



**MTSA-HW and MTSA-PC
MPEG Test Systems
Generator Application
User Manual**



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User Manual**

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www.tek.com

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Important safety information

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

To safely perform service on this product, additional information is provided at the end of this section. (See page x, *Service safety summary*.)

General safety summary

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

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

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

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

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

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use. Do not use the provided power cord for other products.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, make sure that the product is properly grounded. Do not disable the power cord grounding connection.

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

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

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

The measuring terminals on this product are not rated for connection to mains or Category II, III, or IV circuits.

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

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

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

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

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

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

Wear eye protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

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

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

Do not operate in an explosive atmosphere.

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

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

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use care when lifting and carrying the product. This product is provided with handles for lifting and carrying.

Service safety summary

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

To avoid electric shock. Do not touch exposed connections.

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

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

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

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

Terms in this manual

These terms may appear in this manual:



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



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

Symbols and terms on the product

These terms may appear on the product:

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



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

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



CAUTION
Refer to Manual

Protective Ground
(Earth) Terminal

Standby

Preface

The MTSA MPEG system applications are described in the following three user manuals:

- **Analyzer applications**
- **Generator applications**
- **Carousel applications**

NOTE. To view the full list of applications, find the *MTSA-HW and MTSA-PC Quick Start User Manual* at www.tek.com.

The MTSA can be delivered to you as a rack mountable 1RU full rack instrument (MTSA-HW), or as a standalone software (MTSA-PC). For product ordering purposes, the following naming conventions are used in this manual:

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

Table i: Overview of the MTSA Generator applications

Application	Desktop icon
Multiplexer – Multiplexes table information and packetized elementary streams together to synthesize new transport streams. A fine level of control is provided to allow nonconformances and test cases to be specified for new transport streams.	 Multiplexer
TS Editor – Viewing and editing transport stream packets, using a hexadecimal view of the packet contents and semantic interpretation of the header. Provides facilities to remap PIDs, recalculate PCR values and introduce PCR inaccuracies.	 TS Editor
ISDB-T Remux – Remultiplexes an existing 188- or 204-byte transport stream file into an ISDB-T/Tb (ARIB STD-B31) compliant file (204 bytes per packet). The created file extension is .RMX and includes TMCC and IIP sections.	 ISDB-T Remux
MPEG Player – Plays MPEG-2 streams.	

Table i: Overview of the MTSA Generator applications (cont.)

Application	Desktop icon
Make Seamless Wizard – Guides the user through the process of creating an MPEG-2 file for use by Stream Player in continuously looped operation.	 Make Seamless Wizard
TS Cutter – Extracts sections of MPEG-2 files to new files.	 Stream Cutter
Script Pad – Enables users to create and modify System Information (SI) scripts.	 ScriptPad

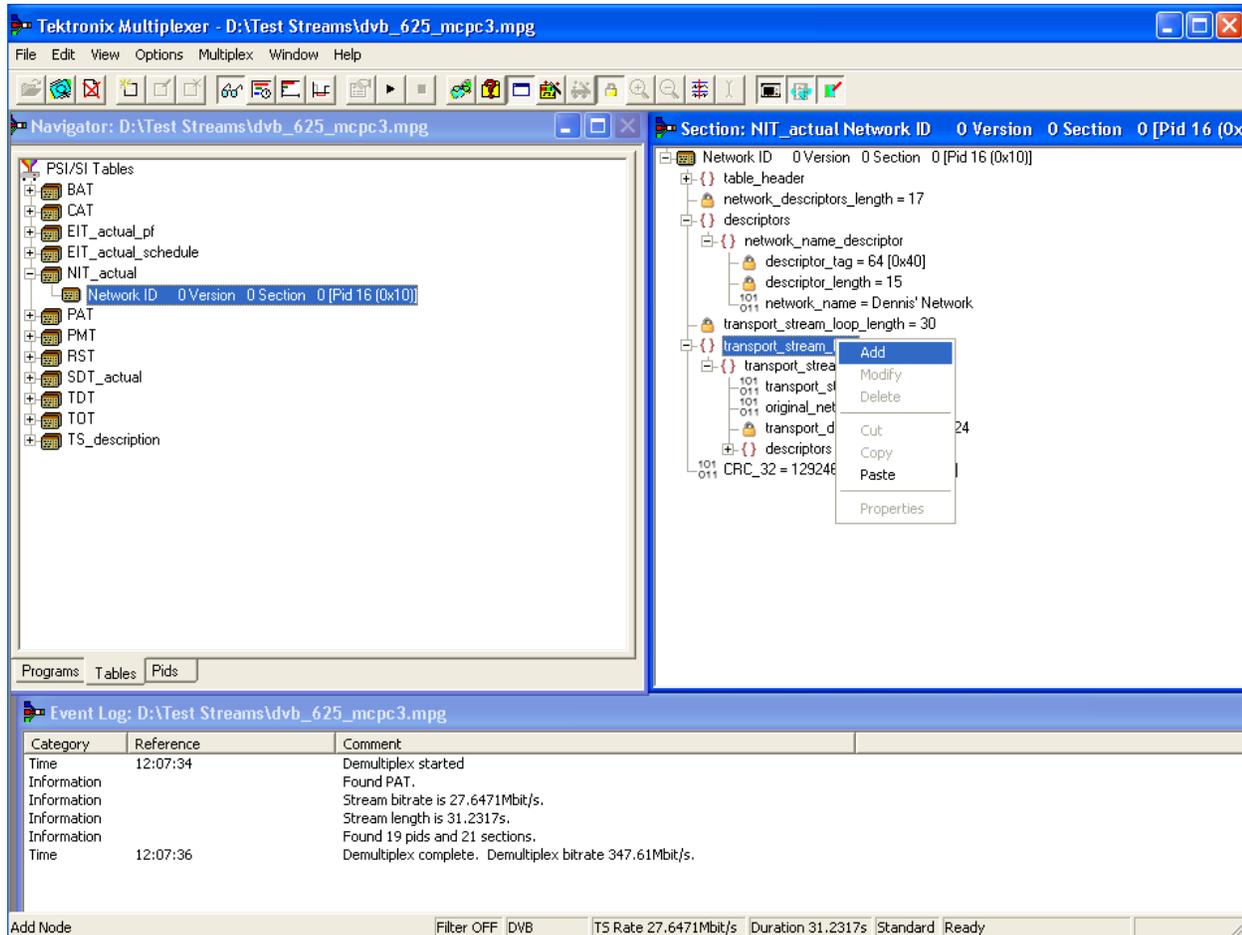
Product documentation

The following table lists the documentation available for your **MTSA-HW and MTSA-PC** product:

Language	Document	Part number	Purpose
English	MTSA-HW and MTSA-PC Quick Start User Manual	071-3661-00	Describes how to install and get started using the test systems.
English	MTSA-HW and MTSA-PC Analyzer Applications User Manual	077-1600-00	Describes the operation of the following analyzer applications: TSCA, PES Analyzer, T-STD Buffer Analyzer, and ES Analyzer.
English	MTSA-HW and MTSA-PC Generator Applications User Manual	077-1601-00	Describes the operation of the following generator applications: Multiplexer, MPEG Player, TS Editor, ISDB-T Remux, Make Seamless Wizard, Transport Stream Cutter, and Script Pad.
English	MTSA-HW and MTSA-PC Carousel Applications User Manual	077-1602-00	Optional manual supporting module-level servicing of the instrument.
English	MTSA-HW and MTSA-PC Release Notes	077-1604-00	Describes known issues with the test systems.
English	MTS4EA HEVC / AVC Video and Compressed Audio Analyzer User Manual	077-1134-xx	Describes the operation of the MTSA-PC application software.
English	PQA600C and PQASW Picture Quality Analyzer User Manual	077-1137-xx	Describes the operation of the PQA application software.

Multiplexer - Getting started

The **Multiplexer** provides offline multiplexing of **ATSC, MPEG-2, DVB, and ISDB** Transport Streams:



Transport streams (TS), Elementary Streams (ES), Packetized Elementary Streams (PES), and Packet Identifiers (PID) can be selected, manipulated and recombined to form customized, synthesized transport streams. Program Specific Information (PSI), Service Information (SI), and Program and System Information Protocol (PSIP) are often referred to as simply SI in this section.

The functions provided include:

- Wizards for common tasks, such as populating streams with Program Specific Information/Service Information/Program and System Information Protocol (PSI / SI / PSIP), and programs
- Table contents that are displayed in and edited from structure diagrams (tree diagrams)

- Transport Streams that either conform strictly to the standards selected for interpretation or have precisely engineered, known, nonconformances.
- Two or more instances of Multiplexer can run concurrently. This allows table information to be copied from one file to another
- The source data for nonconformant streams can be saved in a raw format, which can be quickly reloaded as the basis for generating more stream data
- Conformance of edits to the standards is checked interactively and enforced by default. Checking and enforcement may be turned off when specifying nonconformances to be introduced into the new transport stream

On opening, streams are analyzed and displayed according to the selected standard: MPEG, DVB, ATSC, or ISDB. Scripts are used by the analysis process; this allows private PSI/SI tables and descriptors to be defined

NOTE. *Most examples given in this section of the manual are based on DVB SI. You should remember that the Multiplexer is equally at home with all major DTV standards, MPEG-2, DVB, ATSC, and ISDB as well as the major extensions to those standards.*

The Transport Stream Analyzer program should always be used for reliable analysis of transport streams containing DSM-CC or MPE addressable sections

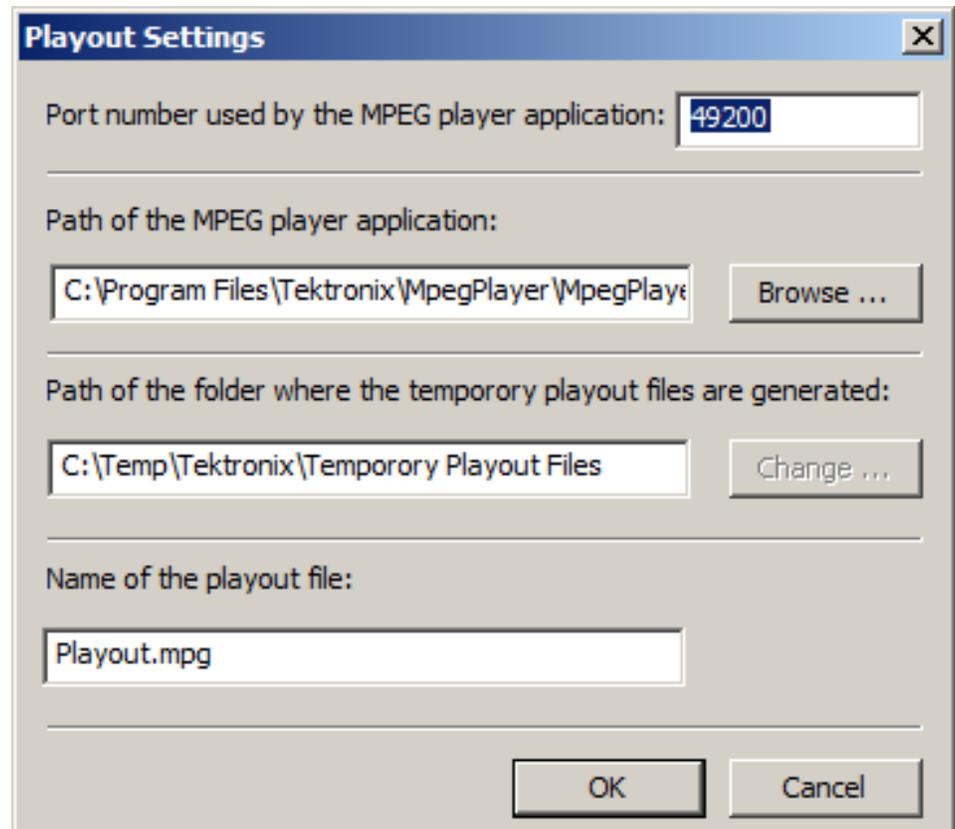
In the absence of TS Analyzer, it is acceptable to use Multiplexer for analysis, provided that the DSM-CC or MPE scripts are first applied using Expert mode in the Stream Interpretation dialog box (See page 8, Scripts.)

However, when multiplexing streams containing DSM-CC or MPE addressable sections, the related scripts must not be active

Multiplexer in Playout mode

You can initiate a playout in the **Multiplexer** application using the playout feature as soon as the multiplex operation is complete. The **Multiplexer** creates a temporary transport stream in the location specified by the **Playout Settings** and then initiates a playout by loading this file into the player. To play the stream in the loop mode, enable the loop mode in the **Playout Settings**.

To obtain the **Playout Settings** dialog box, you must select **Multiplex > Playout Settings** :



NOTE. It may be necessary to run the **Multiplexer** as an administrator and disable the **Windows** firewall for the playout feature to function.

H.264 ES input characteristics

H.264 elementary streams received by the Multiplexer should comply with ISO/IEC-14496-10/2005 Rec. H.264. Transport streams generated by the Multiplexer should comply with ISO/IEC-13818-1/2000/AMD_3/2004.

PTS/DTS timestamp generation

- The generated transport stream will contain DTS and PTS values calculated at a constant frame and bit rate. A default frame rate of 25 fps will be used, unless otherwise specified by the user or derived from the optional VUI (Video Usability Information) parameters within the stream.
- You can specify the constant bit rate or it may be detected automatically by scanning the transport stream. The scanned bit rate is calculated as follows:

$$\text{Bit rate} = \frac{\text{Scanned Number of Bytes}}{(\text{Number of Frames} / \text{Frame Rate})}$$
- If the transport stream contains the optional HRD (Hypothetical Reference Decoder) parameters, then the contained maximum bit rate value is displayed to the user as a guide.
- If the transport stream contains optional HRD parameters together with SEI (Supplemental Enhancement Information) Buffering Period and Picture Timing messages then the PTS and DTS values will be derived from them. That is, the PTS/DTS values will always be consistent with any ES layer parameters.

H.265/HEVC support

The Multiplexer will open and remultiplex CBR Transport Stream files that include H.265/HEVC video elements. The streams received and generated by the Multiplexer should comply with the following standards:

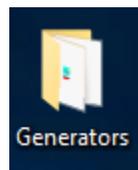
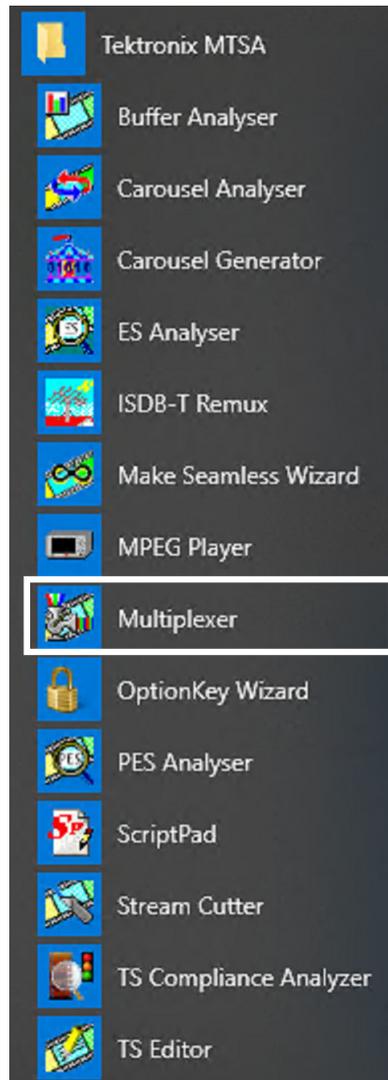
- H.265/HEVC: ITU-T H.265, Series H: Audiovisual and Multimedia Systems, Infrastructure of audiovisual services – Coding of moving video, High efficiency video coding April 2013
- HEVC in TS: ISO/IEC 13818-1:201X/PDAM 3 (E) Rec. ITU-T H.222.0/Amd.3, Information Technology – Generic Coding of Moving Pictures and Associated Audio Information: Systems, Amendment 3, Transport of High Efficiency Video Coding (HEVC) Streams over ITU-T Rec H.222.0 | ISO/IEC 13818-1

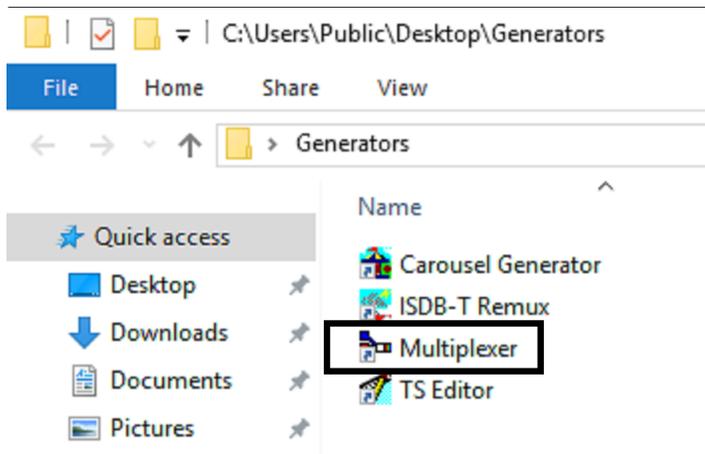
Be aware of the following:

- The Examine TS window allows you to copy H.265/HEVC elements or programs from another CBR transport stream file into a new Multiplexer file (See page 61, *Examine Transport Stream window*.)
- The Multiplexer will not import H.265/HEVC elements directly from disk

Starting the program

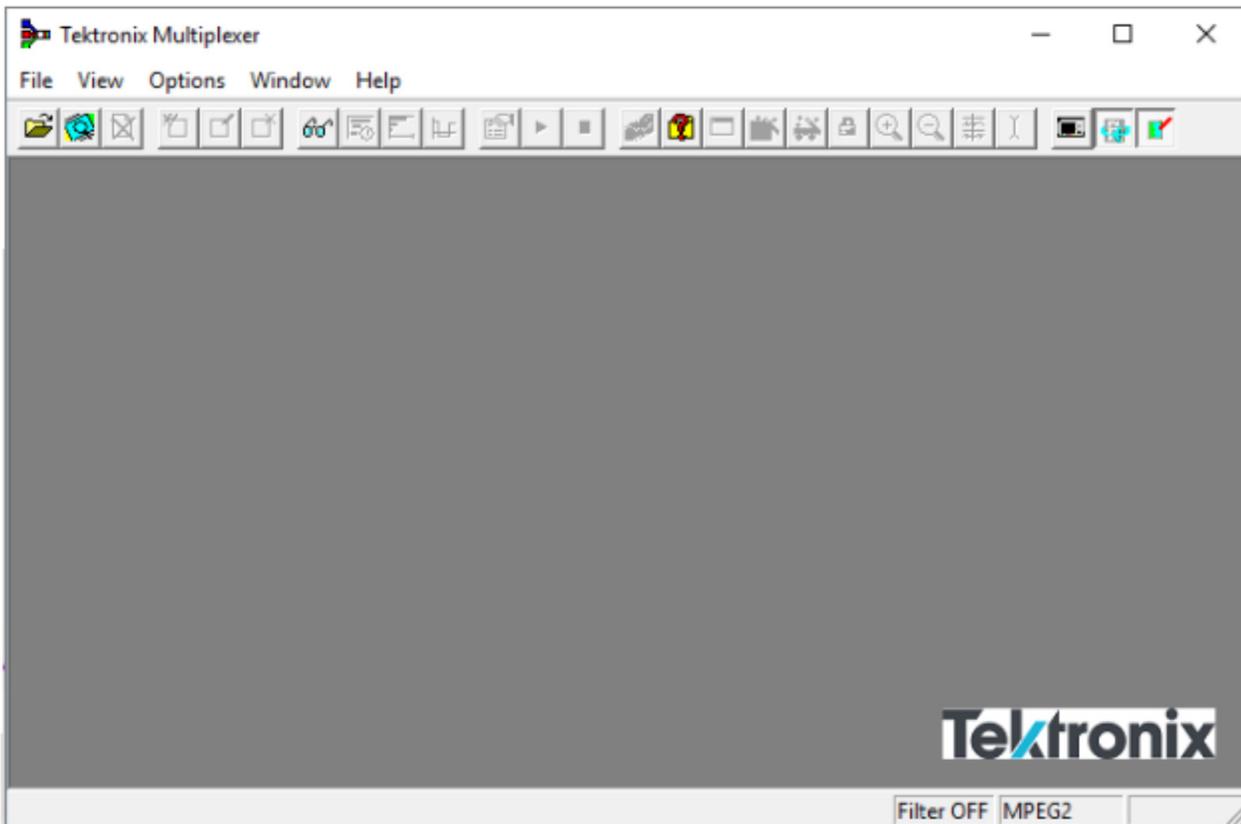
The program can be started by selecting the **Tektronix Multiplexer** application by going to **Start > Tektronix MTSA > Multiplexer**. Alternatively, you can double click the **Generators** folder from your desktop and then select the **Multiplexer**.





Initial appearance

Once the program has started and is ready for use, it will open a Main Window that looks like the following figure:



Use the **View** menu to select a standard that will be used to interpret Transport Streams, and then open a Transport Stream file or import a multiplex configuration file.

Initial menu options

When the application is opened, you are presented with options relevant only to opening new or existing multiplex files. Options that are not relevant at this time are inactive (grayed out).

File menu options. The following table lists the options available in the initial **File** menu:

Table 1: File menu options

Command	Function
New	Opens new multiplex configuration file.
Open	Opens an MPEG file for use. The program opens the file selection dialog box allowing you to choose the required file.
Examine TS	Opens the Examine TS window, which allows a brief summary of the stream to be viewed before it is subjected to full analysis.
Close	Currently disabled
Import...	Opens a previously saved multiplex configuration file.
Export...	Currently disabled
Export As...	Currently disabled
1 <filename>	A list of the four most recently used files. If the program has recently been installed the list may be empty or hold less than four files. Selecting a file name opens that file for use.
2 <filename>	
3 <filename>	
4 <filename>	
Exit	Finishes running the program.

View menu options. The following table lists the options available in the initial **View** menu:

Table 2: View menu options

Command	Function
Interpretation	Opens the Stream Interpretation dialog box. This allows the scripts to be used in stream analysis to be selected.
Event Log	Opens the Event Log window.
Toolbar	Displays or hides the Toolbar.
Status Bar	Shows or hides the Status Bar.

A check mark next to an option indicates that the object is currently visible.

Scripts

SI scripts are necessary to enable SI table and descriptor data to be analyzed successfully. Scripts are used to enable analysis of SI data dictated by the various international standards, for example, MPEG-2, DVB, ATSC, and ISDB.

Essential scripts are installed and enabled using the Stream Interpretation dialog box. In the absence of any enabled scripts, only the PAT table will be analyzed; all other data will be presented as private data.

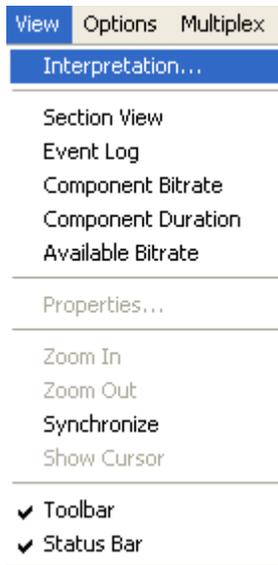
If a suitably configured script is selected and enabled before a stream is opened, custom data will be analyzed when the stream is opened. If the script is not selected or enabled, the stream will be analyzed, but any custom data will be reported as either an error in the stream configuration or as an elementary stream PID.

Scripts can be selected and enabled only when no files are open. The Stream Interpretation dialog box is available when a file is open, but all activity is disabled.

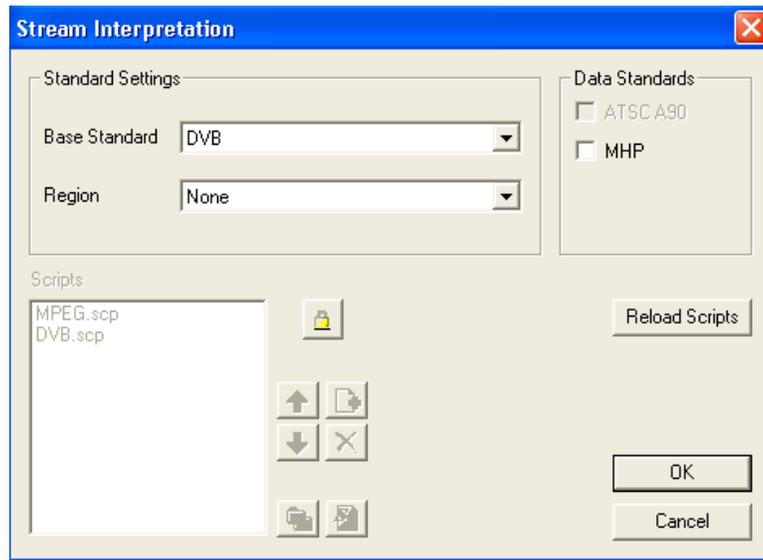
Note that a script file will not be used for analysis until:

- It is present in the Scripts text box in the current analysis mode.
- It is successfully enabled by closing the Stream Interpretation dialog box using the OK button.

