User Manual

Tektronix

MTS 100
MPEG Test System

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This document supports software version 2.00
and above.

CE

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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.

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.

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 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.

Use Proper Voltage Setting

Before applying power, ensure that the line selector is in the proper position for the power source being used.

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.

Safety Terms and Symbols

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

CSA Certified Power Cords

CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

Compliances

Consult the product specifications for IEC Installation Category, Pollution Degree, and Safety Class.

Product Description

This section describes the MTS 100 MPEG Test System. It describes what the MTS 100 does and the programs that make up the MTS 100 system.

Overview

The MTS 100 creates, generates, acquires, and analyzes MPEG2 transport streams containing MPEG1 or MPEG2 elementary streams.

From a single program with one elementary stream, to multiple programs with many elementary streams, the MTS 100 can create an extensive variety of streams.

Output and acquisition of transport streams can be done at rates from 1 Mbit/s to 60 Mbit/s. Based on the standard 8 Gbytes of hard disk space available, you can store at least 15 minutes of transport stream data at 60 Mbits/s. Output and acquisition may be either of limited length (a single file) or continuous (using end-to-start looping).

The Data Store I/O provides a variety of hardware connections, including TTL serial, ECL parallel, ECL serial, G.703, and RS-422.

Elementary stream files are provided on the Bit Stream CD-ROM. They include both test signals and motion sequences. Using the MTS 100 Multiplexer application, a variety of transport stream files can be created.

You analyze transport stream data (acquired by the Data Store System) with the Analyzer application. The Analyzer provides a graphical view of the MPEG transport stream, which includes definitions of each field in the transport stream and PES packets, as well as the Program Association Table and Map Table.

The platform for the MTS 100 is a Windows NT workstation. The whole system arrives at your site, fully configured and ready to use. The installed MTS 100 software includes the Data Store System and five application programs: Analyzer, Multiplexer, PSI and SI Table Editor, Channel Coder, and Packet Jitter.

Analyzer

The Analyzer displays transport stream data in several ways.

Hierarchical View. A hierarchical 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.

Syntax View. The syntax view displays the interpreted view for a transport 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.

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 the MTS 100's ability to create error-free transport streams it 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 shipped with the MTS 100. All items except the monitor are in the box containing the server.

- A Tektronix 17 inch monitor and monitor cable. The monitor power cord is shipped in the MTS 100 accessories package.
- The Compaq server with the Data Store Board and Data Store Disks already installed (referred to as the MTS 100 server)
- Keyboard
- Mouse
- Software enable key (HASP) for the parallel port (It is already installed on the parallel port.)
- *MTS 100 User Manual*
- Compaq documentation and back-up copies of the Compaq software
- A Windows NT software and documentation package (Windows NT is installed on the MTS 100. The software is provided in case the loaded version becomes corrupted.)
- The emergency repair disk (Use this disk as described in the Windows NT System Guide.)
- An MTS 100 Installation Software CD-ROM. This is provided for reinstalling the MTS 100 software in case it becomes corrupted.
- CD-ROM containing the MPEG2 Elementary Streams for MTS 100.
- Two power cords (One each for the MTS 100 server and the monitor.)
- Six SMB to BNC adaptors (Three with 50 Ω cables and three with 75 Ω cables.)
- A 9–pin cable (Use this cable to meet EMI requirements)
- A 25–pin cable (Use this cable to meet EMI requirements)
- A 50 Ω network terminator on the ethernet port.

Installation

The installation of the MTS 100 is straight forward. Once all items have been unpacked, the assembly of the individual items making up the system should only require a few minutes.

CAUTION. *To avoid damage to the MTS 100 during shipping, retain the original shipping carton. Shipping the MTS 100 in any other packaging may void the warranty.*

Assembling the MTS 100 System

Before you begin to assemble the MTS 100, please make sure that you have selected an appropriate location. The feature list of a good site (repeated from the Compaq documentation) include:

- A sturdy, level site that includes dedicated and properly grounded circuits, air conditioning equipment, and static electricity protection
- A 3 inch (7.6 cm) clearance at the front and back of the computer for proper ventilation (You will probably want additional access to the rear panel for connecting signals.)
- A separate electrical circuit for the MTS 100
- A place where no heavy electrical equipment will be located near the server

Once a good site has been selected, begin assembling the MTS 100 using the procedure given below. (An illustration of the rear panel is shown in Figure 1–1.)

1. Check that the input voltage selection switch is set to the appropriate input voltage. (Find the switch on the rear panel of the MTS 100 server.)
2. Connect the keyboard to the keyboard port on the rear panel of the MTS 100 server.
3. Connect the mouse to the mouse port on the rear panel of the MTS 100 server.
4. Verify the software key (HASP) is attached to the parallel port on the rear panel of the MTS 100 server. See Figures 1–1 and 1–3. (It should already be connected.)

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

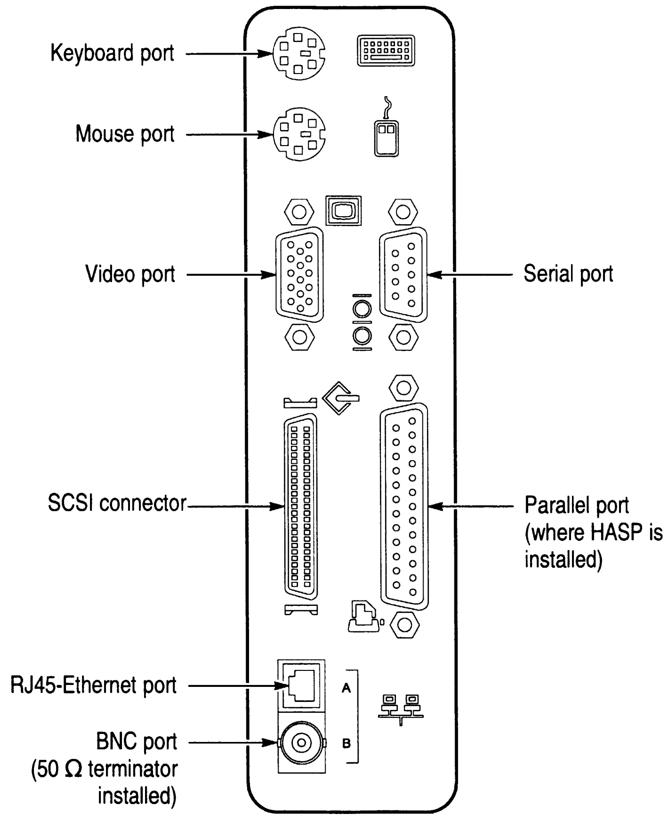


Figure 1–1: The rear panel of the MTS 100 server

5. If the MTS 100 is being connected to a network, connect it now. If not, connect the 50 Ω BNC terminator to the port. (The 50 Ω terminator may already be connected.) See Figure 1–1.

6. Connect the monitor cable to the monitor and to the rear of the MTS 100 server at the monitor port.

NOTE. *Although the MTS 100 is based on a standard computer configuration, do not use the MTS 100 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.*

7. Connect the power cord to the monitor and to a power source. See Table 1–1.
8. Connect the power cord to the MTS 100 server and to a power source.

Power Mains

The MTS 100 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 100 server (the ProSignia 500) will operate, with the correct power cord and line voltage selector setting, from either 115 VAC or 230 VAC power mains. The rear panel of the server has a voltage selection switch that must be set to the correct voltage range prior to turning on the MTS 100. See Figure 1–2.

CAUTION. *To avoid damage to the server, check that the voltage selection switch is set for the correct mains voltage before turning on.*

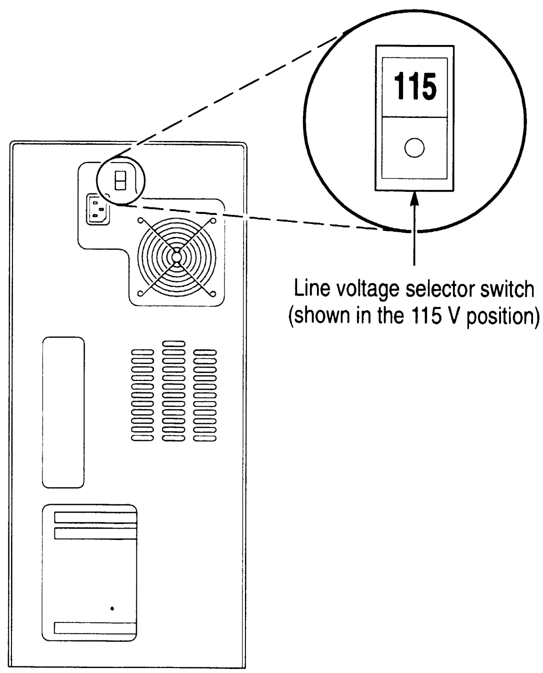


Figure 1–2: Server Voltage Selection Switch

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

Mains Frequency

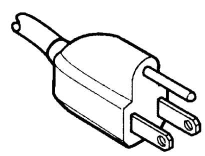
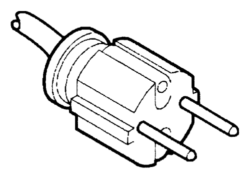
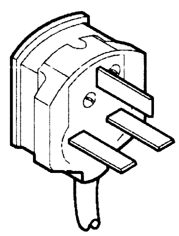
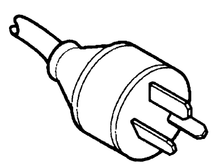
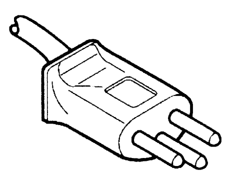
The ProSignia server and the monitor both operate on either 50 or 60 Hz line frequencies.

CAUTION. *To prevent damage to the MTS 100 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 a power failure.*

Power Cord Options

The server and monitor are delivered from the factory with a 60 Hz/117 VAC power cord, unless one of the power cord options was ordered. Table 1–1 provides a description of the power cord options.

Table 1–1: Power Cord Identification

Plug Configuration	Normal Usage	Option Number
	North America 115 V	Standard
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 240 V	A3
	Switzerland 230 V	A5

Parallel Port and Ethernet

The parallel port must have the software enable key (HASP) installed to operate. The Ethernet port must either be connected to a network or be terminated to allow the MTS 100 to function correctly.

HASP

The software is enabled by a software enable key which is referred to as a HASP. See Figure 1–3. It comes installed on the parallel port and is transparent to parallel port applications, such as connection to a printer. Without the HASP in place on the ProSignia Parallel Port the MTS 100 will not operate. Do not lose the HASP.

CAUTION. *Do not lose the HASP (software enable key). The MTS 100 will not operate without it being installed on the parallel port.*

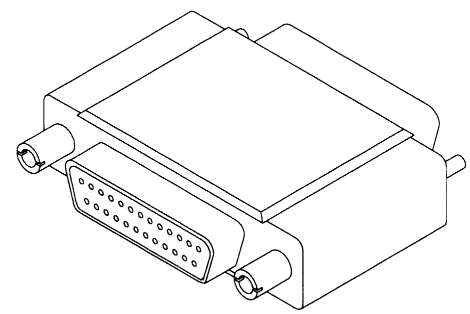


Figure 1–3: MTS 100 Software Hasp

The software enabler (HASP) should remain with the MTS 100 at all times. If the entire instrument is returned for service, ship the HASP with the server .

NOTE. *The software enabler key (HASP) is required by the Tektronix Service Center if the ProSignia server is returned for repair.*

Ethernet Termination

If the MTS 100 is operating in a stand-alone mode, one of the Ethernet connectors needs to be terminated. When shipped, the MTS 100 has a 50 Ω BNC type connector installed on the ethernet connector. If the termination is not installed when operating in a stand-alone mode, the software will generate network error messages.

MTS 100 I/O

The MTS 100 rear panel input/output connectors (I/O) are located in two EISA slots on the ProSignia server rear panel. Specification of the I/O ports are in *Appendix A*, *Specifications*. Figure 1–4 shows the arrangement of the I/O connectors. A detailed description of each of the connectors follows the illustration.

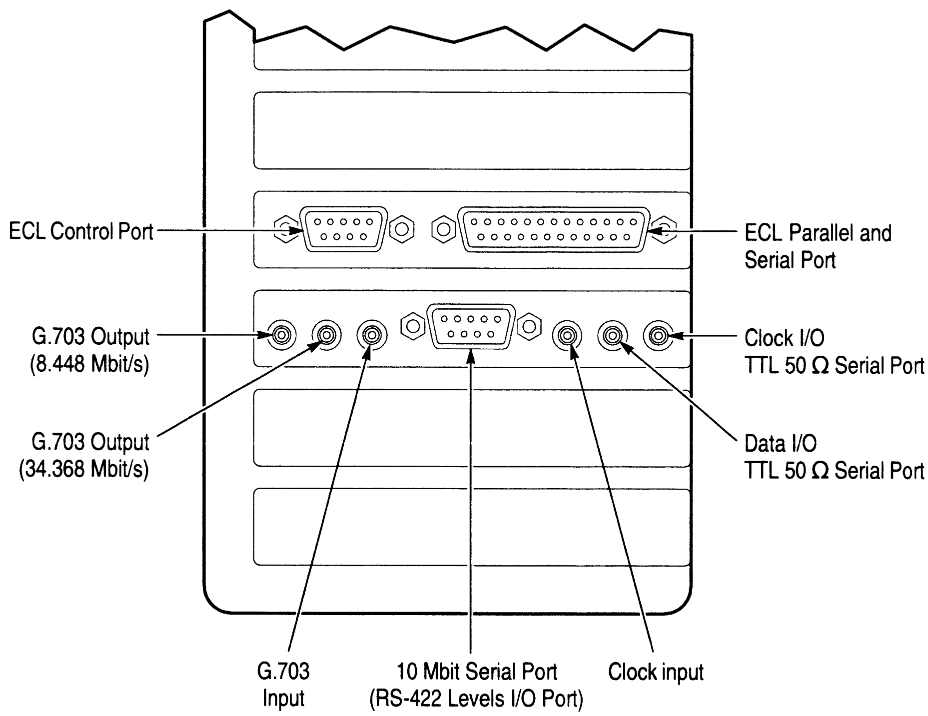


Figure 1–4: The MTS 100 Signal I/O Ports

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.) Its pinout is shown in Figure 1–5 and Table 1–2.

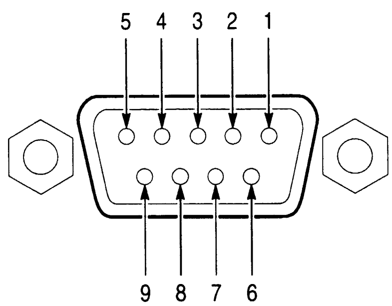


Figure 1–5: Pinout of the ECL Control Port

Table 1–2: ECL Control Port Pinout

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 Port

This 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 pinout is shown in Figure 1–6 and Table 1–3.

NOTE. *The ECL Parallel Port shares this connector with the ECL Serial Port. The two ports cannot be used simultaneously.*

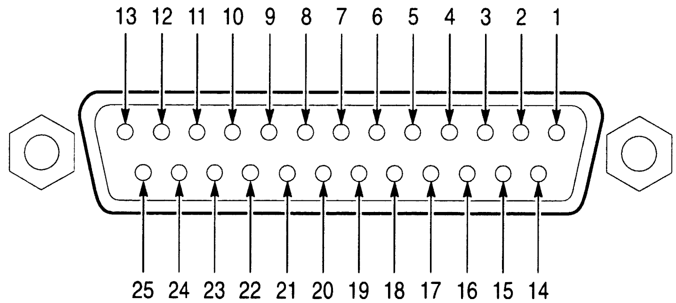


Figure 1–6: Pinout of the ECL Parallel Port

Table 1–3: ECL Parallel Port Pinout

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		

Asserted Low differential signal.

***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.

When the parallel port is used independent of the ECL Control Port, there are two operating modes:

- Slave acquisition. Captures input signals using an external clock as the sync source.
- Master generation. Outputs signals using the MTS 100 internal clock.

When the ECL Control Port controls the parallel port, there are two additional operating modes:

- Master acquisition. Captures input signals using the ECL Control Port signals to lock onto the signal.
- Slave generation. Outputs signals using an external clock as the sync source.

ECL Serial Port

This port receives and transmits MPEG-2 transport streams at ECL levels. It is a differential, bidirectional port that operates independently or is controlled by the ECL Control Port. Its pinout is shown in Figure 1–6 and Table 1–4.

Table 1–4: ECL Serial Port Pinout

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

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

NOTE. *The ECL Serial Port shares this connector with the ECL Parallel Port. The two ports cannot be used simultaneously.*

When the serial port is used independently from the ECL Control Port there are three operating modes:

- Slave acquisition. Captures input signals using an external clock as the sync source.
- Master generation. Outputs signals using the MTS 100 internal clock.
- Master generation. Outputs signals using the MTS 100 external clock.

When the serial port is used with the control port, there are three additional operating modes:

- Master acquisition. Captures input signals using the control signals from the ECL Control Port to lock onto the signal.
- Master acquisition. Captures input signals using an external clock to lock onto the signal.
- Slave generation. Outputs signals using an external clock as the sync source.

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

This serial interface complies with the electrical characteristics of ITU-T Recommendation G.703 (HDB3 code) for 8.448 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. It will cause the MTS 100 to exceed EMI emission requirements.*

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 Figure 1–7 and Table 1–5.

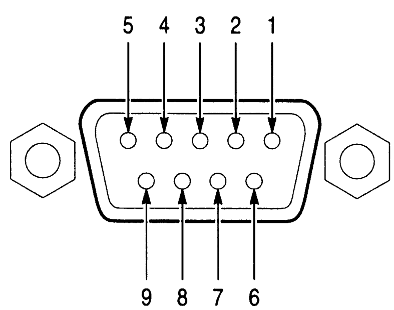


Figure 1–7: Pinout of the 10 Mbit Serial Port (RS-422 Levels I/O Port)

Table 1–5: 10 Mbit Serial Port Pinout

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.

This interface uses two signals:

- Data. This is the serial bit stream.
- Clock. This is a continuous data transmission clock.

You can choose three modes of operation:

- Acquisition. Captures an input signal using external timing reference.
- Internal generation. Generates an output signal using the MTS 100 internal clock as the timing reference.
- External generation. Generates an output signal using the Clock input as the timing reference.

Clock Input

This is the optional timing input for the ECL Serial, ECL Parallel, TTL and 10 Mbit Serial outputs. Its maximum operating frequency is 45 MHz.

TTL 50 Ohm 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 MTS 100 Inputs/Outputs

The MTS 100 comes with adapters for connecting the SMB connectors on the Data Store to standard BNC connectors. All other signal connecting cables and adapters required to install the MTS 100 are the responsibility of the user.

Connecting Cables

The maximum usable cable length for the various ports, on the MTS 100, 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 coax and low-capacitance properly pair-twisted cables will support longer transmission than miniature coax 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	MBits/Second Rate	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
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 MTS 100 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. It will cause the MTS 100 to exceed EMI emission requirements.

First Time Operation

Once you have installed the MTS 100, it is ready to operate.

Turning On the MTS 100

Turn on the power switch located on the front of the MTS 100 server. Whenever you power on the MTS 100, it goes through the Windows NT initialization process. (For more information on the Windows NT initialization process, please see the Windows NT documentation.) When it is finished, press CTRL + ALT + Delete, as instructed by the message box. This displays the login dialog box.

Logging In

Enter "MTS100" as the Username and no password (just press return) to log into the MTS 100. These are the default values set at the factory. This is the login where you should do 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 are required to 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 may change the passwords. If you change any of the passwords, 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 MTS 100 group shown in Figure 1–8.

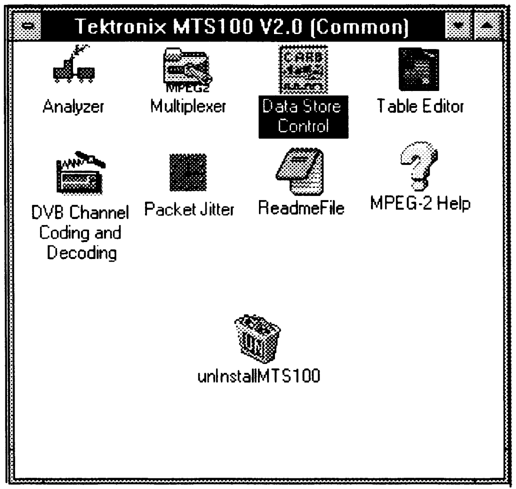


Figure 1–8: The Tektronix MTS 100 Group

This manual explains how to use the six applications in the Tektronix MTS 100 group. If you want information on any application other than those found in the Tektronix MTS 100 group, please consult the Windows NT documentation.

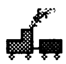
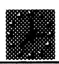
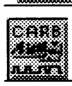
Additional Support

Additional support for the MTS 100 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 MTS 100 support.

Operating Basics

There are six different applications provided with the MTS 100. Their names and functions are given in Table 2–1.

Table 2–1: List of MTS 100 applications and their functions

Icon	Application Name	Function
	Analyzer (MPEG2 System Analyzer application)	Analyzes transport stream files and packetized elementary streams.
	Table Editor (Edit Table application)	Creates PMT, NIT, SDT, BAT, and EIT files.
	Packet Jitter	Adds jitter to the PCR data in the transport stream file.
	Multiplexer (MPEG2 Transport Multiplex Generator)	Creates transport stream files from PSI and SI table files, video and or audio elementary stream files, and data files.
	DVB Channel Coding and Decoding (Coder/Decoder application)	Codes and decodes transport stream files to DVB specifications.
	Data Store Control (Data Store Administrator)	Manages the Data Store Disks. It also controls acquisition and generation of MPEG-2 transport streams.

Running the Software

Start any of the applications by double-clicking on the icon. 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 and the Windows NT operating systems. If you are not comfortable with these operating systems, please review the Windows NT documentation.*

Menu Map

The MTS 100 operating software accommodates the six applications by providing application specific menu structures. There are a number of commands that are similar, but not identical across the applications. The menu maps that follow outline the commands and their options for each of the applications. The maps are arranged by application, beginning with the set for the analyzer application. See Tables 2–2 through 2–7.

Table 2–2: Commands from the MPEG2 System Analyzer Application (Analyzer)

Menu	Command	Function
File	Open	Opens an existing file (*.trp, *.tp. or *.es)
	Save	Saves current file to disk
	Print	Prints the current display
	Printer Setup	Sets up the printer information (Normally used to change from portrait to landscape)
	Exit	Closes the Analyzer application
Edit	Next	Displays the next item (current item number + 1)
	Previous	Display the previous item (current item number – 1)
	First	Goes to the first available item
	Last	Goes to the last available item
	Goto	Goes to the item number entered in the text box
	Number of Items	Gives the total number of items available
	Next Error	Goes to the next item that has an error
Selection	PSI hierarchic	Creates a new window displaying the hierarchy for the currently selected window
	SI hierarchic	Display an SI (DVB) hierarchic view of the transport stream
	Multiplex	Displays the Transport Packet Stream (all PIDs)
	Transport Packet	Displays the selected Transport Packet
	PES Packet	Displays the interpreted view of the various fields of the selected PES Packet
	Elementary Stream	Extracts the elementary streams from an MPEG2 – DVB Multiplex transport stream file and stores them in a file
	PSI/SI	Displays the interpreted view of the PSI/SI tables
	Filters	Opens the Filters submenu
Analysis	Multiplex Characteristics — Rate	Displays the Multiplex Rate and the number of programs. Can also change the Multiplex Rate from the text box for diagnostic purposes.
	Multiplex Characteristics — Multiplex Allocation	Displays the distribution of the MPEG2 transport stream file PIDs in pie chart format
	Multiplex Characteristics — PID Map	Display the sequence of PIDs in the transport stream
	Check CRC	Checks the CRC calculation against the one given in the transport stream file dependent upon the view
	Syntaxic	Performs a Syntax analysis on the transport stream
	Consistency Check	Check for consistency within the stream
	PSI/SI Rate	Analyze the rates of the various PSI/SI tables within the stream

Table 2–2: Commands from the MPEG2 System Analyzer Application (Analyzer) (Cont.)

Menu	Command	Function
	PCR	Displays the PCR clock for each program in a timing diagram
	PTS/DTS	Analyzes the PTS/DTS time stamps. Displays the results in a timing diagram.
	Semantic	Check all transport packets for semantic errors
	Dynamic – T-STD	Conduct a transport stream system target decoder simulation
	Dynamic – LTW	Check the effect of LTW (Legal Time Window) offset and piecewise rate field values
	Dynamic Smoothing Buffer	Conduct a smoothing buffer simulation
	Automatic	Perform an automatic sequence of analyses
Options	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 base (decimal or hexidecimal) used in interpreted and heirarchic views
	Font	Allows you to change the display font size and style
	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	Cascade	Displays all open windows overlapped with the Title Bars showing
	Tile	Displays all open windows using the same amount of application window
	Arrange Icons	Aligns all icons at the bottom of the application window
	Close View	Closes the currently selected dialog box
	Close All	Closes all open widows, including icons
	Add View	Adds an additional window of the selected window type— may have options to change the display
	1, 2, 3, 4, etc.	Jumps to a previously open window
Help	Contents	Provides help specific to the Analyzer application
	Using Help	Standard Windows help
	About	Gives information about the Analyzer application (version and date)

Table 2–3: Commands from the MPEG2 Transport Multiplex Generator (Multiplexer)

Menu	Command	Function
File	New	Opens a new configuration file
	Open	Opens an existing configuration file
	Save	Saves the current configuration file to a disk or hard drive
	Save As	Saves the current configuration file under a new name
	Close	Closes the current configuration file
	Exit	Closes the Multiplexer application
Edit	Add	Adds an item to the multiplex
	Delete	Deletes the selected item (and any sub-items) from the multiplex
Multiplex	Go	Creates the transport stream file from the configuration file
View	Hierarchic	Displays the configuration file in a "tree structure"
	Dynamic	Displays the configuration file with the program shown relative with respect to time
Options	DVB	Turns on or off DVB required table files
	Dynamic SI	Toggles Dynamic SI on/off
	Directories	Configure default directories
	Save Environment	Save the current options settings to a file
	Load Environment	Read and apply a previously saved environment
	Default Environment	Reset all options to the default settings
Help	Contents	Help specific to the Multiplexer application
Help	Using Help	Standard Windows help
	About MPEG 2 System Multiplexer	Displays information about the Multiplexer application (version number & date)

Table 2–4: Commands from the Data Store Administrator Application (Disk Manager)

Menu	Command	Function
File	FAT Read	Lists the files available on the Data Store Disks and their status
	CARB File Read to PC	Copies a file from the Data Store Disks to the system hard drive (or other regular disk)
	PC File Write to CARB	Copies a file from the system hard drive (or other "regular" media) to the Data Store Disks
	File Delete	Marks a file to be deleted on the Data Store Disks (Can be un-deleted before disk compression if the file is not at either end of the list)
	File Undelete	Removes the delete mark from a file on the Data Store Disks
	Exit	Closes the Data Store Administrator application

Table 2–4: Commands from the Data Store Administrator Application (Disk Manager) (Cont.)

Menu	Command	Function
Acq/Gen	Acquire	Acquires a file from the selected input port and stores it on the Data Store Disks
	Generate	Generates a transport stream (from a transport stream file stored on the Data Store Disks) and outputs it from the selected output port
	Interrupt	Stops the current Acquire or Generation process
Service	Card Reset	Performs a software reset on the Data Store board (use after an error)
	Resource Parameters	Changes the resource parameters
	Partitioning	Creates the disk partitions. Must be run each time Data Store Disks are added, removed, or replaced.
	FAT Delete	Initializes the Data Store Disks. The partitions are preserved, but all files are lost.
	Compress	Frees the disk space of all files marked as "delete"
Help	About	Gives information on the version of the Disk Manager software

Table 2–5: 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

Table 2–6: Commands from the PSI and SI Table Editor Application (Edit Table)

Menu	Command	Function
File	New	Creates a new table of the selected type
	Open	Opens an existing table of the selected type
	Save	Saves the currently selected table to a file
	Save As	Saves the currently selected table under a new name
	Save All	Saves all open tables to their respective files
	Close	Closes the currently selected table
	Global View	Shows the association between selected NIT, SDT, and EIT table files
	Exit	Exits the Edit Table application
	Program Map Table	Displays 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	Displays 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.
	Service Descriptor Table	Displays 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	Displays 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	Displays 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.
Edit	Add	Adds various items to the Table file
	Delete	Deletes the currently selected item and all its sub-items. (The main icon cannot be deleted.) (The deleted item is not copied to the Window's clipboard.)
	Cut	Deletes the currently select item and all its sub-items. (The main icon cannot be deleted.) (Copied to the Window's clipboard.)
	Copy	Copies the currently selected item and all available sub-items to the Window's clipboard. (The main icon cannot be copied to the clipboard.)
	Paste	Pastes the content of the clipboard at the currently selected location
Section	Next	Displays the next section. (Current section number + 1.)
	Previous	Displays the previous section. (Current section – 1.)
	Number	Displays the entered section number
	New	Creates a new section with the default values
	Delete	Deletes the current section. (No warning or recovery.)
Analyse	Coherence	Checks the open table files for both internal and intra-table coherence to the standards
Help	Index	Gives help on topics specific to the Edit Table application
	About	Gives version information about the Edit Table application

Table 2–7: Commands from the Packet Jitter Application

Menu	Command	Function
File	Open	Opens a transport stream file for addition of jitter
File	Quit	Exits the Packet Jitter application
Jitter	Definition	Allows you to define the PCRs and type of jitter added
Jitter	Go (Calculate)	Calculates a new transport stream file with jitter added (*.jit).
?	Help	Provides help for the Packet Jitter application

NOTE. *If you want to use the Analyzer to look at the file resulting from the Packet Jitter application, you must first rename the file. Change the file extension from *.jit to *.trp.*

Tutorials and Reference Sections

Tutorials and reference information are provided to help familiarize you with the six software applications in the MTS 100. The first of three tutorials begins on page 2–11. 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 100. The files required for these exercises are shipped with the MTS 100.

The *Reference* section explains all of the commands available from each of the six applications that are part of the MTS 100 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”.

Getting Elementary Bit Stream Files

There are two sources of Elementary Bit Stream Files. A CD-ROM is shipped with each instrument. The CD-ROM contains picture signals, common industry test signals, and sample signals used for the following tutorials. These signals are in both 525/60 and 625/50 standards. In addition to the video signals, audio signals are included on this disk.

A second way to access these same signals, and any new bit streams, is through the Tektronix MTS 100 FTP site.

Copy from CD-ROM

The signals used in the following tutorials are shipped with the MTS 100 on a CD-ROM. In order to perform the tutorials it is necessary to load the test signals onto the C: drive. Once these streams are loaded they can be analyzed or multiplexed into a transport stream. Note that the CD-ROM also contains some additional audio and video test signals that you may want to use.

Loading a Stream When you need to load a video stream the correct path is:

d:\Video\line rate\file name

For example: **d:\Video\625\SAMPLE.MP2**

When you need to load an audio stream the correct path is:

d:\Audio\file name

For example: **d:\Audio\10KHZ.MP2**

The files that support the tutorials are listed in Table 2–8.

Table 2–8: Files that support the tutorials

File Name	Description
1KHZ.MP2	A 1 kHz audio signal
SAMPLE.TRP	A sample transport file
DEMO_060.MP2	------
DEMO_015.MP2	------
10KHZ.MP2	A 10 kHz audio signal

FTP Site Location

Tektronix maintains an FTP site of video bit streams for your convenience. If you have no access to FTP, please contact Tektronix at 1–800–TEK–WIDE, ask for MTS 100 support and an engineer will be glad to help you get the data. If you have Internet access, but are having trouble accessing the site, please contact your system administrator for assistance.

The site is “ftp.tek.com”, user “anonymous”, and the password is your email address. The directory is“/tv/test/streams”. In this directory you will find a README.TXT file that describes the contents of the directory. At various directories of the site you’ll find more README.TXT files.

