User Manual

Tektronix

MPEG Test System
MTS 210 Options 1A, 1G, and AG
MTS 215 Deferred-Time Applications

071-0078-00

This document supports software version 2.2

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Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

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.

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; or c) 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.

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General Safety Summary

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

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

Injury Precautions

Use Proper Power Cord. To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload. To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Avoid Overvoltage. To avoid electric shock or fire hazard, do not apply potential to any terminal, including the common terminal, that varies from ground by more than the maximum rating for that terminal.

Avoid Electric Shock. To avoid injury or loss of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

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

Do Not Operate Without Covers. To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse. To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions. To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere. To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Power Source. Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation. To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Symbols and Terms

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.*

Terms on the Product. These terms may appear on the product:

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

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

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

DANGER High Voltage	Protective Ground (Earth) Terminal	ATTENTION Refer to Manual	Double Insulated

Certifications and Compliances

Refer to the specifications section for a listing of certifications and compliances that apply to this product.

Preface

This document applies to the deferred-time analysis and generation software and hardware of the Tektronix MTS 210 and MTS 215 MPEG Test Systems.

***NOTE**. The MTS 215 and the MTS 210 option AG include all applications discussed in this user manual. The MTS 210 option 1A includes all applications except the Multiplexer. The MTS 210 option 1G includes all applications except the deferred-time Analyzer. You can upgrade an option 1A or 1G Test System to either an MTS 210 option AG or an MTS 215; see your Tektronix representative for more information.*

For information about the additional MTS 215 real-time analysis hardware and software, refer to the *MTS 200 Series Real-Time Analyzer User Manual*, Tektronix part number 071-0076-0X, that is provided with the MTS 215.

For information about the Windows NT Workstation operating system, refer to the Microsoft documentation that accompanied your test system.

For information about the Compaq Proliant server, refer to the Compaq documentation that accompanied your test system.

For the latest information about Tektronix MPEG Test System features and bugs, refer to the *MTS 200 Series Read This First* document, Tektronix part number 071-0079-0X, that accompanied your test system.

Contacting Tektronix

Product Support	For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time
	Or contact us by e-mail: tm_app_supp@tek.com
	For product support outside of North America, contact your local Tektronix distributor or sales office.
Service Support	Contact your local Tektronix distributor or sales office. Or visit our web site for a listing of worldwide service locations.
	http://www.tek.com
For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000

Product Description

This section describes the capabilities and components of the Tektronix MPEG Test System. options AG, 1A, and 1G. These features are shared by the MTS 215 MPEG Test System.

Overview

The MTS 210 hardware and software make it possible to create, generate, acquire, and analyze MPEG-2 transport streams and DVB multiplexes. The MTS 210 option AG and MTS 215 include the following applications:

- Multiplexer
- Deferred-time Analyzer
- Table Editor
- DVB Channel Coder/Decoder
- Packet Jitter [Adder]
- Data Store Administrator

The MTS 210 option 1A is intended for transport stream analysis and does not include the Multiplexer application.

The MTS 210 option 1G is intended for transport stream generation and does not include the Deferred-time Analyzer application.

All MTS 210 and MTS 215 Test Systems contain the Data Store system which can acquire and output transport streams at rates from 1 Mbit/s to 55 Mbit/s. Given the standard 18 Gbytes of Data Store disk capacity, the MTS 210 can store over 40 minutes of transport stream data at 55 Mbits/s. You can also use end-to-start looping to continuously (and indefinitely) acquire or output up to 18 Gbytes of transport stream. Data Store I/O can be through a variety of hardware connections, including TTL serial, ECL parallel, ECL serial, G.703, and RS-422.

Applications

The five Tektronix MPEG Test System applications are the Analyzer, the Multiplexer, the PSI and SI Table Editor, the Channel Coder/Decoder, and Packet Jitter.

Analyzer

With the Deferred-time Analyzer, you can analyze transport stream data (acquired by the Data Store System) with the Analyzer application. The Analyzer provides several graphical views of MPEG and DVB transport stream; the views give access to each field—and each *bit*, if you wish, in the transport packets, PES packets, and the various PSI and SI tables.

Hierarchic View. The hierarchic view provides a diagram of the data components carried by the transport stream. Icons are used to identify the PAT (Program Association Table), NIT (Network Information Table), PMT (Program Map Table), PES (Packetized Elementary Stream), packets, and the three types of elementary streams (video, audio, and data). Additional icons indicate the PID (Packet Identification) number for each data component.

Interpreted View. The interpreted view shows every field in the selected transport packet, table section, or PES (packetized elementary stream) packet. Any packet in the file may be accessed. Search for errors in this view.

Timing Displays. Two types of timing displays are available: PCR (Program Clock Reference) contained in the transport packet headers and PTS/DTS (Presentation/Display Time Stamp) contained in PES packet headers. The PCRs are shown in a graphical form indicating their arrival time. The graphical display of the PTS/DTS shows a time line for each access unit (such as a video frame) indicating data arrival and value of each time stamp.

Multiplexer

The Multiplexer provides the means to develop a limitless variety of MPEG transport stream files, using the elementary streams provided.

Transport streams are produced by the software in non-real time, typically 10 to 100 times the play time of the resulting file. A hierarchy display, similar to the Analyzer, displays the structure of the transport stream.

Up to 20 programs, with 10 elementary streams each, may be included in one transport stream file.

Elementary stream files containing both stationary test signals and motion sequences are provided on the Bit Stream CD ROM. With the MTS 210 Multiplexer and Table Editor applications, you can create a variety of transport stream files that contain one or more of the provided test signals and motion sequences.

PSI and SI Table Editor

Data necessary for the DVB IRD (Digital Video Broadcasting Integrated Receiver Decoder) to automatically configure itself is available in the MPEG2 Program Specific Information (PSI). Digital Video Broadcasting Specific Information (DVB-SI) adds information that enables DVB IRDs to automatically tune to a particular service and allows services to be grouped into categories with relevant schedule information.

The PSI and SI Table Editor allows the user to enter and change the data in the SI and PSI tables to fit requirements.

Channel Coder

The European Digital Broadcasting Project (DVB) has specified a baseline system for satellite broadcasting. The Channel Coding portion of the specification has the following coding flow:

- MPEG2 Transport stream file (Multiplexer)
- Energy Dispersal — randomizing
- Outer Coder RS (204, 188) — for byte error correction
- Interleaver — better burst error correction
- Inner Coder (Viterbi p/q) — bit error correction
- QPSK Modulator

This application provides the defined channel coding for the transport stream file and also provides the decoding to return the coded file to a standard transport stream file.

Packet Jitter

In addition to creating error-free transport streams, the MTS 210 can also create transport stream files with known errors.

The Packet Jitter application allows you to create transport stream files with simulated timing errors that affect the clocks derived from the transport file. This allows you to test the robustness of decoders under various conditions.

Accessories

The following accessories are standard with the MTS 210. All items except the monitor are shipped in the box that contains the server.

- Tektronix 17 inch monitor and monitor cable. (the monitor power cord is shipped in the MTS 210 accessories package.)
- Compaq server with the Data Store system installed (referred to as the MTS 210 server).
- Keyboard and mouse
- Software enable key (HASP; installed on the server parallel port).
- *MTS 210 MPEG Test System User Manual* (this document)
- *MTS 200 Series Read This First*, part number 071-0079-0X
- Compaq documentation and back-up copies of the Compaq software
- Windows NT software and documentation package.
- Emergency repair disk.
- MTS 210 Installation Software CD ROM, provided for reinstalling the MTS 210 software in case it becomes corrupted.
- A CD ROM containing MPEG-2 Elementary Streams
- Two power cords: one each for the MTS 210 server and the monitor.
- Six SMB to BNC adaptors: three with 50 Ω cables and three with 75 Ω cables.
- One shielded 9–pin cable (use this cable to meet EMI requirements).
- One shielded 25–pin cable (use this cable to meet EMI requirements).

Installation

Tektronix MPEG Test System installation involves selecting an installation site, installing the server pedestal and door, and connecting all necessary cabling. Once all items are unpacked, system assembly should require just a few minutes. Save the shipping carton and all the inserts for use if reshipment of the MTS 210 server becomes necessary. Repackaging instructions are in *Appendix F.*

CAUTION. *To avoid damage to the MTS 210 during shipping, retain the original shipping carton. Shipping the MTS 210 in any other packaging may void the warranty.*

Assembling the Test System

Before you begin to assemble the test system, please make sure that you have selected an appropriate location.

- Choose a sturdy, level site that includes dedicated and properly grounded circuits, air conditioning equipment, and static electricity protection.
- Provide a minimum of three inches (7.6 cm) clearance at the front and back of the computer for proper ventilation.
- Make sure that no heavy electrical equipment will be located nearby.

Once a good site has been identified, begin assembling the MTS 210 using the procedure given below. (Figure 1–1 illustrates the rear panel of the test sytem.)

WARNING. *Be careful lifting and moving the MTS 210 server. It is heavy.*

1. Install the pedestal on the MTS 210 server.

   a. Carefully set the server on its top.

   b. Align the post on the pedestal with the slots in the server case.

   c. Slide the pedestal into the slots until the retaining clip on the pedestal snaps into place on the server base.

   d. Carefully turn the server over to set it upright on the pedestal.

2. Install the door on the front of the server.

   a. Line up the hinge pins of the two hinges on the right side of the server door with the hinge pin holes in the server chassis.

  b. Lower the hinge pins into the hinge pin holes and close the door.

3. Connect the keyboard to the keyboard port on the rear panel of the MTS 210 server.

4. Connect the mouse to the mouse port on the rear panel of the server.

5. Verify the software key (HASP) is attached to the parallel port on the rear panel of the MTS 210 server. See Figures 1–1 and 1–2. (It should already be connected.)

***NOTE**. If you need to use the parallel port for another function, connect that cable through the HASP.*

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6. If the MTS 210 is being connected to a network, connect it now. Two types of ethernet ports are provided: an AUI port and an RJ45 port. See Figure 1–1. The ethernet ports do not require termination.

7. Connect the monitor cable to the monitor and to the rear of the MTS 210 server at the video port in expansion slot six. Do not use the built-in video connector.

8. Connect the power cord to the monitor and to a power source.

9. Connect the power cord to the MTS 210 server and to a power source.

***NOTE**. Although the MTS 210 is based on a standard computer configuration, do not use the MTS 210 for any other purpose or install boards not provided or recommended by Tektronix. These actions may cause your system to operate in an unexpected manner. However, you may connect it to an appropriate network.*

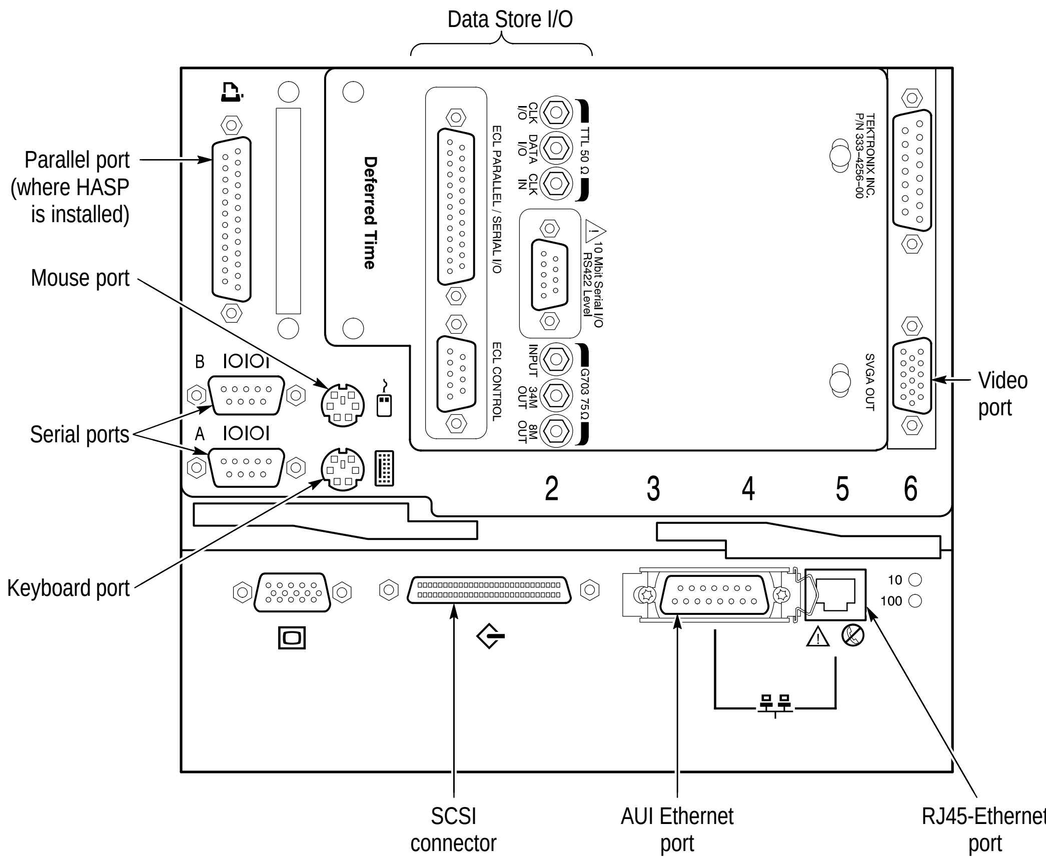


Figure 1–1: The rear panel of the MTS 210 server

Supplying Power

The MTS 210 server and monitor are designed to operate from a single-phase power source having one of its current-carrying conductors at or near earth ground (the neutral conductor). Systems that have both current-carrying conductors live with respect to ground, such as phase-to-phase or multiphase systems, are not recommenced as power sources. A protective ground connection, by way of the grounding conductor, in the power cord is essential for safe operation.

WARNING. *This equipment is designed for connection to a earth-grounded AC outlet. The grounding plug is an important safety feature. To avoid risk of electrical shock or damage to your equipment, do not disable this feature.*

Mains Voltage Range. The MTS 210 server (the ProLiant 2500) operates on power mains from 100 VAC to 230 VAC.

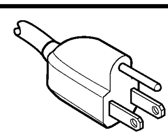
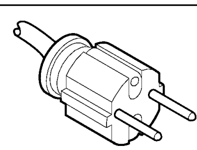
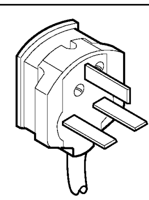
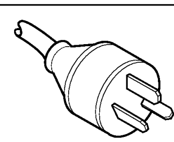
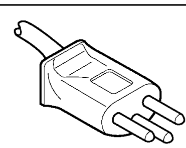
The monitor operates on either 115 VAC or 230 VAC source also without having to set a voltage selection switch.

Mains Frequency. The ProLiant server and the monitor both operate on either 50 Hz or 60 Hz line frequencies.

CAUTION. *To prevent damage to the server, you should protect the instrument from power fluctuations and temporary interruptions with a regulating uninterruptable power supply (UPS). This device protects the hardware from damage caused by power surges and voltage spikes. In addition, it keeps the system in operation during power failure.*

Power Cord Options. The server and monitor are delivered from the factory with a power cord for 60 Hz/117 VAC North American operation unless one of the power cord options was ordered. Table 1–1 shows the power cord options.

Table 1–1: Power cord identification

Plug Configuration	Normal Usage	Option Number
	North America 125 V/15A Plug NEMA 5-15P	Standard
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 230 V	A3
	Switzerland 230 V	A5

Software Enable Key

The MPEG Test System software is enabled by the software enable key (the HASP; see Figure 1–2), which is installed on the parallel port and is transparent to parallel port applications, such as printing. The HASP must be in place on the ProLiant parallel port for the MTS 210 to operate. Do not lose the HASP. The software enabler (HASP) should remain with the MTS 210 at all times. If the entire instrument is returned for service, ship the HASP with the server.

CAUTION. *Do not lose the HASP (software enable key). The MTS 210 will not operate without it being installed on the parallel port. The software enabler key (HASP) also is required by the Tektronix Service Center if the ProLiant server is returned for repair.*

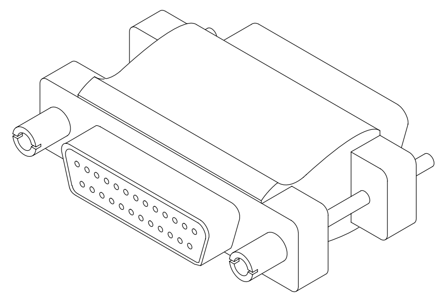


Figure 1–2: MTS 210 HASP

MTS 210 I/O

The MTS 210 rear panel input/output connectors (I/O) are located in two EISA slots on the ProLiant server rear panel. Specification of the I/O ports are in *Appendix A, Specifications*. Figure 1–3 shows the arrangement of the I/O connectors. A detailed description of each of the connectors follows the illustration.

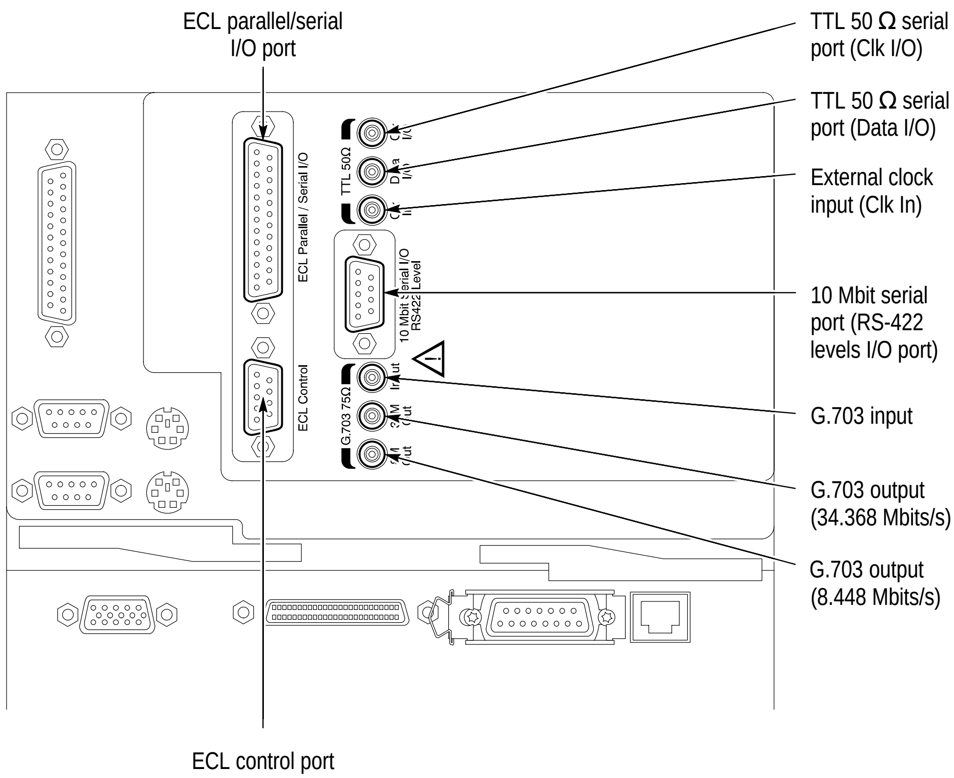
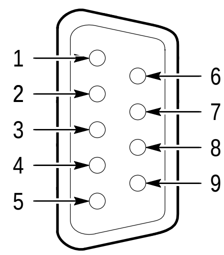


Figure 1–3: The MTS 210 signal I/O ports

ECL Control Port

The bidirectional differential control port adds flexibility to the ECL Parallel and Serial Ports. Adding the three control signals provides two more operating modes. (Using this port is optional.) The ECL control port pinout is shown in Table 1–2.

Table 1–2: ECL control port pinout

ECL control port	Pin	Function
	1	CHCLK (Channel Clock)
	2	Ground
	3	CHSYNC (Channel Sync)
	4	CHCLKEN (Channel Clock Enable)
	5	Shield
	6	$\overline{\text{CHCLK}}$ (Channel Clock)
	7	Ground
	8	$\overline{\text{CHSYNC}}$ (Channel Sync)
	9	$\overline{\text{CHCLKEN}}$ (Channel Clock Enable)

$\overline{\text{Asserted Low}}$ differential signal.

ECL Parallel/Serial I/O Port

The ECL Parallel/Serial I/O port receives and transmits MPEG-2 transport streams at ECL levels. It is a differential, bidirectional port that operates independently or in conjunction with the ECL Control Port. The port transmits or receives either parallel or serial data depending on settings made in the Data Store Administrator application.

Operating Modes. When the ECL Parallel/Serial I/O port is used independently of the ECL Control Port there are three operating modes:

- Slave acquisition. Captures input signals using the clock signal on the ECL Parallel/Serial I/O port as the timing source.
- Master generation. Outputs signals using the MTS 210 internal clock.
- Master generation with external clock. Outputs signals using a timing signal applied to the external clock input (Clk In).

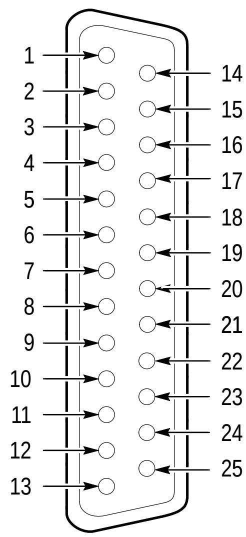
When the ECL Parallel/Serial I/O port is used in conjunction with the control port, there are three additional operating modes:

- Master acquisition. Captures input signals using control signals from the ECL Control Port to drive the signal source.
- Master acquisition with external clock. As above, but uses a timing signal applied to the external clock input (Clk In) as the clock source.
- Slave generation. Outputs signals using the ECL control port inputs as the timing source.

NOTE. Master — The unit provides the clock for data transmission.
Slave — The unit does not generate the data clock. The unit returns the clock provided by an external source.

Parallel Pinout. The parallel data pinout of the ECL Parallel/Serial I/O port is shown in Table 1–3.

Table 1–3: ECL parallel data pinout

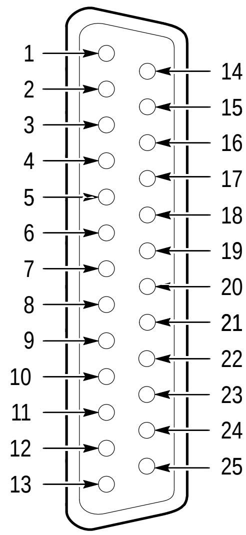


ECL parallel port	Pin	Function	Pin	Function
	1	DCLK	14	$\overline{\text{DCLK}}$
	2	ground	15	ground
	3	DATA 7	16	$\overline{\text{DATA 7}}$
	4	DATA 6	17	$\overline{\text{DATA 6}}$
	5	DATA 5	18	$\overline{\text{DATA 5}}$
	6	DATA 4	19	$\overline{\text{DATA 4}}$
	7	DATA 3	20	$\overline{\text{DATA 3}}$
	8	DATA 2	21	$\overline{\text{DATA 2}}$
	9	DATA 1	22	$\overline{\text{DATA 1}}$
	10	DATA 0	23	$\overline{\text{DATA 0}}$
	11	DVALID	24	$\overline{\text{DVALID}}$
	12	PSYNC	25	$\overline{\text{PSYNC}}$
	13	shield		

$\overline{\text{Asserted Low}}$ *differential signal.*

Serial Pinout. The serial data pinout of the ECL Parallel/Serial I/O port is shown in Table 1–4.

Table 1–4: ECL serial data pinout

ECL serial port	Pin	Function
	1	DCLK
	2	ground
	3 - 9	Not Managed
	10	DATA 0
	11	DVALID
	12	PSYNC
	13	shield
	14	$\overline{\text{DCLK}}$
	15	ground
	16 – 22	Not Managed
	23	$\overline{\text{DATA 0}}$
	24	$\overline{\text{DVALID}}$
	25	PSYNC

$\overline{\text{Asserted Low}}$ differential signal.

G.703 Output (8.448 and 34.368 Mbit/s) and G.703 Input

This serial interface complies with the electrical characteristics of ITU-T Recommendation G.703 (HDB3 code) for 8.448 Mbit/s and 34.368 Mbit/s.

There are two modes of operation:

- Acquisition. Locks to incoming signal and is self clocking.
- Generation (internal clock source). Uses an internal clock source.

This interface uses three Data Store circuit board mounted SMB connectors. One connector is a dedicated input for both bit rates. The other two connectors are dedicated outputs, one for the 34.368 Mbit/s output and the other for the 8.443 Mbit/s output. To reduce spurious emissions, only the output currently being used should be connected.

***NOTE**. Do not leave an SMB-to-BNC adaptor cable on an unused G.703 output. Doing so will cause the MTS 210 to exceed EMC emission requirements.*

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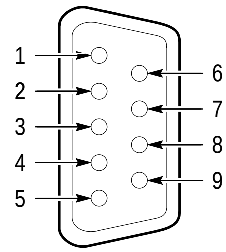
10 Mbit Serial Port (RS-422 Levels I/O Port)

The 10 Mbit Serial port can transmit and receive MPEG transport signals. It has bidirectional clocks and data pairs. The maximum operating frequency is 10 Mbit/sec. It uses RS-422 voltage levels, with line-to-line input termination of 110 Ω. The pinout is shown in Table 1–5.

Table 1–5: 10 Mbit serial port pinout

10 Mbit serial port	Pin	Function
	1	DATA IN
	2	CLK IN
	3	DATA OUT
	4	CLK OUT
	5	ground
	6	$\overline{\text{DATA IN}}$
	7	$\overline{\text{CLK IN}}$
	8	$\overline{\text{DATA OUT}}$
	9	$\overline{\text{CLK OUT}}$

$\overline{\text{Asserted Low}}$ differential signal.

The 10 Mbit Serial port uses the following signals:

- Data In and Data Out. These are MPEG serial bit streams.
- Clock In and Clock Out. These are continuous data transmission clocks.

You can choose from three modes of operation:

- Acquisition. Captures an input signal using external timing reference.
- Internal generation. Generates an output signal using the Tektronix MPEG Test System internal clock as the timing reference.
- External generation. Generates an output signal using the Clock input as the timing reference.

Clock Input

The Clk In connector provides optional timing input for the ECL Serial, ECL Parallel, TTL and 10 Mbit Serial outputs. Its maximum operating frequency is 45 MHz.

TTL 50 Ω Serial Port (Data & Clock I/O)

The TTL 50 Ω Serial Port receives and transmits at TTL levels. It consists of clock and data inputs with dedicated connectors. The Data signal is a serial bit stream, and the Clock signal is a continuous data transmission clock. The maximum operating frequency is 45 Mbits/s.

There are three modes of operation:

- Acquire. Captures an input signal.
- Internal Generation. Generates a signal that is locked to the internal clock.
- External Generation. Generates a signal locked to an external reference (the Clock Input).

Cables and Mating Connectors for Data Store Inputs/Outputs

The test system is supplied with adapters for connecting the Data Store SMB connectors to standard BNC connectors. It may be necessary to acquire or assemble other signal connecting cables and adapters in order to install the test system in your facility.

The maximum usable cable length for the various ports on the MTS 210 are a function of data rate, cable type, and ambient environment. See Table 1–6. Low data rates can stand longer cable lengths than high data rates. Low-loss coaxial cable and low-capacitance properly pair-twisted cable can support longer transmission paths than miniature coaxial cable or ribbon cable. Excess RF noise can induce noise in the cable which will reduce the usable length.

The only ports designed as a transmission system are the G.703 I/Os. The others are basically short-range interconnects. Note that most ports must control cable delay matching, to maintain clock to data timing margin, or data integrity will suffer.

Table 1–6: Estimated maximum cable lengths

Port	Rate, Mbits/s	Maximum length	Cable type	Comments
G.703	8.448	275 meters	Belden 8281	4 dB atten at 4.224 MHz
G.703	34.368	125 meters	Belden 8281	4 dB atten at 17.18 MHz
10 MBit (RS422)	1	100 meters	24 AWG unshielded twisted pair	Ref. ANSI/TIA/ EIA-422-B-1994
10 MBit (RS422)	10	15 meters	24 AWG unshielded twisted pair	Ref. ANSI/TIA/ EIA-422-B-1994

Table 1–6: Estimated maximum cable lengths (cont.)

Port	Rate, Mbits/s	Maximum length	Cable type	Comments
TTL	10	50 meters	RG58 type	Calculated Value
TTL	50	25 meters	RG58 type	Calculated Value
ECL Parallel	1	50 meters	Belden 8112	Calculated Value
ECL Serial	45	5 meters	Belden 8112	Calculated Value

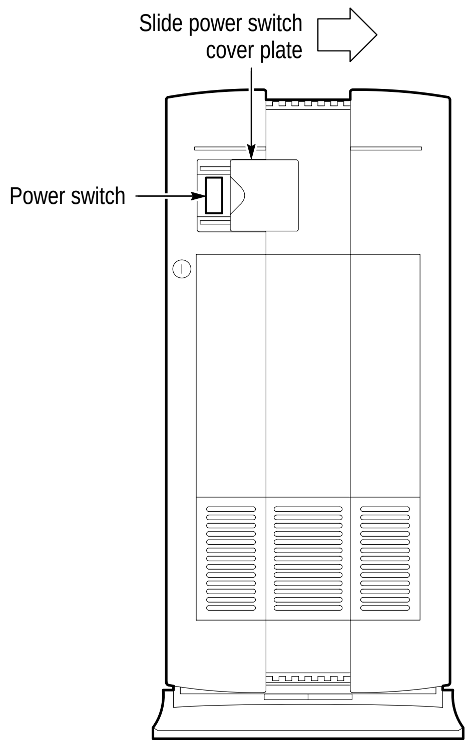
Adapters

The test system comes with six SMB-to-BNC adapter cables. Three of the adapters are 75 Ω to match the impedance of the G.703 inputs and outputs. The other three adapters are 50 Ω for use with the TTL Serial Port (Clock and Data) and Clock Inputs.

Do not leave an SMB-to-BNC adapter cable on an unused G.703 output. Doing so will cause the test system to exceed EMC emission requirements.

First Time Operation

Once you have installed the Compaq Proliant server, the Tektronix MPEG Test System is ready to operate. Slide the power switch cover plate to the right as shown in and press the power switch.



The MTS 210 then goes through the Windows NT initialization process, which can take up to two minutes. (For more information on the Windows NT initialization process, please see the Windows NT documentation.) Under normal circumstances no action is required until the **Begin Logon** window appears; when it does, press CTRL + ALT + DELETE (all three keys simultaneously) to open the **Logon Information** dialog box.

Logging In

To logon to the MTS 210, enter “MTS100” in the **User name** box, leave the password blank, and then press RETURN (these are the default values set at the factory). This is the login account you should use for most of your work.

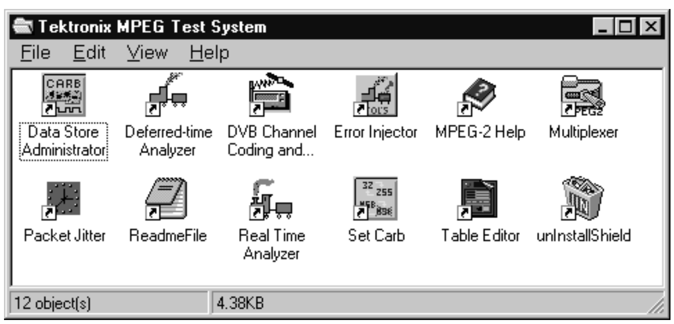
There are two other logins and passwords available. The first is “guest” with no password. This level has only limited access to files and applications. The second is “administrator” with “MPEG2” as the password. This user has administrator privileges. You must use this login when performing any software upgrades.

CAUTION. *The administrator user has all the privileges of an administrator. If you are connected to a network, you may have more privileges than you realize within the network. It is recommended that you do not perform normal operations while logged in as administrator.*

You can change the passwords if necessary; refer to the Windows NT documentation for instructions. If you change any password, be sure to create a new emergency repair disk. (See page C–1.)

The Initial Window

Once you have logged in, you will have access to the Tektronix MPEG Test System program group.



This manual explains how to use the Tektronix MTS 210 applications. Refer to the *MTS200 Series Real-Time Analyzer User Manual*, Tektronix part number 071-0076-00, for information about the MTS 215 Real-Time Analylzer application.

Additional Support

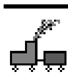
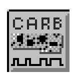
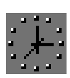
Additional support for the MTS 210 can be obtained from the Tektronix support number. The support number is available from North America. Call 1-800-TEK WIDE (1-800-835-9433) and ask for MPEG Test System support.

Operating Basics

There are eight applications provided with the MTS 210. Their names and functions are given in Table 2–1.

NOTE. *The Analyzer application is not included with option 1G. The Multiplexer application is not included with option 1A. The Real-Time Analyzer application, included with the MTS 215, is discussed in the* MTS 200 Series Real-Time Analyzer User Manual.

Table 2–1: MTS 210 applications

Icon	Application Name	Function
	Analyzer (MPEG2 System Analyzer application)	Analyze transport stream files and packetized elementary streams.
	Data Store Control (Data Store Administrator)	Manage the Data Store Disks. It also controls acquisition and generation of MPEG-2 transport streams.
	DVB Channel Coding and Decoding (Coder/Decoder application)	Code and decode transport stream files to DVB specifications.
	Multiplexer (MPEG2 Transport Multiplex Generator)	Create transport stream files from PSI and SI table files, elementary stream files, and data files. Not included with the MTS 210 option 1A.
	Packet Jitter	Add jitter to the PCR data in the transport stream file.
	Table Editor (Edit Table application)	Create and edit PMT, NIT, SDT, BAT, and EIT files.
	Error Injector	Insert or correct errors in transport stream packets.
	Set Carb	Set parameters of the Data Store system.

Running the Software

Start any of the applications by clicking its name in the Tektronix MPEG Test System submenu. The HASP® (parallel port software key) must be installed for any of the applications to operate. If the Data Store board is not installed, the

Data Store Control will not initialize correctly and you will receive an error message.

NOTE. *This manual is written assuming a basic level of familiarity with the Windows 95 or the Windows NT 4.0 operating system. If you are not comfortable with either operating system, review the Windows NT documentation.*

Tutorials and Reference Sections

Tutorials and reference information are provided to help familiarize you with the six software applications in the MTS 210. The first of three tutorials begins on page 2–7. The *Reference* section begins on page 3–1.

The tutorials step you through both analyzing transport stream files and creating (multiplexing) MPEG2 transport streams files and transport streams. They are presented in a step-by-step manner and designed so that you can follow along using your own MTS 210. The files required for these exercises are shipped with the MTS 210.

The *Reference* section explains all of the commands available from each of the six applications that are part of the MTS 210 package. The explanations are given in the following order: Menu Bar commands, Command Buttons, and finally commands that can only be accessed through “mouse-clicks”.

Acquiring Elementary Bit Stream Files

The standard configuration of the Tektronix MPEG Test System contains several video and audio elementary stream files and a sample transport stream file. These files contain pictures, common industry test signals, and sample signals in MPEG-2 format. They may be used for the following tutorials and for constructing your own transport streams.

There are two sources of additional elementary stream files: a CD ROM (part number 063-1914-0x) that is supplied with the instrument and the Tektronix FTP site.

CD ROM

To use files from the CD ROM, either copy the files to the appropriate directories on the MTS 210 system disk (drive C) or leave the CD ROM in drive D.

Audio Files. The CD ROM contains the following audio files in the Audio directory:

15kz–064.mp2	4kz–064.mp2
15kz–128.mp2	4kz–128.mp2
15kz–192.mp2	4kz–192.mp2
15kz–256.mp2	4kz–256.mp2
1kz–064.mp2	Music064.mp2
1kz–128.mp2	Music128.mp2
1kz–192.mp2	Music192.mp2
1kz–256.mp2	Music256.mp2
400–064.mp2	Sync–064.mp2
400–128.mp2	Sync–128.mp2
400–192.mp2	Sync–192.mp2
400–256.mp2	Sync–256.mp2

The file names indicate the elementary stream bit rate. The file 15kz–256.mp2, for example, contains a 15 kHz audio tone at 0.256 Mbits/s.

Video Files. The CD ROM contains the following video files. The Video\525 directory contains streams with 525-line video; the Video\625 directory contains streams with 625-line video. Both directories contain all listed files.

100b_015.mp2	Mulb_120.mp2
100b_060.mp2	Pulb_015.mp2
100b_120.mp2	Pulb_060.mp2
Bbc3_015.mp2	Pulb_120.mp2
Bbc3_060.mp2	Sync_015.mp2
Bbc3_120.mp2	Sync_060.mp2
Cact_015.mp2	Sync_120.mp2
Cact_060.mp2	Tens_015.mp2
Cact_120.mp2	Tens_060.mp2
Mobl_015.mp2	Tens_120.mp2
Mobl_060.mp2	V700_015.mp2
Mobl_120.mp2	V700_060.mp2
Mulb_015.mp2	V700_120.mp2
Mulb_060.mp2	

The file names indicate the elementary stream bit rate. The file 100b_060.mp2, for example, contains a video elementary stream with a bit rate of 6.0 Mbits/s.

Examples. The CD ROM also contains the following files in the Examples directory:

10khz.mp2	Demo_060.mp2
1khz.mp2	Sample.trp
Demo_015.mp2	

The MPEG Test System FTP Site

A second way to access these same signals (and any new bit streams that may become available), is via anonymous FTP from the Tektronix FTP site, ftp.tek.com. If you have a web browser, point it to the following URL:

FTP://ftp.tek.com/tv/test/streams/Element/

Otherwise, use FTP to contact ftp.tek.com, log in as "anonymous," and use your email address as the the password. MPEG files are available in subdirectories of /tv/test/streams/Element. Each directory contains a Readme.txt file that describes the contents of the directory.

If you have no access to FTP, please contact Tektronix at 1-800-TEK-WIDE and ask for MPEG Test System support. An engineer will be glad to help you get the data. If you have Internet access but are having trouble accessing the site, contact your system administrator for assistance.

The following script illustrates the procedure for connecting to the MPEG Test System FTP site. Your entries are indicated with bold face type.

```
% ftp ftp.tek.com

Connected to inet1.tek.com.
220 inet1 FTP server (Version wu–2.4(1) Sun Jan 29 12:29:00 GMT
1995) ready.

Name (ftp.tek.com:user): anonymous

331 Guest login ok, send your complete e–mail address as password.

Password: enter your email address

230–

230– T E K T R O N I X F T P A R C H I V E

230–                /

230–

230 Guest login ok, access restrictions apply.

ftp> cd /tv/test/streams/Element
```

```
250 CWD command successful.
```

```
ftp> get README.TXT
```

The data included in this distribution, on the FTP site, is available to the user on an “as-is” basis. Tektronix disclaims any and all warranties, whether express, implied, or statuary, including any implied warranties of merchantability or of fitness for a particular purpose.

Tutorial: Analyze a Signal

This section is intended to introduce you to the features and capabilities of the MPEG-2 System Analyzer. This “guided tour” uses step-by-step procedures and a standard MTS 210 sample transport stream file so you can follow along with your own system.

NOTE. *To help you follow along with your own MTS 210, all steps that require your action are numbered.*

Terms

Wherever possible, this manual uses terminology consistent with Microsoft® Windows™ and MPEG-2 standards. Refer to the Windows documentation (included with the Tektronix MPEG Test System) for definitions and explanations of Windows terminology. Refer to the *Glossary* at the back of this manual for definitions of terms unique to MPEG or the test system; refer to the *Index*, also at the back of this manual, to locate other mentions of any subject.

Getting Help

As you follow the procedures in this section, remember that additional information about almost every aspect of MPEG-2/DVB bit streams and analyzer operation is available from three convenient sources:

- The *Reference* section of this manual. *Using the Analyzer* begins on page 3–1.
- The Analyzer Help menu
- The MPEG-2 Help utility, which contains applicable MPEG-2 standards in Windows Help format.

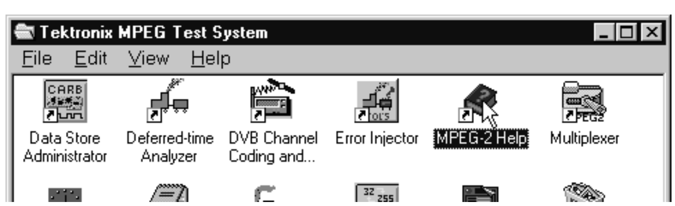


Figure 2–1: Starting the MPEG-2 Help utility

Starting the Analyzer Application

Start the Analyzer by clicking on the Analyzer name in the Tektronix MPEG Test System submenu.

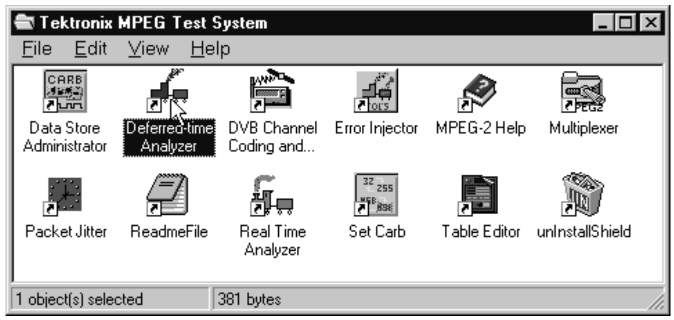


Figure 2–2: Starting the Analyzer

The Analyzer starts with the Tektronix/Matra background in the application window. Note the location of the features named in Figure 2–3.

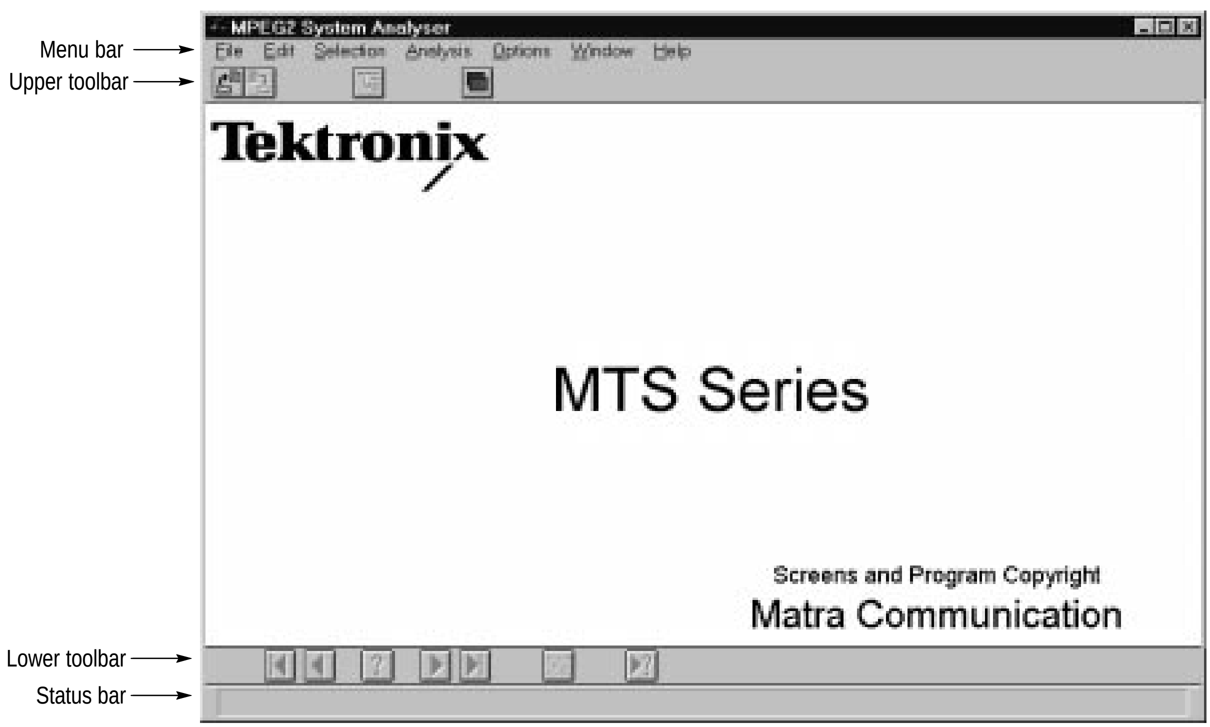


Figure 2–3: The Analyzer application window

Menu Bar

There are seven main analyzer menus:

File. File menu commands control the analyzer/disk interface and printing.

Edit. Use Edit menu commands to move among items (transport packets, elementary stream packets, PSI or SI DVB table sections) of the type displayed in the selected document window.

Selection. Use Selection menu commands to control extractions from a transport stream file.

Analysis. Analysis menu commands provide access the stream analysis functions.

Options. Use Options menu commands to select analyzer configuration options.

Window. Use Window menu commands to manage the various open document windows.

Help. The Help menu provides access to various forms of help.

Upper Toolbar

Figure 2–4 shows the functions available from the upper toolbar.

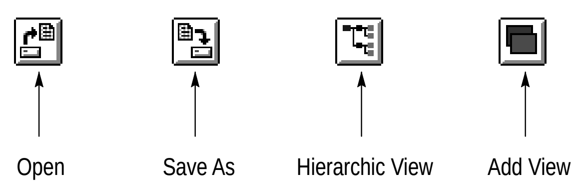


Figure 2–4: Command buttons on the upper toolbar

To display a reminder of the button function in the status bar (at the bottom of the application window) at any time, position the mouse cursor over the command button.

Lower Toolbar

Figure 2–5 shows the functions available from the lower toolbar. These commands duplicate those in the Edit menu; they are available only when the active window contains one of a possible series of items.

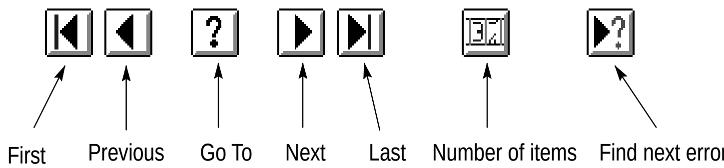


Figure 2–5: Command buttons on the lower toolbar

Again, position the cursor over a command button as shown in Figure 2–6 to display a button function reminder in the status bar.

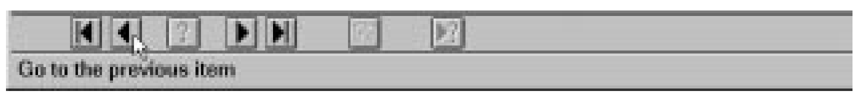


Figure 2–6: Using the status bar

Opening an Existing Transport Stream File

Your MTS 210 has the sample transport stream file SAMPLE.TRP to assist in following the tutorial.

1. From the File menu, choose Open. This brings up the Open dialog box as shown in Figure 2–7.

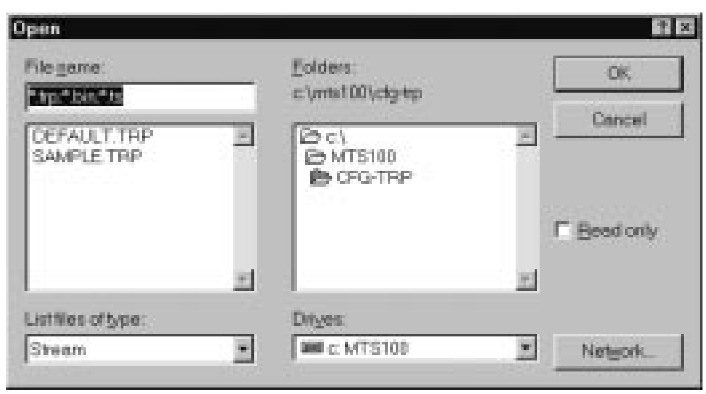


Figure 2–7: The Open dialog box

2. Select Stream from the list of File Types.

3. Select SAMPLE.TRP from the file name list.

4. Choose OK. Figure 2–8 shows the resulting document window. This is the hierarchic view of the multiplex encoded in the sample transport stream.

***NOTE**. The Analyzer cannot generate a hierarchic view if the stream does not contain a PAT (program allocation table, PID 0) or PMT (program map table).*

The hierarchic view that appears when you first open a file is based on the first versions of the PAT and PMT tables found in the stream. You can use the Next command in the Edit menu or click on the Next command button (in the lower toolbar) to go to the next PSI version, if any, in the stream.

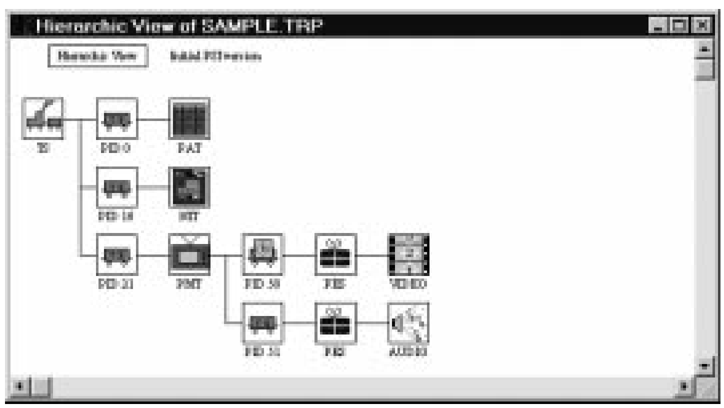


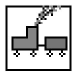
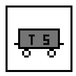
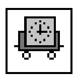
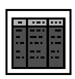
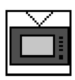
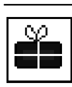
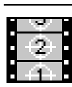
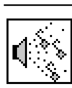
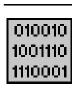
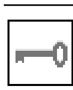
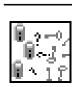
Figure 2–8: The hierarchic view of the SAMPLE.TRP stream

The Hierarchic View

The hierarchic view allows you to select an icon that represents a particular element in the stream and make a more detailed analysis. When selected, an icon displays in reverse video. After selection, all the extraction and analysis functions are available through the toolbars and menus.

Table 2–2 identifies the icons used in the hierarchic view.

Table 2–2: Icons used in the hierarchic view

Icon	Element Type
 TS	Multiplex transport packets. This icon represents all (188- and 204-byte) transport packets that make up the stream. If you visualize the transport stream as a train, this icon represents every car in the train, regardless of its configuration (flat car, boxcar, or hopper for example) and what it contains.
	Transport packets of a particular PID (Program ID). Other elements (tables, clocks, PES packets) are the "payload" contained within transport packets or are constructed from the payload of several transport packets that have the same PID. The PID number appears under the icon. In the hierarchic view, the icon to the right of this icon represents the payload of packets with this PID.
	Transport Packets that contain independent PCR clocks. The PID appears under the icon.
 PAT	PAT (Program Association Table) sections. Always contained in PID 0 transport packets.
 PMT	PMT (Program Map Table) sections.
	NIT (Network Information Table) Provides access to SI Tables through the PSI/SI command from the Selection menu. Also used for Private sections. When the DVB option (in the Options menu) is selected, this icon can also represent SDT, BAT, EIT, and TDT sections.
 PES	Packetized Elementary Stream (PES). This icon represents all packets that, together, contain a given elementary stream. Individual PES packets are assembled from the payloads of several transport packets.
 VIDEO	Video elementary stream
 AUDIO	Audio elementary stream
 DATA	Data elementary stream
 ECM	ECM (Entitlement Control Message) sections
 EMM	EMM (Entitlement Management Message) sections

Icon menus. Each type of hierarchic view icon has a context-specific shortcut menu that allows quick access to the functions available specifically for the chosen element. Figure 2–9 shows the shortcut menus for the common icons. Display this menu by clicking the *right* mouse button on the icon. Hold the mouse button down, highlight the desired command, and release the button to select the command.

***NOTE**. In all cases, you can select the first command on the shortcut menu (or the only command in one-item menus) by double-clicking on the icon. For all but elementary stream icons, this will open an "interpreted view" of the packet or section. Please continue with this tutorial to learn more about interpreted views.*

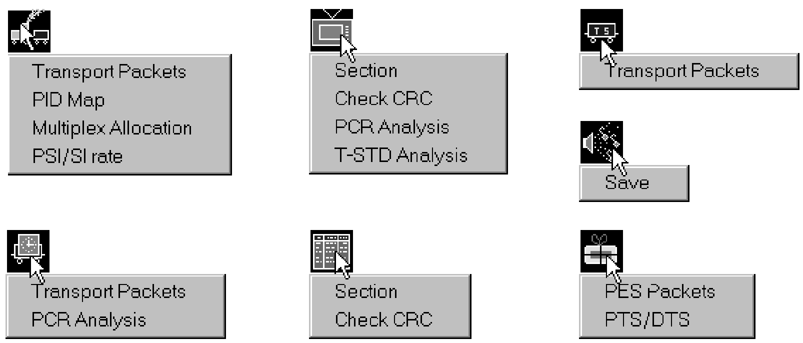


Figure 2–9: Hierarchic view shortcut menus

Additional Information from the TS Icon

1. Click on the TS icon with the *right* mouse button and hold the button down to open the TS shortcut menu, as shown in Figure 2–10.

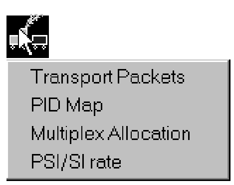


Figure 2–10: The TS icon shortcut menu

2. Highlight Transport Packets and release the button. This opens an interpreted view of the first complete transport packet in the stream, as shown in Figure 2–11.

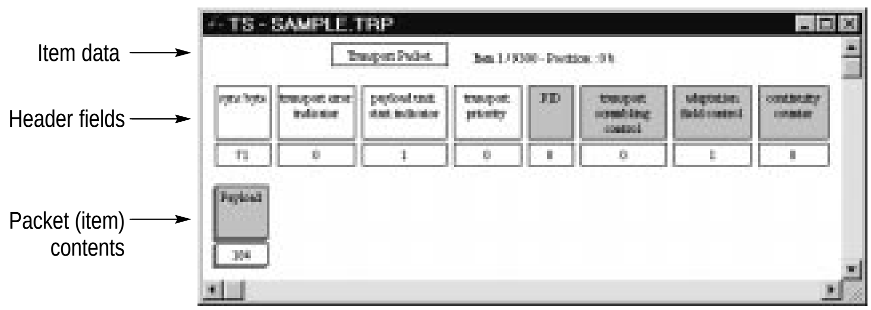


Figure 2–11: The interpreted view of the first transport packet

---

***NOTE**. You can also open the same interpreted view simply by double-clicking on the TS icon.*

The Interpreted View

The interpreted view shows the structure of the transport packet and provides access to all the information contained in the packet header and payload. The transport packet display shows one transport packet at a time.

1. Use the command buttons on the lower toolbar to quickly scroll among the transport packets. Notice that the Item number changes as you scroll through the transport packets.

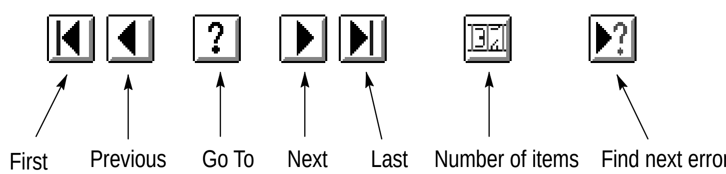


Figure 2–12: Command buttons on the lower toolbar

The transport stream in SAMPLE.TRP consists of 9300 transport packets, as indicated by the item number (Item 1/9300) at the top of the display. Many interpreted views do not indicate the total number of items when the view is first opened; click on either the Number of Items or the Last command button to add the information to the item data.

Since this is an analysis program, you should be looking for errors in the stream.

2. Find the next error in the stream by clicking the Next Error button. The program will search forward in the stream until it either finds an error or reaches the end of the file. If it finds an error, the interpreted view automatically displays the transport packet that contains the error.

3. Double-click on any packet field name for more information about the field, as shown in Figure 2–13.

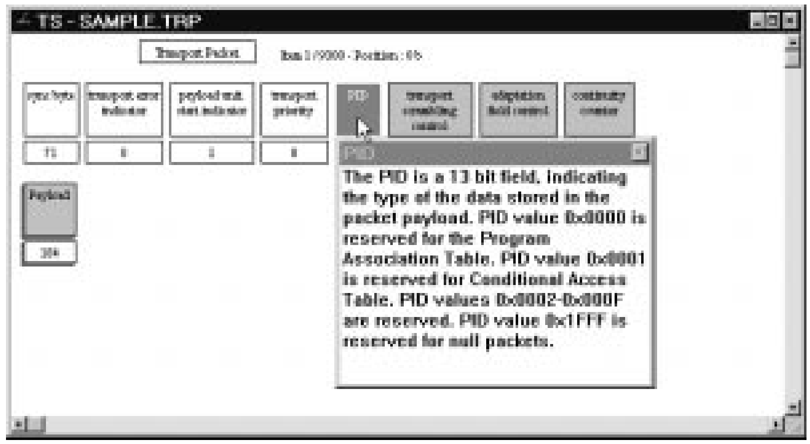


Figure 2–13: Double-click for an explanation of the field

Now see what it has to say about the value of the PID.

4. Click anywhere in the interpreted view outside of the PID message box to dismiss the message. Then double-click on the PID value (0), to display help information about the value, as shown in Figure 2–14. In this case, the message reminds you that PID 0 always identifies the PAT.

Figure 2–14: Help information for the packet field value

Sometimes you can learn more by looking at field values displayed in hexadecimal base. Now change the display to show hexadecimal values.

5. Choose Base from the Options menu, select the Hexadecimal option button in the Base dialog box, and click OK. Or simply press the F2 function key to

toggle field values (and values in the hierarchic view) between decimal and hexadecimal base.

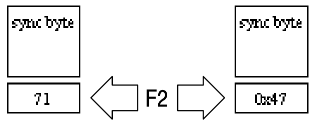


Figure 2–15: Press F2 to toggle numeric base

The Hexadecimal View

The hexadecimal view shows all bytes that make up the current item. An MPEG-2 transport packet consists of 188 or 204 bytes.

1. To open a hexadecimal view, first click the Add View command button—on the upper toolbar—to open the View Type submenu, as shown in Figure 2–16.

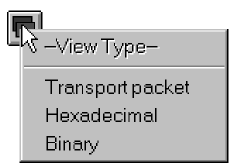


Figure 2–16: The View Type submenu

2. Choose Hexadecimal from the submenu. This produces the hexadecimal dump shown in Figure 2–17.

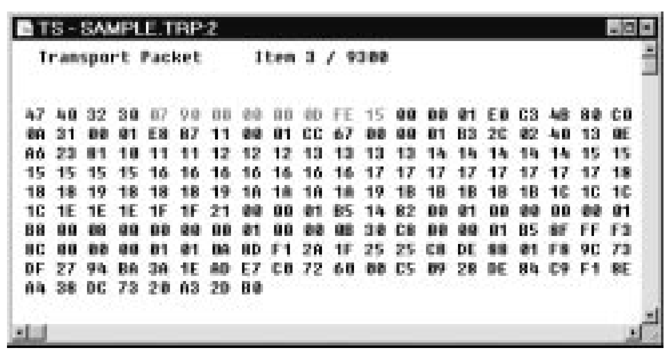


Figure 2–17: Hexadecimal view of a transport packet

Notice that the first few bytes appear in blue characters on the MTS 210 display to indicate that they are required header information for the type of item. A transport packet has four required bytes. The blue, required bytes may be followed by several bytes shown in gray (for an example, use the command buttons to go to item three of SAMPLE.TRP). These gray bytes are optional or variable header information. The remaining bytes, displayed with black characters, are the payload or data bytes.

3. Close both transport packet windows (interpreted and hexadecimal views) so you are ready to look at a PID map of the sample transport stream.

PID Map

The PID map can help you quickly locate the stream location and exact packet (item) number of a particular table section

1. Click on the hierarchic view TS icon with the *right* mouse button. Hold the button down to reveal the shortcut menu, as shown in Figure 2–18.

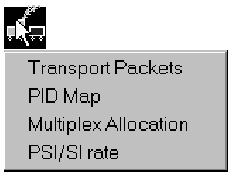


Figure 2–18: The TS icon shortcut menu

2. Choose PID Map from the menu. This creates the window shown in Figure 2–19.

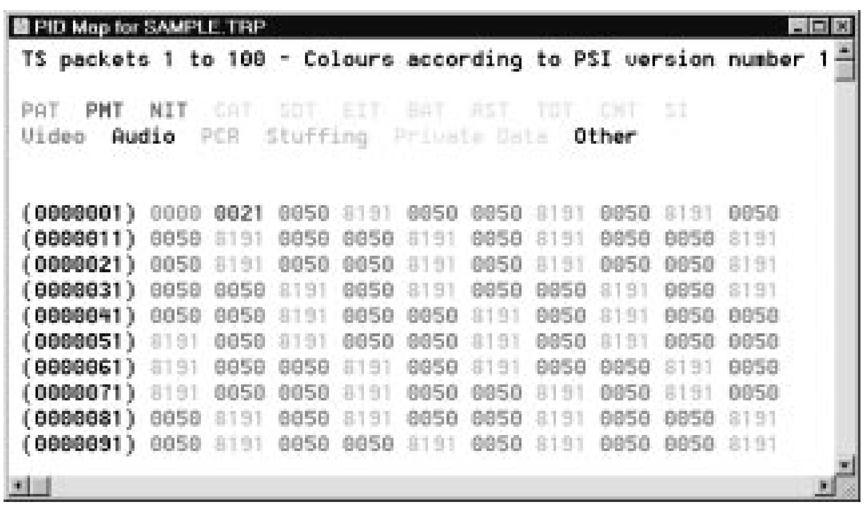


Figure 2–19: The PID map of SAMPLE.TRP packets 1 to 100

The PID map represents every transport packet in the stream with its PID (for uniformity, every PID is listed in a four digit field). In the map, each unique PID is color-coded according to the type of element it identifies. For example, the PIDs of packets that contain PAT sections are displayed in light green characters. The black numbers down the left side of the window indicate the packet number of the first packet of every row. Notice that the first PAT section is in packet one.

3. Click the Next command button (you remember: the one with the "▶" on it) repeatedly until you see the next light green PID. The second PAT section in SAMPLE.TRP is in packet 334.

4. Close the PID map so you are ready to look at Multiplex Allocation in the sample transport stream.

Multiplex Allocation

You can use the Multiplex Allocation view to discover what fraction of the transport stream multiplex is used by each PID.

1. Once again, click on the hierarchic view TS icon with the *right* mouse button to open the shortcut menu. This time, choose Multiplex Allocation to create the window shown in Figure 2–20.

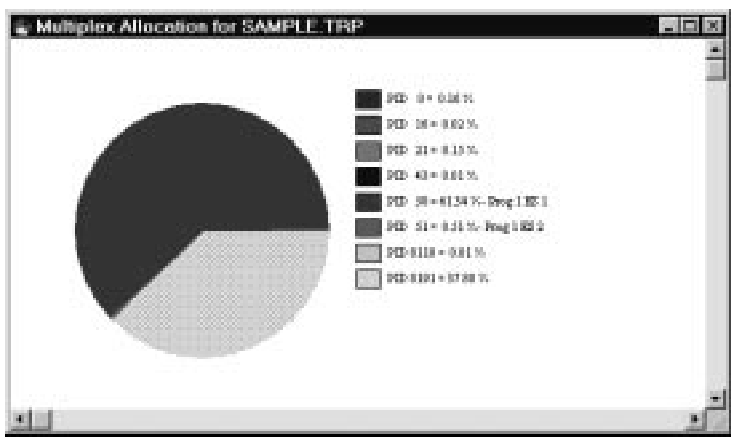


Figure 2–20: The Multiplex Allocation document window

The multiplex allocation pie chart is useful in determining which PIDs are present in the transport stream and in confirming that each PID is using the expected amount of the multiplex.

***NOTE**. PID 8191 is the stuffing PID; it is not shown in the hierarchic view.*

2. Close the multiplex allocation window so you are ready to look at the transport packets of a particular PID with a minimum of clutter.

Additional Information from the Transport Packet Icon

The transport packet (rail car) icon represents transport stream packets that are identified with a particular PID. Other elements (such as table sections or PES packets) are the payload contained within these transport packets; the elements may be fully contained within one packet or constructed from the payload of several packets with the same PID. The PID number appears under the transport packet icon. In the hierarchic view, the icon immediately to the right of a transport packet icon represents the payload.

1. Press function key F2, if necessary, to display hierarchic view values in decimal base.

2. Double-click on the PID 21 transport packet icon, as shown in Figure 2–21.

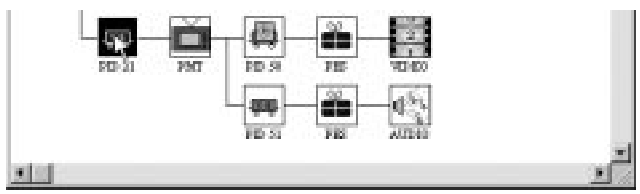


Figure 2–21: Double-click on the PID 21 icon

The analyzer opens a window similar to Figure 2–22.

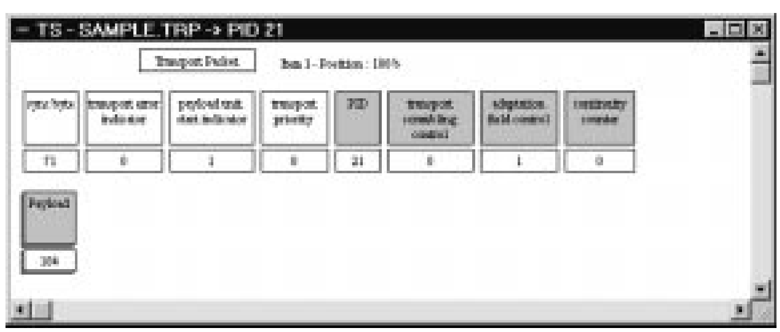


Figure 2–22: Interpreted view of the first PID 21 transport packet

You can search for errors and get additional information about the fields and field values just as you did with the transport packet at the TS level. The difference is that now you are looking at only the packets of PID 21, which contain PMT sections describing program one.

3. Click the Last command button in the lower toolbar to go to the last PID 21 packet in the transport stream (if you have forgotten which button to use, move the cursor slowly over all buttons in the lower toolbar while watching the messages in the status bar, immediately below). Notice—by looking at the item data near the top of the window as shown in Figure 2–23—that there are only 14 transport packets of the 9300 in the SAMPLE.TRP stream that are identified with PID 21.

Figure 2–23: The last PID 21 packet in SAMPLE.TRP

By the way, the item position is the number of the first byte in the packet relative to the beginning (byte 0) of the transport stream file. In other words, there are 1625260 bytes in the file (and stream) before this packet.

As with the TS interpreted view, you can open a hexadecimal view of the packet through the Add View command button. Another way to look at the packets is in a binary view.

1. Click on the Add View button as shown in Figure 2–24.

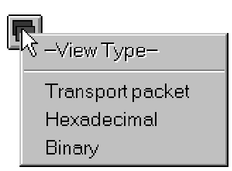


Figure 2–24: The View Type submenu

2. Select Binary from the View Type submenu. The analyzer opens a window similar to Figure 2–25.

Notice that the first eight-bit byte, which corresponds to the sync byte (see the interpreted view in Figure 2–22), is 01000111. Not surprisingly, this is the binary equivalent of 71 decimal and 0x47 hex. The next three bits correspond to the following three packet fields, and the 13 bits after that (to the end of the third byte) correspond to the PID. Sure enough, 00000 00010101 equals 21 decimal.

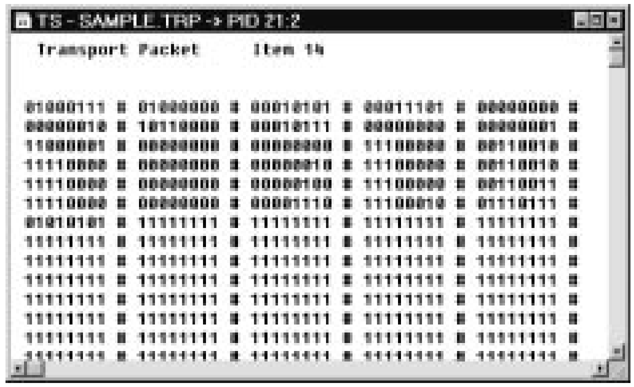


Figure 2–25: The binary view of PID 21 item 14

3. Close the PID 21 interpreted and binary view windows before you proceed.

Additional Information from the PAT Icon

The PAT icon represents PAT (Program Association Table) sections. PAT sections are always contained in PID 0 transport packets.

1. Click on the hierarchic view PAT icon with the *right* mouse button. Hold the button down to reveal the shortcut menu, as shown in Figure 2–26.

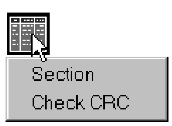


Figure 2–26: The PAT icon shortcut menu

2. Choose Section from the shortcut menu to open an interpreted view of the PAT (Program Association Table). The window resembles Figure 2–27.

***NOTE**. You can also open the same interpreted view simply by double-clicking on the PAT icon.*

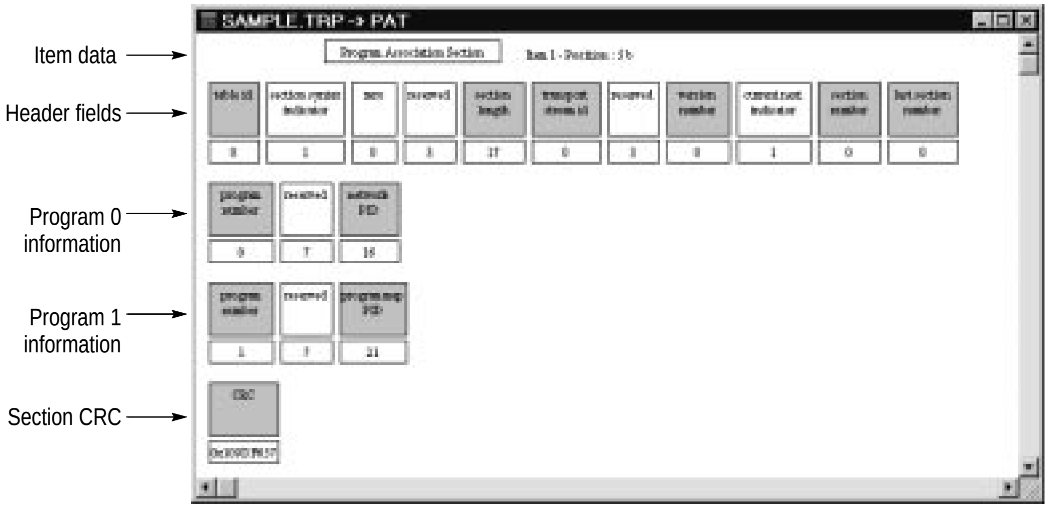


Figure 2–27: The PAT section interpreted view

You can do all the same things at the PAT section level that you can at the transport packet level. You can search for errors, get information on the fields and field values, and scroll among the PAT sections contained in the stream.

3. Close this window before you proceed.

The analyzer automatically calculates and checks the CRC of the first PAT section when opening a transport stream file. Select the second PAT shortcut menu command, Check CRC, to calculate the CRC (cyclic redundancy code) of every PAT section in the stream and compare it to the number coded into the section's CRC field.

4. Click on the PAT icon with the right mouse button and hold the button down to show the PAT shortcut menu. Highlight the Check CRC command and release the button. If no erroneous CRCs are found, the analyzer creates the dialog box shown in Figure 2–28.

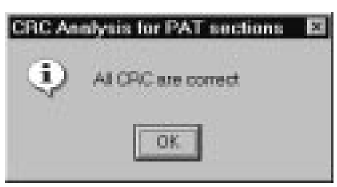


Figure 2–28: The CRC Analysis dialog box

5. Click OK to close the dialog box and then close the PAT interpreted view to continue with the tutorial.

Additional Information from the PMT Icon

The PMT (Program Map Table) icon, like all others in the hierarchic view, has its own shortcut menu. As with most other icons, you can double-click on the PMT icon to open an interpreted view of PMT sections.

Section

1. Click on the PMT icon with the *right* mouse button and hold the button down to take a look at the PMT shortcut menu, as shown in Figure 2–29.

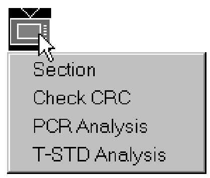


Figure 2–29: The PMT shortcut menu

2. Choose Section from the menu or release the right mouse button and double-click with the left button to open an interpreted view similar to Figure 2–30.

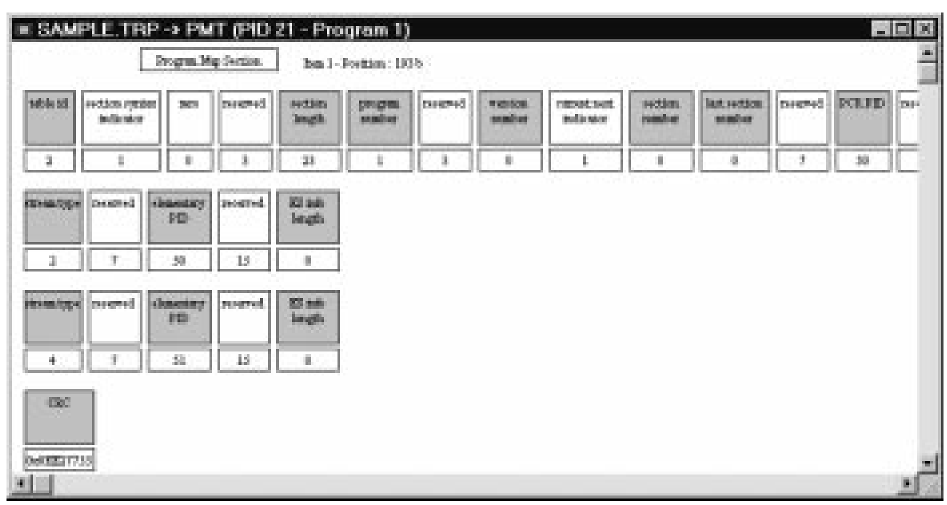


Figure 2–30: The PMT interpreted view

Syntax Analysis

Perform a Syntax Analysis on this PMT section.

1. From the Analysis menu choose Syntaxic, as shown in Figure 2–31.

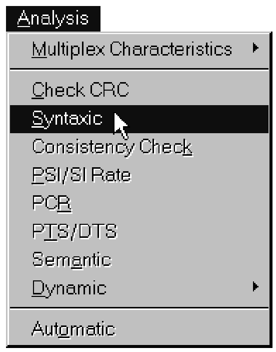


Figure 2–31: Choosing Syntaxic from the Analysis menu

Syntax analysis checks all PMT sections in the stream for errors and variations from the standard. It searches for errors that are within the PMT itself and relative to the other tables (NIT and SDT for example). The example does not have any PMT syntax errors, as shown in Figure 2–32.

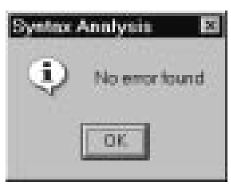


Figure 2–32: The Syntax Analysis message window

2. Click OK to close the Syntax Analysis message window.

Now, the fact that no syntax errors were found in any of the PMT sections does not guarantee that there are no such errors in the entire stream. Let’s widen the search.

3. Click anywhere on the hierarchic view window to select it. (Or minimize the PMT interpreted view window; the remaining, hierarchic view window is then automatically selected.)

4. Once again, choose Syntaxic from the Analysis menu. This time, the analyzer searches the entire stream for errors. If it finds any (and it does in SAMPLE.TRP), it opens a window similar to Figure 2–33.

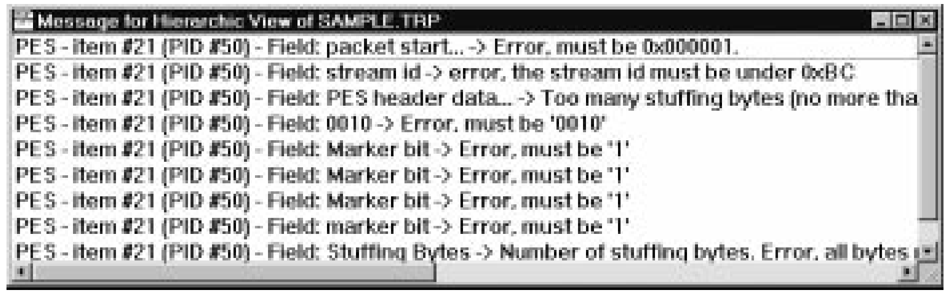


Figure 2–33: A message window listing syntax errors

Each line in the message window represents one syntax error. You can double-click on a line to open an interpreted view of the item that contains the error. Notice that in this case all errors are in one PES packet. Let's wait until the discussion of the PES icon to talk about these errors.

5. Close the syntax error message window before you proceed.

Check CRC

You can check the CRCs in all PMT sections through the shortcut menu just as you did with the PAT sections.

You can *also* check every CRC in the transport stream just like you checked the syntax of all items in the stream:

1. Select the hierarchic view again.
2. Choose Check CRC from the Analysis menu, as shown in Figure 2–34.

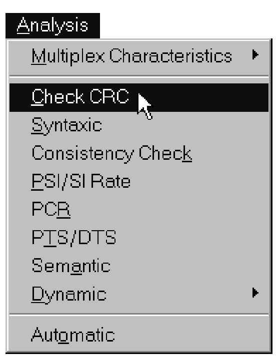


Figure 2–34: Choosing Check CRC from the Analysis menu

If CRC errors are found, the analyzer lists the errors in a window similar to Figure 2–33. Because SAMPLE.TRP contains no CRC errors, however, the analyzer displays the message window shown in Figure 2–35.

Figure 2–35: CRCs in all sections are correct

3. Click OK (or press Enter) to dismiss the CRC analysis message window and close the interpreted view window before proceeding.

PCR Analysis

PCR (Program Clock Reference) analysis allows you to see a graphical representation of the PCRs versus time.

1. Click on the PMT icon with the *right* mouse button and hold the button down to open the PMT shortcut menu, as shown in Figure 2–36.

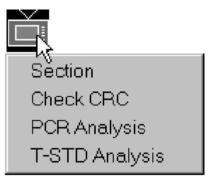


Figure 2–36: The PMT shortcut menu

2. Choose PCR Analysis from the menu to open a PCR diagram window similar to Figure 2–37. This diagram shows the first ten clocks in the program.

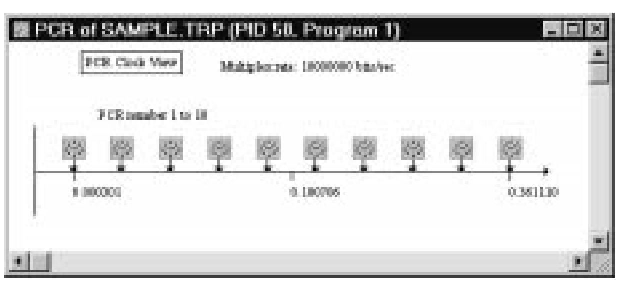


Figure 2–37: The PCR analysis display

3. Double-click on the third clock icon. This brings up the PCR value window as shown in Figure 2–38.

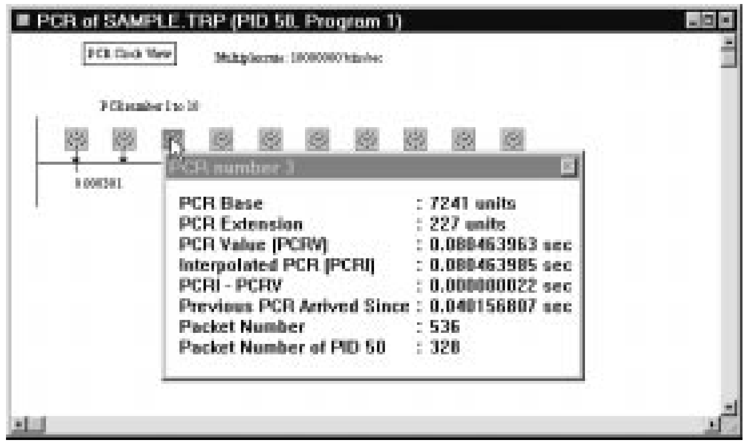


Figure 2–38: Double-click on the clock icon to list clock values

You can also display the values of all of ten diagrammed PCRs at once.

4. Click the Add View command button in the upper toolbar.

5. Choose PCR Values from the View type submenu, as shown in Figure 2–39. The analyzer creates a window, similar to Figure 2–40, that lists the values for all ten PCRs in the diagram.

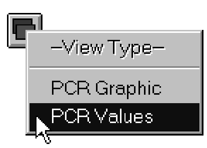


Figure 2–39: The PCR View Type submenu

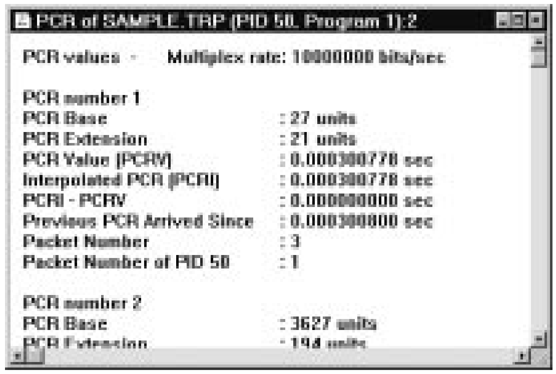


Figure 2–40: The PCR values display

You can navigate among the program PCRs with the command buttons on the lower toolbar.

6. Click the Next command button to show the values of the next ten PCRs (numbers 11 through 20) in the stream.
7. Select the PCR diagram window again — the window title says: PCR of SAMPLE.TRP (PID 50, Program 1):1 — and notice that the diagram also shows PCRs 11 through 20.
8. Close all windows except the hierarchic view before continuing with the tutorial.

T-STD Analysis

T-STD analysis checks the selected program against the (transport stream system target) decoder model that is defined in the MPEG-2 standard.

1. Select the Options menu and make sure that Visual TSTD and LTW is selected as shown in Figure 2–41.

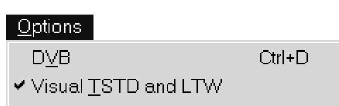


Figure 2–41: Visual TSTD and LTW selected

2. Choose T-STD Analysis from the PMT shortcut menu, as shown in Figure 2–42.

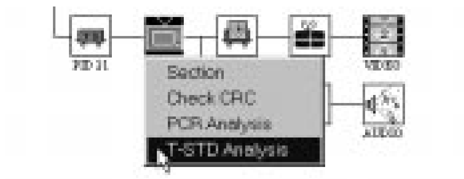


Figure 2–42: Choosing T-STD Analysis from the shortcut menu

Because visual mode is selected, the analyzer opens a Buffering Simulation window similar to Figure 2–43. The window contains dynamic bar graphs of the video, audio, and system buffers; the graphs show how full each buffer is at a given point in decoding and change color from blue to yellow to red as buffer overflow approaches and occurs. Notice that the simulation is not real-time and may take several minutes. If you have the time, do watch to see what happens, as SAMPLE.TRP will cause buffer overflows and have errors to report when the simulation in done.

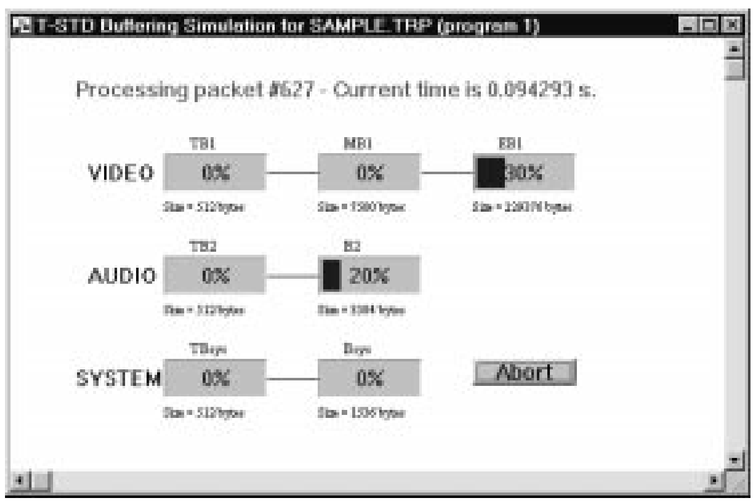


Figure 2–43: The T-STD Buffering Simulation window

3. If you don't have the time to let the simulation finish on its own, click the Abort button in the lower-right of the simulation window. The simulation pauses and you can choose to resume analysis or close the window.

Buffer overflows occur near the end of SAMPLE.TRP, and the analyzer opens the window shown in Figure 2–44. Each line of text in the window represents one error. As the analyzer discovers additional errors, it adds them to the bottom of the list. At the end of analysis, all activity in the Buffer Simulation window stops.

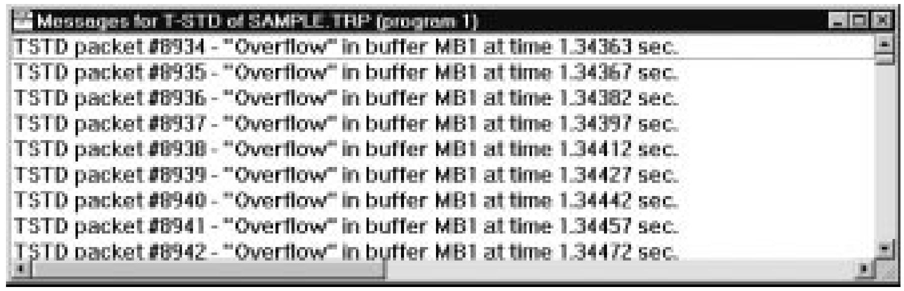


Figure 2–44: The T-STD error list

4. Close all windows except the hierarchic view before continuing with the tutorial.

Additional Information from the PES Packet Icon

The PES (Packetized Elementary Stream) packet icon represents all packets that, together, contain a given elementary stream. Individual PES packets are assembled from the payloads of several transport packets. You can learn more about the PES packets and their PTS/DTS (Presentation and Decode Time Stamps) through this icon.

Interpreted View

1. Click on the PID 50 PES icon with the *right* mouse button and hold the button down to take a look at the PES shortcut menu, as shown in Figure 2–45.

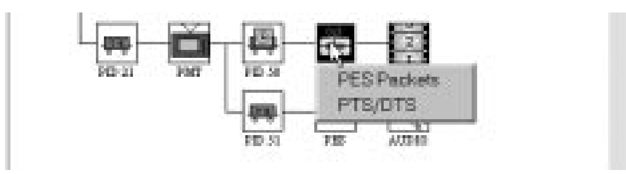


Figure 2–45: The drop-down menu for the PES icon

2. Choose PES Packets from the menu (or release the right mouse button and double-click with the left button) to open an interpreted view similar to Figure 2–46.

Notice that the item data (near the top of the window) now includes a Time: entry. This is the time that the first byte of the packet appears in the transport stream, relative to the beginning of the stream. The time is included in all interpreted views that you open after performing an analysis that involve a multiplex rate calculation. Both the PCR analysis and the T-STD analysis, performed while looking at the PMT icon, involve a “mux rate” calculation.

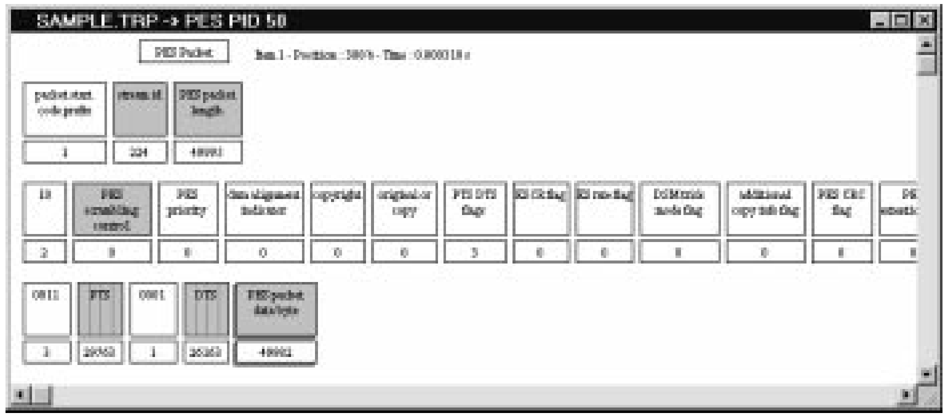


Figure 2–46: The PES packet interpreted view

This interpreted view offers all of the same options as were given in the previous discussions. Remember the syntax errors the analyzer reported when you performed a “Syntaxic” analysis of the entire stream? They are in a PID 50 PES packet.

3. Click the Next Error button on the lower toolbar. The program checks each packet in the stream for errors. If it finds an error, it automatically jumps to the transport packet containing the error. There are several errors in the last PID 50 PES packet in SAMPLE.TRP, as shown in Figure 2–47. The errors are highlighted in red on the MTS 210 display.

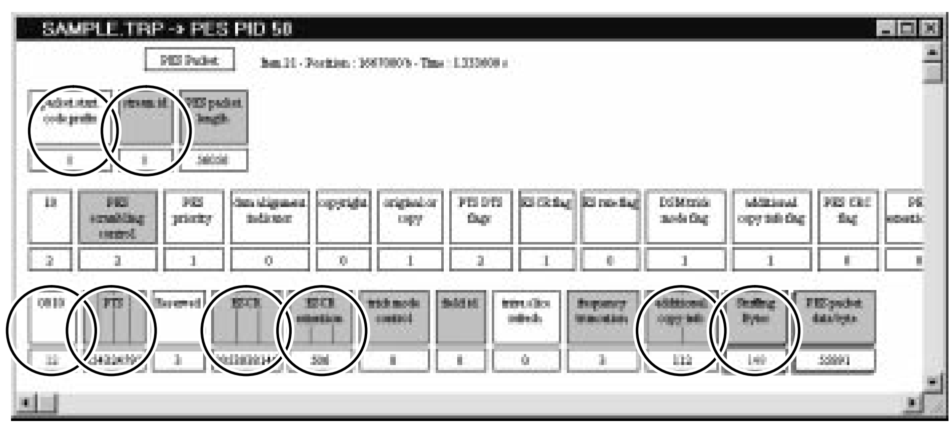


Figure 2–47: The PES Packet with the errors circled

You can find out more about any error by double-clicking on the field name and its value.

