences.
7. Select Audio from the list on the left hand side of the Preferences dialog box.
8. Under General audio settings, clear the Enable audio check box.
9. Click the Save button to accept the changes and close the Preferences dialog box.

Network Installation

The MTS400P system can be attached to a computer network. Refer to your Network Administrator for details of the correct network configuration. For installation and operating instructions, refer to the documentation that is supplied with the network hardware and software.

Network Troubleshooting

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

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

Basic Requirements

Fulfill the following requirements before troubleshooting your host machines:

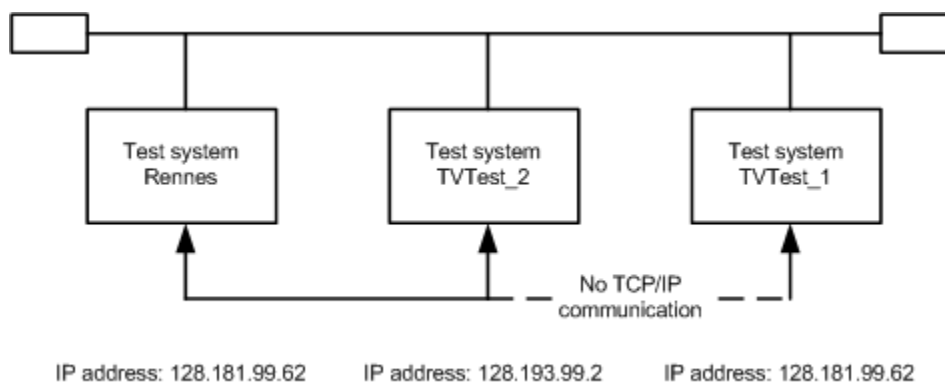
- Configure your system for use on the network as described in the documentation that is supplied with the Network Adapter card. Contact your network administrator for details.
- Ensure that any applications that you may have loaded on your test system since receiving it are not using the ports assigned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

IP Parameters

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

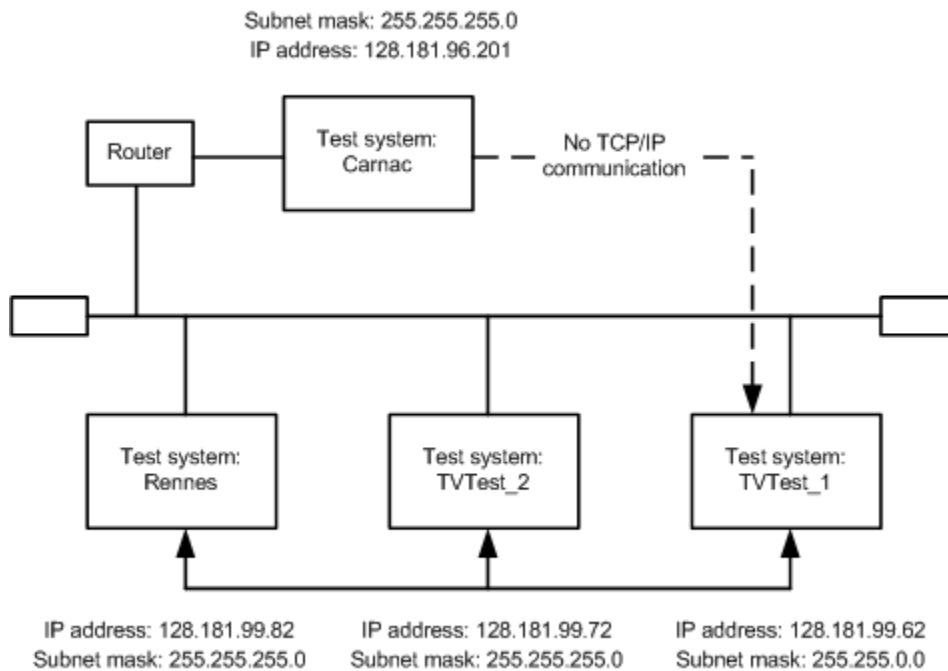
Incorrect IP address. If the IP address for your test system is incorrect (not unique), then you may not be able to communicate over the network. In the next figure, TVTest_1 uses the same IP address as Rennes. If Rennes is started first, TVTest_1 will recognize the IP address conflict and will not load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

If your IP address is incorrect, and the IP address does not exist on your subnet, you may be able to communicate from the device (system or monitoring station), but you may not be able to communicate to the device.



Incorrect subnet mask. Subnets and subnetting networks are complex and require a thorough understanding of IP addressing. Call your network administrator if you think your networking problem involves subnets. The next figure shows a simple (and fairly common) subnet mask problem.

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

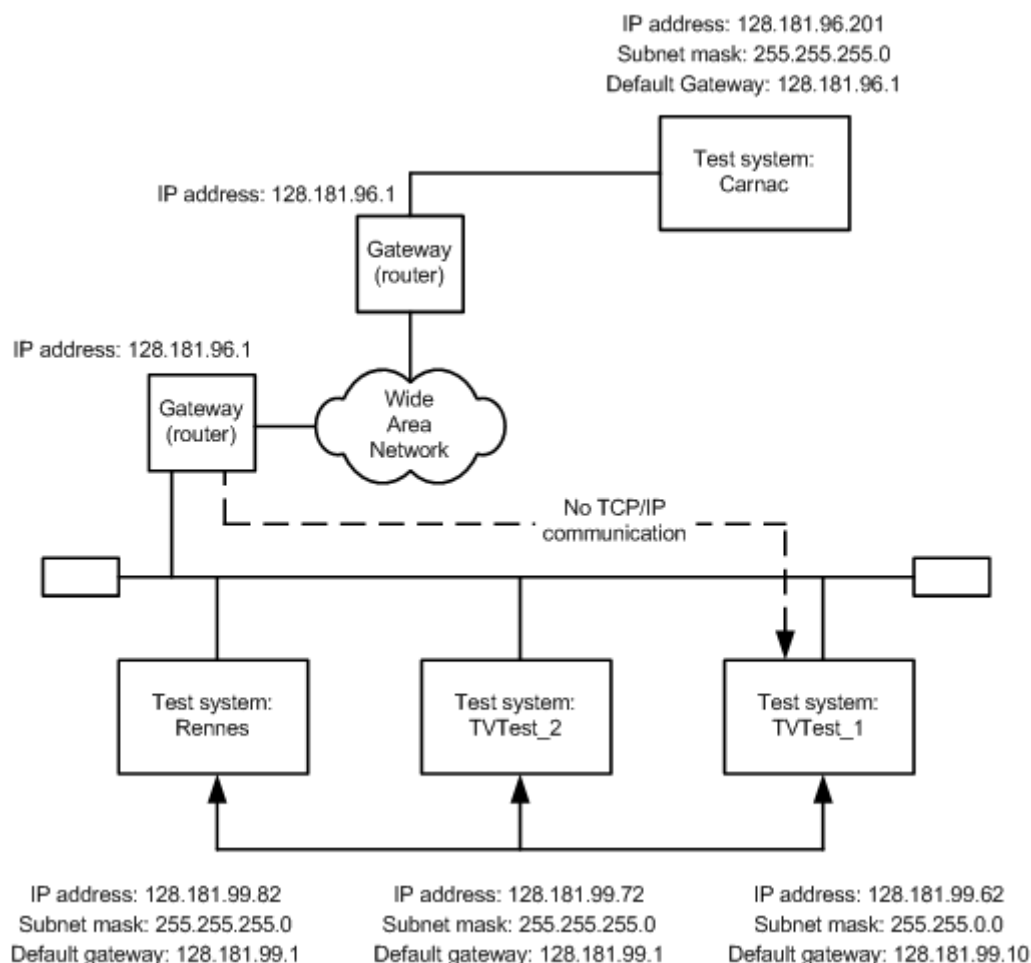


TVTest_1 cannot communicate with Carnac, because, according to the subnet mask on TVTest_1, Carnac and TVTest_1 are logically on the same network. Consequently, messages sent from TVTest_1 to Carnac are never routed. Because these two devices do not share a connection, TVTest_1 will never find the correct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

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

Incorrect default gateway IP address.

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



Common Troubleshooting Procedures

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

Pinging a host machine.

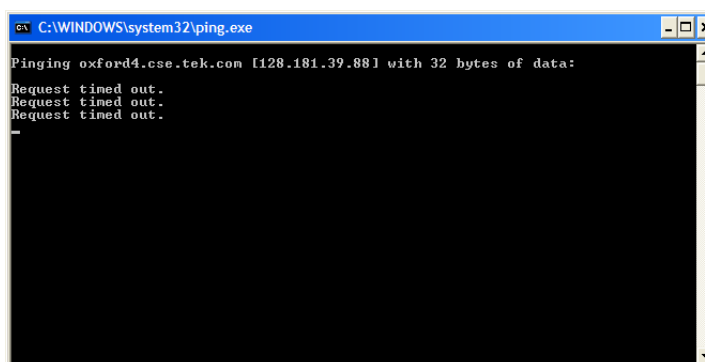
One of the utilities provided with all TCP/IP installations is ping.exe. (Look in the C:\windows\system32\ directory.) This utility allows you to send communication packets to and record the response from a host machine. This determines whether your packets arrived at the destination. To run ping, use the following procedure:

1. Select **Run** from the Start menu. The Run dialog box appears.
2. Type one of the following into the Run text box:
ping machineName
ping IPAddress
In the examples, machineName and IPAddress represent the host machine name and IP address, respectively, of the networked device you are trying to ping.

3. Click **OK**.

A DOS window indicates whether or not the machine is responding to the ping. In the figure, the destination machine (Oxford4) is not responding.

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

A screenshot of a DOS command window titled "C:\WINDOWS\system32\ping.exe". The window shows the command "Pinging oxford4.cse.tek.com [128.181.39.88] with 32 bytes of data:" followed by three lines of output: "Request timed out.", "Request timed out.", and "Request timed out.". The window has a standard Windows-style title bar with minimize, maximize, and close buttons.

```
C:\WINDOWS\system32\ping.exe
Pinging oxford4.cse.tek.com [128.181.39.88] with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
```

Tracing the route of TCP/IP packets.

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

1. Select **Run** from the Start menu. The Run dialog box appears.

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

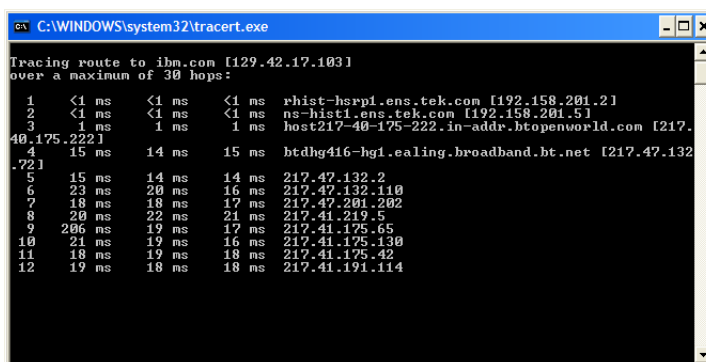
`tracert machineName`

`tracert IPAddress`

In the examples, `machineName` and `IPAddress` represent the host machine name and IP address, respectively, of the networked device you are trying to reach.

3. Click **OK**.

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



```

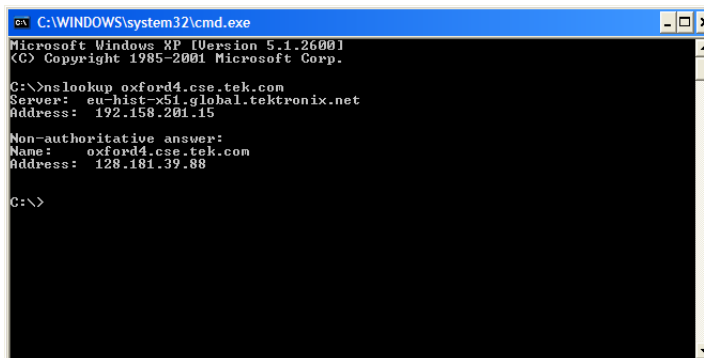
C:\WINDOWS\system32\tracert.exe
Tracing route to ibm.com [129.42.17.103]
over a maximum of 30 hops:
  0  <1 ms    <1 ms    <1 ms    rhist-hsrpl.ens.tek.com [192.158.201.21]
  1  <1 ms    <1 ms    <1 ms    ns-hist1.ens.tek.com [192.158.201.51]
  2  1 ms     1 ms     1 ms     host217-40-175-222.in-addr.btopenworld.com [217.40.175.222]
  3  15 ms    14 ms    15 ms    btdhg416-hg1.ealing.broadband.bt.net [217.47.132.2]
  4  15 ms    14 ms    14 ms    217.47.132.2
  5  23 ms    20 ms    16 ms    217.47.132.110
  6  18 ms    18 ms    17 ms    217.47.201.202
  7  20 ms    22 ms    21 ms    217.41.219.5
  8  206 ms   19 ms    17 ms    217.41.175.65
  9  21 ms    19 ms    16 ms    217.41.175.130
 10  18 ms    19 ms    18 ms    217.41.175.42
 11  19 ms    18 ms    18 ms    217.41.191.114
 12

```

Finding IP addresses for devices on your network.

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

1. Select **Run** from the Start menu. The Run dialog box appears.
2. Enter one of the following and push Enter, where machineName or IPAddress is the network name or IP address, respectively, of the device you are trying to look up.
 nslookup machineName
 nslookup IPAddress
 The network name and IP address of the device you are trying to look up is displayed. If your network uses DNS, the IP address and network name of the DNS server is also displayed.



```

C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\>nslookup oxford4.cse.tek.com
Server: eu-hist-x51.global.tektronix.net
Address: 192.158.201.15

Non-authoritative answer:
Name: oxford4.cse.tek.com
Address: 128.181.39.88

C:\>
  
```

Sources of Network Information

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

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

- Cisco Systems, Inc. – <http://www.cisco.com/>

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

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

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

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

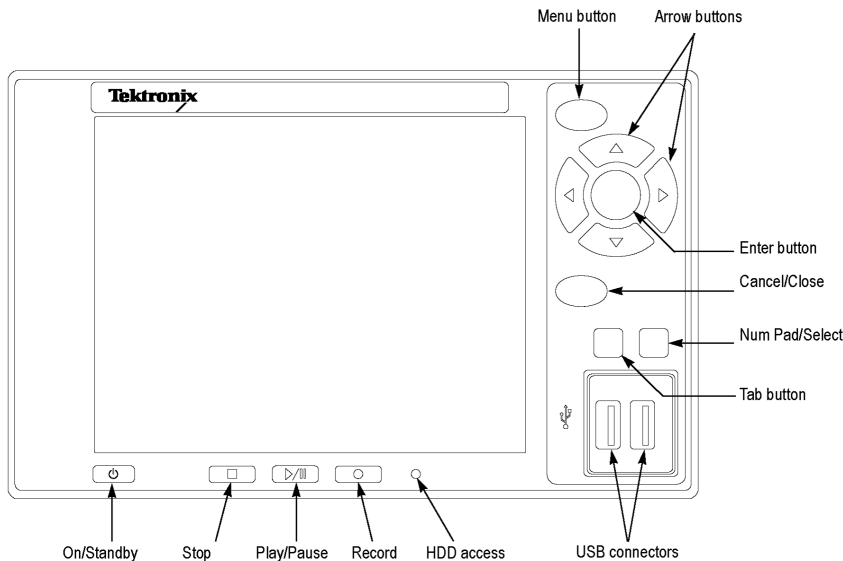
Functional Check

Perform the performance verification procedure if you are operating the instrument for the first time (to verify that the instrument shipped without damage) or if you suspect that the instrument is not working properly.

The procedure is located in the *MTS400P Specifications and Performance Verification Technical Reference* document.

Operation

Front Panel Controls and Connectors



CAUTION. If you power off the instrument using the On/Standby switch, the current instrument settings are not saved (this operation corresponds to an emergency shutdown in Windows XP). To prevent data loss, use the Shutdown command from the File menu to power off the instrument.

Table 4: Front panel controls and connectors

Control	Function
On/Standby Switch	Use this button to power on or off the instrument.
Stop Button	<p>This button performs the following functions:</p> <ul style="list-style-type: none"> ■ If this button is pressed while a stream data is being output, the data output stops. ■ If this button is pressed while the pretrigger portion is filled and the instrument waits for a trigger event or the posttrigger portion is being recorded, the recorded data is stored in a file.
Enter Button	Use this button to execute the selected menu command or enable all setting changes in a dialog box.
Cancel/Close Button	Use this button to cancel the selected operation. When any menu command list is displayed, it closes the command list temporarily.

Table 4: Front panel controls and connectors (cont.)

Control	Function
Play/Pause Button	<p>This button performs the following functions:</p> <ul style="list-style-type: none"> ■ If this button is pressed, the data output starts. ■ If this button is pressed while the Record screen is displayed, it switches to the Play screen. ■ If this button is pressed while a stream data is being output, the data output pauses. Press the button again to start the stream output. <p>When an M-TMCC transport stream is selected, the MTS400P system outputs the stream from the start packet in the super frame to the maximum number of packets that can be looped as an integral multiple of the number of super frames. When an ISDB-T transport stream is selected, the MTS400P system outputs the stream from the start packet in the OFDM (Orthogonal Frequency Division Multiplexing) frame to the maximum number of packets that can be looped as 2 X N of the number of OFDM frames. If any of the transport streams within the ISDB-T transport stream have different modulation parameters, select Non TS from the Packet Size command in the Play menu.</p> <p>The status indicator light in the button illuminates when stream data is being output. The light blinks when the stream output pauses.</p>
Record Button	<p>This button performs the following functions:</p> <ul style="list-style-type: none"> ■ Press this button to record the stream data that is being applied. ■ If this button is pressed while the Play screen is displayed, it switches to the Record screen. <p>The status indicator light in the button blinks when a sync word is being detected, or when the pretrigger portion of the stream data has been recorded.</p>
HDD Access Indicator	This indicator illuminates when the hard disk drive is in operation.
Menu Button	Use this button to toggle the display of the menu command list on or off.
Arrow Buttons	Use the arrow buttons to maneuver on the LCD display. For example, you can use these buttons to move the Icon cursor or to move among the menu selections.
Num Pad/Select Button	<p>Use this button to enable or disable any setting changes in a dialog box. It is also used to open the keypad, where you can enter numeric values for a text box.</p> <p>When an ISDB-T file is selected in the Play screen or an ISDB-T signal is captured in the Record screen, pressing this button causes the ISDB-T Information dialog box to appear.</p>
Tab button	Use this button to select the numeric parameters in open dialog boxes.
USB Connectors	Use the USB 2.0 connectors to connect the keyboard and mouse provided with the instrument for Windows operations. You can also connect other USB devices.