How to Use the FTP Site. In the following script, the bold face type is what you type.

```
% ftp ftp.tek.com
```

```
Connected to inet1.tek.com.

220 inet1 FTP server (Version wu-2.4(1) Fri Sep 2 10:54:04 GMT 1994)

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

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 100 sample transport stream file so you can follow along with your own system.

NOTE. *To help you follow along with your own MTS 100, all steps that require your action are numbered.*

Terms

Wherever possible, this manual uses terminology consistent with Microsoft® Windows™ and MPEG standards. Refer to the Windows documentation (included with the MTS 100 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. Start this utility from the Windows Program Manager by double-clicking on the MPEG-2 Help icon in the MTS 100 program group.

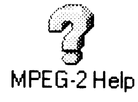


Figure 2–1: The MPEG-2 Help icon

Starting the Analyzer Application

Start the analyzer application by double-clicking on the Analyzer icon in the MTS 100 program group.

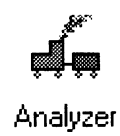


Figure 2–2: The Analyzer icon

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

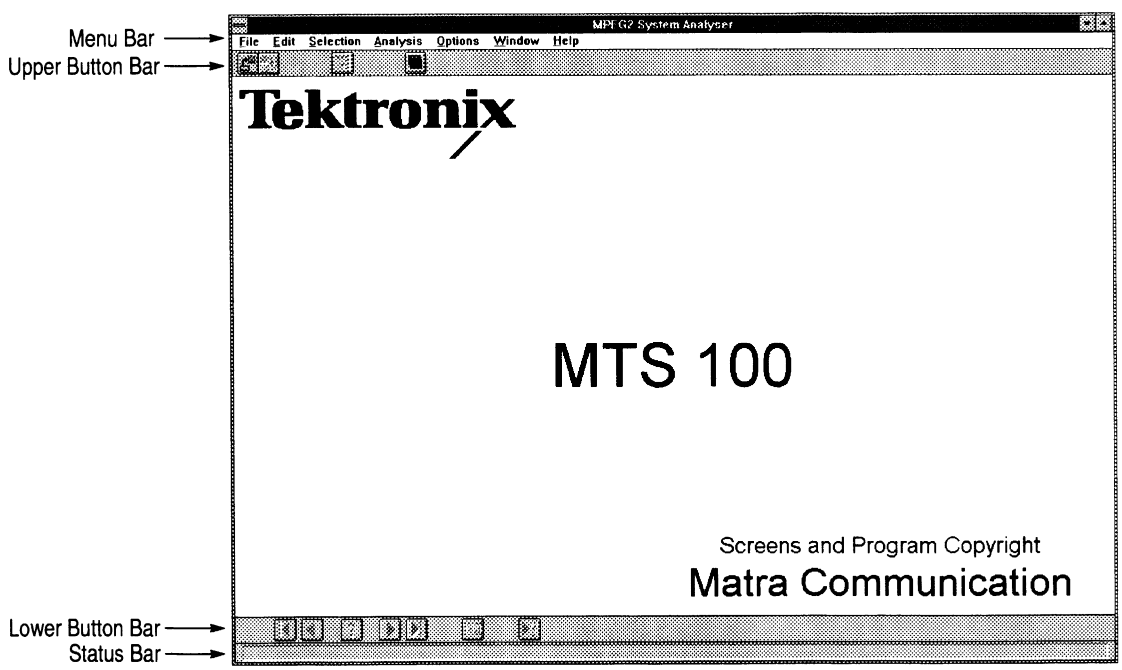


Figure 2–3: The Analyzer application window

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 Button Bar

Figure 2–4 shows the functions available from the upper button bar.

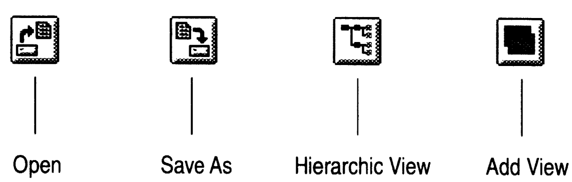


Figure 2–4: Command buttons on the upper button bar

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 Button Bar

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

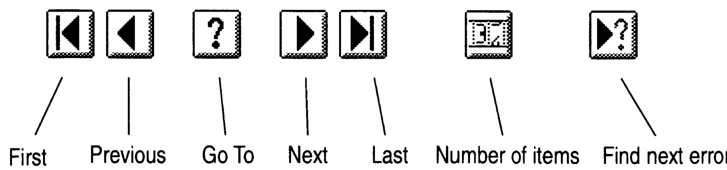


Figure 2–5: Command buttons on the lower button bar

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

Opening an Existing Transport Stream File

Your MTS 100 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 2–6.

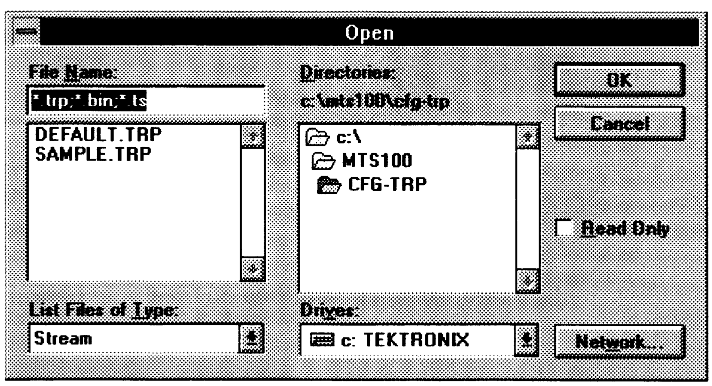


Figure 2–6: The Open dialog box

2. Select Stream from the list of File Types.

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

4. Choose OK. Figure 2–7 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 button bar) to go to the next PSI version, if any, in the stream.

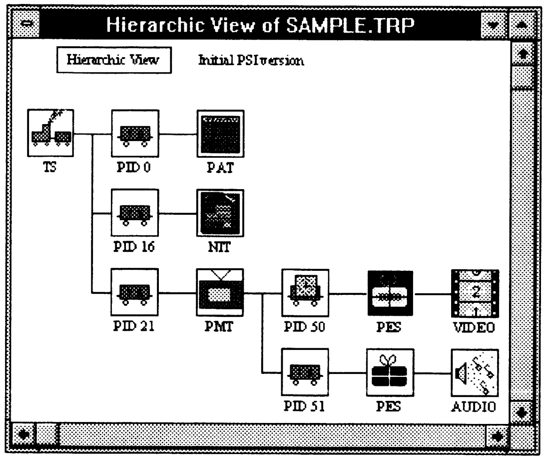


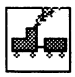
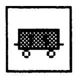
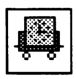
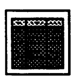
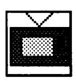
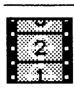
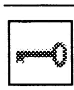
Figure 2–7: The hierarchic view of the SAMPLE.TRP transport stream

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 button bars and menus.

Table 2–9 identifies the icons used in the hierarchic view.

Table 2–9: 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 2–8 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.*

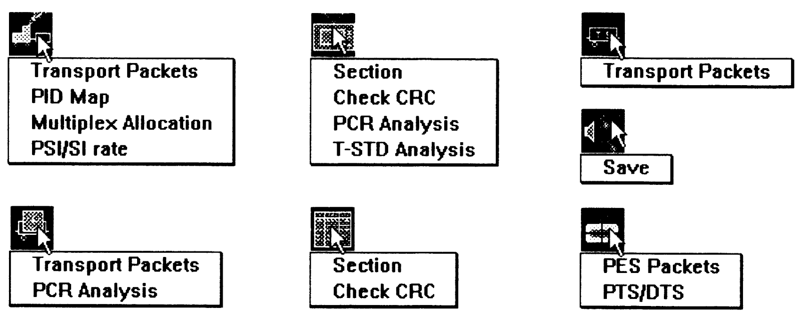


Figure 2–8: Hierarchic view shortcut menus

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 2–9.

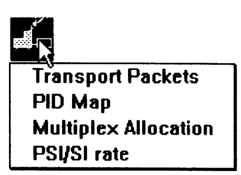


Figure 2–9: The TS icon shortcut menu

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 2–10.

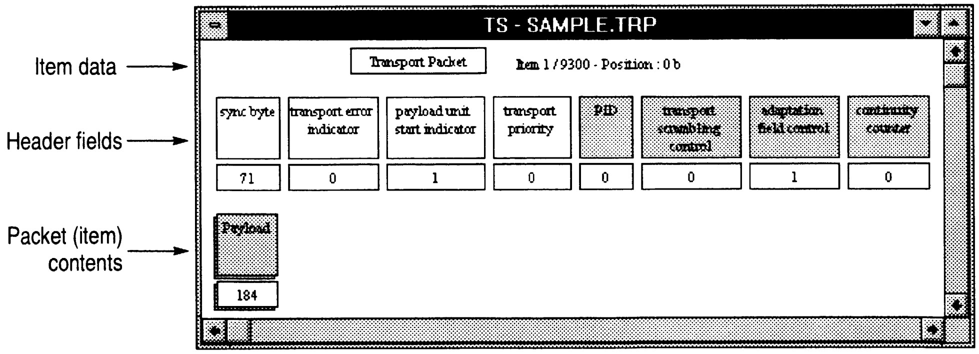


Figure 2–10: The interpreted view of the first transport packet

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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 button bar to quickly scroll among the transport packets. Notice that the Item number changes as you scroll through the transport packets.

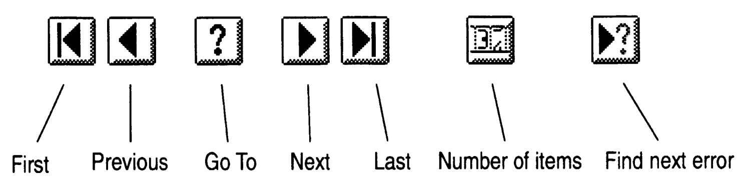


Figure 2–11: Command buttons on the lower button bar

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 2–12.

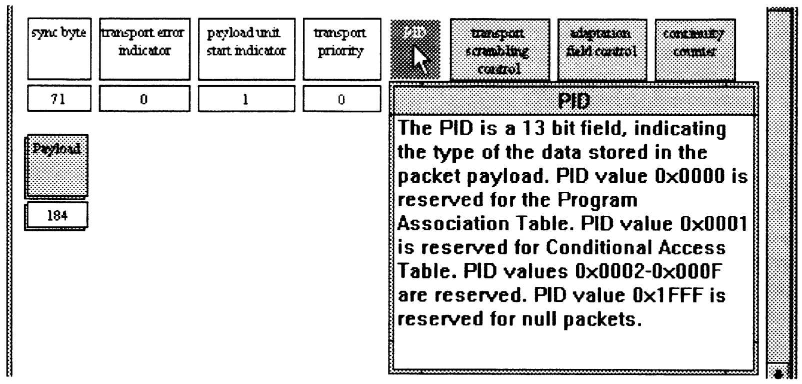


Figure 2–12: Double-click for an explanation of the field

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 2–13. In this case, the message reminds you that PID 0 always identifies the PAT.

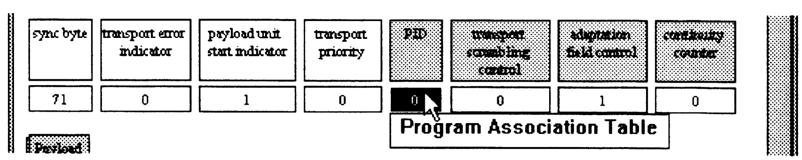


Figure 2–13: Help information for the packet field value

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.

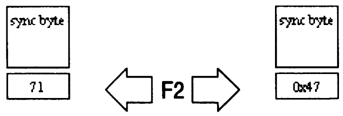


Figure 2–14: Press F2 to toggle numeric base

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 button bar—to open the View Type submenu, as shown in Figure 2–15.

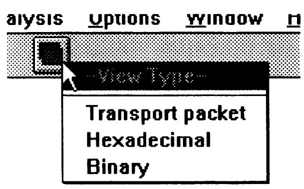


Figure 2–15: The View Type submenu

2. Choose Hexadecimal from the submenu. This produces the hexadecimal dump shown in Figure 2–16.

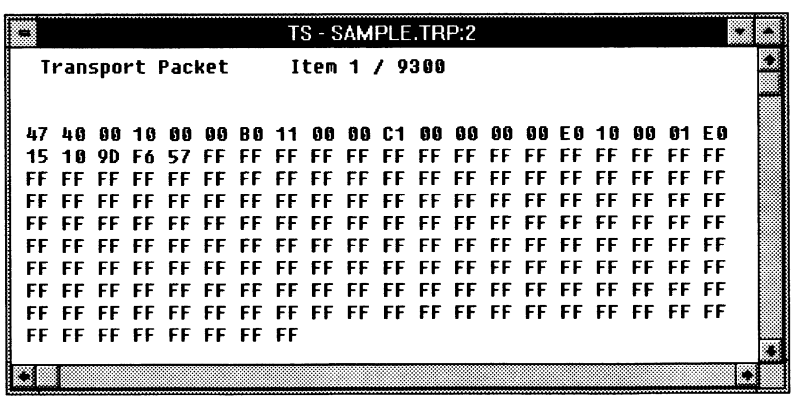


Figure 2–16: Hexadecimal view of the first transport packet

Notice that the first few bytes appear in blue characters on the MTS 100 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 2–17.

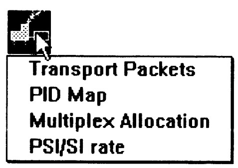


Figure 2–17: The TS icon shortcut menu

2. Choose PID Map from the menu. This creates the window shown in Figure 2–18.

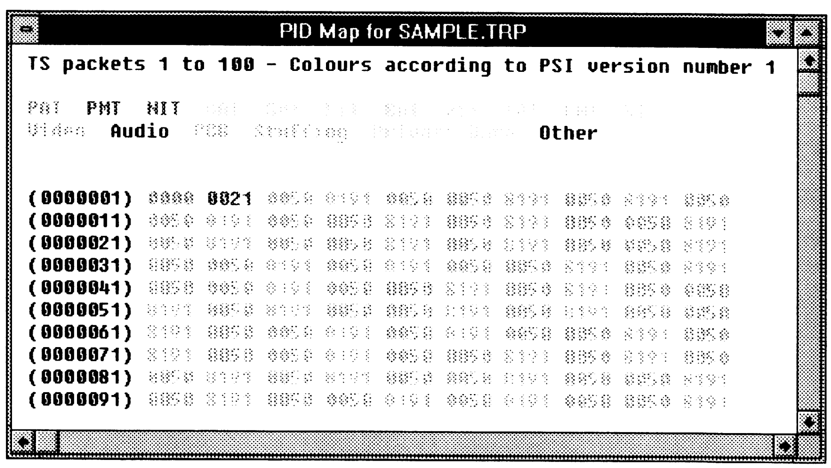


Figure 2–18: The PID map of SAMPLE.TRP packets 1 to 100

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 2–19.

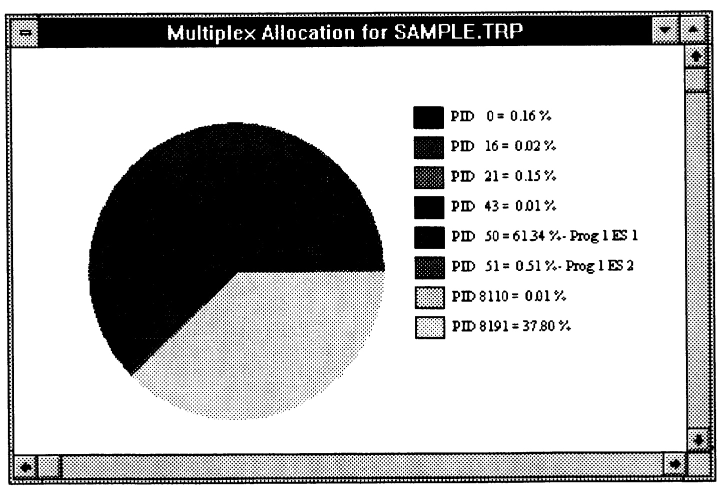


Figure 2–19: The Multiplex Allocation document window

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 2–20.

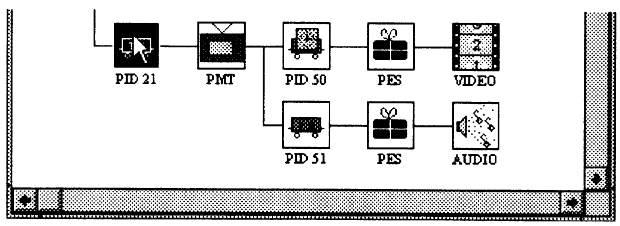


Figure 2–20: Double-click on the PID 21 icon

The analyzer opens a window similar to Figure 2–21.

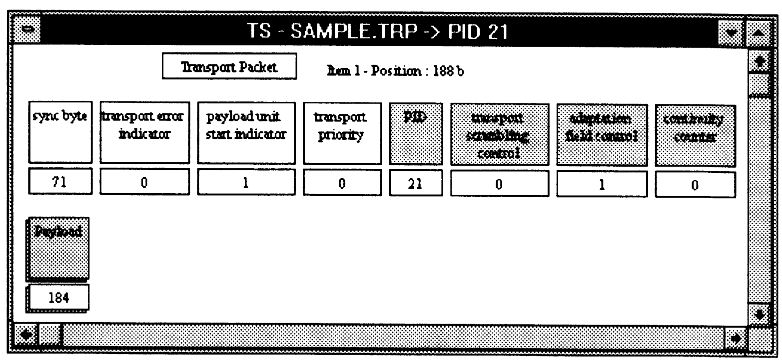


Figure 2–21: The interpreted view of the first PID 21 transport packet

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 button bar 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 button bar 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 2–22—that there are only 14 transport packets of the 9300 in the SAMPLE.TRP stream that are identified with PID 21.

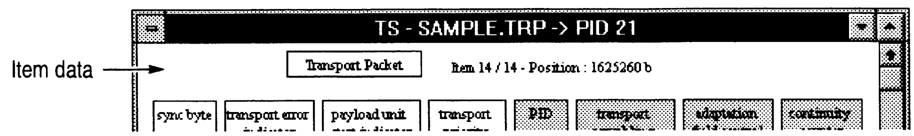


Figure 2–22: The last PID 21 packet in SAMPLE.TRP

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.

The Binary View

1. Click on the Add View button as shown in Figure 2–23.

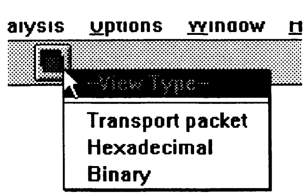


Figure 2–23: The View Type submenu

2. Select Binary from the View Type submenu. The analyzer opens a window similar to Figure 2–24.

   Notice that the first eight-bit byte, which corresponds to the sync byte (see the interpreted view in Figure 2–21), 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.

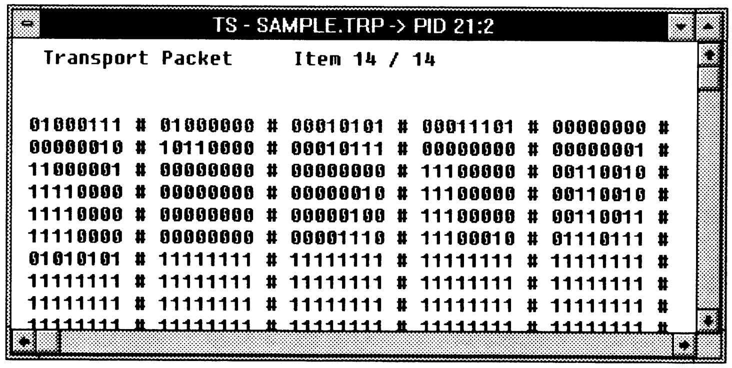


Figure 2–24: The binary view of PID 21 item 14

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 2–25.

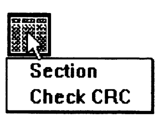


Figure 2–25: The PAT icon shortcut menu

2. Choose Section from the shortcut menu to open an interpreted view of the PAT (Program Association Table). The window resembles Figure 2–26.

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

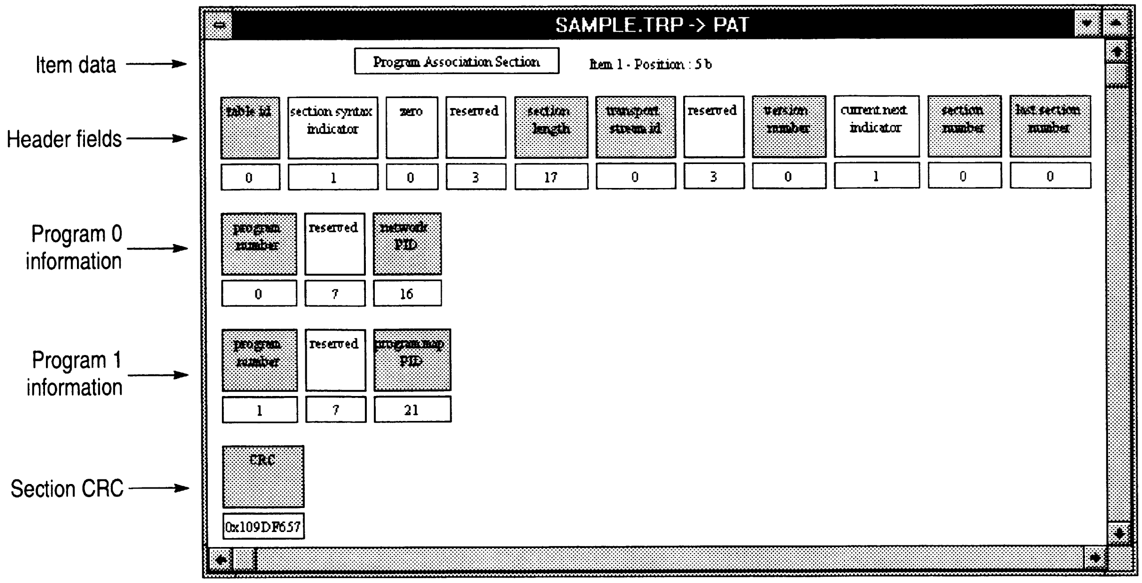


Figure 2–26: The PAT section interpreted view

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 2–27.

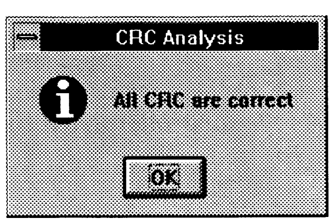


Figure 2–27: The CRC Analysis dialog box

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 2–28.

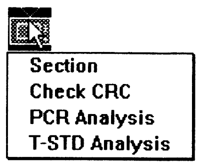


Figure 2–28: The PMT shortcut menu

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 2–29.

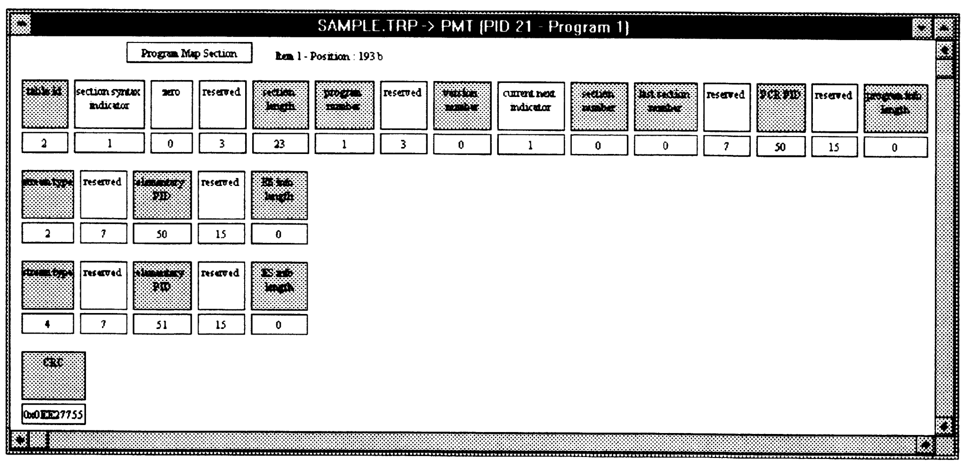


Figure 2–29: The PMT interpreted view

Syntax Analysis

Perform a Syntax Analysis on this PMT section.

1. From the Analysis menu choose Syntaxic, as shown in Figure 2–30.

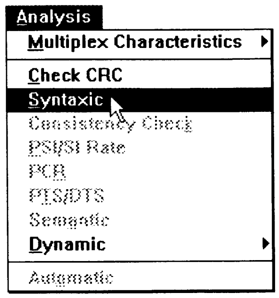


Figure 2–30: Choosing Syntaxic from the Analysis menu

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 2–31.

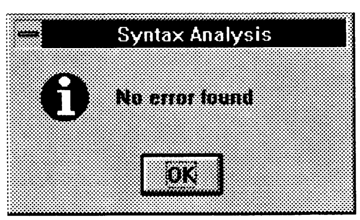


Figure 2–31: The Syntax Analysis message window

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 2–32.

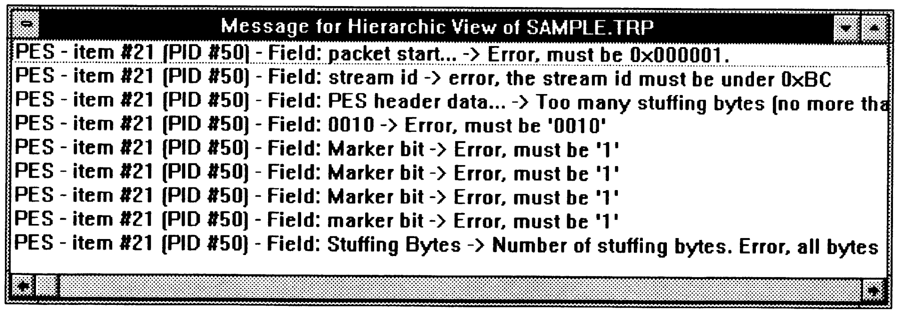


Figure 2-32: A message window listing syntax errors

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 just 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 2-33.

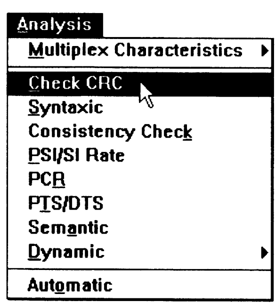


Figure 2-33: Choosing Check CRC from the Analysis menu

If CRC errors are found, the analyzer lists the errors in a window similar to Figure 2-32. Because SAMPLE.TRP contains no CRC errors, however, the analyzer displays the message window shown in Figure 2-34.

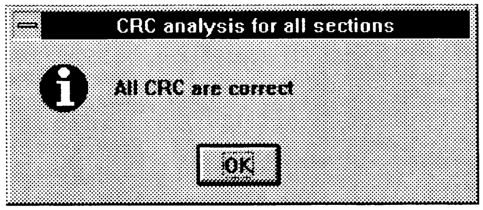


Figure 2–34: CRCs in all sections are correct

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 vs. 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 2–35.

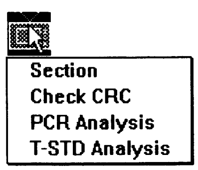


Figure 2–35: The PMT shortcut menu

2. Choose PCR Analysis from the menu to open a PCR diagram window similar to Figure 2–36. This diagram shows the first ten clocks in the program.

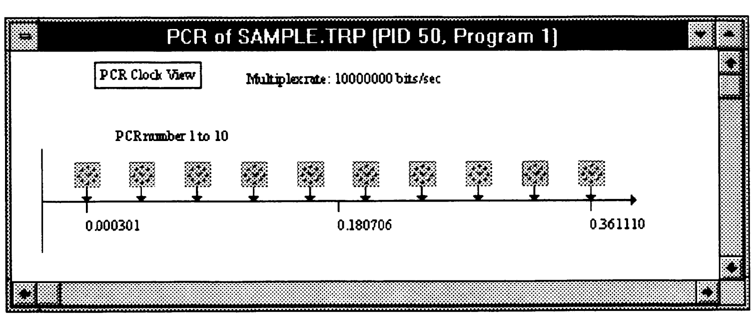


Figure 2–36: The PCR analysis display

3. Double-click on the third clock icon. This brings up the PCR value window as shown in Figure 2–37.

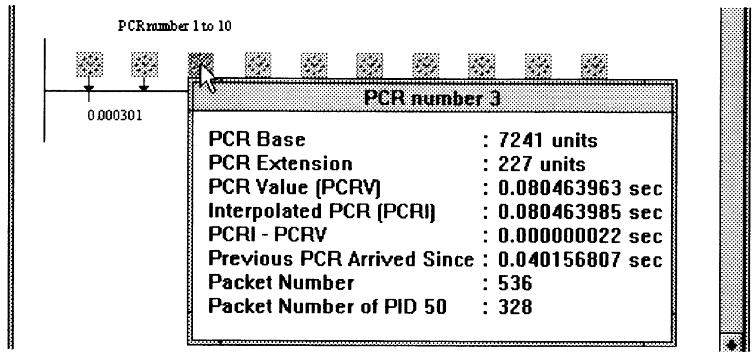


Figure 2–37: Double-click on the clock icon to list clock values

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

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

5. Choose PCR Values from the View type submenu, as shown in Figure 2–38. The analyzer creates a window, similar to Figure 2–39, that lists the values for all ten PCRs in the diagram.

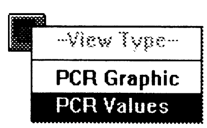


Figure 2–38: The PCR View Type submenu

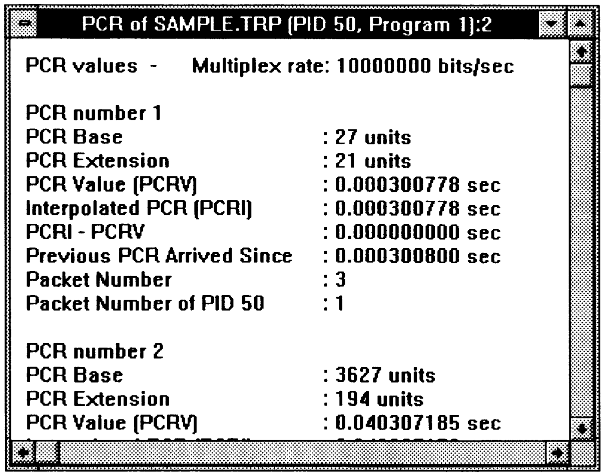


Figure 2–39: The PCR values display

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

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 2–40.

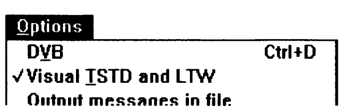


Figure 2–40:

2. Choose T-STD Analysis from the PMT shortcut menu, as shown in Figure 2–41.

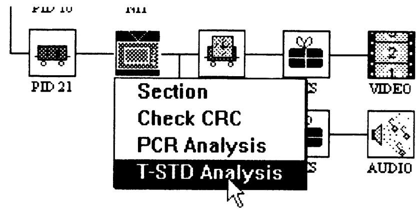


Figure 2–41: Choosing T-STD Analysis from the PMT shortcut menu

Because visual mode is selected, the analyzer opens a Buffering Simulation window similar to Figure 2–42. 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.

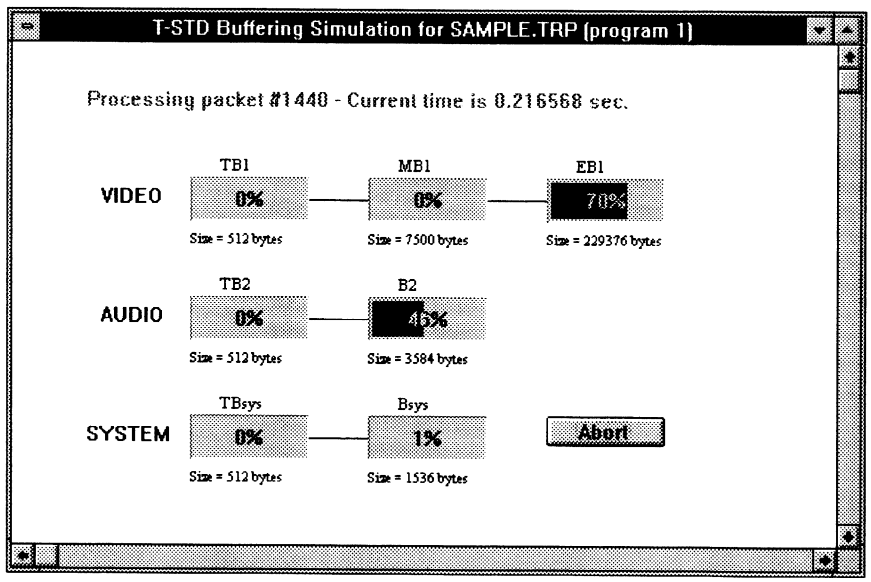


Figure 2–42: The T-STD Buffering Simulation window

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 2–43. 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.

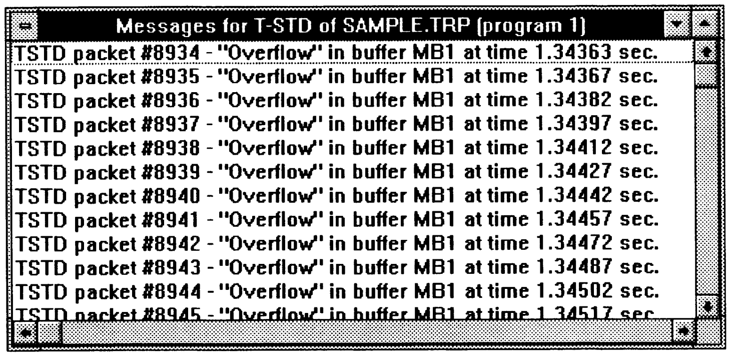


Figure 2–43: The T-STD error list

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 2–44.

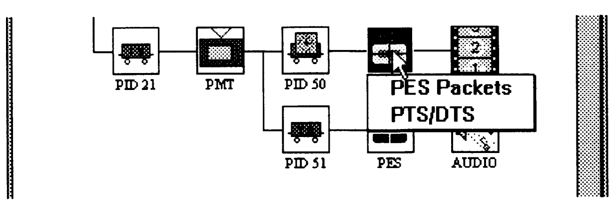


Figure 2–44: The drop-down menu for the PES icon

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 2–45.

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.

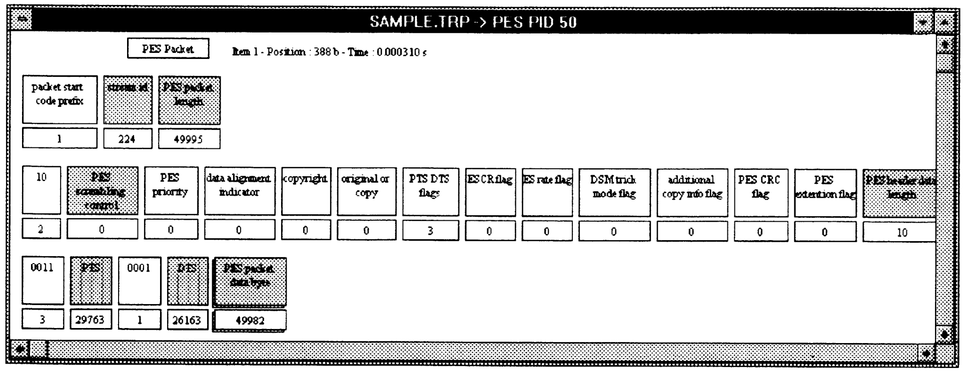


Figure 2–45: The PES packet interpreted view

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 button bar. 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 2–46. The errors are highlighted in red on the MTS 100 display.

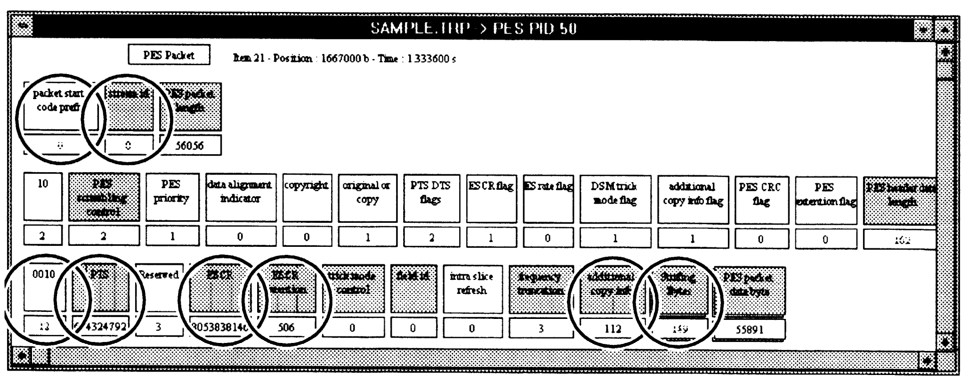


Figure 2–46: The PES Packet with the errors circled

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 2–47, to learn more about the field.

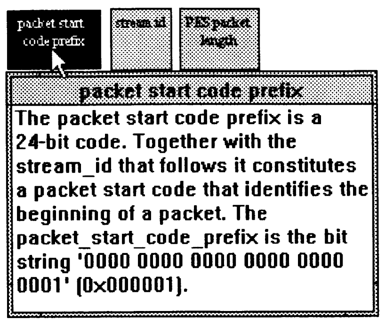


Figure 2–47: Double-click for information about the field

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 2–48, to reveal the value help/error message.

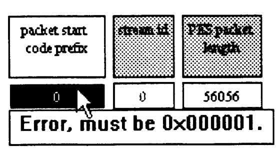


Figure 2–48: Double-click for information for the field value

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 2–49.

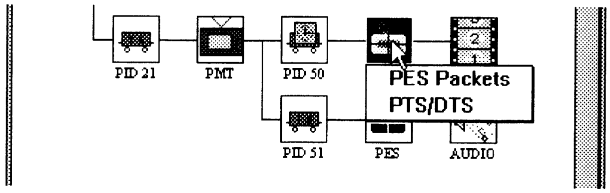


Figure 2–49: The PID 50 PES shortcut menu

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 2–50.

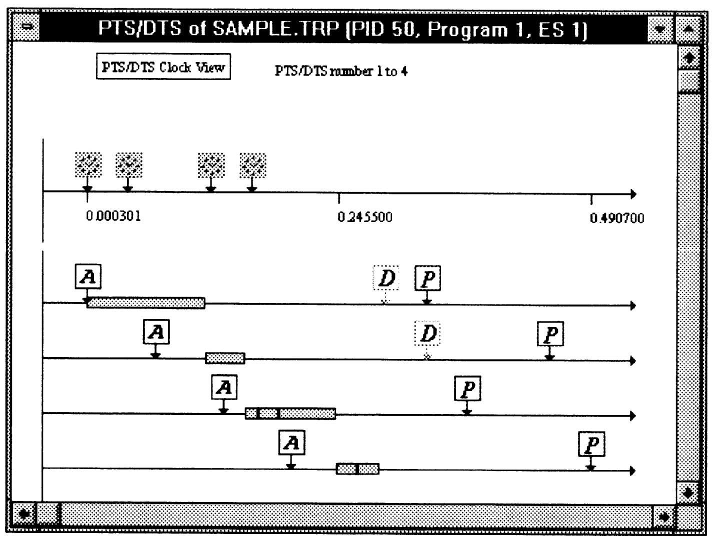


Figure 2–50: The PTS/DTS diagram

NOTE. *The diagram in Figure 2–50 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 2–51 for an example of a diagram from a correctly encoded stream.

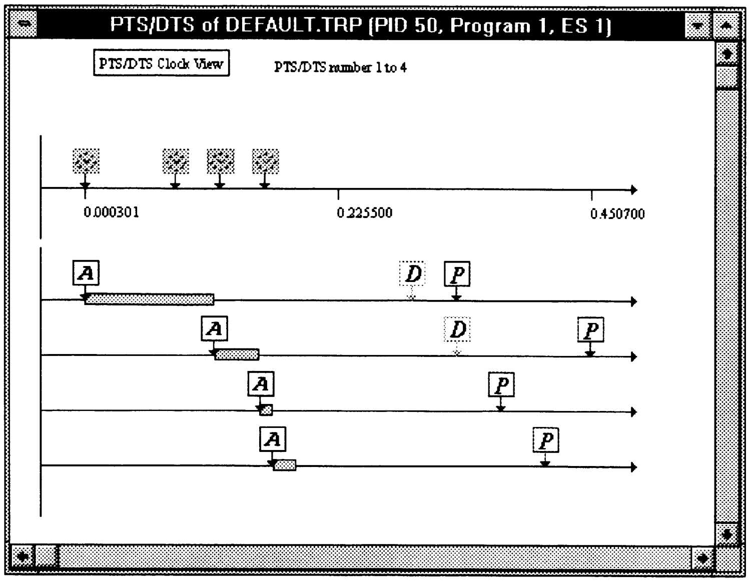


Figure 2–51: PTS/DTS diagram from a correctly encoded stream

Table 2–10 lists and explains the icons used in the PTS/DTS diagram.

Table 2–10: 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 2–10 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 2–52.

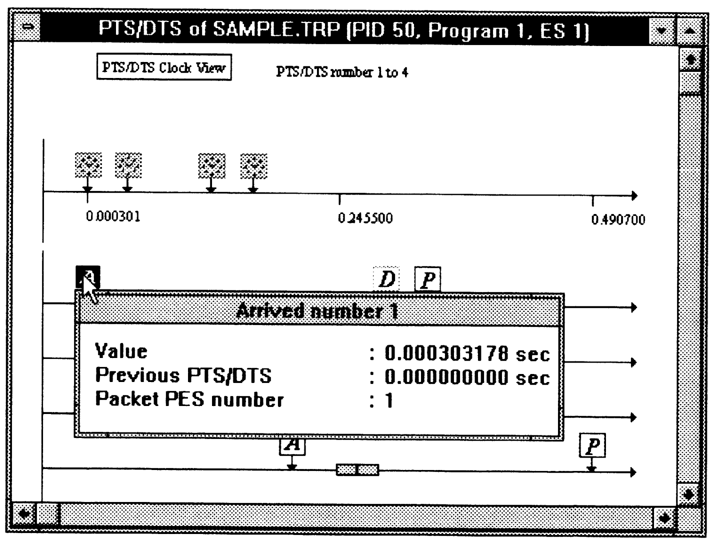


Figure 2–52: Information about the first arrival time

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 2–53, to learn more about the access unit.

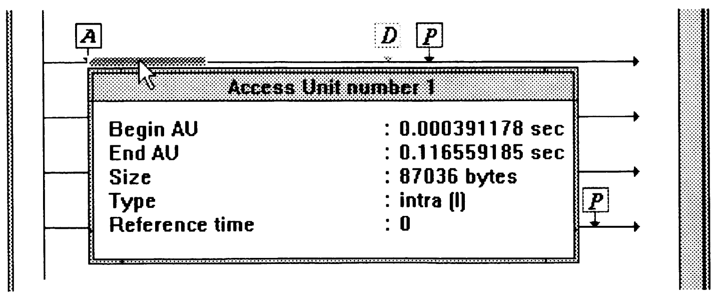


Figure 2–53: Information about the first access unit

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

6. If you wish, experiment using the lower button bar 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 2–54.

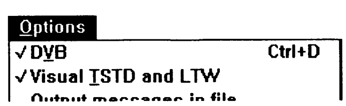


Figure 2–54: The check mark indicates that DVB is selected

3. Select the hierarchic view, if necessary, and then choose PSI/SI from the Selection menu. The dialog box shown in Figure 2–55 appears.

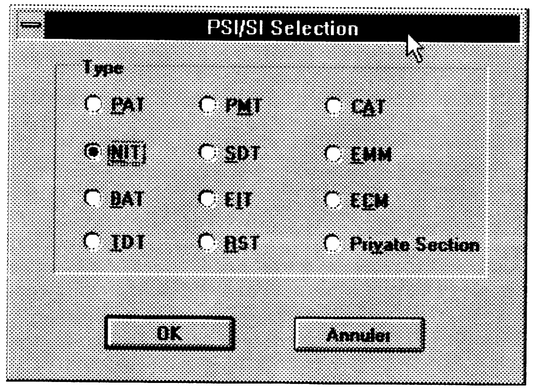


Figure 2–55: The PSI/SI Selection dialog box

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

---

4. Click NIT as shown in Figure 2–55.
5. Click OK to open an interpreted view of the first NIT section in the stream as shown in Figure 2–56. 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.*

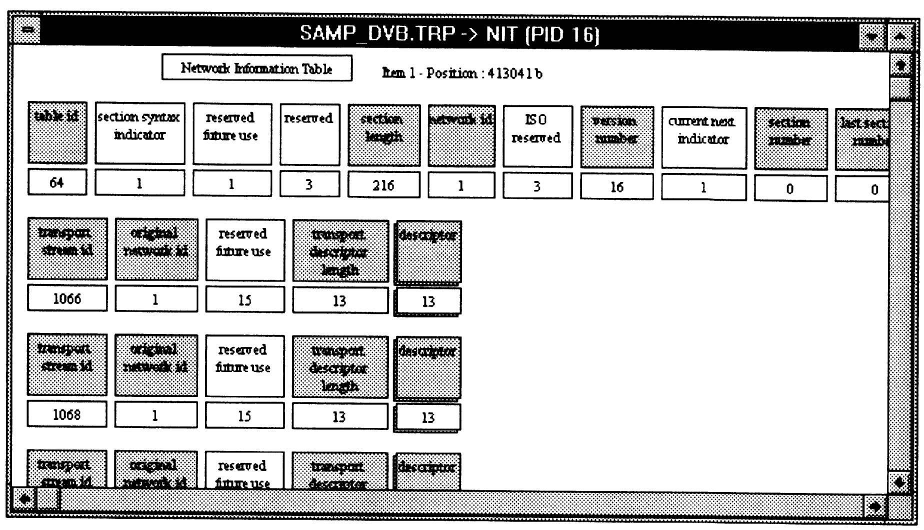


Figure 2–56: The NIT section interpreted view

6. Double-click on a descriptor field, if the NIT contains them, as shown in Figure 2–57. The resulting descriptor message box contains an ASCII decode of the network information associated with the transport stream.

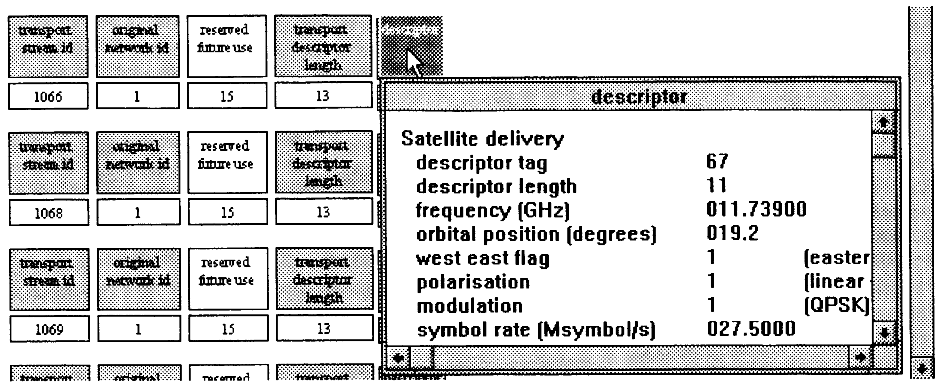


Figure 2–57: Double-click for an ASCII decode of the descriptor

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 100 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 2–58 appears.

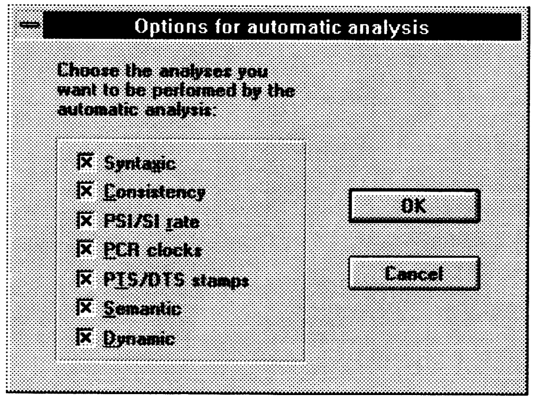


Figure 2–58: The automatic analysis Options dialog box

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 100, 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 2–59 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.

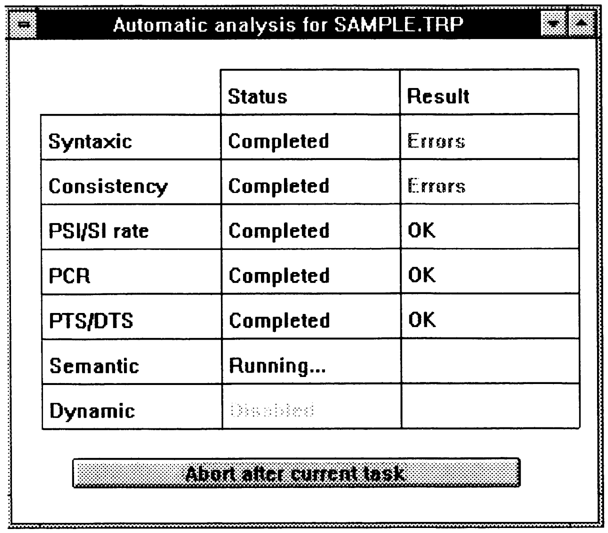


Figure 2–59: The automatic analysis results table (Dynamic analysis disabled)

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 2–60. 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 2–61

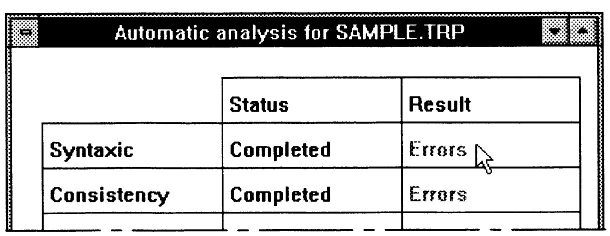


Figure 2–60: Double-click for error details

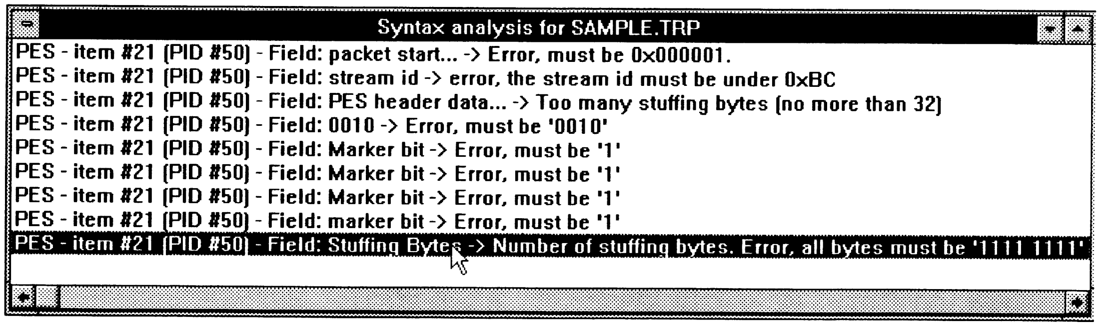


Figure 2–61: The list of syntax errors found in SAMPLE.TRP

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 2–61, to open a window resembling Figure 2–62. 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.

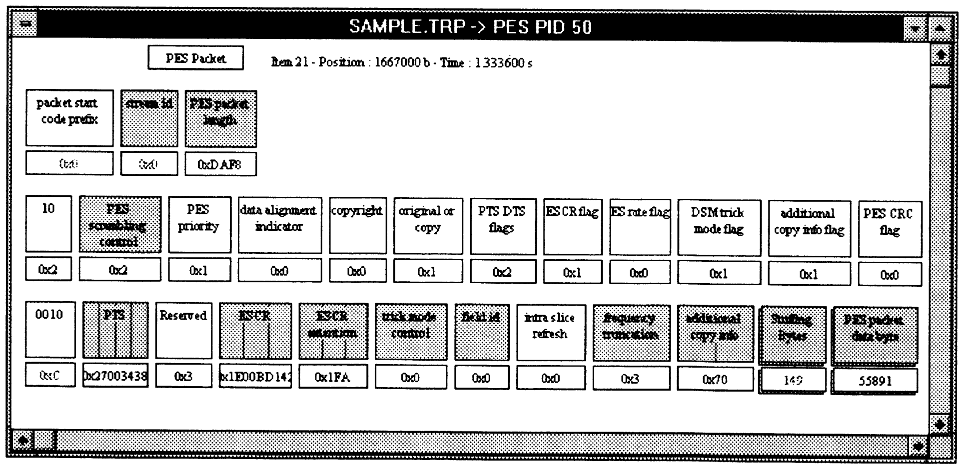
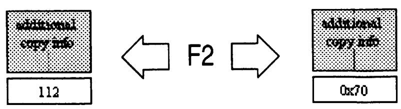


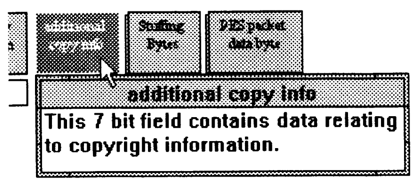
Figure 2–62: The interpreted view of a PES packet with syntax errors

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

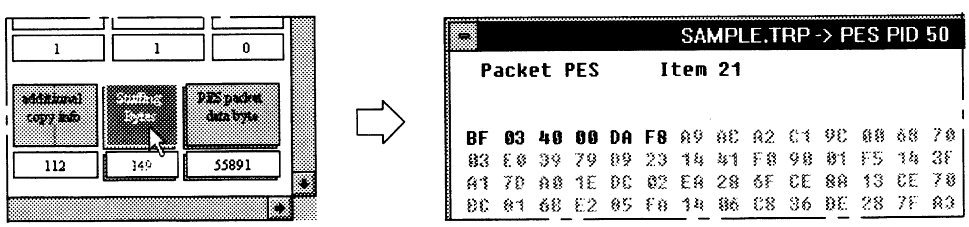
- Each "block" in the interpreted view represents a field of data. The field value (or number of bytes in a data field) appears below the field name. Press the F2 key to toggle the value between decimal base and hexadecimal base.



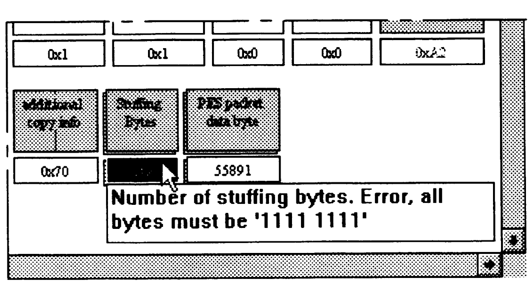
- Double-click on a field name for more information about the field.



- 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 100 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 Broadcasting) 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 100.

NOTE. *To aid in following along with your own MTS 100, 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 100.

A transport stream file is a file on a disk. When the MTS 100 sends this file out one of the rear-panel connectors (properly timed), it becomes a transport stream.

Start the Multiplexer

Double-click on the Multiplexer icon. This starts the Multiplexer application as shown in Figure 2–64.

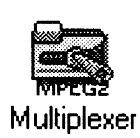


Figure 2–63: The Multiplexer icon

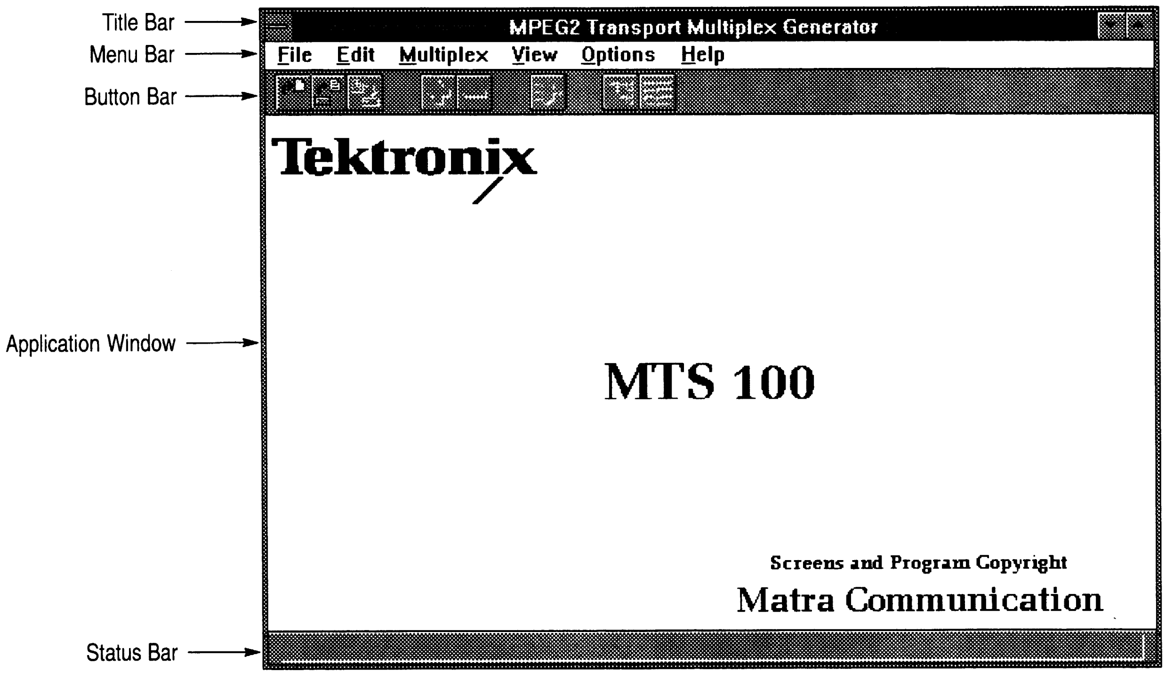


Figure 2–64: The initial window for the Multiplexer application

Making a Simple Transport Stream File

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

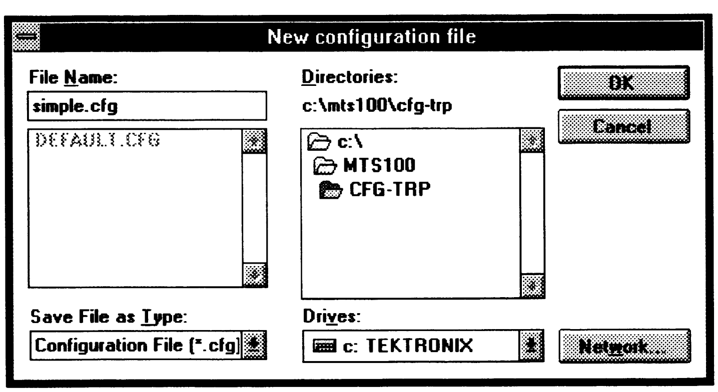


Figure 2–65: The New configuration file dialog box

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 *Structure of the Multiplexer File* 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.)

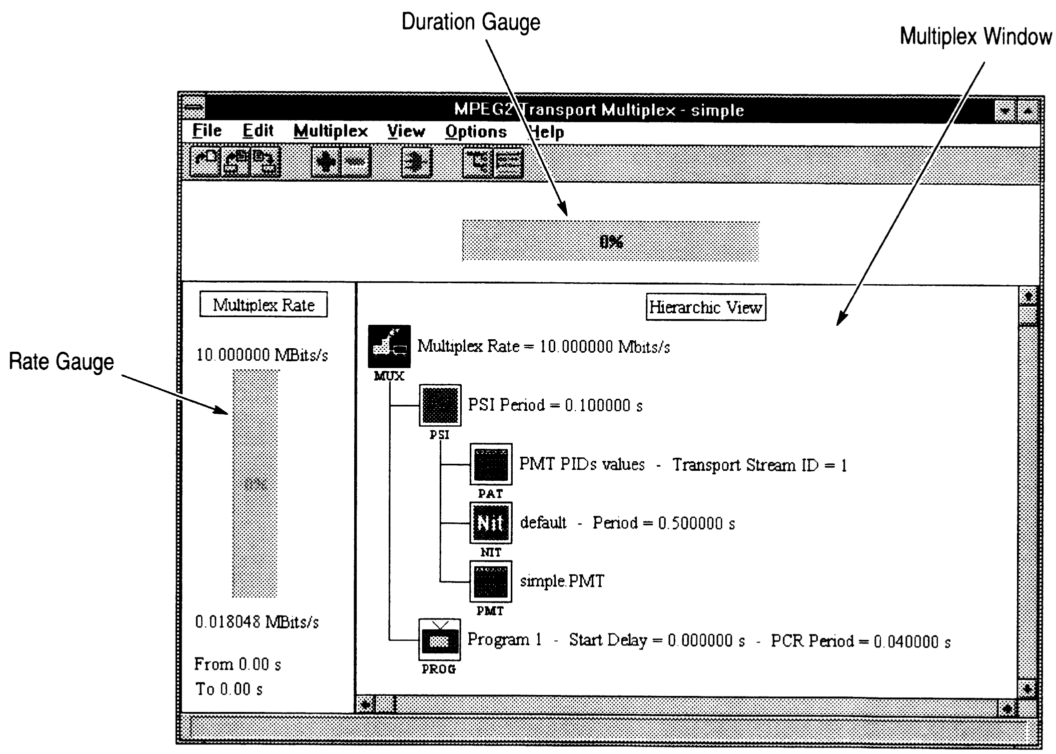


Figure 2–66: The Multiplexer application window, showing the default configuration

The 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 2–11 explains these icons.

Table 2–11: The icons in the multiplexer hierarchic view

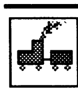
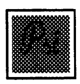
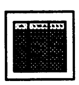
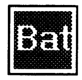
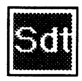
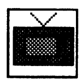
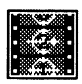
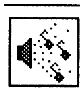
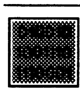
Icon	Meaning
 MUX	Multiplex — the main icon for the configuration file. Required.
 PSI	Program Specific Information (PSI) — contains the data that allows the demultiplexing of the programs by decoders. Required.
 PAT	Program Association Table (PAT) — This is the main PSI table. It links the program numbers 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.
 PMT	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.
 SI	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.
 NIT	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 2-11: The icons in the multiplexer hierarchic view (Cont.)

Icon	Meaning
 BAT	Bouquet Association Table (BAT) — provides information regarding bouquets (a collection of services marketed as a single entity). Optional (for DVB).
 SDT	Service Description Table (SDT) — contains data describing the services in the system, for example, names of services, the service provider, etc. Optional (for DVB).
 EIT	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 button bar (or choose the Add command from the Edit menu). This opens the dialog box shown in Figure 2–67.

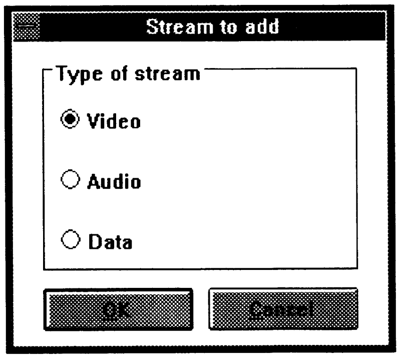


Figure 2–67: The Stream to Add dialog box

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.

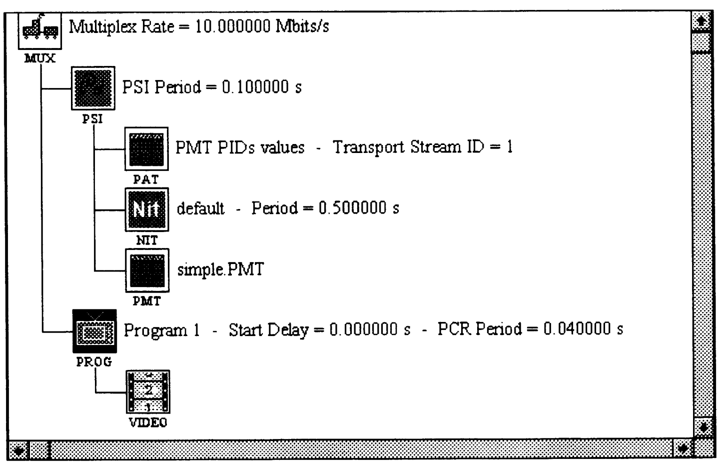


Figure 2–68: The hierarchy with a video icon added to program 1

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.

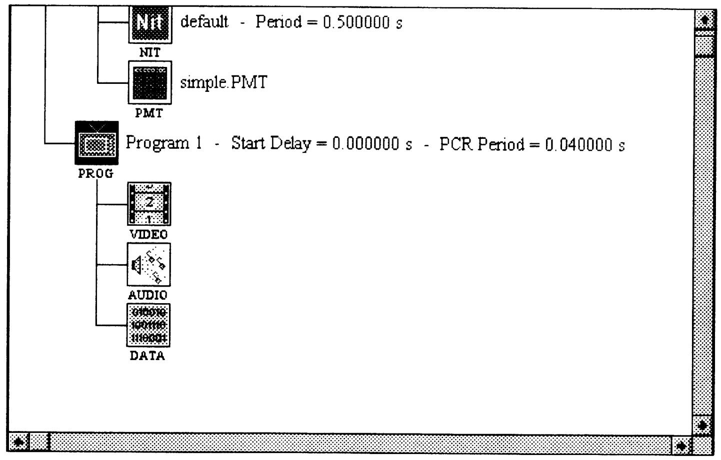


Figure 2–69: The hierarchy with the audio and data icons added

The next step is to 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.

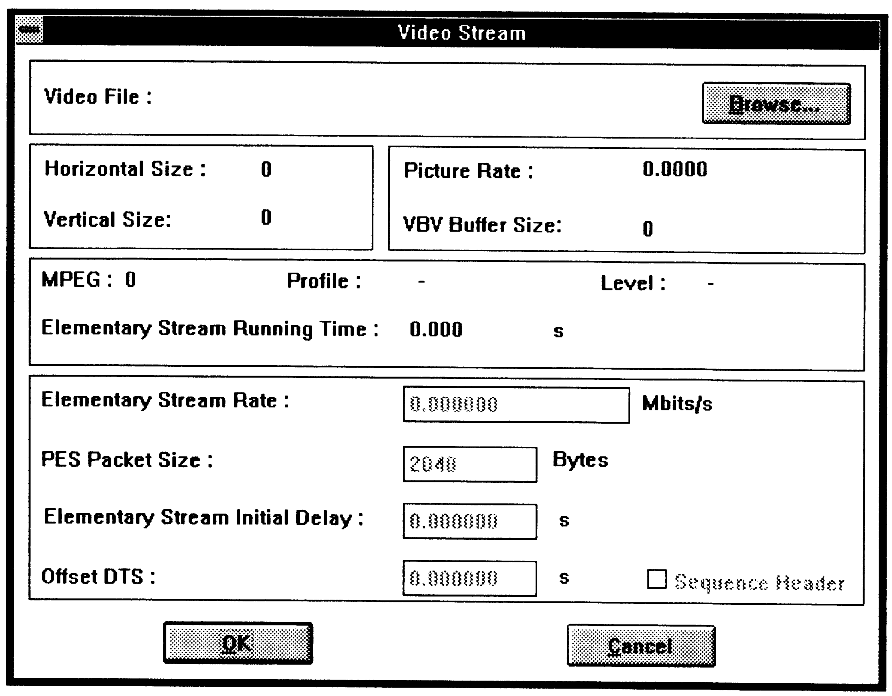


Figure 2–70: The Video Stream dialog box

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.)

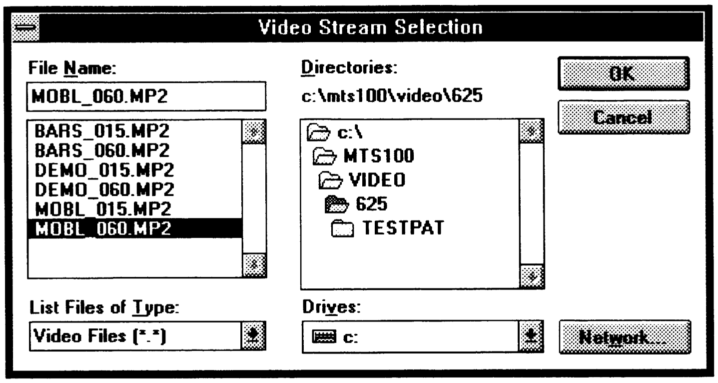


Figure 2–71: The Video Stream Selection dialog box

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.*

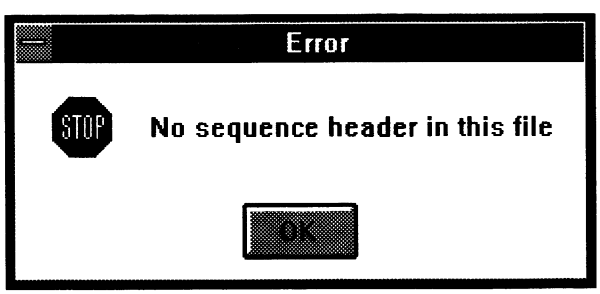


Figure 2–72: Click OK and select another (.mp2) file

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

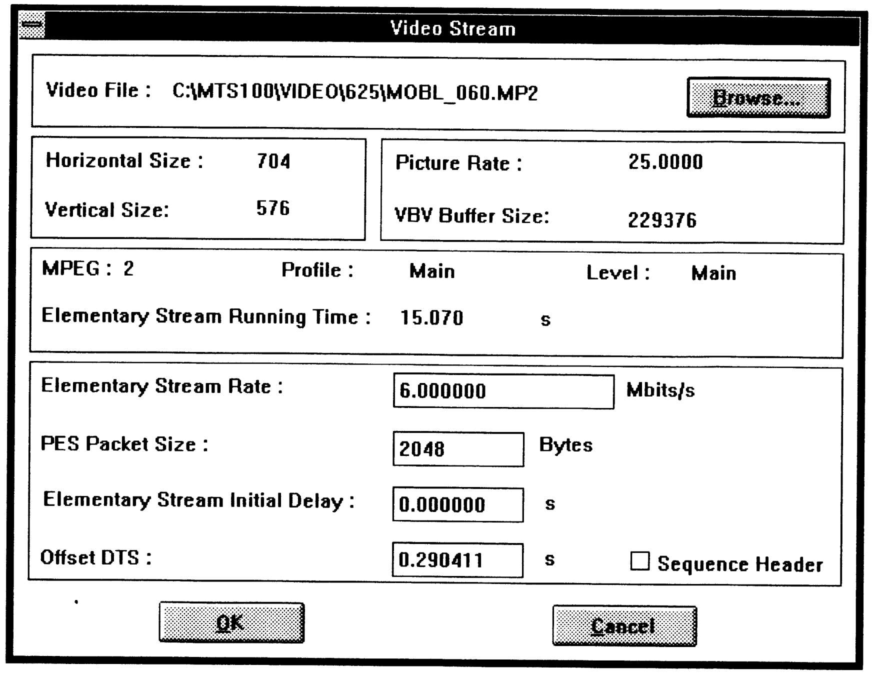


Figure 2–73: Details of the selected video elementary stream

Only the bottom five parameters (Elementary Stream Rate, PES Packet Size, Elementary Stream Initial Delay, Offset DTS, and Sequence Header) are editable. If you would like more information on these fields, please refer to *Video Icon*, beginning on page 3–96 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.

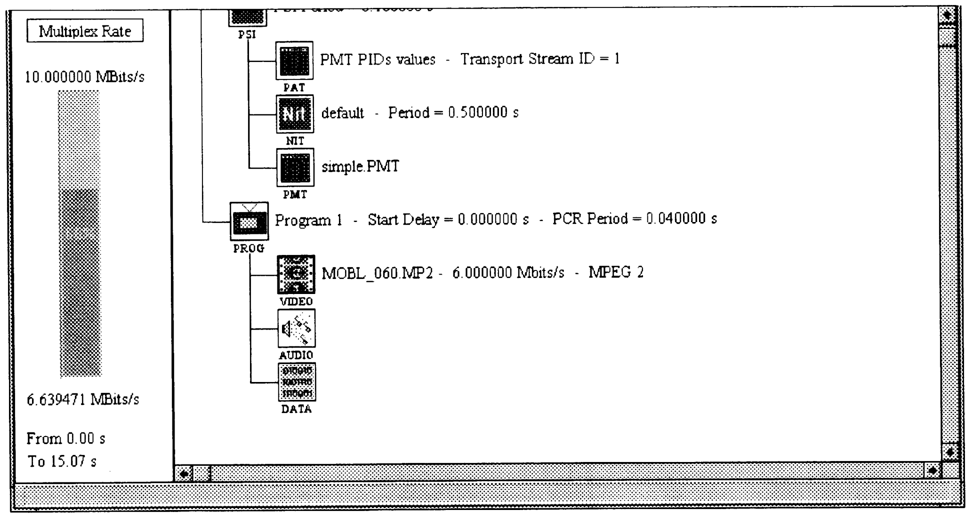


Figure 2–74: The hierarchy and rate gauge after associating a file with the video icon

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.

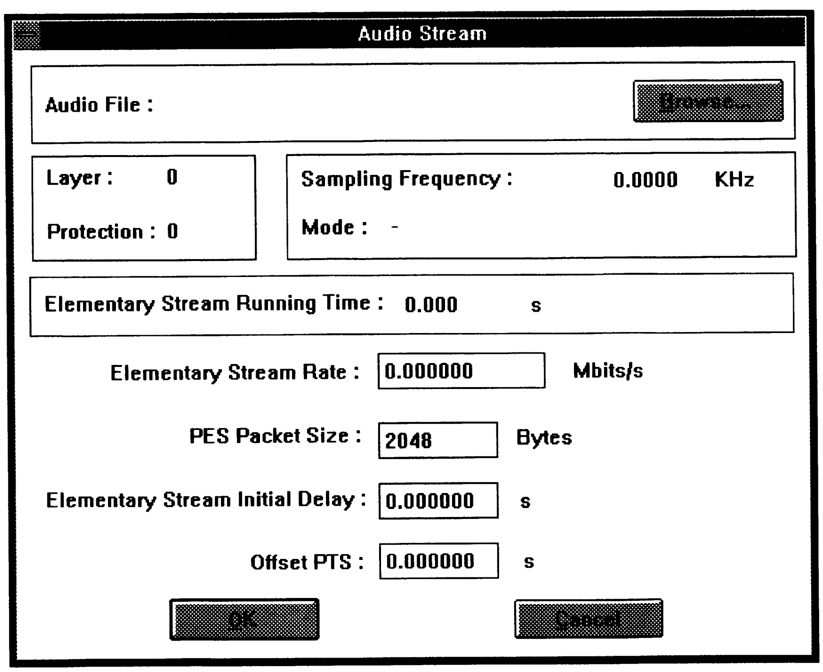


Figure 2–75: The Audio Stream dialog box

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

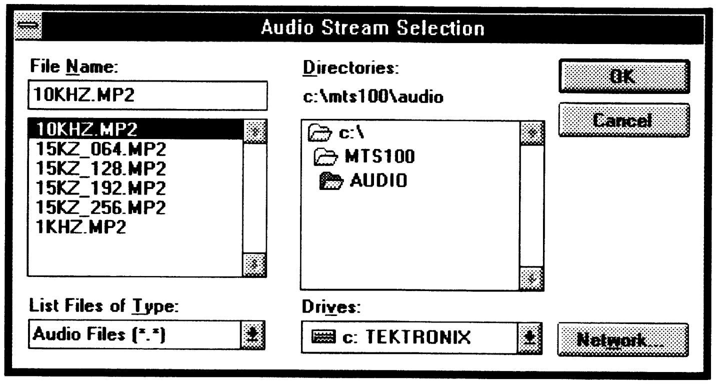


Figure 2–76: The Audio Stream Selection dialog box

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.

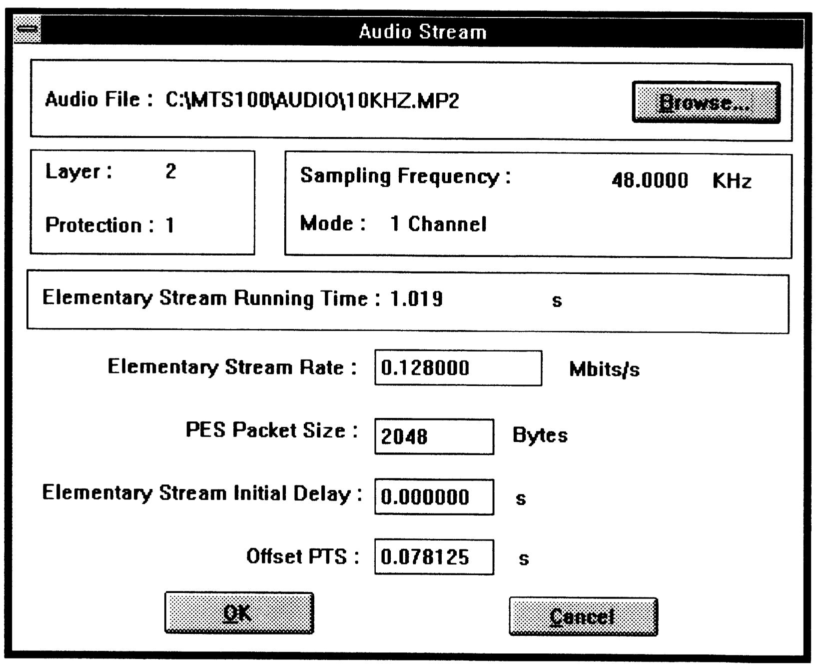


Figure 2–77: Details of the selected audio elementary stream

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 in the *Using the Multiplexer* section beginning on page 3–100.) 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.

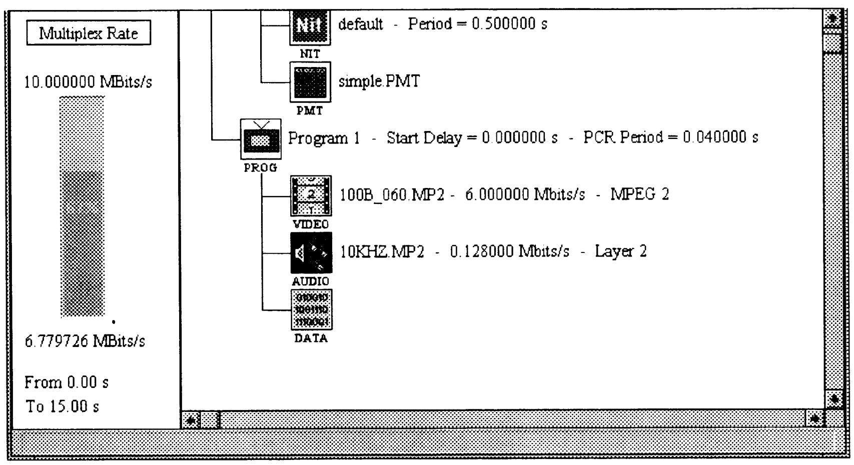


Figure 2–78: The hierarchy and rate gauge after the addition of an audio elementary stream

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.

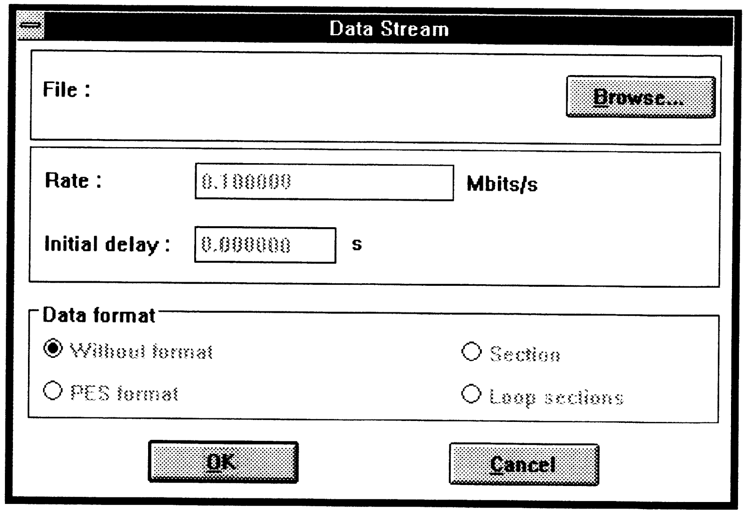


Figure 2–79: The Data Stream dialog box

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. 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 button 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.

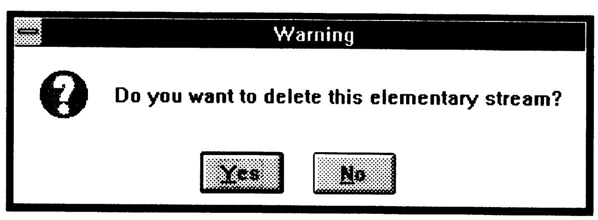


Figure 2–80: Click Yes to delete the data stream icon

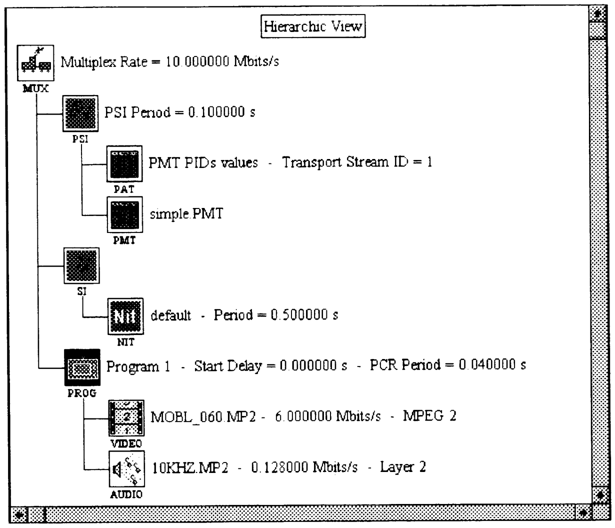


Figure 2–81: The hierarchy with the Data icon deleted

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 button bar. The Multiplex Output File dialog box appears as shown in Figure 2–82.

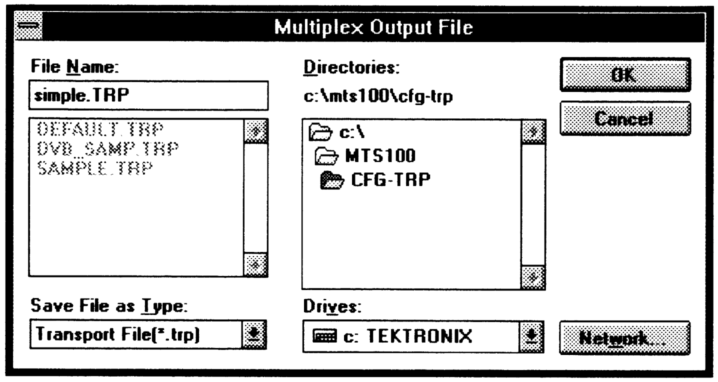


Figure 2–82: The Multiplex Output File dialog box

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 the c:\carb0\mono\loop directory.

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 100 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.

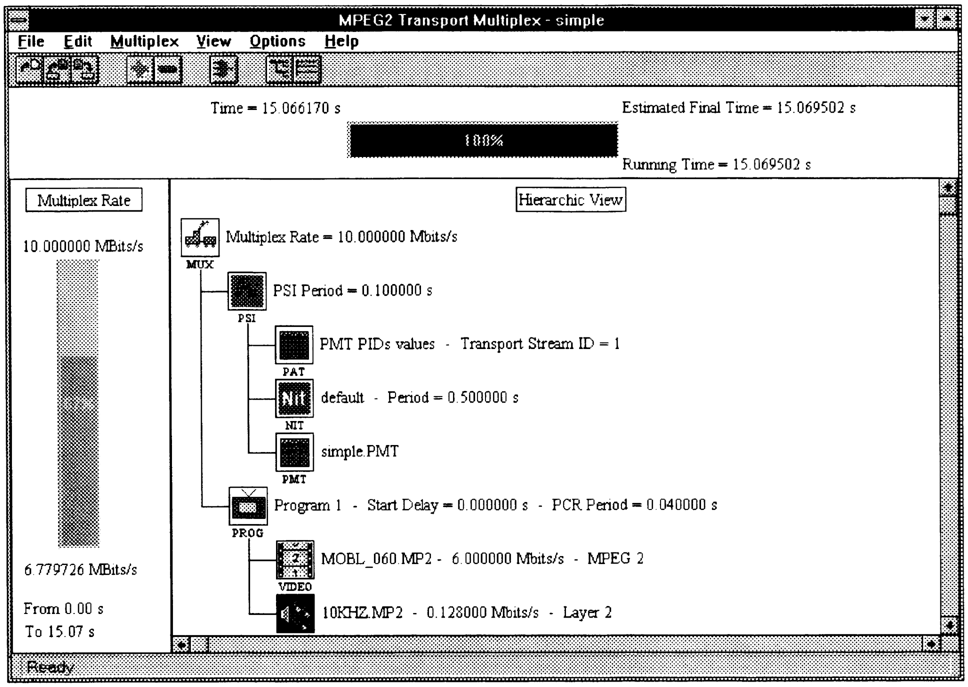


Figure 2–83: The Multiplexer display after completion of the Go command

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 button bar. This creates program 2.

3. Choose Add a second time to create program 3. Figure 2–84 shows the resulting hierarchy.

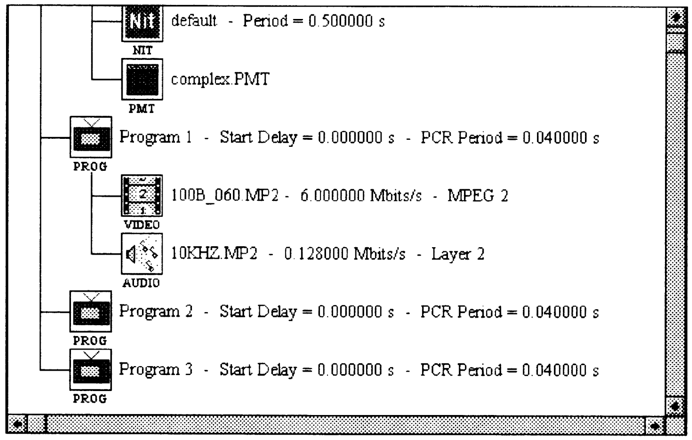


Figure 2–84: The hierarchy with programs 2 and 3 added

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

---

4. Follow the procedures given on pages 2–53 to 2–60 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.

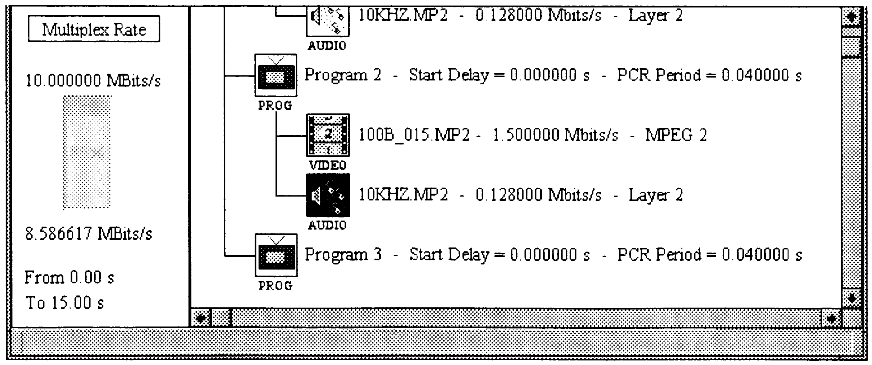


Figure 2–85: The configuration file with elementary streams added to program 2

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.

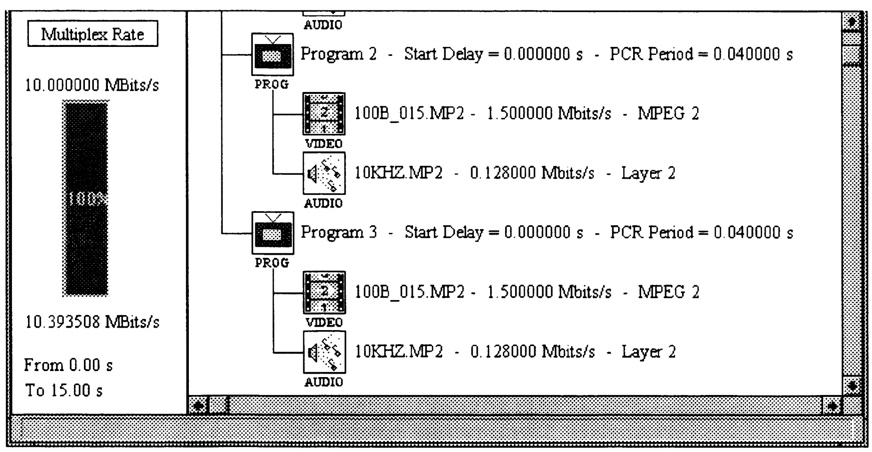


Figure 2–86: The rate gauge shows an overflowed multiplex

Notice that the rate gauge reads 100% and is now red on the MTS 100 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 button bar. This results in Figure 2–87.

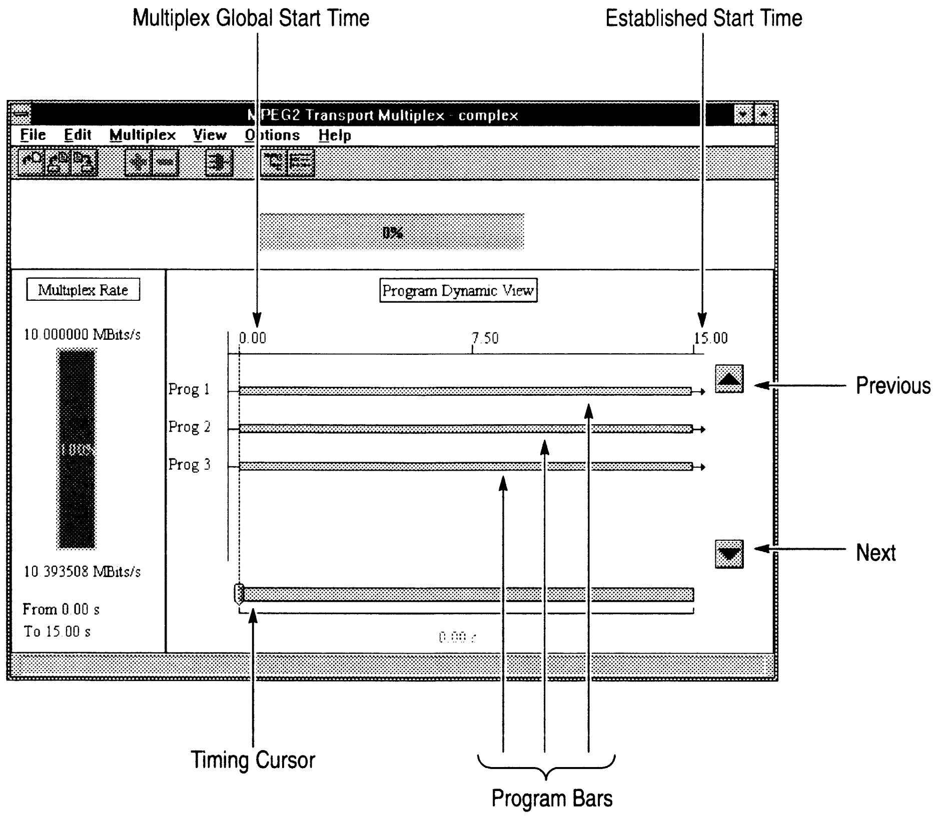


Figure 2–87: The dynamic view of the complex.cfg configuration file

This view shows the timing relationships between the programs. (For more information about the dynamic view, please see page 3–79 in the *Reference* section.)

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 button bar.
2. Double-click on the program 2 PROG icon. This results in the dialog box shown in Figure 2–88.

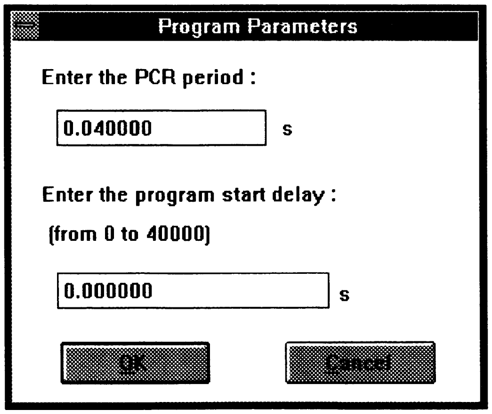


Figure 2–88: The Program Parameters dialog box for program 2

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 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.

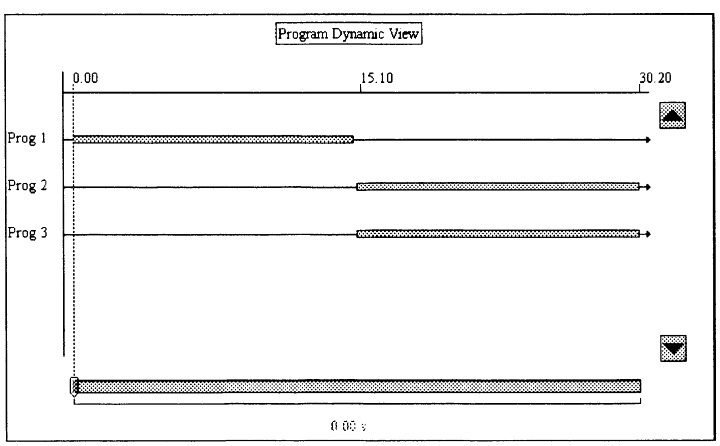


Figure 2–89: The dynamic view after you delay programs 2 and 3

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). You can "grab" the Timing Cursor by clicking on the left mouse button and holding it down until you have dragged the cursor to the desired position. (You can also use the left and right arrow keys, but they will only move you one step at a time.)

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.)

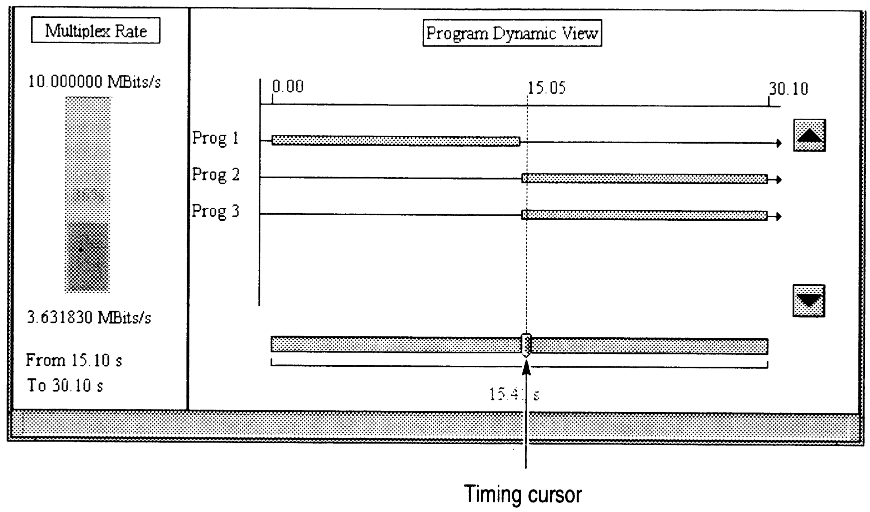


Figure 2–90: Moving the timing cursor

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.

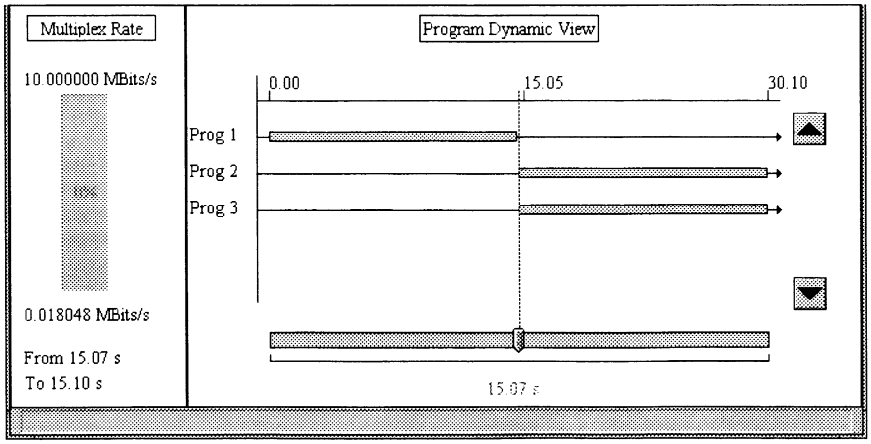


Figure 2–91: The timing cursor is in the space between the programs

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.)

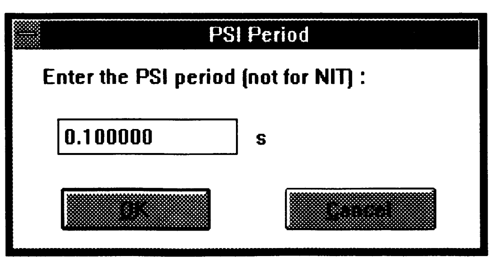


Figure 2–92: The default PSI Period dialog box

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).

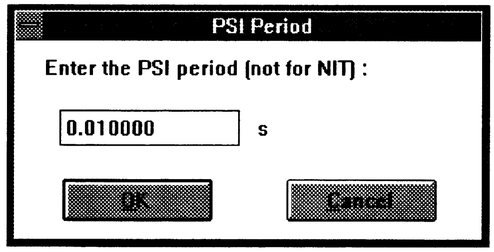


Figure 2–93: The PSI period is changed to 0.01 seconds

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.

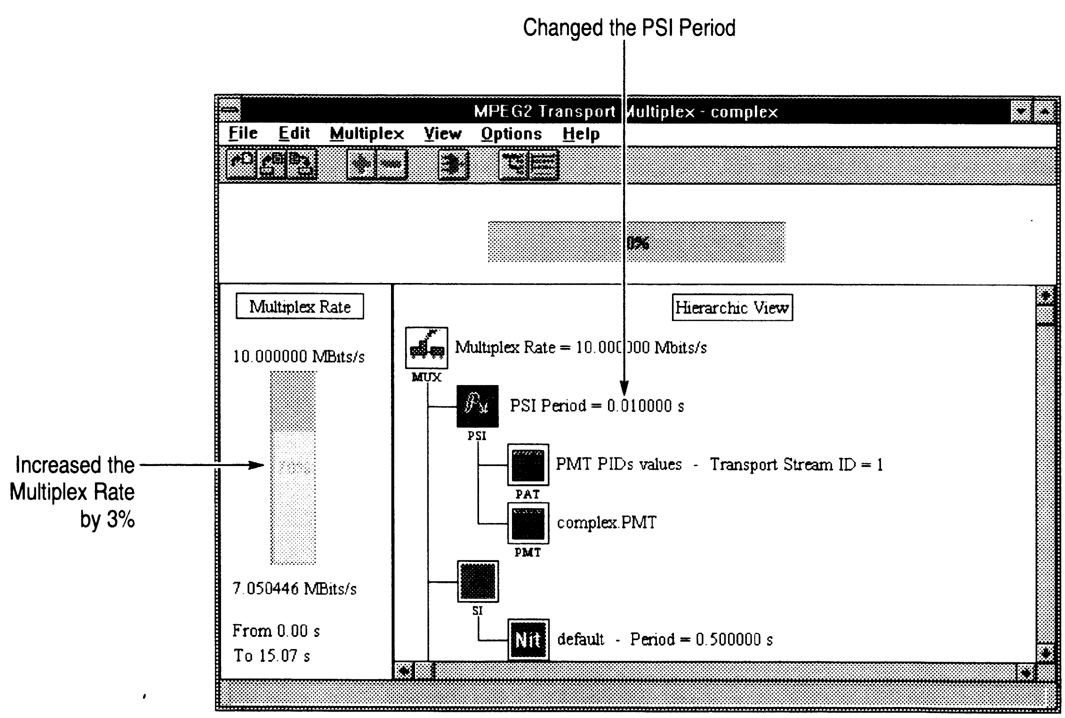


Figure 2–94: The configuration file after changing the PSI period

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.

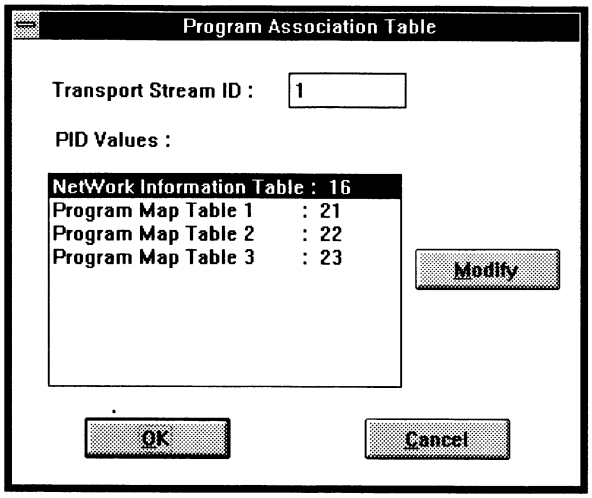


Figure 2–95: The Program Specific Information dialog box

2. Highlight the Network Information Table.
3. Choose the Modify command button.

This opens 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, however.

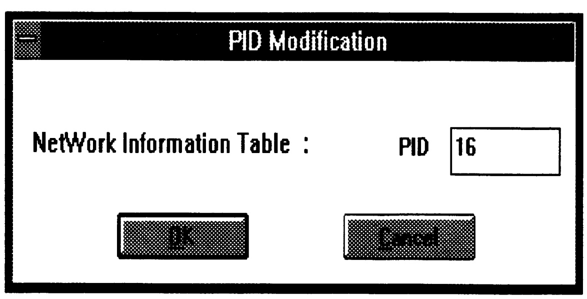


Figure 2–96: PID Modification dialog box

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 on the Edit Table application, refer to *Using the PSI and SI Table Editor*, beginning on page 3–105.

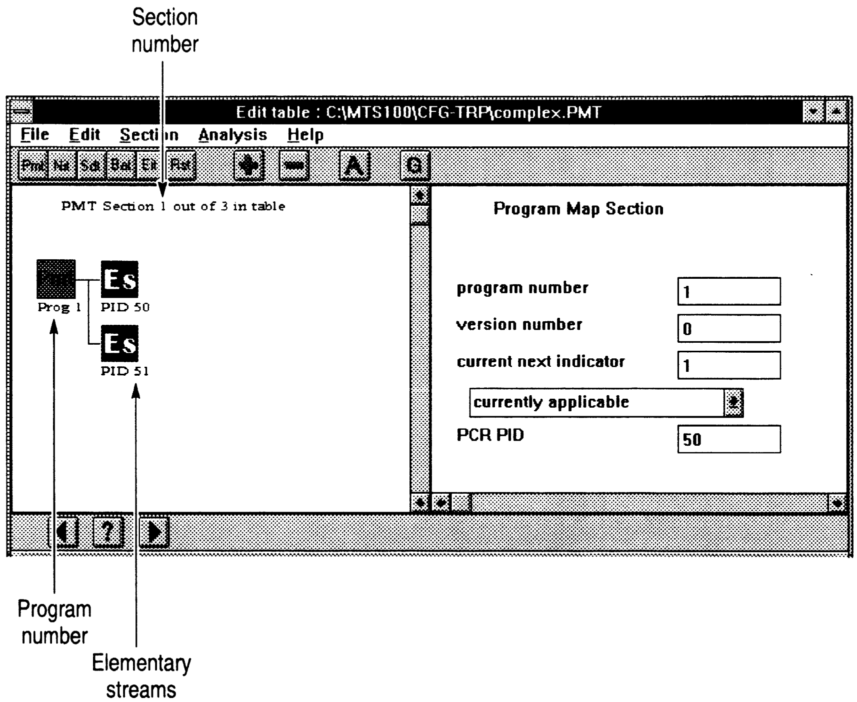


Figure 2–97: The Edit Table application with complex.pmt loaded

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. The default is the same as 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 that 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 shorter than the longest elementary stream.*

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 button bar. (See Figure 2–98.)

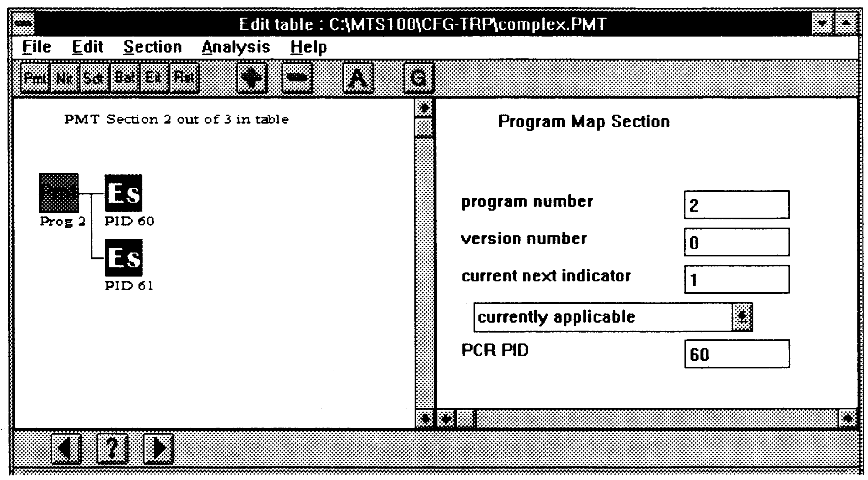


Figure 2–98: Section 2 (program 2) of the PMT

3. Select the PMT icon.

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

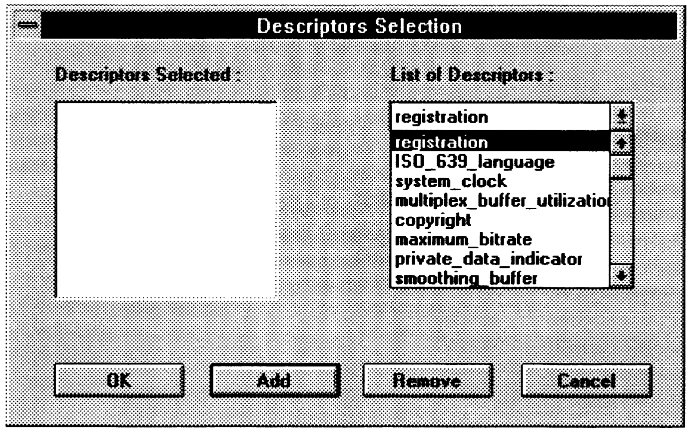


Figure 2–99: The Descriptors Selection dialog box

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.

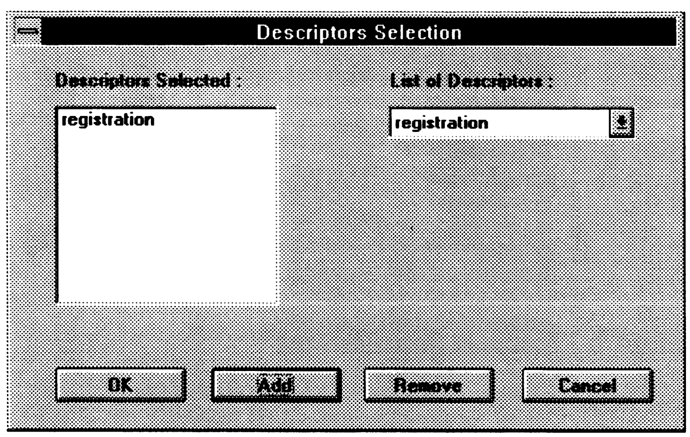


Figure 2–100: The Descriptors Selection dialog box with registration selected

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

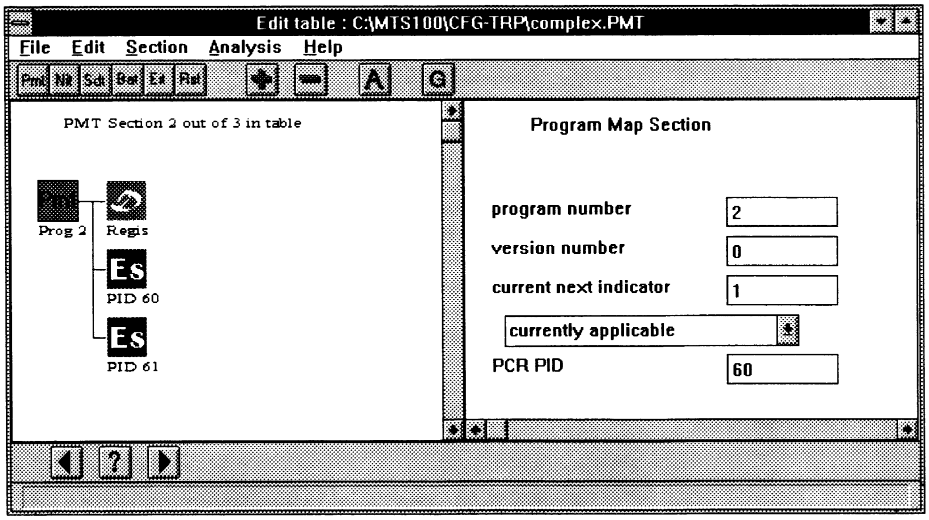


Figure 2–101: A registration descriptor added to section 2 of the PMT

Check the information added in the descriptor.

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

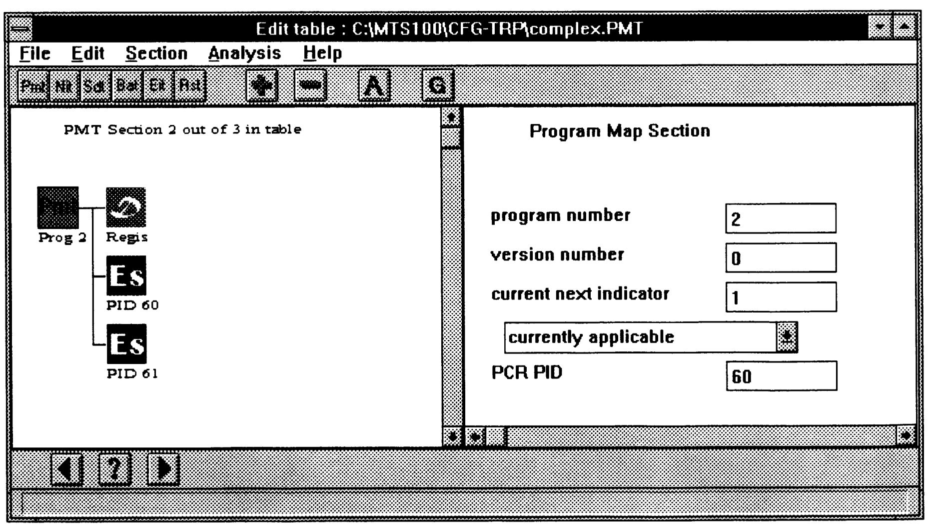


Figure 2–102: The information for the Video Stream descriptor field

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 button 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.

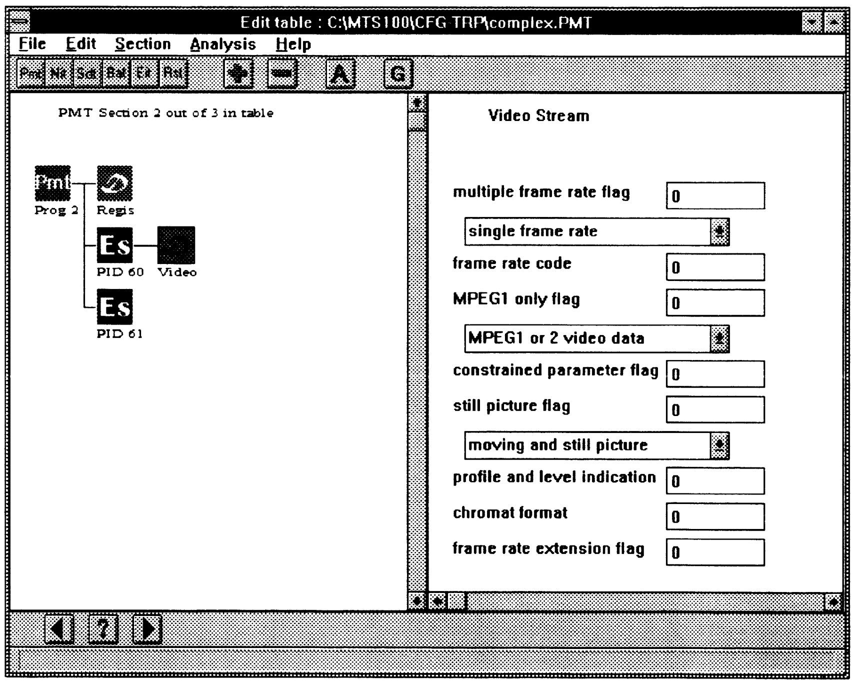


Figure 2–103: The Video Stream descriptor at the Elementary Stream level

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.)

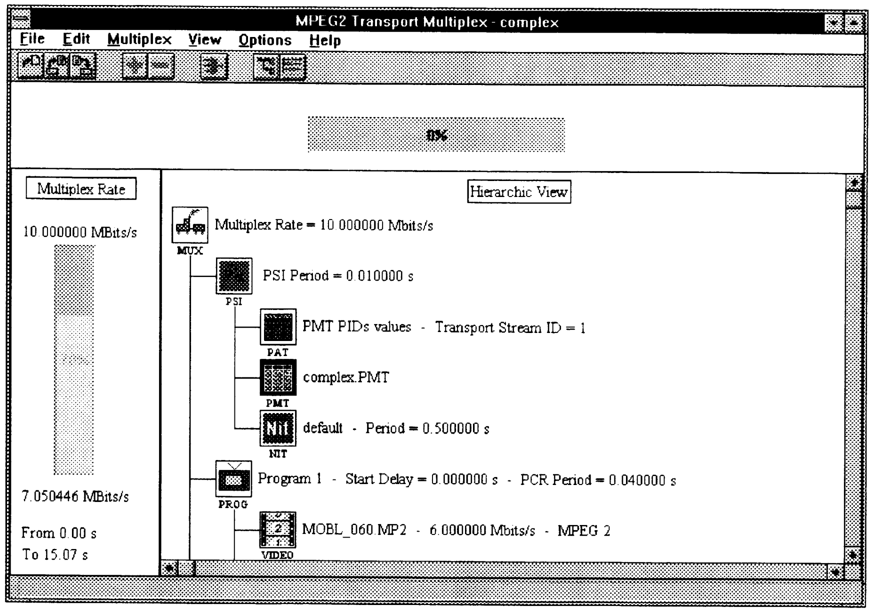


Figure 2–104: The complex.cfg after returning from the Edit Table application

This only gives 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 3–105) 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.)

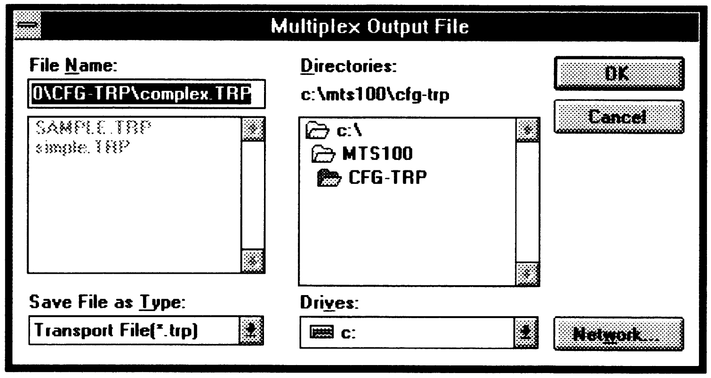


Figure 2–105: The Multiplex Output File dialog box

2. Choose OK and begin the multiplex process.

When the multiplex is complete, you have the transport stream file.

3. 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.

Double click on the Data Store Control icon to start the application.

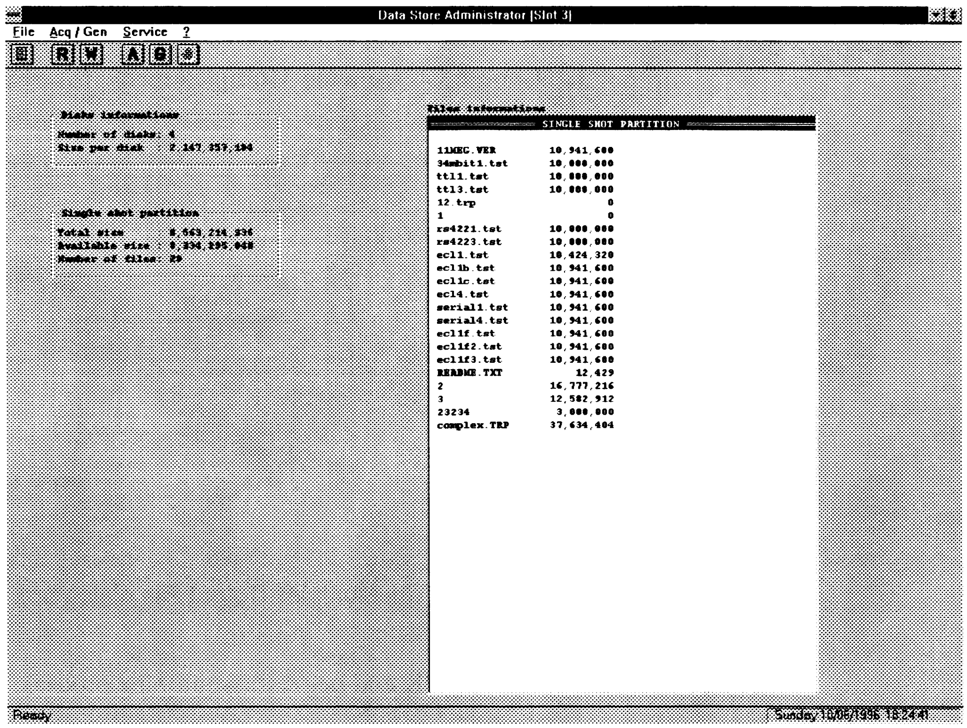


Figure 2–106: The initial display of the Data Store Administrator application

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.*

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

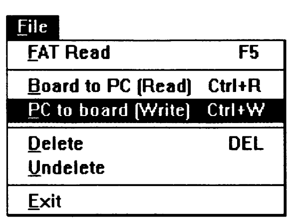


Figure 2–107: Find the command under the File menu

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

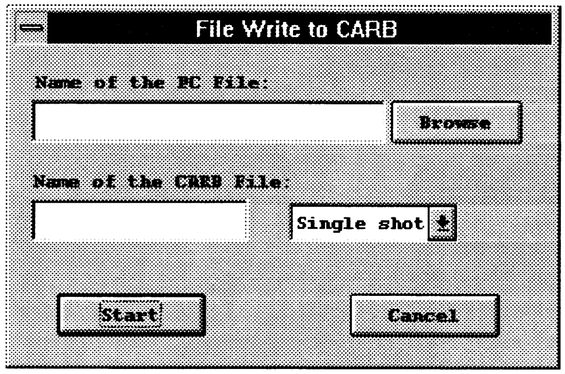


Figure 2–108: The File Write to CARB dialog box

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

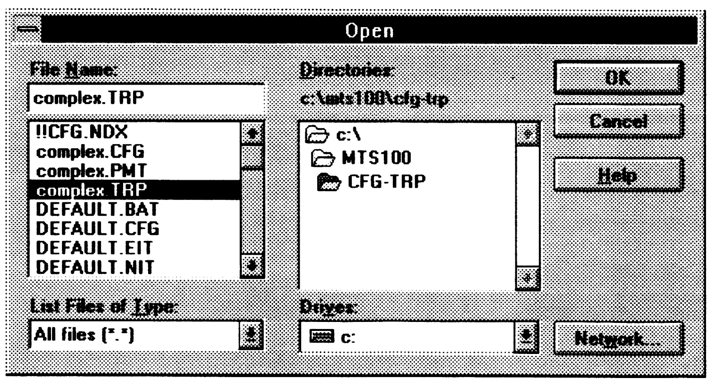


Figure 2–109: The open dialog box from the Browse command button

3. Select the COMPLEX.TRP file.

4. Choose OK. 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.

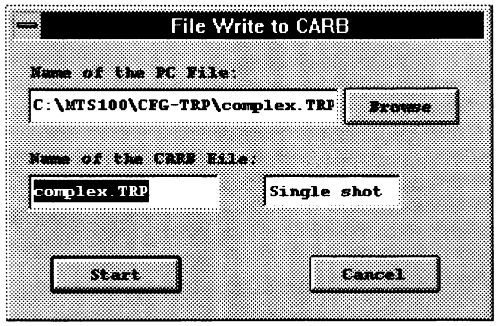


Figure 2–110: The File Write to CARB dialog box with all the information entered

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

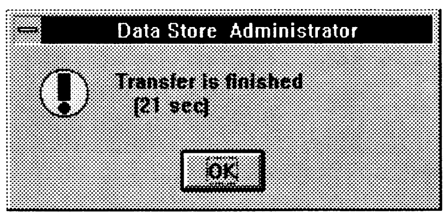


Figure 2–111: Click OK to acknowledge data transfer

Generating a Transport Stream

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

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

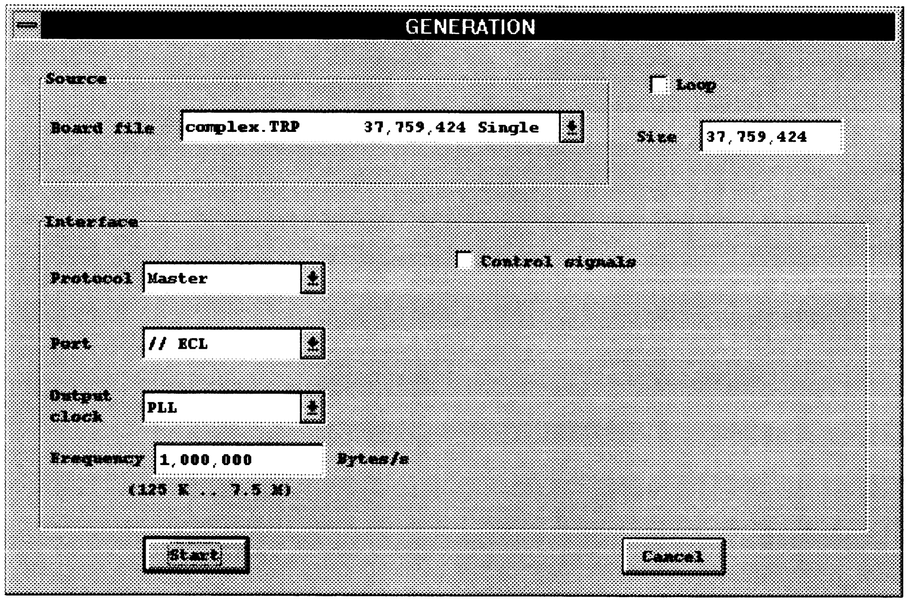


Figure 2–112: The Generation dialog box

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.

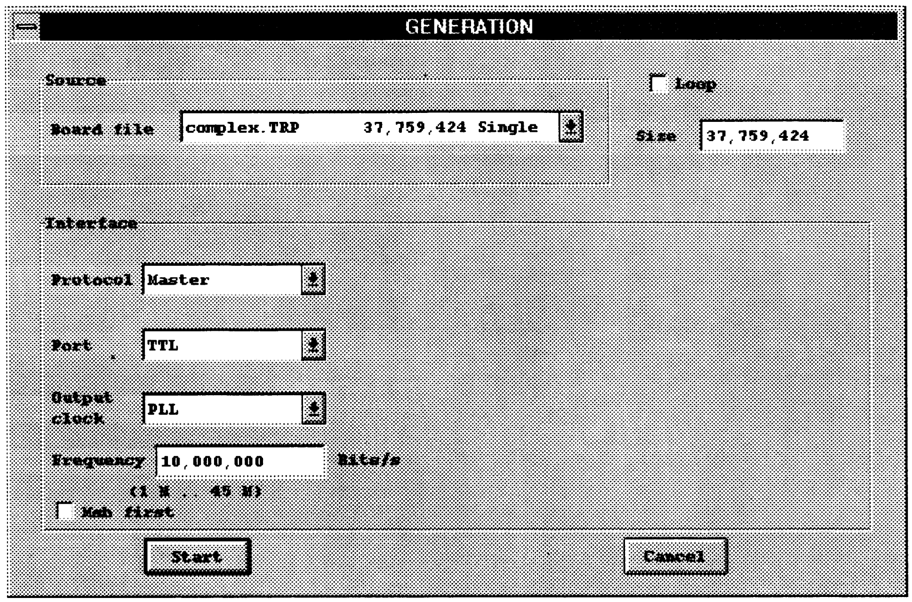


Figure 2–113: The Generation dialog box after all the parameters are entered

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

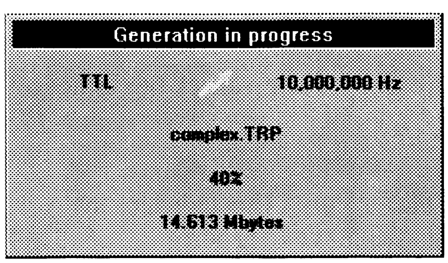


Figure 2–114: The MTS 100 is sending out a transport stream

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.

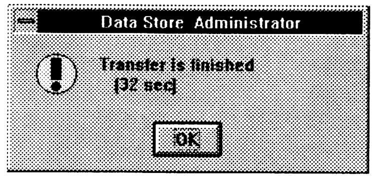


Figure 2–115: Transport stream generation is finished

This completes the basic tutorial on creating and sending 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

This section explains how to add DVB information to the transport stream file. DVB information is optional since not all systems require this information.

This section is a continuation from the previous tutorial. It is written assuming 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 100, all steps requiring action are numbered.*

---

1. Open the Multiplexer application by double-clicking on the (Multiplexer icon from the Tektronix MTS 100 group).
2. Choose Open, from the File menu.
3. Select complex.cfg.
4. Choose OK. This opens the previous configuration file and displays it in the application window.

Now save this file under a different name.

5. Choose the Save As command from the File menu.
6. Enter "dvb.cfg" 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 results in the display shown in Figure 2–116.

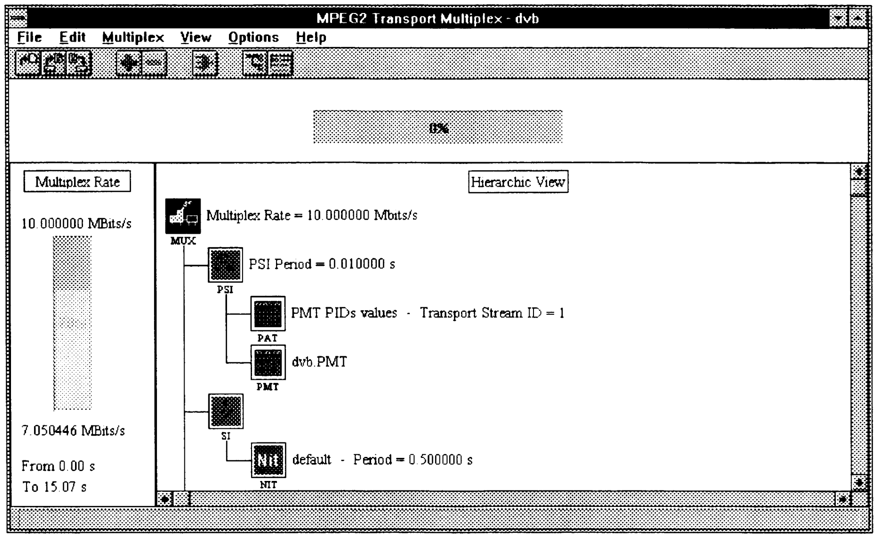


Figure 2–116: The configuration file with the DVB option included

Notice the two major differences from the standard configuration file:

- There is an additional icon, SI Service Information.
- The NIT (Network Information Table) moves to below the SI icon.

9. Double-click on the SI icon to bring up the DVB File Selection dialog box as shown in Figure 2–117.

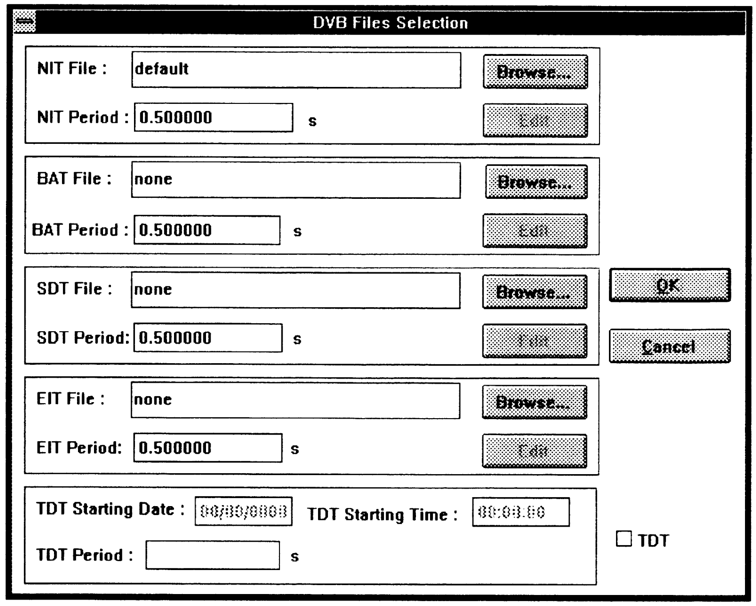


Figure 2–117: The DVB Files Selection dialog box

This dialog box allows you to add BAT (Bouquet Association Table), SDT (Service Description Table), EIT (Event Information Table), and TDT (Time and Date Table) information to the transport stream file. You use the Browse command button to select from currently existing files. Default files are provided with the MTS 100 to save you time in creating your own DVB files.

Next, you will 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. See Figure 2–118.

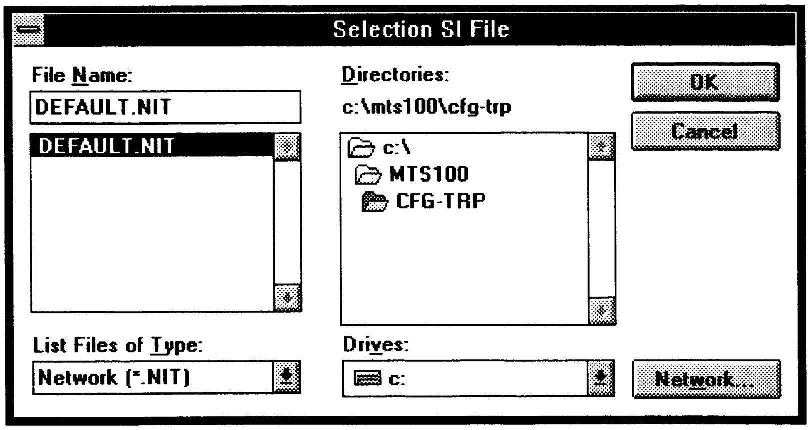


Figure 2–118: Selecting the default NIT file

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.
15. Click OK to complete the file selection.
16. Click Browse in the SDT File section of the DVB Files Selection window.
17. Select default.SDT in the Selection SI File dialog box.
18. Click OK to complete the file selection.

    You will see a warning (see Figure 2–119). This problem will be addressed later in the tutorial.

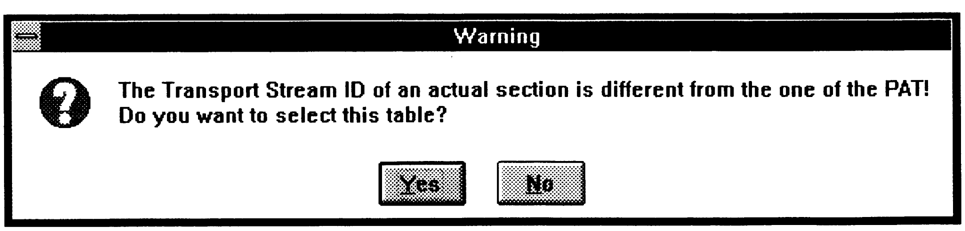


Figure 2–119: Warning that the transport steam ID doesn't match the PAT value

19. Click Yes to continue.
20. Click Browse in the EIT File section of the DVB Files Selection window.
21. Select default.EIT in the Selection SI File dialog box.

22. Click OK to complete the file selection.

    You will see a warning (see Figure 2–119). As with the SDT warning, this problem will be addressed later in the tutorial.

23. Click Yes to continue.

24. In the DVB Files Selection dialog box, click OK.

    The hierarchic view now looks like Figure 2–120.

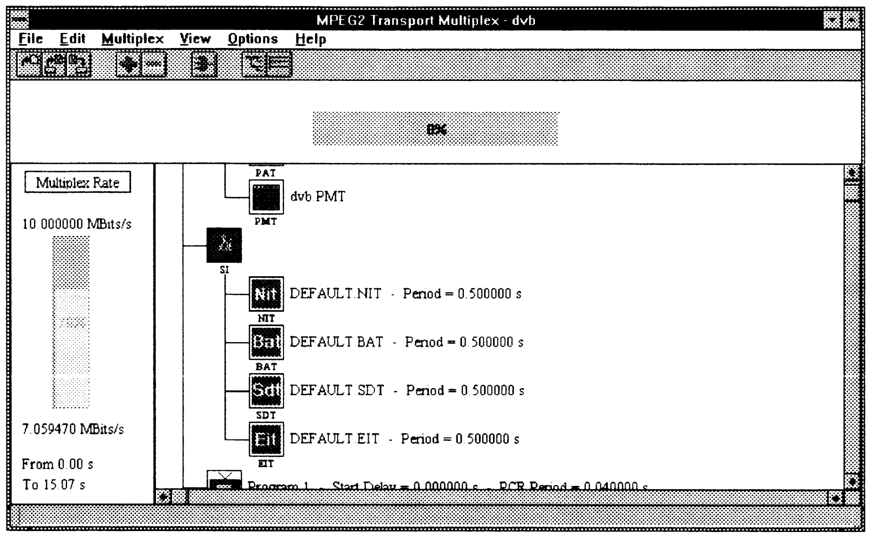


Figure 2–120: Hierarchic view after adding DVB files

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

25. Double-click on the NIT icon. This displays the NIT dialog box (see Figure 2–121).

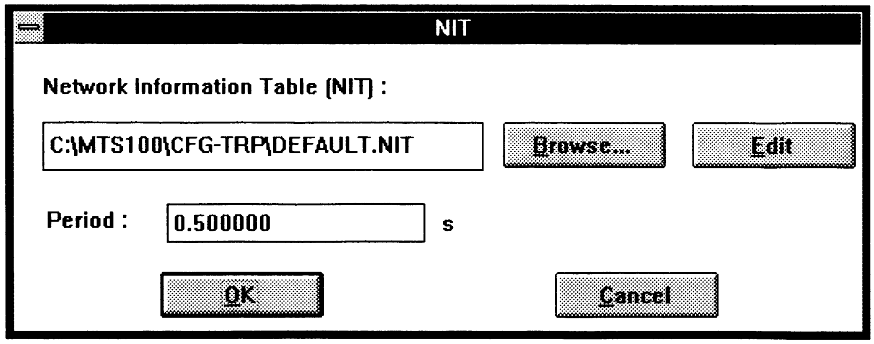


Figure 2–121: The NIT dialog box

26. Click Edit in the NIT dialog box. This starts the Table Editor application (see Figure 2–122).

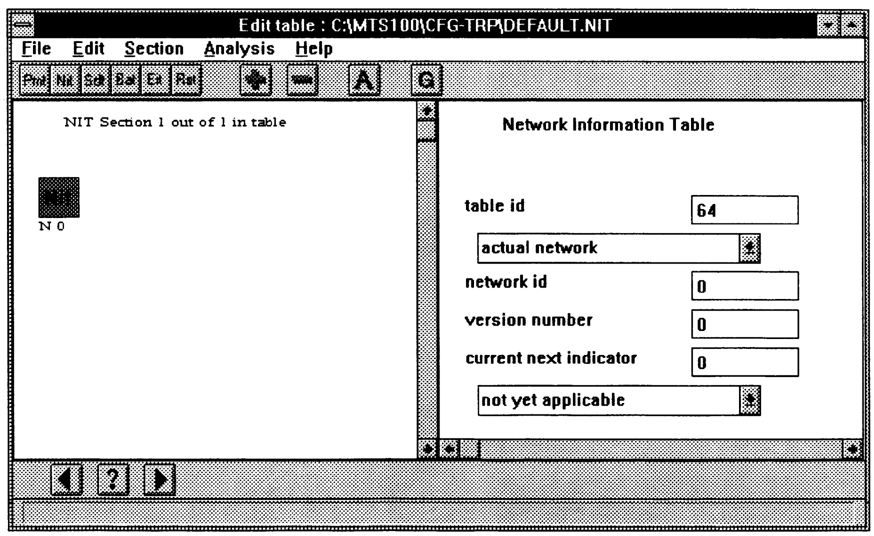


Figure 2–122: The Table Editor with the NIT file loaded

27. Select Coherence from the Analysis menu or the A button on the button bar. This will run an analysis of the NIT. A message window will appear, displaying the problems found in the table (see Figure 2–123).

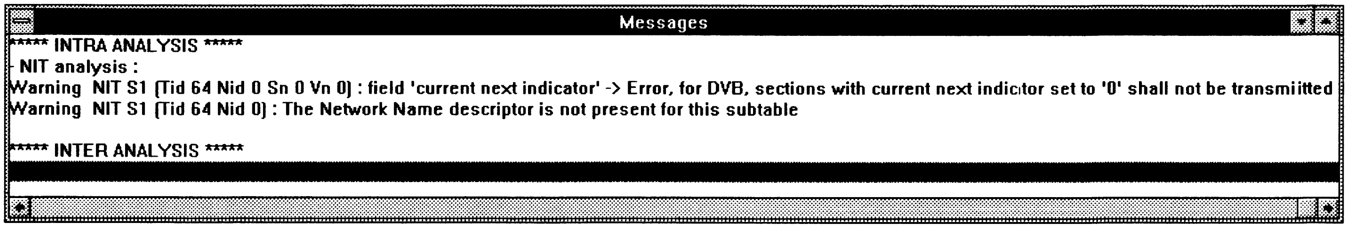


Figure 2–123: NIT analysis messages

28. To display the section of the NIT where the first problem occurs, double-click directly on the first warning.

    Double-clicking on a warning or error message in the Messages window will always display the section of the table where the problem can be corrected in the Edit window (the right side) of the Table Editor. In this case, because the problem is corrected in the NIT rather than in additional elements such as a descriptor, the Edit window doesn't change (see Figure 2–124).

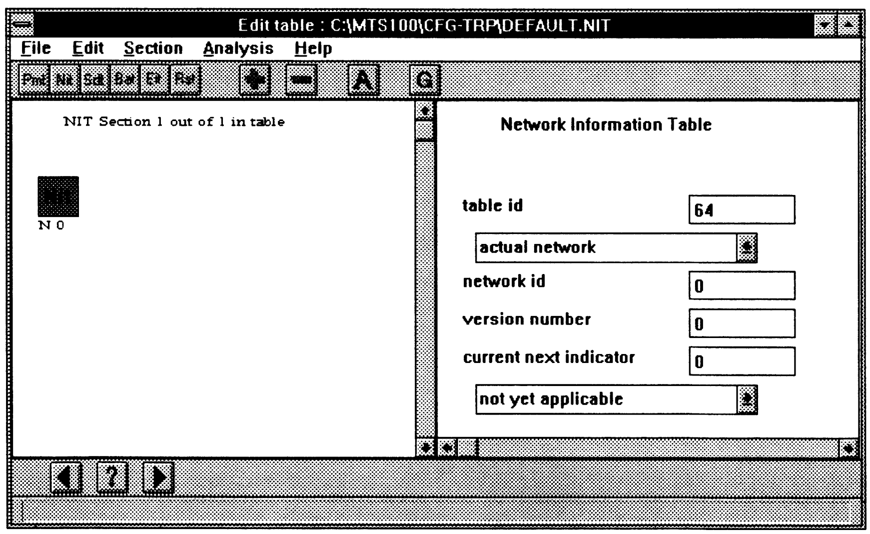


Figure 2–124: The Table Editor with the NIT file loaded

29. Select "currently applicable" from the current next indicator drop-down list (see Figure 2–125).

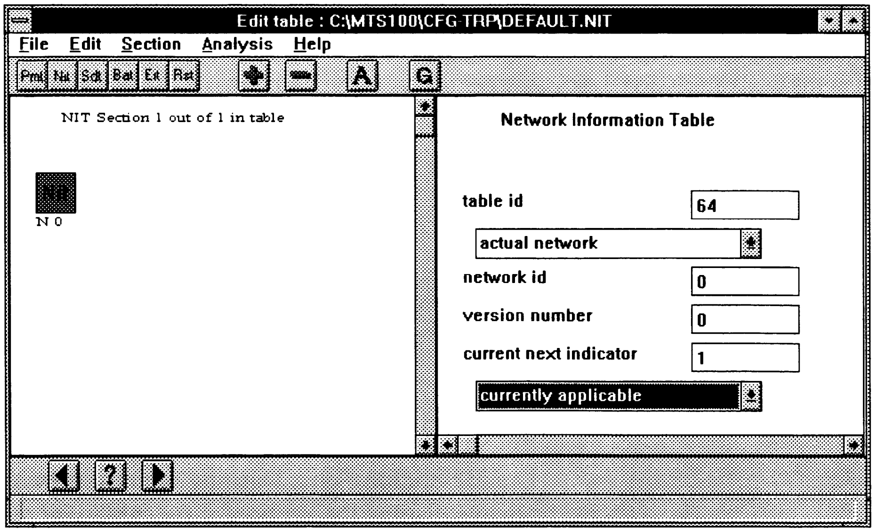


Figure 2–125: Correcting the current next indicator

30. Select Coherence from the Analysis menu or the A button on the button bar. This runs the analysis again. Note that when the Messages window appears, there is only one warning.

31. Double-click on the remaining warning. To clear this problem, you must add a descriptor that contains the network name.

32. Select the NIT icon.

33. Choose Add from the Edit menu or + from the button bar. This displays the Add dialog box (see Figure 2–126).

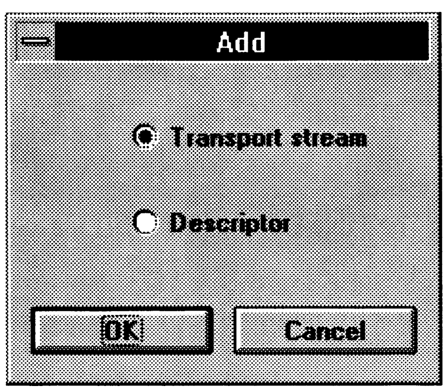


Figure 2–126: The Add dialog box

34. Select Descriptor and click on OK. This displays the Descriptors Selection dialog box shown in Figure 2–127.

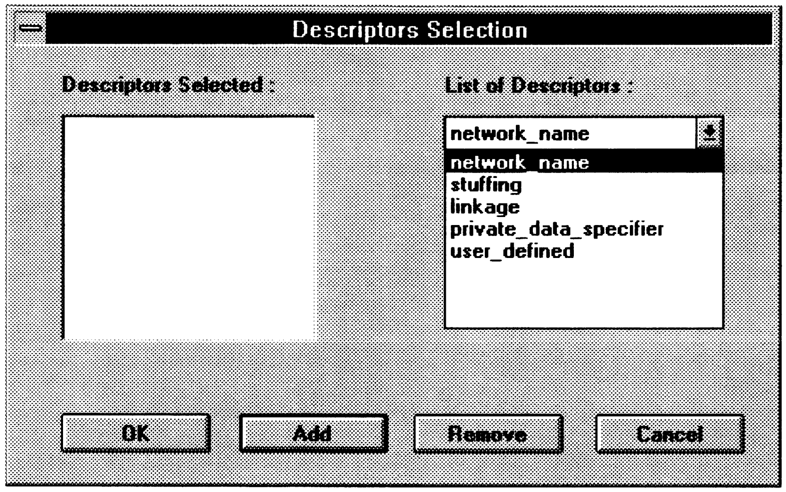


Figure 2–127: Adding a Descriptor

35. Select network_name from the drop-down list.

36. Click on Add.

37. Click on OK to complete the descriptor selection. This results in the display shown in Figure 2–128.

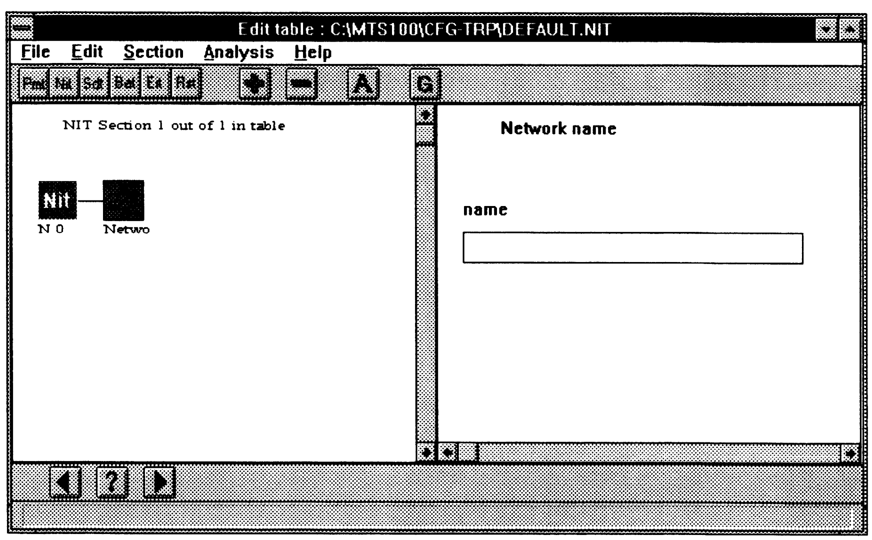


Figure 2–128: The display after adding the Network_name descriptor

38. Click on the “Netwo” descriptor icon.

39. Type Tektronix in the name text box.

40. Select Save As from the File menu.

NOTE. *You should not change the DEFAULT.NIT file. It is provided to save you time if you use it as a starting point for creating new NIT files.*

---

41. Type dvb.NIT for the file name and click on OK.

42. Select Exit from the File menu. This returns you to the NIT window.

43. From the NIT window, select Browse.

44. Select dvb.NIT and click on OK.

45. Click on OK in the NIT window.

    This changes the NIT file associated with the dvb.cfg file to dvb.NIT. See Figure 2–129.

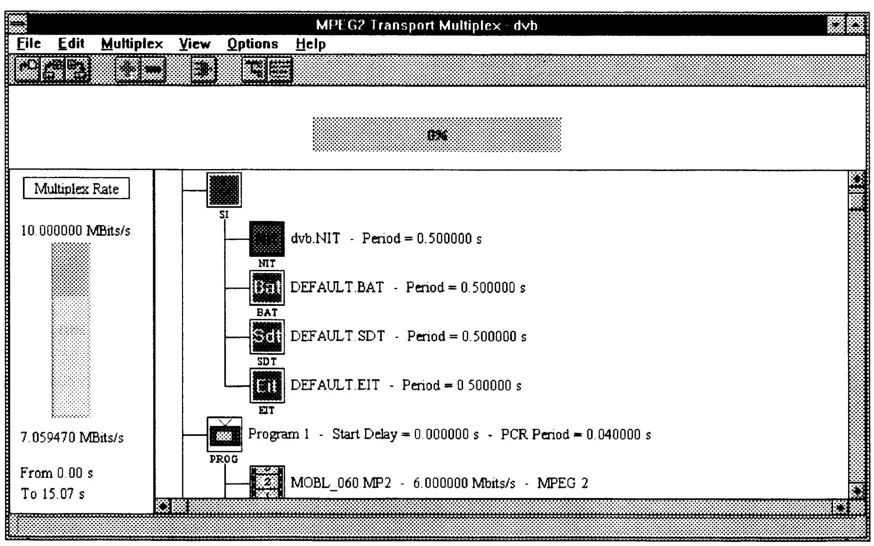


Figure 2–129: The display after changing the NIT file

Next you will edit the Bouquet Association Table (BAT).

46. Double-click on the BAT icon. This displays the BAT dialog box (see Figure 2–130).

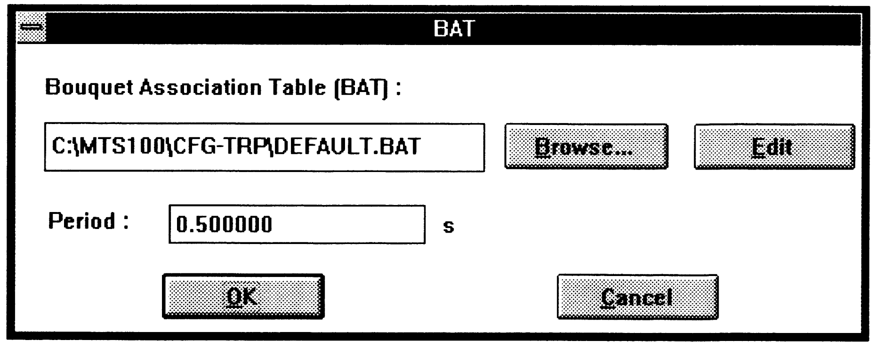


Figure 2–130: The BAT dialog box

47. Click Edit in the BAT dialog box. This starts the Table Editor application (see Figure 2–131).

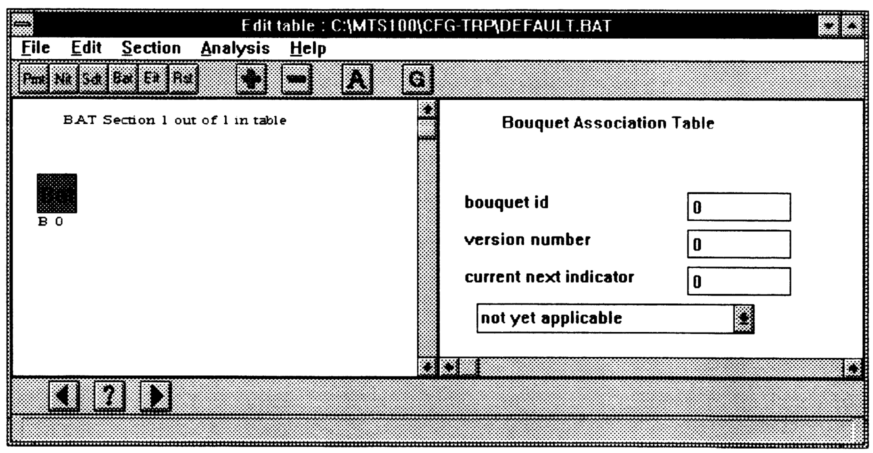


Figure 2–131: The Table Editor with the BAT file loaded

48. Select Coherence from the Analysis menu or the A button on the button bar to run an analysis of the BAT. A message window will appear, displaying the problems found in the table (see Figure 2–132).

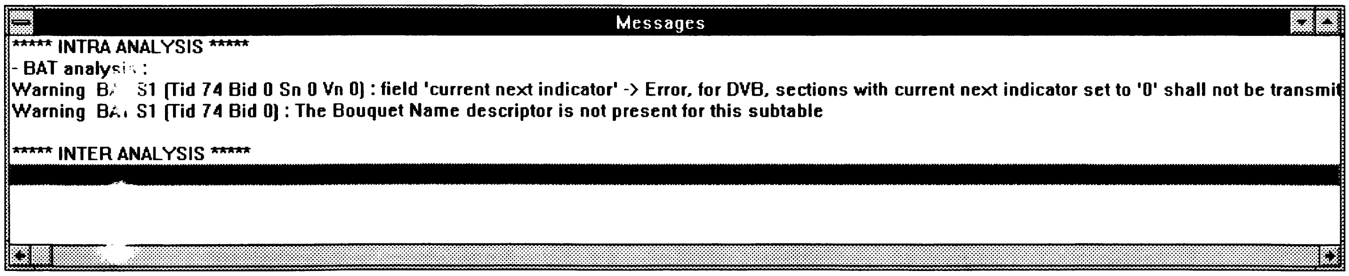


Figure 2–132: BAT analysis messages

49. To display the section of the BAT where the first problem occurs, double-click directly on the first warning.

In this case, as with the NIT, because the problem is corrected in the NIT subtable rather than in additional elements such as a descriptor, the Edit window of the Table Editor doesn't change (see Figure 2–133).

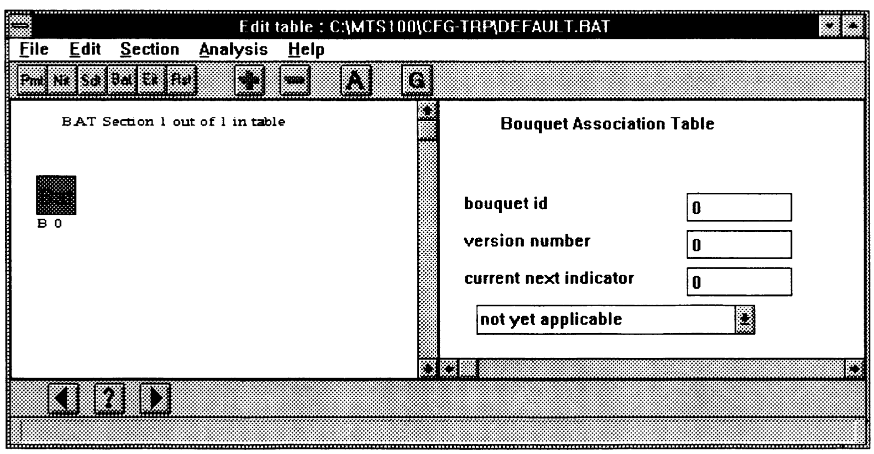


Figure 2–133: The Table Editor with the BAT file loaded

50. 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.

51. Choose Add from the Edit menu or + from the button bar. This displays the Add dialog box. See Figure 2–134.

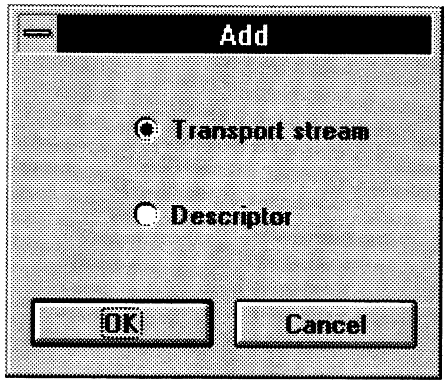


Figure 2–134: The Add dialog box

52. Select Descriptor and click on OK. This displays the Descriptors Selection dialog box shown in Figure 2–135.

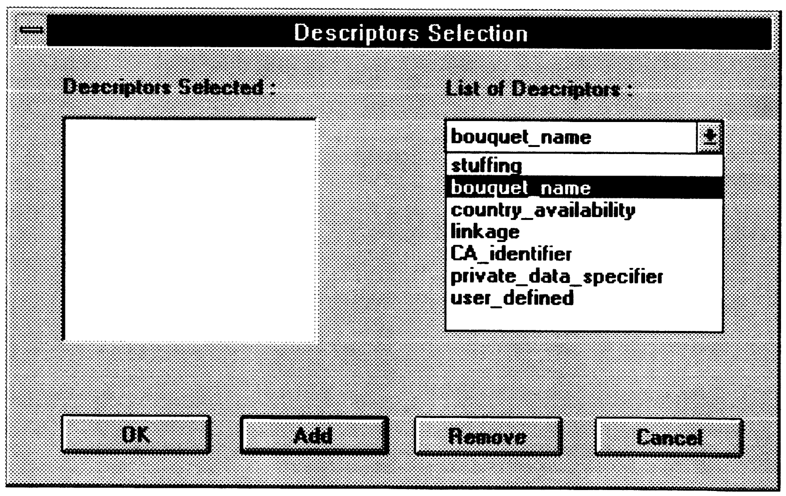


Figure 2–135: Adding the bouquet_name Descriptor

53. Select bouquet_name from the drop-down list.

54. Click on Add.

55. Click on OK to complete the descriptor selection.

56. Select Coherence from the Analysis menu or the A button on the button bar. Note that there are no more warnings.

57. Select Save As from the File menu.

NOTE. *You should not change the DEFAULT.BAT file. It is provided to save you time if you use it as a starting point for creating new BAT files.*

58. Type dvb.BAT for the file name and click on OK. See Figure 2–136.

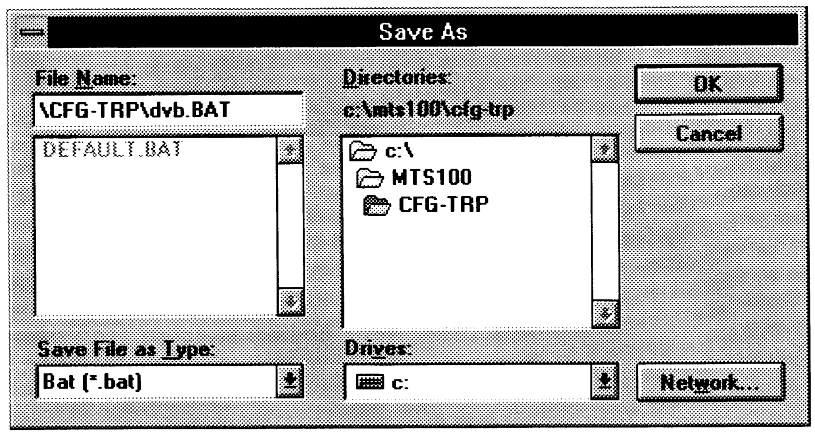


Figure 2–136: Saving the dvb.BAT file

59. Select Exit from the File menu. This returns you to the BAT window.

60. From the BAT window, select Browse.

61. Select dvb.BAT and click on OK. See Figure 2–137.

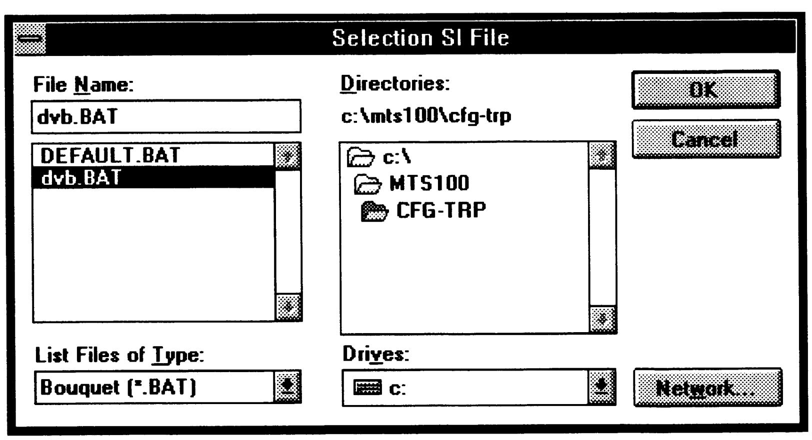


Figure 2–137: Selecting the dvb.BAT file

62. Click on OK in the BAT window.

This changes the BAT file associated with the dvb.cfg file to dvb.BAT. See Figure 2–138.

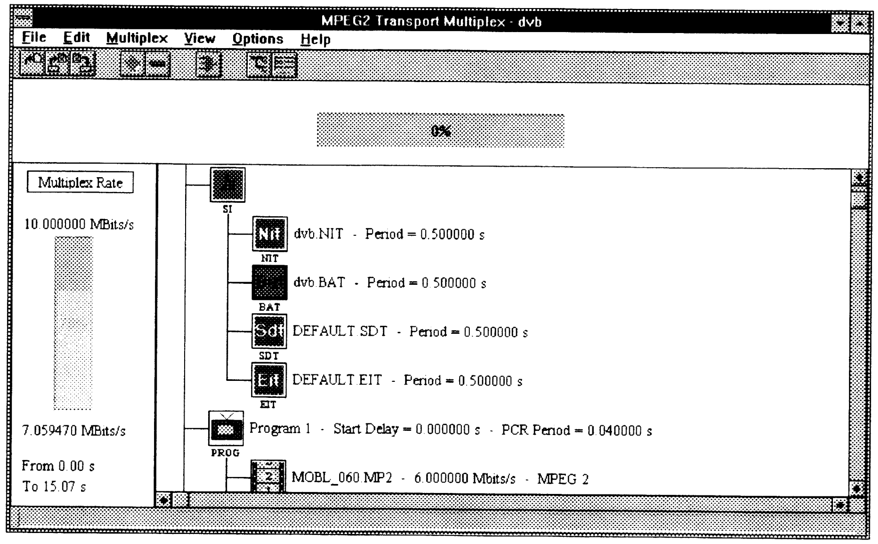


Figure 2–138: The display after changing the BAT file

63. Double-click on the SDT icon. This displays the SDT dialog box.

64. Click Edit in the SDT dialog box. This starts the Table Editor application (see Figure 2–139).

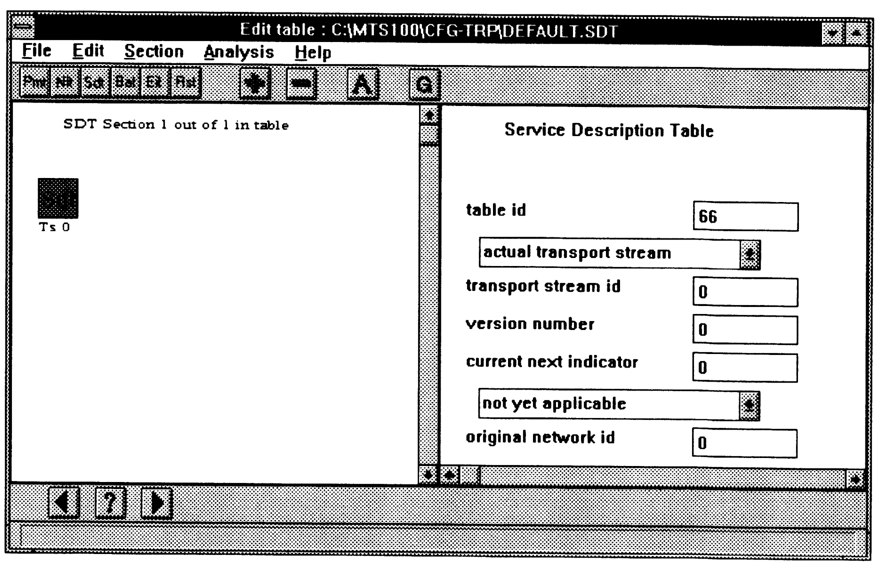


Figure 2–139: The Table Editor with the SDT file loaded

65. Select Coherence from the Analysis menu or the A button on the button bar to run an analysis of the SDT. A message window will appear, displaying the problems found in the table (see Figure 2–140).

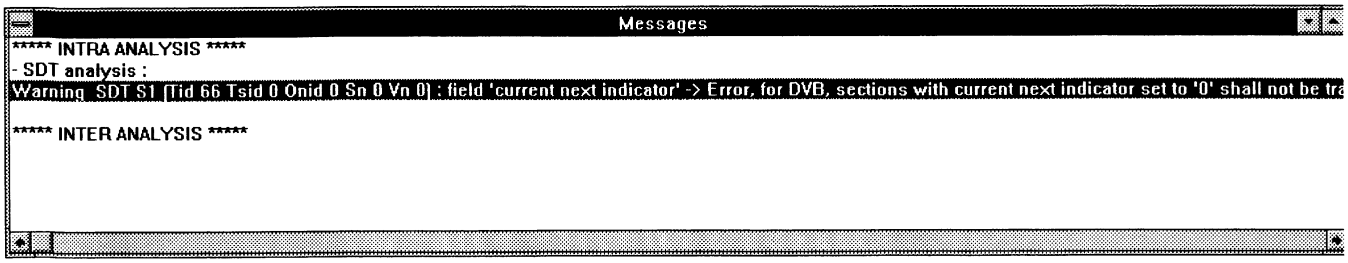


Figure 2–140: SDT analysis messages

66. To display the section of the SDT where the problem occurs, double-click directly on the warning.

67. Select “currently applicable” from the current next indicator drop-down list. See Figure 2–141.

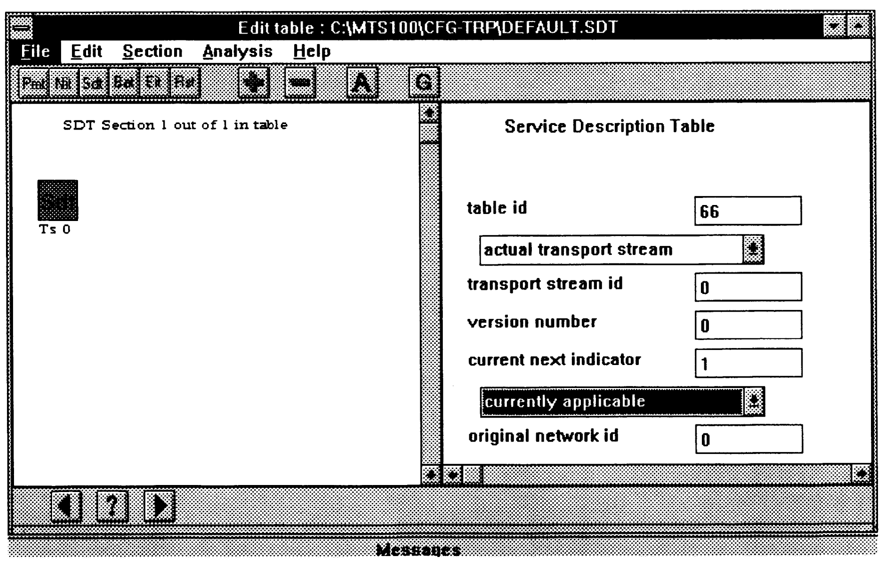


Figure 2–141: The Table Editor with the SDT error fixed

68. Select Coherence from the Analysis menu or the A button on the button bar. Note that there are no more warnings.