4. Double-click on the “packet start code prefix” box, as shown in Figure 2–48, to learn more about the field.

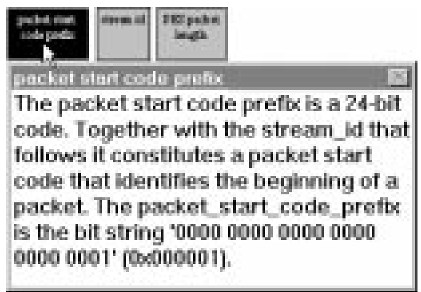


Figure 2–48: Double-click for information about the field

5. Read about the field and then click on the field box *once* to dismiss the message window.

6. Double-click on the field, as shown in Figure 2–49, to reveal the value help/error message.

Figure 2–49: Double-click for information for the field value

7. Close the interpreted view window.

PTS/DTS

PTS/DTS analysis extracts the presentation and decode time stamps embedded in the elementary stream and shows their relative time positions in a graphical display window. Through this display, you can check that all of the time stamps “make sense” (PTS must be later than DTS, and both must be after the associated data arrives) and check for the existence of B fields, which have no DTS.

1. Click on the PID 50 PES icon with the *right* mouse button and hold the button down to open the PES packet shortcut menu, as shown in Figure 2–50.

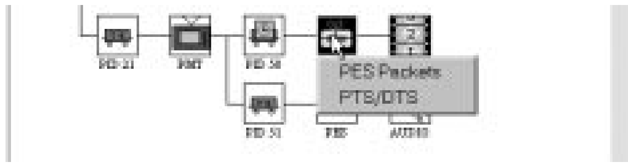


Figure 2–50: The PID 50 PES shortcut menu

2. Highlight PTS/DTS and release the button. This opens a window containing a diagram of the first four PTS/DTS “events” in the elementary stream, as shown in Figure 2–51.

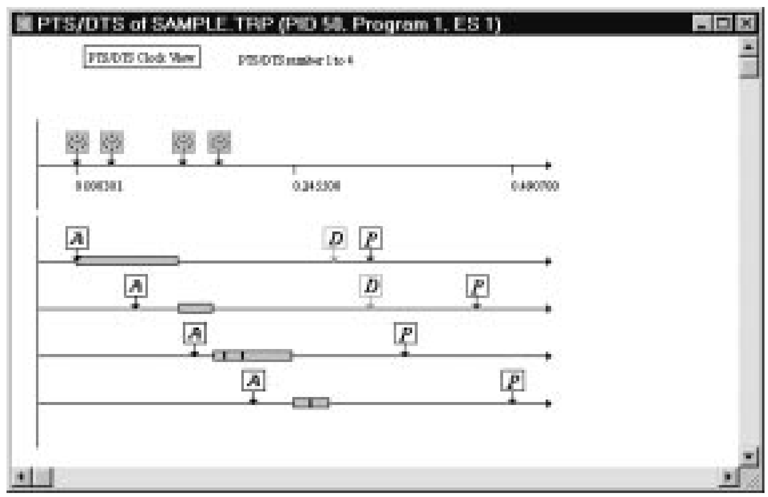


Figure 2–51: The PTS/DTS diagram

***NOTE**. The diagram in Figure 2–51 reveals some errors in the SAMPLE.TRP PID 50 elementary stream:*

- *Three of the arrival times do not coincide with the start of the associated access unit.*
- *Two of the PTS/DTS events involve more than one access unit.*

Both of these errors suggest problems in the encoding process. See Figure 2–52 for an example of a diagram from a correctly encoded stream.

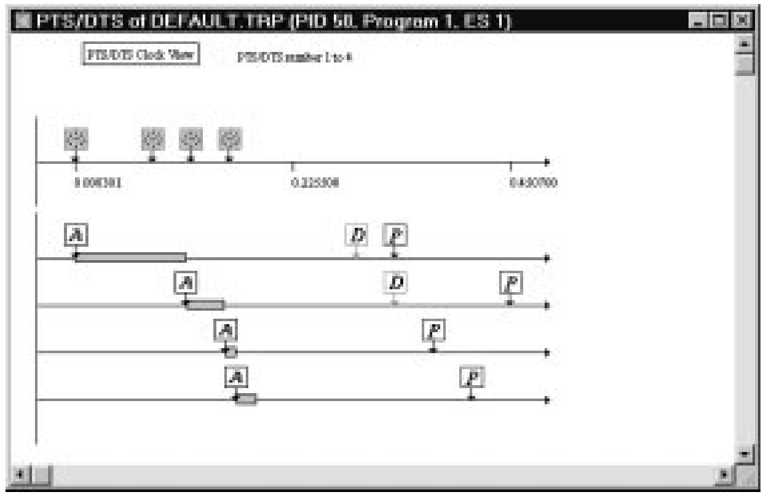
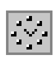
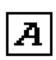
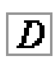
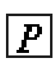


Figure 2–52: PTS/DTS diagram from a correctly encoded stream

Table 2–3 lists and explains the icons used in the PTS/DTS diagram.

Table 2–3: PTS/DTS graphic view icons

Icon	Represents	Double-click for
	PCR (program clock reference)	Value Location in transport stream (TS packet number)
	Arrival time of the PTS/DTS	Value Time since the previous PTS/DTS arrived Location in elementary stream (PES packet number)
	DTS (decode time stamp)	Value Location in elementary stream (PES packet number)
	PTS (presentation time stamp)	Value Location in elementary stream (PES packet number)
	AU (access unit)	Begin time End time Size in bytes Type of frame (intra, predicted, or bidirection) Reference time

The example timing diagram illustrates several features of a correctly encoded MPEG-2 video stream:

- Access units arrive one after another, as you can see from the left ("early") side of the diagram.
- The order of access unit decoding and presentation is visible in the right (later) portion of the diagram.

- Intra (I) and predicted (P) pictures must be decoded before presentation and therefore have both DTS and PTS. B (bidirection) frames are decoded and presented at the same time and therefore have only presentation time stamps.
- B frames use information in an associated P frame; the P frame must be decoded before the B frame(s), but is presented after. In the example, then, the order of frame decoding is IPBB, but the order of presentation is IBBP.

As the Table 2–3 heading indicates, you can get more information about the various objects in the diagram by double-clicking on the icon.

3. Double-click on the first arrival icon to reveal its values, as shown in Figure 2–53.

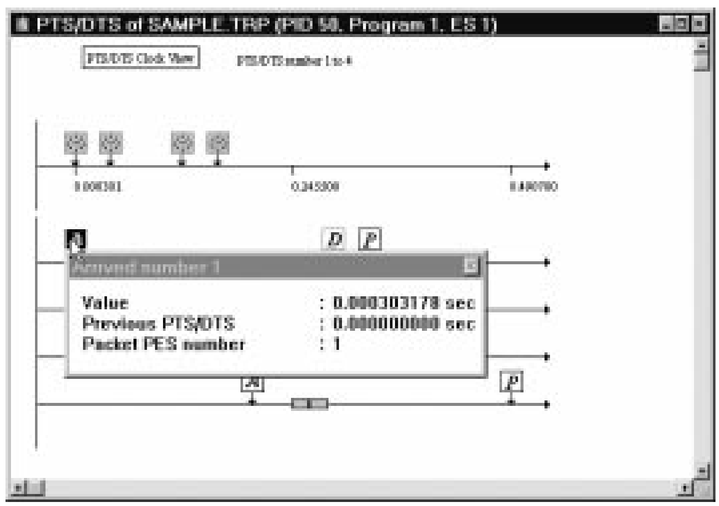


Figure 2–53: Information about the first arrival time

4. Click within the PTS/DTS diagram window, but outside of the Arrived value window, to dismiss the value window.

5. Double-click on the first AU icon, as shown in Figure 2–54, to learn more about the access unit.

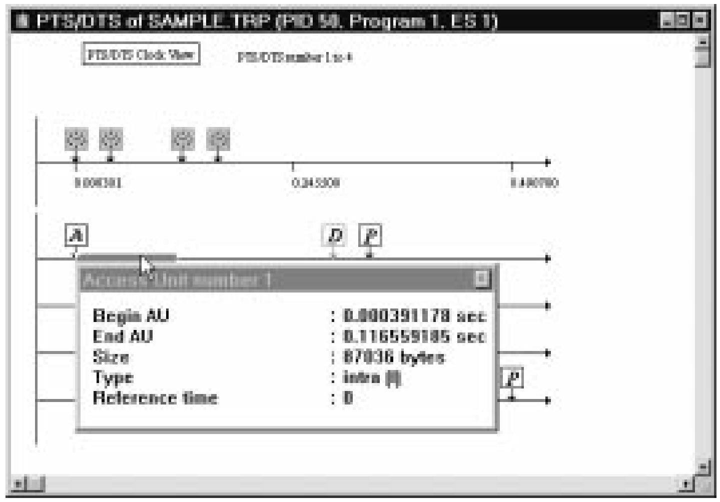


Figure 2–54: Information about the first access unit

Just as you did with interpreted views, you can navigate among the time stamps of an elementary stream with the lower toolbar command buttons (and the equivalent commands in the Edit menu).

6. If you wish, experiment using the lower toolbar command buttons to move among all the time stamps in the elementary stream (or at least the part of the stream that was saved in SAMPLE.TRP).

7. When you are ready, close all windows but the hierarchic view of SAMPLE.TRP and continue with the tutorial.

Viewing PSI/SI Data

1. If possible, open a DVB (Digital Video Broadcast) transport stream file. If you do not have such a file available, continue with the original file, SAMPLE.TRP.

2. Select the Options menu and choose DVB if it isn't already check-marked (✓), as shown in Figure 2–55.

Figure 2–55: The check mark indicates that DVB is selected

3. Select the hierarchic view, if necessary, and then choose PSI/SI from the Selection menu. The dialog box shown in Figure 2–56 appears.

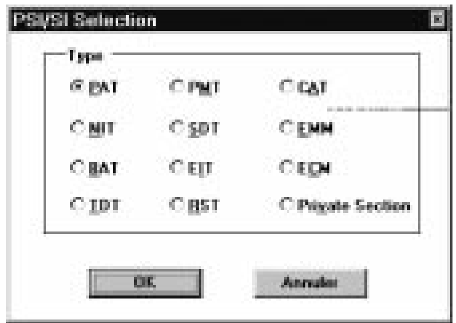


Figure 2–56: The PSI/SI Selection dialog box

***NOTE**. Annuler is the Cancel button for this dialog box.*

4. Click NIT as shown in Figure 2–56.
5. Click OK to open an interpreted view of the first NIT section in the stream as shown in Figure 2–57. The exact appearance of the view will depend on the configuration of your particular DVB stream.

***NOTE**. You can also open this view by double-clicking on the NIT icon or by selecting Section from the icon shortcut menu.*

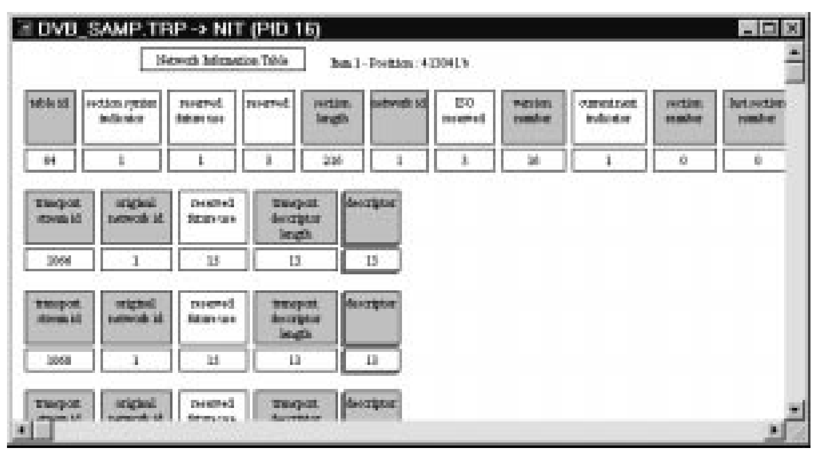


Figure 2–57: The NIT section interpreted view

6. Double-click on a descriptor field, if the NIT contains them, as shown in Figure 2–58. The resulting descriptor message box contains an ASCII decode of the network information associated with the transport stream.

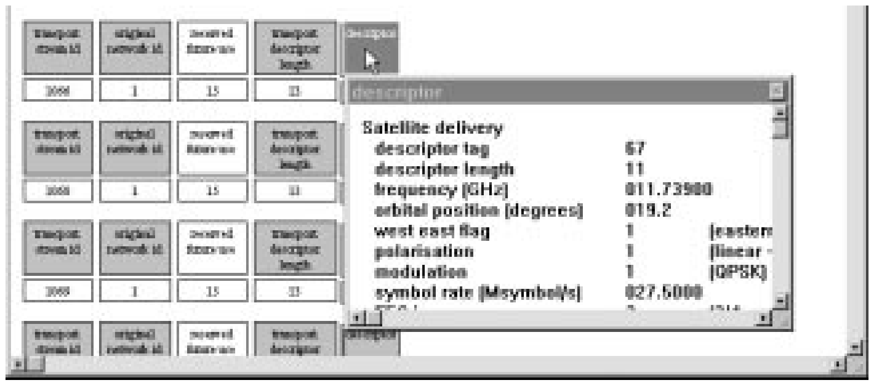


Figure 2–58: Double-click for an ASCII decode of the descriptor

You can use the same technique to view descriptor information in any DVB table in the stream.

7. Close the NIT section window.

Automatic Analysis

In the course of this tutorial, you have used the MPEG-2 System Analyzer to perform several kinds of analysis on various stream elements. The analyzer also has an automatic analysis feature that simplifies evaluation of the entire transport stream, yet still permits detailed analysis of many types of error.

The following procedure assumes that you still have the hierarchic view of SAMPLE.TRP open on your MTS 210 display. If you closed that window to view a DVB stream in the last section of this tutorial, open SAMPLE.TRP again before you continue.

1. Choose Automatic analysis from the Options menu. The dialog box shown in Figure 2–59 appears.

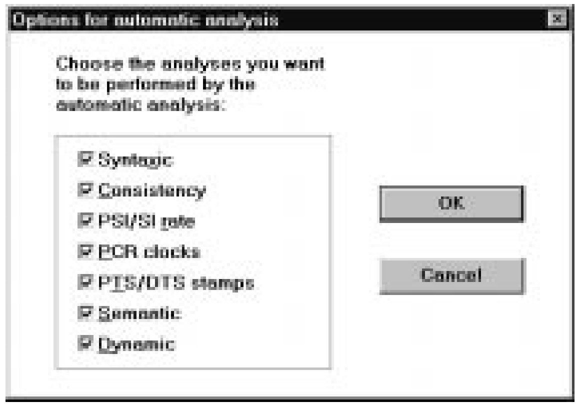


Figure 2–59: The automatic analysis Options dialog box

2. By default, automatic analysis includes all the listed tests. Automatic analysis takes several seconds to several minutes, depending on the size and complexity of the file, speed of your MTS 210, and the number and type of analyses selected through this dialog box. Dynamic analysis, the last selection in the dialog box, takes much longer than all other tests combined. If you are following this exercise to familiarize yourself with the analyzer, click on the Dynamic check-box to de-select Dynamic analysis.

***NOTE**. The MPEG-2 System Analyzer can conduct three kinds of Dynamic analysis: T-STD (transport stream target decoder), LTW (legal time window), and Smoothing Buffer. Automatic analysis includes only T-STD analysis; the remaining dynamic analyses must be performed manually. Refer to the* Reference *section of this manual for more information about Dynamic analysis.*

3. Choose OK to confirm the selections and close the dialog box.

4. Choose Automatic from the Analysis menu. The window shown in Figure 2–60 appears. This Automatic analysis window contains a table that shows the progress and results of the various tests. As the analysis sequence proceeds, cells in the Status column change from blank to Running to Completed. As each test is completed, either OK or Errors (in red) appears in the corresponding Result cell, depending on the results of the analysis.

   If you wish to end the analysis at any time, click Abort after current task, at the bottom of the window.

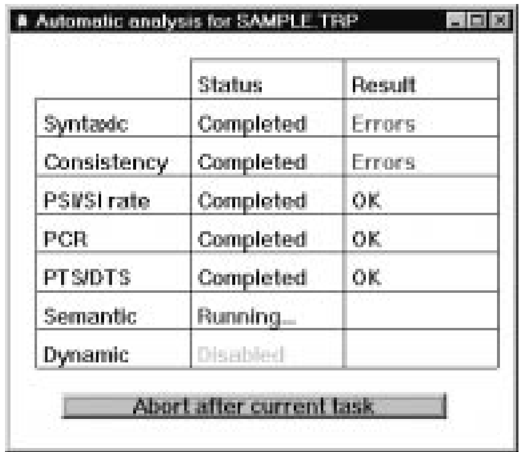


Figure 2–60: The automatic analysis window

5. When all analyses are complete, the Automatic analysis window provides access to detailed information about each detected error. For a list of the syntax errors in SAMPLE.TRP, for example, double-click in the Syntaxic Result cell, as shown in Figure 2–61. A window that lists the errors appears in the Analyzer application window; the window listing the syntax errors in SAMPLE.TRP is similar to Figure 2–62.

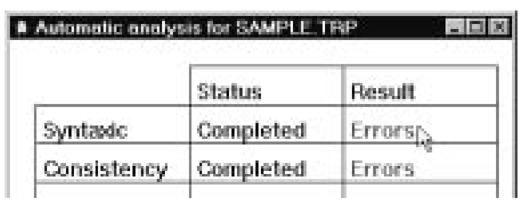


Figure 2–61: Double-click for error details

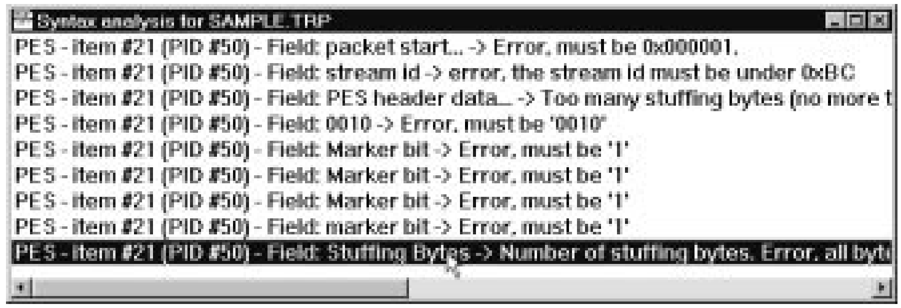


Figure 2–62: The list of syntax errors found in SAMPLE.TRP

Double-clicking on a listed syntax, PCR, PTS/DTS, or semantic error leads to even more information about the error.

6. Double-click on a syntax error, as shown in Figure 2–62, to open a window resembling Figure 2–63. This window contains an interpreted view of the section (in this case, a PES packet) that contains the error. Red characters (on the PC monitor) indicate syntax errors.

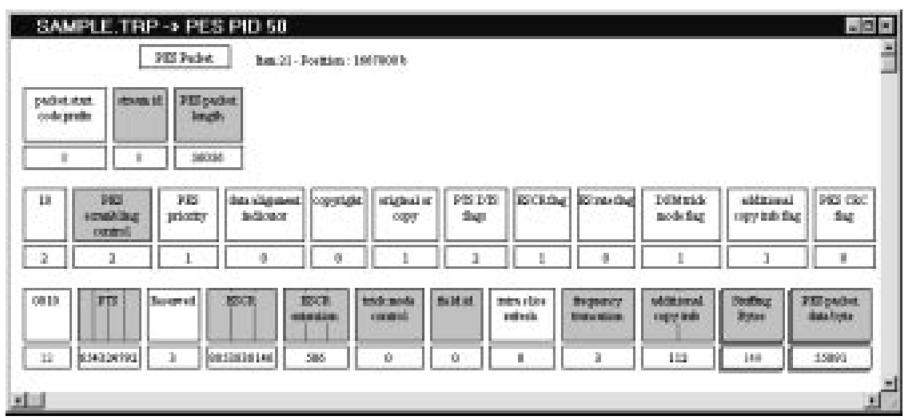
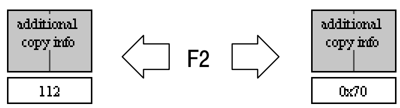


Figure 2–63: Interpreted view of a PES packet with syntax errors

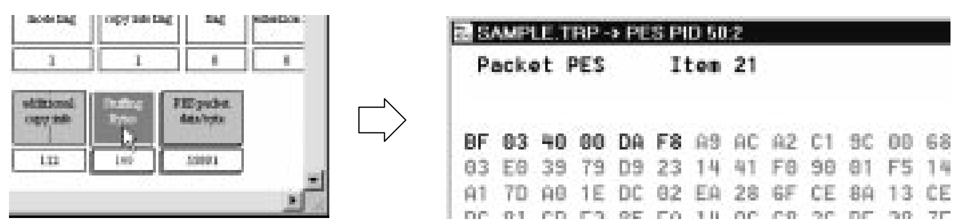
This is a good opportunity to review some of the techniques you can use to learn more from an interpreted view.

- Each “block” in the interpreted view represents a field of data. The field value (or number of bytes in a data field) appears below the field name. Press the F2 key to toggle the value between decimal base and hexadecimal base.



- Double-click on a field name for more information about the field.

- Double-click on a data field name to add a byte-by-byte hexadecimal view of the interpreted view.



- Double-click on the field value/size to reveal additional information about the value and error, if any.

7. Return to step 5 and double-click in the remaining “Error” results cells. The type of display and information available is the same as when the individual analysis is conducted manually (by selecting it from the Analysis menu). Refer to the *Reference* section for more information about each type of analysis.

Quitting the Analyzer

This completes the tutorial for the MPEG-2 System Analyzer. Exit the application by choosing **Exit** from the File menu.

Tutorial: Creating an MPEG-2 Transport Stream

This section explains how to create an MPEG-2 transport stream. First, you will make a simple transport stream file, then a significantly more complex one. Finally, this section gives a brief introduction of how to send the signal that you created out one of the ports on the MTS 210 rear panel as an actual transport stream. There is an optional tutorial following this one that explains how to build a transport stream file that contains DVB (Digital Video Broadcast) information.

This section steps you through the Multiplexer, Edit Table, and Disk Manager applications. These procedures are "step-by-step," so you can follow along with your own instrument. You will use files provided with the MTS 210.

***NOTE**. To aid in following along with your own MTS 210, all steps requiring action are numbered.*

Terms

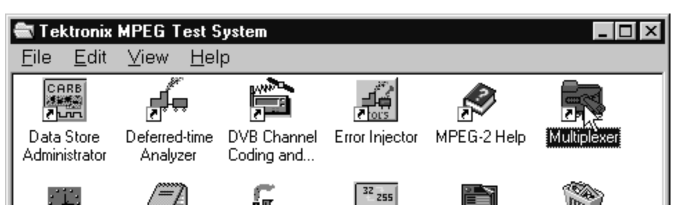
There are two specific terms used in this section that are not interchangeable: transport stream and transport stream file.

A transport stream is the signal that comes out (or in) one of the connectors on the rear panel of the MTS 210.

A transport stream file is a file on a disk. When the MTS 210 sends this file out one of the rear-panel connectors (properly timed), it becomes a transport stream.

Start the Multiplexer

Click on the Multiplexer name in the Tektronix MPEG Test System submenu. This starts the Multiplexer application as shown in Figure 2–64.



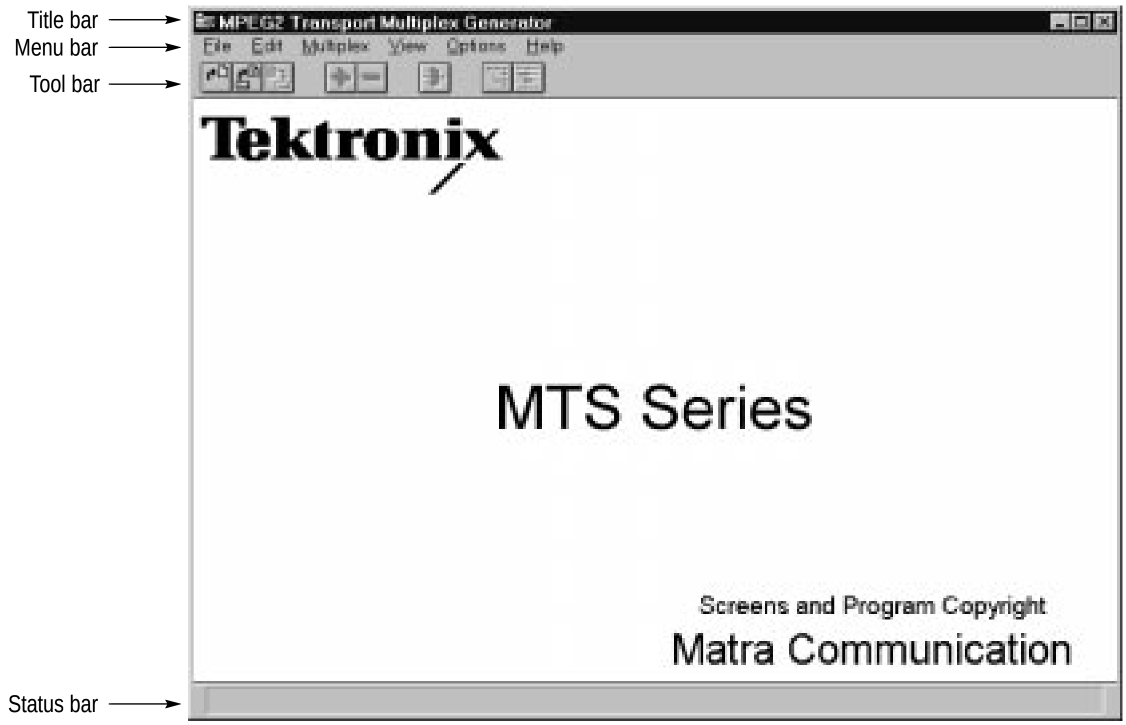


Figure 2–64: The Multiplexer application window

Making a Simple Transport Stream File

1. Choose New from the File menu or the New command button from the tool bar. This results in the New configuration file box shown in Figure 2–65.

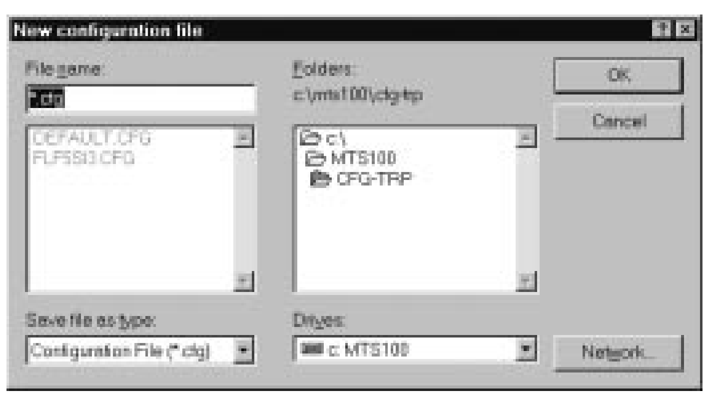


Figure 2–65: The New configuration file dialog box

Notice that you are not going to make a transport stream file right away, but rather a configuration file. Since transport stream files can be huge, they are not generated immediately. Instead, configuration files (*.cfg) are created first. These contain all of the information required to make the transport stream. (For more information on how they work, please see *File Conventions*, beginning on page 3–59.)

2. Enter the name "simple" in the File Name text box (the *.cfg extension is added automatically).
3. Choose OK. The Multiplexer application now displays the default configuration file. (See Figure 2–66.)

Figure 2–66: The default configuration in the application window

The Multiplex application window has three parts: the Duration gauge, the Rate gauge, and the Multiplex window.

The Duration gauge gives the status of the multiplex operation. The gauge sits at 0% until you tell the application to create the transport stream file. Since this process often takes some time, the Duration gauge tells what percentage of the operation is complete.

The Rate gauge shows the percentage of the available transport stream currently used. Above the rate gauge bar the target multiplex rate. Below the rate gauge is the amount currently in use, the actual rate. The actual rate is calculated with the following formula:

Rate = PSI rate + SI rate + Video rate + Audio rate + Data rate

Below the actual rate is the time period when the highest multiplex rate occurs.

The Multiplex window displays the current configuration file in hierarchic form. Several icons appear in the Multiplex window to represent specific elements of the transport stream multiplex. Table 2–4 explains these icons.

Table 2–4: The icons in the multiplexer hierarchic view

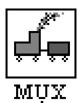
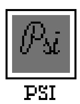
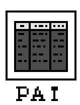
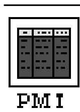
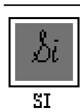
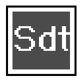
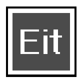
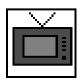
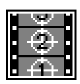
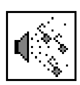
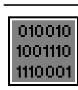
Icon	Meaning
	Multiplex — the main icon for the configuration file. Required.
	Program Specific Information (PSI) — contains the data that allows the demultiplexing of the programs by decoders. Required.
	Program Association Table (PAT) — This is the main PSI table. It links the program numbers and the Program Map Table (PMT) PID. Every transport stream must have a PAT that is always PID0. This table is required to identify the PID numbers for the table(s) defining each program. Required.
	Program Map Table (PMT) — Specifies the PID values and describes the program components. There is a PMT for every program in the transport stream. The table states the PID for each elementary stream associated with a specific program. There are no specific PID values for PMTs, however certain transmission systems (such as Grand Alliance and DVB) require specific values. Required.
	Service Information (SI) — provides information on services and events carried by different multiplexes or even on other networks. It has up to four tables below it: NIT, BAT, SDT, and EIT. Required if using DVB.
	Network Information Table (NIT) — provides information about the physical network. Required. It is found under PSI if not in DVB mode and under SI if in DVB mode.

Table 2–4: The icons in the multiplexer hierarchic view (Cont.)

Icon	Meaning
 BAI	Bouquet Association Table (BAT) — provides information regarding bouquets (a collection of services marketed as a single entity). Optional (for DVB).
 SDI	Service Description Table (SDT) — contains data describing the services in the system, for example, names of services, the service provider, etc. Optional (for DVB).
 EII	Event Information Table (EIT) — contains data concerning events and programs (a concatenation of one or more events under the control of a broadcaster), such as event name, start time, duration, etc. Optional (for DVB).
 PROG	Program Required — Each transport stream is required to have at least one program with one elementary stream.
 VIDEO	Video Elementary Stream Optional (must be at least one elementary stream in the program).
 AUDIO	Audio Elementary Stream Optional (must be at least one elementary stream in the program).
 DATA	Data Elementary Stream Optional (must be at least one elementary stream in the program).

The simplest transport stream possible would have one program with one elementary stream in it. In this example, you will put two elementary streams in one program.

Add Elementary Streams

Add an elementary stream to program 1.

1. Select the program 1 icon.
2. Click the Add (+) command from the tool bar (or choose the Add command from the Edit menu). This opens the dialog box shown in Figure 2–67.

Figure 2–67: The Stream to Add dialog box

3. Select the Video option button and click OK (you will eventually add one elementary stream of each type). This adds a Video icon to program 1 as shown in Figure 2–68.

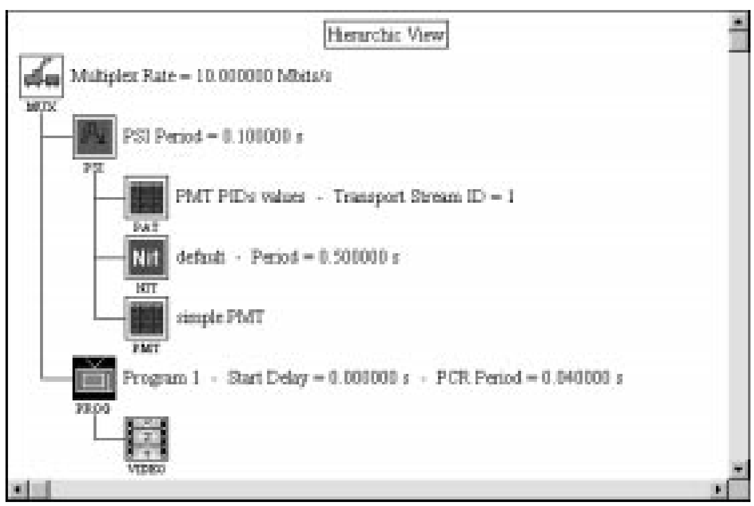


Figure 2–68: The hierarchy with a video icon added to program 1

4. Repeat this procedure (click the Add button, select a type of stream, and click OK) twice to add an Audio icon and a Data icon to the hierarchy. The application window resembles Figure 2–69 when you are done.

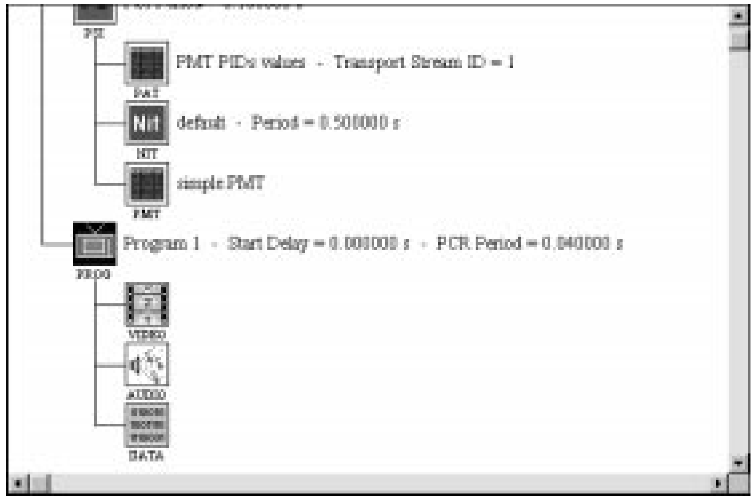


Figure 2–69: The hierarchy with the audio and data icons added

Next, associate elementary stream files with the video, audio, and data icons.

5. Double-click on the video icon. This opens the Video Stream dialog box shown in Figure 2–70.

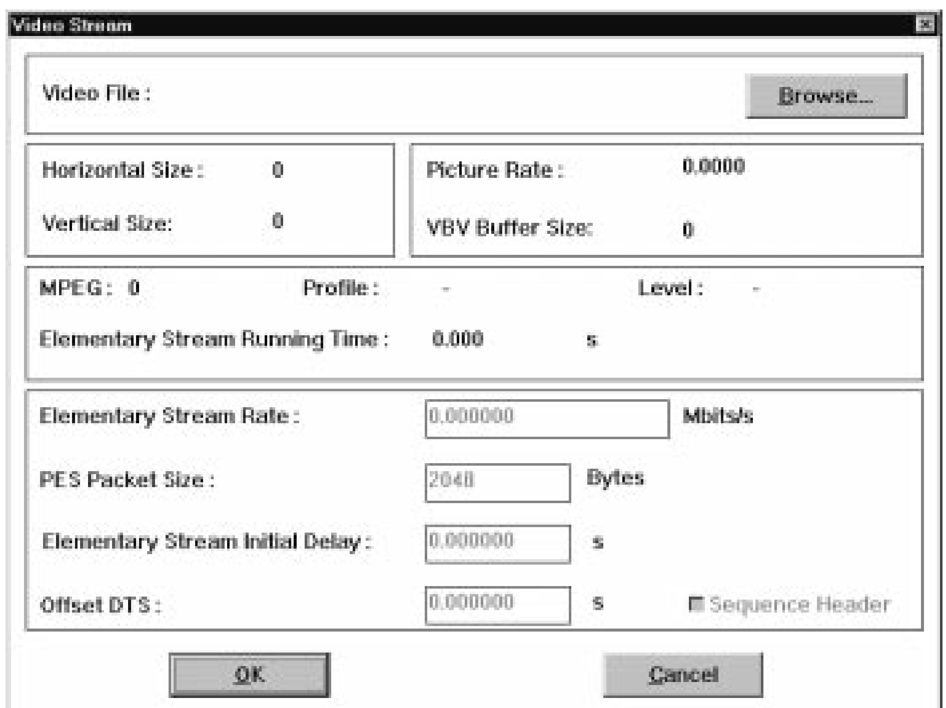


Figure 2–70: The Video Stream dialog box

6. Click the Browse button. This allows you to select a video elementary stream from existing files throught the Video Stream Selection dialog box. (See Figure 2–71.)

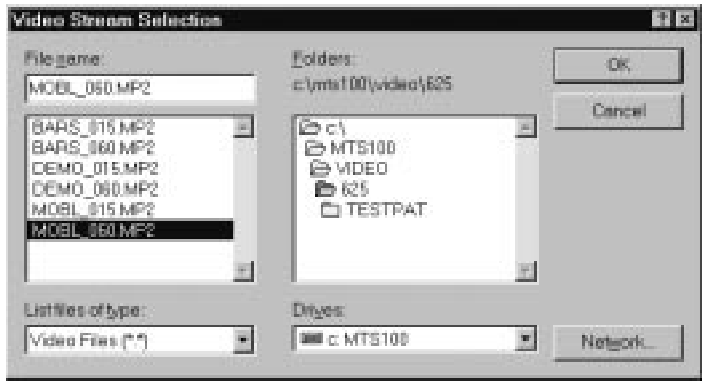


Figure 2–71: The Video Stream Selection dialog box

7. Select c:\mts100\video\625\MOBL_060.MP2, as shown in Figure 2–71.

8. Click OK.

***NOTE**. The List Files of Type box in the Video Stream Selection dialog box does not specify the .mp2 file extension. However, you may not select "just any file" for use as a video elementary stream file. If you select an unacceptable file, you will see the message box shown in Figure 2–72.*

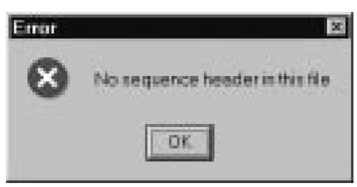


Figure 2–72: Click OK and select another (.mp2) file

All the information about the video elementary stream file loads automatically into the Video Stream dialog box, as shown in Figure 2–73.

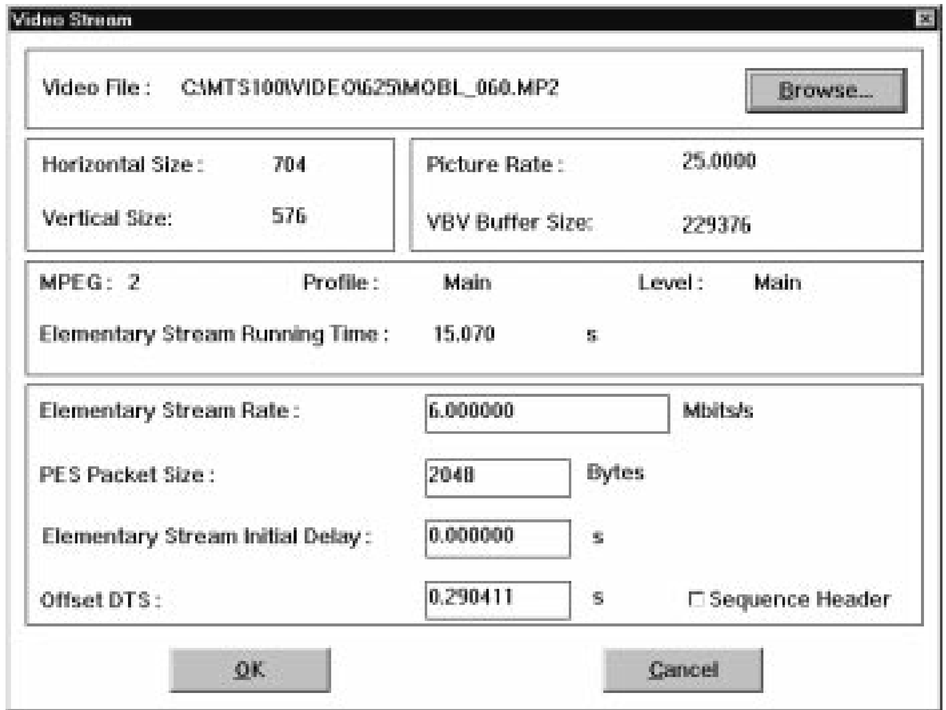


Figure 2–73: Details of the selected video elementary stream

Only four parameters (Elementary Stream Rate, PES Packet Size, Elementary Stream Initial Delay, and Offset DTS) are editable. If you would like more information on these fields, please refer to *Selecting a Video Stream*, beginning on page 3–91 of this manual.

9. Click OK to accept the settings and close the dialog box. The lower portion of the Multiplexer application window now resembles Figure 2–74. Notice that mobl_060.mp2 is now associated with the video icon. Note too, that the Multiplex Rate gauge is beginning to fill.

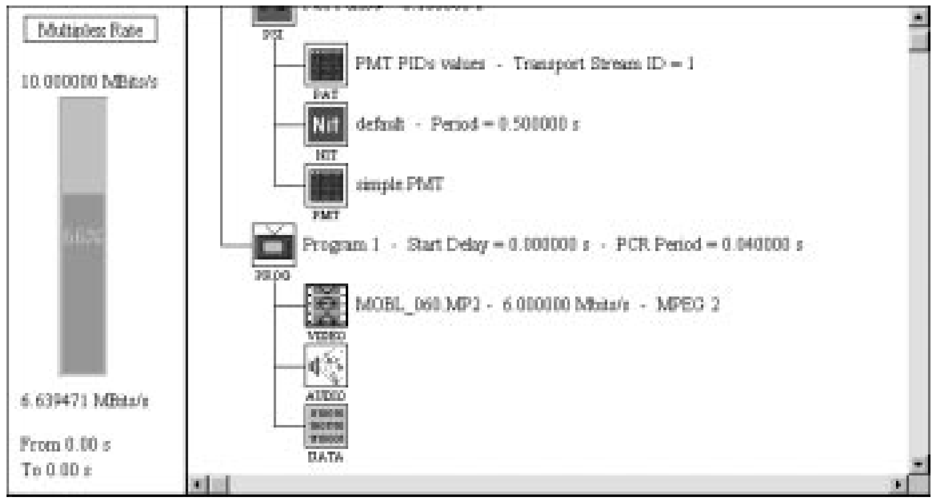


Figure 2–74: The display after a video file is associated

Now associate an Audio elementary stream file with the Audio icon.

10. Double-click on the audio icon. This opens the Audio Stream dialog box shown in Figure 2–75.

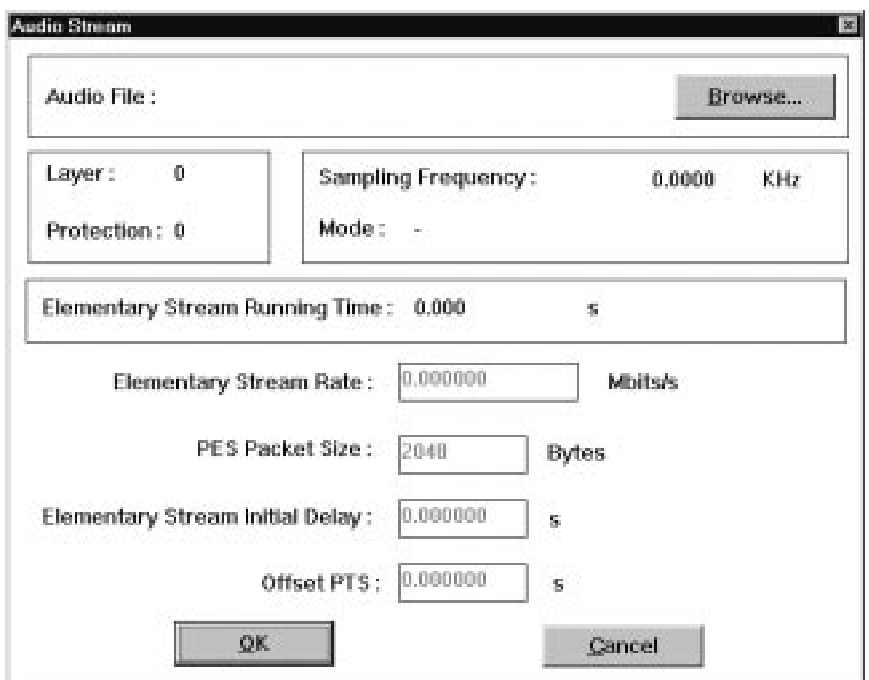


Figure 2–75: The Audio Stream dialog box

11. Click the Browse button to open the Audio Stream Selection dialog box shown in Figure 2–76.

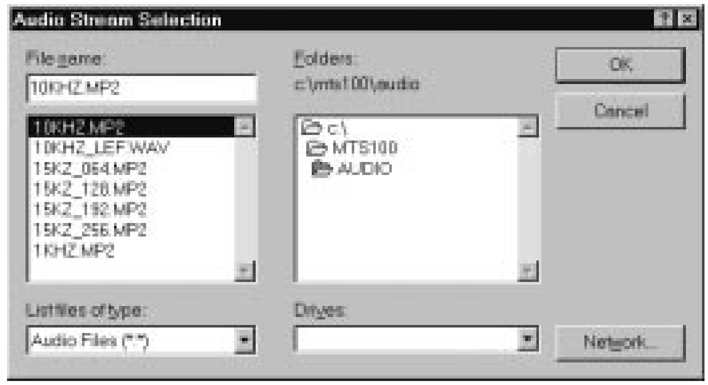


Figure 2–76: The Audio Stream Selection dialog box

12. Select c:\mts100\audio\10KHZ.MP2.

13. Choose OK. This returns you to the Audio Stream dialog box with all the information about the 10KHZ.MP2 file entered, as shown in Figure 2–77.

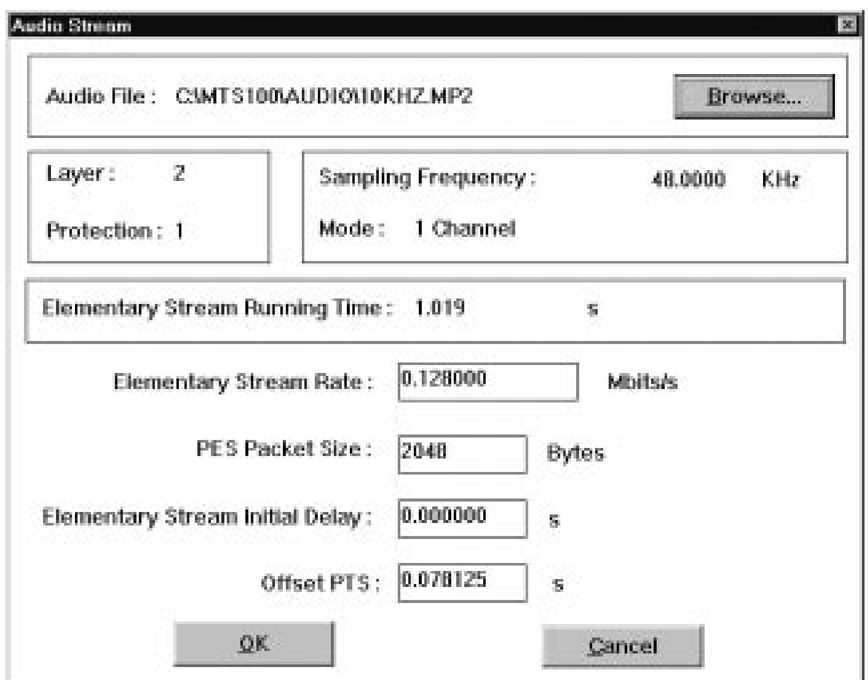


Figure 2–77: Details of the selected audio elementary stream

Just like the Video Stream dialog box, the Audio Stream dialog box allows you to edit only the parameters near the bottom of the dialog box. (Learn more about these parameters under *Selecting an Audio Stream*, on page 3–93 of this manual.) The default parameters are acceptable for the current application.

14. Click OK to select the settings and close the dialog box. This returns you to the hierarchic display of the configuration file as shown in Figure 2–78.

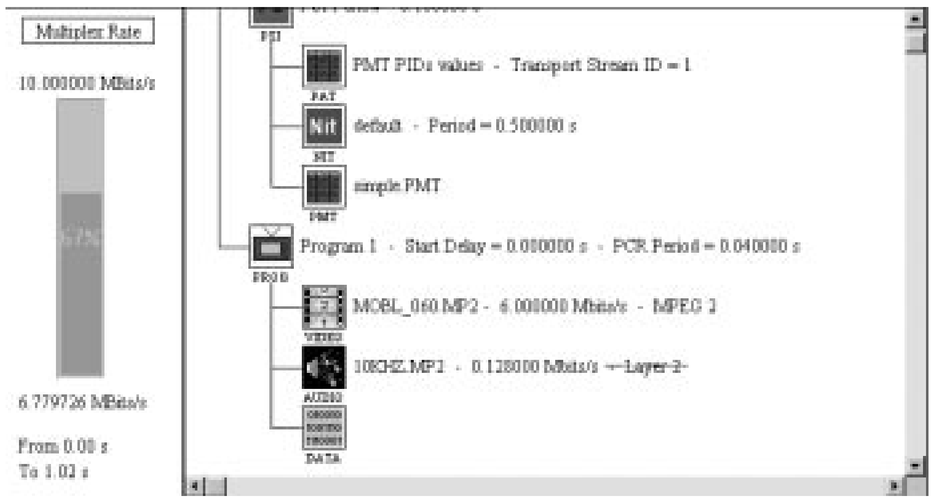


Figure 2–78: The display after an audio file is associated

Notice that 10KHZ.MP2 is now associated with the Audio Icon and the Multiplexer Rate gauge is now a little closer to full with the addition of the audio stream.

You would follow a similar procedure to associate a file with the Data icon.

15. Double-click on the Data icon to open the Data Stream dialog box as shown in Figure 2–79.

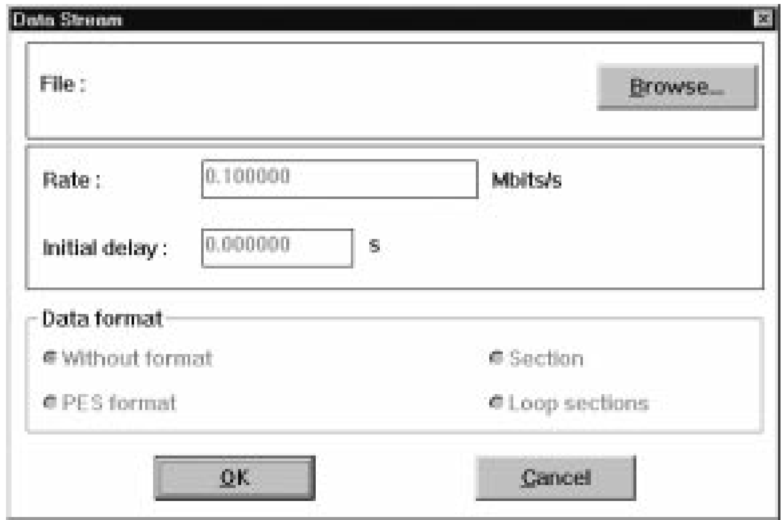


Figure 2–79: The Data Stream dialog box

Notice that this dialog box does not have as much information in it as the Video Stream and Audio Stream dialog boxes. This is because it does not require elementary streams — a file of any type is acceptable.

16. Click Cancel to close this dialog box without entering a file.

17. Select the Data icon again. This time you will delete it.

18. Choose either the Delete (–) command button from the tool bar or Delete from the Edit menu and click Yes when the dialog box shown in Figure 2–80 appears. The hierarchy now resembles Figure 2–81.

Figure 2–80: Click Yes to delete the data stream icon

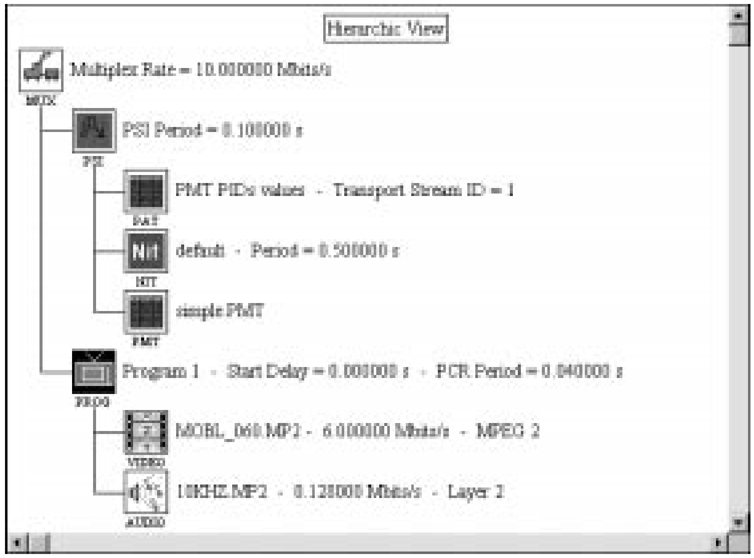


Figure 2–81: The hierarchy with the Data icon deleted

19. Choose Save from the File menu to save the configuration file.

Create the Transport Stream File

You are ready to create a transport stream file.

1. Choose Go from the Multiplex menu, or Go from the tool bar. The Multiplex Output File dialog box appears as shown in Figure 2–82.

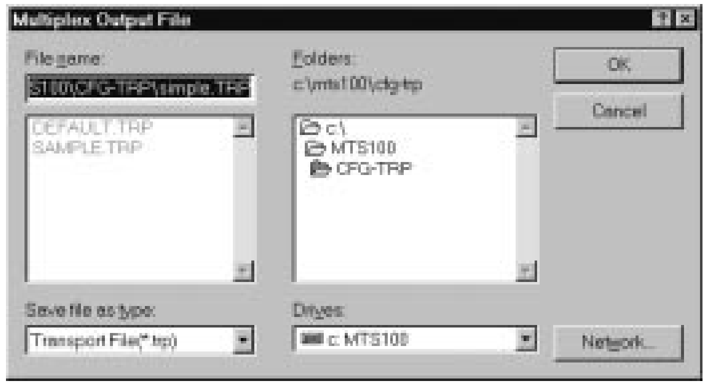


Figure 2–82: The Multiplex Output File dialog box

***NOTE**. The transport stream files can be large. Make sure you have adequate space on the selected drive before beginning.*

You can create the transport stream file directly on the Data Store Board hard drives by placing the Multiplex Output file in either c:\carb0\mono or c:\carb0\loop.

Notice that the current configuration file name becomes the default transport stream file name (with the file name extension changed to .trp).

2. Choose OK to begin creating the simple.trp transport stream file in the default directory (c:\mts100\cfg-trp). As the MTS 210 generates the transport stream file, the Duration gauge fills, showing the status of the operation. When generation is complete, the gauge reads 100% and the Information message box appears to indicate that the Transport Stream has been multiplexed.

3. Click OK to continue. The multiplex display resembles Figure 2–83.

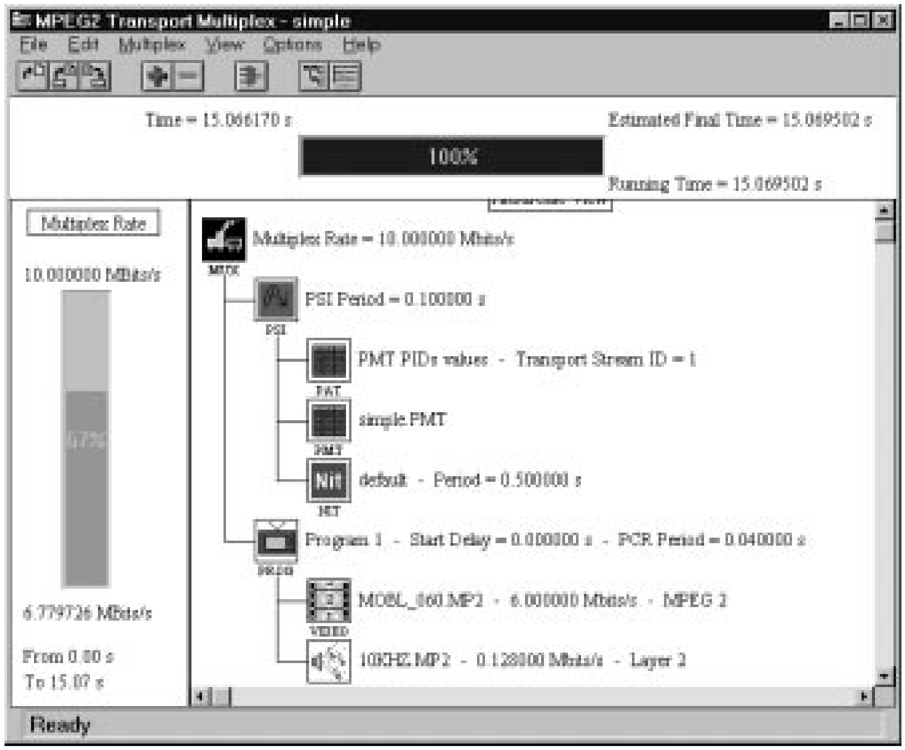


Figure 2–83: Transport stream creation is complete

You have now successfully created an simple transport stream file. Next you will make a more complex transport stream file.

Making a Complex Transport Stream File

Now you are going to add to simple.cfg file to create complex.cfg, a more complicated configuration file. Start at the point where you left off (as shown in Figure 2–83) from the previous steps.

1. Choose Save As from the File menu. The standard Windows Save As dialog box appears.
2. Enter “complex” in the File Name text box.
3. Choose OK. This saves the information in simple.cfg to a new configuration file called complex.cfg, creates a new .pmt file (called complex.pmt), and places the name “complex” in the window title. (Notice that the Duration gauge has also reset itself to 0%.)

Add More Programs

Now you are going to add two additional programs.

1. Select the MUX (engine and tender) icon.
2. Choose Add from the Edit menu or the tool bar. This creates program 2.
3. Choose Add a second time to create program 3. Figure 2–84 shows the resulting hierarchy.

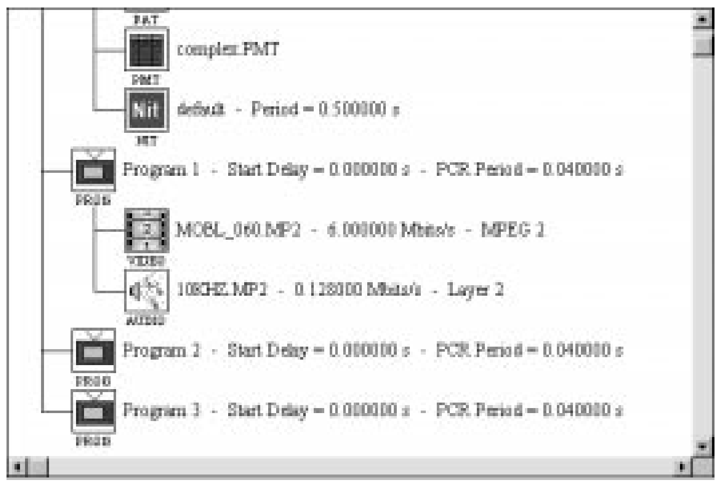


Figure 2–84: The hierarchy with programs 2 and 3 added

***NOTE**. The configuration file can accept up to 20 programs.*

4. Follow the procedures given on pages 2–49 to 2–58 to add the c:\mts100\video\625\testpat\100B_015.MP2 video elementary stream and the c:\mts100\audio\10KHZ.MP2 audio elementary stream to program 2.

***NOTE**. Each program can accept up to 10 elementary streams, with a maximum of 5 of any one type.*

The lower portion of the resulting application window looks like Figure 2–85. Notice the Multiplex Rate gauge is at 85% and is yellow after adding the video and audio streams to program 2. This is just an indication that the transport stream is beginning to get full.

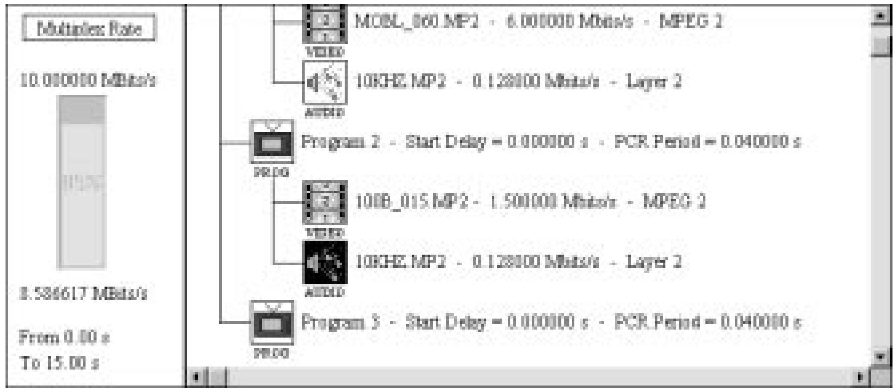


Figure 2–85: Elementary streams added to program 2

5. Add the same video and audio elementary stream files to program 3. The same part of the application window now resembles Figure 2–86.

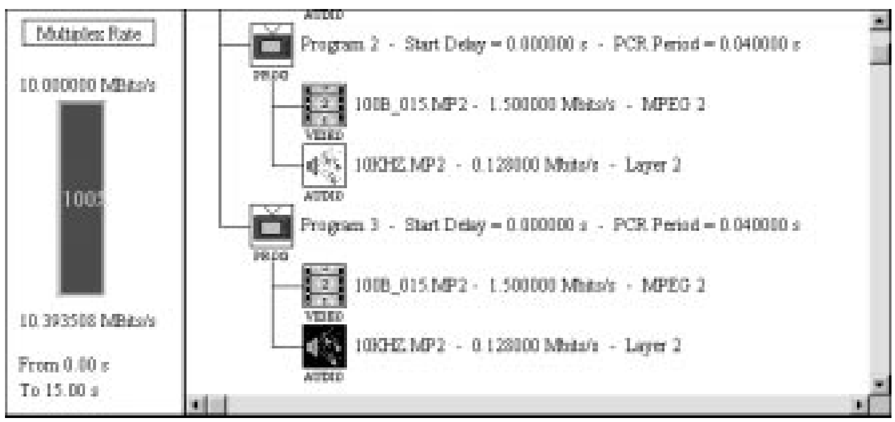


Figure 2–86: The rate gauge shows an overflowed multiplex

Notice that the rate gauge reads 100% and is now red on the MTS 210 display. Also notice that the rate reported at the bottom of the gauge is greater than the specified maximum rate at the top. If you multiplex the stream now, you risk losing data.

Now change the view from hierarchic to dynamic.

6. From the View menu, choose Dynamic, or choose Dynamic from the tool bar. This results in Figure 2–87.

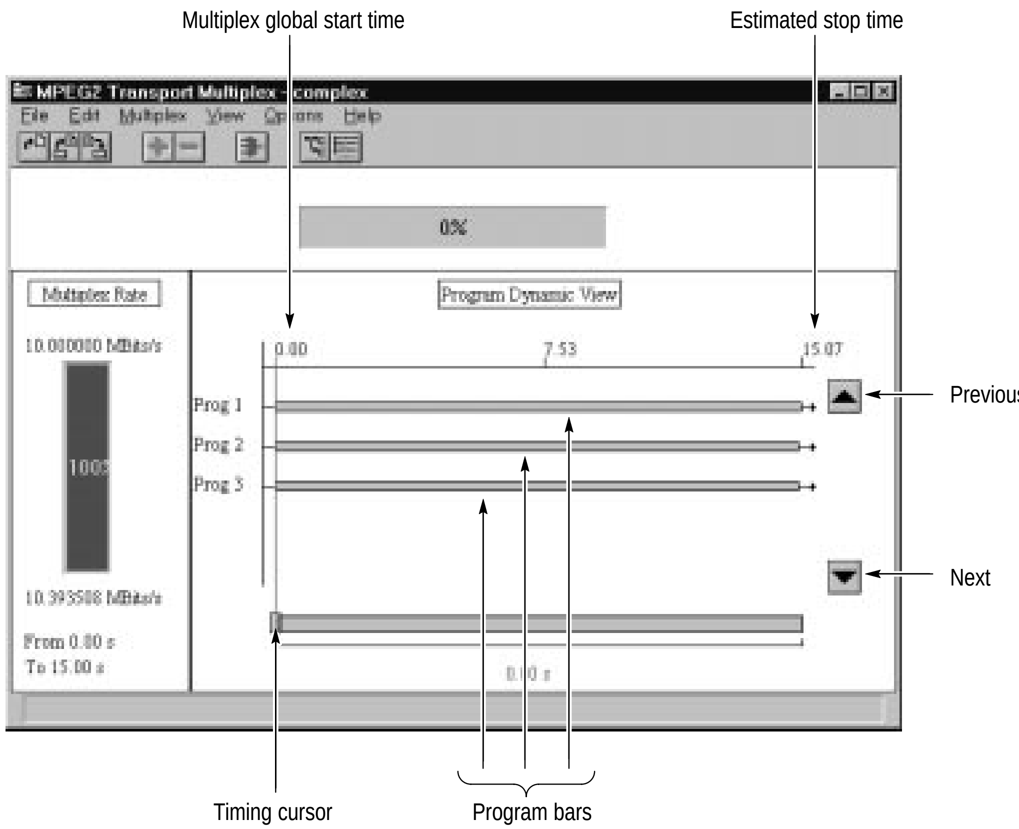


Figure 2–87: The dynamic view of the complex.cfg configuration file

This view shows the timing relationships between the programs. (For more information, please see *The Dynamic View*, on page 3–71 of this manual.)

Next you are going to change to program start time for programs 2 and 3 so the multiplex rate drops to an acceptable level.

Changing a Program's Starting Time

1. Return to the hierarchic view by choosing the Hierarchy command button from the tool bar.
2. Double-click on the program 2 PROG icon. This results in the dialog box shown in Figure 2–88.

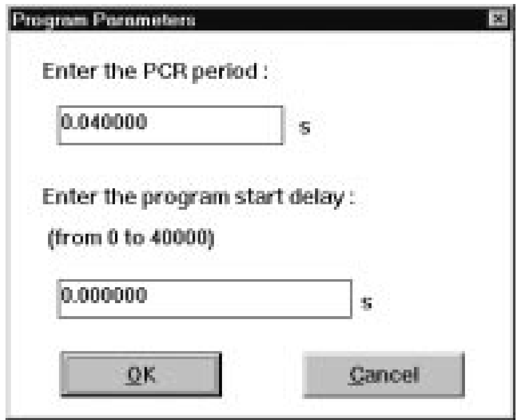


Figure 2–88: The Program Parameters dialog box for program 2

You need to enter a number in the Program Start Delay text box that will make program 2 start after program 1. Referring to Figure 2–87, you can see that the estimated stop time for all programs is now 15.0 seconds.

3. Enter “15.2” in the program start delay text box.
4. Click OK. The rate gauge drops and turns yellow.
5. Repeat for program 3. Notice that the rate gauge now shows 67% and is again in the green range.
6. Now go to the Dynamic view, shown in Figure 2–89, to see the new timing relationship between the programs.

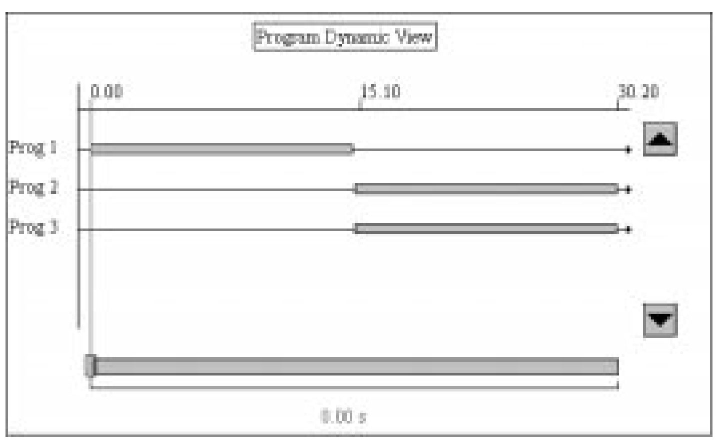


Figure 2–89: The dynamic view after you delay programs 2 and 3

See that programs 2 and 3 do not begin until program 1 ends, but also notice that the resulting transport stream now takes longer (look at the Estimated Stop Time). Use the left mouse button to click and drag the timing cursor to the right and left. Once the timing cursor is selected, you can also move it 0.01 second at a time with the the left and right arrow keys.

7. Move the timing cursor into the area with only program 2 and 3 in it. Notice that the Multiplex Rate drops even lower (Figure 2–90.)

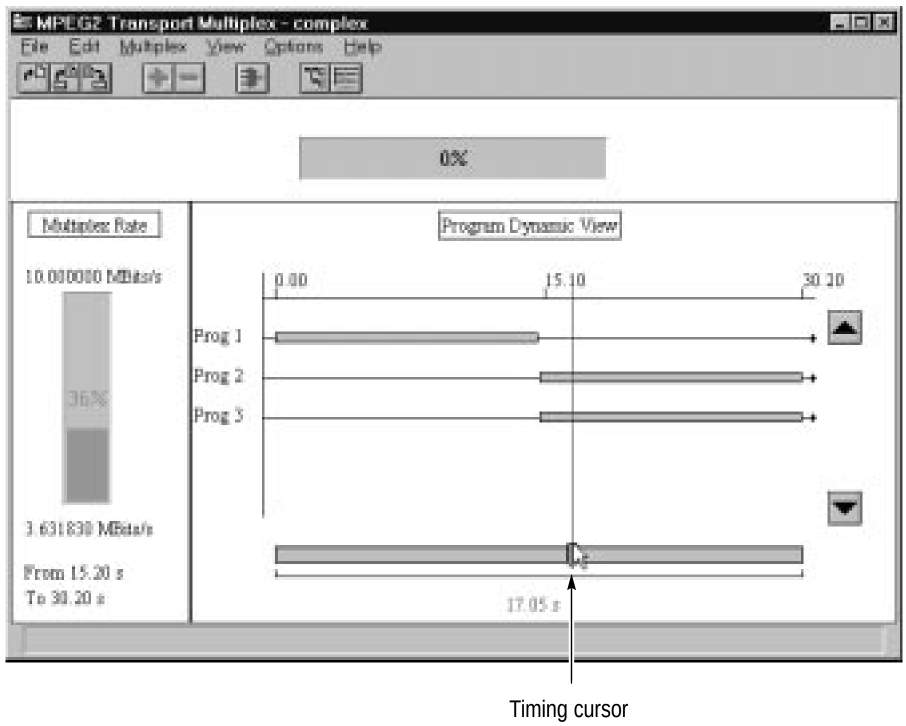


Figure 2–90: Moving the timing cursor

8. For practice, see if you can move the timing cursor to the space between the end of program 1 and the beginning of programs 2 and 3 (Figure 2–91). Use the left and right arrow keys for fine cursor movement.

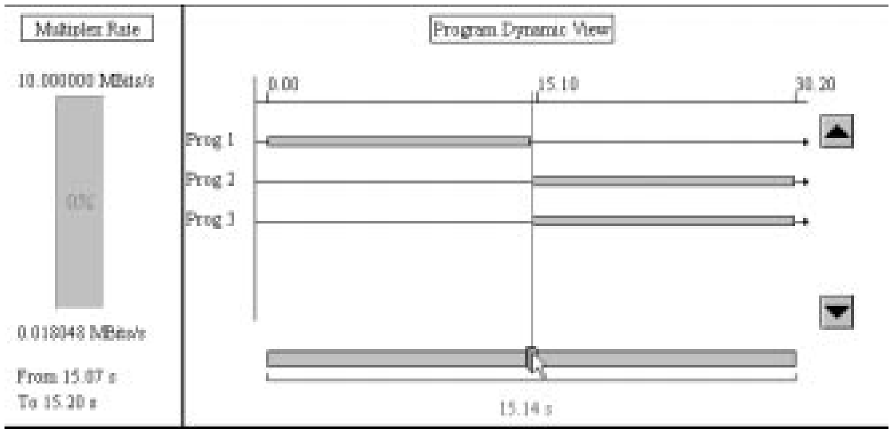


Figure 2–91: The timing cursor is in the space between the programs

9. Return to the hierarchic view.

Customizing the Header Information

Now you can "customize" the header information for the transport stream file. Double-click on the various header information icons in order to customize them.

PSI. The PSI contains Program Specific Information.

1. Double-click on the PSI Icon. This opens the PSI Period dialog box. (See Figure 2–92.)

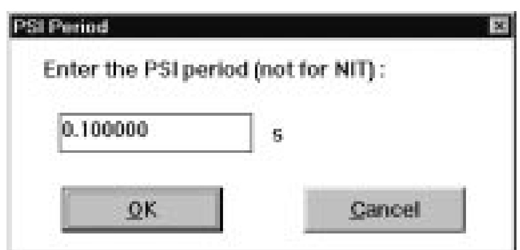


Figure 2–92: The default PSI Period dialog box

This dialog box allows you to change how often the PSI (Program Specific Information) appears in the stream. In this example, you want to send the PSI information more often than the default, so you must decrease the period.

2. Enter 0.01 in the text box (Figure 2–93).

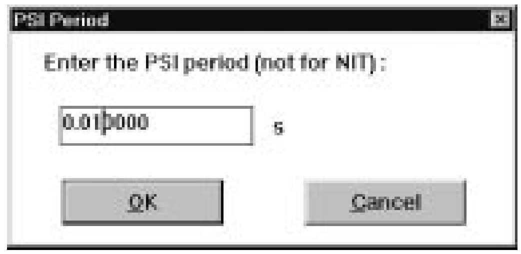


Figure 2–93: The PSI period is changed to 0.01 seconds

3. Click OK.

Notice the affect of the new PSI period on the hierarchic view and the multiplex rate (Figure 2–94). First, the new period is displayed after the PSI icon in the hierarchy; second, this action used an additional 3% of the available multiplex space as shown in the rate gauge.

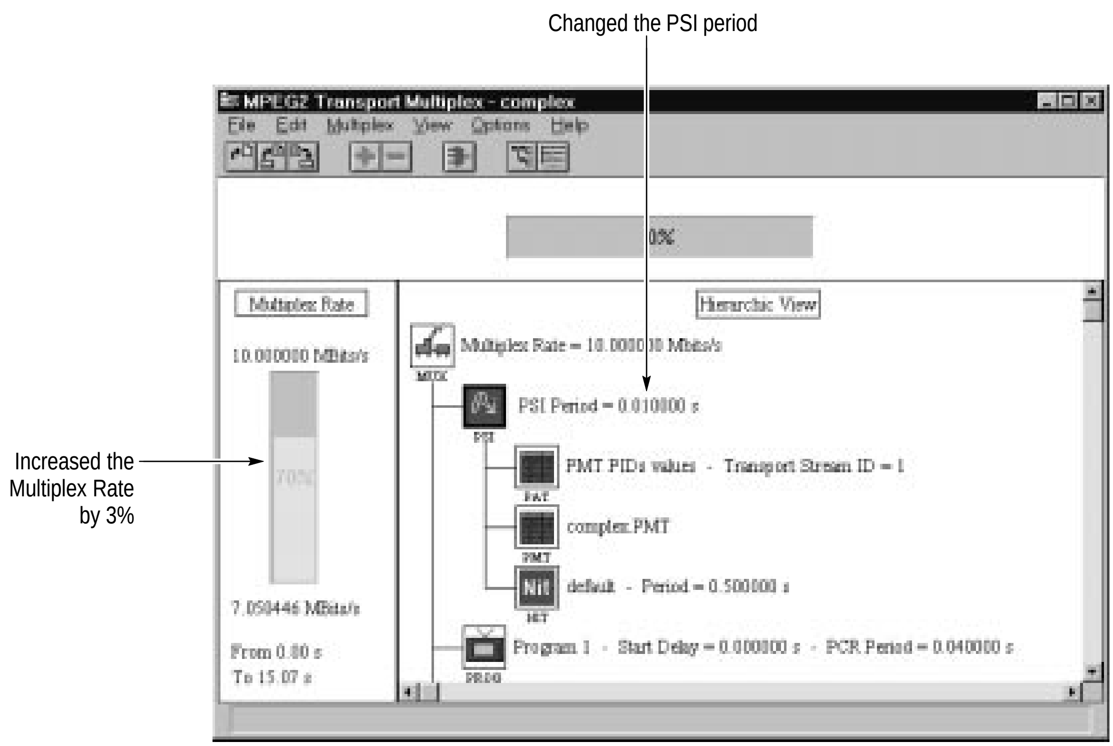


Figure 2–94: The configuration file after changing the PSI period

PAT. The PAT is the Program Association Table. It lists the PIDs for the Header Tables. In this case, it includes the PMTs (one for each program) and NIT.

1. Double-click on the PAT icon. This brings up the Program Specific Information dialog box as shown in Figure 2–95. This dialog box allows you to change the PID numbers of the Network Information Table and/or the Program Map Tables.

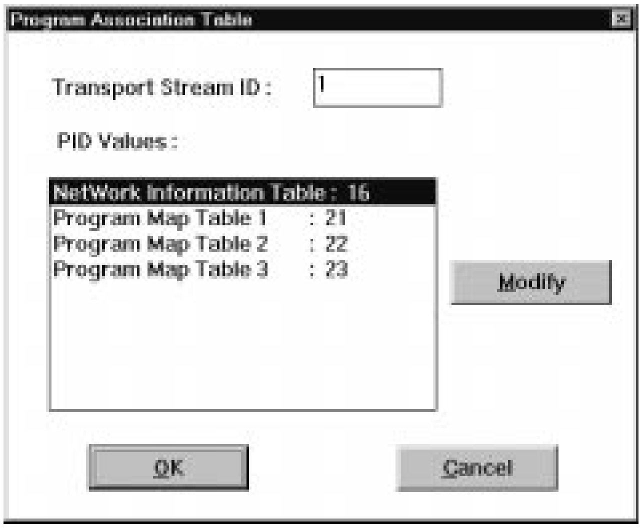


Figure 2–95: The Program Specific Information dialog box

2. Highlight NetWork Information Table, as shown in the illustration.

3. Click Modify to open the PID Modification dialog box as shown in Figure 2–96. To change the PID, enter a new number in the text box. There is no need to change the PID of the NIT in this example, however.

Figure 2–96: PID Modification dialog box

4. Close the PID Modification dialog box.

5. Close the Program Specific Information dialog box.

PMT. The PMT (Program Map Table) contains all the specific information about the programs in the transport stream file.

1. Double-click on the PMT icon. This automatically starts the Edit Table Application with complex.pmt (the PMT for the complex.cfg configuration file) loaded, as shown in Figure 2–97.

For more information about the Edit Table application, refer to *Using the PSI and SI Table Editor*, beginning on page 3–103.

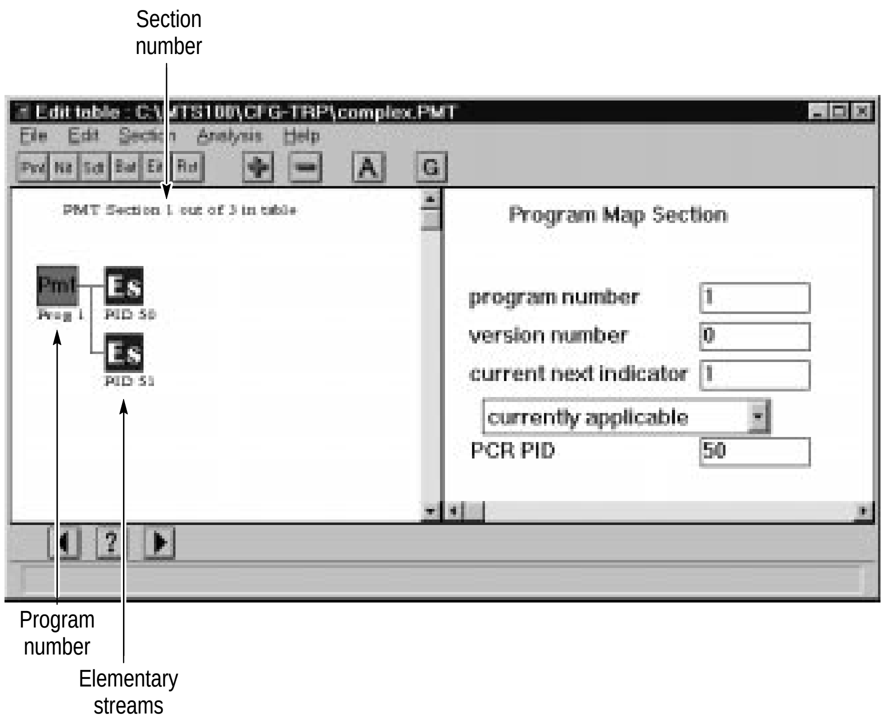


Figure 2–97: The Edit Table application with complex.pmt loaded

There are a few things to notice about this display before continuing.

- There is one section for each program and the current file has three programs.
- Section 1 of 3 is currently being displayed.
- There are two elementary streams (ES; one video and one audio) associated with this program.

***NOTE**. You can change the PCR PID (in the last text box of the right-hand “Edit” window). The default is the first elementary stream in the program. If you change it to a different value, and that value is not the PID of another elementary stream in the program, the PCRs will then reside in their own transport packets. This should be done if the elementary stream that would carry the PCR by default is not the longest elementary stream in the program.*

Add some descriptors to section 2 of the PMT (program 2).

2. Display Section 2 by choosing either Next from the Section menu or Next from the tool bar. (See Figure 2–98.)

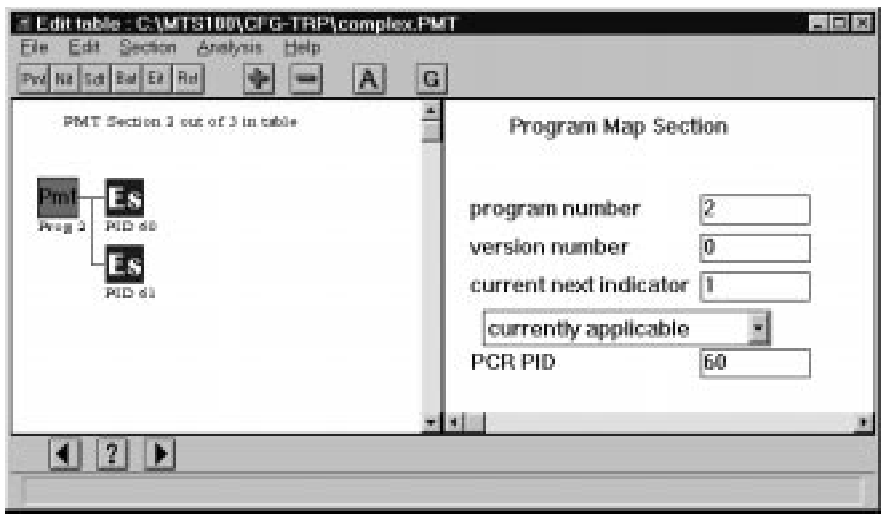


Figure 2–98: Section 2 (program 2) of the PMT

3. Select the PMT icon.

4. Choose either Add from the Edit menu or “+” from the tool bar. This brings up the Descriptors Selection dialog box. (See Figure 2–99.)

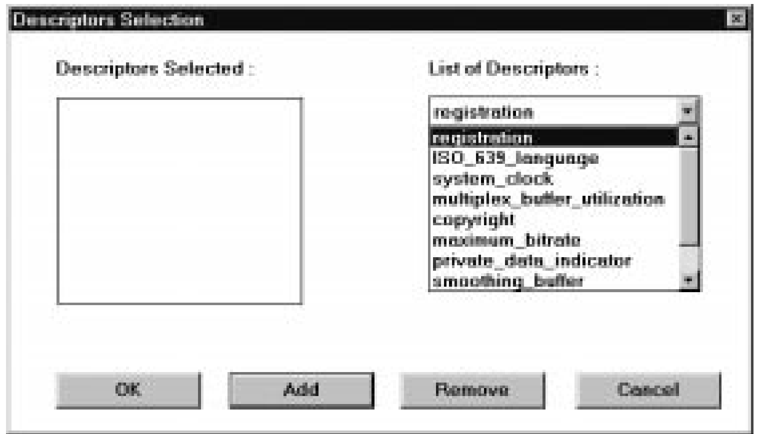


Figure 2–99: The Descriptors Selection dialog box

5. Click on the List of Descriptors drop-down list to display the list of descriptors available.
6. Add a registraton descriptor.
   a. Select registration from the drop-down list.
   b. Choose Add. This adds the descriptor to the Descriptors Selected list.

The dialog box now resembles Figure 2–100.

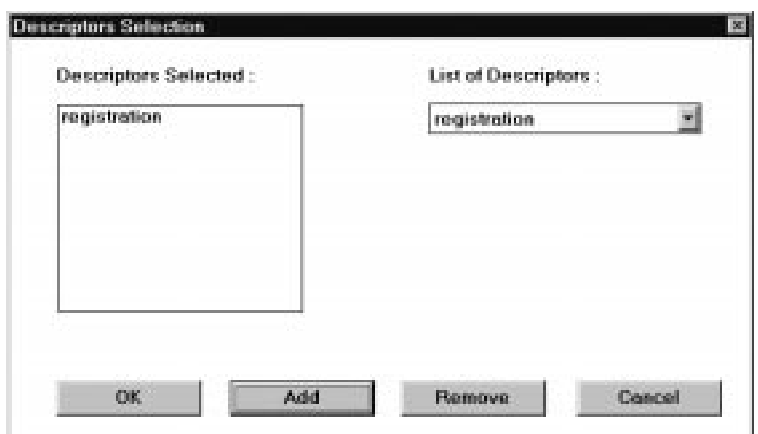


Figure 2–100: Registration selected

7. Choose OK to add the descriptor. This results in Figure 2–101.

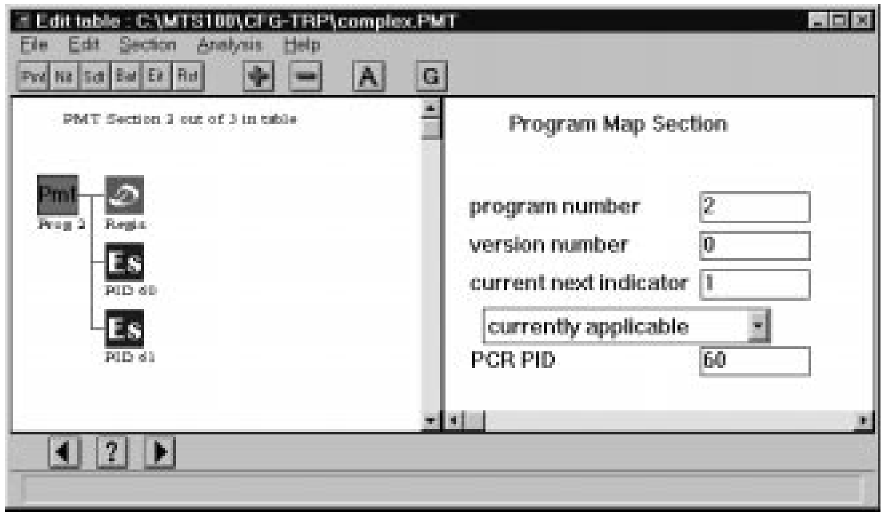


Figure 2–101: A registration descriptor added to PMT section 2

Check the information added in the descriptor.

8. Click on the descriptor icon. (See Figure 2–102.)

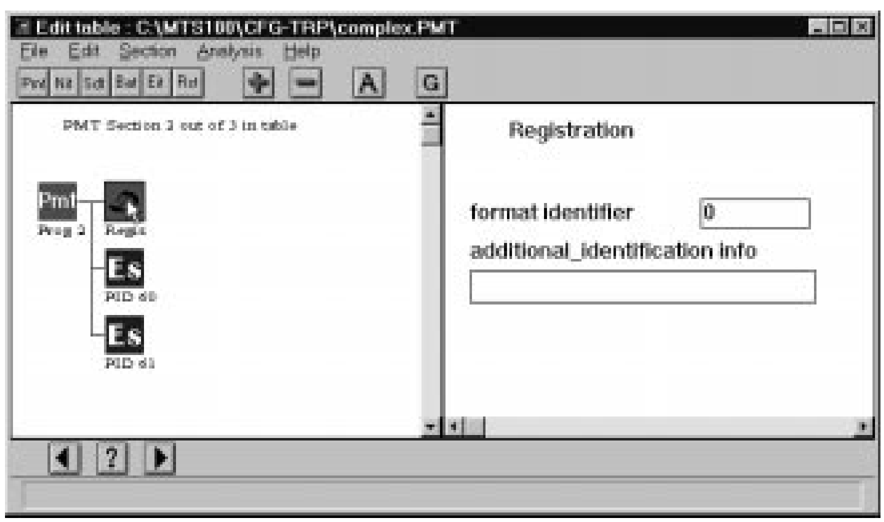


Figure 2–102: The information for the Video Stream descriptor field

Do not change any of the information.