Handling scripts



To open the **Stream Interpretation** dialog box pictured below, first close all files and then select **View > Interpretation** . The **Stream Interpretation** dialog box appears:



The top half of the dialog box is concerned with selecting scripts. The Scripts text box lists the scripts currently selected. The area adjacent to the text box is dedicated to **Expert** mode controls.

Selecting scripts

The selection area of the **Stream Interpretation** dialog box is best viewed and used from left to right.

In the **Base Standard** section, select the **MPEG-2, DVB, ATSC, or ISDB** standard for analysis.

The selected standard dictates the availability of the remaining options in the **Regions** and **Data Standards** sections.

In the **Regions** section, select the country-specific region to be added to the basic standard scripts. If you select **None**, only the standard scripts are listed in the **Scripts** text box. The remaining country-specific extensions add extra scripts to the current listing. The **Choice of Regions** option determines the availability of the options in the **Data Standards** section:

Base Standard	Description	Region
MPEG-2 only	Interprets and analyzes the packets in conformance to the MPEG-2 standards.	None Custom
DVB	Interprets and analyzes the Transport Stream Packets according to the specifications of the DVB and MPEG-2 standards.	None Custom UK DTG Australian Nordig
ATSC	Interprets and analyzes the Transport Stream Packets according to the specifications of the ATSC and MPEG-2 standards.	None Custom
ISDB	Interprets and analyzes the Transport Stream Packets according to the specifications of the ISDB and MPEG-2 standards.	ISDB-T ISDB-S ISDB-T (One segment ISDB-TB (Brazil) ISDB-TB (One segment Brazil)

The **Data Standards** section offers a choice of data-specific scripts.

NOTE. *The scripts listed by default reside in the default installation directory (tektronix\scripts). Other directory locations can be specified in Expert Mode. All selections will be retained between sessions.*

Checking syntax

Scripts are syntactically analyzed when the **OK** button is selected. They are also checked when the application is opened. A fault in the syntax of a script will not necessarily prevent a stream from being analyzed, but it may result in incomplete analysis of the stream.

Scripts listed in the Scripts text box will not be used for stream analysis until they have been successfully checked (the application has been opened or the Stream Interpretation dialog box has been closed with no script-related error messages issued).

For an intermediate check of scripts listed in the Scripts text box, select the **Reload Scripts** button. This performs the same action as the **OK** button but leaves the dialog box open.

Syntax errors will be indicated and reported in the *Event Log* (See page 60.).

Expert mode



Expert Mode allows you to select and customize the scripts to be used in stream analysis and multiplexing. Note that when the expert mode is selected, the Custom extension option is automatically selected and the management buttons are enabled. In Expert mode, all scripts become available to be added to the script list. The scripts will be checked and loaded, ready to be used for analysis, when the **OK** button is selected:



The script management buttons controls the scripts currently listed in the **Scripts** text box:

Table 3: Script management

Buttons	Function
	<p>Script files are parsed in the order that they are listed; in some circumstances this may be important. To move a file in a list, highlight the file name and select the Up or Down arrow button as required. Each press of the button will move the file up or down one place in the list until it reaches the top or the bottom.</p>
	<p>Add a script to the list: A standard Windows file selection dialog box is opened. The default file extension is .scp. Select the required file. The selected script will be added to the bottom of the list. If necessary, move it using the Up and Down buttons.</p> <p>Scripts can be loaded from any directory.</p>
	<p>Delete the highlighted script.</p>
	<p>Change scripts default directory: by default, all scripts are found in a default directory created during installation (tektronix\scripts). This button can be used to set a different default directory.</p> <p>Note that all scripts supplied by Tektronix in the default installation are installed in a single directory; as long as this directory is designated as the default directory, they will work satisfactorily.</p>
	<p>View highlighted script with the associated application; by default, script files are associated with the ScriptPad utility.</p>

For a script file to be viewed successfully, the file extension (.scp) must be associated with a text editor in the Microsoft Windows environment. The MPEG Test System installation program by default associates a script editing utility called ScriptPad; you can use another text editor, for example, Microsoft Notepad, if preferred. ScriptPad is a simple script editor that can be installed with the MPEG Test System. Scripts can be viewed and edited as required (depending upon the file permissions).

Opening a stream

When opening a multiplexing, you can, open an existing stream or to open a previously prepared multiplex configuration file.

When a preparing a stream to be multiplexed, you can:

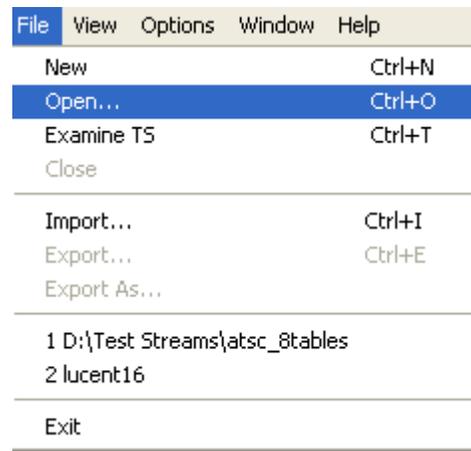
- Create a new null stream, using **File > New**.
- Open an existing stream
- Import a multiplexer configuration file

Opening an MPEG stream

Any file holding a recorded or synthesized sample of a stream that conforms to the relevant standards can be opened and used as a basis for a new multiplex. Note that the Examine TS option can be used to preview stream. (See page 61.)

Some nonconformant streams can be opened, although, only the conformant parts can be edited usefully. Any tables that are carried in a conformant PID and have the correct syntax will appear in the output transport stream, as will any elementary streams (whether referenced by a table or not) which are in the input transport stream.

To open a file holding a transport stream, select **File > Open**. If the required file is in the list of recent files, open it from the list using the **Open File** dialog box:



Alternatively use the **Ctrl+O** keyboard shortcut or drag the file from Windows Explorer and drop it into the Multiplexer window. A shortcut button is available on the Toolbar for opening a file:



Opening multiplex configuration files

Any file holding a recorded or synthesized sample of a stream, which conforms to the relevant standards, can be opened. Many nonconformant streams can be opened provided that the PAT, PMT, and MGT tables correctly specify all the other tables and their PIDs.

Multiplexer is used for generating both conformant and nonconformant streams. Having generated a nonconformant stream, it may not be possible to successfully open it again in Multiplexer.

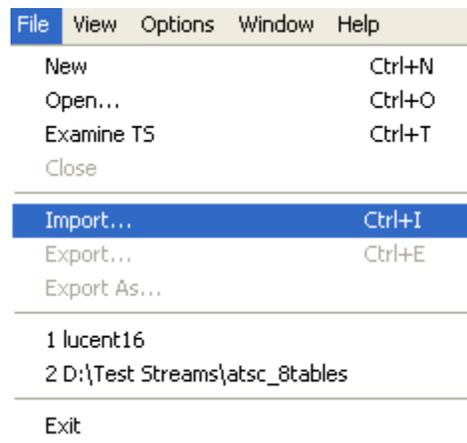
The specification for a new transport stream may be saved to a multiplex configuration file. This also saves time for opening large MPEG files, since the specification contains the results of the analysis from opening the original MPEG file.

NOTE. *The multiplex configuration file does not contain a copy of the transport stream; instead it refers to the original MPEG file by the full path name. Deleting or moving the MPEG file will result in a dialog box prompting for the new location of the file.*

Double-clicking on a *.muxml or *.mux file in Windows Explorer will open the file in a new instance of Multiplexer.

Importing a file. Importing opens a multiplex configuration file and the MPEG file on which it is based.

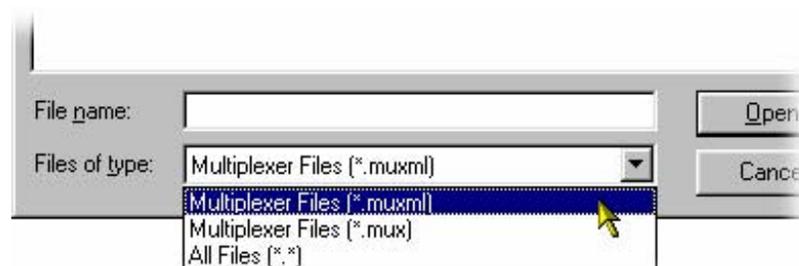
To open a previously exported multiplex configuration file, select **File > Import**. If the required file is in the list of recent files, it can be opened from the list to save using the Import file dialog box:



Alternatively, use the **Ctrl+I** keyboard shortcut or drag the file from Windows Explorer and drop it into the **Multiplexer** window.

NOTE. *Multiplexer reads the name and location of the MPEG file from the multiplex configuration file and then opens it automatically. The previously stored changes in the configuration file are applied to the display.*

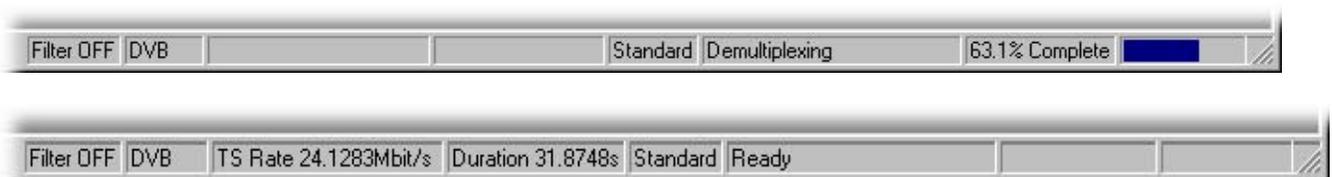
Note that the import dialog box offers a choice of file types: *.muxml, *.mux and *.*:



Initial stream analysis

The **Navigator Tables** view window opens as soon as you open or import a file. The program now starts to analyze the file with the loaded scripts to determine what tables are present.

As the file is analyzed, the Top Levels of the Transport Structure diagram are drawn in the Navigator window. The right pane in the Status Bar at the bottom of the program window shows the progress of analysis:



Files that are imported require less processing because they were analyzed in the session from which they were exported.

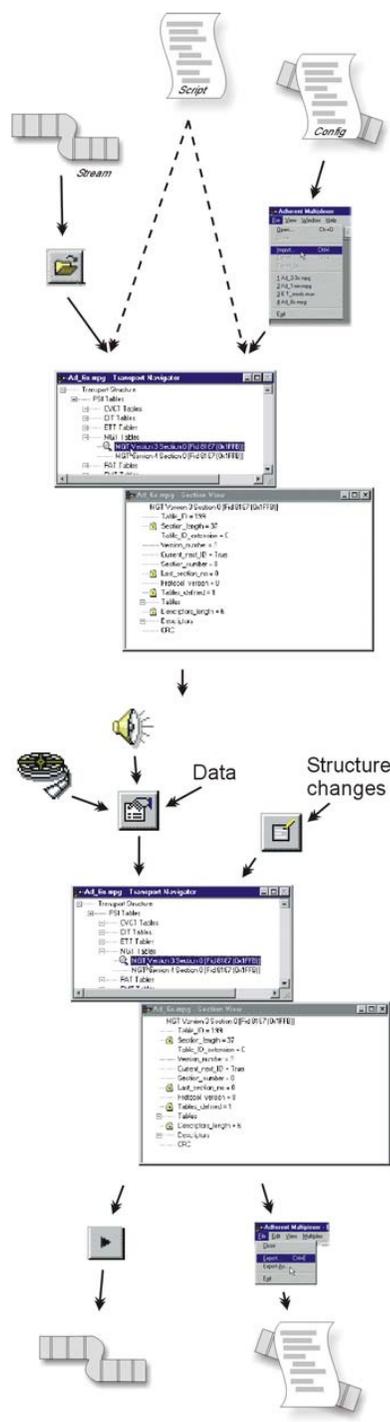
What to do next The file can now be manipulated to form a specification with which to synthesize a new transport stream. Tables, elementary streams, and PIDs are viewed and selected using the Navigator views. The components of any table selected in the Navigator views are viewed and selected using the Section View window.

Tables, Programs and PIDs can be added and modified using the wizards or manually. A selection of menu options is provided to facilitate manipulation of the data.

The Multiplex menu has options to inhibit and re-enable forced conformance to the selected standards.

Having manipulated the file, a transport stream can be synthesized to the new specification by the multiplex engine. The engine is started from the Multiplex menu or using a toolbar button. The source file is used as reference data by Multiplexer and the output written to a different file.

The following illustration gives an overview of the **Multiplex** process:



Open/Import

Any file holding a recorded or synthesized sample of a stream that conforms to the relevant standards can be opened. (See page 77, *Opening an MPEG file.*)

Importing opens a multiplex configuration file and the MPEG file on which it is based.

(See page 14, *Importing a file.*)

Transport Structure Demultiplex

As the file is analyzed, the Top Levels of the Transport Structure diagram are drawn in the Transport Navigator.

(See page 15, *Initial stream analysis.*)

Transport Structure Modifications

The file can now be manipulated to act as the specification to synthesize a new transport stream. The tables and elementary streams are viewed and selected either with the aid of Wizards or in the Navigator windows.

Output/Export

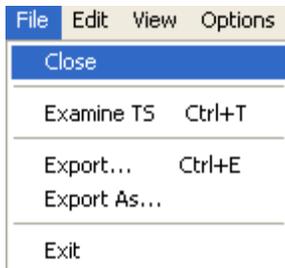
The Multiplex Engine synthesizes a new transport stream and writes it to an MPEG file.

To ensure that the specification for any synthesized stream can be reused, it can be saved to a multiplex configuration file.

(See page 111, *Multiplexer - Multiplexing transport streams.*)

Closing files

To close files, select **File > Close**. This will close both the MPEG file and any multiplex configuration file that is open:



A shortcut button is also available on the Toolbar for closing a file, which has a standard file close symbol:



If a multiplex configuration file has been edited, and the changes not exported, the program will ask if the file should be saved.

Select **Yes** to export the file, **No** to close the file without saving, or **Cancel** to undo the close command and keep the file open:



Multiplexer - Menus and controls

This section describes the various menu options, toolbar controls, status bar, icons, and user interface.

Menu options

The following pages describe all of the menu options. Since many of the options are context sensitive, they will be available only when their function is appropriate for the selected display or window element. When a menu option is not available, the option is grayed out.

File menu options The following table lists the options available in the **File** menu:

Table 4: File menu options

Command	Function
Close	Closes the current file. This option is available as soon as analysis starts. If the wrong file is being opened, or the wrong options are selected, selecting this option will abandon the analysis and close the file.
Examine TS	Opens the Examine TS window, which allows a brief summary of the stream to be viewed before it is subjected to full analysis.
Export...	Exports the current multiplex specification in a form that can be imported even if it no longer generates a conformant transport stream. This option is disabled when no file is open.
Export As...	Exports the current file, as above, and allows a different file name to be specified. This options is disabled when no file is open.
Exit	Closes any file that is open and terminates the program.

Edit menu options The following table lists the options available in the **Edit** menu:

Table 5: Edit menu options

Command	Function
Add	Adds a table/section/loop to the currently selected item in the Navigator or Section View.
Modify	Edits the information in the currently selected field or item.
Delete	Deletes the item currently selected.
Cut	Cuts the current selection from the Window.
Copy	Copies the contents of the current selection to the clipboard.
Paste	Pastes data from the clipboard to the part of the transport structure that holds that type of data.
Export Payload	Extracts and exports the payload of the source transport stream PID in the form of a simple data file.
Export Elementary Stream	Removes the transport stream PID and PES headers and exports the remaining information as a simple data file.
Export Section Data	Extracts and exports section data. The created file can be imported as ES using Multiplexer's Add function or as SI using the Import Section Data option (see next option).
Import Section Data	Imports SI data from a file and analyzes it. The section is added to the Navigator view.

View menu options The following table lists the options available in the **View** menu:

Table 6: View menu options

Command	Function
Interpretation	Displays a read-only dialog box for viewing scripts that have been selected for analysis. See <i>Initial Menu Options</i> , (See page 268.)
Section View	Opens the window and displays the table section currently selected in the Navigator view.
Event Log	Displays the list of events that are recorded in the Event Log.
Component Bit rate	Displays a graphical comparison of the stream bit rates.

Table 6: View menu options (cont.)

Command	Function
Component Duration	Displays a graphical comparison of the stream component durations.
Available Bit rate	Displays a graphical view of the bit rate in the stream.
Properties	Opens a properties dialog box for editing the currently selected item in the Transport Navigator window.
Zoom In	Zooms in the Available Bit rate and Component Duration views.
Zoom Out	Zooms out from the Available Bit rate and Component Duration views.
Synchronize	Synchronizes zoom levels of the Available Bit rate and Component Duration views (toggle).
Show Cursor	Shows or hides the cursor in the Available Bit rate and Component Duration views.
Toolbar	Shows or hides the Toolbar.
Status Bar	Shows or hides the Status Bar.

Options menu options

The following table lists the options available in the **Options** menu:

Table 7: Options menu options

Command	Function
Display Filter	Opens the SI Filter dialog box.
Single Section View	Selects single or multiple section view. When disabled, multiple section views can be opened.
Program Wizard	Invokes the Program wizard.
Transport Wizard	Invokes the Transport wizard.
H264/H265 Bitrate detection settings	Opens the H264/H265 stream bitrate detection settings dialog box. (See page 40.)

Multiplex menu options The following table lists the options available in the **Multiplex** menu:

Table 8: Multiplex menu options

Command	Function
Start	Starts the Multiplex Engine, to synthesize a new transport stream file.
Stop	Aborts multiplexing. The output file is closed and contains all of the data synthesized up to the point where the multiplex engine stopped. This option is available only while the Multiplex Engine is running.
Standard Mode	Enforces conformance to the selected standards when editing some fields that can be generated automatically.
Expert Mode	Inhibits the above conformance checking so that nonconformant files may be created.
Report	Provides the option of printing all or part of the transport structure to either a file or a printer.
Seamless	When enabled, the program specified in Seamless Settings is processed and made seamless.
Seamless Settings	Opens a dialog box in which the Make seamless parameters are specified.
Playout	When enabled, generates and captures MPEG-2 transport streams that are compliant with ATSC, DVB, and ARIB standards.
Playout Settings	Opens the Playout Settings dialog box in which path of the MPEG player application and the folder where the temporary files are specified.
Loop	Sets whether the stream is output using the looping method.
Update	Opens a dialog box in which the parameters in a stream are updated when looped.

Window menu options The following table lists the options available in the **Window** menu:

Table 9: Window menu options

Command	Function
Cascade	Cascades the open windows when Options > Single Section View is disabled.
Tile	Tiles the windows horizontally when Options > Single Section View is disabled.
Arrange Icons	Aligns icons of any minimized windows at the bottom of the program's main window.
1 <window title>	Makes the named window active, putting it on top of any window that had been hiding all or part of it.
2 <window title>	
3 ... etc.	

Help menu options The following table lists the options available in the **Help** menu:

Table 10: Help menu options

Command	Function
About Multiplexer	Opens a dialog box that displays the program version number and license number.

Toolbar

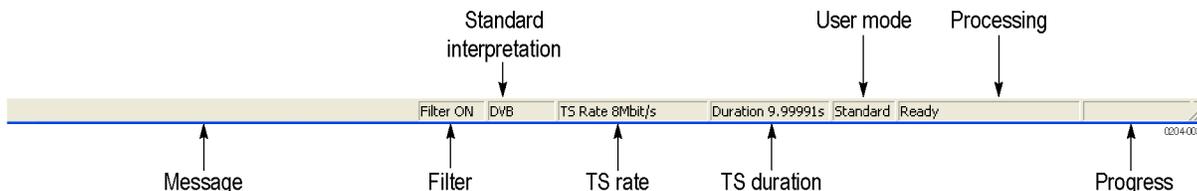


Toolbars provide a set of convenient shortcuts for the more frequently used menu options. The buttons are context sensitive and are enabled or disabled depending upon the currently highlighted view or the action being performed.

The Toolbar can be hidden from view by selecting **View > Toolbar**.

Status bar

The Status Bar may be hidden from view. However, it is always at the bottom of the main window when it appears. For example:



The following information is displayed from left to right on the Status Bar:

Message field. Provides a description of any button or menu option over which the cursor pointer is placed. Other noncritical messages may also be shown.

Filter status. Indicates the status (On/Off) of the SI Filter.

Standard interpretation. Indicates the selected standard with which the file is processed: **MPEG-2**, **ATSC**, **DVB**, or **ISDB**.

TS rate and duration. Shows the transport stream rate and the duration at that rate. A default rate is displayed during initial analysis.

User mode. Shows the User mode selected: **Expert** or **Standard**. The **Standard** mode **prevents** changes to certain fields. The **Expert** mode **enables editing**.

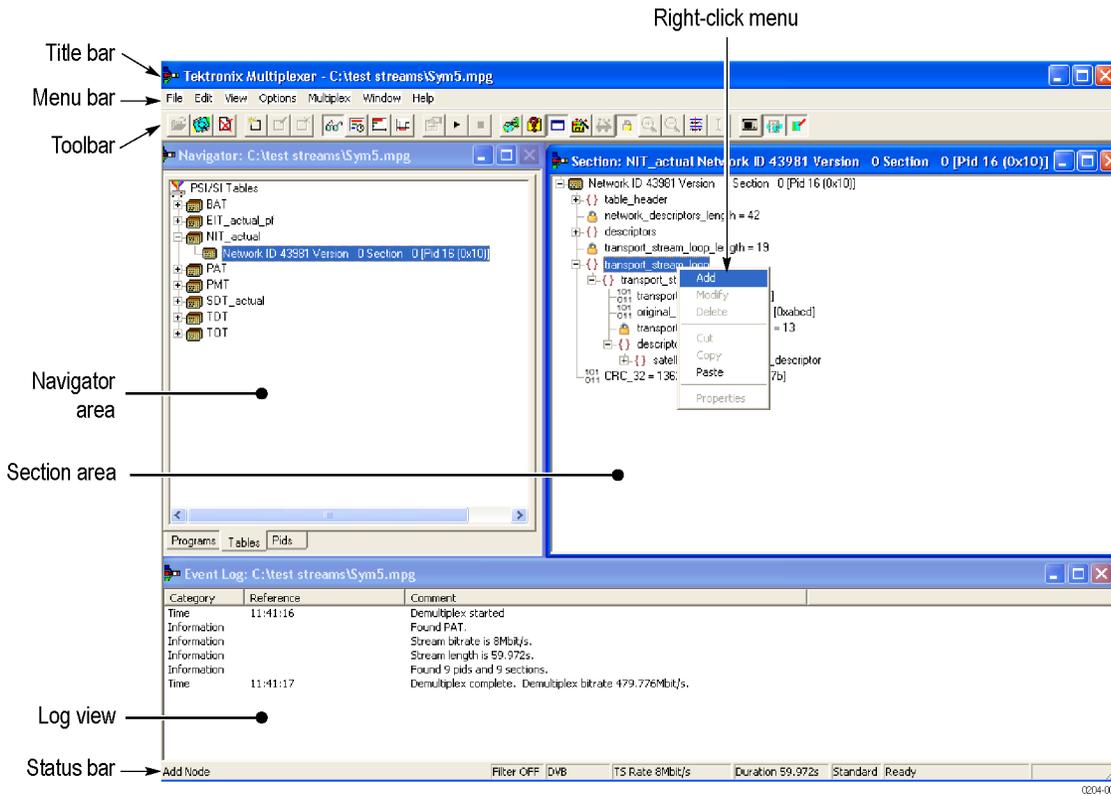
Processing status. Indicates the progress (%) during initial analysis and multiplexing.

Processing progress. Indicates the progress during initial analysis and multiplexing.

The Status bar can be hidden from view by selecting **View > Status Bar**.

NOTE. The status bar (Standard interpretation) displays ISDB-T SS whenever the ISDB interpretation with Single segment extension is selected.

User interface



NOTE. The Menu Bar contains the complete selection of options available in the Multiplexer. Shortcuts to options are available through the toolbar and context-sensitive shortcut menus.

Icons

Icons are used throughout the Multiplexer user interface to help you to identify components and make visual links with toolbar shortcuts and menu options.

The following table lists all icons used in the **Multiplexer user interface**:

Table 11: Icons

Icon	Description	Icon	Description
	About Multiplexer		Program
	Add		Program Group
	Audio stream		Program Wizard
	Bit field		Properties

Table 11: Icons (cont.)

Icon	Description	Icon	Description
	Close		Report
	Container/Loop		Seamless
	Copy		Seamless Settings
	Current selection		Section
	Cut		Section timing
	Delete		Section View
	Display Filter dialog box		Single window
	Examine Transport Stream		Standard mode
	Exit		Start
	Expert mode		Stop
	Export		Table
	Export As		Transport Stream icon
	Export Elementary Stream		Transport Wizard
	Export Payload		Unknown
	Export Section Data		Video stream
	Import Section Data		View Event Log
	Modify		View Component Duration

Table 11: Icons (cont.)