Remember when you first selected this file from the DVB Files Selection window and you received an error message? That message said that the transport stream ID in the SDT file did not match the value of the transport stream ID in the PAT. You will now correct that error. Refer to Figure 2–142. Note that the value of the Transport Stream ID is 1.

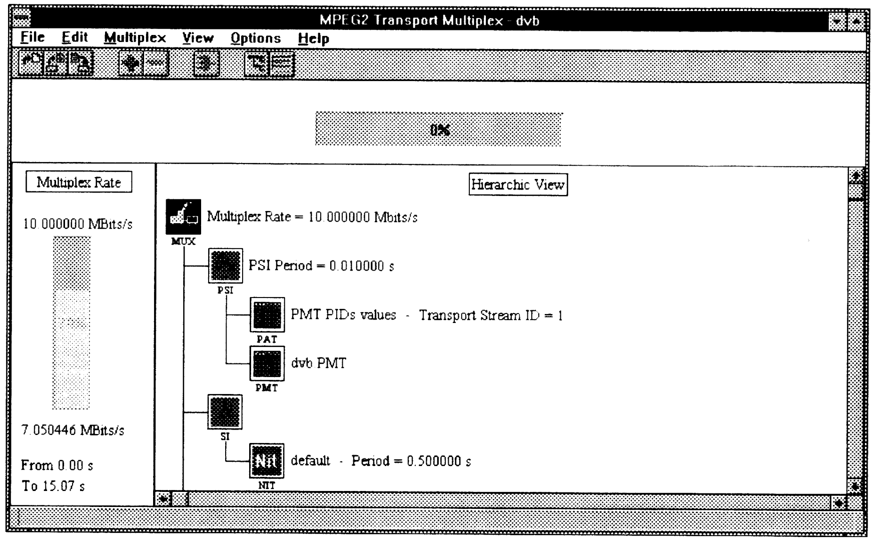


Figure 2–142: The Transport Stream ID is next to the PAT icon

69. Enter 1 in the Transport Stream ID text box.

If you did not correct this problem now, you would get an error message when you exited the Table Editor reminding you that the Transport Stream ID did not match the one in the PAT.

This kind of problem does not show up when you analyze a file by itself. If you changed the display in the Table Editor to the Global View, which shows the relationships between the various DVB files, and then ran an analysis, this problem would be uncovered. We will not cover the Global View in this tutorial. For more information on the Global View, see *Using the Table Editor* on page 3–105.

70. Select Save As from the File menu.

71. Type dvb.SDT for the file name and click on OK. See Figure 2–143.

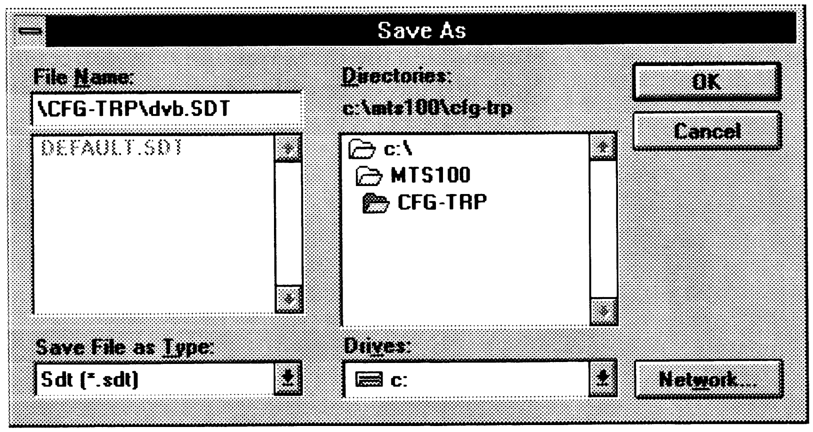


Figure 2–143: Saving the dvb.SDT file

72. Select Exit from the File menu. This returns you to the SDT window.
73. From the SDT window, select Browse.
74. Select dvb.SDT and click on OK.
75. Click on OK in the SDT window.

    This changes the SDT file associated with the dvb.cfg file to dvb.SDT.

You will now edit the EIT file.

76. Double-click on the EIT icon. This displays the EIT dialog box.
77. Click Edit in the EIT dialog box. This starts the Table Editor application (see Figure 2–144).

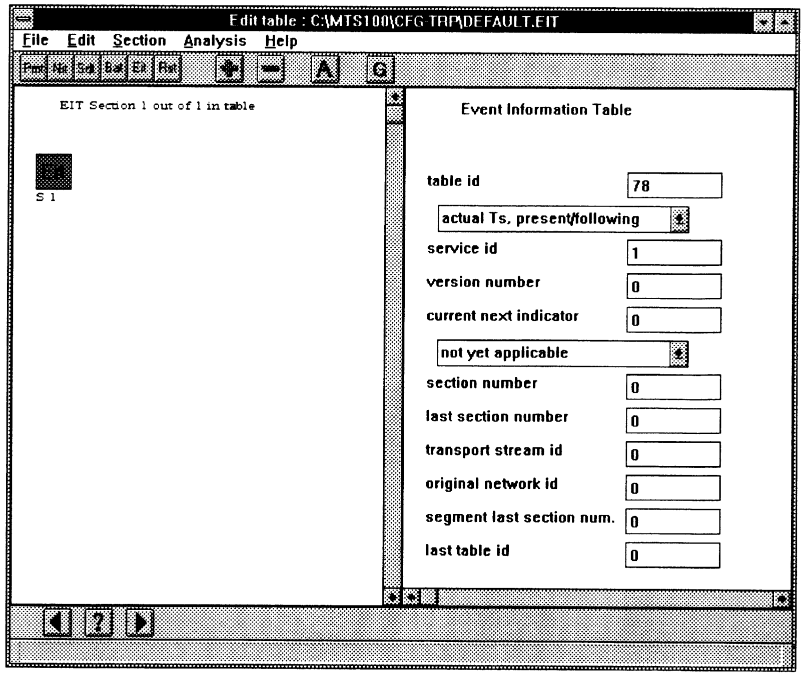


Figure 2–144: The Table Editor with the EIT file loaded

78. Select Coherence from the Analysis menu or the A button on the button bar to run the Coherence analysis. A message window will appear displaying the problems found (see Figure 2–145).

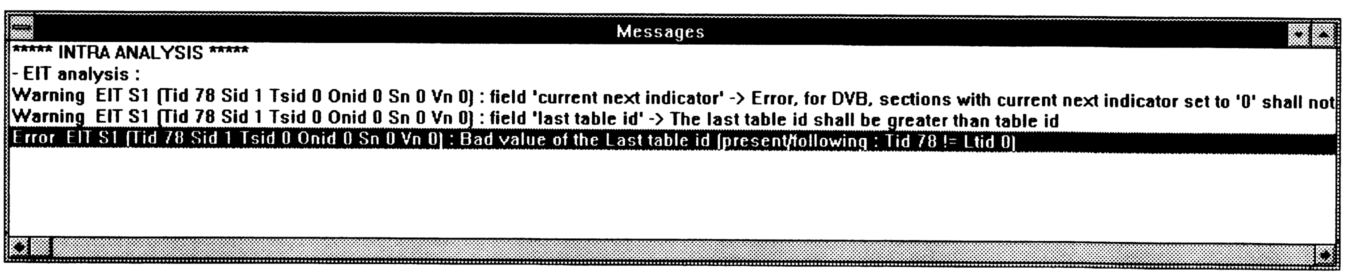


Figure 2–145: EIT analysis messages

79. To display the section of the EIT where the first problem occurs, double-click directly on the warning.

80. Select “currently applicable” from the current next indicator drop-down list.

81. Double-click the second warning in the Messages dialog box.

82. Enter 78 in the “last table id” text box.

83. Select Coherence from the Analysis menu or the A button on the button bar to run the Coherence analysis again. See Figure 2–146.

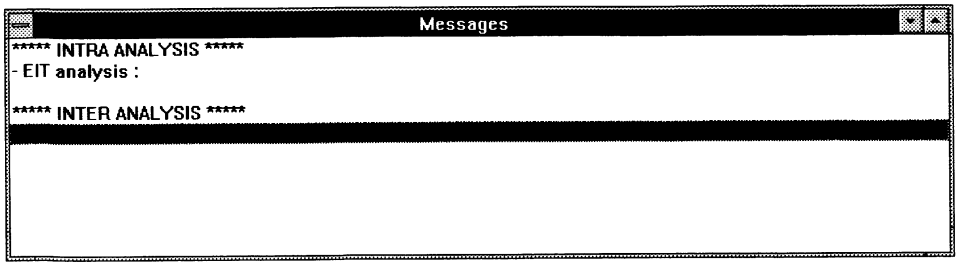


Figure 2–146: EIT analysis after fixing the problems

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.

84. Enter 1 in the Transport Stream ID text box.

85. Select Save As from the File menu.

86. Type dvb.EIT for the file name and click on OK. See Figure 2–147.

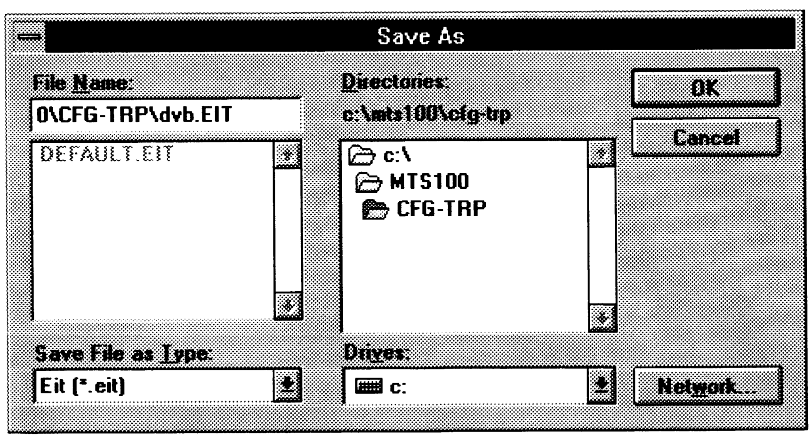


Figure 2–147: Saving the dvb.EIT file

87. Select Exit from the File menu. This returns you to the EIT window.

88. From the EIT window, select Browse.

89. Select dvb.EIT and click on OK. See Figure 2–148.

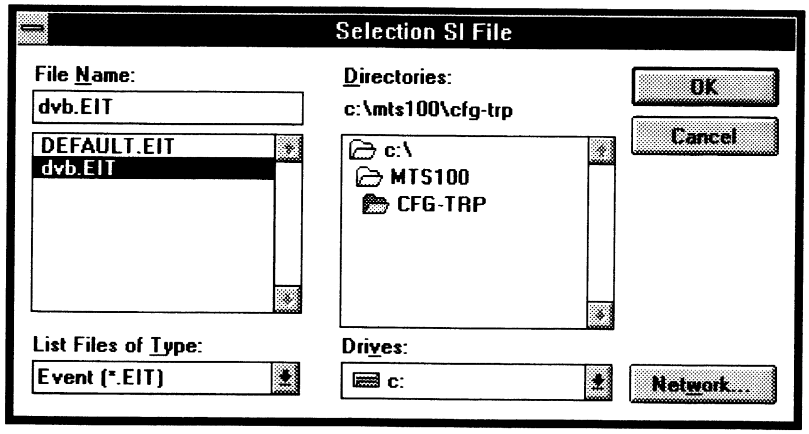


Figure 2–148: Selecting the dvb.EIT file

90. Click on OK in the EIT window.

    This changes the EIT file associated with the dvb.cfg file to dvb.EIT.

    The hierarchic view now looks like Figure 2–149.

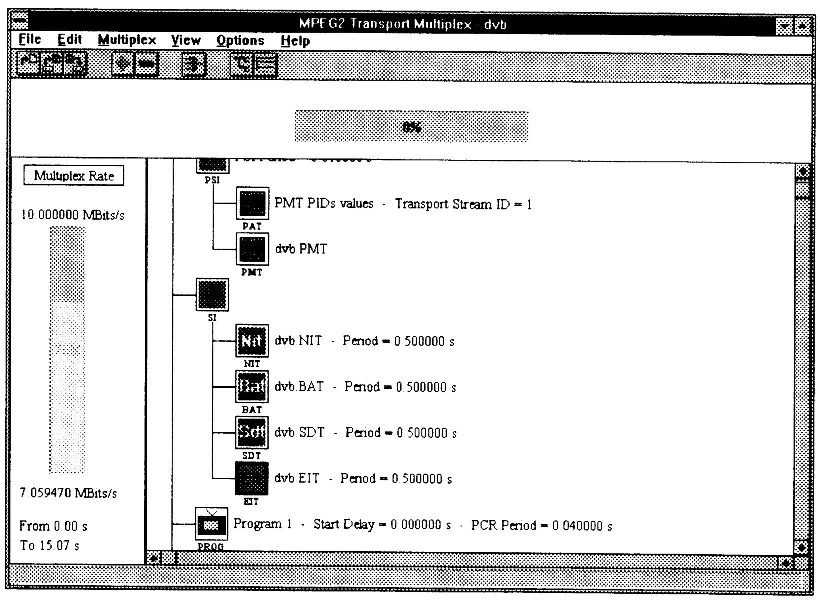


Figure 2–149: Hierarchic view after editing the DVB files

91. Double-click on the SI icon to bring up the DVB File Selection dialog box. See Figure 2–150.

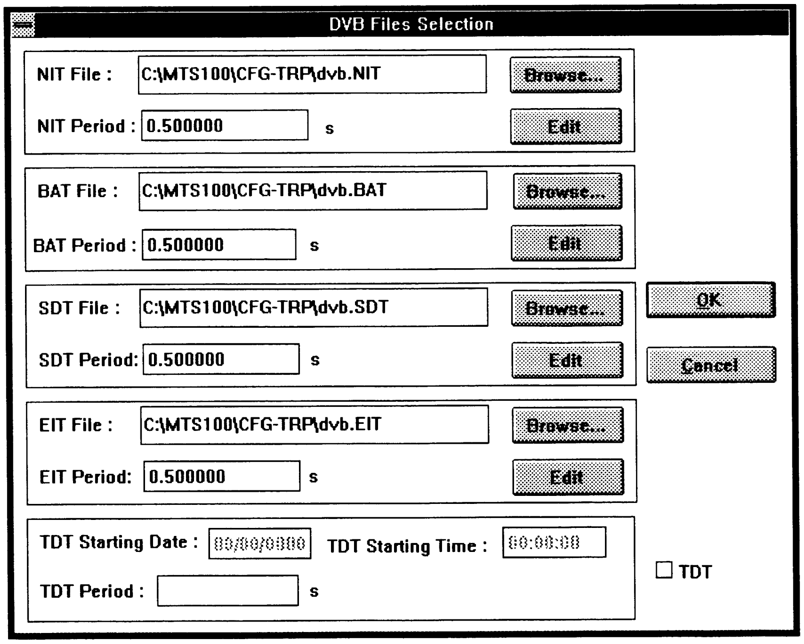


Figure 2–150: The DVB Files Selection dialog box

From this dialog box you can directly enter the Time and Date Table (TDT) information. Note that the values for the TDT Starting Date and TDT Starting Time are grayed. This means they cannot be edited.

92. Click on the TDT option box in the lower-right corner of the DVB Files Selection dialog box.

Note the starting date and starting time values are now black, meaning they are now editable.

93. Enter 10/18/1996 into the TDT Starting Date text box.

94. Enter 01:00:00 in the TDT Starting Time text box.

The TDT Period specifies how often the time and date stamp is placed into the transport stream.

95. Enter 0.1 in the TDT Period text box. See Figure 2–151.

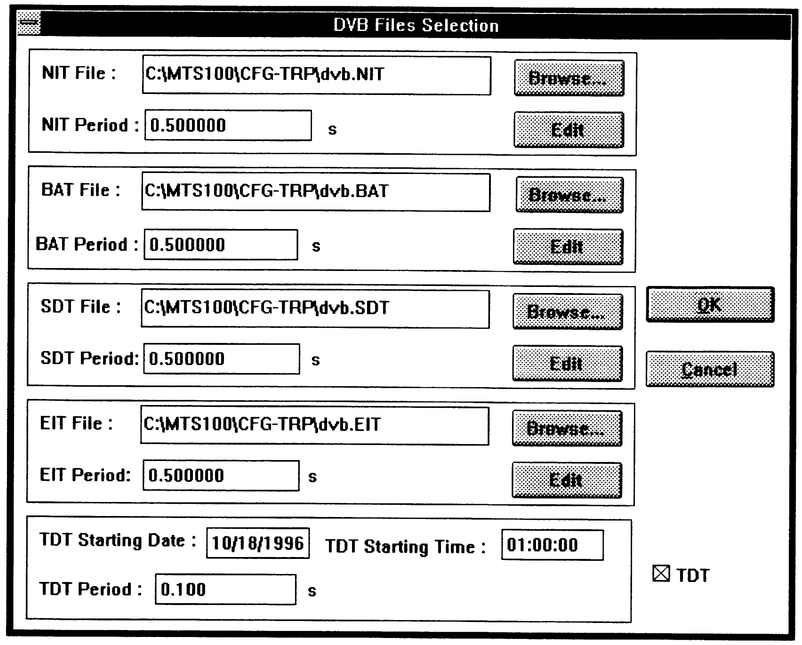


Figure 2–151: Entering TDT information

96. Click on OK.

Note that the Hierarchic view now shows a TDT icon. See Figure 2–152.

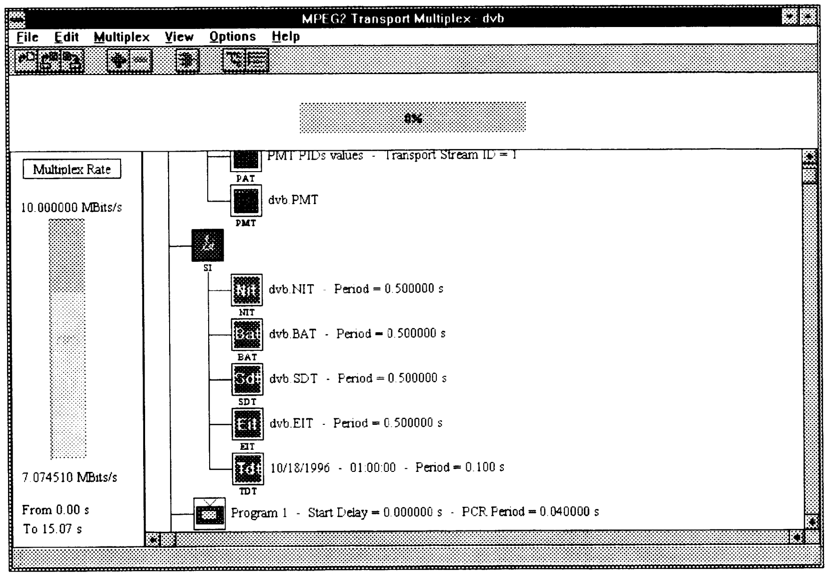


Figure 2–152: Hierarchic view after entering the TDT values

This concludes the tutorial on how to create an MPEG-2 transport stream file with DVB information.

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.

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

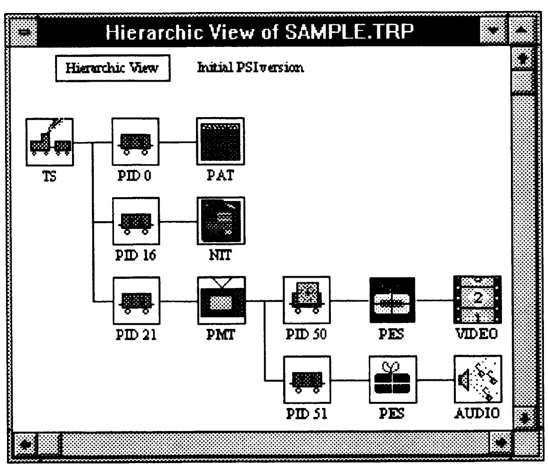
Finally, the analyzer gives you the ability to extract information from the binary stream and save it to a file for later use or analysis. This information includes the following:

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

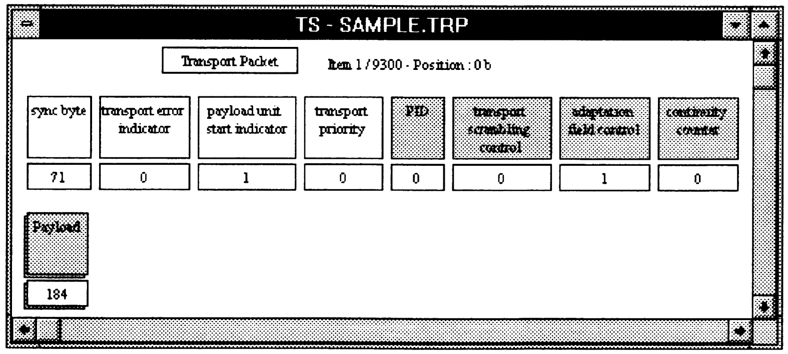
Terms

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.

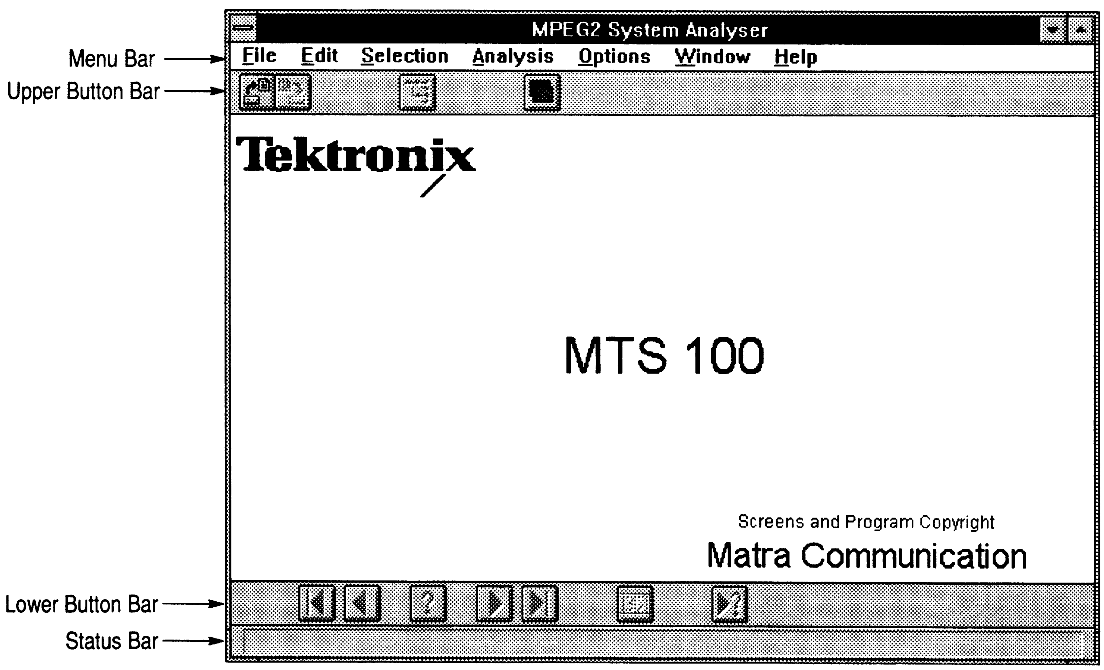


The Interpreted view shows the various fields that make up small sections of the stream—or data (such as tables and elementary stream packets) embedded in it. The interpreted view shown below is of one 188-byte transport packet in the SAMPLE.TRP binary stream; this view can be created by double-clicking on the TS (engine and tender) icon in the Hierarchic view. See *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.

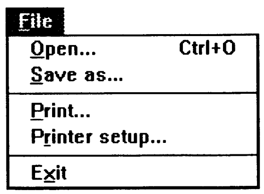


All other Analyzer windows appear within the application window. The menu bar is immediately below the window title and provides access to the various Analyzer commands. The upper button bar, immediately below the menu bar, and the lower button bar, below the application workspace, provide direct access 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

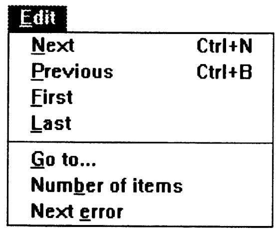
The Menu Bar provides access to the seven main Analyzer menus.

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.

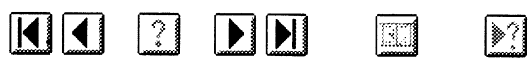


Use	To
Open	Open an existing transport stream, packets, or PSI/SI file.
Save as	Save the current selection to disk
Print	Print the current view
Printer setup	Change printer settings
Exit	Quit the Analyzer application

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 button bar.

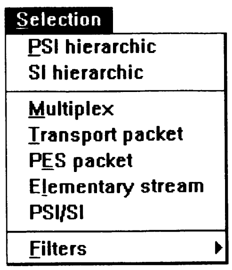


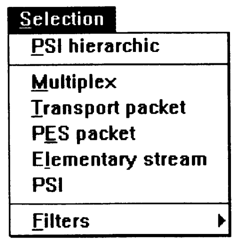
The buttons are shown below. The button commands are, from left to right: First, Previous, Go to, Next, Last, Number of items, and Next error.



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

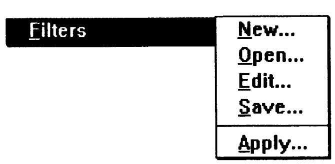
Selection Menu. The Selection menu provides access to several different views of stream data on several different levels.





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

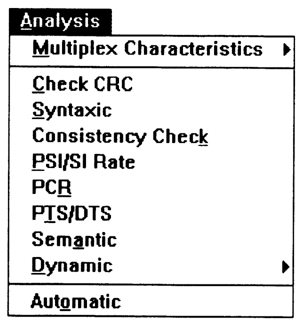
Filters Submenu. The Filters submenu enables extraction of transport stream components or objects that meet user-specified criteria. Refer to *Filters*, beginning on page 3–46, for a complete explanation.



Use	To
New	Create a new filter
Open	Open an existing filter (.flt) file
Edit	Modify a filter

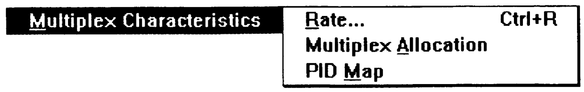
Use	To
Save	Save a filter to a disk (.flt) file
Apply	Apply a filter to the stream represented by the selected hierarchic view

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).



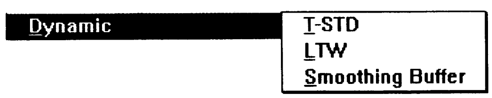
Use	To
Multiplex Characteristics	Open the Multiplex Characteristics submenu
Check CRC	Check CRCs of the various tables in the selected PSI hierarchy (*Check CRCs* begins on page 3–24)
Syntaxic	Check the stream for syntax errors (*Syntax Analysis* begins on page 3–25)
Consistency Check	Check for consistency 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.



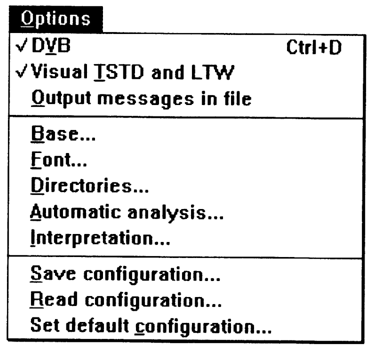
Use	To
Rate	Display the overall multiplex rate as calculated from the first ten PCRs and, if the calculated rate is incorrect, enter the correct value (*Multiplex Rate* begins on page 3–22)
Multiplex Allocation	Display a pie chart of PID allocation in the stream (*Allocation* begins on page 3–23)
PID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



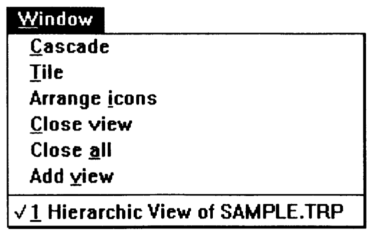
Use	To
T-STD	Conduct a transport stream system target decoder simulation (*T-STD Analysis* begins on page 3–39)
LTW	Check the effect of LTW (legal time window) offset and piecewise rate field values (*LTW Analysis* begins on page 3–43)
Smoothing Buffer	Conduct a smoothing buffer simulation (*Smoothing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

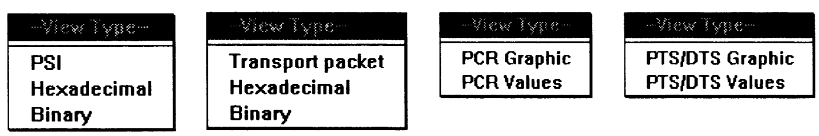


Use	To
DVB	Toggle the DVB option on/off
Visual TSTD and LTW	Toggle the graphic view of TSTD and LTW dynamic analysis on/off
Output messages in file	Toggle output message option on/off
Base	Specify the numeric base (decimal or hexadecimal) used in the interpreted and hierarchic views
Font	Specify the 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.

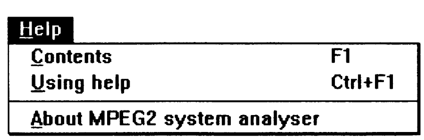


These commands—with the exception of Add view—work as in all Windows applications. Use Add view to create a new window that displays the data of the current window in a different format. A small submenu, like those shown below, appears when you choose Add view.



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

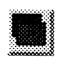
Help Menu.



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 Button Bar

The following table lists the command buttons found on the Upper Button Bar. 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 an edited stream. 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 Button Bar

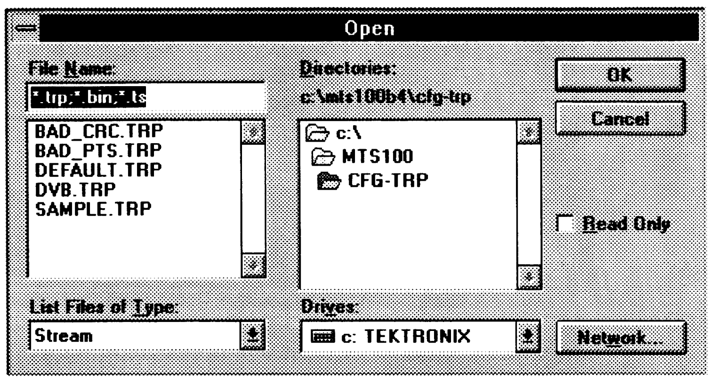
The commands from the Lower Button Bar are only available if the selected document window contains items (stream packets, transport tables, elementary stream packets, PES, PSI table sections, or SI DVB table sections). When the document window does not contain any of these items, these command buttons 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 button bar, 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:\CARBO.
- 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.

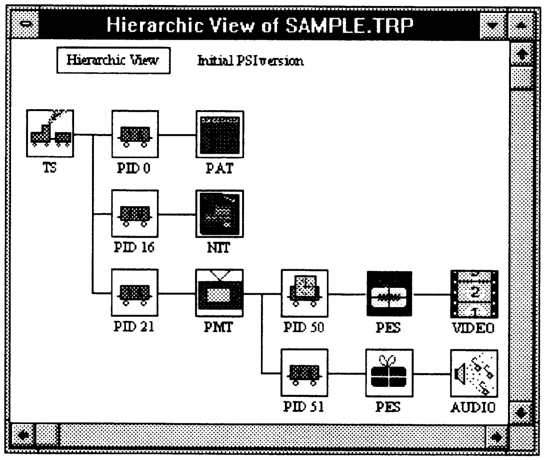
When you open a transport stream file, a PSI hierarchic view appears in the application window. If you open a transport packet, PES, or section file, an interpreted view appears.

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 button bar) 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

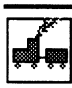
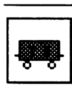
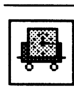
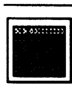
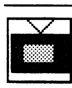
Icon	Element Type
 TS	Multiplex transport packets. This icon represents all (188-byte) transport packets that make up the stream.
	Transport packets of a particular PID (Program ID). Other elements (tables, clocks, PES packets) are the “payload” contained within transport packets or are constructed from 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.)

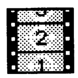
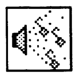
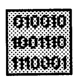
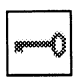
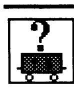
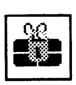
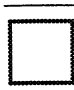
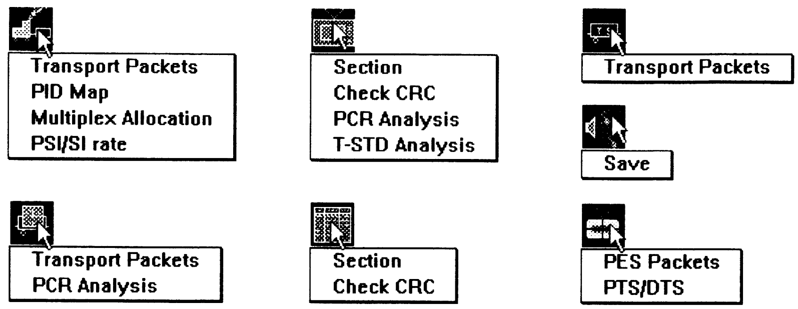
Icon	Element Type
 PES	Packetized Elementary Stream (PES). This icon represents all packets that, together, contain a given elementary stream. Individual PES packets are assembled from the payloads of several transport packets.
 VIDEO	Video elementary stream
 AUDIO	Audio elementary stream
 DATA	Data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

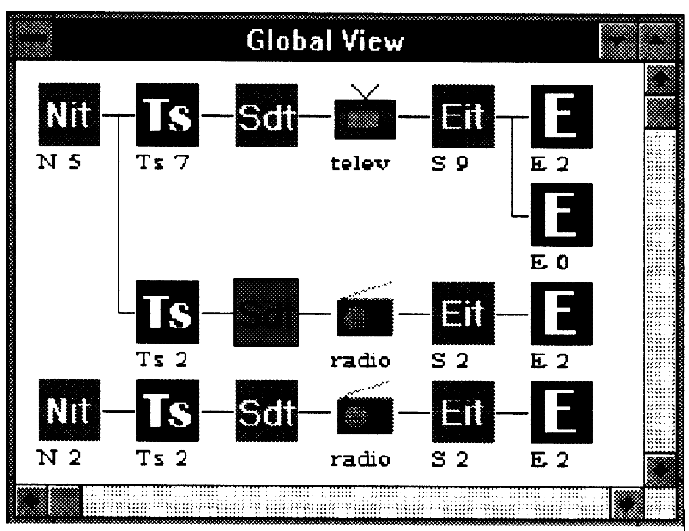
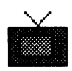
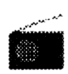


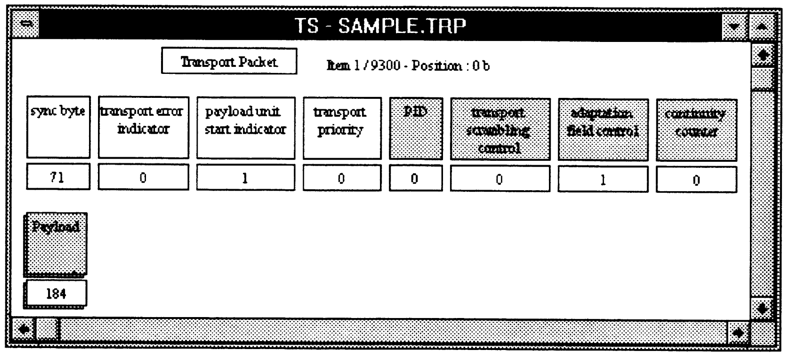
Table 3–3: Icons used in the SI hierarchic view

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.

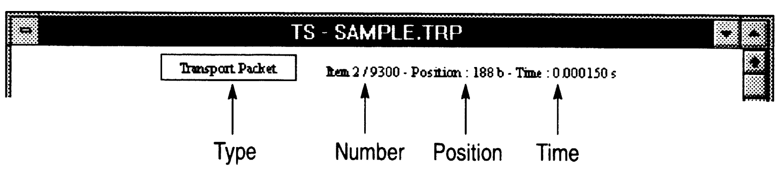
The Interpreted View

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

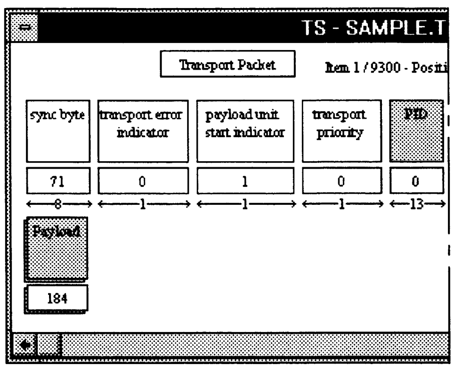
The currently interpreted packet or section is called an "item." Information about the item's relationship to other items and position in the transport stream appears near the top of the interpreted view window.

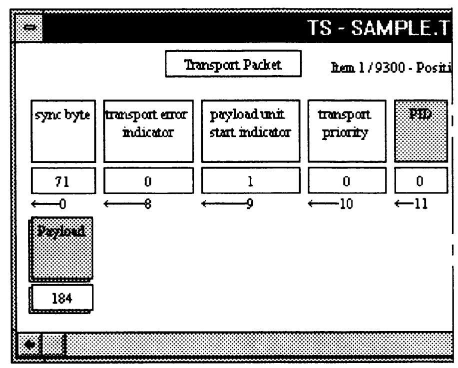


- The item number is the position of the current item relative to all such items in the transport stream. The total number of items (9300 in the example) is displayed if you have used a command button (in the lower button bar) to either go to the last item or count the items in the stream. You can also 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 Button Bar*, 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

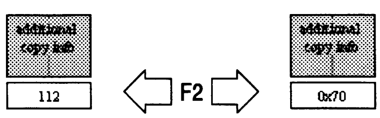
typing CTRL+R. The analyzer also performs the calculation as part of several other analyses, including PCR, PSI/SI rate, PTS/DTS, and Dynamic.

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.

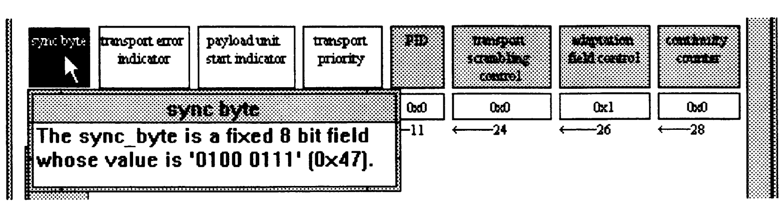




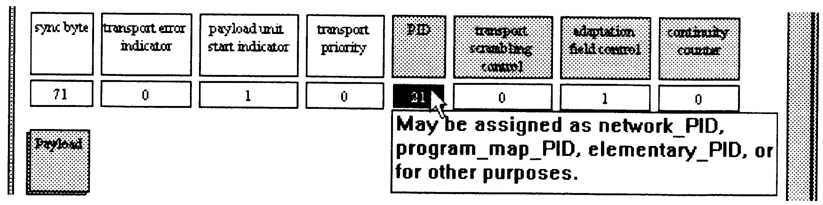
The length of data fields—such as the Payload in the above windows—is always shown (in decimal number of *bytes*) in the value rectangle. Value rectangles of information fields contain the value of the field. To toggle information field values (but not data field lengths) between decimal and hexadecimal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



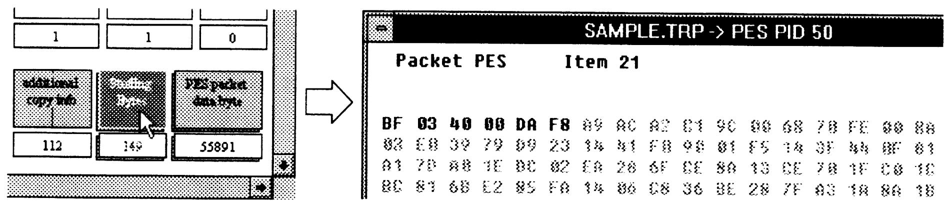
Double-click on the name box for an explanation of a field.



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

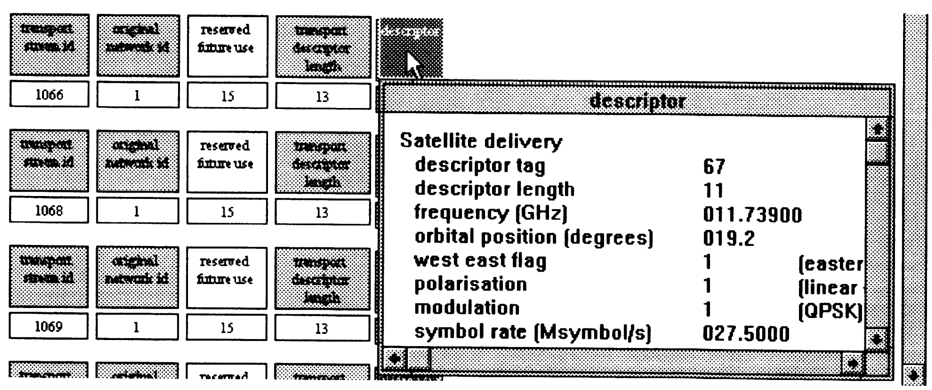


Double-click on a data field name to add a byte-by-byte hexadecimal view of the interpreted section, table, or packet.



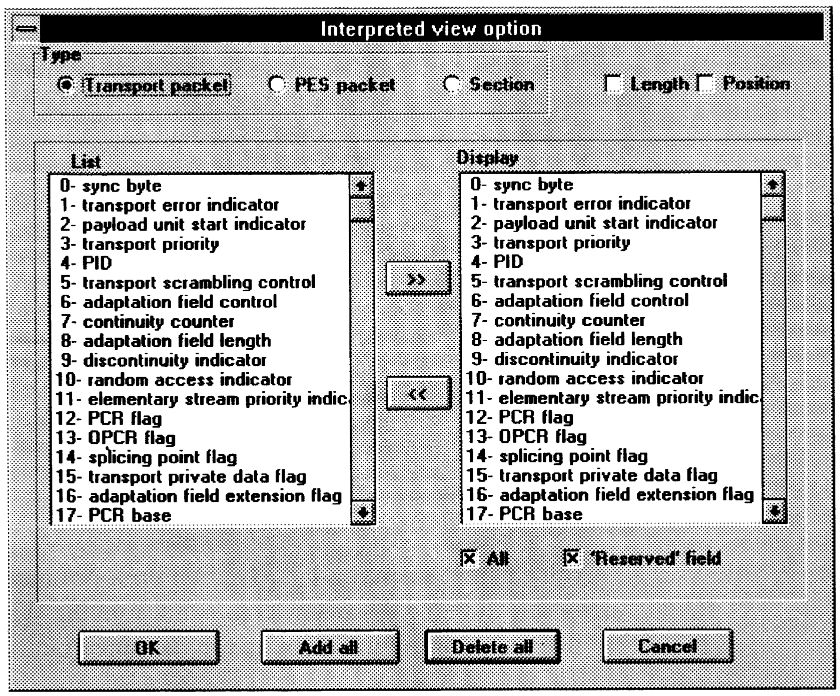
You can also display a hexadecimal view or binary view of any section or packet by selecting the Add view command from the Window menu or by clicking on the Add view command button in the upper button bar.

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.



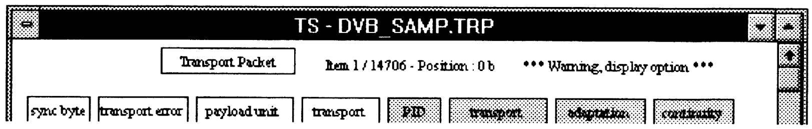
The Length and Position settings, explained on page 3–18, apply to all interpreted views. You can use the remaining controls to determine which fields appear in transport packet, PES packet, or (table) section interpreted views.

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.

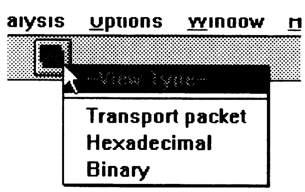
4. When you have made any changes to the displayed fields, ***Warning, display option*** appears at the top of the interpreted view window.



5. To restore the interpreted view to the original "display all fields" 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 button bar) or select the Add view command from the Window menu. A submenu, appropriate to the current item, appears as shown.

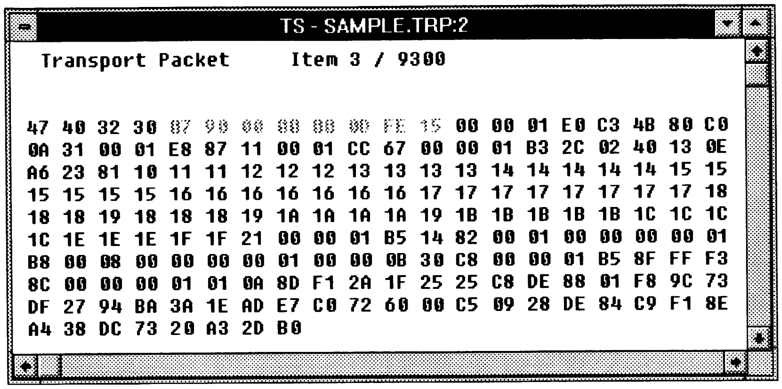


Select the top submenu command (Transport packet in the example) to add a new interpreted view; select Hexadecimal or Binary to view the bytes or bits that are the basis for the interpreted view.

The Hexadecimal View

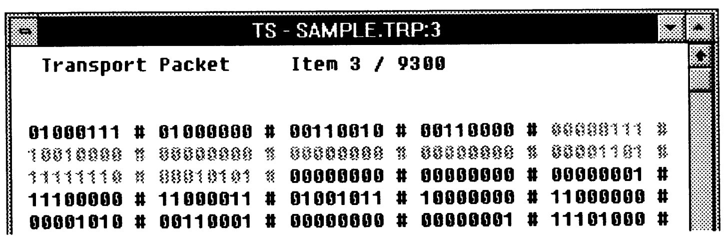
The hexadecimal view shows the contents of the current item on a byte-by-byte basis. The first few bytes appear in blue characters on the PC display to indicate that they are required header information for the type of item. A transport packet has four required bytes; a PES packet has six. The blue, required bytes may be followed by several bytes shown in gray. These "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.

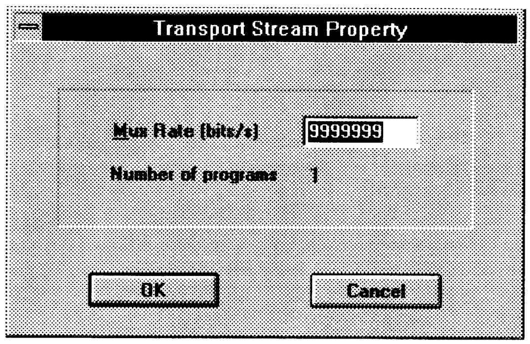


Multiplex Analyses

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.

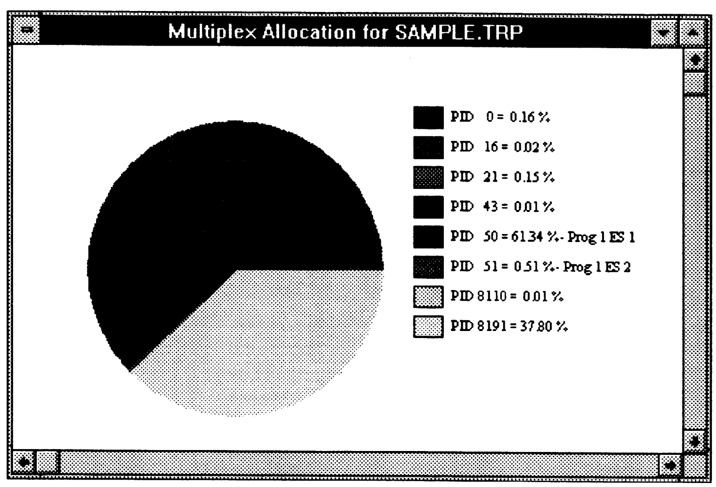


The analyzer calculates the multiplex rate from the first ten PCRs found in the transport stream. Because the sample is small and the precision of the number is high, there can be error in the calculation. To ensure maximum accuracy of analyses that use the multiplex rate to calculate results and detect 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.

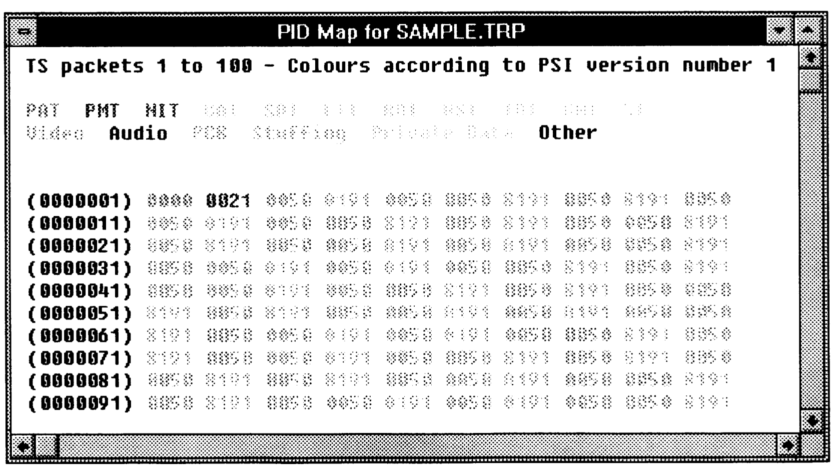


- The percentages shown in the graph key are calculated by dividing the actual number of transport packets of a given PID by the total number of packets in the transport stream file.
- All PIDs found in the transport stream are represented; those that are not referenced in a PAT or PMT will appear in 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.

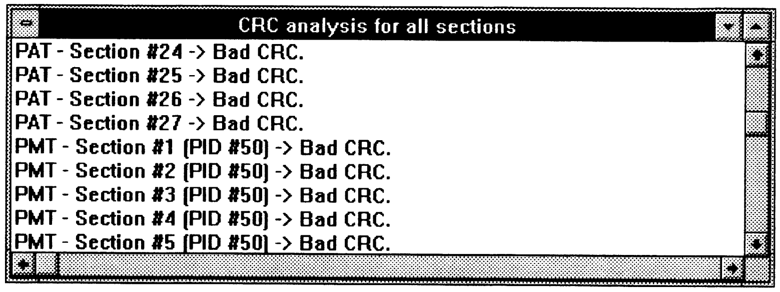
To open a PID map of transport stream file, select the hierarchic view and then choose PID Map from the Multiplex Characteristics submenu. A window containing a PID map of the first 100 packets appears in the application window. Use either the Edit menu commands or the command buttons in the lower button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

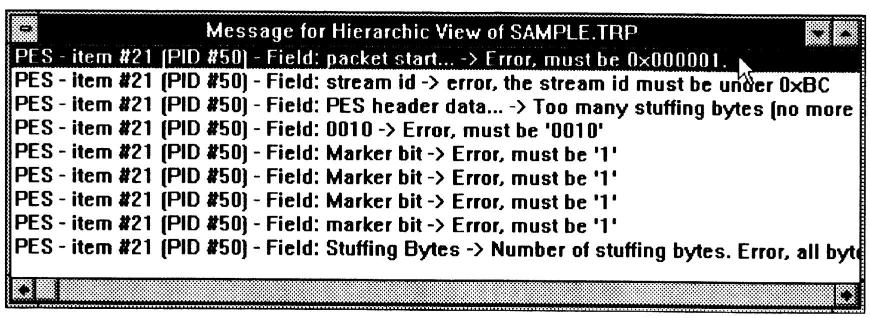
The analyzer automatically calculates and compares (checks) the CRC of the first PAT section when opening a transport stream file. To check all CRCs in a transport stream, select the stream's PSI hierarchic view and then choose the Check CRC command of the Analysis menu. If the analyzer finds CRC errors,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



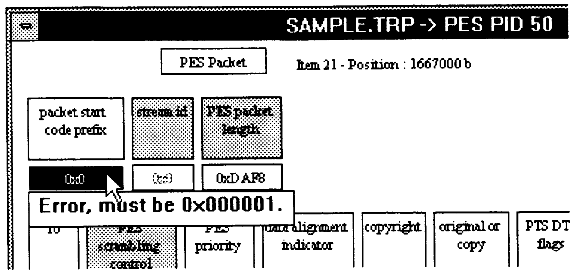
Double-click on a line to open an interpreted view of the table section that contains the particular CRC error. The CRC field value is displayed in red characters in the interpreted view to draw your attention to the error.

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.

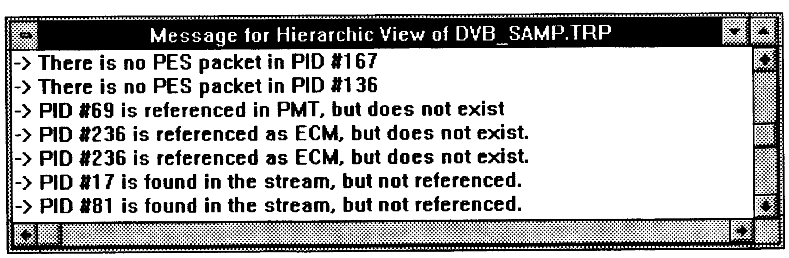
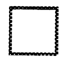
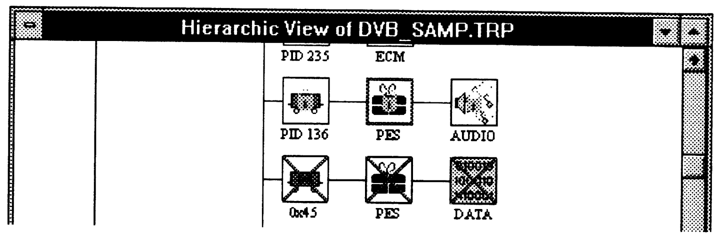
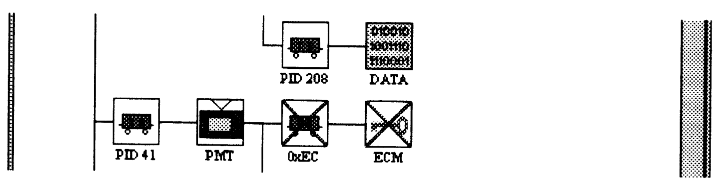


Table 3–4: PSI consistency error symbols

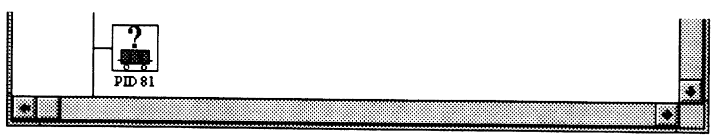
Symbol	Significance
	A red square (border) surrounding a base icon indicates that the data does not match the stream type declared in a PSI table.
	A red "X" over a base icon indicates that a specific PID, declared in a PSI table, cannot be found in the transport stream.
	The question mark is added to 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.

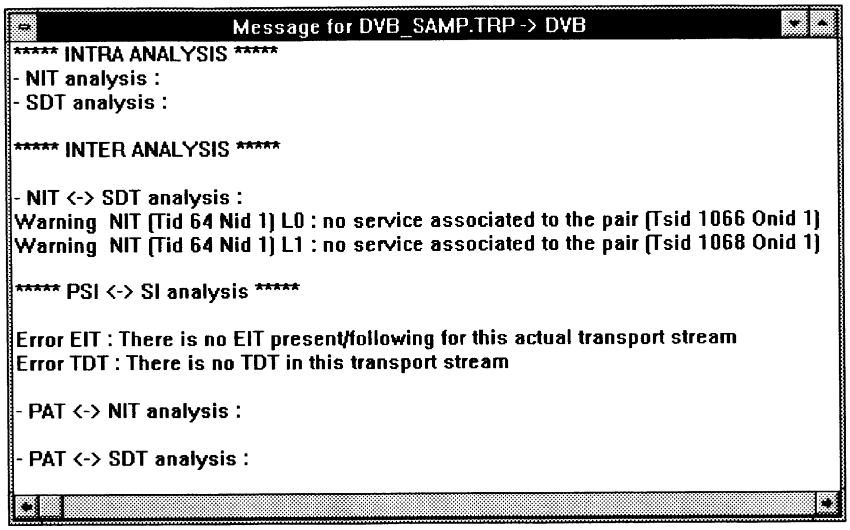
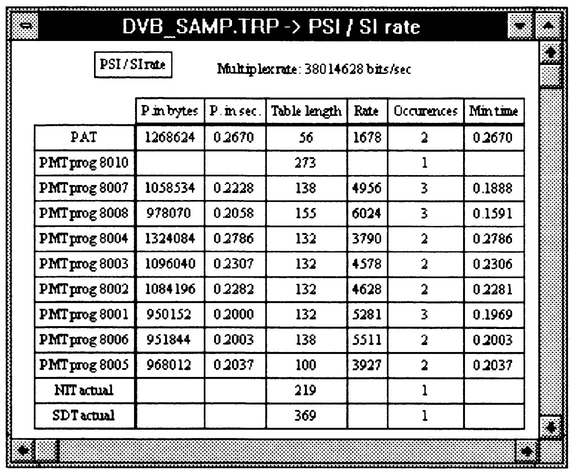


Table 3–5: SI consistency error abbreviations

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.


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
PMT prog 8010			273		1	
PMT prog 8007	1058534	0.2228	138	4956	3	0.1888
PMT prog 8008	978070	0.2058	155	6024	3	0.1591
PMT prog 8004	1324084	0.2786	132	3790	2	0.2786
PMT prog 8003	1096040	0.2307	132	4578	2	0.2306
PMT prog 8002	1084196	0.2282	132	4628	2	0.2281
PMT prog 8001	950152	0.2000	132	5281	3	0.1969
PMT prog 8006	951844	0.2003	138	5511	2	0.2003
PMT prog 8005	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	The size of the table *in bytes*
Rate	The table length *in bits* divided by the average period (column three*8/column two); table bits per second of transport stream
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

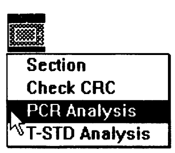
The MPEG-2 System Analyzer can conduct two types of timing analysis: PCR (program reference clock) and PTS/DTS (presentation/decode time stamps). The PCR "clocks" are encoded in transport stream packets and pertain to a given MPEG-2 program. The PTS/DTS are encoded into PES packets and pertain to that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

PCR Analysis

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

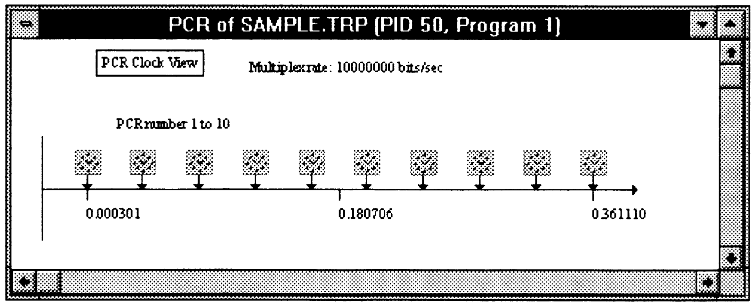
- You can view a graphic diagram of the PCR clocks of each program in the stream.
- You can see the "vital statistics" (numerical data) of each PCR clock.
- You can search for errors in the clocks of one program or all of the programs in the transport stream.

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.



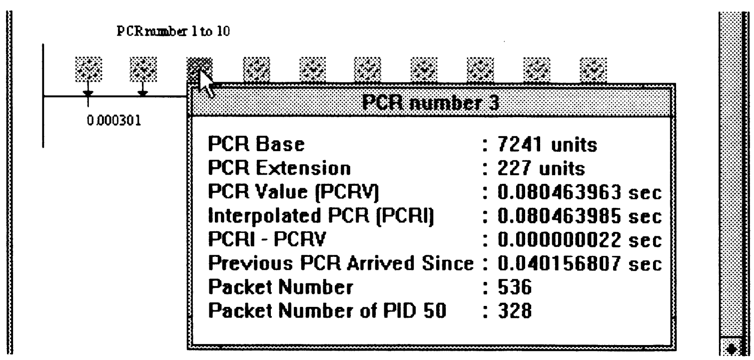
(You can also begin PCR analysis by choosing PCR from the Analysis menu. A dialog box will appear. Enter the number of the program you wish to analyze and click on OK.)

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 button bar 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.



- 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" 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.

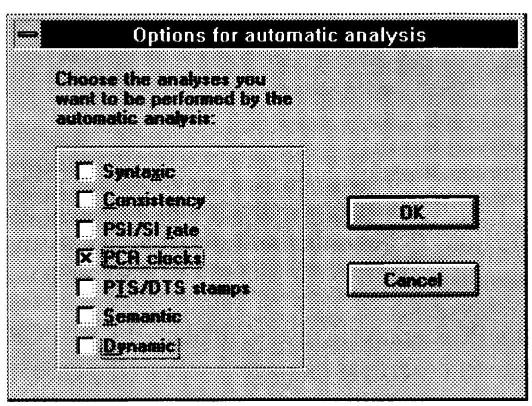
- "Packet Number" identifies the packet that contains the PCR relative to all packets in the transport stream. To display an interpreted view of the packet, double click on the TS (engine and tender) icon in the hierarchic view and then use the Edit menu or lower button bar to go to that item number.
- "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 and then go to that 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 button bar. 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 button bar.

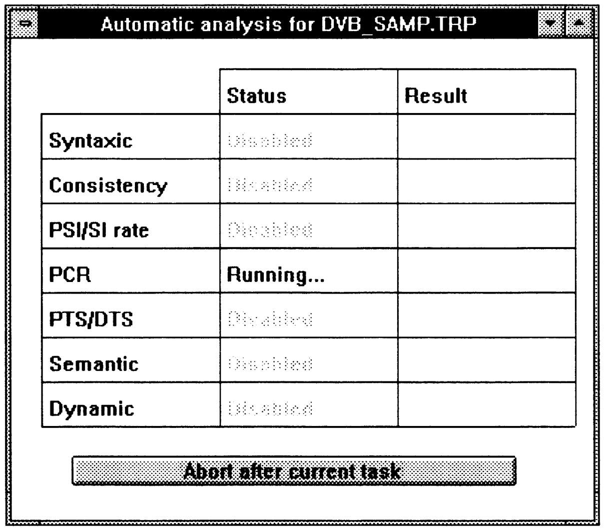
Another, better way to search for all PCR errors in the entire transport stream file is to use Automatic analysis. Automatic analysis is explained in detail beginning on page 3–44; follow this procedure to search for PCR errors only:

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.

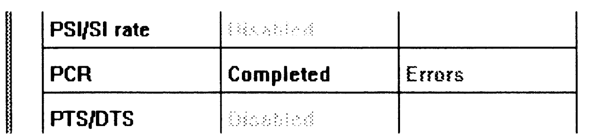


3. Select the PSI hierarchic view of the stream you wish to check for PCR errors.

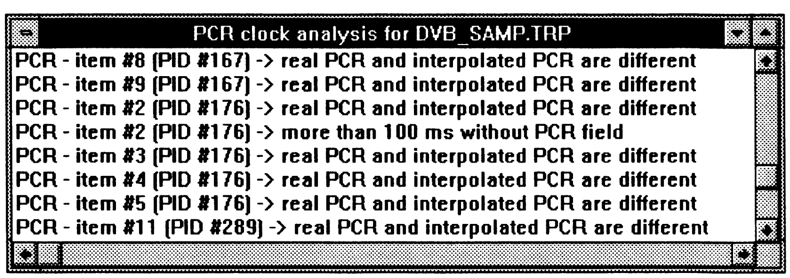
4. Choose Automatic from the Analysis menu. An automatic analysis status window appears to show the progress of the PCR analysis.



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.

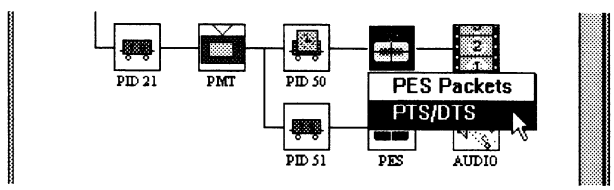
PTS/DTS Analysis

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.

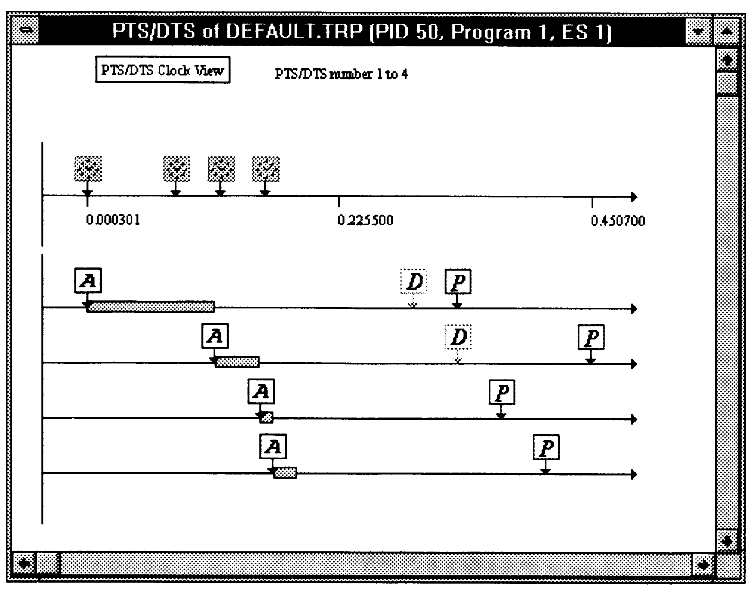
PTS/DTS analysis also enables viewing the "vital statistics" (numerical data) of various timing objects and searching for PTS/DTS errors in one elementary stream or all elementary streams in the file.

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.

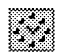


2. Release the button. A PTS/DTS timing diagram window appears, showing the first four PTS/DTS "events" and the closest PCRs. Table 3–7 explains the icons used and lists the information you can display by double-clicking on each icon.



***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

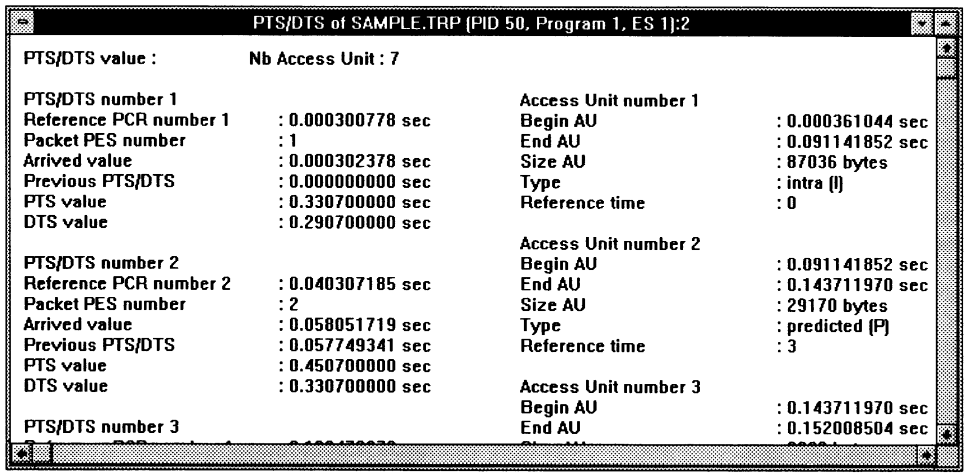
The arrows leading down from the A, D, and P icons to the time line are normally black; they are red (on the PC display) when an error is associated with the object. Red characters also highlight errors in the PTS/DTS value windows that appear when you double-click on an icon.

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 button bar 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 button bar) 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:

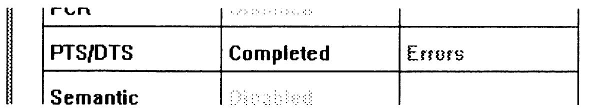
1. Choose Automatic analysis from the Options menu. An Options dialog box appears in the analyzer application window.

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.

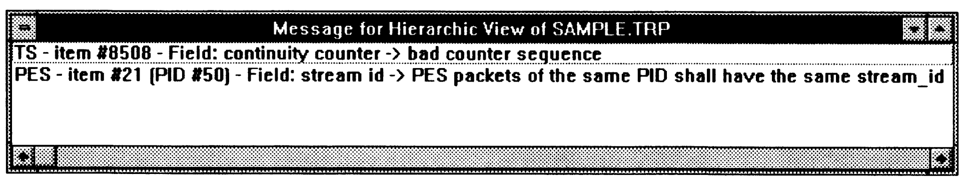
6. Double-click on a listed error to create a PTS/DTS graphic view that contains the erroneous time stamp. A red arrow leading from an icon to the time line indicates an error. Double-click on the icon that represents the incorrect time stamp to create a value window for the stamp.

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.

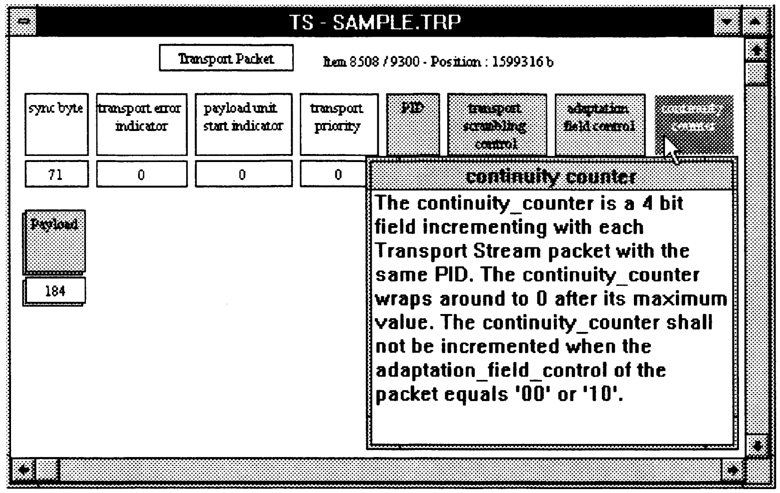
2. Choose Semantic from the Analysis menu. If the analyzer finds any errors, a message window, containing a list of the errors, appears.



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

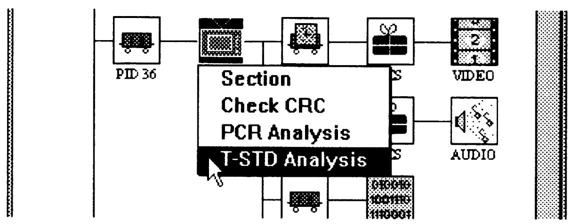
Both T-STD and LTW analysis have a visual mode that you can toggle on and off by selecting Visual TSTD and LTW in the Options menu. Visual mode graphically represents the contents of the various decoder buffers, shows the progress of the analysis, and provides a way to abort the process; it does, however, 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

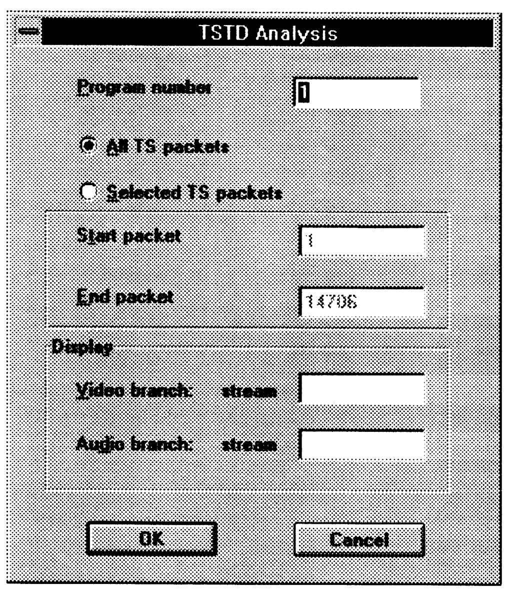
The MPEG-2 System Analyzer can perform T-STD analysis either on a selected program in the current transport stream or on all programs in the stream.

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.

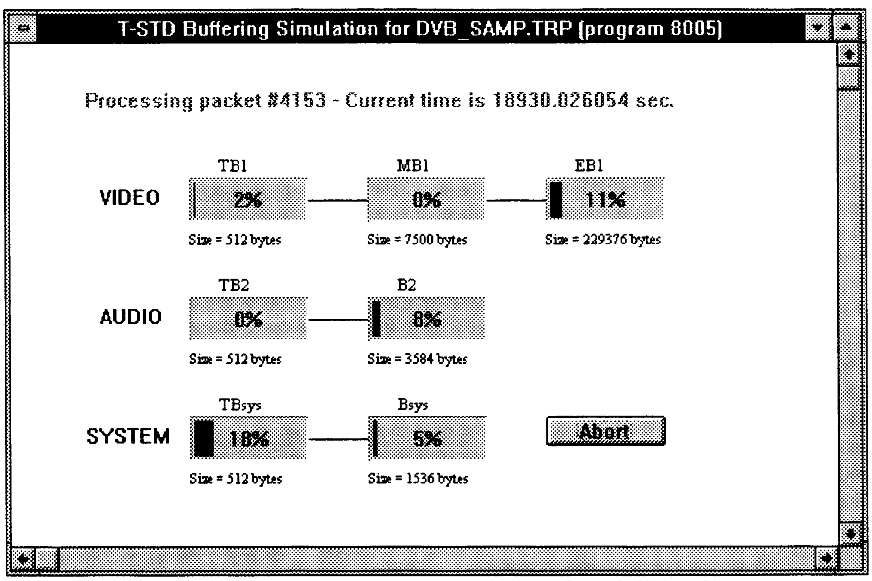


You must enter the program you wish to analyze. The program number in this dialog box refers to the order that the particular program is listed in the hierarchic view.

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:

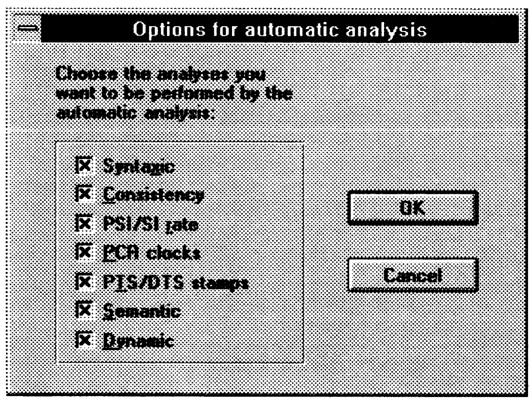
- A counter that shows the current packet number
- A display of the current PCR time
- Dynamic bar graphs of the three video branch buffers. If the program has no video elementary stream, "***unused***" appears under each bar (instead of size information). The buffer bars change colors to indicate the 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.

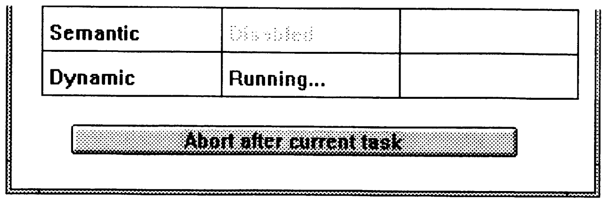
Analyzing all Programs in the Stream. You can use Automatic analysis to check the entire stream at once for T-STD buffering errors. Automatic analysis is explained in detail beginning on page 3–44; follow this procedure to search for T-STD errors only:

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

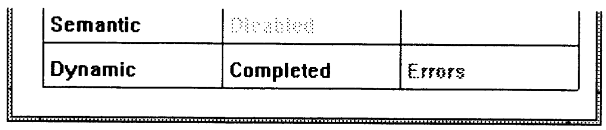


2. Select the Dynamic check box and clear all others. Then click OK.
3. Select the PSI hierarchic view of the stream you wish to check for T-STD errors.
4. Choose Automatic from the Analysis menu. An automatic analysis progress/results window appears. A Buffering Simulation window *will not* appear,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

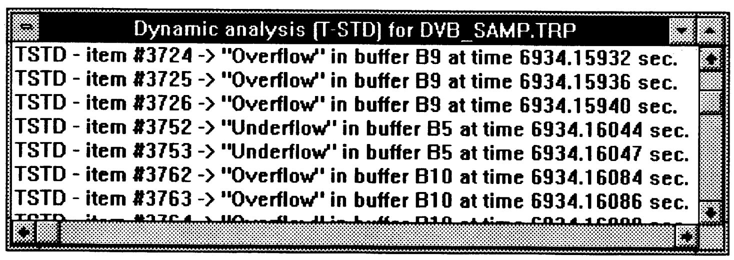
type CTRL+ALT+DEL and use the Windows NT End Task command to quit the analyzer application completely.



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.

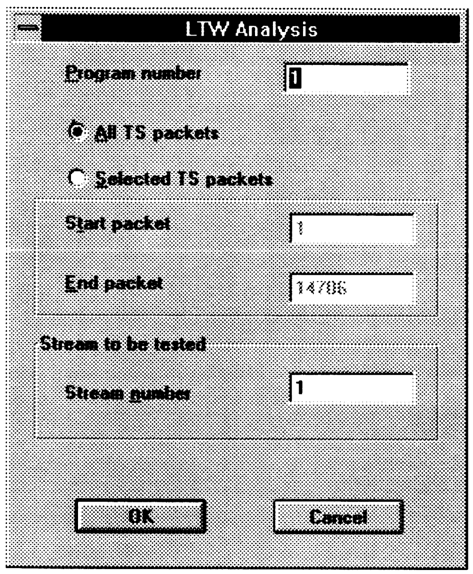
- Overflow at the beginning of the simulation may not indicate encoder problems, as the analyzer must wait for the first DTS in the stream before emptying the EB and B buffers. Buffer overflow after the first DTS, however, indicates improper encoding.
- T-STD errors can arise from several different sources,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

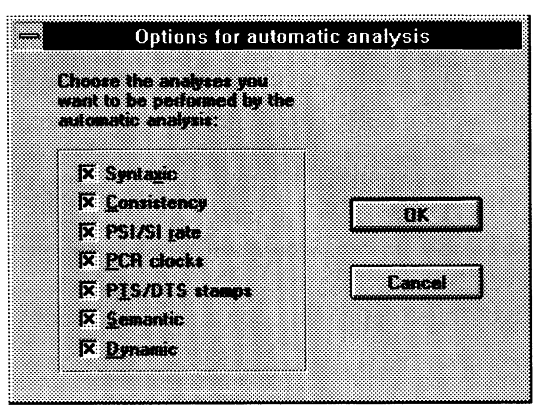
To begin smoothing buffer analysis, select the hierarchic view and then choose Smoothing Buffer in the Dynamic submenu of the Analysis menu. If the analyzer detects any overflow or underflow errors, it creates a message window and lists the errors. There is no graphic representation of smoothing buffer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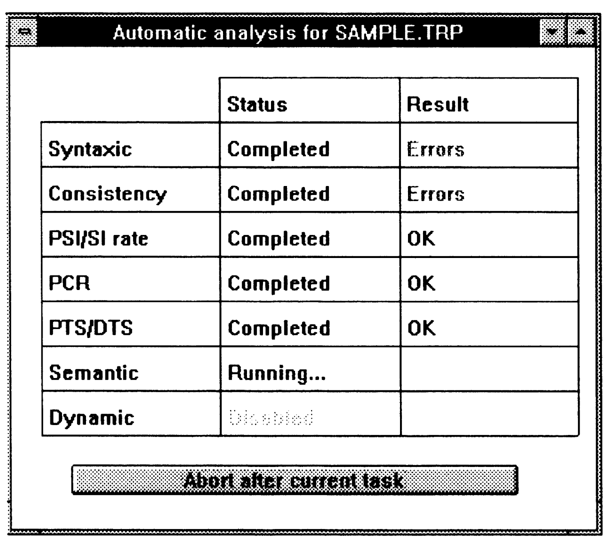
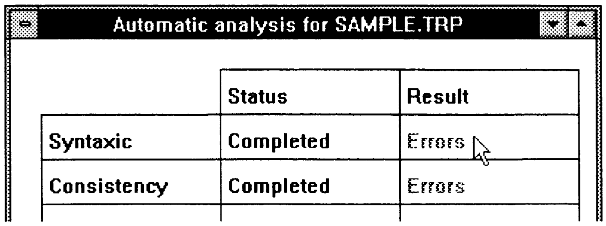
3. Choose OK to confirm the selections and close the dialog box.

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.

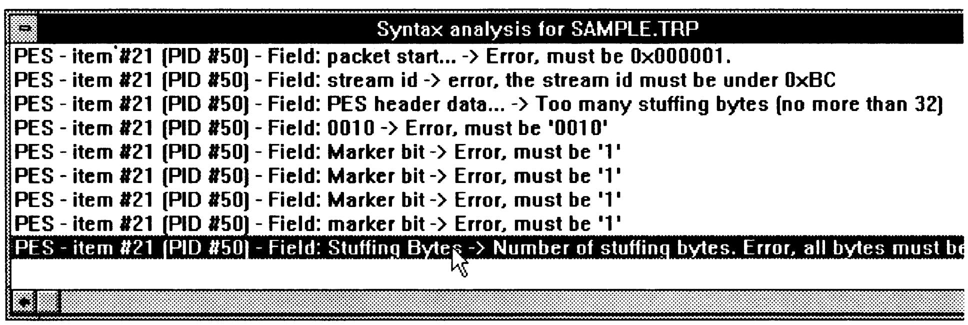


If you wish to end the analysis at any time, click on Abort after current task, at the bottom of the window.

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).

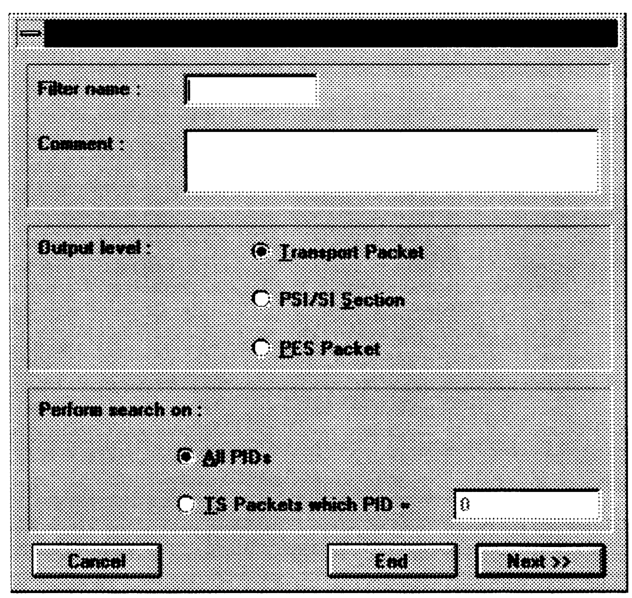
- Transport packets of a given PID in which the payload unit start indicator is set to one.
- PSI/SI (table) sections of a given PID that contain a descriptor tag with a value of 64.
- PES packets of a given PID that lack both PTS and DTS (PTS/DTS flag set to zero).

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.



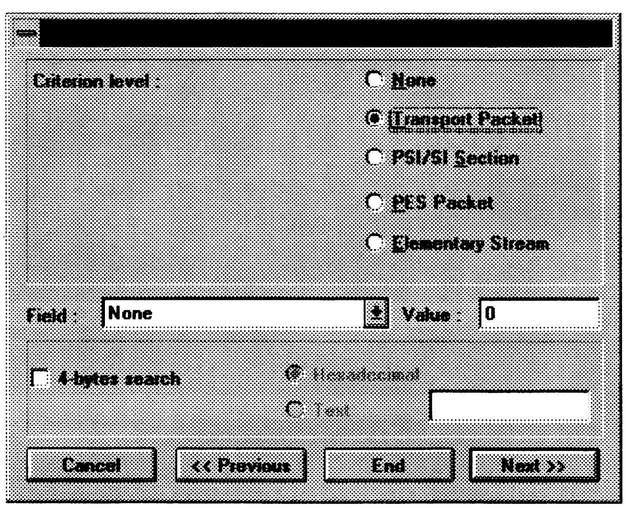
2. Enter the appropriate information and select options as necessary.
   - The filter name can be up to eight characters long. By default, the name you enter is proposed as the file name when you save the filter.

- 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*.

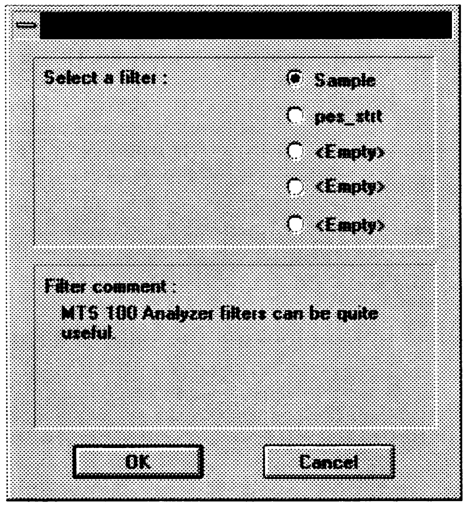
It may help to be aware of several conventions that apply to this dialog box:

- 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.

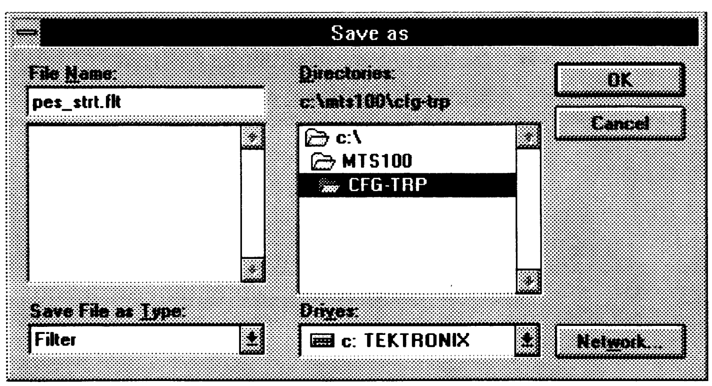
5. Click Next >> to define up to two more filter criteria; click << Previous to return to the first filter definition dialog box; or click End to conclude filter definition.

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.



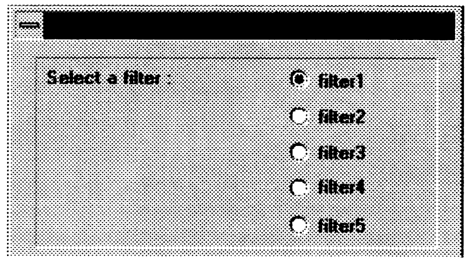
A standard Windows Save As dialog box appears. The filter name (with a .flt extension) is in the File Name box. Click OK to accept the file name and save the filter file; enter a different name and then click OK to save the file under a different name.



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:

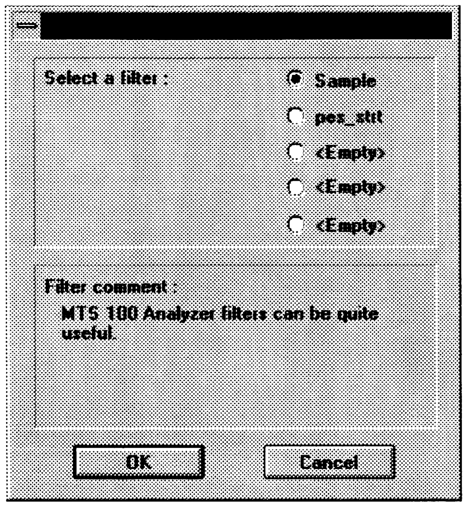
1. Select Edit from the Selection/Filters submenu. The filter list dialog box appears.
2. Select a filter and then click OK. The first filter definition box, with current filter selections and settings, appears.
3. Proceed as if you were creating a new filter (see page 3–47), changing existing selections 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

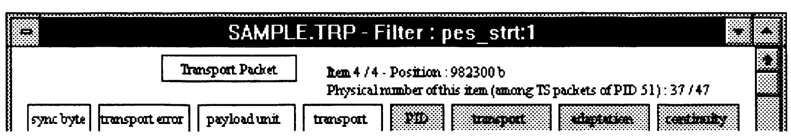
1. Open an existing filter, or create a new one.
2. Select the hierarchic view or a transport packet (interpreted) view of the transport stream.

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 button bar 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.



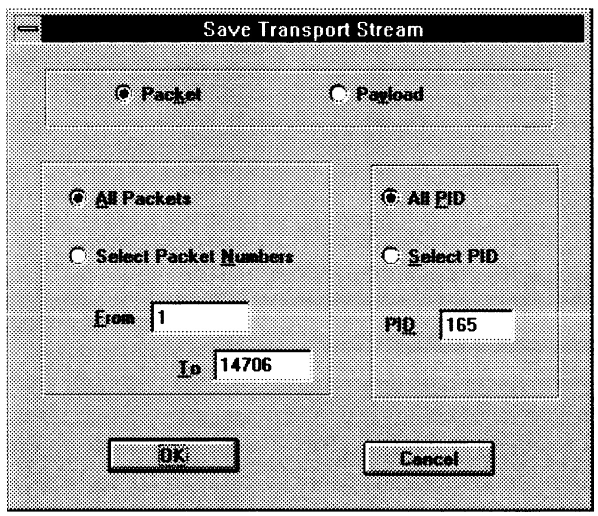
If the analyzer finds no item that satisfies all filter criteria, it says so.

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

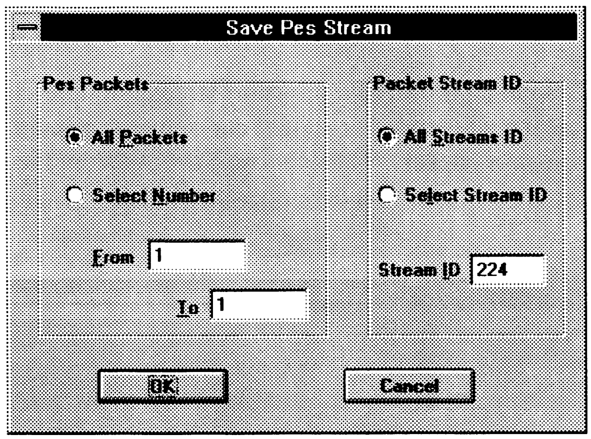
To save a portion of a transport stream, double-click on a hierarchic view TS (engine and tender or freight car) icon to open an interpreted view of the transport packets. Then choose Save As from the File menu or click the Save command button on the upper button bar. A dialog box appears.



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

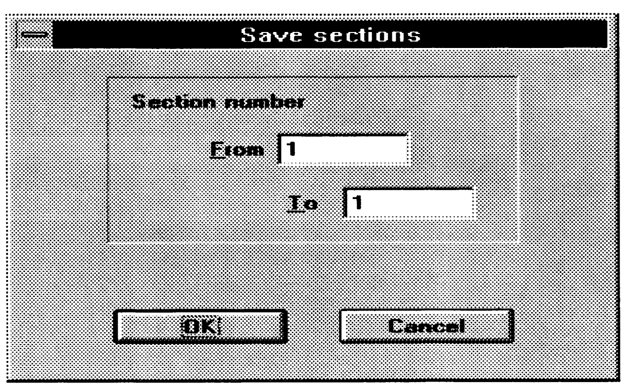
To save some or all of the packets in a PES stream, open an interpreted view of the PES packets and choose Save As from the File menu or click the Save command button. A dialog box appears.



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

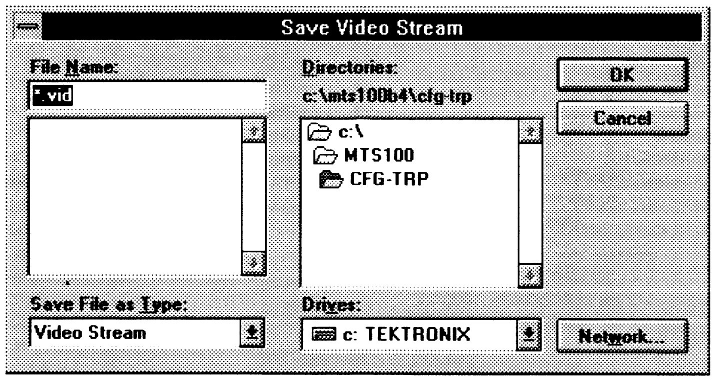
To save one or more sections of a particular table (PAT, PMT, NIT, SDT, for example) in the transport stream, double-click on the hierarchic view table icon to open an interpreted view of the section. (If you want to save more than one section, click the End button on the lower button bar to go to the 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.

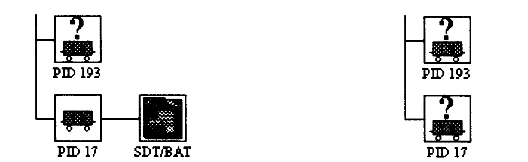


The Options Menu

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.

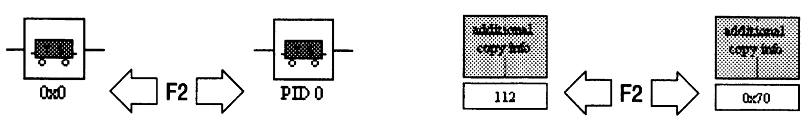
If this option is selected and you open a file of a transport stream with PAT CRC errors, for example, the analyzer writes a list of the errors to a ASCII text file. The file receives the name of the transport stream file, but has a .log extension; it is saved in the directory specified through the Options 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

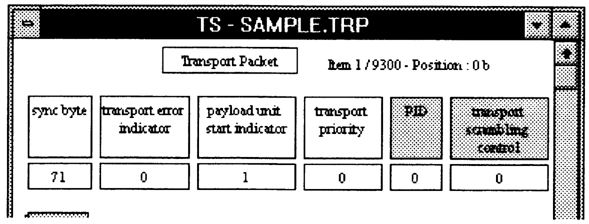
The Base command opens a dialog box for selecting the numeric base used in the hierarchic and interpreted views. You may find it more convenient to remember that F2 is the shortcut key for toggling between the two settings.



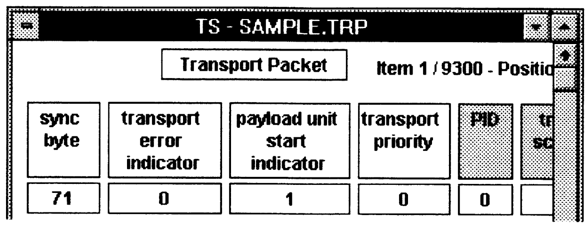
Hierarchic view Interpreted view

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.

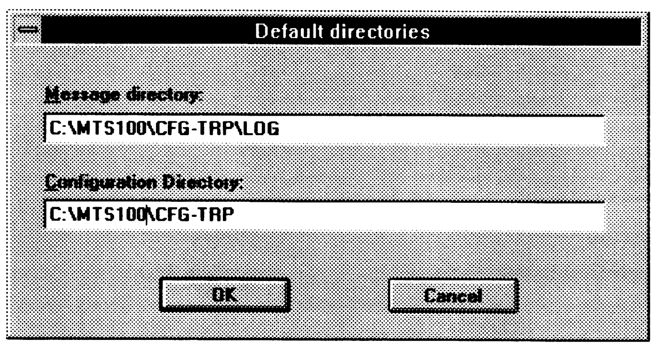


Seven point Times roman (default)



Nine 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

The Multiplexer software generates MPEG-2 transport stream files from elementary streams and table files.

***NOTE**. This software complies with ISO/IEC 13818-1 (MPEG-2 Systems) November 1994. Please refer to this document for more details on parameter values to generate correct files.*

This section explains the commands available from the Multiplexer application with the exception that the Multiplexer calls the Edit Table application. Find these commands under the Edit Table application beginning on page 3–105.

This section first covers structure of the Multiplexer files and then the commands from the Menus and Button Bars, concluding with a discussion of the embedded commands.

***NOTE**. You will not be able to start the Multiplexer application if the Analyzer or Data Store Administrator are running.*

Structure of the Multiplexer Files

The Multiplexer application creates MPEG-2 transport stream files. These transport stream files may have up to 20 programs with each program having up to 10 elementary streams (video, audio, or data). A maximum of 5 of any type of elementary stream can be included in a transport stream.

The transport stream files can be huge. In order to make the Multiplexer application responsive and easy to work with, the transport streams are not generated immediately. Instead, you work with configuration files. (See Figure 3–1.)

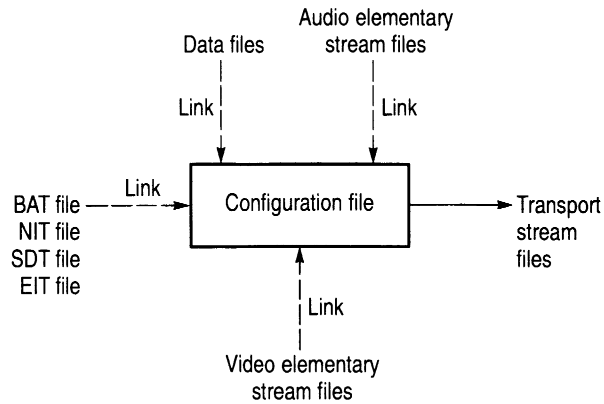


Figure 3–1: How the configuration file works

The configuration file contains all the directions for making the desired transport stream. The configuration file contains general information (such as the Mux Rate) and also links to the required files (such as the video elementary stream files). (You create the BAT, NIT, SDT, and EIT files using the Edit Table application.) The configuration file is similar in structure to a Windows *.ini file.

An example of a configuration file is shown at the end of this section, beginning on page 3–102. Notice that each heading is enclosed in brackets, for example, [Video Stream 1 Prog 2].

You can save the configuration file independent of transport stream construction. This allows you to make transport streams with only minor variations by using the same base configuration file.

NOTE. *Windows NT cannot handle files larger than 2 GB. Therefore, 2 GB is the maximum size for a transport stream file on the system hard disk. This restriction does not apply to files created on the Data Store Disks.*

Directory Structure

The directories of the MTS 100 system disk (not the Data Store Disks) are named to make it easy to find the associated files required to make the transport stream file.

You can find video elementary stream files in the MTS100\video\ directory. The video elementary stream files are further subdivided by line-number and function.

You can find audio elementary stream files in the MTS100\audio\ directory.

You can find all other files (the Table files, etc.) in the MTS100\cfg-trp\ directory.

Default Display

The default display (see Figure 3–2) is the beginning display whenever you start a new configuration file. (The example below does not include DVB information, because it is not part of the default.) The Multiplexer application window has three parts: the Duration Gauge, Rate Gauge, and Multiplex Window.

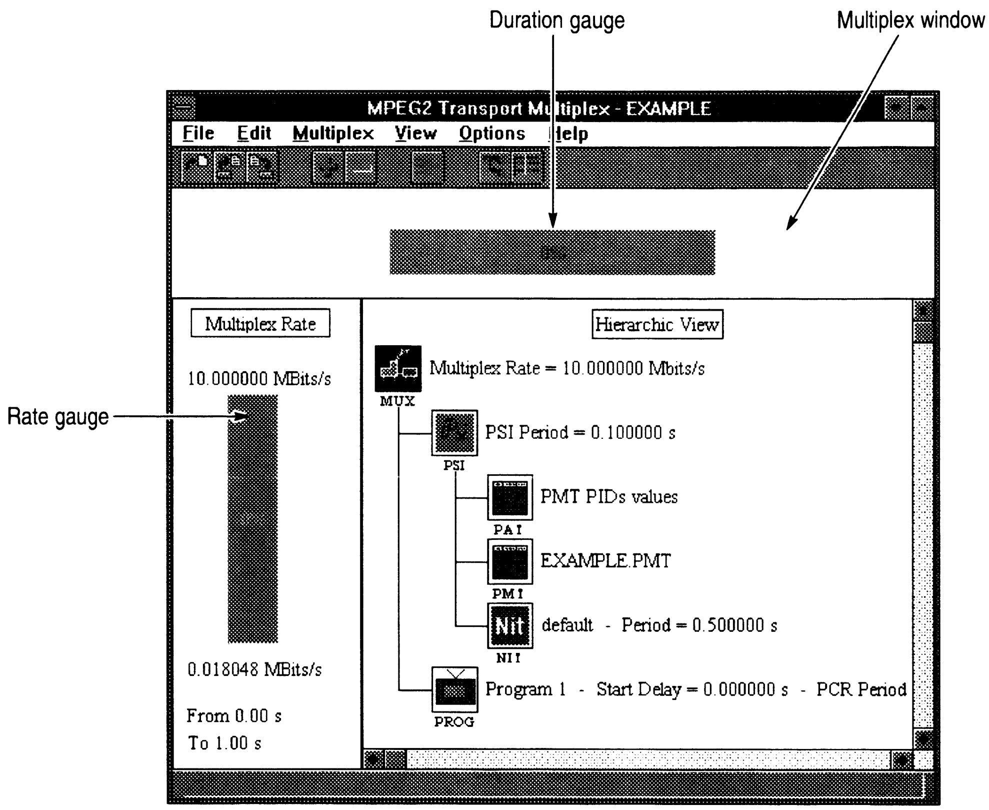


Figure 3–2: The default display of the Multiplexer application

Duration Gauge

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

Rate Gauge

The Rate Gauge shows the percentage of the available transport stream currently being used. Above the rate gauge bar is the target multiplex rate. Below the rate gauge bar is the amount currently in use, the Actual Rate. This number comes from 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.

NOTE. *The Actual Rate number and the time when 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, see page 3–79.*

The Rate Gauge Bar changes colors dependent upon the rate. From 0–75%, the bar is green. From 76–90%, the bar is yellow. Above 90%, the bar is red. (If you try to create a stream that uses more than 100% you get messages warning of Multiplexer overflow.)

Multiplex Window

The Multiplex Window displays the current configuration file. It can display the file in one of two forms, either dynamic or hierarchic display. The dynamic view is explained on page 3–79. The hierarchic view is the one shown in Figure 3–2. Each icon of the hierarchic view is explained in Table 3–8.

Table 3–8: The icons in the hierarchic view

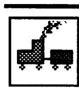
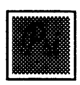
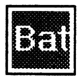
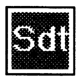
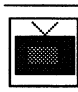
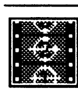
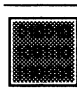
Icons	Meaning
 MUX	Multiplex — the main icon for the configuration file. Required.
 PSI	Program Specific Information (PSI) — contains the data that allows the demultiplexing of the programs by decoders. Required.
 PAT	Program Association Table (PAT) — This is the main PSI table. It links the program numbers and the Program Map Table (PMT) PID. Every transport stream must have a PAT and it is always PID0. This table is required to identify the PID numbers for the table(s) defining each program. Required.
 PMT	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 some transmission systems (such as Grand Alliance and DVB) require specific values. Required.
 SI	Service Information (SI) — provides information on services and events carried by different multiplexes or even on other networks. It consists of the four tables: NIT, BAT, SDT, and EIT. Required if using DVB.

Table 3–8: The icons in the hierarchic view (Cont.)

Icons	Meaning
 NIT	Network Information Table (NIT) — provides information about the physical network. Found under the PSI icon for non-DVB and under the SI icon for DVB configurations.
 BAT	Bouquet Association Table (BAT) — provides information regarding bouquets (a collection of services marketed as a single entity). Optional. (Only DVB)
 SDT	Service Description Table (SDT) — contains data describing the services in the system such as names of services, the service provider, etc. Optional. (Only DVB)
 EIT	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. (Only DVB)
 TDT	Time and Date Table (TDT)– provides the UTC time and data information Optional (Only DVB).
 PROG	Program (may have up to 20 Programs) Required — Each transport stream is required to have at least one program with one elementary stream.