Now add a video stream descriptor to the video elementary stream.

9. Select the PID 60 ES icon.

10. Choose Add from the tool bar.

11. Select video_stream from the List of Descriptors.

12. Choose the Add command button to add it to the Descriptors Selected list.

13. Choose OK.

14. Click on the resulting descriptor icon to bring up the display shown in Figure 2–103.

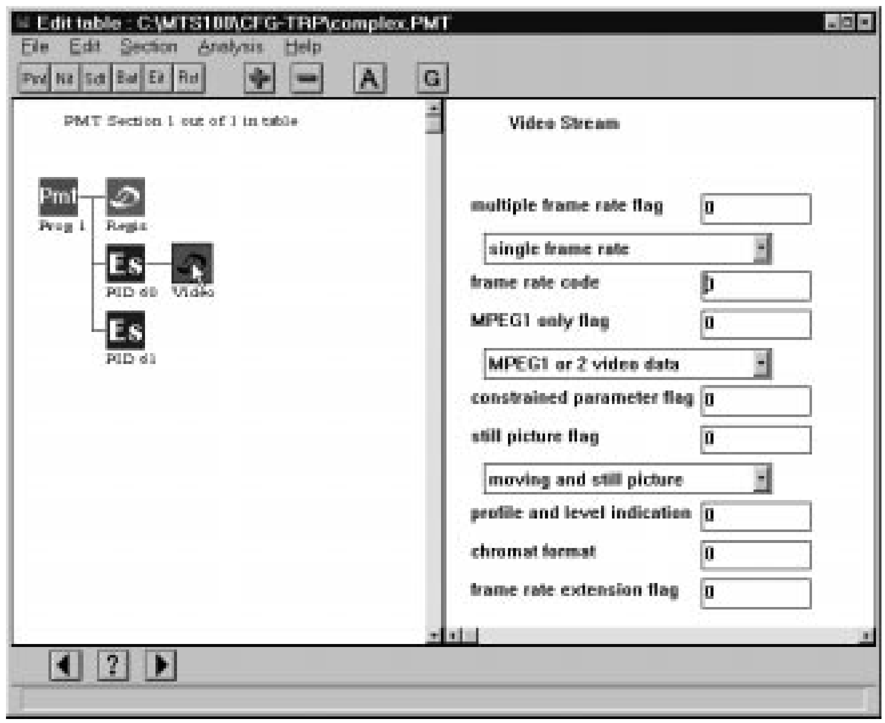


Figure 2–103: The descriptor at the Elementary Stream level

15. Choose Save from the File menu to save your work.

16. Exit the Edit Table application and return to the Multiplex application. (Figure 2–104.)

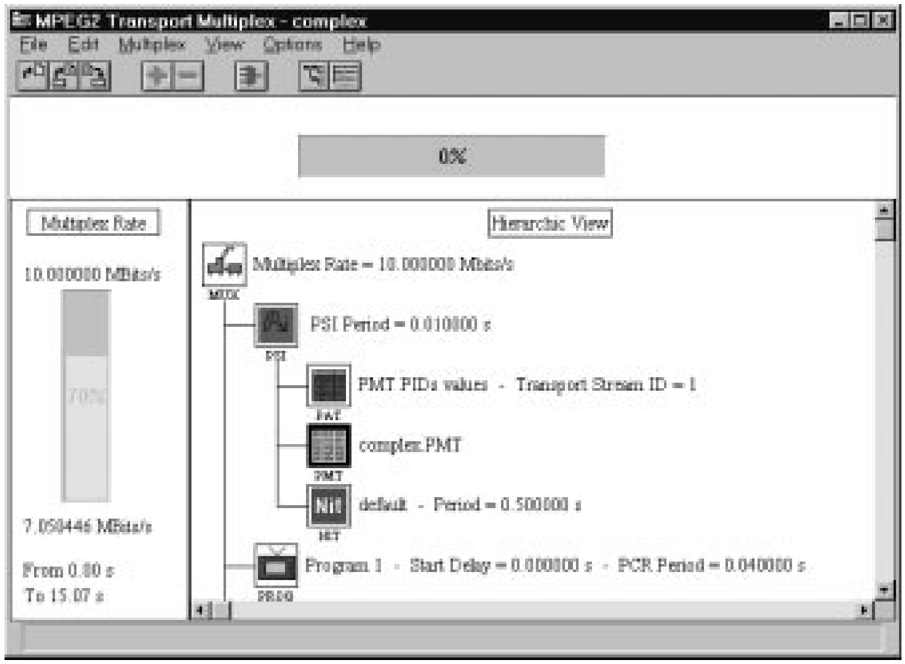


Figure 2–104: The complex.cfg after table editing

This gives only a small sample of the things that can be done to customize the header information. Find additional information in both *Using the PSI and SI Table Editor* (beginning on page 3–103) and *Using the Multiplexer* (beginning on page 3–59), in the *Reference* section of this manual.

Making the Complex.TRP Transport Stream File

You are ready to generate the complex transport stream file.

1. Choose Go from the Multiplex menu. (See Figure 2–105.)

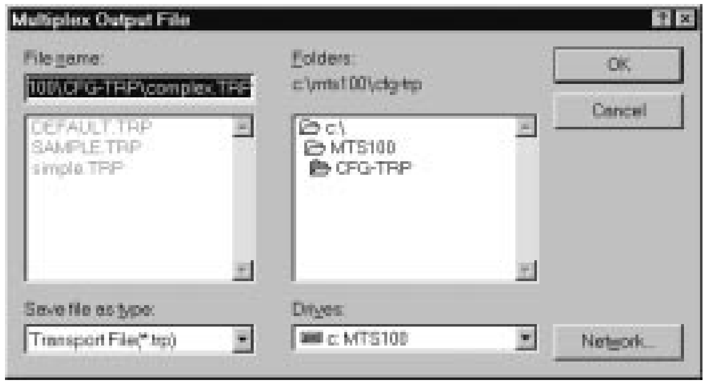
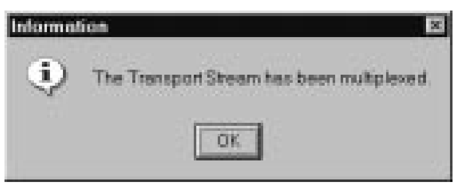


Figure 2–105: The Multiplex Output File dialog box

2. Choose OK and begin the multiplex process.

When the multiplex is complete, the duration gauge reads 100% and the following message appears.



3. Click OK; then exit the Multiplexer application.

In the next steps you will send the transport stream file out the 50 Ω TTL serial port as a transport stream.

Sending a Transport Stream

To generate a transport stream (from a transport stream file) use the Data Store Administrator application.

Select the Data Store Control icon on the Tektronix MPEG Test System submenu to start the application.

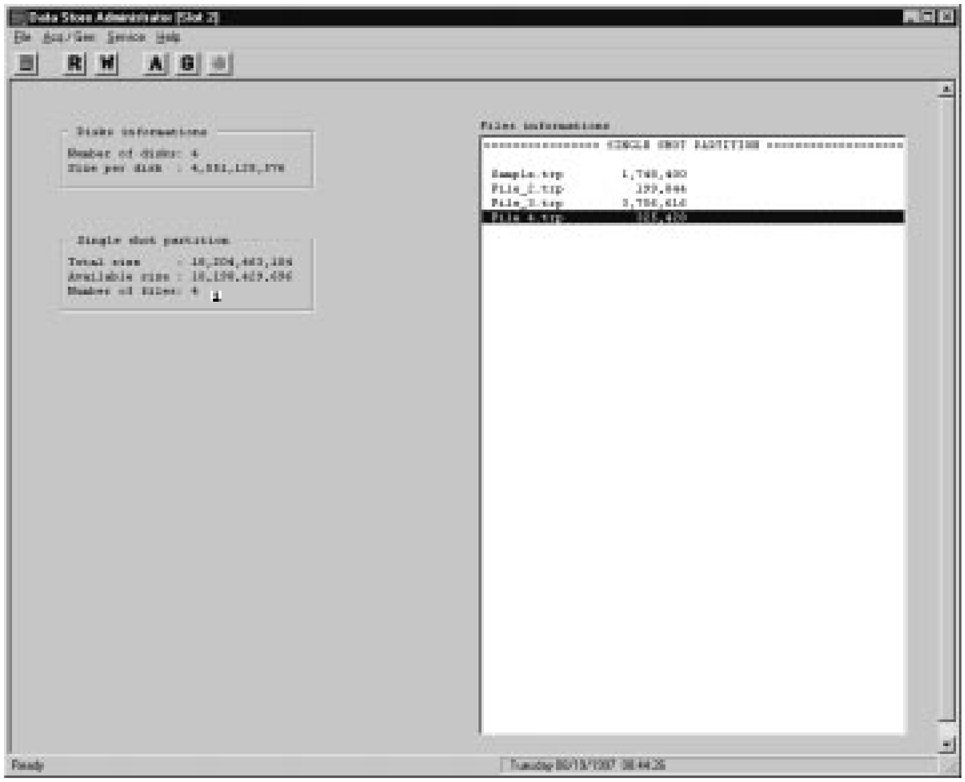


Figure 2–106: The Data Store Administrator application window

Moving a File to the Data Store Disks

Before you can send a transport stream file out as a transport stream, you must first move it from where it is currently stored (in this case the system hard drive) to the Data Store Disks.

***NOTE**. You can create transport stream files directly on the Data Store Disks and skip moving the files to them. See more information in the* Using the Multiplexer *section.*

---

1. Choose PC to board (Write) from the File menu. (Figure 2–107)

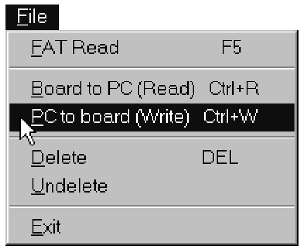


Figure 2–107: Find the command under the File menu

You get the File Write to CARB dialog box as shown in Figure 2–108.

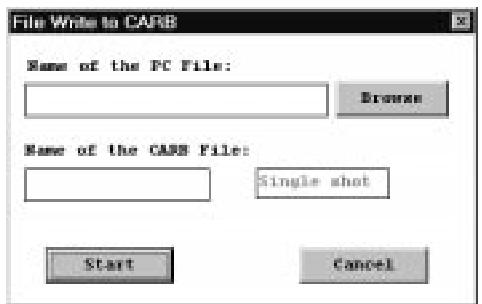


Figure 2–108: The File Write to CARB dialog box

2. Choose the Browse command button to search for the COMPLEX.TRP file. (See Figure 2–109.)

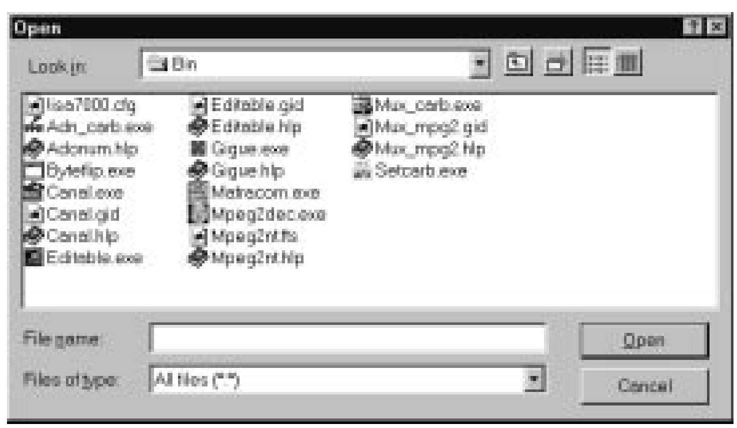


Figure 2–109: The Windows NT 4.0 Open dialog box

3. Change the directory to c:\Mts100\Cfg-trp and select complex.trp.

4. Click Open. You return to the File Write to CARB dialog box with the name of the PC file entered. It should now look like Figure 2–110.

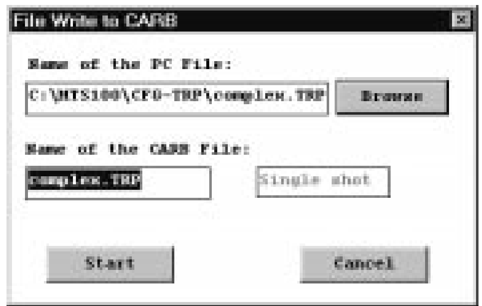


Figure 2–110: The dialog box with a file selected

5. Choose Start. When the transfer is complete, the message box shown in Figure 2–111 appears.

Figure 2–111: Click OK to acknowledge data transfer

Generating a Transport Stream

You are now ready to generate a transport stream from this transport stream file.

1. Choose Generation from the tool bar. Figure 2–112 shows the resulting dialog box.

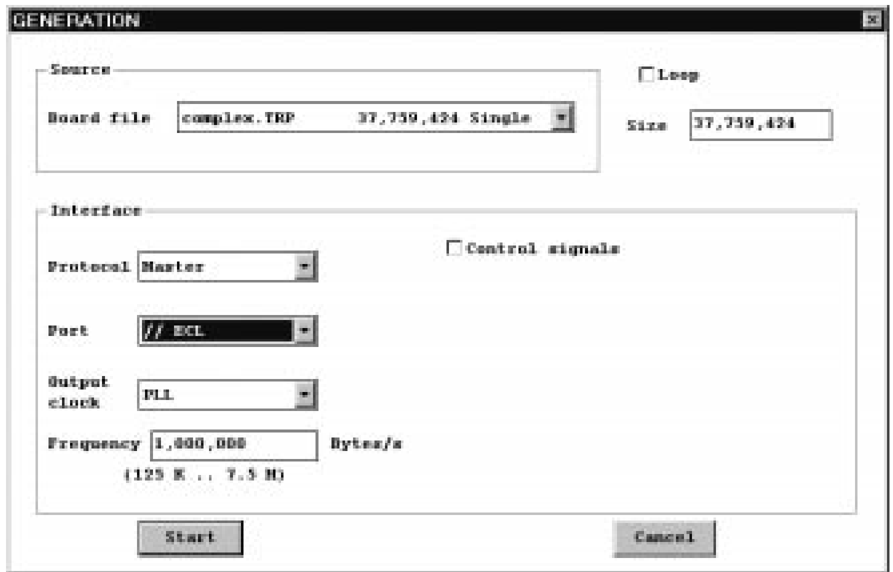


Figure 2–112: The Generation dialog box

***NOTE**. This dialog box is automatically filled in with the first file on the Data Store Disks. If there are other files on your Data Store Disks, then complex.trp may not initially appear in the CARB File field.*

---

2. If complex.trp is not in the CARB File Field, select it from the drop-down list.
3. Make sure that the Loop check box is not selected.
4. Select Master for Protocol.
5. Select TTL for Port. (This indicates that you are going to send the transport stream out the 50 Ω TTL port.)

***NOTE**. You can only output a signal from one port at a time.*

---

6. Set the Output Clock as PLL.
7. Enter 10,000,000 in the Frequency text box.

***NOTE**. You must enter the correct output frequency. Transport stream files do NOT carry any bit rate information so you must know the correct rate for the transport stream file.*

Figure 2–113 shows the resulting dialog box.

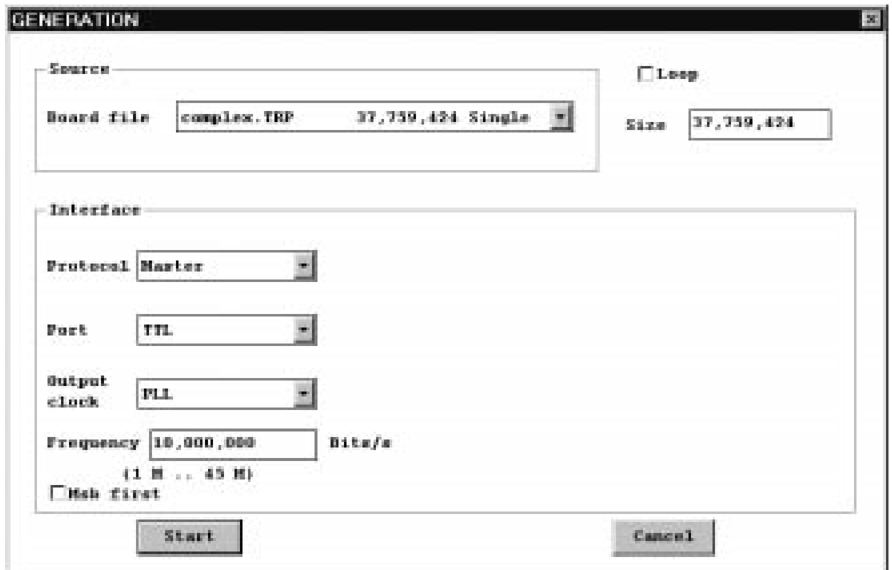


Figure 2–113: The dialog box with all parameters entered

8. Choose Start to begin the generation. Figure 2–114 shows the message box displayed while generation occurs.

Figure 2–114: Transport stream generation in progress

If you have the 50 Ω TTL port connected to an oscilloscope you can observe the transport stream. (It is only 32 seconds long.) The message box in Figure 2–115 tells when the transport stream generation is complete.

Figure 2–115: Transport stream generation is finished

This completes the basic tutorial on creating and outputting a transport stream. If you need additional information, please see the *Using the Multiplexer*, *Using the PSI and SI Table Editor*, and *Using the Data Store Administrator* chapters in the *Reference* section of this manual.

Tutorial:
Creating Transport Stream Files with DVB Information

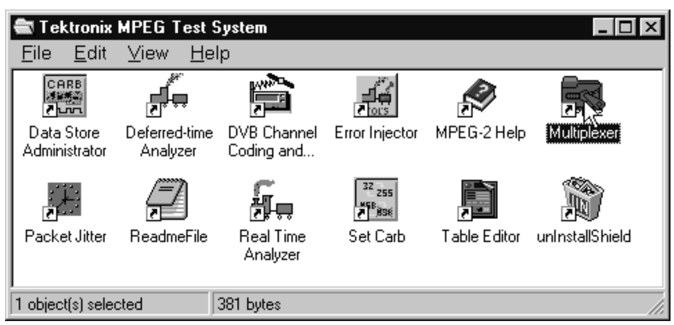
The tutorial in this section steps you through the procedures for adding DVB information to a transport stream file. DVB information is optional since not all systems require it.

This section is a continuation from the previous tutorial. It assumes that you have completed the previous work and have the files created in the tutorial available.

***NOTE**. To aid in following along with your own MTS 210, all steps requiring action are numbered.*

---

1. Open the Multiplexer application by clicking the Multiplexer name in the Tektronix MPEG Test System program group.



2. Choose Open from the Multiplexer File menu.
3. Select complex.CFG.
4. Choose OK. This opens the previous configuration file and displays it in the application window.

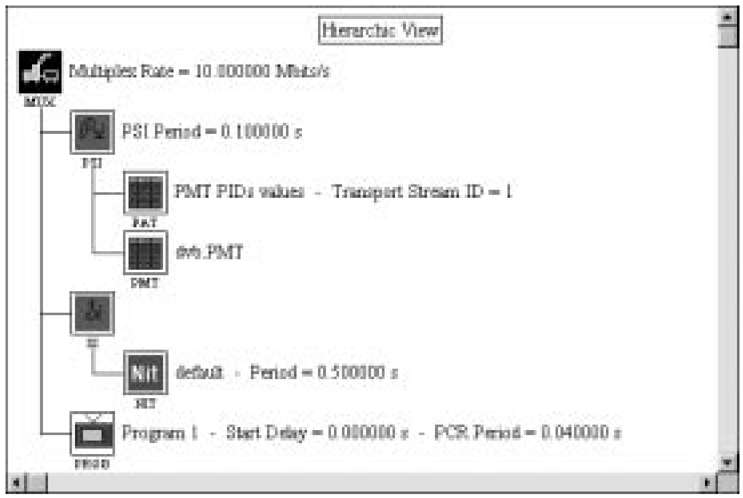
Now save the file under a new name.

5. Choose the Save As command from the File menu.
6. Type **dvb** in the File Name text box.
7. Choose OK.

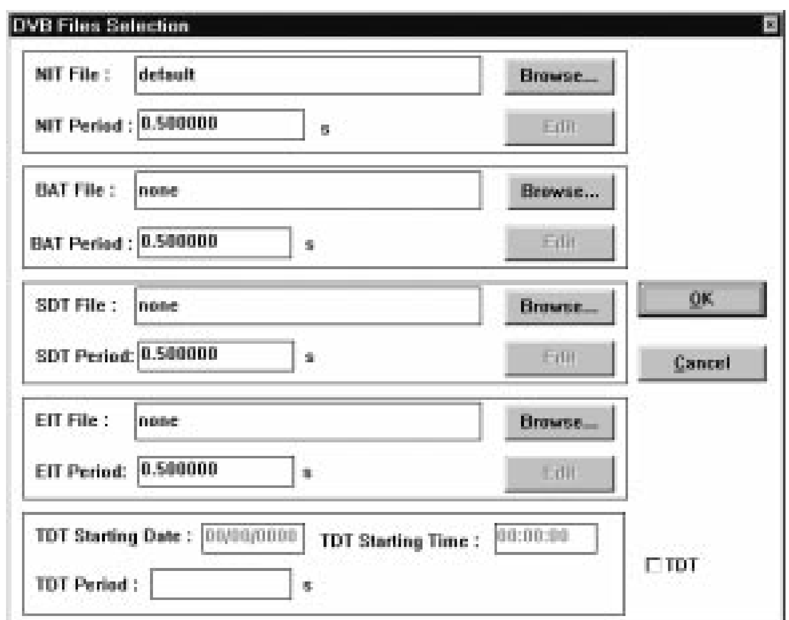
Now add the basic DVB information.

8. Choose DVB from the Options menu so that DVB is checked. This changes the appearance of the hierarchy.

- The SI (Service Information) icon is added.
- The NIT (Network Information Table) icon moves to below the SI icon.



9. Double-click on the SI icon to open the DVB File Selection dialog box.



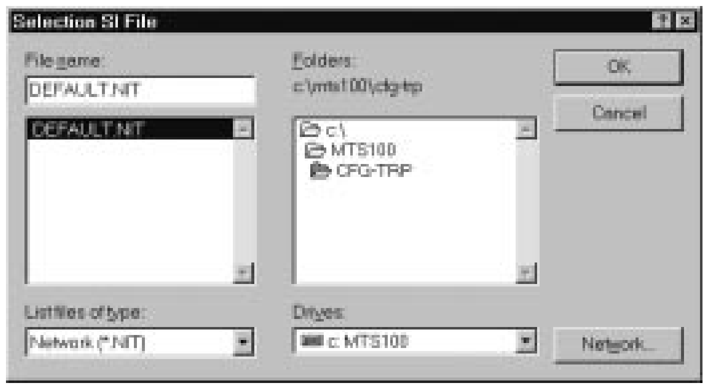
This dialog box allows you to add and edit the NIT, BAT (Bouquet Association Table), SDT (Service Description Table), EIT (Event Information Table), and

TDT (Time and Date Table) information to the transport stream file. The Browse command buttons enable selection from currently existing files. Default files are provided with the MTS 210 to save you time in creating your own DVB files.

Next, assign some default DVB files to the transport stream.

10. Click Browse in the NIT File section of the DVB Files Selection window.

11. Select DEFAULT.NIT in the Selection SI File dialog box.



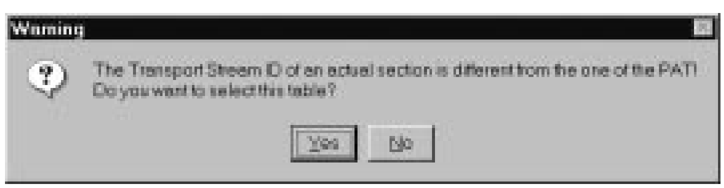
12. Click OK to complete the file selection.

13. Click Browse in the BAT File section of the DVB Files Selection window.

14. Select DEFAULT.BAT in the Selection SI File dialog box and click OK to complete the file selection.

15. Click Browse in the SDT File section of the DVB Files Selection window.

16. Select DEFAULT.SDT in the Selection SI File dialog box and click OK to complete the file selection. A “stream ID” warning message appears. This problem will be addressed later in the tutorial.



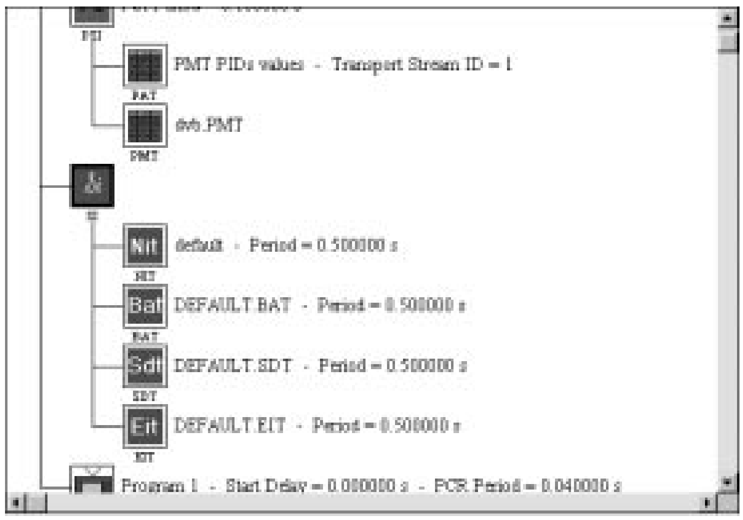
17. Click Yes to dismiss the warning and continue.

18. Click Browse in the EIT File section of the DVB Files Selection window.

19. Select DEFAULT.EIT in the Selection SI File dialog box. Click OK to complete the file selection. Again, the "stream ID" warning message appears. This problem will also be addressed later in the tutorial.

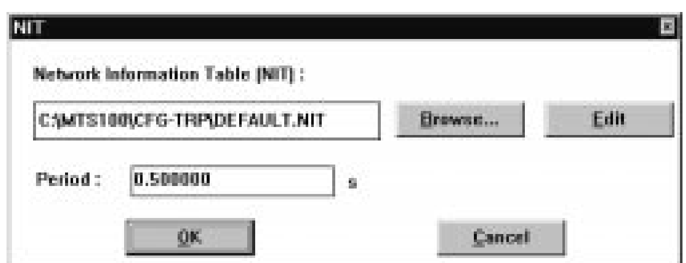
20. Click Yes to continue.

21. Click OK in the DVB Files Selection dialog box. The hierarchic view now includes icons for the tables you have added.

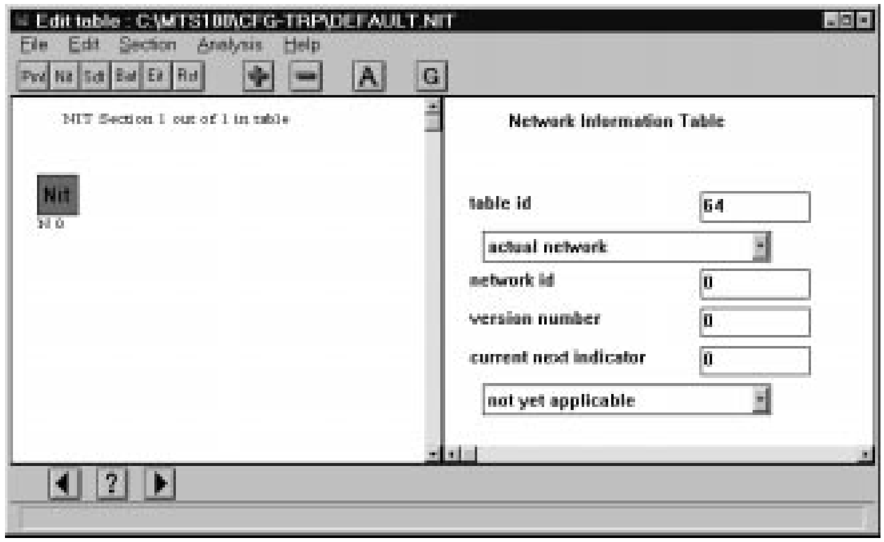


You will now edit the information in the individual DVB files.

22. Double-click on the NIT icon. This opens the NIT dialog box.

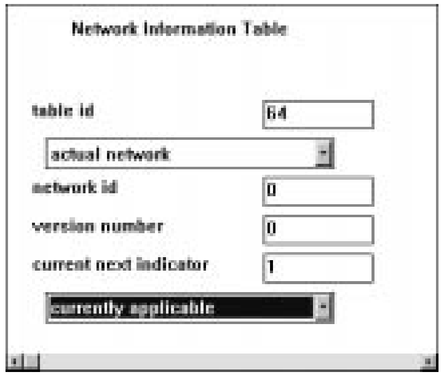


23. Click Edit. This launches the Table Editor application with DEFAULT.NIT open and ready to edit.



24. Select Coherence on the Edit Table Analysis menu or, better yet, click the A command button on the tool bar. This runs a coherence analysis on the NIT. A message window appears, listing the problems found in the table.

25. To correct the first error listed in the message window, select “currently applicable” from the current next indicator drop-down list.



26. Again select Coherence from the Edit Table Analysis menu or click the A button on the tool bar to run the analysis again. Note that the messages window now lists only one warning.

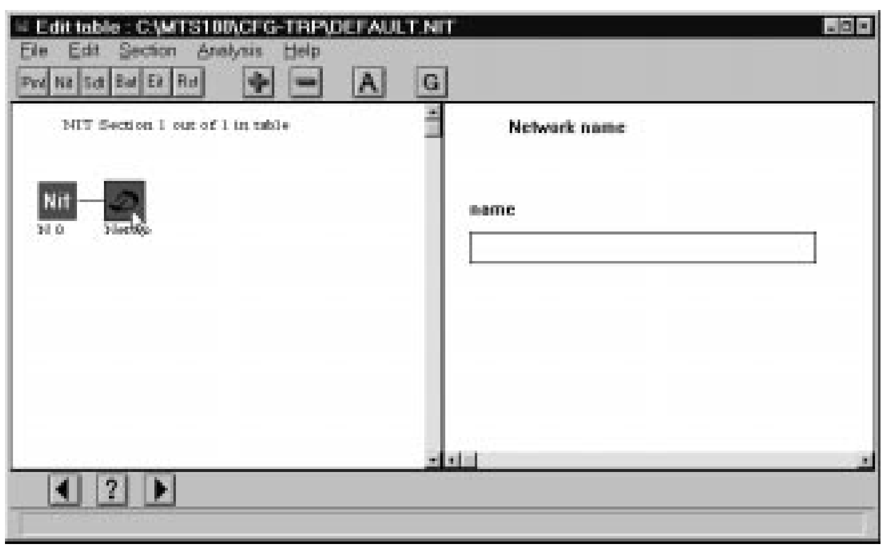
27. To clear this problem, you must add a descriptor that contains the network name. Choose Add from the Edit Table Edit menu or click the + (Add) command button. This displays the Add dialog box.

28. Select Descriptor and click OK. This displays the Descriptors Selection dialog box.

29. Select network_name from the drop-down list of descriptors.

30. Click Add and then click OK to complete the descriptor selection. The descriptor icon is added to the right of the NIT icon in the Edit Table application window.

31. Click on the “Netwo” descriptor icon.



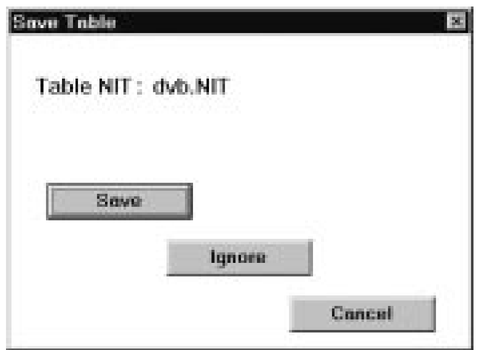
32. Type **Tektronix** in the name text box.

33. Select Save As from the Edit Table File menu.

***NOTE**. Do not choose the* Save *command. Doing so would change the default .NIT file. The default file is provided as a template to save you time when creating new NIT files and should be kept as universally applicable as possible.*

34. Type **dvb** in the file name box and click OK. The .NIT extension is added automatically.

35. Select Exit from the Edit Table File menu. This should return you to the NIT dialog box of the Multiplexer application. If the Edit Table application first presents a Save Table dialog box, click Ignore (you have already saved dvb.NIT).



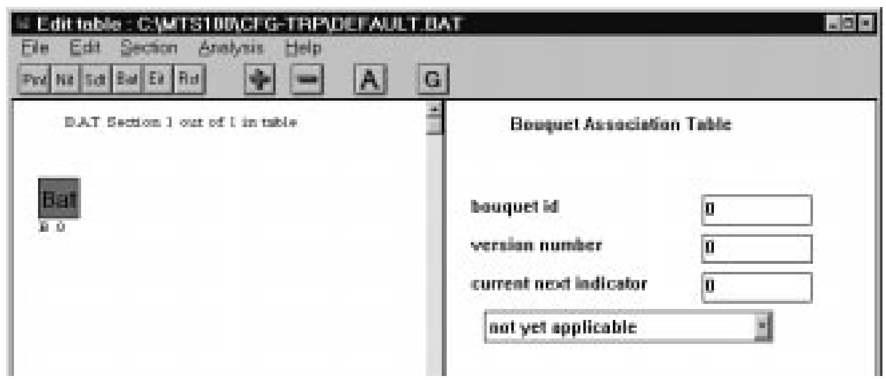
36. Notice that the NIT dialog box still shows that DEFAULT.NIT is selected. Click Browse and select dvb.NIT from the Selection SI File dialog box (highlight dvb.NIT in the files list and click OK).

37. When the selection box closes, click OK in the NIT window to confirm the file selection and dismiss the window. The NIT file associated with the dvb.cfg configuration file is now dvb.NIT.

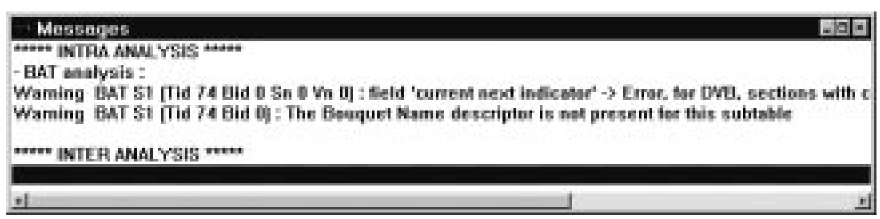
Next, edit the Bouquet Association Table (BAT).

38. Double-click on the BAT icon to open the BAT dialog box.

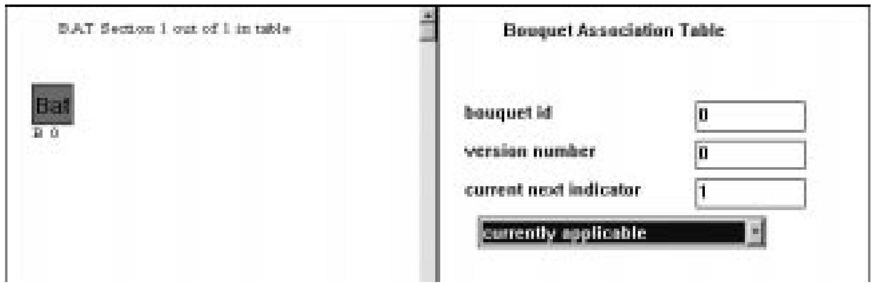
39. Click Edit in the BAT dialog box. This starts the Table Editor application with DEFAULT.BAT open for editing.



40. Click the Edit Table Analysis (A) command button to run a coherence analysis of the BAT. Edit Table creates a message window that lists the problems found in the table.



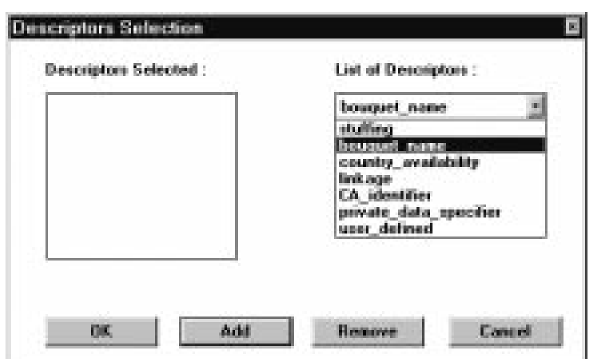
41. The first warning line reveals that the value of the current next indicator field is incorrect. To remedy this, select "currently applicable" from the current next indicator drop-down list.



The second warning says the Bouquet Name descriptor is not present for this subtable.

42. Click the Edit Table Add (+) command button to open the Add dialog box.

43. Select Descriptor and click OK. This displays the Descriptors Selection dialog box.



44. Select bouquet_name from the drop-down List of Descriptors.

45. Click Add, then OK to complete descriptor selection.

46. Again click the Edit Table A (analyze) command button. Note that there are no more warnings.

47. Select Save As from the File menu.

***NOTE**. Do not choose the* Save *command. Doing so would change the default .BAT file. The default file is provided as a template to save you time when creating new BAT files and should be kept as universally applicable as possible.*

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48. Type **dvb** in the File Name text box and click OK. The table description is saved as dvb.BAT.

49. Select Exit from the Edit Table File menu. This returns you to the BAT dialog box of the Multiplexer application.

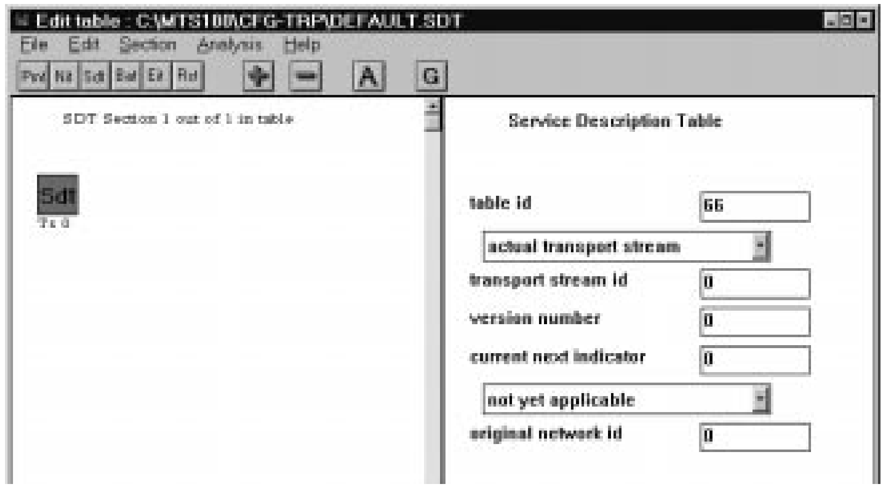
50. In the BAT dialog box, click Browse.

51. Select dvb.BAT from the Selection SI File dialog box (highlight dvb.BAT in the files list and click OK).

52. Click OK in the BAT dialog box to accept the selection of dvb.BAT and dismiss the box. This associates dvb.BAT with the BAT icon in the dvb.cfg configuration file.

53. Double-click on the SDT icon to display the SDT dialog box.

54. Click Edit in the SDT dialog box. This again starts the Table Editor application, this time with DEFAULT.SDT open for editing.



55. If you run a coherence analysis on the SDT, you will find that the current next indicator should be set to currently applicable (1), as it was for the NIT and BAT. Change the current next indicator now.

56. Save the SDT as dvb.sdt (choose Save As from the Edit Table File menu, type **dvb**, and click OK).

57. Exit the Edit Table application. Remember the error message that appeared when you first added DEFAULT.SDT to the hierarchy? It's back. Now, however, you can discover the stream ID and add the information to dvb.SDT to correct the error.

You can discover the transport stream ID from the PAT icon in the Multiplexer hierarchy; unfortunately, you cannot scroll to view that icon until you close the SDT window.

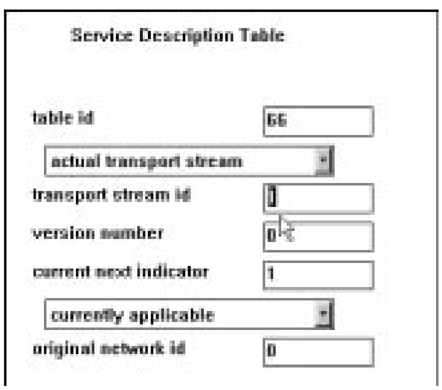
58. Click OK in the Error window to close it and click OK in the SDT window to close it as well.

59. Scroll the Multiplex window until you can see the PMT icon. Notice that the transport stream ID is 1.

60. Scroll the SDT icon back into view and double-click it; then click Browse and select dvb.SDT from the Selection SI File dialog box. You will again receive the “different Stream ID” message.

61. Click Yes in the Warning message window; then click Edit in the SDT dialog box.

62. When the Edit Table application window opens, change the SDT transport stream ID to 1.



63. Choose Save and then Exit from the Edit Table File menu. Click OK in the SDT dialog box. The transport stream ID Error message no longer appears.

You will now edit the EIT file.

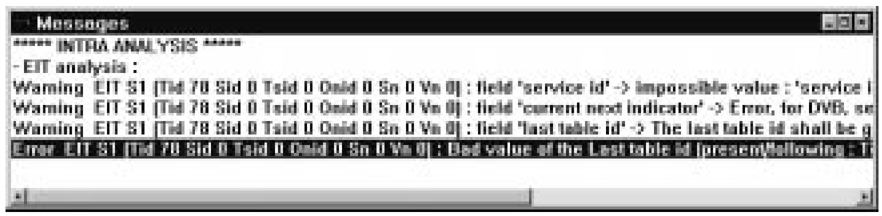
64. Double-click on the EIT icon to open the EIT dialog box.

65. Click Edit in the EIT dialog box to start the Table Editor application.

66. Perform a coherence analysis as before (click the A command button).

67. Notice that the Messages window contains three warnings and an error message:

- The service id value is incorrect (Warning)
- The current next indicator should be "1" (Warning)
- The last table id value is incorrect (Warning and Error)

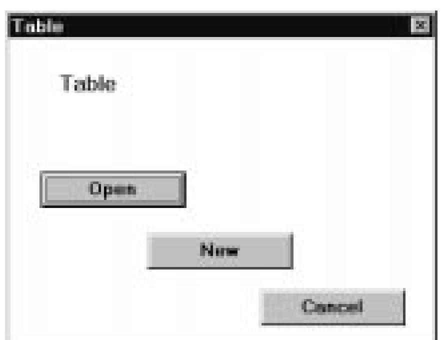


68. Change the current next indicator field to currently applicable, as you have done in other tables.

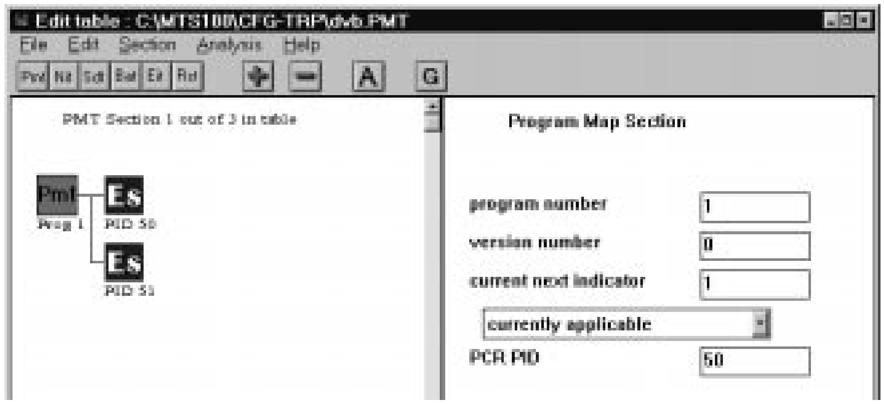
69. Type **78** (the ID of this table) in the last table id text box.

70. The service id should be the same as the program id of the associated PMT. Follow these steps to discover the program id:

a. Click the PMT command button on the Edit Table tool bar. The Table dialog box appears.



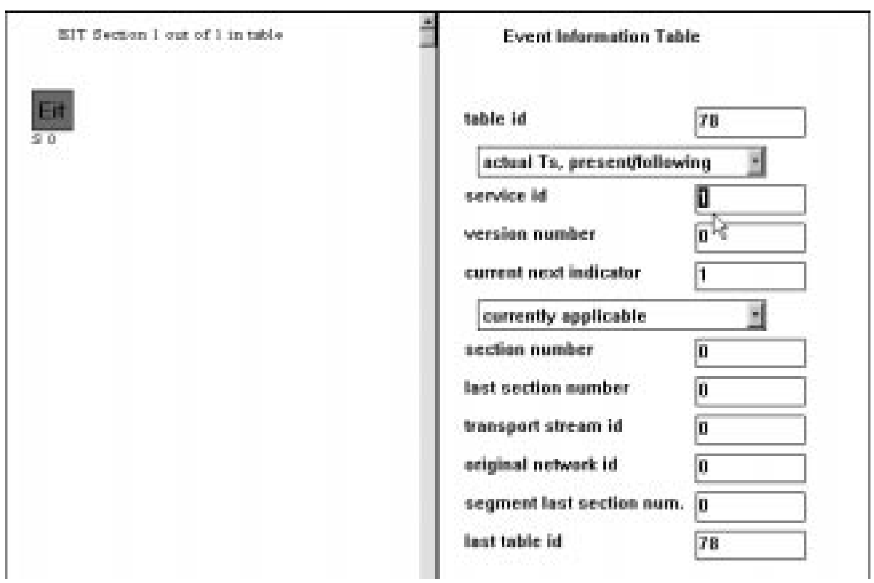
b. Click Open. The standard Windows Open dialog box appears. Open c:\mts100\cfg-trp\dvb.PMT. The edit table workspace changes to show the PMT and its values.



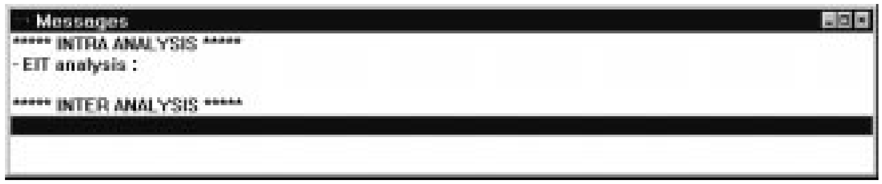
c. Notice that the program id of the first PMT section is 1.

d. Choose Close on the Edit Table File menu to close the PMT file and return to the EIT display.

71. Type **1** into the service id text box.



72. Perform a coherence analysis on the EIT to confirm that all reported errors are corrected.

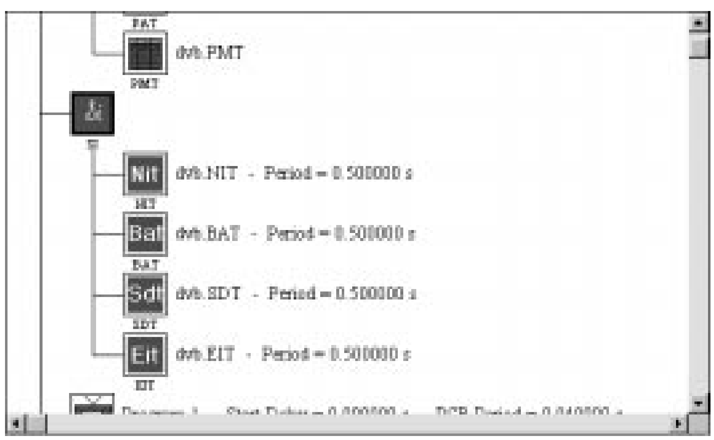


73. Recall that when you opened this file from the DVB Files Selection dialog box you received the same Transport Stream ID error message as you did with the SDT file. You will receive the same message again when you exit the Edit Table application. Correct the error now by entering 1 in the transport stream id text box.

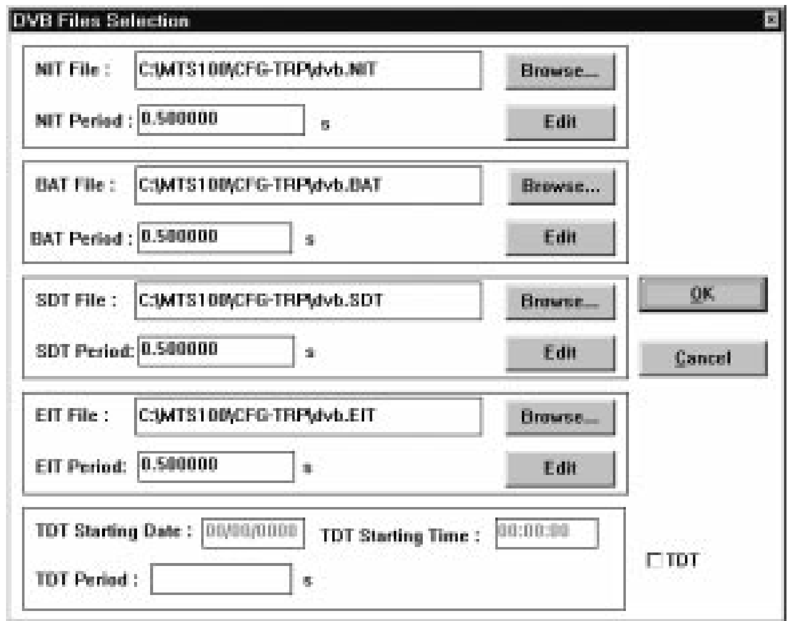
74. Save the EIT as dvb.EIT and exit Edit Table. The Transport Stream ID error message appears because DEFAULT.EIT is still selected.

75. Click OK to dismiss the error message and then click Browse in the EIT dialog box to select dvb.EIT through the Selection SI File window. When you are done, click OK to accept the selection and dismiss the EIT dialog box.

The SI hierarchy should now look like this:



76. Double-click on the SI icon to again open the DVB File Selection dialog box.



You can enter the Time and Date Table (TDT) information directly through this dialog box. Note, however, that the values for the TDT Starting Date and Starting Time are grayed (and unavailable) until you select the TDT check-box in the lower-right corner of the window.

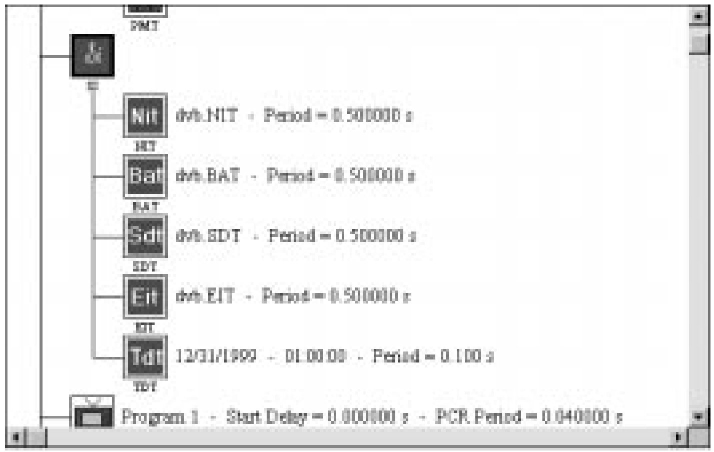
77. Select the TDT option box in the lower-right corner of the DVB Files Selection dialog box.

78. Type **12/31/1999** into the TDT Starting Date text box.

79. Type **01:00:00** in the TDT Starting Time text box.

80. Type **0.1** in the TDT Period text box. The TDT Period specifies how often the time and date stamp is placed into the transport stream.

81. Click OK. Notice that the Hierarchic view now shows a TDT icon.



82. Choose Save from the File menu or click the Save command button to save all the changes to dvb.CFG.

This concludes the tutorial for creating an MPEG-2 transport stream file with DVB information. Refer to *Using the PSI and SI Table Editor*, beginning on page 3–103, for additional information about editing the various tables that have been discussed in this section.

Using the Analyzer

The MPEG-2 System Analyzer can examine MPEG-2/DVB binary streams on the following three levels:

- Transport stream (TS)
- Elementary stream packets (PES packets)
- PSI (MPEG Program-Specific Information) and SI (DVB Service Information) tables

The program is not designed to analyze the audio, video, or data contents of the elementary streams, although you may extract and save the elementary streams to separate files for use in other applications.

Overview

The three major functions of the Analyzer application are analysis, filtering, and information extraction (saving streams and stream components).

Analysis

The program can analyze several different aspects of the MPEG transport stream and its embedded objects.

- Multiplex characteristics
- CRCs
- Syntax, or structure
- Consistency
- PSI/SI rate
- PCR
- PTS/DTS
- Semantics, or coherence among multiplexed components
- Dynamic T-STD, LTW, and smoothing buffer usage

For convenient one-step analysis of most aspects of all levels of the MPEG data stream, you can also perform an Automatic Analysis.

Filtering

The MPEG-2 System Analyzer filters enable finding and viewing transport stream packets, PES packets, and PSI/SI table sections that meet up to four criteria of your choosing. You can search for rare, significant, or troublesome stream items on the basis of several characteristics:

- Program ID (PID)
- The presence and value of of up to three selected packet or section fields
- A sequence of up to four bytes
- The presence of the start of an elementary stream access unit

Saving Streams and Stream Components

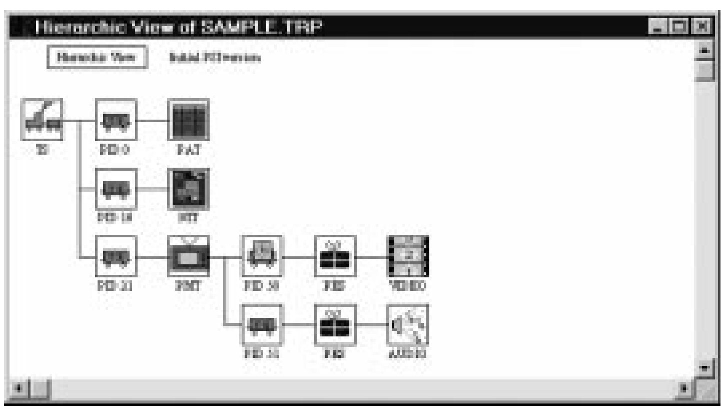
Finally, the analyzer gives you the ability to extract information from the binary stream and save it to a file for later use or analysis. This information includes the following:

- Transport packets
- PES packets
- PSI and SI tables
- Elementary streams

Terms

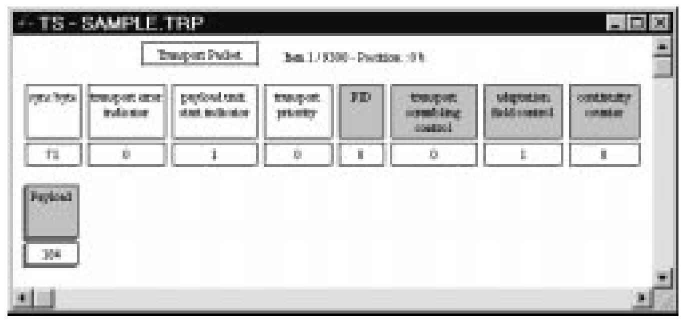
There are two terms that are specific to the Analyzer application. They are Hierarchic view and Interpreted view.

The Hierarchic view is a graphic representation of the MPEG transport stream file that uses icons to show the interrelationship of stream components. See *The Hierarchic View*, beginning on page 3–13, for a detailed explanation.



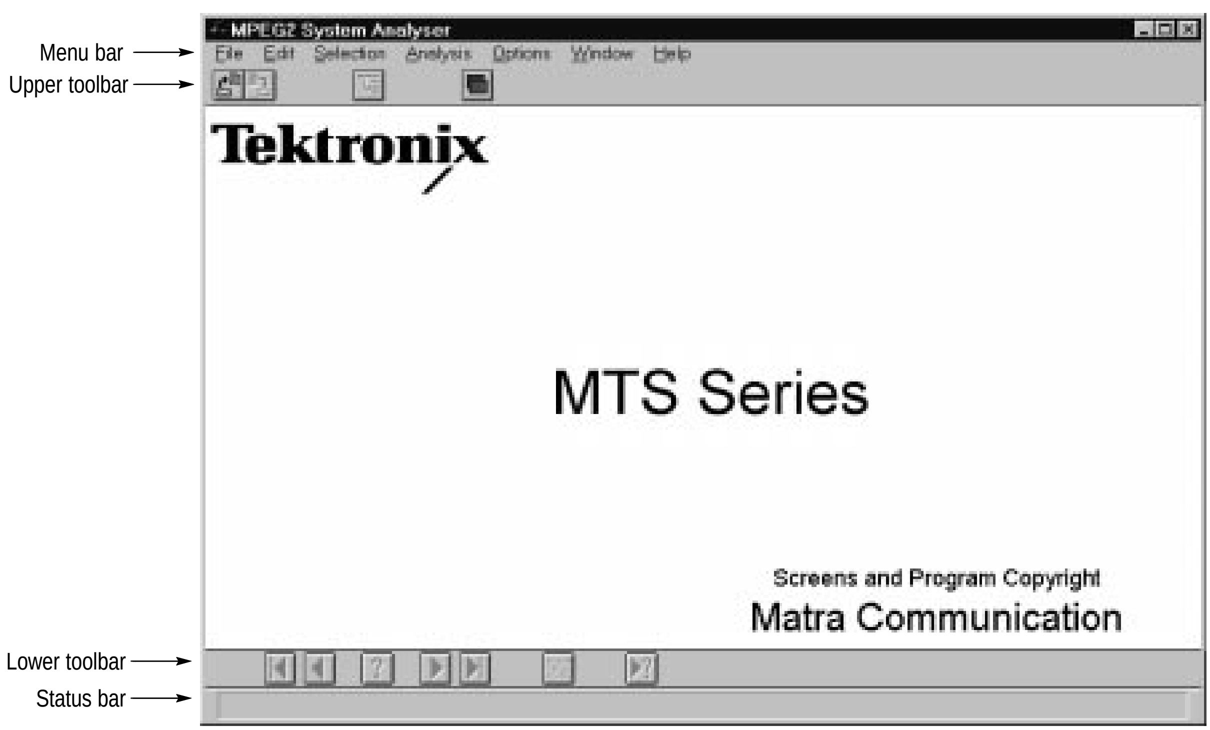
The Interpreted view shows the various fields that make up small sections of the stream—or data (such as tables and elementary stream packets) embedded in it.

The interpreted view shown below is of one 188-byte transport packet in the SAMPLE.TRP binary stream; this view can be created by double-clicking on the TS (engine and tender) icon in the Hierarchic view. Refer to *The Interpreted View*, beginning on page 3–17, for a detailed explanation.



Analyzer Application Window

The analyzer application window appears on the Windows desktop when you start the program.



All other Analyzer windows appear within the application window. The menu bar is immediately below the window title and provides access to the various Analyzer commands. The upper toolbar, immediately below the menu bar, and the lower toolbar, below the application workspace, provide direct access to commonly used menu commands. The status bar, on the bottom of the window, displays information about the various menu commands and command buttons.

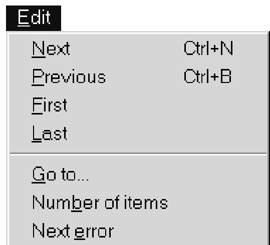
Menu Bar

The Menu Bar provides access to the seven main Analyzer menus.

File Menu. The File menu controls the Analyzer/Disk interface. The commands in this menu operate as in all Windows applications. See *Opening a File*, on page 3–12, and *Extracting and Saving Stream Elements*, on page 3–53, for more information about opening the various MTS 100 file types and saving transport stream data to files.

Use	To
Open	Open an existing transport stream, packets, or PSI/SI file.
Save as	Save the current selection to disk
Print	Print the current view
Printer setup	Change printer settings
Exit	Quit the Analyzer application

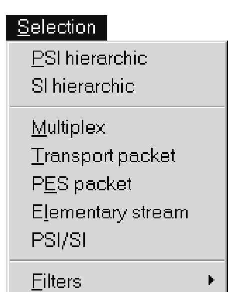
Edit Menu. Use the Edit menu to navigate among sections of a stream or objects embedded in a stream. These commands duplicate the actions of the command buttons on the lower toolbar.

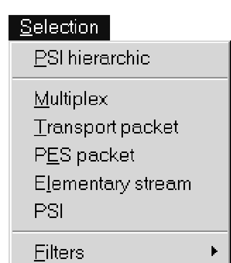


The buttons are shown below. The button commands are, from left to right: First, Previous, Go to, Next, Last, Number of items, and Next error.

Use	To
Next	Go to the next item (PAT, transport packet, PES packet, table section...)
Previous	Go back to the previous item
First	Go to the first item
Last	Go to the last item
Go to	Go to a selected item
Number of items	Count and display the number of items
Next error	Locate and display the next item that has at least one syntax error

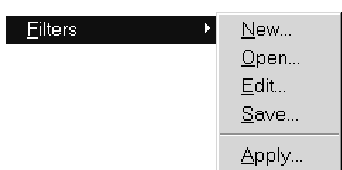
Selection Menu. The Selection menu provides access to several different views of stream data on several different levels.





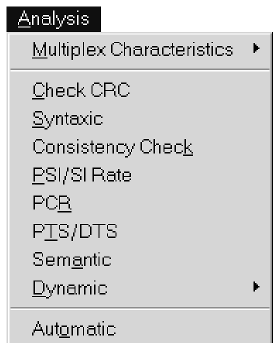
Use	To
PSI hierarchic	Create a new hierarchic view of the transport stream represented by selected window
SI hierarchic	Display an SI (DVB) hierarchic view of the transport stream; this command is present only when DVB is selected in the Options menu
Multiplex	Display an interpreted view of the transport packets (all PIDs). This command is equivalent to double-clicking on the TS (engine and tender) icon and is not available when a hierarchic view is selected
Transport packet	Display an interpreted view of the transport packets of a specified PID
PES packet	Display an interpreted view of the PES packets encoded in the transport packets of a specified PID
Elementary stream	Extract an elementary stream and save in a file
PSI/SI or PSI	Display an interpreted view of the specified PSI/SI sections; SI only present when DVB is selected in the Options menu
Filters	Open the Filters submenu

Filters Submenu. The Filters submenu enables extraction of transport stream components or objects that meet user-specified criteria. Refer to *Filters*, beginning on page 3–46, for a complete explanation.



Use	To
New	Create a new filter
Open	Open an existing filter (.flt) file
Edit	Modify a filter
Save	Save a filter to a disk (.flt) file
Apply	Apply a filter to the stream represented by the selected hierarchic view

Analysis Menu. Use the analysis menu commands to analyze stream contents and characteristics either automatically (selected analyses one after another) or manually (one analysis at a time).



Use	To
Multiplex Characteristics	Open the Multiplex Characteristics submenu
Check CRC	Check CRCs of the various tables in the selected PSI hierarchy (*Check CRCs* begins on page 3–24)
Syntaxic	Check the stream for syntax errors (*Syntax Analysis* begins on page 3–25)
Consistency Check	Check for consistency within the stream (*Consistency Check* begins on page 3–26)
PSI/SI Rate	Analyze the rates of the various PSI/SI tables within the stream (*PSI/SI Rate Analysis* begins on page 3–29)
PCR	Check the program clock references in the stream (*PCR Analysis* begins on page 3–30)
PTS/DTS	Check the time stamps in a selected elementary stream (*PTS/DTS Analysis* begins on page 3–34)
Semantic	Check all transport packets for semantic errors (*Semantic Analysis* begins on page 3–37)
Dynamic	Open the Dynamic (analysis) submenu
Automatic	Perform an automatic sequence of analyses (*Automatic Analysis* begins on page 3–44)

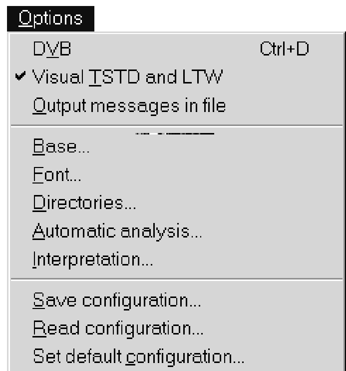
Multiplex Characteristics Submenu. The Multiplex Characteristics submenu provides access to multiplex-related information.

Use	To
Rate	Display the overall multiplex rate as calculated from the first ten PCRs and, if the calculated rate is incorrect, enter the correct value (*Multiplex Rate* begins on page 3–22)
Multiplex Allocation	Display a pie chart of PID allocation in the stream (*Allocation* begins on page 3–23)
PID Map	Display the sequence of PIDs in the transport stream (*PID Map* begins on page 3–24)

Dynamic Submenu. The Dynamic analysis submenu contains selections for dynamic analysis of the MPEG bit stream.

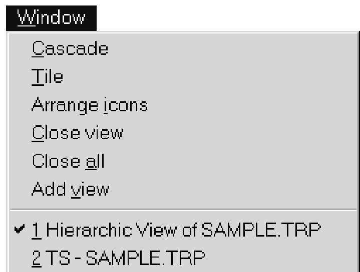
Use	To
T-STD	Conduct a transport stream system target decoder simulation (*T-STD Analysis* begins on page 3–39)
LTW	Check the effect of LTW (legal time window) offset and piecewise rate field values (*LTW Analysis* begins on page 3–43)
Smoothing Buffer	Conduct a smoothing buffer simulation (*Smoothing Buffer* begins on page 3–44)

Options Menu. Use the Options menu to set various Analyzer options as well as save and restore program configurations. Refer to *The Options Menu*, on page 3–55, for more information.

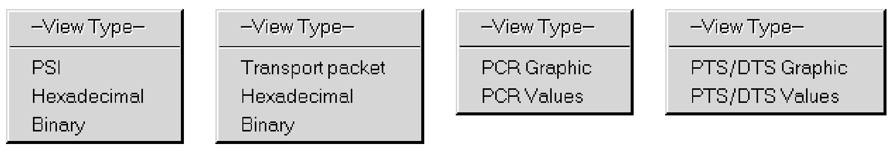


Use	To
DVB	Toggle the DVB option on/off
Visual TSTD and LTW	Toggle the graphic view of TSTD and LTW dynamic analysis on/off
Output messages in file	Toggle output message option on/off
Base	Specify the numeric base (decimal or hexadecimal) used in the interpreted and hierarchic views
Font	Specify the text font (typeface and size) used in analyzer views
Directories	Configure default directories
Automatic Analysis	Configure automatic analysis (specify the analyses to perform)
Interpretation	Configure the interpreted view
Save configuration	Save the current user configuration to a file
Read configuration	Read and apply a previously saved user configuration
Set default configuration	Reset all options to the default settings

Window menu. The Window menu is used to manage the various open windows.

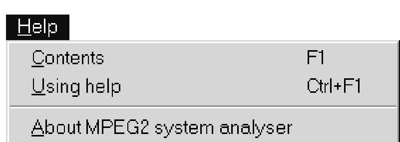


These commands—with the exception of Add view—work as in all Windows applications. Use Add view to create a new window that displays the data of the current window in a different format. A small submenu, like those shown below, appears when you choose Add view.



Use	To
(the first choice)	Create a duplicate of the selected view
Hexadecimal	Create a byte-by-byte, hexadecimal view of the data
Binary	Create a bit-by-bit, binary view of the data
(PCR or PTS/DTS) Values	Create a view that lists numeric values related to the clock or time stamp

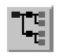
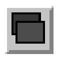
Help Menu.



Use	To
Contents	Open a Help window and display the table of contents
Using help	Get help using Help
About...	Display the MPEG-2 System Analyzer version and copyright

The Upper Toolbar

The following table lists the command buttons found on the upper toolbar. Click the appropriate button to choose one of the functions.

Icon	Name	Function
	Open	Opens an existing stream. Equivalent to the Open command in the File menu.
	Save	Saves streams and stream elements. Equivalent to the Save As command in the File menu.
	Hierarchy	Displays the hierarchic structure of the current PSI. Equivalent to the PSI hierarchic command of the Selection menu.
	View	Opens a new window related to the current window. Selecting this icon brings up a submenu that offers a choice of window display modes. This selection is similar but not equivalent to the Add view command in the Window menu.

The Lower Toolbar

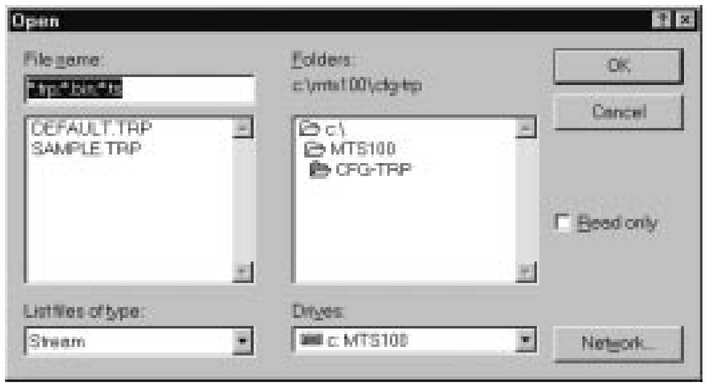
The commands from the lower toolbar are only available if the selected document window contains items (stream packets, transport tables, elementary stream packets, PES, PSI table sections, or SI DVB table sections). When the document window does not contain any of these items, these command buttons are not available.

Click the appropriate command button to choose one of these functions.

Icon	Name	Function
	Start	Accesses the first item. Equivalent to the First command in the Edit menu.
	Previous	Selects previous item. Equivalent to the Previous command in the Edit menu.
	Go To	Used to go directly to an item. Equivalent to the Go to command in the Edit menu.
	Next	Selects the next item. Equivalent to the Next command in the Edit menu.
	End	Goes to the last item. Equivalent to the Last command in the Edit menu.
	Number	Displays the number of items. Equivalent to the Number of items command in the Edit menu.
	Error	Finds and displays the next item that contains at least one syntax error. Equivalent to the Next Error command in the Edit menu.

Opening a File

The MPEG-2 System Analyzer can open MPEG-2 transport stream files (.trp, .bin, or .ts file extensions), PES packet files (.pes extension), and section files (.si extension). To open a file, select Open from the file menu, click the Open command button in the upper toolbar, or type CTRL+O. Then choose the file from the Windows Open dialog box



- Select the appropriate drive, directory, and file type. Sample files are in the c:\MTS100\CFG-TRP directory; if you wish to open a file on the Data Store Disk, change the directory to c:\CARB0.
- Select the file you want to open from the list of files.
- Double-click on the file name, click the OK button, or press ENTER.

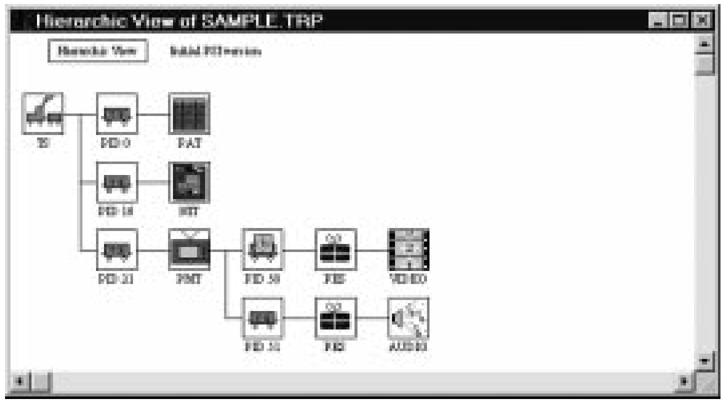
When you open a transport stream file, a PSI hierarchic view appears in the application window. If you open a transport packet, PES, or section file, an interpreted view appears.

***NOTE**. The Analyzer cannot generate a hierarchic view if the stream does not contain a PAT (program allocation table, PID 0) or PMT (program map table).*

The hierarchic view that appears when you first open a file is based on the first versions of the PAT and PMT tables found in the stream. Use the Next command in the Edit menu or click on the Next command button (in the lower toolbar) to go to the next PSI version, if any, in the stream.

The Hierarchic View

The hierarchic view uses icons to show the interrelationship of stream components, and is the starting point for many types of analysis. The figure below shows the hierarchic view of a simple MPEG-2 transport stream.



Stream Elements and Icons

The hierarchic view icons, described in Table 3–1, represent the different elements that make up or are embedded in a transport stream.

Table 3–1: Icons used in the PSI hierarchic view

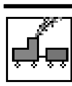
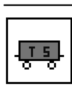
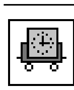
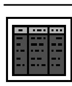
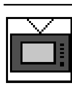
Icon	Element Type
 TS	Multiplex transport packets. This icon represents all (188-byte) transport packets that make up the stream.
	Transport packets of a particular PID (Program ID). Other elements (tables, clocks, PES packets) are the payload contained within transport packets or are constructed from the payload of several transport packets that have the same PID. The PID number appears under the icon.
	Transport Packets that contain independent PCR clocks. The PID appears under the icon.
 PAT	PAT (Program Association Table) sections. Always contained in PID 0 transport packets.
 PMT	PMT (Program Map Table) sections
 NIT	NIT (Network Information Table) Provides access to SI Tables through the PSI/SI command from the Selection menu. Also used for Private Data sections.

Table 3–1: Icons used in the PSI hierarchic view (Cont.)

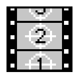
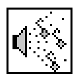
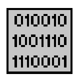
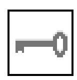
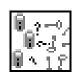
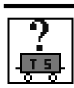
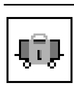
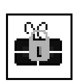
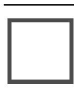
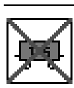
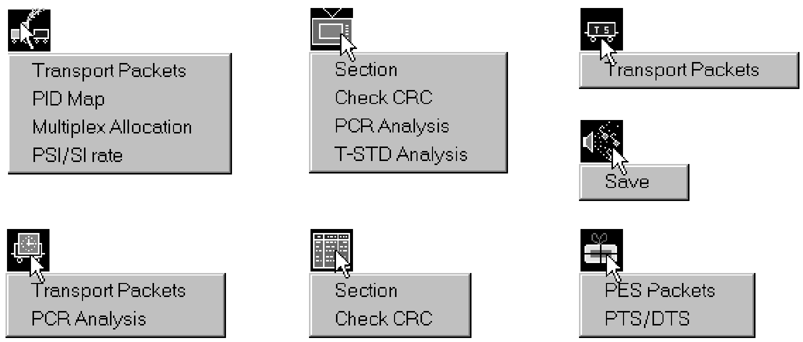
Icon	Element Type
 PES	Packetized Elementary Stream (PES). This icon represents all packets that, together, contain a given elementary stream. Individual PES packets are assembled from the payloads of several transport packets.
 VIDEO	Video elementary stream
 AUDIO	Audio elementary stream
 DATA	Data elementary stream
 ECM	ECM (Entitlement Control Message) sections
 EMM	EMM (Entitlement Management Message) sections

Table 3–2: Special hierarchic view symbols

Symbol	Significance
	The question mark is added to a TS icon when the transport packets have undefined PIDs and are not referenced by any PSI table. (Note that this is permissible in MPEG-2, but may indicate a PSI configuration problem.)
 	The lock symbol, superimposed on an icon, indicates that part of the stream is scrambled. Scrambling on the transport stream level is indicated by a lock on the TS (rail car) icon and the following PES and ES icons; scrambling on the PES level is indicated by a lock only on the PES and ES icons.
	A red square (border) surrounding a base icon after a Consistency analysis indicates that the data type, declared in a PSI table, is not valid.
	A red X over a base icon as a result of Consistency analysis indicates that a specific PID, declared in a PSI table, cannot be found in the transport stream.

Double-click for an interpreted view. Double-click on an icon to display an interpreted view of the stream element. Refer to *The Interpreted View*, beginning on page 3–17, for more information.

Icon menus. Each type of icon has a context-specific shortcut menu that allows quick access to the functions available specifically for the chosen element. Display this menu by clicking the *right* mouse button on the icon. Hold the mouse button down, highlight the desired command, and release the button to select the command. In all cases, you can select the first command on the menu (or the only command in one-item menus) by double-clicking on the icon.



The SI (DVB) Hierarchic View

If the open transport stream file contains DVB SI tables, you can use the SI hierarchic command in the Selection menu to display an SI hierarchic view, as shown below. Table 3–3 describes the icons used in the SI hierarchic view.

__NOTE__. The SI hierarchic command is available only when DVB is selected in the Options menu.

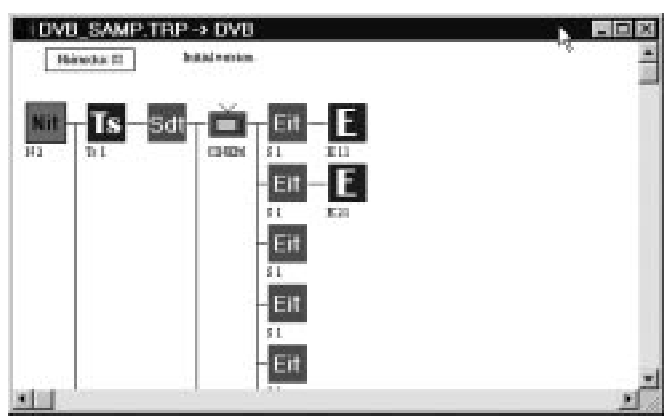
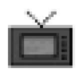
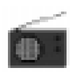


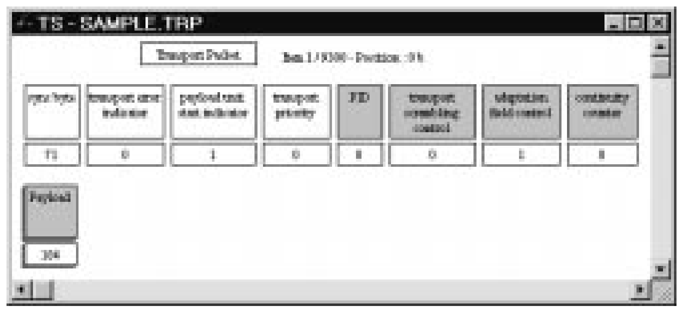
Table 3–3: Icons used in the SI hierarchic view

Icon	Element Type
Nit	NIT (network information table) sections
Sdt	SDT (service description table) sections
Eit	EIT (event information table) sections
Bat	BAT (Bouquet Association Table) sections
Ts	Transport stream referenced in an NIT or BAT
E	Event referenced in an EIT
	TV service referenced in an SDT
	Radio service referenced in an SDT
Txt	Teletext service referenced in an SDT

Double-click for an interpreted view. As with the PSI hierarchic view, you can double-click on the table icons to display an interpreted view of table sections. Refer to *The Interpreted View,* beginning on page 3–17, for more information.

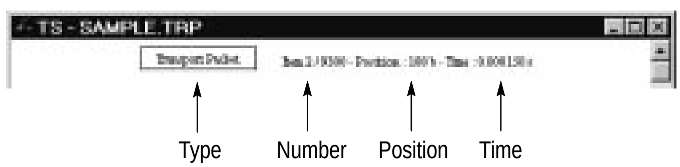
The Interpreted View

The interpreted view contains a graphic presentation of one transport packet, table section, or PES packet at a time, while providing access to all similar packets or sections that make up the MPEG-2 transport stream or are embedded in it. The interpreted view of a transport stream packet is shown below. You can create this view by double-clicking on the multiplex transport packet (engine and tender) icon in the hierarchical view.



Item Information

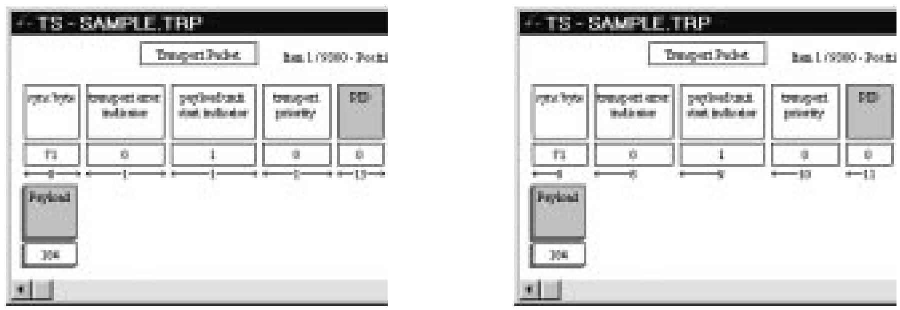
The currently interpreted packet or section is called an “item.” Information about the item’s relationship to other items and position in the transport stream appears near the top of the interpreted view window.



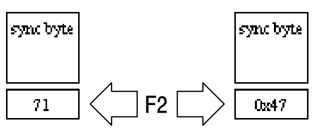
- The item number is the position of the current item relative to all such items in the transport stream. The total number of items (9300 in the example) is displayed if you have used a command button (in the lower toolbar) to either go to the last item or count the items in the stream. You can also use command buttons to move back and forth among the items and to search for an item with a syntax error. Refer to *The Lower Toolbar*, on page 3–11, for more information.
- The position is that of the first *byte* in the item, relative to the beginning of the transport stream. The example item is the second 188-byte packet in the stream, thus it is no surprise that it begins with byte 188.
- The time is also relative to the beginning of the stream; it is displayed after a multiplex rate calculation. Perform a multiplex rate calculation by selecting it from the Multiplex characteristics submenu of the Analysis menu or by typing CTRL+R. The analyzer also performs the calculation as part of several other analyses, including PCR, PSI/SI rate, PTS/DTS, and Dynamic.

Fields

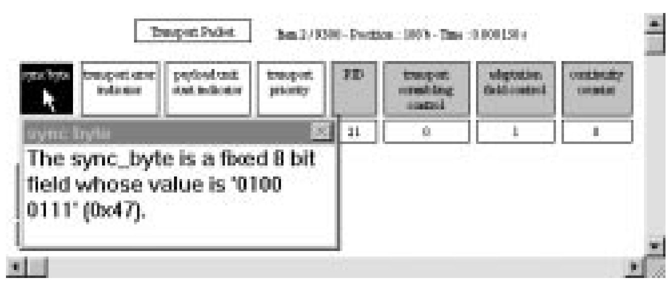
The interpreted view shows the fields of information and data that make up the section or packet. Each field is represented by a name box and a value rectangle below it. Fields vary in length from one bit to many bytes. The width of each box/rectangle does not indicate the length of the field. You can configure the interpreted view, through the Interpretation command on the Options menu (see page 3–20), to show the length or position (in *bits*) of each information field. The length or position is indicated below the value rectangles.



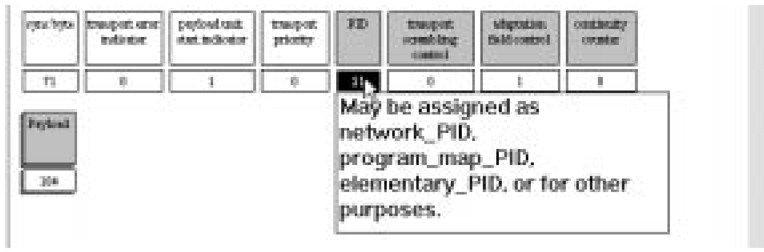
The length of data fields—such as the Payload in the above windows—is always shown (in decimal number of *bytes*) in the value rectangle. Value rectangles of information fields contain the value of the field. To toggle information field values (but not data field lengths) between decimal and hexadecimal base, press the F2 key.



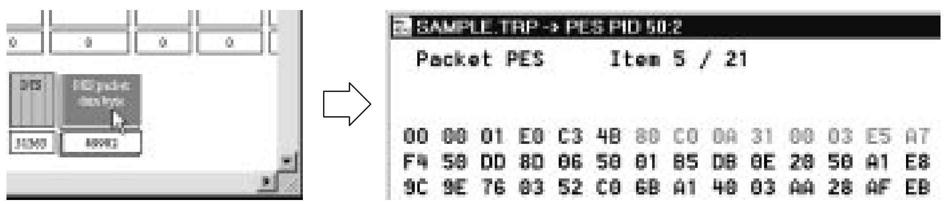
Double-click on the name box for an explanation of a field.



Double-click on the value rectangle for additional information about the value.

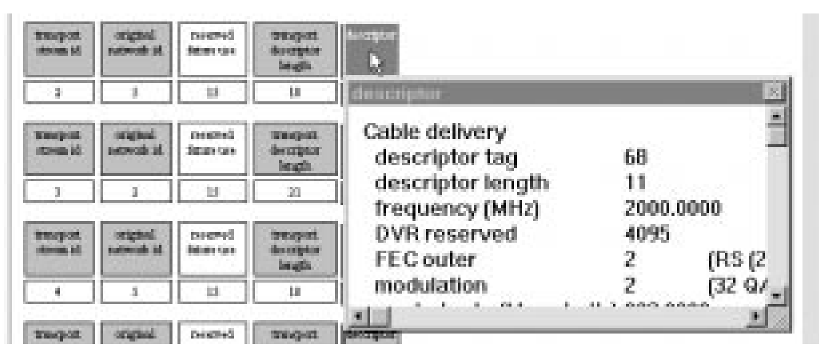


Double-click on a data field name to add a byte-by-byte hexadecimal view of the interpreted section, table, or packet.



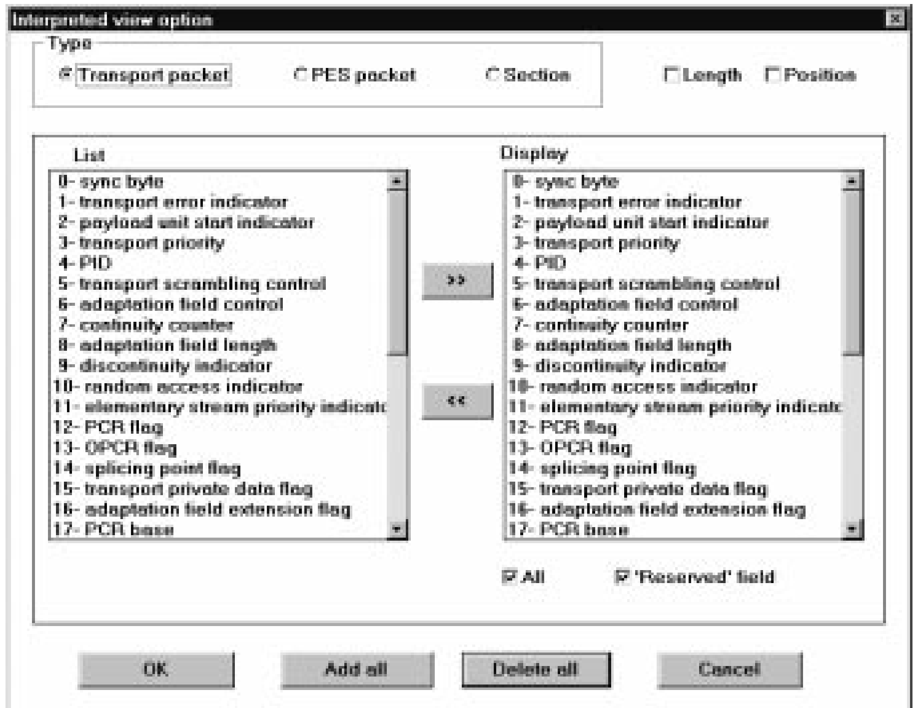
You can also display a hexadecimal view or binary view of any section or packet by selecting the Add view command from the Window menu or by clicking on the Add view command button in the upper toolbar.

Double-click on the descriptor field name in an SI table (NIT, SDT, EIT, or BAT) section for an ASCII decode of the descriptor information.



Interpreted View Options

You can customize the appearance of the interpreted view through the Interpretation command on the Options menu. The Interpreted view options dialog box, with default selections, is shown below.



The Length and Position settings, explained on page 3–18, apply to all interpreted views. You can use the remaining controls to determine which fields appear in transport packet, PES packet, or (table) section interpreted views.

1. Click the option button in the Type field to select the type of interpreted view you wish to change.

2. As shown, the default display is All fields, including the Reserved field. To hide a field, select it in the Display list box and click the << button.

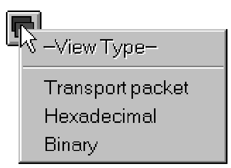
3. To show just a few fields, click Delete all; this clears the display box, All check box, and ‘Reserved’ field check box. Then select a field name from the List list box and click the >> button. Repeat this until all the fields you wish to display are listed in the Display box. If you also want to display the Reserved field, select that check box. Finally, click OK. The changes take effect immediately.

4. When you have made any changes to the displayed fields, ***Warning, display option*** appears at the top of the interpreted view window.

5. To restore the interpreted view to the original configuration, choose Interpretation from the Options menu, click the appropriate Type option button, click either Add all or the All check box, and finally click OK.

Hexadecimal and Binary Views

You can always add a hexadecimal view of the current interpreted view item by double-clicking on a payload or data bytes name box. However, some items such as table sections do not have these fields. To create a hexadecimal or binary view for any interpreted view item, either click on the Add view command button (in the upper toolbar) or select the Add view command from the Window menu. A submenu, appropriate to the current item, appears as shown.

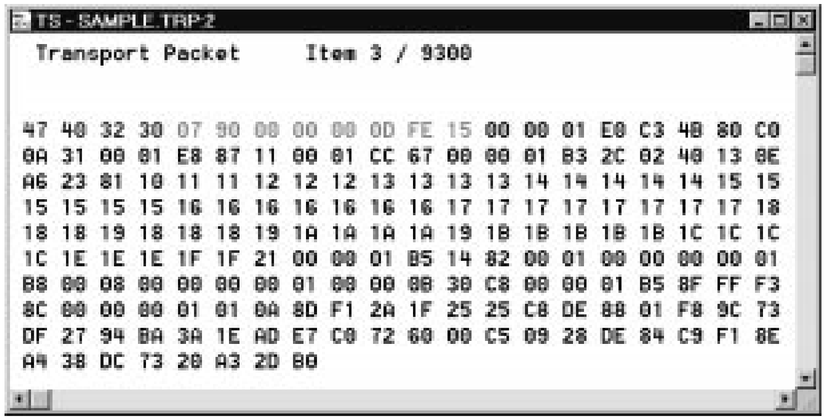


Select the top submenu command (Transport packet in the example) to add a new interpreted view; select Hexadecimal or Binary to view the bytes or bits that are the basis for the interpreted view.