Rear Panel Connectors






The rear panel connectors are described in the Installation section. (See page 6, *Rear Panel Connectors*.)









Software Applications

The MTS400P MPEG Test System provides a comprehensive and integrated suite of real-time and deferred (offline) analysis tools. The tools include TS (transport stream) compliance, buffer, PES, MPEG2, and MPEG4 video and audio elementary stream analyzers. Also included are an editor and a multiplexer to create stream content, and test and error-stressing streams.

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

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.

Application	Desktop Icon ¹
Analyzers	
Transport Stream Compliance Analyzer (TSCA) – Real-time transport stream analysis with user-selectable MPEG-2, DVB, ATSC and ISDB conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing /transport rate graphs and error message logs.	 TS Compliance Analyser
Transport Stream Compliance Analyzer (TSCA) – Deferred transport stream analysis with user-selectable MPEG-2, DVB, ATSC and ISDB conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing/transport rate graphs and error message logs.	 TS Compliance Analyser
Packetized Elementary Stream (PES) Analyzer – PES analysis with selectable test options. Shows PES program structure, header contents, packet contents, PTS/DTS timing graphs and analysis reports.	 PES Analyser
Transport Stream – System Target Decoder (T-STD) Buffer Analyzer analyzes program streams modeling their behavior in, and their conformance to, the MPEG-2 T-STD Buffer Model. Includes a trace facility.	 Buffer Analyser
Elementary Stream – Analyzer Elementary Stream analysis at video picture and audio level. This includes vector graphs and macroblock picture quality.	 ES Analyser

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

¹ If installed.

Starting an Application

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

The MTS400 Series system application user manuals provide full descriptions of all applications. The following table shows the hierarchy of applications in the Start menu.

Menu hierarchy

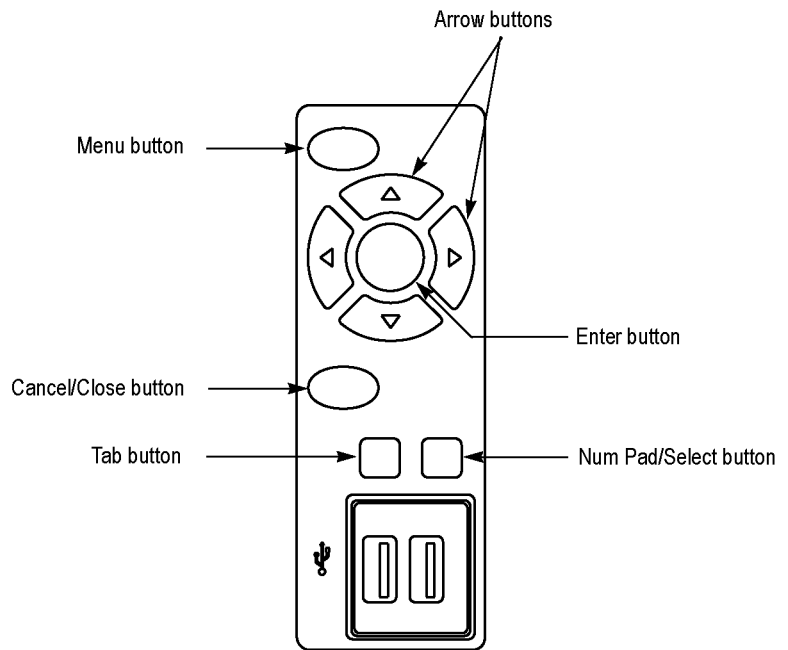
Tektronix MTS400 >	Analyzers >	Buffer Analyzer
		Carousel Analyzer
		ES Analyzer
		PES Analyzer
		TS Compliance Analyzer
	Generators >	Carousel Generator
		Multiplexer
		TS Editor
	Player >	MPEG Player
	Utilities >	Make Seamless Wizard
		ScriptPad
		Stream Cutter
		TTS Utility
	OptionKey Wizard	

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

Accessing Menu Commands

1. To access any menu command of an open MTS400P application, do the following:
 - Press the **Menu** button; the File menu command list opens. Use the up (▲) or down (▼) arrow button to move through the command list. Press the **Enter** button to execute the selected command. Use the left (◀) or right (▶) arrow button to select the desired menu. Press the **Cancel/Close** button to close the command list temporarily.
2. Press the **Menu** button again to close the menu command list.

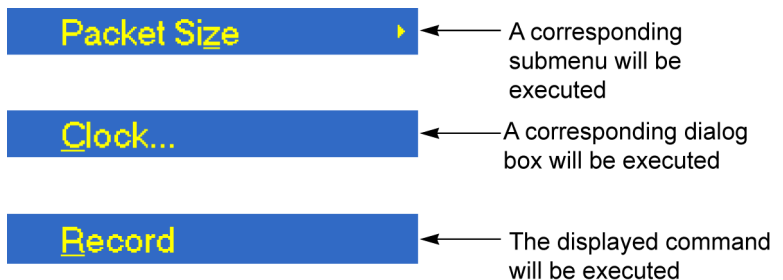
NOTE. When you press the left arrow button while the File menu is displayed or when you press the right arrow button while the Utility menu is displayed, the Windows Control menu appears.



Display States of the Menu Commands

The menu commands can have the following three display states:

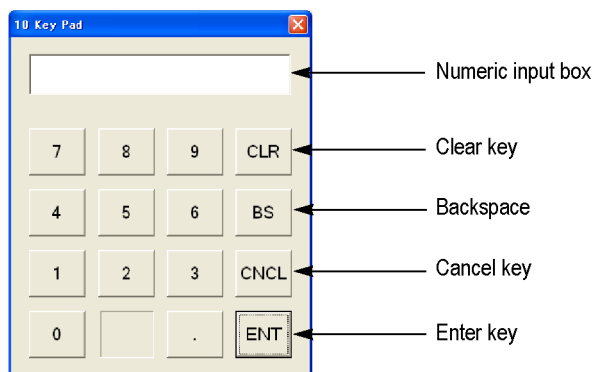
- A command followed by ► indicates that a corresponding submenu will be displayed after you press the **Enter** button or the right (▶) arrow button.
- A command followed by an ellipsis (...) indicates that a corresponding dialog box will open after you press the **Enter** button.
- A command name by itself will be executed after you press the **Enter** button.



Entering Numeric Data

Using the Keypad

1. Open a dialog box in which you want to change a parameter.
2. Press the **Tab** button repeatedly to select (highlight) the numeric parameter that you want to change in the open dialog box.
3. Press the **Num Pad/Select** button to open the keypad.
4. Press the **Tab** button or the arrow buttons to move to the number you want to input (when the keypad first opens, the dotted line box is located on the ENT key).
5. Press the **Num Pad/Select** button. This displays the selected number in the numeric input box.
6. Repeat steps 4 and 5 to input the desired parameter value.
7. Press the **Enter** button (or select the ENT key and then press the **Num Pad/Select** button). This saves the new value in the numeric input box and closes the keypad.



Using the Arrow Buttons

Perform the following procedure to change a value by using the arrow buttons:

1. Open the dialog box in which you want to change a parameter.
2. Press the **Tab** button repeatedly to select the numeric parameter that you want to change in the open dialog box.
3. Press the left (◀) arrow button to begin editing the parameter. This highlights the last digit.
4. Press the left (◀) or right (▶) arrow button to move the highlighted cursor to the value you want to change.
5. Press the up (▲) or down (▼) arrow button to increase or decrease the value.
6. Repeat steps 4 and 5 to enter all of the desired values. To add a digit, press the left (◀) arrow button.
7. Press the **Enter** button to save the changed numeric values.

Duplex Operation

The MTS400P system can be operated in duplex mode (ASI/SMPTE/DVB Parallel (SPI) only). For example, while the Player is playing out a stream, the TS Compliance Analyzer can be analyzing a separate stream or, if the output is looped back to the input, the output of the Player can be monitored by TS Compliance Analyzer (TSCA).

Setting Up Loopback

With loopback in operation you can:

- Use the MPEG Player to play out a stream
- Loop the instrument output back to the input
- Monitor/analyze the incoming stream using the TSCA

Before starting:

- Identify the stream to be played out (in this example, the sym1.mpg test stream is used).
- Choose the output/input interface (ASI/SMPTE310 or DVB SPI) and make the necessary connections (loop between the connectors) at the rear of the instrument.

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

NOTE. You can choose either ASI or SMPTE310 to be supplied through the BNC connectors. The DVB SPI output is enabled by default, whatever the settings are in the player. IP support is disabled by default.

MPEG player setup.

1. Open the MPEG Player: **Start > Programs > Tektronix MTS400 > Player > MPEG Player.**
2. Open a stream: **File > Open... > sym1.mpg.**
3. Make the following settings in the **Play** menu:

Packet size: 188

Update: On

Sync: TS Packet

Loop: On

Other: Standard: DVB

TSCA setup.

1. Open the TSCA: **Start > Programs > Tektronix MTS400 > Analyzers > TS Compliance Analyzer.**
2. In the start-up dialog box (**Open Transport Stream...**), select **Change...** in Stream Interpretation and select the DVB base standard with no extensions. Close the Stream Interpretation dialog box.
3. Select **Real-time Analysis** and select **ASI** from the **Interfaces** drop-down list.
4. Select **OK**.

Start the playout and analysis.

1. Return to the MPEG Player window and play the stream by selecting: **Play > Start/Stop** or use the toolbar button.
2. In the Player window, note that the status bar is now displayed and that playout has started.
3. Return to the TSCA window and note that analysis has started.

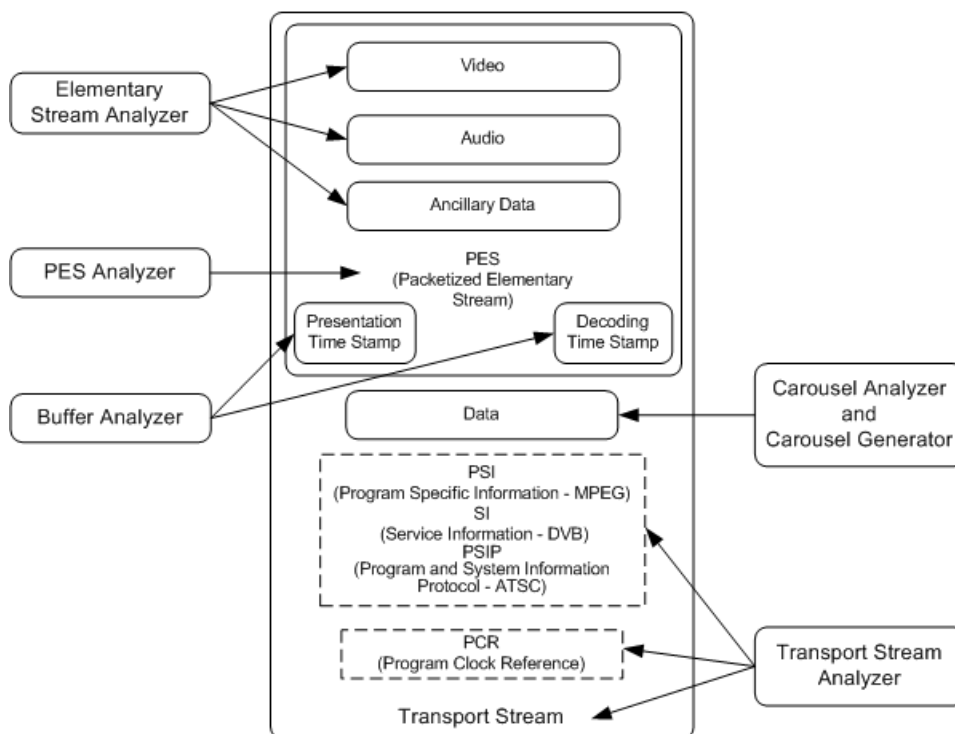
The MPEG Player is now playing out the sym1.mpg transport stream and, through the ASI input and output on the instrument connector panel, the TSCA is monitoring and analyzing the stream.

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

Procedures

Using the MTS400 Series Applications

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



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

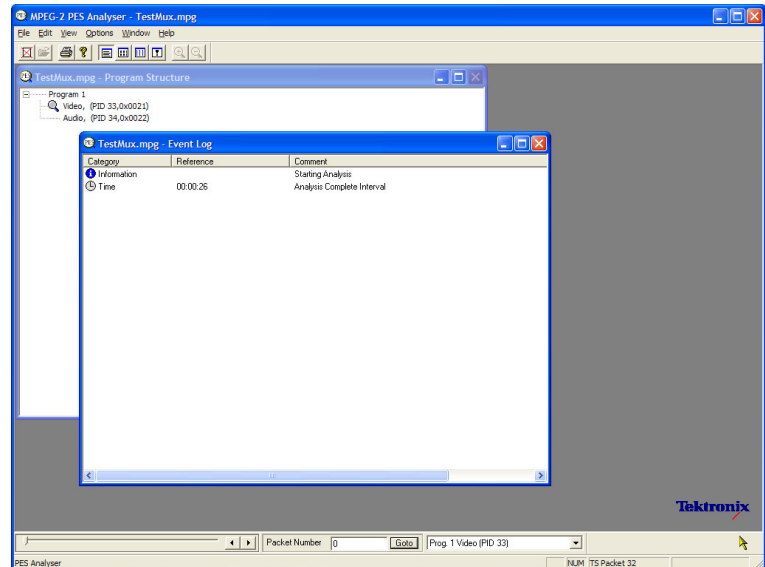
Transport Stream Compliance Analyzer

The TSCA provides real-time and off-line analysis of transport streams to check for compliance with a range of DTV standards. Streams can be received through a range of RF and IPTV interfaces. A practical application of the TSCA is described in Examine Stream Content with TSCA section. (See page 62, *Examining Stream Content with the TSCA*.)

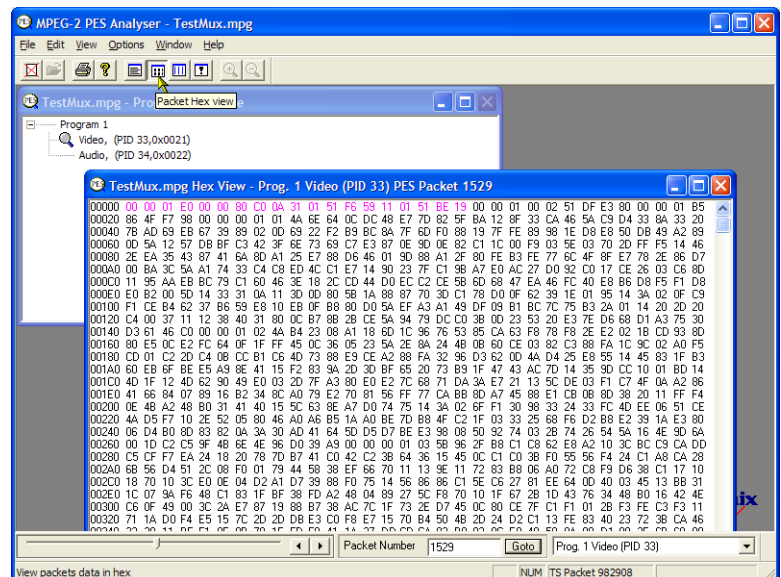
PES Analyzer

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

1. Open the PES Analyzer. **Start > Program > Tektronix MTS400 > Analyzers > PES Analyzer.**
2. Select **File > New**. Locate and open a transport stream, for example, the stream created earlier, testmux.mpg.
The analysis progress is displayed in the status bar and the Event Log. The Program Structure view is displayed when analysis is complete. In this example you can see that the stream carries a single program, which contains one video and one audio elementary stream on PIDs 33 and 34 respectively.



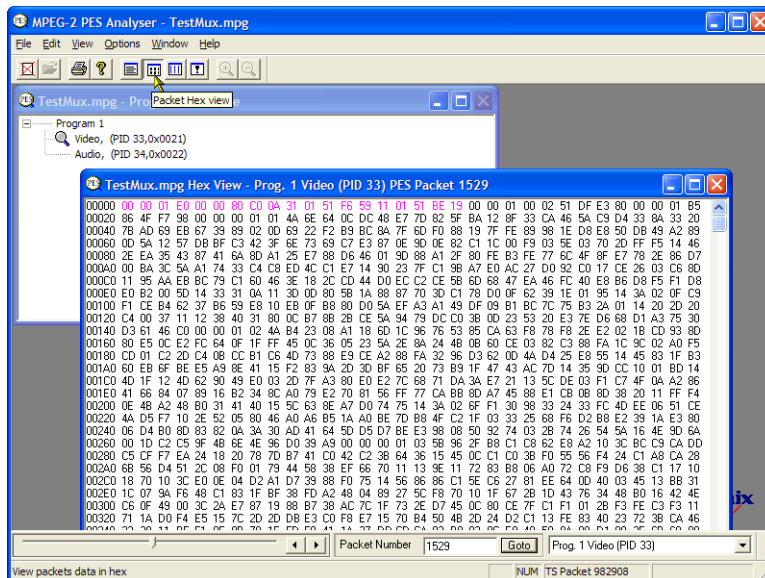
3. Select the video stream in the Program Structure view; the magnifying glass icon will indicate that it has been selected.
4. Open each view option in the View menu, that is, Event Log, Hex, Interpretation, and PTS/DTS Timing. Each action opens a new view in the PES Analyzer window. It may be useful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

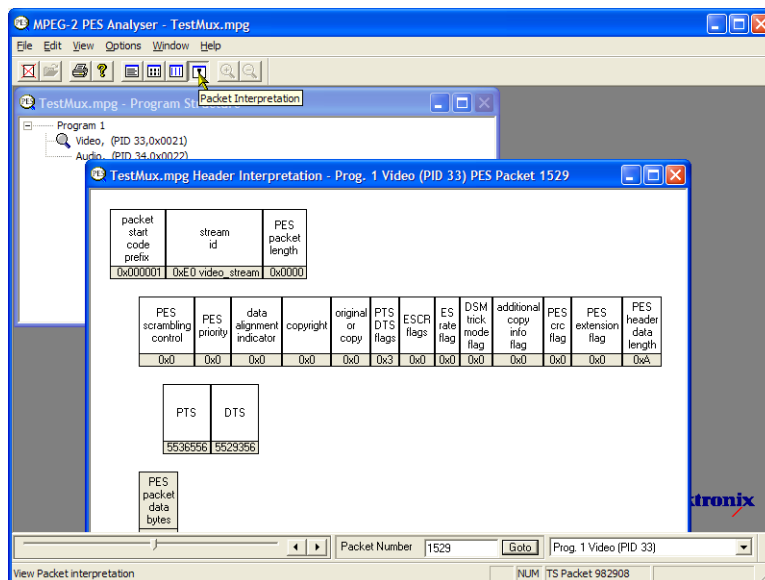
In this view, you can examine every byte in the PES.