 VIDEO	Video Elementary Stream (may have up to 5 video elementary streams for a total of 10 elementary streams per program) Optional (must be at least one elementary stream in the program).
 AUDIO	Audio Elementary Stream (may have up to 5 audio elementary streams for a total of 10 elementary streams per program) Optional (must be at least one elementary stream in the program).
 DATA	Data Elementary Stream (may have up to 5 data elementary streams for a total of 10 elementary streams per program) Optional (must be at least one elementary stream in the program).

Menu Bar

The Menu Bar accesses the six main Multiplexer menus:

File. Controls the Multiplexer/Disk interface.

Edit. Adds or deletes items from the Multiplexer stream.

Multiplex. Performs the multiplex operation.

View. Changes the display format to aid in multiplex construction.

Options. Allows you to use the DVB MPEG-2 transport stream format.

Help. Accesses various forms of help.

Menu Bar Commands

The following sections describe each command available from the Menu Bar.

File

Commands found under the File menu provide methods for creating new files, opening existing files, saving files, closing files and exiting the Multiplexer application.

New. This command displays the Name of Future Configuration File dialog box as shown in Figure 3–3. Enter the desired file name in the File Name text box. Notice that the *.cfg extension is automatically added to the file to identify it as a configuration file. If you choose an existing configuration file name, the Multiplexer application asks if you want to overwrite the existing file.

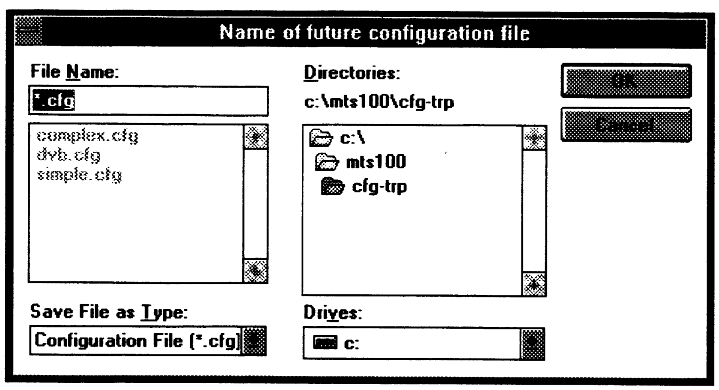


Figure 3–3: The dialog box that appears after selecting New from the File Menu

The New command results in a new basic configuration file (in hierarchic view) waiting to be filled in as shown in Figure 3–4.

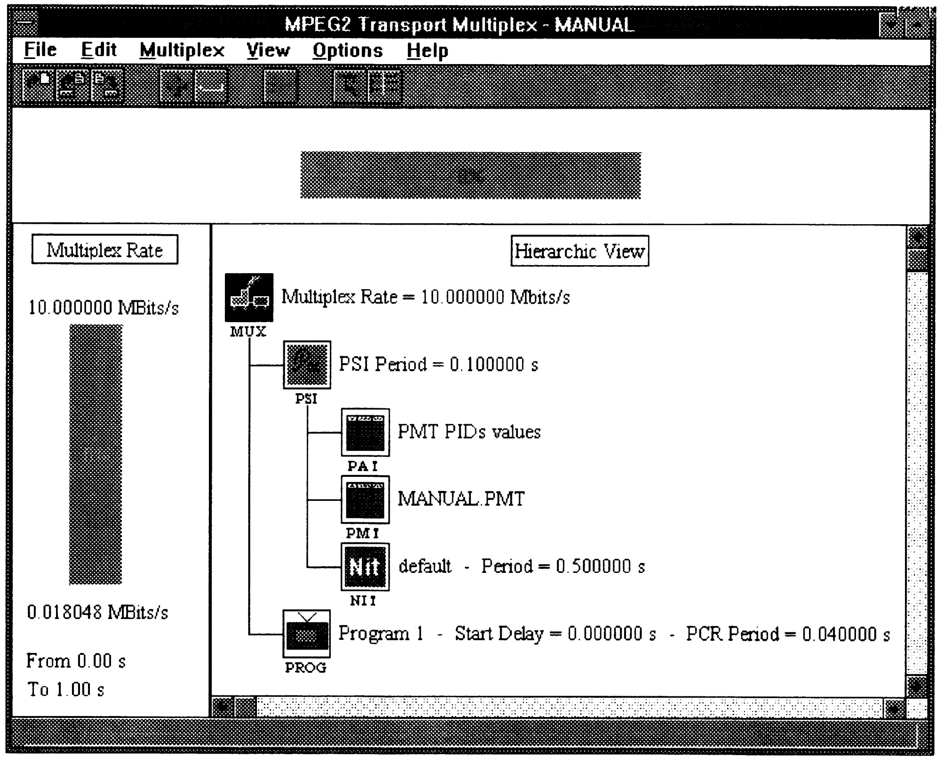


Figure 3–4: The Multiplexer window after selecting a new configuration file (manual)

The New command in the File Menu is the same as on the Top Button Bar.

Open. This command displays the Configuration File dialog box so the user can select an existing configuration file to load into the Multiplex Window. See Figure 3–5.

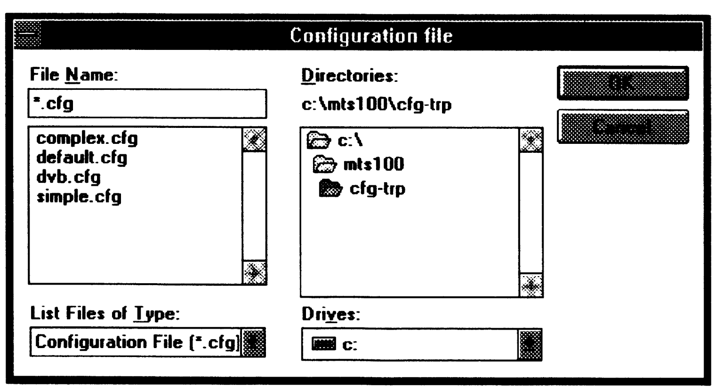


Figure 3–5: The dialog box that appears after selecting Open from the File Menu

If a configuration file is already loaded, the Open command replaces this file with the selected file.

The Open command in the File menu is the same command as from the Top Button Bar.

Save. This command saves the active configuration file to the disk. The Save command is not available if a configuration file is not loaded.

This Save command in the File menu is the same command as from the top button bar.

Save As. This command allows you to save the current configuration file under a different name. This command is not available if a configuration file is not loaded. See Figure 3–6.

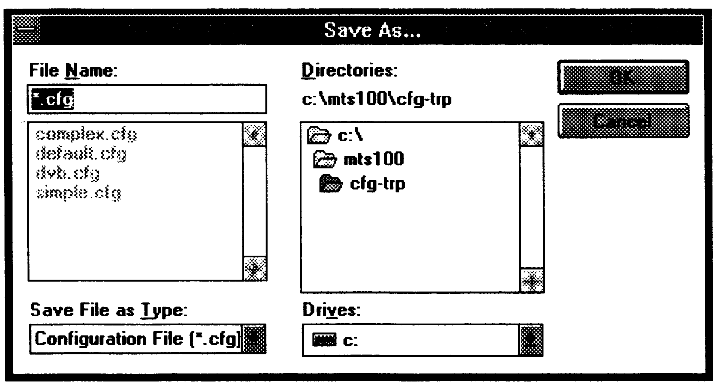


Figure 3–6: The Save As dialog box

Close. This command closes the open configuration file and restores the initial main window.

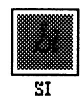
Quit. This command closes the Multiplexer application. It checks to see if you want to save the open configuration file first.

Edit

Use the Edit menu for additions and removals to the configuration file.

Add. This command adds a component to the multiplex. What component is added, differs based on which icon is selected. The list of icons and what can be added to them is given in Table 3–9.

Table 3–9: The icons that have the Add command available

Name		Icon	Add Function
MUX	Multiplex		Adds an empty program to the end of the configuration file (Up to 20 programs)
SI	Service Information		Adds DVB files to the configuration file. (Only available with DVB option.)
Prog	Program		Adds an elementary stream to the selected program. (Up to 10 elementary streams per program)

NOTE. *The Add command has no effect on the other icons.*

When you use Add with the Multiplex icon, a new Program icon is added to the end of the configuration file. Up to 20 programs are allowed in a transport stream.

The PAT's PMT PID values are automatically updated when ever a program is added to the configuration file. For example, Figure 3–7 shows the initial PID values of a default multiplex stream. Figure 3–8 shows the PID values after adding an additional program. Notice that you do not need to update the PID values; it is done automatically unless you have specific value requirements.

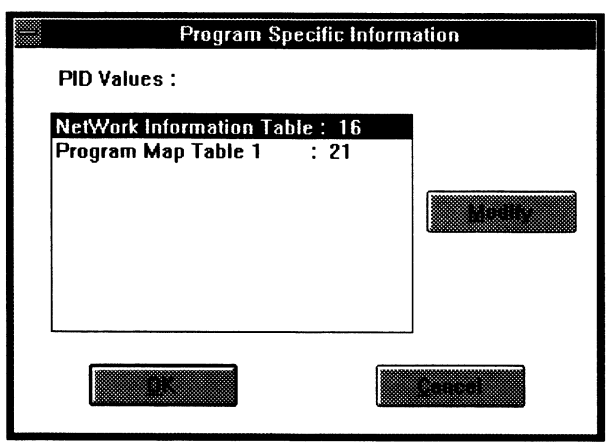


Figure 3–7: The initial PID values

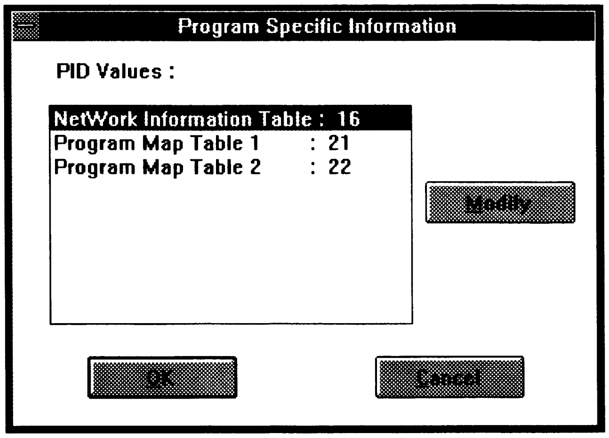


Figure 3–8: The PID values after adding a program

NOTE. *You can change the PCR PID using the Edit Table application. If the PCR is not one of the elementary streams in the program it will be in its own packets. This may be useful for some applications or experiments. (See page 3–133.)*

When you use Add with the SI (service information) icon, you add DVB files to the multiplex. This causes the DVB SI File Selection dialog box to open. See Figure 3–9. Use this dialog box to select DVB files for addition to the transport stream. The Edit command button calls the Edit Table application where you can edit the selected files. You can also access this dialog box by double-clicking on the SI icon.

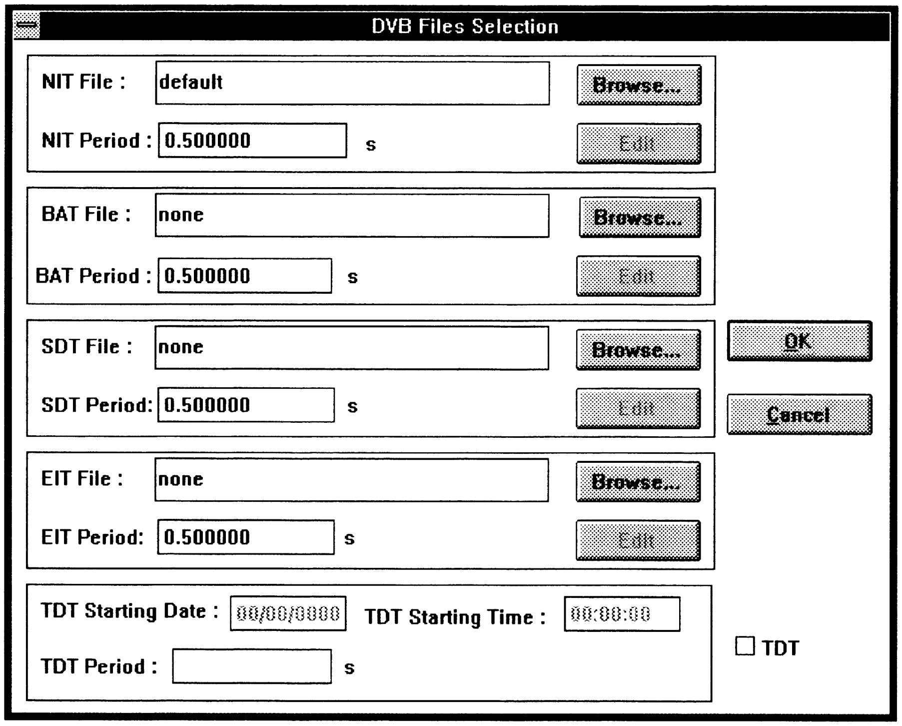


Figure 3–9: The DVB SI File Selection dialog box

To select a table, either type it directly into the text box (use the full path name) or use the associated Browse command button. Selecting Browse displays a dialog box similar to Figure 3–10. Select the desired file from this dialog box.

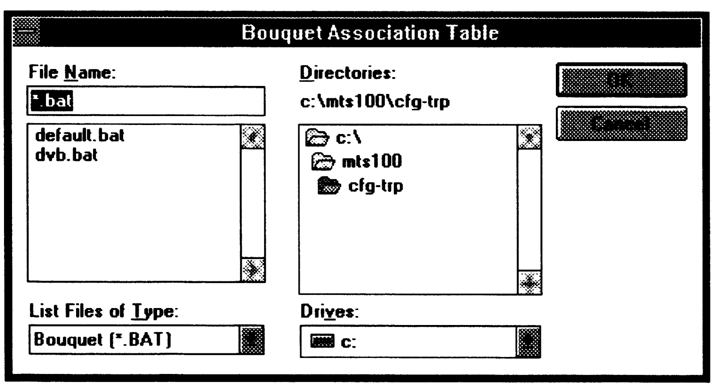


Figure 3–10: An example of a dialog box from the Browse command button

NOTE. *To get more information about the Edit Table application, see Using the PSI and SI Table Editor on page 3–105.*

When the Edit Table application launches from the Multiplexer application, you cannot add or delete ES (elementary streams) in the Edit Table application to avoid incoherence.

When you add SI files to the configuration file, their associated icons are displayed in the hierarchic window as components to the SI. The DVB rate is also updated, along with the multiplex rate. (See Figure 3–11.)

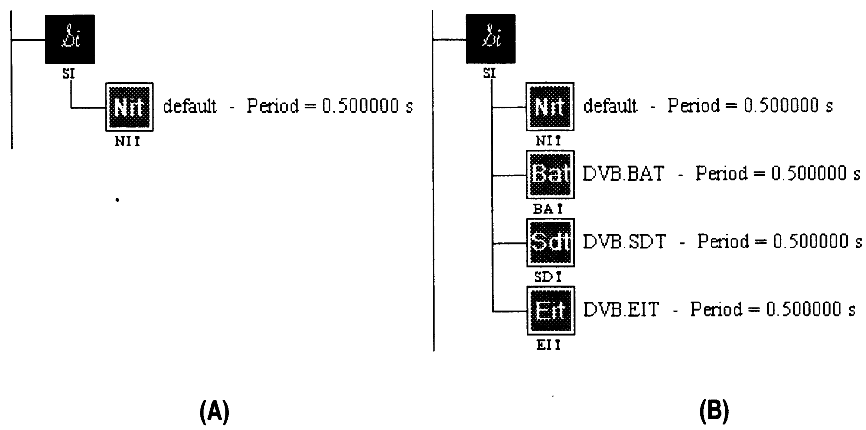


Figure 3–11: (A)The original display (B) The display with all available SI tables added

If you use Add with the Program icon to add an elementary stream to the active program, the stream is simply added to the end of that program's list. The elementary streams are not sorted by type. The dialog box in Figure 3–12 appears asking the elementary stream type to add.

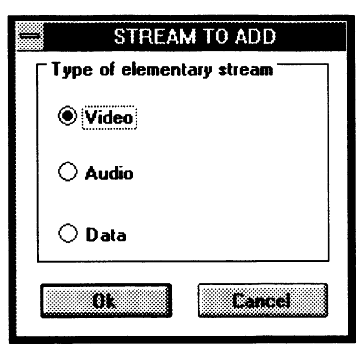


Figure 3–12: The Stream To Add dialog box

The new icon is placed in the hierarchic window as a component of the selected program. (What icon is displayed depends on the type of elementary stream selected.) The elementary stream is not yet linked to a file. (How to link to an elementary stream file is explained on page 3–96.) Figure 3–13 shows a program with all three types of elementary streams added.

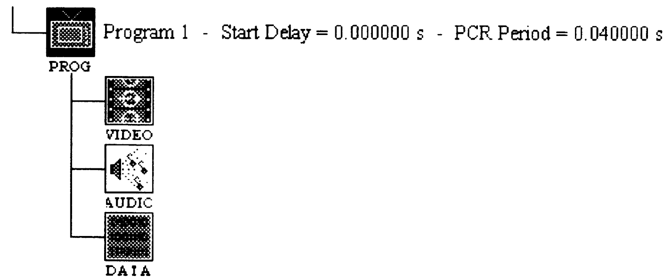


Figure 3–13: A program with all three types of elementary streams added

The Add command in the Edit menu is the same command as from the top button bar.

CAUTION. *Although MPEG-2 transport streams allow elementary streams with encoding changes between field and frame, the Multiplexer will not do this.*

Delete. This command deletes the selected icon 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, see DVB in the Options menu on page 3–75.)

If the NIT file exists (and is different from the default), the current NIT is replaced by the default NIT. The 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 deleting the program. See Figure 3–14.

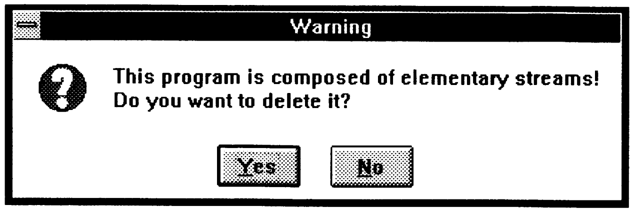


Figure 3–14: The Warning dialog box

When you delete a program, its PID number 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 has no effect on the other components. There must always be a PAT icon, a PMT icon (even if the PMT is empty), and an NIT icon.

The Delete command in the Edit menu is the same command as from the top button bar.

Multiplex

The Multiplex menu provides a command for starting the multiplex calculation.

Go. This command generates the transport stream file corresponding to the current configuration file.

If the configuration file definition is not complete, the transport stream generation does not begin and a message box displays indicating the problem. The multiplex definition is not complete in the following cases:

- There is an empty program (a program without an elementary stream)
- There are undefined elementary streams (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.

***CAUTION.** Windows NT, as installed on the MTS 100, cannot handle files larger than 2 GB. Therefore files greater than this size must be created directly on the Data Store Disks.*

The duration gauge indicates the progress of multiplex generation, as shown in Figure 3–15. Times shown are "real" stream times; generation will take much longer.

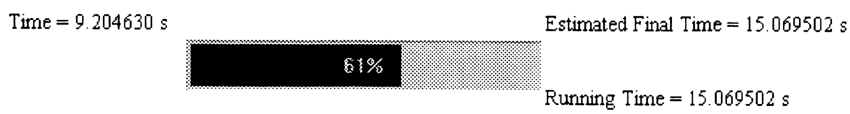


Figure 3–15: The duration gauge during a multiplex calculation

- 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.
- Final Time is an estimate of the duration of the entire stream.
- The percentage shown on the gauge is simply the current (stream) Time 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). You can stop the multiplex calculation at any time by pressing the Escape key.

Options

The Options menu allows you to include DVB specific information into the configuration file.

DVB. The DVB (Digital Video Broadcasting) Specific Information (SI) provides the configuration file with up to four additional tables (and the NIT moved). These tables contain information on services and events carried on different multiplexes or even different networks. The four SI tables are:

- NIT (Network Information Table) — provides information about the physical network. This table is mandatory. (It appears under the PSI icon in non-DVB mode.)
- BAT (Bouquet Association Table) — provides information regarding bouquets (collections of services marketed as a single item).

- SDT (Service Description Table) — contains data describing the services in the system. For example, the name of the services, the service provider, etc.
- EIT (Event Information Table) — 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) — contains information relating to the current time and date.

When you switch between DVB and non-DVB, the SI icon appears and disappears as required and the NIT icon is either below the SI or under the PSI icon (see Figures 3–16 and 3–17). To add the rest of the tables, use the Add command as described beginning on page 3–66.

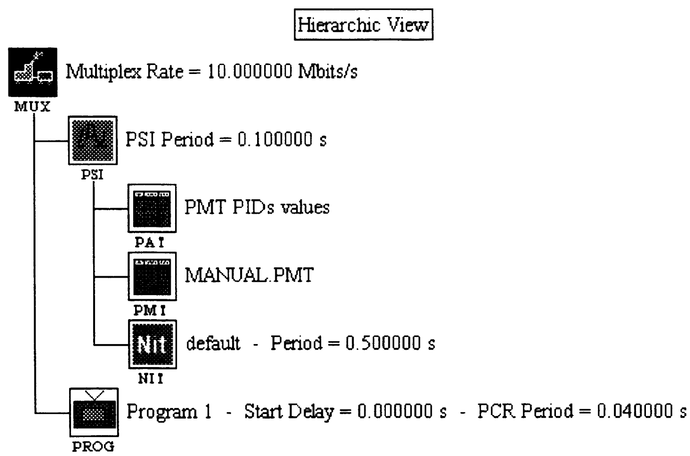


Figure 3–16: The non-DVB hierarchic view

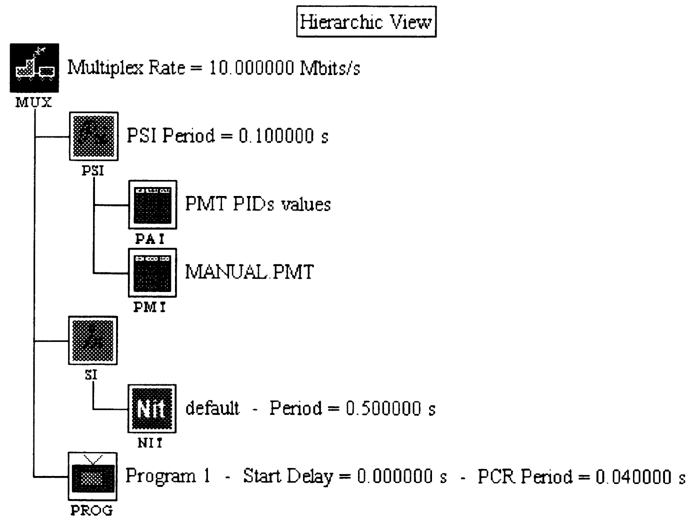


Figure 3–17: The default DVB hierarchic view

When you want to switch out of the DVB option and you have SI tables (other than the NIT) you will get the warning in Figure 3–18. If you choose to delete them, they are removed from the configuration file. (The separate SI table files themselves are not deleted.)

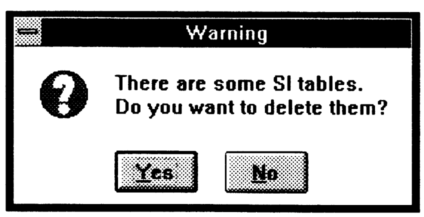


Figure 3–18: The warning if you are switching out of DVB

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 in Figure 3–19 appears. Add a TDT and try again.

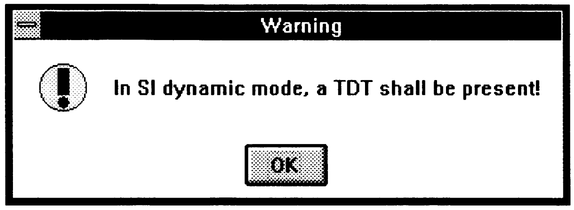


Figure 3–19: The "no TDT" warning

Directories. Use the Directories command to specify default directories for various types of files. Choosing Directories opens the dialog box shown in Figure 3–20.

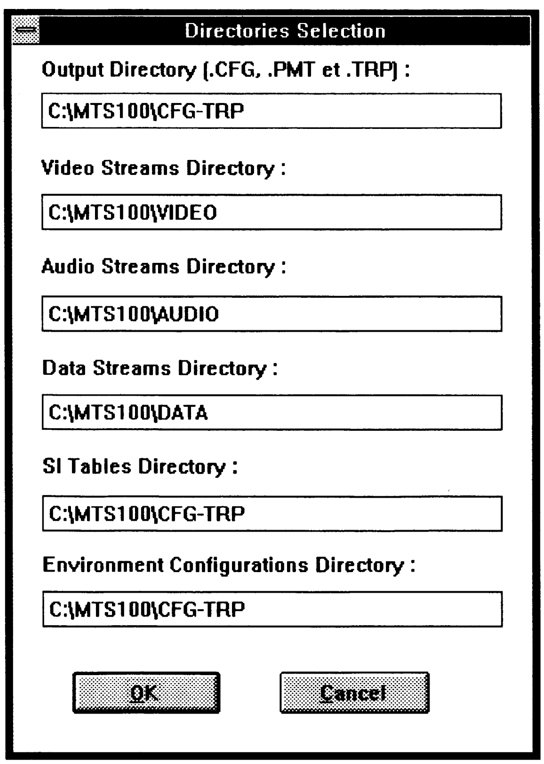


Figure 3–20: The Directories Selection dialog box

Change directories by entering the complete path in the appropriate text boxes; click OK to accept the displayed paths and close the dialog box.

Do not change from the default directories without good reason, as other MTS 100 applications also read from and write to many of the same directories. Changing directories may make it difficult or inconvenient to find files later.

Save Environment. Choose Save Environment to save the current option settings to a file; a standard Windows file saving dialog box (as shown in Figure 3–21) 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.

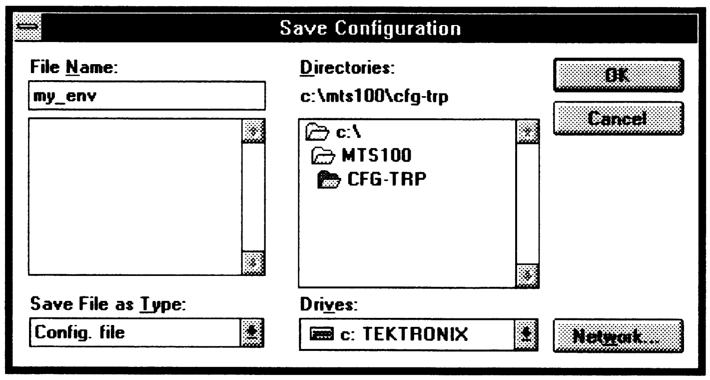


Figure 3–21: The Save Configuration dialog box

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 in Figure 3–22 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.

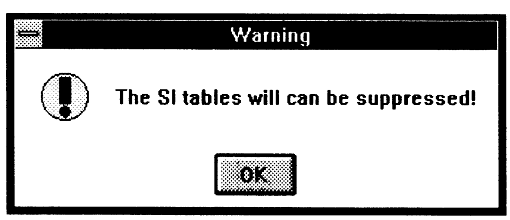


Figure 3–22: The DVB warning message

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. The dialog box shown in Figure 3–23 appears to give you one more chance to reconsider. Click Yes to confirm the command; click No to cancel.

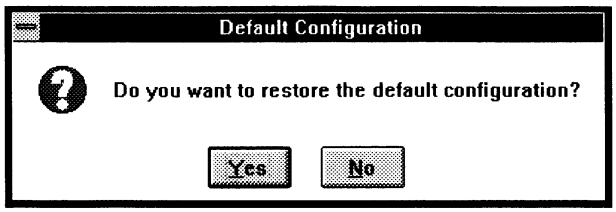


Figure 3–23: The Default Configuration dialog box

Because the DVB option is not selected in the default option settings, the warning message shown in Figure 3–22 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, the dialog box shown in Figure 3–24 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.

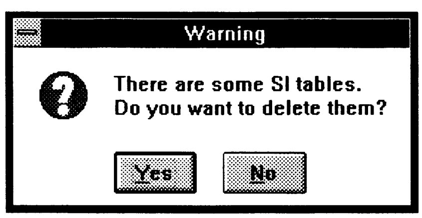


Figure 3–25:

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

View

The View menu allows the transport hierarchy to be displayed in whatever form is most advantageous for the current application.

Hierarchic. Displays the configuration file in a hierarchic (outline/normal) view. Figure 3–26 gives an example.

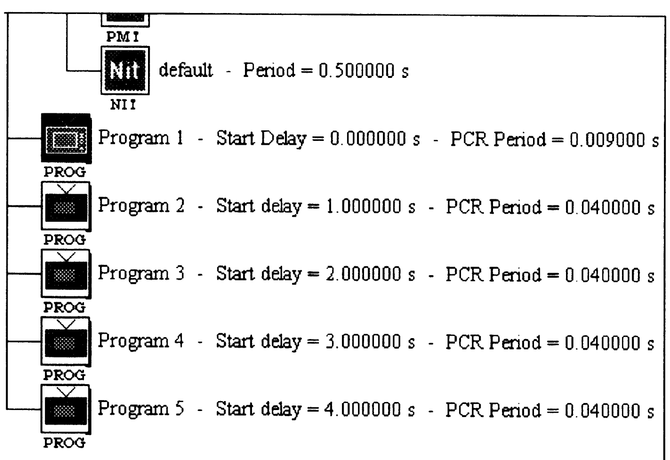


Figure 3–26: The hierarchic view of a configuration file

Dynamic. Displays the programs in a bar graph vs. time view. Figure 3–27 shows a configuration file with five programs having their start time all delayed 1 second from each other. This is the Dynamic view of the configuration file shown in Figure 3–26.

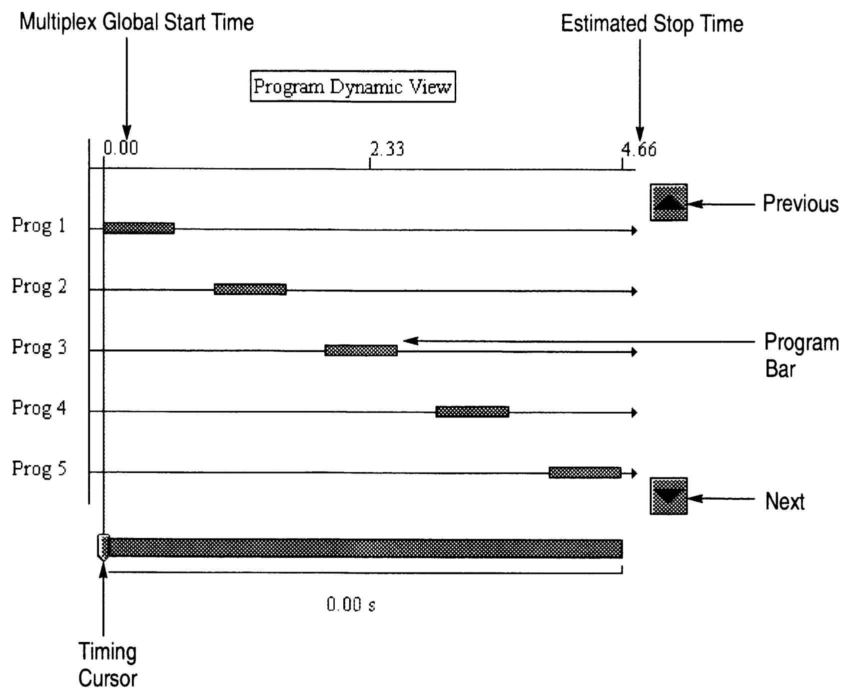


Figure 3–27: The dynamic view of the configuration file shown in Figure 3–26

There are several parts to the dynamic view:

Multiplex Global Start Time. The beginning time of the multiplex.

Estimated Stop Time. The ending time for the multiplex. All the elementary streams for all the programs have been sent.

Previous. If there are programs with a lower number, use this command button to display them.

Next. If there are programs with a higher number, use this command button to display them.

Timing Cursor. Move the timing cursor by selecting the slider bar and "slide" it to the desired location. You can also use the left and right arrow keys. Notice that the multiplex rate in the Rate Gauge is not the worst case, but rather the value at the timing cursor.

Program Bar. The location of the program's elementary streams in time. You can double-click on the program bar and display specific information about that program. (See Figure 3–28.) (This dialog box is not editable.)

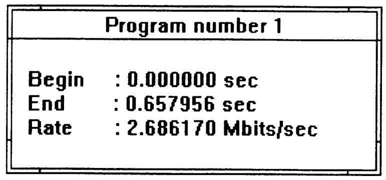


Figure 3–28: Specific information about a program (obtained by double-clicking on the program bar

Help

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

Contents. The Contents command brings up help information that is specific to the Multiplexer application.

Using Help. This is the standard Windows help command that explains how to use the help features.

About MPEG-2 System Multiplex. The About command produces the About box for the Multiplexer application. You can check the version number here to be sure that you are using the latest version of the software. (See Figure 3–29.)

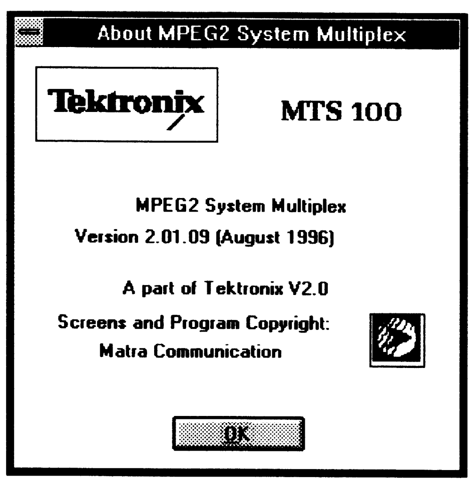
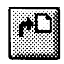
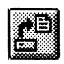
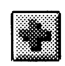
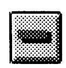
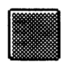
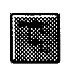
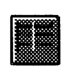


Figure 3–29: The Multiplexer About box

Button Bar Commands

Table 3–11: The Button Bar Commands

Command Button	Command Name	Function
	New	Creates a new multiplex. Same as New from the File menu (see page 3–64)
	Open	Opens a configuration file. Same as Open from the File menu (see page 3–65)
	Save	Saves the active configuration file. Same as Save from the File menu (see page 3–66)
	Add	Adds a component to the multiplex. Same as Add from the Edit menu (see page 3–66)
	Delete	Deletes the active component from the multiplex. Same as Delete from the Edit menu (see page 3–71)
	Go	Launches the multiplex calculation and generates the TS (transport stream) file. Same as Go from the Multiplex menu (see page 3–72)
	Hierarchic	Changes to Hierarchic view. Same as Hierarchic from the View menu (see page 3–79)
	Dynamic	Changes to Dynamic view. Same as Dynamic from the View menu (see page 3–79)

Embedded Commands

There are many functions that can only be accessed by clicking on the icon. Different functions are listed, along with what occurs with a left-click (normal), double-left-click (normal double-click), and a right-click. In general, a single-click selects the icon and a right-click expands or collapses the hierarchy display. The double-click for each icon is explained in more detail after the table.

Table 3–12: The icons and their embedded functions

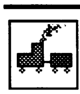
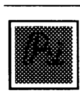
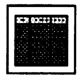
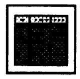
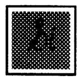
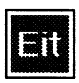
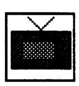
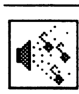
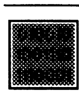
Icon	Single-Click	Double-Click	Right-Click
 MUX	selects the icon	brings up the Multiplex Parameters dialog box	collapses or expands the hierarchy at the Multiplexer icon
 PSI	selects the icon	brings up the PSI Period dialog box.	collapses or expands the hierarchy at the PSI icon

Table 3–12: The icons and their embedded functions (Cont.)

Icon	Single-Click	Double-Click	Right-Click
 PAI	selects the icon	brings up the Program Specific Information dialog box	nothing (bottom of the hierarchy)
 PMI	selects the icon	starts the Edit Table application with the PMT already loaded	nothing (bottom of the hierarchy)
 SI	selects the icon	brings up the DVB Files Selection dialog box	collapses or expands the hierarchy at the SI icon
 NII	selects the icon	brings up the NIT dialog box	nothing (bottom of the hierarchy)
 BAI	selects the icon	brings up the BAT dialog box	nothing (bottom of the hierarchy)
 SDI	selects the icon	brings up the SDT dialog box	nothing (bottom of the hierarchy)
 EII	selects the icon	brings up the EIT dialog box	nothing (bottom of the hierarchy)
 TDT	selects the icon	brings up the TDT dialog box	nothing (bottom of the hierarchy)
 PROG	selects the icon	brings up the Program Parameters dialog box	collapses or expands the hierarchy at the Program icon
 VIDEO	selects the icon	brings up the Video Stream dialog box	nothing (bottom of the hierarchy)
 AUDIC	selects the icon	brings up the Audio Stream dialog box	nothing (bottom of the hierarchy)
 DAIA	selects the icon	brings up the Data Stream dialog box	nothing (bottom of the hierarchy)

Collapsing/Expanding the Hierarchy

When you right-click on any icon you can expand or collapse the hierarchy structure below that icon. See examples in Figures 3–30 and 3–31. This is useful if you are working with large number of programs that also have large numbers of elementary streams.

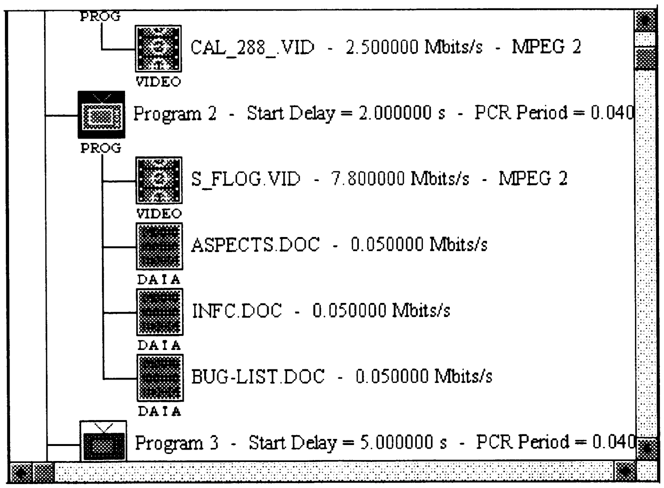


Figure 3-30: The initial display

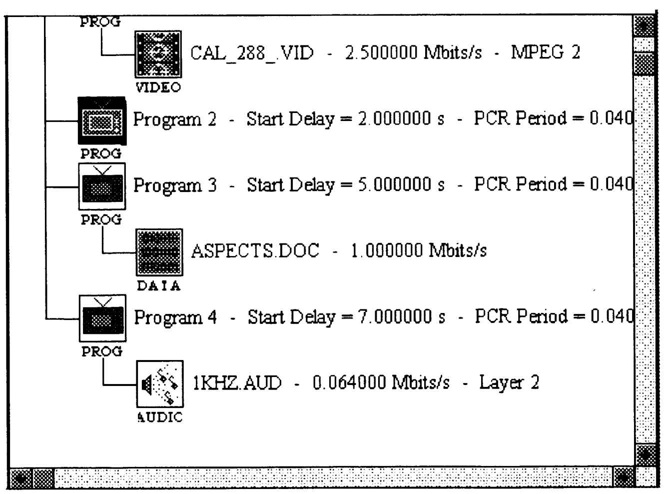


Figure 3-31: The display after collapsing program 2 (the icon is shadowed indicating that it has been collapsed)

Multiplex Icon

Double-clicking on the icon brings up the Multiplex Parameters dialog box shown in Figure 3–32.

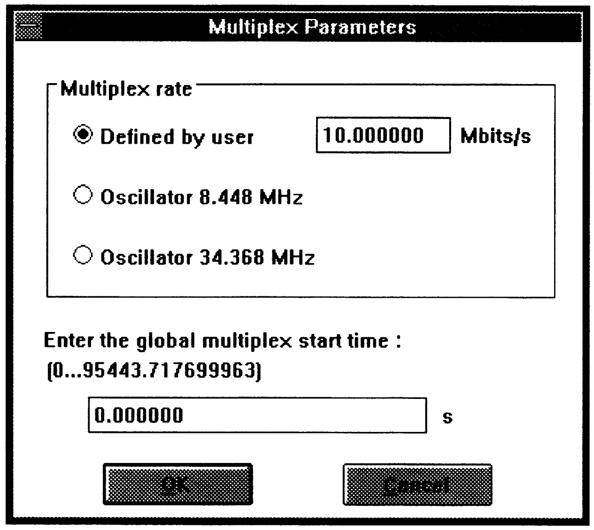


Figure 3–32: The Multiplex Parameters dialog box

From the Multiplex Parameters dialog box you can select both the Multiplex Rate and the Global Multiplex Start Time.

The Multiplex Rate is the number shown in the Rate Gauge, see Figure 3–33. This number defines the data rate for the generator. It also defines the size of the transport stream multiplex. If you lower the Multiplex Rate, you will be able to fit less in the transport stream, assuming constant data rates (see page 3–97 for more information on elementary stream data rates). You can either define your own Multiplex Rate (the default is 10 Mbits/s) or using one of the predefined G703 frequencies: 8.448 MHz or 34.368 MHz.

***NOTE.** If you are creating this transport stream file for a G.703 port, you MUST use the 8.448 or 34.368 MHz option button if you want the correct G703 rate.*

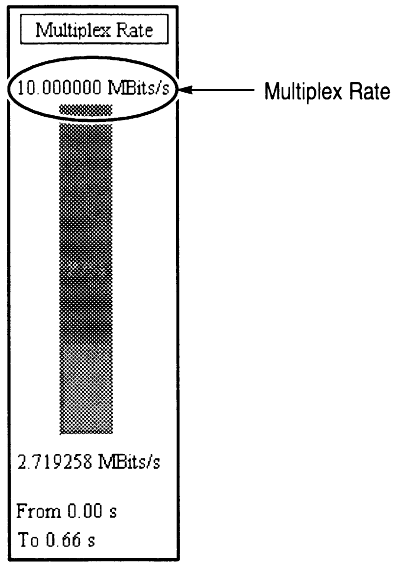


Figure 3–33: The Rate Gauge, notice the Multiplex Rate

The Global Multiplex Start Time is the "clock-on-the-wall" time when the multiplex begins. You can easily see the effect of changing the start time from the dynamic view. Figure 3–34 shows a configuration file with its Multiplex Start Time at 0.00 seconds. Figure 3–35 shows the same configuration file with the Multiplexer Start Time moved to 10.0 seconds.

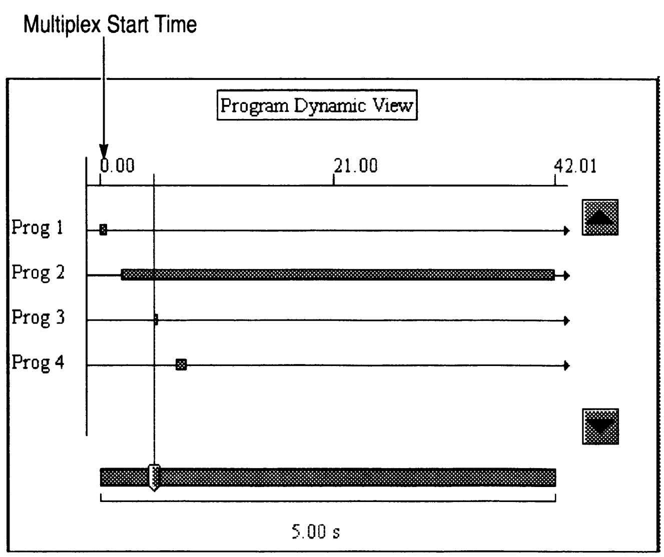


Figure 3–34: The Multiplex Start Time at 0.0 seconds

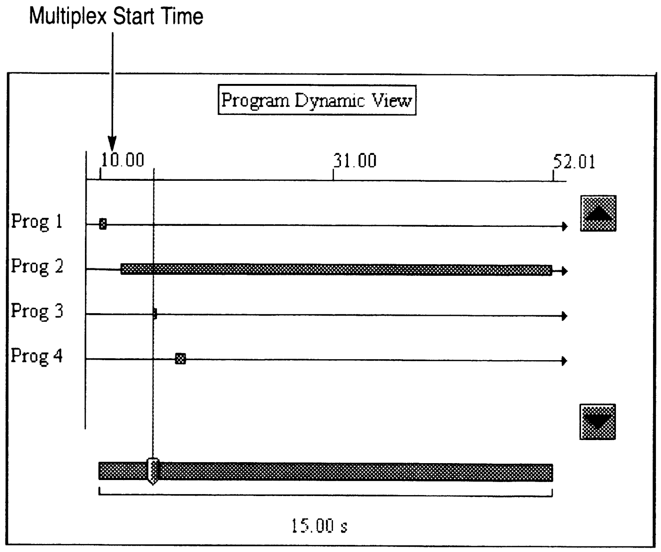


Figure 3–35: The Multiplex Start Time at 10.0 seconds

There are three different timing offsets available: the Global Multiplex Start Time, Program Start Delay, and Elementary Stream Offset. Note that only the Global Multiplex Start Time is available from the Multiplexer Parameters dialog box. Figure 3–36 shows how all the timing offset fit together and how the multiplexer handles the extra space created.

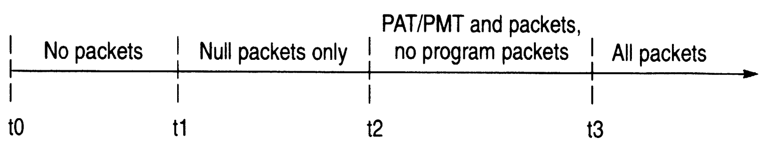


Figure 3–36: How the multiplex handles the various offsets

t0 = 27 MHz clock-on-the-wall is zero

t1 = Global Multiplex Start Time (set in conjunction with the total bit rate) see page 3–86

t2 = Program Start Delay (set for each program) see page 3–96

t3 = Elementary Stream Offset (set for each video, audio, or data ES) see pages 3–98, 3–101, and 3–102.

PSI Icon

Double-clicking on the PSI icon brings up the PSI Period dialog box shown in Figure 3–37. This number sets the interval between times that the PSI information is sent. MPEG-2 requires that this number be less than 0.1 s (10 times per second). However, the multiplexer application allows you to set this number out of specification. This allows you to thoroughly test out your receiving system. If you make this number too small, you will not have any room in your transport stream for any additional information.

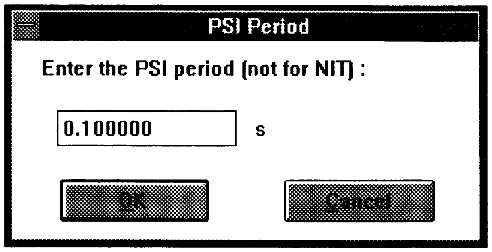


Figure 3–37: The PSI Period dialog box

PAT Icon

Double-clicking on the PAT icon brings up the Program Specific Information dialog box as shown in Figure 3–38. From this dialog box you can check the values of the PIDs for the Program Map Tables (PMT) in the configuration file.

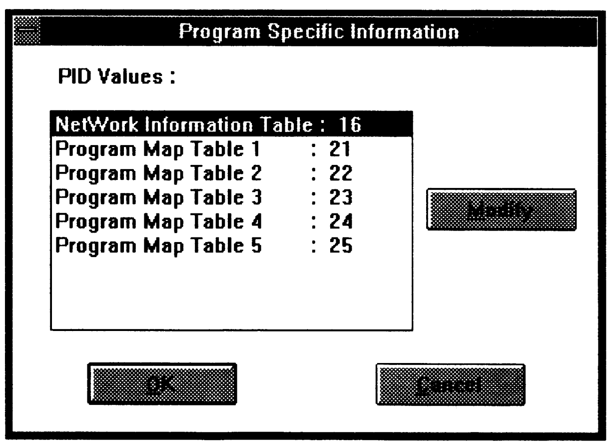


Figure 3–38: The Program Specific Information dialog box

If you want to edit any of these PID numbers, select (highlight) the PID number and then choose the Modify command button. This results in the dialog box shown in Figure 3–39. Enter the desired PID number in the text box and then choose OK. The PID number for the Program Map Table is automatically updated to the desired value.

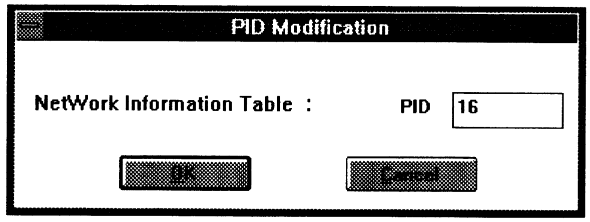


Figure 3–39: The PID Modification dialog box

PMT Icon

Double-clicking on the PMT icon starts the Edit Table application with the PMT already loaded. Additional information on the Edit Table application is given on page 3–105.

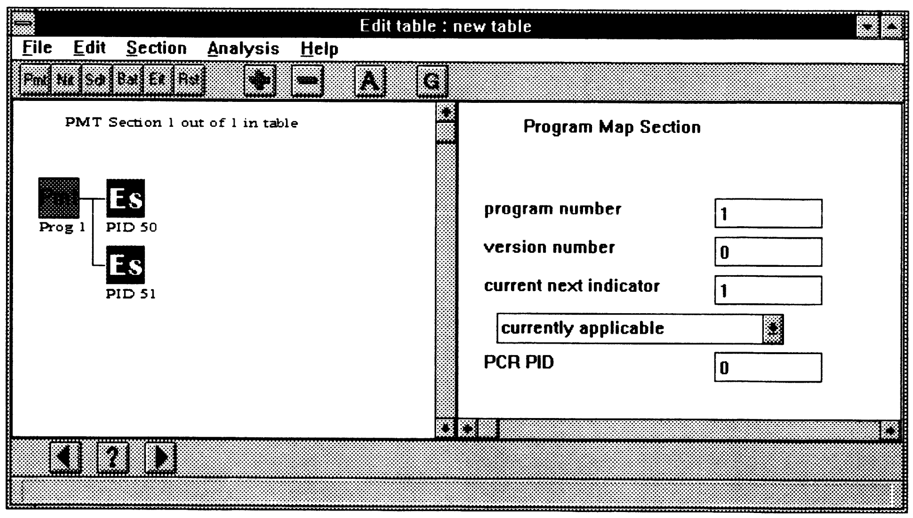


Figure 3–40: The results from double-clicking the PMT icon

SI Icon

Double-clicking on the SI icon brings up the DVB Files Selection dialog box (see Figure 3–41). This is the same dialog box that the Add command in the Edit menu brings up when the SI icon is selected. Please see page 3–68 for more information on this dialog box.

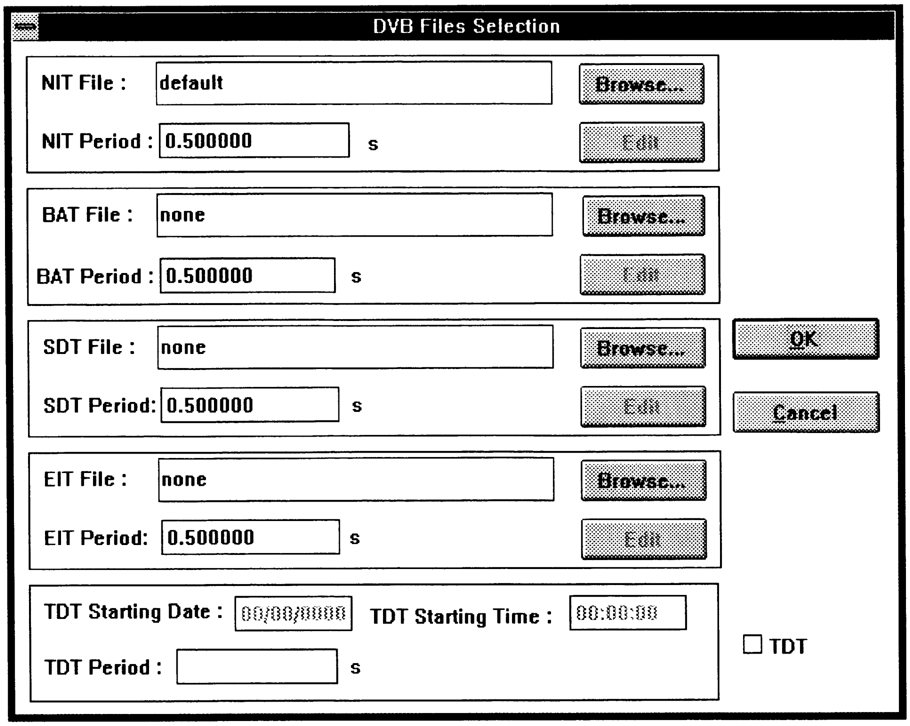


Figure 3–41: The DVB Files Selection dialog box

NIT Icon

Double-clicking on the NIT icon brings up the NIT dialog box as shown in Figure 3–42. This dialog box allows you to select a new Network Information Table (NIT) and change the frequency that the NIT information is placed on the transport stream.

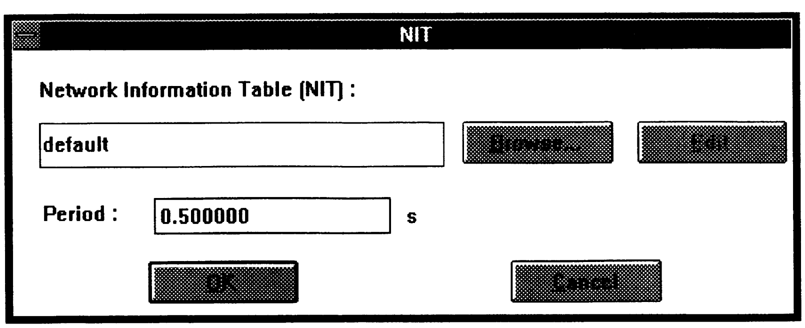


Figure 3–42: The NIT dialog box

You select a new NIT by choosing the Browse command button. This brings up the dialog box shown in Figure 3–43. You then select from the NIT files available. If you want to change an NIT file, choose the Edit command button.

This command button automatically calls the Edit Table application with the selected NIT file already loaded. More information on the Edit Table is given on page 3–105.

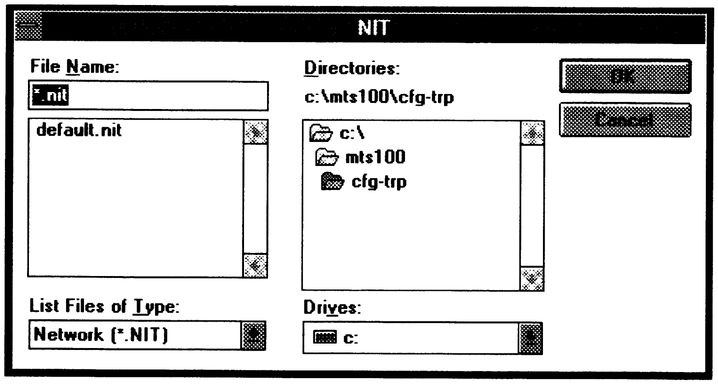


Figure 3–43: The NIT dialog box called by the Browse command button

---

NOTE. *If you want to return the NIT to the default file, select the NIT icon and then choose delete from the Edit menu.*

You can also change the Period from the NIT dialog box. The Period is the amount of time between sending the NIT information. (The default value is 0.5 s or 2 times per second.) You can send it more often, but that will eat into the multiplex rate available for the elementary streams. The Multiplexer application allows you to set the Period much higher than the standard, creating transport streams to thoroughly exercise the MPEG-2 receiving equipment.

BAT Icon

Double-clicking on the BAT icon brings up the BAT dialog box shown in Figure 3–44. This dialog box allows you to select a new BAT file and change the frequency that the BAT information is placed in the transport stream.

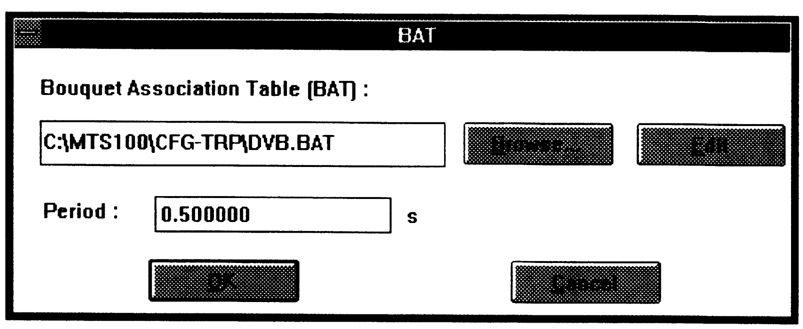


Figure 3–44: The BAT dialog box

You select a new BAT by choosing the Browse command button. This brings up the dialog box shown in Figure 3–45. You can then select from the BAT files available. If you want to change a BAT file, choose the Edit command button. This command button automatically calls the Edit Table application with the selected BAT file already loaded. More information on the Edit Table is given on page 3–105.

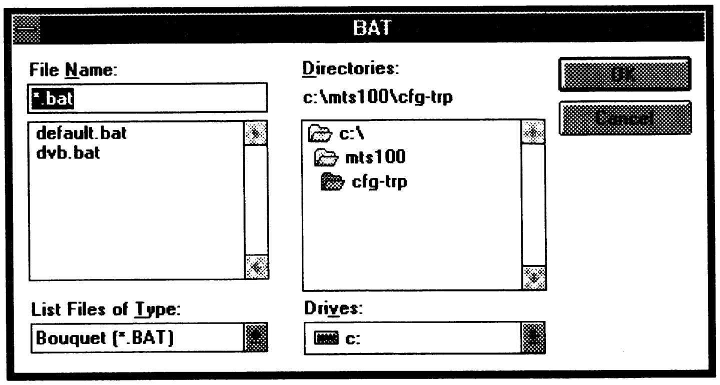


Figure 3–45: The BAT dialog box for selecting a BAT file

You can also change the Period from the BAT dialog box. The Period is the amount of time between sending the BAT information. (The default is 0.5 s or 2 times per second.) You can send it more often, but that will eat into the multiplex rate available for the elementary streams. The Multiplexer application allows you to set the Period much higher than the standard to create transport streams that thoroughly exercise the MPEG-2 receiving equipment.

SDT Icon

Double-clicking on the SDT icon brings up the SDT dialog box as shown in Figure 3–46. This dialog box allows you to select a new SDT file and change the frequency that the SDT information is placed in the transport stream.

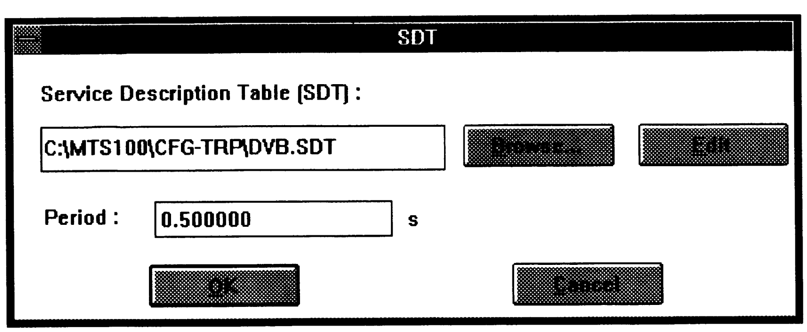


Figure 3–46: The SDT dialog box

Select a new SDT by choosing the Browse command button. This brings up the dialog box shown in Figure 3–47. You can then select from the SDT files available. If you want to change an SDT file, choose the Edit command button. This command button automatically calls the Edit Table application with the selected SDT file already loaded. More information on the Edit Table is given on page 3–105.

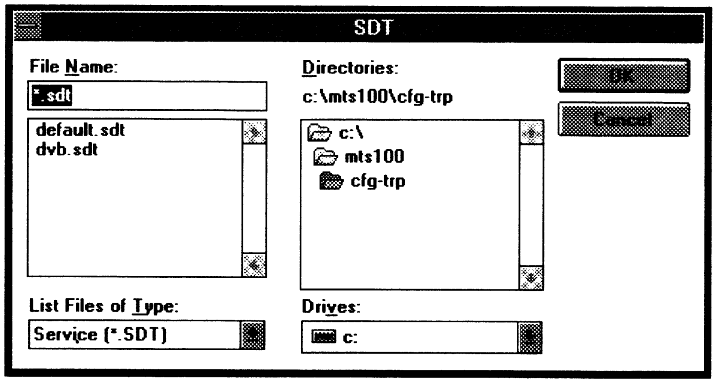


Figure 3–47: The SDT dialog box for selecting an SDT file

You can also change the Period from the SDT dialog box. The Period is the amount of time between sending the SDT information. (The default is 0.5 s or 2 times per second.) You can send it more often, but that will eat into the multiplex rate available for the elementary streams. The Multiplexer application allows you to set the Period much higher than the standard to create transport streams that thoroughly exercise the MPEG-2 receiving equipment.

EIT Icon

Double-clicking on the EIT icon brings up the EIT dialog box shown in Figure 3–48. This dialog box allows you to select a new EIT file and change the frequency that the EIT information is placed on the transport stream.

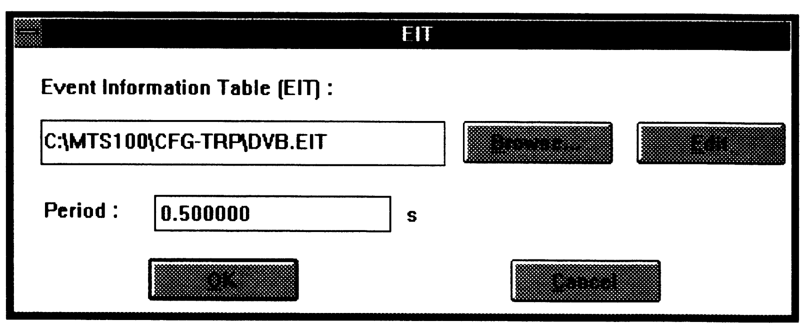


Figure 3–48: The EIT dialog box

Select a new EIT by choosing the Browse command button. This brings up the dialog box shown in Figure 3–48. You can then select from the EIT files available. If you want to change an EIT file, choose the Edit command button. This command button automatically calls the Edit Table application with the selected EIT file already loaded. More information on the Edit Table is given on page 3–105.

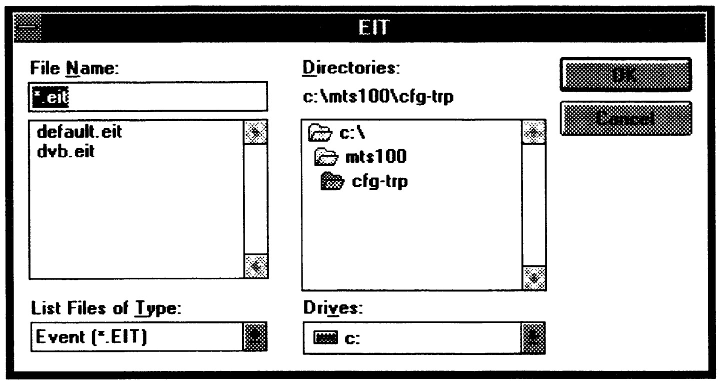


Figure 3–49: The EIT dialog box for selecting the EIT file

You can also change the Period from the EIT dialog box. The Period is the amount of time between sending the EIT information. (The default is 0.5 s or 2 times per second.) You can send it more often, but that will eat into the multiplex rate available for the elementary streams. The Multiplexer application allows you to set the Period much higher than the standard creating transport streams that thoroughly exercise the MPEG-2 receiving equipment.

TDT Icon

Double-clicking on the TDT icon brings up the Time and Date dialog box shown in Figure 3–50. This dialog box enables you to enter the UTC time and date code to be placed in the transport stream.

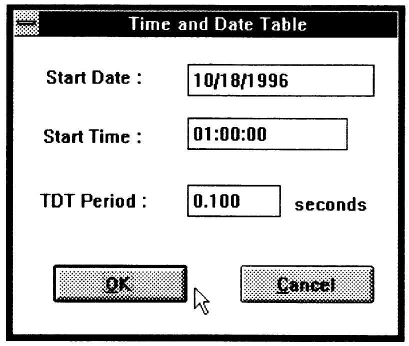


Figure 3–50: The TDT dialog box

Type the appropriate date (in the format MM/DD/YYYY) into the Start Date text box. Type the appropriate time (in the format HH:MM::SS) into the Start Time text box. The value in the TDT Period box specifies how often the time and date stamp is placed into the transport stream. Type a value between 0.100 and 100.000 into the TDT Period text box. When you have typed in all the necessary information, click OK.

Program Icon

Double-clicking on the Program icon brings up the Program Parameters dialog box shown in Figure 3–51. This dialog box allows you to set the PCR (Program Clock Reference) period and any required Program Start Delay.

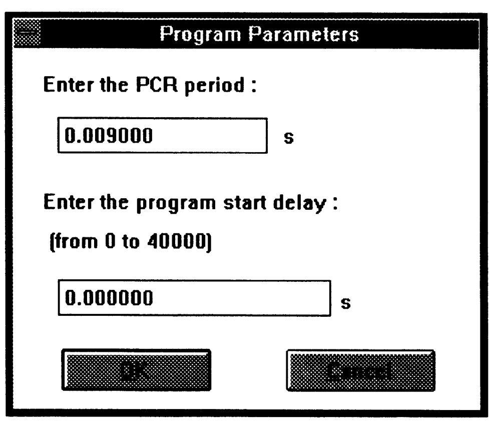


Figure 3–51: The Program Parameters dialog box

The PCR period is the amount of time that will pass between sending PCR signals. MPEG-2 requires a maximum of 0.1 seconds between PCR signals (10 times/second). This is also the largest value that the text box will accept without a warning message. Note that if you set the PCR period to 0.1 second, the resulting transport stream will show errors.

NOTE. *You can change the PCR PID using the Edit Table application. If the PCR is not one of the elementary streams in the program it will be in its own packets. This may be useful for some applications or experiments.* *See page 3–133.*

The Program Start Delay is the amount of time from the start of the multiplex, that you want to wait before beginning to send the elementary streams in this program. The best way to see the effect of the Program Start Delay is to look at the configuration file in dynamic view. Figure 3–52 illustrates how the Program Start Delay affects the resulting transport stream. Each of the five programs start at a different time. This allows the transport stream to carry more information than if all of the programs started at the same time.

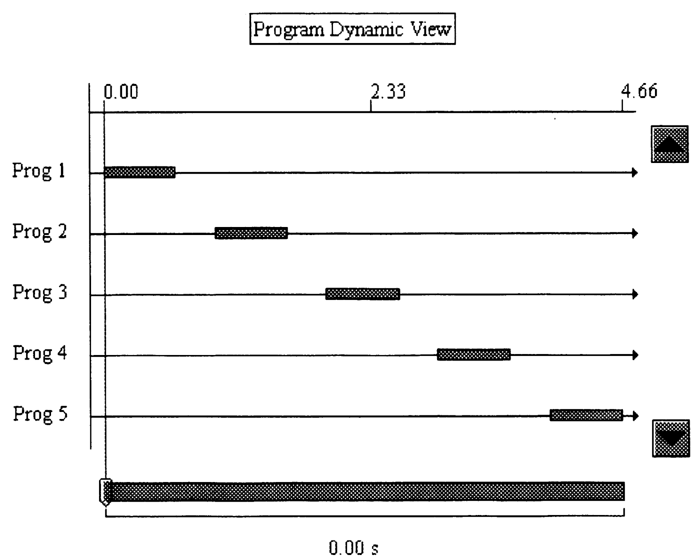


Figure 3–52: Illustration of the Program Start Delay

Figure 3–36 on page 3–87 illustrates how this timing offset affects the overall transport stream file. The Program Start Delay is t2 in the illustration.

Video Icon

Double-clicking on the Video icon brings up the Video Stream dialog box as shown in Figure 3–53. This dialog box allows you to select a video elementary stream to link to the Video icon and to modify the timing of that stream to fit your particular requirements.

Use the Browse command button to select a video elementary stream to link to the configuration file. The Browse command button brings up a dialog box that is similar to the other file selection dialog boxes. You can select a file with any file extension, but the Multiplexer application will not accept it unless it has the correct video header information.

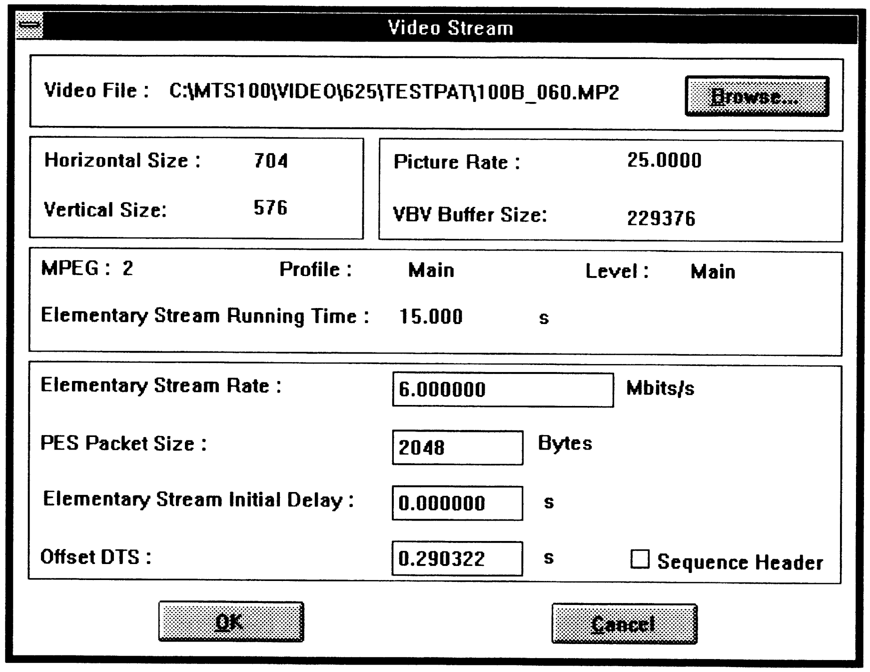


Figure 3–53: The Video Stream dialog box

There are only five parameters (in addition to the file selection) that are editable from this dialog box. The rest are information only, extracted from the video file's header information. The editable information includes: the Elementary Stream Rate, the PES Packet Size, the Elementary Stream Delay, Offset DTS, and Sequence Header (which is either selected or not).

The Elementary Stream Rate is how fast the elementary stream is to be multiplexed into the transport stream, after compression. The default value is the value found in the elementary stream header. This is the recommended value. You can adjust this value as required to meet your specific requirements, as long as you do not need to have the transport stream decoded in real time. If you slow the rate down too much, the decoder will not have all the information required to decode in real time, but it would still work fine in other conditions.

The PES Packet Size can range from 0 to 64000, with the default of 2048. A packet size of 0 will put the complete video picture in one PES packet.

The Elementary Stream Initial Delay can range from 0 to 20,000 seconds. This is the time after beginning multiplexing the Program that this video elementary stream should start to be multiplexed into the transport stream. This will extend the length of the program, but not free up room in the multiplex. (See Figures 3–54A, B, and C.)

If Sequence Header is unchecked, when a video stream is inserted into the transport stream, all of the video stream is inserted. If the Sequence Header is checked, the data ahead of the first sequence header is stripped before the video stream is inserted into the transport stream.

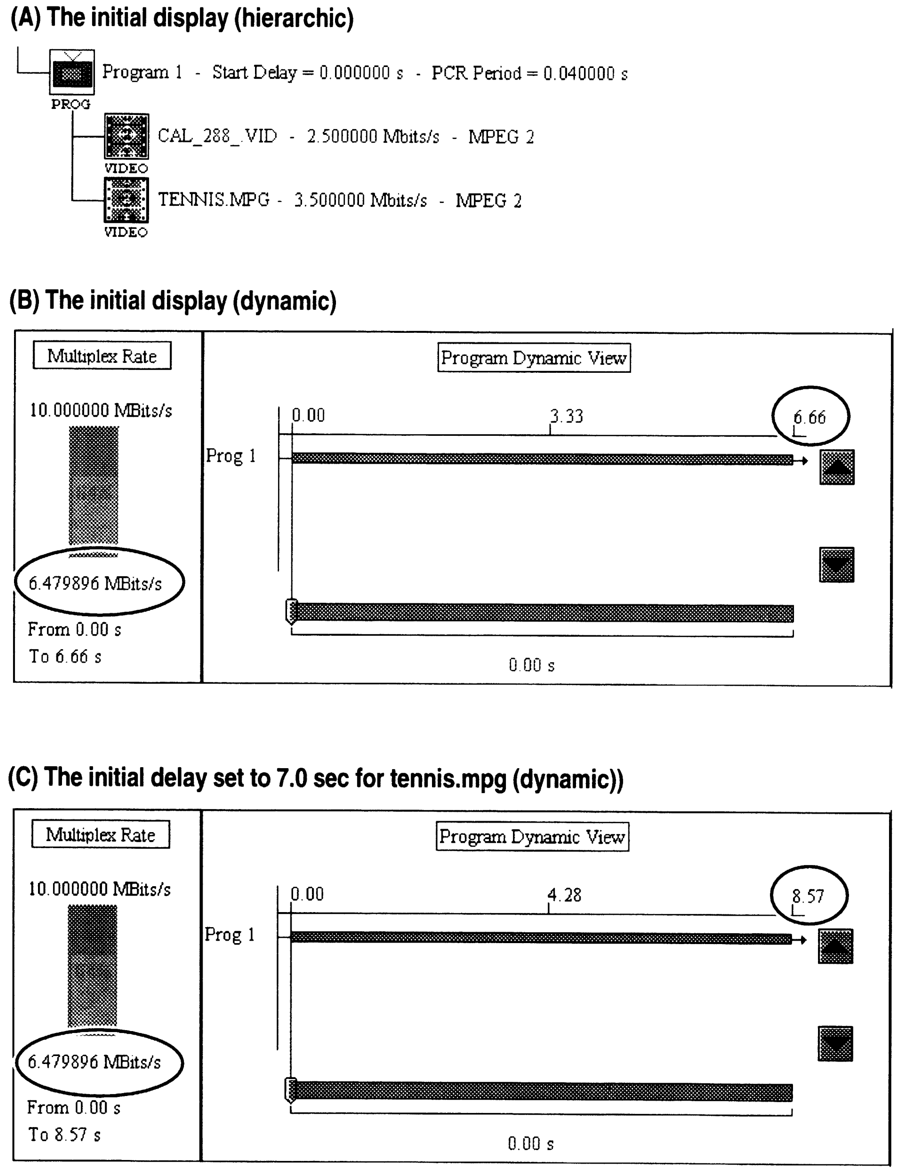


Figure 3–54: Changing the Elementary Stream Initial Delay

NOTE. *This does NOT reduce the size of the multiplex. Null packets fill in at the same rate that the elementary stream packets would have been placed into the stream.*

Figure 3–36, on page 3–87, illustrates how this timing offset affects the overall transport stream file. The Elementary Stream Initial Delay is t3 in the illustration.

The Offset PTS is the amount of time between the PTS (presentation time stamp) and the DTS (Decode Time Stamp).

Audio Icon Double-clicking on the Audio icon brings up the Audio Stream dialog box as shown in Figure 3–55.

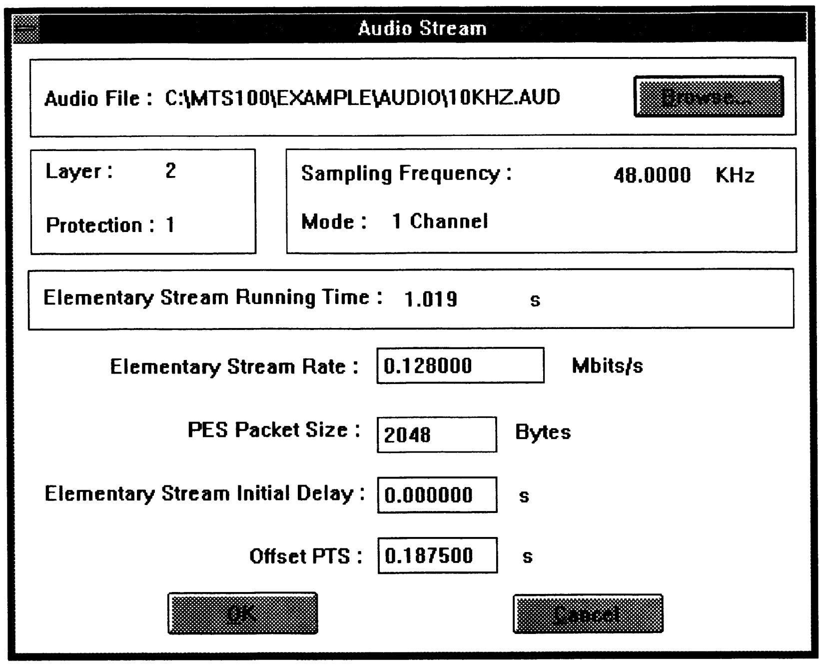


Figure 3–55: The Audio Stream dialog box

Use the Browse command button to select an audio elementary stream to link to the configuration file. The Browse command button brings up a dialog box that is similar to any other file selection dialog box. You can select a file with any file extension, but the Multiplexer application will not accept it unless it has the correct audio header information.

Besides the Browse button, there are four editable fields in the Audio dialog box: Elementary Stream Rate, PES Packet Size, Elementary Stream Initial delay, and Offset PTS.

The Elementary Stream Rate is how fast the elementary stream is to be multiplexed into the transport stream, after compression. The default value is the value found in the elementary stream header. This is the recommended value. You can adjust this value as required to meet your specific requirements, as long as you do not need to have the transport stream decoded in "real time." If you slow the rate down too much the decoder will not have all the information required to decode in real time, but it would still work fine in any other condition.

The PES Packet Size can range from 40 to 64000.

The Elementary Stream Initial Delay can range from 0 to 20,000 seconds. This is the time after the multiplexing of the Program has started that this elementary should start to be multiplexed into the transport stream. This will extend the length of the program, but not free up room in the multiplex. See Figures 3–54A, B, and C for an illustration using the video elementary stream.

Figure 3–36 on page 3–87 illustrates how this timing offset affects the overall transport stream file. The Elementary Stream Initial Delay is t3 in the illustration.

The Offset PTS is the amount of time between the PTS (presentation time stamp) and arrival time.

Data Icon

Double-clicking on the Data icon brings up the Data Stream dialog box shown ing Figure 3–56. You can then select a file to link to the configuration file by using the Browse command button. There are no limitations on the type of the file. You also use this dialog box to set the data rate and the Initial Delay.

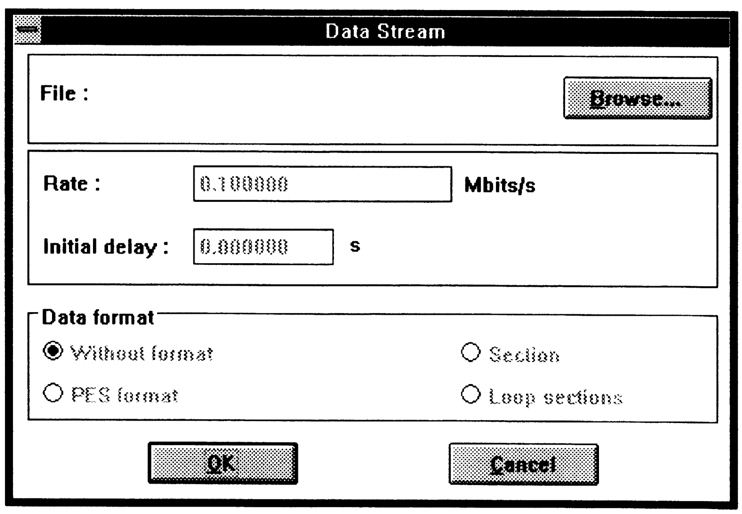


Figure 3–56: The Data Stream dialog box

Use the Browse command button to select a file to link to the configuration file. The Browse command button brings up a dialog box that is similar to any other file selection dialog box. You can select a file with any file extension.

The Rate is how fast the data is to be multiplexed into the transport stream. The default value is 1 Mbit/s.

The Initial Delay is the amount of time from the beginning of the Program before the data is multiplexed into the transport stream. It operates the same as the Initial Delay for both the video and audio elementary streams.

Figure 3–36, on page 3–87, illustrates how this timing offset effects the overall transport stream file. The Elementary Stream Initial Delay is t3 in the illustration.

The selections in the Data Format box are used to specify the data will be formatted in the transport stream. Select Without Format if the data should not be formatted. Select PES format to have the data multiplexed into the transport stream in PES format. Select Section if you want your data formatted in sections. Select Loop sections if they sections should be looped.

Example of a Configuration File

An example of a configuration file is shown below. Notice that each heading is enclosed in brackets.