Icon	Description	Icon	Description
	New		View Component Bit rate
	Open		View Available Bit Rate
	Paste		Playout-Playout the created TS using Mpeg Player
	Loop		Update

Cutting and pasting

Table types, sections, and PIDs can be cut, copied, and pasted using the Windows clipboard. Only one selection can be held on the clipboard at a time. Alternatively, a selection can be dragged and dropped using the mouse.

Cutting a selection to the clipboard. A selection (table type, section or PID) can be deleted and automatically placed on the Windows clipboard. It can then be pasted to a different file or back into the current file. Highlight the selection in the Navigator Tables or PIDs view and select **Edit > Cut** or use the **Ctrl+X** keyboard shortcut.

Copying a selection to the clipboard. A selection (table type, section or PID) can be copied to the Windows clipboard. From the clipboard, it can be pasted to a different file or back into the current file.

Highlight the required selection in the Navigator Tables or PIDs view and then select **Edit > Copy** or use the **Ctrl+C** keyboard shortcut.

Pasting a selection from the clipboard. More than one instance of Multiplexer can run concurrently on a machine. A selection (table type, section, or PID) can be pasted from the clipboard into any open transport stream file. The contents of the clipboard are not affected by the paste operation, so the section can be pasted to many files and more than once to the same file.

Activate the Navigator Tables or PIDs view of the required transport stream file (that is, in an instance of Multiplexer). Then select **Edit > Paste**, or use the **Ctrl+V** keyboard shortcut.

The section or version is always appended to the end of the list under the appropriate table. Program or version numbers are automatically created. If the table is not present in the multiplex configuration, it will be created automatically.

Dragging and dropping

A concept familiar to Windows users is "drag and drop" in which files can be highlighted by clicking on them with the mouse and then dragged and dropped to a new location, either in the same application or across applications.

In Multiplexer, the main uses of the drag and drop feature are to modify multiplexes and to build new ones.

Elements can be dragged within Multiplexer, or from the Multiplexer Browser, Windows Explorer or other instances of Multiplexer.

The program references and the numbering will be automatically added and/or updated when a new program is dropped onto the **Navigator Programs** view.

NOTE. *Only the MPEG aspects of the transport structure are updated. Tables specific to DVB and ATSC are not updated.*

Manipulation in Program view.

The following manipulations are available in the Program view:

- When using the Navigator Program view, a program can be copied or dragged. The program can be dropped only on the transport stream node of the Program view.
- Only the standard MPEG elements are copied, namely the PAT entry, the PMT section and the elementary streams. Standard dependent information is not copied, for example, DVB SDT.
- When a conflict occurs with the target, new values will be allocated for the Program and PID numbers.
- Elementary streams can also be dragged and dropped between the Program Views. They can be dropped only onto the elementary stream root node.
- An elementary stream may have a stream type, a component tag and descriptors associated with it; this information is retained during a drag and drop in the program view. The program view displays this information when the properties dialog box is activated.

Multiplexer - Wizards

In the **Navigator Programs** view, wizards provide you with a step-by-step approach to building streams to be multiplexed by offering defaults for PSI / SI and the opportunity to include user-selected programs. The standard previously selected in the Interpretation dialog box will dictate which PSI / SI components are offered.

There are two major wizards: the **Transport Wizard** and the Program Wizard. Other minor wizards may be opened by these major wizards or they may be opened in a new window to facilitate specific tasks, such as adding EIT information. When configuring a new multiplex, the **Transport Wizard** is opened, followed by the Program Wizard; although, on completion of the Transport phase, an opportunity to exit the wizard process you have before the Program Wizard opens. For some detailed operations, only the appropriate wizard can be opened.

At their most basic level, wizards open, in a logical order, the property dialog boxes that are available when building a stream manually.

The following paragraphs provide a step-by-step description of the wizards.

Wizard controls

The following control buttons are provided on the wizard dialog boxes where relevant:

Next	Retain changes made using this dialog box and move to next dialog box.
Back	Discard changes made using this dialog and return to the previous dialog box.
Cancel	Exit the wizard and discard all changes.
Finish	Exit the wizard and implement all changes.

Transport wizard

Toolbar icon:



The **Transport Wizard** allows you to easily create a basic stream populated with the PSI / SI necessary to hold program information. It may also be opened when PSI/SI is to be added to an existing stream.

Creating a new transport stream

The following steps show the screens used in the creation of a DVB stream.

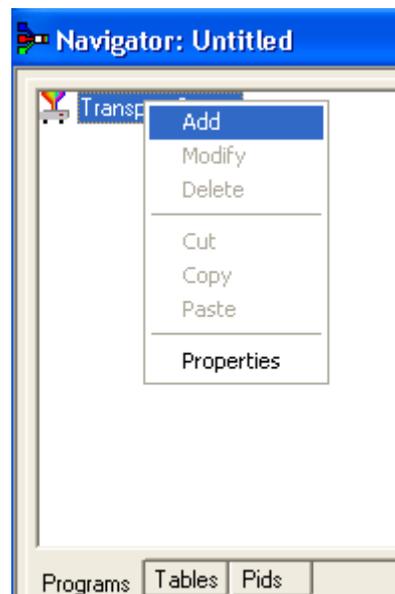
NOTE. *When the Transport Wizard is used to populate a new stream, if the defaults in the various dialog boxes are retained, then the resulting stream will conform to the selected standard.*

1. To open a new file, select **File > New** .
2. Select the **Program** tab in the Navigator view:

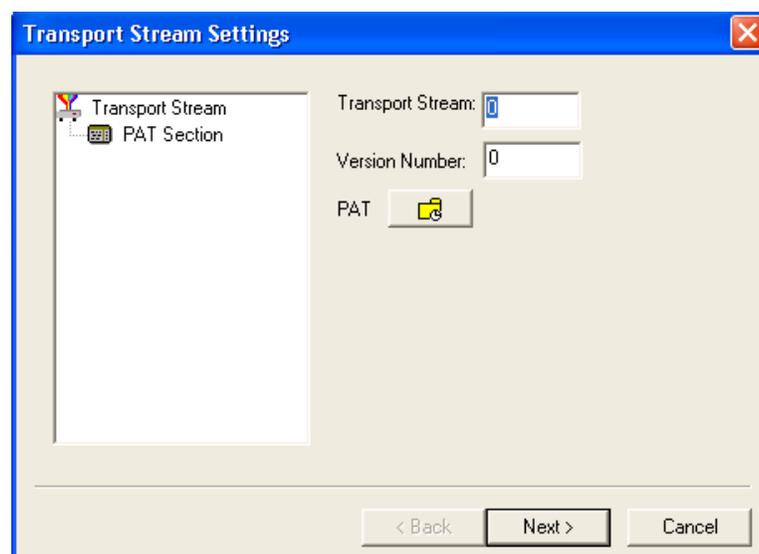


3. Select and highlight the Transport Structure element. At this stage of creating a new stream, this will be the only element visible in the **Program Navigator** view.

4. Select **Add** from the shortcut menu. The **Transport Stream Settings** dialog box appears:

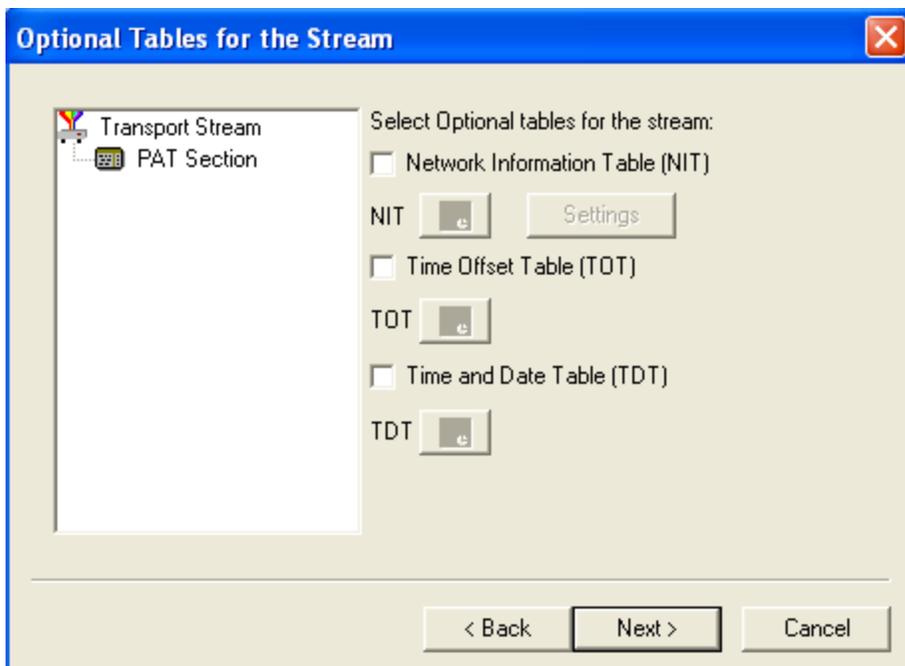


The **Transport Stream Settings** dialog box allows you to set up the transport stream identity (part of the **PAT section**) and version. Adjustments can also be made to the PAT timing, if required, by selecting the PAT button. PAT timing - see *Editing PSI/SI Table Properties*: (See page 86.)



NOTE. You cannot add a PAT with the ISDB interpretation and Single segment extension selected. When you click Add, the Add a Program wizard is displayed instead of the Transport Stream Settings.

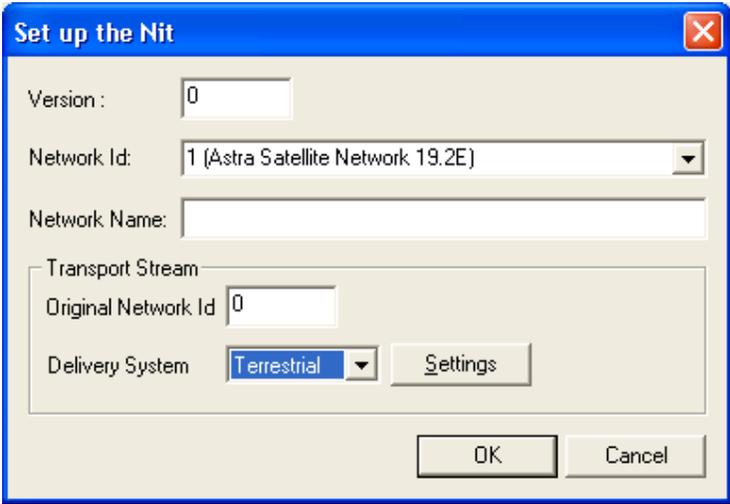
- In the **Transport Stream Settings** dialog box, click **Next** to move to the **Optional Tables** dialog box. This dialog box allows you to include and configure basic PSI / SI information if required:



- Select the check box next to each table to add the table name. The table name is added to the graphical representation on the left and the associated buttons are also enabled. You can modify the settings of the table such as, timing.

For NIT, TOT, and TDT Timing information, see *Editing PSI/SI Table Properties*. (See page 86.)

- NIT settings**
7. In the **Optional Tables for the Stream** dialog box, click **Settings** for the Network Information Table (NIT). The Set up the NIT dialog box appears:



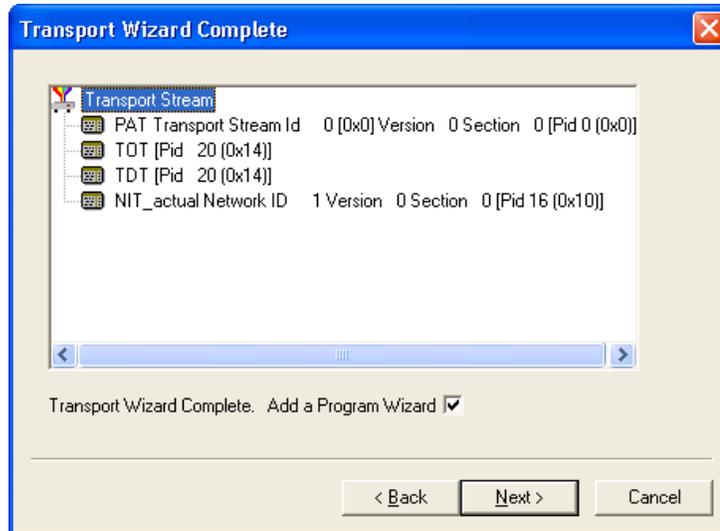
The screenshot shows a dialog box titled "Set up the Nit". It contains the following fields and controls:

- Version:
- Network Id:
- Network Name:
- Transport Stream section:
 - Original Network Id:
 - Delivery System:
 - Settings:
- OK:
- Cancel:

8. Enter or select the required values and click **OK**.

NOTE. *If a Delivery System other than Undefined is selected, an additional settings dialog box becomes available, specific to the Delivery System chosen.*

9. Select **Next** to move to the **Transport Wizard Complete** dialog box. This dialog box allows you to review the changes made by the wizard before confirming the process. The process can be cancelled, thereby losing all changes, by selecting the **Cancel** button.



At this stage in the creation of a new multiplex, if you want to add programs, leave the Add Program Wizard check box enabled and select **Next**. If you want to add them by some other means, clear the Add a Program Wizard check box. The **Next** button label will change to Finish, which allows you to exit the wizard and implement all changes.

When the **Transport Wizard** has closed, note that the Navigator views are updated with the new PSI/SI.

Program wizard

Toolbar Icon: 

The **Program Wizard** allows you to add programs as required to a stream that is already populated with basic PSI/SI. Each use of the **Program Wizard** allows the addition of one program. Adding more programs requires the wizard to be opened each time.

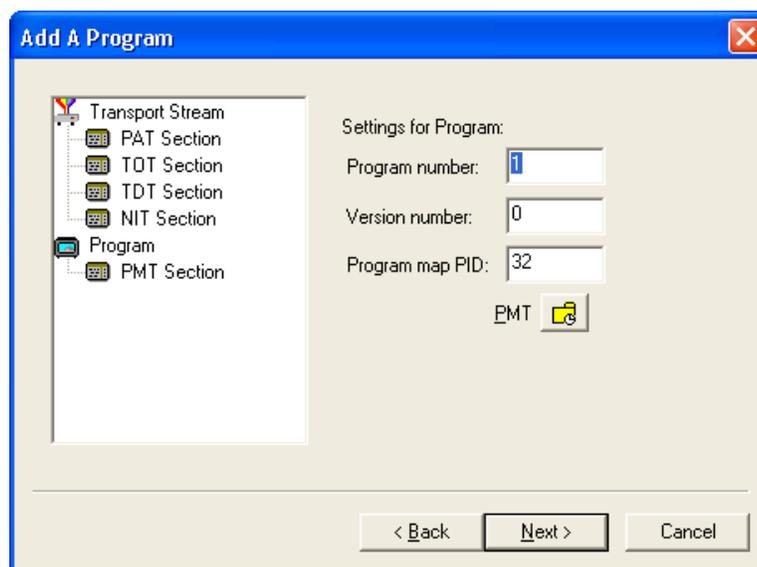
If a new stream is being created, the **Transport Wizard** offers an opportunity to open the **Program Wizard**. Alternatively, in the **Navigator Programs** view, highlight the **Programs** node and select **Add** from the shortcut menu.

Adding a program to a transport stream

To add a program to the Transport Stream, follow these steps:

NOTE. When the Program Wizard is used to add programs to a stream, if the defaults in the various dialogs are retained, the resulting stream will conform to the DVB standard.

1. When you open the **Program Wizard**, either as a continuation of creating a new stream or as an attempt to add a new program, a dialog box similar to that shown below appears:



The values placed automatically in the three displayed fields will be the next in the sequence of programs. (In the example screen, the stream contains no prior programs, therefore this is program number 1. PID 32 is used because that is the first free PID after the reserved PSI/SI PIDs.)

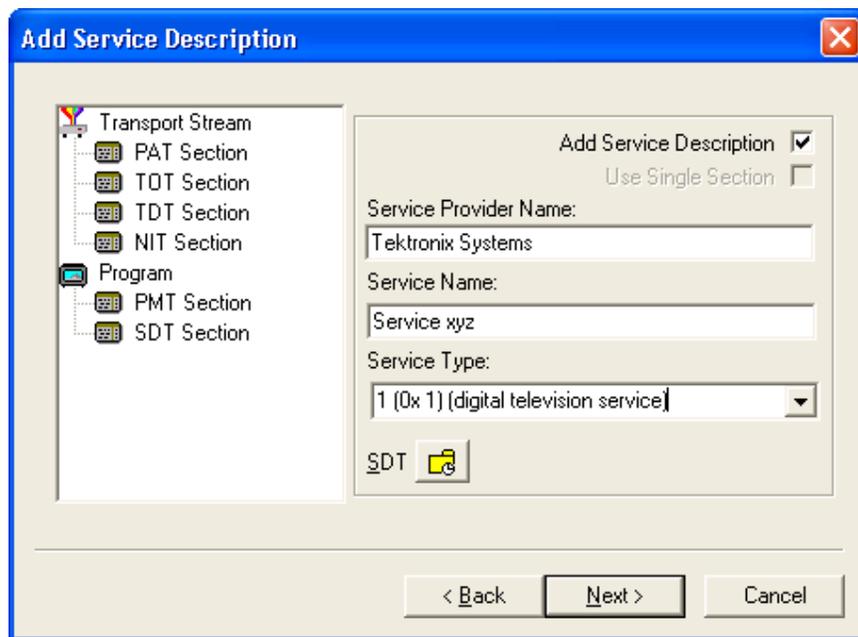
PMT Timing - see *Editing PSI/SI Table Properties*. (See page 86.)

2. Select **Next** to move to the Add Service Description dialog box.

NOTE. If ISDB interpretation with Single Segment extension is selected the program number starts from 8 (default). However, you can enter numbers from 1 to 7.

Service description dialog box

The **Service Description** dialog box allows you to identify the **Service Provider** that you must associate with a program:



3. By default, the Add Service Description check box is clear. When it is enabled, a Service Provider Name and a Service Name must be entered and a Service Type selected from the dropdown list. If no details are provided, the section will still be created but the relevant descriptors will be empty.

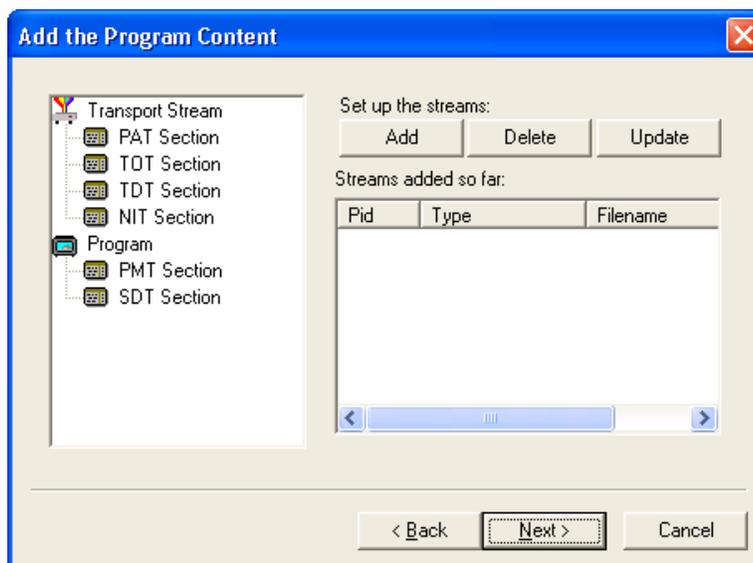
Enabling the **Use Single Section** check box will cause the **SDT** descriptors to be added to the existing **SDT** section. If the stream contains no **SDT** section, the check box is disabled.

SDT timing - see *Editing PSI/SI Table Properties*. (See page 86.)

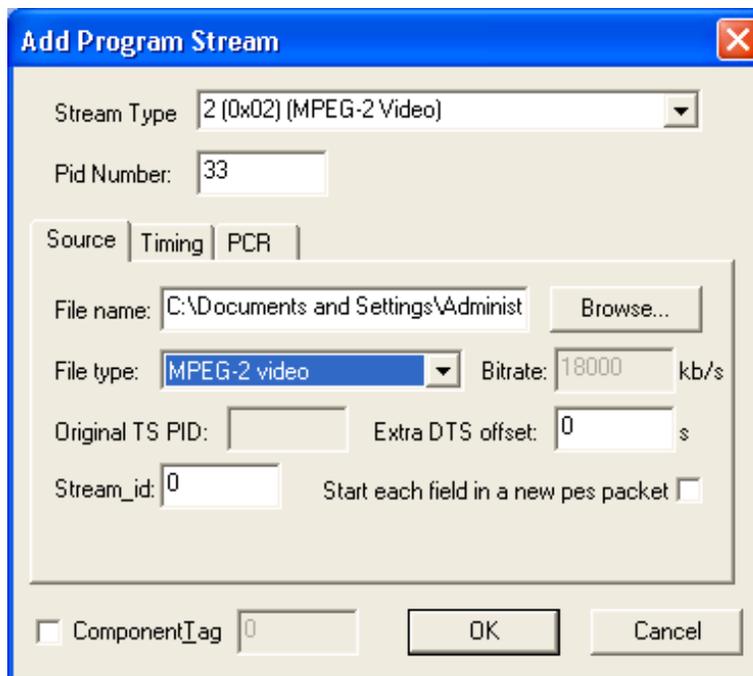
4. Select **Next** to move to the **Program Content** dialog box.

Program Content dialog box

This dialog box allows you to compile a list of elementary streams to be associated with the program in the final multiplex:



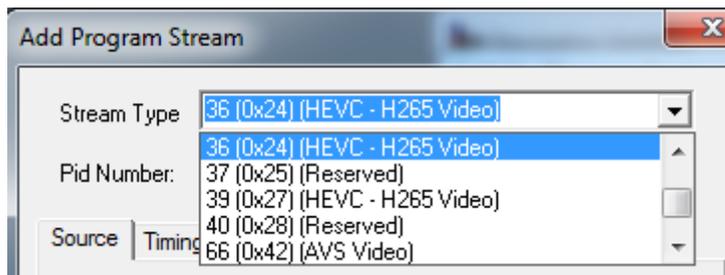
5. Select **Add** to display the **Add Program Stream** dialog box. This dialog box allows you to identify elementary streams to be included in the new multiplex. You must specify the **PID** and **Stream Type** of the new stream. You can also allocate a **Component Tag** if you wish:



If the **Component Tag** is enabled, it can be referenced by other tables, for example, the **Event Information** table.

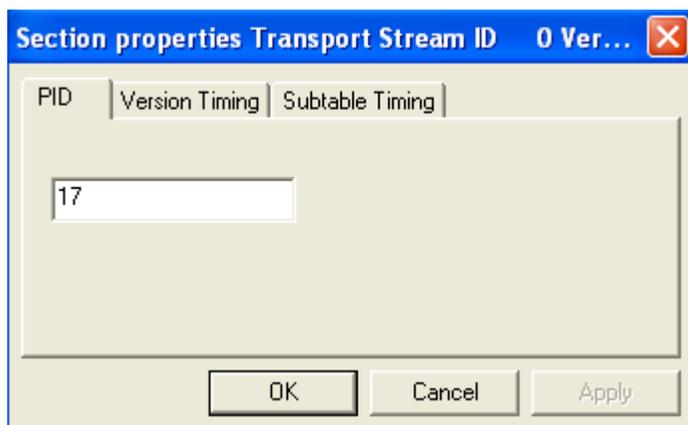
The dialog box consists of three tabbed pages that specify the source of the stream, its timing within the multiplex, and whether it should be carrying a PCR PID.

6. Select a **Stream Type** from the dropdown list. This will be the **Stream Type** allocated to the stream in the new multiplex:



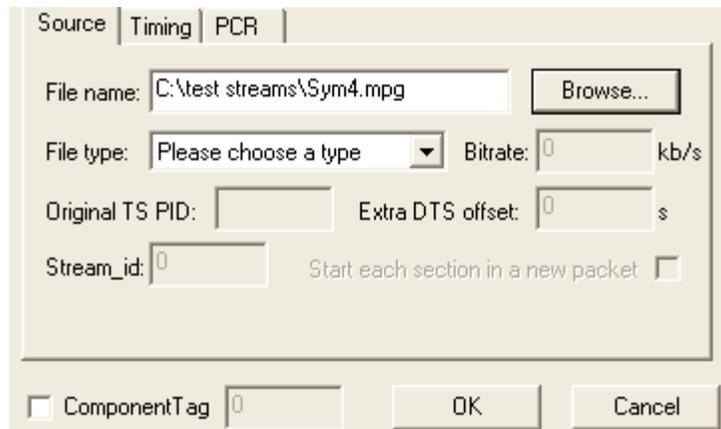
NOTE. The Stream Type dropdown list displays the previously selected stream as the default type.

7. Allocate a **PID** Number in which the elementary stream is to be carried:



8. Enable the **Component Tag** check box, if required. Enter a **Component Tag** number (0-255) in the enabled field.

Source tab. Use the **Source** tab of the **Add Program** dialog box to select and specify the elementary stream to be included in the new multiplex:



9. Enter an elementary stream File Name. You can enter it directly or use the Browse button to open a standard Windows file selection dialog box.