The Hexadecimal View

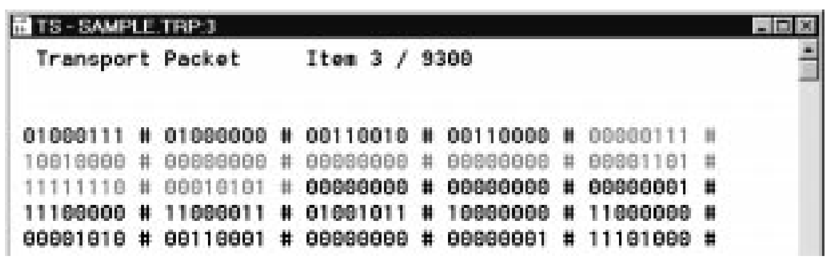
The hexadecimal view shows the contents of the current item on a byte-by-byte basis. The first few bytes appear in blue characters on the PC display to indicate that they are required header information for the type of item. A transport packet has four required bytes; a PES packet has six. The blue, required bytes may be followed by several bytes shown in gray. The “gray bytes” are optional or variable header information. The remaining bytes, displayed with black characters, are the payload or data bytes.

The hexadecimal view window shows the number of the displayed item, just like the interpreted view. When you use the command buttons to move among similar items in the stream, the hexadecimal view changes to display the contents of the current item.



The Binary View

The binary view displays the current item on a bit-by-bit basis. The same character color conventions used in the hexadecimal view apply to the binary view. The contents will also change when you use the command buttons to move among items in the stream.

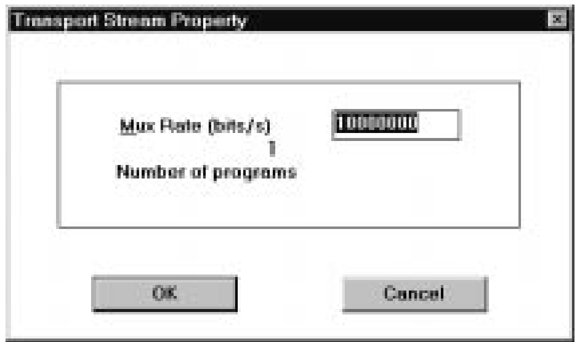


Multiplex Analyses

The Analyzer can provide valuable information about the way programs are multiplexed into the MPEG-2 transport stream through the Multiplex Characteristics command on the Analysis menu. The Multiplex Characteristics submenu has three commands: Rate, Multiplex Allocation, and PID Map.

Multiplex Rate

To calculate the multiplex rate of a transport stream, select the window that contains the hierarchic view and then either choose Rate from the Multiplex Characteristics submenu or type CTRL+R. The Transport Stream Property dialog box appears displaying the multiplex (mux) rate and the number of programs in the stream.

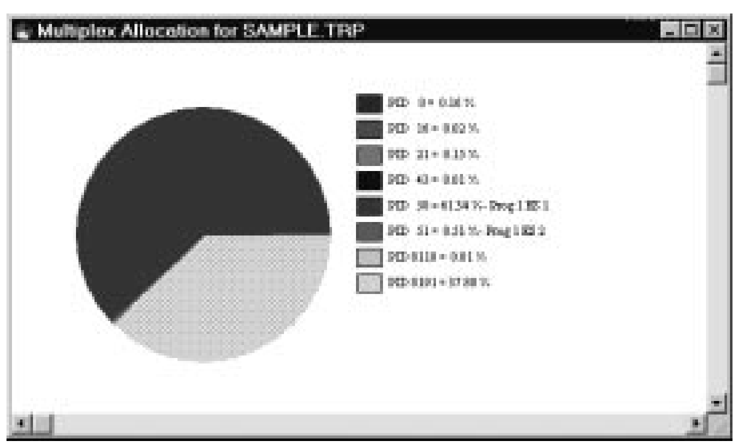


The analyzer calculates the multiplex rate from the first ten PCRs found in the transport stream. Because the sample is small and the precision of the number is high, there can be error in the calculation. To ensure maximum accuracy of analyses that use the multiplex rate to calculate results and detect errors, you can enter the actual multiplex rate (if you know it) in the dialog box.

For example, if the exact multiplex rate of a stream is 10 Mb/s instead of the reported 9,999,999 bits/s, enter 10000000 in the Mux Rate text box before clicking OK. This increases the accuracy of subsequent PCR, PTS/DTS, and Dynamic analyses, which use the multiplex rate in their calculations.

Allocation

Choose Multiplex Allocation from the Multiplex Characteristics submenu to see a pie chart of the transport stream that shows the stream fraction occupied by packets of each unique PID. The analyzer calculates the portion of the stream used by the various PIDs and creates a Multiplex Allocation window.

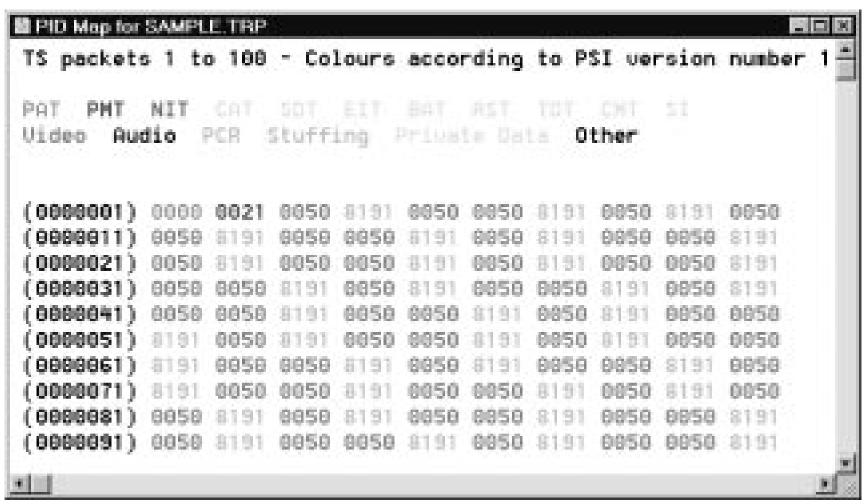


- The percentages shown in the graph key are calculated by dividing the actual number of transport packets of a given PID by the total number of packets in the transport stream file.
- All PIDs found in the transport stream are represented; those that are not referenced in a PAT or PMT will appear in the hierarchic view only after a consistency check (described under *Consistency Check* on page 3–26).
- PID 8191 is reserved for stuffing bytes; it is not shown in the hierarchic view.

PID Map

The PID map lists the PID of every transport packet in the stream. In the map, each packet is represented by its PID, and each unique PID is color-coded according to the type of element it identifies. For example, the PIDs of packets that contain data for video elementary streams are displayed in light blue characters.

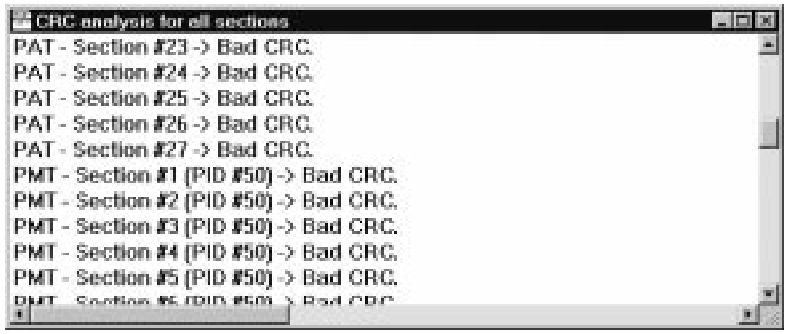
To open a PID map of transport stream file, select the hierarchic view and then choose PID Map from the Multiplex Characteristics submenu. A window containing a PID map of the first 100 packets appears in the application window. Use either the Edit menu commands or the command buttons in the lower toolbar to display the PID maps of other 100-packet portions of the stream.



Check CRC

Many MPEG-2 tables (such as the PAT, PMT, and SDT) have CRC (Cyclic Redundancy Code) fields. CRC field values are calculated from table data during encoding. The decoder performs another calculation from received data and compares the result to the field value in order to verify that the received data is correct.

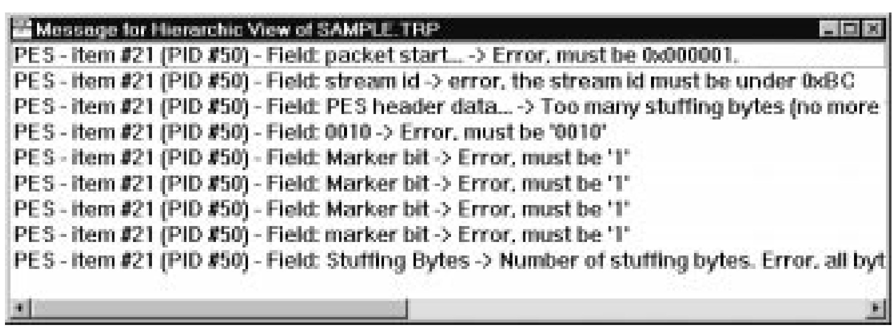
The analyzer automatically calculates and compares (checks) the CRC of the first PAT section when opening a transport stream file. To check all CRCs in a transport stream, select the stream's PSI hierarchic view and then choose the Check CRC command of the Analysis menu. If the analyzer finds CRC errors, it opens a message window. Each line of text in the window represents one CRC error.



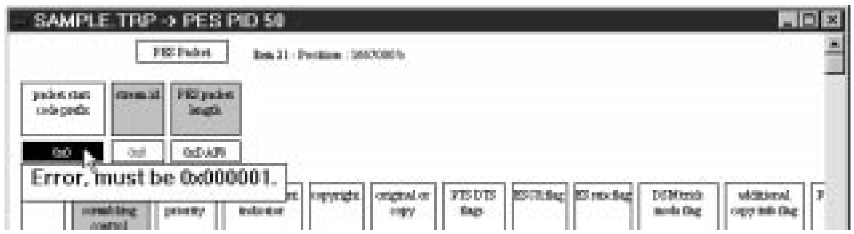
Double-click on a line to open an interpreted view of the table section that contains the particular CRC error. The CRC field value is displayed in red characters in the interpreted view to draw your attention to the error.

Syntax Analysis

To perform a syntax analysis of all elements in the transport stream file, select the hierarchic view and then choose Syntaxic from the Analysis menu. To analyze the syntax of one stream element, first open an interpreted view of the element (double-click on the icon in the hierarchic view) and then select Syntaxic from the Analysis menu. If the analyzer finds any errors, it opens a message window that lists all the errors found, one error per line of text.



Each line in the syntax analysis window represents one error. Double-click on the line to open an interpreted view of the item that contains the error. The erroneous field value(s) are displayed in red characters. Double-click on the value rectangle, as shown below, to confirm the error.



Consistency Check

The analyzer can check for consistency within both PSI (MPEG-2) and SI (DVB) hierarchies. To perform a consistency check, select the window containing the hierarchic view and then select Consistency Check from the Analysis menu.

***NOTE**. The analyzer automatically performs a PSI consistency check on the first 2000 valid transport packets when you first open a transport stream file. Errors can easily occur in later packets; always conduct a manual consistency check to be sure of discovering all consistency errors in the transport stream file.*

PSI Consistency Check

If the analyzer finds any consistency errors in a PSI hierarchy, it opens a window similar to the next illustration; each line of the window represents one error. Double-clicking on a line *does not* have an affect. However, the analyzer does redraw the hierarchic view after a consistency check to show errors with special icon symbols as listed in Table 3–4 and shown on page 3–27.

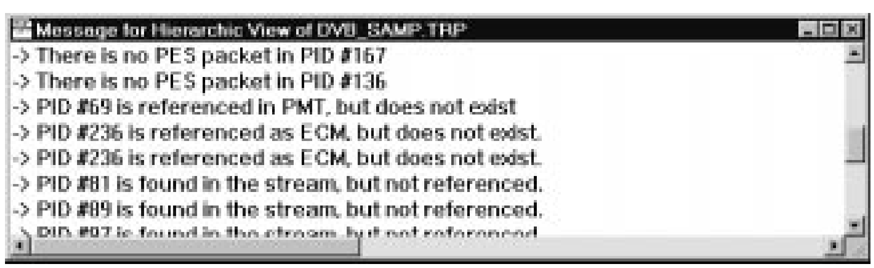
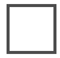
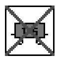
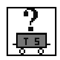
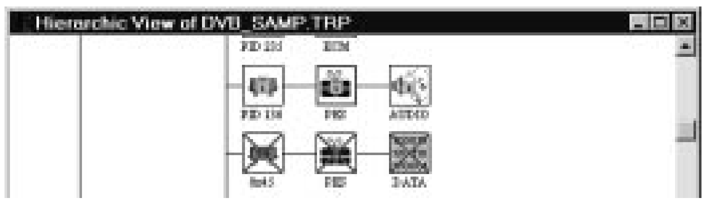
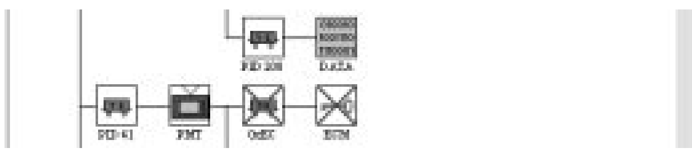


Table 3–4: PSI consistency error symbols

Symbol	Significance
	A red square (border) surrounding a base icon indicates that the data does not match the stream type declared in a PSI table.
	A red X over a base icon indicates that a specific PID, declared in a PSI table, cannot be found in the transport stream.
	The question mark is added to a TS icon when the transport packets have undefined PIDs or are not referenced by any PSI table. (Note that this is permissible in MPEG-2, but may indicate a PSI configuration problem.)



No PES packet in PID #136, and
PID #69 is referenced in PMT but does not exist (0x45=69)



PID #236 is referenced as ECM but does not exist (0xEC=236)

PID #81 is found in the stream, but not referenced (in the PAT or a PMT)

SI Consistency Check

If the analyzer finds any syntax errors in an SI hierarchy, it creates a message window that lists the errors. The SI consistency error messages use the abbreviations listed and defined in Table 3–5.

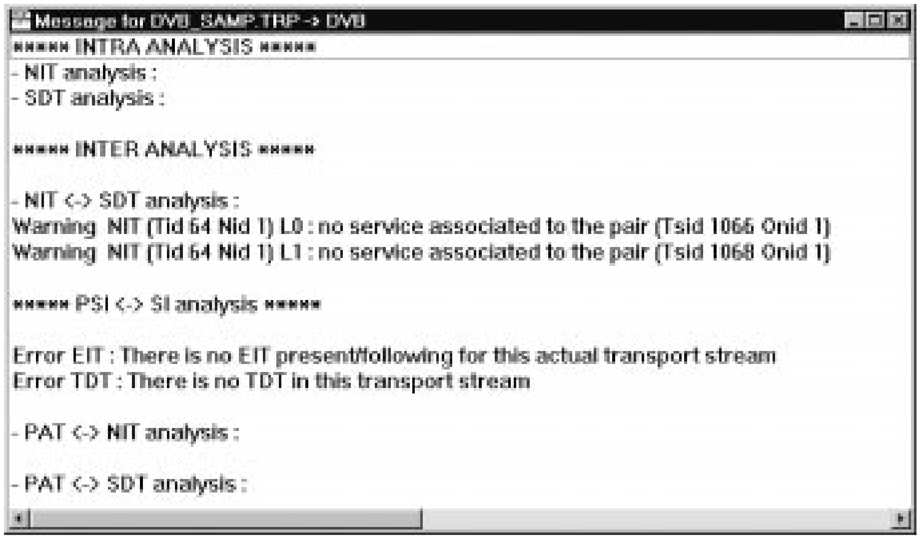
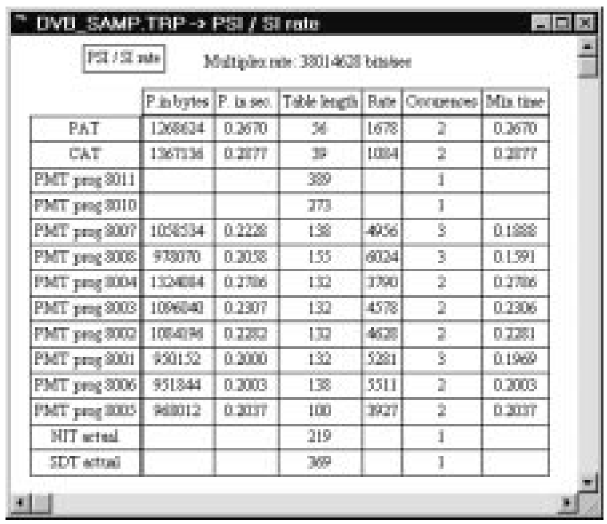


Table 3–5: SI consistency error abbreviations

Abbreviation	Meaning
S *n*	Section number *n* (software order)
L *n*	Loop number *n*
FDL	First descriptor loop
D *n*	Descriptor number *n* in the loop
Nid *n*	Network_id = *n*
Tid *n*	Table_id = *n*
Tsid *n*	Transport_stream_id = *n*
Sid *n*	Service_id = *n*
Onid *n*	Original_network_id = *n*
Eid *n*	Event_id = *n*
Bid *n*	Bouquet_ id = *n*
Pn *n*	Program number *n*
Sn *n*	Section number *n*
Vn *n*	Version number *n*

PSI/SI Rate Analysis

To perform a PSI/SI rate analysis of a transport stream, select the hierarchic view and then choose the PSI/SI Rate command from the Analysis menu. The analyzer opens a window that contains tabulated information about the various tables (PAT, PMT, NIT, SDT) in the transport stream and the frequency of their insertion into the stream. Table 3–6 explains the columns in the PSI/SI rate table. (Notice that the rate table refers to each PSI/SI table occurence as a "sub table.")



DVB_SAMP.TRP -> PSI / SI rate

PSI / SI rate   Multiplex rate: 38014628 bits/sec

	P. in bytes	P. in sec.	Table length	Rate	Occurences	Min time
PAT	1268624	0.2670	56	1678	2	0.2670
CAT	1267136	0.2077	39	1084	2	0.2077
PMT prog 3011			389		1	
PMT prog 3010			273		1	
PMT prog 3007	1058534	0.2228	138	4956	3	0.1888
PMT prog 3008	978070	0.2058	155	6024	3	0.1591
PMT prog 3004	1324084	0.2786	132	3790	2	0.2786
PMT prog 3003	1096040	0.2307	132	4578	2	0.2306
PMT prog 3002	1084196	0.2282	132	4628	2	0.2281
PMT prog 3001	950152	0.2000	132	5281	3	0.1969
PMT prog 3006	951844	0.2003	138	5511	2	0.2003
PMT prog 3005	968012	0.2037	100	3927	2	0.2037
NIT actual			219		1	
SDT actual			369		1	

Table 3–6: Information in the PSI/SI rate table

Column	Reports
P. in bytes	The average number of *bytes* from the start of one table occurrence in the transport stream to the start of the next occurrence
P. in sec.	The average time (period, in seconds) between consecutive table occurrences; (P. in bytes)*(8 bits per byte)/(multiplex rate)
Table length	Table size *in bytes*
Rate	The average subtable bits per second of transport stream; that is, the table length *in bits* divided by the average period.
Occurrences	The number of times the table occurs in the transport stream file
Min time	The shortest time (in seconds) between consecutive table occurrences

Keep the following in mind when interpreting the PSI/SI rate table:

- The times listed depend on the analyzer's calculation of the multiplex rate. It is good practice to check the multiplex rate before conducting a PSI/SI rate analysis and to correct the result if necessary. Refer to *Multiplex Rate*, on page 3–22, for more information.

- The PMT program numbers are not readily apparent from the hierarchical view. To discover the number of the program mapped by a particular PMT, double-click on the PMT icon; the program number is listed in the title of the interpreted view window. Program numbers are also listed in the interpreted view of the PAT.

Timing Analyses

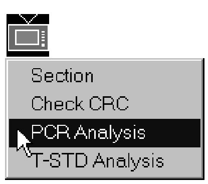
The MPEG-2 System Analyzer can conduct two types of timing analysis: PCR (program reference clock) and PTS/DTS (presentation/decode time stamps). The PCR “clocks” are encoded in transport stream packets and pertain to a given MPEG-2 program. The PTS/DTS are encoded into PES packets and pertain to that elementary stream only.

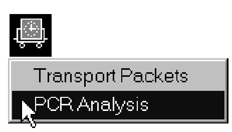
PCR Analysis

PCR analysis can be broken into three distinct tasks or capabilities:

- You can view a graphic diagram of the PCR clocks of each program in the stream.
- You can learn more about each PCR clock.
- You can search for errors in the clocks of one program or all of the programs in the transport stream.

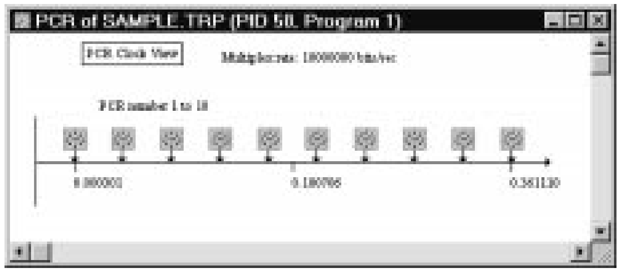
Viewing a PCR graphic diagram. To see a graphic diagram of the PCRs in a specific program, use the *right* mouse button to click on the PMT or TS (with PCR) icon and open the shortcut menu. Hold the button down and highlight the PCR Analysis command—as shown below—and then release the button to begin the analysis.





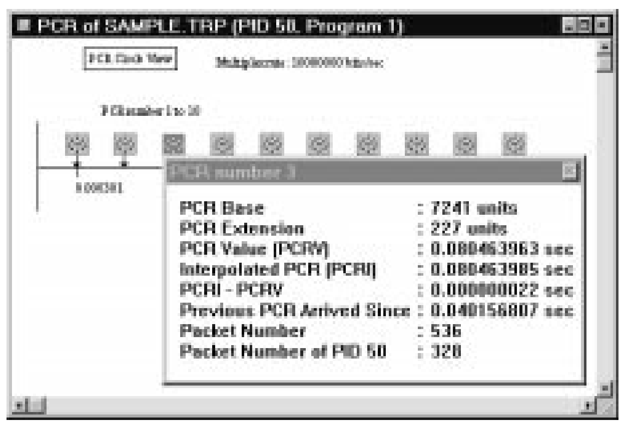
(You can also begin PCR analysis by choosing PCR from the Analysis menu. A dialog box will appear. Enter the number of the program you wish to analyze and click on OK.)

The analyzer opens a PCR graphic view window. Typically, the first view contains the ten clocks found first in the transport packets of the selected program. Each clock face icon represents one PCR clock. The arrow leading down from the clock icon to the time line is normally black; it is red (on the PC display) when analysis has detected a clock timing error.



Use either the commands in the Edit menu or the command buttons on the lower toolbar to view the remaining clocks (of the selected program) in the transport stream.

Listing PCR values. Double-click on a clock icon to list detailed information about the clock.



- Interpolated PCR (PCRI). The analyzer calculates Interpolated PCR (PCRI) from the previous PCR value, the number of intervening bits, and the multiplex rate. If either the previous PCR or the multiplex rate is incorrect, the PCRI is also invalid. An invalid PCRI can cause a false PCRI-PCRV error.

  If a PCR analysis results in many PCRI-PCRV errors, check the multiplex rate as described on page 3–22. In the case of an isolated PCRI-PCRV error, always check the previous PCR for accuracy.

- Previous PCR Arrived Since. Previous PCR Arrived Since is the time elapsed since the previous PCR of the same program. Any value over 0.1 second is an error and is displayed in red characters.

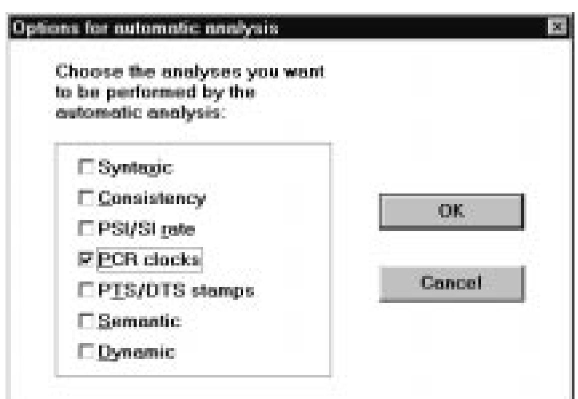
- Packet Number. The packet number identifies the transport packet that contains the PCR. To display an interpreted view of the packet, double click on the TS (engine and tender) icon in the hierarchic view to open an interpreted view of the first transport packet, and then use the Edit menu or lower toolbar buttons to go to the packet that has the same item number as the PCR packet number.
- Packet Number of PID *n*. Packet Number of PID *n* identifies the packet that contains the PCR relative to all packets that have the same program ID. To display an interpreted view of the packet, double click on the PID *n* PCR (freight car with clock) icon to open an interpreted view of the PID *n* packets, and then go to the packet with the same item number.

To list the values for all PCRs shown in the graphic view window, either choose Add view from the Window menu or click on the add view command button in the upper toolbar. Then choose PCR Values from the View Type submenu.

Searching for PCR errors. As mentioned earlier, PCR errors are indicated by red arrows in the graphic view. The erroneous information will also appear in red characters on the PCR value lists. One way to search for PCR errors is to open a PCR graphic view and then click the next error command button on the lower toolbar.

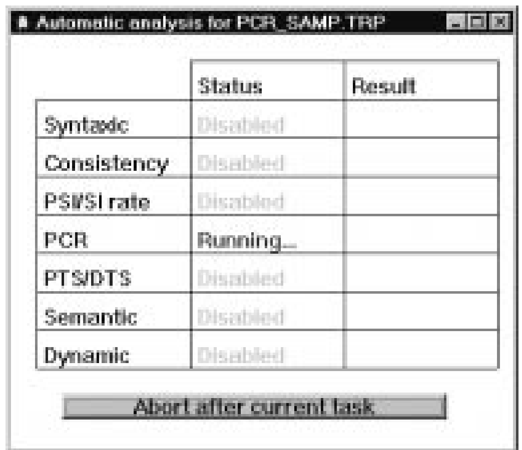
Another, better way to search for all PCR errors in the entire transport stream file is to use Automatic analysis. Automatic analysis is explained in detail beginning on page 3–44; follow this procedure to search for PCR errors only:

1. Choose Automatic analysis from the Options menu. An automatic analysis options dialog box appears in the analyzer application window.
2. Clear all check boxes except the one corresponding to PCR clocks. Then click on OK.



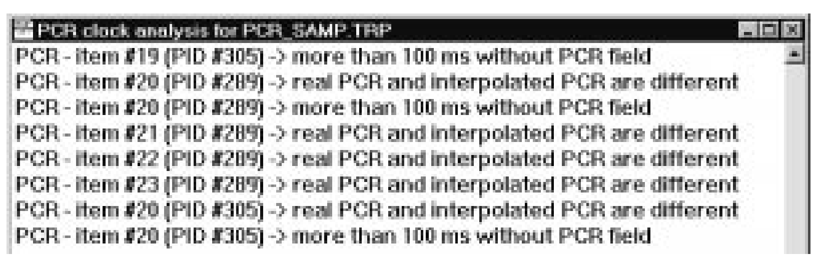
3. Select the PSI hierarchic view of the stream you wish to check for PCR errors.

4. Choose Automatic from the Analysis menu. An automatic analysis status window appears to show the progress of the PCR analysis.



5. When the analysis is complete, either OK (black characters) or Errors (red characters) will appear in the PCR result cell.

6. If errors are reported in the PCR result cell, double-click on the cell. A window containing a list of errors appears. Each line of the list represents one PCR error.



7. Double-click on a line to create a PCR graphic view that contains the erroneous clock. Double-click on the clock icon to create a window that lists the PCR values.

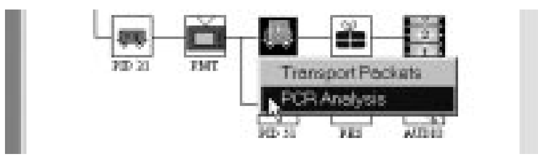
PTS/DTS Analysis

PTS/DTS analysis extracts the presentation and decode time stamps from PES packets encoded in the transport stream and shows those time stamps in a graphical format. The PTS/DTS timing diagram, like the PCR clock diagram, provides access to numerical data about the time stamps; it also offers information about the associated MPEG-2 access units.

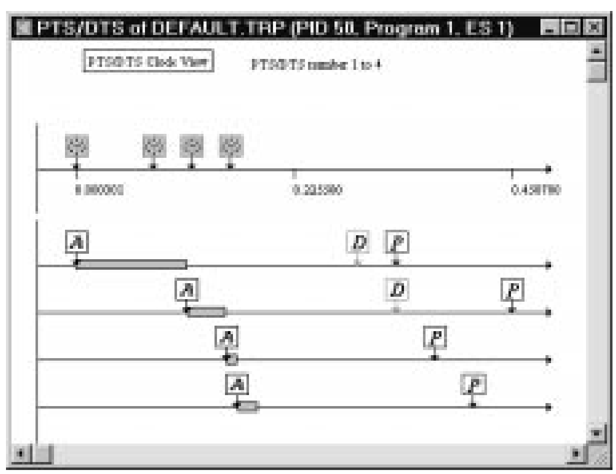
PTS/DTS analysis also enables viewing the “vital statistics” (numerical data) of various timing objects and searching for PTS/DTS errors in one elementary stream or all elementary streams in the file.

Viewing a PTS/DTS timing diagram.

1. *Right*-click on the PES icon associated with the stream you want to analyze. Hold the mouse button down and highlight PTS/DTS on the shortcut menu.

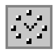


2. Release the button. A PTS/DTS timing diagram window appears, showing the first four PTS/DTS “events” and the closest PCRs. Table 3–7 explains the icons used and lists the information you can display by double-clicking on each icon.



***NOTE**. You can also begin PTS/DTS analysis by choosing PTS/DTS from the Analysis menu. A dialog box will appear. Enter the numbers of the program and stream you wish to analyze and then click OK.*

Table 3–7: PTS/DTS graphic view icons

Icon	Represents	Double-click for
	PCR (program clock reference)	Value Location in transport stream (TS packet number)
A	Arrival time of the PTS/DTS	Value Time since the previous PTS/DTS arrived Location in elementary stream (PES packet number)
D	DTS (decode time stamp)	Value Location in elementary stream (PES packet number)
P	PTS (presentation time stamp)	Value Location in elementary stream (PES packet number)
	AU (access unit)	Begin time End time Size in bytes Type of frame (intra, predicted, or bidirection) Reference time

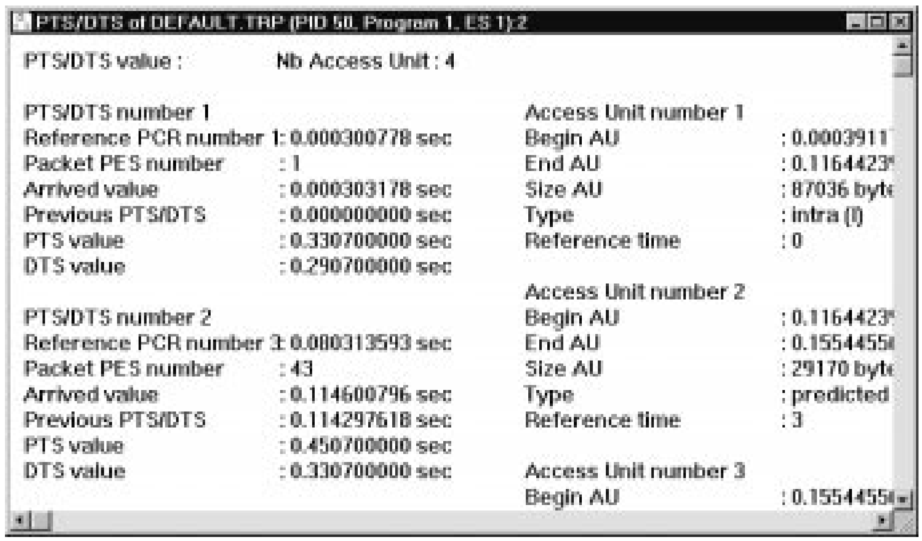
The arrows leading down from the A, D, and P icons to the time line are normally black; they are red (on the PC display) when an error is associated with the object. Red characters also highlight errors in the PTS/DTS value windows that appear when you double-click on an icon.

The example timing diagram illustrates several features of a correctly encoded MPEG-2 video stream:

- Access units arrive one after another, as you can see from the left (“early”) side of the diagram.
- The order of access unit decoding and presentation is visible in the right (later) portion of the diagram.
- Intra (I) and predicted (P) pictures must be decoded before presentation and therefore have both DTS and PTS. B (bidirection) frames are decoded and presented at the same time and therefore have only presentation time stamps.
- B frames use information in an associated P frame; the P frame must be decoded before the B frame(s), but is presented after. In the example, then, the order of frame decoding is IPBB, but the order of presentation is IBBP.

3. Use the Edit menu commands or the command buttons on the lower toolbar to view diagrams of other time stamps—and search for time stamp errors—in the same elementary stream.

4. To view the data for all time stamps and access units at once, choose Add view from the Window menu or click on the Add view command button. Then choose PTS/DTS values from the View type submenu. The resulting window lists information about the displayed time stamps in the left column and information about the access units on the right. The number of access units in the display appears after “Nb Access Unit:” at the top of the window. Incorrect values (such as equal PTS and DTS values, or an arrived value that is later than either the PTS or DTS) are displayed in red characters.



Searching for PTS/DTS errors. As mentioned earlier, one way to search for PTS/DTS errors is to open a graphic view and look for red arrows leading from A, P, and D icons to the time line. If no errors are present, click on the Next error command button (on the lower toolbar) to search for errors later in the elementary stream.

Another, better way to check the entire transport stream file for PTS/DTS errors is to use Automatic analysis. Automatic analysis is explained in detail beginning on page 3–44; follow this procedure to search for PTS/DTS errors only:

1. Choose Automatic analysis from the Options menu. An Options dialog box appears in the analyzer application window.

2. Clear all check boxes except the one corresponding to PTS/DTS stamps. Then click on OK.

3. Select the PSI hierarchic view of the stream you wish to check for errors.

4. Choose Automatic from the Analysis menu. An automatic analysis status window (as shown on page 3–33) appears. When the analysis is complete, either OK (black characters) or Errors (red characters) will appear in the PTS/DTS result cell.

5. If the PTS/DTS result cell reports errors, double-click on the cell. A window containing a list of errors appears. Each line of the list identifies an incorrect time stamp and describes the error.

6. Double-click on a listed error to create a PTS/DTS graphic view that contains the erroneous time stamp. A red arrow leading from an icon to the time line indicates an error. Double-click on the icon that represents the incorrect time stamp to create a value window for the stamp.

Semantic Analysis

Perform the following steps to conduct a Semantic analysis of an MPEG-2 transport stream:

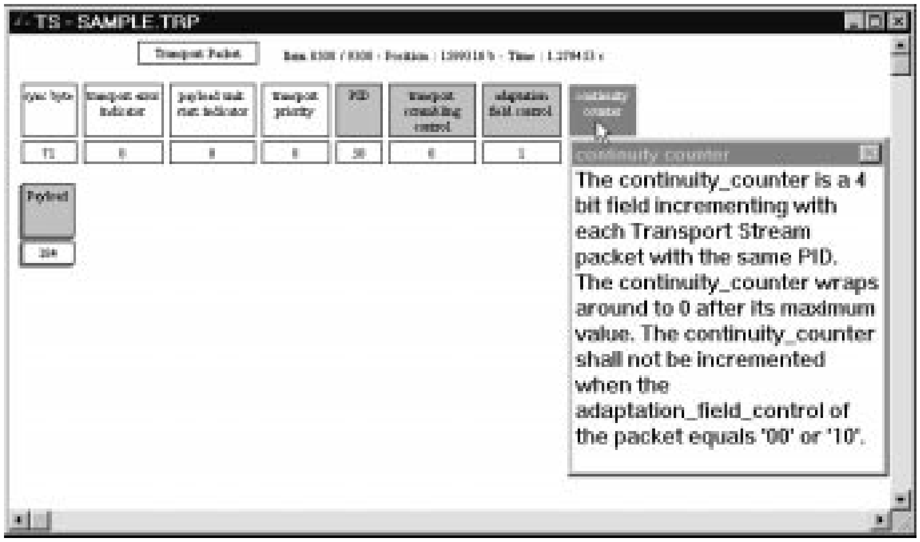
1. Select the PSI hierarchic view of the stream you wish to analyze.

2. Choose Semantic from the Analysis menu. If the analyzer finds any errors, a message window, containing a list of the errors, appears.

3. Double click on a list entry to create an interpreted view of the item that contains the error.

***NOTE**. The error description in the message window identifies the item and field containing the error. The analyzer does not identify semantic errors with red characters or special symbols in the interpreted view.*

4. For more information about the erroneous field, double-click on the name of the field that contains the error.



Dynamic Analysis

The analyzer can conduct three types of dynamic analysis.

- T-STD, which checks the selected program against the (transport stream target) decoder model that is defined in the MPEG-2 standard.
- LTW (legal time window) offset, which checks the validity of the optional LTW offset and piecewise rate adaptation fields of the transport packets.
- Smoothing buffer simulation

Visual Mode

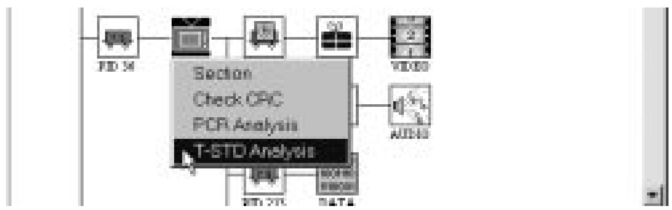
Both T-STD and LTW analysis have a visual mode that you can toggle on and off by selecting Visual TSTD and LTW in the Options menu. Visual mode graphically represents the contents of the various decoder buffers, shows the progress of the analysis, and provides a way to abort the process; it does, however, increase the time required for the analyses. Visual mode selection does not affect how the analyzer reports errors. Toggle visual mode on or off before you begin a T-STD or LTW analysis.

T-STD Analysis

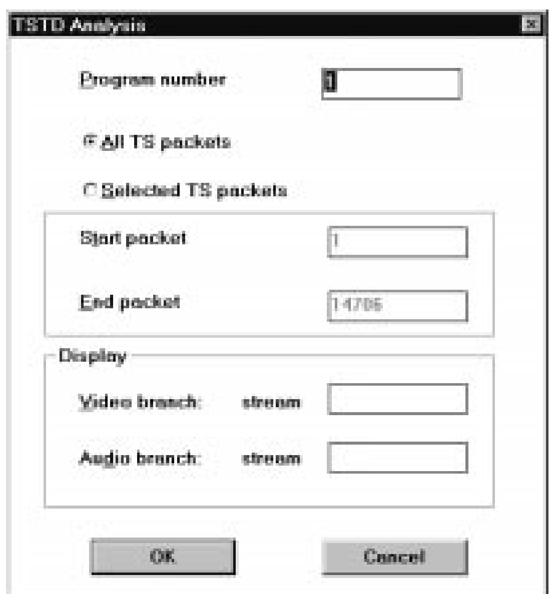
The MPEG-2 System Analyzer can perform T-STD analysis either on a selected program in the current transport stream or on all programs in the stream.

Analyzing a Selected Program. There are two ways to begin analysis of a single program:

- Click on the appropriate PMT icon with the *right* mouse button; then choose T-STD Analysis from the shortcut menu. The analyzer checks all video and audio streams in the program, and, if visual mode is selected, creates a buffering simulation window, as shown on page 3–40. The graphic simulation shows the buffer use of the first video stream and the first audio stream listed in the PMT.



- With a hierarchic view selected, choose T-STD from the Dynamic submenu of the Analysis menu. A dialog box appears.

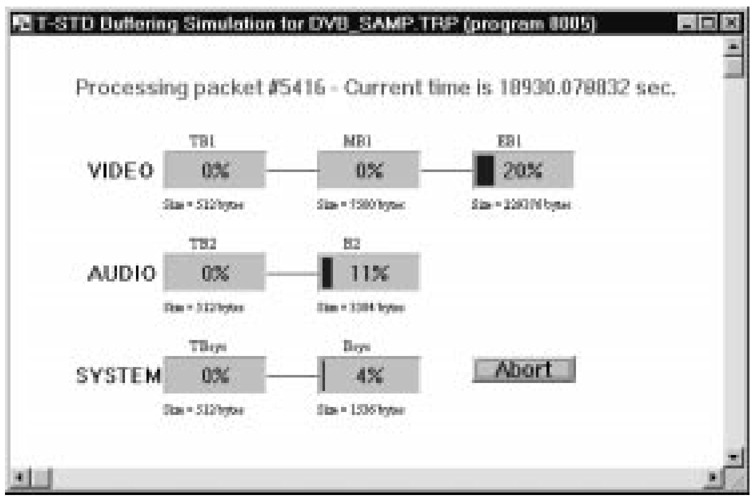


You must enter the program you wish to analyze. The program number in this dialog box refers to the order that the particular program is listed in the hierarchic view.

To limit the portion of the stream to be analyzed, click the “Selected TS packets” option button and enter the starting and ending packet numbers.

The analyzer checks all elementary streams in the selected program but, by default, shows a graphic presentation of only the first video and the first audio elementary streams listed in PMT and hierarchic view. If you wish to see how a different stream uses the buffers, enter the stream number according to the order the stream is listed among the video and audio streams in the program.

When you have entered all the appropriate information, click OK. If you have selected visual mode, a Buffering Simulation window appears.



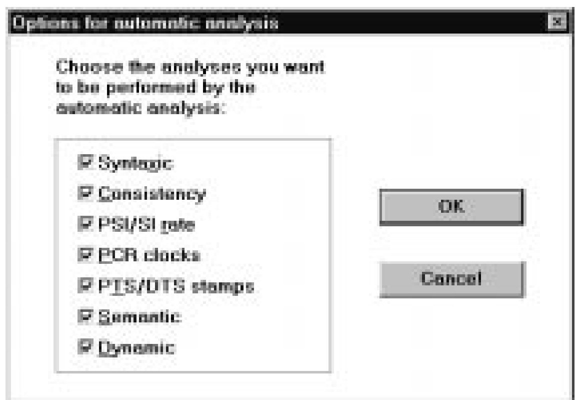
The Buffering Simulation window has the following features:

- A counter that shows the current packet number
- A display of the current PCR time
- Dynamic bar graphs of the three video branch buffers. If the program has no video elementary stream, “***unused***” appears under each bar (instead of size information). The buffer bars change colors to indicate the usage: blue = normal; yellow = filling up; orange = close to overflow; and red = buffer full.
- Dynamic bar graphs of the three audio branch buffers that use the same usage and color conventions as the video branch buffers.
- Dynamic bar graphs of the two system buffers that also use the same usage and color conventions as the video branch buffers.
- An Abort button that permits you to pause or end the simulation before the end of the stream.

T-STD analysis can take several minutes, depending on the size of the transport stream file. If the analyzer encounters buffer overflow or underflow errors, it creates a message window and lists the errors. At the end of analysis, all activity in the Buffer Simulation window stops; if you are not using visual mode, the analyzer presents an “End of simulation” dialog box.

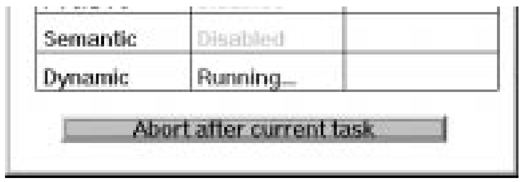
Analyzing all Programs in the Stream. You can use Automatic analysis to check the entire stream at once for T-STD buffering errors. Automatic analysis is explained in detail beginning on page 3–44; follow this procedure to search for T-STD errors only:

1. Choose Automatic analysis from the Options menu. The automatic analysis options dialog box appears in the analyzer application window.



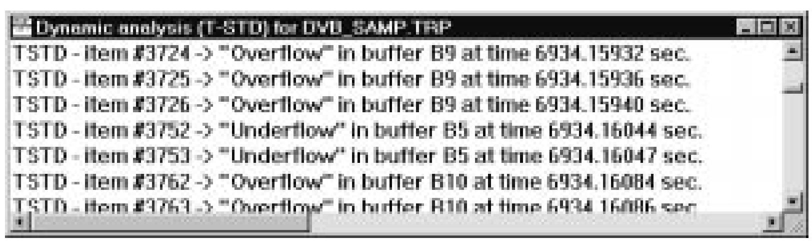
2. Select the Dynamic check box and clear all others. Then click OK.
3. Select the PSI hierarchic view of the stream you wish to check for T-STD errors.
4. Choose Automatic from the Analysis menu. An automatic analysis progress/results window appears. A Buffering Simulation window *will not* appear, even if Visual TSTD and LTW is selected in the Options menu.

T-STD analysis of an entire stream can take *many* minutes, depending on the size of the file. The only way to stop an automatic dynamic analysis is to type CTRL+ALT+DEL and use the Windows NT End Task command to quit the analyzer application completely.



When analysis is complete, either OK (black characters) or Errors (red characters) appears in the Dynamic result cell.

5. If the analyzer has found errors, double-click in the results cell to create a message window that lists all errors, one per line.



6. To identify the program that contains an error, double-click the corresponding line in the message window. An interpreted view of the transport stream packet appears. Note the PID and then look in the PSI hierarchic view to find the stream associated with that PID.

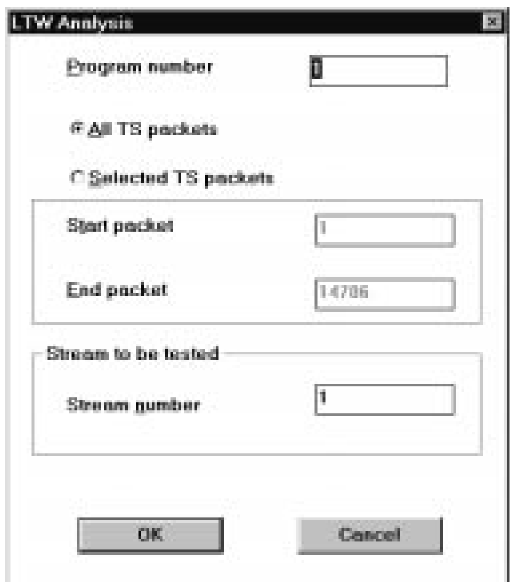
T-STD Notes.

- Overflow at the beginning of the simulation may not indicate encoder problems, as the analyzer must wait for the first DTS in the stream before emptying the EB and B buffers. Buffer overflow after the first DTS, however, indicates improper encoding.
- T-STD errors can arise from several different sources, including PCR errors, PTS/DTS errors, and multiplexing errors. PCR analysis, PTS/DTS analysis, and analysis of the Multiplex Characteristics may help locate the problem.

- Remember that although the error message window lists the last packet that results in buffer overflow or underflow, the cause of the error is probably earlier in the stream.

LTW Analysis

LTW analysis checks the validity of the optional LTW offset and piecewise rate adaptation fields of the transport packets that contain the selected stream. The analyzer does this by remultiplexing the packets to place each at the end of its legal time window and then performing a standard T-STD analysis on the resulting transport stream. To begin LTW analysis, choose LTW from the Dynamic submenu of the Analysis menu. A dialog box, similar to the one for T-STD analysis, appears.



To analyze the stream listed fourth under the program listed third in the hierarchic view, enter 3 in the Program number box and 4 in the Stream number box. To limit the portion of the stream to be analyzed, click the “Selected TS packets” option button and enter the starting and ending packet numbers.

When you have entered all appropriate values, click OK. If you have selected Visual TSTD and LTW from the Options menu, a graphic window identical to the T-STD Buffering Simulation window (shown on page 3–40) appears. However, because only one stream is analyzed at a time, only the video or audio branch buffers (depending on the type of stream) are used.

***NOTE**. If the packets of the selected stream do not contain LTW offset fields, the analyzer conducts a normal T-STD analysis of the stream.*

LTW analysis can take several minutes, depending on the size of the transport stream file. If the analyzer encounters buffer overflow or underflow errors, it creates a message window and lists the errors. At the end of analysis, all activity in the Buffer Simulation window stops; if you are not using visual mode, the analyzer presents an "End of simulation" dialog box.

Smoothing Buffer

This analysis simulates a smoothing buffer using the values in the smoothing buffer descriptor field that is optional in PMTs.

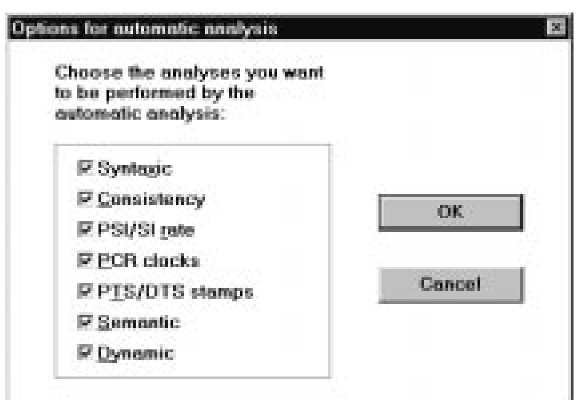
To begin smoothing buffer analysis, select the hierarchic view and then choose Smoothing Buffer in the Dynamic submenu of the Analysis menu. If the analyzer detects any overflow or underflow errors, it creates a message window and lists the errors. There is no graphic representation of smoothing buffer analysis.

Automatic Analysis

Automatic analysis makes it possible to conduct a sequence of analyses on an entire transport stream file with one click of the mouse button. It provides a convenient way to screen a newly captured transport stream for a wide variety of errors. As explained in the discussions of PCR analysis (page 3–32), PTS/DTS analysis (page 3–36), and T-STD dynamic analysis (page 3–41), Automatic analysis can be especially helpful in performing a search for errors in the entire transport stream/multiplex, as opposed to the narrow searches of a single program or stream conducted by initiating the same single analysis through the Analysis menu.

Conduct an automatic analysis with the following steps:

1. Choose Automatic analysis from the Options menu. The following dialog box appears.



2. By default, automatic analysis includes all the listed tests. Automatic analysis takes several seconds to many minutes, depending on the size and complexity of the file, speed of your computer, and the number and type of analyses selected through this dialog box. Dynamic analysis, the last selection in the dialog box, takes much longer than all other tests combined. Be sure you want to check all elementary streams in the transport stream multiplex for compatibility with standard decoder buffers before selecting the Dynamic check box. You may find it more convenient to select all analyses but Dynamic for the first look at a transport stream and later go back and select only Dynamic when you are ready to confirm decoder compatibility.

***NOTE**. The MPEG-2 System Analyzer can conduct three kinds of Dynamic analysis: T-STD (transport stream target decoder), LTW (legal time window), and Smoothing Buffer. Automatic analysis includes only T-STD analysis; the remaining dynamic analyses must be performed manually. Refer to* Dynamic Analyses*, on page 3–38, for more information.*

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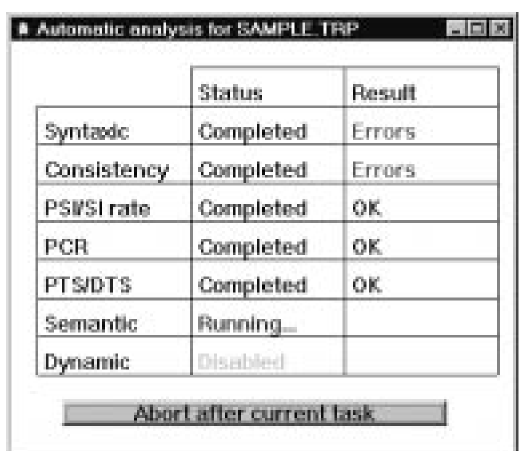
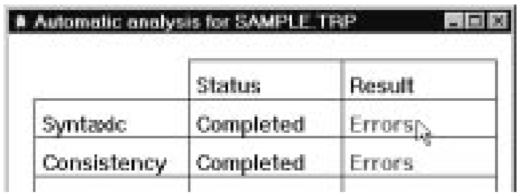
3. Choose OK to confirm the selections and close the dialog box.

4. Choose Automatic from the Analysis menu. A window containing an analysis status and results table appears. As the analyses proceed, cells in the Status column change from blank to Running to Completed. As each test is completed, either OK (black characters) or Errors (in red characters) appears in the corresponding Result cell, depending on the results of the individual analysis.

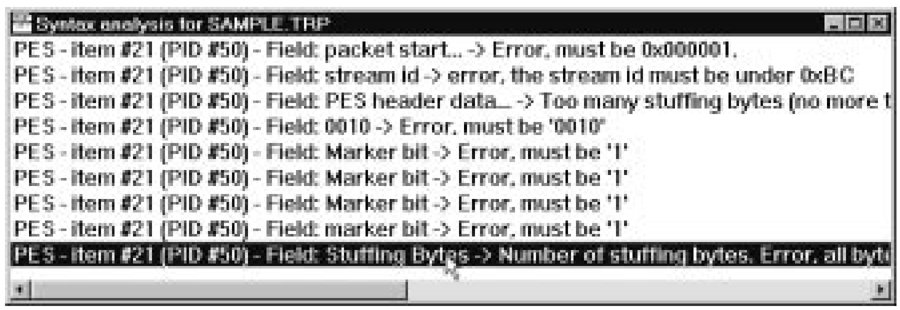


If you wish to end the analysis at any time, click on Abort after current task, at the bottom of the window.

5. When all analyses are complete, the Automatic analysis window provides access to detailed information about each detected error. For a list of the syntactic errors in SAMPLE.TRP, for example, double-click in the Syntaxic Result cell.



A window that lists the errors appears in the Analyzer application window.



6. Double-clicking on a listed syntax, PCR, PTS/DTS, semantic, or Dynamic error leads to still more information about the error. The type of display and information available is the same as when the individual analysis is conducted manually (by selecting it from the Analysis menu). Double-clicking on a syntax error, for example, creates an interpreted view of the section (in this case, a PES packet) that contains the error. Red field value characters indicate syntax errors.

Filters

The MPEG-2 System Analyzer filtering capability enables finding and viewing transport stream packets, PES packets, and PSI/SI table sections that meet one or more criteria of your choosing. For example, you can create filters to find and display the following stream objects:

- Transport packets that contain the first bytes of all PES packets of a given elementary stream (as indicated by the presence in the payload of hexadecimal string 00 00 01).
- Transport packets of a given PID in which the payload unit start indicator is set to one.

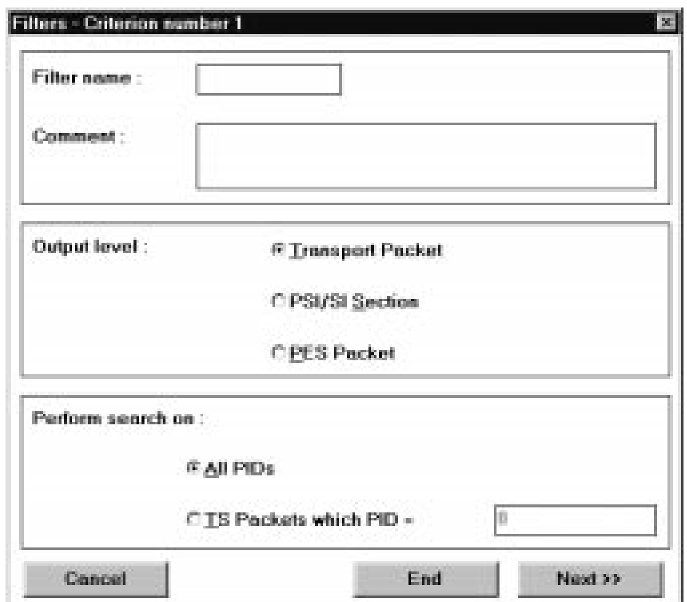
- PSI/SI (table) sections of a given PID that contain a descriptor tag with a value of 64.
- PES packets of a given PID that lack both PTS and DTS (PTS/DTS flag set to zero).

In defining a filter, you first specify the output level (transport packets, table sections, or PES packets) and, if necessary, the PID. Then you enter up to three more filtering criteria. When applied, the filter will look for packets or sections that meet all criteria and open an interpreted view of the first item found.

Once a filter is created, you can save it to its own (.flt) file for use in later analyzer sessions. You can also edit existing filters and save them under a new name. You can save an unlimited number of filters and have up to five open at any time, ready to apply to the current transport stream.

Defining a Filter

1. Choose Filters from the Selection menu; then choose New from the Filters submenu. The first filter definition dialog box appears.



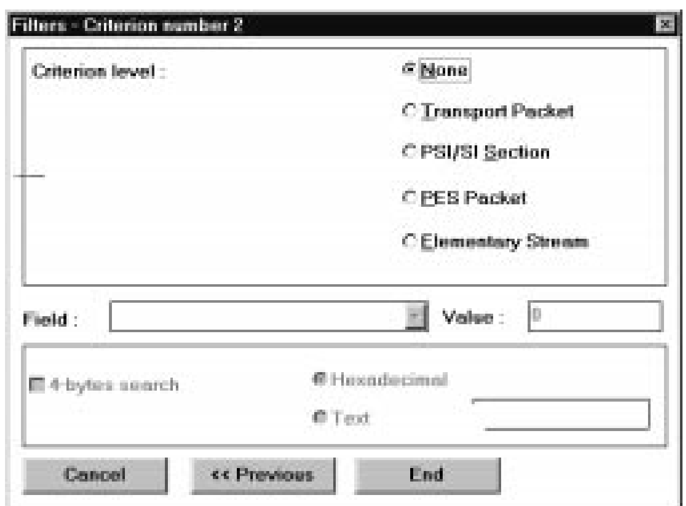
2. Enter the appropriate information and select options as necessary.
   - The filter name can be up to eight characters long. By default, the name you enter is proposed as the file name when you save the filter.
   - The comment field can contain up to 255 characters. Enter a description that will help you identify the filter and its function when you later open, edit, or apply it.

- Output level is the type of object that you want to find. The filter result is an interpreted view representing the packets or sections that meet the filter (search) criteria.
- Enter the PID of the packets you wish to filter; you can select All PIDs only if you have specified transport packet output.

Your selections in this dialog box fill in the blanks in the statement "I want to find the [blank_1] items that are identified with [blank_2]..." where blank_1 is the output level and blank_2 is either "any PID" or PID *n*.

The remaining filter definition steps let you add "...and that [satisfies another criterion] and [satisfies a third criterion] and [satisfies a fourth criterion]." Strictly speaking, none of these additions is necessary, but a filter without at least one extra criterion would do no more than you could by double-clicking on a hierarchic view icon. The third and fourth filter criteria are optional but may help you narrow your search to exactly the packet or section you are interested in.

3. Click the Next button. The second filter definition dialog box appears.



4. Use this dialog box to fill the blanks in one of the two following statements:

- Each item I am looking for must be—or contain the part of—a [blank_3] that has a [blank_4] field with the value [blank_5].
- Each item I am looking for must be—or contain the part of—a [blank_3] that contains the byte sequence [blank_6].

Where blank_3 is the Criterion level, blank_4 is a selection from the Field drop-down list box, blank_5 is a number entered in the (field) Value box, and blank_6 is a hexadecimal or text value entered into the last value box when the “4 bytes search” check box is selected.

For example, you can make selections to complete the above statements in the following ways:

- Each item I am looking for must be a *PES packet* that has a *PTS/DTS flag* field with the value *3*.
- Each item I am looking for must contain the part of a *PES packet* that contains the byte sequence *00 00 01*.
- Each item I am looking for must be a *transport packet* that contains the byte sequence *00 00 01 C0*.

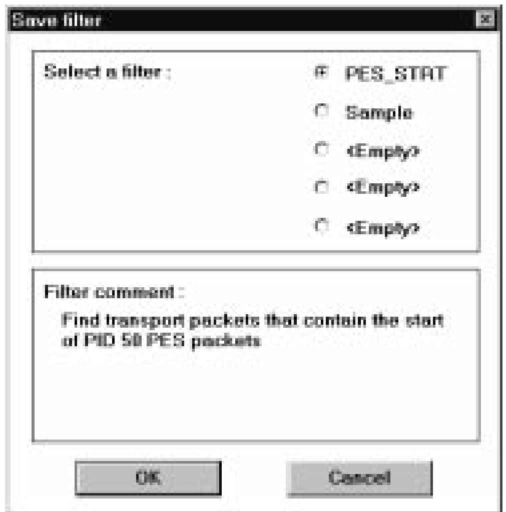
It may help to be aware of several conventions that apply to this dialog box:

- Some criterion levels may not be available, depending on the output level specified in the first filter definition dialog box.
- The fields listed in the Field: drop-down list box depend on the criterion level selection.
- The Next button disappears when you select the Elementary Stream criterion level or the 4-bytes search check box because the filter cannot be any more specific than these selections.
- Selecting the Elementary Stream criterion gives you no further options; the Field drop-down list contains only Beginning of Access Unit (AU), and 4-bytes search is not available. Use Elementary Stream criterion to find either transport stream packets that contain the start of an AU or PES packets that contain the start of an AU.

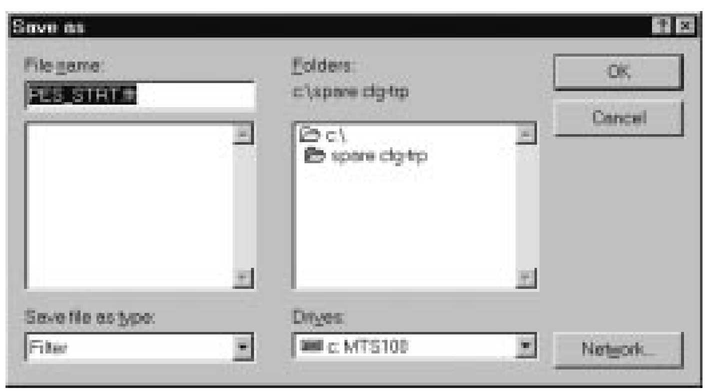
5. Click Next >> to define up to two more filter criteria; click << Previous to return to the first filter definition dialog box; or click End to conclude filter definition.

Saving a Filter

Once a filter is defined, you can save it to a file for use in later analyzer sessions. Choose Save from the Filters submenu (of the Selection menu). A dialog box showing all currently loaded filters appears. Select the option button that corresponds to the filter you wish to save; then click OK.



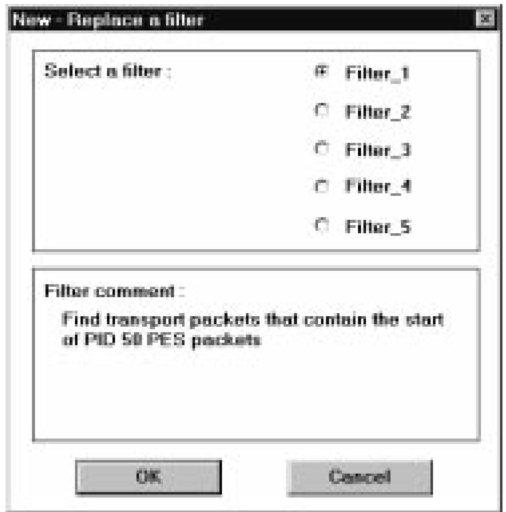
A standard Windows Save As dialog box appears. The filter name (with a .flt extension) is in the File Name box. Click OK to accept the file name and save the filter file; enter a different name and then click OK to save the file under a different name.



Opening a Filter

To open a previously saved filter, select Open from the Selection/Filters submenu. If no more than four filters are already loaded, the standard Windows Open dialog box appears. Select and open the filter as you would any document from within any Windows application.

If five filters are already loaded, the dialog box showing all currently loaded filters appears. Select a filter to be replaced by the filter you are opening and then click OK. The Windows Open dialog box now appears.



Editing a Filter

Follow these steps to edit an existing, open filter:

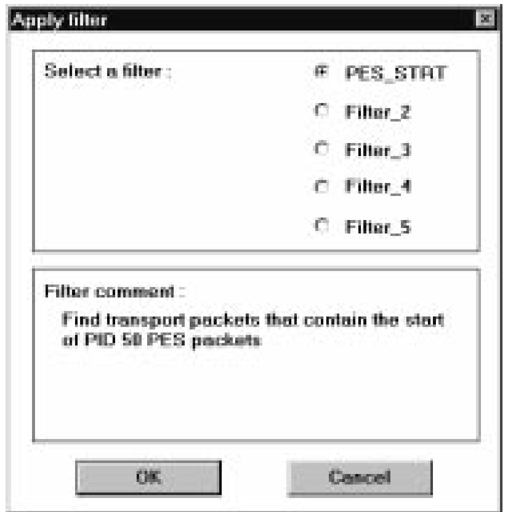
1. Select Edit from the Selection/Filters submenu. The filter list dialog box appears.
2. Select a filter and then click OK. The first filter definition box, with current filter selections and settings, appears.
3. Proceed as if you were creating a new filter (see page 3–47), changing existing selections and making new ones as necessary. When you are done, click End.

If you change the name of the filter in the course of editing it, the new name will appear in place of the original name in the filter list dialog box. Note that the saved filter file is not affected. You may save the edited filter as described under *Saving a Filter.* Use the original name if you wish to overwrite the old .flt file; enter a new name if you don't.

Applying a Filter

1. Open an existing filter, or create a new one.
2. Select the hierarchic view or a transport packet (interpreted) view of the transport stream.

3. Choose Apply from the Selection/Filters submenu. The filter selection dialog box appears.



4. Select the option button that corresponds to a named filter. The comment field applies to the selected filter.

5. Click OK. The analyzer displays an interpreted view of the first packet or section (if any) that satisfies all filter criteria. Use the lower toolbar command buttons to move among all items in the stream that meet the criteria. Notice that window heading reminds you that this is a filtered view and that messages at the top of the window provide useful information about the items found.

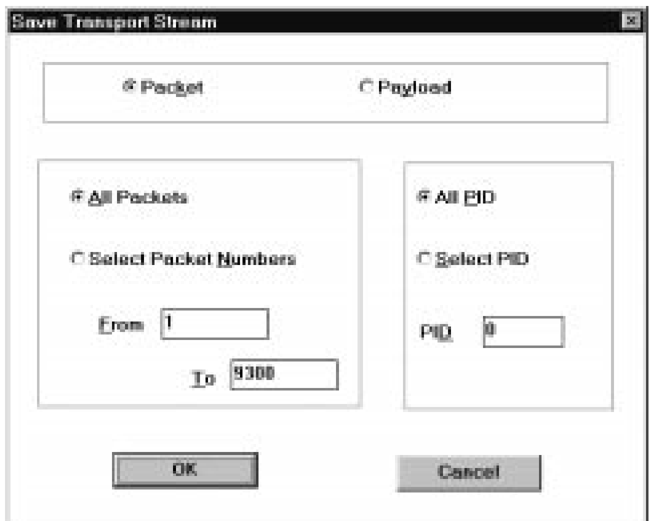
If the analyzer finds no item that satisfies all filter criteria, it says so.

Extracting and Saving Stream Elements

The analyzer allows you to extract transport packets, PES packets, PSI and SI tables, and elementary streams from the from the current transport stream and save them to disk files for later use or analysis.

Transport Packets

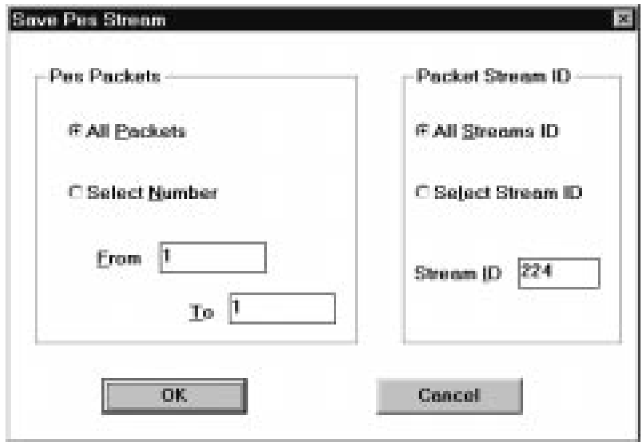
To save a portion of a transport stream, double-click on a hierarchic view TS (engine and tender or freight car) icon to open an interpreted view of the transport packets. Then choose Save As from the File menu or click the Save command button on the upper toolbar. A dialog box appears.



Make the appropriate selections and click OK. A standard Windows Save as dialog box opens, with the file type set to Transport Stream (.trp). Select the appropriate drive and directory, enter a file name, and click OK.

PES Packets

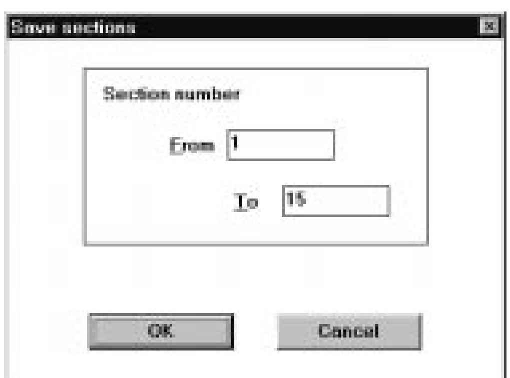
To save some or all of the packets in a PES stream, open an interpreted view of the PES packets and choose Save As from the File menu or click the Save command button. A dialog box appears.



Make the appropriate selections and click OK. A standard Windows Save as dialog box opens, with the file type set to Pes Stream (.pes). Select the appropriate drive and directory, enter a file name, and click OK.

PSI and SI Tables

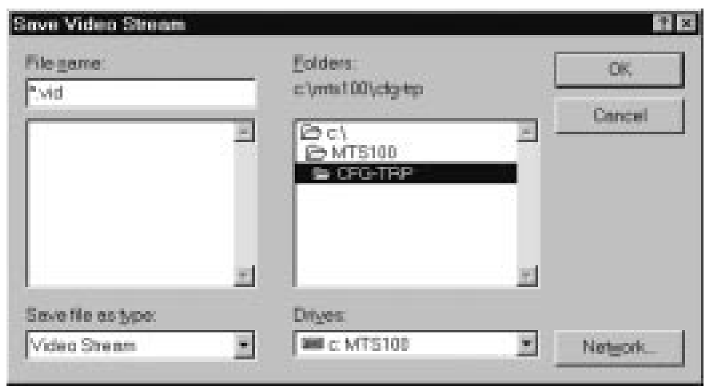
To save one or more sections of a particular table (PAT, PMT, NIT, SDT, for example) in the transport stream, double-click on the hierarchic view table icon to open an interpreted view of the section. (If you want to save more than one section, click the End button on the lower toolbar to go to the last section and, more importantly, discover the number of sections in the stream.) Then choose Save As from the File menu or click the Save command button. A dialog box appears.



To save a particular section or sections, enter the appropriate From and To values (if you clicked the End button before choosing Save As, the number of the last section appears in the To box). Click OK to open A standard Windows Save as dialog box. The file type matches the type of section (for example, PAT/.pat). Select the appropriate drive and directory, enter a file name, and click OK.

Elementary Streams

To save an elementary stream, double-click on the stream icon in the PSI hierarchic view. A Save as dialog box appears with the file type set to match the type of stream. Select the appropriate drive and directory, enter a file name, and click OK.



The Options Menu

The options menu provides you a way to customize analyzer configuration and to save your configuration choices in a file so you can easily restore them in future analyzer sessions.

DVB Option

Select DVB in the Options menu to activate/deactivate recognition of DVB syntax and semantics.

✓DVB (DVB recognized) DVB not recognized

When DVB is not selected, the SI hierarchic command disappears from the Selection menu, and the analyzer interprets any DVB SI sections as private sections. Activate DVB when you are analyzing DVB SI streams; deactivate it only if you know the streams you are analyzing contain no DVB elements.

Visual TSTD and LTW

This selection determines whether the T-STD and LTW dynamic analyses are conducted as visual buffer simulations or “in the background.” Refer to *Visual Mode* on page 3–38 for more information.

Output Messages in File

Select this option to automatically save error messages and the contents of error message windows to a text file.

If this option is selected and you open a file of a transport stream with PAT CRC errors, for example, the analyzer writes a list of the errors to a ASCII text file. The file receives the name of the transport stream file, but has a .log extension; it is saved in the directory specified through the Options menu Directories command. You may read the .log file with any ASCII text editor, such as the Windows NT Notepad application.

The analyzer similarly creates a .log file when necessary and saves any message window error lists that are generated during stream analysis. Examples of error lists are those that can result when you conduct a syntax analysis or a consistency check and those that result when you double-click on an “Error” result cell after an automatic analysis.

Remember that selecting this option can, over time, result in many error log files in the Message directory. It is good practice to periodically delete outdated files.

Base

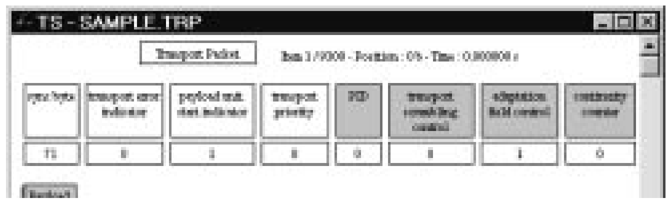
The Base command opens a dialog box for selecting the numeric base used in the hierarchic and interpreted views. You may find it more convenient to remember that F2 is the shortcut key for toggling between the two settings.

Hierarchic view

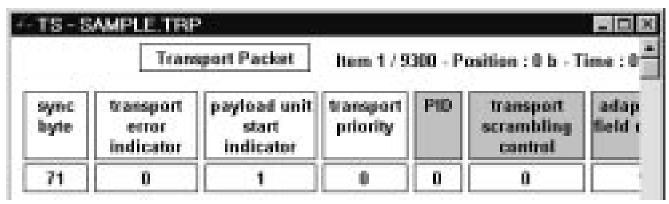
Interpreted view

Font

Use the Font command in the Options menu to change the typeface used in the hierarchic and interpreted views. Choosing the command opens a dialog box for selecting font, style (normal, bold, italic), and size. Make your selections and click OK. The display changes immediately.



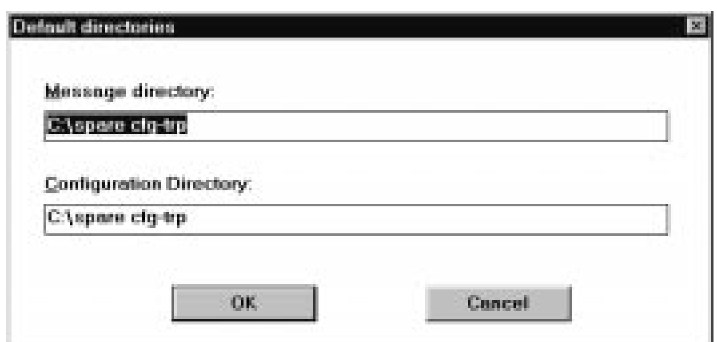
Five point Times roman (default)



Eight point Arial bold

Directories

Use this command to specify default directories for output messages and configuration files. Enter the complete paths in the Message directory and Configuration directory text boxes; then click OK.



Automatic Analysis

Use this command to configure the automatic analysis sequence. Refer to *Automatic Analysis*, beginning on page 3–44, for complete instructions.

Interpretation

Choose this command to control the information that appears in the transport packet, PES packet, and section interpreted views. See *Interpreted View Options* on page 3–20 for a full explanation.

Configuration

All selections you make through the Options menu change the analyzer configuration. The configuration in use when you exit the analyzer application is restored the next time you start the program. The three configuration commands in the Options menu let you save one or more configurations to files for later use and allow you to easily return to the default configuration.

Save Configuration. Use Save configuration to save the current option settings to a file. A standard Windows Save as dialog box opens. Be sure to select a Drive and Directory that will make it easy to later retrieve the file; then enter a descriptive name for the configuration file and click OK. The file receives the extension .acf by default.

Read Configuration. Choose Read configuration from the Options menu to restore a configuration file that you saved earlier. A standard Windows Open dialog box appears. Change the Drive and Directory if necessary and then select the file name. Click OK to restore the configuration saved in the file.

Set Default Configuration. Choose Set default configuration to restore all the default analyzer settings. A dialog box appears to give you one more chance to reconsider. Click OK to confirm the command. The following settings make up the default configuration:

Option	Default Setting
DVB	Not selected
Visual TSTD and LTW	Selected
Output messages in file	Not selected
Base	Decimal
Font	Times New Roman, Regular, seven point
Directories	See note below
Automatic Analysis	All analyses selected
Interpretation	Neither field Length nor Position displayed All fields displayed for all types of interpreted view

***NOTE**. When you select Set default configuration, the message and configuration directories are changed to the directory that contains the most recently opened file. This can cause confusion because the directories remain the same until you change them through the Options menu Directories command, read a saved configuration file, or—after opening a file from a different directory—again select Set default configuration.*

Using the Multiplexer

This section is intended as a reference for the Multiplexer application. When necessary, the Multiplexer automatically starts the MTS 210 Edit Table application. Refer to *Using the PSI and SI Table Editor*, beginning on page 3–103, for information about Edit Table. Save your changes and close Edit Table before resuming work in the Multiplexer window.

Overview

With the Tektronix MPEG Test System Multiplexer application, you can specify the characteristics and contents of an MPEG-2 or DVB transport stream and then generate a file that contains the transport stream for use in testing MPEG-2 or DVB hardware or software applications.

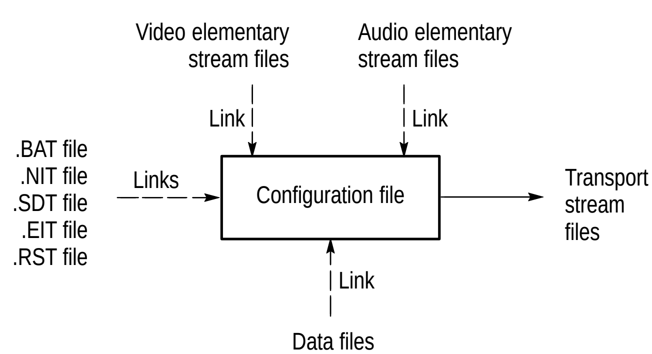
Definitions

The use of the terms “multiplex” and “transport stream” in this section may cause confusion. In practice, *multiplexing* is the process of combining and arranging the program data and (PSI and SI) overhead so it can be transmitted and later decoded; this application is called the Multiplexer because that is what it does. The product of the process is both a multiplex *and* a transport stream.

Technically speaking, a *transport stream* is a digital data structure, defined in ISO/IEC 13818-1, that is tailored to communicate one or more programs encoded according to MPEG-2 standards. The transport stream data may be broadcast, transmitted, or stored in a computer file as it is on the MTS 210 system and data store disks.

File Conventions

When it generates a transport stream, the Multiplexer combines information from elementary stream files and table files according to instructions contained in a configuration (.cfg) file.



To create an MPEG-2 or DVB transport stream with the Multiplexer, you must first create a configuration file that contains all the instructions for making the desired transport stream. The configuration file contains general information, such as the Mux Rate, and also links to other required files, such as the video elementary stream files and PSI and SI table files. (You can create the BAT, NIT, SDT, and EIT files, if necessary, with the Edit Table application.)

The configuration file is similar in structure to a Windows *.ini file. An example configuration file appears at the end of this section, beginning on page 3–99. The configuration file is independent of the transport stream, which allows you to create transport streams with only minor variations by using the same base configuration file.

The overall procedure for creating a transport stream with the MTS 210 Multiplexer is as follows:

1. Create a new configuration file with default information.

2. Add stream icons to program 1.

3. Add more programs and stream icons as desired.

4. Associate Video, Audio, and Data files with all stream icons.

5. Add and edit SI (DVB) tables, if necessary.

6. Edit multiplex, PSI table, and program parameters as necessary; confirm that the highest actual multiplex rate does not exceed the rate chosen for the multiplex (transport stream) as a whole.

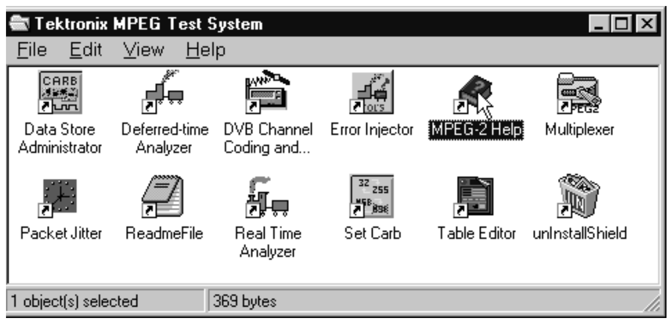
7. Generate the transport stream file from the configuration file.

A tutorial for creating an MPEG-2 configuration file and transport stream begins on page 2–45; a tutorial for creating a configuration file with DVB information begins on page 2–83.

Getting Help

Remember that additional information about almost every aspect of Multiplexer operation and MPEG-2/DVB bit streams is available from two convenient sources:

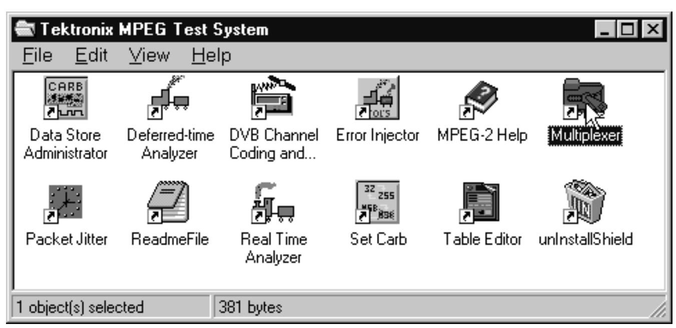
- The Contents command on the Multiplexer Help menu
- The MPEG-2 Help utility, which contains much of the ISO/IEC 13818-1 MPEG-2 standard in Windows Help format. Start this utility from the Tektronix MPEG Test System program group.



You can access either source any time you are using the MTS 210 Multiplexer.

Starting the Multiplexer

To start the Multiplexer, double-click the Multiplexer icon in the Tektronix MPEG Test System program group window.

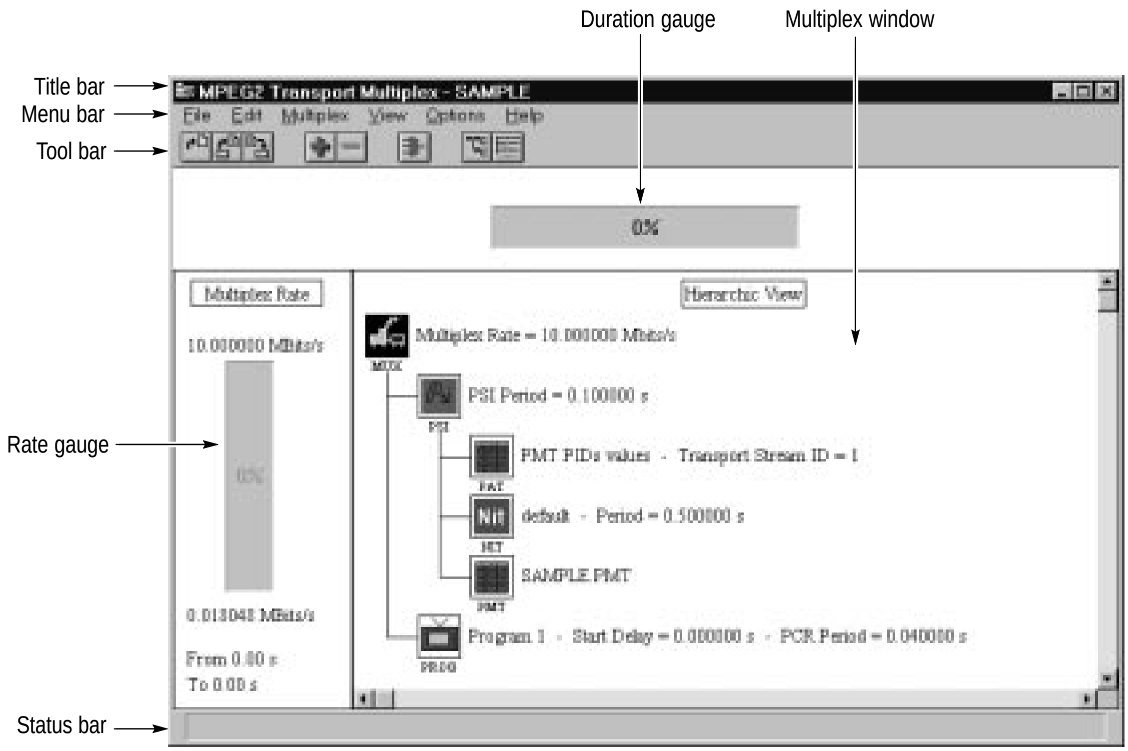


***NOTE**. You cannot start the Multiplexer application if either the MTS 210 Analyzer or the MTS 210 Data Store Administrator is running.*

The Multiplexer application window opens to its most recent size and screen location; size the window and position it as necessary on your Windows NT desktop.

The Application Window

The Multiplexer application window has the common Windows features: a title bar, a menu bar, a tool bar, and a status bar. Once you open a new or existing configuration file, the center workspace is divided into three parts: the duration gauge, the rate gauge, and the multiplex window.

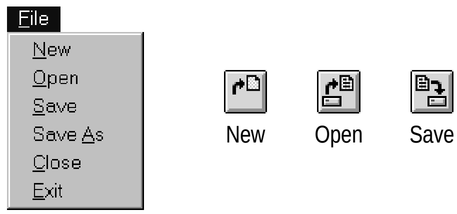


Menu Bar and Tool Bar

The Menu Bar accesses the six main Multiplexer menus. The command buttons on the tool bar provide convenient shortcuts for many menu commands.

File Menu. Use the commands in the File menu for creating new files, opening existing files, saving files, closing files, and exiting the Multiplexer application.

You can choose the New, Open, and Save commands by clicking the equivalent command buttons.

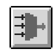


Use	To
New	Open a new configuration file
Open	Open an existing configuration file
Save	Save the current configuration file
Save As	Save the current configuration file under a new name
Close	Close the current configuration file
Exit	Close the Multiplexer application

Edit Menu. Use the Edit menu to add and delete items in the configuration file hierarchy. Both commands on the Edit menu have command button equivalents.

Use	To
Add	Add an item to the multiplex
Delete	Delete the selected item (and any sub-items) from the multiplex

Multiplex Menu. The Multiplex menu has one command; choose it or click the equivalent command button to generate a transport stream file (also known as a "multiplex") according to the instructions in the configuration file.



Go (generate a Multiplex)

Use	To
Go	Create (generate) a transport stream file from the configuration file

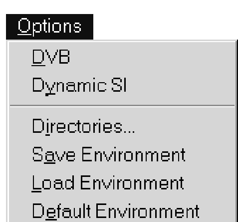
View Menu.

Hierarchic

Dynamic

Use	To
Hierarchic	Display a hierarchic view of the configuration file
Dynamic	Display a timing diagram of the programs listed in the configuration file

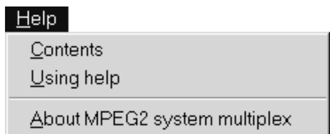
Options Menu. For more information, refer to *The Multiplexer Environment*, beginning on page 3–73.



Use	To
DVB	Toggle DVB required table files (SI) on and off
Dynamic SI	Toggle Dynamic SI on/off
Directories	Configure default directories
Save Environment	Save the current options settings to a file

Use	To
Load Environment	Read and apply a previously saved environment
Default Environment	Reset all options to the default settings

Help Menu.



Use	To
Contents	Open a Help window specific to the Multiplexer application
Using Help	Display standard Windows help (about using help)
About MPEG 2 System Multiplexer	Display the Multiplexer application version and copyright

The Duration Gauge

The duration gauge is active only during multiplex (transport stream) generation. The gauge shows 0% until you choose the Go command from the Multiplex menu or click the equivalent command button. Then the gauge shows what portion of the operation is complete. When the entire transport file has been generated, the gauge shows 100%. The gauge returns to 0% when you close the configuration file and later reopen it and when you save the configuration file under a new name. Refer to *Generating a Multiplex*, beginning on page 3–98, for more information.

The Rate Gauge

The rate gauge shows the portion of available transport stream capacity that is used for program data and overhead. The target, maximum multiplex rate appears above the gauge. The highest actual rate appears below the gauge. The actual rate is calculated with the following formula:

Rate = PSI rate + SI rate + Video rate + Audio rate + Data rate

Below the actual rate is the time period during which the highest multiplex rate occurs.

***NOTE**. The actual rate number and the time it occurs are the worst case for the resulting transport stream. To see the rate across the entire transport stream, change to the dynamic view; refer to* The Dynamic View, *on page 3–71, for more information.*

The color or the rate gauge bar depends on the portion of the available rate used by the highest actual rate as listed in Table 3–8.

Table 3–8: Multiplex rate bar colors

Actual rate/maximum rate	Bar color
0 to 69%	Green
70% to 89%	Yellow
90% and above	Red

Notice that you can create and save a configuration file with greater than 100% mulitplex rate usage. However, the application warns you of multiplex overflow if you attempt to generate a transport stream from a configuration that uses more than 100% of the available multiplex rate.