- 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.

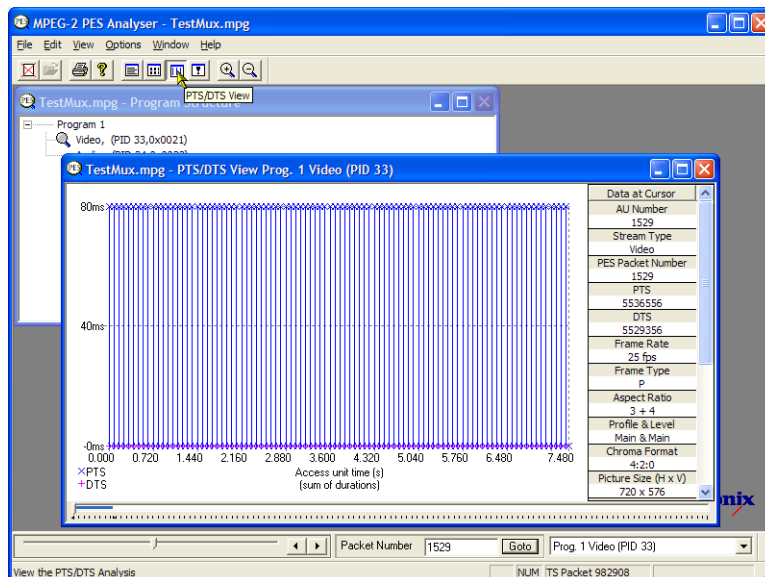


PTS/DTS View:

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.

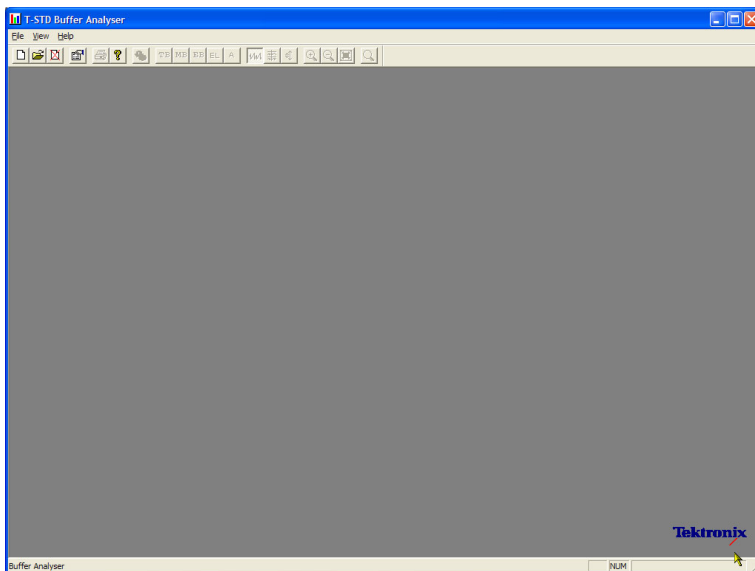
Select the toolbar magnifying glass and click on the view to zoom in and out of the graph. The slider at the bottom of this window indicates where the displayed packets are in relation to the rest of the file.



T-STD Buffer Analyzer

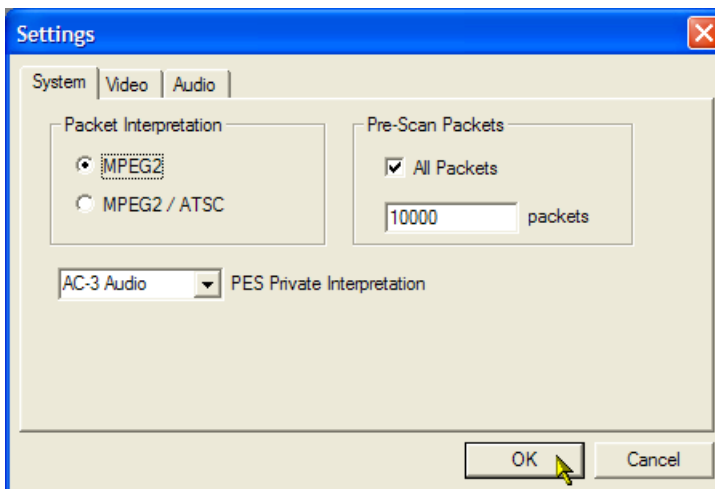
The T-STD Buffer Analyzer models the behavior of the buffers in the hypothetical Transport Stream System Target Decoder, as specified in ISO/IEC 13818-1. It can process video, audio, and system control streams. The results of the analysis are displayed as graphs of the buffer capacity over time and a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

1. Open the T-STD Buffer Analyzer. **Start > Program > Tektronix MTS400 > Analyzers > Buffer Analyzer.**

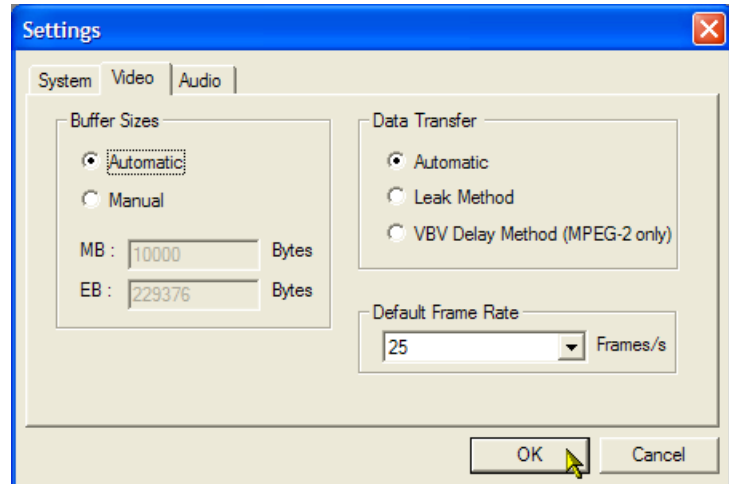


2. Review the configuration settings. **View > Settings.**

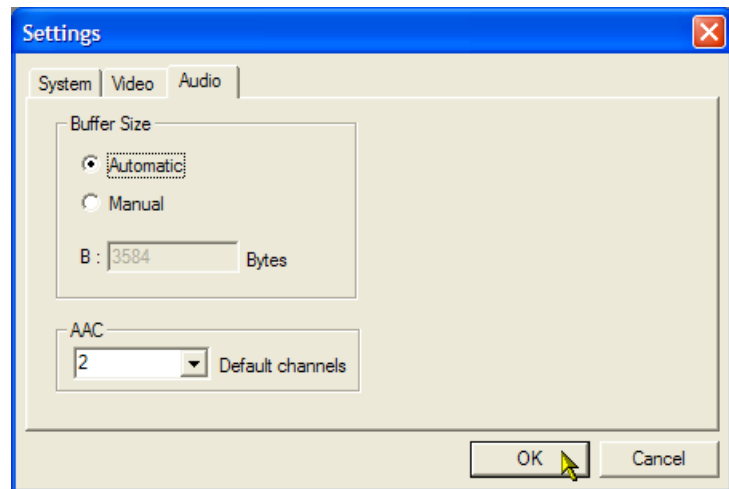
In the System tab of the Settings dialog box, select **MPEG2 Packet Interpretation** and select **Pre-Scan Packets All Packets**.



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



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

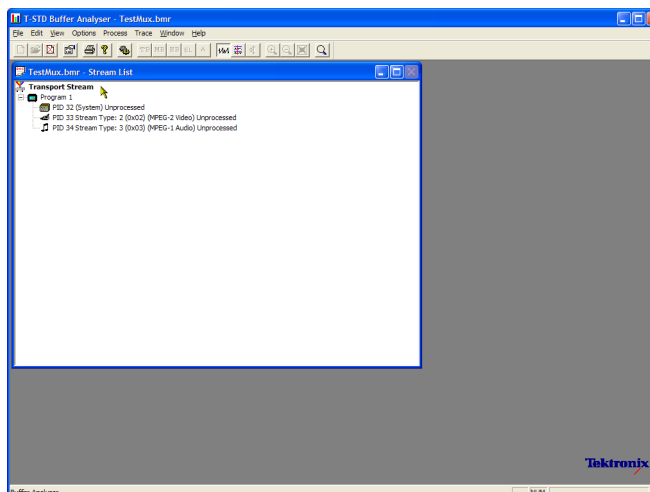


6. Select a file for analysis. **File > New.**
7. Locate and open an MPEG file. For example, testmux.mpg, created in earlier application examples.

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

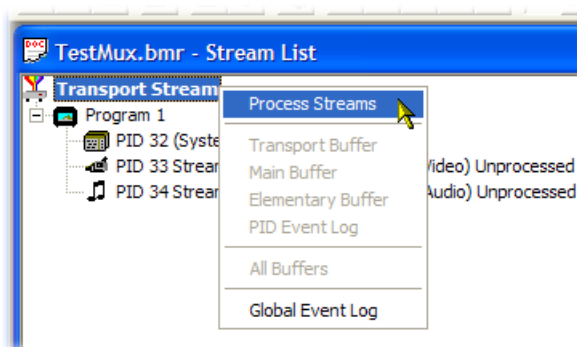
Accept the default name and open the file.

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



8. Select **Process Streams** from the 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:

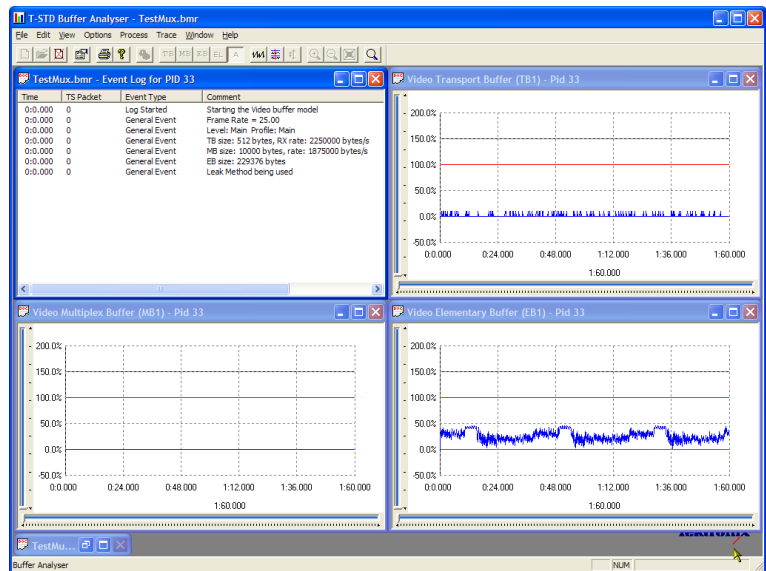
- Use the toolbar magnifying glass icons to zoom in and out of the selected graph. Zoom value can be reset using the Reset Zoom toolbar button.
- All open graphs can be viewed and manipulated separately. Use the Options > Synchronize Views to synchronize all views with the currently selected view.
-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

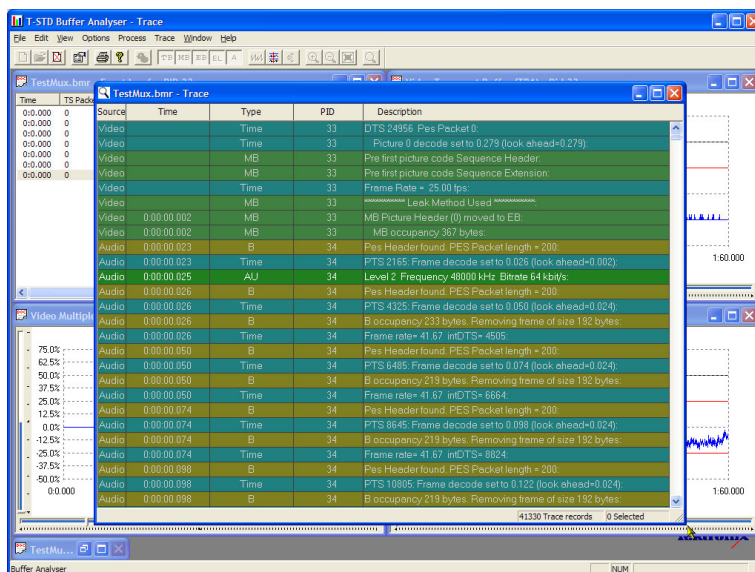


Video Elementary Buffer:

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.



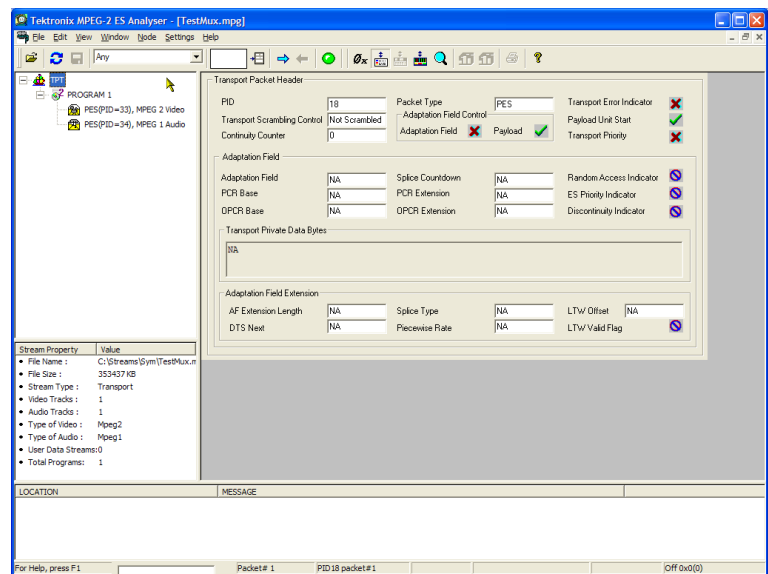
Elementary Stream Analyzer

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

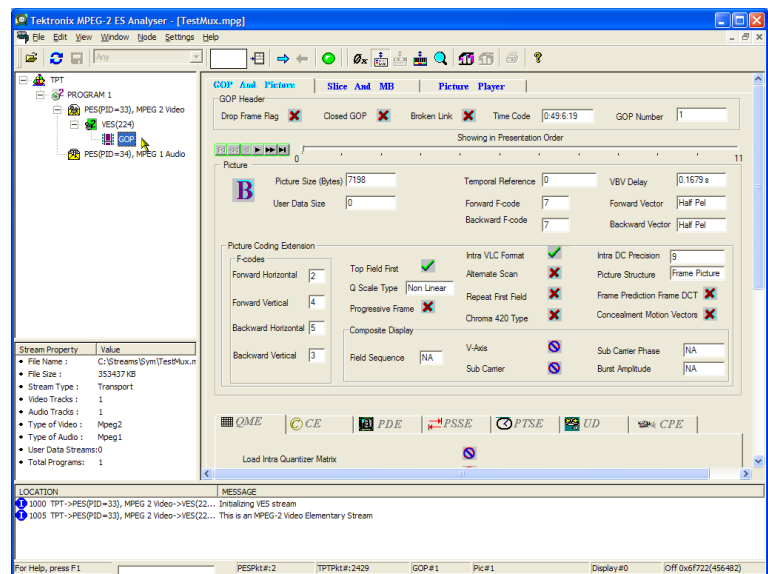
ES Analyzer is a complex application which you can use to analyze many aspects of video and audio streams. For this reason, the following procedure shows you how to access some of the analysis screens; detailed explanation of their content and meaning can be found in the *MTS400 Series Analyzer Application User Manual*.

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

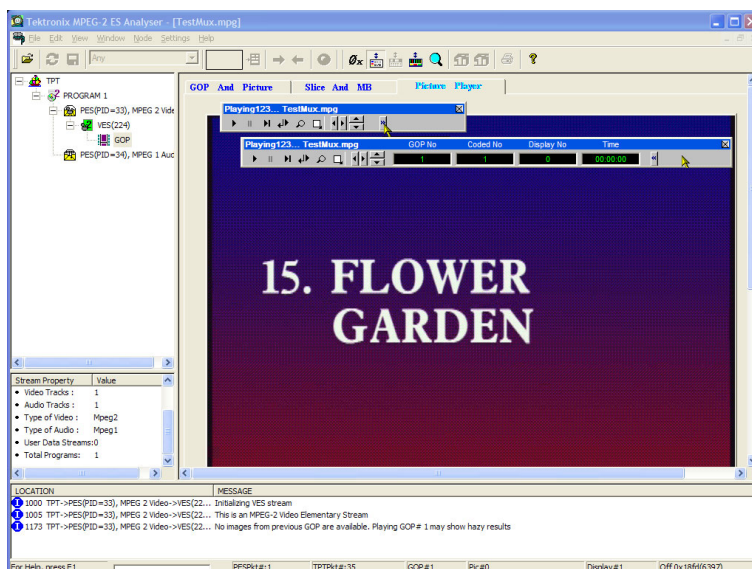
2. Select a file for analysis. **File > New.**
Locate and open an MPEG file. For example, testmux.mpg, created in earlier application examples.



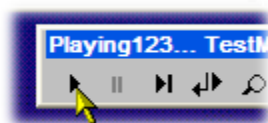
3. Click on each successive node in the navigation window until the GOP (Group of Pictures) is highlighted in the Program 1 / PES (PID 33), MPEG 2 Video branch.