10. Select the **File** type of the selected stream from the dropdown list:

- If you select MPEG-2 video, the bit rate is detected automatically and displayed in the Bit rate field.
- If you select H.264 / H.265 video, the Bitrate Detection dialog box is opened.

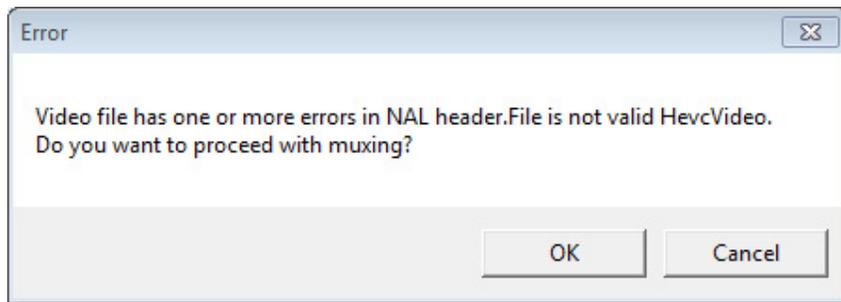
If the video stream contains HRD information, the bit rate is automatically calculated. (See page 40, *Calculating the bit rate for H.264 / H.265 HRD streams.*)

If the video stream does not contain HRD information, the bit rate must be calculated manually. (See page 41, *Calculating the bit rate for H.264 / H.265 non-HRD streams.*)

When the selected file type does not match with the selected file name, an error message shows to alert you that you must reselect the correct file type:

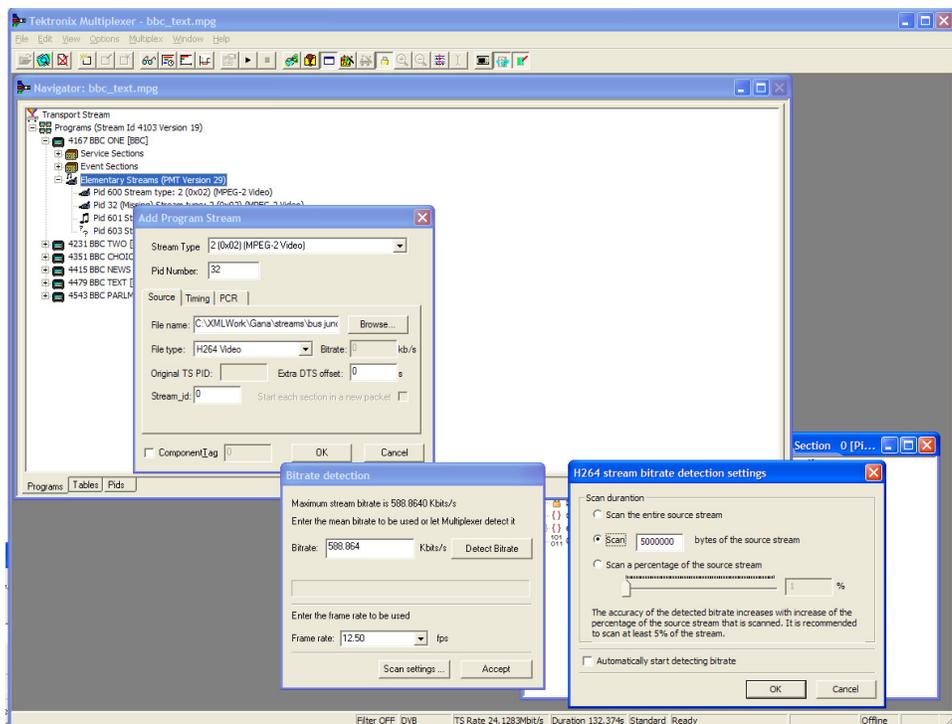


NOTE. If H.265 is selected and the stream contains errors, then the following error pop-up appears:



11. If you select H.264 video with SEI stream, a Suppress PTS/DTS insertion check box is displayed. Select this check box to suppress the PTS/DTS insertion.

Calculating the bit rate for H.264 / H.265 HRD streams. If HRD information is detected in the stream, the maximum bit rate is calculated automatically and displayed in the Bitrate Detection dialog, as shown in the following screen capture. You can override the calculated bit rate, either by entering a value manually or by selecting **Detect Bitrate**:



12. When the displayed bit rate is satisfactory, select **Accept**.
13. To alter the settings used for bit rate detection, before the bit rate is detected, select **Scan Settings**.

When you select **Scan Settings**, the **H264 / H265 Stream Bitrate Detection Settings** dialog box is displayed.

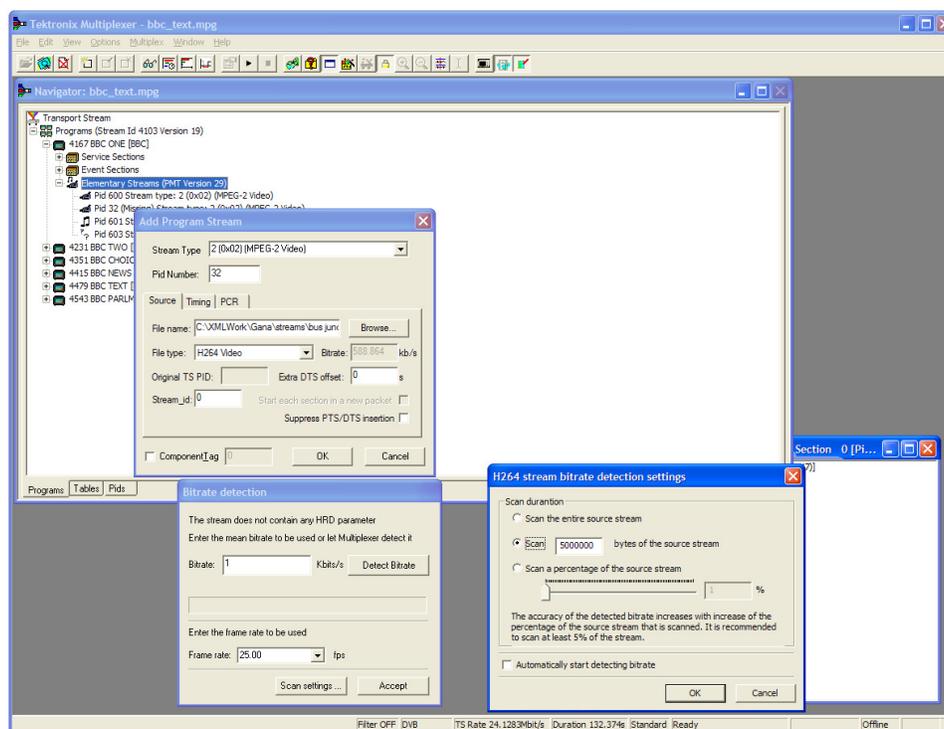
The **H264 / H265 Stream Bitrate Detection Settings** dialog box has three Scan Duration options. Select one of the following options to proceed:

- Scan the entire source stream
- Select the number of bytes in the stream to scan
- Select a percentage of the stream to scan.

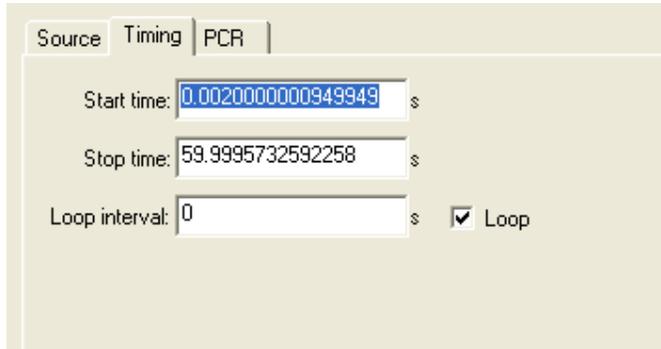
NOTE. *The accuracy of the detected bit rate increases with the percentage of the source stream that is specified.*

The chosen setting will be used in subsequent calculations. Select **Automatically start detecting bitrate** to use the selected setting.

Calculating the bit rate for H.264 / H.265 non-HRD streams. If no HRD information is detected in the stream, you must either enter a value manually or use the **Detect Bitrate** function in the **Bitrate Detection** dialog box:

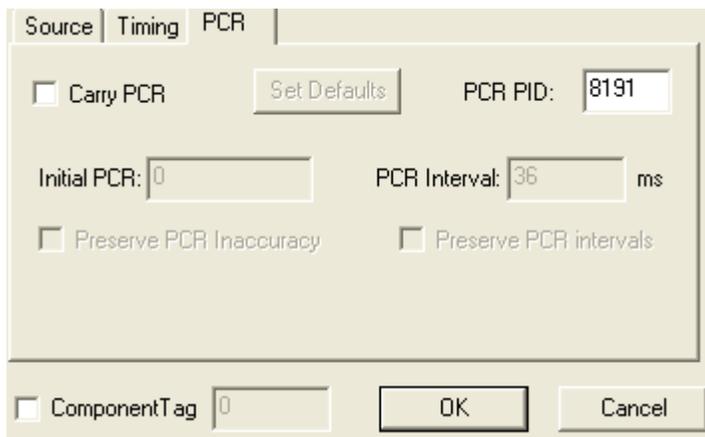


Timing tab. The **Timing** tab of the **Add Program** dialog box is used to specify the portion of the new multiplex that the selected stream will use. The default start time is set to 0.002 s:



12. Complete the fields as required. The **default** settings assume that the stream is to be carried throughout the new multiplex, looping if necessary.

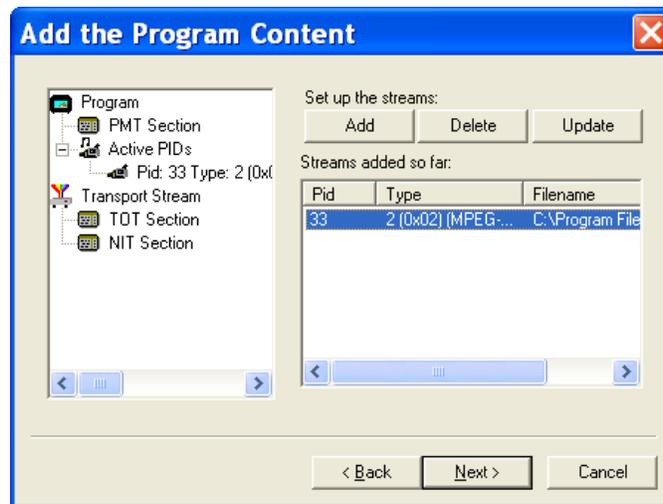
PCR tab. The **PCR** tab of the **Add Program** dialog box is used to specify whether **PCR** information should be carried with the selected elementary stream or in a separate associated PID:



13. If the PCR is to be held in an associated PID, disable the Carry PCR check box and enter a PCR PID number.
14. If the **PCR** is to be carried with the stream, enable the **Carry PCR** check box and complete the remaining fields as required.

Set Defaults returns the settings to their initial values.

15. Select the **OK** button to complete adding an elementary stream to the listing in the Program Wizard.
16. More streams can be added using the **Add** button. Listed streams can be deleted using the **Delete** button. Details of listed streams can be modified using the **Update** button.



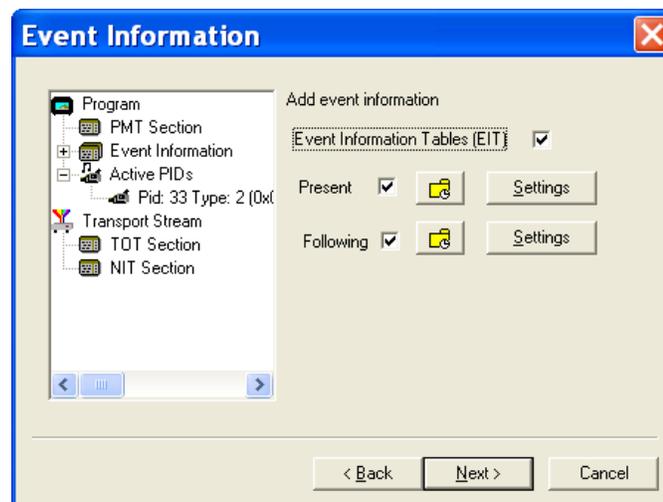
This completes the addition of one or more program streams.

17. Select **Next** to move to the **Event Information** dialog box.

For more details about the fields on these tabs, refer to *Adding an Unreferenced Elementary Stream*. (See page 92.)

Event Information dialog box

The **Event Information** dialog box allows you to add the **Present** and the **Following** event information:



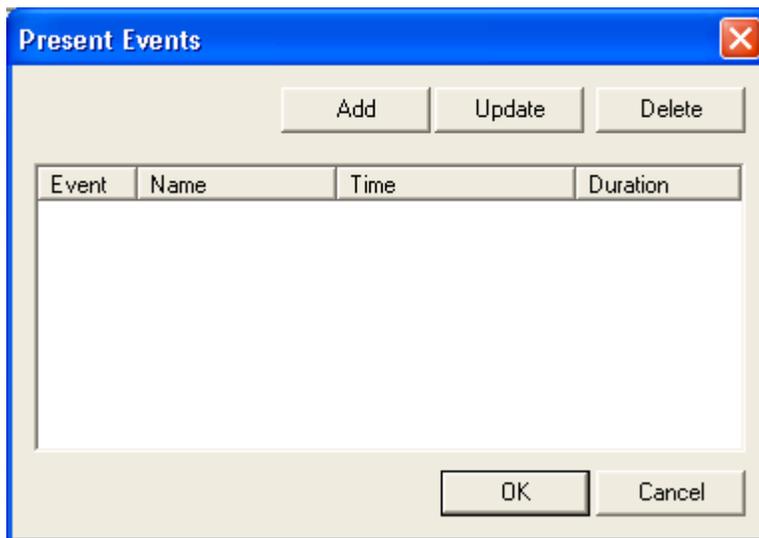
18. If you need to include the **Event Information** table (EIT) in the multiplex, you must first enable the **Event Information Table** check box.

19. Enable **Present and Following** check boxes as required.

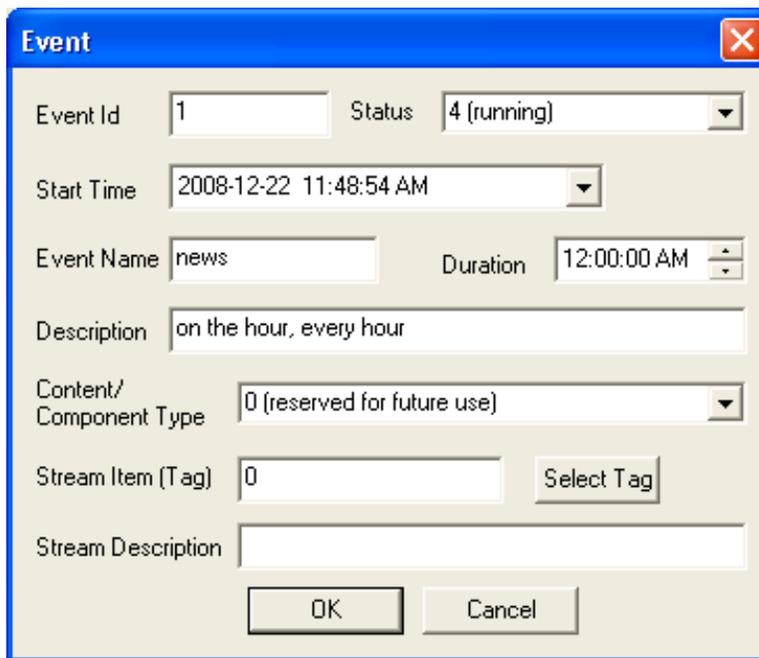


Present / Following timing - For more information on **Present / Following** timing, see *Editing PSI / SI Table Properties*. (See page 86.).

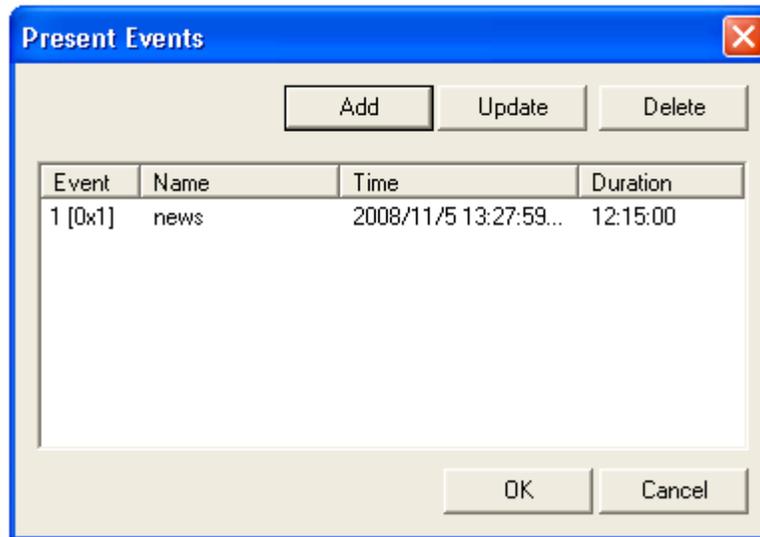
20. Use the **Settings** buttons to open the **Present / Following Events** dialog box:



21. In the **Present / Following Events** dialog box, click **Add**. The **Event** dialog box appears. Add and specify events as required:



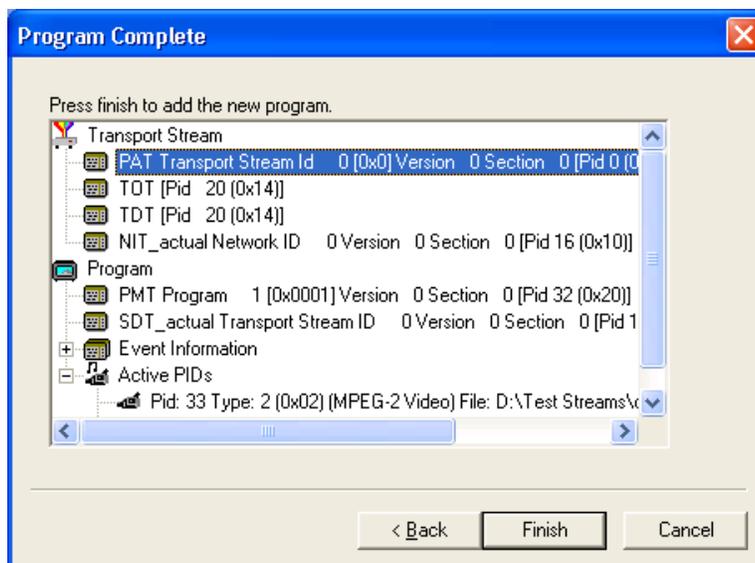
22. Click **OK**:



23. In the **Event Information** dialog box, click **Next** to move to the **Program Complete** dialog box.

Program Complete dialog box

The **Program Complete** dialog box provides you with a summary of the created **Transport** structure:



24. To confirm and implement the Transport Structure, select the **Finish** button.

Note that the proposed structure is created in the Navigator views.

This completes the procedure of adding a program to a transport stream using the Program Wizard.

Multiplexer - Views

Multiplexer contains a number of views, which are displayed in the working area of the user interface. All of the views can be manipulated using conventional Windows techniques. The **Navigator** and **Error Log** views can be docked against the edges of the UI or floated independently of the Multiplexer window. The Section view can be manipulated within the Multiplexer window, including tiling and cascading where multiple Section views are displayed.

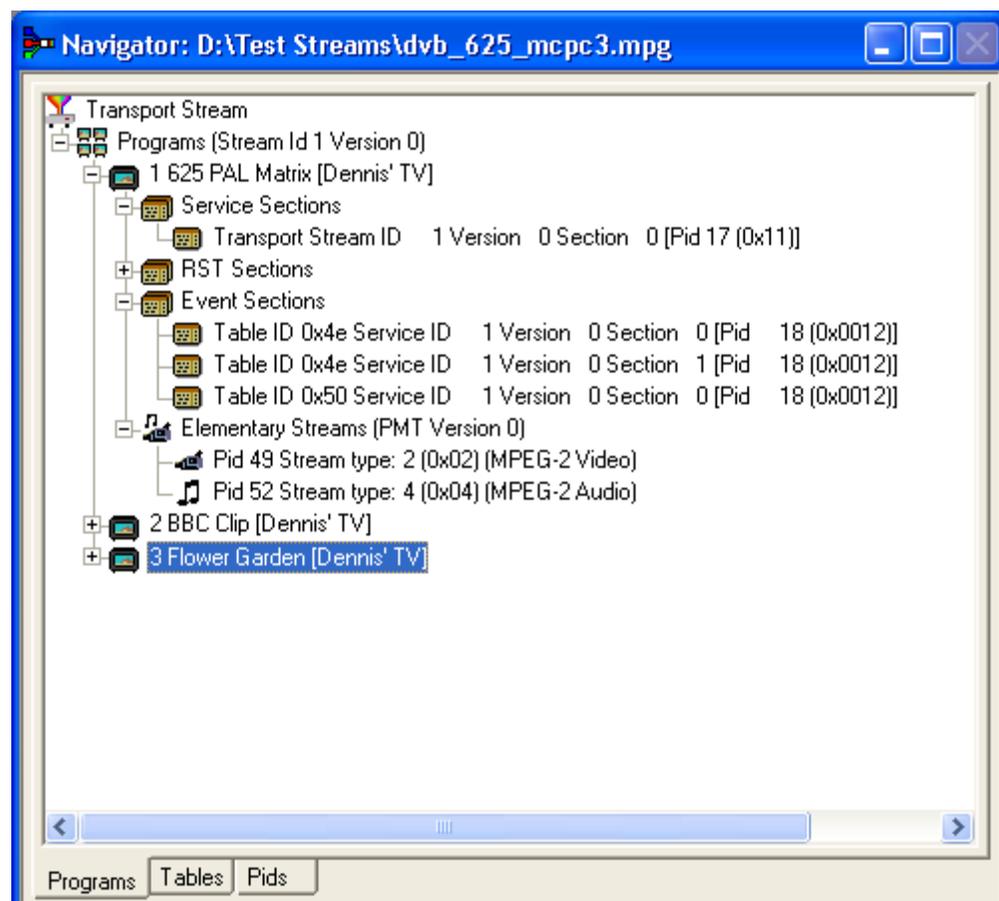
Each available view displays a different aspect or level of detail of stream analysis and manipulation.

Navigator views

The **Navigator** view contains three subviews or tabs: Programs, Tables, and PIDs.