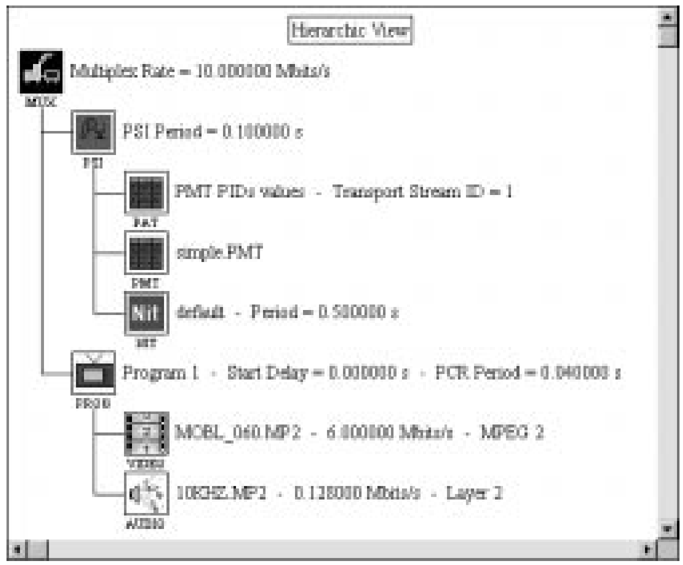
The Multiplex Window

The Multiplex Window displays the current configuration file in one of two forms: the hierarchic view and the dynamic view. The hierarchic view is a graphic representation of the transport stream/multiplex configuration that uses icons to show the interrelationship of stream components. The dynamic view shows the timing relationships between the various programs in the transport stream; it is very useful for seeing how the programs use the available multiplex rate and for resolving timing conflicts.

The multiplex window views are explained later in this section. *The Hierarchic View* is next; *The Dynamic View* begins on page 3–71.

The Hierarchic View

The hierarchic view uses icons to show the interrelationship of transport stream components and is the workbench for assembling and editing transport stream configuration files. When you create a new configuration file or open an existing one, the configuration appears first in the hierarchic view, as shown below.



Hierarchy Icons

Each transport stream item is represented in the hierarchic view by a unique icon. Table 3–9 lists and explains all of the icons and lists the actions you can perform by clicking the icon with either mouse button (in all cases, click once with the left button to select the icon and the item it represents).

Some items (and their icons) apply only to DVB streams and can appear only when DVB is selected on the Options menu; refer to *Environment Options*, on page 3–73, for more information.

Table 3–9: Hierarchic view icons

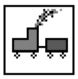
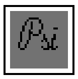
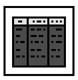
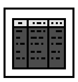
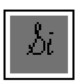
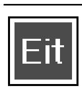
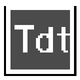
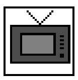
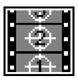
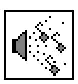
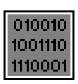
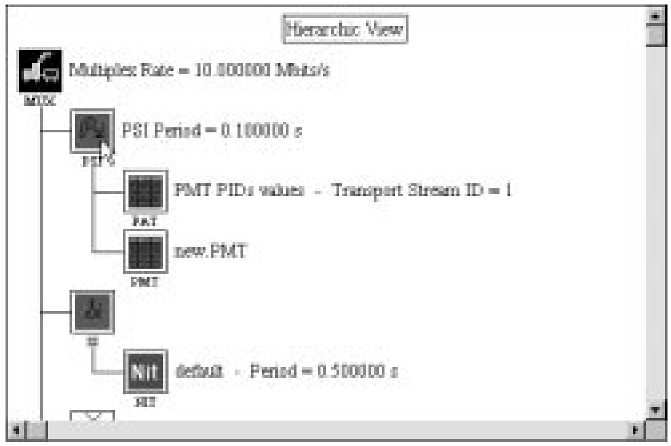
Icon	Item	Double-click to	Right-click?
 MUX	Multiplex. This is the main icon for the configuration file. Required.	Set multiplex rate and start time	Yes, collapses/expands the hierarchy at this icon
 PSI	Program Specific Information (PSI). MPEG2 decoders use PSI when demultiplexing the programs in a transport stream. Required.	Set the PSI period	Yes, collapses/expands the hierarchy at this icon
 PAT	Program Association Table (PAT). The PAT provides the correspondence between each program in the stream and the PMT that describes the program. The PAT is always identified with PID 0. Required.	Read and set the PIDs of associated tables and programs	No
 PMT	Program Map Table (PMT). The PMT specifies a PID value for each elementary stream associated with the program and describes the program components. Some transmission systems (such as Grand Alliance and DVB) require specific PID values. Required.	Edit the PMT (with the Edit Table application)	No
 SI	Service Information (SI). SI consists of up to five tables (NIT, BAT, SDT, EIT, and TDT) and provides information on services and events carried by this multiplex, different multiplexes, and even on other networks. Required for DVB configuration files.	Add or edit DVB table files (NIT, BAT, SDT, and EIT); set TDT parameters	Yes, collapses/expands the hierarchy at this icon
 NIT	Network Information Table (NIT). The NIT provides information about the physical network. Required; found under the PSI icon for non-DVB and under the SI icon for DVB configurations.	Select or edit the NIT file and set the NIT period	No
 BAT	Bouquet Association Table (BAT). The BAT provides information regarding service bouquets (collections of services that are marketed as single entities). Optional. (DVB only)	Select or edit the BAT file	No
 SDT	Service Description Table (SDT). The SDT contains data describing the services in the system such as names of services, the service provider, etc. Optional. (DVB only)	Select or edit the SDT file	No
 EIT	Event Information Table (EIT). The EIT contains data concerning events and programs (a concatenation of one or more events under the control of a broadcaster), such as event name, start time, duration, etc. Optional. (DVB only)	Select or edit the EIT file	No

Table 3–9: Hierarchic view icons (Cont.)

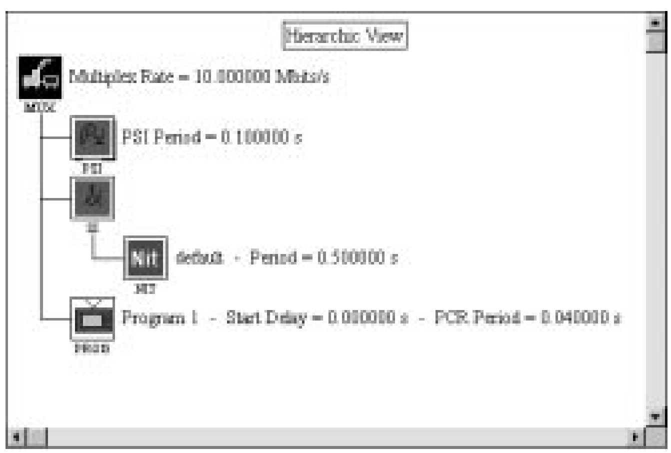
Icon	Item	Double-click to	Right-click?
 TDT	Time and Date Table (TDT). The TDT provides the UTC time and data information Optional (DVB only).	Set TDT parameters	No
 PROG	Program. A multiplex can have up to 20 programs. Required. Each transport stream must have at least one program with one elementary stream.	Set the PCR period and program start delay.	Yes, collapses/expands the hierarchy at this icon
 VIDEO	Video Elementary Stream. A program may have up to 5 video elementary streams and up to 10 elementary streams of all types. Optional (although each program must have at least one elementary stream).	Select a video elementary stream or set stream parameters.	No
 AUDIO	Audio Elementary Stream. A program may have up to 5 audio elementary streams and up to 10 elementary streams of all types. Optional (although each program must have at least one elementary stream).	Select an audio elementary stream or set stream parameters.	No
 DATA	Data Elementary Stream. A program may have up to 5 data elementary streams and up to 10 elementary streams of all types. Optional (although each program must have at least one elementary stream).	Select a data file or set stream parameters.	No

Collapsing and Expanding the Hierarchy

You can expand or collapse the hierarchy structure below several hierarchy items by right-clicking the icon. For example, if you right-click the PSI icon...



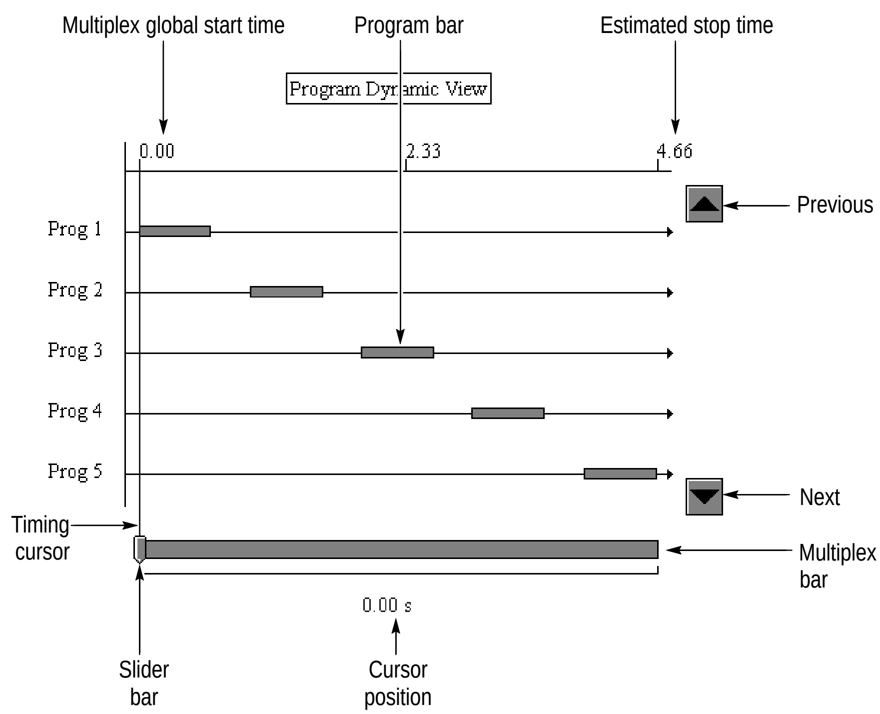
...the hierarchy will collapse below the icon, hiding the PAT and PMT. This is useful if you are working with large number of programs that also have large numbers of elementary streams.



Right-click on the PSI icon to restore the hierarchy to its original appearance.

The Dynamic View

The dynamic view is a diagram that shows the timing relationships of all programs in the multiplex. The entire multiplex is represented by a wide bar at the bottom of the diagram. The programs that make up the multiplex are shown as narrower bars, each on its own time line above the multiplex bar. The duration, starting time, and ending time of a program is indicated by the length and horizontal position of the program bar. The figure below shows the dynamic view of a configuration file that has five programs, each with its start time delayed one second after the end of the previous program.



***NOTE**. When the dynamic view is visible, the rate gauge shows the actual multiplex rate of the transport stream at the time indicated by the cursor position.*

Features

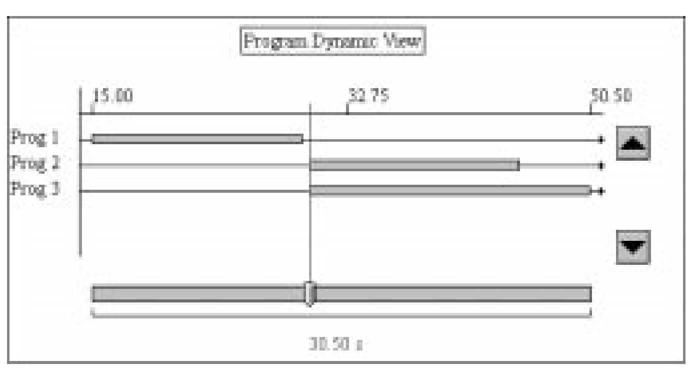
There are several important features of the dynamic view:

- **Multiplex Global Start Time.** The beginning time of the multiplex. Double-click the multiplex icon (in the hierarchic view) to set this time.
- **Estimated Stop Time.** The ending time for the multiplex, when all elementary streams for all programs have been sent.

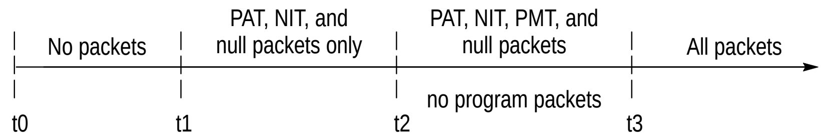
- **Timing Cursor.** Move the timing cursor by selecting the slider bar; hold the mouse button down and slide the cursor to the desired location. Click the multiplex bar on either side of the cursor to move the cursor one second at a time. Once you have moved the cursor by sliding it or clicking the multiplex bar, you can also move it 0.1 second at a time with the left and right arrow keys.
- **Previous.** The dynamic view can display up to five program bars at once. If there are more than five programs in the multiplex, click this button to display the the program (if any) with the next lower number.
- **Next.** If there are more than five programs in the current multiplex, click this command button to display the the program (if any) with the next higher number.
- **Program Bar.** The program bar indicates the timing relationship of the program relative to the entire multiplex. Double-click the program bar to open a message window containing program timing values. Click anywhere else in the multiplex window to dismiss the value message window.

Timing Offsets

The Multiplexer lets you set two timing offsets in addition to the global multiplex start time: program start delay and elementary stream initial delay. You can see the effects of all three delays in the following dynamic view, which shows the timing relationships of three identical programs. The global multiplex start time is 15.00 seconds, programs 2 and 3 have 15.5 second program start delays, and the video elementary stream in program 3 has a 5 second initial delay.



The diagram below shows how all the timing delays fit together and how the multiplexer handles the extra space created.



- t0 = 27 MHz system clock (clock-on-the-wall) is zero
- t1 = Global Multiplex Start Time (set in conjunction with the total bit rate) see page 3–83
- t2 = Program Start Delay (set for each program) see page 3–89
- t3 = Elementary Stream Initial Delay (set for each video, audio, or data ES) see pages 3–92, 3–94, and 3–95.

The Multiplexer Environment

To prevent confusion with transport stream configurations and configuration files, this section refers to the Multiplexer application settings as the “environment” rather than the more familiar “configuration.”

You can change environment settings through three commands on the Options menu: DVB, Dynamic SI, and Directories. You can save and restore environments through the remaining three Options menu commands; refer to *Saving and Restoring Multiplexer Environments*, on page 3–77, for instructions.

The Multiplexer environment options are saved when you exit the application and restored the next time you launch it. However, the DVB and Dynamic SI settings become part of a configuration file when you save it. Therefore, opening an existing configuration file can change the DVB and Dynamic SI settings.

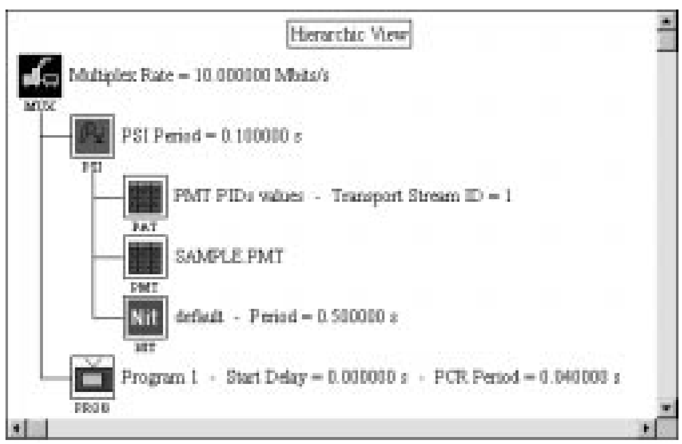
Environment Options

Three commands on the Options menu control settings of the multiplexer environment: DVB, Dynamic SI, and Directories.

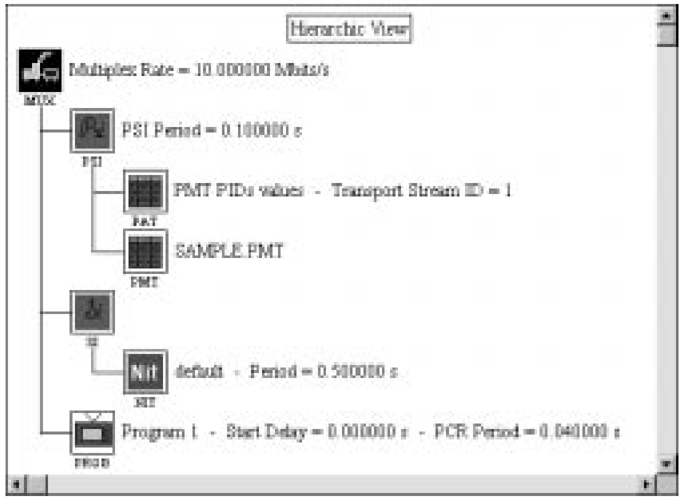
DVB. The DVB (Digital Video Broadcasting) option determines whether DVB Specific Information (SI) may be added to the configuration file. SI exists in the NIT and up to four additional tables that are encoded into the multiplex (transport stream). The SI tables contain information regarding services and events carried on this multiplex as well as different multiplexes or even different networks. Besides the NIT, the SI tables are the BAT, SDT, EIT, and TDT.

- NIT (Network Information Table). The NIT provides information about the physical network. This table is mandatory. (It appears under the PSI icon in non-DVB mode.)
- BAT (Bouquet Association Table). The BAT provides information regarding bouquets (collections of services marketed as a single item).
- SDT (Service Description Table). The SDT contains data describing the services in the system. For example, the name of the services, the service provider, etc.
- EIT (Event Information Table). The EIT contains data concerning events and programs (a concatenation of one or more events under the control of a broadcaster), such as event name, start time, duration, etc.
- TDT (Time and Date Table). The TDT contains information relating to the current time and date.

The DVB option is off in the default Multiplexer environment and results in this default non-DVB hierarchic view:



When you toggle the DVB option on, the SI icon appears in the hierarchy and the NIT moves beneath it. This is the default DVB hierarchic view:



You may add the appropriate SI tables to this hierarchy; refer to *Adding and Editing SI Tables,* beginning on page 3–95, for more information.

Toggling the DVB option off when the hierarchy contains no SI tables simply removes the SI icon and moves the NIT back under the PSI icon. However, if you have added SI tables, a warning message reminds you that the SI tables will be removed.

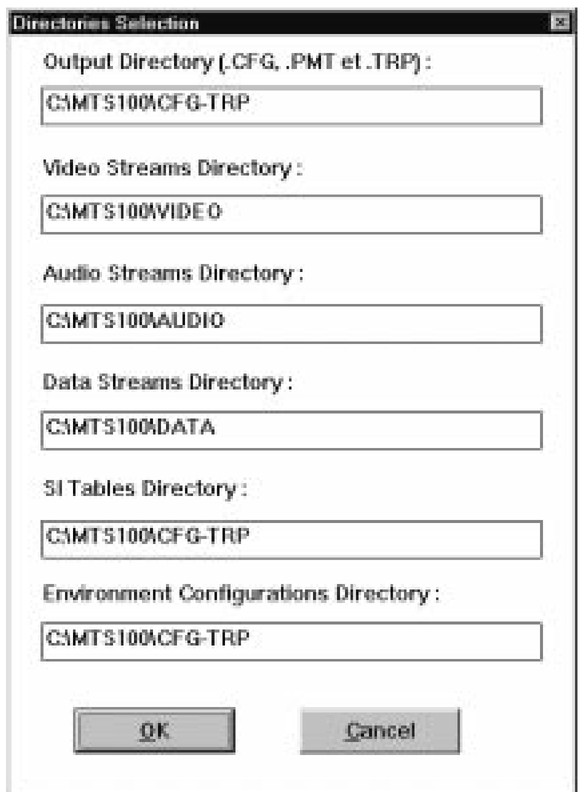
If you click Yes, the SI tables are removed from the configuration file (the separate SI table files themselves are not deleted from the disk); if you click No, the Multiplexer remains in DVB mode.

Dynamic SI. When Dynamic SI is selected, the multiplexer dynamically manages the contents of the SDT and EIT according to the TDT time. All SDT running status fields are changed according to the program state (running/not running). The EIT is managed as follows:

- Present events are removed when necessary
- Following events become Present events
- Schedule events change to Following events when necessary

If, when Dynamic SI is selected, you attempt to generate a multiplex from a configuration file that does not contain a TDT, the Warning shown below appears. Add a TDT and try again.

Directories. Use the Directories command to open the Directories Selection dialog box to specify default directories for various types of files used by the Multiplexer application.

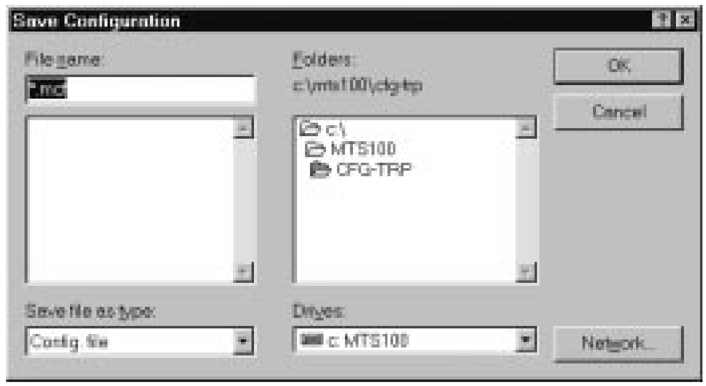


The recommended directories are shown in the above illustration. Change directories by entering the complete path in the appropriate text boxes; click OK to accept the displayed paths and close the dialog box.

Saving and Restoring Multiplexer Environments

Use the Save Environment, Load Environment, and Default Environment commands of the Options menu to save and later restore multiplexer environments.

Save Environment. Choose Save Environment to save the current option settings to a file; a standard Windows file saving dialog box opens.



The drive and directory settings are the selections made through the Directories command. By default, the file receives the extension .mcf (multiplexer configuration file). Enter a descriptive name for the settings file and click OK to save the file and dismiss the dialog box.

Load Environment. Choose Load Environment from the Options menu to restore a (.mcf) settings file that you saved earlier. If you choose Load Environment when the DVB option is selected, the warning message shown below appears to remind you that the DVB option may not be selected in another environment (the warning should say “The SI tables can be suppressed”). Click OK to acknowledge the warning.

A standard Windows Open dialog box appears. Again, the drive and directory settings are the selections made through the Directories command. Change the Drive and Directory if necessary and then select the appropriate (.mcf) file name. Click OK to restore the settings and dismiss the dialog box.

Default Environment. Choose Default Environment to restore all the default multiplexer settings. A warning message appears to give you one more chance to reconsider. Click Yes to confirm the command; click No to cancel.

Because the DVB option is not selected in the default option settings, the warning message shown on page 3–77 appears if you choose to restore the default settings when DVB is selected. Click OK to acknowledge the warning. If there actually are SI tables in the current multiplex configuration, yet another message appears.

Click Yes to remove the tables from the current hierarchy; click No to restore all defaults but the DVB option, which will remain selected.

Table 3–10 lists the default multiplexer options settings.

Table 3–10: The default multiplexer settings

Option	Default Setting
DVB	Not selected
Dynamic SI	Not selected
Directories	
Output	c:\mts100\cfg-trp
Video Streams	c:\mts100\video
Audio Streams	c:\mts100\audio
Data Streams:	c:\mts100\data
SI Tables	c:\mts100\cfg-trp
Configurations	c:\mts100\cfg-trp

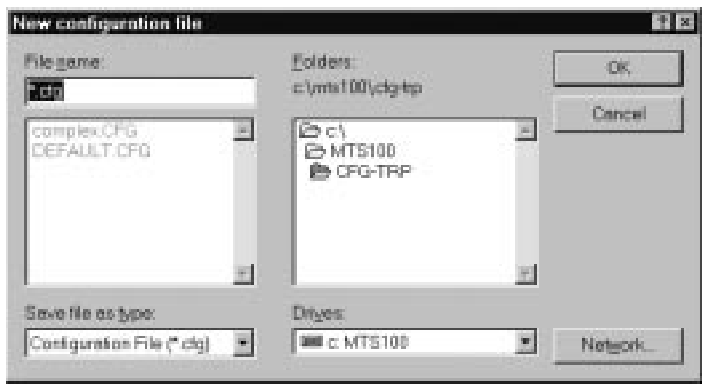
Creating and Editing a Configuration File

To create an MPEG-2 or DVB transport stream with the multiplexer application, you must first create a configuration file that describes the stream. A tutorial for creating an MPEG-2 configuration file and transport stream begins on page 2–45; a tutorial for creating a configuration file with DVB information begins on page 2–83.

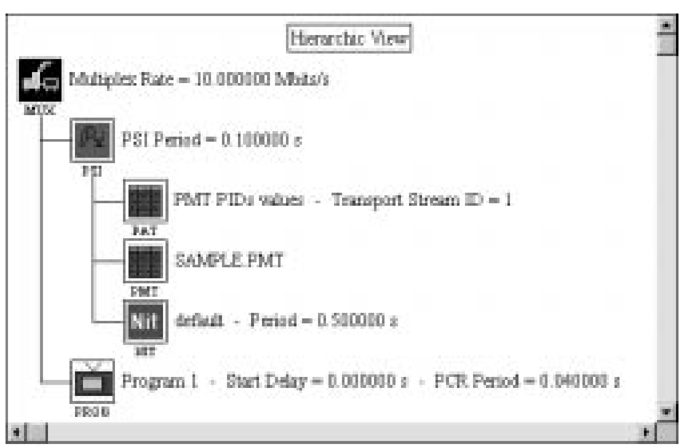
This section explains the basic techniques and includes reference material regarding configuration files.

Creating or Opening a Configuration File

To create a new configuration file, choose New from the File menu or click the New button (the left-most command button on the tool bar). The standard Windows dialog box appears.



Enter an appropriate name in the File name text box and click OK; the .cfg extension is added automatically. The default hierarchy appears in the Multiplex window.



To open an existing file, select Open from the File menu or click the Open command button (the second button on the tool bar). The Configuration file dialog box appears. Again, this is the standard Windows Open file dialog box.

Enter or select the file name and click OK (just as in any other Windows application). The configuration file opens with its hierarchy in the Multiplex window.

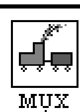
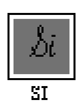
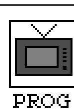
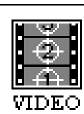
The DVB Option

If you intend to create a DVB transport stream from the new configuration file, be sure that DVB is selected in the Options menu before proceeding; if you do not intend to include DVB (SI) tables in the eventual transport stream, check to be sure that DVB is not selected. The status of the DVB option is saved with the configuration file; therefore, opening an existing .cfg file can change the status of the option. Refer to *DVB* under *Environment Options*, on page 3–73, for more information.

Adding and Editing Hierarchy Items

To add items to the configuration file hierarchy, select the appropriate hierarchy icon and choose Add from the Edit menu or click the Add (+) command button on the Multiplexer tool bar. Table 3–11 summarizes the use of the Multiplexer Add command.

Table 3–11: Using the Add command

Icon	Item Name	Use the Add Command to
	Multiplex	Add an empty program to the end of the hierarchy (Up to 20 programs)
	Service Information	Add DVB files to the configuration (Only available with DVB option.)
	Program	Add an elementary stream to the selected program (Up to 10 elementary streams per program)
	Video Stream	Splice another video stream to the existing stream. The multiplex rate of the added stream can be no higher than that of the existing stream.

***NOTE**. The Add command is not available when other icons are selected.*

You can tell from the appearance of the Add and Delete command buttons whether you can use the Add and Delete commands with the selected item. As shown below, the + or – symbol on the button is highlighted (and appears blue on the MTS 210 monitor) to indicate that the corresponding command is available.

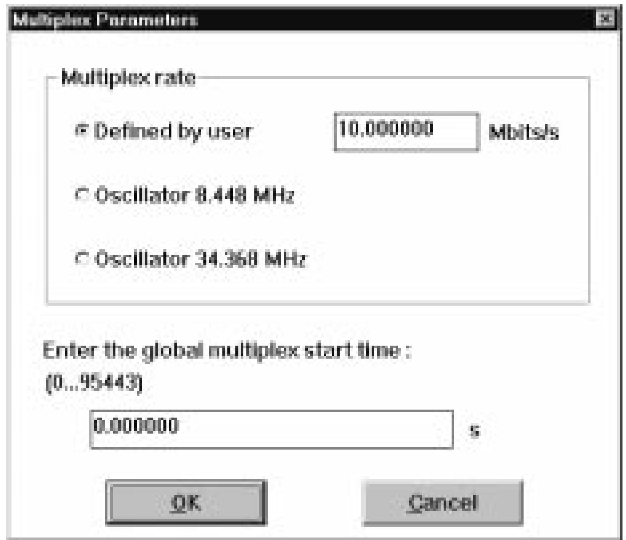
Refer to *Deleting Hierarchy Items*, on page 3–97, for more information about the Delete command.

You can begin editing the contents or characteristics of most items by double clicking on the icon. Table and Stream file associations and many other parameters are edited from within the Multiplexer application. Table files themselves are edited from within the Edit Table application, which you can launch from the Multiplexer when necessary. Editing that can be done in the Multiplexer is explained in this section; table editing is discussed in *Using the PSI and SI Table Editor*, beginning on page 3–103.

Instructions for the following procedures appear in this section:

- Editing Multiplex Parameters (page 3–82)
- Editing the PSI Period (page 3–83)
- Editing PAT Parameters (page 3–84)
- Editing the PMT (page 3–85)
- Editing the NIT (page 3–85)
- Adding Programs to the Multiplex (page 3–88)
- Editing Program Parameters (page 3–88)
- Adding Elementary Streams to a Program (page 3–90)
- Selecting a Video Stream (page 3–91)
- Selecting an Audio Stream (page 3–93)
- Selecting a Data Stream (page 3–94)
- Adding and Editing SI Tables (page 3–95)

Editing Multiplex Parameters. Double-click the MUX icon to open the Multiplex Parameters dialog box.

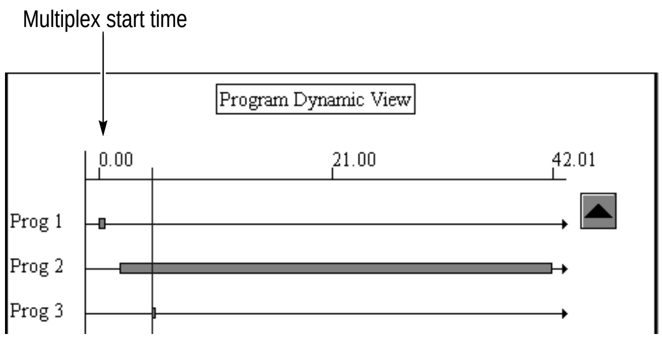


Select or enter the appropriate multiplex rate and enter the global multiplex start time, if appropriate. Click OK to accept the values and dismiss the dialog box.

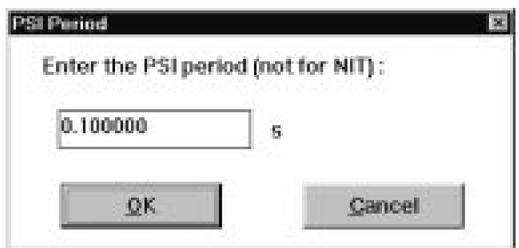
The Multiplex Rate is the number shown in the multiplexer rate gauge. This number defines the data rate for the generator. You can either define your own multiplex rate (the default is 10 Mbits/s) or use one of the predefined G703 frequencies: 8.448 MHz or 34.368 MHz.

***NOTE**. If you are creating a transport stream file for a G.703 port, you MUST select either the 8.448 or the 34.368 MHz option for the correct G703 rate.*

The global multiplex start time is the system clock time at the beginning of the transport stream. You can see the effect of changing the start time in the dynamic view.

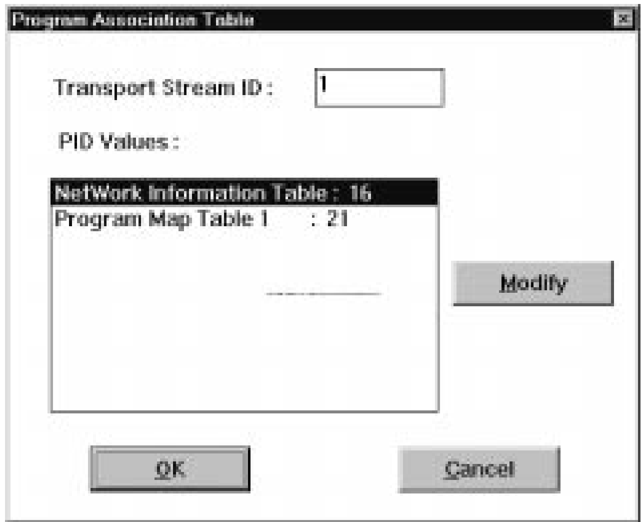


Editing the PSI Period. Double-click the PSI icon to open the PSI Period dialog box.



Enter the appropriate period for the PAT and PMT. Click OK to accept the value and dismiss the dialog box. MPEG-2 requires a PSI period of 0.1 s (10 times per second) or less. However, the Multiplexer allows you to set this number out of specification in order to thoroughly test your receiving system. Remember that if you make the period too small, you will have less of the available multiplex rate left in the transport stream for other, perhaps more important, information.

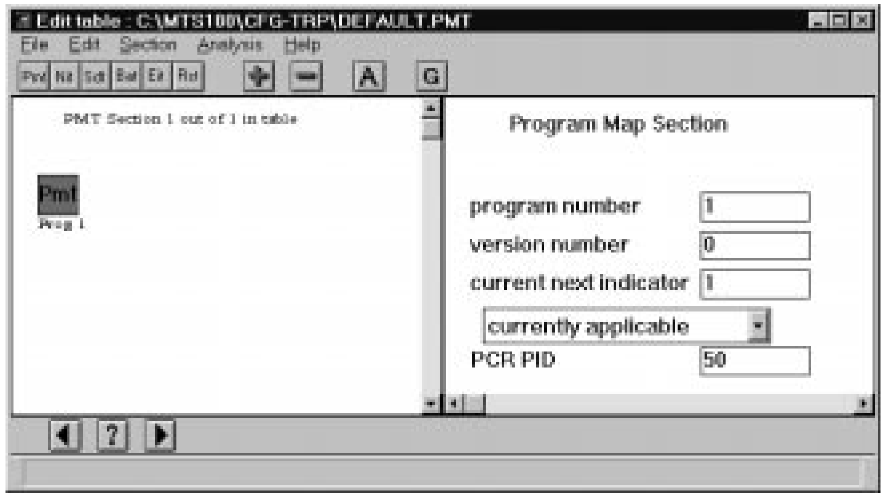
Editing PAT Parameters. Double-click the PAT icon to open the Program Association Table dialog box.



To change the transport stream ID, enter the new value in the text box and click OK. To change the PID of a PMT section, highlight the section entry in the PID Values list box and then click Modify. Enter the desired PID number in the resulting PID Modification dialog box and click OK in both the PID Modification box and in the Program Association Table dialog box.

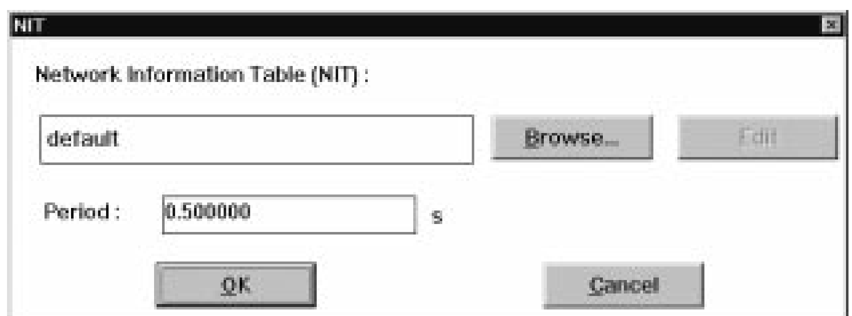
***NOTE**. The Multiplexer automatically assigns PIDs when you add programs and tables. You need not change program PIDs unless the intended stream use requires it. Many table PIDs are specified in the appropriate MPEG or DVB standard. Do not change a table PID unless you know the consequences and have a good reason for doing so.*

Editing the PMT. Double-click on the PMT icon to start the Edit Table application with the .PMT file open for editing (the application creates the .PMT file if it does not already exist).



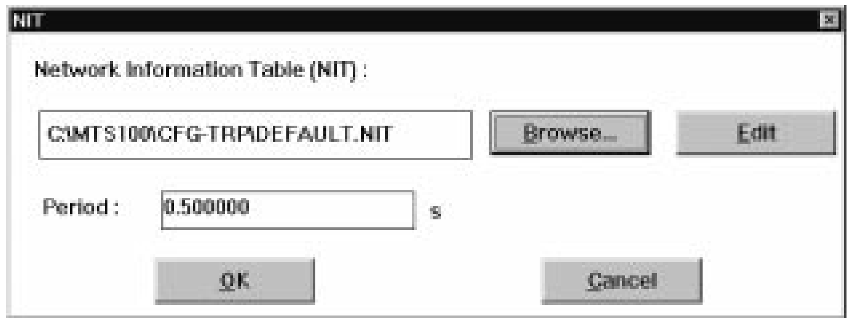
You can enter appropriate information in the Edit window, on the right half of the Edit Table application window, and you can add descriptors by clicking the Add (+) command button. Refer to *Using the PSI and SI Table Editor*, beginning on page 3–103, for complete instructions.

Editing the NIT. Double-click the NIT icon to open the NIT dialog box.



If you have not already associated a .NIT file with the NIT icon, the table name field will contain only the word “default.” You must select a file, through the Browse button, before you can edit the Network Information Table.

1. Click Browse in the NIT dialog box. The Selection SI File dialog box appears; select DEFAULT.NIT or another file to use as a template. When you complete file selection (either by double-clicking the file name or by highlighting the file name and clicking OK), the file selection dialog box closes and leaves the NIT dialog box open. The name of the opened file is in the table name field.



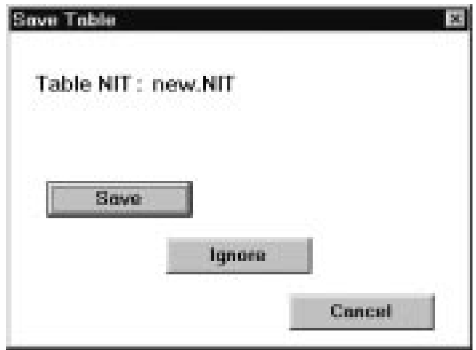
2. Click Edit to start the Edit Table application with the selected .NIT file open for editing.

3. Use the Save As command on the Edit Table File menu to save the table under a new, unique name (usually the name of the configuration file); the table automatically receives the .NIT filename extension when you save it.

4. Edit the table as necessary. You can enter appropriate information in the Edit window, on the right half of the Edit Table application window, and you can add transport streams or descriptors by clicking the Add (+) command button. Refer to *Using the PSI and SI Table Editor*, beginning on page 3–103, for complete instructions.

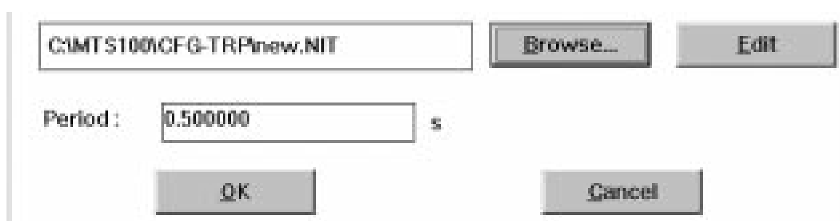
5. Save the file again before exiting Edit Table. If you attempt to exit without saving changes to the table, the Save Table dialog box opens to give you the

opportunity to save the changes, ignore the changes and exit the application anyway, or cancel the exit command and return to the Edit Table application.



6. After you exit Edit Table, the NIT dialog box remains in front of the Multiplexer application window with the original file name (usually DEFAULT.NIT) in the table name box.

7. Click Browse to open the Selection SI Tables dialog box and select the newly edited and saved table.

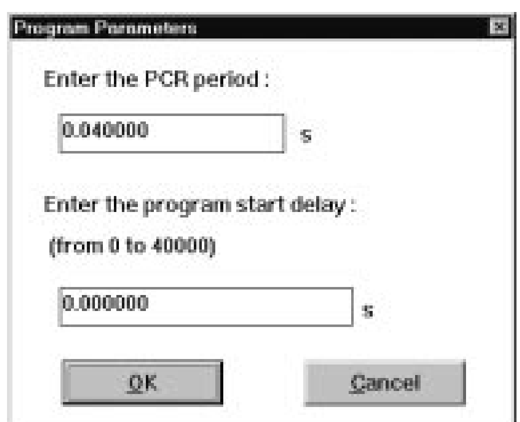


8. If appropriate, change the period (the time between occurrences of the NIT in the transport stream). Then click OK to accept the NIT file and its period setting and to dismiss the NIT dialog box. The name of the table file and the period appear to the right of the NIT icon in the Multiplexer hierarchic view.

Adding Programs to the Multiplex. To add a program to the hierarchy, select the MUX (multiplex) icon and then click the Add (+) command button. A new program icon is added to the end of the configuration hierarchy. A transport stream can contain up to 20 programs.

Adding a program automatically adds a section to the PMT and updates the PAT to reference the PID of the new section. Once you have added a program, be sure to edit the program parameters and add elementary streams, as necessary.

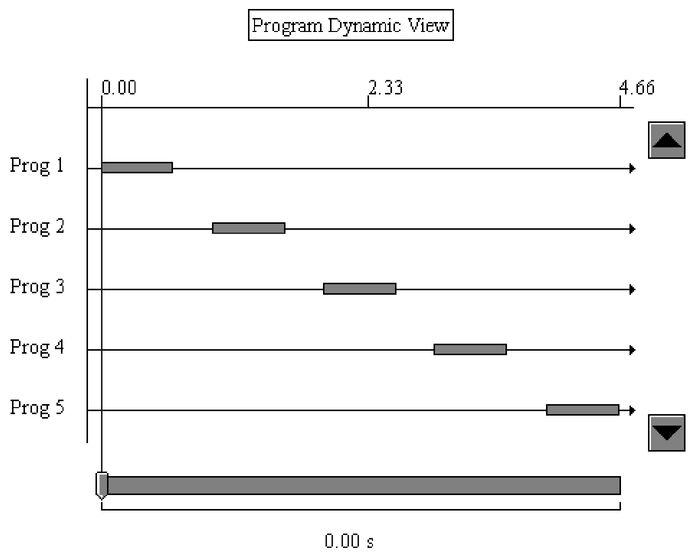
Editing Program Parameters. Double-click on the Program icon to open the Program Parameters dialog box and set the PCR (Program Clock Reference) period and program start delay.



The PCR period determines the frequency of program clock references in the program stream. MPEG-2 requires at least 10 clock references per second, for a maximum of 0.1 seconds between PCR signals. If you enter a PCR period over 0.1 seconds, you will receive a warning when you close the Program Parameters dialog box.

***NOTE**. The Multiplexer encodes the PCR by default with the first elementary stream you add to the program. You can, however, change the PID of either PCR or elementary stream when you edit the PMT (see page 3–85 for instructions). If the PCR is not encoded with one of the elementary streams, it will be in its own packets. This may be useful for some applications or experiments.*

Program start delay determines the start time of the program relative to the beginning of the transport stream. Select dynamic view to see the effect of program start delay.



The above dynamic view shows how program start delay affects the resulting transport stream. Each of the five programs starts at a different time. The start delays allow the transport stream to carry more information than if all programs started at the same time.

Adding Elementary Streams to a Program. Adding an elementary stream to a program is a two-step process. First, add a video, audio, or data stream icon to the hierarchy. Then associate a file (of the appropriate type) with the stream icon.

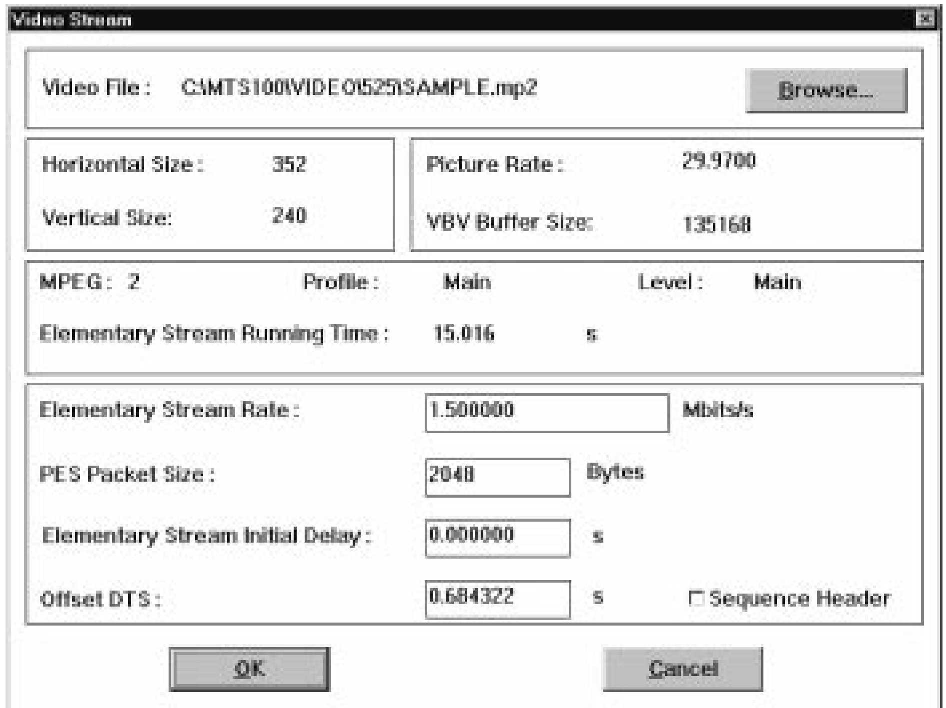
To add a stream icon to the program, select the program icon and click the Add (+) button or press INSERT. The Stream to add dialog box opens.

Select the type of stream that you wish to add and click OK. The appropriate icon appears in the hierarchy as a component of the selected program. Each new stream icon is simply added to the end of the program's list. Elementary streams are not sorted by type.

Now you must associate a stream file with each new icon. Begin the process by double-clicking on the elementary stream icon; refer to *Selecting a Video Stream* (on page 3–91), *Selecting an Audio Stream* (on page 3–93), or *Selecting a Data Stream* (on page 3–94) for more information.

CAUTION. *Although MPEG-2 transport streams allow elementary streams with encoding changes between field and frame, the Multiplexer does not support such changes.*

Selecting a Video Stream. Double-click on the Video icon to open the Video Stream dialog box. Through the dialog box, name a video stream file and set several parameters that determine how the Multiplexer encodes the stream.



Either enter the complete path and file name in the video file name box or click Browse to select the video elementary stream. Browse opens a standard Windows file selection dialog box. You can select a file with any file extension, but the Multiplexer application will not accept the file unless it has the correct video sequence header.

There are five editable parameters (in addition to the file selection) in this dialog box. The remaining parameters are extracted from the file's video header and are included as information only. The editable information includes elementary stream rate, PES packet size, elementary stream initial delay, offset DTS, and use of the sequence header.

- The elementary stream rate is the rate at which the elementary stream is to be multiplexed into the transport stream, after compression. The default value is the rate specified in the elementary stream header. This is the recommended value. You can change the rate to meet your specific requirements, as long as you do not intend to decode the transport stream in real time. A rate that is too slow will not give the decoder all the information required to decode in real time.

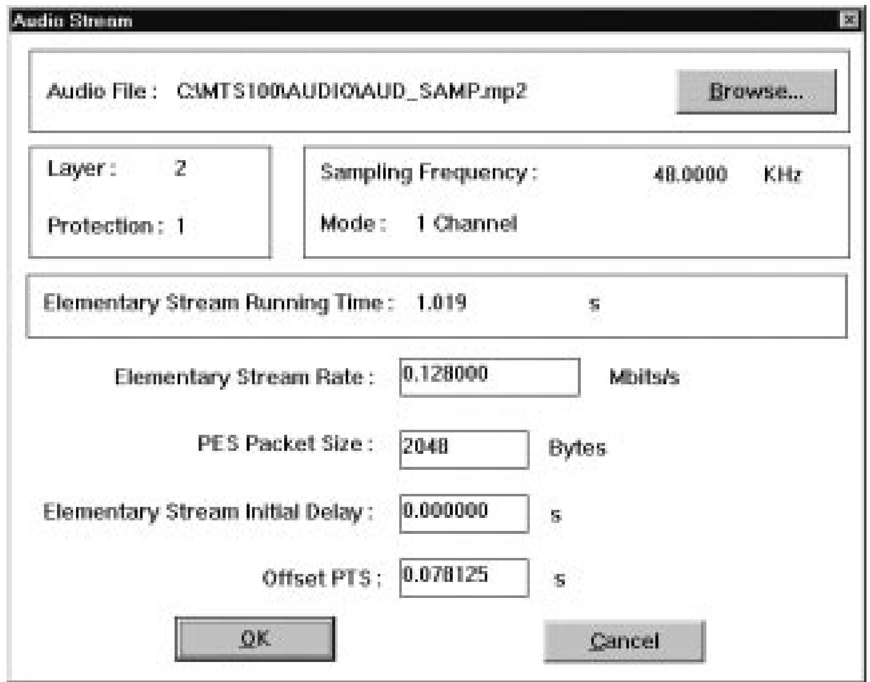
- The PES packet size can range from 100 to 64000 bytes; the default is 2048 bytes. If you specify a packet size of 0, the Multiplexer will put the complete video picture in one PES packet.
- The elementary stream initial delay determines when the elementary stream begins appearing in the transport stream. The delay is relative to the start of the program, which can have its own delay relative to the start of the transport stream (refer to *Editing Program Parameters*, on page 3–88, for more information). Delaying the start of the elementary stream extends program length by an equal amount of time but does not reduce the fraction of multiplex rate used during the delay.

***NOTE**. The multiplex rate is not reduced during an elementary stream initial delay. Null packets fill in to replace elementary stream packets in the time between the start of the program and the start of the elementary stream.*

- Offset DTS is the time interval between the PTS (presentation time stamp) and the DTS (Decode Time Stamp).
- Sequence header, when selected, causes the Multiplexer to ignore any video stream data before the first sequence header. If you leave Sequence Header unchecked, the Multiplexer inserts the entire video stream into the multiplex.

When you are done selecting the video stream file and setting the stream parameters, click OK to confirm the choices and close the dialog box. Information about the selected file appears to the right of the video icon.

Selecting an Audio Stream. Double-click on the Audio icon to open the Audio Stream dialog box. Through the dialog box, name an audio stream file and set parameters that determine how the Multiplexer encodes the stream.



Either enter the complete path and file name in the audio file name box or click Browse to select the audio elementary stream. Browse opens a standard Windows file selection dialog box. You can select a file with any file extension, but the Multiplexer application will not accept the file unless it has the correct audio header information.

There are four editable parameter fields in the Audio Stream dialog box: elementary stream rate, PES packet size, elementary stream initial delay, and offset PTS.

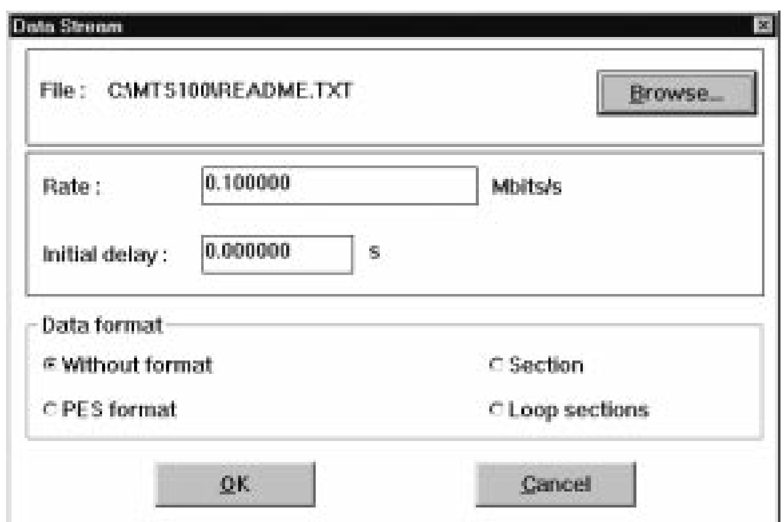
- The elementary stream rate is the rate at which the elementary stream is to be multiplexed into the transport stream. The default value is the rate specified in the elementary stream header. This is the recommended value. You can change the rate to meet your specific requirements as long as you do not intend to decode the transport stream in real time. A rate that is too slow will not give the decoder all the information required to decode in real time.

- The PES packet size can range from 100 to 64000 bytes.

- The elementary stream initial delay determines when the elementary stream begins appearing in the transport stream. The delay is relative to the start of the program, which can have its own delay relative to the start of the transport stream (refer to *Editing Program Parameters*, on page 3–88, for more information). Delaying the start of the elementary stream extends program length by an equal amount of time, but does not reduce the fraction of multiplex rate used during the delay.
- Offset PTS is the interval between the PTS (presentation time stamp) and arrival time.

When you are done selecting the audio stream file and setting the stream parameters, click OK to confirm the choices and close the dialog box. Information about the selected file appears to the right of the audio icon.

Selecting a Data Stream. Double-click on the data icon to open the Data Stream dialog box. Through the dialog box, name a data file and set parameters that determine how the Multiplexer encodes the stream.



Either enter the complete path and file name in the file box or click Browse to select the data file. Browse opens a standard Windows file selection dialog box. You can select a file with any file extension.

- Rate determines how quickly the data is multiplexed into the transport stream. The default value is 0.1 Mbit/s.

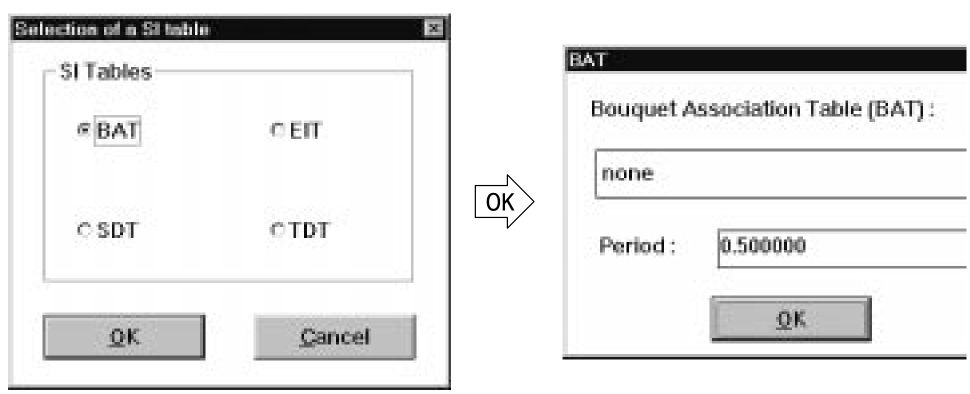
- The initial delay determines when the data begins appearing in the transport stream. The delay is relative to the start of the program and works in the same way as the initial delays for the video and audio elementary streams.
- Use the data format selections to specify how the data is to be formatted in the transport stream. Select without format if the data is not in PES or section format. Select PES format if the data is in PES format. Select Section if the data is in section format. Select Loop sections if the data is in section format and the sections should be looped.

When you are done selecting the data file and setting the stream parameters, click OK to confirm the choices and close the dialog box. Information about the selected file appears to the right of the data icon.

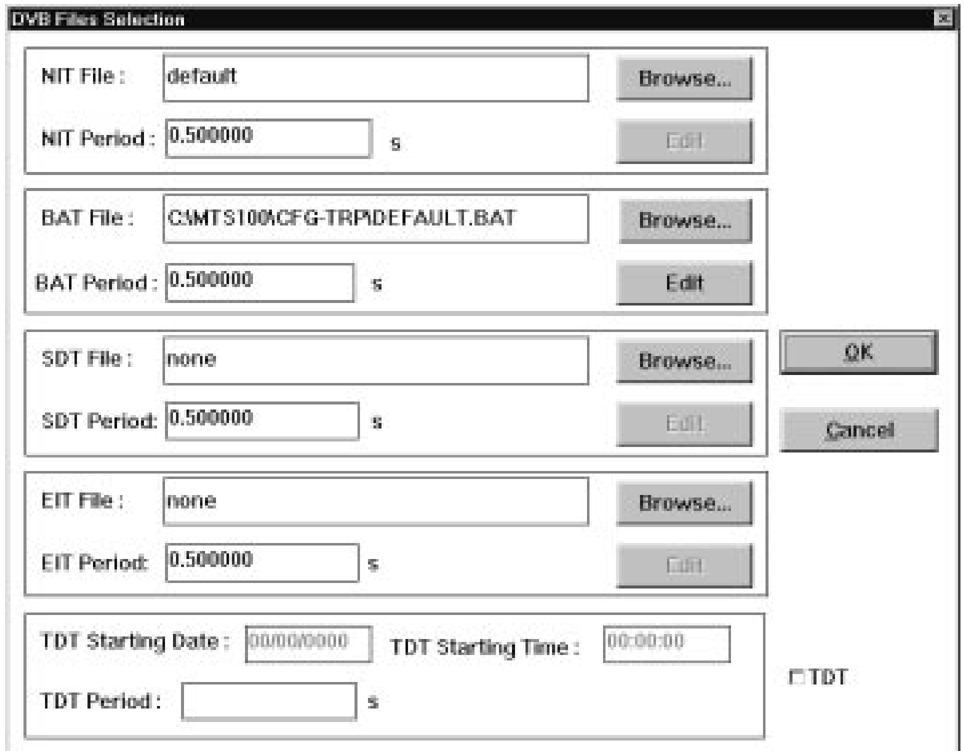
Adding and Editing SI Tables. The SI icon is present in the Multiplexer hierarchy when DVB is selected on the Options menu.

To add or edit SI tables (NIT, BAT, SDT, EIT, and TDT), select the SI icon and click the Add (+) command button, select the icon and press INSERT, or double-click the SI icon.

Select the SI icon and use the Add command (or press INSERT) to add one SI table at a time.



Double-click the SI icon to open the DVB File Selection dialog box and select/edit two or more of the tables.



Use the same selection and editing techniques that are described for the NIT beginning on page 3–85:

1. Select a template table file either by entering the name directly into the text box (use the full path name) or by clicking Browse.
2. Click Edit to open the Edit Table application. Be sure to save the table file under a new name (usually the name of the configuration file).
3. When you are done editing the table and have returned to the table dialog box, select the newly edited and renamed table file either by clicking Browse or by entering the path and table name in the file name box.
4. Change the table period if necessary. You may wish to set the period much higher than the standard 0.5 seconds to create a transport stream that thoroughly exercises the MPEG-2 receiving equipment.
5. When you are finished, click OK (*not* Cancel) to confirm the table selec-tion(s) and table period(s).

A tutorial for creating a configuration file with DVB information begins on page 2–83. The tutorial contains detailed instructions for adding the SI table files. For more complete information about editing the tables, refer to *Using the PSI and SI Table Editor*, which begins on page 3–103.

Once you add a table, you can later double-click the (NIT, BAT, SDT, EIT, or TDT) icon to open a table dialog box and select a new table file, edit the table, or set the table period.

Deleting Hierarchy Items

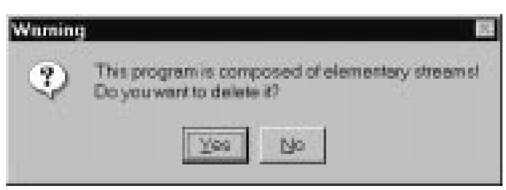
The Delete command on the Edit menu deletes the selected item and any icons under it. For example, if you delete a program, all the associated elementary streams are also deleted.

You can only delete the following:

- Programs (check first if it has elementary streams)
- Elementary Streams: Video, Audio, and Data
- SI Tables: EIT, SDT, BAT, TDT, and NIT (replaced with the default NIT). The SI itself cannot be deleted. If you want to remove the SI, deselect DVB in the Options menu; refer to *DVB*, on page 3–73, for more information.

If the NIT file exists (and is different from the default), the current NIT is replaced by the default NIT. An NIT must always be present. If you try to delete the NIT and it is already the default NIT, no action occurs, even though the command is available. The BAT, SDT, or EIT are simply deleted from the configuration file. The multiplex rate and the Rate Gauge are updated after each deletion from the SI file.

If you choose to delete a program and it is not empty (it has elementary streams), a dialog box appears requesting confirmation before the Multiplexer application will delete the program.



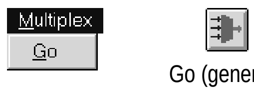
When you delete a program, its PID is automatically removed from the PAT.

If an elementary stream is selected, it deletes the selected elementary stream. The Rate Gauge is then updated.

The Delete command in the Edit menu is equivalent to the Delete (–) command button on the upper tool bar.

Generating a Multiplex

Once you have finished creating a configuration file, you may generate the described multiplex/transport stream by choosing Go from the Multiplex menu or by clicking the equivalent command button.



Go (generate a Multiplex)

If the configuration file definition is not complete, transport stream generation does not begin, and a message box appears to indicate the problem. The multiplex definition is not complete in the following cases:

- There is an empty program (a program without an elementary stream).
- There is an undefined elementary stream or the Multiplexer cannot find the linked file.

After checking the validity of data, a dialog box opens up and asks for the TS file name. It always starts with the current configuration name with the .trp extension. That name is not required and you can change it as desired. (The .trp extension is required.)

You can place the transport stream file directly on the Data Store Disks. The c:\carb0\mono directory is the link to the Data Store Disks.

***NOTE**. Although Windows NT as installed on the MTS 210 cannot handle files larger than 2 GB, files greater than this may be generated and placed directly on the Data Store Disks.*

The duration gauge shows the progress of multiplex generation.

Times shown are “real” stream times; actual .trp file generation takes much longer.

- Time (on the left side of the gauge) indicates the stream time elapsed since the beginning of the stream; it is equivalent to bits written divided by the multiplex rate.
- Estimated Final Time is an estimate of the duration of the entire stream.

- The percentage shown on the gauge is simply the current Time (on the left side of the gauge) divided by the Estimated Final Time (times 100).
- Running Time shows the actual stream duration after generation is complete.

During transport stream file generation, all other commands are disabled (grayed). Press the ESC key to stop multiplex calculation at any time.

An Example Configuration File

You can view (and edit) configuration files with any text editing application such as Notepad, which is included with Windows NT. An example of a configuration file is shown below. Notice that each heading is enclosed in brackets.

```
[MUX]
CountProg=1
Mux Rate=10.000000
Global time=0.000000
Type of scrambling=0
DVB Option=1
Dynamic SI Option=0

[PSI]
PSI Period=0.100000
NIT PID=16
PID PMT 1=21
PID PMT 2=22
PID PMT 3=23
PID PMT 4=24
CAT=0
Nb EMM=0

[SI]
NIT File=default
BAT File=C:\MTS100\CFG-TRP\DEFAULT.BAT
SDT File=none
EIT File=none
NIT Period=0.500000
BAT Period=0.500000
SDT Period=0.500000
EIT Period=0.500000
```

```
[Prog 1]
Nb Video=1
Nb Audio=0
Nb Data=0
Nb ECM=0
PCR period=0.040000
Starting time=0.000000

[Video Stream 1 Prog 1]
Video file=C:\MTS100\VIDEO\625\MOBL-015.MP2
Rate=2.500000
PES packet size=2048
Initial delay=0.000000
Offset DTS=0.141244
MPEG=2
Profile Level=164
Chroma format=1
vbv size=55296
Nb frames per s=25.000000
Horizontal size=352
Vertical size=288
Stream Id=224
Picture=1.000000

[Prog 2]
Nb Video=1
Nb Audio=0
Nb Data=0
Nb ECM=0
PCR period=0.040000
Starting time=2.000000

[Video Stream 1 Prog 2]
Video file=C:\MTS100\EXAMPLE\VIDEO\625\MOBL_060.MP2
Rate=7.800000
PES packet size=2048
Initial delay=0.000000
Offset DTS=0.000000
MPEG=2
Profile Level=132
Chroma format=1
vbv size=1251328
Nb frames per s=25.000000
Horizontal size=720
Vertical size=576
Stream Id=224
Picture=1.000000
```

```
[Prog 3]
Nb Video=0
Nb Audio=0
Nb Data=1
Nb ECM=0
PCR period=0.040000
Starting time=5.000000

[Data Stream 1 Prog 3]
Data file=C:\MTS100\BIN\CANAL.HLP
Rate=1.000000
Initial delay=0.000000
Stream Id=240
Data loop=0
PES format=0

[Prog 4]
Nb Video=0
Nb Audio=1
Nb Data=0
Nb ECM=0
PCR period=0.040000
Starting time=7.000000

[Audio Stream 1 Prog 4]
Audio file=C:\MTS100\EXAMPLE\AUDIO\1KHZ.AUD
Rate=0.064000
PES packet size=2048
Initial delay=0.000000
Offset PTS=0.375000
Layer=2
ID=1
Sampling frequency=48.000000
Protection=1
Mode=3
Stream Id=192
```

Using the PSI and SI Table Editor

With the PSI and SI Table Editor application, you can create and edit the following components of MPEG-2 and DVB transport streams/multiplexes:

- MPEG-2 Program Specific Information (PSI) contained in the PMT (Program Map Table).
- Digital Video Broadcasting Specific Information (DVB-SI), contained in five different tables:

  Network Information Table (NIT)

  Service Description Table (SDT)

  Event Information Table (EIT)

  Bouquet Association Table (BAT)

  Running Status Table (RST)

PSI tables give information pertaining only to the multiplex that contains them. The PMT identifies and indicates the locations of the streams that make up each service and the Program Clock Reference (PCR) fields for a service. The table is transmitted in sections.

In contrast, DVB-SI tables provides information on services and events carried by different multiplexes and other networks.

- The NIT conveys information relating to the physical organization of the multiplex, the transport streams carried on a given network, and the characteristics of the network itself.

  Transport Streams are identified In the NIT by the combination of an original network ID and a transport stream ID.
- The BAT provides information regarding bouquets (collections of services that are marketed as a single entity).
- The SDT contains data describing the services in the system.
- The EIT contains data concerning events and programs, such as event name, start time, duration, etc.. (An event is a grouping of elementary broadcast data streams with a defined start and end time belonging to a common service. A program is a concatenation of one of more events under the control of a broadcaster.)

The PSI and SI Table Editor application can also display a global view of the relationships between the various SI tables.

For brevity, the PSI and SI Table Editor application is referred to as the Edit Table application throughout this manual.

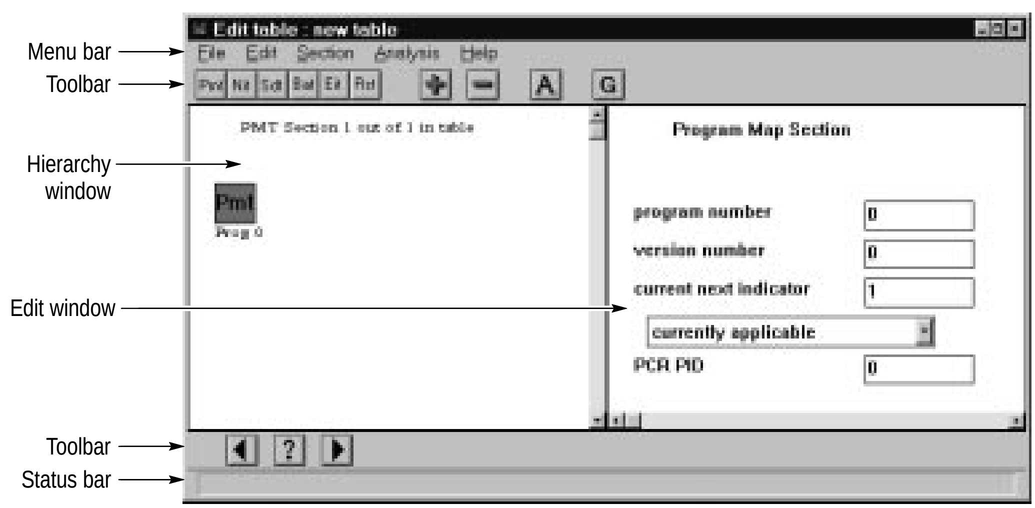
***NOTE**. This software complies with Draft prETS 300 468 May 1996 document. Please refer to this document for more details on parameter values in order to generate correct tables.*

Edit Table Application Window

You can access the Edit Table application in two ways.

- Through the Windows Start menu.
- While in the Multiplexer application, double-click the PMT icon or select Edit in one of the SI table dialog boxes (this method ensures correct association of the table and configuration files.)

The Figure below shows the default application window with the default PMT table file displayed. Most parts of the Edit Table window are similar for all table types. The exceptions are the Hierarchy window and Edit window.



Hierarchy Window The Hierarchy window shows the structure of the currently selected table. Additions to and deletions from the table are made in this window. Insert and change the parameter values in the Edit window.

Edit Window

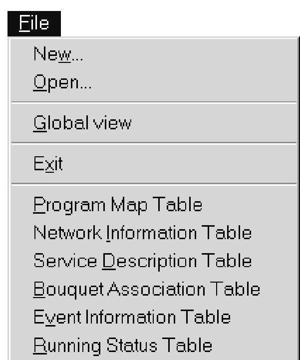
The Edit window displays and edits the parameters contained in the currently selected icon. If you want to add or delete an entire item, select it from the Hierarchy window.

Menu Commands

The following section lists the commands available from the Menu bar and explains their function and use.

File Menu. The File menu provides the commands for file management. It accesses the Global View and opens new or existing table files. It also closes the application.

With no tables open

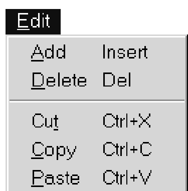


With at least one table open

Use	To
New	Create a new table file
Open	Open an existing table file
Save	Save the current selection to disk
Save as	Save the current selection with a new file name
Save All	Save all open tables to their respective files
Close	Close the currently selected table
Global View	Show the association between selected NIT, SDT, and EIT table files
Exit	Exit (quit) the Edit Table application
Program Map Table	Display the current PMT. If a PMT is not currently open, then you can either create a new one or open an existing PMT file.
Network Information Table	Display the current NIT table file. If an NIT file is not currently open, then you can either create a new file or open an existing NIT file.

Use	To
Service Descriptor Table	Display the current SDT file. If an SDT file is not currently open, then you can either create a new file or open an exiting SDT file.
Bouquet Association Table	Display the current BAT file. If a BAT file is not currently open, then you can either create a new file or open an existing BAT file.
Event Information Table	Display the current EIT file. If no EIT file is currently open, then you can either create a new file or open an existing EIT file.
Running Status Table	Display the current RST file. If no RST file is currently open, then you can either create a new file or open an existing RST file.

Edit Menu. The Edit menu allows you to add and delete items from the table files.



Use	To
Add	Add various items to the table file
Delete	Delete the currently selected item and all its sub-items. Deleted items are not copied to the Windows clipboard. (The main icon cannot be deleted.)
Cut	Cut the currently select item and all its sub-items and copy them to the Windows clipboard. (The main icon cannot be deleted.)
Copy	Copy the currently selected item and all available sub-items to the Windows clipboard. (The main icon cannot be copied to the clipboard.)
Paste	Pastes the content of the clipboard at the currently selected location

Section Menu. Each table file can have up to 800 sections.

The sections of a PMT correspond to programs. The sections of an NIT describe the physical organization of the multiplex (network). The sections of the SDT describe transport streams. The sections of a BAT describe a bouquet. The sections of the EIT each describe a service.

Use	To
Next	Display the next section. (Current section number + 1.)
Previous	Display the previous section. (Current section – 1.)
Number	Display the entered section number
New	Create a new section with the default values
Delete	Delete the current section. (No warning or recovery.)

Analysis Menu. The Analysis menu allows you to check the integrity of your table files.

Use	To
Coherence	Check the open table files for both internal and intra-table coherence to the standards. Refer to *Coherence Analysis*, on page 3–115.

Help Menu. The Help menu provides standard Windows and application-specific information.

Use	To
Index	Launch Windows Help, if necessary, and open the Edit Table help index
About	Open the About window and discover version information about the Edit Table application

The Command Buttons

The command buttons on the upper and lower toolbars act as shortcuts for several menu commands. Table 3–12 lists the tool bar commands and their functions.

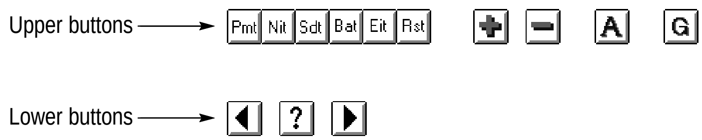
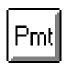
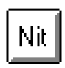
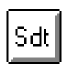
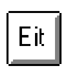
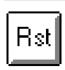


Table 3–12: Functions available from the tool bars

Icon	Function	Equivalent Menu Command
	Select, create, or open a PMT	File: Program Map Table
	Select, create, or open an NIT	File: Network Information Table
	Select, create, or open an SDT	File: Service Description Table
	Select, create, or open a BAT	File: Bouquet Association Table
	Select, create, or open an EIT	File: Event Information Table
	Select, create, or open an RST	File: Running Status Table
	Add an item to the selection	Edit: Add (see page 3–116)
	Cut the selected item	Edit: Cut (see page 3–119)
	Analyze the table coherence	Analysis: Coherence
	Access the Global View	File: Global View (see page 3–148)
	View the previous section (current section number –1)	Section: Previous (see page 3–113)
	View a specific section	Section: Number... (see page 3–113)
	View the next section (current section number +1)	Section: Next (see page 3–113)

Hierarchy Icons

Table 3–13 lists all of the icons that may be displayed and their meanings.

Table 3–13: Icons used in the Edit Table application

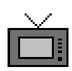
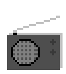
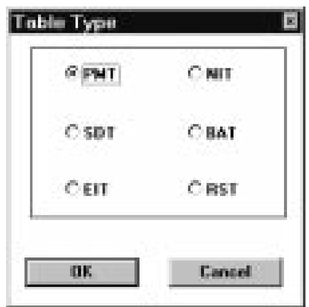
Icon	Meaning
Pmt	Beginning of a Program Map Table (PMT only)
Nit	Beginning of a Network Information Table (NIT and global view only)
Sdt	Beginning of a Service Descriptor Table (SDT and global view only)
Bat	Beginning of Bouquet Association Table (BAT only)
Eit	Beginning of an Event Information Table (EIT and global view only)
Es	Elementary Stream (PMT only)
Ts	Transport Stream (NIT, BAT, and global view only)
S	Service (SDT and global view only)
E	Event (EIT and global view only)
	Descriptor
	Subdescriptor
	A service defined as a TV service (in a descriptor); its name appears instead of its Service ID number (Global View only)
	A service defined as a Radio service (in a descriptor); its name appears instead of its Service ID number (Global View only)
Txt	A service defined as a Teletext service (in a descriptor); its name appears instead of its Service ID number (Global View only)

Table File Operations

Table descriptions are contained in individual files that are manipulated much like any other file in Windows NT. Unlike document files in a typical word processing application, however, only one table file of a given type (PMT, NIT, SDT, BAT, EIT, or RST) can be open at a time.

Creating a New Table

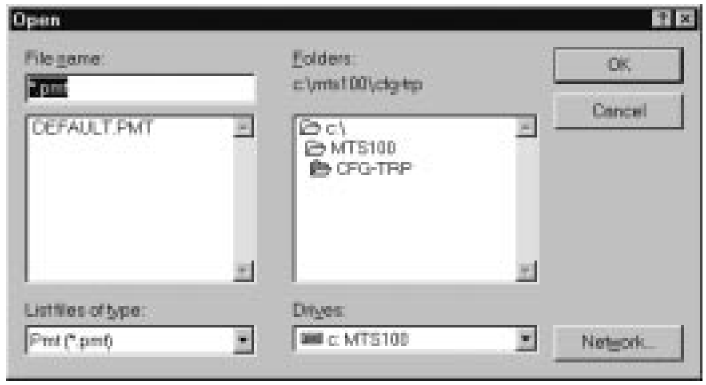
Choose the New command from the File menu to open the Table Type dialog box. Select the desired option button (PMT, NIT, SDT, BAT, or EIT) and then choose OK.



If a table of the selected type is open, the table editor automatically closes it unless you have changed the table since it was last saved. If there are unsaved changes, Edit Table opens the Save Table dialog box to give you the opportunity to save the changes before closing the file, ignore the changes and close the file, or cancel the New command.

Opening an Existing Table

To open an existing table file, choose Open from the File menu. The Table Type dialog box is opened; select the appropriate table type and click OK. A standard Windows Open dialog box appears.



Select the desired table file from the list. (You can change directories as required.)

After selecting the OK command button, the selected file is displayed in the Hierarchy and Edit windows.

Saving Tables

The Save, Save As, and Close commands (in the File menu) work as in most other Windows applications. The Edit Table application also has a convenient Save All command that lets you save all open table files in one operation.

Save. The Save command saves the current table file. If the current table file is untitled, then the Save As dialog box is automatically displayed.

Save As. Choose the Save As command to save a table file under a new name. The Windows Save As dialog box appears. Enter a new name in the File Name Text box and choose OK. The correct extension for the table type (.pmt, .nit, .sdt, .bat, .eit, or .rst) is added automatically to the file name.

***NOTE**. The Edit Table application requires the correct file name extension. Do not use a different extension.*

Save All. The Save All command allows you to save all open table files at the same time. (The Save command only saves the current file.) If any of the files is untitled, it will automatically provide the Save As dialog box. After you name the file, the application continues saving the remaining files.

Close. The Close command closes the current table file window, but it does not close the application.

The Save Table dialog box appears if the table file has unsaved changes or if it is currently untitled. You can then either save the file, ignore the changes (and close without saving), or cancel the close command.

Selecting Among Open Tables

In Edit Table, you can have only one of each table type open at a time, and you can display only one of the open tables at a time. To quickly select among all open tables, click the command button that corresponds to the desired table type or select the type of table from the File menu.

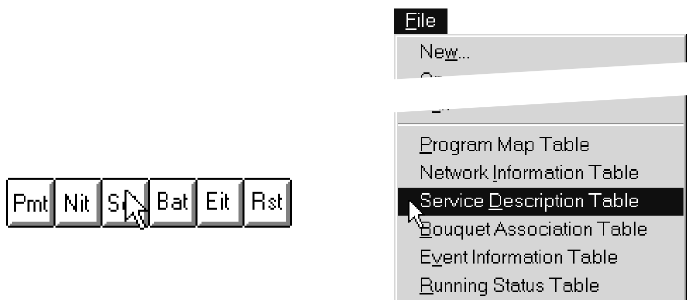
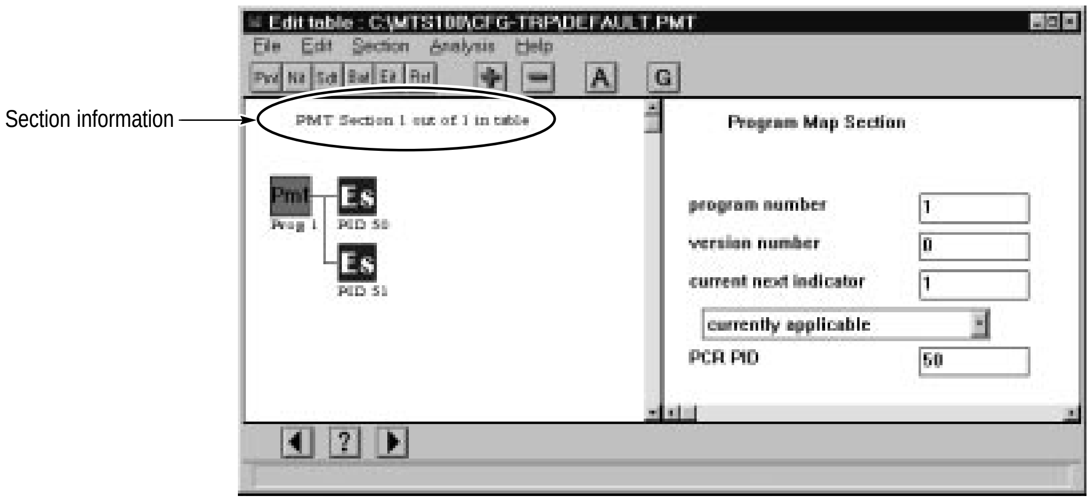


Table Sections

The sections of a PMT correspond to programs. The sections of an NIT describe the physical organization of the multiplex (network). The sections of the SDT describe transport streams. The sections of a BAT describe a bouquet. The sections of the EIT each describe a service. Each table file can have up to 800 sections.



The Section menu contains commands for moving among table sections.

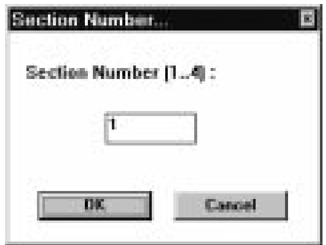
Next. Choose the Next command (or click the Next command button on the lower tool bar) to display the next section of the table file. (Next is defined as the current section number +1.)

If the last section is currently displayed, you will receive an error message and the application will continue to display the current section.

Previous. Choose the Previous command (or click the Previous command button) to display the previous section of the current table file. (Previous is defined as the current section –1.)

If the first section is currently being displayed, you receive an error message and the application continues to display the current section.

Number. Choose the Number command, or click the Go To (?) command button, to select the section number to display (rather than scrolling through them). The Section Number dialog box appears.



Enter the desired section number in the text box and choose OK. The application then displays the desired section number. If you enter a section number that is beyond the range of available section numbers, the last available section is displayed.

New. The New command adds a new section at the end of the table file and then displays that section. For example, if you are initially displaying section 2 of 5, after the New command, section 6 of 6 is displayed.

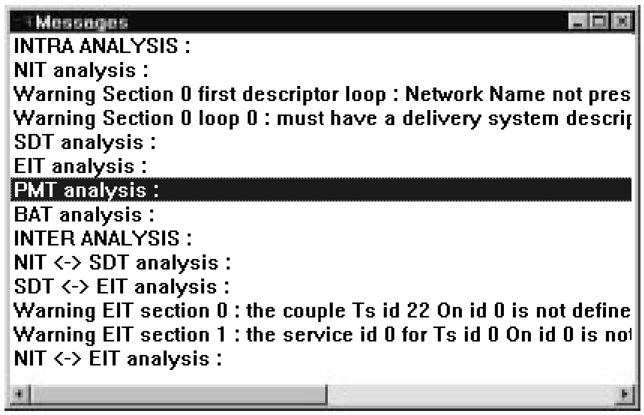
The new section contains only the default information for that table file.

Delete. The Delete command removes the currently displayed section. If the deleted section is a middle section, the sections that follow are then appropriately renumbered.

***CAUTION.** Sections are deleted without confirmation. Take care when using this command; deleted sections* cannot *be recovered.*

Coherence Analysis

Choose the Coherence command (on the Analysis menu) or click the A button on the tool bar to conduct an analysis of all open table files (not just the table file displayed). The application returns with a report listing any non-conformities to the standard, both within a table file (INTRA ANALYSIS) and between the open table files (INTER ANALYSIS).

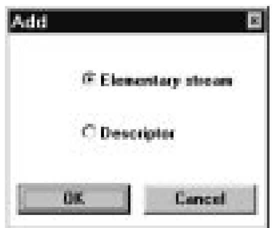


Double-click on any error listed in the Messages window to select the table and item (such as a stream, event, service, or descriptor) that contains the error. The hierarchy of the appropriate table section will be displayed in the Hierarchy window; the non-conforming table item will be selected with its parameters visible in the Edit window.

You can correct the errors through the Edit window and then rerun the Coherence Analysis to check the corrections. The message box shown below appears after an analysis of error-free table files.

Adding Table Items

To add an item to a table section, first select the insertion point by clicking the appropriate table, stream, loop, or descriptor icon. Then choose Add from the Edit menu or click the Add (+) command button on the upper tool bar. Where there is only one appropriate type of item, that item is automatically added. In most cases, however, Edit Table opens a dialog box for specifying the type of item to add.



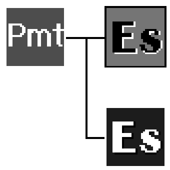
The items available depend on the table type and the insertion point. At the table icon level, you have the following choices:

Selected icon	Items that can be added
PMT	An elementary stream or a descriptor
NIT or BAT	A transport stream or a descriptor
SDT	A service
EIT	An event or a descriptor
RST	An event

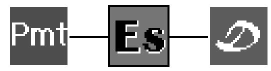
You can add the following items at the stream, event, or service level:

Icon	Items
Elementary stream	Another elementary stream or a descriptor
Transport stream	Another transport stream or a descriptor
Service	Another service or a descriptor
Event (EIT)	Another event or a descriptor
Event (RST)	Another event

At the stream/service/event level, a stream, service, or event is added “in parallel” to the existing item; a descriptor is added to the item.

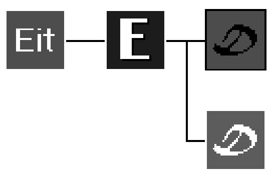


Stream selected,
stream added

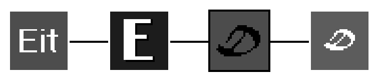


Stream selected,
descriptor added

At the descriptor level, you can add another (parallel) descriptor. You can also add a subdescriptor to some types of descriptor (refer to *Table Item Parameters*, beginning on page 3–120).

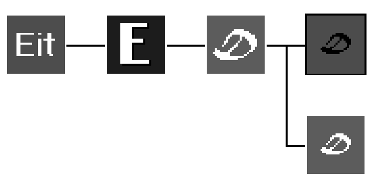


Descriptor selected,
descriptor added

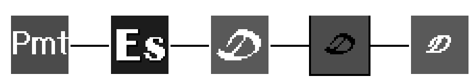


Descriptor selected,
subdescriptor added

At the subdescriptor level, you can add another, parallel subdescriptor or—in one case—a sub-subdescriptor.



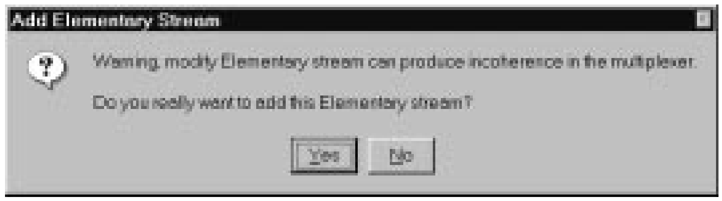
Subdescriptor selected,
subdescriptor added



Subdescriptor selected,
sub-subdescriptor added

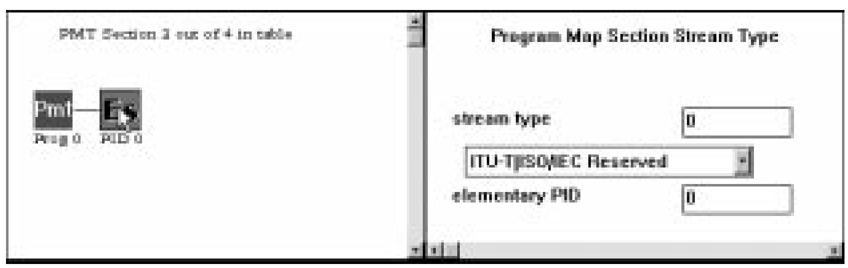
Adding a Stream, Service, or Event

When you add a transport stream, service, or event, the icon is placed immediately in the hierarchy. When you choose to add an elementary stream to a PMT, the following warning window appears.



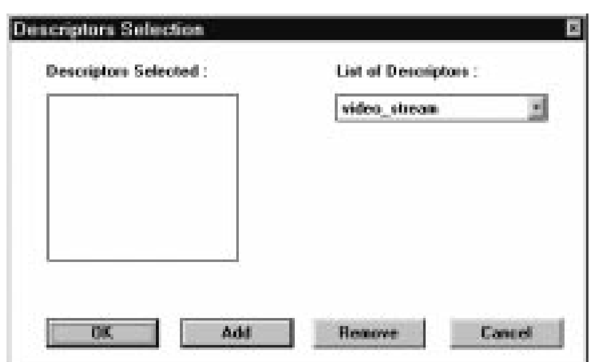
Because it is likely to produce incoherence, you may not add or delete elementary streams when you start Edit Table from the Multiplexer application.

After you add a new item, select the icon and enter the appropriate values in the Edit window text boxes on the right side of the Edit Table application window. See *Table Item Parameters*, beginning on page 3–120, for more information about the various stream, service, and event parameters.



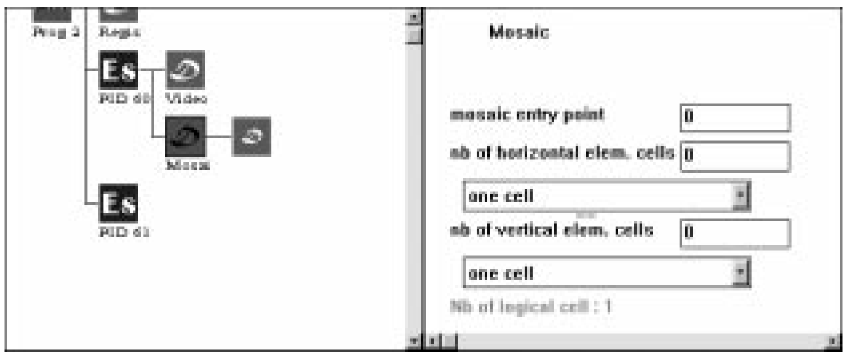
Adding Descriptors

When you select Descriptor in the Add dialog box and click OK, Edit Table opens the Descriptors Selection dialog box.