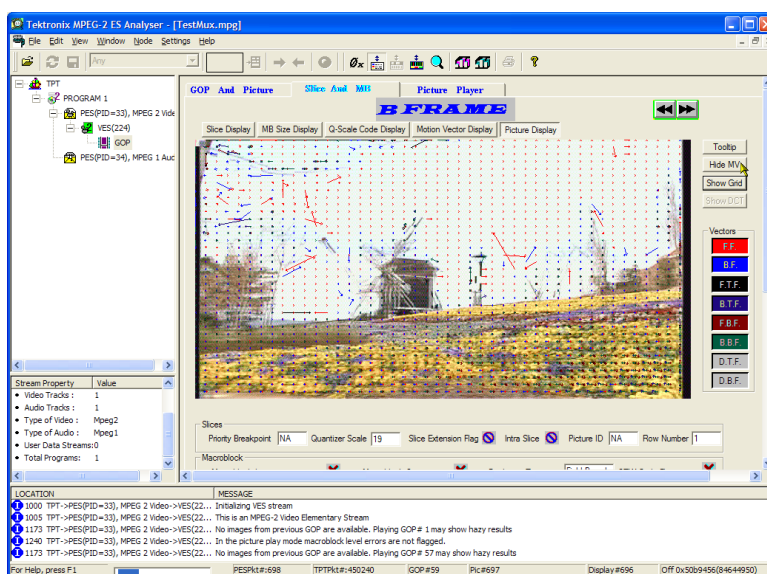
4. Select the Picture Player tab. Note that the Picture Player remote control is displayed.
5. Click the Show Information button to expand the control bar. The extra information shows the position in the file of the displayed picture; more information is shown in the status bar.



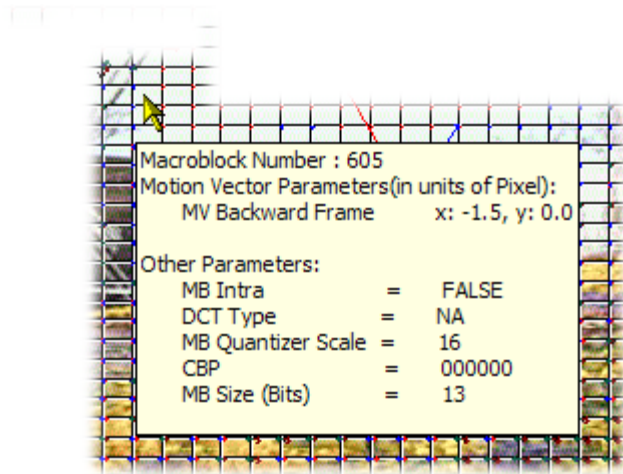
6. Start playing the stream by clicking the play button on the control bar.
If you stop the playout, you can select the other GOP tabs (GOP and Picture, Slice and MB), and examine the characteristics of that frame.



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



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

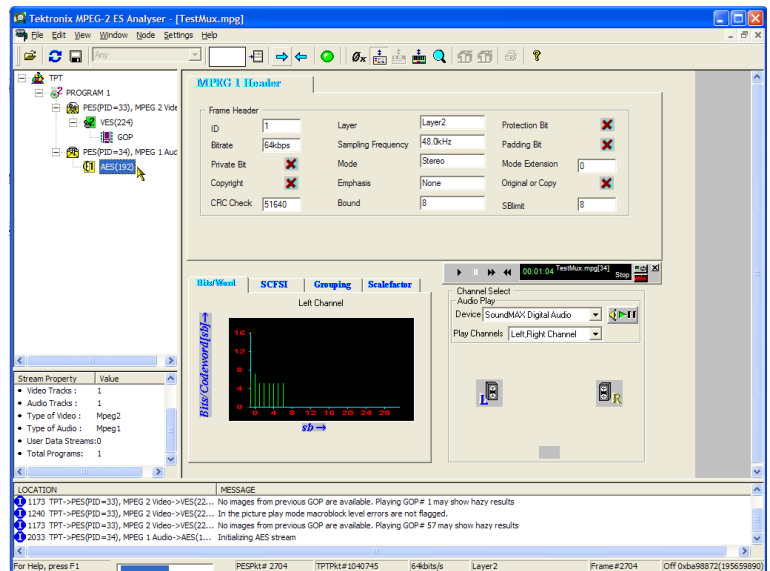


9. Use the Previous Frame and Next Frame buttons to move backward and forwards in the stream and compare the motion vectors.



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

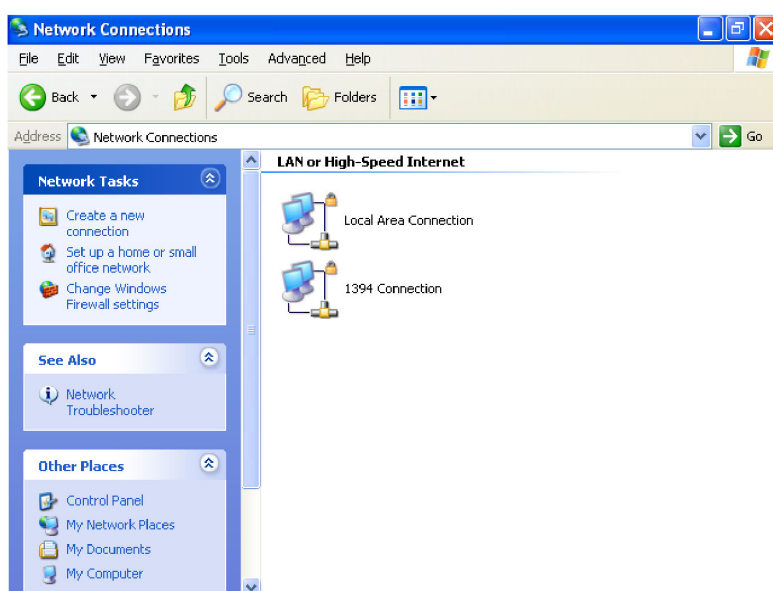
10. Click on each successive node in the navigation window until the GOP (Group of Pictures) is highlighted in the Program 1/PES (PID 34), MPEG 1 Audio branch. Use the audio control bar to review the audio track. You will need to use headphones to hear the output.



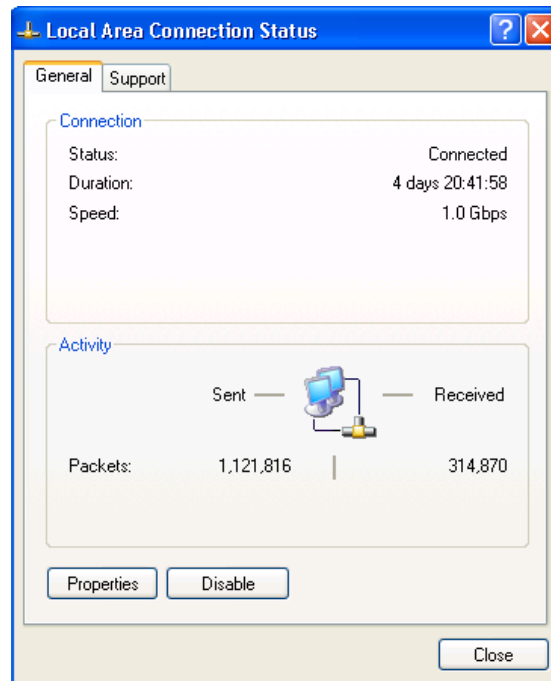
Setting Ethernet Network Parameters

Perform the following procedure to set the network parameters for the MTS400P system:

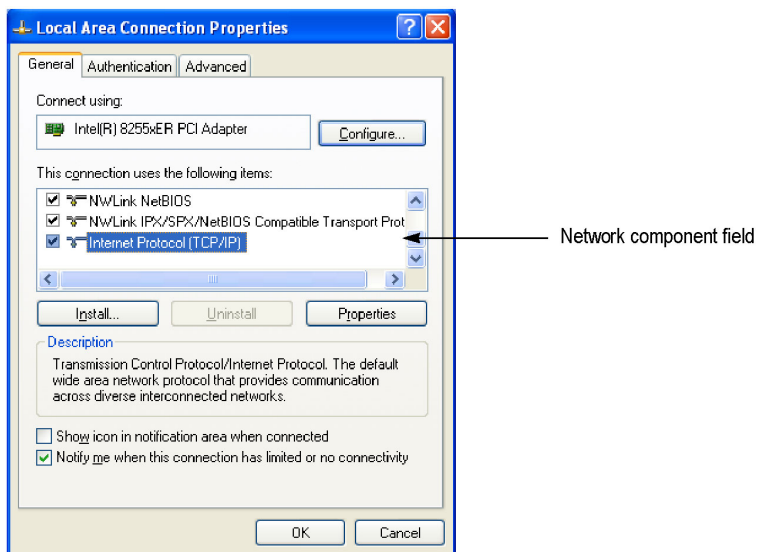
1. Connect the keyboard and the mouse provided with the instrument to the USB connectors on the front panel. You can connect them to either of the connectors.
2. Select **File > Minimize** or **File > Exit** to close the Play (or Record) screen. The Windows XP desktop appears.
3. Select **Settings > Control Panel** from the Start menu. The Control Panel window appears.
4. Double-click the **Network Connections** icon in the window. The Network Connections window appears.



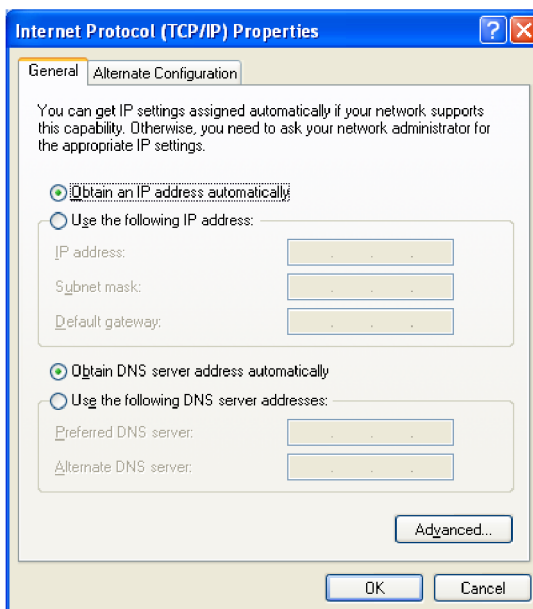
5. Double-click the **Local Area Connection** icon. The Local Area Connection Status dialog box appears.



6. Click the **Properties** button. The Local Area Connection Properties dialog box appears.



7. In the network component field, click **Internet Protocol (TCP/IP)**.
8. Click the **Properties** button.



The settings in the dialog box depend on whether a DHCP (Dynamic Host Configuration Protocol) server is in the network connected to the MTS400P system.

When the DHCP Server Is in the Network

If the DHCP server is in the network, perform steps 9 and 10, otherwise skip to step 11.

9. In the dialog box, select **Obtain an IP address automatically** and **Obtain DNS server address automatically**.

10. Click the **OK** button.

The MTS400P accesses the DHCP server and obtains the addresses automatically when connected to the network.

Refer to the user documentation supplied with your server OS for detailed information about DHCP server functions.

NOTE. *In some network environments, the MTS400P system may not be able to obtain the IP address automatically from a DHCP server. In this case, you need to enter the appropriate address value in each submenu item.*

When the DHCP Server Is Not in the Network

If the DHCP server is not in the network, perform the following procedure to set the network parameters.

11. If you connect the MTS400P system directly to a single PC:

- In the dialog box, select **Use the following IP address**.
- Set the **IP address** parameter to be the same IP address as the PC's address except for the last number. The last number must be different from the last number in the PC's IP address.
- Set the **Subnet mask** parameter to be the same net mask (subnet mask) used by the PC. Do not enter a number if the PC does not have a net mask.
- You do not need to enter a **Default gateway** if you are directly connected to a single PC.

12. If you connect the MTS400P system to your local Ethernet network:

- In the dialog box, select **Use the following IP address**.
- Ask your local network administrator and set the appropriate addresses.



CAUTION. *To prevent communication conflicts on your Ethernet network, ask your local network administrator for the correct numbers to enter in the dialog box if you connect the MTS400P system to your local Ethernet network.*

13. Verify the Ethernet connection by using a ping command from the PC. (See page 16, *Pinging a host machine*.)

Application Examples

This section provides the following application examples:

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

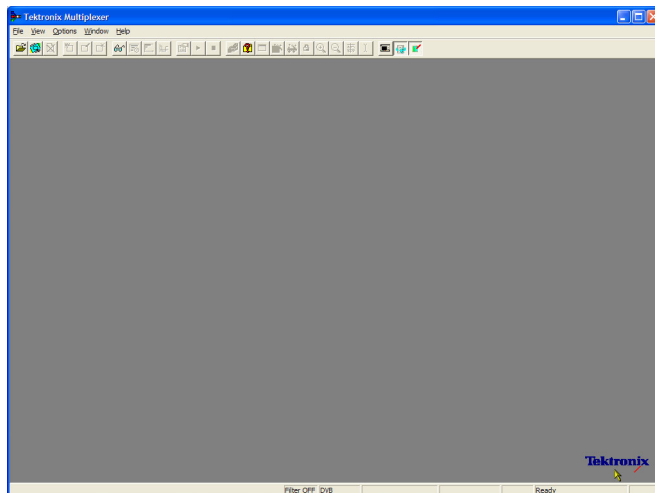
Creating, Viewing, and Analyzing a Transport Stream

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

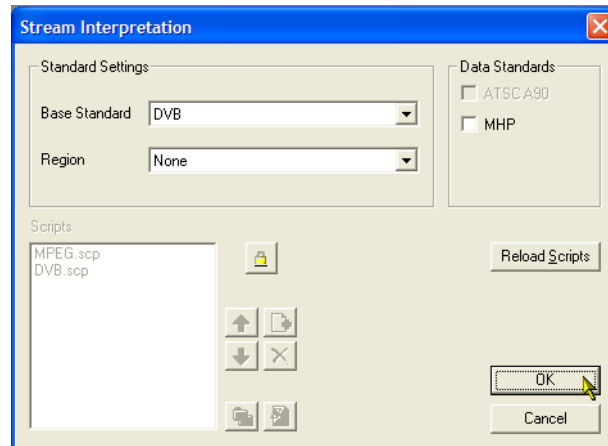
Create a new stream using the multiplexer

In this section of the application example, you will create a new transport stream using the MTS400 Series Multiplexer application. You will introduce one error so that you will be able to observe it in a later section of the application example.

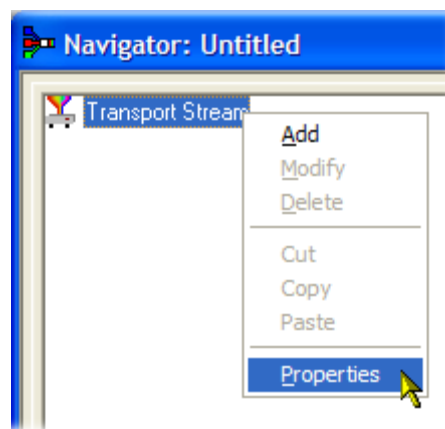
1. Open the Multiplexer application. **Start > Programs > Tektronix MTS400 > Generators > Multiplexer.**



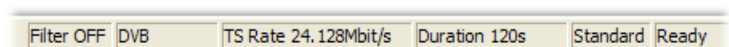
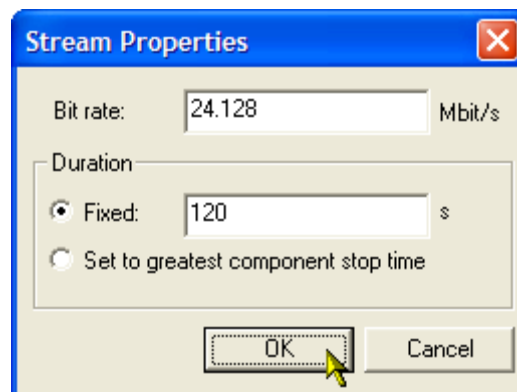
2. Select **View > Interpretation**.
3. In the Stream Interpretation dialog box, ensure that the selected Base Standard is DVB and that the Region is None.
4. Select **OK** to close the Stream Interpretation dialog box.



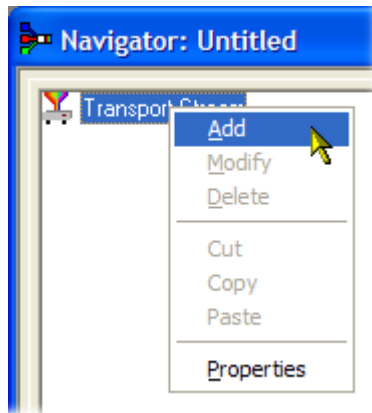
5. Select **File > New**.
6. In the Navigator window, highlight the Transport Stream node and select **Properties** from the context menu.



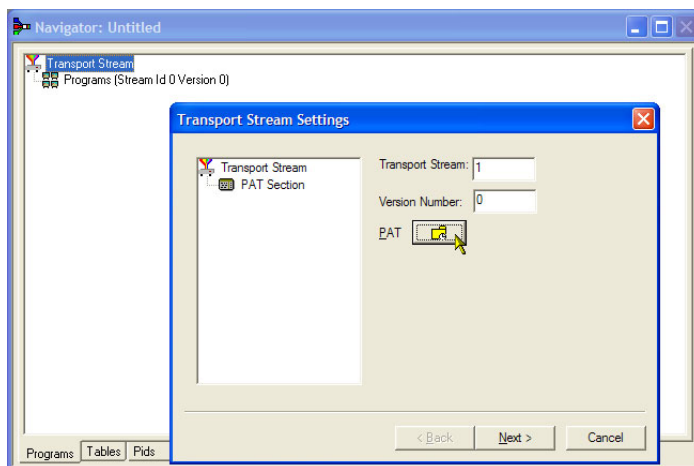
7. In the Stream Properties dialog box, enter a bit rate of 24.128 Mbit/s and a fixed duration of two minutes (120 seconds). Select OK.
Note that the two values are displayed in the status bar.