```
[MUX]
CountProg=4
Mux Rate=10.000000
Global time=0.000000

[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

[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
```

```
[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

Data necessary for the DVB IRD (Digital Video Broadcasting Integrated Receiver Decoder) to automatically configure itself is available in the MPEG-2 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.

In a DVB environment, the viewer of tomorrow will be receiving a multitude of channels with his IRD. These services could range from interactive television, to near video on demand to specialized programming.

The viewer will need help. DVB-SI provided the elements necessary for the development of the Electronic Program Guides (EPG) that are likely to become a feature of new digital television television services. DVB-SI needs to describe the technical attributes of each service being offered by an individual broadcaster. Other information is given such as: start time, the name of the service provider, and the classification of the event (sports, news, etc.).

The PSI and SI Table Editor application can create and edit:

- MPEG-2 Program Specific Information (PSI)
- Digital Video Broadcasting Specific Information (DVB-SI)
  Network Information Table (NIT)
  Service Description Table (SDT)
  Event Information Table (EIT)
  Bouquet Association Table (BAT)

The PAT, CAT, and PMT Program Specific Information tables give information only for the multiplex that contains them. Only the PMT is editable from this application.

- Program Map Table (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. The table is transmitted in sections.

In contrast, Service Information (SI) provides information on services and events carried by different multiplexes, and even other networks. SI is structured as six tables, but this application is only interested in three tables. These SI tables are segmented into one or more sections before being inserted into the transport Stream Packets.

- Bouquet Association Table (BAT): provides information regarding bouquets (a collection of services marketed as a single entity).

- Service Description Table (SDT): contains data describing the services in the system. These include: names of services, service provider, etc.
- Event Information Table (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 of more events under the control of a broadcaster), such as event name, start time, duration, etc.

Transport Streams are identified by the combination of an original network ID and a transport stream ID in the NIT.

- Network Information Table (NIT): conveys information relating to the physical organization of the multiplex. This includes: transport streams carried via a given network and the characteristics of the network itself.

The PSI and SI Table Editor application can also show a global view of the relation between three of the tables: NIT (networks), SDT (services), and EIT (events).

One of each file type can be open at the same time. (Notice that only one type is visible at a time.)

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.*

Overview

You can access the Edit Table application in two ways:

- Double-click the Edit Table icon in the Tektronix MTS 100 program group.
- Through the PMT icon in the Multiplexer application (this method ensures correct association of the table and configuration files.)

Figure 3–57 shows the default display with the default PMT Table file displayed. Most parts of the display called out are similar for all table types. The exceptions are the Hierarchy Window and Edit Window.

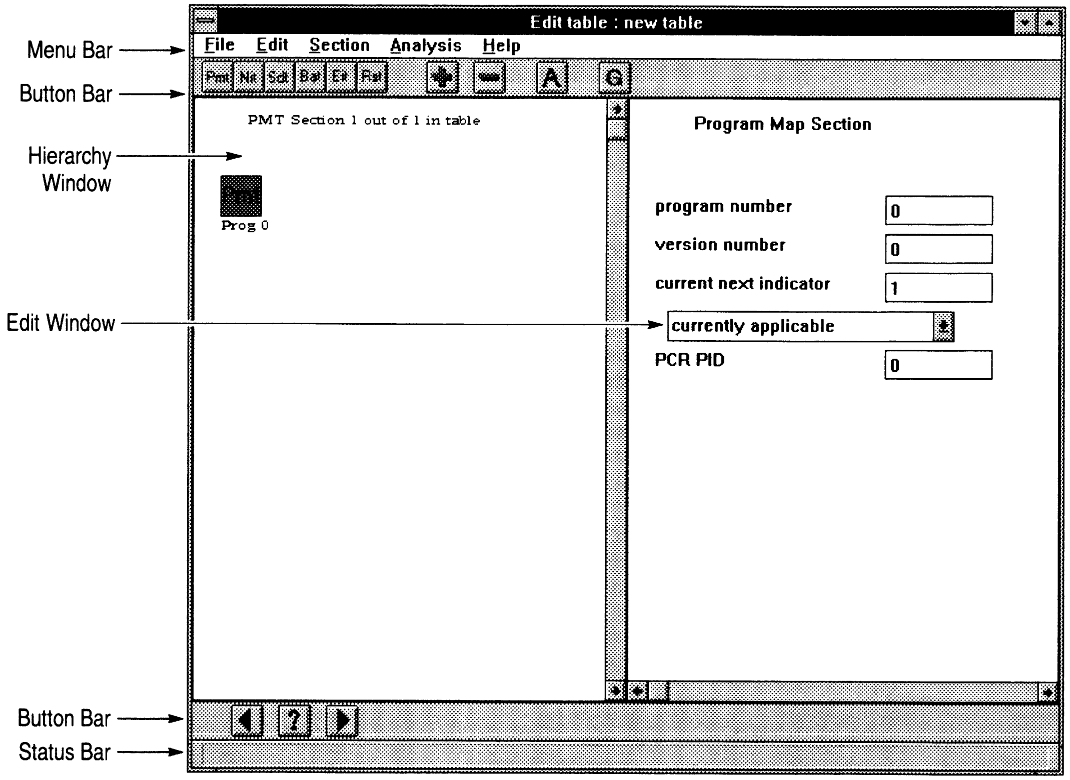


Figure 3–57: The Edit Table window with a file open

Application Window

The Application Window contains both the Edit Window and Hierarchy Window. The "default" background is only visible when no Table files are displayed.