1. Select the type of descriptor you wish to add from the drop-down List of Descriptors.

2. Click Add. The descriptor name appears in the Descriptors Selected list.
3. Repeat steps 1 and 2 until the Descriptors Selected field lists all desired descriptors.
4. Click OK to add the selected descriptors to the table and hierarchy.
5. Select the descriptor icons one at a time and enter the appropriate information in the Edit window text boxes. See *Table Item Parameters,* beginning on page 3–120, for more information about the various descriptor parameters.



Removing and Copying Table Items

Use the Delete, Cut, Copy, and Paste commands of the Edit menu as you would in any Windows application to edit the table section.

Delete. The Delete command removes the selected item and any items below it in the hierarchy display. The icons that represent the file type can not be deleted. The delete command does *not* place removed items onto the clipboard.

Cut. The Cut command is identical to the Delete command except that cut items are placed on the clipboard. They can then be pasted back in the table file at the same or a different location.

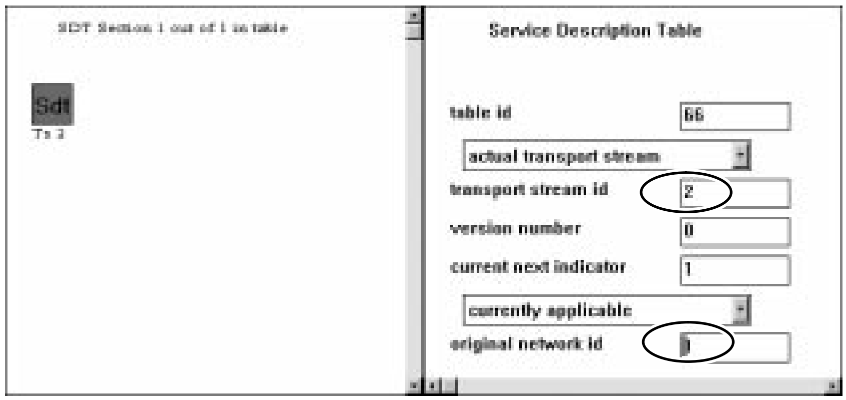
Copy. The Copy command copies the currently selected item to the clipboard. It is then available to paste at different locations. All items below the selected item on the hierarchy are also copied to the clipboard.

You cannot copy the entire table with this command. If you wish to copy the entire table, use the File menu Save As command and save the table file under a different name.

Paste. The paste command places the contents of the clipboard at the selected point in the table file.

Table Item Parameters

Editing a table involves entering the appropriate information and parameter values for each table section, elementary stream, descriptor, and subdescriptor. For example, an SDT must have the appropriate original network ID and transport stream ID if it is to be associated with the correct transport stream.



This section lists the fields and parameters of each item available in the MTS 210 Edit Table application. Other parameters are either fixed or determined automatically by the application. If you need more information about PSI and SI table items, refer to *Learning More About Table Items*, on page 3–146.

Tables

You can specify the parameters of five PSI and SI tables: PMT, NIT, SDT, BAT, and EIT.

PMT. The Program Map Table identifies the streams that make up each service and indicates the packets that contain the service streams and PCRs.

Parameter	Possible Values	Notes
Program number	0 to 65535	Identifies the program
Version number	0 to 31	Incremented by 1 when the information contained in the table section changes.
Current next indicator	0 (not yet applicable) 1 (currently applicable)	Select through the drop-down list box or enter 0 or 1; the corresponding entry changes automatically.
PCR PID	0 to 8191	The PID of the transport packets that contain the PCR fields for this program. By default, it is the PID of the first ES in the program. If you enter a PID other than those of the program streams, the PCRs reside in their own transport packets.

A PMT may be further defined with the addition of the following descriptors:

Registration
Conditional_access
ISO_639_language
System_clock
Multiplex_buffer_utilization
Copyright
Maximum_bitrate
Private_data_indicator
Smoothing_buffer
Service_move
User defined

Refer to *PSI Descriptors* (page 3–128) and *SI Descriptors* (page 3–134) for more information.

NIT. The Network Information Table conveys information relating to the physical organization of the multiplexes (transport streams) carried on a given network and to the characteristics of the network itself.

Parameter	Possible Values	Notes
Table ID	64 (actual network) 65 (other network)	Select through the drop-down list box or enter 64 or 65; the corresponding entry changes automatically.
Network ID	0 to 65535	ETSI publication ETR 162 lists valid IDs for various networks.
Version number	0 to 31	Incremented by 1 when the information contained in the table section changes.
Current next indicator	0 (not yet applicable) 1 (currently applicable)	Select through the drop-down list box or enter 0 or 1; the corresponding entry changes automatically.

An NIT may be further defined with the addition of the following descriptors:

Network_name
Stuffing
Linkage
Private_data_specifier
User defined

Refer to *SI Descriptors*, beginning on page 3–134, for more information.

SDT. The Service Description Table lists the names and other parameters associated with each service in a particular multiplex.

Parameter	Possible Values	Notes
Table ID	66 (actual transport stream) 70 (other transport stream)	Select through the drop-down list box or enter 66 or 70; the corresponding entry changes automatically.
Transport stream ID	0 to 65535	Identifies the transport stream that this SDT pertains to.
Version number	0 to 31	Incremented by 1 when the information contained in the table section changes.
Current next indicator	0 (not yet applicable) 1 (currently applicable)	Select through the drop-down list box or enter 0 or 1; the corresponding entry changes automatically.
Original Network ID	0 to 65535	This is the network ID of the originating delivery system.

An SDT may be further defined with the addition of the following descriptors:

Stuffing
Bouquet_name
Service
Country_availability
Linkage
NVOD_reference
Time_shifted_service
Mosaic
CA_identifier
Telephone
Private_data_specifier
User defined

Refer to *SI Descriptors*, beginning on page 3–134, for more information.

BAT. The Bouquet Association Table provides a means of grouping services that might be used as one way a decoder presents the available services to the viewer. A particular service can belong to one or more bouquets.

Parameter	Possible Values	Notes
Bouquet ID	0 to 65535	ETSI publication ETR 162 lists valid IDs for various bouquets.
Version number	0 to 31	Incremented by 1 when the information contained in the table section changes.
Current next indicator	0 (not yet applicable) 1 (currently applicable)	Select through the drop-down list box or enter 0 or 1; the corresponding entry changes automatically.

A BAT may be further defined with the addition of the following descriptors:

Stuffing
Bouquet_name
Country_availability
Linkage
CA_identifier
Private_data_specifier
User defined

Refer to *SI Descriptors*, beginning on page 3–134, for more information.

EIT. The Event Information Table is used to transmit information relating to all events that occur or will occur in the MPEG multiplex. The EIT contains information about the current transport stream and optionally covers other transport streams that the decoder can receive.

Parameter	Possible Values	Notes
Table ID	78 (actual TS present/follow) 79 (other TS present/follow) 80 to 95 (actual TS, schedule) 96 to 111 (other TS, schedule)	Select through the drop-down list box or enter the appropriate number; the corresponding entry changes automatically.
Service ID	1 to 65535	Must be the same as the program number in the corresponding PMT.
Current next indicator	0 (not yet applicable) 1 (currently applicable)	Select through the drop-down list box or enter 0 or 1; the corresponding entry changes automatically.

Parameter	Possible Values	Notes
Section number	0 to 255	Is incremented by 1 for each additional section with the same table ID, service ID, TSID, and original network ID.
Last section number	0 to 255	The number of the last section with the same table ID, service ID, TSID, and original network ID.
Transport stream ID	0 to 65535	Identifies the transport stream that this EIT pertains to.
Original Network ID	0 to 65535	This is the network ID of the originating delivery system.
Segment last section number	0 to 255	The last section of this subtable seg-ment. If the subtable is not segmented, it is the same as the last section number.
Last table ID	0 to 255	The last table ID used. Equal to the ID of this table, if there are no other tables.

Elementary Streams (in PMT)

The PMT can have up to ten elementary streams. A transport stream (and therefore a single PMT) can have no more than five elementary streams of a given type.

Parameter	Possible Values	Notes
Stream type	*see table below*	Select through the drop-down list box; Edit Table changes the corresponding value.
Elementary PID	16 though 8190	Assigned automatically by Edit Table; change to prevent conflicts with other elementary streams in other programs.

Stream Types. The following stream types may be assigned:

Stream Type Description	Value
ITU–T | ISO/IEC Reserved	0
ISO/IEC 11172 Video	1
ITU–T Rec. H.262 | ISO/IEC 13818–2 Video or ISO/IEC 11172–2 constrained parameter video stream	2
ISO/IEC 11172 Audio	3
ISO/IEC 13818–3 Audio	4
ITU–T Rec. H.222.0 | ISO/IEC 13818–1 private_sections	5
ITU–T Rec. H.222.0 | ISO/IEC 13818–1 PES packets containing private data	6

Stream Type Description	Value
ISO/IEC 13522 MHEG	7
ITU–T Rec. H.222.0 | ISO/IEC 13818–1 Annex A DSM CC	8
ITU–T Rec. H.222.1	9
ISO/IEC 13818–6 type A	10
ISO/IEC 13818–6 type B	11
ISO/IEC 13818–6 type C	12
ISO/IEC 13818–6 type D	13
ISO/IEC 13818–1 auxiliary	14
ITU–T Rec. H.222.0 | ISO/IEC 13818–1 Reserved	15 – 127
User Private	128 – 255

Descriptors. An elementary stream may be further defined with the addition of the following descriptors:

Video_stream
Audio_stream
Hierarchy
Registration
Data_stream_alignment
Target_background_grid
Video_window
Conditional_access
ISO_639_language
Multiplex_buffer_utilization
Copyright
Maximum_bitrate
Private_data_indicator
Smoothing_buffer
STD
IBP
Mosaic
Stream_identifier
Teletext
User defined

Refer to *PSI Descriptors* (page 3–128) and *SI Descriptors* (page 3–134) for more information.

Transport Streams (in NIT or BAT)

The transport streams carried in a network or bouquet are uniquely identified by a combination of transport_stream_id and original_network_id.

Parameter	Possible Values	Notes
Transport stream ID	0 to 65535	Identifies the transport stream; correlates to TSID parameters in the SDT and EIT.
Original Network ID	0 to 65535	This is the network ID of the originating delivery system.

Transport streams may be further defined with the addition of the following SI descriptors:

Service_list
Stuffing
Satellite_delivery_system
Cable_delivery_system
Private_data_specifier
User defined

Refer to *SI Descriptors*, beginning on page 3–134, for more information.

EIT Events

Parameter	Possible Values	Notes
Event ID	0 to 65535	Identifies the event
Start time	Date Time (24 hour)	yyyy/mm/dd (today's date is suggested) hh/mm/ss
Duration	00:00:00 to 99:59:59	hh/mm/ss
Running status	0 (Undefined) 1 (Not running) 2 (Starts in a few seconds) 3 (Pausing) 4 (Running)	Select through the drop-down list box or enter the value and click the EIT icon; Edit Table changes the corresponding entry.
Free CA mode	0 (Not scrambled) 1 (Scrambled)	Select through the drop-down list box; Edit Table changes the numeric value.

EIT events may be further defined with the addition of the following SI descriptors:

Stuffing
Linkage
Short_event
Extended_event
Tme_shifted_event
Component
CA_identifier
Content
Parental_rating
Telephone
Private_data_specifier
Short_smoothing_buffer
User defined

Refer to *SI Descriptors*, beginning on page 3–134, for more information.

RST Events

The Running Status Table updates the timing status of one or more events, which may be necessary when a scheduling change causes an event to be early or late. The RST has no parameters or descriptors of its own; event parameters describe the event and indicate its running status.

Parameter	Possible Values	Notes
Transport stream ID	0 to 65535	Identifies the transport stream to which the RST pertains; the TS can be in any multiplex within the delivery system.
Original Network ID	0 to 65535	This is the network ID of the originating delivery system.
Service ID	1 to 65535	Must be the same as the program number in the corresponding PMT.
Event ID	0 to 65535	Identifies the event
Running status	0 (Undefined) 1 (Not running) 2 (Starts in a few seconds) 3 (Pausing) 4 (Running)	Select through the drop-down list box or enter the value and click the event icon; Edit Table changes the corresponding entry.

PSI Descriptors

Descriptors are structures that may be used to extend the definitions of programs and program elements. You can add the appropriate PSI descriptors to a PMT or to the elementary streams under a PMT.

Audio Stream. The audio_stream_descriptor identifies the coding version of an audio elementary stream.

Parameter	Possible Values	Notes
Free format flag	Bitrate index ≠ 0000 (0) Bitrate index = 0000 (1)	Select through the drop-down list box; Edit Table changes the numeric value.
ID	0 or 1	Set this to the same value as the ID fields in the audio stream.
Layer	0 to 3	Set this to the same value as the layer fields in the audio stream.
Variable rate audio indicator	No decoding discontinuity (0) Decoding discontinuity (1)	Select through the drop-down list box; Edit Table changes the numeric value.

Conditional Access. The conditional_access_descriptor is used, where required, to enable scrambling, either system-wide or of a service, program, elementary stream, or event.

Parameter	Possible Values	Notes
CA system ID	0 to 65535	Indicates the applicable type of CA (scrambling) system; private and not defined in international standards.
CA PID	0 to 8191	The PID of the transport stream packets that contain conditional access (ECM or EMM) information.
Private data bytes	*An even number of hexadecimal characters*	May be speciified by the CA system provider.

Copyright. The copyright_descriptor may be used to identify copyrighted work. The descriptor applies to the entire program when added to a PMT and to a single elementary stream when added to an ES.

Parameter	Possible Values	Notes
Copyright identifier	0 through 2^{32}	Identifies the copyright registration authority; number is provided by ISO/IEC JTC1/SC29.
Additional copyright information	*An even number of hexadecimal characters*	May be specified by the copyright registration authority.

Data Stream Alignment. The data_stream_alignment_descriptor indicates the type of alignment used in the elementary stream.

Parameter	Possible Values	Notes
Alignment type	1 (Slice, video access unit, or audio syncword) 2 (Video access unit) 3 (GOP or SEQ) 4 (SEQ)	Select through the drop-down list box; Edit Table changes the numeric value. (GOP = group of pictures)

Hierarchy. The hierarchy_descriptor identifies program elements that contain parts of elementary streams that are multiplexed in multiple transport streams.

Parameter	Possible Values	Notes
Hierarchy type	1 (Spacial scalability) 2 (SNR scalability) 3 (Temporal scalability) 4 (Data partitioning) 5 (Extension bitstream) 6 (Private stream) 15 (Base layer)	Select through the drop-down list box or enter the number and click the descriptor icon; Edit Table changes the corresponding entry.
Hierarchy layer index	0 to 63	The hierarchy index of the elementary stream; no two streams in a program can have the same index.
Hierarchy embedded layer index	0 to 63	Defines the hierarchy table index of the program element that must be accessed before the elementary stream can be decoded.
Hierarchy channel	0 to 63	Indicates the intended transmission channel of the elementary stream.

IBP. The IBP_descriptor indicates how groups of (I, P, and B) pictures are encoded in the video elementary stream.

Parameter	Possible Values	Notes
Closed GOP flag	0 or 1	Set to 1 when a group of pictures header is encoded before every I-frame.
Identical GOP flag	0 or 1	Set to 1 when the sequence of picture types between I-frames is the same throughout the sequence.
Max GOP length	1 to 16383	The maximum number of coded pictures between any two I-pictures in the sequence.

ISO 639 Language. The ISO_639_language_descriptor, through subdescriptors, identifies the language or languages used in associated program elements. You may set two subdescriptor parameters through Edit Table.

Parameter	Possible Values	Notes
ISO 639 language code	*Three alpha characters*	See ISO 639
Audio type	1 (clean effects) 2 (hearing impaired) 3 (visual impaired commentary)	Select through the drop-down list box; Edit Table changes the numeric value.

Maximum Bitrate. The maximum_bitrate_descriptor indicates the highest bitrate, including transport overhead, to be encountered in the program or program element. If the descriptor is added to the PMT, the indicated bitrate applies to the entire program; if it is added to the ES icon, it applies to a single elementary stream.

Parameter	Possible Values	Notes
Maximum bitrate	0 to 4194303 (2^{22})	Units are 50 bytes/second

Multiplex Buffer Utilization. The multiplex_buffer_utilization_descriptor provides upper and lower time limits for occupancy of the T-STD multiplex decoder. This information may be used by some remultiplexing devices.

Parameter	Possible Values	Notes
Bound valid flag	Not valid (0) Valid (1)	Applies to the LTW offset bounds of this descriptor; select through the drop-down list box; Edit Table changes the numeric value.
LTW offset lower bound	0 to 32767	The lower limit, in (27 MHz/300) clock periods, of LTW offset values in the stream(s) referenced by this descriptor.
LTW offset Upper bound	0 to 32767	The upper limit, in (27 MHz/300) clock periods, of LTW offset values in the stream(s) referenced by this descriptor.

Private Data. The private_data_descriptor can facilitate compatible private extensions to the PSI data stream.

Parameter	Possible Values	Notes
Private data indicator	0 to 2^{32}	The value of this parameter has no universal meaning; the target decoder must be able to interpret the value.

Registration. The registration_descriptor is used to identify private data formats.

Parameter	Possible Values	Notes
Format identifier	0 to 2^{32}	Assigned by a registration authority.
Additional identification information.	*An even number of hexadecimal characters*	Defined by the assignee of the format_identifier.

Smoothing Buffer. The smoothing_buffer_descriptor describes the smoothing buffer for the program or elementary stream.

Parameter	Possible Values	Notes
SB leak rate	0 to 4194303 (2^{22})	The rate at which data is removed from the buffer, in units of 400 bits/second.
SB size	0 to 4194303 (2^{22})	Size of the smoothing buffer, in bytes.

STD. The STD_descriptor determines how the T-STD transfers elementary stream data from the multiplex buffer to the elementary stream buffer. The leak method is the default, used if this descriptor is not present.

Parameter	Possible Values	Notes
Leak valid flag	0 (VBV_delay method) 1 (Leak method)	Select through the drop-down list box; Edit Table changes the numeric value.

System Clock. The system_clock_descriptor conveys information about the system clock used to generate program time stamps.

Parameter	Possible Values	Notes
External clock reference indicator	0 (Internal reference) 1 (External reference)	Select through the drop-down list box; Edit Table changes the numeric value
Clock accuracy integer	0 to 63	These parameters together indicate system clock accuracy in ppm; if clock_accuracy_integer = 0, system clock accuracy is, by default, 30 ppm.
Clock accuracy exponent	0 to 7	

Target Background Grid. The target_background_grid_descriptor, combined with the video_window_descriptor, determines the placement of an undersized picture on the display area. The target_background_grid_descriptor describes the display area.

Parameter	Possible Values	Notes
Horizontal size	0 to 16383	Horizontal size, in pixels, of the target background grid (display area).
Vertical size	0 to 16383	Vertical size, in pixels, of the target background grid (display area).
Aspect ratio information	1 (1.0000) 2 (0.6735) 3 (0.7031) 4 (0.7615) 5 (0.8055) 6 (0.8437) 7 (0.8925) 8 (0.9157) 9 (0.9815) 10 (1.0255) 11 (1.0695) 12 (1.0950) 13 (1.1575) 14 (1.2015)	Select the correct ratio through the drop-down list box; Edit Table automatically changes the parameter value. See ISO/IEC13818-2 for a definition of aspect_ratio_information.

Video Stream. The video_stream_descriptor identifies the coding parameters of a video elementary stream.

Parameter	Possible Values	Notes
Multiple frame rate flag	0 (Single frame rate) 1 (Multiple frame rates)	Select through the drop-down list box; Edit Table changes the numeric value
Frame rate code	1 (23.976) 2 (24.0, 23.976*) 3 (25.0) 4 (29.97, 23.976*) 5 (30.0, 23.976*, 24*, 29.97*) 6 (50.0, 25.0*) 7 (59.94, 23.976*, 29.97*) 8 (60.0, 23.976*, 24.0*, 29.97*, 30.0*, 59.94*)	Frames per second *ed rates are permitted when the multiple frame rate flag = 1
MPEG1 only flag	0 (MPEG1 or 2 video data) 1 (MPEG1 video data)	Select through the drop-down list box; Edit Table changes the numeric value.
Constrained parameter flag	0 or 1	Set to 0 when the video stream may contain both constrained and unconstrained video data; always set to 1 when the MPEG1_only_flag is set to 0.
Still picture flag	0 (Moving and still pictures) 1 (Still pictures)	Available when the MPEG1_only_flag is 0; Select through the drop-down list box; Edit Table automatically changes the numeric value.
Profile and level indicator	0 to 255	Available when the MPEG1_only_flag is 0; set this to the same value as the profile_and_level_indication fields in the video stream.
Chroma format	1 (4:2:0) 2 (4:2:2) 3 (4:4:4)	Available when the MPEG1_only_flag is 0; set this to the same value as the chroma_format fields in the video stream.
frame rate extension flag	0 or 1	Available when the MPEG1_only_flag is 0; set this flag to 1 when either the frame_rate_extension_n or the frame_rate_extension_d field in the video stream is non-zero.

Video Window. The video_window_descriptor, combined with the target_background_grid_descriptor, determines the placement of an undersized picture (or window) on the display area. The video_window_descriptor determines the location of the smaller picture on the display area and the priority of the picture when it overlaps with other pictures on the same display.

Parameter	Possible Values	Notes
Horizontal offset	0 to 16383	Horizontal position of the video window, in pixels, from the left edge of the background grid (display area).
Vertical offset	0 to 16383	Vertical position of the video window, in pixels, from the top edge of the background grid (display area).
Window priority	0 to 15	Zero is the lowest priority, 15 is the highest; windows with priority 15 are always visible.

SI Descriptors

You can add appropriate SI descriptors to PMT, NIT (and TS), BAT (and TS), SDT services, and EIT events.

Bouquet Name. The bouquet_name_descriptor carries the bouquet name in text form.

Parameter	Possible Values	Notes
Name	*Alphanumeric characters*	—

CA Identifier. The CA_identifier descriptor indicates that the bouquet, service, event, or component is associated with a conditional access system and identifies the type of CA system. You must add a subdescriptor in order to specify the CA system; the table lists values for the CA system subdescriptor parameter.

Parameter	Possible Values	Notes
CA system ID	Reserved (0) Standardized Systems (1) Canal Plus (256) CCETT (512) Deutch Telecom (768) Eurodec (1024) France Telecom (1280) Irdeto (1536) Jerrold/GI (1792) Matra Communication (2048) News Datacom (2304) Nokia (2560) Norwegian Telecom (2816) NTL (3072) Philips (3328) Scientific Atlanta (3584) Sony (3840) Tandberg Television (4096) Thomson (4352) TV/Com (4608) HPT—Croatian P&T (4864) HRT—Croatian R&TV (5120) IBM (5376) Nera (5632) BetaTechnik (5888)	When you select the system ID through the drop-down list box, Edit Table automatically changes the numeric value. Each CA system specifier has been assigned a range of numeric values; see ETR 162 for more information. You may enter an appropriate number in the value box and click the subdescriptor icon; Edit Table automatically changes the CA system specifier name to match.

Cable Delivery System. The cable_delivery_system_descriptor identifies the characteristics of the cable delivery system.

Parameter	Possible Values	Notes
Frequency	0000.0000 to 9999.9999	MHz
FEC outer	1 (No outer FEC coding) 2 (RS 204/188)	Select through the list box or enter the appropriate value and click the descriptor icon.
Modulation	1 (16 QAM) 2 (32 QAM) 3 (64 QAM) 4 (128 QAM) 5 (256 QAM)	Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropri-ate entry in the corresponding field.

Parameter	Possible Values	Notes
Symbol rate	000.0000 to 999.9999	Msymbols/second
FEC inner	1 (1/2 conv. code rate) 2 (2/3 conv. code rate) 3 (3/4 conv. code rate) 4 (5/6 conv. code rate) 5 (7/8 conv. code rate) 15 (No conv. coding)	Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropriate entry in the corresponding field.

Component. The component_descriptor identifies the type of component stream and may be used to provide a text description of the elementary stream.

Parameter	Possible Values	Notes
Stream content	1 (Video) 2 (Audio) 3 (Teletext)	Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropriate entry in the corresponding field.
Component type	*Value depends on stream content; see the following table*	
Component tag	0 to 255	Enter the same value as in the PMT stream_identifier descriptor (if present).
ISO 639 language code	*A 3-character language code as defined in ISO 639*	Use when the stream content is audio or teletext.
Description	*Alphanumeric characters*	A text description of the elementary stream.

The possible component types depend on the value of the stream content parameter.

Stream Content	Possible Component Type Values
Video (1)	1 (4:3 aspect ratio) 2 (16:9 aspect ratio with pan vectors) 3 (16:9 aspect ratio without pan vectors) 4 (Greater than 16:9 aspect ratio)
Audio (2)	1 (Single mono channel) 2 (Dual mono channel) 3 (Stereo (2 channel)) 4 (Multi-lingual, multi-channel) 5 (Surround sound) 64 (For visually impaired) 65 (For the hard of hearing)
Teletext (3)	1 (EBU teletext subtitles) 2 (Associated EBU teletext) 10 through 13, 32 through 35 (Various DVB subtitle types; refer to ETS 300 468)

Content. The content_descriptor classifies event content. ETS 300 468 lists more than 75 content classifications such as "motor sport" or "musical/opera." The content descriptor must have a content nibble subdescriptor. The following table describes the subdescriptor parameters.

Parameter	Possible Values	Notes
Content nibble level 1	1 (Movie) 2 (News/current affairs) 3 (Show/game show) 4 (Sports) 5 (Children/youth programs) 6 (Music/ballet/dance) 7 (Arts/culture) 8 (Social/political/economics) 9 (Education/science/factual 10 (Leisure hobbies)	The content class. Select through the drop-down list box; Edit Table automatically changes the numeric value. You may also enter an appropriate number in the value box and click the subdescriptor icon; Edit Table automatically changes the CA system specifier name to match.
Content nibble level 2	*Choices depend on and correspond to the level 1 selection. See ETS 300 468 for a complete list.*	The content sub-class. Select through the drop-down list box, Edit Table automatically changes the numeric value.
User nibble (2 fields)	0 to 15	Defined by the broadcaster

Country Availability. The country_availability_descriptor can either list the countries for which the bouquet or service is intended or those countries for which it is *not* intended. You can add both an intended and a not intended descriptor; if the lists conflict, the not intended descriptor takes precedence.

Parameter	Possible Values	Notes
Country availability flag	0 (Not intended) 1 (Intended)	Enter the flag value or select from the drop-down list box.
Country code	*One or more 3-character country codes as specified in ISO 3166 [2] or ETR 162*	Do not insert spaces between the codes. For example, to specify both the UK and Scandinavia, enter GBR900.

Extended Event. The extended_event_descriptor can provide a detailed description of an event. You may use a set of up to 16 extended event descriptors in addition to the short event descriptor.

Parameter	Possible Values	Notes
Descriptor number	0 to 15	Determines the order of this descriptor in the set of associated descriptors.
Last descriptor number	0 to 15	The number of the last descriptor in this set of extended event descriptors.
ISO 639 language code	*A 3-character language code as defined in ISO 639*	The language of the descriptor text
Text char	*Up to 256 alphanumeric characters*	The descriptor text

You can use extended event subdescriptors to arrange text into two columns. Each subdescriptor Edit window has an “item description char” field and an “item char” field. In a typical application, the information in the extended event subdescriptors is arranged as follows:

item_description_chars_1	item_chars_1
item_description_chars_2	item_chars_2
item_description_chars_3	item_chars_3

Actual content could resemble the following:

Title:	MTS 210, The Movie
Director:	John D. Rector
Producer:	Jack Producer

The number of subdescriptors appears as “Nb item:” (in gray characters) on the extended event descriptor Edit window.

Linkage. The linkage_descriptor identifies a service that can be presented when the consumer requests additional information.

Parameter	Possible Values	Notes
Transport stream ID	0 to 65535	Identifies the TS that contains the indicated information service
Original network ID	0 to 65535	The network ID of the originating delivery system for the indicated information service.
Service ID	0 to 65535	Uniquely identifies an information service within a transport stream; must be the same as the program number in the corresponding PMT.
Linkage type	1 (Information) 2 (Electronic program guide) 3 (CA replacement)	Enter the value or select from the drop-down list box.
Private data bytes	*An even number of hexadecimal characters*	

Mosaic. The mosaic_descriptor and subdescriptors can describe a mosaic component, which is a collection of different video images that form a coded video component. Each video image occupies a small region of the screen. The information in the descriptors and subdescriptors determines the content and arrangement of the mosaic. Refer to ETS 300 468 for a full explanation of the mosaic descriptor and subdescriptors.

Parameter	Possible Values	Notes
Mosaic entry point	0 or 1	A value of 1 indicates that this mosaic is the highest in a hierarchy.
Nb of horizontal elementary cells	0 (one cell) 1 (two cells) ... 7 (eight cells)	Cells = value+1 Enter the value or select from the drop-down list box.
Nb of vertical elementary cells	0 (one cell) 1 (two cells) ... 7 (eight cells)	Cells = value+1 Enter the value or select from the drop-down list box.

The mosaic subdescriptors have the following parameters:

Parameter	Possible Values	Notes
Logical cell ID	0 to 63	
Cell presentation info	0 (undefined) 1 (video) 2 (still picture) 3 (graphics/text)	Enter the value or select from the drop-down list box.
Cell linkage info	0 (undefined) 1 (bouquet related) 2 (service related) 3 (other mosaic related) 4 (event related)	Enter the value or select from the drop-down list box.
Bouquet ID	0 through 65535	Present only if the cell linkage info value is 1.
Original network ID	0 through 65535	Present when cell linkage info value is 2, 3, or 4.
Transport stream ID	0 through 65535	
Service ID	0 through 65535	
Event ID	0 through 65535	Present only if the cell linkage info value is 4.

Each mosaic subdescriptor may have several *sub*subdescriptors. The subsubdescriptors have only one parameter, the elementary cell ID, which can have a numeric value from 0 to 63.

Network Name. The network_name_descriptor provides the network name.

Parameter	Possible Values	Notes
Network name	*Alphanumeric characters*	The network name

NVOD Reference. The NVOD_reference_descriptor, in conjunction with the time shifted service and time shifted event descriptors, provide a mechanism for describing a group of services that carry the same event sequence at start times that are offset from one another. Such a group of time-shifted services is known as near video on demand, or NVOD.

The NVOD reference descriptor uses subdescriptors to list the services that together form an NVOD service. The following table lists the NVOD reference subdescriptor parameters.

Parameter	Possible Values	Notes
Transport stream ID	0 to 65535	Identifies the TS that contains the service
Original network ID	0 to 65535	The network ID of the originating delivery system for the service.
Service ID	0 to 65535	Uniquely identifies the service within a transport stream; must be the same as the program number in the corresponding PMT.

Parental Rating. The parental_rating_descriptor, through subdescriptors, can contain a rating based on country and age of the potential viewers. The following table lists the parental rating subdescriptor parameters.

Parameter	Possible Values	Notes
Country code	*A 3-character country code*	Codes are specified in ISO 3166 [2]
Rating (+3 = minimum age)	1 to 15	The suggested minimum age of viewers is the rating plus three; thus a rating of 4 suggests that viewers should be at least 7 years old.

Private Data Specifier. The private_data_specifier_descriptor identifies the source of private data used in the SI stream so the decoder can reliably interpret the private data. The location of this descriptor determines the entities (network, bouquet, events, or services) to which it applies; refer to ETS 300 468 for a complete explanation.

Parameter	Possible Values	Notes
Private data specifier	0 to 2^{32}	Assigned in ETR 162 [6]

Satellite Delivery System. The satellite_delivery_system_descriptor identifies the characteristics of the satellite delivery system.

Parameter	Possible Values	Notes
Frequency (GHz)	000.00000 to 999.99999	—
Orbital position	000.0 to 999.9	Degrees; many possible entries are meaningless
West east flag	0 (Western position) 1 (Eastern position)	Enter the value or select from the drop-down list box
Polarization	0 (linear–horizontal) 1 (linear–vertical) 2 (circular–left) 3 (circular–right)	Enter the value or select from the drop-down list box
Modulation	0 (undefined) 1 (QPSK)	Enter the value or select from the drop-down list box
Symbol rate	000.0000 to 999.9999	Msymbols/second
FEC inner	1 (1/2 conv. code rate) 2 (2/3 conv. code rate) 3 (3/4 conv. code rate) 4 (5/6 conv. code rate) 5 (7/8 conv. code rate) 15 (No conv. coding)	Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropriate entry in the corresponding field.

Service. The service_descriptor provides the service type, service name, and service provider.

Parameter	Possible Values	Notes
Service type	0 (reserved) 1 (digital television) 2 (digital radio sound) 3 (teletext) 4 (NVOD reference) 5 (NVOD time-shifted service) 6 (mosaic) 7 (PAL coded signal) 8 (SECAM coded signal) 9 (D/D2–MAC) 10 (FM radio) 128 to 254 (user defined)	Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropriate entry in the corresponding field.
Provider name	*Alphanumeric text*	
Service name	*Alphanumeric text*	

Service List. The service_list_descriptor uses subdescriptors to list the services in a transport stream by service ID and type. The table lists the service list subdescriptor parameters.

Parameter	Possible Values	Notes
Service ID	0 to 65535	Uniquely identifies the service within a transport stream; must be the same as the program number in the corresponding PMT except when the service type is NVOD reference.
Service type	0 (reserved) 1 (digital television) 2 (digital radio sound) 3 (teletext) 4 (NVOD reference) 5 (NVOD time-shifted service) 6 (mosaic) 7 (PAL coded signal) 8 (SECAM coded signal) 9 (D/D2–MAC) 10 (FM radio) 128 to 254 (user defined)	Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropriate entry in the corresponding field.

Service Move. The service_move_descriptor enables a decoder to track a service as it is moved from one transport stream to another.

Parameter	Possible Values	Notes
New original network ID	0 to 65535	The ONID of the transport stream after the move
New transport stream ID	0 to 65535	The TSID after the move

Short Event. The short_event descriptor provides the event name and a short text description of the event. If a longer description is required, use up to 15 extended event descriptors *in addition* to this descriptor.

Parameter	Possible Values	Notes
ISO 639 language code	*A 3-character language code as defined in ISO 639*	The language of the text used in this descriptor
Event name	*Alphanumeric text*	
Description	*Alphanumeric text*	

Short Smoothinq Buffer. The short_smoothinq_buffer_descriptor can appear in EIT present/following and EIT schedule tables to indicate the bit rate of each event.

Parameter	Possible Values	Notes
SB size	0 (DVB reserved) 1 (buffer = 1536 bytes)	Enter the value or select from the drop-down list box
SB leak rate	0 (DVB reserved) 1 (0.0009 Mbits/s) 2 (0.0018 Mbits/s) ... 60 (108.0 Mbits/s)	Refer to ETS 300 468 for a complete list of possible values. Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropriate entry in the corresponding field.
DVB reserved bytes	*An even number of hexadecimal characters*	—

Stream Identifier. The stream_identifier_descriptor can attach a component tag to PMT transport stream descriptions. This component tag allows the EIT, through the same tag in a component descriptor, to reference the stream.

Parameter	Possible Values	Notes
Component tag	0 to 255	—

Stuffing Descriptor. The stuffing_descriptor provides a means of inserting dummy descriptors for table stuffing.

Parameter	Possible Values	Notes
Descriptor length	0 to 255	Bytes

Telephone. The telephone_descriptor provides a telephone number that can be used for modem dial-up; communication via modem may be used with narrow-band interactive channels.

Parameter	Possible Values	Notes
Foreign availability	0 (from inside the country) 1 (from outside the country)	Enter the value or select from the drop-down list box
Connection type	0 to 31	Type must be recognized by the decoder

Parameter	Possible Values	Notes
Country prefix	*Alphanumeric characters*	Consistent with international and local telecommunications standards.
Int'l area code	*Alphanumeric characters*	
Operator code	*Alphanumeric characters*	
National area code	*Alphanumeric characters*	
Core number	*Alphanumeric characters*	

Teletext. The teletext_descriptor, with subdescriptors, can appear in an ES definition in the PMT to identify streams that contain EBU teletext data. The table lists the teletext subdescriptor parameters.

Parameter	Possible Values	Notes
ISO 639 language code	*A 3-character language code as defined in ISO 639*	The language of the teletext data
Teletext type	1 (initial teletext page) 2 (teletext subtitle page) 3 (addit'l information page) 4 (program schedule page)	Select through the list box or enter the appropriate value and click the descriptor icon; the application makes the appropriate entry in the corresponding field.
Teletext magazine number	0 to 7	Identifies the magazine
Teletext page number	0 to 255	Identifies the page

Time Shifted Event. The time_shifted_event_descriptor identifies an event that is a time-shifted copy of another event.

Parameter	Possible Values	Notes
Reference service ID	0 to 65535	The ID of the NVOD reference service; does not have a corresponding service in the PMT.
Reference event ID	0 to 65535	Identifies the reference event (of which this event is a copy).

Time Shifted Service. The time_shifted_service_descriptor identifies a service that is a time-shifted copy of another service.

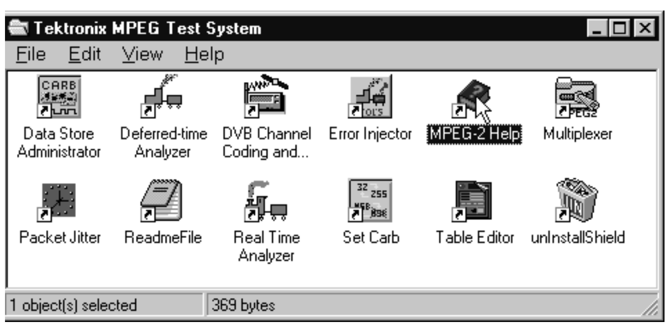
Parameter	Possible Values	Notes
Reference service ID	0 to 65535	The ID of the NVOD reference service (of which this service is a copy); does not have a corresponding service in the PMT.

User. The user defined descriptor may be added to almost any table, stream, service, or event definition.

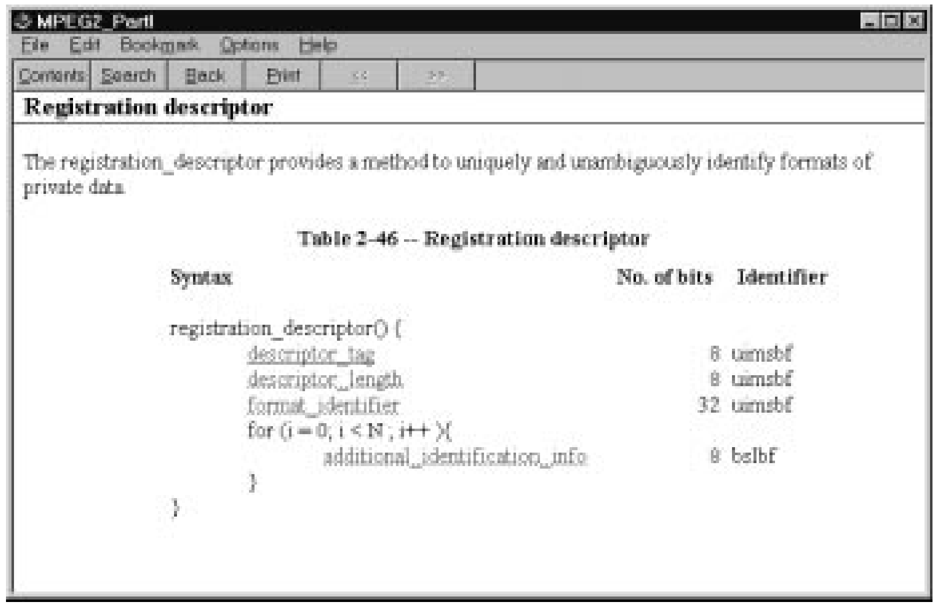
Parameter	Possible Values	Notes
Descriptor tag	128 to 254	Pick your own.
Private bytes	*An even number of hexadecimal characters*	—

Learning More About Table Items

PSI tables are defined in the ISO/IEC 13818-1 international standard; SI tables and descriptors are defined in ETS 300 468. The ISO/IEC 13818-1 text is included, in Windows help format, with the MTS 210. To open this document, click MPEG-2 Help in the Tektronix MPEG Test System submenu.

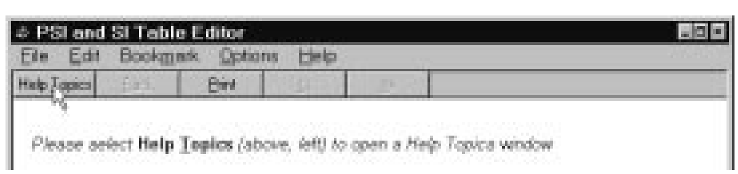


Once the help application opens, use the Contents and Search commands to find the information you need. For example, you can find a detailed description of the registration descriptor by clicking Contents, and then clicking the following hyperlinks: TECHNICAL ELEMENTS; PROGRAM AND PROGRAM ELEMENT DESCRIPTORS; Registration descriptor.



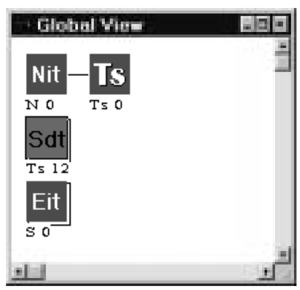
You may also wish to refer to ISO/IEC 13818-2 for additional information about video encoding or ISO/IEC 13818-3 for information about audio encoding. These publications are available through the ISO (International Organization for Standardization. The URL of the ISO web page is http://www.iso.ch/ the URL of the online ISO catalog is http://www.iso.ch/infoe/catinfo.html (current as of March 1997).

ETS 300 468 is available through the European Telecommunications Standards Institute (ETSI). The URL of the ETSI web page is http://www.etsi.fr/ (current as of March 1997). Much of the information in ETS 300 468 is available through the Edit Table Help menu. You will notice that Edit Table. Help has many fewer hyperlinks than MPEG-2 help; to find information about most topics, click the **Help Topics** command button on the Help window tool bar.

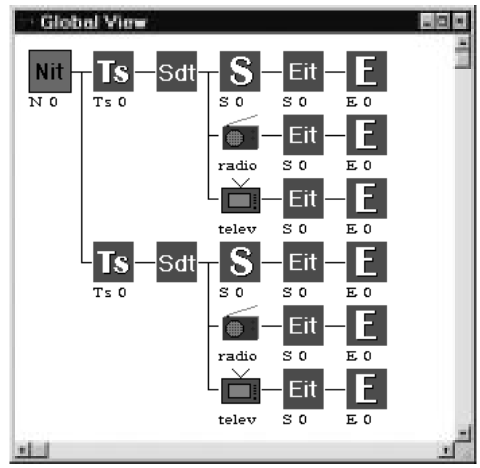


Global View

The Global View command opens a window that shows the association between selected NIT, SDT, and EIT table files. These files can have some relationship to each other, or none at all.

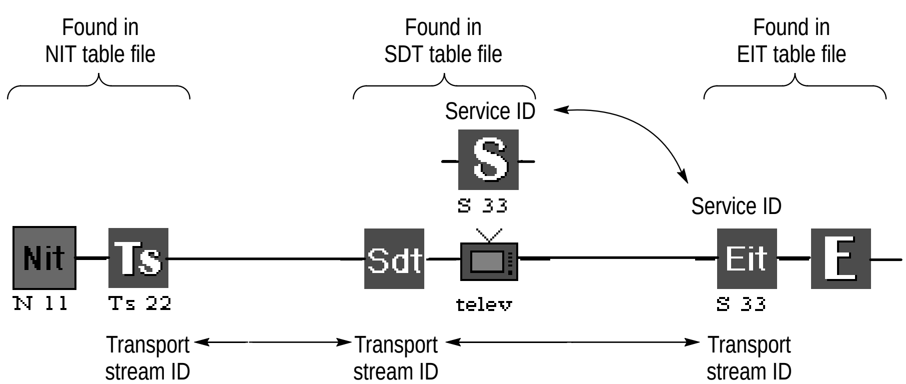


Unassociated tables



Highly associated tables

The files with a high degree of association are not interdependent. You can use these table files with table files other than the associated ones. The association ties together the files as shown below.



The NIT contains the Transport Stream, with a Transport Stream ID defined in the Transport Stream's Edit window.

If the Transport Stream ID (from the SDT Edit window) is the same, then the SDT is associated with the NIT.

If the SDT has a service that has a descriptor, there may be a service or special service icon (shown in Table 3–13 on page 3–109). The service Edit window contains the service ID parameter.

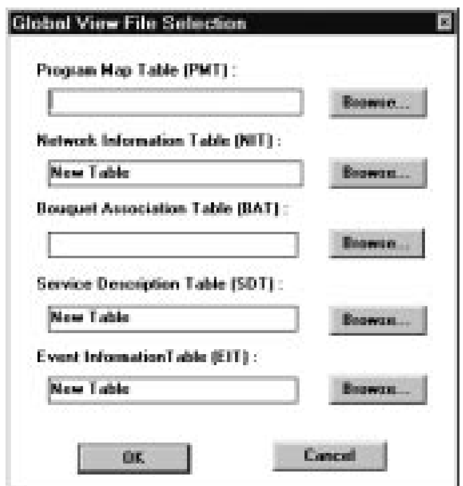
If the EIT parameters (from the Edit window) are the same as the SDT parameters for both the Service ID and the Transport Stream ID, then the EIT is associated with the SDT.

NIT and SDT files can be associated without an EIT file. Likewise, SDT and EIT files can be associated without an NIT file. NIT and EIT files cannot be associated without a SDT file between them. (The Service ID is only present in the SDT.)

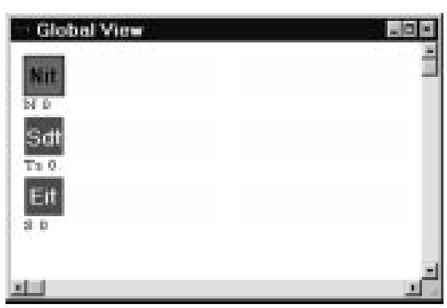
Creating Files with Complex Associations (Tutorial)

This section describes how to make table files with complex associations between networks, services, and events. Many of the simpler steps are not explained in detail. If you need help, please review the tutorial on *Creating Transport Stream Files with DVB Information* beginning on page 2–83.

1. Start by closing all currently open table files. (Use the Close command from the File menu.)
2. Create new NIT, SDT, and EIT table files. (Use the New command from the File menu.)
3. Choose Global view from the File menu (or click the G button on the upper tool bar). This brings up the Global View File Selection dialog box with the New table files as the default parameters.

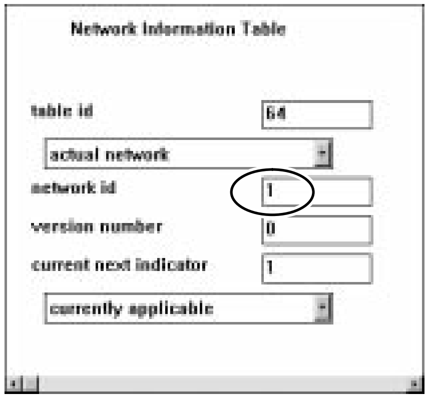


4. Click OK. This opens the Global View window.



5. Click the NIT icon in the global view to display the NIT in the Edit Table hierarchy and Edit windows.

6. Enter 1 in the network ID text box.



7. Click on the NIT icon to apply the change. Notice that the number below the NIT icon changes to N1 in both the Edit Table hierarchy and the Global View.

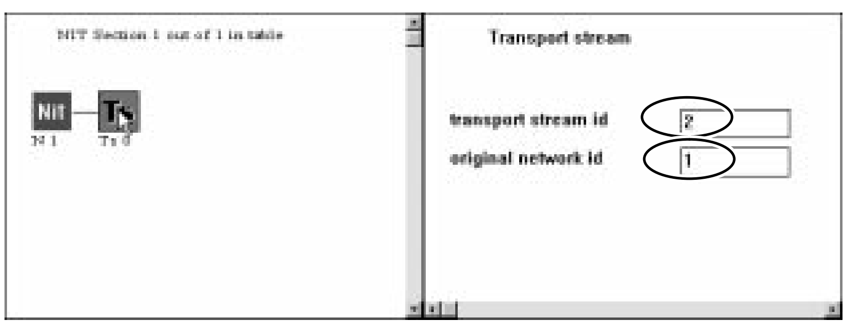
8. Add a transport stream to the NIT.

a. Click the Add (+) button on the upper tool bar.

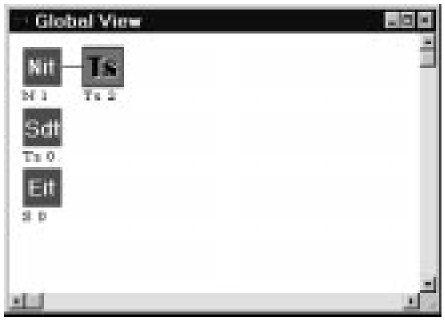
b. Select Transport stream in the resulting dialog box.

c. Click OK.

9. Select the TS icon. Enter 2 as the transport stream ID and 1 as the original network ID. Notice that the network ID has the same number as the network ID at the NIT level.



10. Apply the changes by clicking on the TS icon. Notice that both the Edit Table hierarchy and the Global View show the changes.



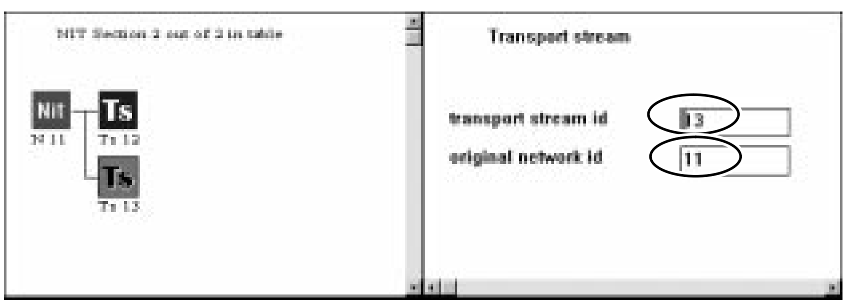
11. Add an another transport stream. (Choose Add from the tool bar. Transport stream is already selected in the Add dialog box; click OK.)

12. Click on the new TS icon to select it. Enter 3 as the transport stream ID and 1 as the original network ID.

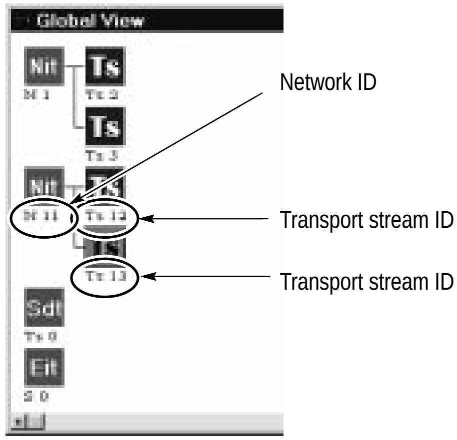
13. Apply the changes (click the TS icon) and notice the results in the hierarchy and Global View.

14. Create a new NIT section (choose New from the Section menu) and change the network ID to 11.

15. Add two transport streams to the new section. Enter 12 as the transport stream ID of the first and 13 as the ID of the second; give them both the original network ID of 11.

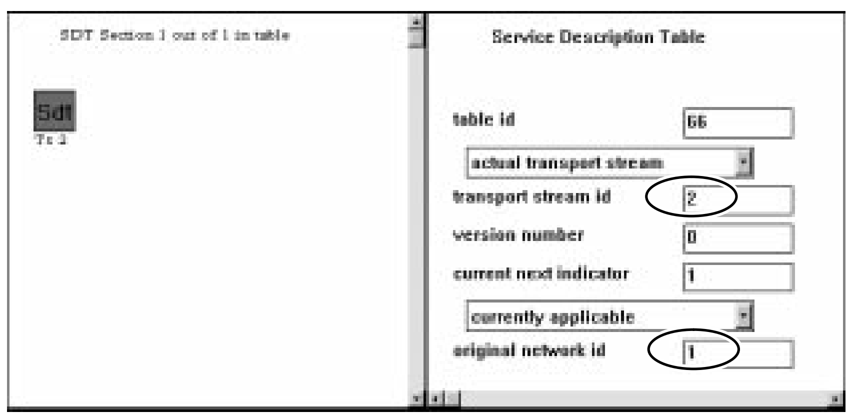


16. Notice the changes to the Global View.

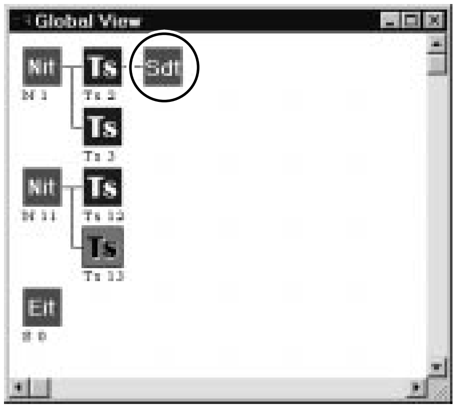


17. Click the SDT command button (or the SDT icon in the Global view) to display the SDT file.

18. Enter 2 in the transport stream ID field and 1 in the original network ID field.



19. Apply these changes (click in the hierarchy window.). Notice that the SDT is now associated with transport stream 2 in the Global View.



Experiment, if you like, with associating the SDT with other transport streams. For example, change the stream ID to 3; or change the network ID to 11 and the stream ID to 12. Watch the Global View when you click in the hierarchy window to apply the changes. When you are done experimenting, return the settings to stream ID = 2 and network ID = 1.

20. Click the Add button three times to add services to the SDT. Enter 4, 5, and 6 as the respective service IDs.

21. When you are done, notice that the service ID number is displayed under each of the service icons in both the Edit Table hierarchy and the Global View.

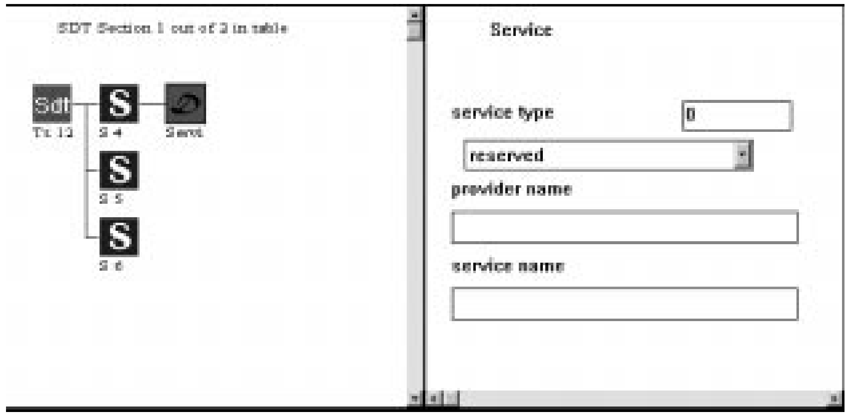
22. Add a service descriptor to service S4.

a. Select the S4 icon; then click the Add button.

b. Select Descriptor in the Add dialog box; then click OK. The Descriptors Selection dialog box appears.

c. Select service from the drop-down List of Descriptors and click Add. Then click OK to finish adding the descriptor to service four.

23. Click the new descriptor icon to select it.



24. Select digital television from the drop-down service type list box; the service type value automatically changes from 0 to 1. Enter your name in the provider name text box and enter `Television` in the service name box.

25. Click in the hierarchy window to apply the changes to the descriptor. Notice that the S4 icon in the Global View changes to resemble a television set.

26. Add service descriptors to both S5 and S6.

a. Select the S4 service descriptor icon in the hierarchy window; then choose Copy from the Edit menu (or type CTRL+C).

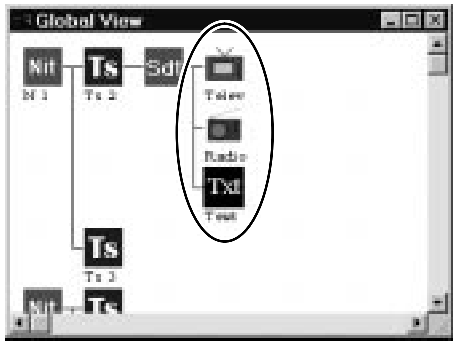
b. Select the S5 Service icon; then choose Paste from the Edit menu.

c. Select the S6 Service icon and type CTRL+V to paste the service descriptor.

27. Select the S5 descriptor (D) icon in the hierarchy. Change the service type to digital radio sound and enter `Radio` in the service name text box.

28. Select the S6 descriptor icon. Change the service type to teletext and enter `Text` in the service name text box.

29. Click again in the hierarchy window. Notice that the S5 and S6 icons in the global view have also changed appearance.



30. Create a new SDT section (choose New from the Section menu); notice that a new SDT icon appears near the bottom of the global view, not associated with any other icon.

31. Enter 3 in the transport stream ID text box and 1 in the original network ID box. Click in the hierarchy window to apply the changes and notice that the new SDT icon is now associated with TS3 in the global view.

32. Add three services and give them service IDs 41, 51, and 61 respectively.

33. Copy the S4, S5, and S6 service descriptors from the previous section and paste them onto S41, S51, and S61.

a. Click the previous button on the lower tool bar—or click the SDT icon associated with TS2 in the global view—to return to the first table section.

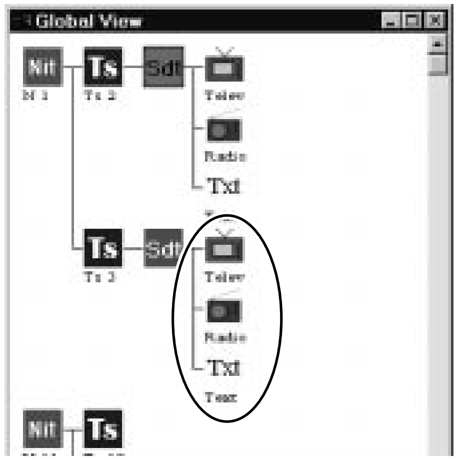
b. In the hierarchy, select the descriptor icon connected to service S4; then choose Copy from the Edit menu (or type the CTRL+C key equivalent).

c. Click the next button to return to SDT Section 2.

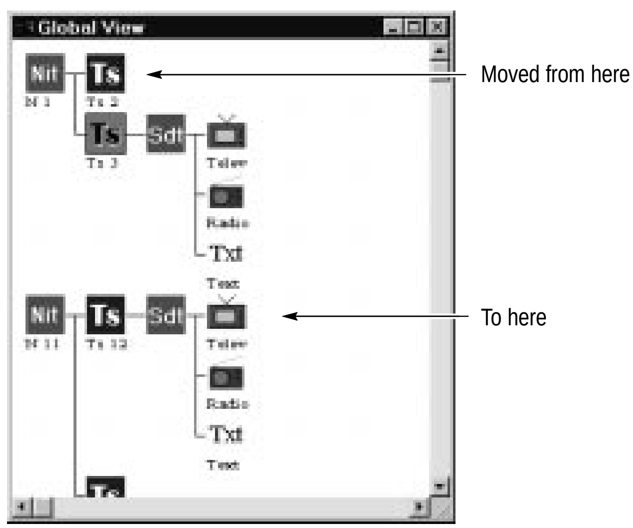
d. Select the S41 hierarchy icon and then choose Paste from the Edit menu (or type the CTRL+V key equivalent).

e. Repeat the procedures in steps a through d to copy the S5 and S6 descriptors to S51 and S61.

34. Notice that the full SDT tree in the global view is associated with transport stream 3 (TS3).



35. In the global view, click the SDT icon associated with TS3. Then, in the Edit window, change the transport stream ID from 2 to 12 and the original network ID from 1 to 11. Notice how the SDT section moves to TS12 in the global view.

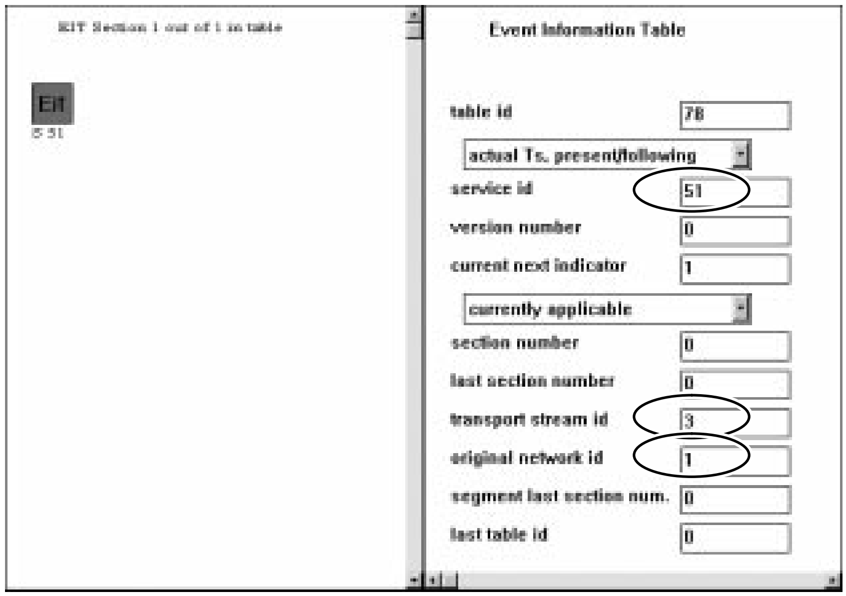


36. Click the EIT command button (or click the EIT icon in the Global View) to select the EIT file.

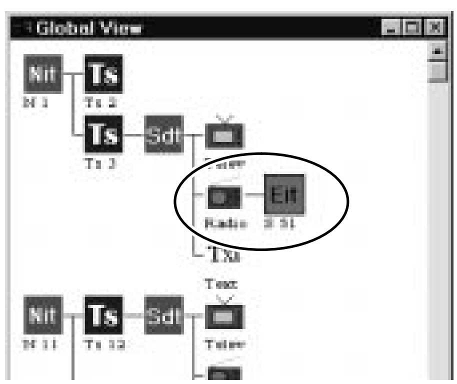
37. Make the following parameter entries:

- Service ID = 51

- Transport stream ID = 3
- Original network ID = 1



38. Click in the hierarchy to apply these changes. Notice that the EIT is now associated with S51 (radio service) of TS3 in the Global View.



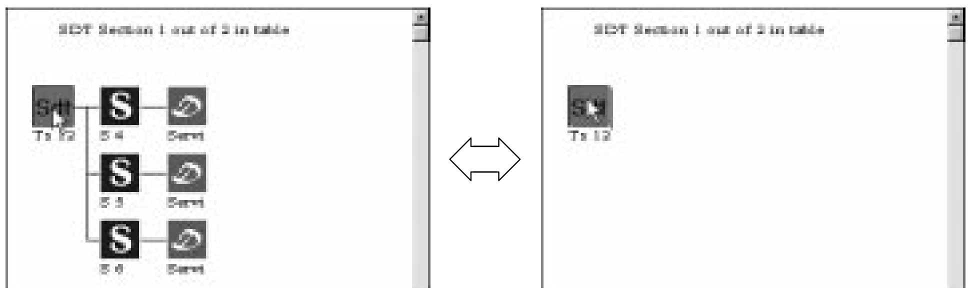
39. Create a new EIT section. (From the Section menu, choose New.)

40. Associate this EIT section with transport stream TS12, service S4 (television), on network N11. (Service ID = 4, transport stream ID = 12, and original network ID = 11.)

41. Apply these changes. Notice in the Global View that the new EIT is associated with the television service of TS12.

42. In the global view, click the SDT icon associated with TS12 to select section 1 of the SDT.

43. In the Edit Table hierarchy window, double-click the SDT icon to collapse the hierarchy. Double-click again to restore the service and descriptor icons.



44. Double-click various icons in the global view to see how that hierarchy can collapse under the clicked icon.

This concludes the Edit Table exercise. Several important rules of SI tables have been illustrated in this section:

- The NIT sets the network ID.
- The NIT contains transport streams.
- Transport streams set their own IDs.
- The SDT is associated with a transport stream through the TS ID and the original network ID.
- An SDT contains services.
- Service descriptors set the service ID.
- EITs are associated to SDTs through service ID, transport stream ID, and original network ID.

NOTE. *The table files that you have created will not pass a Coherence analysis. They are intended only to illustrate associations between the various table types.*

Using the Data Store Administrator

The Data Store Administrator application manages the Data Store disks. It also manages MPEG-2 transport stream acquisition and generation. Since the Windows File Manager does not manage the Data Store disks, the Data Store Administrator also performs all the low-level functions normally accomplished with the File Manager.

This application, the SCSI drivers, and the EISA card are optimized to guarantee a continuous data acquisition or generation rate of at least 55 Mbits/second for a minimum of 19 minutes (approximately 40 minutes in later instruments with 18 Gbyte data storage space) without interruption of the flow and no loss of data. "Looped" acquisition and generation is also available.

Terms

The terms *Data Store disk* and *system disk* are NOT interchangeable when describing how the Data Store Administrator operates. *CARB* is a French acronym for "Data Store."

Data Store Disk. The Data Store disks are four hard drives physically connected to the Data Store circuit board. These disks are used by the Data Store Administrator when generating and acquiring transport streams. They can also be used by the Multiplexer and Analyzer when dealing with files that are too large for the system disk.

Four 2 Gbyte Data Store disks, for a total capacity of 8 Gbytes, are standard on Tektronix MPEG Test Systems with serial numbers below B060000. Later instruments have 4.5 Gbyte Data Store disks, for a total of 18 Gbytes.

System Disk. The system disk is the fixed disk drive (hard disk) that contains theWindows NT operating system files and the MTS 210 application software. You can access this disk as on any personal computer using the Windows File Manager. The system disk is configured during manufacture as the Mts100 (C:) drive

CARB. The term CARB, a French acronym referring to the Data Store disks or the Data Store board, is used often in the Data Store Administrator user interface. CARB appears in this manual when necessary to reflect on-screen nomenclature and avoid ambiguity.

Special Features of the Data Store Disks

In order to generate or acquire MPEG-2 transport streams, the Data Store disks have some special features required to accommodate constant, high bit rate input/output.

First, no more than 255 files may be stored. Second, there is a rigid file structure. Normally, file data can be scattered all over a hard disk, fitting in wherever there is room. The Data Store disks must store each file in a single block. This requirement has additional implications. When you delete a file, you do not necessarily free up disk space. This is illustrated in Figure 3–1.

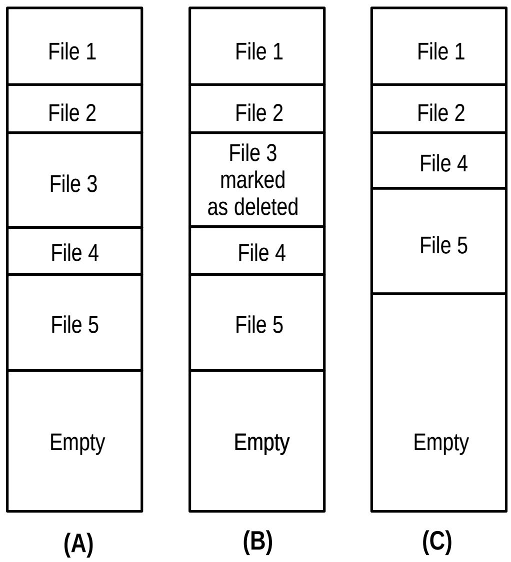


Figure 3–1: How the data store disks manage their files

Column (A) shows the initial file structure. If a new file is added to the Data Store disks, it is placed after file 5 at the top of the empty section.

Column (B) shows what happens when you “delete” file 3. Because file 3 is surrounded by other files it is only *marked* as deleted, but it is not actually deleted and cannot be overwritten. Thus, the disk space is not free for storing other files. To free the disk space, you must “compress” the Data Store disks. You can “undelete” it any time before you invoke the **Compress** command. Notice, however, that you *can* delete the last file listed (File 5 in columns A and B) as it is adjacent to the empty disk space and can add directly to that space.

Column (C) shows what happens after a Compress command (see page 3–181). File 3 is removed, files 4 and 5 are moved so that they now follow file 2, and the space freed by moving files 4 and 5 is added to the empty space. This is the only way to free disk space after deleting a middle file (other than first deleting all files below it until the file is the last listed).

***NOTE**. The Compress function requires approximately one second per megabyte of disk space to compress the Data Store disks. In other words, the Compress function can take a long time. (For example, 8 Gbyte = 8192 Mb; 8192 seconds is 136.5 minutes.)*

Due to the rigid file structure, it is strongly advised that you use the Data Store disks only for acquiring and generating transport stream files or storing large transport stream (*.trp) files.

Starting the Application

To start the Data Store Administrator, double-click the application icon in the Tektronix MPEG Test System program group window, as shown in Figure 3–2.

***NOTE**. The Analyzer and Multiplexer applications must be closed before starting the Data Store Administrator.*

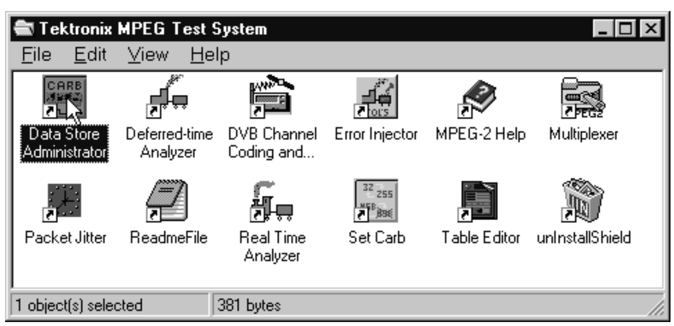


Figure 3–2: Starting the Data Store Administrator

The Application Window

When you open the Data Store Administrator, the application window shown in Figure 3–3 occupies the screen.

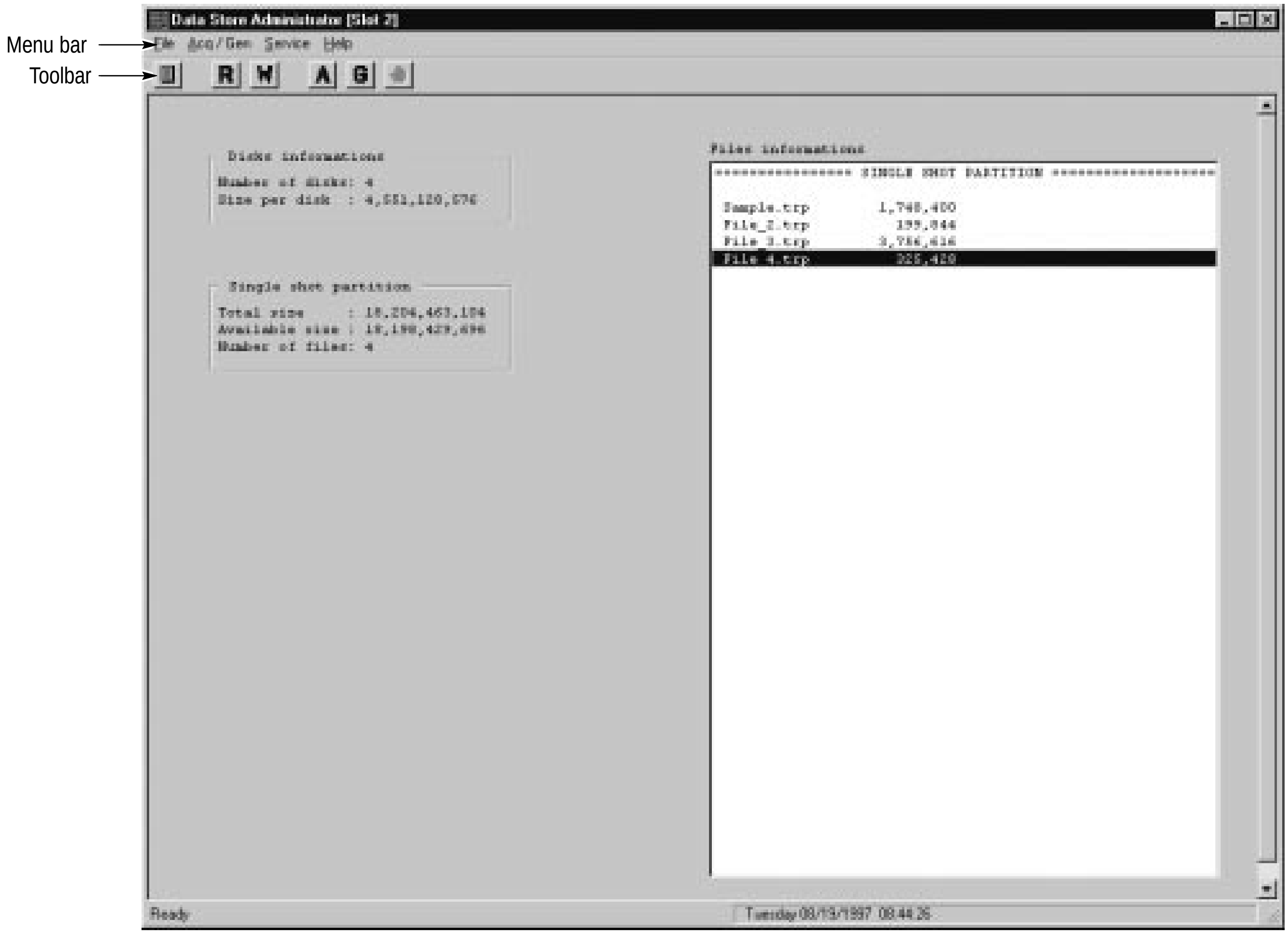
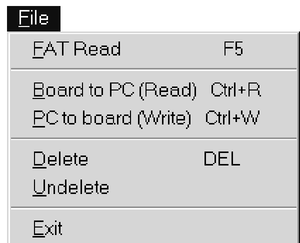


Figure 3–3: The Data Store Administrator application window

Menus

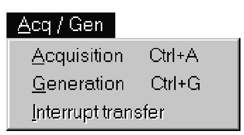
This section summarizes the commands available in the various Data Store Administrator menus

File Menu



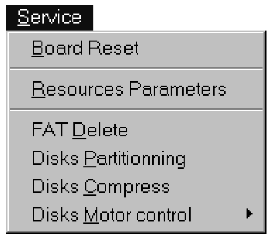
Use	To
FAT Read	List the files available on the Data Store disks
Board to PC (Read)	Copy a file from the Data Store disks to the system hard drive (or other disk)
PC to board (Write)	Copy a file from the system hard drive (or other media) to the Data Store disks
Delete	Mark a Data Store file to be deleted (unless the file is at the bottom of the list, it can be un-deleted any time before disk compression)
Undelete	Remove the delete mark from a Data Store file
Exit	Quit the Data Store Administrator application

Acq/Gen Menu



Use	To
Acquisition	Acquire a transport stream from the selected input port and save it as a Data Store file
Generation	Generate a transport stream from a transport stream file stored on the Data Store disks and outputs it from the selected output port
Interrupt transfer	Stop the current Acquire or Generation process

Service Menu

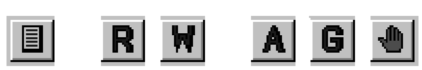


Use	To
Board Reset	Perform a software reset on the Data Store board (use after an error)
Resource[s] Parameters	Change the Data Store resource parameters
FAT Delete	Initialize the Data Store disks. The partitions are preserved, but all files are lost.
Disk[s] Partitioning	Create disk partitions. Must be run each time Data Store disks are added, removed, or replaced.
Disk[s] Compress	Free the disk space of all deleted files (marked DEL)
Disk[s] Motor control	Stop and restart the Data Store disk motors or specify automatic stop and set the delay.

? (Help) Menu

Use	To
About	Open the software version information window

Toolbar Command Buttons



The toolbar contains command buttons for several frequently used menu commands. Click a button to select the corresponding menu command. The commands are, from left to right:

FAT Read; see page 3–167 for additional information

Board to PC (Read); see page 3–168 for additional information

PC to board (Write); see page 3–169 for additional information

Acquisition; see page 3–172 for additional information

Generation; see page 3–176 for additional information

Interrupt transfer; see page 3–179 for additional information

Using File Menu Commands

The File menu provides file management commands such as file copies and deletes. The commands available from the File menu are: FAT Read, Board to PC (Read), PC to board (Write), Delete, Undelete, and Exit.

***NOTE**. Don't forget that* CARB *refers to the Data Store disks.*

FAT Read

FAT stands for File Allocation Table. The FAT Read command lists the files available on the Data Store disks and shows their status. See Figure 3–4. A FAT Read occurs whenever the Data Store Administrator is launched.

Figure 3–4: The FAT Information display

The FAT Information display gives the following information:

- Number of Disks detected on the Data Store board. There should be four. Any fewer indicates that you may have a malfunctioning disk. (The MTS 210 can operate with fewer than four disks if one or more fails and immediate replacements are not available.)
- Size of each disk (in bytes)
- Partition information
- File name(s)

- File size(s) in bytes.
- Files marked as “deleted” (DEL). These files are deleted when the **Disks Compress** command is selected from the Service menu.

Board to PC (Read)

The **Board to PC (Read)** command copies a file from the Data Store disks to the system hard drive (or other regular disk). Figure 3–5 shows the **File Read from CARB** dialog box.

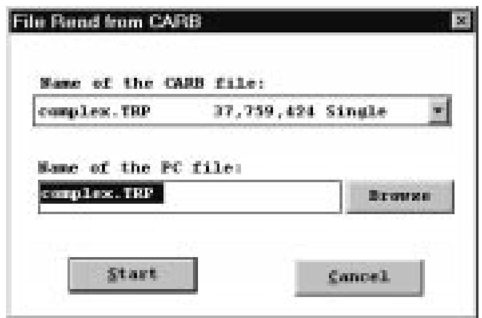


Figure 3–5: The File Read from CARB dialog box

***NOTE**. This command is not always necessary to read files from the Data Store disks. The Analyzer application can read files directly from the Data Store disks using the c:\carb0\mono directory.*

Select the name of the Data Store disk file from the drop-down list box. Then enter the new name for the system disk file. Click **Browse** if you wish to open a **Save As** dialog box and select a directory on the system disk. See Figure 3–6.

Figure 3–6: The Save As dialog box

After entering a name in the text box, click **Save** (or simply press ENTER). The **File Read from CARB** dialog box will reappear; click **Start** to copy the file to the system disk.

Use the **Board to PC** command to move files that you have acquired with the Data Store system to the system hard drive for analysis.

***NOTE**. It is possible to capture files on the Data Store disks that will not fit on the system disk. You may want to check, through the Windows NT File Manager, to see if there is room on the system disk for the file(s) you plan to copy.*

PC to Board (Write)

The **PC to board (Write)** command copies a file from the system to the Data Store disks. Use this command to move transport stream files created with the Multiplexer application (and possibly modified with the Packet Jitter or Coder/Decoder applications) to the Data Store disks. Once there, you can use them to generate transport streams.

***NOTE**. This command is not always necessary to write files to the Data Store disks. The Multiplexer application can write files directly to the Data Store disks using the c:\carb0\mono directory.*

---

1. Choose the command from the File menu or click the corresponding (W) toolbar button. The resulting **File Write to CARB** dialog box is shown in Figure 3–7.

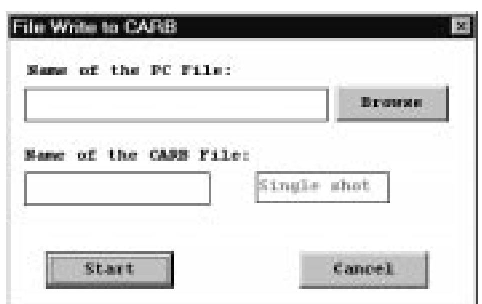


Figure 3–7: The File Write to CARB dialog box

2. Enter the full path and file name or click **Browse** to select the file that you wish to transfer to the Data Store disks.
3. Then enter an appropriate file name in the **Name of the CARB File** text box.

4. Finally, click **Start** to copy the file onto the Data Store disks.

Delete The **Delete** command marks a Data Store file to be deleted.

1. To delete a file, select its name in the "**Files informations**" box, as shown in Figure 3–8, and then choose **Delete** from the File menu. To select more than one file from the list, hold the CTRL key down and then click the name of each file you wish to delete.

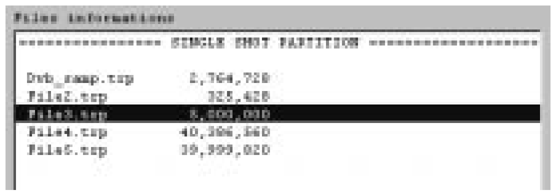


Figure 3–8: Selecting a file to delete

2. The warning message shown in Figure 3–9 always opens, giving you an opportunity to abort the file deletion.

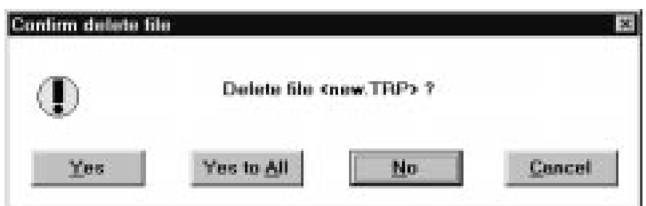


Figure 3–9: The Warning dialog box

In most cases, you can later undelete a file that is marked as deleted as long as you have not compressed the Data Store disks (see page 3–181). However, if you delete the last file (or files) in the FAT table, it (or they) will be removed immediately. In this case, you are given a special warning, shown in Figure 3–10, that the file is not recoverable.

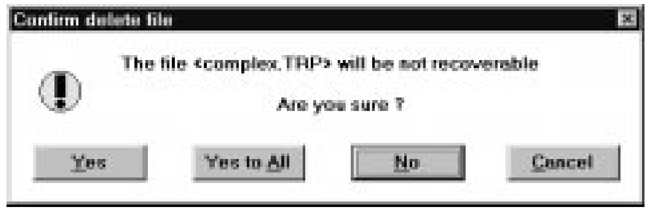


Figure 3–10: The last file is removed immediately

***NOTE**. The “file will not be recoverable” warning also appears when you select the first-listed file for deletion. However, the warning is incorrect. Only the last files in the FAT may be deleted without performing a disk compression.*

Use the **Delete** command to free up space on the Data Store disks, but remember that, if you wish to actually remove files that are listed anywhere but at the end of the FAT, you must also select the **Disks Compress** command from the Service menu (refer to *Disk[s] Compress* on page 3–181 for more information).

Undelete

The **Undelete** command removes the DEL (delete) mark from a file on the Data Store disks. If you change your mind and no longer want to delete a file, use this command to return it to normal status.

To undelete a file, highlight its name in the **Files informations** box, as shown in Figure 3–11, and choose the Undelete command from the File menu. To select more than one file from the list, hold the CTRL key down and then click the name of each file you wish to undelete.

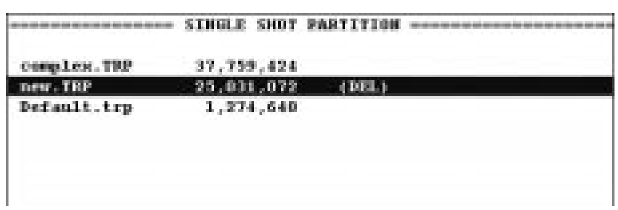


Figure 3–11: Selecting a file to undelete

Using Acq/Gen Menu Commands

The Acq/Gen menu gives you access to commands to acquire or generate MPEG-2 transport streams. There are three commands available from this menu: **Acquisition**, **Generation**, and **Interrupt transfer**.

Acquisition

The **Acquisition** command acquires a transport stream from the selected input port and stores it on the Data Store disks as a transport stream file. Figure 3–12 shows the Acquisition dialog box.

The Output group contains the CARB File text box and a Partition Type drop-down list box. Enter the name that you want the transport stream saved under in the CARB File text box. If the Data Store disks have more than one partition, then choose the Partition type from the list box.

***NOTE**. The name of the Data Store File cannot already be in use by an existing file or a file marked as "deleted".*

The Size group allows you to either define the size of the file acquired or leave it open ended. If you want to leave the file size undefined, select the Not Defined check box. This option allows the file to continue acquiring data until you choose the Interrupt command (see page 3–179). If you do not select this check box, you must enter a value in the text box. This number cannot be larger than the selected partition size. When the MTS 210 has collected a file the same size as defined in the text box, the acquisition process stops.

***NOTE**. The File Size must be greater than 1024 bytes.*

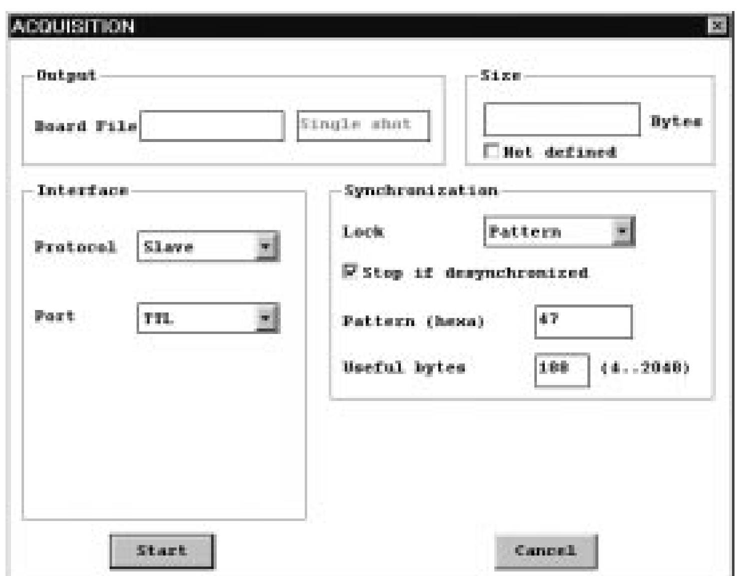


Figure 3–12: The ACQUISITION dialog box

The Interface group contains the Protocol, Port, Internal Clock, and Frequency parameters. See Figure 3–13.

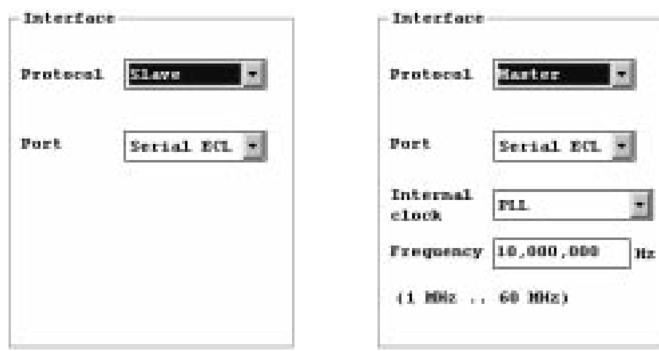


Figure 3–13: Examples of the Interface group

The Acquisition Protocol can be either Slave or Master. If it is Slave, the input signal supplies the clock; therefore, neither Internal Clock or Frequency parameters are available. Except that if the Port is set to G.703, the clock frequency must be specified. If Protocol is set to Master, the Data Store board generates the clock. Only the Parallel and Serial ECL ports can have Master Protocol.

The Port parameter allows you to select at which port the incoming signal will be available. The different ports conform to their own specification. The available ports are: //ECL (Parallel ECL), Serial ECL, G.703, TTL (50 Ohm TTL), and 10 Mbit Serial Port (RS–422).

The Internal Clock selects which of the internal references is used as the clock. The options include: PLL, Osc 34.368 MHz, Ocs. 8.448 MHz, and External Clock. If you select the PLL, then the Frequency parameter is available.

The frequency parameter should match the rate of the incoming signal. The frequency range available is dependent upon the port as given in Table 3–14.

***NOTE**. The data rates for the G.703 ports must be exact. The PLL is not available. Only these G.703 frequencies are available.*

Table 3–14: Frequencies available for each port

Port	Minimum frequency	Maximum frequency
Parallel ECL	125 kHz	7.5 MHz
Serial ECL	1 MHz	60 MHz
G.703	8.448 MHz	34.368 MHz

Table 3–14: Frequencies available for each port (Cont.)

Port	Minimum frequency	Maximum frequency
TTL	1 MHz	45 MHz
10 Mbit Serial (RS422)	1 MHz	10 MHz

NOTE. *The frequency step size is 1 Hz.*

The Synchronization group (Figure 3–14) determines how the incoming signal locks. The options include: none, PSYNC signal, and Pattern. None and Pattern are available to all ports. PSYNC is only available to the ECL ports.

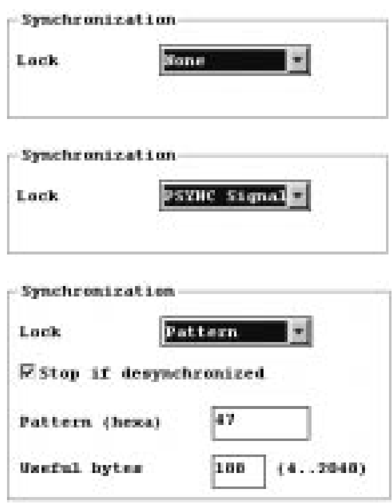


Figure 3–14: Examples of the Synchronization group

If you choose None and are using a serial port, you can not be sure to start at the beginning of a byte or packet. In this case, it is better to choose pattern synchronization. With Pattern synchronization, the first three packets are lost.