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

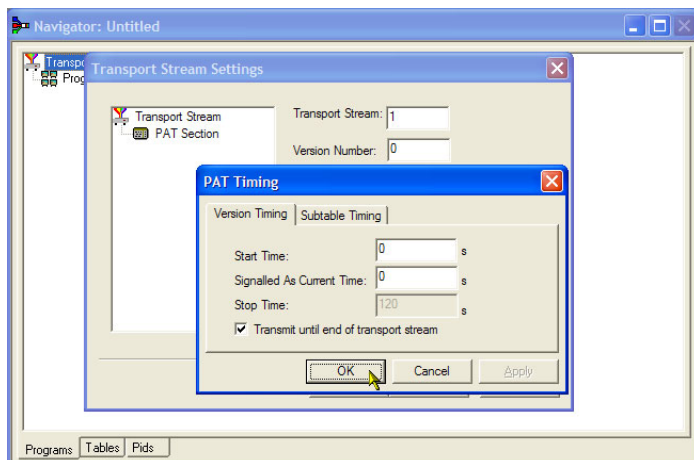


9. In the Transport Stream Settings dialog box, enter 1 as the **Transport Stream** identity.
10. Select the **PAT** (Program Allocation Table) folder icon button to open the PAT Timing dialog box.

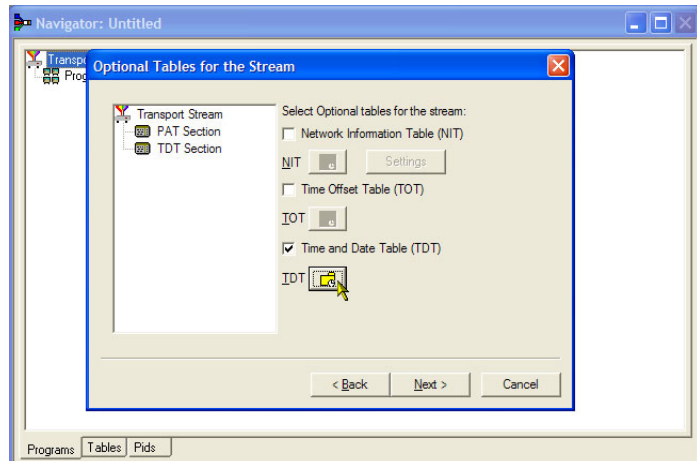


In the Version Timing tab window, note that the PAT timing Start time (0 s) and Stop time (120 s) mean that the PAT will be transmitted for the stream duration.

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



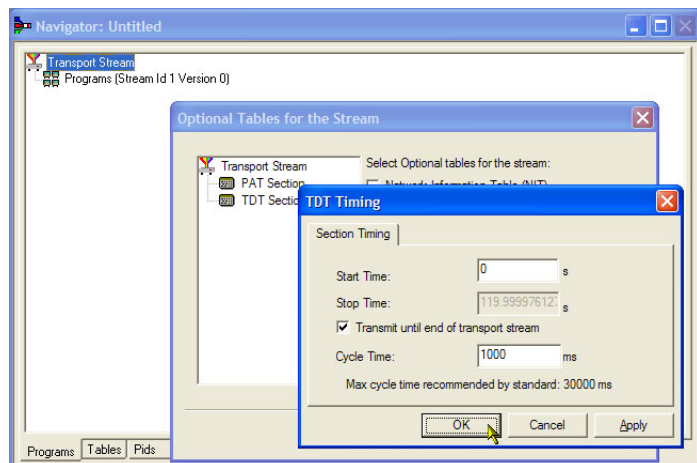
13. In the Optional Tables for the Stream dialog box, select the **TDT** (Time and Date Table) check box and select the **TDT** folder icon button.



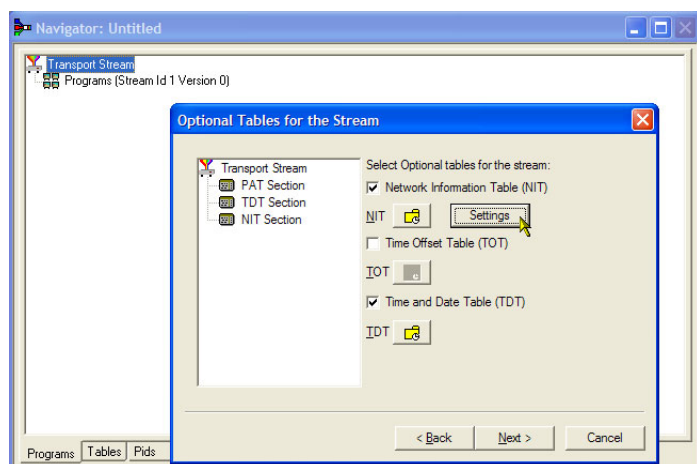
In the TDT Timing dialog box, confirm that the Start Time is zero and the Stop Time is the same as the duration previously set.

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

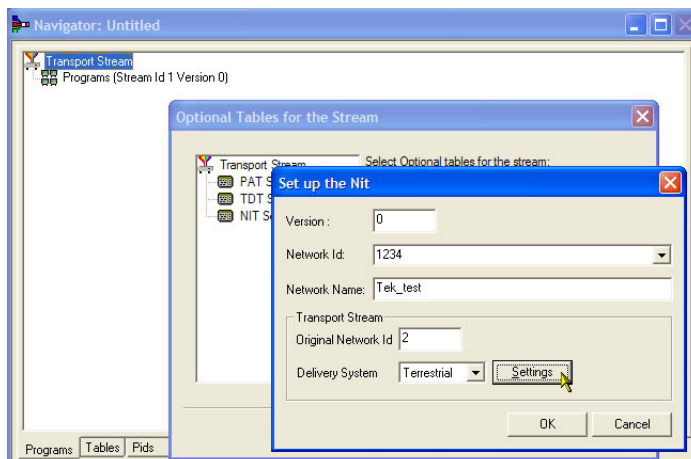
14. Enter a **Cycle Time** of 1000 ms.
15. Select **OK** to close the TDT Timing dialog box.



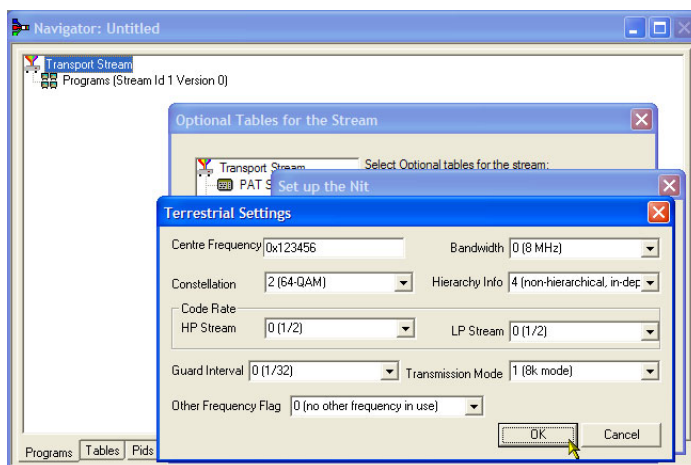
16. In the Optional Tables for the Stream dialog box, select the **NIT** (Network Information Table) check box and select the **NIT** Settings button.



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

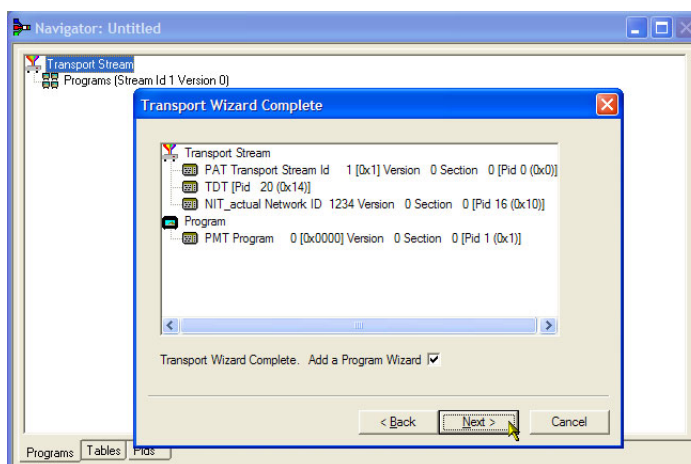


20. In the Terrestrial Settings dialog box, enter 0x123456 in the **Centre Frequency** field.
21. Select **2 (64-QAM)** from the Constellation drop-down list.
22. Select **4 (non-hierarchical, in-depth interleaver)** from the Hierarchy Information drop-down list.
23. Select **1 (8k mode)** from the Transmission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



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

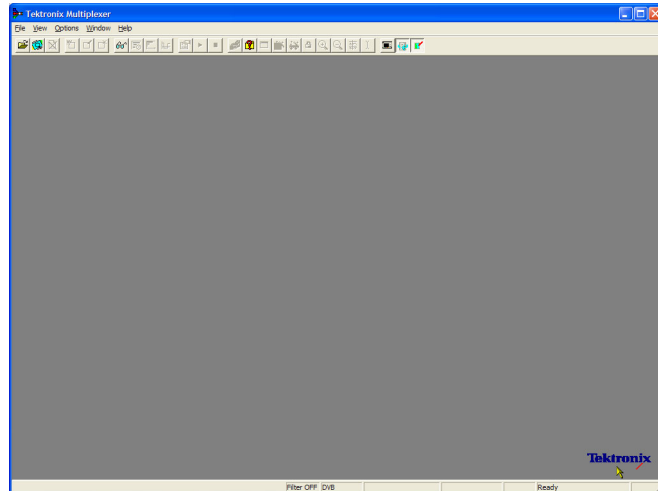
26. In the Optional Tables for the Stream dialog box, select **Next** and display Transport Wizard Complete dialog box. The transport stream set up is complete. Now you need to add some content in the form of video and audio elementary streams.



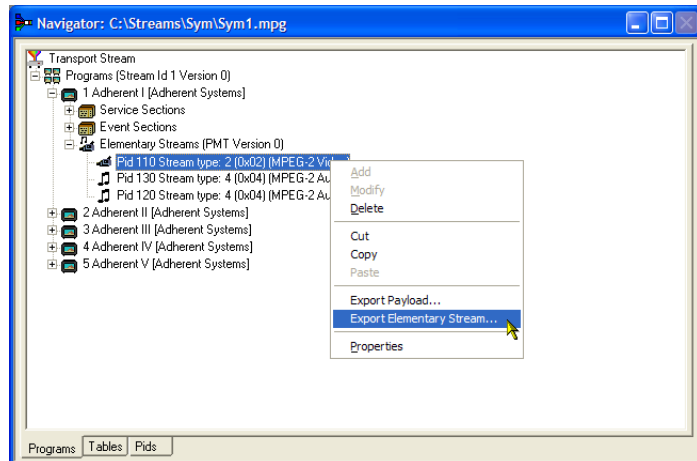
Elementary stream acquisition.

For this example, you need to add a video and an audio elementary stream to the transport stream that you have created. You can extract suitable streams from one of the sample transport streams supplied with the MTS400 installation. The stream suggested is Sym1.mpg; this is available on the E: drive of your MTS400.

1. Open a second instance of the multiplexer. **Start > Programs > Tektronix MTS400 > Generators > Multiplexer.**
2. Select **File > Open.**
3. In the **Set MPEG File to Edit** dialog box, locate and open sym1.mpg.



4. Expand the program 1 node and the dependent Elementary Streams node.
5. Highlight the PID 110 node. This PID is carrying an MPEG-2 video elementary stream. The es file extension will be added automatically.
6. Select **Export Elementary Stream** in the context menu.
7. In the **Save As** dialog box, enter a file name (Sym1pid110.es) and save the file to a suitable location.



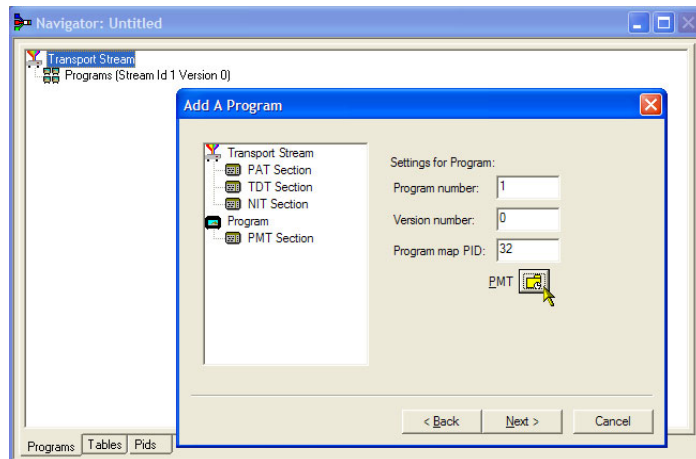
8. Repeat the action for PID120. Name the file Sym1pid120.es.
9. Select **File > Exit** to close this instance of the Mux.

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

Add elementary streams.

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

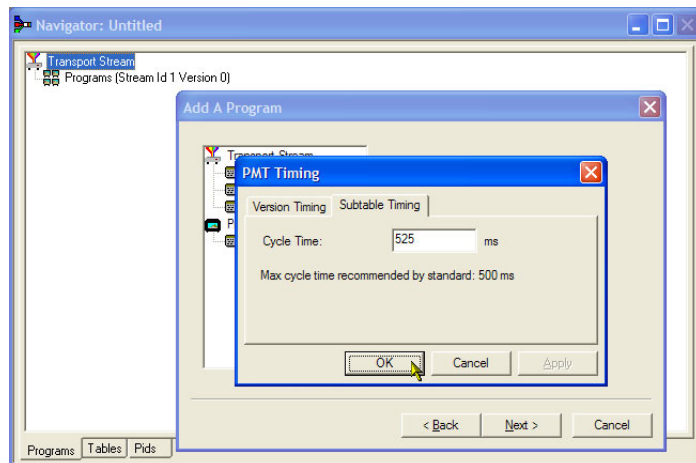
1. Ensure that **Add a Program Wizard** is checked and select **Next**. See step 26.
2. In the Add a Program dialog box, enter 1 as the program number.



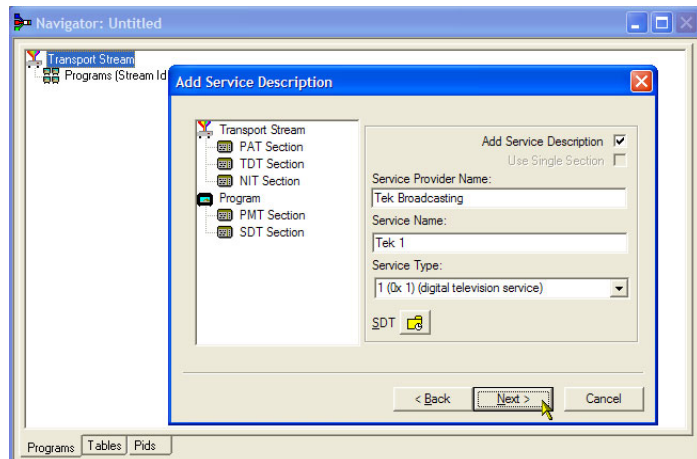
3. In the PMT Timing dialog box, select the Subtable Timing tab.

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

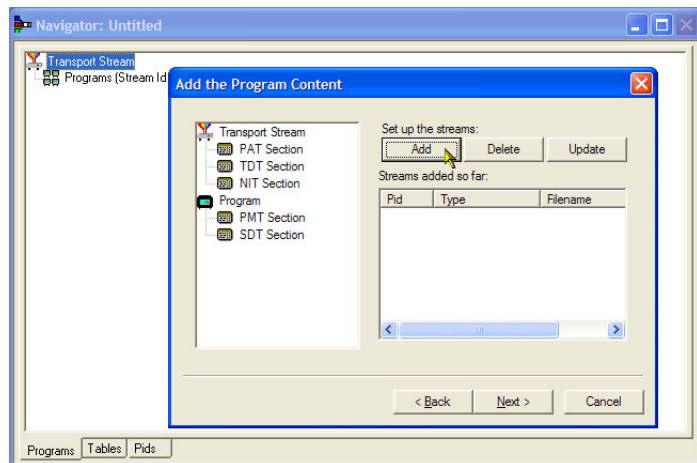
4. For this example stream, set the **CycleTime** to 525 ms.
5. Select **OK** to close the PMT Timing dialog box.
6. In the Add a Program dialog box, select **Next**.



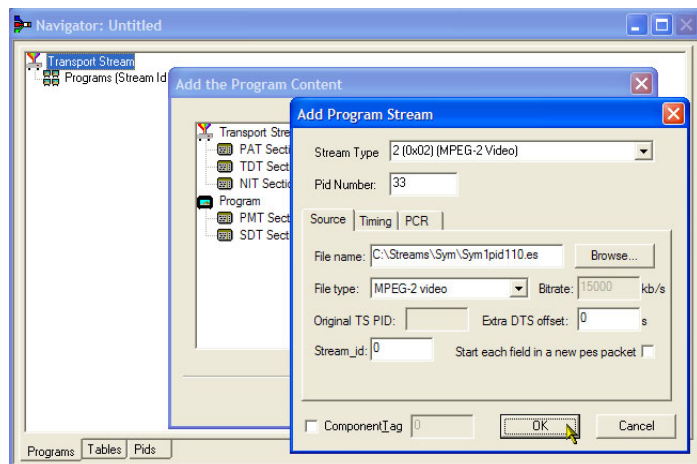
7. In the Add Service Description dialog box, select the **Add Service Description** check box.
8. Enter a **Service Provider Name**, for example, Tek Broadcasting.
9. Enter a **Service Name**, for example, Tek1.
10. Enter a **Service Type**, for example, 1 (0x1) (digital television service).
11. Select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



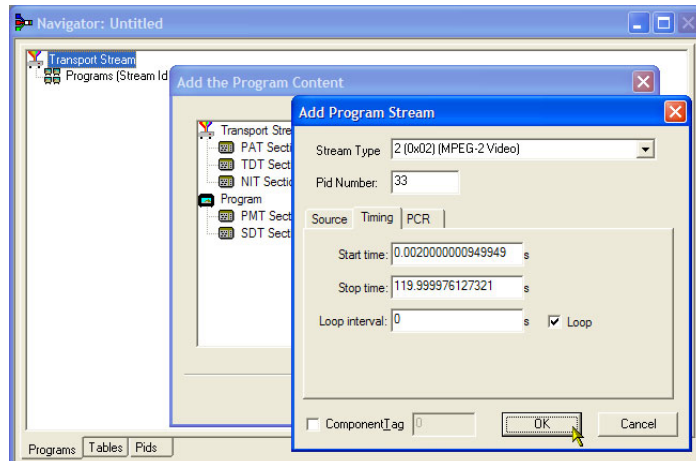
12. In the Add the Program Content dialog box, select **Add** to add a video elementary stream.