Hierarchy Window

The Hierarchy Window shows the structure of the currently selected Table. Additions and deletions to the Table are made from this window. Editing the parameter values is done from the Edit Window.

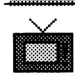
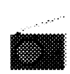
Edit Window

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.

Icon List

Table 3–13 lists all of the icons that may be displayed and their meanings.

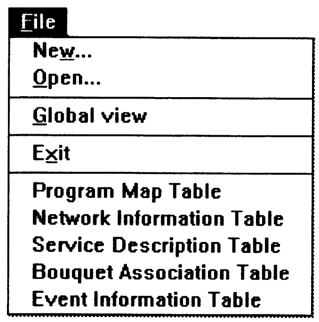
Table 3–13: Icons used in the Edit Table Application

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 (or sub-descriptor)
	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)

Menu Bar Commands

The following section lists the commands available from the Menu Bar and explains their function and use.

File



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. The commands available from the File menu include: New, Open, Global View, Exit, Program Map Table, Network Information Table, Service Description Table, Bouquet Association Table, and Event Information Table.

New. The New command brings up the Table Type dialog box. See Figure 3–58. Select the desired option button (PMT, NIT, SDT, BAT, or EIT) and then choose OK. This brings up the default Table file for the selected type.

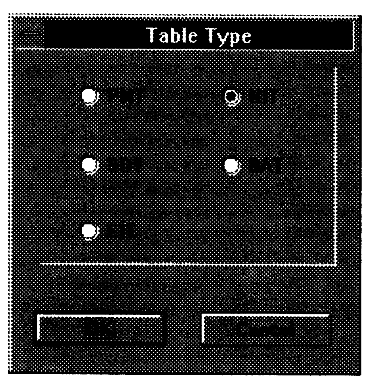


Figure 3–58: The Table Type dialog box

If there is already a Table of the selected type open, then you get the Save Table dialog box, which asks what you would like done with the current Table (save, ignore, or cancel). Save saves the current Table. Ignore closes the current Table without saving it. Cancel returns you to the current Table. Figure 3–59 shows an example of the Save Table dialog box for the NIT table.

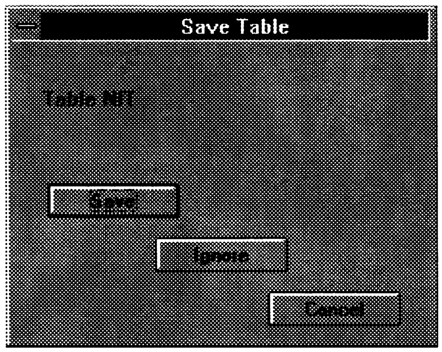


Figure 3–59: An example of a Save Table dialog box for an NIT table

Open. The Open command begins by displaying the Table Type dialog box (Figure 3–60).

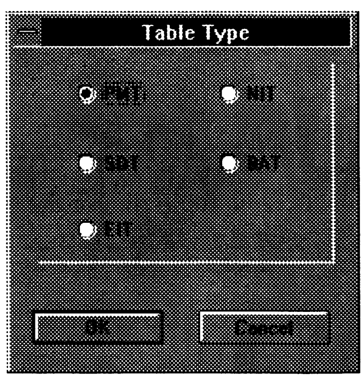


Figure 3–60: The Table Type dialog box

Select one of the Table types, using the option button. After choosing OK, the Open dialog box, similar to Figure 3–61 appears.

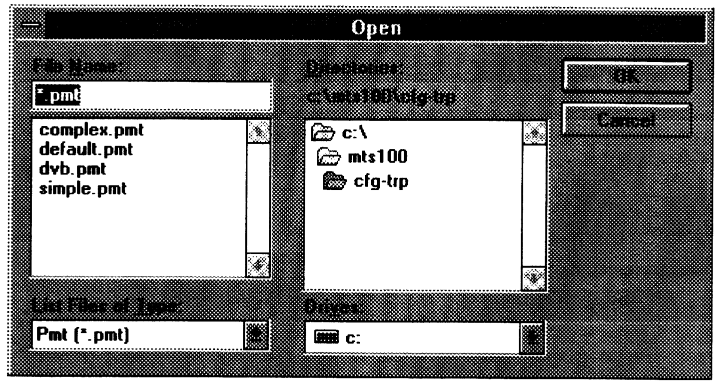


Figure 3–61: The Open dialog box

Select the desired Table file from the list. (You can change directories as required.)

The *.pmt extension is REQUIRED for PMT files. Each Table type requires its own extension.

After selecting the OK command button, the selected file is displayed in the Hierarchy and Edit Windows.

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. (See the Save As command for more information.)

If you want to save all of the open Table files, use the Save All command instead.

Save As. The Save As command allows you to save a Table file under a new name. Figure 3–62 shows the Save As dialog box. Enter a new name in the File Name Text box and choose OK. The correct extension for the file type (in this case *.pmt) is automatically added to the file name.

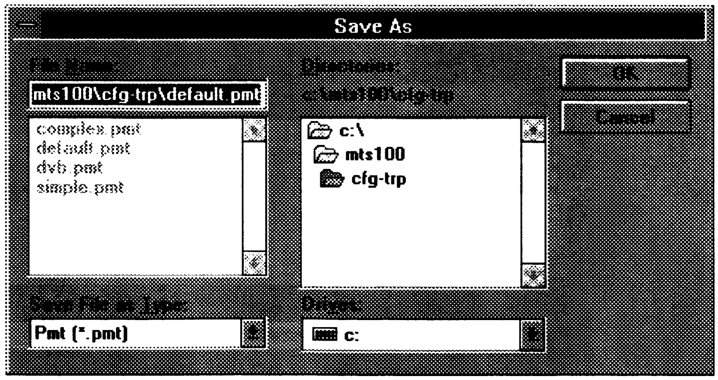


Figure 3–62: The Save As dialog box

NOTE. *The Edit Table application requires the correct extension for the file name (dependent upon Table type). 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 one of the files is untitled, it will automatically provide the Save As dialog box. You can name the file and then the application continues saving the rest of the files.

Close. The Close command closes the current Table file window, but it does not close the application.

If the Table file is currently untitled, it provides the Save Table dialog box as shown in Figure 3–63. You can then either save the file, ignore the file and close anyway, or cancel the close command.

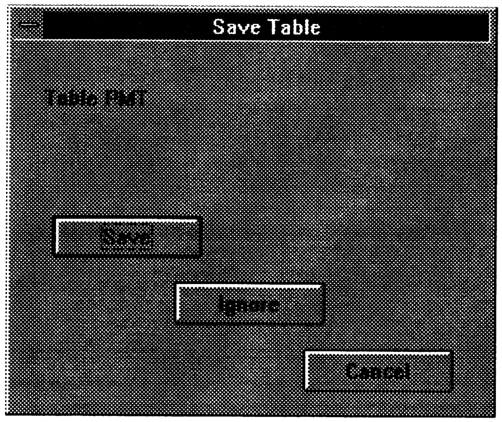


Figure 3–63: The Save Table dialog box

Global View. The Global View command shows the association between selected NIT, SDT, and EIT Table files. These files can have some relationship or none at all. Figure 3–64A shows files having no association to each other, while Figure 3–64B shows three Table files that have a high degree of association.

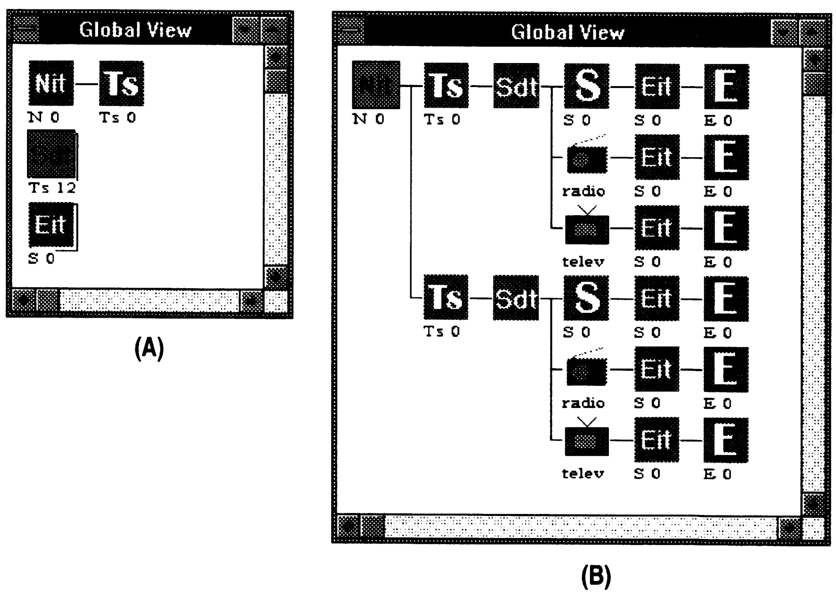


Figure 3–64: (A) is a group of unassociated Table files (B) is a group of highly associated Table files

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 in Figure 3–65 and is explained below.

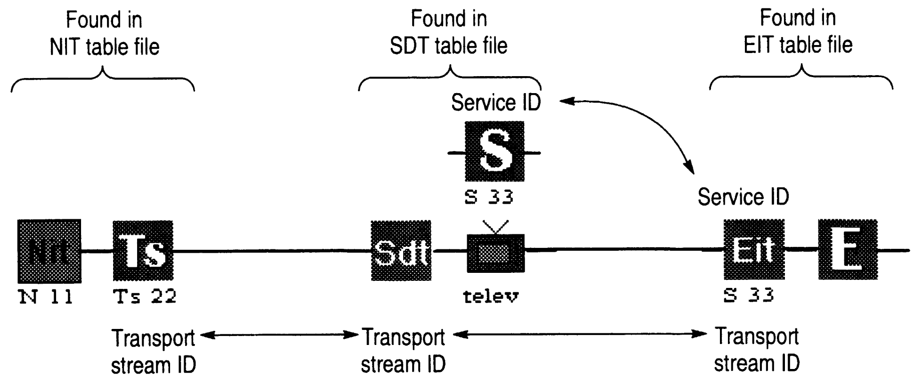


Figure 3–65: Illustration of how Table files are associated with each other

The NIT contains the Transport Stream, with a Transport Stream ID defined in the Transport Stream's Edit Window.

If the SDT's Transport Stream ID (from the SDT's edit window) is the same, then the SDT is associated with the NIT.

If the SDT has a Service and that Service has a Service Descriptor, there may be a service or "special" service icon (shown in Table 3–13). The Service's Edit window contains the service ID parameter.

If the EIT's parameters (from the Edit Window) are the same as the SDT's 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.)

An explanation of how to create a complex association of files is given on page 3–155.

Exit. This command closes the Edit Table application. If any files have not been saved, it will ask if you want to save each one before exiting.

Program Map Table. If you choose this command with a PMT already open, it will place the current PMT in the Application Window.

Choose this command without a PMT file currently open and you receive the Table dialog box shown in Figure 3–66.

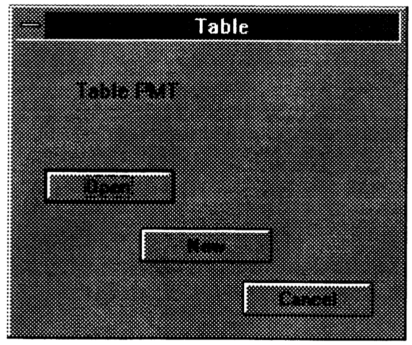


Figure 3–66: The Table dialog box

From here, you can open an existing *.pmt file, create a new *.pmt file, or cancel this command and do nothing. If you choose to open an existing file, you get the Open dialog box shown in Figure 3–67.

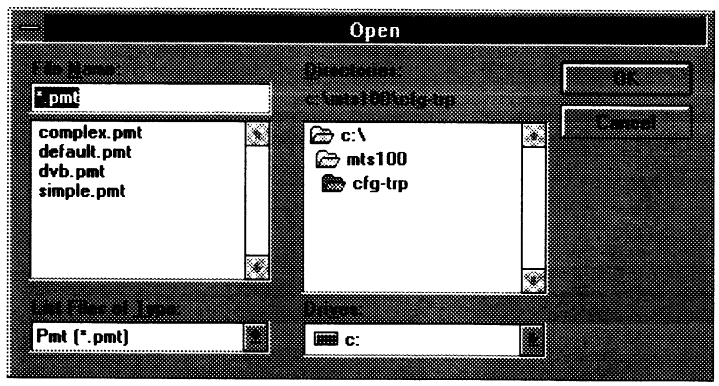


Figure 3–67: The Open dialog box for PMT files

Select the desired file from the list and choose OK.

If you select New from the Table dialog box, then the default PMT file is displayed in the Application Window as shown in Figure 3–68.

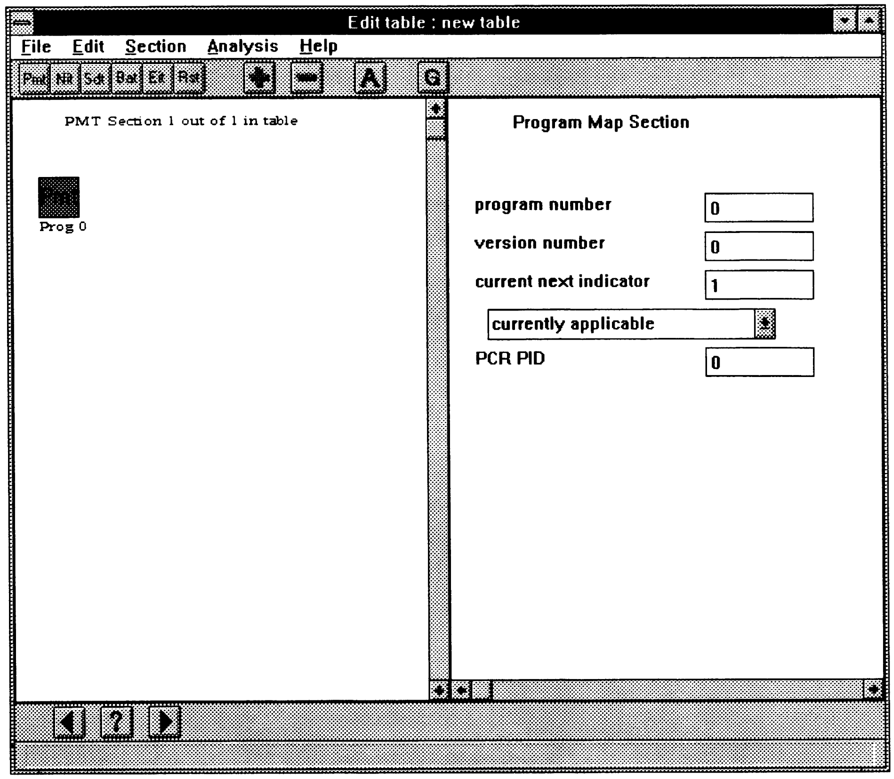


Figure 3–68: The default PMT file

The PMT's various parts are described in further detail on page 3–133.

Network Information Table. If you choose this command with an NIT already open, it will place the current NIT in the Application Window.

Choose this command without an NIT file currently open and you get the Table dialog box shown in Figure 3–69.

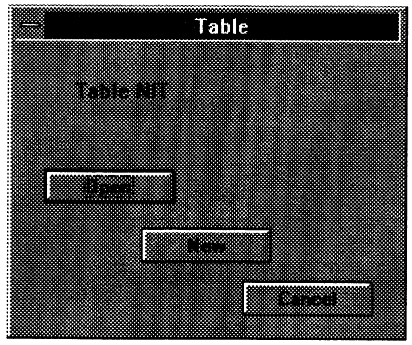


Figure 3–69: The Table dialog box for NIT tables

From here, you can open an existing *.nit file, create a new *.nit file, or cancel this command and do nothing. If you choose to open an existing file, you get the Open dialog box shown in Figure 3–70.

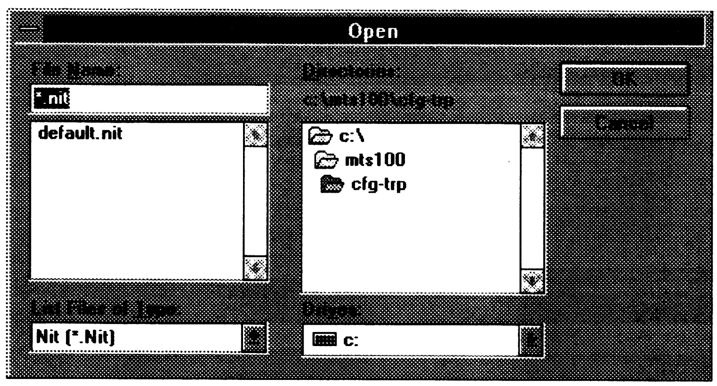


Figure 3–70: The Open dialog box for NIT files

Select the desired file from the list and choose OK.

If you select New from the Table dialog box then the default NIT file is displayed in the application window as shown in Figure 3–71.

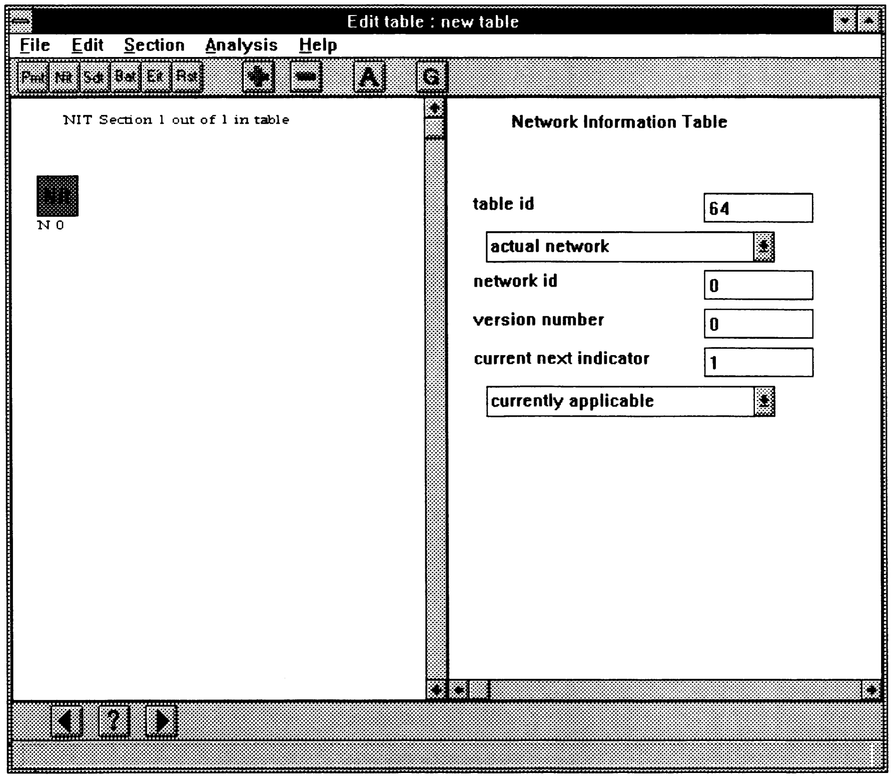


Figure 3–71: The default NIT Table file

The NIT's various parts and parameters are discussed in more detail on page 3–138.

Service Descriptor Table. If you choose this command with an SDT already open, it places the current SDT in the Application Window.

If you choose this command without an SDT file currently open, you get the Table dialog box shown in Figure 3–72.

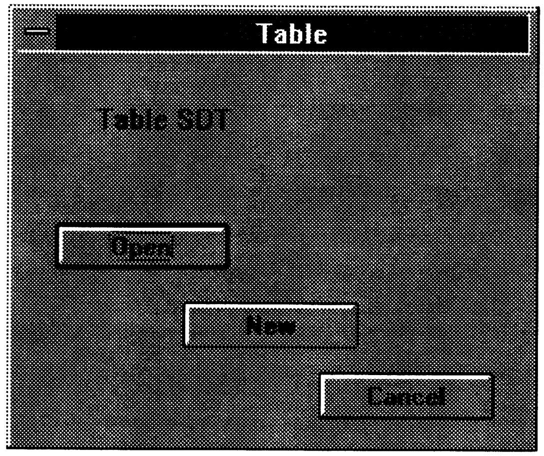


Figure 3–72: The Table dialog box for SDT

From here, you can open an existing *.sdt file, create a new *.sdt file, or cancel this command and do nothing. If you choose to open an existing file, you get the Open dialog box shown in Figure 3–73.

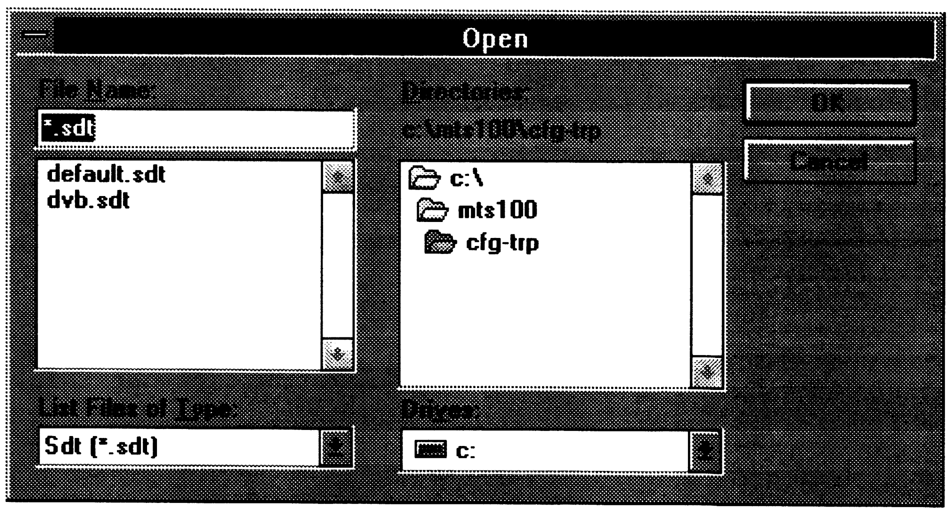


Figure 3–73: The Open dialog box for SDT files

Select the desired file from the list and choose OK.

If you select New from the Table dialog box then the default SDT file is displayed in the Application Window shown in Figure 3–74.

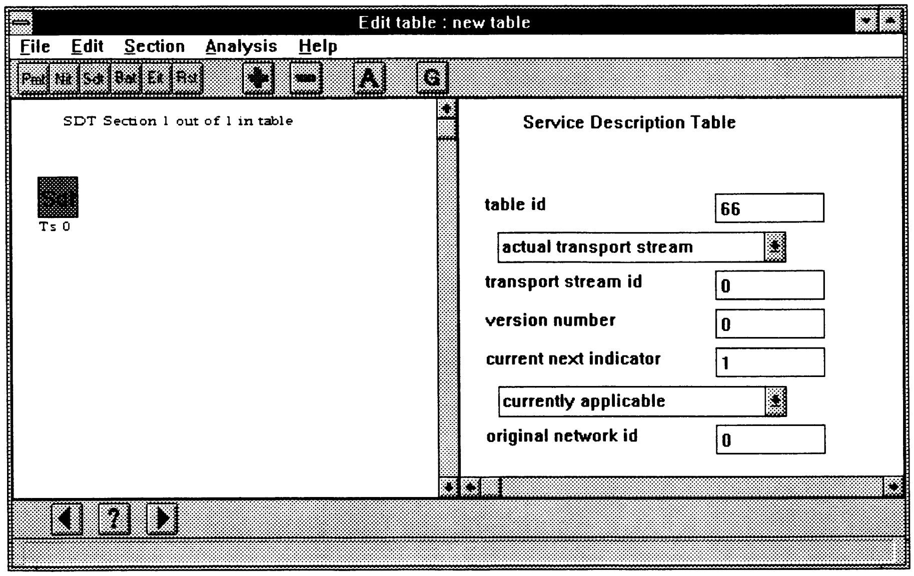


Figure 3–74: The default SDT file

The SDT's various parts and parameters are described on page 3–143.

Bouquet Association Table. If you choose this command with a BAT already open, it places the current BAT in the Application Window.

If you choose this command without a BAT file currently open, you get the Table dialog box shown in Figure 3–75.

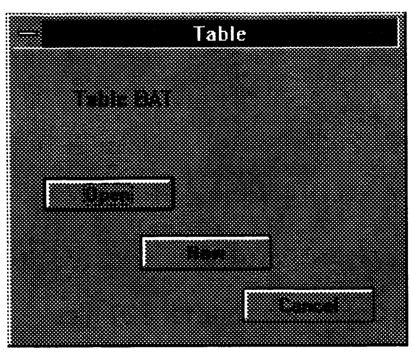


Figure 3–75: The Table dialog box for BAT files

From here you can select to either open an existing *.bat file, create a new *.bat file, or cancel this command and do nothing. If you choose to open an existing file, you get the Open dialog box shown in Figure 3–76.

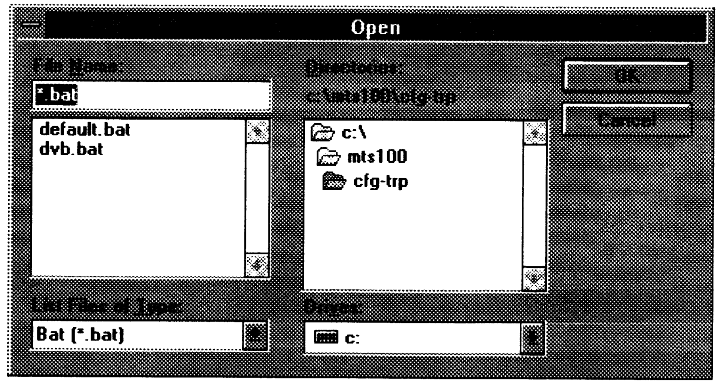


Figure 3–76: The Open dialog box for BAT files

Select the desired file from the list and choose OK.

If you select New from the Table dialog box then the default BAT file is displayed in the application window shown in Figure 3–77.

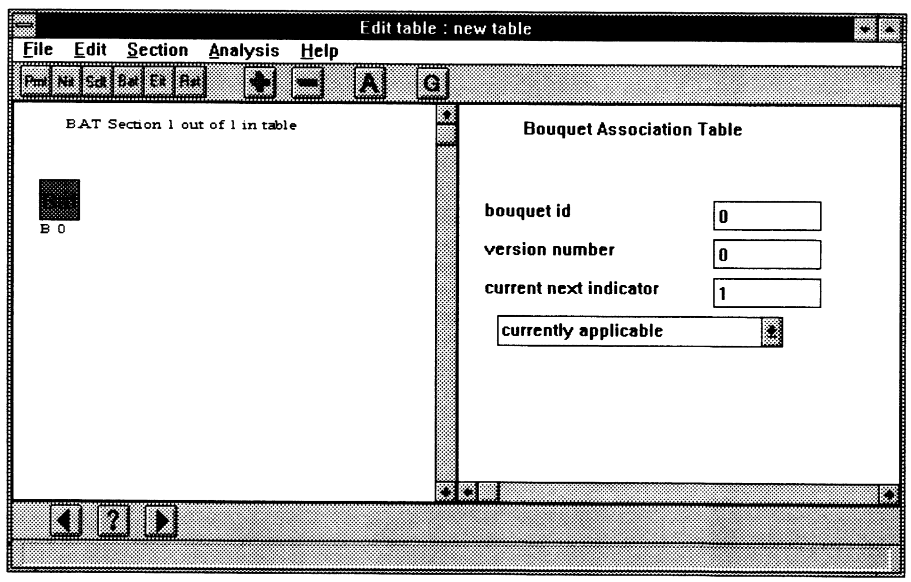


Figure 3–77: The default parameters for BAT files

The BAT's various parts and parameters are described in more detail beginning on page 3–146.

Event Information Table. If you choose this command with an EIT already open, it places the current EIT in the Application Window.

If you choose this command without an EIT file currently open, you get the Table dialog box shown in Figure 3–78.

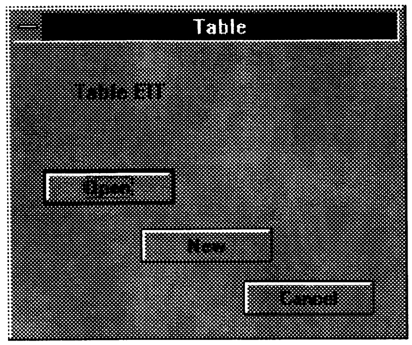


Figure 3–78: The Table dialog box for EIT files

From here, you can open an existing *.eit file, create a new *.eit file, or cancel this command and do nothing. If you choose to open an existing file, you get the Open dialog box shown in Figure 3–79.

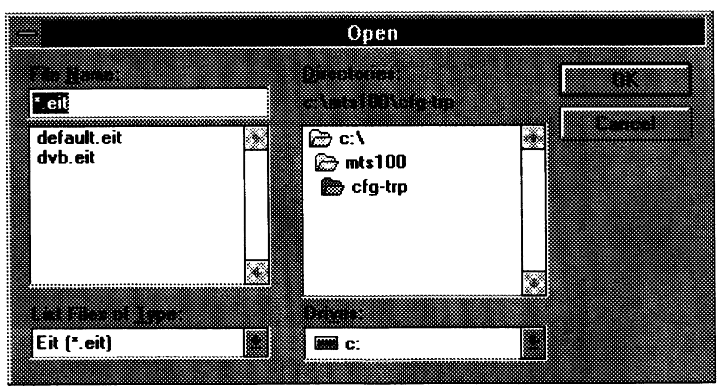


Figure 3–79: The Open dialog box for EIT files

Select the desired file from the list and choose OK.

If you select New from the Table dialog box then the default EIT file is displayed in the Application Window shown in Figure 3–80.

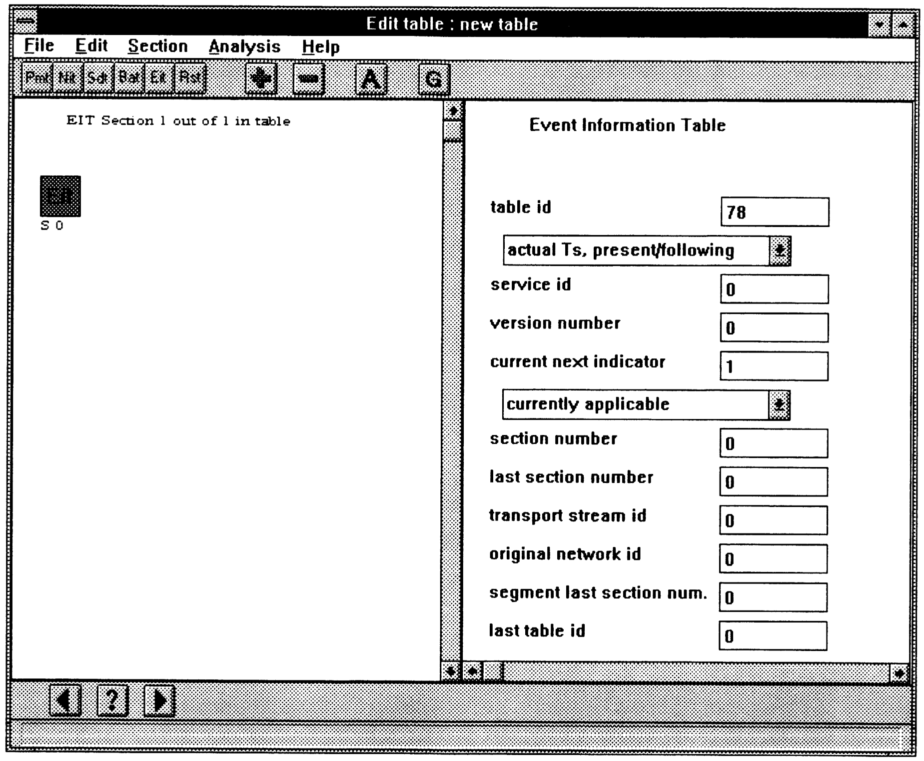
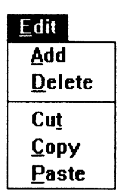


Figure 3–80: The default file for EIT files

The EIT's various parts and parameters are discussed in more detail on page 3–150.

Edit The Edit menu allows you to add and delete items from the Table files.



Add. The Add command allows you to add items to the Table files. What you can add is dependent upon the table and the icon selected in the Hierarchy Window. Table 3–14 lists the items available for addition.

CAUTION. *Modifying elementary stream information at the PMT level can produce incoherence in the Multiplexer. You are always given a warning before adding or removing elementary streams from the PMT file. If you access the Edit Table application from the Multiplexer application, the addition/deletion of elementary streams is not permitted.*

Table 3–14: Items available through the Add command

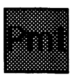
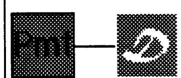
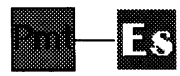
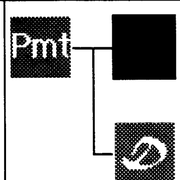
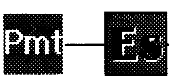
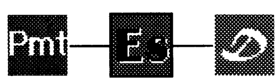
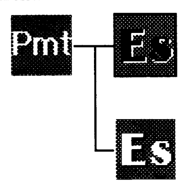
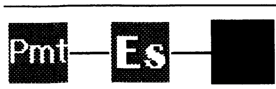
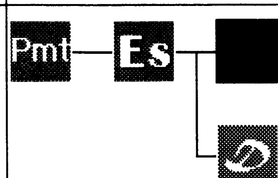
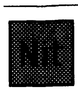
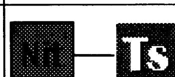
Icon Selected	Items Available through the Add Command	
 PMT	 PMT — descriptor or	 PMT — elementary stream
 PMT — descriptor	 additional PMT — descriptor	
 PMT — elementary stream	 PMT — elementary stream — descriptor or	 additional PMT — elementary stream
 PMT — elementary stream — descriptor	 additional PMT — elementary stream — descriptor	
 NIT	 NIT — transport stream or	 NIT — descriptor

Table 3–14: Items available through the Add command (Cont.)

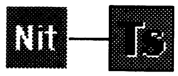
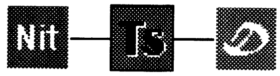
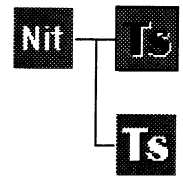
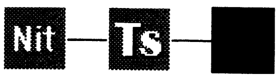
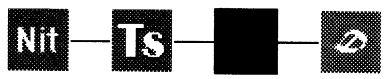
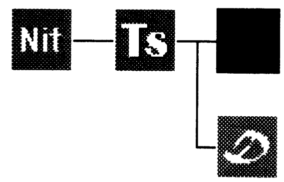
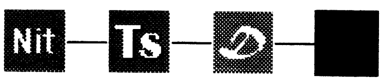
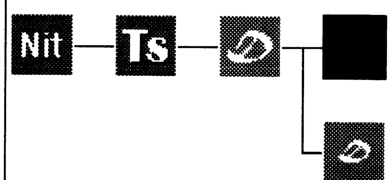
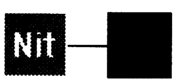
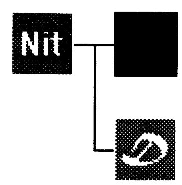
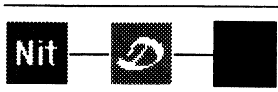
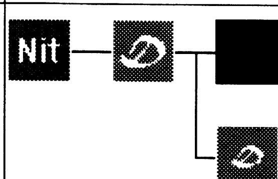
Icon Selected	Items Available through the Add Command	
 NIT — transport stream	 NIT — transport stream — descriptor or	 additional NIT — transport stream
 NIT — transport stream — descriptor	 NIT — transport stream — descriptor — sub-descriptor or	 additional NIT — transport stream — descriptor
 NIT — transport stream — descriptor — sub-descriptor	 additional NIT — transport stream — descriptor — sub-descriptor	
 NIT — descriptor	 NIT — descriptor — sub-descriptor or	 Additional NIT — descriptor
 NIT — descriptor — sub-descriptor	 additional NIT — descriptor — sub-descriptor	
 SDT	 SDT — service	

Table 3–14: Items available through the Add command (Cont.)

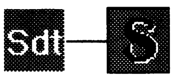
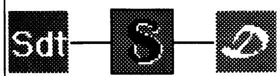
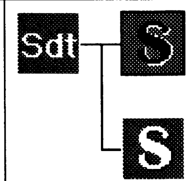
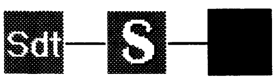
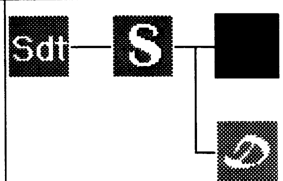
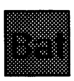
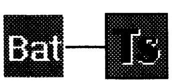
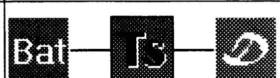
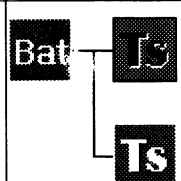
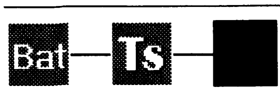
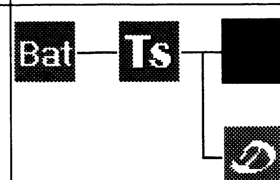
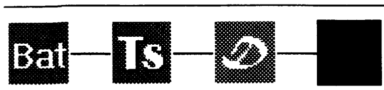
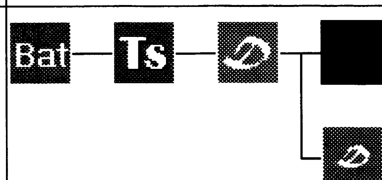
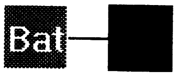
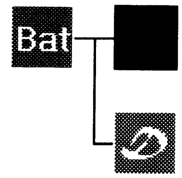
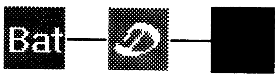
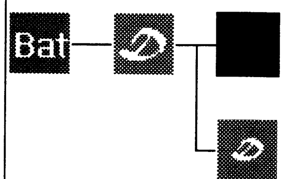
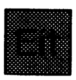
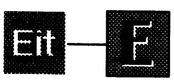
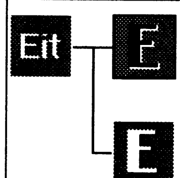
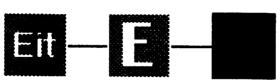
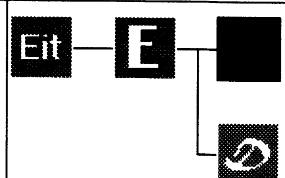
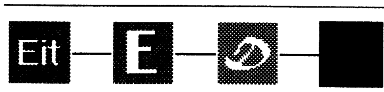
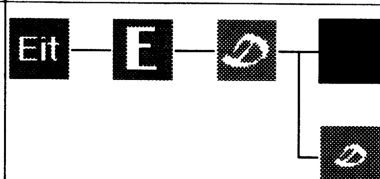
Icon Selected	Items Available through the Add Command	
 SDT — service	 SDT — service — descriptor or	 additional SDT — service — descriptor
 SDT — service — descriptor	 additional SDT — service — descriptor	
 BAT	 BAT — transport stream or	 BAT — descriptor
 BAT — transport stream	 BAT — transport stream — descriptor or	 additional BAT — transport stream
 BAT — transport stream — descriptor	 BAT — transport stream — descriptor — sub-descriptor or	 additional BAT — transport stream — descriptors
 BAT — transport stream — descriptor — sub-descriptor	 additional BAT — transport stream — descriptor — sub-descriptor	

Table 3–14: Items available through the Add command (Cont.)

Icon Selected	Items Available through the Add Command	
 BAT — descriptor	 BAT — descriptor — sub-descriptor or	 additional BAT — descriptor
 BAT — descriptor — sub-descriptor	 additional BAT — descriptor — sub-descriptor	
 EIT	 EIT — event	
 EIT — event	 EIT — event — descriptor or	 additional EIT — event
 EIT — event — descriptor	 EIT — event — descriptor — sub-descriptor or	 additional EIT — event — descriptor
 EIT — event — descriptor — sub-descriptor	 additional EIT — event — descriptor — sub-descriptor	

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 the items removed on the clipboard.

Cut. The Cut command is identical to the Delete command except, the item(s) cut are placed on the clipboard. They can then be pasted back in the Table file at the same or a different location.

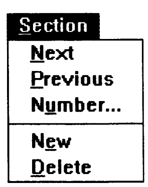
Copy. The Copy command copies the currently selected item to the clipboard. It is then available to paste at different locations. All items below the selected item on the hierarchy are also copied to the clipboard.

You cannot copy the entire table. If you need to copy the entire table, use the Save As command.

Paste. The paste command places the contents of the clipboard at the selected point in the Table file.

Section

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.

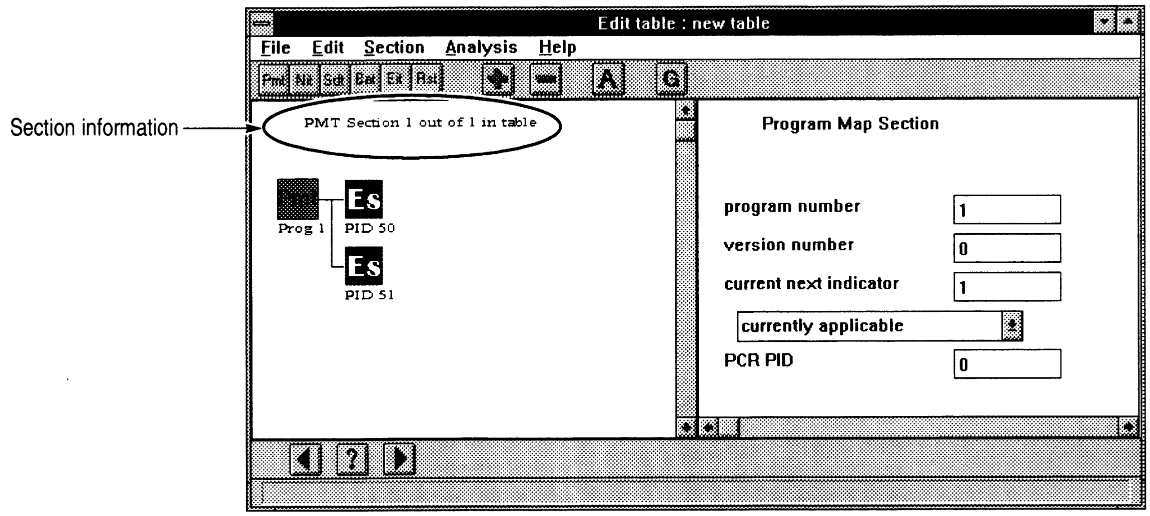


Figure 3–81: Note the location of the section number information

Next. Changes the Application Window to display the next section of the Table file. (Next is defined as the current section number +1.)

If the last section is currently being displayed, then you will receive an error message and the application will continue to display the current section.

Previous. Changes the Application window 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, then you receive an error message and the application continues to display the current section.

Number. The Number command allows you to select the section number to display (rather than scrolling through them). Figure 3–82 shows the Section Number dialog box. Enter the desired section number in the text box and choose OK. The application then displays the desired section number.

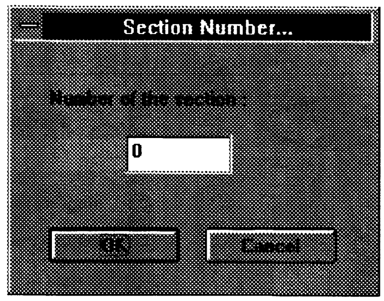


Figure 3–82: The Section Number dialog box

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 it was a middle section the rest of the sections are then appropriately renumbered.

CAUTION. *Sections are deleted without confirmation. Take care when using this command, deleted sections cannot be recovered.*

Analysis

The Analysis menu allows you to check the integrity of your Table files.

Coherence. The Coherence command runs an analysis of the currently open Table files (not just the Table file displayed). It 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). See Figure 3–83.

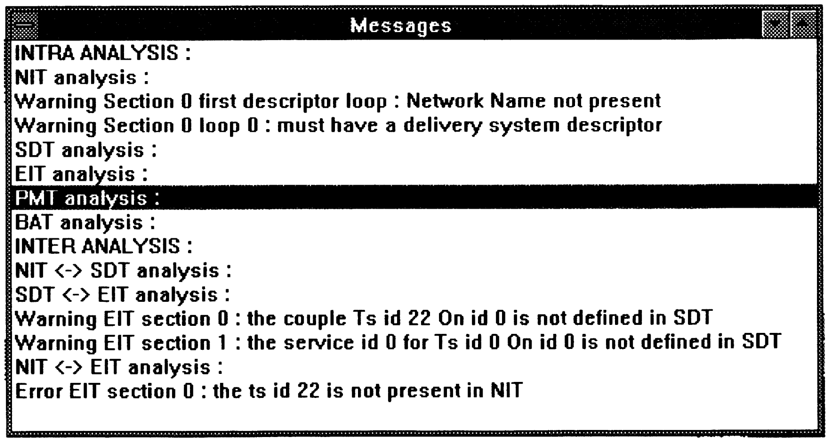


Figure 3–83: A typical message box displayed from the Coherence command

You can correct the errors found by this command and then rerun the Coherence command. Figure 3–84 shows the message box after running Coherence on error-free Table files.

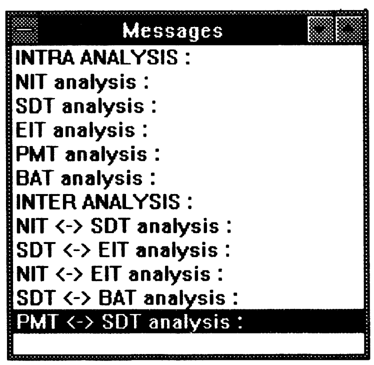
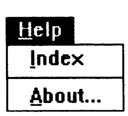


Figure 3–84: Error-free Table files

Help The Help menu provides standard Windows and application-specific information.



Index. The Index command gives a list of topics you can select from to receive more information about PSI and SI Tables.

About. The About command brings up the About box shown in Figure 3–85. You can find information on the particular date and release of the application software here. Please refer to this box before calling the Tektronix help line, so that you can give this information to Customer Support to aid in fixing your problem.

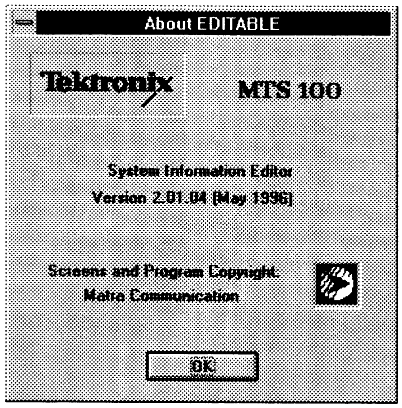


Figure 3–85: The About box

Button Bars

Top Button Bar

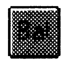
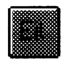
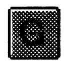
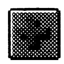
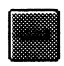
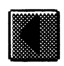
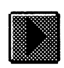
Bottom Button Bar

The command buttons in the Button Bars are short-cuts for commands from the Menu Bar. Table 3–15 lists the Button Bar commands and their functions.

Table 3–15: Functions Available from the Button Bars

Icon	Function	Location of Command in the Edit Menu
	Create or open a PMT	Program Map Table, from the File menu (see page 3–114)
	Create or open an NIT	Network Information Table, from the File menu (see page 3–116)
	Create or open an SDT	Service Description Table, from the File menu (see page 3–118)

Table 3–15: Functions Available from the Button Bars (Cont.)

Icon	Function	Location of Command in the Edit Menu
	Create or open a BAT	Bouquet Association Table, from the File menu (see page 3–120)
	Create or open an EIT	Event Information Table, from the File menu (see page 3–121)
	Access the Global View	Global View, from the File menu (see page 3–113)
	Analyze the table coherence	Coherence, from the Analysis menu (see page 3–130)
	Add an item to the selection	Add, from the Edit menu (see page 3–123)
	Cut the selected item	Cut, from the Edit menu (see page 3–128)
	View the previous section (current section number – 1)	Previous, from the Section menu (see page 3–129)
	View a specific section	Number..., from the Section menu (see page 3–129)
	View the next section (current section number + 1)	Next, from the Section menu (see page 3–129)

All Available Items and Parameters for Each Table File Type

PMT The Program Map Table identifies and indicates the locations of the streams (PID of packets carrying information) that make up each service. (You can change the PCR PID. The default is the same as 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 that program, the PCRs will reside in their own transport packets. This should be done if the elementary stream that would carry the PCR by default is shorter than the longest elementary stream.)

This table is transmitted in sections, with each section corresponding to a program. (A program is made of elementary streams, up to a total of ten.)

Table 3–16: PMT Parameters

Icon	Parameters	Values	Bits
Pmt	table ID	0x02 (set by application)	8
	section syntax indicator	1 (set by application)	1
	section length	(calculated by application)	12
	program ID	identifies the program described by this section	16
	version number	incremented by 1 (modulo 32)	5
	current next indicator	0: not yet applicable 1: currently applicable	1
	section number	0x00 (set by application)	8
	last section number	0x00 (set by application)	8
	PCR PID	PID of the transport stream packets containing the Program Clock reference fields valid for the program specified by this program ID	13
Pmt	registration descriptor provides a method to uniquely identify private data formats		
	descriptor tag	5 (set by the application)	8
	descriptor length	(calculated by application)	8
	format identifier		32
Pmt	system clock descriptor conveys information about the system clock that was used to generate the time stamps		
	descriptor tags	11 (set by the application)	8
	descriptor length	(calculated by application)	8
	external clock reference indicator	0: internal 1: external	1
	clock accuracy integer	fractional frequency accuracy of the system	6
	clock accuracy exponent	clock in parts per million	3
Pmt	multiplex buffer utilization descriptor provides bounds on the occupancy of the STD multiplex buffer		
	descriptor tag	12 (set by application)	8
	descriptor length	(calculated by application)	8
	mdv valid flag (multiplex delay variation)		
	multiplex delay variation		
	multiplex strategy	1: early 2: late 3: middle	

Table 3–16: PMT Parameters (Cont.)

Icon	Parameters	Values	Bits
Pmt	CA descriptor specifies both system-wide conditional access management information (such as EMMs) and elementary stream-specific information (such as ECMs).		
	descriptor tag	9 (set by application)	8
	descriptor length	(calculated by application)	8
	CA system ID	CA system applicable	16
	CA PID	PID for the transport stream packets that contain either the ECm or EMM	13
Es	stream type	type of elementary (application suggests different values)	8
	elementary PID	PID of the transport stream packets that carry the elementary stream	13
Es	video stream descriptor provides basic information that identifies the coding parameters of a video elementary stream		
	descriptor tag	2 (set by application)	8
	descriptor length	(calculated by application)	8
	multiple frame rate flag	0: single 1: multiple	1
	frame rate code	identifies the frame rate (if multiple)	4
	MPEG-2 flag	0: MPEG1 1: MPEG-2	1
	constrained parameter flag	0: may contain both constrained parameters and unconstrained video streams 1: does not contain unconstrained video streams	1
	still picture flag	0: moving and still 1: still	1
Es	audio stream descriptor provides basic information which identifies the coding version of an audio elementary stream		
	descriptor tag	3 (set by application)	8
	descriptor length	(calculated by application)	8
	free format flag	0: bit rate index ≠ "0000" 1: bit rate index = "0000"	1
	ID	same value as the ID field in the audio stream	1
	layer	same value as the layer field in the audio stream	2

Table 3–16: PMT Parameters (Cont.)

Icon	Parameters	Values	Bits
	hierarchy descriptor provides information to identify the program elements containing components of hierarchically-coded video and audio, and private streams that are multiplexed in multiple streams		
	descriptor tag	4 (set by application)	8
	descriptor length	(calculated by application)	8
	hierarchy type		4
	hierarchy layer index		6
	hierarchy embedded layer index		6
	hierarchy priority		6
	data stream alignment descriptor describes the type of alignment present in the associated elementary stream		
	descriptor tag	6 (set by application)	8
	descriptor length	(calculated by application)	8
	alignment type		8
	target background grid descriptor describes a grid of unit pixels projected on to the display area (a monitor)		
	descriptor tag	7 (set by application)	8
	descriptor length	(calculated by application)	8
	horizontal size	size in pixels	14
	vertical size	size in pixel	14
	pel aspect ratio		4
	video window descriptor describes the grid location (target background grid) where the top left pixel of the display window or video presentation display rectangle unit should be displayed		
	descriptor tag	8 (set by application)	8
	descriptor length	(calculated by application)	8
	horizontal offset	horizontal position of top left pixel	14
	vertical offset	vertical position of top left pixel	14
	window priority	0 to 15 (window with priority 15 is always visible)	4

Table 3–16: PMT Parameters (Cont.)

Icon	Parameters	Values	Bits
	ISO 639 language descriptor specifies the language of the associated program element		
	descriptor tag	10 (set by application)	8
	descriptor length	(calculated by application)	8
	ISO 639 language code sub-descriptor		
	ISO 639 language code		
	audio type	0: 1: clean effects 2: hearing impaired 3: visual impaired commentary	2
	CA descriptor specifies both system-wide conditional access management information (such as EMMs) and elementary stream-specific information (such as ECMs).		
	descriptor tag	9 (set by application)	8
	descriptor length	(calculated by application)	8
	CA system ID	CA system applicable	16
	CA PID	PID for the transport stream packets that contain either the ECM or EMM	13

NIT The Network Information Table groups together services belonging to a particular network provider. It contains all the tuning information that might be used during the set-up of the decoder. It is also used to signal a change in the tuning information.

This table is transmitted in sections, with each section describing the physical organization of the multiplex (network). The NIT conveys information relating to the network:

- The transport streams in the network
- Characteristics of the network

Table 3–17: NIT Parameters

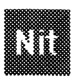
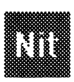
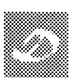
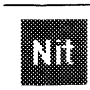
Icon	Parameters	Values	Bits
	table ID	0x40: actual network 0x41: other network	8
	section syntax indicator	1 (set by application)	1
	section length	(calculated by application)	12
	network ID	identifies the delivery system (network)	16
	version number	incremented by 1 (modulo 32)	5
	current next indicator	0: not yet applicable 1: currently applicable	1
	section number	(updated by application)	8
	last section number	(updated by application)	8
 	network name descriptor provides the network name in text form		
	descriptor tag	0x40 (set by application)	8
	descriptor length	(calculated by application)	8
	network name	network name	n
 	service list descriptor provides a means of listing the services by service ID and service type		
	descriptor tag	0x41 (set by application)	8
	descriptor length	(calculated by application)	8

Table 3–17: NIT Parameters (Cont.)

Icon	Parameters	Values	Bits
Nit	stuffing descriptor provides a means of invalidating previously coded descriptors or inserting “dummy” descriptor for table stuffing		
	descriptor tag	0x42 (set by application)	8
	descriptor length	(calculated by application)	8
Nit	cable delivery system descriptor describes a cable delivery system		
	descriptor tag	0x44 (set by application)	8
	descriptor length	(calculated by application)	8
	frequency		32
	FEC outer		4
	modulation		5
	symbol rate		28
	FEC inner		4
Nit	linkage descriptor identifies a service that can be presented if the consumer requests for additional information related to a specific entry described in the SI system		
	descriptor tag	0x4A (set by application)	8
	descriptor length	(calculated by application)	8
	transport stream ID		16
	original network ID		16
	service ID		16
	linkage type	0: information 1: Electronic Program Guide 2: CA replacement	8

Table 3-17: NIT Parameters (Cont.)

Icon	Parameters	Values	Bits
Nit	satellite delivery system descriptor describes a satellite delivery system		
	descriptor tag	0x43 (set by application)	8
	descriptor length	(calculated by application)	8
	frequency		32
	orbital position		16
	west east flag	0: western position 1: eastern position	1
	polarization	0: linear – horizontal 1: linear vertical 2: circular – left 3: circular – right	2
	modulation	0: 1: QPSK	5
	symbol rate		28
	FEC inner	0: 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	4
Ts	transport stream ID	label identifying transport stream	16
	original network ID	label identifying the network id of the originating delivery system	16
Ts	network name descriptor provides the network name in text form		
	descriptor tag	0x40 (set by application)	8
	descriptor length	(calculated by application)	8
	network name	network name	n
Ts	service list descriptor provides a means of listing the services by service ID and service type		
	descriptor tag	0x41 (set by application)	8
	descriptor length	(calculated by application)	8

Table 3–17: NIT Parameters (Cont.)

Icon	Parameters	Values	Bits
	service list service ID sub-descriptor		
	service ID	identifies the service	
	service type	1: digital television 2: digital radio 3: teletext 4: NVOD reference	2
	stuffing descriptor provides a means of invalidating previously coded descriptors or inserting “dummy” descriptor for table stuffing		
	descriptor tag	0x42 (set by application)	8
	descriptor length	(calculated by application)	8
	cable delivery system descriptor describes a cable delivery system		
	descriptor tag	0x44 (set by application)	8
	descriptor length	(calculated by application)	8
	frequency		32
	FEC outer		4
	modulation		5
	symbol rate		28
	FEC inner		4
	linkage descriptor identifies a service that can be presented if the consumer requests for additional information related to a specific entry described in the SI system		
	descriptor tag	0x4A (set by application)	8
	descriptor length	(calculated by application)	8
	transport stream ID		16
	original network ID		16
	service ID		16
	linkage type	0: information 1: Electronic Program Guide 2: CA replacement	8

Table 3–17: NIT Parameters (Cont.)

Icon	Parameters	Values	Bits
 	satellite delivery system descriptor describes a satellite delivery system		
	descriptor tag	0x43 (set by application)	8
	descriptor length	(calculated by application)	8
	frequency		32
	orbital position		16
	west east flag	0: western position 1: eastern position	1
	polarization	0: linear – horizontal 1: linear vertical 2: circular – left 3: circular – right	2
	modulation	0: 1: QPSK	5
	symbol rate		28
	FEC inner	0: 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	4

SDT The Service Descriptor Table list the names and other parameters associated with each service in a particular multiplex.

This table is transmitted in sections, with each section describing a transport stream. A transport stream is made of several services (uniquely identified by the service ID).

Table 3–18: SDT Parameters

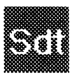
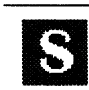
Icon	Parameters	Values	Bits
			
	table ID	0x42: actual network 0x46: other network	8
	section syntax indicator	1 (set by application)	1
	section length	(calculated by application)	12
	transport stream ID	identifies the transport stream	16
	version number	incremented by 1 (modulo 32)	5
	current next indicator	0: not yet applicable 1: currently applicable	1
	section number	(updated by application)	8
	last section number	(updated by application)	8
	original network ID	label identifying the network ID of the originating delivery system	16
	service ID	label identifying this service	16
	EIT schedule flag	0: 1: EIT schedule information for this service is present in the current transport stream	1
	EIT present following flag	0: 1: EIT present/following information for the service present in the current transport stream	1
	running status	status of the service1: not running 2: starts in few seconds 3: pausing 4: running	3
	free CA mode	0: all component streams of the service are not scrambled 1: one or more may be controlled by a CA system	1
 	stuffing descriptor provides a means of invalidating previously coded descriptors or inserting "dummy" descriptor for table stuffing		
	descriptor tag	0x42 (set by application)	8
	descriptor length	(calculated by application)	8

Table 3–18: SDT Parameters (Cont.)

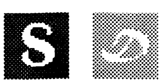
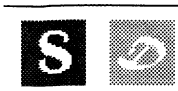
Icon	Parameters	Values	Bits
	service descriptor provides the names of the service provider and the service text form together with the service type		
	descriptor tag	0x48 (set by application)	8
	descriptor length	(calculated by application)	8
	Service type	1: digital television 2: digital radio sound 3: teletext	8
	service provider length	(calculated by application)	8
	service provider name	provider name	8
	service name length	(calculated by application)	8
	service name	service name	8
	linkage descriptor identifies a service that can be presented if the consumer requests for additional information related to a specific entry described in the SI system		
	descriptor tag	0x4A (set by application)	8
	descriptor length	(calculated by application)	8
	transport stream ID		16
	original network ID		16
	service ID		16
	linkage type	0: information 1: Electronic Program Guide 2: CA replacement	8
	time shifted service descriptor indicates services which are time shifted copies of other services		
	descriptor tag	0x4C (set by application)	8
	descriptor length	(calculated by application)	8
	reference service ID	identifies the reference service of a NVOD collection of services	16
	bouquet name descriptor provides the bouquet name in text form		
	descriptor tag	0x47 (set by application)	8
	descriptor length	(calculated by application)	8
	bouquet name	bouquet name	n

Table 3–18: SDT Parameters (Cont.)

Icon	Parameters	Values	Bits
	country availability descriptor specifies countries where the service is intended to be available/or not available		
	descriptor tag	0x49 (set by application)	8
	descriptor length	(calculated by application)	8
	country availability flag	0: not available 1: available	1
	country code		24
	NVOD reference descriptor in conjunction with time-shifted-service and time-shifted-event descriptors, provides a mechanism for efficiently describing a number of services that carry the same sequence of events, but with the start times offset from one another gives a list of the services that together form Near Video On Demand (NVOD)		
	descriptor tag	0x42 (set by application)	8
	descriptor length	(calculated by application)	8
		not currently implemented	
	NVOD transport stream ID sub-descriptor		
	transport stream ID		
	original network ID		
	service ID		
	CA identifier descriptor indicates whether a particular bouquet, service, event, or component is associated with a conditional access system and identifies the CA system		
	descriptor tag	0x53 (set by application)	8
	descriptor length	(calculated by application)	8
	CA system ID		16

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.

This table is transmitted in sections, with each section describing a bouquet. A bouquet is made of transport streams (uniquely identified by a combination of original network ID and transport stream ID).

Table 3–19: BAT Parameters

Icon	Parameters	Values	Bits
Bat	table ID	0x4A (set by application)	8
	section syntax indicator	1 (set by application)	1
	section length	(calculated by application)	12
	bouquet ID	identifies the bouquet	16
	version number	incremented by 1 (modulo 32)	5
	current next indicator	0: not yet applicable 1: currently applicable	1
	section number	(updated by application)	8
	last section number	(updated by application)	8
Bat	service list descriptor provides a means of listing the services by service ID and service type		
	descriptor tag	0x41 (set by application)	8
	descriptor length	(calculated by application)	8
		not currently implemented	
	service list service ID sub-descriptor		
	service ID		
	service type	1: digital television 2: digital radio 3: teletext 4: NVOD reference 5: NVOD time-shifted service 6: mosaic 7: PAL coded signal 8: SECAM coded signal	3
Bat	stuffing descriptor provides a means of invalidating previously coded descriptors or inserting "dummy" descriptor for table stuffing		
	descriptor tag	0x42 (set by application)	8
	descriptor length	(calculated by application)	8

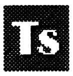
Table 3–19: BAT Parameters (Cont.)

Icon	Parameters	Values	Bits
Bat	bouquet name descriptor provides the bouquet name in text form		
	descriptor tag	0x47 (set by application)	8
	descriptor length	(calculated by application)	8
	bouquet name	bouquet name	n
Bat	country availability descriptor specifies countries where the service is intended to be available/or not available		
	descriptor tag	0x49 (set by application)	8
	descriptor length	(calculated by application)	8
	country availability flag	0: not available 1: available	1
	country code		24
Bat	linkage descriptor identifies a service that can be presented if the consumer requests for additional information related to a specific entry described in the SI system		
	descriptor tag	0x4A (set by application)	8
	descriptor length	(calculated by application)	8
	transport stream ID		16
	original network ID		16
	service ID		16
	linkage type	0: information 1: Electronic Program Guide 2: CA replacement	8
Bat	CA identifier descriptor indicates whether a particular bouquet, service, event, or component is associated with a conditional access system and identifies the CA system		
	descriptor tag	0x53 (set by application)	8
	descriptor length	(calculated by application)	8
	CA system ID		16
Ts			
	transport stream ID	label identifying transport stream	16
	original network ID	label identifying the network ID of the originating delivery system	16

Table 3–19: BAT Parameters (Cont.)

Icon	Parameters	Values	Bits
Ts	service list descriptor provides a means of listing the services by service ID and service type		
	descriptor tag	0x41 (set by application)	8
	descriptor length	(calculated by application)	8
		not currently implemented	
	service list service ID sub-descriptor		
	service ID		
	service type	1: digital television 2: digital radio 3: teletext 4: NVOD reference 5: NVOD time-shifted service 6: mosaic 7: PAL coded signal 8: SECAM coded signal	3
Ts	stuffing descriptor provides a means of invalidating previously coded descriptors or inserting “dummy” descriptor for table stuffing		
	descriptor tag	0x42 (set by application)	8
	descriptor length	(calculated by application)	8
Ts	bouquet name descriptor provides the bouquet name in text form		
	descriptor tag	0x47 (set by application)	8
	descriptor length	(calculated by application)	8
	bouquet name	bouquet name	n
Ts	country availability descriptor specifies countries where the service is intended to be available/or not available		
	descriptor tag	0x49 (set by application)	8
	descriptor length	(calculated by application)	8
	country availability flag	0: not available 1: available	1
	country code		24

Table 3–19: BAT Parameters (Cont.)

Icon	Parameters	Values	Bits
 	linkage descriptor identifies a service that can be presented if the consumer requests for additional information related to a specific entry described in the SI system		
	descriptor tag	0x4A (set by application)	8
	descriptor length	(calculated by application)	8
	transport stream ID		16
	original network ID		16
	service ID		16
	linkage type	0: information 1: Electronic Program Guide 2: CA replacement	8
 	CA identifier descriptor indicates whether a particular bouquet, service, event, or component is associated with a conditional access system and identifies the CA system		
	descriptor tag	0x53 (set by application)	8
	descriptor length	(calculated by application)	8
	CA system ID		16

EIT The Event Information Table is used to transmit information relating to all the events that occur or will occur in the MPEG multiplex. The EIT contains information about the current transport, and optionally covers other transport streams that the decoder can receive.

This table is transmitted in sections, with each section describing a service. A service is made of several events uniquely identified by event ID.

Table 3–20: EIT Parameters

Icon	Parameters	Values	Bits
Eit	table ID	0x4E: actual transport stream present/to follow 0x4F: other transport stream present/to follow 0x5x: actual transport stream schedule 0x6x: other transport stream schedule	8
	section syntax indicator	1 (set by application)	1
	section length	(calculated by application)	12
	service ID	identifies the service	16
	version number	incremented by 1 (modulo 32)	5
	current next indicator	0: not yet applicable 1: currently applicable	1
	section number	The number of the section. It is incremented by 1 for each additional section (updated by application)	8
	last section number	The number of the last section (updated by application).	8
	transport stream ID	label identifying transport stream	16
	original network ID	label identifying the network	16
	last table ID	last table ID	8
E	event ID	identification number of the described event	16
	start time	start date (dd/mm/yy) and time (hh:mm:ss) (generated in MJD and UTC by application)	40
	duration	duration (hh:mm:ss) (generated in BCD by application)	24
	running status	status of the event 1: not running 2: starts in few seconds 3: pausing 4: running	3
	free CA mode	0: all component streams of the event are not scrambled 1: one or more streams is controlled by a CA system	1

Table 3–20: EIT Parameters (Cont.)

Icon	Parameters	Values	Bits
	stuffing descriptor provides a means of invalidating previously coded descriptors or inserting "dummy" descriptor for table stuffing		
	descriptor tag	0x42 (set by application)	8
	descriptor length	(calculated by application)	8
	linkage descriptor identifies a service that can be presented if the consumer requests for additional information related to a specific entry described in the SI system		
	descriptor tag	0x4A (set by application)	8
	descriptor length	(calculated by application)	8
	transport stream ID		16
	original network ID		16
	service ID		16
	linkage type	0: information 1: Electronic Program Guide 2: CA replacement	8
	short event descriptor provides the name of the event and a short description of the event in text form		
	descriptor tag	0x4D (set by the application)	8
	descriptor length	(calculated by application)	8
	ISO 639 language code	language of the following text field	24
	event name length	(calculated by application)	8
	event name	event name	
	event text length	(calculated by application)	8
	event text	short description of event	
	extended event descriptor provides a detailed text description of an event (used in addition to the short event descriptor)		
	descriptor tag	0x4E (set by the application)	8
	descriptor length	(calculated by application)	8

Table 3–20: EIT Parameters (Cont.)

Icon	Parameters	Values	Bits
E	time shifted event descriptor indicates event which is a time-shifted copy of another event		
	descriptor tag	0x4F (set by the application)	8
	descriptor length	(calculated by application)	8
	reference service ID	identifies the reference service of a NVOD collection of services	16
	reference event ID	identifies the reference event of which the event is a time-shifted copy	16
E	component descriptor identifies the type of component stream and may be used to provide a text description of the elementary stream		
	descriptor tag	0x50 (set by the application)	8
	descriptor length	(calculated by application)	8
	stream content	1: video 2: audio 3: teletext	4
	component type	0: subtitles 1: teletext	8
	component tag		8
	ISO 639 language code	language of the following text field	24
	text description		n
E	CA identifier descriptor indicates whether a particular bouquet, service, event, or component is associated with a conditional access system and identifies the CA system		
	descriptor tag	0x53 (set by application)	8
	descriptor length	(calculated by application)	8
	CA system ID		16
E	content descriptor provides classification information for an event		
	descriptor tag	0x54 (set by the application)	8
	descriptor length	(calculated by application)	8

Table 3–20: EIT Parameters (Cont.)

Icon	Parameters	Values	Bits
 	content nibble sub-descriptor		
	content nibble level 1	0: 1: movie 2: news/current affairs 3: show/game show 4: sports 5: children's/youth programs 6: music/ballet/dance 7: arts/culture 8: social/political/economics 9: education/science/factual 10: leisure hobbies	
	content nibble level 2	if level 1 is 1: movie: 0: movie general 1: detective/thriller 2: adventure/western/war 3: science fiction/fantasy/horror 4: comedy 5: soap/melodrama/folkloric 6: romance 7: serious/classical/religious/historical 8: adult movie	
		if level 1 is 2: news/current affairs 0: news/current affairs (general) 1: news/weather report 2: news magazine 3: documentary 4: discussion/interview/debate	
		if level1 is 3: show/game show 0: show/game show (general) 1: game show/quiz/contest 2: variety show 3: talk show	
		if level 1 is 4: sports 0: sports (general) 1: special events 2: sports magazine 3: football/soccer 4: tennis/squash 5: team sports 6: athletics 7: motor sport 8: water sport 9: winter sport 10: equestrian 11: martial sport	

Table 3–20: EIT Parameters (Cont.)

Icon	Parameters	Values	Bits
		if level 1 is 5: children's/youth programs 0: youth programs (general) 1: pre-school children's programs 2: programs for 6-14 3: programs for 10-16 4: educational/school programs 5: cartoons/puppets	
		if level 1 is 6: music/ballet/dance 0: music/ballet/dance (general) 1: rock/pop 2: serious/classical music 3: folk traditional music 4: jazz 5: musical/opera 6: ballet	
		If level 1 is 7: arts/culture 0: arts/culture (general) 1: performing arts 2: fine arts 3: religion 4: popular culture/traditional art 5: literature 6: film/cinema 7: experimental film video 8: broadcasting/press 9: news media 10: arts/culture magazines 11: fashion	
		If level 1 is 8: social/political/economics 0: social/political/economics (general) 1: magazine/reports/documentary 2: economics/social advisory 3: remarkable people	
		If level 1 is 9: educational/science/factual 0: educational/science/factual (general) 1: nature/animal/environment 2: technology/natural science 3: medicine/physiology/psychology 4: foreign countries/expedition 5: social/spiritual science 6: further education	

Table 3–20: EIT Parameters (Cont.)

Icon	Parameters	Values	Bits
		if level 1 is 10: leisure hobbies 0: leisure hobbies (general) 1: tourism/travel 2: handicraft 3: motoring 4: fitness and health 5: cooking 6: advertisement/shopping	
	user nibble		4
	user nibble		4
	parental rating descriptor gives a rating based on age and allows for extensions based on other rating criteria		
	descriptor tag	0x55 (set by the application)	8
	descriptor length	(calculated by application)	8
		not currently implemented	
	parental rating sub-descriptor		
	country code		
	rating (minimum age 3)		7

Creating Files with Complex Associations

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 2–87.

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. This brings up the Global View File Selection dialog box with the New Table files as the default parameters. (See Figure 3–86.)

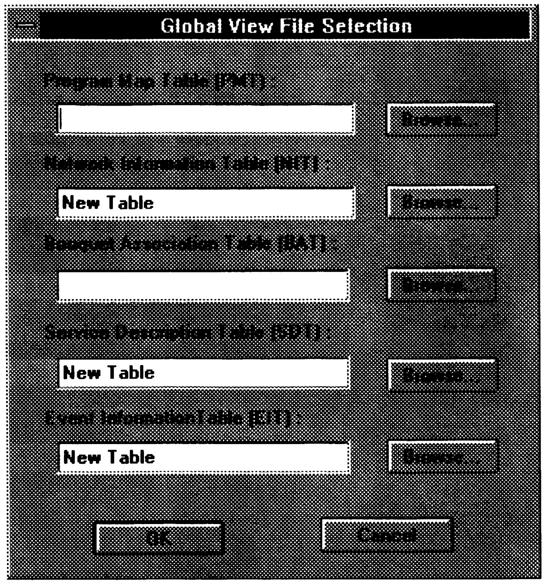


Figure 3–86: The default Global View File Selection

4. Choose OK. This opens the Global View window as shown in Figure 3–87.

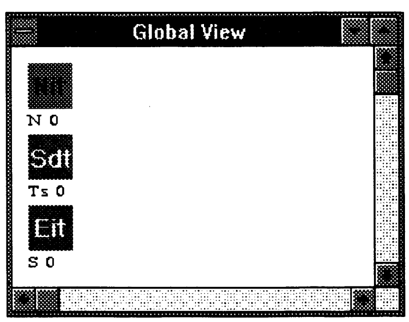


Figure 3–87: The initial Global View application window

5. Open the NIT Table display, by choosing NIT on the Button Bar.
6. Enter "1" in the network ID text box. See Figure 3–88.

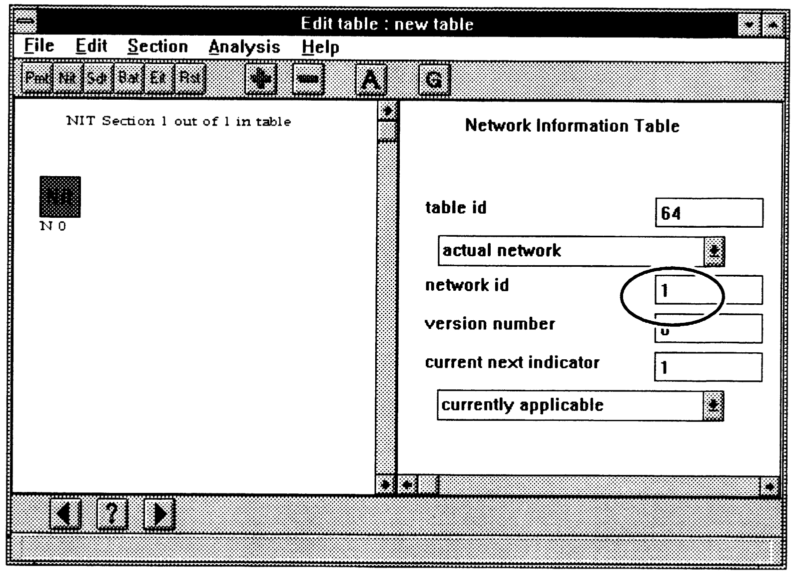


Figure 3–88: The NIT display – "1" is entered in the network ID text box

7. Click on the NIT icon to apply the change to the Global View application. See Figure 3–89. Notice that the number below the NIT icon has changed to N1.

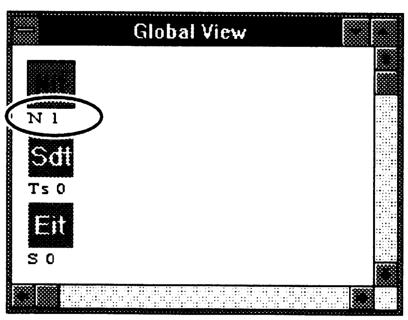


Figure 3–89: Global View after applying the change

8. Add a transport stream by choosing Add from the Button Bar.

9. Enter "2" as the transport stream ID and "1" as the original network ID. See Figure 3–90. Notice that the network ID has the same number as the network ID at the NIT level.