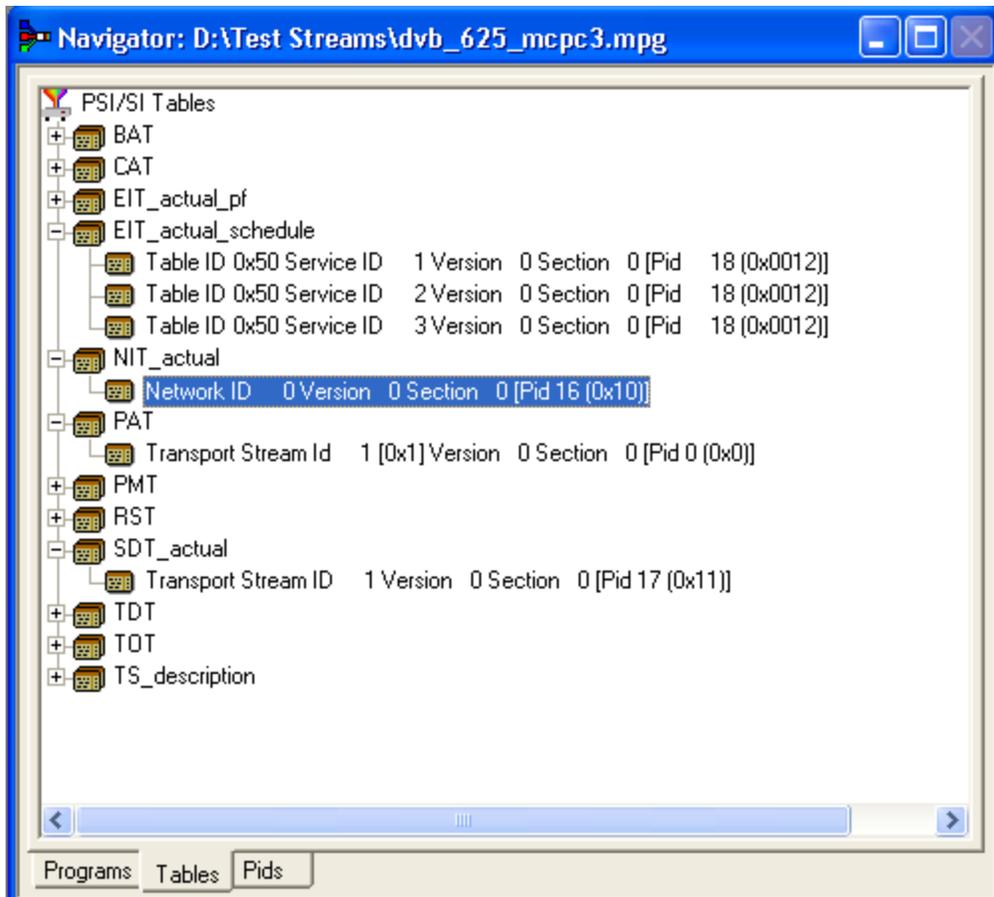
Program views

The **Navigator Programs** view extracts and displays system information that is relevant to programs. Information that is not directly related to programs (for example, NIT), or that has not been incorporated into a program (for example, elementary streams not listed in a PMT) will be omitted from the **Program** view. The system information is still available for viewing in the **Navigator Tables** and **PIDs** views:



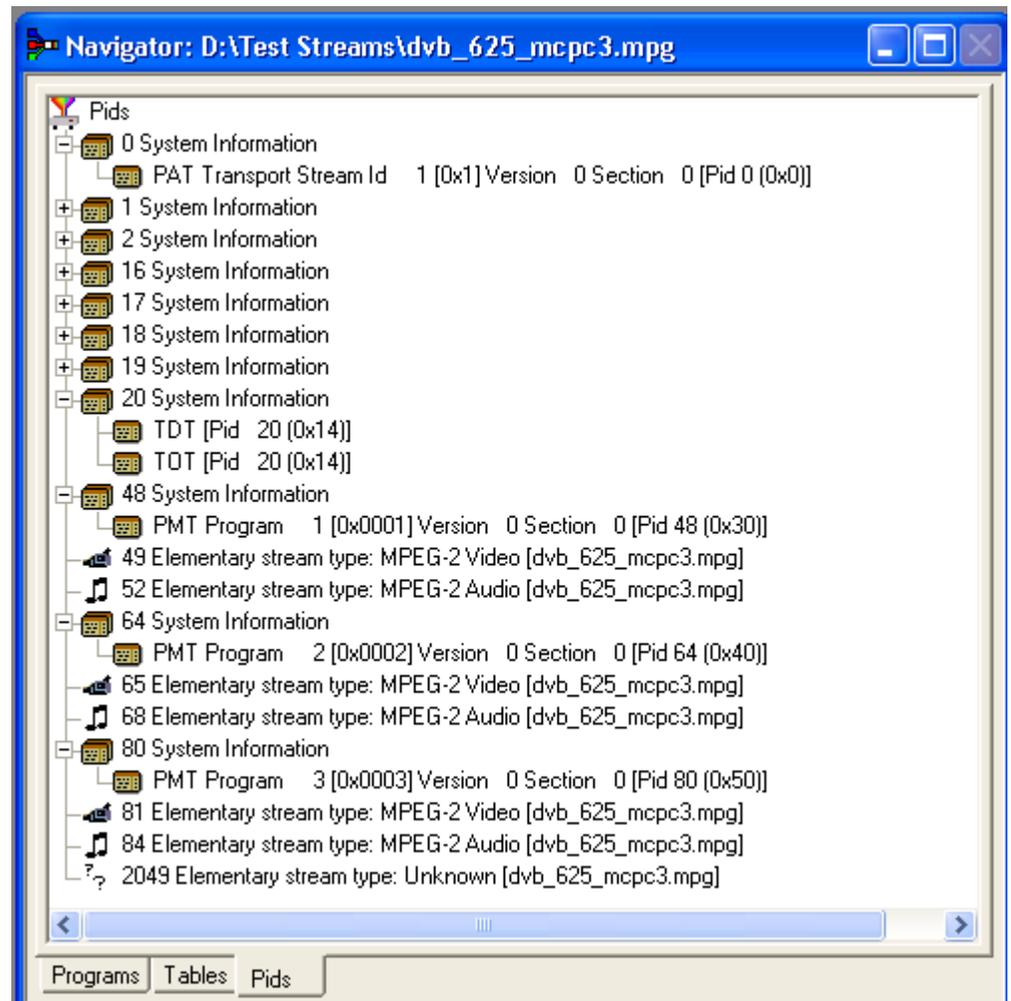
It is recommended that manipulation of programs and elementary streams should take place from the **Program** view.

Tables view The **Tables** view shows a high-level structure of the Program and System Information Protocol (PSIP), Service Information (SI), and Program Specific Information (PSI) tables. More detailed payload information can be examined and edited, for a selected section of a table, using the **Section View**:



Any PSI/SI information that the program cannot confidently analyze, will be shown in the PIDs view.

PIDs view The PIDs view displays the PIDs contained in the stream. The PIDs are displayed in ascending numerical order:

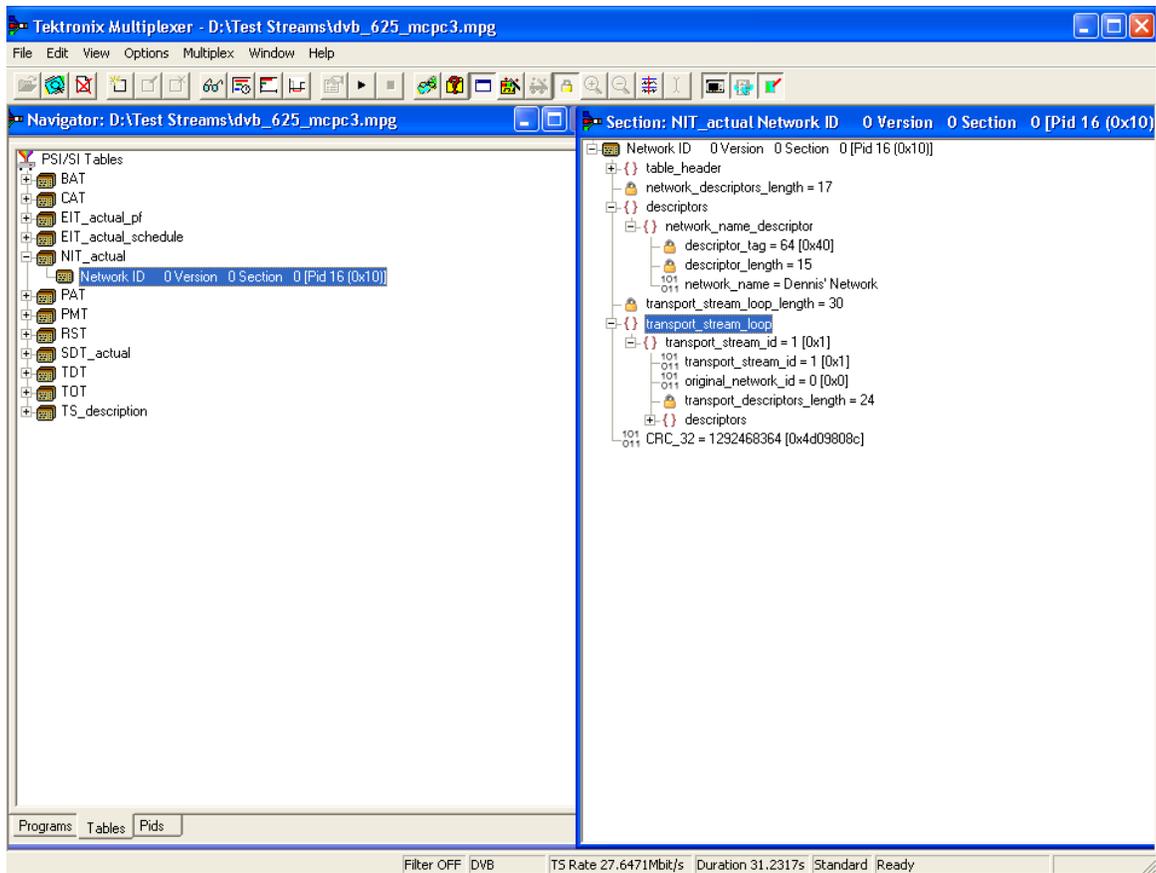


PSI/SI table types are identified in the section nodes of System Information nodes.

Elementary stream PIDs are identified by source and type where possible.

Section view

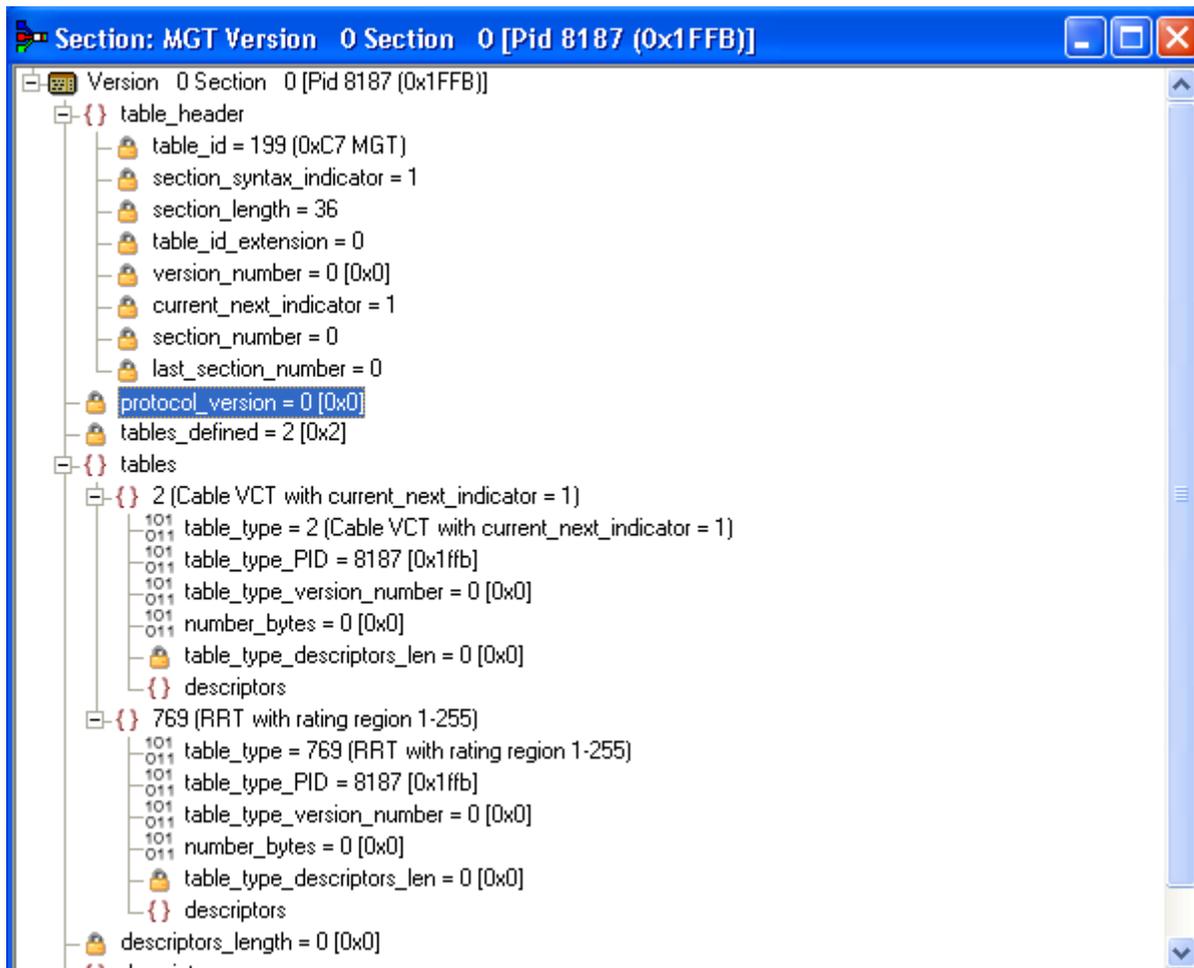
The **Section** view displays the contents of the currently selected section in any of the **Navigator** views:



The **Section** view is dynamic in that it will be instantly refreshed if a new section is highlighted in the **Navigator** view. If no section is selected, the **Section** view will be blank.

The **lock** icon next to certain elements of the table in the **Section** view indicates that those items have restricted access due to the mode of user operation: **Expert** or **Standard**.

Syntax of a section The following diagram shows a section from a **Master Guide Table (MGT)**:



The syntax specified for an MGT in the ATSC standard A65 is:

```

master_guide_table_section () {
    table_id
    section_syntax_indicator
    private_indicator
    zero
    section_length
    table_id_extension
    reserved
    version_number
    current_next_indicator
    section_number
    last_section_number
    protocol_version
    tables_defined

```

```

    for (i=0;i<tables_defined;i++) {
        table_type
        reserved
        table_type_PID
        reserved
        table_type_version_number
        number_bytes
        reserved
        table_type_descriptors_length
        for (k=0;k<N;k++)
            descriptor()
    }
    reserved
    descriptor_tag
    descriptors_length
    for (I = 0;I< N;I++)
        descriptor()
    CRC_32
}

```

The terms used in this manual to describe the components, represented by nodes, in the structure diagram are:

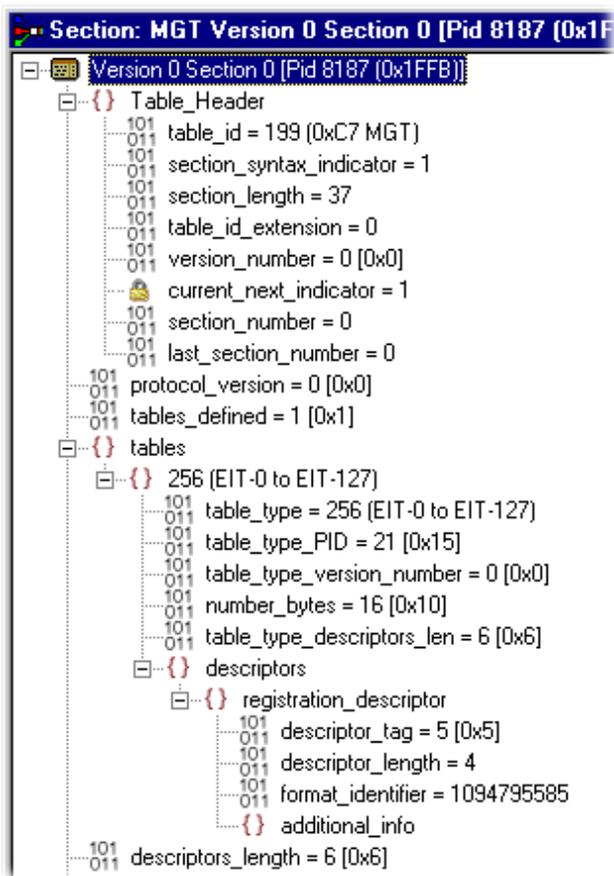
Container. A term used to describe a node in the structure diagram which may contain zero, one or more loops. It is analogous to the for (i=0;i<loops_defined;i++) statement used to describe the syntax of a table in the ATSC standards. The container is always preceded by a field which specifies the number of loops it contains.

Loop. Describes a data structure composed of a specified set of fields and subordinate loops. The structure diagram shows each loop as a node with the fields and subordinate loops as children. Each loop node in the section view represents one iteration of the loop body (the contents of the curly braces { }) in the syntax specified by the ATSC standards.

Field. Fields are referred to in the standards documents as both data items and fields. They are the smallest pieces of information that make up a table.

For example, taking an MGT that defines three tables, the Section View represents the syntax and contents of the Tables container like this:

The loop for the first table, EIT-0 has been expanded to show the fields and subordinate loops that it contains:



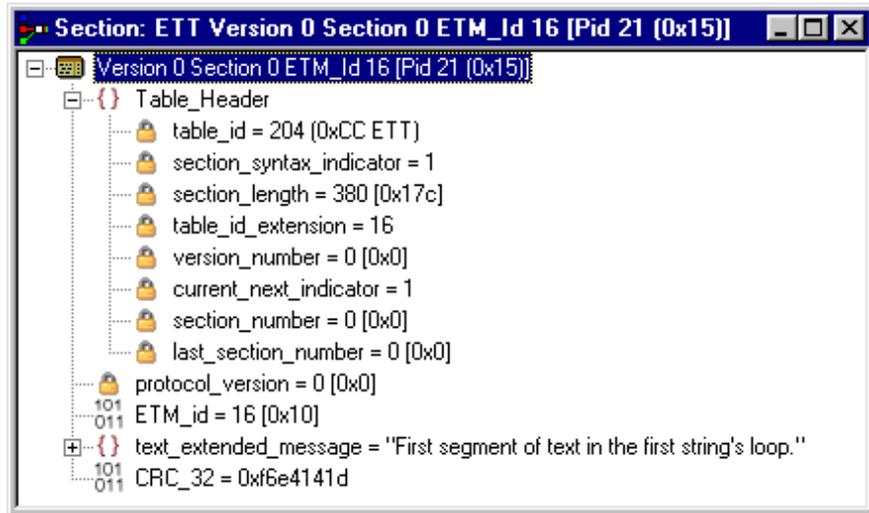
Syntax of a multiple string structure

The ATSC standard A65 defines a data structure called the **Multiple String Structure**. An instance of this structure may contain zero or more strings and each string may contain zero or more segments. The syntax specified for a **Multiple String Structure** in A65 is:

```

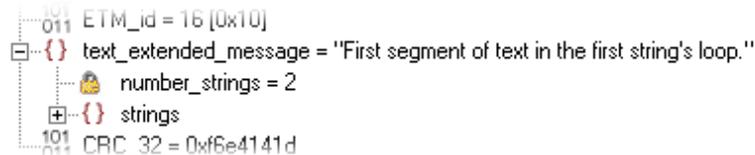
multiple_string_structure () {
    number_strings
    for (i= 0;i< number_strings;i++) {
        ISO_639_language_code
        number_segments
        for (j=0;j<number_segments;j++) {
            compression_type
            mode
            number_bytes
            for (k= 0;k<number_bytes;k++)
                compressed_string_byte [k]
        }
    }
}
    
```

Using the notation of container, loop, and field nodes, the Section View represents the Multiple String Structure in the same way as any other data structure. For example: an **Extended Text Table** (ETT) carries its `extended_text_message` in a Multiple String Structure. The default view of a section of an ETT in the Section View looks like this:



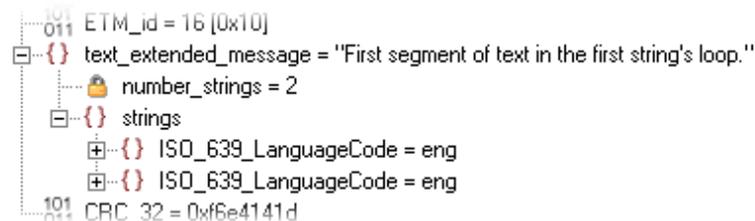
Section View displays a node for the `extended_text_message` (with as much as possible of the first segment) from the first string.

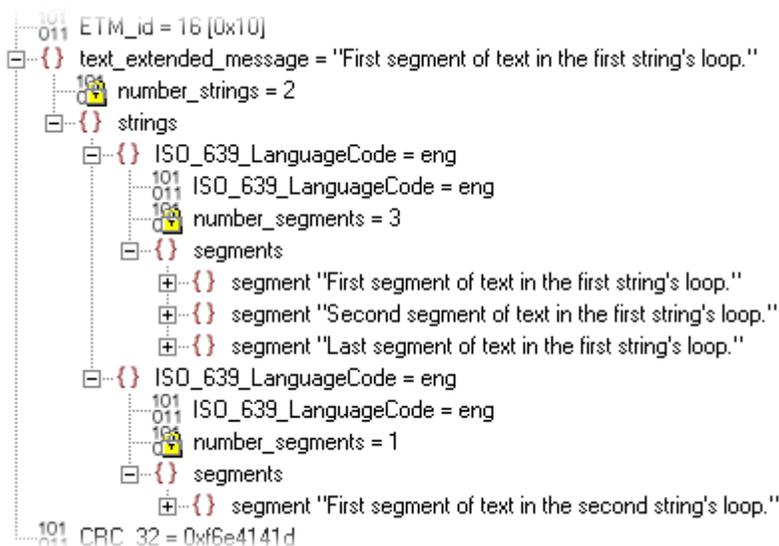
Expanding the node reveals a `number_strings` field which specifies the number of strings and a container which holds them (strings):



The `number_strings` field shows that there are two strings in this example. Expanding the `strings` container shows the loop for each string. From this it can be seen that both strings are in English.

Expanding each of the strings reveals the number of segments (`number_segments`) that make up each string and a `segments` container. Similarly, expanding the `segments` container reveals segments:





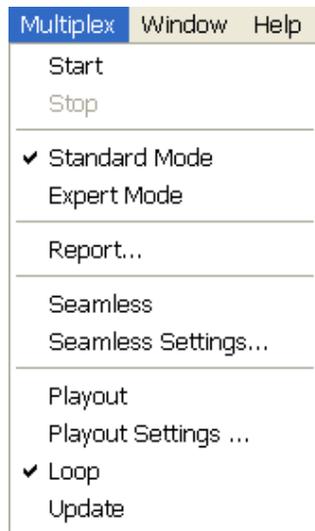
The contents of each segment loop define what compression and character set are used, followed by the actual text. The text is held in the compressed_string field.

Expert and Standard modes

The Multiplexer has two modes of operation for conformance checking when editing table contents. These are selected from the Multiplex menu. The checks that affect the Navigator are:

Standard mode. Prevents changing the PID of a table whose PID number is specified in the standard, for example, PID 0x0 carries the PAT.

Expert mode. A warning is displayed and confirmation requested before changing the PID of a table whose PID number is specified in the standard. A check mark next to the option in the menu indicates the mode selected. The mode is also indicated in the status bar:



In the **Section View** a **padlock**  symbol shows next to all of the fields that cannot be edited in the current mode. For example, the following screens show the same tables in **Standard** and **Expert** mode:

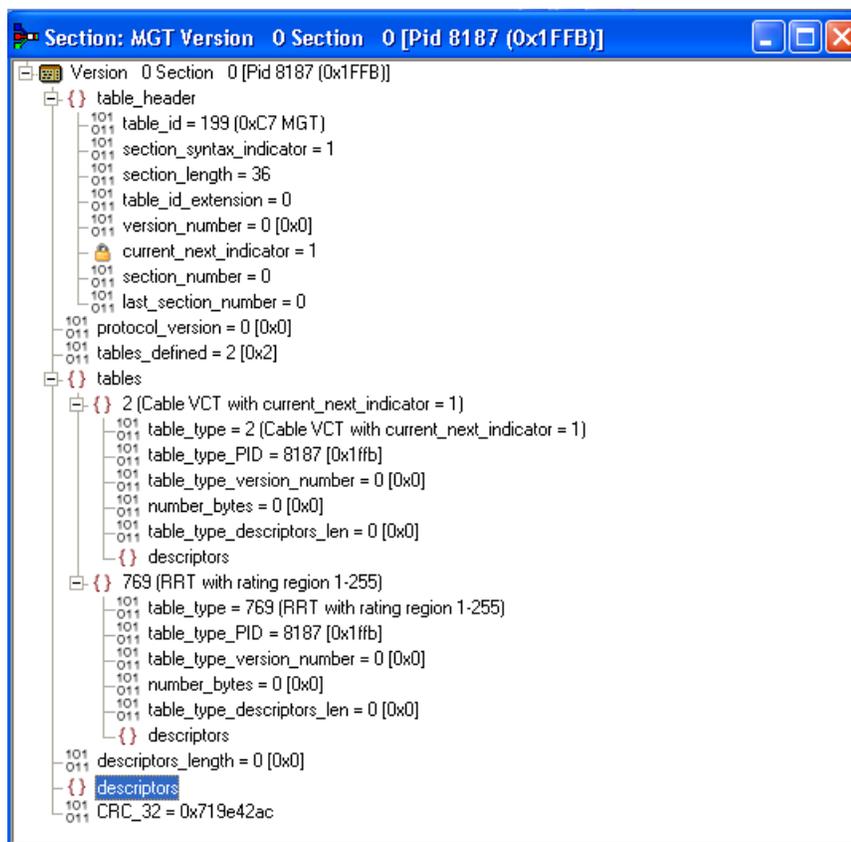


Figure 1: Expert mode

NOTE. The current next indicator in both Standard and Expert mode cannot be edited. This is because the field is affected solely by the Section Properties concerned with Version Timing. (See page 87.)