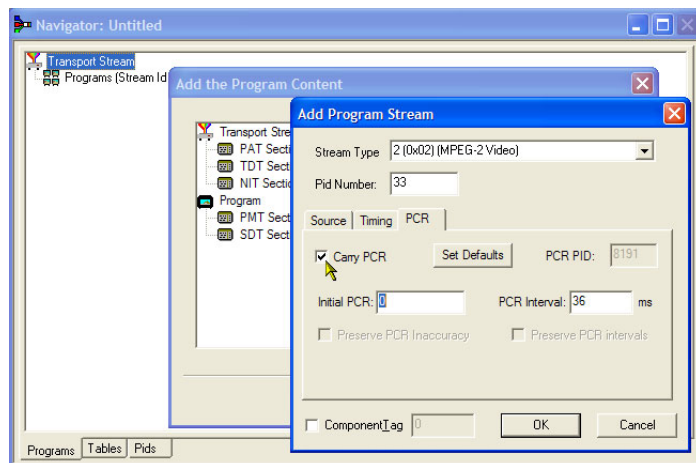
13. In the Add Program Stream dialog box, select **2 (0x02) (MPEG-2 Video)** from the Stream Type drop-down list.
14. Ensure that the **Source** tab is selected.
15. Enter a File Name, or use **Browse** to locate the video elementary stream previously set up (Sym1pid110.es).
16. Select **MPEG-2 video**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



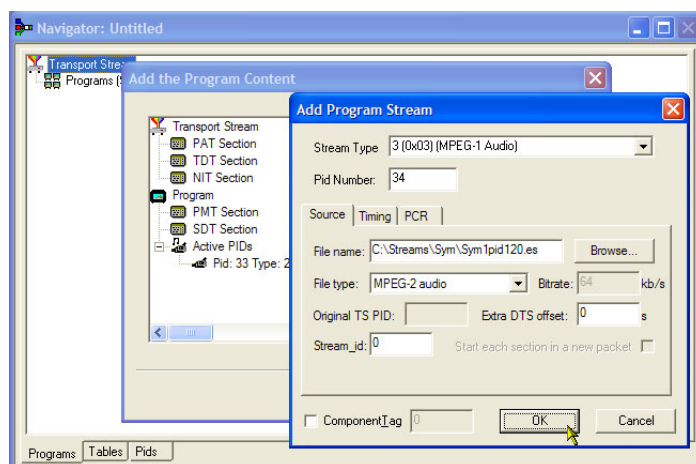
Select the **Timing** tab. Note that the elementary stream is going to run for the length of the stream previously set, that is, 120 s.



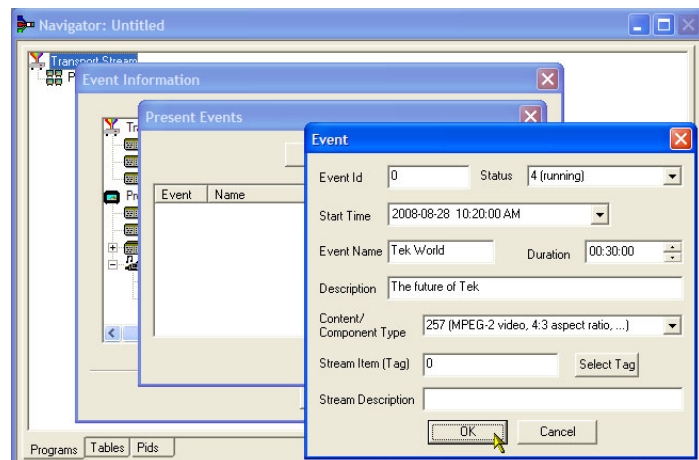
17. Select the **PCR** tab. Ensure that the **Carry PCR** check box is selected.



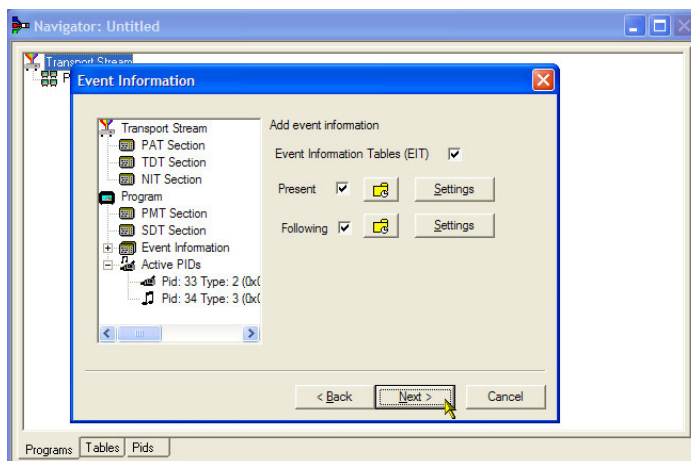
18. Select **OK** to close the Add Program Stream dialog box.
19. In the Add Program Content dialog box, select **Add** again to add an audio elementary stream.
20. Select **3 (0x03) (MPEG-1 Audio)** from the Stream Type drop-down list.
21. In the Add Program Stream dialog box, ensure that the **Source**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



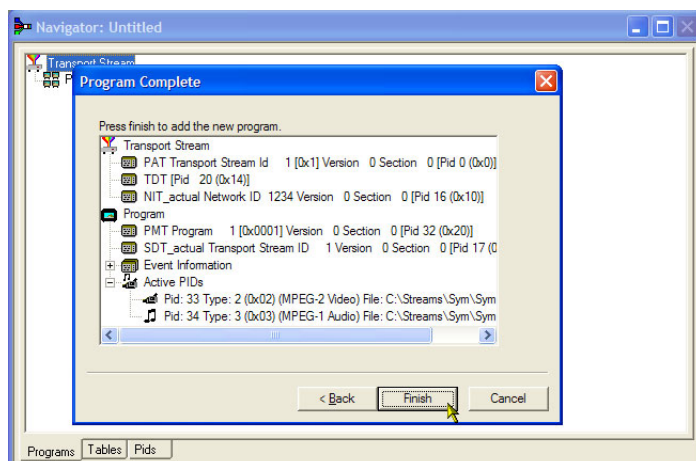
23. Select **MPEG-2 audio** from the File type drop-down list. Note that the file bit rate has been entered automatically.
24. Select the **Timing** tab. Note that the elementary stream is going to run for the length of the stream previously set, that is, 120 s.
25. Select the **PCR** tab. Ensure that the Carry PCR check box is cleared.
26. Enter 33 in the **PCR PID** field. This is the PID that will carry the PCR information – also the video es, Carry PCR.
27. Select **OK** to close the Add Program Stream dialog box.
28. Select **Next**.
29. In the Event Information dialog box, select the Event Information Tables (EIT) check box.
30. Ensure that the Present check box is selected.
31. Select **Present Settings**.
32. In the Present Events dialog box, select **Add** to set up the present event information, that is, the time of this broadcast. In the Event dialog box, select 4 (running) from the Status drop-down list.
33. Set the Start Time to 2008-08-28 10:20:00 AM.
You can change the time and date by highlighting the individual field and entering the required value.



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



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



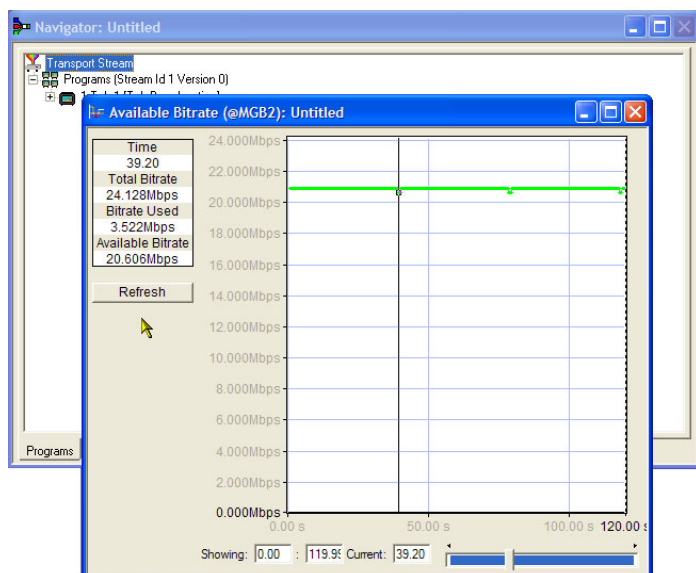
You have finished creating the structure and content of the proposed transport stream. You can now make a couple of checks to ensure that the stream will compile successfully.

54. Select **View > Available Bitrate**.

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

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

55. Close the Available Bitrate graph.



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

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

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

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

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.

58. Select **File > Export**.

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

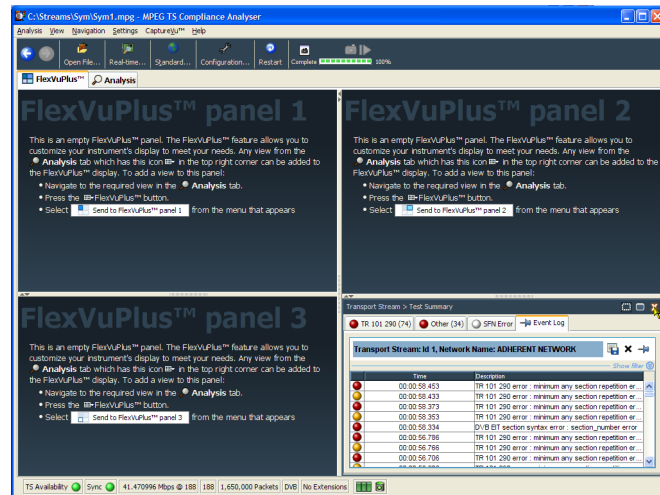
60. Using **File > Import**, the multiplex structure file can be reopened at any time to add elementary streams or structural information.

Setting up the *FlexVuPlus™* display

Using *FlexVuPlus*, you can select up to four views from the analysis detail views to be displayed together to facilitate basic transport stream monitoring or more detailed diagnostic monitoring.

For this exercise, close each of the currently displayed *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 are numbered.

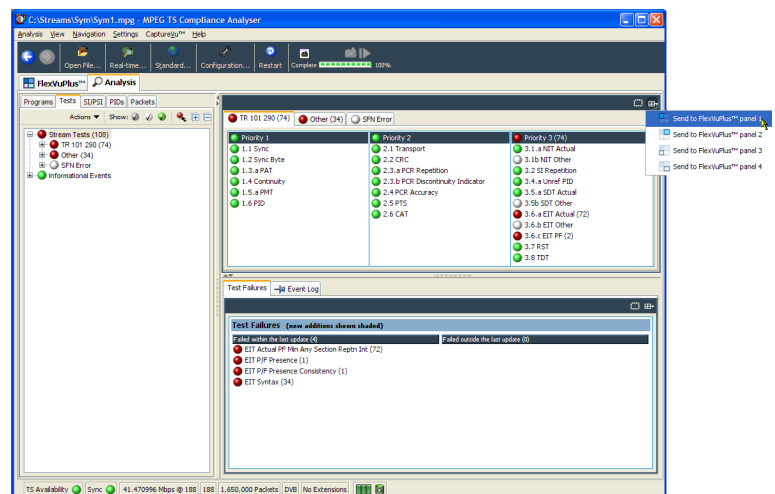


Set up panel 1

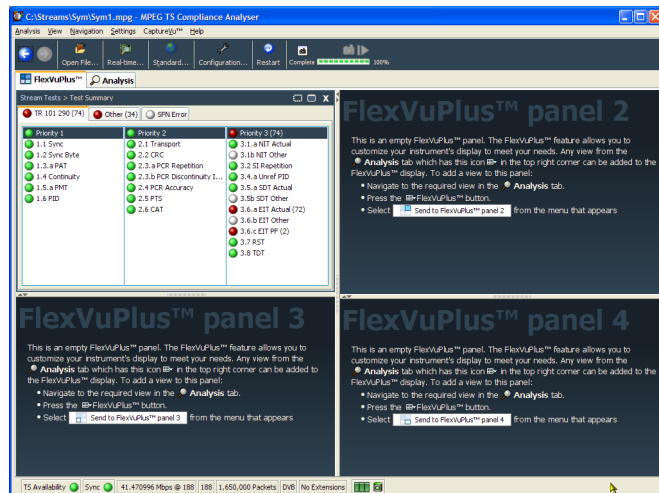
1. Select the **Analysis** tab and then the **Tests** tab.

In the top right corner of all detail views is a *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.

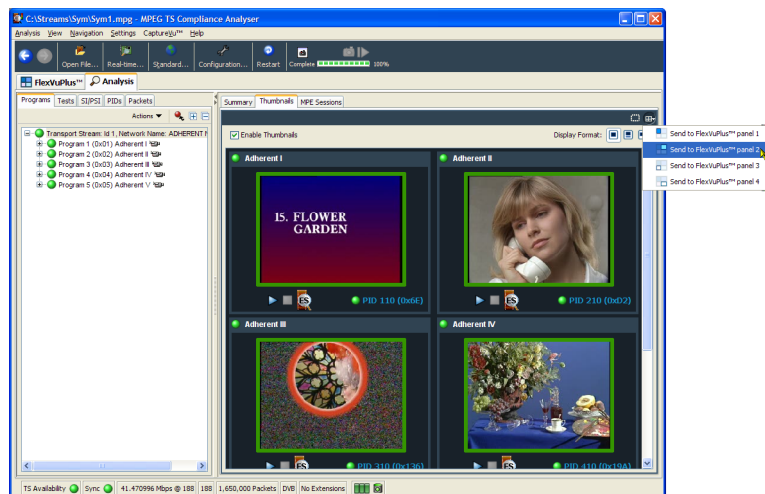


- The *FlexVuPlus* display now contains the Test Summary view in panel 1.

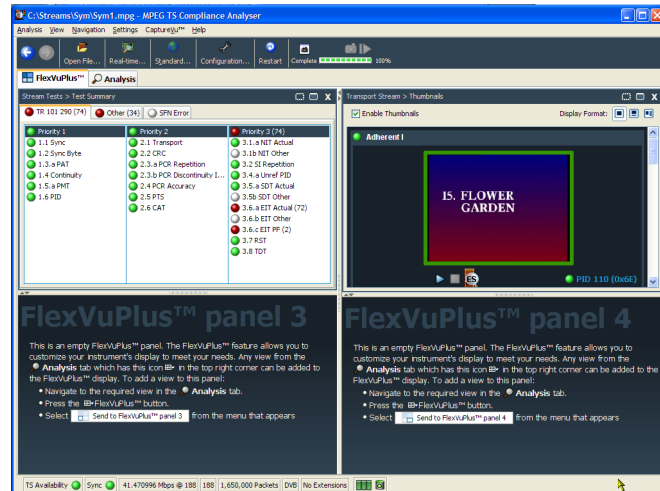


Set up panel 2.

- 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.

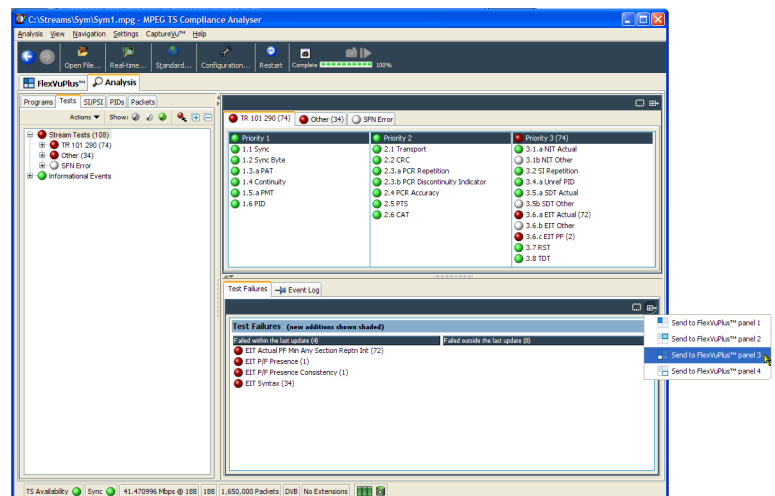


6. The *FlexVuPlus* display now contains the Thumbnail view in panel 2.

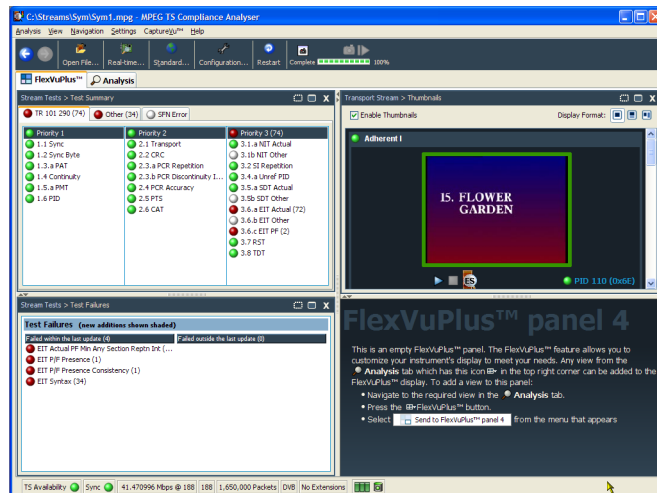


Set up panel 3.

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.



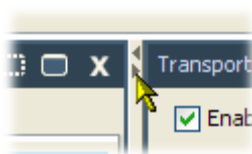
9. The *FlexVuPlus* display now contains the Test Failures view in panel 3.



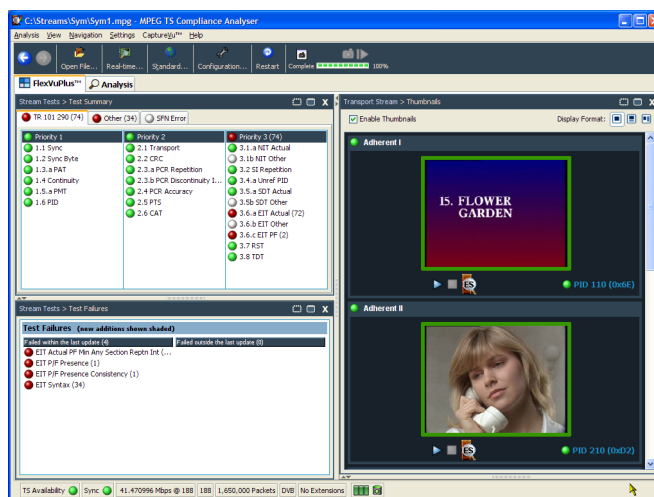
Since only three panels are used in this example, you can expand the thumbnails view to fill the right side of *FlexVuPlus™*. You can expand panel 2 vertically by selecting the panel expand button.