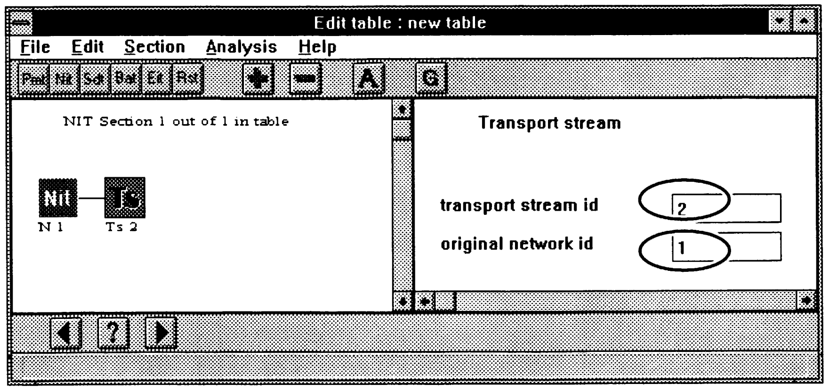


Figure 3–90: NIT with the transport stream added

10. Apply the changes by clicking on the TS icon. See Figure 3–91.

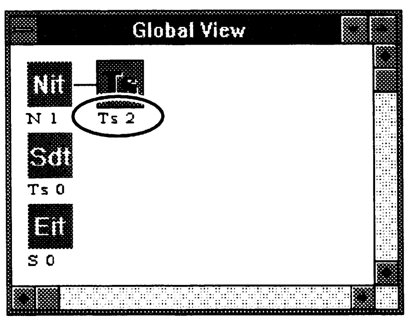


Figure 3–91: The Global View after applying the changes

11. Add an additional transport stream. (Choose Add from the Button Bar.)

12. Enter "3" as the transport stream ID and "1" as the original network ID. See Figure 3–92.

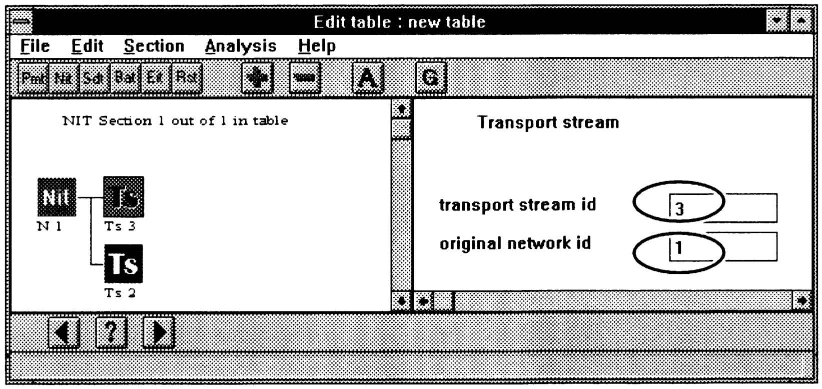


Figure 3–92: Adding an additional transport stream

13. Apply the changes. See Figure 3–93.

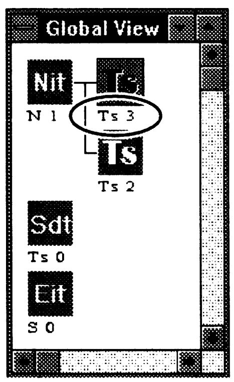


Figure 3–93: The Global View after applying the changes

14. Create a new section for the NIT file. (Choose New from the Section menu.)
15. Add 2 transport streams. (Use Add from the Button Bar.)
16. Enter "11" as the original network ID in both transport streams.
17. Enter "12" and "13" respectively as the transport stream ID.
18. Apply these changes. See Figure 3–94.

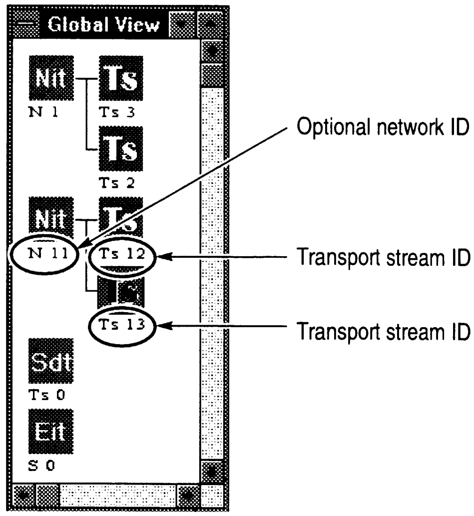


Figure 3–94: The second network ID added

19. Display the SDT file.

20. Enter "2" as the transport stream ID and "1" in the original network ID. See Figure 3–95.

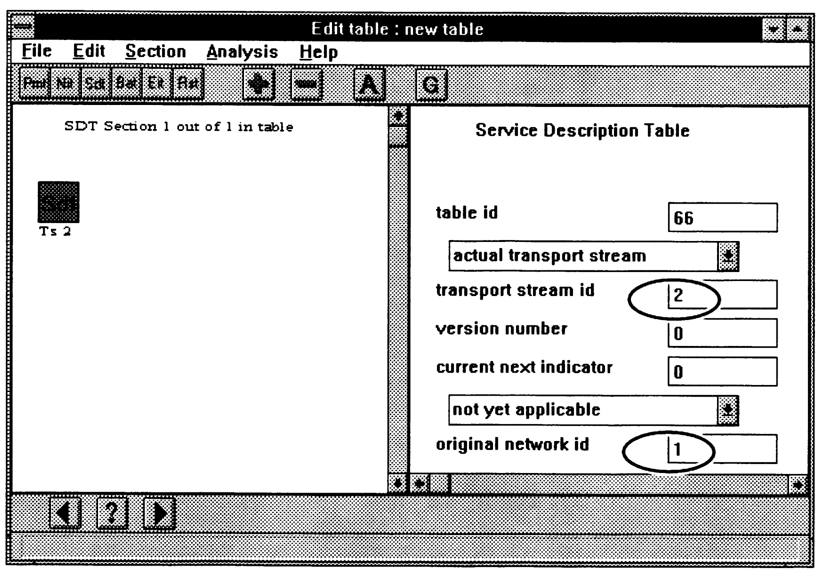


Figure 3–95: The SDT file

21. Apply these changes. (Click on the SDT icon.) See Figure 3–96. Notice that the SDT is now associated with transport stream "2".

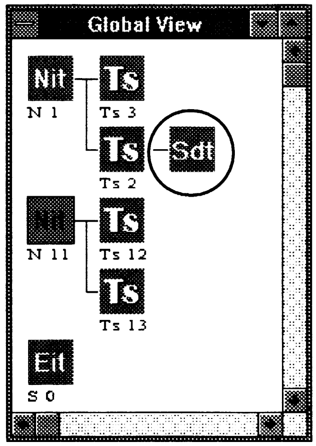


Figure 3–96: Applying the changes to the SDT file

22. Add three services to the SDT. (Use Add from the Button Bar.)

23. Enter “4”, “5”, and “6” as the respective service IDs.

24. Apply these additions. See Figure 3–97. Notice that the service ID number is displayed under each of the service IDs.

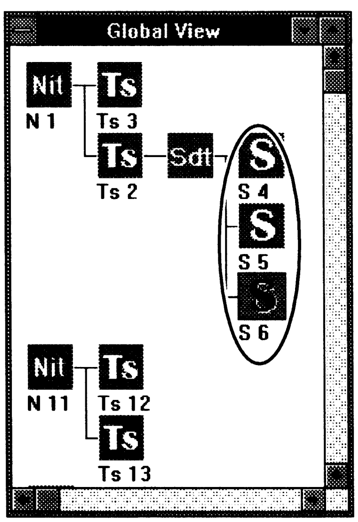


Figure 3–97: Adding three services to the SDT file

25. Add a service descriptor to service S4.

26. Select “digital television” from the service type drop-down list box.

27. Enter your company's name (in this case it is "Tektronix") in the provider name text box.

28. Enter "television" in the service name text box. All these changes are shown in Figure 3–98.

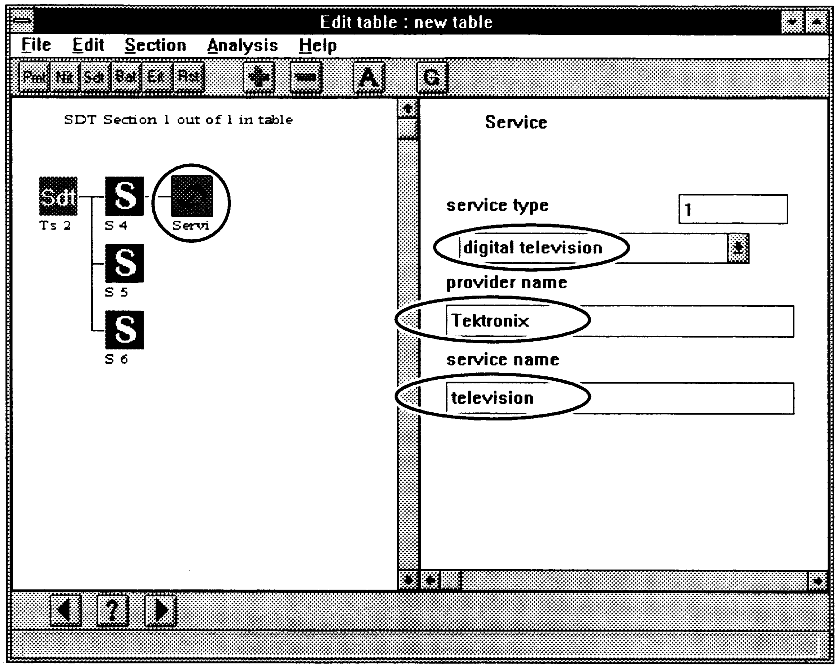


Figure 3–98: The service descriptor for service S4

29. Apply the changes to the descriptor. See Figure 3–99. Notice that the S icon has changed to a television set.

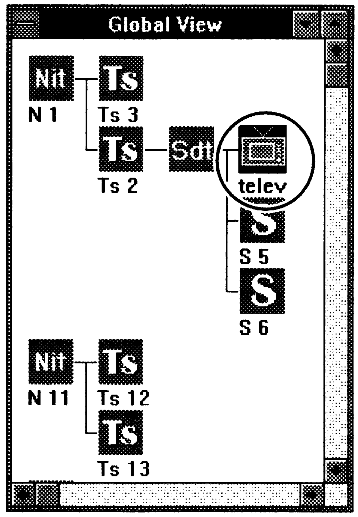


Figure 3–99: The digital television service descriptor

30. Add service descriptors to both S5 and S6.

31. For S5: select "digital radio" from the service type, enter your company name in the provider name text box, and enter "radio" in the service name text box.

32. For S6: select "teletex" from the service type, enter your company name in the provider name text box, and enter "text" in the service name text box.

33. Apply the changes. See Figure 3–100. Notice that S5 and S6 also changed to special icons.

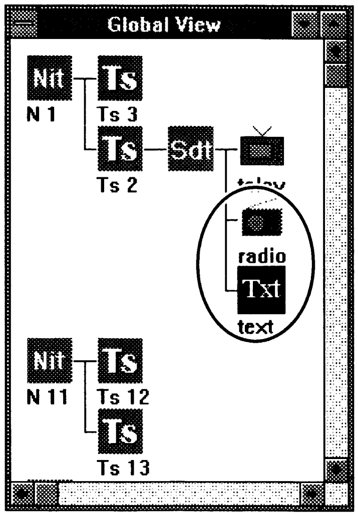


Figure 3–100: The service descriptors have all changed to special icons

34. Create a new section for the SDT table. (Choose New from the Section menu.)

35. Enter "3" in the transport stream ID.

36. Add three services and give them service IDs "41", "51", and "61" respectively.

37. Add a service descriptor to each service.

38. For service descriptor S41: select "digital television" from the service type, enter your company name in the provider name text box, and enter "television" in the service name text box.

39. For service descriptor S51: select "digital radio" from the service type, enter your company name in the provider name text box, and enter "radio" in the service name text box.

40. For service descriptor S61: select "teletex" from the service type, enter your company name in the provider name text box, and enter "text" in the service name text box.

41. Apply these additions. See Figure 3–101. Notice that the full SDT tree is associated with transport stream 3 (TS3).

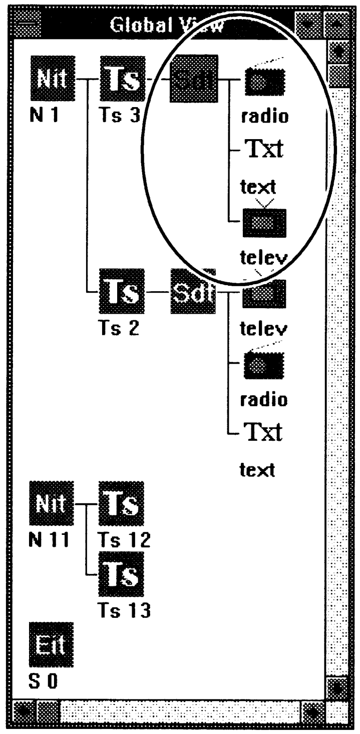


Figure 3–101: The addition of the new SDT section

42. Change the association of section 1/1 of the SDT file by changing the transport stream ID to "12" and the original network ID to "11". See Figure 3–102.

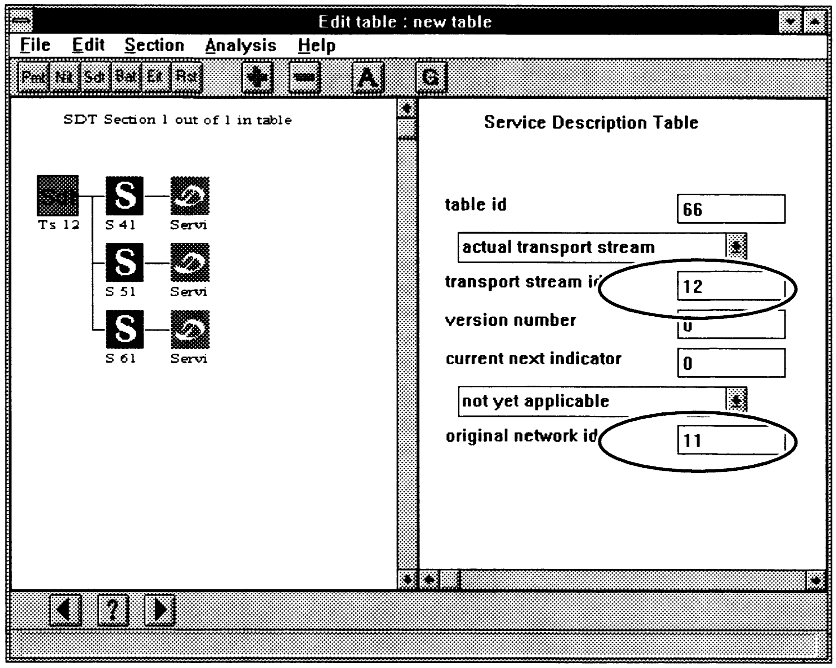


Figure 3–102: What fields to change in order to change the SDT file association

43. Apply these changes. See Figure 3–103. Notice that part of the SDT file moves to TS12.

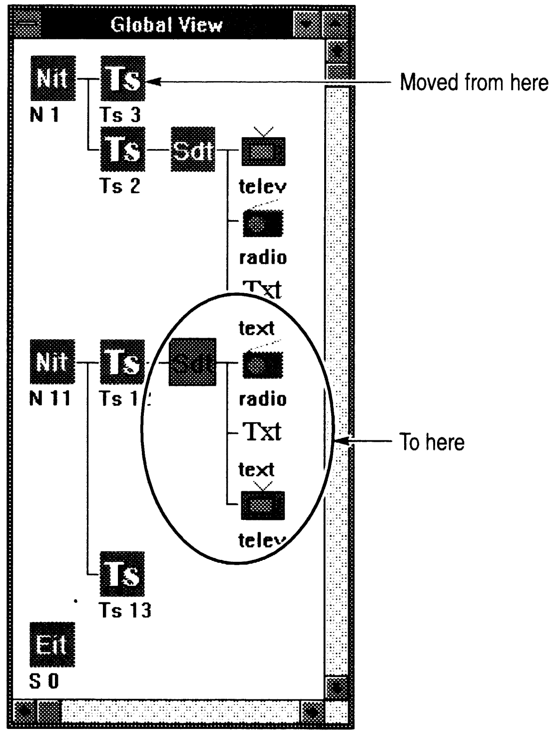


Figure 3–103: The SDT file is now associated with TS12

44. Open the EIT file.

45. Enter "5" in the service ID.

46. Enter "2" in the transport stream ID. See Figure 3–104.

47. Enter "1" in the original network ID.

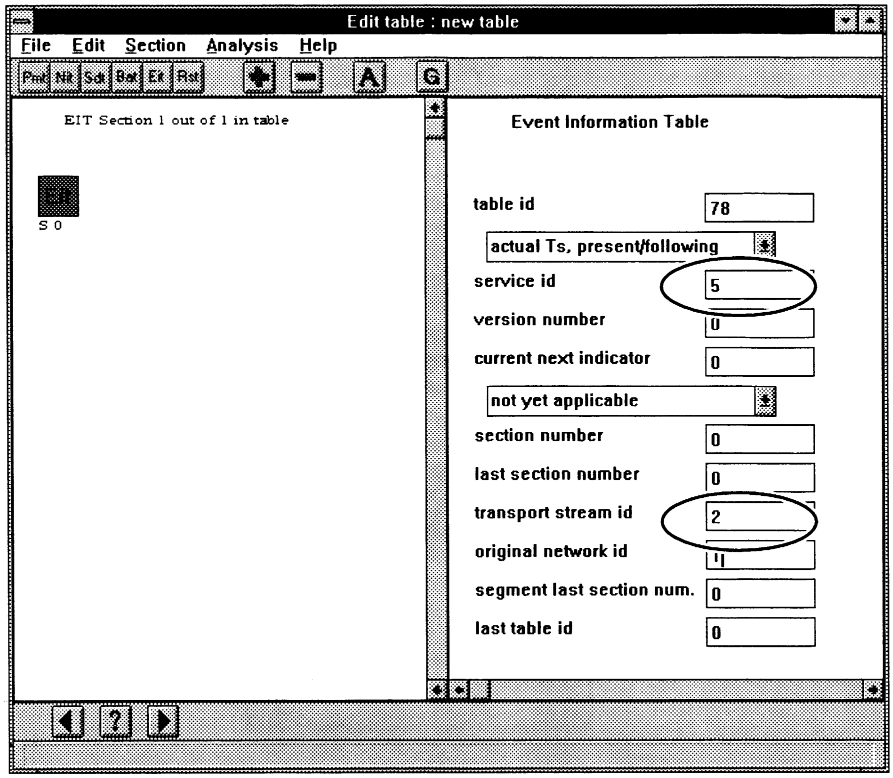


Figure 3–104: The EIT file

48. Apply these changes. See Figure 3–105. Notice that the EIT is now associated with S5 (radio service) in the TS2 transport stream.

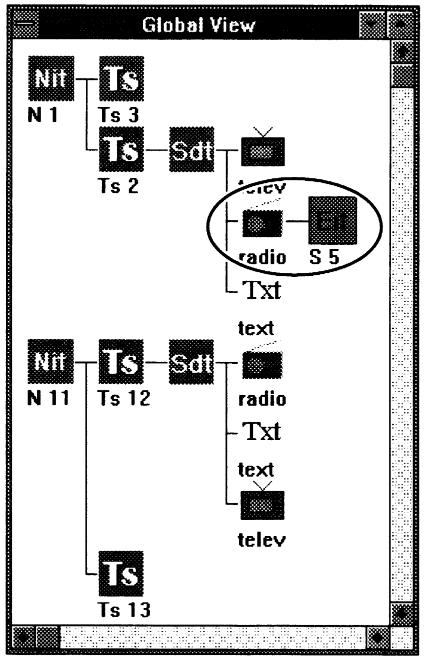


Figure 3–105: The EIT is now associated with S5

49. Create a new EIT section. (From the Section menu, choose New.)

50. Associate this EIT section with transport stream TS12, service S41 (television) on network N11. (Enter "12" in the transport stream ID, "41" in the service ID, and "11" in the original network ID test boxes.)

51. Apply these changes. See Figure 3–106. Notice that the EIT is now associated with TS12/S41.

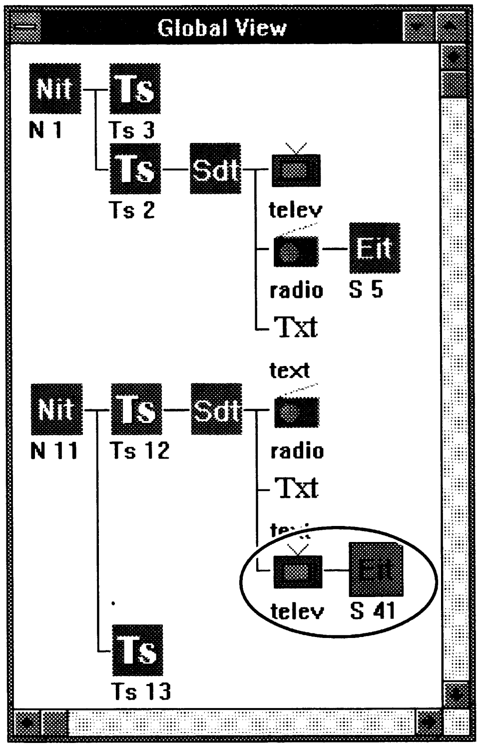


Figure 3–106: The EIT is associated with S41

NOTE. *The Table files that you created will not "pass" if you run Coherence, from the Analysis menu. They were only intended to reflect association between files.*

To summarize the associations and what was done in this section:

- NIT sets the network ID.
- NIT contains transport streams.
- Transport streams set their own IDs. (Also includes original network ID information.)
- SDT is associated with a transport stream through the TS ID and the original network ID.
- SDT contains services.
- Services set the service ID (through the service descriptor).
- EITs are associated to SDTs through service ID, transport stream ID, and original network ID.

Using the Data Store Administrator

The Data Store Administrator application manages the Data Store Disks. It also generates and acquires the MPEG-2 transport streams. Since the Windows File Manager does not manage the Data Store Disks, the Disk Store Administrator also performs all the low-level functions normally done by the File Manager. The Data Store Administrator is referred to as "Disk Manager" for simplification. Within the Tektronix MTS100 V2.0 window, you launch the Data Store Administrator with the Data Store Control icon.

This application can acquire or generate continuous bit streams for several minutes at data rates up to 60 Mbits/second.

The SCSI drivers and EISA card are optimized to guarantee a continuous data acquisition or generation rate of at least 60 Mbits/second, for a minimum of 15 minutes, without interruption of the flow and no loss of data. This file size constraint does not apply for "looped" acquisition or generation.

NOTE. *The Analyzer and Multiplexer applications must be closed before starting the Data Store Administrator.*

Terms

There are two terms that are NOT interchangeable, used when describing how the Disk Manager operates: Data Store Disk and system disk.

The Data Store Disks are the four hard drives physically connected to the Data Store board. These disks are used by the Data Store Administrator for generating and acquiring transport streams. However, they can also be used by the Multiplexer and Analyzer when dealing with large files.

The system hard disk is the hard disk that contains the MTS 100 application software and other software applications. You can access this disk using the Window's File Manager. It is shipped from the factory as the C: drive. If your MTS 100 is connected to a network, the network drives can NOT be used in place of the system hard disk. Move files from the network drive to the system hard drive before attempting to use them.

The term "CARB" is used in many commands. It is a French acronym referring to the Data Store Disks or the Data Store Board. This term is only used in command names.

Special Features of the Data Store Disks

In order to both generate and acquire, the Data Store Disks have some special features enabling them to deal with a constant bit rate.

The first feature of the Data Store Disks is only 32 files are permitted on MTS 100 servers with serial numbers below B019999. MTS 100 servers with serial numbers above B020000 can have up to 255 files.

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 the 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 3–107.

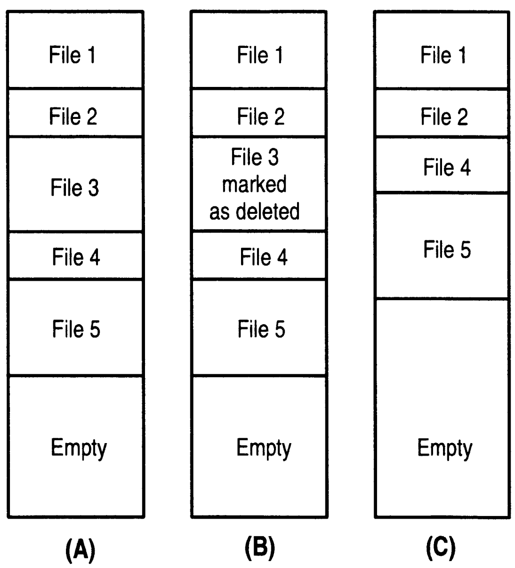


Figure 3–107: How the Data Store Disks manage their files

Column (A) shows the initial file structure. If a new file was added to the Data Store Disks, it would be placed after file 5 in 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; it is not actually deleted. Thus, the disk space is not free for other files to use. You can “undelete” it any time before a Compress command. However, if you deleted file 1 or file 5, they would be immediately deleted. These files are adjacent to the empty disk space and can add directly to that space.

Column (C) shows what happens after a Compress command (see page 3–193). File 3 is removed; files 4 and 5 have 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.

NOTE. *The Compress function can take a LONG time. The Compress function requires about 1 second per megabyte of disk space to compress the Data Store Disks.*

Due to the rigid file structure, it is strongly advised not to use the Data Store Disks for anything other than acquiring and generating transport stream files or storing large transport stream (*.trp) files.

Setting the Maximum Number of Files

The maximum number of files on the Data Store Disks is set at the factory. However, if you update your software, you should check the maximum number of files setting before you run any of the upgraded programs.

To set the maximum number of files on the Data Store Disks:

1. Run the Windows NT File Manager.
2. From the File menu, select Run.
3. Type:

   ```
   c:\MTS100\BIN\SETCARB.EXE
   ```

   and select OK.

4. If your MTS 100 has a serial number of B010100 to B019999, the File Number setting should be 32 (see Figure 3–108). If your MTS 100 has a serial number of B020000 or above, the File number setting should be set to 255.

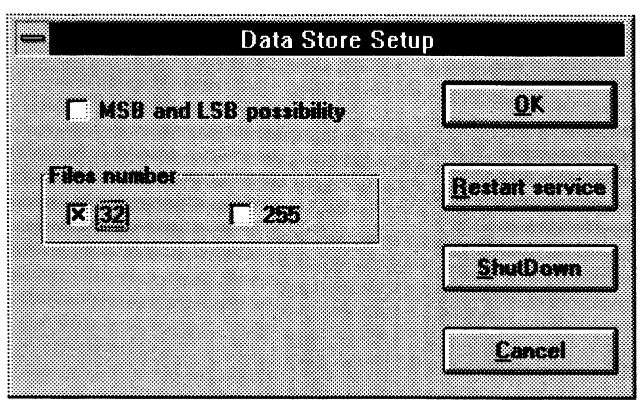


Figure 3–108: Settings for MTS 100 systems with serial numbers below B020000

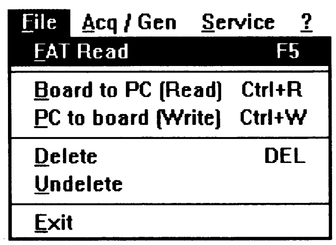
5. If you changed the file number setting, select Restart Service. Otherwise, select Cancel.

   MTS 100 systems with serial numbers between B010100 and B019999 cannot use 255 files or the MSB/LSB option.

Menu Commands

This section explains all the commands available under the various menus, what they do, and how to use them.

File



The File menu provides “normal” file management commands such as file copies and deletes. The commands available from the File menu are: FAT Read, CARB File Read to PC, PC File Write to CARB, File Delete, File 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 their status. See Figure 3–109. A FAT Read occurs whenever the Data Store Administrator is launched.

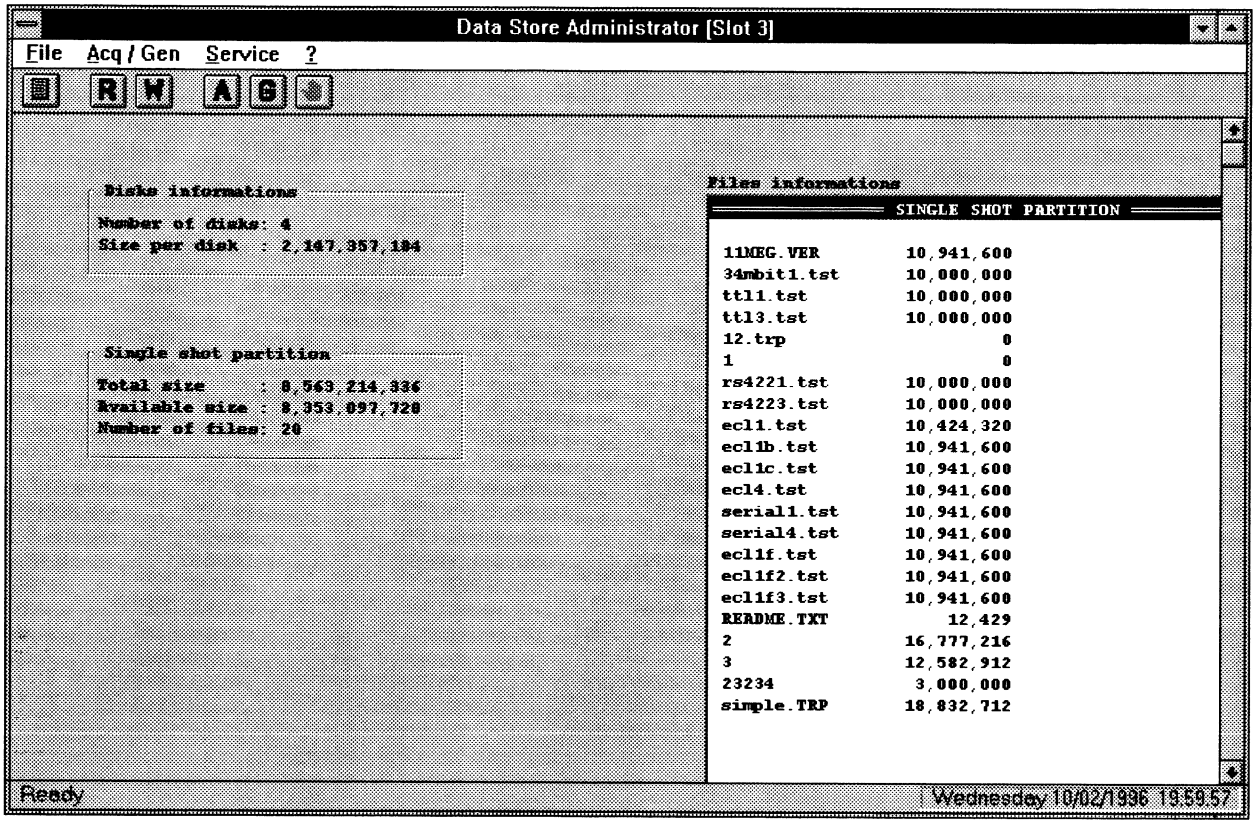


Figure 3–109: The FAT Information dialog box

The FAT Information dialog box gives the following information:

- Number of Disks detected on the Data Store Board. There should be four. Any less and you may have a malfunctioning disk. (The MTS 100 can operate with less than four disks if one is bad and you cannot get an immediate replacement.)
- Size of the smallest disk (in bytes). All four disks should be the same size.
- Number of partitions (1 or 2)
- File name.
- File size in bytes.
- Files marked as “deleted” (DEL). The file is not actually deleted, except by the Compression command. (The first and last files are never marked as deleted — they are always deleted immediately.)

CARB File Read to PC. The CARB File Read to PC command copies a file from the Data Store Disks to the system hard drive (or other regular disk). Figure 3–110 shows the File Read from CARB dialog box.

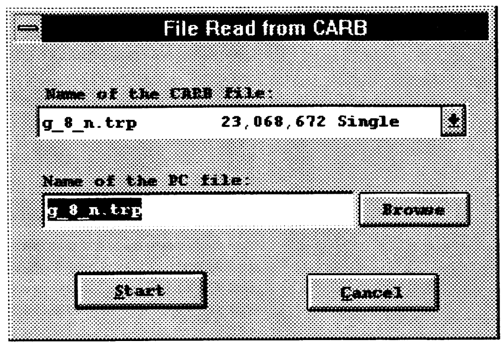


Figure 3–110: The File Read from CARB dialog box

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 file on the Data Store Disks from the drop-down list box. Then you enter the new file name for the system disk. You can select the directory on the system hard disk by using the Browse command button. See Figure 3–111.

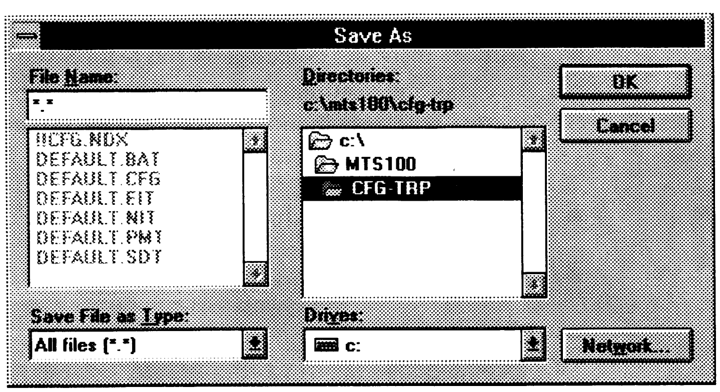


Figure 3–111: The Save As dialog box, from the File Read from CARB

After entering a name in the text box, choose OK. The file is then copied to the system hard disk.

Use this command to move files that the MTS 100 has acquired, 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. The maximum space available on the system disk is 2 GB, minus the space used by system and application software. 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 File Write to CARB. The PC File Write to CARB command copies a file from the system hard drive (or other regular media) to the Data Store Disks. Figure 3–112 displays the File Write to CARB dialog box.

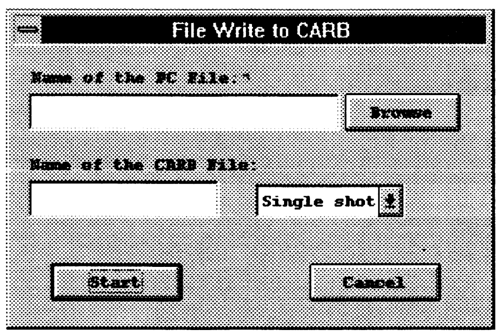


Figure 3–112: The File Write to CARB dialog box

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.*

Use the Browse command button to select a file to copy to the Data Store Disks, Figure 3–113.

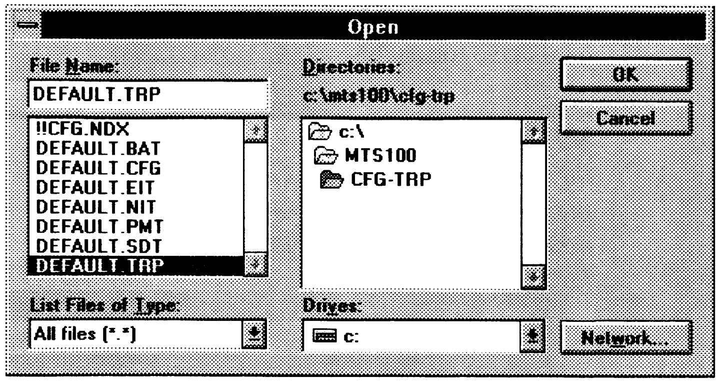


Figure 3–113: The Open dialog box, from Write File to CARB's Browse command button

After selecting a file for the PC file, enter the name that you want it saved under in the Name of CARB File text box. Choosing OK copies the file onto the Data Store Disks.

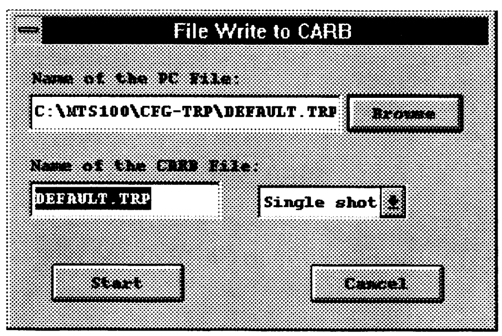


Figure 3–114: The completely filled in File Write to CARB dialog box

Use this command to move transport stream files created with the Multiplexer application (and maybe modified with the Jitter or Coder/Decoder applications) to the Data Store Disks. Once there, you can use them to generate transport streams.

File Delete. The File Delete command marks a file to be deleted on the Data Store Disks. Figure 3–115 shows the CARB File Choice dialog box.

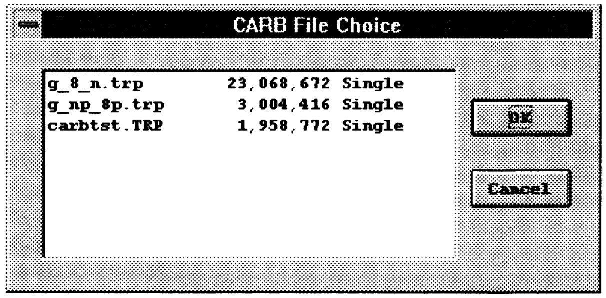


Figure 3–115: The CARB File Choice dialog box, select a file to delete

Select a file for deletion, by highlighting it and then choosing OK. You will always get the warning message of Figure 3–116 , asking if you are sure that you want that file deleted.

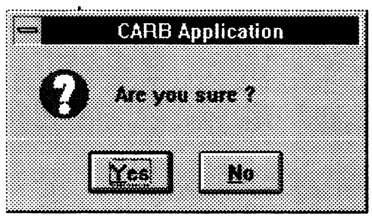


Figure 3–116: The Warning dialog box

Normally, you can undelete a file that is marked as deleted as long as you have not run Compress (see page 3–193). However, if the file is the first or last in the FAT table, it will be deleted immediately. In this case, you are given an additional warning, shown in Figure 3–117, that the file is not recoverable.

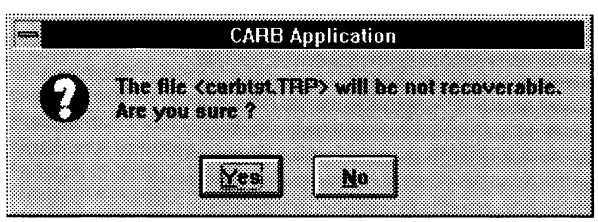


Figure 3–117: The additional warning if the file will be deleted immediately

Use this command to free up space on the Data Store Disks, but remember, no files are deleted until a compression takes place unless the file is first or last in the list.

File Undelete. The File Undelete command removes the 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.

Figure 3–118 shows the CARB File Choice dialog box. It lists all the files currently marked as deleted. To "undelete" a file, highlight it and choose OK.

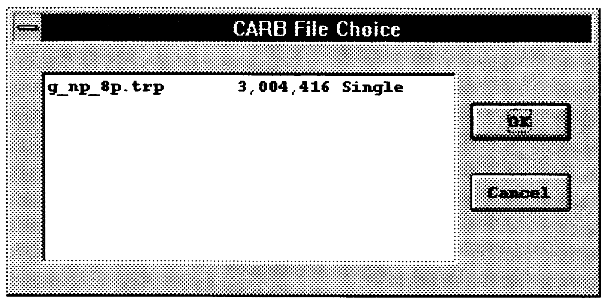
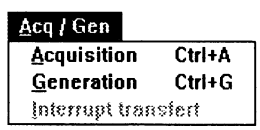


Figure 3–118: The CARB File Choice dialog box for undeleting files

Acq/Gen

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 3–119 shows the Acquisition dialog box.

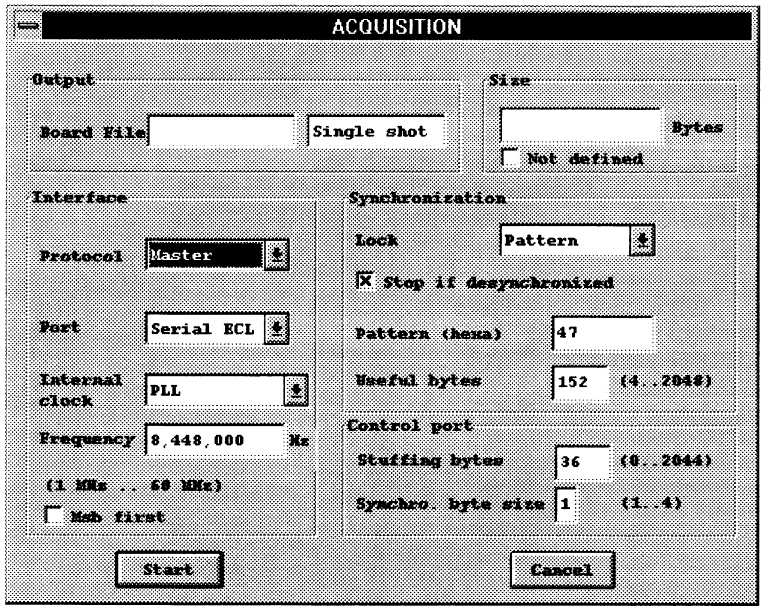


Figure 3–119: The Acquisition dialog box

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 3–191). 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 100 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.*

When acquiring a signal over a long time with Version 1.0 of the MTS 100 software, error checking occasionally stops the acquisition process. To prevent error checking from stopping the acquisition process, you can set the value of the DefaultPeriodeStatus registry parameter to 0, which eliminates error checking. Beginning with Version 1.1 of the MTS 100 software, it is no longer necessary to change the value of the DefaultPeriodeStatus registry parameter for long acquisitions.

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 3–21.

Table 3–21: Values for DefaultAlwaysDialogBox Registry Parameter

Value	Description
1	A dialog box is displayed after all transfers (default).
0	A dialog box is not displayed after transfers.

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.

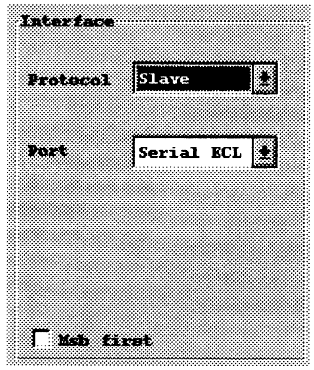
```
C:\HKEY_CURRENT_USER\SOFTWARE\CARB\CARBO
```

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.*

To change to value of the DefaultAlwaysDialogBox registry parameter, use the REGEDT32.EXE program. The REGEDT32 program is located in the C:\WINNT35\SYSTEM32 directory.

NOTE. *Windows NT, as installed on the MTS 100, limits the size of any file to 2 Gbytes. You can acquire a transport stream file that exceeds this size, but you will not be able to move the file from the Data Store Disks to the system hard drive.*

The Interface group contains the Protocol, Port, Internal Clock, and Frequency parameters. See Figure 3–120.



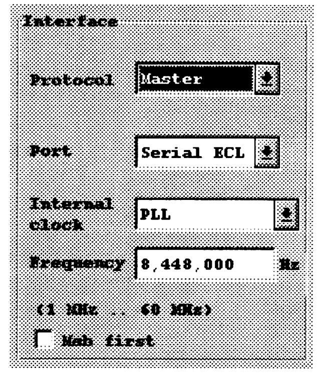


Figure 3–120: Examples of the Interface group

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 3–22.

***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 3–22: 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
TTL	1 MHz	45 MHz
10 Mbit Serial (RS422)	1 MHz	10 MHz

NOTE. *The frequency step size is 1 Hz.*

Synchronization. The Synchronization group (Figure 3–121) 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.

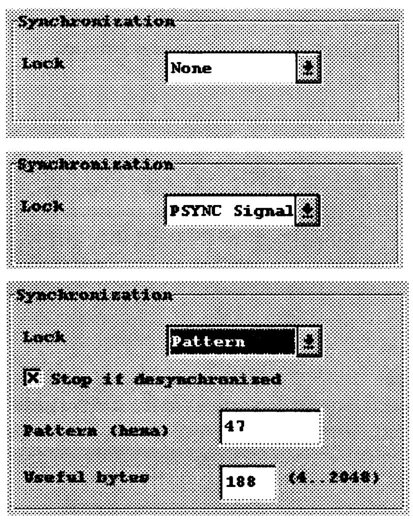


Figure 3–121: Examples of the Synchronization group

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.

Synchronization in PSYNC Signal Mode. 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.

Synchronization/Loss of Synchronization Report During Acquisition. The mechanisms of synchronization and loss of synchronization vary according to the synchronization method used given in Table 3–23.

Table 3–23: 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 3–122. There are two or three parameters in this group.

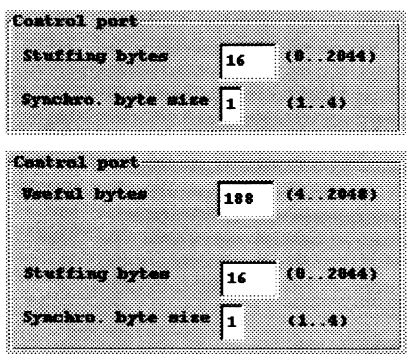


Figure 3–122: Examples of the Control Port group

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.*

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 3–123 shows the Generation dialog box.

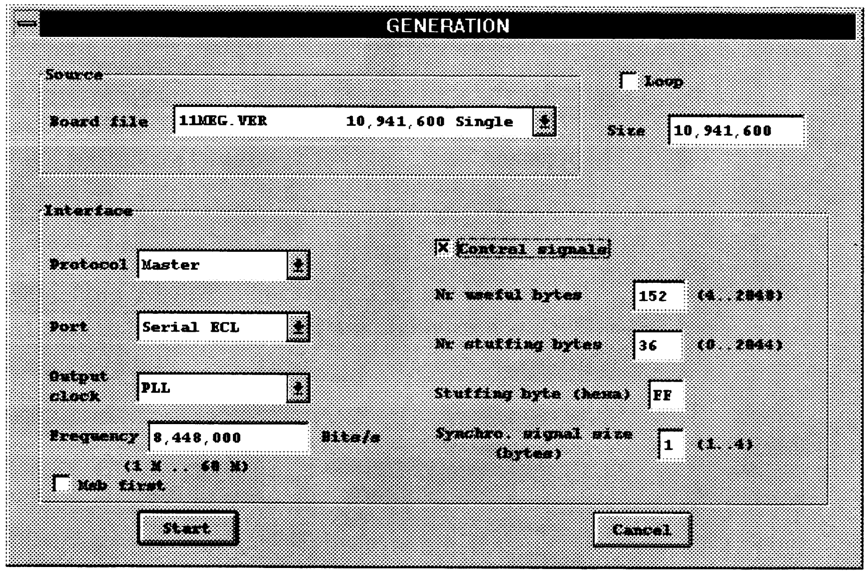


Figure 3–123: The Generation dialog box

The Source group contains the Data Store Disks file selection. Select a file from the drop-down list.

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 only sent 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 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).*

When generating a signal over a long time with Version 1.0 of the MTS 100 software, error checking occasionally stops the generation process. To prevent error checking from stopping the generation process, you can set the value of the DefaultPeriodeStatus registry parameter to 0, which eliminates error checking. Beginning with Version 1.1 of the MTS 100 software, it is no longer necessary to change the value of the DefaultPeriodeStatus registry parameter for generating long signals.

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 3–24.

Table 3–24: Values for DefaultAlwaysDialogBox Registry Parameter

Value	Description
1	A dialog box is displayed after all transfers (default).
0	A dialog box is not displayed after transfers.

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.*

To change to value of the DefaultAlwaysDialogBox registry parameter, use the REGEDT32.EXE program. The REGEDT32 program is located in the C:\WINNT35\SYSTEM32 directory.

The Interface group allows you to select the output port and set it up 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 3–25 lists all of the non-control signal parameters available.

Table 3–25: The parameters available from each port

Port	Control Signal (DEN Signal)	Oscillator (8.448 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 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 oscillators are available. Only these G.703 frequencies are available.*

The Control Signals Check box is only available with the ECL ports since they are the only ones with a DEN (data enable) signal. If this 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 MSB/LSB Order

With Version 1.1 or higher of the MTS 100 software, you can change the bit order of the transport stream. How this is done depends on the hardware level of your system.

For SN B020000 and Above. MTS 100 systems with serial numbers B020000 and above can reverse the bit order of a transport stream serial port output. The bit order of the generated transport stream is set from the Generation dialog box. Within the Generation dialog box, use the check box, located at the lower-left corner of the dialog box, to specify the bit order of the transport stream output to the serial port.

You can specify whether the MSB/LSB option appears within the Generation dialog box by using the SETCARB program.

To change the MSB/LSB setting:

1. Run the Windows NT File Manager.
2. From the File menu, select Run.
3. Type:

   ```
   c:\MTS100\BIN\SETCARB.EXE
   ```

   and select OK.

4. To enable changing the bit order, verify the MSB and LSB possibility option box is checked. If you do not want the option of the bit order being changed, uncheck the MSB and LSB possibility option box.

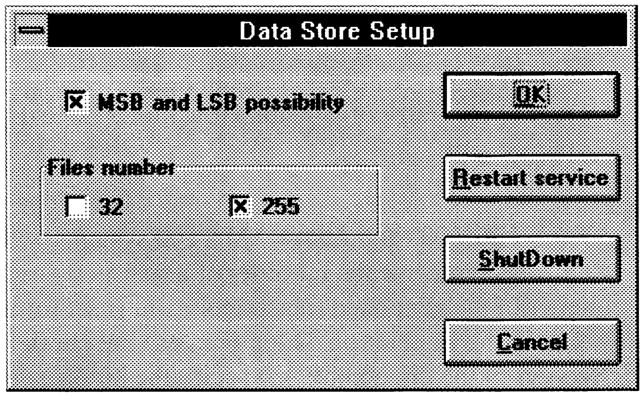


Figure 3–124: Changing the MSB/LSB Possiblity

5. If you changed the MSB and LSB possibility option box, select Restart Service. Otherwise, select Cancel.

   MTS 100 systems with serial numbers between B010100 and B019999 cannot use 255 files or the MSB/LSB option.

For SN B01XXXXX. If your MTS100 has a serial number of B01XXXX, you cannot change the bit order of a transport stream output to a serial port using the MTS 100 software. However, Version 1.1 or higher of the software includes a separate DOS-based program, byteflip.exe, you can use to reverse the bit order of a file used to generate the transport stream.

To reverse the bit order of each byte in a file:

1. From within Windows, open a DOS Prompt window.
2. In the DOS Prompt window, enter the following command:

   ```
   byteflip inputfile outputfile
   ```

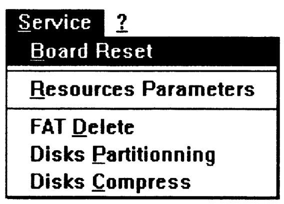
   Where inputfile is the name of the source file and outputfile is the name of the reversed bit order file. If outputfile already exists, it will be overwritten. The size of inputfile is limited to half the available system disk space.

NOTE. *Files that have been processed by the byteflip program cannot be read by the analyser and should not be sent out through the parallel port. Byteflip should only be used to invert files that have been acquired from an MSB-first serial source, or before generating to a destination that expects an MSB-first transport stream.*

Interrupt. The Interrupt command stops the current Acquisition or Generation process.

Service

The Service menu allows you to access housekeeping functions for the Data Store Disks and the Data Store Board. The commands available from this menu are: Card Reset, Resource Parameters, FAT Delete, Partitioning, and Compress.



Card Reset. The Card 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 Parameters. The Resource Parameters command changes the resource parameters for the Data Store Board. These parameters should never be changed during normal operation.

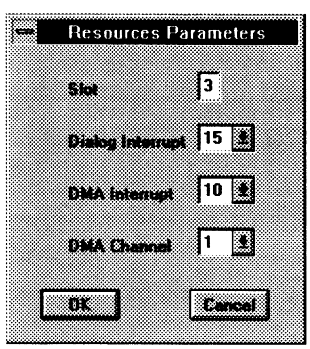


Figure 3–125: The Resource Parameters dialog box

Figure 3–125 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 3.)
- 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.

Partitioning. The 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 3–126.)

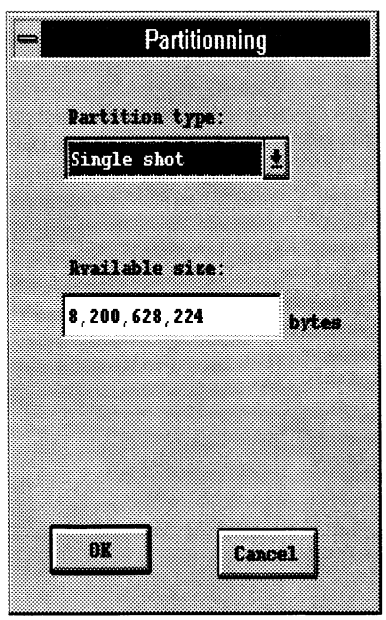


Figure 3–126: The Partitioning dialog box

Select the partition type from the drop-down list box. It can be: single shot, loop, or single and a loop.

Compress. The 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 3–127.

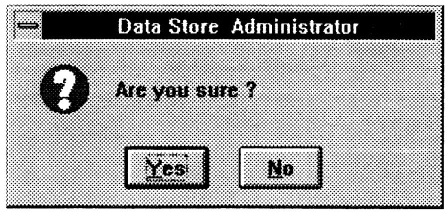


Figure 3–127: The Compress confirmation dialog box

NOTE. *The command can take a long time to complete. The Compress function requires about 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 3–172.

Help The Help menu offers information about the Disk Manager application. The only command available under this menu is About.

About. The About command displays the software version of the Data Store Administrator.

Button Bar Commands

The Button Bar contains shortcuts to frequently used commands. The commands include (from left to right):

FAT Read (see page 3–174 for additional information)

CARB File Read to PC (see page 3–176 for additional information)

PC File Write to CARB (see page 3–177 for additional information)

Acquisition (see page 3–180 for additional information)

Generation (see page 3–186 for additional information)

Interrupt (see page 3–191 for additional information)

MTS 100 to MTS 100 Transfers

The easiest way to check the operation of an MTS 100 is with another MTS 100. The results of MTS 100 to MTS 100 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 give rise to the insertion of stuffing data. See Table 3–26 for information MTS 100 to MTS 100 transfers.

Table 3–26: MTS 100 to MTS 100 transfer results

Interface	Generation Mode	Acquisition Mode	Expected Result
Any	Non-looping	Size: Generator's File Size Sync: None	Auto stop, files are identical
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 (220 Bytes)
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 (220 Bytes) increments.

Table 3–26: MTS 100 to MTS 100 transfer results (Cont.)

Interface	Generation Mode	Acquisition Mode	Expected Result
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 (220 Bytes) increments.

Using the Packet Jitter Application

Part of the MTS 100'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 multipex 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 Multiplex 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 100.

A transport stream file is a file on a disk. When the MTS 100 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, double-click on the Packet Jitter icon.

Menu Bar Commands

File 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 3–128.

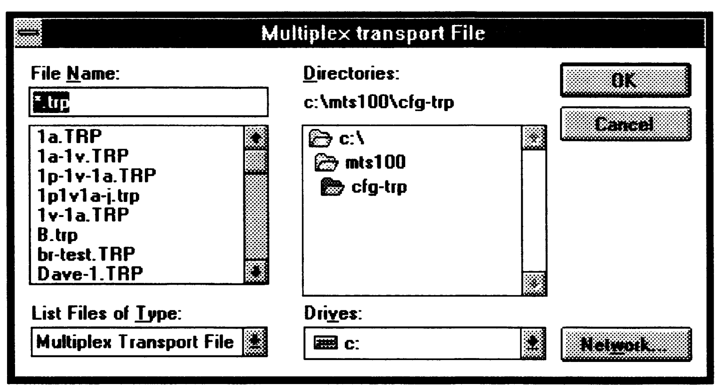


Figure 3–128: The Multiplex Transport File dialog box

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 3–129. Use this as a quick reference for PID numbers when defining the jitter (see page 3–199).

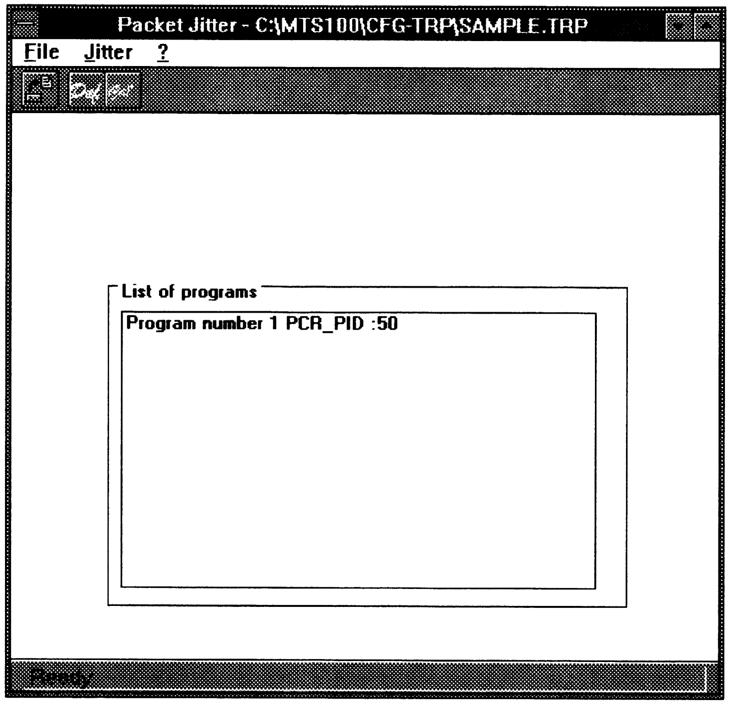
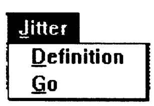


Figure 3–129: The List of Programs window

Quit. The Quit command closes the Packet Jitter application. No verification of the Quit command is given before exiting the application.

Jitter

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 3–130.

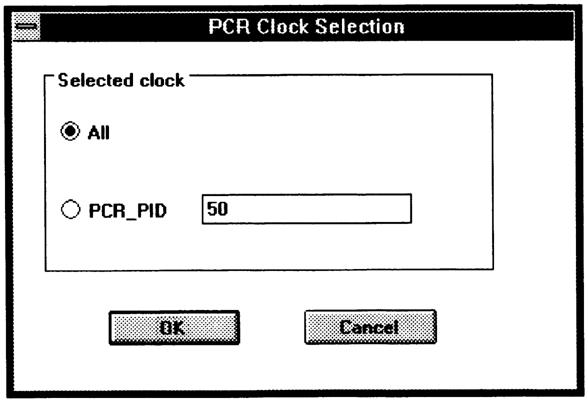


Figure 3–130: The PCR Clock Selection dialog box

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 3–131.

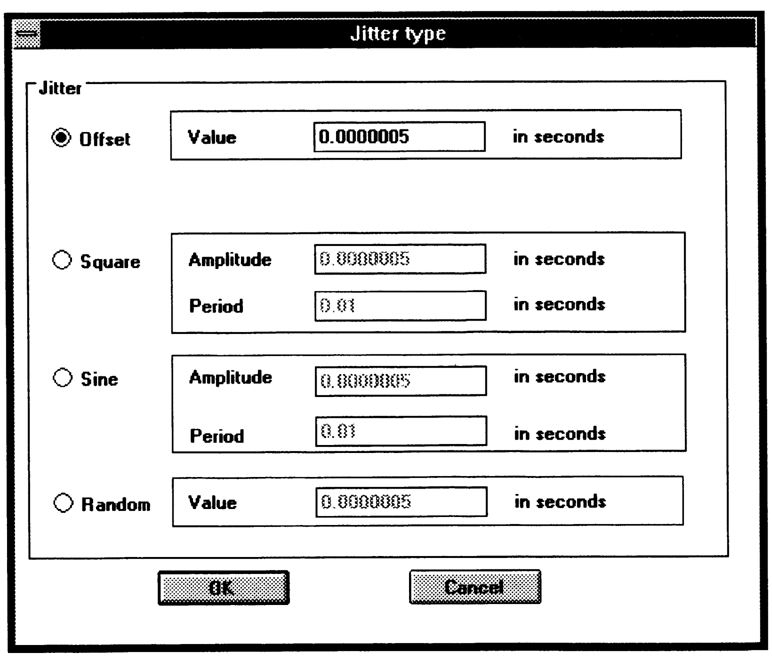


Figure 3–131: The Jitter Type dialog box

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 PCR. 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 3–132.

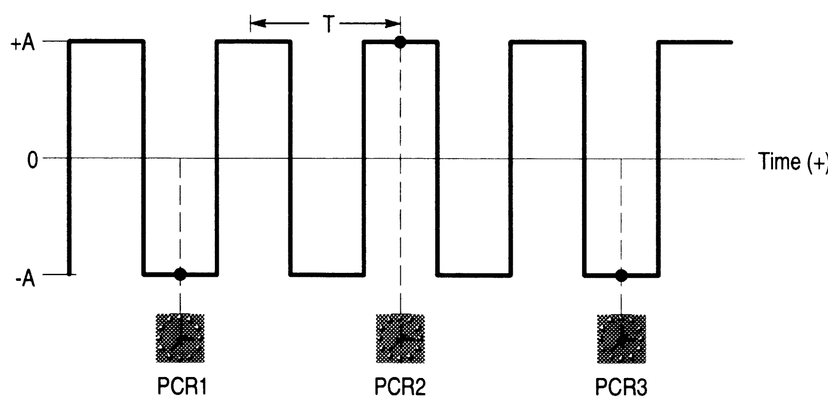


Figure 3–132: Illustration of the square jitter function

Using PCR2 in Figure 3–132 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 3–133 illustrates this concept.

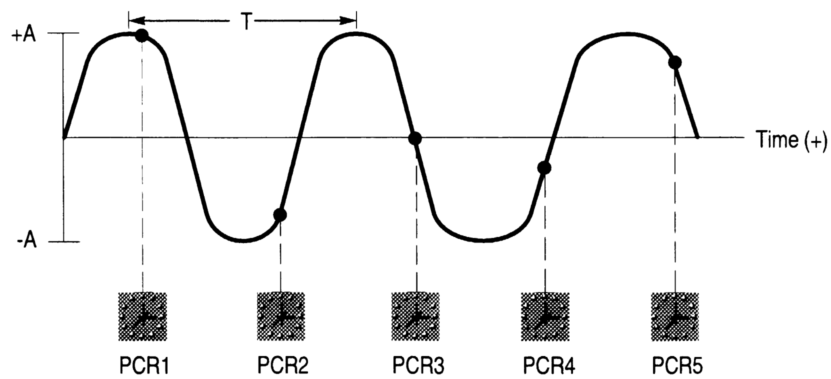


Figure 3–133: Illustration of the sine jitter function

Using PCR2 from Figure 3–133 as an example, the value of the sine wave at PCR2 is –.707A. Thus, the "jitter-added" equals PCR2 –.707A

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 ± 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 3–132.

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 3–134.

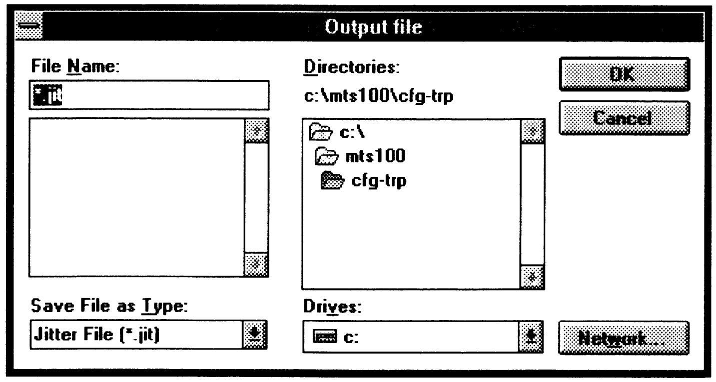


Figure 3–134: The Output File dialog box

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 3–135, 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.

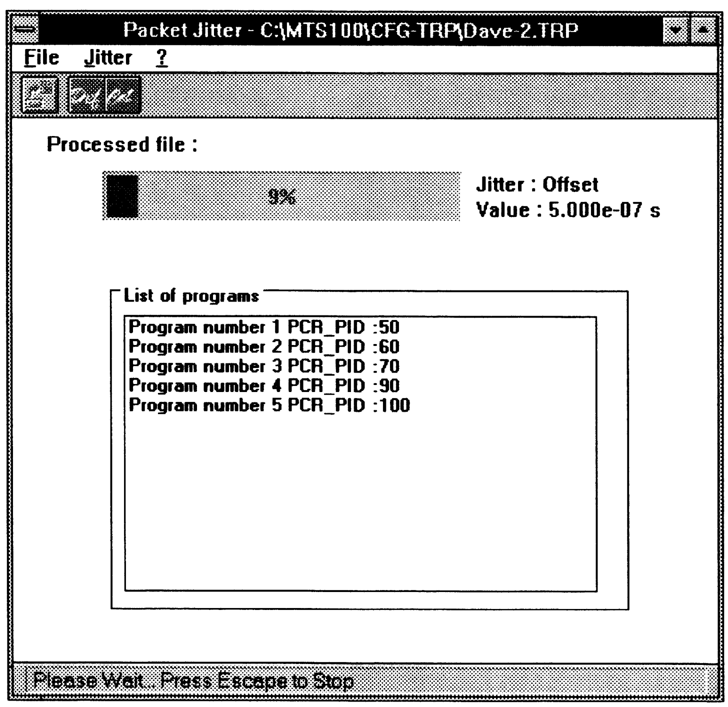


Figure 3–135: The application window while the jitter transport stream is calculated

When the calculation is complete, the status gauge reads 100%. The new file can then be used as a transport stream file.

Figure 3–136 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 100, you would see that most of the clocks are in error (red).

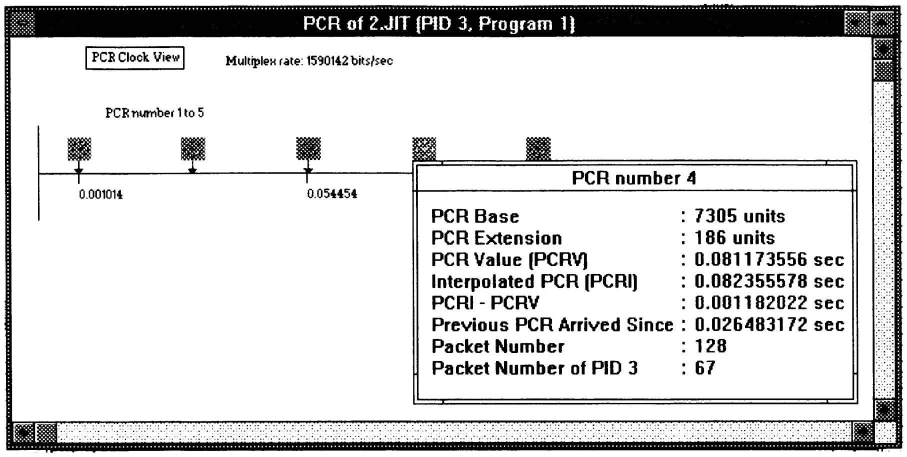
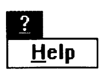


Figure 3–136: PCR analysis of a "jittered" transport stream file

? The ? menu allows you to access the Help command.



Help. The Help command gives you additional information about the application and its commands.

Button Bar

There are three commands on the Button Bar: Open, Definition, and Calculate; they are explained in Table 3–27.

Table 3–27: Commands available from the Packet Jitter Button Bar

Icon	Name	Function
	Open	Chooses the transport stream file and places its program PID numbers in the List of Programs window. (See page 3–198.)
	Definition	Defines the type of Packet Jitter added to the transport stream file. (see page 3–199.)
	Calculate	Creates a new transport stream file with the defined amounts of jitter added to the PCRs. (see page 3–202.)

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 3–28 lists the type of coding/decoding, the type of input expected, and the resulting file.

Table 3–28: 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 3–137 shows the resulting display with the major parts named.

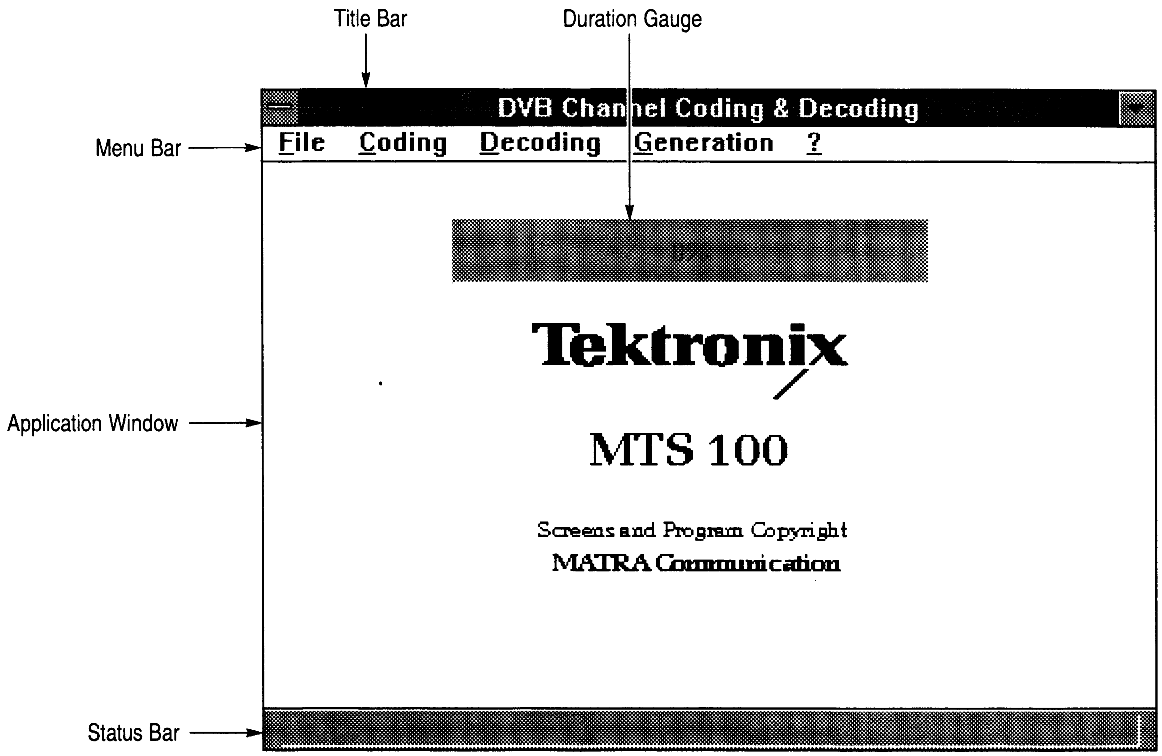


Figure 3–137: The initial display for the Coding/Decoding application

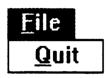
Gauge. The Gauge gives the status of the coding or decoding operation in percent.

Menu Bar Commands

This section lists the commands available from the Menu Bar and explains how to use them.

File

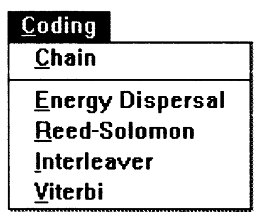
The File menu only offers the Quit command.



Quit. The Quit command exits the Coder/Decoder application.

Coding

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 3–138 shows the Coding Chain dialog box.

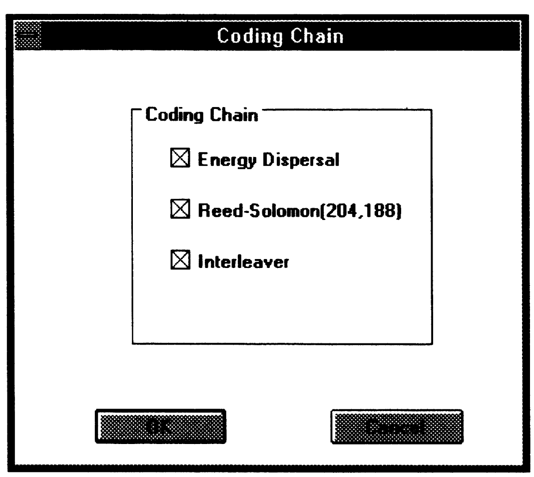


Figure 3–138: The Coding Chain dialog box

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 3–139 is displayed. Select the file to code using this dialog box.

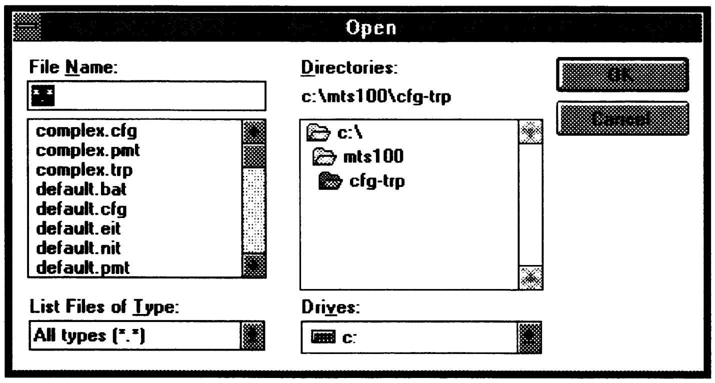


Figure 3–139: The Open dialog box for the Chain command

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 3–221, Interleaver is on page 3–223, and Reed-Solomon is on page 3–222).

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, see Energy Dispersal Coding on page 3–221.

Selecting Energy Dispersal brings up the dialog box shown in Figure 3–140.

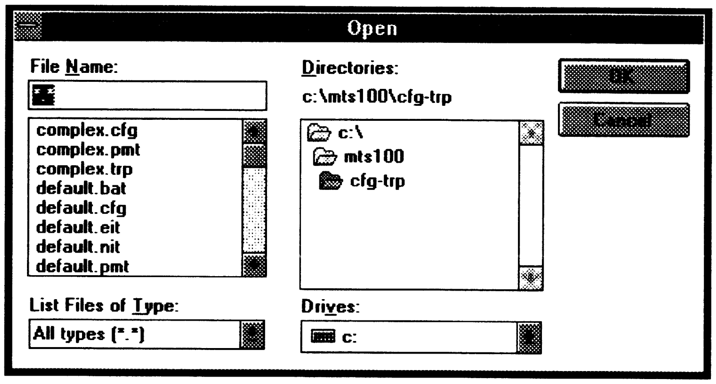


Figure 3–140: The Open dialog box for the Energy Dispersal command

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 3–222.

Figure 3–141 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.

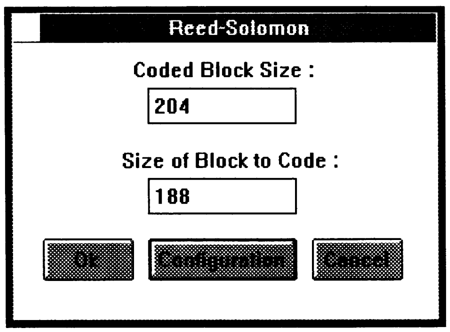


Figure 3–141: The Reed Solomon dialog box

If you choose the Configuration command button, the dialog box shown in Figure 3–142 appears.

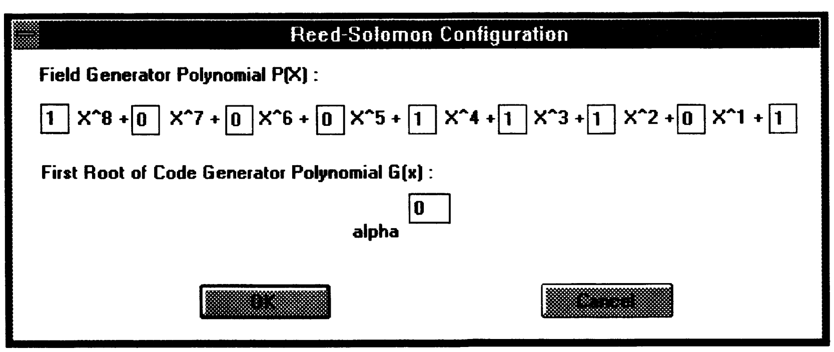


Figure 3–142: The Reed-Solomon Configuration dialog box

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 3–223 for more information on the coding process.

When you choose the Interleaver command, the dialog box in Figure 3–143 appears. (There are no parameters for you to adjust for this coding module.)

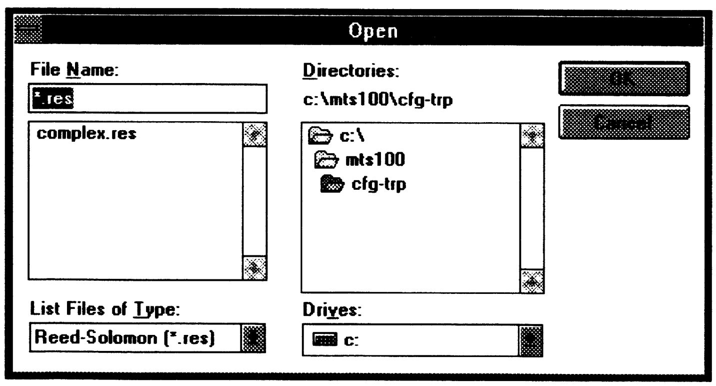


Figure 3–143: The Open dialog box for Interleaver coding

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”.

The 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, see *Viterbi Coding* on page 3–224.

***NOTE.** This application does not provide a method to decode Viterbi coding.*

The dialog box in Figure 3–144 appears when you choose Viterbi.

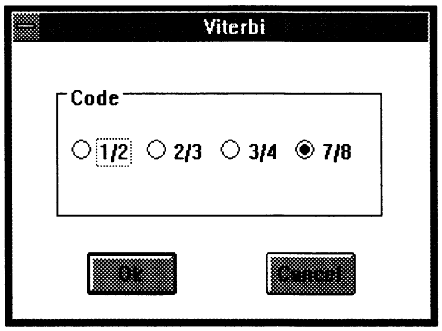


Figure 3–144: The Viterbi dialog box

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 3–145 appears.