If Pattern is selected as the lock mode, then there are additional parameters that also must be entered. These include: Stop if Desynchronized, Pattern (hex), and Useful Bytes. If the Stop if Desynchronized check box is selected, the acquisition stops with an error message box after 8 bad synchronization bytes.

The Pattern is the actual synchronization signal in hexadecimal. For standard transport packets, the sync byte is 47.

The Useful Bytes parameter is the size of the transport packet. The standard size is 188.

The simultaneous presence of PSYNC and the synchronization pattern is not verified. The PSYNC signal is only used to trigger the start of acquisition (detection of the first leading edge). Thus no desynchronization criterion exists in this case. After the start of acquisition, the presence of the PSYNC signal is not verified.

The mechanisms of synchronization and loss of synchronization vary according to the synchronization method used given in Table 3–15.

Table 3–15: How synchronization works

Synchronization method	Acquisition begins with	Loss of synchronization
none	1st clock received	never
by PSYNC signal	1 recognition	never
by pattern	3 exact recognitions	Absence of exact recognition during 8 cycles

If either of the ECL ports are in Master mode, then an additional group, Control Port, is presented. See Figure 3–15. There are two or three parameters in this group.

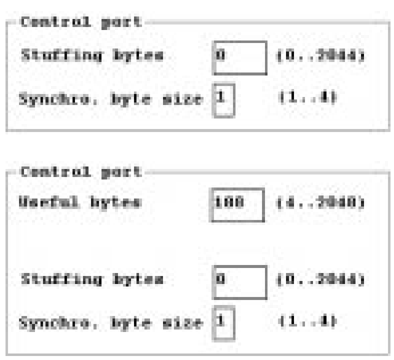


Figure 3–15: Examples of the Control Port group

The Useful Bytes parameter is the number of useful bytes as validated by a validation signal.

Stuffing Bytes is the number of bytes when the DEN (data enable) is off.

Synchro. Byte Size is the synchronization signal size, in bytes. It can range from 1 to 4 bytes.

NOTE. *Only connect equipment to ports in use. This will prevent confusing data. For example, for G.703 output, both G.703 ports are active at the selected rate, but the voltage level is different on each port.*

Changing Registry Values. To turn off the display of the dialog box after every transfer, change the DefaultAlwaysDialogBox registry parameter. The possible settings for the DefaultAlwaysDialogBox are shown in Table 3–18.

Table 3–16: DefaultAlwaysDialogBox registry parameter values

Value	Description
0x1	A dialog box is displayed after all transfers (default).
0	A dialog box is not displayed after transfers.

To change to value of the DefaultAlwaysDialogBox registry parameter, exit the Data Store Administrator and use the Registry Editor program, Regedt32.exe, located in the C:\WINNT\system32 directory.

NOTE. *You do not have to be logged in with System Administrator rights to change the DefaultAlwaysDialogBox parameter.*

Use the following path to access the DefaultAlwaysDialogBox registry parameter.

```
C:\HKEY_CURRENT_USER\SOFTWARE\CARB\CARBO
```

CAUTION. *To prevent file corruption, verify that the Data Store Administrator is not running before editing the DefaultAlwaysDialogBox parameter. When the Data Store Administrator quits, it writes to the registry file and may overwrite the value of the DefaultAlwaysDialogBox you have set.*

Generation

The **Generation** command generates a transport stream (from a transport stream file on the Data Store disks) and outputs it from the selected output port. Figure 3–16 shows the Generation dialog box.

The Source group contains the Data Store disks file selection. Select a file from the drop-down list.

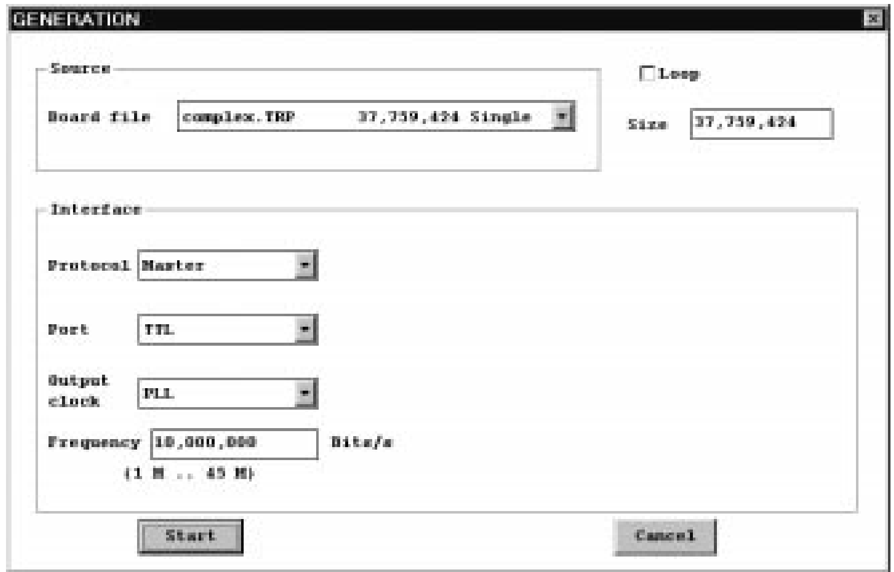


Figure 3–16: The Generation dialog box

***NOTE**. The file must be on the Data Store disks to generate a transport stream.*

If the Loop box is checked, it sends the file out continuously until it receives a manual interrupt command. If it is not checked, the file is sent only once.

The Size text box is the size of the transport stream to be generated. It is automatically filled in when a file is selected. You can use commas or spaces to separate the digits. You can enter a smaller number if you do not want to use the entire transport stream. If the Loop box is checked, the Size text box is not available.

***NOTE**. Minimum file size for looping generation is one megabyte (1 Mb).*

The Interface group allows you to select the output port and configure it to your requirements. The parameters in this group include: Protocol, Port, Output Clock, Frequency, Control Signals, Number Useful Bytes, Number Stuffing Bytes, Stuffing Byte, and Synchronization Signal Size. All these parameters are not always available. The availability is based on the Protocol and Port selected.

The Protocol can be either Master (the Data Store board generates the reference clock) or Slave (the clock is generated by an external source). Only the ECL ports can use Slave protocol.

The Port drop-down list box selects which output port to use. The choices are: //ECL (Parallel ECL), Serial ECL, G.703, TTL (the TTL 50 Ohm port), and 10 Mbit serial port (RS–422).

NOTE. *Make sure equipment is only connected to ports in use. This will prevent unexpected results.*

All of the other parameters are based on the selected port. Table 3–17 lists all of the non-control signal parameters available.

Table 3–17: The parameters available from each port

Port	Control signal (DEN signal)	Oscillator (8.448 MHz or 34.368 MHz)	PLL		External clock
			Min	Max	
Parallel ECL	Available	N/A	125 kHz	7.5 MHz	Available
Serial ECL	Available	Available	1 MHz	60 MHz	Available
G.703	Not Available	Available	Not Available	Not Available	N/A
TTL	Not Available	Available	1 MHz	45 MHz	Available
10 Mbit Serial	Not Available	N/A	1 MHz	10 MHz	Available

Output Clock allows you to select either one of the two internal oscillators (8.448 MHz or 34.368 MHz) or the PLL. If you select the PLL, the Frequency text box is displayed. Enter the desired frequency within the allowable range (125 kHz to 60 MHz.) The frequency step size is 1 Hz.

NOTE. *The data rates for the G.703 ports must be exact. Therefore only the two internal oscillators with the G.703 frequencies are available.*

The Control Signals check box is available only with the ECL ports since they are the only ones with a DEN (data enable) signal. If Control Signals is selected you are in “burst mode.”

NOTE. *If you select burst mode, be sure that the first byte(s) of the file are sync bytes (SB), typically 0x47, because the SB signal is on during the first byte(s) of the file.*

The Number of Useful Bytes is the number of bytes when DEN is on.

The Number of Stuffing Bytes is the number of bytes when the DEN is off. All stuffing bytes have the same value, that entered in the Stuffing Byte text box.

The Sync Signal Size is the number of bytes when the SB signal (Sync Byte) is on.

Changing Registry Values. To turn off the display of the dialog box after every transfer, change the DefaultAlwaysDialogBox registry parameter. The possible settings for the DefaultAlwaysDialogBox are shown in Table 3–18.

Table 3–18: DefaultAlwaysDialogBox registry parameter values

Value	Description
0x1	A dialog box is displayed after all transfers (default).
0	A dialog box is not displayed after transfers.

To change to value of the DefaultAlwaysDialogBox registry parameter, exit the Data Store Administrator and use the Registry Editor program, Regedt32.exe, located in the C:\WINNT\system32 directory.

NOTE*. You do not have to be logged in with System Administrator rights to change the DefaultAlwaysDialogBox parameter.*

Use the following path to access the DefaultAlwaysDialogBox registry parameter.

```
C:\HKEY_CURRENT_USER\SOFTWARE\CARB\CARBO
```

CAUTION. *To prevent file corruption, verify that the Data Store Administrator is not running before editing the DefaultAlwaysDialogBox parameter. When the Data Store Administrator quits, it writes to the registry file and may overwrite the value of the DefaultAlwaysDialogBox you have set.*

Interrupt Transfer

The **Interrupt transfer** command stops the current Acquisition or Generation process.

Using Service Menu Commands

The Service menu contains “housekeeping” commands for the Data Store disks and the Data Store board. The commands available from this menu are: **Board Reset**, **Resource[s] Parameters**, **FAT Delete**, **Disk[s] Partitioning**, **Disk[s] Compress**, and **Disk[s] Motor control**.

Board Reset

The **Board Reset** command performs a software reset on the Data Store board. Use this command after an error occurs (such as locking the application) to “fix” the software.

Resource[s] Parameters

The **Resource Parameters** command changes the resource parameters for the Data Store board. These parameters should never be changed during normal operation.

Figure 3–17: The Resource Parameters dialog box

Figure 3–17 displays the Resources Parameters dialog box. The parameters available include:

- Slot is the slot number where the Data Store board is physically located. (Default is 2.)
- Dialog Interrupt is the interrupt used for the dialog between the PC and the Data Store board. (Default is 15.)
- DMA Interrupt is the interrupt used for DMA exchange. (Default is 10.)
- DMA Channel is the channel used for DMA exchange. (Default is 1.)

FAT Delete

The **FAT Delete** command initializes the Data Store disks. The partitions are preserved, but all files are lost. Performing a Fat Delete has the same affect as deleting all files in the Files informations list (with the **Delete** command on the File menu) and then using the **Compress** command (described below). You cannot recover these files; be sure you are aware of the consequences before using the Fat Delete command.

Disk[s] Partitioning

The **Disk[s] Partitioning** command creates the disk partitions. It must be run each time Data Store disks are added, removed, or replaced. It can be run whenever you want to change the size or number of partitions. (See Figure 3–18.)

CAUTION. *Partitioning erases all files from the Data Store disks; erased files* cannot *be recovered. Be sure to transfer important files to the system disk or another backup medium before partitioning the Data Store disks.*

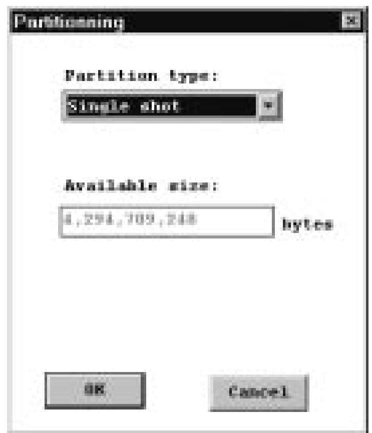


Figure 3–18: The Partitioning dialog box

Select the partition type from the drop-down list box. The choices are Single shot, Loop, and Single shot & loop. When you select Single shot & loop, you must also specify the portion of the available size you wish to use as the loop partition.

Disk Compress

The Disk[s] Compress command frees the disk space of all files marked for deletion. This command performs the actual deletion and then optimizes the files on the Data Store disks for maximum efficiency. You are always given a message box to confirm this operation. See Figure 3–19.

Figure 3–19: The Compress confirmation dialog box

***NOTE**. The command can take a long time to complete. The Compress function requires approximately one second per megabyte of disk space to compress the Data Store disks.*

For more information on why compression is necessary, see *Special Features of the Data Store disks* beginning on page 3–162. If you wish to remove all files from the Data Store disks, use the **FAT Delete** command, described on page 3–180.

Disk[s] Motor control

The Disk Motor control submenu contains three commands: **Automatic control Parameters**, **Start Disks motor**, and **Stop Disks motor**.

Figure 3–20: The Disks Motor control submenu

Select **Stop Disks motor** to stop the Data Store disk motors when you intend to leave the MTS 210 server running for an extended period but know that you will not be using the Data Store system for some time. Stopping the Data Store disk motors will extend their life. Note that restarting the Data Store Administrator application or copying a file either to or from the system disk will also automatically restart the disk motors.

Select **Start Disks motor** to manually restart the Data Store disk motors.

Select **Automatic control Parameters** to set an automatic motor stop delay. **Automatic stop** in the resulting dialog box; the **Motor delay** entry box appears as shown in Figure 3–21. The default delay is 10 minutes; recommended minimum delay period is four hours, or 240 minutes. The disk motors automatically stop after the specified delay period has passed with no disk access.

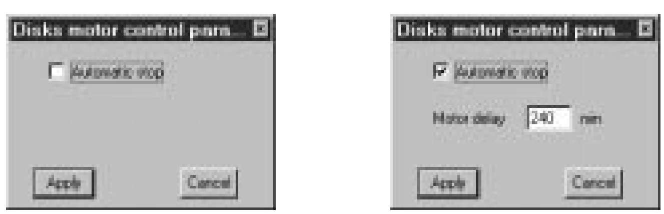


Figure 3–21: Specifying automatic motor control parameters

Changing MSB/LSB Order

When the Data Store system is configured appropriately, you can specify the bit order of the transport stream serial port or input through the **Interface** section of the **ACQUISITION** and **GENERATION** dialog boxes. Select the **Msb first** check box, located at the lower-left corner of the dialog box, when you expect to receive data MSB-first or wish to output MSB-first data. Notice that the option is only available when a serial port is selected *and* when the Data Store system is configured for the option.

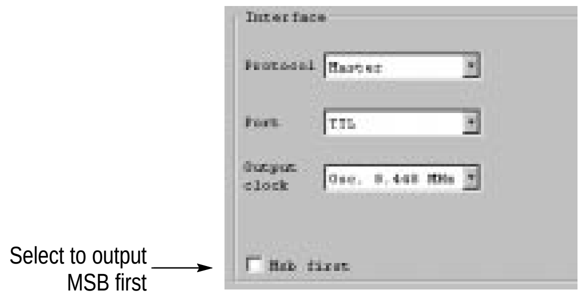


Figure 3–22: The Msb first option

Use the Set CARB application to specify whether the MSB/LSB option appears in the dialog boxes.

1. Select **Set Carb** from the MPEG Test System submenu or program group. The window shown in Figure 3–24 appears.

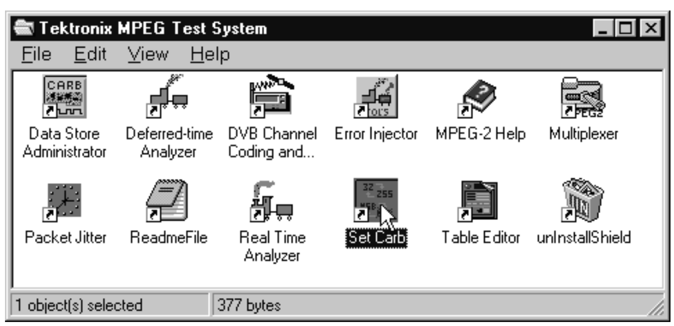


Figure 3–23: Starting the Set CARB application

2. The **Msb first** option appears only when the **MSB and LSB possibility** option is selected. Click the check box to select or clear the option.

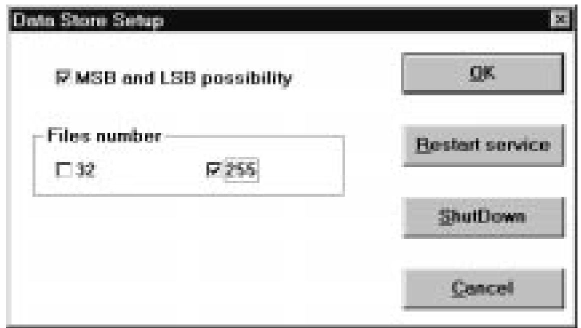


Figure 3–24: The Data Store Setup window

3. After you change the MSB and LSB possibility setting, click **Restart**.

Data Store Transfers

The easiest way to check the operation of an MTS 210 is with another MTS 210 or an MTS 215. The results of MTS 210 to MTS 210 transfers will be vary depending on generation, acquisition, and synchronization mode.

In either acquisition or generation, files can be processed in loop-back mode. During read or write file loop back, the system must be configured to assure that the data flow is never interrupted. The file loop back does not cause the insertion of stuffing data. Refer to Table 3–19 for information on MTS 210 to MTS 210 transfers.

Table 3–19: MTS 210 to MTS 210 transfer results

Interface	Generation mode	Acquisition mode	Expected result
ECL	Non-looping	Size: Generator's File size Sync: Sync Byte	Auto stop, files are identical.
ECL	Non-looping	Size: Generator's file size minus three packets Sync: Pattern	Auto stop, first three packets lost.
ECL	Non-looping	Size: Not defined Sync: None, Pattern, or Sync Byte	No auto stop, manual stop size is truncated in 1 Mbyte (1024 Bytes).

Table 3–19: MTS 210 to MTS 210 transfer results (cont.)

Interface	Generation mode	Acquisition mode	Expected result
ECL	Non-looping	Size: > Generator’s file size Sync: None, Pattern, or Sync Byte	No auto stop, manual stop size is not predictable because the algorithm for smoothing the size of each internal transferred block.
G.703, TTL, or 10 Mbit/sec serial	Non-looping	Size: Generator’s file size Sync: Pattern	Auto stop, first three packets lost and last three packets are stuffed “FF”.
G.703, TTL, or 10 Mbit/sec serial	Non-looping	Size: Not defined Sync: Pattern or None	No Auto stop, manual stop is truncated in 1 Mbyte (1024 Bytes) increments.
G.703, TTL, or 10 Mbit/sec serial	Non-looping	Size: > Generator’s file size Sync: No synchronization or synchronization on pattern with NO stop after desynchronization	Auto stop, remaining packets to the end of the file are stuffed “FF”.
G.703, TTL, or 10 Mbit/sec serial	Non-looping	Size: > Generator’s file size Sync: No synchronization and synchronization on pattern with AUTOMATIC stop after desynchronization	Auto stop, the requested size is not reached. The size of the stored file is not user predictable because of the algorithm for smoothing the size of each internal transferred block.
Any	Looping	Size: Acquirer’s file size Sync: None, Pattern, or Sync Byte (ECL only)	Auto stop.
Any	Looping	Size: Not defined. Sync: None, Pattern, or Sync Byte (ECL only)	No auto stop, manual stop size is truncated in 1 Mbyte (1024 Bytes) increments.

Problems

You may encounter problems while using the Data Store Administrator.

- If the Data Store board does not respond to commands, but the application will respond to mouse or keyboard input, try selecting the **Board Reset** command on the Service menu.
- Some problems result in on-screen error messages; refer to *Error Messages*, below, for a brief explanation of the Data Store error messages.
- You may be able to clear an error condition by shutting the MTS 210 server down and switching power off for approximately five minutes; try doing so before proceeding to *When All Else Fails*, on page 3–187.

Error Messages

The following is a list of error messages and their meanings. Recall that CARB is a French acronym for the Data Store system.

CARB Time out Error (ERR_CARB_TIME_OUT)
Time–out in TEST mode (i.e.: SCSI access, EISA access ...)

Desynchronization (ERR_CARB_DESYNCHRONIZATION)
During an acquisition with stop on desynchronization option, the synchronization pattern has been lost

Disk error (ERR_CARB_DISK_ERROR)
Indicates a disk error on a check condition SCSI request

Disk Initialization Error (ERR_CARB_DISK_INIT)
The first disk does not respond to the initialization sequence.

End of disk Error (ERR_CARB_END_OF_DISK)
Caused by an attempt to access outside the end of the disk or partition

End of file Error (ERR_CARB_END_OF_FILE)
Caused by an attempt to access outside the end of the file

Error busy card (ERR_CARB_DRIVER_BUSY)
There is already a command in progress.

Error : file not found (ERR_CARB_FILE_NOT_FOUND)
The file is not listed on the Data Store disks FAT (file allocation table).

Error : no partition (ERR_CARB_NO_PARTITION)
No partition exists on the Data Store disks; you must create a partition before capturing or storing a file

Error : unknown command code (ERR_CARB_CODE_UNKNOWN)
The CPU has received an unknown command.

FAT Error (ERR_CARB_FAT_ERROR)
No partition exists on the Data Store disks; you must create a partition before capturing or storing a file.

FAT Full Error (ERR_CARB_FAT_FULL)
255 files (32 files, on early instruments) are present on the Data Store disks, not able to create another one

File already exist (ERR_CARB_FILE_ALREADY_EXIST)
Try to create a file that already exist

Line Error (ERR_CARB_LIGNE_ERROR)
Overflow in acquisition mode (the line FIFO is full)

Parameter error (ERR_CARB_PARAM_ERROR)
A parameter of the command is incorrect (i.e.: value out of range).

SCSI Error (ERR_CARB_SCSI_ERROR)
Disk error on non DMA operations

SCSI Overflow Error (ERR_CARB_OVERFLOW_SCSI)
The SCSI memory bank is full, causing an overflow in acquisition mode.

SCSI Read Error (ERR_CARB_READ_SCSI)
Disk error on DMA read operations

SCSI Write Error (ERR_CARB_WRITE_SCSI)
Disk error on DMA write operations

System Error (ERR_CARB_SYST_ERROR)
SCSI memory bank underflow or SCSI disks not responding

Time-out Error (Detected by CPU) (ERR_CARB_DRIVER_TIME_OUT_2)
The Data Store board does not respond to the NT driver request (The CPU board has received the NT driver request but does not respond to it)

Time-out Error (Not detected by CPU) (ERR_CARB_DRIVER_TIME_OUT)
The Data Store board does not respond to the NT driver request (The CPU board has not received the NT driver request)

When All Else Fails

If an error message does not explain the problem sufficiently and a temporary shutdown does not clear the problem, please contact your nearest Tektronix representative or service facility.

Using the Packet Jitter Application

Part of the MTS 210's function is not only to create error-free transport streams but also to create transport stream files with known errors.

The Packet Jitter application allows you to create transport stream files with multiplex errors in assigning the PCRs or which simulate transmission delay variations that affect the clocks of the transport file. This allows you to test the robustness of decoders under various conditions.

This application takes in a transport stream file (*.trp), introduces clock jitter to the *.trp file, and creates a new *.trp file.

This section of the manual explains all of the commands available from the Packet Jitter application.

Application

The main application of the resulting Packet Jitter files is to aid in designing decoder PLLs. The known errors produced by the Packet Jitter application introduce a known amount of jitter into the transport stream. This application modulates the data values in the PCRs away from their correct values. The receiving PLL is then required to filter out these modulations in order to produce a stable clock reference. Use these transport stream files in real-time hardware experiments at the receiver, not for Analyzer tests. The Analyzer application will show the errors purposely introduced into the PCR data.

Terms

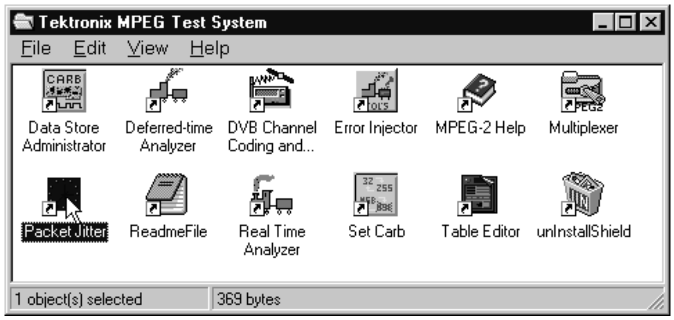
This application is similar to the Multiplexer application in that it outputs a transport stream *file* not a transport stream. Since there is an important difference between the two terms, the definitions are repeated here for emphasis.

A transport stream is the signal that comes out of (or into) one of the connectors on the rear panel of the MTS 210.

A transport stream file is a file on a disk. When the MTS 210 sends this file out one of the rear panel connectors (properly timed), it becomes a transport stream.

Starting the Packet Jitter Application

To start the Packet Jitter application, choose Packet Jitter from the Tektronix MPEG Test System program group.



Menu Commands

Table 3–20: Packet Jitter menu commands

Menu	Command	Function
File	Open	Opens a transport stream file for addition of jitter
	Quit	Exits the Packet Jitter application
Jitter	Definition	Allows you to define the PCRs and type of jitter added
	Go(Calculate)	Calculates a new transport stream file with jitter added (*.jit).
?	Help	Provides help for the Packet Jitter application

File Menu

The File menu commands allow you select a transport stream to work on and to close the application.

Open. Choosing the Open command brings up the Multiplex Transport File dialog box shown in Figure 3–25.

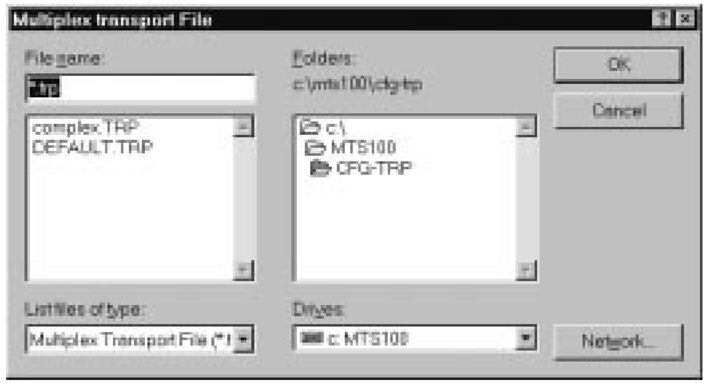


Figure 3–25: The Multiplex Transport File dialog box

Select a file from the File Name list and choose OK. This returns with the List of Programs window in the application window. See Figure 3–26. Use this as a quick reference for PID numbers when defining the jitter (see page 3–192).

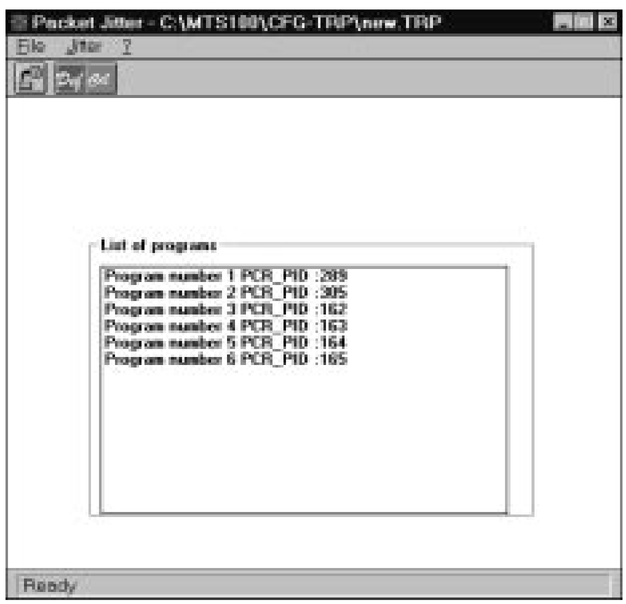
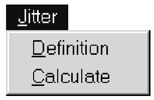


Figure 3–26: The List of Programs window

Quit. The Quit command closes the Packet Jitter application. No verification of the Quit command is given before exiting the application.

Jitter Menu

The Jitter menu commands allow you to define the jitter and perform the jitter calculation.



Definition. Choosing the Definition command brings up the PCR Clock Selection dialog box. See Figure 3–27.

Figure 3–27: The PCR Clock Selection dialog box

This dialog box allows you to choose if the jitter calculation is done to all PCR clocks or only the PCR for one PID (program). This permits you to have a set of reference PCRs in the same transport stream file.

Once the option is selected, choose OK. This brings up the Jitter Type dialog box. See Figure 3–28.

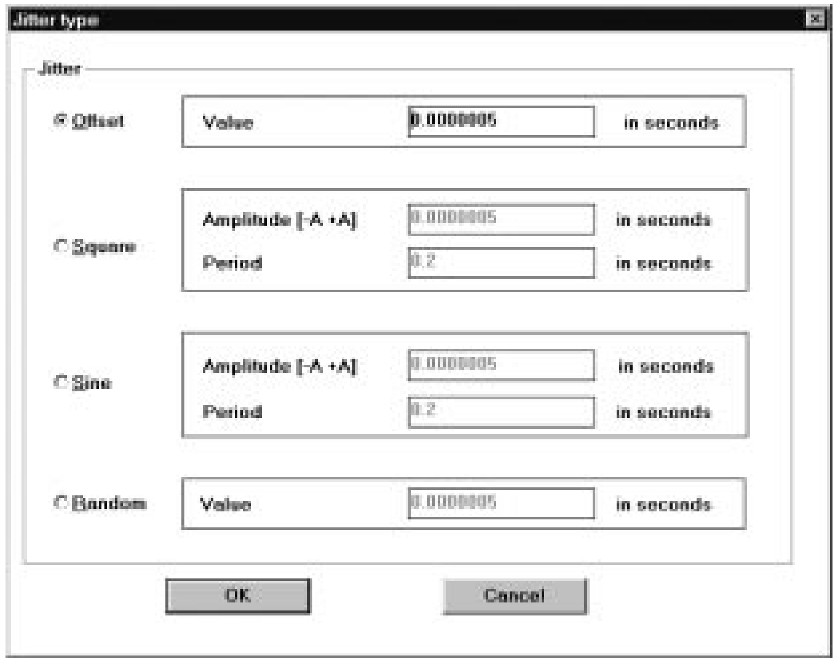


Figure 3–28: The Jitter Type dialog box

The **Jitter Type** dialog box allows you to choose the kind of jitter you want inserted into the PCRs. Select from: Offset, Square, Sine, or Random. Only one option is allowed.

Offset simply adds the value (time) entered in the Value text box to the PCRs. Its equation is:

$$PCR = PCR + offset$$

Where offset equals the time entered in the text box.

Square also adds a value (time) to the PCR but the time is calculated by the equation:

$$PCR(n) = PCR(n) + square(t)$$

Where square(t) equals the value of the square wave defined by the period and amplitude entered in the Jitter Type dialog box at the time defined by PCR(n). See Figure 3–29.

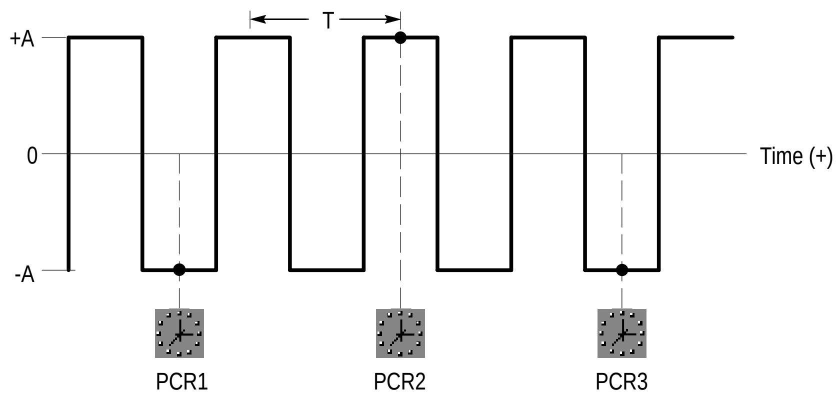


Figure 3–29: Illustration of the square jitter function

Using PCR2 in Figure 3–29 as an example, the value of the square wave at PCR2 is A, thus the “jitter-added” PCR2 = PCR2 + A.

Sine jitter is like the square jitter except it is a sine wave instead of a square wave. The equation for the PCR calculation is:

$$PCR(n) = PCR(n) + Asin(t)$$

Where Asin(t) is the sine function defined by the period entered in the text box in the Jitter Type dialog box times the defined amplitude. Figure 3–30 illustrates this concept.

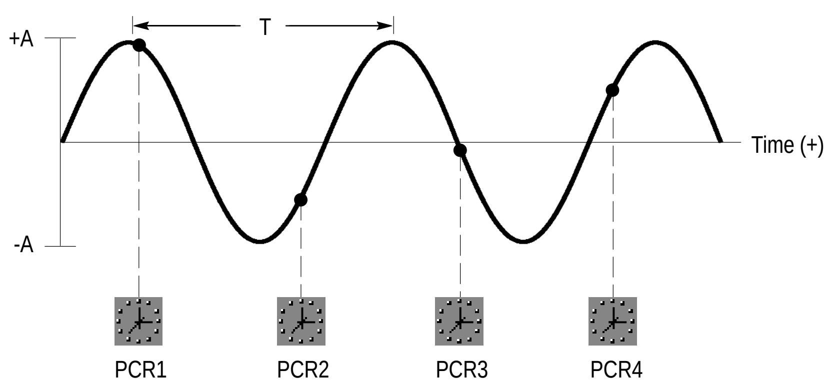


Figure 3–30: Illustration of the sine jitter function

Using PCR2 from Figure 3–30 as an example, the value of the sine wave at PCR2 is –0.55A. Thus, after jitter is applied, PCR2 will equal the correct value of PCR2 less 0.55A.

Random adds uniformly distributed random values to the PCRs. The range of the random values is between 0 and the value (plus or minus) defined in the Value field. The equation for the PCR is then:

$$PCR = PCR \pm random$$

When the desired type of Jitter is defined, choose OK. This does not cause any changes to the *.trp file. It only defines the changes that will be made when the Calculate command is called.

The Jitter application allows you to set jitter frequency independent of the PCR rate. To prevent misleading results, only use jitter frequencies less that one-half the PCR frequency. For example, if the PCR rate is 25 per second (period = 0.04 second) then the maximum jitter frequency the user should specify is 12.5 Hz (period = 0.08 second). For an example of a jitter frequency that is too high for the PCR frequency, see Figure 3–29.

***NOTE**. The PCR Analysis uses the previous PCR as the reference point to calculate the error in the current PCR. This can cause the error calculation to be misleading for some PCR jitter functions. Specifically, the jitter added by the MTS 100 may not be easily interpreted by the PCR analysis display.*

Calculate. The Calculate command uses the parameters defined by the Definition command to create a new transport stream file with jitter included. First, the Calculate command displays the Output File dialog box shown in Figure 3–31.

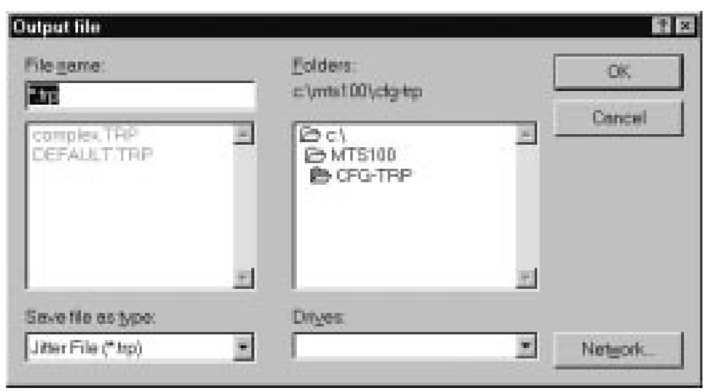


Figure 3–31: The Output File dialog box

Use this dialog box to name the resulting transport stream file. Enter the desired name in the File Name dialog box; the *.trp extension is automatically added. Once you choose OK, the jitter calculation begins. As shown in Figure 3–32, there is a status gauge that shows you how far the calculation has progressed. It also shows the type of Jitter being added and the parameters. The Status Bar also gives information on the calculation.

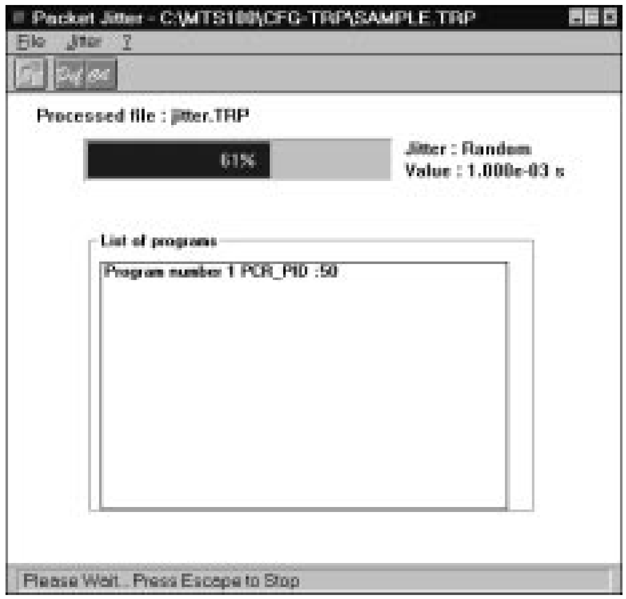


Figure 3–32: The display during jitter calculation

When the calculation is complete, the status gauge reads 100%. The new file can then be used as a transport stream file.

Figure 3–33 shows the result of a “jittered” file that has had its PCRs analyzed by the Analyzer application. If you viewed this screen on the MTS 210, you would see that most of the clocks are in error (red).

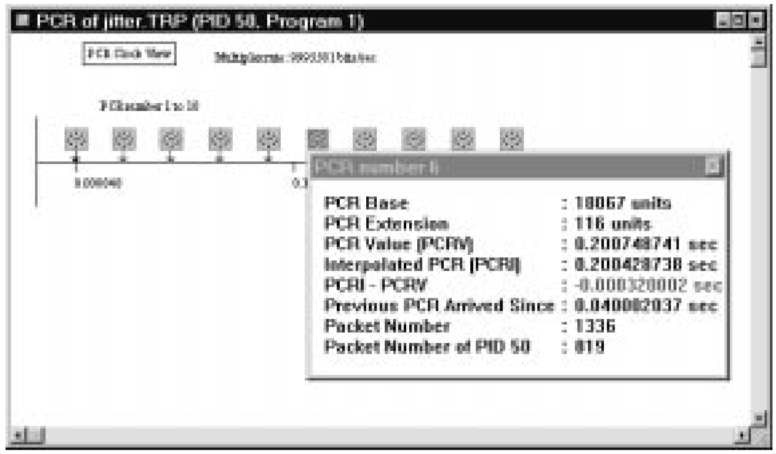
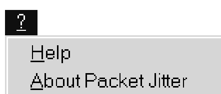


Figure 3–33: PCR analysis of a "jittered" transport stream file

? Menu

The ? menu allows you to access the Help command.



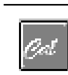
Help. The Help command gives you additional information about the application and its commands.

About Packet Jitter. Choose the About command to display the Packet Jitter version and copyright information.

Toolbar

There are three commands on the toolbar: Open, Definition, and Calculate; they are explained in Table 3–21.

Table 3–21: Commands available from the Packet Jitter toolbar

Icon	Name	Function
	Open	Chooses the transport stream file and places its program PID numbers in the List of Programs window. (See page 3–190.)
	Definition	Defines the type of Packet Jitter added to the transport stream file. (see page 3–192.)
	Calculate	Creates a new transport stream file with the defined amounts of jitter added to the PCRs. (see page 3–195.)

Using DVB Channel Coding & Decoding

The European Digital Broadcasting Project (DVB) has specified a baseline system for satellite broadcasting. The Channel Coding portion of the specification has the following coding flow:

- MPEG-2 Transport stream file (Multiplexer)
- Energy Dispersal — randomizing
- Outer Coder RS (204, 188) — for byte error correction
- Interleaver — better burst error correction
- Inner Coder (Viterbi p/q) — bit error correction
- QPSK Modulator

The Coder/Decoder application provides the defined channel coding for the transport stream file and also provides the decoding to return the coded file to a standard transport stream file.

Table 3–22 lists the type of coding/decoding, the type of input expected, and the resulting file.

Table 3–22: Expected input file types

Operation	Expected Input Type	Output Type
Energy Dispersal	*.trp	*.eds
Reed-Solomon	*.eds	*.res
Byte Interleaving	*.res	*.inl
Viterbi Encoding	*.inl	*.vtb
Byte Deinterleaving	*.inl	*.din
Reed-Solomon decoding	*.din	*.drs
Energy Dispersal removal	*.drs	*.edr

Starting the Application

Start the DVB channel Coding & Decoding application by double-clicking on the DVB Channel Coding and Decoding icon. Figure 3–34 shows the application window with the major parts named.

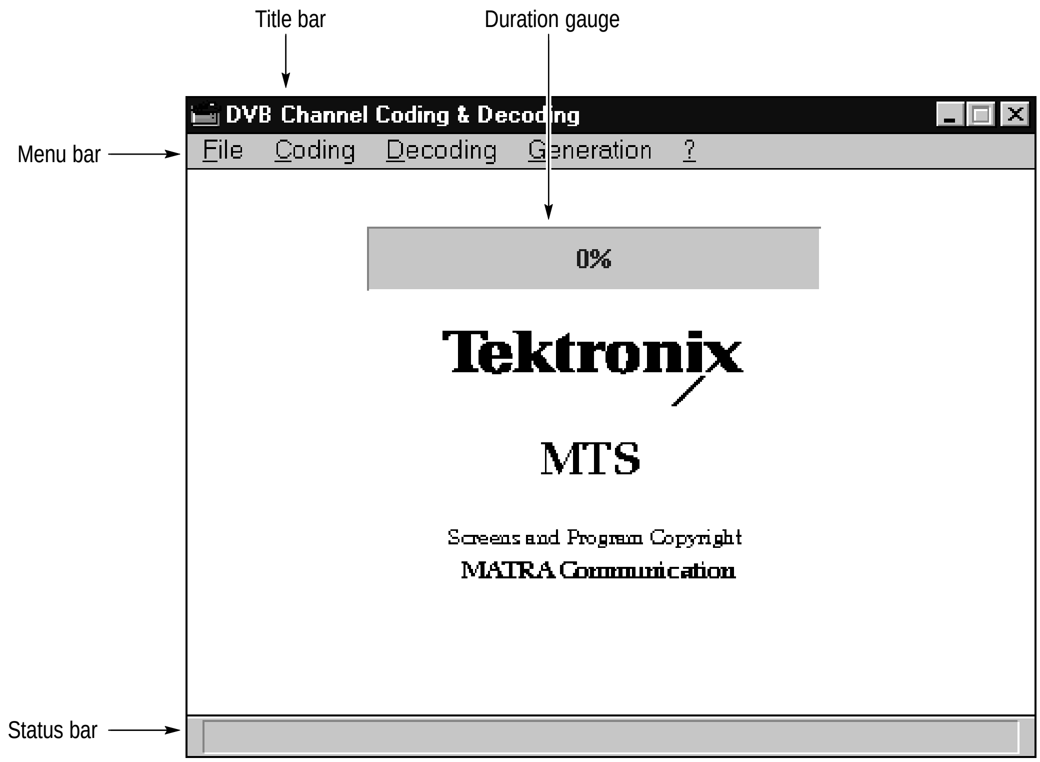


Figure 3–34: The initial Coding/Decoding application window

Duration Gauge. The Gauge gives the status of the coding or decoding operation in percent.

Menu Commands

This section lists the commands available from the Menu bar and explains how to use them.

Table 3–23: Commands from DVB Channel Coding & Decoding

Menu	Commands	Function
File	Quit	Exits the Coder/Decoder application
Coding	Chain	Defines a list of coding modules
	Energy Dispersal	Defines and performs Energy Dispersal coding on a selected file
	Reed - Solomon	Defines and performs Reed-Solomon coding on a selected file
	Interleaver	Defines and performs Interleaver coding on a selected field
	Viterbi	Defines and performs Viterbi coding on a selected file
Decoding	Chain	Defines a string of decoding modules for a file
	De-Interleaver	Decodes a file for Interleaver coding
	Reed - Solomon	Decodes a file for Reed-Solomon coding
	Energy Dispersal Removal	Decodes a file for Energy Dispersal coding
Generation	Pattern	Generates a user-defined repetitive pattern and puts it in a file
	Transport Packet	Generates a user-defined pseudo transport packet and puts it in a file
?	Help	Provides useful information on all the commands and additional information on coding in general

File Menu

The File menu only offers the Quit command.

Quit. The Quit command exits the Coder/Decoder application.

Coding Menu

The Coding menu provides access to the required DVB Channel Coding for satellite broadcasting (Energy Dispersal, Reed-Solomon, Interleaver, and Viterbi). It also provides for chaining the various coding methods together.

Chain. The Chain command allows you to create DVB-compliant files. Figure 3–35 shows the Coding Chain dialog box.

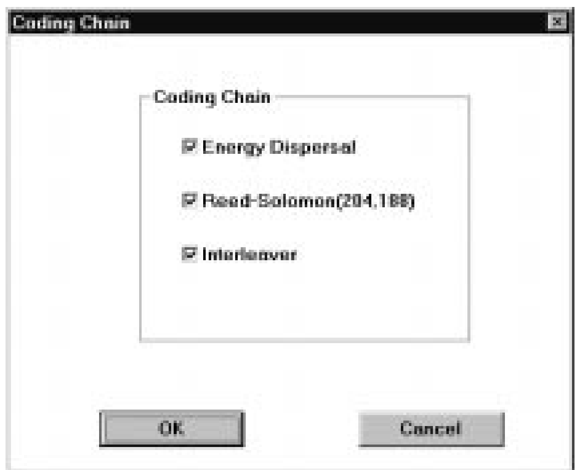


Figure 3–35: The Coding Chain dialog box

Each check box is for one module in the coding chain. When all the check boxes are selected, then coding will produce a DVB-compliant file. If you deselect any of the check boxes, then you will generate a non-compliant file. (This feature is available for testing purposes.)

***NOTE**. If Energy Dispersal is not selected, it is replaced by a "B8 sync byte add only" module in the chain.*

When you select OK for this option box, the dialog box shown in Figure 3–36 is displayed. Select the file to code using this dialog box.

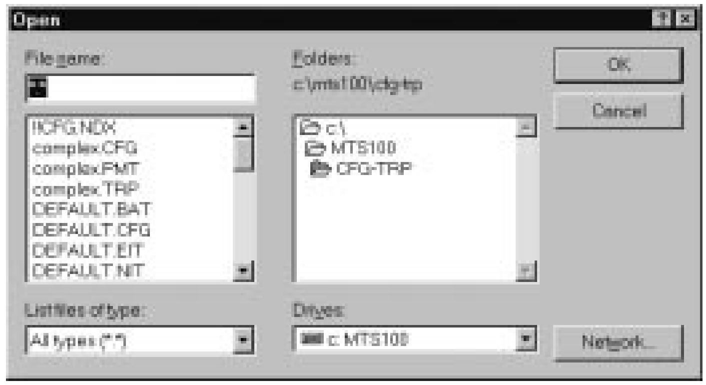


Figure 3–36: The Open dialog box for the Chain command

Although all file types (*.*) are available, the expected file type, for DVB compliance, is a *.trp file. This is a transport stream file. Make a transport stream file by either using the Multiplexer application or by acquiring one from a transport stream input through a rear-panel connector.

Once you select OK, the coding process begins. Each coding module is performed in the order given in the dialog box. During the coding process there is a gauge in the Application Window that gives the status of the coding. The gauge goes from 0 to 100% for each type of coding.

***NOTE**. If you need to stop the coding process, press the ESC key. This stops the coding with the current coding module.*

“READY” in the status bar indicates that the coding process is finished for all selected modules and the application is ready for another command. There are now three additional files in the same directory as the original transport stream file. They are the *.eds, *. res, and *.inl files with the same base name as the original file.

For more information on the individual coding modules, see their individual descriptions (*Energy Dispersal* is on page 3–214, *Interleaver* is on page 3–216, and *Reed-Solomon* is on page 3–215).

Energy Dispersal. The Energy Dispersal command allows you to use this coding scheme alone, instead of in conjunction with the other code modules using the Chain command. This module performs the sync byte inversion for the first of each group of eight transport packets and randomizing the data using a PRBS (Pseudo Random Binary Sequence). For more information on the actual coding, refer to *Energy Dispersal Coding* on page 3–214.

Selecting Energy Dispersal opens the dialog box shown in Figure 3–37.

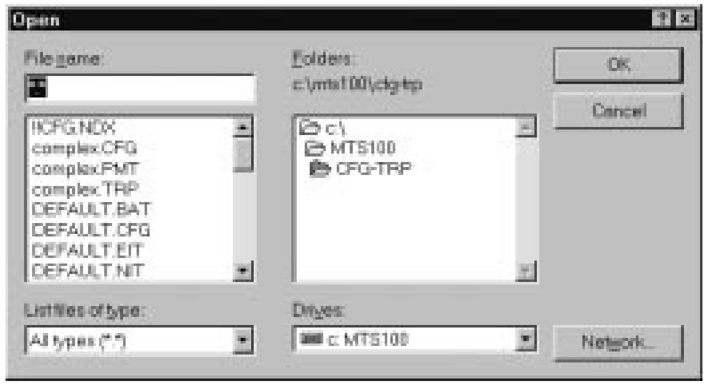


Figure 3–37: The Energy Dispersal Open dialog box

This first byte of the selected input file should be the first byte of a transport stream packet file (the sync byte, 47_{HEX}). Therefore, the input file should be a transport stream file, *.trp. Other file types are permitted, as long as they meet the sync byte requirement.

When you choose OK, the coding process starts. There is a gauge in the Application Window that gives the status of the coding process. When the gauge reads 100% and “READY” is displayed in the Status bar, then the coding process is complete.

The completion of the coding results in a file with the same base name as the original, except the extension is *.eds.

If you choose a file that is not appropriate for Energy Dispersal the coding will occur anyway.

You can stop the coding process at any time, by pressing the ESC key.

Reed-Solomon. The Reed-Solomon coding takes the randomized transport packet (from the Energy Dispersal coding) and adds 16 bytes to the field. (188 initial packet size + 16 bytes of Reed-Solomon = 204 bytes.) For a more detailed explanation of Reed-Solomon coding, see Reed-Solomon Coding on page 3–215.

Figure 3–38 shows the Reed-Solomon dialog box that is displayed after choosing this command. You enter the desired Coded Block Size and Size of Block to Code in the appropriate text boxes. The maximum for both parameters is 255. The default values (204 and 188) are the correct values for DVB.

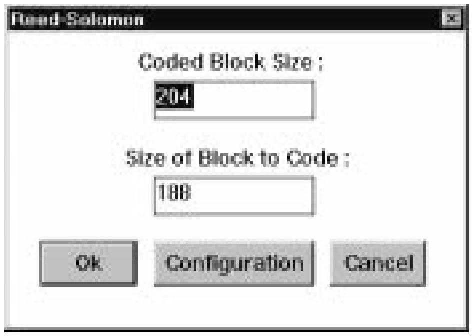


Figure 3–38: The Reed Solomon dialog box

If you choose the Configuration command button, the dialog box shown in Figure 3–39 appears.

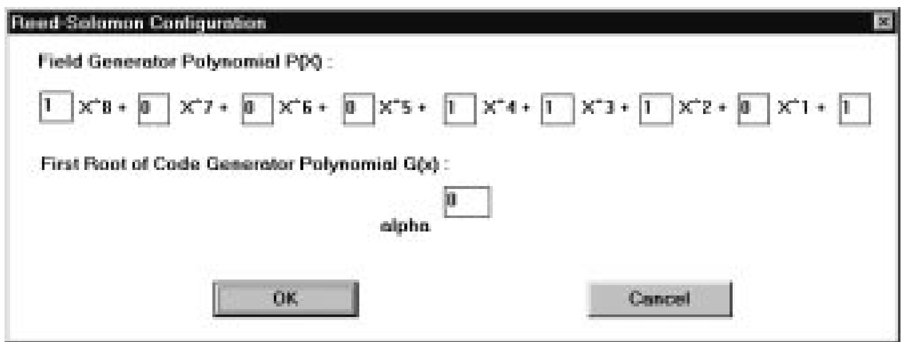


Figure 3–39: The Reed-Solomon Configuration dialog box

The Reed-Solomon Configuration dialog box allows you to define different values for p(x) (the Field Generator Polynomial), and alpha, which is the first root of p(x). The default values are the correct ones for DVB applications.

When the configuration is complete, return to the Reed-Solomon dialog box by selecting OK. When you are ready to code a file, select OK from the Reed-Solomon dialog box. This returns the Open dialog box. Notice that this coding module will only accept an *.eds file (one that has already been Energy Dispersal coded).

Select a file and enter it in the File Name text box. Then choose OK. This starts the Reed-Solomon coding process. The gauge displayed in the Application Window tracks the progress of the coding process. When the coding is complete, the gauge reads 100% and the Status bar says READY.

The coding results in a file with the same base name as the original, except it has the extension *.res.

Interleaver. This module performs the convolutional byte interleaving. See page 3–216 for more information on the coding process.

When you choose the Interleaver command, the dialog box in Figure 3–40 appears. (There are no parameters for you to adjust for this coding module.)

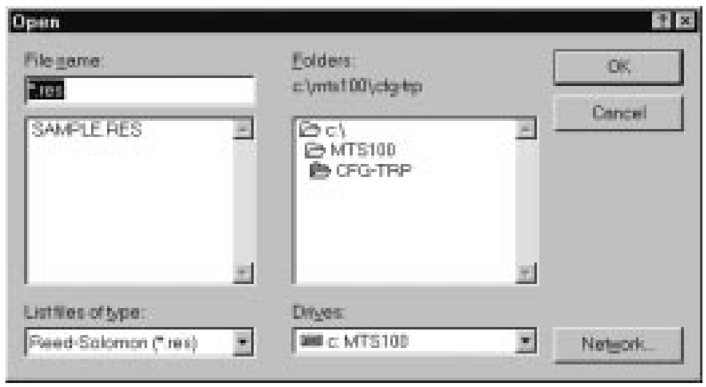


Figure 3–40: The Open dialog box for Interleaver coding

The Interleaver requires a *.res file (a file that has already gone through Reed-Solomon coding). After selecting a file to code, choose OK. This causes the Interleaver coding module to begin. A gauge in the Application Window keeps track of the coding progress. The coding is complete when the gauge reads 100% and the Status bar says READY.

Interleaver coding results in a file with the same base name as the selected file, except the extension is *.inl.

Viterbi. Viterbi performs the inner coding based on Viterbi punctured convolutional code. For more information on the coding, refer to *Viterbi Coding* on page 3–217.

***NOTE**. This application does not provide a method to decode Viterbi coding.*

The dialog box in Figure 3–41 appears when you choose Viterbi.

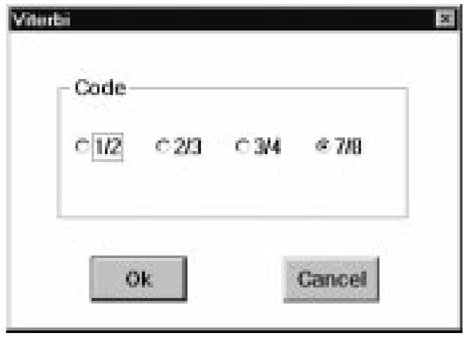


Figure 3–41: The Viterbi dialog box

This dialog box allows you to choose the Viterbi Code. It can be: 1/2, 2/3, 3/4, or 7/8, with 7/8 being the default. When you choose OK, the open dialog box of Figure 3–42 appears.

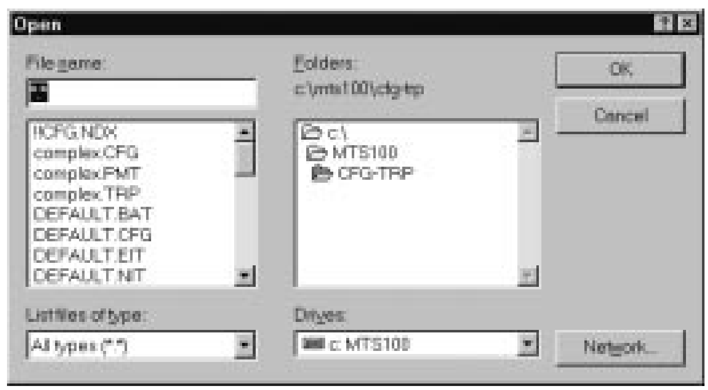


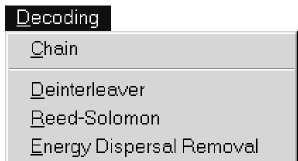
Figure 3–42: The Open dialog box for Viterbi coding

This dialog box allows you to select the file for Viterbi coding. The expected file type is an *.inl (Interleaver coding result). Once you select the file, choose OK. This begins the Viterbi coding process. A gauge in the Application Window tracks the progress of the coding. The coding is complete when the gauge reads 100% and the Status bar says “READY”.

The result of this module is a file with the same base name as the original file, but it now has *.vtb as the extension.

Decoding

The Decoding menu provides access to the required DVB Channel Decoding for satellite broadcasting (Deinterleaving, Reed-Solomon Decoding, and Energy Dispersal Removal). It also provides for chaining the various decoding methods together.



Chain. The Chain command allows you to decode the transport stream file using the DVB-compliant method. Figure 3–43 shows the dialog box associated with the Chain command.

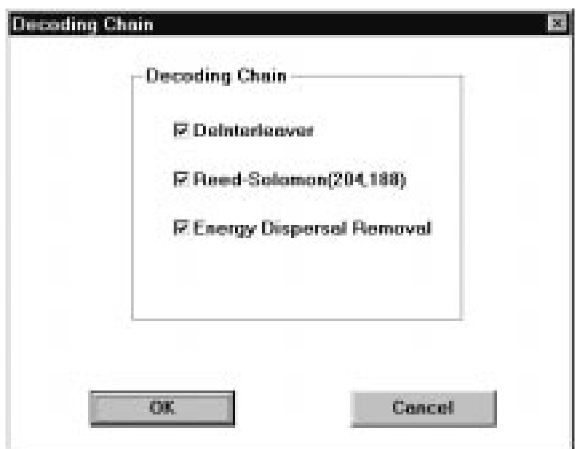


Figure 3–43: The Decoding Chain dialog box

You can deselect any of the check boxes, but all are required to generate DVB-compliant files.

Start Chain decoding by choosing OK. A gauge appears in the Application window that keeps track of the progress of each decoding operation. The whole chain decoding is complete when the gauge reads 100% and the Status bar says “READY.”

If you deselect any of the decoding modules, you may generate DVB non-compliant files. Use this only for testing purposes.

If the Energy Dispersal Removal module is not selected, it is replaced by a B8 sync byte removal module in the chain.

If you need to stop the decoding process, press the ESC key. This will end the entire decoding chain with the current module.

Deinterleaver. Choosing the Deinterleaver command brings up the dialog box shown in Figure 3–44.

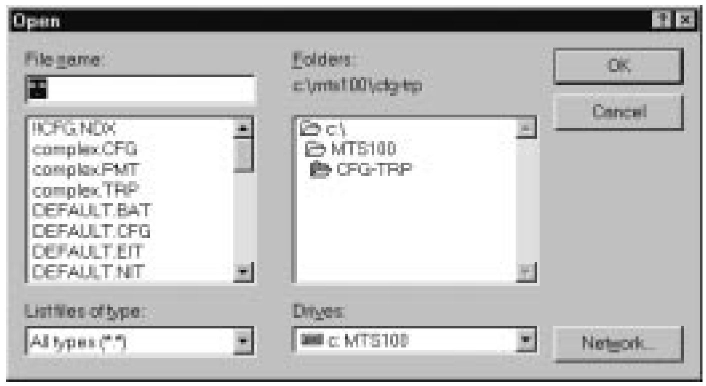


Figure 3–44: The Open dialog box for the Deinterleaver

The expected input file is one generated by the Interleaver coding module (*.inl), but the Deinterleaver module will accept any file.

When you choose OK, the Deinterleaving module begins. The gauge in the Application Window tracks the status of the decoding process. The decoding is complete when the gauge reads 100% and the Status bar says “READY”. The resulting file has the same base name as the original, except is has the extension *.din.

If you need to end the decoding at any time, press the ESC key.

Reed-Solomon. Choosing the Reed-Solomon command brings up the dialog box shown in Figure 3–45.

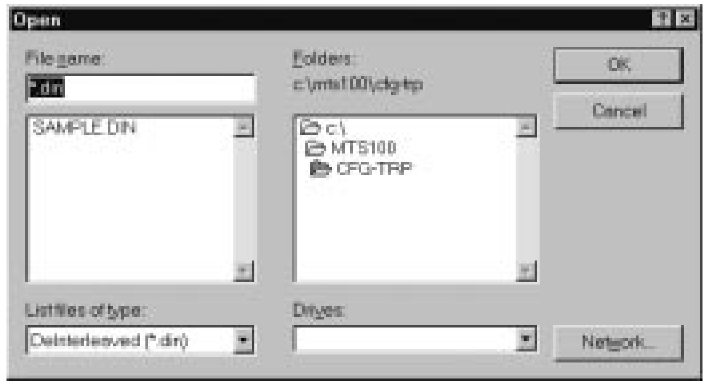


Figure 3–45: The Open dialog box for Reed-Solomon decoding

The expected input file is one generated by the Deinterleaver coding module (*.din).

When you choose OK, the Reed-Solomon decoding module begins. The gauge in the Application Window tracks the status of the decoding process. The decoding is complete when the gauge reads 100% and the Status bar says “READY”. The resulting file has the same base name as the original, except it has the extension, *.drs.

If you need to end the decoding at any time, press the ESC key.

Energy Dispersal Removal. Choosing the Energy Dispersal Removal command brings up the dialog box shown in Figure 3–46.

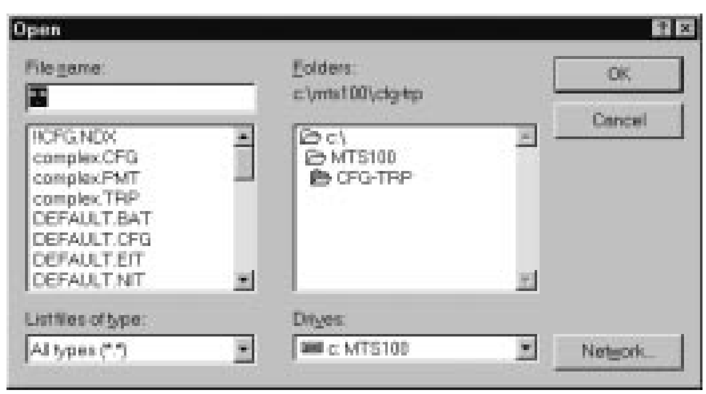


Figure 3–46: The Open dialog box for Energy Dispersal Removal

The expected input file is one generated by the Deinterleaver coding module (*.drs), although this decoding module will accept any file type.

When you choose OK, the Energy Dispersal Removal decoding module begins. The gauge in the Application Window tracks the status of the decoding process. The decoding is complete when the gauge reads 100% and the Status bar says “READY”. The resulting file has the same base name as the original, except it has the extension, *.edr.

If you need to end the decoding at any time, press the ESC key.

Generation

The Generation menu allows you to create new *.trp files by defining a pattern or transport packets.

Pattern. This command generates a user-defined pattern. First, the Save As dialog box shown in Figure 3–47 appears. Note that a default extension is not provided for the file name. However, if you enter a file name without an extension, *.plp is added automatically.

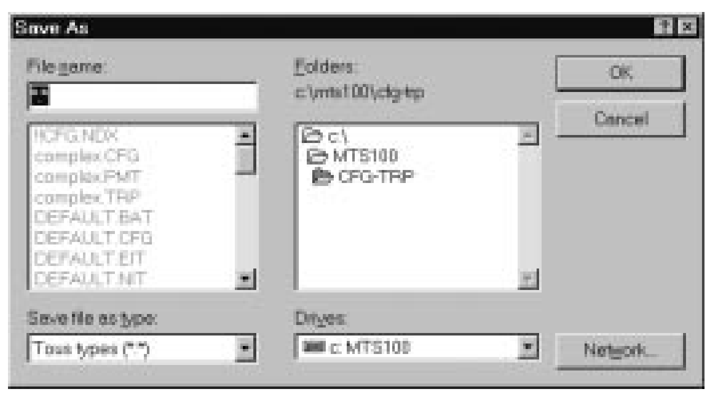


Figure 3–47: The Save As dialog box for the Pattern command

The first Pattern dialog box then appears as shown in Figure 3–48. This dialog box requests the number of bytes in the pattern.

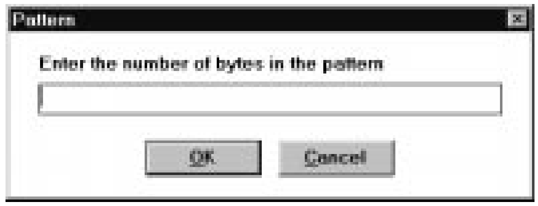


Figure 3–48: Enter the number of bytes in the pattern

The next dialog box, shown in Figure 3–49, defines the Composition Motif (the repetitive pattern). Enter the desired byte value, in hexadecimal. One byte is placed in each Composition Motif dialog box; therefore as many of these dialog boxes will appear as the number of bytes in the pattern (defined in the Pattern dialog box, shown in Figure 3–48).

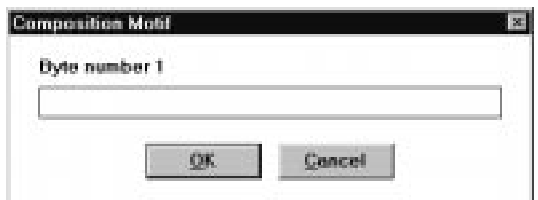


Figure 3–49: The Composition Motif

The final dialog box, shown Figure 3–50, allows you to define the number of times that the pattern repeats. Once this number is entered in the text box and OK is chosen, the pattern is created and stored in the selected file.

Figure 3–50: Set the number of pattern repetitions

Transport Packet. This command generates a repetitive pattern of user-defined transport packets.

Transport Packets, shown in Figure 3–51, is the first dialog box. First, choose if you want to define the payload or choose to have random data loaded. If the CCITT 2^15-1 check box is selected, then random data is generated for the payload. In this case, you can only set the value of the first text box under Transport Packet Header and the last three text boxes are grayed. The default value of the first text box is 47. You can change the value if you wish. If the CCITT 2^15-1 check box is not selected, then you can define the values in all the text boxes under the Transport Packet Header. The default values in this case are 47 00 00 00.

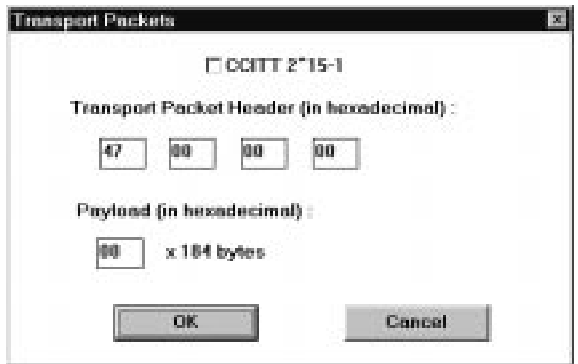


Figure 3–51: The Transport Packets dialog box

You also define the payload, which is then repeated 184 times.

After you have entered all of the desired data, choose OK. This brings up the Number of Packets dialog box as shown in Figure 3–52. Enter the number of transport packets you want in the transport stream file in the text box.

Figure 3–52: The Number of Packets dialog box

After entering the number of packets, choose OK. This brings up the Save As dialog box shown in Figure 3–53. Enter the name of the file that you want the transport packets saved under. Note that a default extension is not provided for the file name. However, if you enter a file name without an extension, *.plp is added automatically.

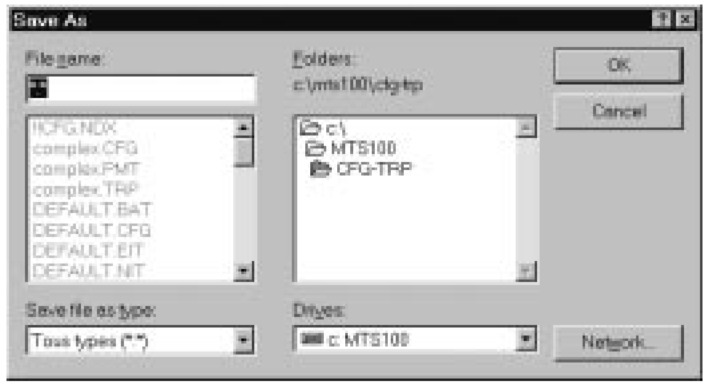


Figure 3–53: The Save As dialog box

When you choose OK, the application creates the desired transport stream file. When the Gauge reads 100%, the transport stream file is complete.

Coding

This section gives an explanation of each of the various types of coding available from this application.

Energy Dispersal Coding

This is the first coding module and the last decoding module.

The input of this coding module is an MPEG-2 transport stream, which is a concatenation of packets of 188 bytes (1 sync byte plus 187 data bytes). See Figure 3–54.

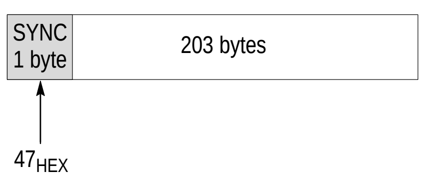


Figure 3–54: The MPEG-2 Transport packet

In order to comply with DVB and to ensure adequate binary transitions, the data from the MPEG-2 multiplex (transport stream file) is scrambled with a Pseudo Random Binary Sequence (PRBS). The processing order at the transmitting side always starts from the Most Significant Bit (MSB) of the synchronization byte (0 of 01000111).

The polynomial for the PRBS generation is : $X^{15} + X^{14} + 1$. It uses the 15-bit shift register shown in Figure 3–55 for scrambling and descrambling (in the channel coding process).

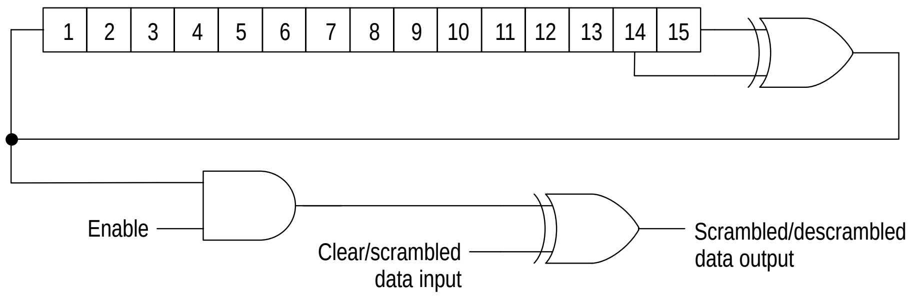


Figure 3–55: The Scrambler/Descrambler schematic for the PRBS

At the start of every eighth transport packet, the sequence 100101010000000 loads into the shift register. This provides an initialization signal for the descrambler. The MPEG-2 sync byte (for the first transport packet in the group of eight packets) is then inverted bit-wise from 47_{hex} to $B8_{hex}$. The first bit at the output of the PRSB generator is applied to the first bit (MSB) of the first byte following the inverted MPEG-2 sync byte ($B8_{hex}$). To aid other synchronization functions, during the MPEG-2 sync bytes of the subsequent seven transport packets, the PRSB generation continues but its output is disabled, leaving these bytes unrandomized. Thus the period of the PRSB sequence is 1503 bytes. See Figure 3–56.

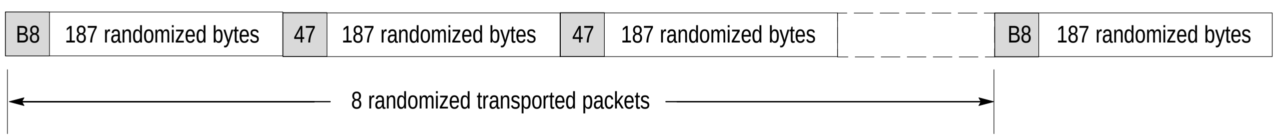


Figure 3–56: The output after Energy Dispersal coding

Reed-Solomon Coding

The Reed-Solomon RS (204, 188) code corrects up to 8 bytes in a 204 byte block. This module takes each randomized transport packet at the output of the Energy dispersal module and produces 204 bytes by calculating and adding 16 bytes at the end of the packet (188 bytes).

The Reed-Solomon calculates in a Gallois Field generated by the polynomial:

$$p(x) = x^8 + x^4 + x^3 + x^2 + 1$$

The RS code generator polynomial (used for the 16 byte calculation) is:

$$g(x) = (x + \alpha^0)(x + \alpha^1)....(x + \alpha^{15})$$

where $\alpha = 02_{hex}$

The RS (204,188), shortened code from the original RS (255,239), is implemented by adding 51 bytes, all set to zero, before the information bytes (a transport packet) at the input of an RS (255, 239) encoder. After the RS coding procedure, these null bytes are discarded.

B8	187 randomized bytes	16 bytes

Figure 3–57: The transport packet after Reed-Solomon coding

Convolutional Interleaving Coding

Convolutional Interleaving, with depth I = 12, is applied to the error protected packets. The conceptual diagram of the Interleaver is shown in Figure 3–58.

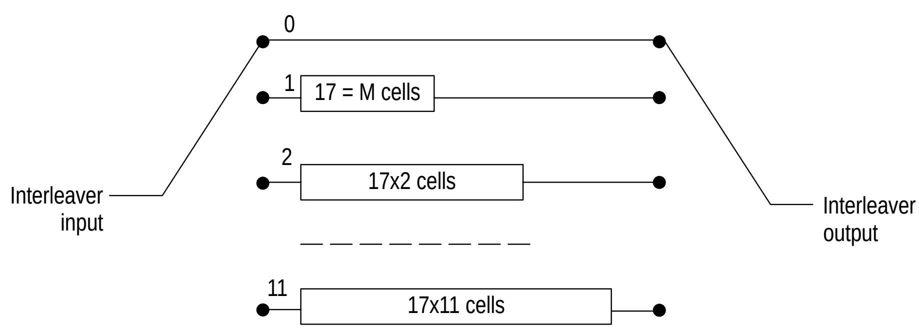


Figure 3–58: The conceptual diagram of the Interleaver coder

The Interleaver has 12 branches, cyclically connected to the input byte-stream by the input switch. Each branch is a FIFO shift register, with depth (MJ) cells.

where M = 17 or N/I
N = 204 the error protected frame length
I = 12 the interleaving depth
J = branch index

The cells of the FIFO contain 1 byte, and the input and output switches are synchronized.

For synchronization purposes, the sync bytes and the inverted sync bytes are always routed in the branch “0” of the Interleaver (corresponding to a null delay).

The Deinterleaver is similar to the Interleaver, but the branch indexes are reversed (that is, j = 0 corresponds to the largest delay). The deinterleaver synchronization can be carried out by routing the first recognized sync byte in the “0” branch.

B8	203 interleaved bytes	47	203 interleaved bytes

Figure 3–59: The Interleaved transport packets

Viterbi Coding

The inner coding is based on a Viterbi punctured convolutional code. See Figure 3–60.

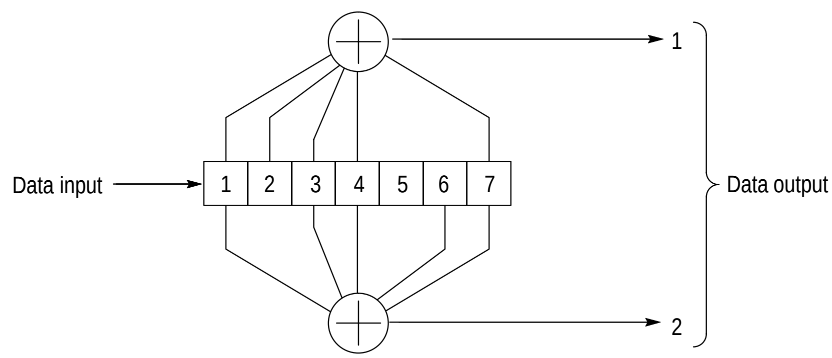


Figure 3–60: Viterbi 1/2 Punctured coding

Each bit of the input stream (MBS first) loads in a 7 (K = 7, constant length) bit shift register. It then executes two polynomial operations. To produce a p/q code (q output bits for p input bits) a “puncture’ is applied to the output of the 1/2 coder.

For instance, in 7/8 mode, 7 bits produce 14 bits of 1/2 code and only 8 are transmitted. (The puncture pattern for 7/8 is 11010101100110.)

Appendix A: Specifications

Specification. A document or a section of a document that lists and describes characteristics and performance requirements of equipment and certain programming material.

Characteristic. A property of the product.

Performance Requirement. A statement that defines a characteristic usually in limit form. This statement is considered to be binding on the company (seller), and can be verified by performing the appropriate portion of the Performance Verification Procedure, or by a separate and available procedure.

Supplemental information. Statements that explain performance requirements or provide performance information. These are not considered to be statements of guaranteed performance and are not ordinarily supported by a performance check.

Performance Conditions

The Performance requirements are valid within the environmental limits if the instrument is adjusted at 25° C ±5° C, and a minimum warm-up time of 20 minutes is allowed.

Hardware Electrical Specifications

The following tables give the specifications for the MTS 210 specific I/O ports.

Table A–1: G.703 — 8.448 MHz

Characteristics	Performance requirements	Supplemental information
Standards Conformance		ITU-CCITT G.703, G.823
Connector		SMB
Line Encoding		HDB3
Serial Bit Rate	8.448 Mbytes/s ± 10 ppm	
Generation/Acquisition Test	Error free	Tested with a 10 Mbyte file (within the constraints of synchronization)
Input		
Voltage Levels		Standard level within 0 to 4 dB cable attenuation at 1/2 clock Standard Levels: Mark from 2.033 V to 2.607 V Space from –0.237 to +0.237 Volts
Return Loss (75 Ω)		12 dB – 211 kHz to 422 kHz 18 dB – 422 kHz to 8.448 MHz 14 dB – 8.448 to 12.672 MHz
Connector		Male SMB (shared with the 34.36 Mbit input)
Jitter Tolerance		177 ns peak-to-peak 20 Hz to 400 Hz 23.6 ns peak-to-peak 3 kHz to 400 kHz Log prorated – 400 Hz to 3 kHz
Output		
Pulse Width		59 ns nominal
Pulse “Mark” Amplitude	2.37 V ± 0.237 V	
No-Pulse “Space” Voltage	0 ± 0.237 V	
Pulse Shape		Conforms to 8.448 MHz Pulse Mask, G.703 Figure 16 (see Figure A–1)
Required Receiver Termination		75 Ω nominal resistive
Jitter		15 ns peak-to-peak with a 20 Hz lower cut-off and a 400 kHz upper cut-off filter 5 ns peak-to-peak with a 3 kHz lower cut-off and a 400 kHz upper cut-off filter Allows a cascade of ten different regenerators before system limit is reached

Table A–1: G.703 — 8.448 MHz (cont.)

Characteristics	Performance requirements	Supplemental information
Connector		Male SMB
Return Loss		12 dB – 211 kHz to 422 kHz 18 dB – 422 kHz to 8.448 MHz 14 dB – 8.448 to 12.672 MHz

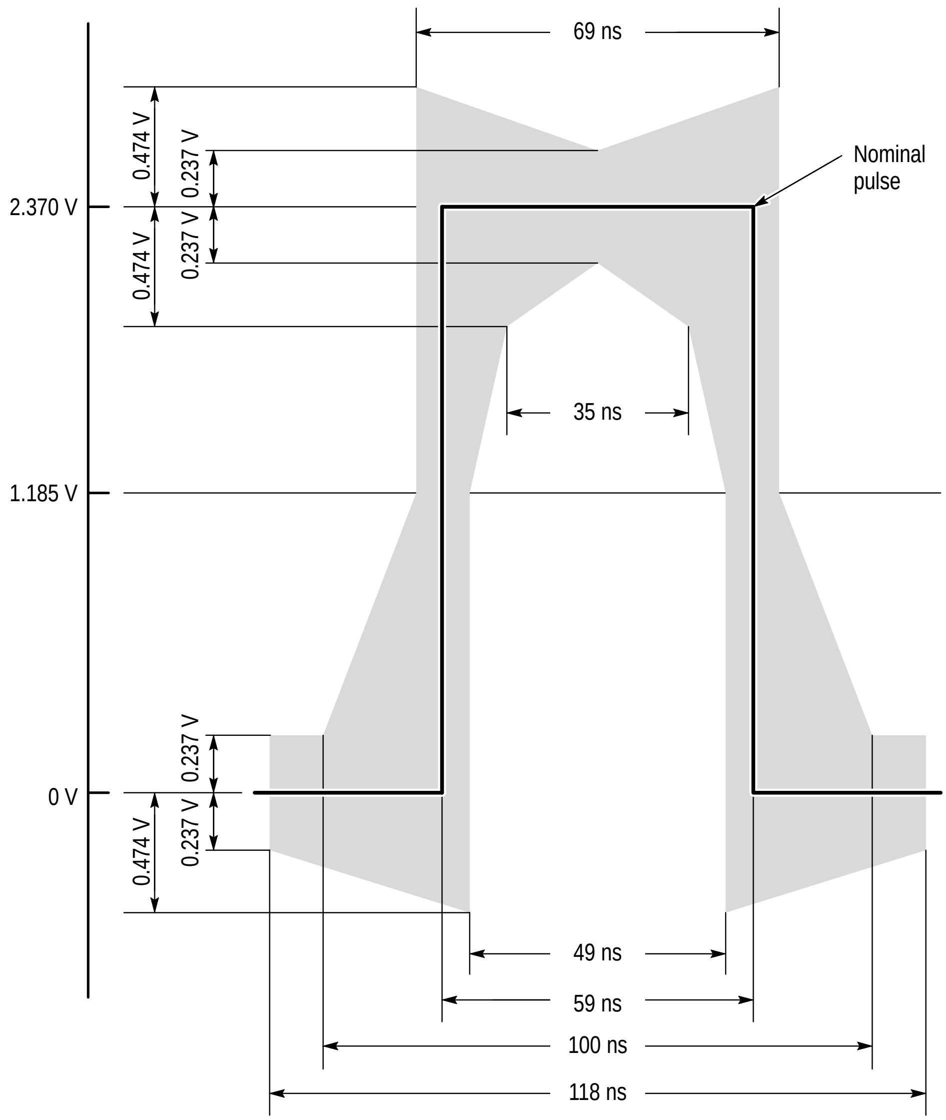


Figure A–1: Pulse specification for a G.703 8.448 MHz pulse

Table A–2: G.703 — 34.368 MHz

Characteristics	Performance requirements	Supplemental information
Standards Conformance		ITU-CCITT G.703, G.823
Connector		SMB
Line Encoding		HDB3
Generation/Acquisition Test	Error free	Tested with a 10 Mbyte file (within the constraints of synchronization)
Serial Bit Rate	34.368 Mbits/s ± 20 ppm	
Input		
Voltage Levels		Standard level within 0 to 4 dB cable attenuation at 1/2 clock Standard level: Mark from 0.9 V to 1.1 V Space from –0.1 V to +0.1 V
Return Loss (75 Ω)		12 dB 860 kHz to 1.72 MHz 18 dB 1.72 MHz to 34.368 MHz 14 dB 34.368 to 51.55 MHz
Connector		Male SMB (shared with the 8 Mbit input)
Jitter Tolerance		43.7 ns peak-to-peak – 100 Hz to 1 kHz 4.37 ns peak-to-peak – 10 kHz to 800 kHz Log prorated – 1 kHz to 10 kHz
Output		
Pulse Width		14.5 ns nominal
Pulse “Mark” Amplitude	1.0 V ± 0.1 V	
No-Pulse “Space” Voltage	0 ± 0.1 V	
Pulse Shape		Conforms to 34.368 MHz Pulse Mask, Figure 17/G.703 (see Figure A–2)
Required Receiver Termination		75 Ω nominal resistive
Jitter		10 ns peak-to-peak with a 100 Hz lower cut-off and a 800 kHz upper cut-off filter 2.45 ns peak-to-peak with a 10 kHz lower cut-off and a 800 kHz upper cut-off filter Allows a cascade of ten different regenerators before system limit is reached
Return Loss		12 dB – 860 kHz to 1.72 MHz 18 dB – 1.72 MHz to 34.368 MHz 14 dB – 34.368 MHz to 51.55 MHz

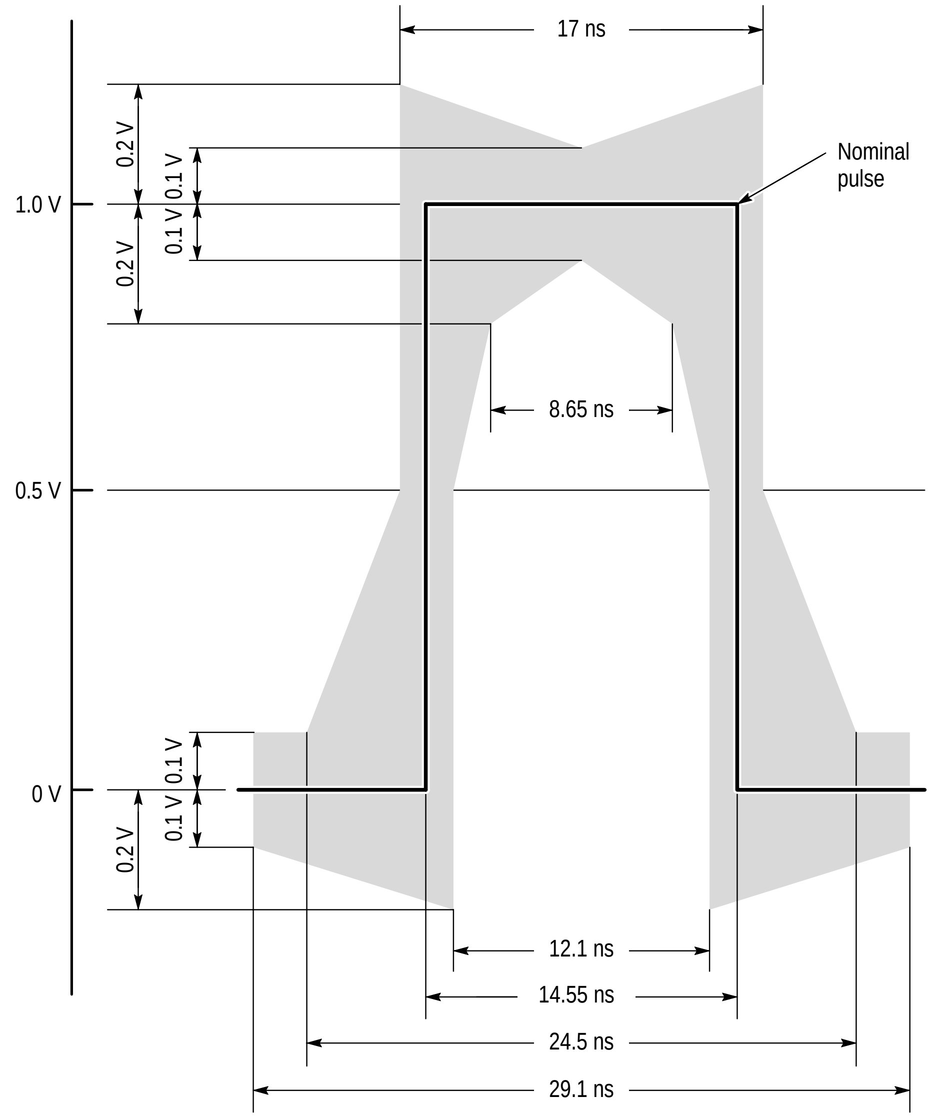
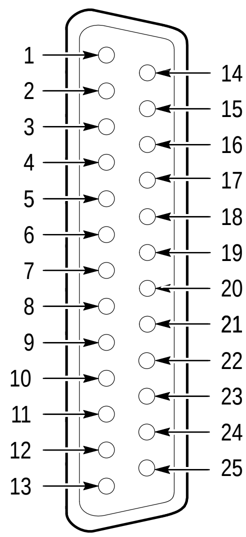


Figure A–2: Pulse specification for G.703 34.368 MHz

Table A–3: ECL parallel, serial, and control ports

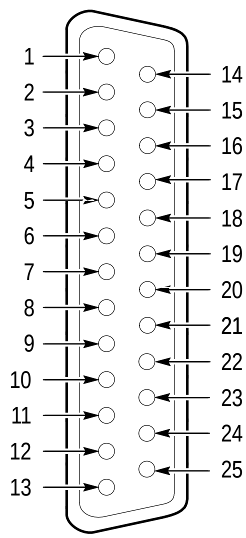
Characteristics	Performance requirements	Supplemental information
Connector		Parallel Data: D25 (pinout is given in Table A–4) Serial Data: D25 (pinout is given Table A–5) Flow Control: D9 (pinout is given in Table A–6)
Generation/Acquisition Test Master/Slave Slave/Master (w/control)	All error free	Tested with a 10 Mbyte file at maximum data rates (within the constraints of synchronization)
Digital Format		Binary, positive logic
Input Maximum Data Rate		 Serial: 55 Mbits/s Parallel: 7.5 Mbytes/s
Minimum Data Rate		Clock Rate: 1 MHz Serial: 1 Mbits/s Parallel: 125 Kbytes/s
Signal Level Amplitude		Differential ECL Compliant with the ECL 100K levels
Time Reference		Rising edge of the clock
Output Maximum Data Rate		 Serial: 55 Mbits/s Parallel: 7.5 Mbytes/s
Minimum Data Rate		Clock rate: 1 MHz Serial: 1 Mbits/s Parallel: 125 Kbytes/s
Clock to Data Timing		Data changes within 5 ns of falling clock edge
Signal Level Amplitude		Differential ECL Compliant with the ECL 100K levels
Required Receiver Termination		110 Ω, line-to-line

Table A–4: ECL parallel data pinout

ECL parallel port	Pin	Function	Pin	Function
	1	DCLK	14	$\overline{\text{DCLK}}$
	2	Ground	15	Ground
	3	DATA 7	16	$\overline{\text{DATA 7}}$
	4	DATA 6	17	$\overline{\text{DATA 6}}$
	5	DATA 5	18	$\overline{\text{DATA 5}}$
	6	DATA 4	19	$\overline{\text{DATA 4}}$
	7	DATA 3	20	$\overline{\text{DATA 3}}$
	8	DATA 2	21	$\overline{\text{DATA 2}}$
	9	DATA 1	22	$\overline{\text{DATA 1}}$
	10	DATA 0	23	$\overline{\text{DATA 0}}$
	11	DVALID	24	$\overline{\text{DVALID}}$
	12	PSYNC	25	$\overline{\text{PSYNC}}$
	13	Shield		

$\overline{\text{Asserted Low}}$ differential signal.