(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.

Examining Stream Content with the TSCA

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

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

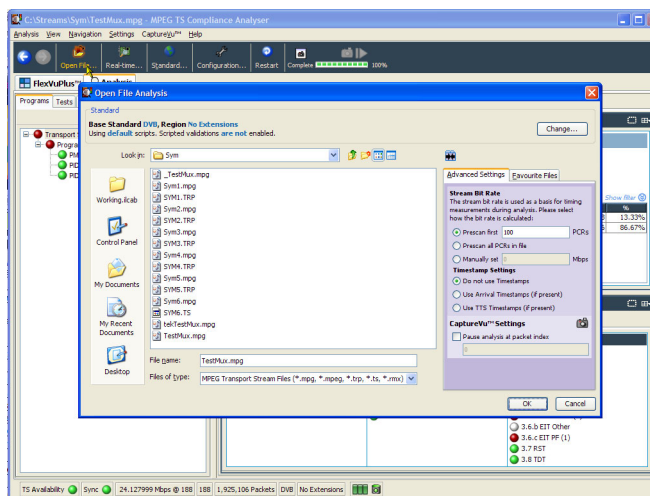
In the TSCA toolbar, select **Open File**.

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

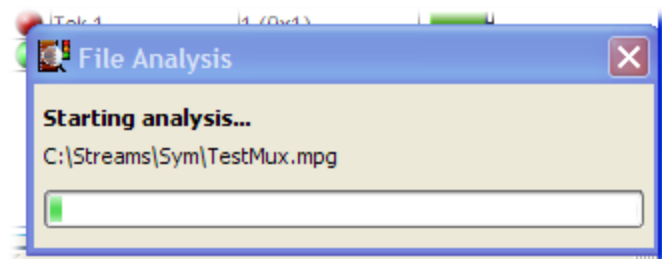
In the Open File Analysis dialog box, ensure that the **Base Standard** is **DVB** and the **Region** is **No Extensions**.

Locate and select the example stream, **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.

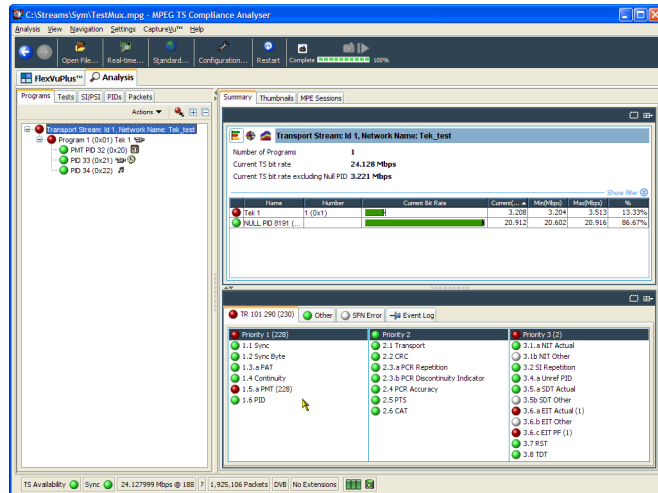


2. Select the **Analysis** tab to display the navigation and related views.
3. Select the **Programs** tab and expand the nodes in the navigation view by clicking the plus symbols.

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

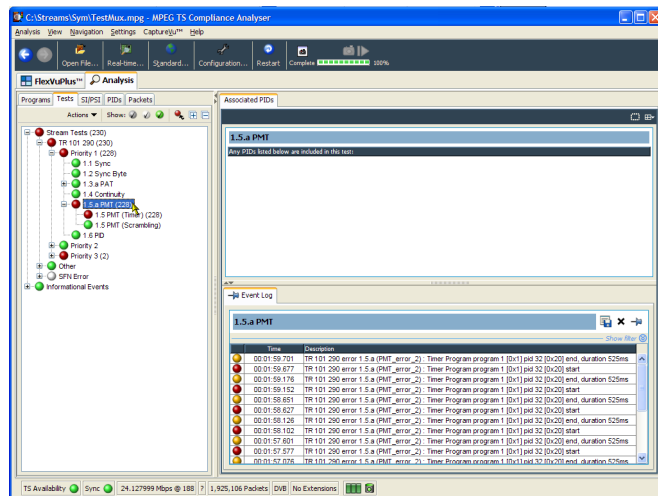
The Transport Stream node and the Program node are both red. This shows that an error has occurred in the stream and is still active.

4. Highlight the Transport Stream node. In the Tests Summary detail view, **TR 101 290** tab, note that test 1.5.a PMT is indicating an error, that is, the associated LED is red.
5. Highlight test 1.5.a PMT and select **View this test** in the Tests tree from the context menu.

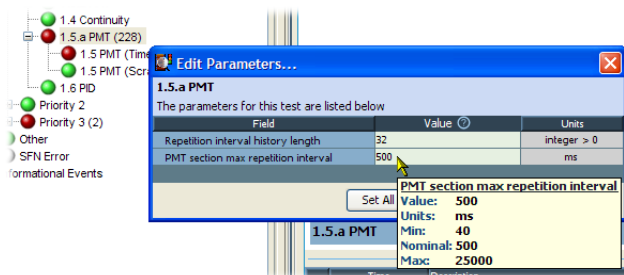


The Tests tab views are displayed. The navigation view is expanded to show the failed test. The detail view shows any PIDs associated with the highlighted test (none in this example) and the event log filtered to show only events for the highlighted test.

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



6. In the navigation view, highlight the 1.5 PMT (Timer) test and select **Edit Parameters** from the context menu.
7. In the Edit Parameters dialog box, note that for this stream the **PMT section max. 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 tooltip), you can see that the rate of 525 ms is within the range recommended by the DVB standard, 40 ms to 25000 ms.



IP Stress Test

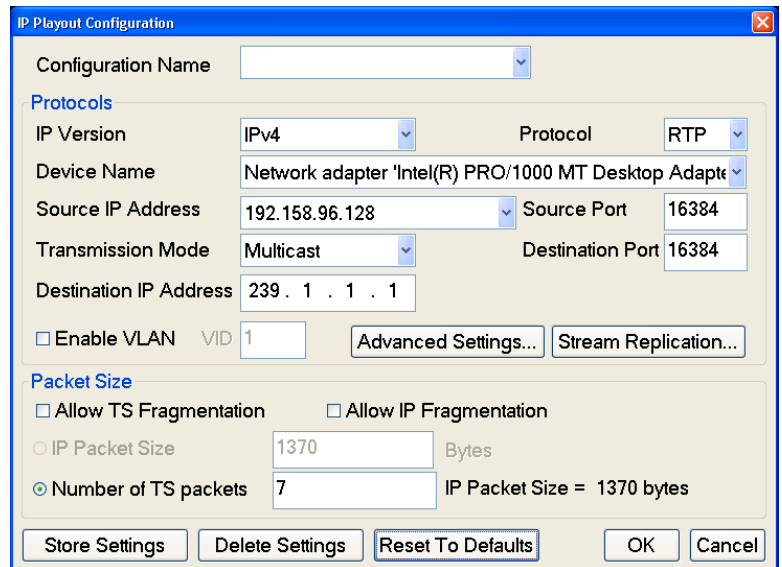
Perform the following steps to set up and to demonstrate the IP stress generation capabilities of the MTS400P system using a portable PC.

NOTE. You can perform the IP stress test for the instruments only if the TSCA option is installed on the MTS400P system.

Set Up

1. Connect the Ethernet cable to the LAN port of the portable PC and the LAN port on the MTS400P system.
2. Power on both the MTS400P system and the portable PC.
3. Start the **MPEG Player** application on the MTS400P system. Ensure that the security dongle is attached to the portable PC and start the TSCA application.
4. In the MPEG Player application, select **Play > Interface > IP**.
5. Select **IP > Configuration**.
Note the Source IP address and ensure that the **Transmission Mode** is set to **Multicast**.

6. Select **OK** on the MTS400P configuration menu and select a test stream file from the D: drive.

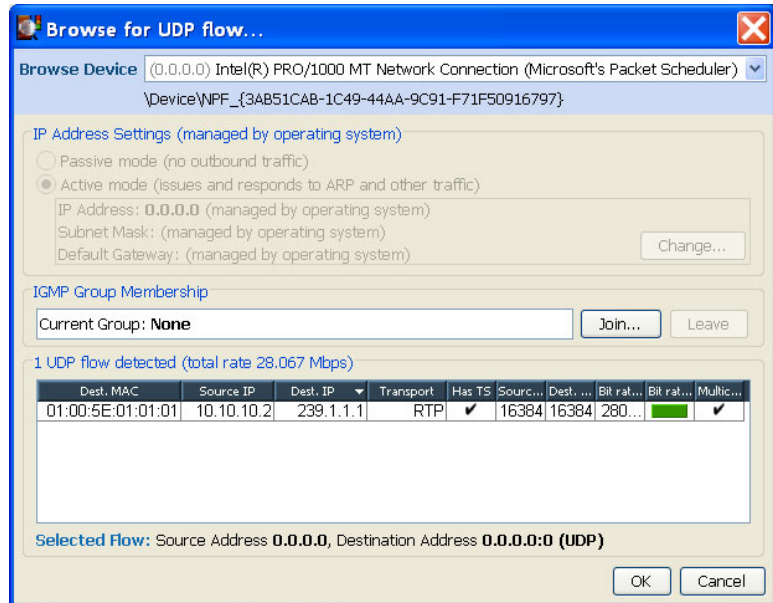


The image shows a screenshot of the 'IP Payout Configuration' dialog box. It has a blue title bar with the text 'IP Payout Configuration' and a close button. The dialog is divided into several sections. At the top is a 'Configuration Name' dropdown menu. Below this is a 'Protocols' section with fields for 'IP Version' (set to 'IPv4'), 'Protocol' (set to 'RTP'), 'Device Name' (set to 'Network adapter 'Intel(R) PRO/1000 MT Desktop Adapt...'), 'Source IP Address' (set to '192.158.96.128'), 'Source Port' (set to '16384'), 'Transmission Mode' (set to 'Multicast'), and 'Destination Port' (set to '16384'). There is also a 'Destination IP Address' field set to '239.1.1.1'. Below these fields are checkboxes for 'Enable VLAN' (unchecked) and 'VID' (set to '1'). There are also buttons for 'Advanced Settings...' and 'Stream Replication...'. The next section is 'Packet Size', which includes checkboxes for 'Allow TS Fragmentation' and 'Allow IP Fragmentation' (both unchecked). It also has radio buttons for 'IP Packet Size' (set to '1370 Bytes') and 'Number of TS packets' (set to '7'). A label indicates 'IP Packet Size = 1370 bytes'. At the bottom of the dialog are buttons for 'Store Settings', 'Delete Settings', 'Reset To Defaults', 'OK', and 'Cancel'.

7. Press the **PLAY** button on the MTS400P system to start playing the selected stream file.
8. Open the **TSCA** application and verify that the Stream Interpretation is set appropriately for the demo.

9. In the TSCA, Select **Real-time**, and then select **Browse**.

A single flow should be seen with same source IP address as the MTS400P Configuration window showed. This means TSCA can see the MTS400P traffic.



10. In the Browser for UDP flow dialog box, select the flow and click **OK**. Click **OK** in the Select Real time Interface dialog box.

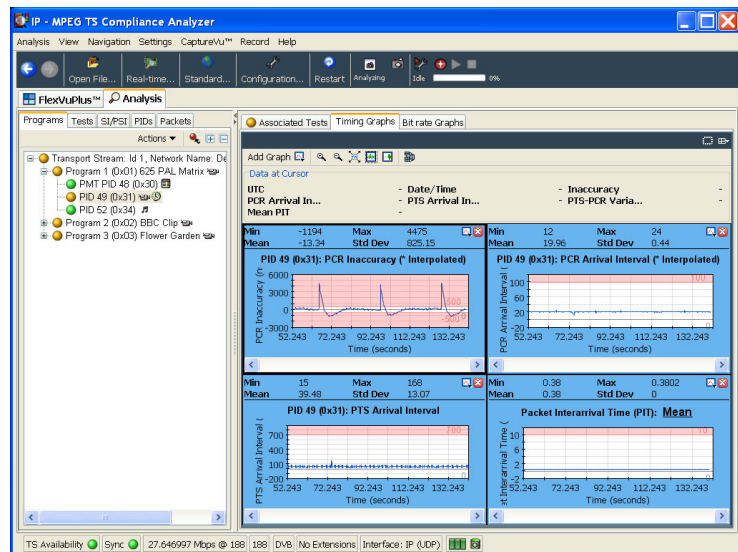
The real time analysis of the stream will be displayed in TSCA. If the stream has no errors, then everything on the TSCA is green.

Outputting the IP Stress Test (Multicast)

This procedure involves playing the MPEG Player in IP mode and analyzing the output stream using a TSCA.

1. In the TSCA, select **Now Playing** and select the **Play** button under one of the thumbnails. This will start the VLC to show decoded video.
This is analogous to the way an STB would decode the video.
2. To see cross-layer timing graphs, do the following:
 - Select **PCR PID** in the left pane of the hierarchical view.
 - Select **Timing Graphs** in the right pane, and then add **PCR Arrival Interval**, **PTS Arrival Interval**, **PCR Inaccuracy**, and **PIT**.
 - Click on one of the graphs to see cursor and values displayed at the same time on all the three graphs.
3. Select **PCR PID** in the MTS400P hierarchy display and right-click. In the PCR Inaccuracy dialog box, do the following to add the jitter:
 - Set **Period** to 100 packets.
 - Set **Amplitude** to 5/27Mhz (within 500ns limit).

View the effects in the timing graphs.



4. In the PCR Inaccuracy dialog box, change **Amplitude 20/27MHz** to **740 ns**.

PCR Accuracy test 2.4 will fail but note that the VLC video decode is largely unaffected by this level of PCR Inaccuracy.

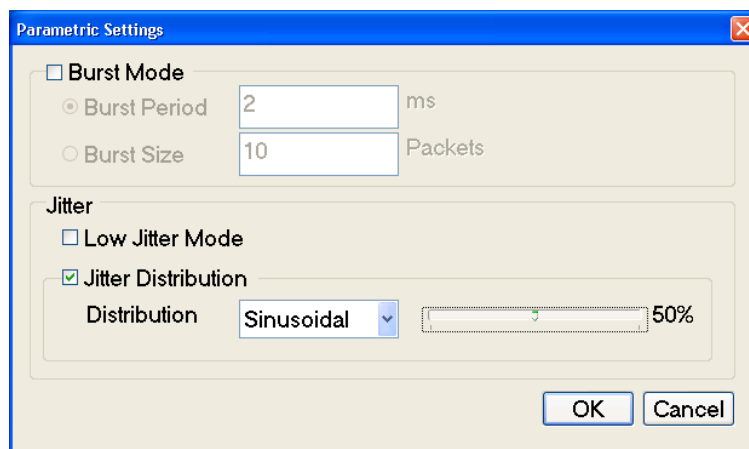
This is representative of a good video delivery network with IP packets being delivered by the network as they should be, but errors in the PCR values were introduced during the encoding and/or multiplexing process.

5. In the MTS400P application, do the following:

- Select **IP > Parametric Settings**.

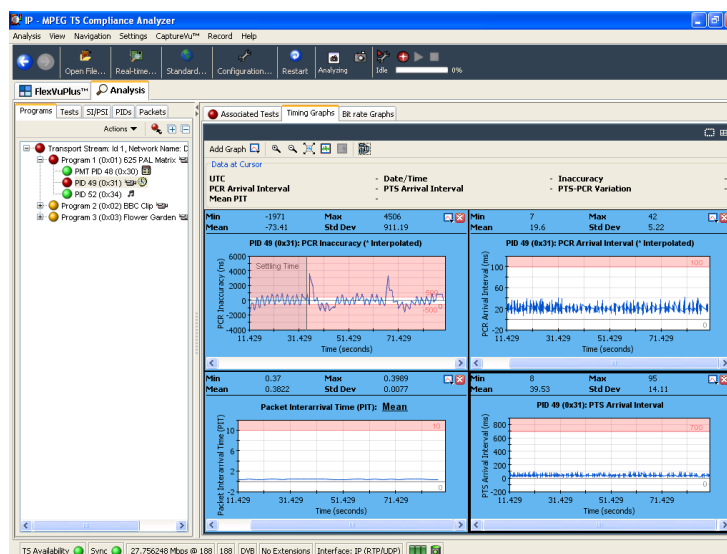
- In the Parametric Settings dialog box, set **Jitter Distribution** to **Sinusoidal** and duration to **50%**.

This represents 50% max variation from normal Ethernet inter packet gap.

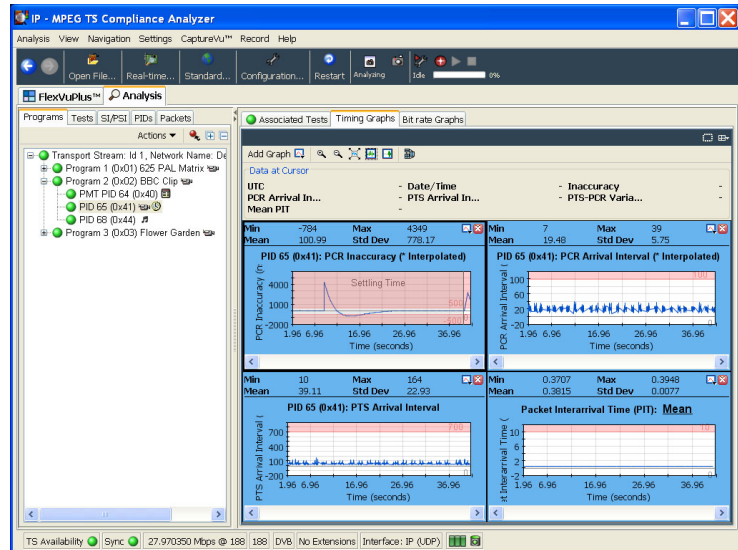


6. Observe the effects in the timing graphs. The values for Min and Max PCR Arrival Interval, PTS Arrival Interval and Packet Inter-arrival time will be increased due to the varying timing of packets arriving.