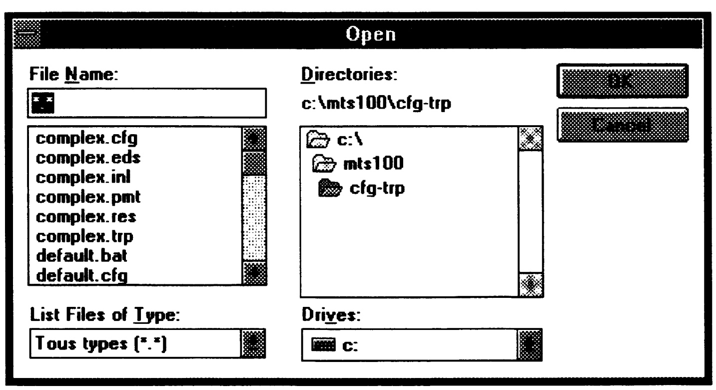
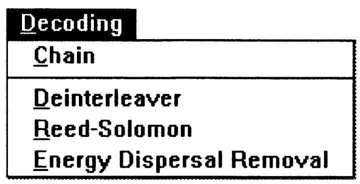


Figure 3–145: The Open dialog box for Viterbi coding

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 READY is in the Status Bar.

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 3–146 shows the dialog box that results after choosing the Chain command.

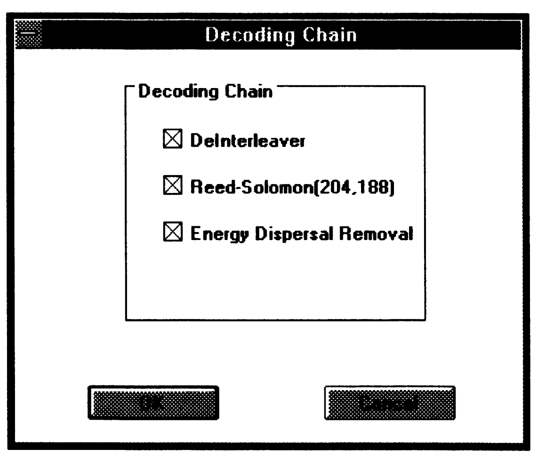


Figure 3–146: The Decoding Chain dialog box

You can deselect any of the check boxes, but all are required to generate DVB compliant files.

Start the 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 3–147.

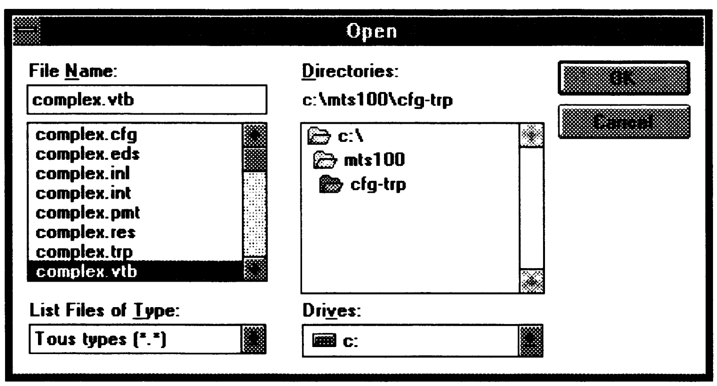


Figure 3–147: The Open dialog box for the Deinterleaver

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 3–148.

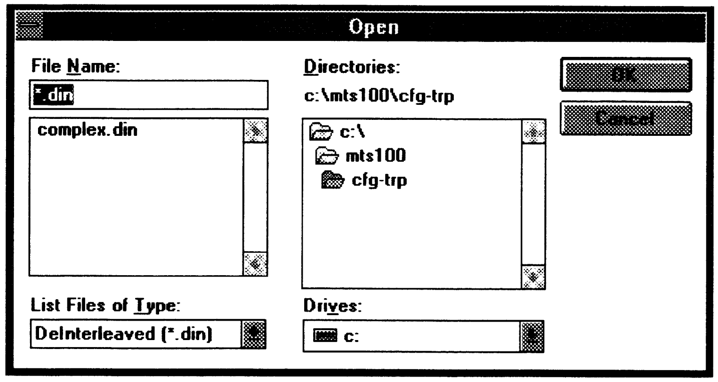


Figure 3–148: The Open dialog box for Reed-Solomon decoding

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 3–149.

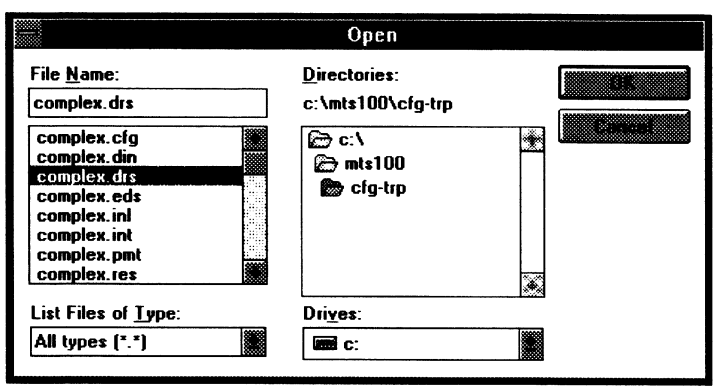


Figure 3–149: The Open dialog box for Energy Dispersal Removal

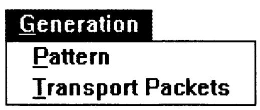
The expected input file is one generated by the Deinterleaver coding module (*.drs), although this decoding module will accept any file type.

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 3–150 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.

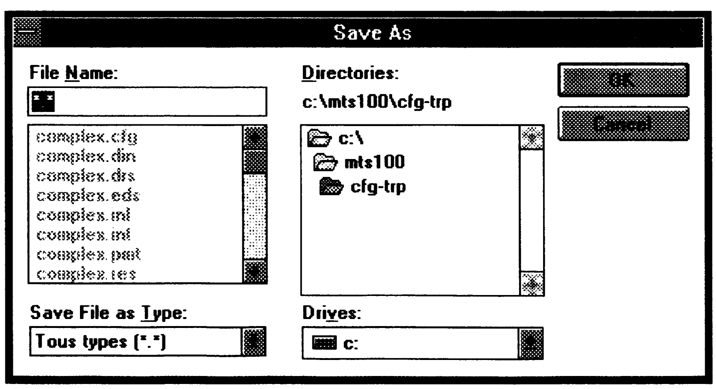


Figure 3–150: The Save As dialog box for the Pattern command

The first Pattern dialog box then appears as shown in Figure 3–151. This dialog box requests the number of bytes in the pattern.

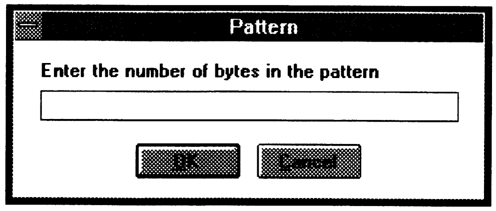


Figure 3–151: The Pattern dialog box requesting the number of bytes in the pattern

The next dialog box, shown in Figure 3–152, 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 3–151).

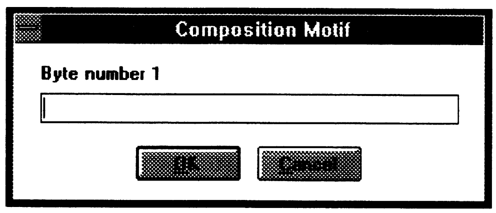


Figure 3–152: The Composition Motif

The final dialog box, shown Figure 3–153, 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.

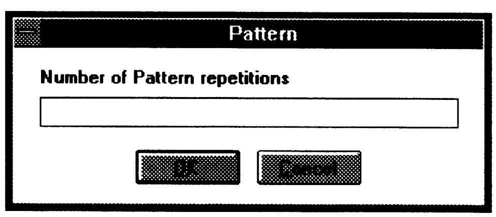


Figure 3–153: The Pattern dialog box that sets the number of pattern repetitions

Transport Packet. This command generates a repetitive pattern of user-defined transport packets.

Figure 3–154 shows the first dialog box, Transport Packets. 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.

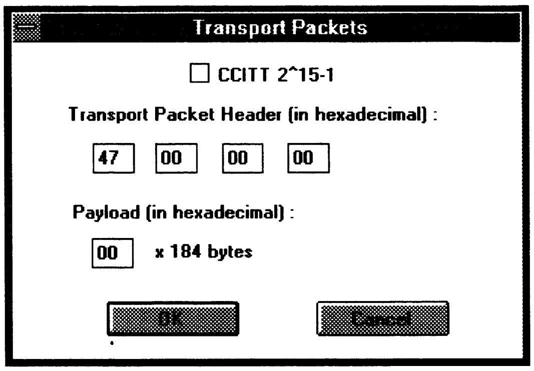


Figure 3–154: The Transport Packet dialog box

You also define the payload, which is then repeated 184 times.

Once all of the desired data is entered, choose OK. This brings up the Number of Packets dialog box as shown in Figure 3–155. Enter the number of transport packets wanted in the transport stream file in the text box.

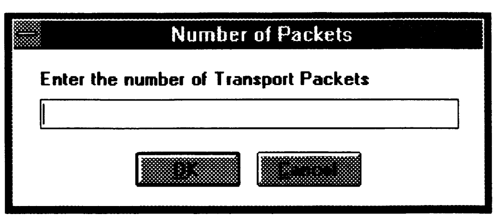


Figure 3–155: The Number of Packets dialog box

After entering the number of packets, choose OK. This brings up the Save As dialog box shown in Figure 3–156. 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.

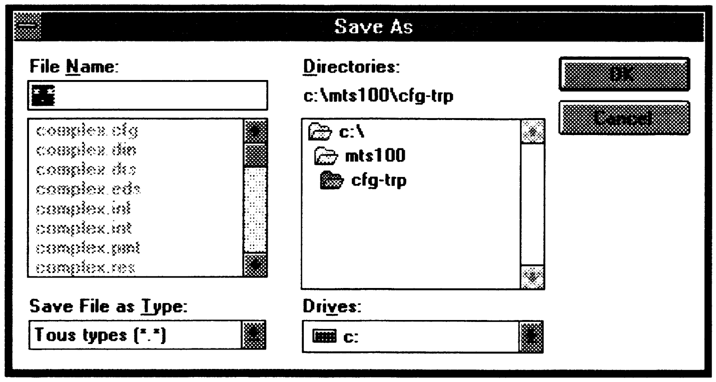


Figure 3–156: The Save As dialog box

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 3–157.

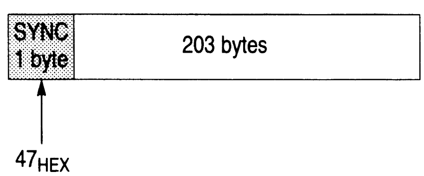


Figure 3–157: The MPEG-2 Transport packet

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 3–158 for scrambling and descrambling (in the channel coding process).

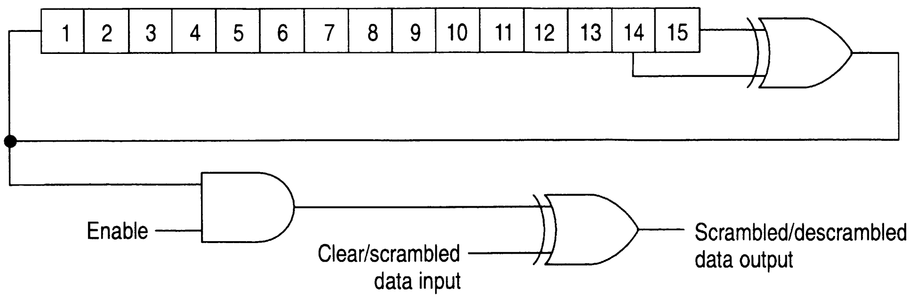


Figure 3–158: The Scrambler/Descrambler schematic for the PRBS

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 3–159.

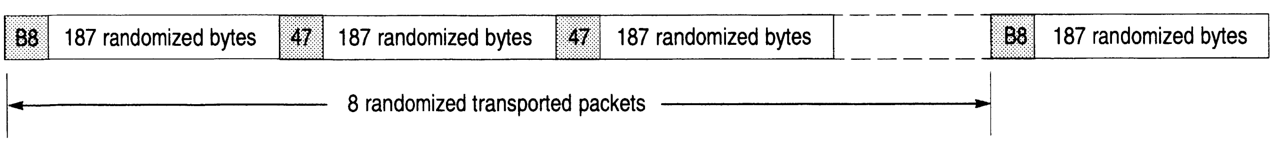


Figure 3–159: The output after Energy Dispersal coding

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.

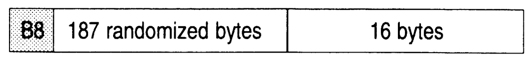


Figure 3–160: The transport packet after Reed-Solomon coding

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 3–161.

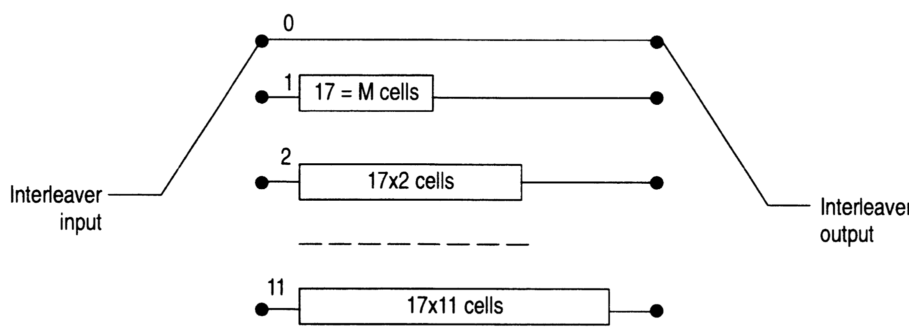


Figure 3–161: The conceptual diagram of the Interleaver coder

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 3–162: The Interleaved transport packets

Viterbi Coding

The inner coding is based on a Viterbi punctured convolutional code. See Figure 3–163.

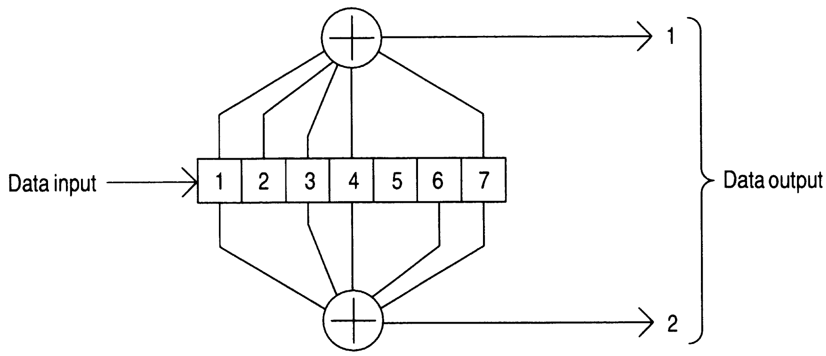


Figure 3–163: Viterbi 1/2 Punctured coding

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

I/O Ports The following tables give the specifications for the MTS 100 specific I/O ports.

Table A-1: G703 — 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/sec ± 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 to 2.607 Volts Space from –0.237 to +0.237 Volts
Return Loss (75 Ohms)		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 nsec peak-to-peak 20 Hz to 400 Hz 23.6 nsec peak-to-peak 3 kHz to 400 kHz log prorated 400 Hz to 3 kHz
Output Pulse Width		59 nsec nominal
Pulse "Mark" Amplitude	2.37 ± 0.237 Volts	
No-Pulse "Space" Voltage	0 ± 0.237 Volts	
Pulse Shape		Conforms to 8.448 MHz Pulse Mask, G.703 Figure 16 (see Figure A-1)
Required Receiver Termination		75 ohms nominal resistive
Jitter		15 nsec peak-to-peak with a 20 Hz lower cut-off and a 400 kHz upper cut-off filter. 5 nsec 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: G703 — 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

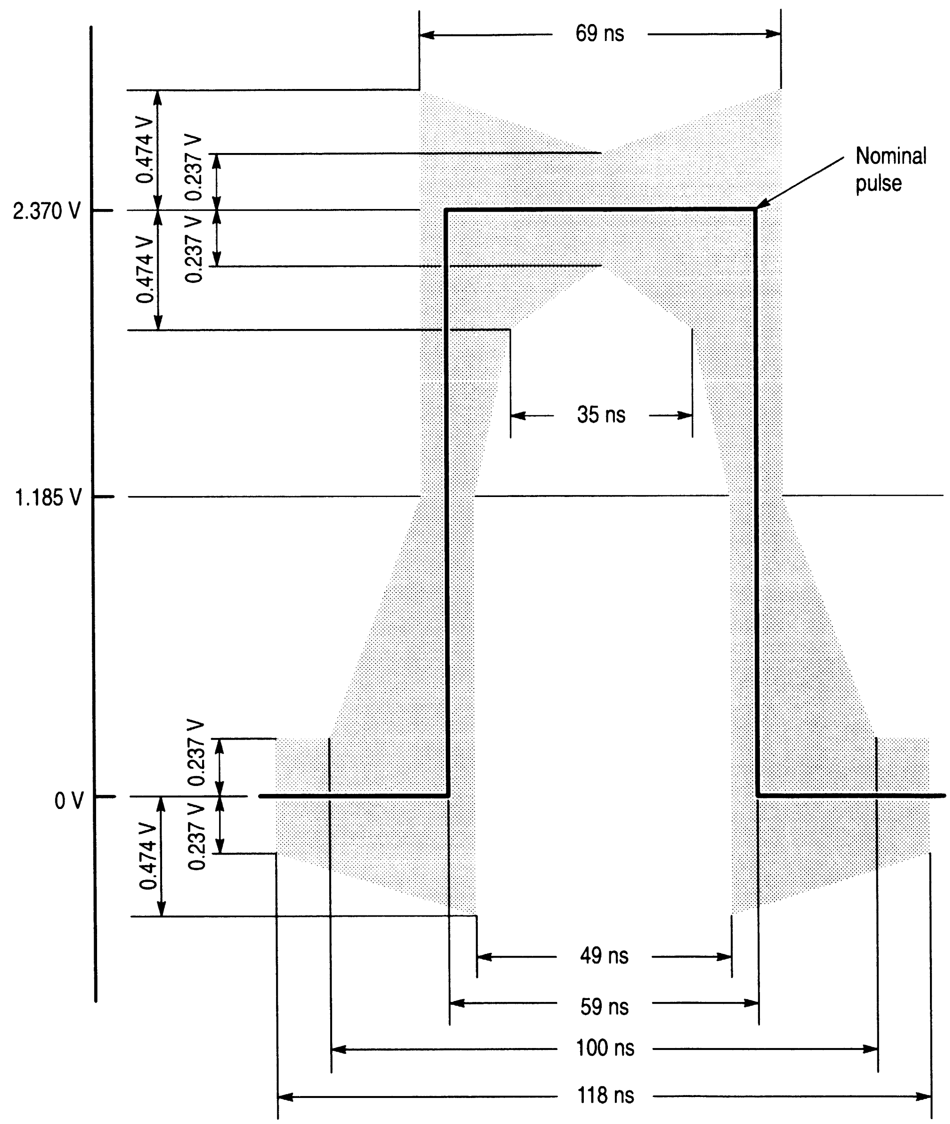


Figure A-1: Pulse specification for a G703 8.448 MHz pulse

Table A-2: G703 — 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/sec ± 20 ppm	
Input		
Voltage Levels		Standard level within 0 to 4 dB cable attenuation at 1/2 clock. Standard level: Mark from 0.9 to 1.1 Volts Space from –0.1 to +0.1 Volts
Return Loss (75 Ohms)		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 nsec peak-to-peak 100 Hz to 1 kHz. 4.37 nsec peak-to-peak 10 kHz to 800 kHz. log prorated 1 kHz to 10 kHz
Output		
Pulse Width		14.5 nsec nominal
Pulse “Mark” Amplitude	1.0 ± 0.1 Volts	
No-Pulse “Space” Voltage	0 ± 0.1 Volts	
Pulse Shape		Conforms to 34.368 MHz Pulse Mask, Figure 17/G.703 (Figure A–2)
Required Receiver Termination		75 Ohms nominal resistive
Jitter		10 nsec peak-to-peak with a 100 Hz lower cut-off and a 800 kHz upper cut-off filter. 2.45 nsec 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 to 51.55 MHz

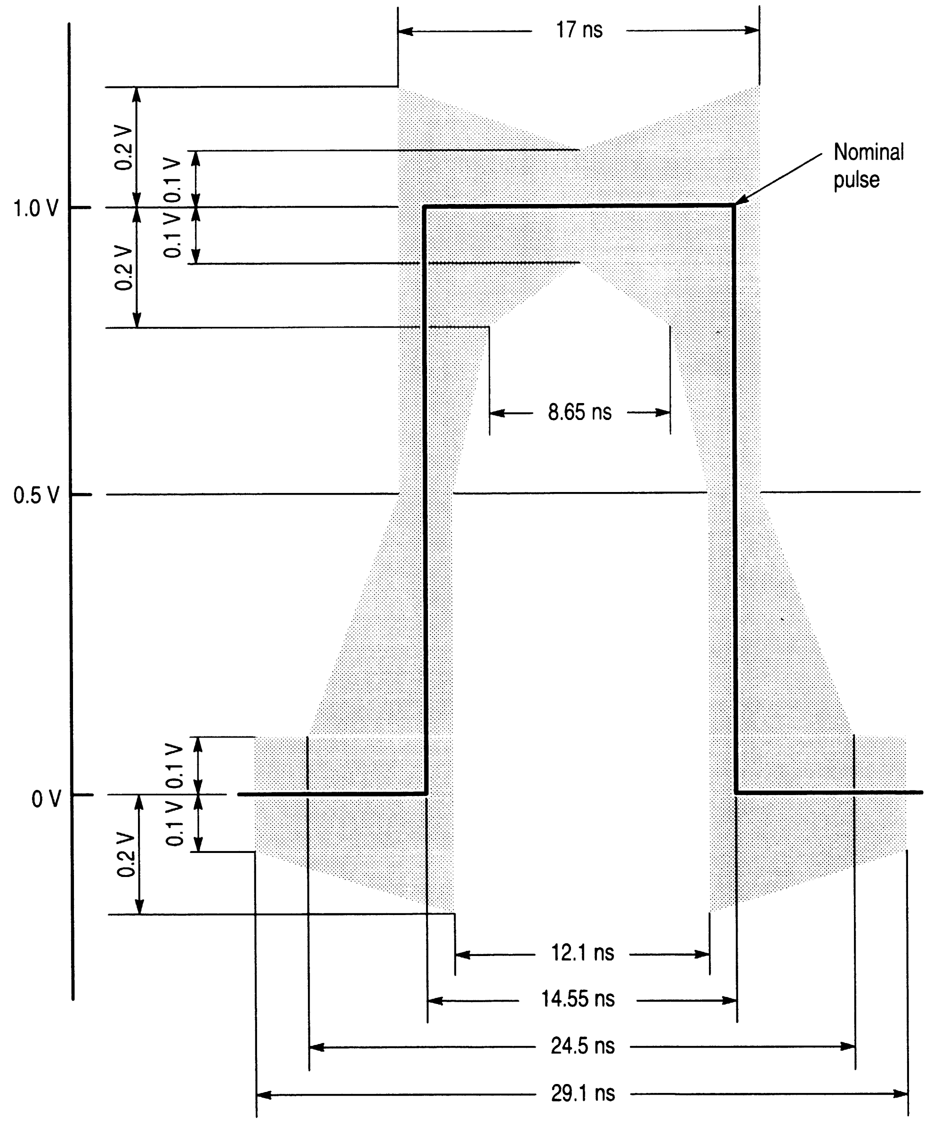


Figure A–2: Pulse specification for G703 34.368 MHz

Table A–3: ECL Parallel, Serial, and Control Ports

Characteristics	Performance Requirements	Supplemental Information
Connector		Parallel Data: D25 (Pinout is given in Figure A–3 and Table A–4) Serial Data: D25 (Pinout is given in Figure A–3 and Table A–5) Flow Control: D9 (Pinout is given in Figure A–4 and 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		60 Mbits/s Serial: 60 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
Clock to Data Timing		Data changes within 5 ns of falling clock edge
Time Reference		Rising edge of the clock
Output		
Maximum Data Rate		60 Mbits/s Serial: 60 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
Required Receiver Termination		110 ohms, line-to-line

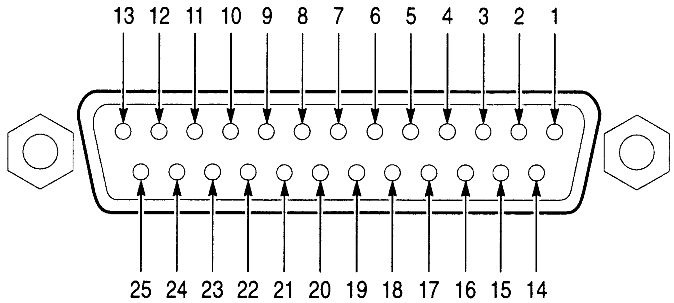


Figure A–3: Pinout of the ECL Parallel Port

Table A–4: Pinout of the 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	DATA 1
10	DATA 0	23	DATA 0
11	DVALID	24	DVALID
12	PSYNC	25	PSYNC
13	shield		

Table A–5: Pinout of the ECL Serial Port

Pin	Function	Pin	Function
1	DCLK	14	DCLK
2	ground	15	ground
3	—	16	—
4	—	17	—
5	—	18	—
6	—	19	—

Table A–5: Pinout of the ECL Serial Port (Cont.)

Pin	Function	Pin	Function
7	—	20	—
8	—	21	—
9	—	22	—
10	DATA 0	23	DATA 0
11	DVALID	24	DVALID
12	PSYNC	25	PSYNC
13	shield		

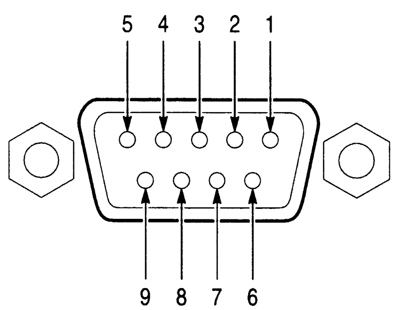


Figure A–4: Pinout of the ECL Control Port

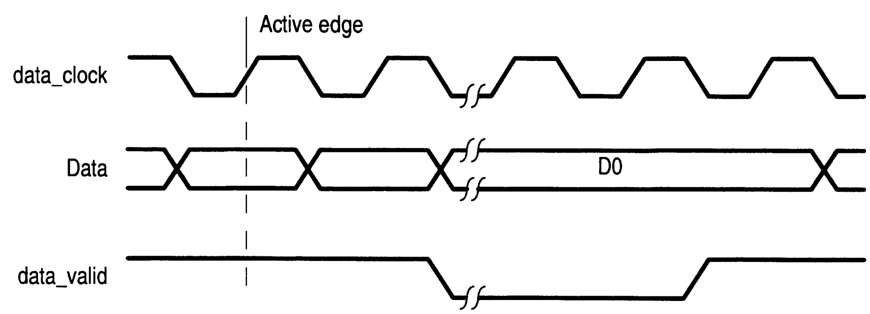


Figure A–5: Timing diagram for the ECL Serial Port

Table A–6: Pinout of the ECL Control Port

Pin	Function
1	CHCLK
2	ground
3	CHSYNC
4	CHCLKEN
5	shield
6	CHCLK
7	ground
8	CHSYNC
9	CHCLKEN

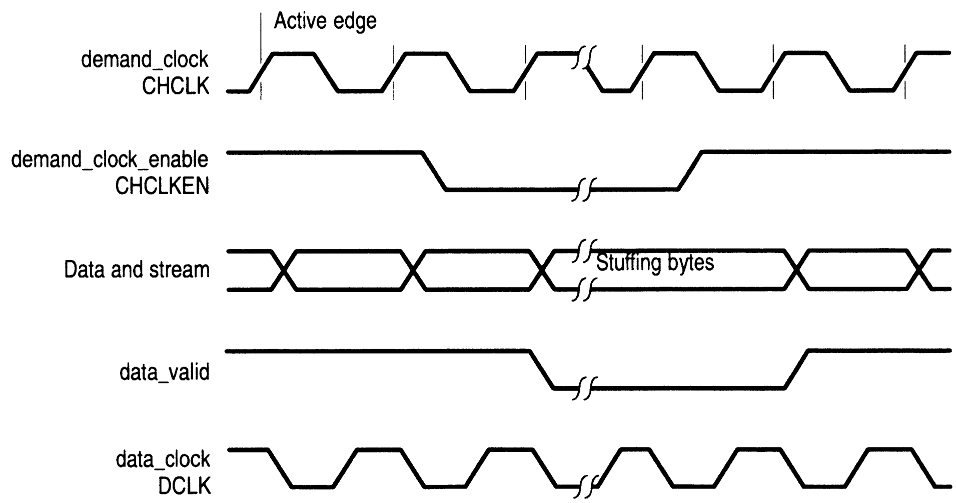


Figure A–6: ECL Timing diagram with control port

Table A–7: 50 Ω TTL I/O

Characteristics	Performance Requirements	Supplemental Information
Connectors		male SMB
Rise & Fall Times		between 2 and 6.5 ns
Signal swing into 50 (output)	Low < 0.3 Volts High > 2.65 Volts	
Digital Format		Binary, positive logic
Maximum Data Rate		45 Mbits/s
Minimum Data Rate		1 Mbit/s

Table A–7: 50 Ω TTL I/O (Cont.)

Characteristics	Performance Requirements	Supplemental Information
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 nominally resistive
Timing Diagram		DATA signal is stable on the leading edge of the clock signal (See Figure A–7)
Clock to Data Timing		Data changes within 5 ns of falling clock edge
Signal Level Amplitude (input)		TTL Low < 0.8 Volts High > 2.0 Volts

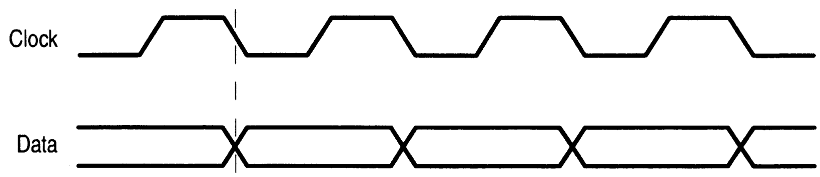


Figure A–7: Timing diagram for the TTL Serial port and the separate clock input

Table A–8: 10 Mbit Serial Port (RS-422 Levels I/O Port)

Characteristics	Performance Requirements	Supplemental Information
Connector		9-pin sub-miniature d connector (see Figure A–8 and Table A–9)
10 Mbit Serial Voltage Levels		Differential outputs measured single-ended
Output		Low < 0.5 Volts High > 2.5 Volts
Input		Low < –0.5 Volts differential High > 0.5 Volts differential
Common Mode Range		±5 Volts
10 Mbit Serial Rise & Fall Times		between 2 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)

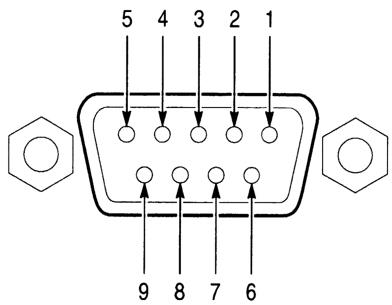


Figure A–8: Pinout of the 10 Mbit Serial Port

Table A–9: Pinout of the 10 Mbit Serial Port

Pin	Function
1	DATA IN
2	CLK IN
3	DATA OUT
4	CLK OUT
5	ground
6	DATA IN
7	CLK IN
8	DATA OUT
9	CLK OUT

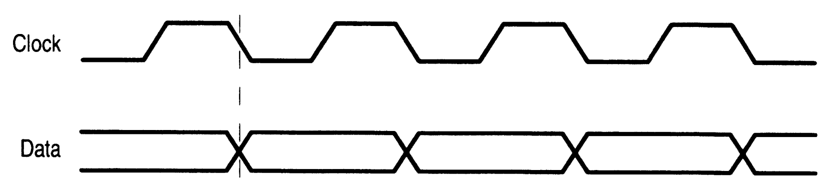


Figure A–9: Timing diagram for the 10 Mbit Serial port

Table A-10: Clock Port

Characteristics	Performance Requirements	Supplemental Information
Clock Port Voltage Levels		TTL Low < 0.8 Volts High > 2.0 Volts
Termination		50 Ohms, nominally resistive
Range		125 kHz to 45 MHz

PLL

NOTE*. The resolution of the Data Store Board's PLL is dependent upon its frequency.*

Table A-11: PLL

Characteristics	Performance Requirements	Supplemental Information
Range		125 kHz to 45 MHz
Resolution SN B019999 and below SN B020000 and above		 32 Hz from 25 MHz to 45 MHz 16 Hz from12.5 MHz to 25 MHz etc. The step size drops by a factor of two as the frequency is halved. 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 $\pm$ Resolution
PLL Frequency Equation SN B019999 and below only		 $f_{PLL}(MHz) = 16.896 \times \frac{M}{2^{24}} \times \frac{32}{2^N}$ (M= 24 bit value in the range of 775758 to 1551515) $(0 \leq N \leq 8)$

Power Specifications

Table A–12: Power

Characteristics	Performance Requirements	Supplemental Information
Power Consumption		
Data Store Board only		30 Watts

Table A–13: Power Requirements

Characteristics	Performance Requirements	Supplemental Information
Range Line Voltage		100 to 120 VAC (–10%, +6%) 220 to 240 VAC (–10%, +6%)
Line Frequency		60 Hz / 50 Hz
Fuse		8 / 4 A

Mechanical (Physical) Characteristics

Table A–14: Data Store Board Mechanical Characteristics

Characteristics	Supplemental Information
Dimensions	
Height	3.40 inches (8.64 cm)
Width	5.5 inches (14 cm)
Length	13.9 inches (35.3 cm)
Net Weight	2.063 lbs. (.937 kg)
Shipping Weight	2.438 lbs. (1.107 kg)

Table A–15: MTS 100 Mechanical Characteristics

Characteristics	Supplemental Information
Dimensions	Base unit (does not include monitor, keyboard, or mouse)
Height	21.93 inches (55.8 cm)
Width	8.96 inches (22.8 cm)
Length	17.25 inches (43.8 cm)
Net Weight	37.0 lbs. (16.8 kg)
Shipping Weight	72 lbs. (without monitor – monitor is shipped separately)

Environmental Characteristics

Table A-16: Environmental Characteristics

Characteristics	Supplemental Information
Temperature Non-operating Operating	 –20° C to +60° C +10° C to +35° C
Altitude Non-operating Operating	 0 to 30,000 feet (9144 meters) 0 to 10,000 feet (3048 meters)
Humidity Operating Non-operating	 20% to 80% (Maximum 10% change/hour) 5-90% humidity, non-condensing
Vibration (Operating)	 From 5 to 350 Hz: 0.000125 g^2/Hz Acceleration Power Spectral Density (APSD) From 350 to 500 Hz: –3dB/Octave Slope At 500 Hz: 0.0000876 g^2/Hz APSD 0.24 GRMS Overall 10 Minutes/Axis
Shock (Non-Operating)	 Half-sine wave shock levels: 20g (instrument), 11 ms duration, 3 shocks per axis
Transportation	Qualified under NTSC Test Procedure 1A, Category II (24-inch drop)
Vehicle Vibration (Random Vibration)	Vibrate along all three axes at an overall vibration level of 1.33 GRMS. One hour per axis
Second Manual Handling (Shock)	Drop on all sides once from a height of 24 inches. Drop on the bottom from a height of 48 inches. Monitor Drop: From 40 cm all sides, 55 cm on bottom

Table A–16: Certifications and compliances

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 55022 — Class A Radiated and Conducted Emissions EN 50082-1 Immunity: IEC 801-2 — Electrostatic Discharge Immunity IEC 801-3 — RF Electromagnetic Field Immunity IEC 801-4 — Electrical Fast Transient/Burst Immunity IEC 801-5 — Power Line Surge Immunity Conditional Statements: 1) Using the high quality Tektronix shielded cables attached to the ECL Ser/Par and ECL Control ports that it was qualified with. 2) Using conductive tape applied inside the rear edge of the PC side panel. Low Voltage directive 73/23/EEC, amended by 93/68/EEC: EN 60950 — Safety of Information Technology Equipment, Including Electrical Business Equipment

Appendix B: What to Do if an Application Locks Up

As with all software, the MTS 100 applications occasionally locks up. Follow the steps below to close a locked up application.

1. If you are in the Data Store Administrator application, first try a Card Reset. (The Card Reset command from the Service menu, see page 3–191.)
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 access the Windows NT Security dialog box.
   b. Choose the Task List command button. This brings up 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.
   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 100 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 100 server without first exiting Windows NT. Use the manual reset method only if the entire MTS 100 server is not responsive.*

Some low-level parameters in the CARB 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 an Emergency Repair Disk. The second part tells you how to reload the MTS 100 software if your installed copy becomes corrupted.

Creating an Emergency Repair Disk

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.

To make a new emergency repair disk, you need one 3½ inch disk. Mark it clearly that this is the emergency repair disk for MTS 100 serial number xxxxxxx. (It is not necessary that this disk already be formatted.)

NOTE. *The emergency repair disk is MTS 100 specific. Make sure that the emergency repair disk is clearly marked with its MTS 100 serial number.*

---

1. Choose the Run command, from the File menu in the Program Manager.
2. Enter "rdisk" in the Run dialog box. This displays the Repair Disk Utility dialog box as shown in Figure C–1.

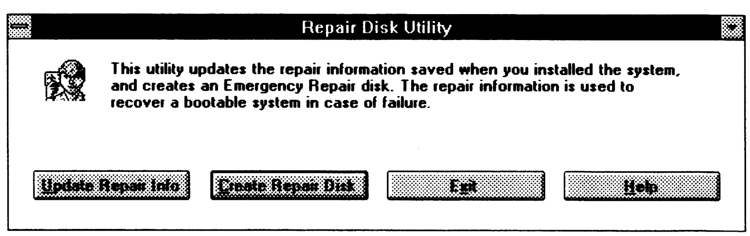


Figure C–1: The Repair Disk Utility dialog box

3. Choose the Create Repair Disk command button.
4. Insert the floppy disk in the A drive and choose OK. (See Figure C–2.) The utility then formats the disk and loads the information.

Figure C–2: Warning that all data on the disk will be erased

5. When the operation is complete, choose the Exit command button to leave the Repair Disk Utility. Remove the disk from the a:\ drive and keep it in a safe place.

Using the Emergency Repair Disk

When do you use the emergency repair disk? If your system files are corrupt and you are unable to recover the previous start up configuration (Last Known Good – the Windows NT startup screen option), you use the emergency repair disk to restore your system to its initial setup state. 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 exactly how to restore your system.

Another time that you may need your Emergency repair disk is to restore user passwords if they are forgotten. Make sure that you update the emergency repair disk each time that you add a user or change a password.

Using the Emergency Repair Disk

See the Windows NT manual for more information.

CAUTION. *The files on the Emergency Repair Disk are MTS 100 specific. (The disk shipped with the MTS 100 is the* **ONLY** *one that will work with that MTS 100). Do not lose this disk. If you lose your Emergency Repair Disk, create a new one as described on page C–1.*

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 MTS 100.
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 100 Software

Use the procedures below to reinstall your MTS 100 software if it is accidently deleted or becomes corrupted. Software has been supplied on CD-ROM.

CAUTION. *To avoid an unintended loss of data, before you reinstall the software, be sure to backup any files you have created that are located in the c:\MTS100 directory.*

This is not necessarily the procedure used to upgrade the software. Use the directions provided with the software upgrade to perform upgrades.

1. Verify that the system disk on the MTS 100 workstation has 80 MB of free space. The program will not install if the system disk has less than 80 MB of free space.
2. If you are reinstalling the software because the MTS 100 software has become corrupted, you should uninstall the software using unInstallMTS100, located in the Tektronix MTS 100 V2.0 group.
   a. To remove the existing MTS 100 software, double-click on the unInstallMTS100 icon (see Figure C–3).

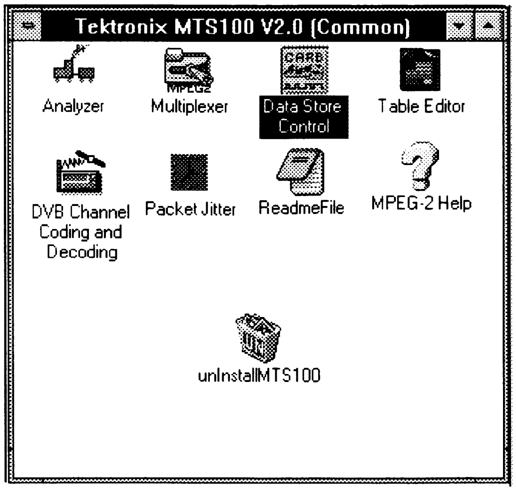


Figure C–3: The Tektronix MTS 100 V2.0 window

b. When the dialog box asks you to confirm the file deletion, click on Yes.

3. Place the MTS 100 Installation Software CD-ROM into the CD-ROM drive (usually D:\).

4. Restart Windows NT.

CAUTION. *To prevent incorrect installation of the MTS 100 software, be certain to log into Windows NT as administrator before you install the MTS 100 software.*

---

5. Log into Windows NT as administrator (Username = administrator and password = MPEG2). You must log in as "administrator" in order to install applications.

6. Close any applications that are running. Nothing should be running except the Program Manager.

7. Display the Program Manager.

8. Choose Run from the File menu. This displays the Run dialog box shown in Figure C–4.

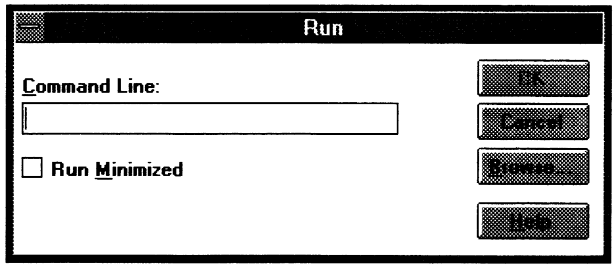


Figure C–4: The Run dialog box

9. Type “d:\setup” in the Command Line text box. Click OK to continue.

   This starts the MTS 100 Software Installation and brings up the dialog box shown in Figure C–5.

Figure C–5: The MTS 100 Software Installation dialog box

10. After reading the text in the dialog box, click Next.

    This brings up the dialog box shown in Figure C–6.

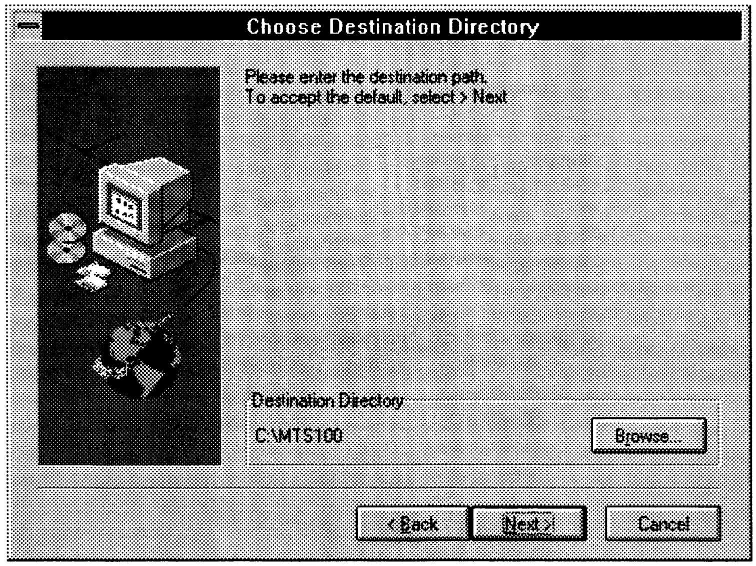


Figure C–6: Specifying the destination directory

11. Specify the directory into which the MTS 100 software should be installed. The default directory name is MTS100. If you wish to use a different directory name, click Browse. To accept the default directory name, click on Next.

NOTE. *It is strongly recommended that you use the default directory name.*

After clicking on Next, the dialog box shown in Figure C–7 appears.

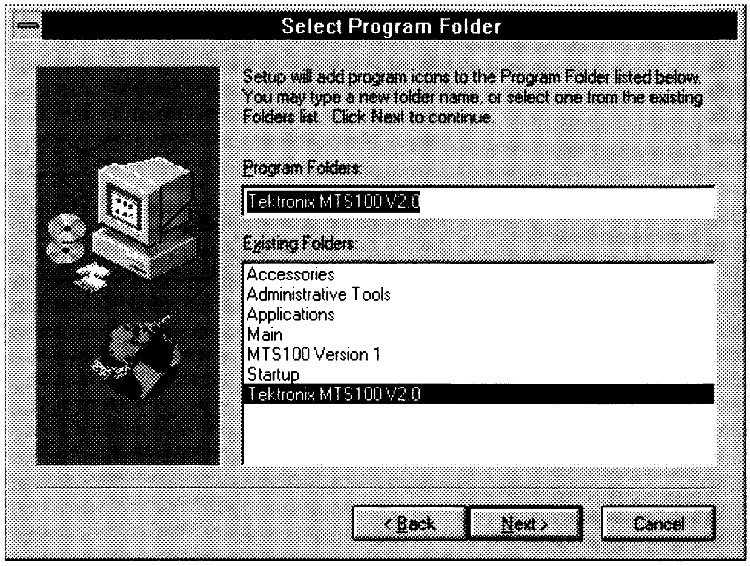


Figure C–7: The Select Program Folder dialog box

12. Select the program folder into which the program icons will be added. The default is “Tektronix MTS 100 V2.0”. Follow the instructions in the dialog box to select a different program folder. Click on Next to continue.

The setup program will begin installing the MTS 100 software. A progress dialog box will appear as shown in Figure C–8.

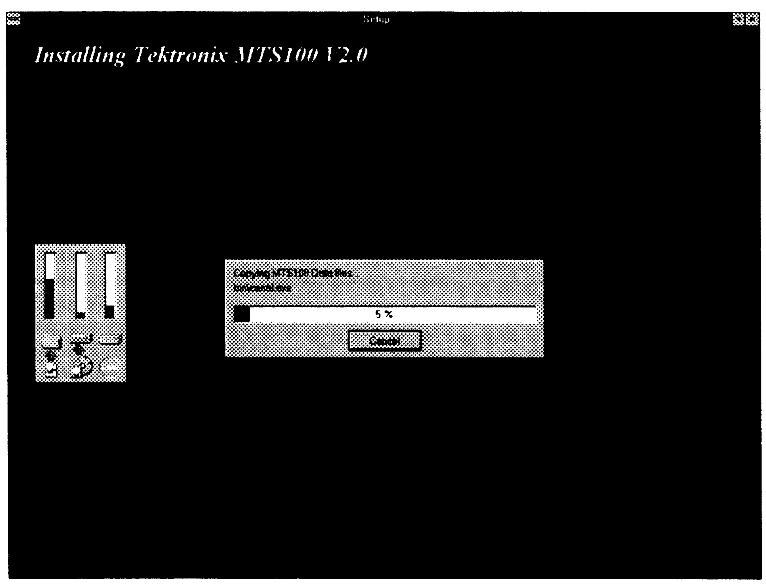


Figure C–8: The progress dialog box

13. After the setup program has copied all the files to the hard drive, an information dialog box will appear. Read the dialog box and click on OK to continue.

14. An information dialog box will appear asking you to verify that the HASP is installed. (See Figure C–9.) Once you have verified that the HASP is installed, click on OK to continue.

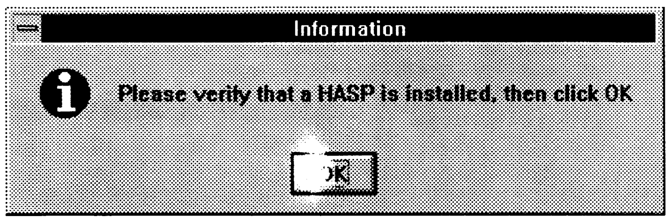


Figure C–9: Information dialog box

15. After the HASP Device Driver is installed, the dialog box in Figure C–10 appears. Click on OK to continue

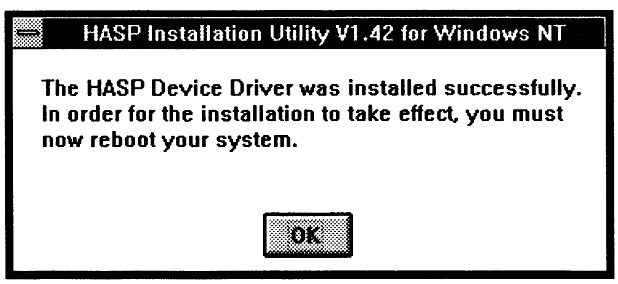


Figure C–10: Notice to reboot your system

NOTE. *The system does not automatically reboot when you choose the OK button. Do not reboot the computer at this time.*

An information dialog box will appear stating that the installation is complete.

16. Next, an information dialog will appear asking you to reboot the system (see Figure C–11). Click on OK to continue.

NOTE. *The system does not automatically reboot when you choose the OK button. Do not reboot the computer at this time.*

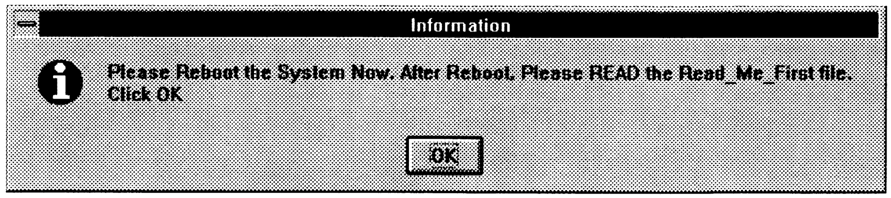


Figure C–11: The Information dialog box

17. The Restart Windows NT dialog box will appear as shown in Figure C–12. Accept the default selection of "Yes, I want to restart my computer now" by clicking on OK.

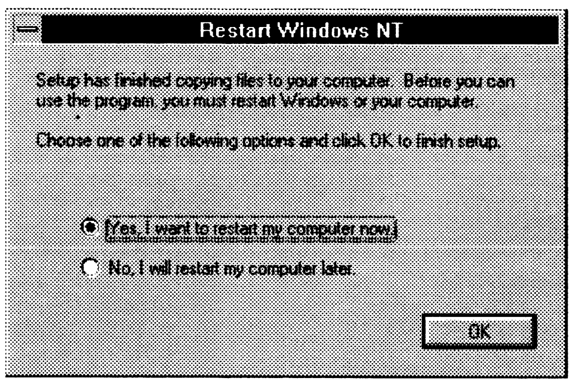


Figure C–12: The Restart Windows NT dialog box

18. After the MTS 100 server reboots, login as the administrator (Username = administrator and password = MPEG2).

19. From the Tektronix MTS 100 V2.0 window, double-click the Data Store Control icon. See Figure C–13.

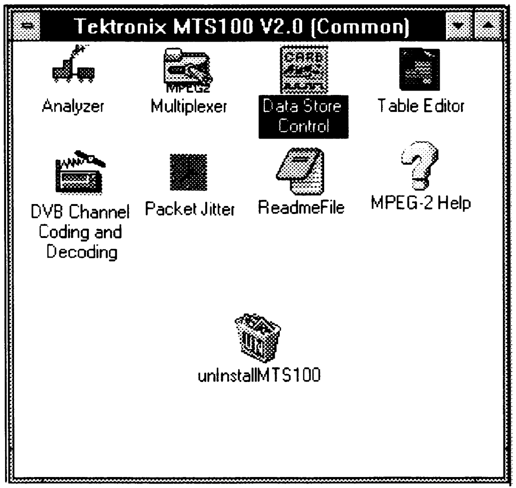


Figure C–13: The Tektronix MTS 100 V2.0 window

20. Select Resources Parameter from the Service menu. The Resource Parameters dialog box will be displayed.
21. Do not change anything in the Resource Parameters dialog box, just click OK.
22. A dialog box will appear stating that you must restart the computer to take the changes into account. Click OK to continue.
23. Quit the Data Store Control program.
24. Double-click the Main icon in the Program Manager window.
25. Double-click the Control Panel icon.
26. Double-click the System icon.
27. Click on Path in the System window.
28. If it is not already present, add the following to the end of the path:

    `;C:\MTS100\bin`

    If you used a different directory name in your installation, use that name instead of MTS100.
29. Click on Set. Exit the System window.
30. Reboot the system.

If your system has a serial number of B020000 or above, you can now use the MTS 100 applications. Your installation of the Version 2.0 software is complete.

CAUTION. *If your system has a serial number between B010100 and B019999, you must perform the following steps before you can use the MTS 100 applications or your system files can become corrupted.*

31. Run the File Manager.

32. From the File menu, select Run.

33. Type:

```
c:\MTS100\BIN\SETCARB.EXE
```

If you did not install the MTS 100 software in the MTS100 directory, use the name of the directory in which you installed the MTS 100 software.

34. Click OK.

35. In the window that appears, turn off the "MSB and LSB possibility" selection (it should not be checked).

36. Select 32 files. See Figure C–14.

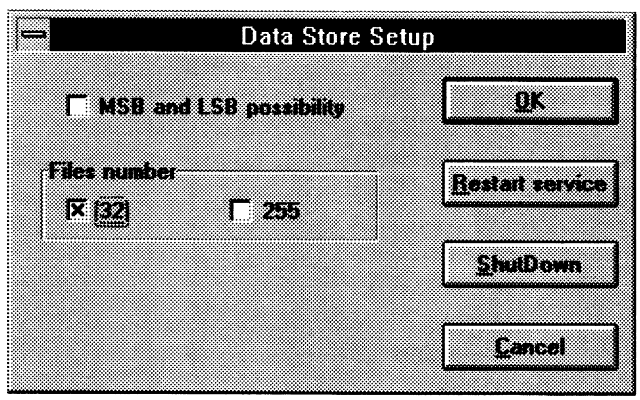


Figure C–14: Settings for MTS 100 systems with serial numbers below B020000

37. Select Restart Service.

NOTE. *MTS 100 systems with serial numbers between B010100 and B019999 cannot use 255 files or the MSB/LSB option.*

Your installation of the Version 2.0 software is complete.

List of Files Included with the MTS 100

Path: C:\MTS100

audio	<Dir>
bin	<Dir>
cfg–trp	<Dir>
video	<Dir>

Path: C:\MTS100\AUDIO

10khz_.mp2
15kz_128.mp2
15kz_256.mp2
15kz_064.mp2
15kz_192.mp2
1khz_ .mp2

Path: C:\MTS100\BIN

!isa7000.cfg
bids47f.dll
editable.exe
mux_carb.exe
adn_carb.exe
byteflip.exe
canal.exe
editable.exe
gigue.exe
matracom.exe
mux_carb.exe
setcarb.exe
adonum.hlp
canal.hlp
editable.hlp
gigue.hlp
mpeg2nt.hlp
mux_mpg2.hlp
bc453rtl.dll
bids47f.dll
carbfile.dll
cw3215.dll
mfc30.dll
msvcrt20.dll
owl253f.dll
synt204a.dll
synt205.dll

Path: C:\MTS100\CFG–TRP

!!cfg.ndx
default.bat
default .cfg
default.eit
default.nit
default.pmt
default.sdt
default.trp
sample.trp

Path: C:\MTS100\VIDEO

525	<Dir>
625	<Dir>

Path: C:\MTS100\VIDEO\525

mobl_015.mp2
mobl_060.mp2

Path: C:\MTS100\VIDEO\525\TESTPAT

100b_015.mp2
100b_060.mp2

Path: C:\MTS100\VIDEO\625

bars_015.mp2
bars_060.mp2
demo_015.mp2
demo_060.mp2
mobl_015.mp2
mobl_060.mp2

Path: C:\MTS100\VIDEO\625\TESTPAT

100b_015.mp2
100b_060.mp2

Path: C:\MTS100

deisl1.isu
readme.txt

Path: C:\WINNT35

adonum.ini
mux.ini
uninst.exe

Path: C:\WINNT35\SYSTEM

ctl3d.dll
ctl3dv2.dll
tek.fot
tek.ttf

Path: C:\WINNT35\SYSTEM32

ctl3d32.dll
haspdos.sys
haspvdd.dll

Path: C:\WINNT35\SYSTEM32\DRIVERS

drvcarb.sys
haspnt.sys

Appendix D: Analyzer Tests

This section describes the tests performed by the Analyzer application on the bitstreams.

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 13919–1 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.*
adaptation_field_control (afc):	if (pid == 0x1FFF) then test that (afc == '01') else test that (afc != '00')

Table D–1: Compliance for the Transport Packet Header (Cont.)

Parameter	Error Checking
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:

<u>if</u> (afc == 'x1')
<u>and</u> (AF.di == '0') or not present
<u>and</u> (pid != 0x1FFF)
<u>and</u> (cc == previous_cc)
<u>then</u> packet is a duplicate

For a duplicate packet, the following test should be performed:

test that 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. <u>if</u> (TPH.afc == '10') <u>then</u> test that (afl == 183) 2. <u>if</u> (TPH.afc == '11') <u>then</u> 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. <u>if</u> (rai == '1') <u>and</u> (TPH.pid == PID_PCR) <u>then</u> 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):	<u>if</u> packet is not duplicate <u>and</u> (TPH.afc == '11') <u>and</u> (previous_spf == 1) <u>and</u> (previous_sc != 0) <u>then</u> test that (spf == 1)
transport_private_data_flag (tpdf):	no test
adaptation_field_extension_flag (afef):	<u>if</u> packet is not duplicate <u>and</u> (TPH.afc == '11') <u>and</u> (previous_afef == 1) <u>and</u> (previous_sc != 0) <u>then</u> 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. <u>if</u> (sl == n) <u>then</u> test that ((byte[n] == 0x00) <u>or</u> (byte[n] == 0xFF) <u>or</u> (byte[n] == 0x47)) <u>and</u> 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. <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)
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)

Table D–5: Compliance for the PMT Sections (Cont.)

Parameter	Error Check
stream_type (st):	no test
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. 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)
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. if descriptor is in CAT section then test that (sum of (dl + 1) == CAT.sl) 2. if descriptor is in PMT section after the program_info_length field then test that (sum of (dl + 2) == PAT.pil) 3. if descriptor is in PMT section after the ES_info_length field then 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):	if (mpeg1of == 1)
	then
	1. descriptor_length = 3
	2. ES = MPEG2
	3. stream_type = 0x02
	4. stream_type : 0b1110 xxxx
	5. constrained_parameter_flag = 0
	else
	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 the descriptor with 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 100 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)

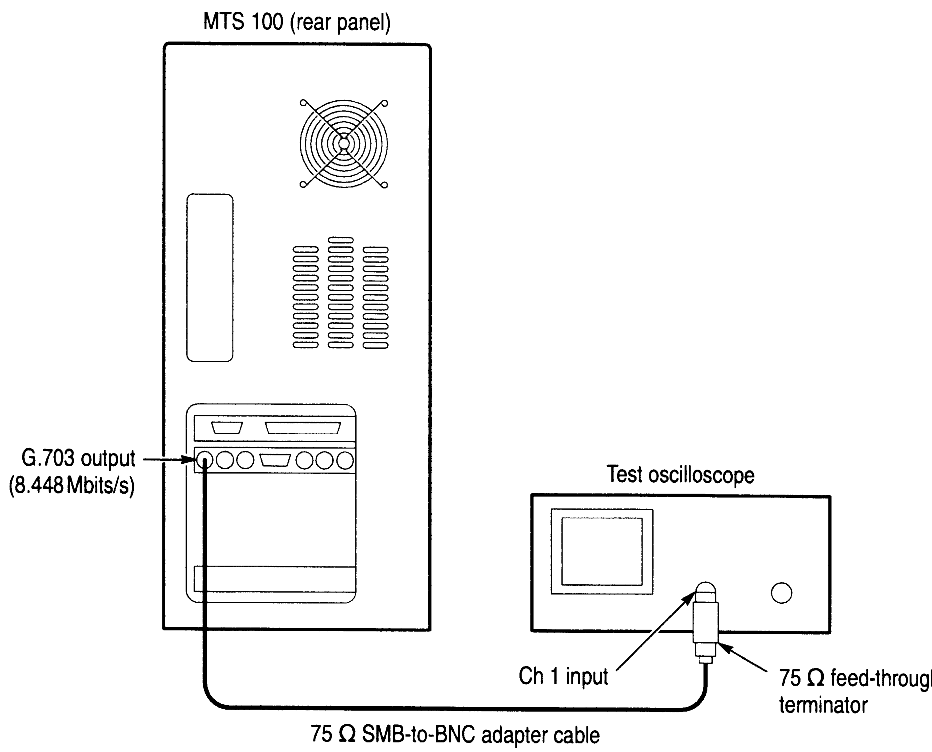


Figure E–1: Initial Connections for the Functional Check

Procedure

1. Turn on the power switch, which is located on the front of the MTS 100 server.
2. Allow the MTS 100 to go through the Windows NT initialization process.
3. When Windows NT initialization is finished, press CTRL + ALT + Delete, as instructed by the message box.
4. Type "MTS100" for Username and nothing for Password. Click on "OK." If the default Username and Password have been changed, use the current valid Username and Password.
5. Once you have correctly logged in, you will access the Windows NT main menu.

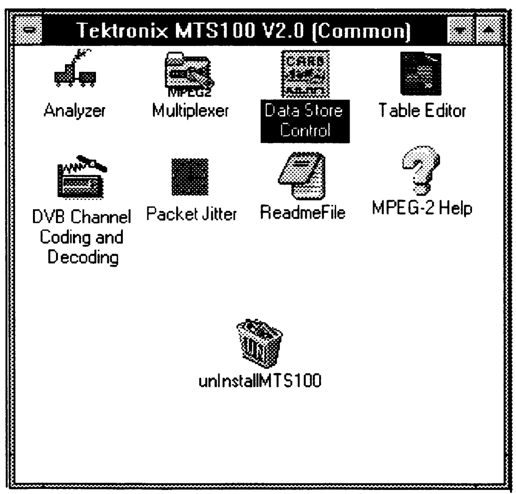


Figure E–2: MTS100 Main Menu

6. Set up the MTS 100 as follows:
   a. Select the Data Store Control icon. See Figure E–2.
   b. Select G (Generator).
   c. Select CARB file: any valid Carb files.
   d. Select Loop.
   e. Select Protocol, Master.
   f. Select Port, G703
   g. Select output clock, 8.448 Mbits.

h. Select Start and wait 5 seconds.

i. Select Stop.

7. Trigger the oscilloscope.

8. 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.

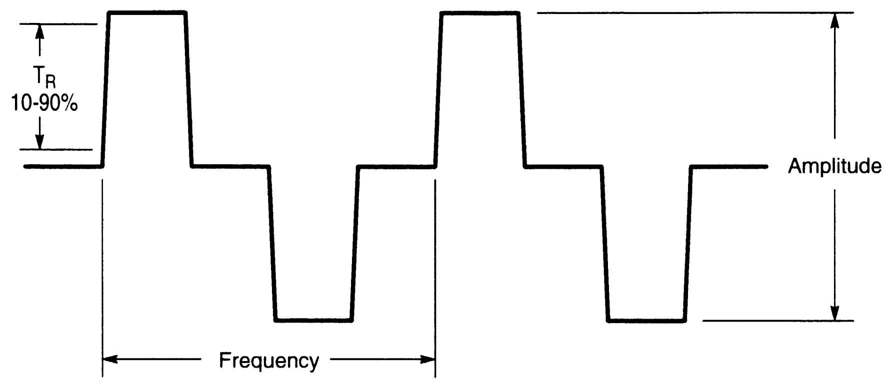


Figure E–3: Measuring the G.703 Output Waveform

9. Move the output cable to the G703, 34 M output. See Figure E–4.

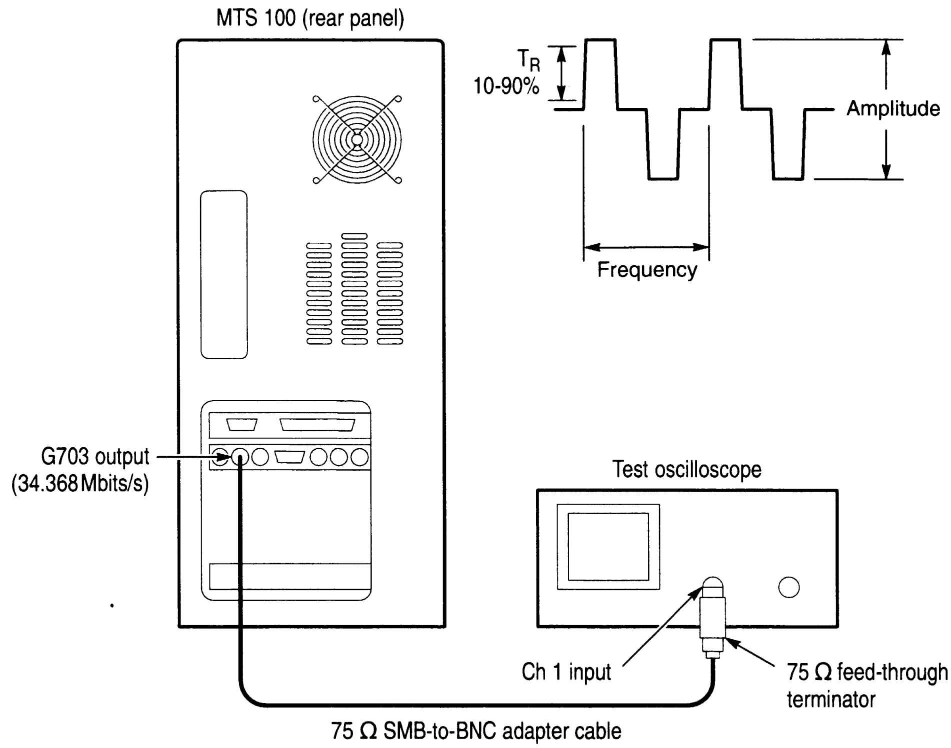


Figure E–4: Hook up for measuring the G.703 34.368 Mbit/s Output

10. Set up the MTS 100 as follows:
    a. Select the Data Store Control icon.
    b. Select G (Generator).
    c. Select CARB file: any valid Carb files.
    d. Select Loop.
    e. Select Protocol, Master.
    f. Select Port, G703
    g. Select output clock, 34.368 Mbits.
    h. Select Start and wait 5 seconds.
    i. Select Stop.
11. Trigger the oscilloscope.
12. 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–4.

13. Remove the 75 Ω SMB-to-BNC adapter cable from the oscilloscope and the MTS 100 G703 34 M Out connector.

14. 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–5.

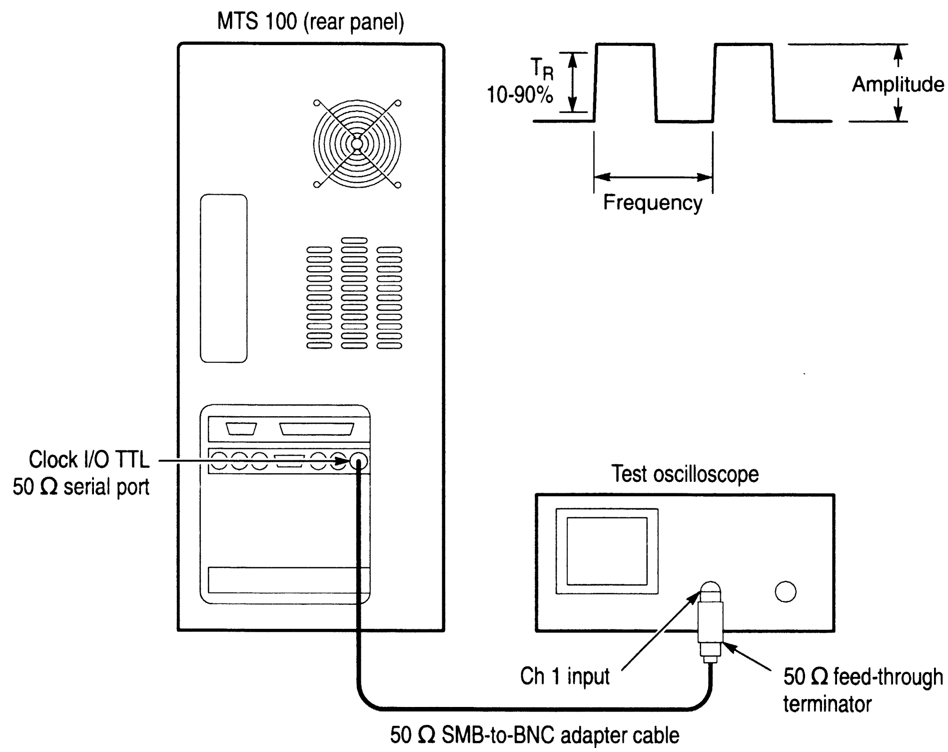


Figure E–5: Hookup for Measuring TTL 50 Ohm Clock I/O Port

15. Set up the MTS 100 as follows:

    a. Select G (Generator).

    b. Select CARB file: any valid Carb files.

    c. Select Loop.

    d. Select Protocol, Master.

    e. Select Port, TTL

    f. Select output clock, 1,000,000 MHz.

    g. Select Start.

16. Trigger the oscilloscope.

17. 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–5.

18. Move MTS 100 output cable to the TTL 50 Ω Data I/O Port. See Figure E–6.

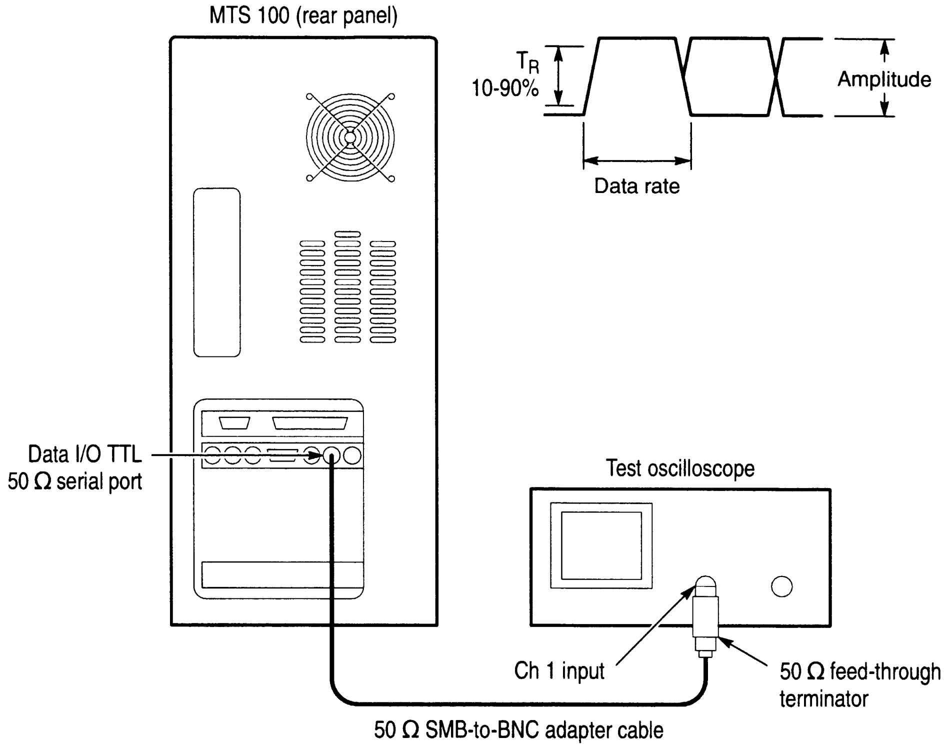


Figure E–6: Hook up to measure the TTL 50 Ohm Data I/O Port

19. Set up the MTS 100 as follows:

   a. Select Stop.

   b. Select G (Generator).

   c. Select CARB file: any valid Carb files.

   d. Select Loop.

   e. Select Protocol, Master.

   f. Select Port, TTL

   g. Select output clock, PLL

   h. Select frequency, 45,000,000 Hz

   i. Select Start.

20. Trigger the oscilloscope on the plus slope.

21. 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–6.

22. Move MTS 100 output cable to the TTL 50 Ω Clock I/O Port. See Figure E–5.

23. Trigger the oscilloscope.

24. 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–5.

This completes the functional check.

Appendix F: Repackaging

The MTS 100 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 cushioning to provide adequate protection.

***NOTE**. The MTS 100 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.*

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. To obtain these items contact your nearest Tektronix office or representative.

Table F–1: Packaging Material

Item	Tektronix Part Number	Index Number
Top Cushion (Cardboard Insert)	004-4474-00	1
Foam Inserts (Total of 2)	004-4473-00	2
Shipping Box	004-4472-00	3
Plastic Shipping Bag	006-2022-00	Not Shown in Figure F–1.

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 and mouse boxes in the package for reshipment. The figure does not show any plastic wrapping material protecting the instrument finish. If you do not have the original plastic shipping bag, the server should be protected against dust and abrasion by using a plastic bag or wrap.

***NOTE**. The software enabler key (HASP) is required by the Tektronix Service Center if the ProSignia server is returned for repair.*

Repackaging the Monitor

If the monitor is being shipped, it should be packaged in accordance with the instructions contained in its documentation.

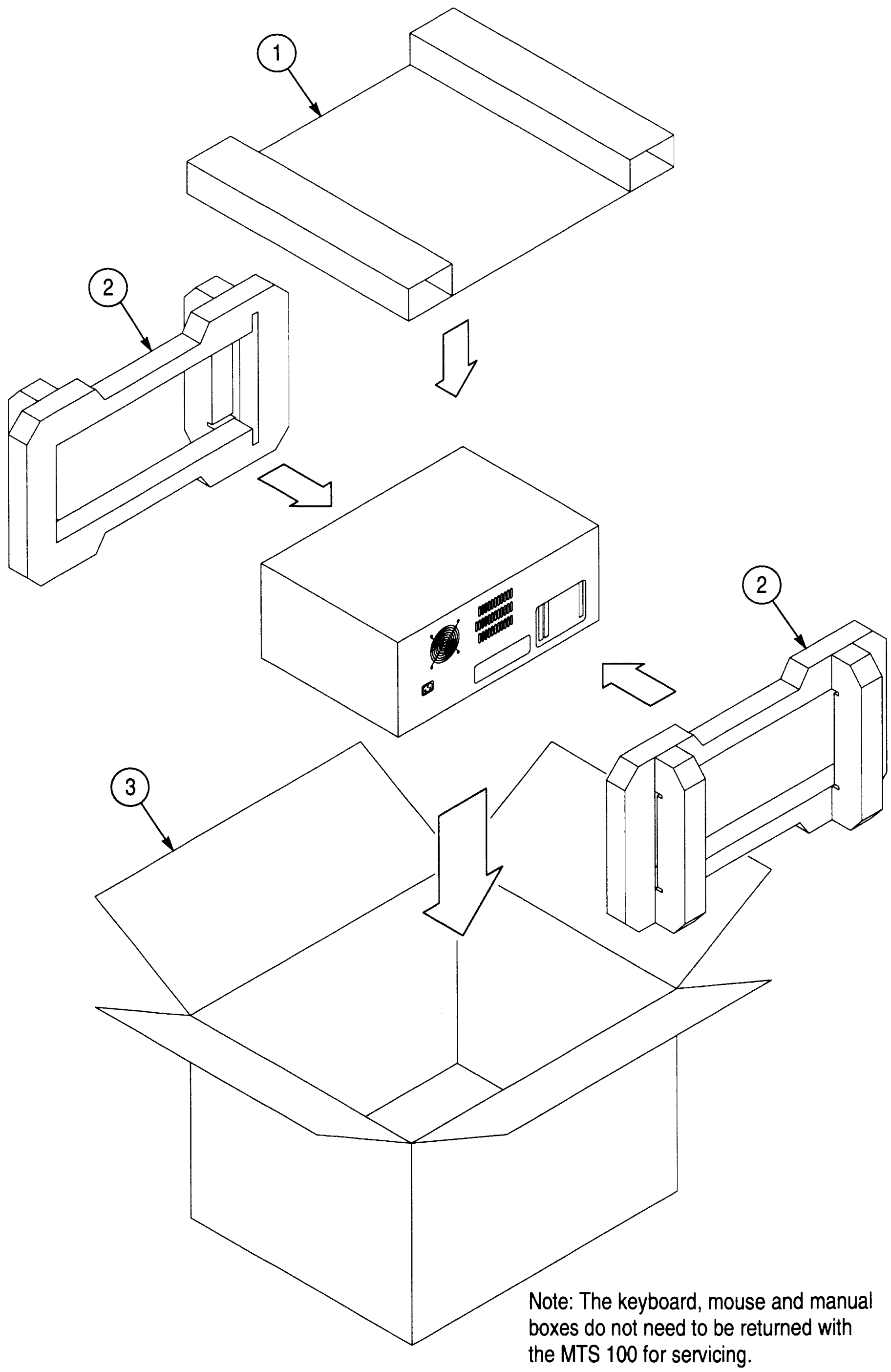


Figure F–1: Repackaging the MTS 100 mainframe

Glossary

***NOTE.** Additional information about MPEG-2 is available through the MPEG-2 Help application, part of the MTS 100 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.

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