The selected mode is also reflected in the Wizards that are used to create of multiplexes. Elements that are restricted in the tables in Standard mode will also be restricted in the relevant wizard. Similarly, elements that are enabled in Expert mode will be enabled in the associated wizard:

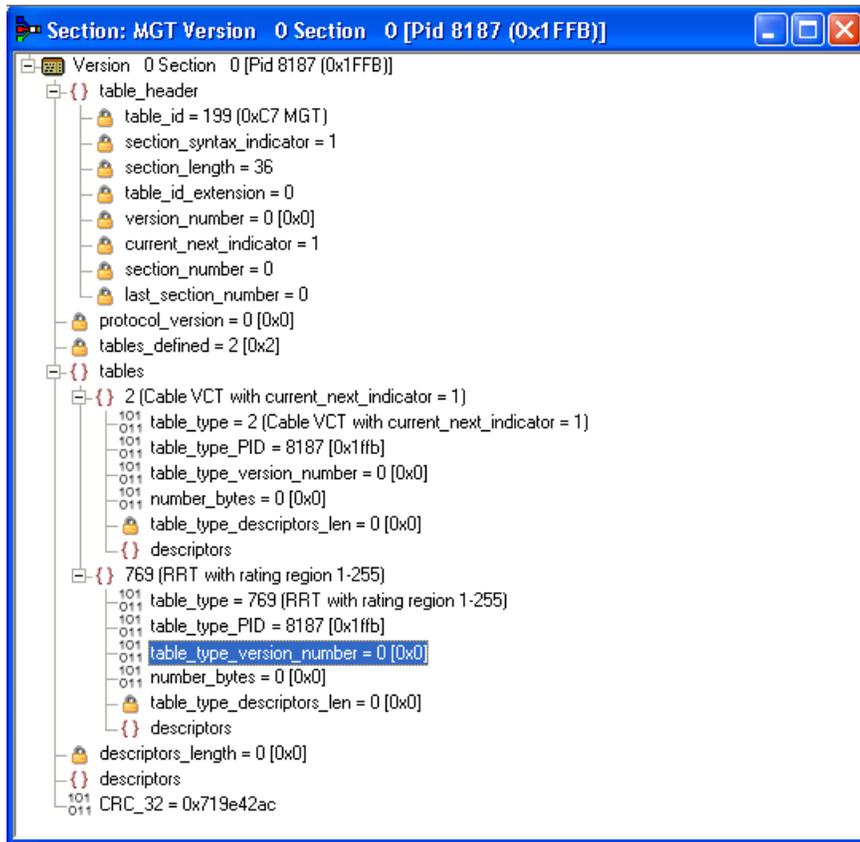
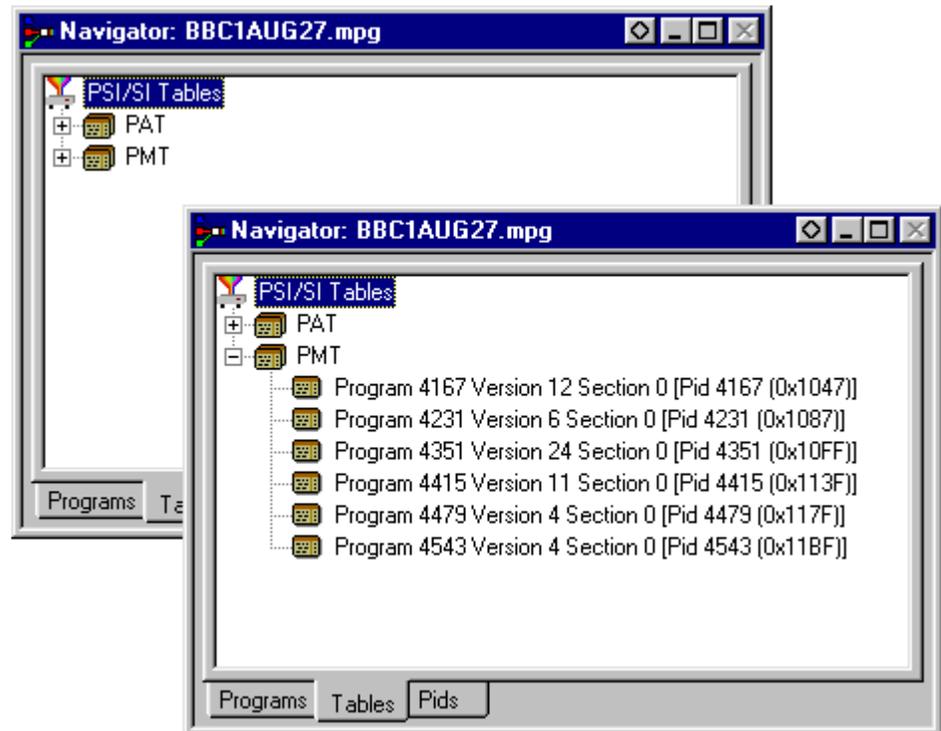


Figure 2: Standard mode

NOTE. The Section View may need to be closed and reopened to update the padlock icons.

Structure diagram manipulation

A tree diagram, with the **root node** or highest level component at the top represents the Transport Structure. Each **square box**  icon showing in the Transport Structure tree below indicates components containing more information beneath them in the structure:



Clicking on the box does not select that node. It only shows or hides the next level of detail under that node.

If the node has a minus sign in the box the level of detail below it is currently displayed. The lower level(s) may be hidden by clicking the mouse pointer on the box.

If the box contains a plus sign, there is another level in the node that is currently hidden. Click the mouse pointer on the box to display the next level of information under the node.

Components that are connected to a branch of the tree without a square box are leaf nodes; the accompanying icon indicates the node type. They display the lowest and finest level of detail available in this diagram. These are either a Section of a Table or a PID.

Fields in the **Section** view that cannot be edited directly are indicated by a **padlock**  symbol.

You can **disable** this protection by selecting **Expert Mode** from the **Multiplex** menu or enable this protection by selecting **Standard Mode**.

Event log

Messages about significant events are written to the Event Log from the time a file is first opened. You can open the Event Log for viewing at any time during or after the initial analysis. When the initial analysis is done, the mean transport rate, bit rate for each PEES PID, and a Demultiplex complete message are written in the **Event log**:

Category	Reference	Comment
Time	12:25:01	Demultiplex started
Information		Found PAT.
Error	Pid 8187	Section on pid 8187 (0x1ffb) has unknown table ID 199 (0xc7). Section is disc...
Error	Pid 8187	Section on pid 8187 (0x1ffb) has unknown table ID 200 (0xc8). Section is disc...
Information		Stream bitrate is 19.3927Mbit/s.
Information		Stream length is 31.0518s.
Information		Found 11 pids and 2 sections.
Time	12:25:02	Demultiplex complete. Demultiplex bitrate 513.803Mbit/s.

The start and end times for generating a new transport stream are shown by the Multiplexer started and Multiplexer completed messages.

Note that when demultiplexing and multiplexing streams, the bit rate at which the demultiplex or the multiplex is performed is given in the Event Log. This is in addition to the stream bit rate derived from the stream itself.

When synthesizing a new transport stream any errors or warnings about the new stream are written to the Event Log between the start and completed messages.

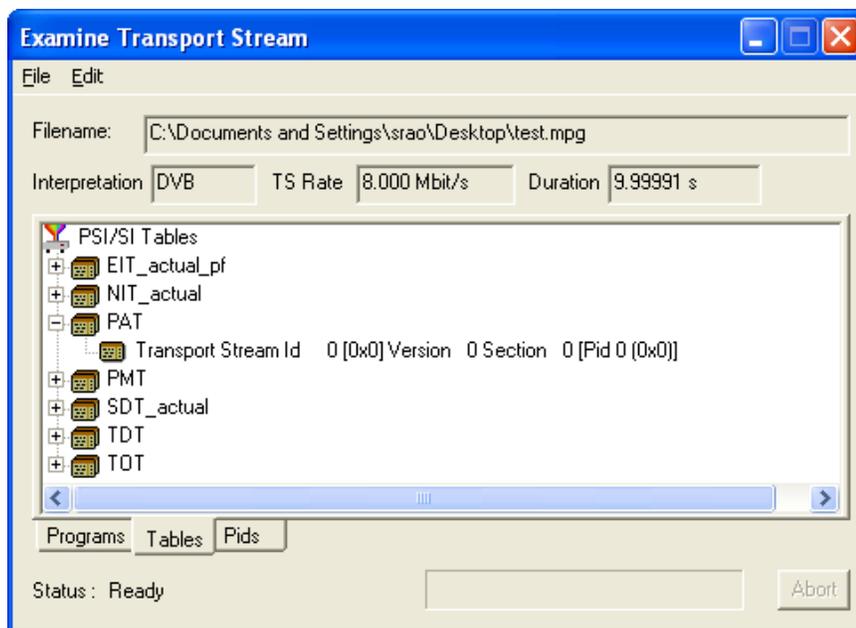
The Category column indicates the type of event. The subject or time of the event is shown in the Reference column and the details are given in the Comment column.

The complete text can be copied onto the Windows clipboard, using the Copy option from the shortcut menu. The text can also be cleared with the Clear command. Both commands are also available from the Edit menu.

Examine Transport Stream window

The **Examine Transport Stream** (Examine TS) window (**File > Examine TS**) performs two main functions within the Multiplexer:

- It allows you to take an overview of a transport stream before subjecting it to full analysis.
- It allows tables and programs to be dragged and dropped from the examined stream to the file that is currently open in Multiplexer:



Menu bar The **Examine TS** window menu bar contains only two items: the **File** and **Edit** menus.

The following table lists the items in the **File** menu:

Table 12: Examine TS - File menu options

Command	Function
Open	Analyzes and opens the selected file in the Examine TS window. Closes the current file.
Close	Closes the Examine TS window.

Edit menu. The following table lists the items in the **Edit** menu:

Table 13: Examine TS - Edit menu options

Command	Function
Copy	Copies the currently highlighted section to the clipboard.

File summary

These fields provide a brief summary of the analyzed file:

- **Filename:** The file name of the examined stream.
- **Interpretation:** The interpretation applied to the stream. This is the same as that selected in the Multiplexer application through the View menu: **MPEG-2, DVB, ATSC, or ISDB.**
- **TS Rate:** The transport stream bit rate derived from the stream.
- **Duration:** The duration of the transport stream.
- **Status:** The status of the stream analysis.

Navigator views

The Examine TS Navigator views correspond to the Navigator views in the main application. Programs, Tables, and PIDs are shown as they would be after a full analysis. The PSI/SI tables are expanded and collapsed in the same manner. The Section view is not available in the Examine TS window.

Examine TS section copy

While examining transport streams, it is possible to copy sections to the main multiplex using the standard Windows techniques: copy and paste or by dragging and dropping them with the aid of the mouse.

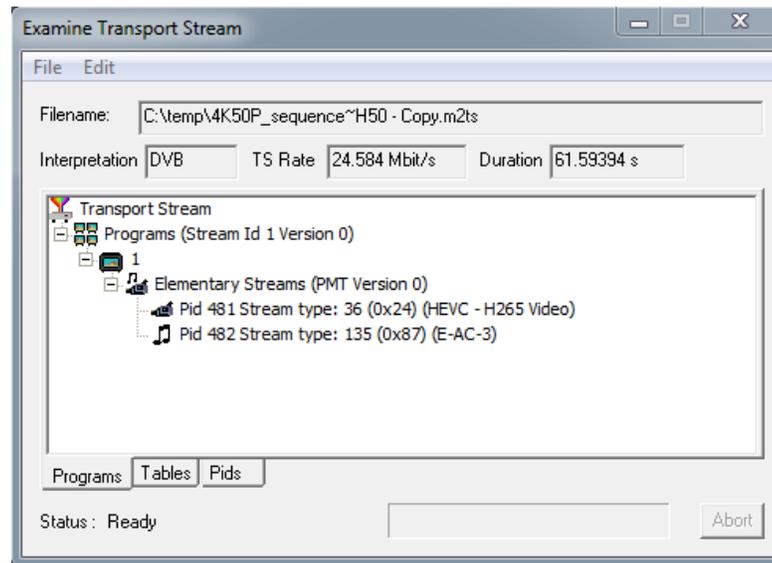
For example, to import a section that is visible in the Examine TS window into the new multiplex configuration:

1. Select the **Navigator Tables** view.
2. Highlight the section to be copied in the **Examine TS** window and do one of the following:
 - Select **Edit > Copy**. With the **Navigator Tables** view active, click **Edit > Paste**.
 - Using the mouse, place the cursor over the highlighted section, press and hold the left button on the mouse and drag the section onto the Navigator Tables view. Release the mouse button.
3. Note that the copied section is placed in the PSI/SI structure at the correct location. If any conflict arises concerning similar PID numbers, a new version is created.

Examine H.265/HEVC streams

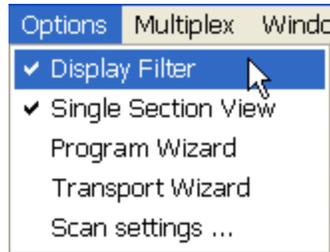
The Multiplexer allows you to copy H.265/HEVC elements or programs from another CBR transport stream file into a new file:

NOTE. *The Multiplexer will not import H.265/HEVC elements directly from disk.*

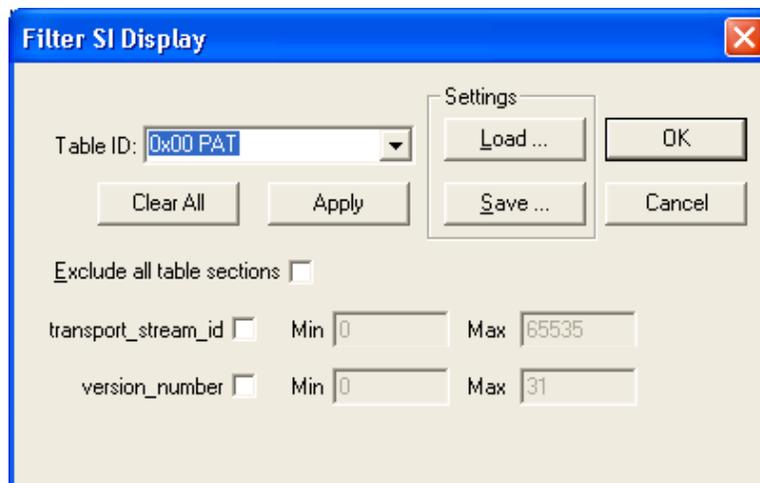


SI filtering

You can exclude Table elements from the **Navigator Tables** view by going to **Display Filter > Options > Display Filter**:

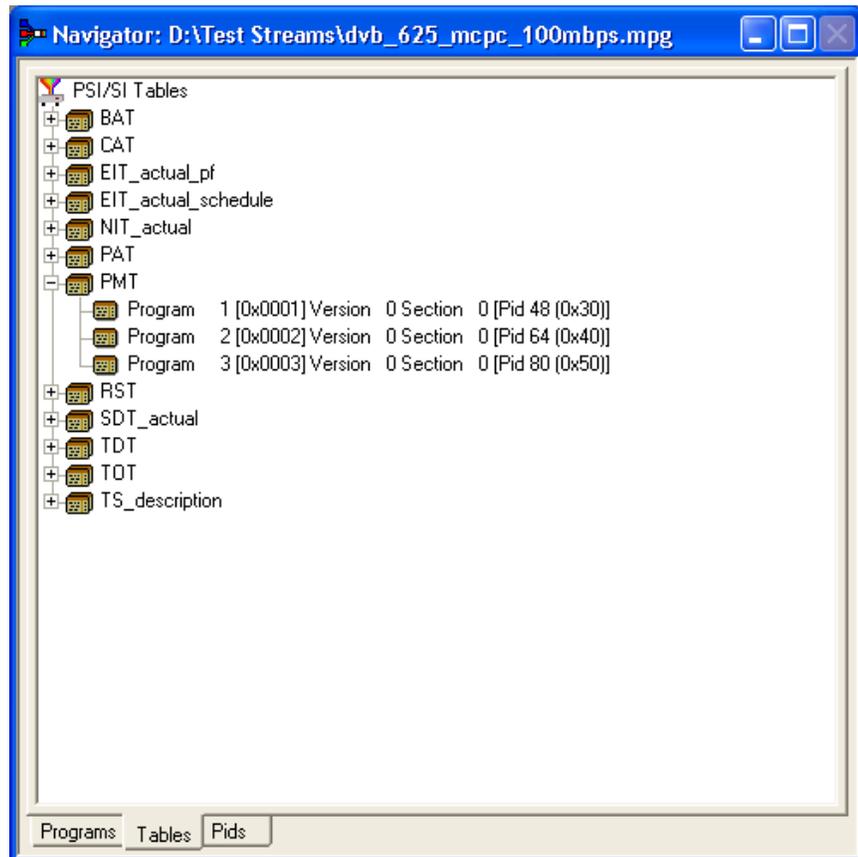


The following dialog box appears:

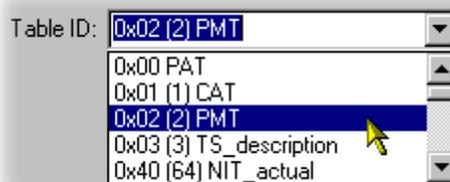


Selecting a table for filtering

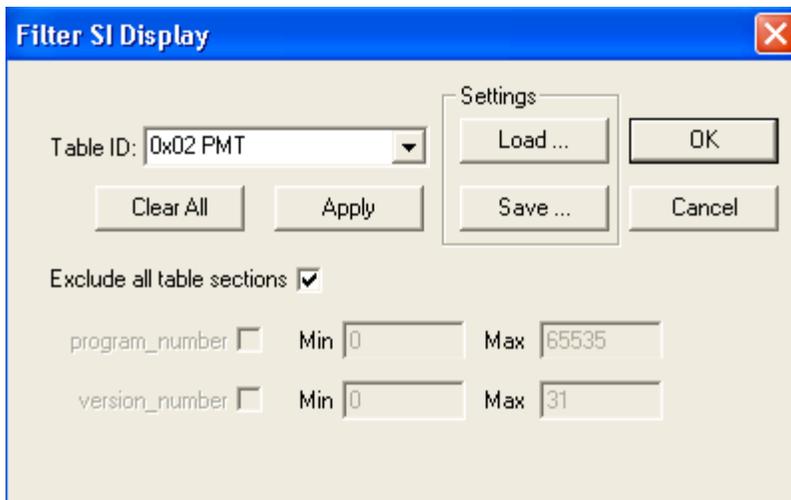
Example: Before filtering, the stream tree may be as shown below:



In the **Filter SI Display** dialog box, table identities are listed in the **Table Id** dropdown menu.

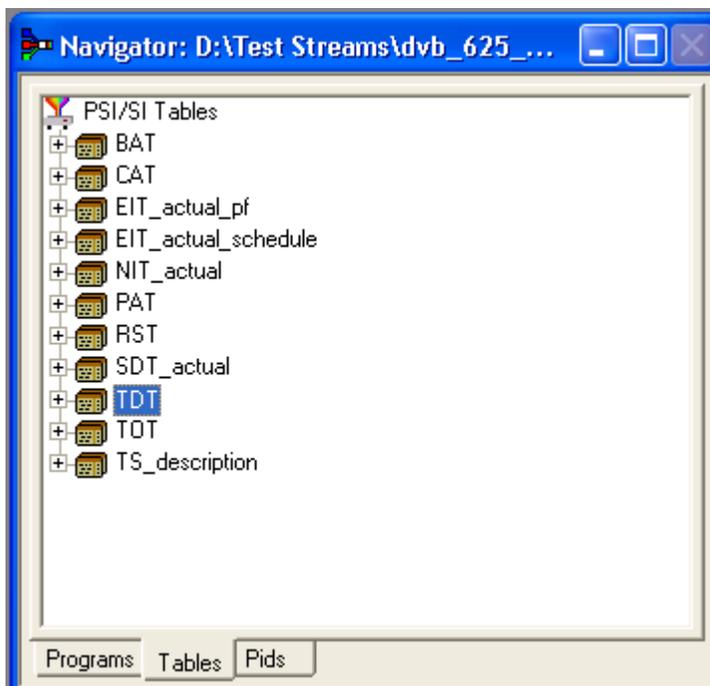


All sections of a table can be excluded by enabling the **Exclude all table sections** check box:



To preview the result of filtering, click the **Apply** button.

Note that all references to the PMT tables is removed as shown below:

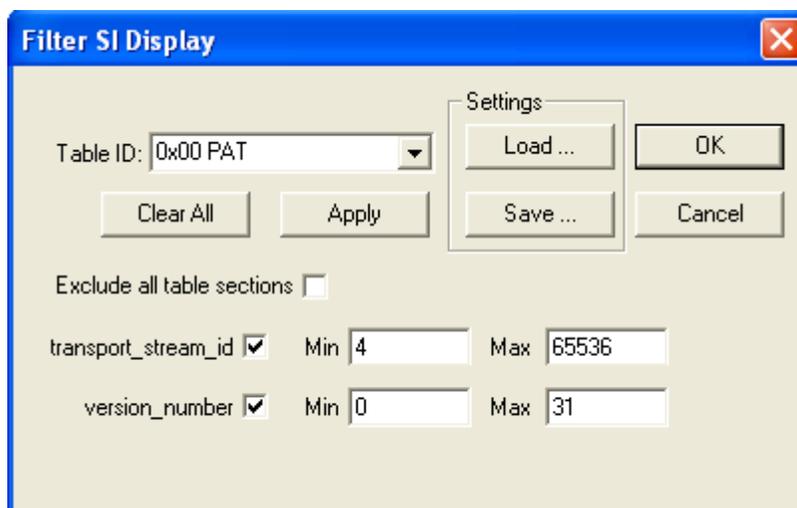


To exclude a range of sections, enable the section by selecting from the **Table ID** dropdown list and entering the required range.

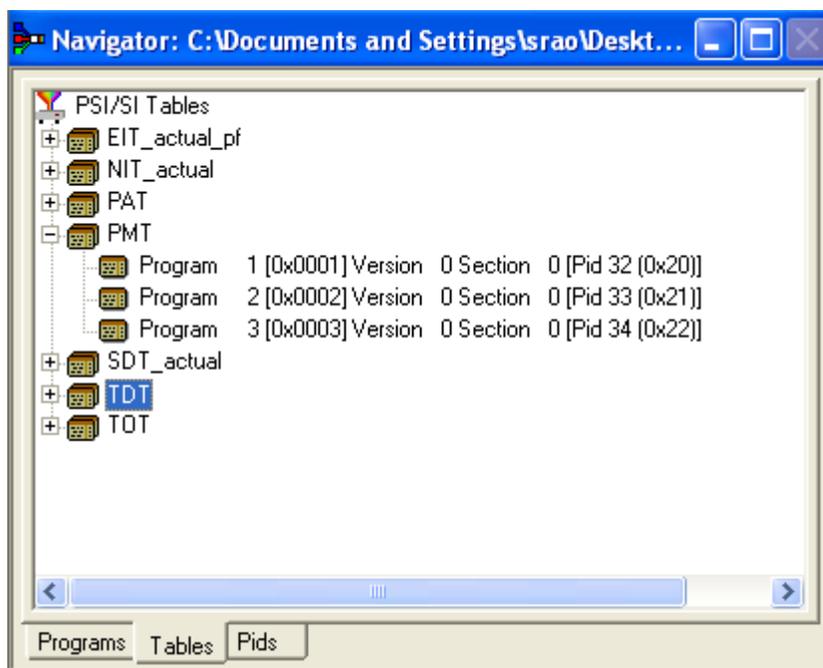
Note that section names shown in the dialog box change according to which table is selected.

To preview the result of filtering, click the **Apply** button.

For example, the following settings will result in the display as shown:



NOTE. Minimum and maximum values may be entered in either decimal (12345) or hexadecimal (0xA12B) format.



The parameters for each table must be set individually. Overall settings can be applied individually by selecting the **Apply** button when a setting is made or as a whole by making all of the settings and selecting the **OK** button.

To preview the result of filtering, select the **Apply** button. All settings can be cleared by selecting the **Clear All** button.

Note that filter settings remain in force for as long as the current multiplex is active. The settings are lost when the Multiplexer is closed unless they have been previously saved.

Saving/loading SI filter settings

The filter settings made in the **Display Filter** dialog box can be saved and subsequently reapplied to the same stream or other streams.

To save the current filter settings, select the **Save** button and enter a name (and location) in the **Save As** dialog box. To retrieve or load filter settings, select the **Load** button and identify the filter file in the **Open** dialog box. The file extension *.fil is used.

Component views

The Component views provide a graphical view of the bit rate and duration of the components of a stream. The management of the views has a number of common features; these are described in the *Common Features*.

Component Bit Rate view

The Component Bit rate view provides a graphical comparison of the stream components.

Open the **Component Bit rate** view either by selecting **View > Component Bit rate** from the menu bar or by using the toolbar button:



Each component includes the following information: **Program** name, **PID**, **Description** and the **Bit rate** in numerical and graphical form. Where appropriate, **Service ID** and **Service Name** will also appear (extracted from the SDT):

Program	Pid	Description	Bitrate (Mb/s)	Bitrate
1 Tektronix I				
	0x0082	MPEG-1/2 Audio	0.407349	
	0x0078	MPEG-1/2 Audio	0.094015	
	0x006e	MPEG-1/2 Video	2.029531	■
2 Tektronix II				
	0x00dc	MPEG-1/2 Audio	0.156667	
	0x00e6	MPEG-1/2 Audio	0.094015	
	0x00d2	MPEG-1/2 Video	4.007894	■
3 Tektronix III				
	0x0140	MPEG-1/2 Audio	0.219347	
	0x014a	MPEG-1/2 Audio	0.156682	
	0x0136	MPEG-1/2 Video	5.031631	■
4 Tektronix IV				
	0x01a4	MPEG-1/2 Audio	0.282018	
	0x01ae	MPEG-1/2 Audio	0.219356	
	0x019a	MPEG-1/2 Video	10.059628	■
5 Tektronix V				
	0x0208	MPEG-1/2 Audio	0.407360	
	0x0212	MPEG-1/2 Audio	0.282012	
	0x01fe	MPEG-1/2 Video	15.168662	■

Component Duration view

The Component Duration view provides a graphical view of the timing and duration of each program/component within the current stream. Adjustments can be made to the duration of each component.