Table A–5: ECL serial data pinout

ECL serial port	Pin	Function
	1	DCLK
	2	Ground
	3 - 9	Not Managed
	10	DATA 0
	11	DVALID
	12	PSYNC
	13	Shield
	14	$\overline{\text{DCLK}}$
	15	Ground
	16 – 22	Not Managed
	23	$\overline{\text{DATA 0}}$
	24	$\overline{\text{DVALID}}$
	25	$\overline{\text{PSYNC}}$

$\overline{\text{Asserted Low}}$ differential signal.

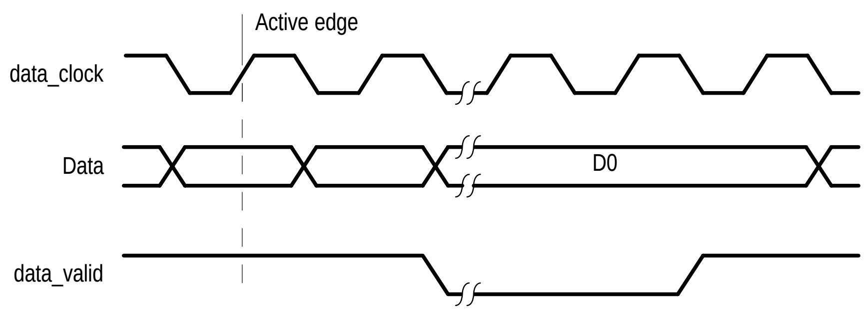
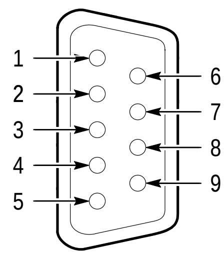


Figure A–3: Timing diagram for the ECL serial port

Table A–6: ECL control port pinout

ECL control port	Pin	Function
	1	CHCLK (Channel Clock)
	2	Ground
	3	CHSYNC (Channel Sync)
	4	CHCLKEN (Channel Clock Enable)
	5	Shield
	6	$\overline{\text{CHCLK}}$ (Channel Clock)
	7	Ground
	8	$\overline{\text{CHSYNC}}$ (Channel Sync)
	9	$\overline{\text{CHCLKEN}}$ (Channel Clock Enable)

$\overline{\text{Asserted Low}}$ differential signal.

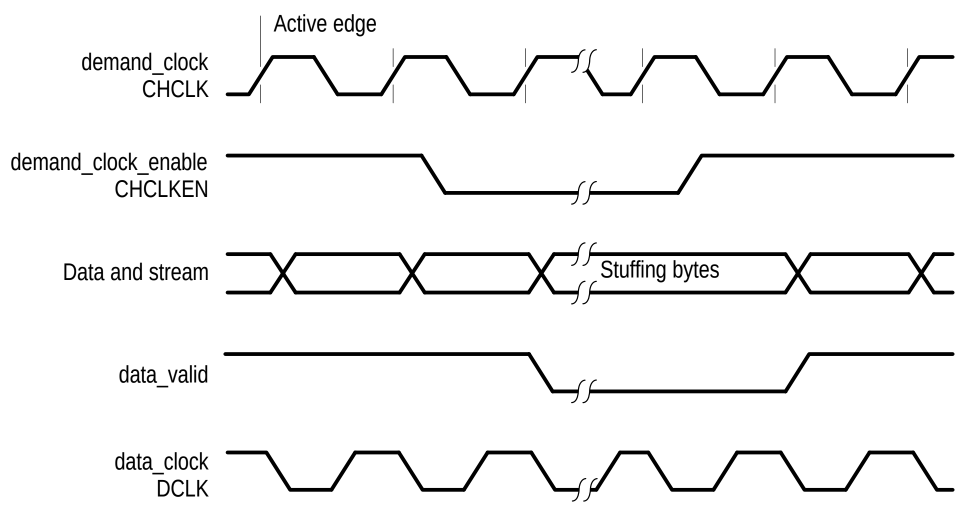


Figure A–4: ECL Timing diagram with control port

Table A–7: 50 Ω TTL I/O

Characteristics	Performance requirements	Supplemental information
Connectors		Male SMB
Rise & Fall Times		Between 2 ns and 6.5 ns
Signal swing into 50 Ω (output)	Low < 0.3 V High > 2.65 V	
Digital Format		Binary, positive logic
Maximum Data Rate		45 Mbits/s
Minimum Data Rate		1 Mbit/s
Generation/Acquisition Test	Error free	Tested with a 10 Mbyte file at maximum data rates (within the constraints of the stop/start bits)
Termination (input)		50 Ω nominal resistive
Timing Diagram		DATA signal is stable on the leading edge of the clock signal (see Figure A–5)
Clock to Data Timing		Data changes within 5 ns of falling clock edge
Signal Level Amplitude (input)		TTL Low < 0.8 V High > 2.0 V

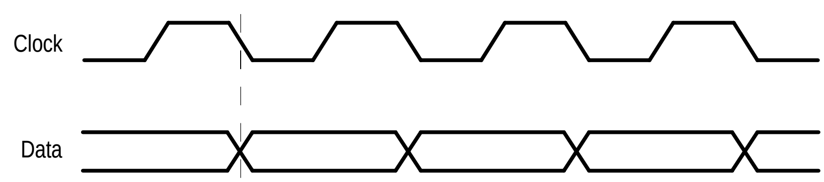


Figure A–5: Timing for the TTL port and the separate clock input

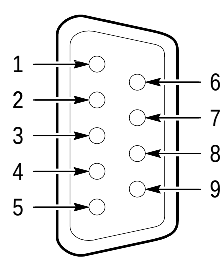
Table A–8: 10 Mbit serial port (RS-422 levels I/O Port)

Characteristics	Performance requirements	Supplemental information
Connector		9-pin sub-miniature D–type connector (see Table A–9)
10 Mbit Serial Voltage Levels		Differential outputs measured single-ended
Output		Low < 0.5 V High > 2.5 V
Input		Low < –0.5 V differential High > 0.5 V differential
Common Mode Range		±5 Volts

Table A–8: 10 Mbit serial port (RS-422 levels I/O Port) (cont.)

Characteristics	Performance requirements	Supplemental information
10 Mbit Serial Rise and Fall Times		Between 2 ns and 12 ns
Maximum Data Rate		10 Mbit/s
Minimum Data Rate		1 Mbit/s
Clock to Data Timing		Data changes within 10 ns of falling clock edge
Generation/Acquisition Test	Error free	Tested with a 10 Mbyte file at maximum data rates (within the constraints of the stop/start bits)

Table A–9: 10 Mbit serial port pinout

10 Mbit serial port	Pin	Function
	1	DATA IN
	2	CLK IN
	3	DATA OUT
	4	CLK OUT
	5	Ground
	6	$\overline{\text{DATA IN}}$
	7	$\overline{\text{CLK IN}}$
	8	$\overline{\text{DATA OUT}}$
	9	$\overline{\text{CLK OUT}}$

$\overline{\text{Asserted Low}}$ differential signal.

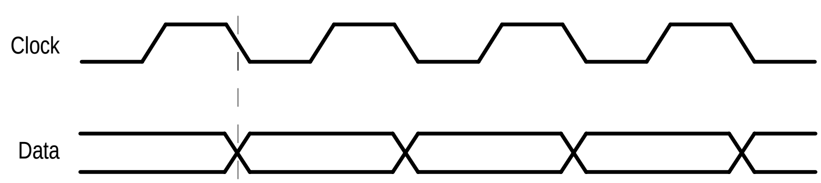


Figure A–6: Timing diagram for the 10 Mbit Serial port

Table A–10: Clock Port

Characteristics	Performance requirements	Supplemental information
Clock Port Voltage Levels		TTL Low < 0.8 V High > 2.0 V
Termination		50 Ω, nominally resistive
Range		125 kHz to 45 MHz

Table A–11: PLL

Characteristics	Performance requirements	Supplemental information
Range		125 kHz to 60 MHz
Resolution		1 Hz
Jitter	0.2 UI peak-to-peak over a 1000 UI delay	
Settling Time		3 seconds after frequency change
Frequency Accuracy		10 ppm ± resolution

Power Specifications

Table A–12: Power requirements

Characteristics	Performance requirements	Supplemental information
Line Voltage		100 to 240 VAC
Line Frequency		60 Hz / 50 Hz
Rated Input Current		6 A to 3 A
Power Consumption (without monitor)		160 Watts nominal

Mechanical (Physical) Characteristics

Table A–13: MTS 210 mechanical characteristics

Characteristics	Supplemental information
Dimensions	Base unit (does not include monitor, keyboard, pedestal, or mouse)
Height	17.92 inches (45.52 cm)
Width	8.83 inches (22.43 cm)
Depth	22.67 inches (57.58 cm)
Net Weight	65 lb (without accessories) (29.54 kg)
Shipping Weight	104 lb (47.17 kg) (with all accessories except monitor; monitor is shipped separately)

Environmental Characteristics

Table A–14: MTS 210 environmental characteristics

Characteristics	Supplemental information
Temperature	
Non-operating (storage)	–20° C (–4° F) to +60° C (140° F) (max. rate of change 20° C or 36° F per hour)
Operating	+10° C (50° F) to +35° C (95° F) (max. rate of change 10° C or 18° F per hour)
Altitude	
Non-operating	0 to 30,000 feet (9144 meters)
Operating	0 to 10,000 feet (3048 meters)
Humidity	
Operating	20% to 80% (max. rate of change 10% per hour)
Non-operating	5% to 90% humidity, non-condensing

Table A–15: Safety certification compliance

Category	Description
Temperature (operating)	+10° C (50° F) to +35° C (95° F)
Altitude (maximum operating)	2000 Meters
Relative Humidity (maximum operating)	80% for temperatures up to 31° C (88° F), decreasing linearly to 50% to at 40° C (104° F)
Safety Class	Class I – grounded product

Table A–16: Certifications and compliances

Category	Standard
EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 50081-1 Emissions: EN 55011 Class A Radiated and Conducted Emissions EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 Radiated RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity Conditional Statements: 1) Using high quality shielded cables, including those supplied as standard accessories. Low Voltage directive 73/23/EEC, amended by 93/68/EEC: EN 60950 Safety of Information Technology Equipment, Including Electrical Business Equipment
Australia Declaration of Conformity	Complies with electromagnetic compatibility standards as required under the Radio Communications Act. Compliance to: AN/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992 (demonstrated with compliance to EN55011 class A)

Appendix B: What to Do if an Application Locks Up

As with all software, the MTS 210 applications occasionally lock up or freeze. Follow the steps below to close a frozen application.

1. If you are in the Data Store Administrator application, first try a Board Reset. (The Board Reset command is on the Service menu, see page 3–180.)

2. If that does not work, or you are in another application, try closing the application using the Windows NT Security dialog box.

  a. Press CTRL+ALT+DEL to open the Windows NT Security dialog box.

  b. Click the Task List button to open the Task List dialog box.

  c. Highlight the locked up application.

  d. Choose the End Task command button. This should close the locked up application. In some circumstances, another window opens to give you the opportunity to wait, end the task, or cancel your "end task" instruction. Follow the window instructions; if you click End Task, the application should close immediately.

  e. If this does not close the application, press CTRL+ALT+DEL again to return to the Windows NT Security dialog box.

  f. Choose the Shutdown command button. This brings up the Shutdown dialog box.

  g. Choose the Shutdown and Restart option button and then choose OK.

3. If this does not end the application or shutdown the unit, power the MTS 210 server down (manual reset) until the hard disks stop spinning and then proceed with a normal power on.

CAUTION. *To avoid data loss, do not power off the MTS 210 server without first exiting Windows NT. Use the manual reset method only if the entire MTS 210 server is not responsive.*

Some low-level parameters in the Data Store boards are read only at power-on. To be sure that all parameters are reset, a complete power-off cycle is recommend if an application locks up.

Appendix C: Software Repair

There are two parts to this appendix. The first part explains how to create and use an Emergency Repair Disk. The second part tells you how to reload the test system software onto your MTS 210 or MTS 215 if the installed copy becomes corrupted.

Creating and Using an Emergency Repair Disk

An emergency repair disk, specific to the system, is supplied with each Tektronix MPEG Test System. Whenever you upgrade the software or change your password, it is strongly recommended that you also create a new emergency repair disk. This will minimize the chances that you will need to completely re-load the operating software for minor problem.

Use the emergency repair disk to restore your system to its initial setup state if your system files become corrupt and you are unable to recover the previous start up configuration (Last Known Good — the Windows NT startup screen option). If you don't have the emergency repair disk, you will have to reinstall Windows NT. Please see the Windows NT System Guide, provided with your back-up copy of Windows NT, for the procedure required to restore your system.

You may also need the emergency repair disk to restore user passwords if they are forgotten. Be sure to update the emergency repair disk each time you add a user or change a password.

CAUTION. *The files on the Emergency Repair Disk are MTS 210-specific; that is, the disk shipped with an MTS 210 is the* **ONLY** *one that will work with that unit. Do not lose this disk. If you lose the Emergency Repair Disk provided with your MTS 210, create a new one as described below.*

Creating an Emergency Repair Disk

To create an emergency repair disk, mark a High Density 3.5-inch disk clearly as the emergency repair disk for MTS 210 (or MTS 215) serial number B0xxxxx (be sure to write the serial number exactly as it appears on the rear panel) and then perform the following steps.

***NOTE**. The emergency repair disk is test-system-specific. Make sure that the emergency repair disk is clearly marked with its serial number. The serial number of your Tektronix MPEG Test System appears on the original emergency repair disk and on the server rear panel, near the power input connector.*

1. Choose **Run** from the Windows NT Start menu.
2. Type **rdisk** in the **Run** dialog box. The **Repair Disk Utility** dialog box, as shown in Figure C–1, opens.

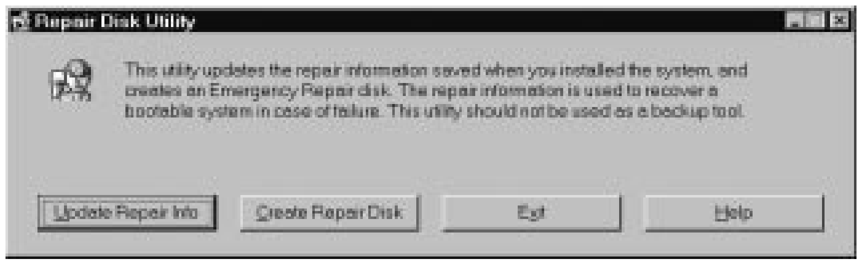


Figure C–1: The Repair Disk dialog box

3. Click **Update Repair Info** to save your current configuration. A message appears to remind you that earlier repair information is overwritten. Click **Yes** to continue.
4. When the process is complete, a message appears to ask if you wish to create an Emergency Repair Disk. Click **Yes**. The message shown in Figure C–2 appears.

Figure C–2: All data on the disk will be erased

5. Insert a 3.5-inch disk in drive A and click **OK**. Rdisk formats the disk and copies the configuration files onto it.
6. When the operation is complete, click **Exit** in the Repair Disk Utility dialog box. Remove the disk from drive A and keep it in a safe place.

Using the Emergency Repair Disk

Always refer to the Windows NT documentation if you need more information.

1. Verify that you have a source of setup information available (the Windows NT back up software package).
2. Insert the Windows NT Setup disk.
3. Restart the Test System.
4. When the Windows NT Setup Screen appears, press **R** (repair).
5. When prompted, insert the emergency repair disk.
6. The emergency repair disk performs the following:
   - Runs CHKDSK.EXE on the WINNT and SYSTEM partitions.
   - Verifies each file in the installation and replaces any that are missing or corrupt.
   - Replaces the System, Security, and Security Accounts Manager hives in the registry.
   - Reinstalls the Boot Loader (the boot sector, BOOT.INI, etc.).

Reinstalling the MTS 210 Software

Use the procedures below to reinstall your Test System software if it is accidently deleted or becomes corrupted. Software has been supplied on CD ROM.

***NOTE**. The following instructions are for* reinstalling *MPEG Test System software on a machine running Windows NT Workstation 4.0 only; procedures for upgrading the software may be different. If you are installing a software upgrade, follow the instructions provided with the upgrade kit.*

Reinstalling the software involves four procedures:

- Uninstalling the software
- Copying the program files

Uninstalling the Software

If you are reinstalling because the MTS 210 software has become corrupted, you should uninstall the software using unInstallShield, available through the Tektronix MPEG Test System submenu.

1. Restart Windows NT.
2. Log in to Windows NT as administrator (Username = administrator; password = MPEG2). You must log in as administrator in order to install the MTS 210 applications.
3. Quit any applications that automatically started at login.
4. Select **unInstallShield** (see Figure C–3).

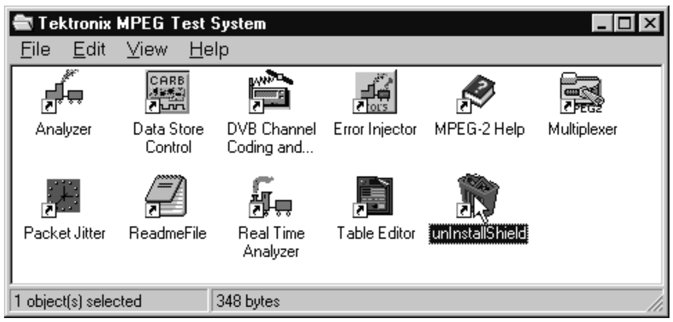


Figure C–3: Uninstall the software

5. When the dialog box asks you to confirm the file deletion, click **Yes**.
6. A window appears to show the progress of the uninstall process. When uninstall is successfully completed, click **OK** to continue.
7. Close the **Tektronix MPEG Test System** window; then start Windows NT Explorer (through the Programs submenu of the Windows NT Start menu).
8. Drag the C:\Mts100 folder to the Recycle Bin.
9. Open the C:\Winnt\Profiles\All Users\Start Menu\Programs folder; then drag the **Tektronix MPEG Test System** folder from the Start Menu folder to the Recycle Bin.
10. Close the Windows NT Explorer window.

Copying the Program Files

1. If you are continuing from the uninstall procedure, go directly to step 4; If you did not uninstall the software, restart Windows NT now.
2. Log in to Windows NT as administrator (Username = administrator; password = MPEG2). You must log in as administrator in order to install the MTS 210 applications.
3. Quit any applications that automatically started at login.

4. Verify that the system disk on the MTS 210 workstation has at least 100 MB of free space. The program will not install if the system disk has less than 100 MB of free space.

5. Place the MTS 210 Installation Software CD ROM into the CD ROM drive. The CD ROM part number depends on the option, as listed in the following table.

MTS option	CD ROM part number
MTS 210 option 1A	063-2945-00
MTS 210 option 1G	063-2946-00
MTS 210 option AG and MTS 215	063-2947-00

6. The setup application starts automatically in a few seconds and displays the dialog box shown in Figure C–4.

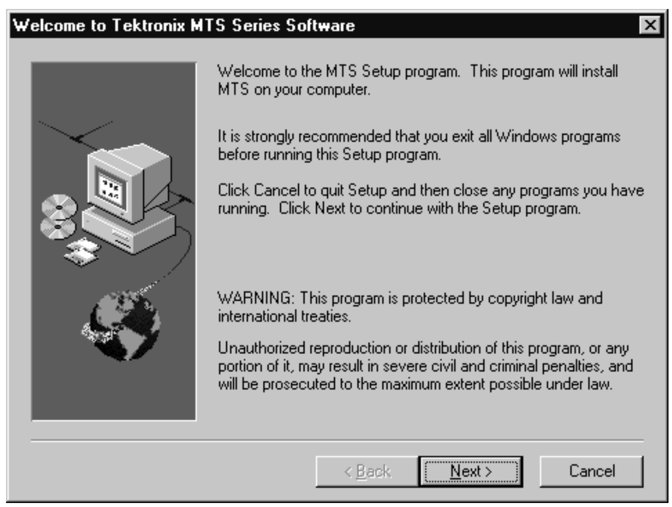


Figure C–4: The MTS 210 software installation dialog box

7. Read the text in the dialog box and then click Next to proceed to the **Choose Destination Directory** dialog box shown in Figure C–5.

Figure C–5: Specifying the destination directory

8. The default directory is C:\Mts100\. To accept the default directory, click **Next**.

***NOTE**. It is strongly recommended that you use the default directory name.*

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9. Click **Next** to accept the default folder name (Tektronix MPEG Test System) and continue. The **Select Components** window opens.

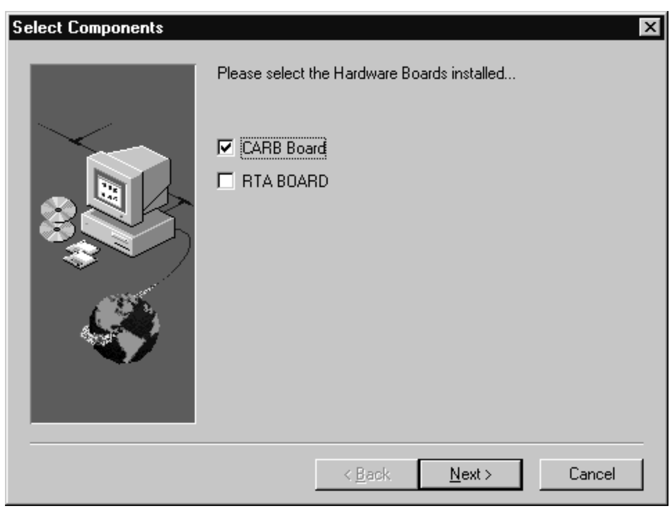

Figure C–6: Select RTA BOARD only for the MTS 215

10. If you are installing software in an MTS 215, select both options; otherwise, select only **CARB Board**. Then click **Next**; a second **Select Components** window opens.

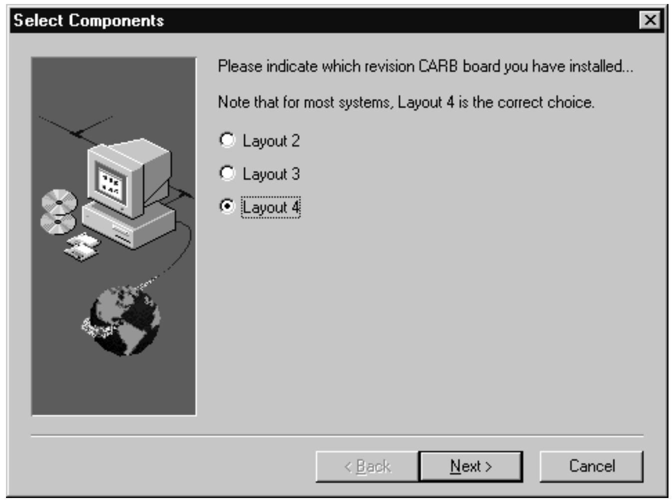

Figure C–7: Select the Data Store board configuration

11. Click **Next** to accept **Layout 4**. The **Select Program Folder** window appears.

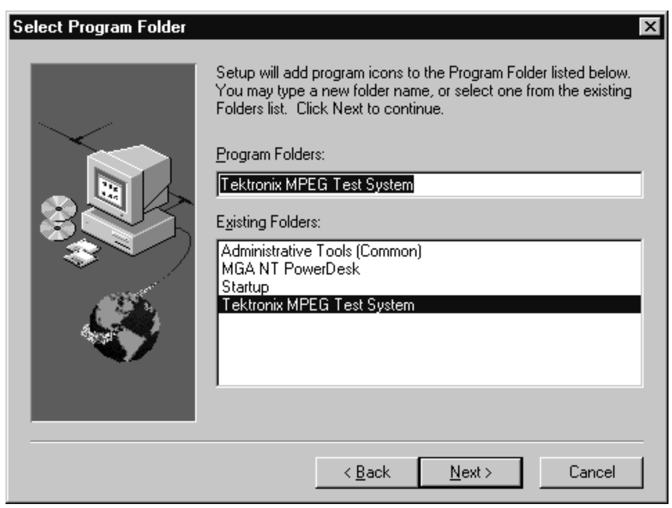

Figure C–8: The Select Program Folder dialog box

12. Click **Next** to accept the default folder name (Tektronix MPEG Test System) and continue. The **Select Components** window opens.

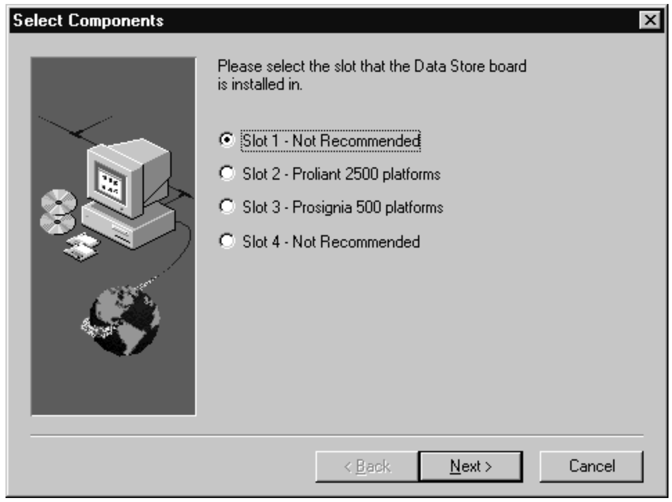

Figure C–9: Specify the Data Store slot

13. You must specify the slot in which the Data Store board is installed. For the Proliant server, select **Slot 2 - Proliant 2500 platforms** and then click **Next**.

NOTE*. You will be unable to use the Data Store Administrator application if you do not specify the correct slot.*

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14. If you selected RTA BOARD in step 10, the **Select Components** window opens again so you can specify the RTA board location. For the Proliant server, select **Slot 4 – Proliant 2500 platforms** and then click **Next**.

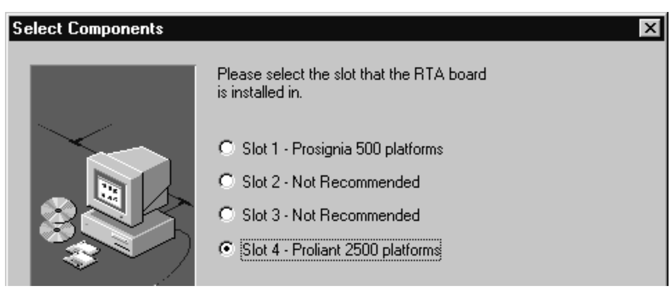

Figure C–10: Specify the RTA slot (MTS 215 only)

NOTE*. You will be unable to use the Real-Time Analyzer application if you do not specify the correct slot.*

The setup program begins installing the MTS 210 software. The activity and progress gauges shown in Figure C–11 appear to show that the installation process is progressing. Installation proceeds without your input (and sometimes with no apparent activity) for approximately 2 ½ minutes.

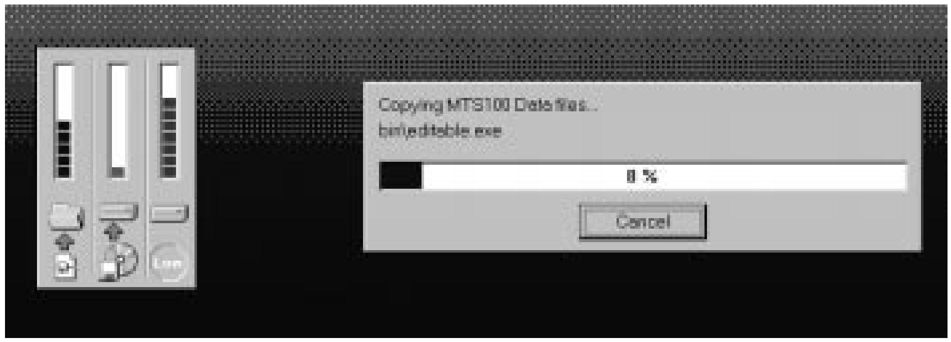

Figure C–11: The progress dialog box and activity gauges

15. As the progress gauge nears 100%, an information dialog box, shown in Figure C–12, reminds you to verify that the HASP is installed. *Be sure* that the HASP is installed as described on page 1–11 of this manual; then click **OK** to continue.

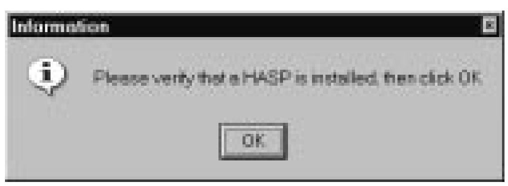

Figure C–12: Check HASP installation

16. A dialog box appears when device driver installation is complete; click **OK** to continue. The installation program finishes copying information to the computer and then opens the **Restart Windows NT** dialog box.

Figure C–13: The Restart Windows NT dialog box

17. Click **OK** to restart the system.

Your reinstallation of the Version 2.2 software is complete.

Tektronix MPEG Test System Files

A list of the files that are installed for the Tektronix MPEG Test System, option AG, begins on this page; the list of files installed for the MTS 210, option 1A, begins on page C–13; and the list of files for the MTS 210, option 1G, begins on page C–16.

MTS 210, Option AG Files

MTS100/README.TXT

MTS100/AUDIO/10KHZ.MP2
MTS100/AUDIO/15KZ_064.MP2
MTS100/AUDIO/15KZ_128.MP2
MTS100/AUDIO/15KZ_192.MP2
MTS100/AUDIO/15KZ_256.MP2
MTS100/AUDIO/1KHZ.MP2

MTS100/BIN/!CAR2500.CFG
MTS100/BIN/!PIA2500.CFG
MTS100/BIN/ADN_CARB.EXE
MTS100/BIN/ADONUM.CNT
MTS100/BIN/ADONUM.HLP
MTS100/BIN/BC453RTL.DLL

MTS 210, Option AG Files (Cont.)

MTS100/BIN/BDS501F.DLL
MTS100/BIN/BIDS47F.DLL
MTS100/BIN/BIDS50F.DLL
MTS100/BIN/BYTEFLIP.EXE
MTS100/BIN/CANAL.CNT
MTS100/BIN/CANAL.EXE
MTS100/BIN/CANAL.HLP
MTS100/BIN/CARBFILE.DLL
MTS100/BIN/CW3215.DLL
MTS100/BIN/CW3220.DLL
MTS100/BIN/D2HTLS32.DLL
MTS100/BIN/DOC2HELP.INI
MTS100/BIN/DYNAMIC.AVI
MTS100/BIN/EDITABLE.CNT
MTS100/BIN/EDITABLE.EXE
MTS100/BIN/EDITABLE.HLP
MTS100/BIN/EINJWIN.CNT
MTS100/BIN/EINJWIN.EXE
MTS100/BIN/EINJWIN.HLP
MTS100/BIN/GIGUE.CNT
MTS100/BIN/GIGUE.EXE
MTS100/BIN/GIGUE.HLP
MTS100/BIN/MATRACOM.EXE
MTS100/BIN/MFC30.DLL
MTS100/BIN/MFC30D.DLL
MTS100/BIN/MFC42.DLL
MTS100/BIN/MPEG2NT.HLP
MTS100/BIN/MSVCRT20.DLL
MTS100/BIN/MUX_CARB.EXE
MTS100/BIN/MUX_MPG2.CNT
MTS100/BIN/MUX_MPG2.HLP
MTS100/BIN/OWL253F.DLL
MTS100/BIN/OWL50F.DLL
MTS100/BIN/RTAMSG.DLL
MTS100/BIN/Rta.cnt

MTS 210, Option AG Files (Cont.)

MTS100/BIN/Rta.hlp
MTS100/BIN/SETCARB.EXE
MTS100/BIN/SYNT207.DLL
MTS100/BIN/SyntaxV.dll
MTS100/BIN/rta.exe

MTS100/CFG–TRP/!!CFG.NDX
MTS100/CFG–TRP/DEFAULT.BAT
MTS100/CFG–TRP/DEFAULT.CFG
MTS100/CFG–TRP/DEFAULT.EIT
MTS100/CFG–TRP/DEFAULT.NIT
MTS100/CFG–TRP/DEFAULT.PMT
MTS100/CFG–TRP/DEFAULT.SDT
MTS100/CFG–TRP/DEFAULT.TRP
MTS100/CFG–TRP/SAMPLE.TRP

MTS100/SERVICE/Flash.exe
MTS100/SERVICE/Flex1310.hex
MTS100/SERVICE/PiAdmin.exe
MTS100/SERVICE/Pia0.cfg
MTS100/SERVICE/README.TXT
MTS100/SERVICE/new_eisa/rtad2810.hex
MTS100/SERVICE/old_eisa/rtad2708.hex

MTS100/VIDEO/525/MOBL_015.MP2
MTS100/VIDEO/525/MOBL_060.MP2
MTS100/VIDEO/525/TESTPAT/100B_015.MP2
MTS100/VIDEO/525/TESTPAT/100B_060.MP2
MTS100/VIDEO/625/BARS_015.MP2

MTS100/VIDEO/625/BARS_060.MP2
MTS100/VIDEO/625/DEMO_015.MP2
MTS100/VIDEO/625/DEMO_060.MP2
MTS100/VIDEO/625/MOBL_015.MP2
MTS100/VIDEO/625/MOBL_060.MP2

MTS 210, Option AG Files (Cont.)

MTS100/VIDEO/625/TESTPAT/100B_015.MP2
MTS100/VIDEO/625/TESTPAT/100B_060.MP2

TEMP/LOOP32.VER
TEMP/MFC30D.DLL
TEMP/MSVCRT20.DLL
TEMP/PKUNZIP.EXE
TEMP/PKZIP.EXE
TEMP/RPCNS4.DLL
TEMP/RPCRT4.DLL
TEMP/RPCSERV.EXE
TEMP/RPCSUPER.DLL

WINNT/MUX.INI

MTS 210, Option 1A Files

MTS100/README.TXT

MTS100/AUDIO/10KHZ.MP2
MTS100/AUDIO/15KZ_064.MP2
MTS100/AUDIO/15KZ_128.MP2
MTS100/AUDIO/15KZ_192.MP2
MTS100/AUDIO/15KZ_256.MP2
MTS100/AUDIO/1KHZ.MP2

MTS100/BIN/!CAR2500.CFG
MTS100/BIN/ADN_CARB.EXE
MTS100/BIN/ADONUM.CNT
MTS100/BIN/ADONUM.HLP
MTS100/BIN/BC453RTL.DLL
MTS100/BIN/BDS501F.DLL
MTS100/BIN/BIDS47F.DLL
MTS100/BIN/BIDS50F.DLL

MTS 210, Option 1A Files (Cont.)

MTS100/BIN/BYTEFLIP.EXE
MTS100/BIN/CANAL.CNT
MTS100/BIN/CANAL.EXE
MTS100/BIN/CANAL.HLP
MTS100/BIN/CARBFILE.DLL
MTS100/BIN/CW3215.DLL
MTS100/BIN/CW3220.DLL
MTS100/BIN/D2HTLS32.DLL
MTS100/BIN/DYNAMIC.AVI
MTS100/BIN/EDITABLE.CNT
MTS100/BIN/EDITABLE.EXE
MTS100/BIN/EDITABLE.HLP
MTS100/BIN/EINJWIN.CNT
MTS100/BIN/EINJWIN.EXE
MTS100/BIN/EINJWIN.HLP
MTS100/BIN/GIGUE.CNT
MTS100/BIN/GIGUE.EXE
MTS100/BIN/GIGUE.HLP
MTS100/BIN/MATRACOM.EXE
MTS100/BIN/MFC30.DLL
MTS100/BIN/MFC30D.DLL
MTS100/BIN/MFC42.DLL
MTS100/BIN/MPEG2NT.HLP
MTS100/BIN/MSVCRT20.DLL
MTS100/BIN/OWL253F.DLL
MTS100/BIN/OWL50F.DLL
MTS100/BIN/SETCARB.EXE
MTS100/BIN/SYNT207.DLL

MTS100/CFG–TRP/!!CFG.NDX
MTS100/CFG–TRP/DEFAULT.BAT
MTS100/CFG–TRP/DEFAULT.CFG
MTS100/CFG–TRP/DEFAULT.EIT
MTS100/CFG–TRP/DEFAULT.NIT

MTS 210, Option 1A Files (Cont.)

MTS100/CFG–TRP/DEFAULT.PMT
MTS100/CFG–TRP/DEFAULT.SDT
MTS100/CFG–TRP/DEFAULT.TRP
MTS100/CFG–TRP/SAMPLE.TRP

MTS100/VIDEO/525/MOBL_015.MP2
MTS100/VIDEO/525/MOBL_060.MP2
MTS100/VIDEO/525/TESTPAT/100B_015.MP2
MTS100/VIDEO/525/TESTPAT/100B_060.MP2
MTS100/VIDEO/625/BARS_015.MP2
MTS100/VIDEO/625/BARS_060.MP2
MTS100/VIDEO/625/DEMO_015.MP2
MTS100/VIDEO/625/DEMO_060.MP2
MTS100/VIDEO/625/MOBL_015.MP2
MTS100/VIDEO/625/MOBL_060.MP2
MTS100/VIDEO/625/TESTPAT/100B_015.MP2
MTS100/VIDEO/625/TESTPAT/100B_060.MP2

TEMP/LOOP32.VER
TEMP/MFC30D.DLL
TEMP/MSVCRT20.DLL
TEMP/PKUNZIP.EXE
TEMP/PKZIP.EXE
TEMP/RPCNS4.DLL
TEMP/RPCRT4.DLL
TEMP/RPCSERV.EXE
TEMP/RPCSUPER.DLL

WINNT/SYSTEM32/CTL3D.DLL
WINNT/SYSTEM32/CTL3DV2.DLL
WINNT/SYSTEM32/DRIVERS/DRVCARB.SYS
WINNT/SYSTEM32/MUX.INI
WINNT/SYSTEM32/RHMMPLAY.DLL

MTS 210, Option 1G Files

MTS100/README.TXT

MTS100/AUDIO/10KHZ.MP2
MTS100/AUDIO/15KZ_064.MP2
MTS100/AUDIO/15KZ_128.MP2
MTS100/AUDIO/15KZ_192.MP2
MTS100/AUDIO/15KZ_256.MP2
MTS100/AUDIO/1KHZ.MP2

MTS100/BIN/!CAR2500.CFG
MTS100/BIN/BC453RTL.DLL
MTS100/BIN/BDS501F.DLL
MTS100/BIN/BIDS47F.DLL
MTS100/BIN/BIDS50F.DLL
MTS100/BIN/BYTEFLIP.EXE
MTS100/BIN/CANAL.CNT
MTS100/BIN/CANAL.EXE
MTS100/BIN/CANAL.HLP
MTS100/BIN/CARBFILE.DLL
MTS100/BIN/CW3215.DLL
MTS100/BIN/CW3220.DLL
MTS100/BIN/D2HTLS32.DLL
MTS100/BIN/DYNAMIC.AVI
MTS100/BIN/EDITABLE.CNT
MTS100/BIN/EDITABLE.EXE
MTS100/BIN/EDITABLE.HLP
MTS100/BIN/EINJWIN.CNT
MTS100/BIN/EINJWIN.EXE
MTS100/BIN/EINJWIN.HLP
MTS100/BIN/GIGUE.CNT
MTS100/BIN/GIGUE.EXE
MTS100/BIN/GIGUE.HLP
MTS100/BIN/MATRACOM.EXE
MTS100/BIN/MFC30.DLL

MTS 210, Option 1G Files (Cont.)

MTS100/BIN/MFC30D.DLL
MTS100/BIN/MFC42.DLL
MTS100/BIN/MPEG2NT.HLP
MTS100/BIN/MSVCRT20.DLL
MTS100/BIN/MUX_CARB.EXE
MTS100/BIN/MUX_MPG2.CNT
MTS100/BIN/MUX_MPG2.HLP
MTS100/BIN/OWL253F.DLL
MTS100/BIN/OWL50F.DLL
MTS100/BIN/SETCARB.EXE
MTS100/BIN/SYNT207.DLL

MTS100/CFG–TRP/!!CFG.NDX
MTS100/CFG–TRP/DEFAULT.BAT
MTS100/CFG–TRP/DEFAULT.CFG
MTS100/CFG–TRP/DEFAULT.EIT
MTS100/CFG–TRP/DEFAULT.NIT
MTS100/CFG–TRP/DEFAULT.PMT
MTS100/CFG–TRP/DEFAULT.SDT
MTS100/CFG–TRP/DEFAULT.TRP
MTS100/CFG–TRP/SAMPLE.TRP

MTS100/VIDEO/525/MOBL_015.MP2
MTS100/VIDEO/525/MOBL_060.MP2
MTS100/VIDEO/525/TESTPAT/100B_015.MP2
MTS100/VIDEO/525/TESTPAT/100B_060.MP2
MTS100/VIDEO/625/BARS_015.MP2
MTS100/VIDEO/625/BARS_060.MP2
MTS100/VIDEO/625/DEMO_015.MP2
MTS100/VIDEO/625/DEMO_060.MP2
MTS100/VIDEO/625/MOBL_015.MP2
MTS100/VIDEO/625/MOBL_060.MP2
MTS100/VIDEO/625/TESTPAT/100B_015.MP2
MTS100/VIDEO/625/TESTPAT/100B_060.MP2

MTS 210, Option 1G Files (Cont.)

TEMP/LOOP32.VER
TEMP/MFC30D.DLL
TEMP/MSVCRT20.DLL
TEMP/PKUNZIP.EXE
TEMP/PKZIP.EXE
TEMP/RPCNS4.DLL
TEMP/RPCRT4.DLL
TEMP/RPCSERV.EXE
TEMP/RPCSUPER.DLL

WINNT/MUX.INI
WINNT/SYSTEM32/CTL3D.DLL
WINNT/SYSTEM32/CTL3DV2.DLL
WINNT/SYSTEM32/DRIVERS/DRVCARB.SYS
WINNT/SYSTEM32/RHMMPLAY.DLL

Appendix D: Analyzer Tests

This section describes the tests performed by the Analyzer application, version 1.0, on the bitstreams.

***NOTE**. This appendix does not include tests added to version 2.0 and later of the Tektronix MPEG Test System software.*

The tests shown in normal typeface can be found in the compliance document (ISO/IEC 13818–4 DIS).

The tests shown in italics are not described in the compliance document, or are described but are erroneous and/or incomplete.

All the fields are indicated, even those for which no tests are performed. The fields are listed exactly in the same order as given in the Standard (ISO/IEC 13818–1 IS of 13 November 1994).

Compliance at the Transport Stream Level

There are two parts at this level: the Transport Packet Header and the Adaptation Field.

Table D–1: Compliance for the Transport Packet Header

Parameter	Error checking
sync_byte (sb):	test that (sb == 0x47)
transport_error_indicator (tei):	test that (tei != 1)
payload_unit_start_indicator (pusi):	if (pid == 0x1FFF) then test that (pusi == '0')
transport_priority (tp):	no test
PID (pid):	1. test that pid is in [0x0000, 0x0001, 0x0010 .. 0x1FFF] 2. issue a warning if pid emulates 0x47 3. verify that there is at least one packet with pid == 0x0000 in the stream
transport_scrambling_control (tsc):	1. if (pid == 0x0000 or 0x0001 or 0x1FFF) then test that (tsc == '00') 2. if (pid == PID_PMT) then test that (tsc == '00')
	***NOTE:** the PID_PMTs are given by the program_map_PID fields in the PAT sections.*

Table D–1: Compliance for the Transport Packet Header (cont.)

Parameter	Error checking
adaptation_field_control (afc):	if (pid == 0x1FFF) then test that (afc == ‘01’) else test that (afc != ‘00’)
continuity_counter (cc):	if (afc in == ‘x1’) and ((AF.di == ‘0’) or (afc == ‘0x’)) and (pid != 0x1FFF) and packet is not a duplicate then test that (cc == previous_cc + 1, modulo 16)
	NOTE: *previous_cc means value of the continuity_counter of the previous TS packet with the same PID.*
data_byte (db):	1. if (pusi == ‘1’) and (pid == PID_PES) and (tsc == ‘00’) or stream has been unscrambled then test that db starts with 0x000001 followed by the correct sid 2. if (pusi == ‘0’) and (pid == PID_PES) and (tsc == ‘00’) or stream has been unscrambled then test that db does not contain 0x000001 followed by the correct sid 3. if (pusi == ‘1’) and (pid == PID_PSI) and (tsc == ‘00’) or stream has been unscrambled then test that db starts with pointer field to the correct table_id 4. if packet is not a duplicate and (previous_AFH.sc == 0) and (tsc == ‘00’) or stream has been unscrambled then test that db starts with 0x000001 followed by the correct sid
	NOTE: *1. PID_PES are given by the elementary_PID fields given in the PMT sections.* *2. PID_PSI are 0x0000 for PAT, 0x0001 for CAT, the PIDs given by the program_map_PID fields in the PAT sections, PID given by the network_PID field in the PAT sections.* *3. correct table_id are 0x00 for PAT, 0x01 for CAT, 0x02 for PMT and [0x40 .. 0xFE] for NIT.* *4. correct sid means ‘1110 xxxx’ for video and ‘110x xxxx’ for audio.* *5. previous_AFH.sc means the value of the splice_countdown field of the previous TS packet with the same PID (duplicate packets and packets with no payload excluded).*

Special Tests in the Case of a Duplicate Packet

The following test should be used to determine whether a packet is a duplicate packet:

if (afc == ‘x1’)
and (AF.di == ‘0’) or not present
and (pid != 0x1FFF)
and (cc == previous_cc)
then packet is a duplicate

For a duplicate packet, the you should test that the previous packet with same PID is not itself a duplicate packet.

Table D–2: Compliance for the Adaptation Field (AF)

Parameter	Error checking
adaptation_field_length (afl):	1. if (TPH.afc == ‘10’) then test that (afl == 183) 2. if (TPH.afc == ‘11’) then test that afl is in [0 .. 182]
discontinuity_indicator (di):	no test
random_access_indicator (rai):	no test
elementary_stream_priority_indicator (espi):	no test
PCR_flag (pcrf):	1. if (opcrf == ‘1’) then test that (pcrf == ‘1’) 2. if (rai == ‘1’) and (TPH.pid == PID_PCR) then test that (pcrf == ‘1’) ***NOTE:*** *the PID_PCR are the PIDs given by the PCR_PID fields in the PMT sections.*
OPCR_flag (opcrf):	no test
splicing_point_flag (spf):	if packet is not duplicate and (TPH.afc == ‘11’) and (previous_spf == 1) and (previous_sc != 0) then test that (spf == 1)
transport_private_data_flag (tpdf):	no test
adaptation_field_extension_flag (afef):	if packet is not duplicate and (TPH.afc == ‘11’) and (previous_afef == 1) and (previous_sc != 0) then test that (afef == 1)
program_clock_reference_base (pcrb):	no test
reserved (r1):	test that (r1 == ‘111111’)
program_clock_reference_extension (pcre):	no test

Table D–2: Compliance for the Adaptation Field (AF) (cont.)

Parameter	Error checking
original_program_clock_reference_base (opcrb):	no test
reserved (r2):	test that (r2 == ‘111111’)
original_program_clock_reference_extension (opcre):	no test
splice_countdown (sc):	if (packet is not duplicate) and (TPH.afc == ‘11’) then test that (sc == previous_sc – 1) ***NOTE:*** *previous_sc is the value of sc in the previous packet of the same PID (duplicate packets and packets with no payload excluded).*

transport_private_data_length (tpdl):	1. test that (tpdl > 0)
	2. test that (tpdl < afl – compute_length())
	compute_length is the following function:
	int compute_length()
	{
	int length = 1
	if (pcrf == ‘1’) then length += 6
	if (opcrf == ‘1’) then length += 6
	if (spf == ‘1’) then length++
	if (afef == ‘1’) then length += afel
	}

private_data_byte (pdb):	no test
adaptation_field_extension_length (afel):	test that (afel > 0)
ltw_flag (lf):	no test
piecewise_rate_flag (prf):	no test
seamless_splice_flag (ssf):	if packet is not duplicate and (TPH.afc == ‘11’) and (previous_ssf == 1) and (previous_sc != 0) then test that (ssf == 1)
reserved (r3):	test that (r3 == ‘11111’)
ltw_valid_flag (lvf):	no test
ltw_offset (lo):	no test
reserved (r4):	test that (r4 == ‘11111111’)
piecewise_rate (pr):	no test

Table D–2: Compliance for the Adaptation Field (AF) (cont.)

Parameter	Error checking
splice_type (st):	1. if (packet carries audio stream) then test that (st == '0000') 2. if (packet carries video stream) then test that st is not in ['0100' .. '1011'] 3. if (not first occurrence of st) and (previous_sc != 0) then test that (st == previous_st)
	NOTE: *1. for a definition of previous_sc, see note 1 of sc.* *2. previous_st means the value of st in the previous packet with the same PID (duplicate packets or packets without payload excluded).* *3. the information about the type of stream (audio or video) can be found in the stream_type fields of the PMT sections.*
DTS_next_au (dtsna):	if (not first occurrence of dtsna) and (previous_sc != 0) then test that (dtsna == previous_dtsna)
	NOTE: *1. for a definition of previous_sc, see note 1 of sc.* *2. previous_dtsna means the value of dtsna in the previous packet with the same PID (duplicate packets or packets without payload excluded).*
marker_bit (mb):	test that (mb == '1') for all mb in the packet
reserved (r5):	test that (r5 == '1111 1111') for all bytes
stuffing_byte (sb):	test that (sb == '1111 1111') for all bytes

Compliance at the PES Packet Level

The following tests should be performed only if the transport_scrambling_control field of the transport packets is equal to ‘00’ or the PES stream has been unscrambled.

Table D–3: Compliance for the PES packet header

Parameter	Error checking
packet_start_code_prefix (pscp):	test that (pscp == 0x000001)
stream_id (sid):	1. sid != a reserved value 2. sid >= 0xBC 3. test that each PES packet carried in the TS packets of the same PID value have the same sid 4. if (packet carries audio) then test that sid is in [0xC0 .. 0xDF] 5. if (packet carries video) then test that sid is in [0xE0 .. 0xEF]
PES_packet_length (pespl):	if sid indicates that packet does not carry video then test that (pespl != 0)
‘10’:	test that these two bits are really equal to ‘10’
PES_scrambling_control (pessc):	no test
PES_priority (pesp):	no test
data_alignment_indicator (dai):	no test
copyright (©):	no test
original_or_copy (ooc):	no test
PTS_DTS_flags (ptsdtsf):	test that (ptsdtsf != ‘01’)
ESCR_flag (escrf):	no test
ES_rate_flag (esrf):	no test
DSM_trick_mode_flag (dsmtmf):	no test
additional_copy_info_flag (acif):	no test
PES_CRC_flag (pescrcf):	no test
PES_extension_flag (pesef):	no test
PES_header_data_length (phdl):	1. test that phdl >= sum of optional data fields (> for stuffing) 2. test that phdl <= 32
‘0010’:	test that these four bits are really equal to ‘0010’
marker bit (mb):	test that (mb == 1) for all mb in the packet
PTS (pts):	no test
‘0011’:	test that these four bits are really equal to ‘0011’

Table D–3: Compliance for the PES packet header (cont.)

Parameter	Error checking
'0001':	test that these four bits are really equal to '0001'
DTS (dts):	no test
reserved (r1):	test that (r1 == '11')
ESCR (escr):	no test
ES_rate (esr):	test that (esr != 0)
trick_mode_control (tmc):	no test
field_id (fid):	test that (fid != '11')
intra_slice_refresh (isr):	no test
frequency_truncation (ft):	no test
rep_cntrl (rc):	test that (rc != 0)
reserved (r2):	test that (r2 == '111')
reserved (r3):	test that (r3 == '11111')
additional_copy_info (aci):	no test
previous_PES_packet_CRC (pppc):	no test
PES_private_data_flag (pespdf):	no test
pack_header_field_flag (phfl):	no test
program_packet_sequence_counter_flag (ppscf):	no test
P–STD_buffer_flag (pstdbf):	no test
reserved (r4):	test that (r4 == '111')
PES_extension_flag_2 (pesef2):	no test
PES_private_data (ppd):	shall not emulate the packet_start_code_prefix (0x000001)
pack_field_length (pfl):	test that (pfl < pespl)
program_packet_sequence_counter (ppsc):	no test
MPEG1_MPEG2_identifier (mpeg1mpeg2i):	no test
original_stuff_length (osl):	if (mpeg1mpeg2i == 1) then test that (osl <= 16) else test that (osl <= 32)
'01':	test that these two bits are really equal to '01'
P–STD_buffer_scale (pstdbscale):	no test
P–STD_buffer_size (pstdbsize):	no test
PES_extension_field_length (pesefl):	test that (pesefl < pespl)
reserved (r5):	test that (r5 == '1111 1111') for all bytes
stuffing_byte (sb):	1. test that (sb == 0xFF) for all bytes 2. test that the number of sb <= 32 in PES packet header

Table D–3: Compliance for the PES packet header (cont.)

Parameter	Error checking
PES_packet_data_byte (pespdb):	no test
padding_byte (pb):	test that (pb == 0xFF) for all bytes

Compliance at the PSI level

The PSI level contains the following sections: PAT, PMT, CAT, NIT, and Private Sections.

Table D–4: Compliance for the PAT sections

Parameter	Error check
table_id (tid):	test that (tid == 0x00)
section_syntax_indicator (ssi):	test that (ssi == ‘1’)
0 (zero):	test that (zero == ‘0’)
reserved (res1):	test that (res1 == ‘11’)
section_length (sl):	1. test that (9 <= sl <= 1021) 2. if (sl == n) then test that ((byte[n] == 0x00) or (byte[n] == 0xFF) or (byte[n] == 0x47)) and test that (byte[n–4] .. byte[n–1] == CRC32) ***NOTE:*** *we use a C-type array notation, so byte[n] means the (n+1)th byte found after sl.*
transport_stream_id (tsid):	verify that tsid is the same for all sections with the same vn
reserved (res2):	test that (res2 == ‘11’)
version_number (vn):	no test
current_next_indicator (cni):	no test
section_number (sn):	no test
last_section_number (lsn):	no test
program_number (pn):	does not take any single value more than once within all sections of a version
reserved (res3):	test that (res3 == ‘111’)
network_PID (npid):	1. test that npid is not in [0x000 .. 0x000F] 2. *test that (npid != 0x1FFF)* 3. test that npid is not a pid already used for audio or video 4. *test that npid is not a pid already used for data* ***NOTE:*** *a npid can be the same as a pmpid.*

Table D–4: Compliance for the PAT sections (cont.)

Parameter	Error check
program_map_PID (pmpid):	1. test that pmpid is not in [0x000 .. 0x000F, 0x1FFF] 2. test that pmpid is not a pid already used for audio, video 3. *test that npid is not a pid already used for data*
CRC32 (crc):	1. test that the CRC value is correct 2. test that the byte following the CRC is 0x00, 0x47 or 0xFF

Table D–5: Compliance for the PMT sections

Parameter	Error check
table_id (tid):	test that (tid == 0x02)
section_syntax_indicator (ssi):	test that (ssi == ‘1’)
‘0’ (zero):	test that (zero == ‘0’)
reserved (res1):	test that (res1 == ‘11’)
section_length (sl):	1. test that (9 <= sl <= 1021) 2. if (sl == n) then test that ((byte[n] == 0x00) or (byte[n] == 0xFF) or (byte[n] == 0x47)) and test that (byte[n–4] .. byte[n–1] == CRC32) ***NOTE:*** *we use a C-type array notation, so byte[n] means the (n+1)th byte found after sl.*
program_number (pn):	1. pn should be the one defined in PAT 2. test that (pn != 0)
reserved (res2):	test that (res2 == ‘11’)
version_number (vn):	1. if (cni == 1) then test that all sections have the same vn 2. test that (v + 1) is the next version and has (cni == 1)
current_next_indicator (cni):	no test
section_number (sn):	test that (sn == 0)
last_section_number (lsn):	test that (sn == 0)
reserved (res3):	test that (res3 == ‘111’)
PCR_PID (pcrpid):	test that pcrpid is not in [0x0002 .. 0x000F]
reserved (res4):	test that (res4 == ‘1111’)
program_info_length (pil):	1. test that (pil < 1024) 2. *test that (pil < (sl – 9))*
descriptor:	see descriptor test (beginning on page D–12)
stream_type (st):	no test

Table D–5: Compliance for the PMT sections (cont.)

Parameter	Error check
reserved (res5)	test that (res5 == ‘111’)
elementary_PID (epid):	test that epid is not in [0x000 .. 0x000F, 0x1FFF]
reserved (res6):	test that (res6 == ‘1111’)
ES_info_length (esil):	test that (esil < 1024)
descriptor:	see descriptor test (beginning on page D–12)
CRC32 (crc):	1. test that the CRC value is correct 2. test that the byte following the CRC is 0x00, 0x47 or 0xFF

Table D–6: Compliance for the CAT section

Parameter	Error check
table_id (tid):	test that (tid == 0x01)
section_syntax_indicator (ssi):	test that (ssi == ‘1’)
0 (zero):	test that (zero == ‘0’)
reserved (res1):	test that (res1 == ‘11’)
section_length (sl):	1. test that (9 <= sl <= 1021) 2. if (sl == n) then test that ((byte[n] == 0x00) or (byte[n] == 0xFF) or (byte[n] == 0x47)) and test that (byte[n–4] .. byte[n–1] == CRC32) ***NOTE:*** *we use a C-type array notation, so byte[n] means the (n+1)th byte found after sl.*
reserved (res2):	test that (res2 == ‘1111 1111 1111 1111 11’)
version_number (vn):	no test
current_next_indicator (cni):	no test
section_number (sn):	no test
last_section_number (lsn):	1. if (cni == 1) then test that all sections have the same vn 2. test that (v + 1) is the next version and has (cni == 1)
descriptor:	see descriptor test (beginning on page D–12)
CRC32 (crc):	1. test that the CRC value is correct 2. test that the byte following the CRC is 0x00, 0x47 or 0xFF

Table D–7: Compliance for the NIT sections

Parameter	Error check
table_id (tid):	test that tid not in [0x00 .. 0x3F]
section_length (sl):	no test

Table D–8: Compliance for the private sections

Parameter	Error check
table_id (tid):	test that tid is in [0x00 .. 0x3F]
section_syntax_indicator (ssi):	no test
private _indicator (pi):	no test
reserved (res1):	test that (res1 == ‘11’)
private_section_length (sl):	no test
table_id_extension (tide):	no test
reserved (res2):	test that (res2 == ‘11’)
version_number (vn):	no test
current_next_indicator (cni):	no test
section_number (sn):	no test
last_section_number (lsn):	1. <u>if</u> (cni == 1) <u>then</u> test that all sections have the same vn 2. test that (v + 1) is the next version and has (cni == 1)
CRC32 (crc)	test that the CRC value is correct

Compliance for the Descriptors

This section covers the compliance testing for the descriptors. This list of descriptors tested includes: All (general), Video Stream, Audio Stream, Hierarchy, Registration, Data Stream Alignment, Target Background Grid, Video window, CA, ISO 636, System Clock, Multiplex Buffer, Utilitation, Copyright, Maximum Bitrate, Private Data, Smoothing Buffer, STD, and IBP.

Table D–9: Compliance for all descriptors

Parameter	Error check
descriptor_tag (dt):	test that dt not in [0, 1, 19 .. 63]
descriptor_length (dl):	1. <u>if</u> descriptor is in CAT section <u>then</u> test that (sum of (dl + 1) == CAT.sl) 2. if descriptor is in PMT section after the program_info_length field <u>then</u> test that (sum of (dl + 2) == PAT.pil) 3. <u>if</u> descriptor is in PMT section after the ES_info_length field <u>then</u> test that (sum of (dl + 2) == PAT.esil)
CRC32 of the section	test that the CRC value is correct

The Video Stream Descriptor has descriptor_tag == 2. It tests that the descriptor is at program and ES level and refers to video.

Table D–10: Video stream descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == mpeg1of * 2 + 1)
multiple_frame_rate_flag (mfrf):	no test
frame_rate_code (frc):	no frame_rate_code in SH > frc
MPEG_1_only_flag (mpeg1of):	<u>if</u> (mpeg1of == 1) <u>then</u> 1. descriptor_length = 3 2. ES = MPEG2 3. stream_type = 0x02 4. stream_type : 0b1110 xxxx 5. constrained_parameter_flag = 0 <u>else</u> 1. descriptor_length = 1 2. ES = MPEG1 3. stream_type = 0x01 4. stream_type = 0b1110 xxxx 5. constrained_parameter_flag = constrained_parameter_flag in the SH
constrained_parameter_flag (cpf):	no test
still_picture_flag (spf):	no test

Table D–10: Video stream descriptor (cont.)

Parameter	Error check
profile_and_level_indication (pali):	pali = profile_and_level_indication in the SHE
chroma_format (cf):	cf = chroma_format in the SHE
frame_rate_extension_flag (fref):	if (fref == 1) then frame_rate_extension_n != 0 and frame_rate_extension_d != 0
reserved (r):	test that (r == '11111')

The Audio Stream Descriptor is the descriptor with descriptor_tag == 3. It tests that the descriptor is at program and ES level and refers to audio.

Table D–11: Audio stream descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 1)
free_format_flag (fff):	if (fff == 1) then bitrate_rate_index in AH = 0b0000 else bitrate_index in AH != 0b0000
ID (id):	id == ID in the AH
layer (l):	l = Layer in the AH
variable_rate_audio_indicator (vrai):	no test
reserved (r):	test that (r == '111')

Hierarchy Descriptor is the descriptor with descriptor_tag == 4. Only MPEG–2 streams may have this descriptor.

Table D–12: Hierarchy descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 4)
reserved (r1):	test that (r1 == '1111')
hierarchy type (ht):	1. if (ht == 1, 2, 3, or 4) then video and ht = profile_and_level in SHE 2. if (ht == 5) then audio
reserved (r2):	test that (r2 == '11')
hierarchy_layer_index (hli):	no test
reserved (r3):	test that (r3 == '11')
hierarchy_embedded_layer_index (heli):	no test
reserved (r4):	test that (r4 == '11')
hiearchy_channel (hc):	no test

Registration Descriptor is the descriptor with descriptor_tag == 5.

Table D–13: Registration descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl >= 4)
format_identifier (fid):	no test
additional_identification_info (aii):	no test

Data Stream Alignment Descriptor is the descriptor with descriptor_tag == 6. It is only available for video and audio streams.

Table D–14: Data stream alignment descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 1)
alignment_type (at)	1. if (at == 01, 02, 03 or 04) then a. video b. data_alignment_indicator in PES header = 1 c. test on the first PES_packet_data_byte 2. if (at == 01) then a. audio b. data_alignment_indicator in PES header = 1 c. the first PES_packet_data_byte = first byte of audio syncword 3. if (at == 01) then a. video and audio b. data_alignment_indicator = 0

Target Backgroound Grid Descriptor is the descriptor with descriptor_tag == 7. It is only available for video streams.

Table D–15: Target background grid descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl = 4)
horizontal_size (hs):	no test
vertical_size (vs):	no test
aspect_ratio_information (ari)	no test

Video Window Descriptor is the descriptor with descriptor_tag == 8. It is only available for a video stream and the Target Background Grid Descriptor must also be present.

Table D–16: Video window descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 4)
horizontal_offset (ho)	ho <= horizontal_size in the target background grid descriptor
vertical_offset (vo)	vo <= vertical_size in the target background grid descriptor
window_priority (wp):	no test

CA Descriptor is the descriptor with descriptor_tag == 9. It is only available in PMT or CAT.

Table D–17: CA descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl >= 4)
CA_system_ID (casid):	no test
reserved (r):	test that (reserved == '111')
CA_PID (capid):	capid != [0x0002, 0x000F] or 0x1FFF
private_data_byte (pdb):	no test

The ISO 639 Language Descriptor is the descriptor with descriptor_tag == 10.

Table D–18: ISO 639 language descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl % 4 == 0)
ISO_639_language_code (iso639lc)	no test
audio_type (at)	1. if (at == 0xAA) then video 2. if (at == 0xBB) or (at == 0xCC) then audio

The System Clock Descriptor is the descriptor with descriptor_tag == 11. It is only available at the program level in a PMT.

Table D–19: System clock descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 2)
external_clock_reference_indicator (ecri):	no test
reserved (r1):	test that (r1 == '1')
clock_accuracy_integer (cai):	no test
clock_accuracy_exponent (cae):	no test
reserved (r2):	test that (r2 == '11111')

The Multiplex Buffer Utilization Descriptor is the descriptor with descriptor_tag == 12.

Table D–20: Multiplex buffer utilization descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 3)
bound_valid_flag (bvf):	no test
LTW_offset_lower_bound (ltwolb):	no test
reserved (r):	test that (r == '1')
LTW_offset_upper_bound (ltwoub):	no test

The Copyright Descriptor is the descriptor with descriptor_tag == 13.

Table D–21: Copyright descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl >= 4)
copyright_identifier (ci):	no test
additional_copyright_info (aci):	no test

The Maximum Bitrate Descriptor is the descriptor with descriptor_tag == 14. It is only available at the program or ES level.

Table D–22: Maximum bitrate descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 3)
reserved (r):	test that (r == ‘11’)
maximum_bitrate (mb):	no test

The Private Data Indicator Descriptor is identified by descriptor_tag == 15.

Table D–23: Private data indicator descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 4)
private_data_indicator (pdi):	no test

The Smoothing Buffer Descriptor is the descriptor with descriptor_tag == 16.

Table D–24: Smoothing buffer descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 6)
reserved (r1):	test that (r1 == ‘11’)
sb_leak_rate (sblr):	no test
reserved (r2):	test that (r2 == ‘11’)
sb_size (sbs):	no test

The STD Descriptor is the descriptor with descriptor_tag == 17.

Table D–25: STD descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 1)
reserved (r):	test that (r == ‘1111111’)
leak_valid_flag (lvf):	no test

The IBP Descriptor is the descriptor with descriptor_tag == 18.

Table D–26: IBP descriptor

Parameter	Error check
descriptor_length (dl):	test that (dl == 2)
closed_gop_flag (cgf):	no test
identical_gop_flag (igf):	no test
max_gop_length (mgl):	no test

Appendix E: Functional Check

The following procedure is used to check MTS 210 basic operation. Only instrument functionality is checked, instrument specifications are not verified. Performing this procedure requires only an oscilloscope, 50 Ω and 75 Ω BNC terminators. In addition, the adapter cables shipped as standard accessories are used to connect to the oscilloscope.

Required Equipment

The following equipment is required to perform this procedure:

- Oscilloscope: Capable of measuring 6 V amplitude and 1.4 ns rise time.
- 50 Ω SMB to BNC adapter cable (Tektronix part number 174-3578-xx)
- 75 Ω SMB to BNC adapter cable (Tektronix part number 174-3579-xx)
- 50 Ω feed-through terminator (Tektronix part number 011-0049-01)
- 75 Ω feed-through terminator (Tektronix part number 011-0103-02)

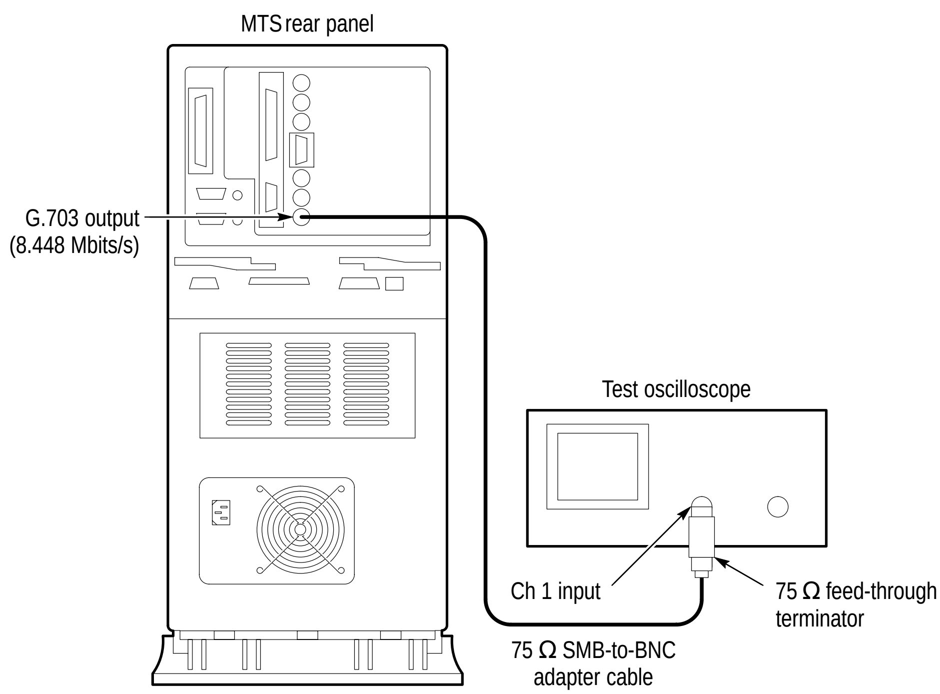

Figure E–1: Initial connections for the functional check

Procedure

1. Connect the equipment as shown in Figure E–1.
2. Switch the Test System server power on.
3. Allow the Test System to go through the Windows NT initialization process. No user intervention is required until initialization is complete.
4. When Windows NT initialization is finished, press CTRL + ALT + DELETE, as instructed by the message box.
5. Type **MTS100** for Username; do not enter a password. Click **OK**. If the default Username or Password have been changed, use the current valid Username and Password.
6. Once you have correctly logged in, double-click Data Store Administrator icon in the Tektronix MPEG Test System program window.

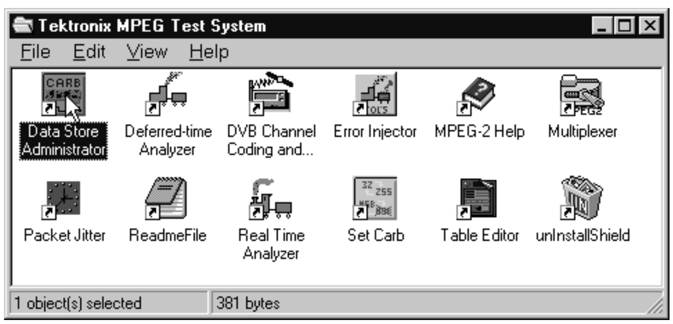

Figure E–2: Starting the Data Store Administrator

7. Set up the Data Store Administrator as follows:
   a. Click the G (Generate) toolbar button.
   b. In the resulting **GENERATION** dialog box, select any valid Data Store file as the Source.
   c. Select the **Loop** option.
   d. In the **Interface** section of the dialog box, make the following selections:
      Protocol = Master.
      Port = G703
      Output clock = 8.448 Mbits.
   e. Click **Start**.

8. Trigger the oscilloscope.

9. Check for a frequency of approximately 4.224 MHz, amplitude of approximately 5.7 volts and a rise time of approximately 1.4 ns. See Figure E–3 for the location of the measurement points in the waveform.

10. Move the output cable to the G703, 34 M output. See Figure E–3.

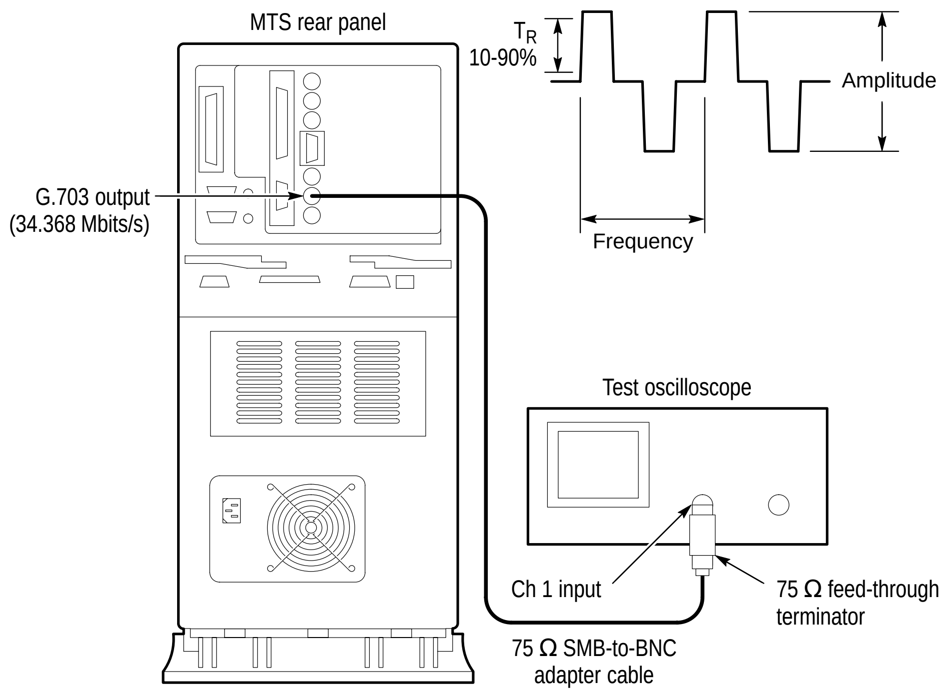

Figure E–3: Setup for measuring the G.703 34.368 Mbit/s output

11. Set up the Data Store Administrator as follows:

- **a.** Click the Stop (red hand) toolbar button.
- **b.** Click the G (Generate) toolbar button.
- **c.** In the resulting **GENERATION** dialog box, select any valid Data Store file as the Source.
- **d.** Select the **Loop** option.
- **e.** In the **Interface** section of the dialog box, make the following selections:

  Protocol = Master.
  Port = G703
  Output clock = 34.368 Mbits

f. Click **Start**.

12. Trigger the oscilloscope.

13. Check for a frequency of approximately 17.2 MHz, peak-to-peak amplitude of approximately 2.3 volts, and a rise time of approximately 3.8 ns. See Figure E–3.

14. Remove the 75 Ω SMB-to-BNC adapter cable from the oscilloscope and the MTS 210 G703 34 M Out connector.

15. Connect a 50 Ω SMB-to-BNC adapter cable from the TTL 50 Ω Clock I/O Port, through a 50 Ω feed-through terminator, to the oscilloscope input. See Figure E–4.

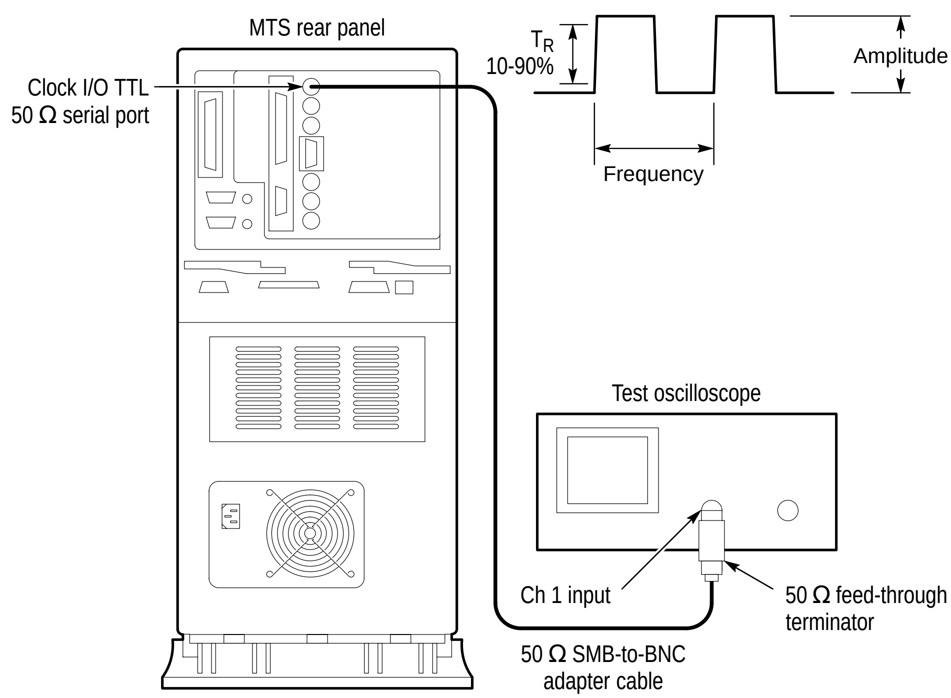

Figure E–4: Setup for measuring the TTL 50 ohm clock I/O port

16. Set up the Test System as follows:

a. Click the Stop (red hand) toolbar button.

b. Click the G (Generate) toolbar button.

c. In the resulting **GENERATION** dialog box, select any valid Data Store file as the Source.

d. Select the **Loop** option.

e. In the **Interface** section of the dialog box, make the following selections:

Protocol = Master.
Port = TTL
Output clock = PLL
Frequency = 1,000,000 Bits/s

f. Click **Start**.

17. Trigger the oscilloscope.

18. Check for a frequency of approximately 1 MHz, amplitude of approximately 3.0 volts and a rise time of approximately 2.0 ns. See Figure E–4.

19. Move the Test System output cable to the TTL 50 Ω Data I/O Port. See Figure E–5.

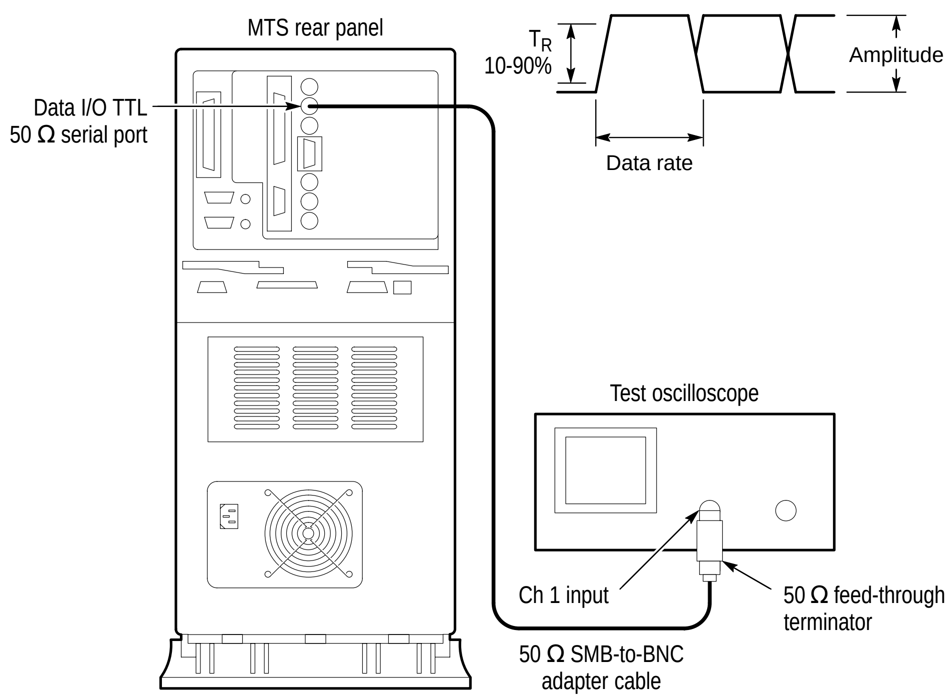

Figure E–5: Setup for measuring the TTL 50 ohm data I/O port

20. Set up the Test System as follows:

a. Select Start.

b. Click the Stop (red hand) toolbar button.

c. Click the G (Generate) toolbar button.

- **d.** In the resulting **GENERATION** dialog box, select any valid Data Store file as the Source.
- **e.** Select the **Loop** option.
- **f.** In the **Interface** section of the dialog box, make the following selections:

  Protocol = Master.
  Port = TTL
  Output clock = PLL
  Frequency = 45,000,000 Bits/s
- **g.** Click **Start**.

21. Trigger the oscilloscope on the plus slope.

22. Check for an amplitude of approximately 3.0 volts, a data rate of 45 MHz and a rise time of approximately 2.0 ns. See Figure E–5.

23. Move the Test System output cable to the TTL 50 Ω Clock I/O Port. See Figure E–4.

24. Trigger the oscilloscope.

25. Check for an amplitude of approximately 3.0 volts, frequency of 45 MHz and a rise time of approximately 2.0 ns. See Figure E–4.

26. In the Data Store Administrator, click the Stop (red hand) toolbar button.

This completes the functional check.

Appendix F: Repackaging

The Tektronix MPEG Test System is shipped in a carton designed to provide it with the maximum protection. If the instrument is subsequently shipped you will need to use this carton and the instrument support inserts to provide adequate protection.

NOTE. *The Test System shipping carton must be used to return the instrument to Tektronix service centers. We cannot honor the warranties if it is not shipped in its original carton or a purchased replacement carton.*

Obtaining Replacement Packaging

New packaging material is available from Tektronix. The part numbers are in Table F–1 and in the Replaceable Mechanical Parts List in the Service Manual. Packaging components are shown in Figure F–1. Each component has an index number which also appears in Table F–1. Contact your nearest Tektronix office or representative to obtain new packaging parts.

Table F–1: Packaging material

Item	Tektronix part number	Index number
Top cushion (Cardboard Insert)	004-4912-00	1
Instrument support inserts; top and bottom	004-4913-00	2
Shipping box	004-4914-00	3

Repackaging the Server

When the server is shipped, it is important to provide it with the maximum protection. Figure F–1 shows how to repackage the server for shipment. As the figure shows, it is not necessary to have the keyboard, mouse, server front door, or server pedestal in the package for reshipment. However, the server pedestal and front door must be removed from the server for reshipment to prevent damage to the packaging or server parts.

NOTE. *The software enabler key (HASP) is required by the Tektronix Service Center if the Test System server is returned for repair.*

Remove the server door first. Open the door all the way and lift up on the door to disengage the hinge pins of the two hinges on the right side of the server door from the hinge pin holes in the server chassis.

Then remove the server pedestal as follows:

1. Carefully place the server on its top.
2. Locate the retaining clip that holds the pedestal on the server.
3. Use your thumb to release the retaining clip and slide the pedestal to disengage the pedestal from the server.

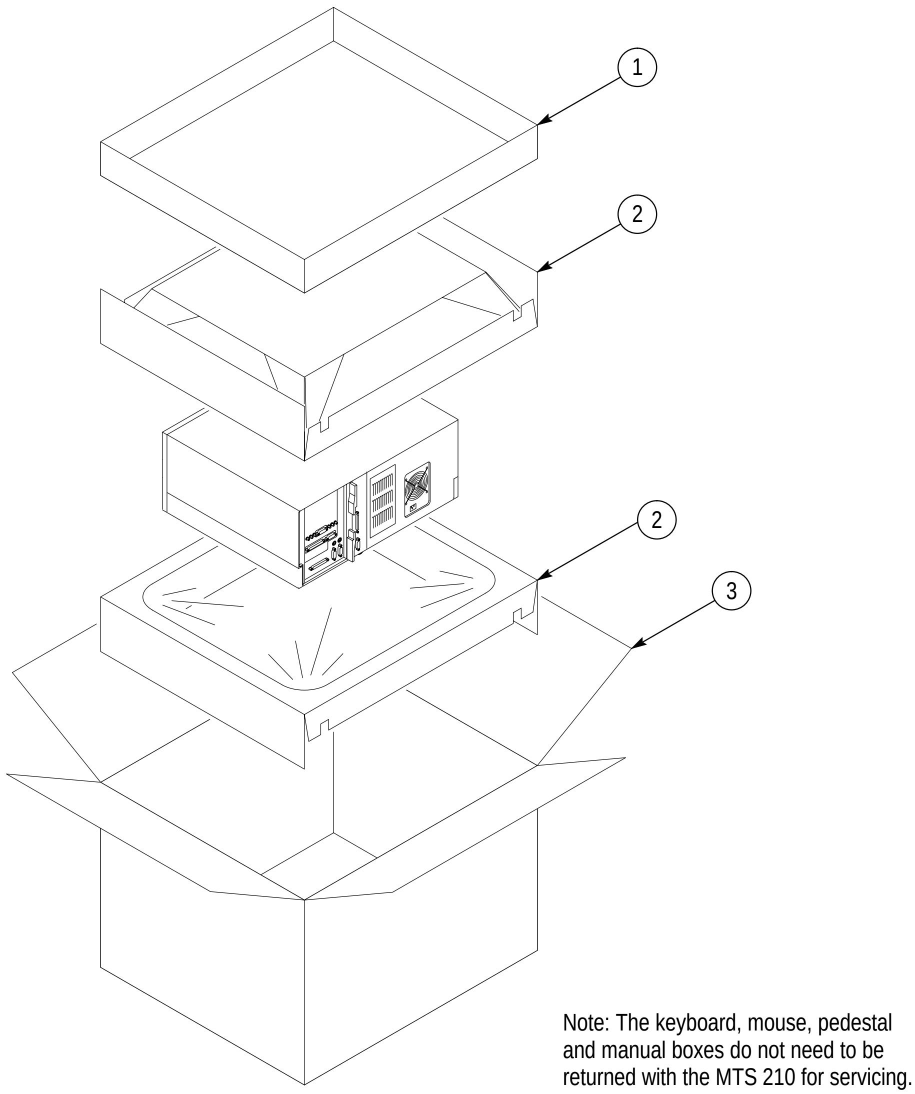

Figure F–1: Repackaging the MTS 210 server

Repackaging the Monitor

If the monitor is being shipped, it should be packaged in accordance with the instructions contained in its documentation.

Glossary

__NOTE__. Additional information about MPEG-2 is available through the MPEG-2 Help application, part of the Tektronix MPEG Test System software.

BAT (Bouquet Association Table)
The BAT provides information regarding bouquets (collections of services marketed as a single entity). DVB only.

CAT (Conditional Access Table)
The CAT provides the association between one or more CA systems, their EMM (Entitlement Management Message) streams, and any special parameters associated with them.

DTS (Decode Time Stamp)
Time when the packet should be decoded.

DVB (Digital Video Broadcast)
A project group of the European Broadcasting Union (EBU).

DVB IRD (Digital Video Broadcasting Integrated Receiver Decoder)
A receiving decoder that can automatically configure itself using the MPEG2 Program Specific Information (PSI).

DVB-SI (Digital Video Broadcast Service Information)
The DVB-SI adds the information that enables DVB IRDs to automatically tune to particular services and allows services to be grouped into categories with relevant schedule information. It has several tables, including: NIT, SDT, BAT, and EIT. (NIT is also required for MPEG2.)

EIT (Event Information Table)
The EIT contains data concerning events (a grouping of elementary broadcast data streams with a defined start and end time belonging to a common service) and programs (a concatenation of one or more events under the control of a broadcaster, such as event name, start time, duration, etc.).

EPG (Electronic Program Guide)
The EPG gives the content of the current program.

GA (Grand Alliance)
This group is establishing the North American HDTV standards.

LTW (Legal Time Window)

NIT (Network Information Table)
The NIT conveys information relating to the physical organization of the multiplex — Transport streams carried via a given network, and the

characteristics of the network itself. Transport streams are identified by the combination of an original network ID and a transport stream ID in the NIT.

NVOD
Near Video on Demand

PAT (Program Association Table)

PCR (Program Reference Clock)
The “clock on the wall” time when the video is multiplexed.

PES
Packetized Elementary Stream

PID
Program ID

PMT (Program Map Table)
The PMT identifies and indicates the locations of the streams that make up each service and the location of the Program Clock Reference (PCR) fields for a service. This table is transmitted in sections.

PSI (Program Specific Information)
The PSI contains all the tables that define the MPEG2 transport stream. It consists of the PAT, PMT, CAT, and NIT tables. (NIT is also used for DVB-SI.)

PTS (Presentation Time Stamp)
When the packet should arrive and its destination.

SDT (Service Description Table)
The SDT contains data describing the services in the system. Examples include: names of services, the service provider, etc.

SI (Service Information)
SI provides information on services and events carried by different Multiplexes, and even other networks. SI is structured as six tables (PAT, NIT, CAT, SDT, EIT, and BAT). The applications are only concerned with NIT, BAT, SDT, and EIT.

Index

Symbols

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