This represents poor network performance and shows the effect that the network can have on MPEG stream timing.



7. In the Parametric Settings dialog box, change the duration of **Jitter Distribution** from **50%** to **100%**.
The values for Min and Max PCR Arrival Interval, PTS Arrival Interval and Packet Inter-arrival time will increase.



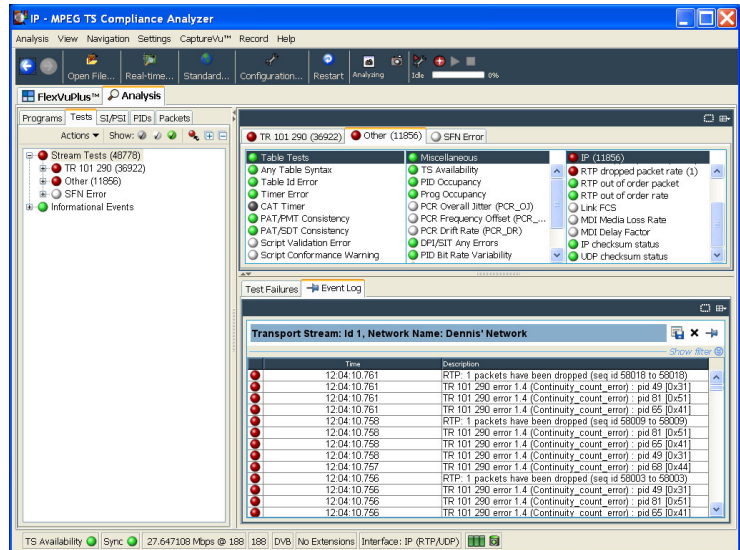
8. To observe the effects in the VLC decoded video, do the following:
- Select the **Program** tab, **Transport Stream** node on the left side and **Now Playing** tab on the right.
 - Click **play** to observe effects in the VLC decoded video.

Using these graphs, you can determine the threshold at which IP packet jitter will cause the device under test to cease decoding the video. This is very important when designing for resilience against IP Network timing problems.

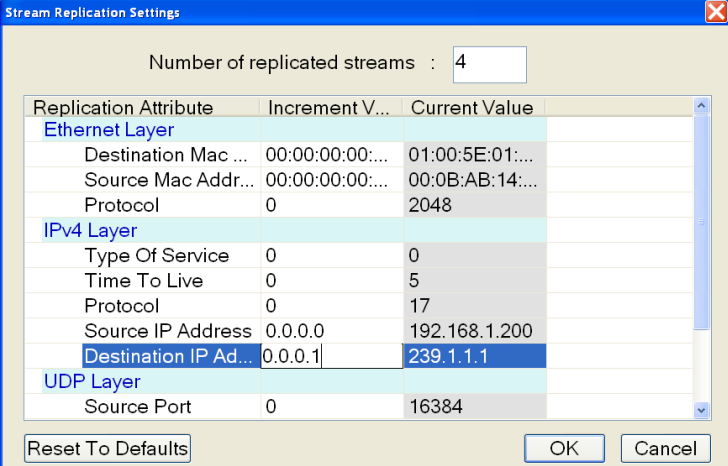
9. Select **IP > Error Generation** to select manual error generation from within the MTS400P IP menu. Click on the different types of errors and observe the effects of packet loss, checksum errors, and sequence errors in the TSCA tests view (Look at Other – IP node in the TSCA test tree and expand it.) Also, observe the effects in the VLC decoded video.
These effects are typical of packet loss or corruption in IP video networks.

10. In the Error Insertion dialog box, select the **Enable Error Insertion** check box, select **Packet Loss** and enter **10 packets/ 1000 packets**.

This represents 1% packet loss and typical design criteria specifications for designers to ensure that the equipment can protect against. Show the effects in TSCA (look for priority 1 CC errors and IP dropped packet errors). Also, observe the effects in the VLC decoded video.



11. Select **IP > Configuration > Stream replication**. In the Number of replicated streams field, enter **4**, change the destination address, and increment the value from 0.0.0.0 to 0.0.0.1. This will play the selected file out on 4 additional flows, each with a destination address incremented by 1.



Stream Replication Settings

Number of replicated streams : 4

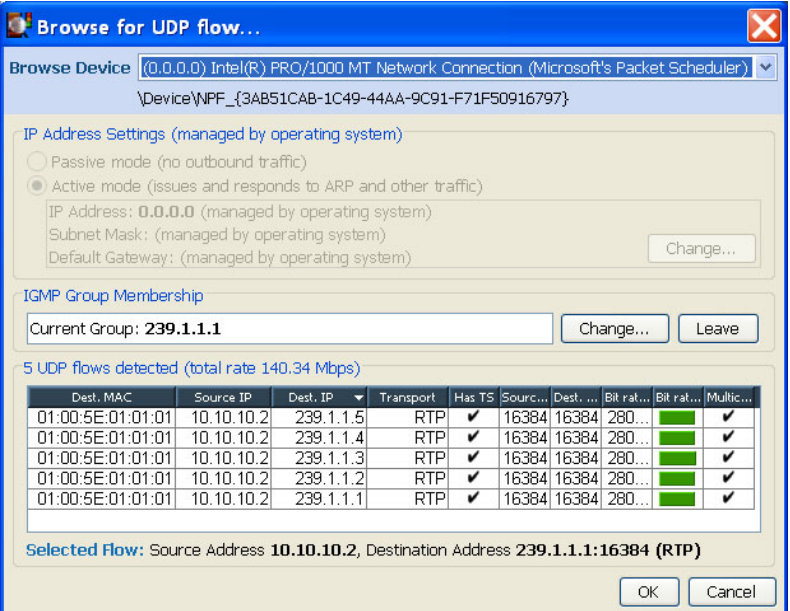
Replication Attribute	Increment V...	Current Value
Ethernet Layer		
Destination Mac ...	00:00:00:00:...	01:00:5E:01:...
Source Mac Addr...	00:00:00:00:...	00:0B:AB:14:...
Protocol	0	2048
IPv4 Layer		
Type Of Service	0	0
Time To Live	0	5
Protocol	0	17
Source IP Address	0.0.0.0	192.168.1.200
Destination IP Ad...	0.0.0.1	239.1.1.1
UDP Layer		
Source Port	0	16384

Reset To Defaults OK Cancel

12. In the TSCA, select **Open File > Real-time > Browse**. Observe that there are now multiple flows available for selection.

Generating multiple flows in this way is representative of real world IPTV multicast environment where multiple SPTS are transmitted.

Jitter and packet errors that are introduced are distributed across the packet flow to have an equal chance of impacting any particular session. This effect can be demonstrated by selecting any one of the flows for analysis and the impact of the above MTS400P stress test cases for IP jitter and packet loss corruption.



Browse for UDP flow...

Browse Device: (0.0.0.0) Intel(R) PRO/1000 MT Network Connection (Microsoft's Packet Scheduler)
 \Device\NPF_{3AB51CAB-1C49-44AA-9C91-F71F50916797}

IP Address Settings (managed by operating system)

☐ Passive mode (no outbound traffic)

☒ Active mode (issues and responds to ARP and other traffic)

IP Address: 0.0.0.0 (managed by operating system)
 Subnet Mask: (managed by operating system)
 Default Gateway: (managed by operating system) Change...

IGMP Group Membership

Current Group: 239.1.1.1 Change... Leave

5 UDP flows detected (total rate 140.34 Mbps)

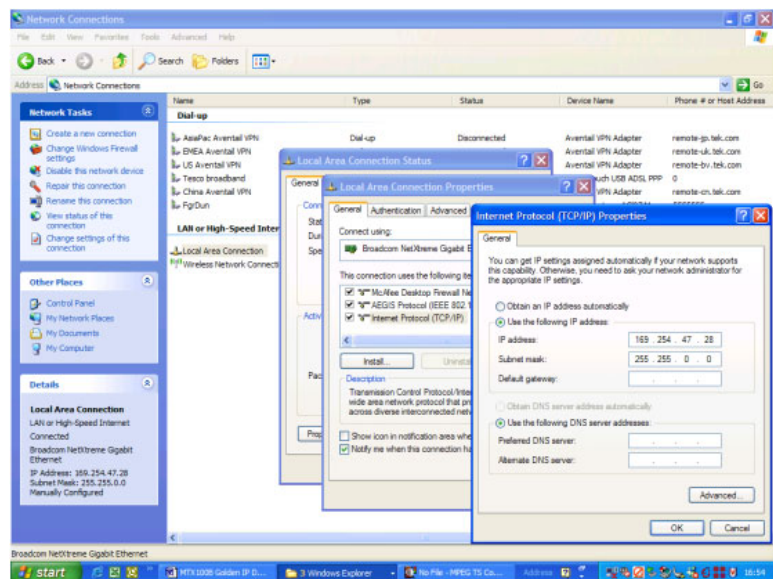
Dest. MAC	Source IP	Dest. IP	Transport	Has TS	Sourc...	Dest. ...	Bit rat...	Bit rat...	Multic...
01:00:5E:01:01:01	10.10.10.2	239.1.1.5	RTP	✓	16384	16384	280...		✓
01:00:5E:01:01:01	10.10.10.2	239.1.1.4	RTP	✓	16384	16384	280...		✓
01:00:5E:01:01:01	10.10.10.2	239.1.1.3	RTP	✓	16384	16384	280...		✓
01:00:5E:01:01:01	10.10.10.2	239.1.1.2	RTP	✓	16384	16384	280...		✓
01:00:5E:01:01:01	10.10.10.2	239.1.1.1	RTP	✓	16384	16384	280...		✓

Selected Flow: Source Address 10.10.10.2, Destination Address 239.1.1.1:16384 (RTP)

OK Cancel

Outputting the IP Stress Test (Unicast)

1. Perform steps 1 through 4 of *Set Up*.
(See page 64.)
2. In step 5 of *Set Up*, set the **Transmission Mode** to **Unicast**.
3. Select **Control Panel > Network Connection > Local Area Connection > Properties > Internet Protocol**.
The Internet Protocol (TCP/IP) Properties dialog box appears.
4. In the dialog box, select **Use the following IP address**.
5. Enter an IP address that is on the same segment as the generator Source IP address noted in step 5 of *Set Up*.
(See page 64.) The easiest way is to increment the IP address by 1.



6. Perform steps 6 through 10 of *Set Up*.
(See page 64.) This will set up the test and perform the steps listed in *Outputting the IP Stress Test (Multicast)* to demonstrate the test.

Accessories

Standard Accessories

The following table lists the standard accessories that are shipped with the MTS400P system:

Quantity	Description	Part number
1 each	Software package: MTS400 Series Application Software Media	020-2994-XX
1 each	TekRestore Software License	063-3906-XX
1 each	Certificate Of Authenticity: Microsoft Windows XP	NA
1 each	Software package: MTS400 Series Product Documentation CD-ROM	063-4197-XX
1 each	MTS400P Quick Start User Manual	
	Option L0 (English)	071-2610-XX
	Option L5 (Japanese)	071-2611-XX
1 each	Supplemental information sheet; China ROHS	071-2185-XX
1 each	Software key, parallel port dongle	119-6962-XX
1 each	USB mouse	119-6936-XX
1 each	USB keyboard	119-B146-XX
1 each	Interface cable (D-sub 25-pin, twisted pair)	012-A220-XX
1 each	Front cover	200-4716-XX
1 each	Power cord	
	Option A0 (North American Power)	
	Option A1 (Universal Euro Power)	
	Option A2 (United Kingdom Power)	
	Option A3 (Australia Power)	
	Option A4 (240V North America Power)	
	Option A5 (Switzerland Power)	
	Option A6 (Japan Power)	
	Option A10 (China Power)	
	Option A11 (India Power)	
	Option A99 (No Power cord or AC adapter)	

Optional Accessories

MTS400P Optional Accessories

The following items are optional accessories:

Quantity	Description	Part number
Option IPTVP		
1 each	Cable assembly; RF, BNC to BNC; 75 Ω	174-5135-XX
Option SX		
1 each	850 nm optical port	131-7834-XX
Option LX		
1 each	1310 nm optical port	131-7957-XX
Option ZX		
1 each	1550 nm optical port	131-7958-XX

User Maintenance

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

- *Preventive Maintenance* provides cleaning instructions
- *In Case of Problems* provides some hints for troubleshooting startup errors
- *Repackaging for Shipment* gives instructions for packing and shipping the instrument

General Care

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



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

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

Preventative Maintenance

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

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

Cleaning the Exterior

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



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

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

Cleaning the Keyboard

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



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

In Case of Problems

This section addresses problems that you may encounter while using the test system. This section does not identify specific problems related to performance verification or adjustments. The diagnostic procedures for the MTS400P system provided in this section can help you isolate problems. For a performance verification procedure, refer to the *MTS400P Specifications and Performance Verification Technical Reference*, supplied as a PDF file on the *MTS400 Series Product Documentation* CD-ROM.

Power-on diagnostics run when you first power on the instrument to start the test system application. These diagnostics check the operating system and hardware for correct operation. If error messages occur during the power-on diagnostics, there may be a system error that prevents the MTS400P 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 the fans start. Check that power is available at the power source. Contact your local Tektronix service center.
Instrument powers on but does not complete the power-on sequence	Check for and remove any disk in the floppy disk drive; make sure the instrument boots from the hard disk drive.
Power-on diagnostics fail	Contact your local Tektronix service center.
Instrument does not recognize accessories such as monitor, printer, or keyboard	Check that accessories are properly connected or installed. Contact your local Tektronix service center.
Instrument will not power off with the On/Standby switch	Try powering off the instrument using the Windows XP shutdown procedure. If the instrument still does not power off, use the task manager to close down tasks. Finally, try the hard shutdown procedure; push and hold the On/Standby switch for five seconds to power off the instrument.

Software Problems

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

If you suspect networking problems, see *Network Troubleshooting*. (See page 13, *Network Troubleshooting*.)

Hardware Problems

Hardware problems can have several causes. Review the installation instructions in this manual to verify that you have properly installed the instrument. There are no user serviceable parts in the MTS400 Series systems, so you should contact your local Tektronix Service representative if your instrument has a hardware problem.

Repackaging for Shipment

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



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

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

Packaging Inspection

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

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

Replacement Packaging Materials

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

Repackaging Procedure

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

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

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

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

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

Index

A

AC line voltage requirement, 2
 Accessories
 BNC cable, 3
 SFP module, 3
 Add Elementary Streams, 50
 Analyzers, 21
 Application Examples, 44
 Arrow buttons, 20
 ASI/SMPTE Input connector, 7
 ASI/SMPTE Output connector, 7

B

Basic Requirements, 13
 Benefits, viii

C

Cancel/Close button, 19
 Cleaning
 exterior, 75
 keyboard, 76
 Cleaning the instrument, 75
 Clock/Ref In connector, 6
 Com connector, 7
 Connecting to a PC, 8
 Conventions, ix
 Create a New Stream, 44
 Crossover Ethernet cable, 8

D

DHCP (Dynamic Host Configuration Protocol), 42
 Documentation, viii
 Duplex operation, 26

E

Electrical power requirements, 2
 Elementary Stream Acquisition, 49
 Elementary Stream Analyzer, 37
 Enter button, 19
 Entering Numeric Data, 25
 Environment operating requirements, 1
 ES Analyzer, 37
 Ethernet connector, 7

Ethernet parameters
 setting, 40
 Examine Stream Content, 62

F

Features, viii
 Finding IP Addresses, 18
 Front Panel Connectors, 19
 Functional Check Procedure, 18

G

GbE interface
 BNC cable, 3
 SFP module, 3
 General care, 75
 Generators, 22

H

Hardware problems, 77
 HDD access indicator, 20

I

IEEE 1394b connector, 8
 Incorrect Default Gateway, 15
 Incorrect IP Address, 13
 Incorrect Subnet Mask, 14
 Initial product inspection, 1
 Installation, 1
 network, 13
 IP Parameters, 13

L

LAN connector, 7
 License, 10
 Loopback, 26

M

Maintenance, 75
 Menu button, 20
 MPEG Player Setup, 26
 MTS400 applications, 28

N

Network Information, 18
 Network installation, 13
 Network Troubleshooting, 13
 Num Pad/Select button, 20
 Numeric data entry, 25

O

On/Standby switch, 19
 ON/STBY power switch, 19
 Operating Considerations, 1
 Operation, 21
 Optional Accessories
 MTS400 Series, 74

P

Packaging, 77
 Packaging Inspection, 77
 PES, 29
 PES Analyzer, 29
 Pinging a Host Machine, 16
 Play/Pause button, 20
 Players, 22
 Playout/Analysis, 27
 Power connector, 8
 Power cord requirements, 2
 Powering Off the Instrument, 10
 Powering On the Instrument, 9
 Preface, viii
 Preventative maintenance, 75
 Printer connector, 7
 Procedures
 setting up FlexVu, 57
 Product
 inspection, 1
 Product Description, 21

R

Rear Panel Connectors, 6
 Record
 button, 20
 Related documentation, viii
 Related documents, viii
 Repackaging for shipment, 77
 Repackaging Procedure, 78
 Replacement, 77

S

- Safety Summary, iii
- Setting Ethernet parameters, 40
- Setting Up Loopback, 26
- Setting up the FlexVu display, 57
- SFP (small format pluggable) port, 7
- SFP module, 3
- Shipping the instrument, 77
- SMPTE310M/ASI input, 7
- SMPTE310M/ASI output, 7
- Software
 - license, 10
- Software Applications, 21
- Software problems, 77
- SPI In/Out connector, 6
- SPI input, 7

- Standard accessories
 - MTS400 Series, 73
- Start menu, 23
- Stop button, 19

T

- T-STD Buffer Analyzer, 32
- Tab button, 20
- Tracing the Route, 17
- Trig In/Out connector, 7
- Troubleshooting
 - power-on failures, 76
- Troubleshooting Procedures, 15
- TSCA, 28
- TSCA Setup, 26

U

- USB connectors, 20
- Using
 - Arrow buttons, 25
 - keypad, 25
- Utilities, 22

V

- VGA connector, 7
- VLC Media Player
 - Installation, 12