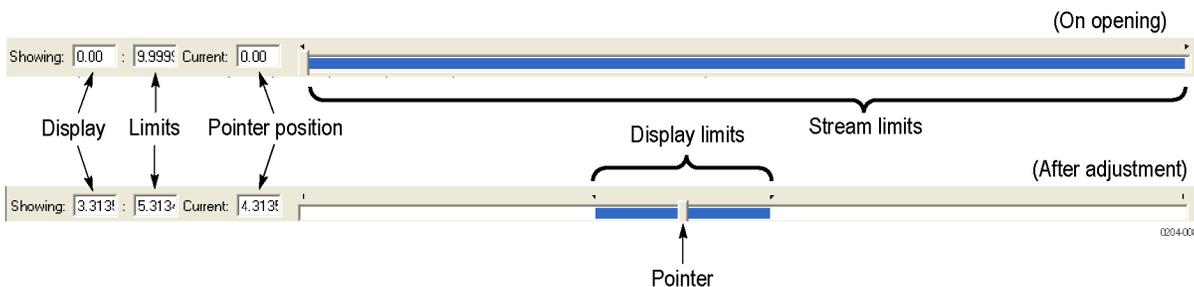
Open the **Component Duration** view by selecting either **View > Component Duration** from the menu bar or by using the toolbar button:



Program	Description	Pid	Start	Stop	Length	Extent
1	Tektronix I		0.00	59.84	59.84	
	MPEG-1/2 Video	110	0.00	59.84	59.84	
	MPEG-1/2 Audio	130	0.00	59.32	59.32	
	MPEG-1/2 Audio	120	0.02	59.32	59.30	
2	Tektronix II		0.00	59.84	59.84	
	MPEG-1/2 Video	210	0.00	59.84	59.84	
	MPEG-1/2 Audio	220	0.01	59.16	59.15	
	MPEG-1/2 Audio	230	0.02	59.28	59.25	
3	Tektronix III		0.00	59.82	59.82	
	MPEG-1/2 Video	310	0.00	59.82	59.82	
	MPEG-1/2 Audio	320	0.01	59.32	59.31	
	MPEG-1/2 Audio	330	0.01	59.22	59.21	
4	Tektronix IV		0.00	59.80	59.80	
	MPEG-1/2 Video	410	0.00	59.80	59.80	
	MPEG-1/2 Audio	420	0.01	59.26	59.25	
	MPEG-1/2 Audio	430	0.01	59.25	59.24	
5	Tektronix V		0.00	59.82	59.82	
	MPEG-1/2 Video	510	0.00	59.82	59.82	
	MPEG-1/2 Audio	520	0.00	59.31	59.30	

The following data is displayed for each component of the stream: Program, Description, PID, Start and Stop time (in numerical and graphical form), Length and Bit rate. The timing and bit rate elements of this information are also available in the **Program Stream Properties** dialog box. (See *Program Content Dialog Box*. (See page 37.)

Scaling bar. The **Scaling** bar, which appears at the top of the **Component Duration** view, allows you to select the portion of the Transport Stream you wish to see:



The *Stream limits* bar represents the full extent of the stream. The *Display limits* bar (dark portion) indicates the portion of the stream that is currently displayed in the body of the view.

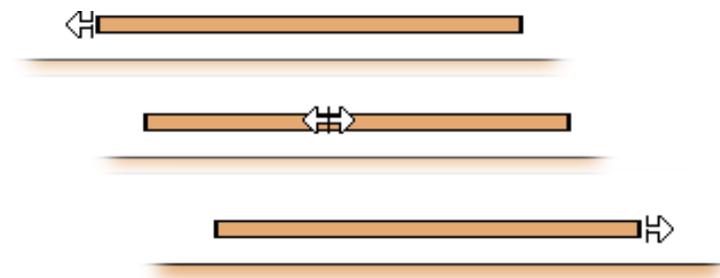
The *Display limits* fields indicate the extents of the *Display limits* bar and the current *Pointer* position.

The *Pointer* can be dragged to a new position on the *Stream limits* bar. The *Display limits* bar will center on the *Pointer*.

Duration control. The duration of each element in the stream is given by the Start and Stop values and shown graphically by the associated bar. The components are color coded according to which program group they belong to.

The Start, Stop and Length values can be changed by clicking on the appropriate field and entering the required value. The associated bar will reflect the change.

The Start, Stop and Length values can also be changed graphically by manipulating the bar. The cursor shape indicates the action that can be taken:



The changes are reflected in the associated field values.

Components can be changed individually. In addition, whole Program groups can be changed by manipulating the Program duration bar, but only when the view is sorted by Program:

Program	Description	Pid	Start	Stop	Length	Extent
1	Tektronix I		11.21	49.76	38.55	
	MPEG-2 Audio	120	14.49	38.17	23.68	
	MPEG-2 Audio	130	11.21	49.76	38.55	
	MPEG-2 Video	110	11.21	49.76	38.55	
2	Tektronix II		0.00	59.84	59.84	

A vertical dotted line indicates the upper limit of the multiplexed stream.

In the Transport Stream Properties dialog box (**View > Properties** with the **Transport Stream** node highlighted in the **Navigator Programs** view), you can determine how and if the stream duration is updated. The available options will be:

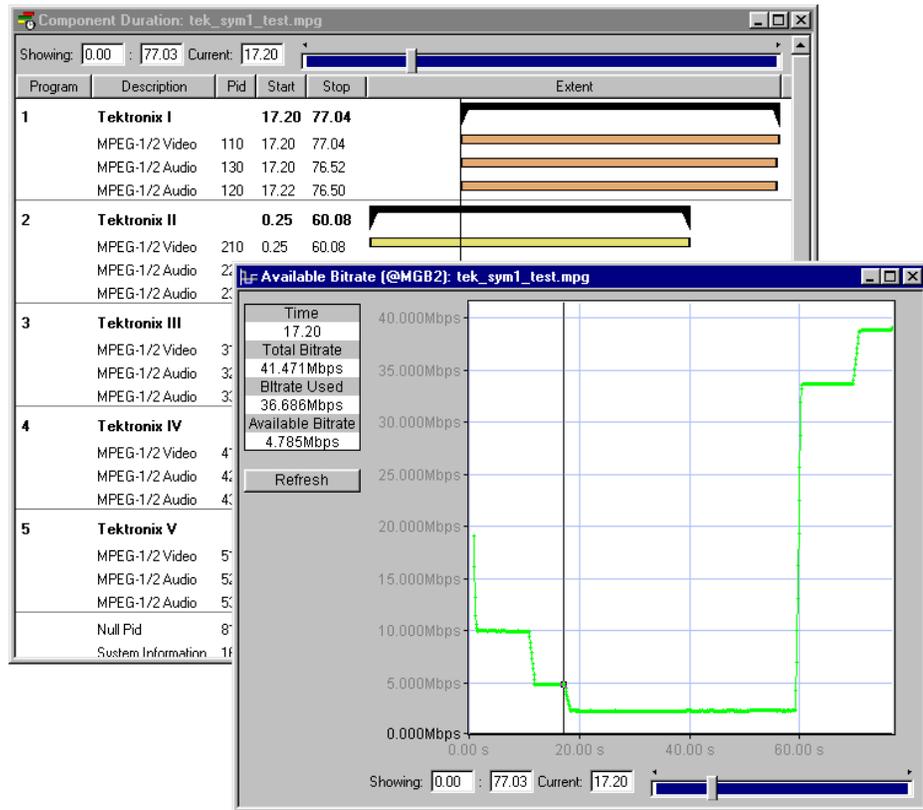
- Select **Fixed** to ensure that the stream duration can only be updated in the Stream Properties dialog box.
- Select **Set** to the greatest component stop time to ensure that the stream duration is set to the greatest stop time recorded in the **SI / PSI / PSIP** tables.

Component start and stop times changed in the Component Duration view are automatically updated in the **SI / PSI** tables.

Available Bit Rate view

The **Available Bit rate** view displays in graphical form the available bit rate for the duration of the multiplex.

The bit rate is calculated using the MGB2 measure (Ref: ETSI TR 101 290). Open the **Available Bit rate** view by selecting **View > Available Bit rate** from the menu bar or by using the toolbar button:



If the bit rate falls below zero, the points will be highlighted in red. When editing a multiplex, you can add components which cause the bit rate to fall below zero and no warnings will be displayed. However, if a transport stream is then generated, errors will be logged and displayed in the Log view.

Use **Refresh** to redraw the graph. Clicking anywhere within the graph will place a vertical cursor at that point; the position and bit rate are displayed in the **Time** and **Available Bit rate** fields.

The zoom level and cursor placement of the **Available Bit rate** and the **Component Duration** views can be synchronized by selecting **View > Synchronize**.

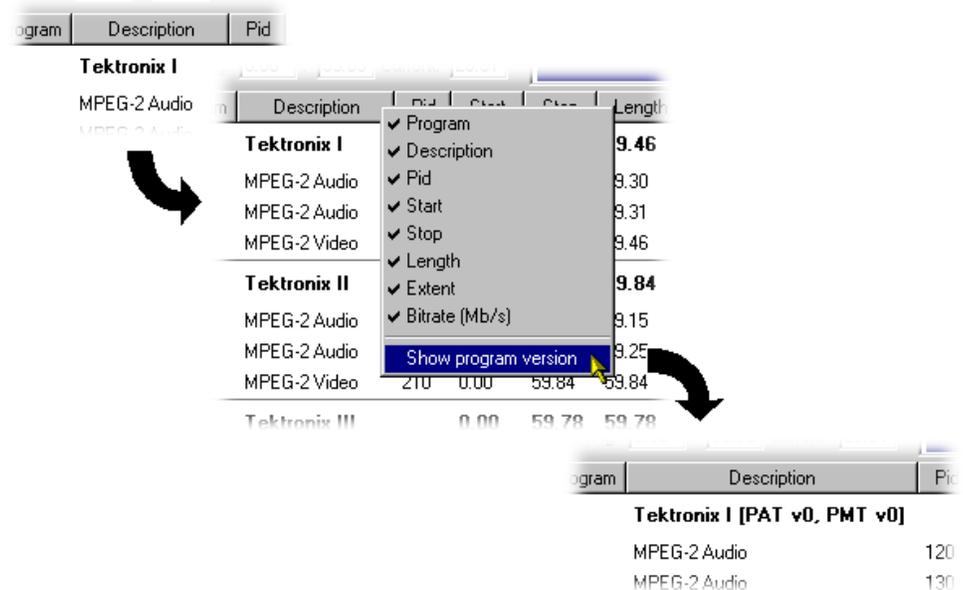
Common features

Columns in the **Component** views can be sorted and rearranged to suit your preferences. Column management in the two Component views is similar.

Field selection. You can select the **fields** you wish to see in each **Component** view. The **Header** bar indicates which are the fields that currently show.

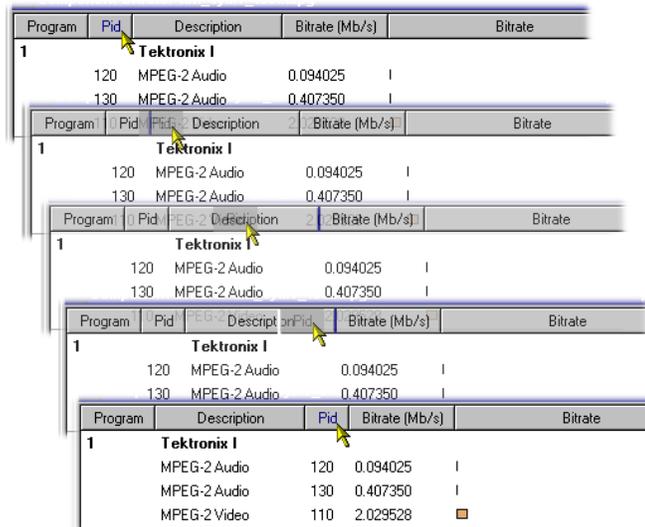
When you right-click on the **Header** bar, a menu appears. You can select which fields you wish to view. A check mark next to a field name indicates that the field display is currently enabled.

You can view the version number of the **PAT** and **PMT** in the **Description** column by enabling the **Show program version** option in the shortcut menu from the **Description** column header:



Similarly, you can show the PID numbers in hexadecimal, by selecting **Display** in hexadecimal from the **PID** column shortcut menu.

Column repositioning. You can reposition **Columns** as required. Click and drag the column to the required position:

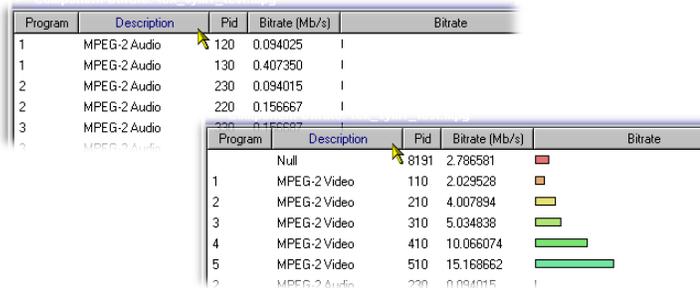


Column width. You can resize **Columns** as required. Place the cursor over the dividing line between two columns; it will change to the resizing cursor. Click and drag the column to the required width. The change will be made to the column to the left of the cursor:



Double-clicking the column divider will automatically resize the column to the left to the optimum size required to view the content.

Column sort. You can sort **Columns** in ascending or descending order. Click the cursor on the heading to sort the column. Clicking again will sort the column in reverse order:



Similarly, the columns can be grouped in Program order, by clicking the **Program** header.

Common menu options

The specifications for components of the various views can be manipulated by options from the Edit menu, View Menu, and Toolbar.

A shortcut menu also provides the **Add, Modify, Delete, Import, Export** and **Properties** options. Place the mouse pointer over the component to change and click the right mouse button to open the menu.

A typical shortcut menu is shown here:



The menu options are context-sensitive and will be enabled or disabled according to the current selection in the view.

The following options are available from the various shortcut menus:

Add	Adds a component to the currently selected item.
Modify	Opens the properties dialog box.
Delete	Deletes the currently selected component.
Properties	Opens a properties dialog box for editing the currently selected item.
Export Payload	Extracts and exports the payload of the source transport stream in the form of a simple data file.
Export Elementary Stream	Removes the transport stream and PES headers and exports the remaining information in the form of a simple data file.
Export Section Data	Extracts and exports section data. The created file can be imported as ES using Multiplexer's Add function or as SI using the Import Section Data... option.
Import Section Data	Imports SI data from a file and analyzes it. The section is added to the Navigator view.

Multiplexer - Editing in the navigator views

Multiplexer provides a variety of ways of building and modifying transport streams for multiplexing. In addition to the Menu Bar options and Toolbar shortcuts built into the Multiplexer, many of the operations can be carried out using familiar drag and drop Windows techniques.

In the following descriptions, the alternative methods for carrying out a task are given at the head of the section, but only one method is described for each action. Other methods for the same action often invoke the same dialog boxes and sequence of follow-on actions.

Dragging and dropping

To drag a file, click on its **name** and hold down the left button of the mouse while dragging the file to the required location. The cursor will change according to the background that it is dragged over:



(With Ctrl key held) when dropped, the file will be copied.



When dropped, the file will be moved (cut and pasted).



When dropped, no action will be taken.

Note that as the file is dragged over elements in the Navigator, receptive elements (elements where the file can be meaningfully dropped) will be highlighted.

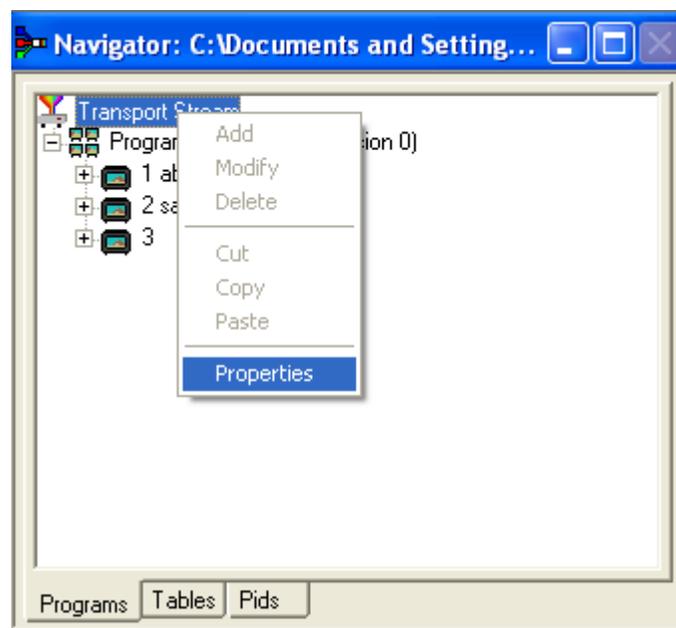
Transport stream

Opening an MPEG file For information on *Opening a Stream*, (See page 13.)

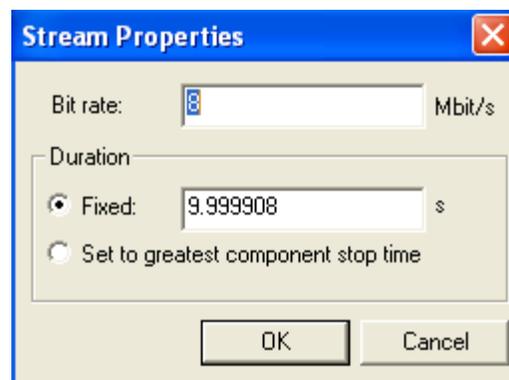
Opening a Multiplexer file For information on *Opening a Stream*, (See page 13.).

Changing transport stream bit rate and duration To specify a new **Bit rate** or duration for the transport stream, select and highlight the **Transport Structure** component in the **Navigator** view.

From the shortcut menu, select **Properties**. The dialog box will be displayed as shown:



Edit the **Bit rate** and **Duration** as required. Click the **OK** button:



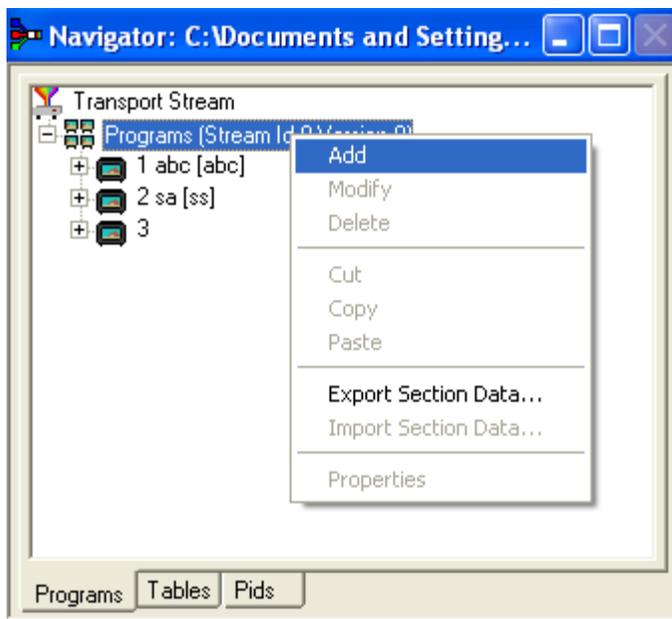
Programs

The introduction of the Navigator Programs view has provided a more program-centered means of manipulating SI/PSI. Whole programs can be added to the multiplex and the application will update the associated tables, including the PAT and PMT.

Note that the nodes of the tree structure in the Navigator Programs view are context sensitive. When dragging and dropping files from either the Examine TS window or from another instance of Multiplexer, a node will be highlighted as the cursor passes over it only when the operation proposed is valid. Note that there may be a short delay before the node is highlighted while the legality of the operation is checked.

Adding a new program

With the **Transport Stream ID** field highlighted in the **Navigator Programs** view, select the **Add** option either from the shortcut menu (PAT highlighted in Navigator Programs view) or the Menu Bar (**Edit > Add**) to open the **Program Wizard**: (See page 34.)



In the Navigator Programs view, the PAT is represented by the Transport Stream ID field.

Copying/moving a program

Methods available:

- Drag and drop (copy only) from the Examine TS window (Programs view) to the Navigator Programs view.
- Drag and drop (copy/move) from another instance of Multiplexer to the Navigator Programs view.

In the Navigator Programs view, programs can only be dropped onto the PAT node.

Tables

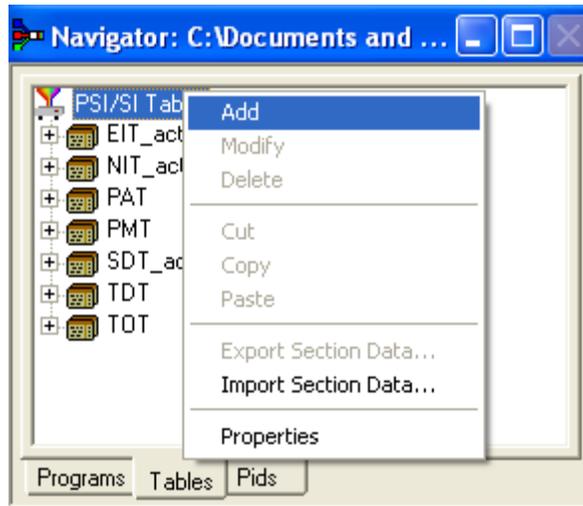
Adding a new PSI/SI table

Methods available:

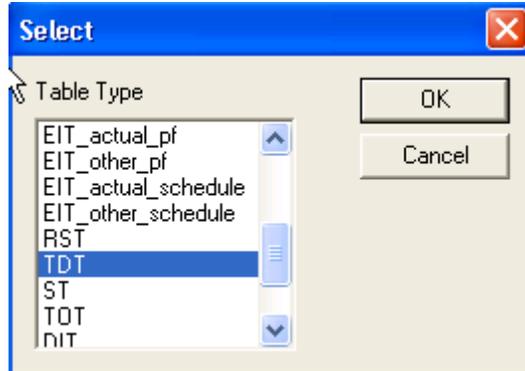
- Highlight the PSI/SI Tables level in the Navigator Tables view and select Add from the shortcut menu.
- Drag and drop (copy only) from the Examine TS window (Tables view) to the Navigator Tables view.
- Drag and drop (copy/move) from another instance of Multiplexer to the Navigator Tables view.

Any table that is defined in the selected standards, and not already present, can be added to the transport stream. To add a **table** to the **Transport Stream**, click **PSI / SI Tables** in the **Navigator Tables** view:

1. Highlight the **PSI / SI Tables** level and select **Add** from the shortcut menu:



This will open the **Select** dialog box. The dialog box displays a list of the table types that are not already present in the stream:



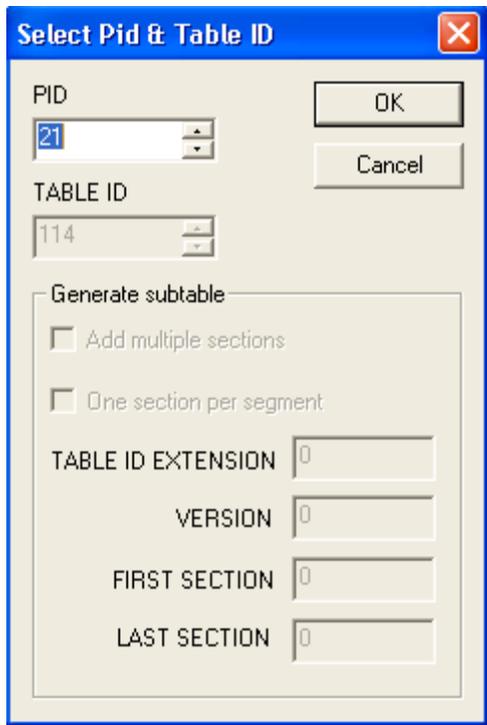
NOTE. A **PAT** table cannot be added when **ISDB** interpretation with **Single segment extension** is selected.

2. Select the required table type and click **OK**.

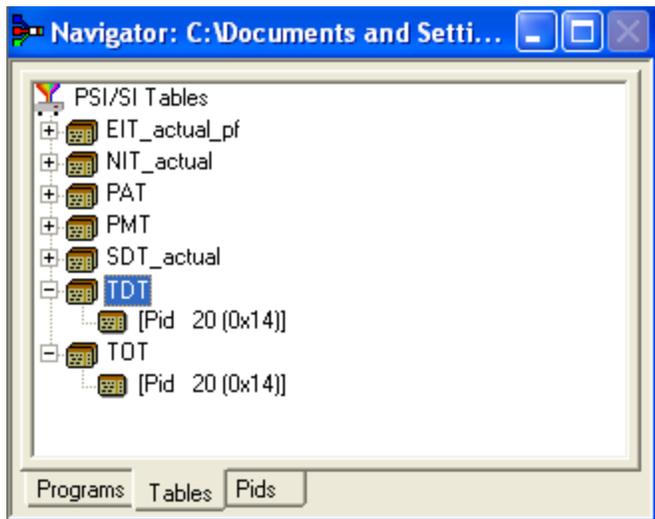
Pressing **Cancel** will abandon the operation without adding a new table.

Only the table types that are not currently specified for the stream are listed. If the required table type is not listed, press the **Cancel** button to close the dialog box without affecting the specification for the stream.

The **Select PID & Table ID** dialog box is displayed only if you need to identify a **PID** and/or **Table ID** . Otherwise, the selected **Table** type is automatically created:



A single section is automatically added to the newly created table type:



Copying a PSI/SI table

Methods available:

- Drag and drop (copy only) from the **Examine TS** window (**Tables** view) to the **Navigator Tables** view.
- Drag and drop (copy/move) from another instance of **Multiplexer** to the **Navigator Tables** view.

Tables can be copied (or moved) from existing multiplexes, using either of the available methods.

If a similar table type is already present in the multiplex, the contents of the copied table will be integrated with it.

Deleting a PSI/SI table

A table is automatically removed when the last section is deleted (See page 90.)

Exporting a table

For more information, see *Exporting a Section*. (See page 90.)

Importing a Table

For more information, see *Importing a Section*. (See page 91.)

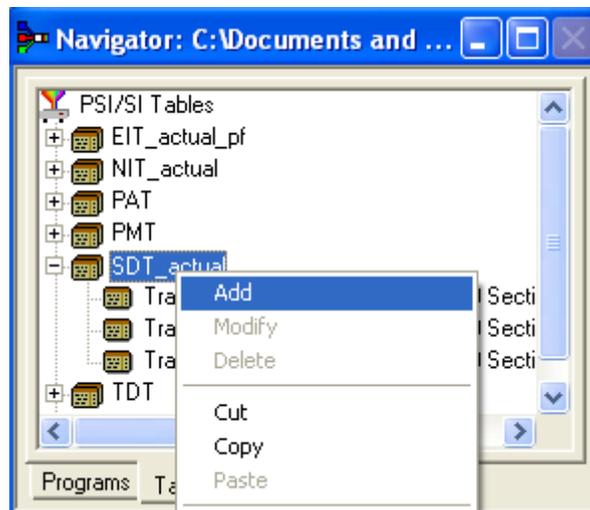
Sections

Adding a new section to a PSI/SI table

Methods available:

- Highlight the parent table level in the **Navigator Tables** view and select **Add** from the shortcut menu.
- Drag and drop (copy only) from the **Examine TS** window (**Tables** view) to the **Navigator Tables** view.
- Drag and drop (copy/move) from another instance of **Multiplexer** to the **Navigator Tables** view.

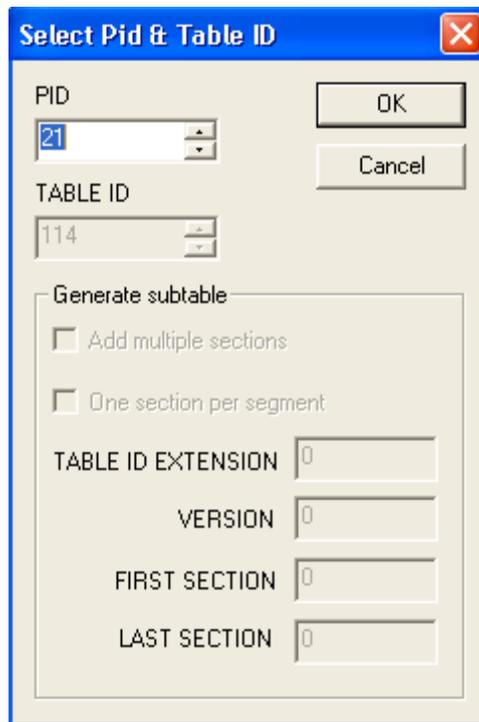
To add a section to a table, select the parent table in the **Navigator Tables** view. For example, to add a section to the **SDT**, select **SDT Tables**:



Then select **Add** from the shortcut menu.

The select **PID & Table ID** dialog box appears only if a **PID & Table ID** need to be identified. Otherwise the selected section is automatically created.

Select the required **PID & Table ID** (where enabled) and press **OK**:



Clicking **Cancel** will abandon the Add operation without adding a new section.

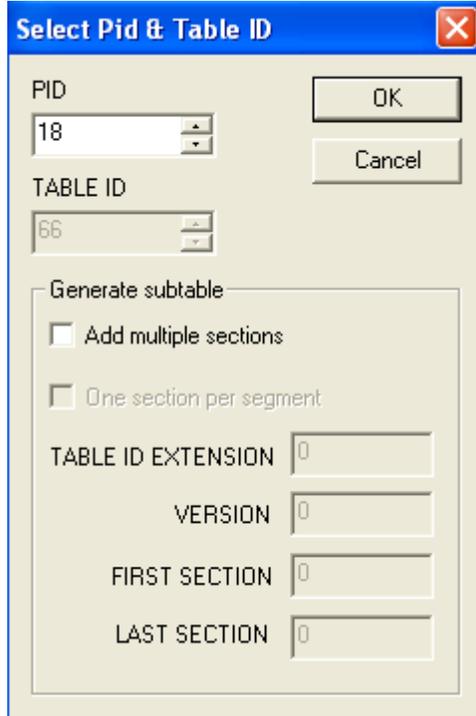
The version/section of a table is created with a new version or section number. The rules used by Multiplexer for numbering are:

- For tables that the selected standard dictates should always have a section number of 0, the version number is increased by one. The new version number is based on the version currently in the table with the most recent number. The version_number is a 5-bit field, so if the new version would be 32, it is reset to 0.

$$versionnumber_{NEW} = (versionnumber_{RECENT} + 1) \text{ modulo } 32$$

$$version_number_{NEW} = (version_number_{RECENT} + 1) \text{ modulo } 32$$

- For any table type that allows a `section_syntax_indicator`, the **Add multiple sections** check box in the **Generate subtable** field is enabled. Additionally, the **One section per segment** check box will only be enabled for the EIT schedule table type:



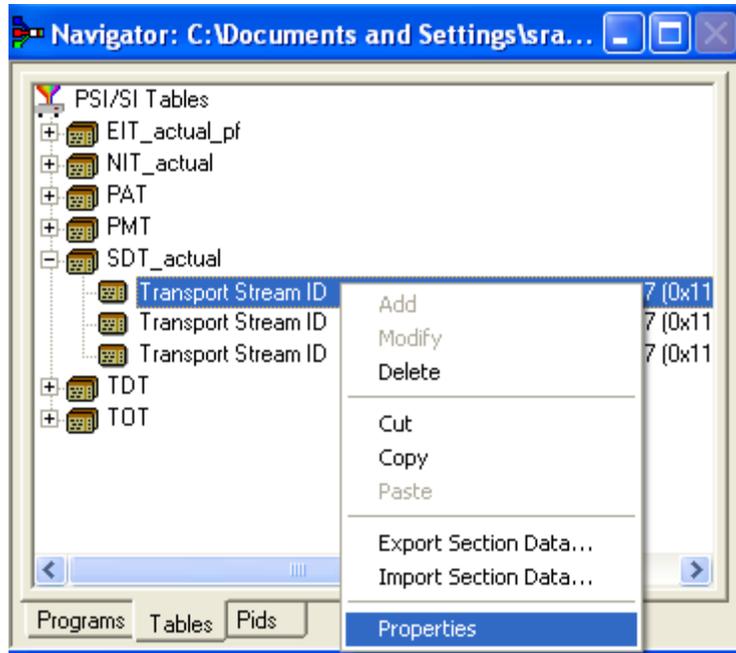
The screenshot shows a dialog box titled "Select Pid & Table ID". It features two spinners: "PID" set to 18 and "TABLE ID" set to 66. There are "OK" and "Cancel" buttons. A "Generate subtable" section contains two checkboxes: "Add multiple sections" (checked) and "One section per segment" (unchecked). Below these are four input fields: "TABLE ID EXTENSION" (0), "VERSION" (0), "FIRST SECTION" (0), and "LAST SECTION" (0).

- Up to 256 sections can be added.
- Additions to existing subtables using the same Table Id Regions and Versions will be rejected.
- When multiple **EIT Schedule** sections are being added, the One section per segment check box is enabled. When it is checked, only the first section in each segment will be created, rather than all sections numbered between First section and Last section.

When dragging and dropping a section, the **Multiplexer** will resolve any numbering conflicts by creating **new** versions of duplicated tables.

Editing PSI / SI table properties

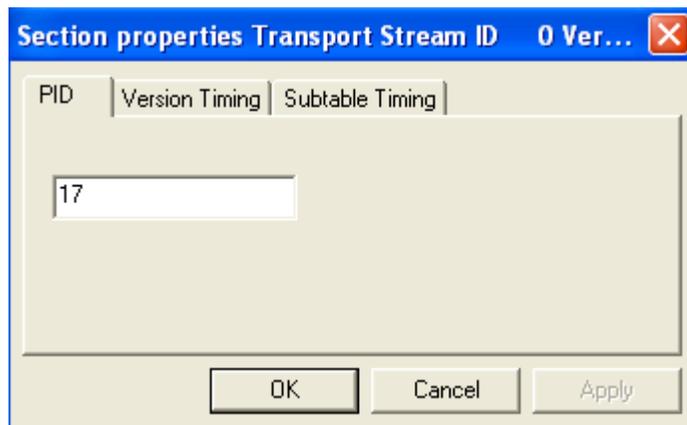
You can add **Table** and **Section Properties** by selecting and highlighting one of the versions/sections within the transport structure and selecting the **Properties** option from the shortcut menu:



This opens a dialog box with four tabs, one for each property. Depending on the type of table, properties can be applied to a specific version or section of the table. The **Multiplexer** allows only operations that make sense in the context of the selected table type.

Properties that can be edited in the **Navigator Tables** view are:

PID number. The **PID** tab appears by default when you open the **Section Properties** dialog box:

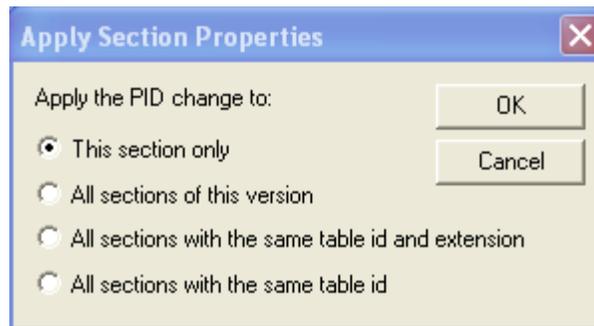


Edit the value and select **OK** to change the **PID** number.

Edit the value and select **Apply** to make the changes and update the other properties (tabs) without having to close this dialog box.

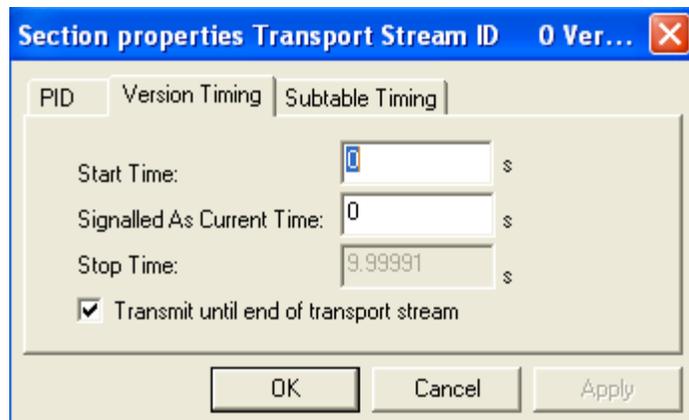
Multiplexer checks the new **PID** number against the selected standards and warns of any nonconformance. If a conflict is found, a warning message is displayed, with the option to continue. **Multiplexer** also checks for conflicts with other PIDs. If the new PID number conflicts with an existing PID, an error message is displayed and the change is rejected; in this case, either choose a different PID number for the table or edit the number of the PID that is currently the owner.

If no conflict is found, another dialog box is opened to define the scope of the changes:



Select the required scope and click **OK**. Selecting **Cancel** will abandon the change.

Version timing. The **Version Timing** tab shows the time when the version will become current, and the start and end times. New values may be specified for any of these times:



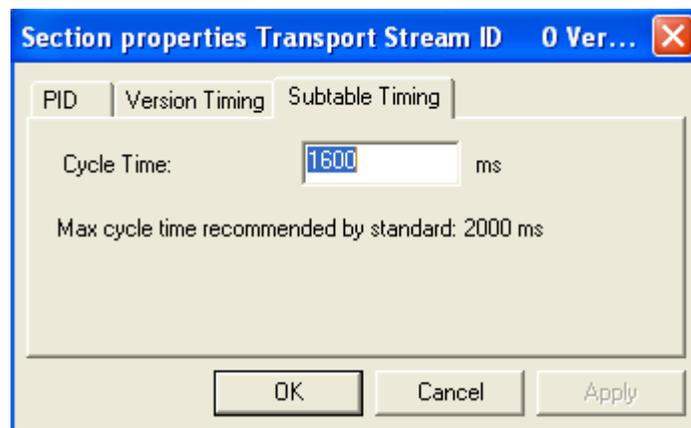
Start Time	Specifies the time at which sections of this version will start to appear in the transport stream.
Signalled As Current Time	Controls the time when the sections with this version will have the <code>current_next_field</code> set to 1. By default when these sections start to appear in the transport stream, the <code>current_next_field</code> of the section set to 0. To specify a version that is always current set the Start Time and Signalled As Current Time fields to the same value.
Transmit until end of transport stream	Enables the section to be repeated until the end of the transport stream. If the check box is disabled, the Stop Time becomes active.
Stop Time	Specifies the time after which no sections of this version will appear in the transport stream.

All the times are in seconds, taken from the start of the transport stream file. The default start time for PAT is 0.00 s and for PMT is 0.001 s.

Edit the values and select **OK** to change the timings. Edit the values and select **Apply** to make the changes and update the other properties (tabs) without having to close this dialog box.

Subtable timing. Service information is usually constrained to appear at regular intervals in the transport stream. This is usually implemented as a maximum time between appearances of all the sections of a subtable (where a table is defined by the `table_id`, `table_id_extension` and `version_number` on the same PID).

Use the **Subtable Timing** tab to specify the desired and the maximum acceptable period between instances of the subtable. When an MPEG file has been opened, this shows the mean time between instances of the subtable in the **Transport Stream**:



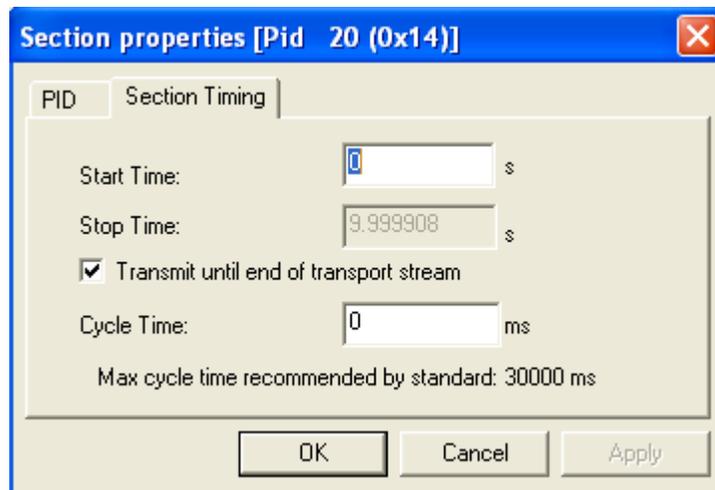
Cycle Time shows the mean time between instances of the subtable specified for synthesizing a new MPEG file. Edit the value can be to specify a different cycle time.

Below **Cycle Time**, the dialog box displays subtable specific information from the currently selected standard.

Edit the values and select **OK** to change **Cycle Times**. Select **Apply** to make the changes and update the other properties (tabs) without having to close this dialog box.

When synthesizing a new transport stream, the multiplex engine tries to insert the subtable at the frequency specified by the **Cycle Time**. An error message is written to the event log whenever a subtable cannot be multiplexed into the stream within the period specified by the maximum cycle time.

Section timing. Where a table can contain only a single section (for example, TOT and TDT), a **Section Timing** tab appears in the **Section properties [Pid ...]** dialog box:



Start Time	Specifies the time at which the first appearance of this section will occur.
Stop Time	When enabled, specifies the time at which the last appearance of this section will occur.
Transmit until end...	When enabled, specifies that the section should be transmitted until the end of the stream.
Cycle Time	Specifies the interval at which the section should be transmitted.
Max cycle time...	Gives the cycle time recommended by the current standard.

Edit the values and click **OK** to change the timings. Click **Apply** to make the changes and update the other properties (tabs) without having to close this dialog box.

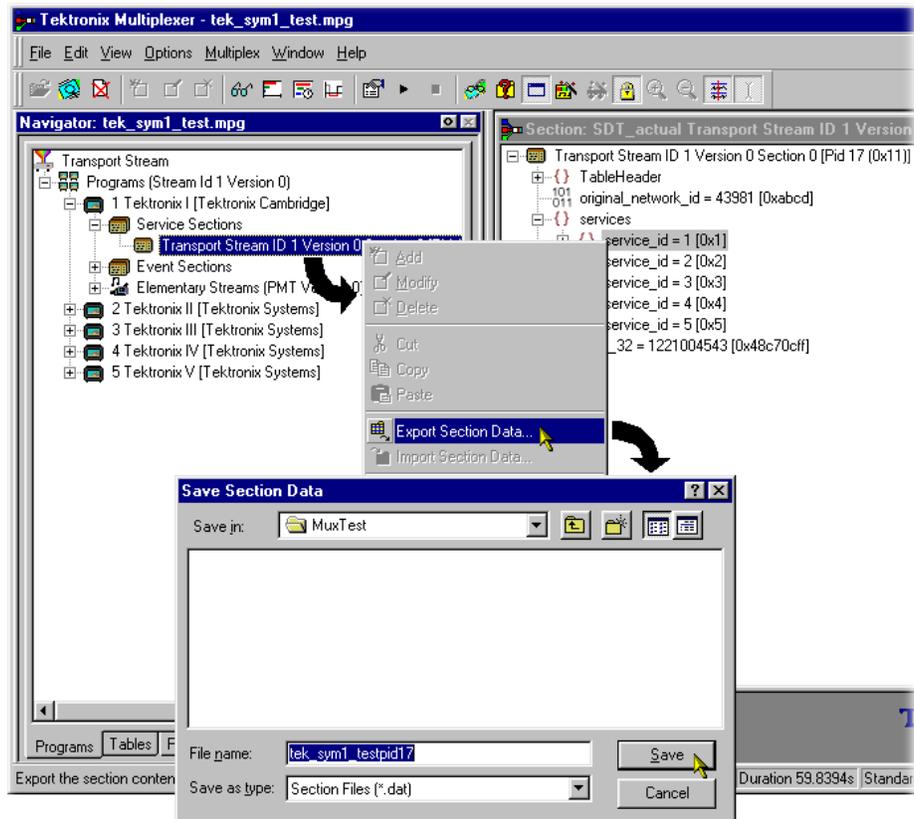
An error message is written to the event log when a table cannot be multiplexed in accordance with the timings set.

Deleting a section Highlight a section in a table in the **Navigator Tables** view and select **Delete** from the shortcut menu. To delete more than one section, select and delete each one in turn. When the last section is deleted from a table, the table is automatically deleted from the structure.

Exporting a section Section data can be exported in the form of a binary file. In the **Navigator Tables** view, highlighting a **Table node** (for example, PMT Tables), allows you to export all sections of the table. Similarly, highlighting a single section entry (for example, Program 123) allows you to export only that section.

Highlight the required section or **Table node** in the **Navigator Tables** view. From the shortcut menu, select **Export Section Data**. Name the file you want to create and choose a location. Select **Save** to confirm the action.

Individual sections can also be exported using the **Navigator Programs** view. Select the required section to be exported. From the shortcut menu, select **Export Section Data**. Name the file you want to create and choose a location. Select **Save** to confirm the action. Note that not all tables are shown in the **Navigator Programs** view, for example, TOT.



Importing a section

In the **Navigator Tables** view, select the **PSI / SI** Table node. From the shortcut menu, select **Import Section Data**. In the **PID** tab of the **Import Section Data** dialog box, identify the PID that is to carry the information. Similarly, in the **Source** tab, identify the file that holds the section data to be imported. Select **OK** to confirm the selection. During the import action, the content of the file is examined to determine where the section(s) should be placed.

ES PIDs

ES PIDs that carry additional **Elementary Streams** can be multiplexed into the synthesized transport stream. Do the following when defining an elementary stream to be added:

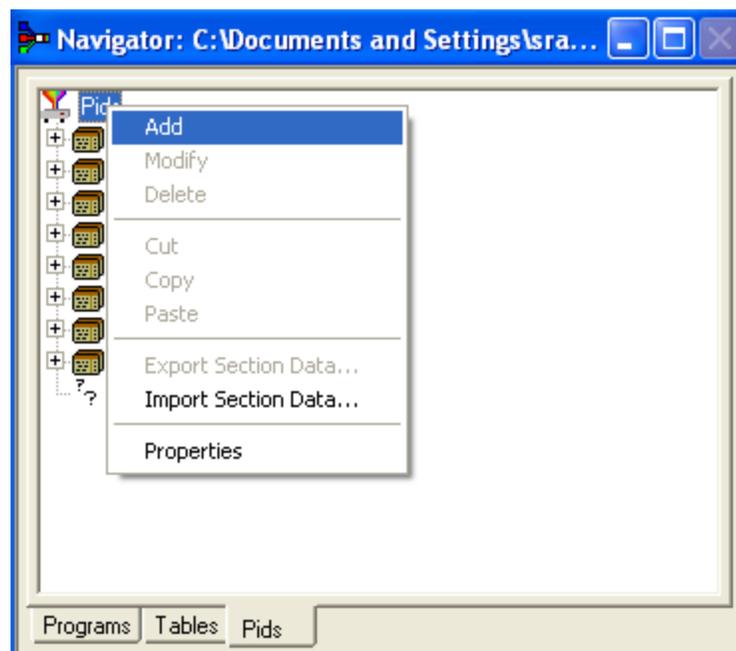
- Allocate a **PID** number
- Define the source of the elementary stream to be added
- Define the timing to be applied to the new stream
- Define the **PCR** placement

Adding an unreferenced elementary stream

Methods available:

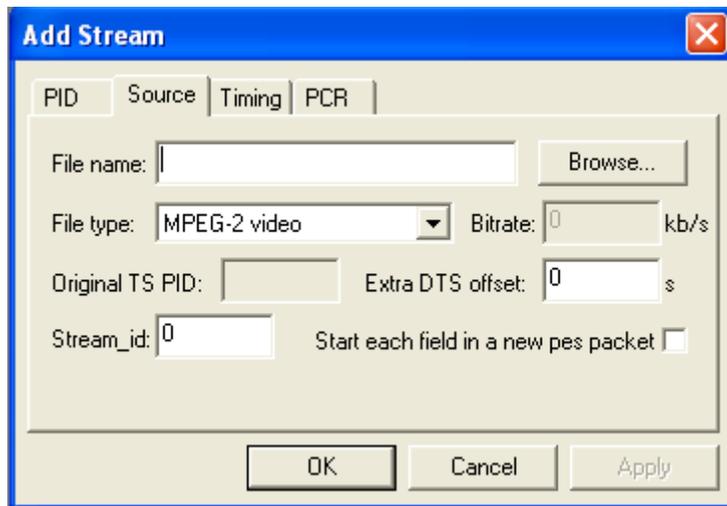
- Select the **ES PIDs** in the Navigator Tables view and select **Add** from the shortcut menu.
- Drag and drop (copy only) from the **Examine TS** window (Tables view) to the **Navigator Tables** view.
- Drag and drop (copy/move) from another instance of the **Multiplexer** to the **Navigator Tables** view.

To add a new stream, select **ES PIDs** in the **Navigator Tables** view and select **Add** from the shortcut menu.



This opens the **Add Stream** dialog box; the **Source** tab appears by default.

Defining the PID source. In the **Add Stream** dialog box, select the **Source** tab, to select and define the **PID** source:



File name	<p>Enter the file name of the stream to be multiplexed. If the file name is unknown, select Browse to open a standard file browser dialog and locate the file required.</p> <p>The names of files being copied to the multiplex will be automatically filled in.</p>
File type	<p>Select the type of file to be multiplexed from the dropdown list box.</p> <p>The following file types are available: MPEG-1 video ES or PES MPEG-2 video ES or PES MPEG-2 audio ES or PES (MPEG-1 or MPEG-2) MPEG-2 AAC audio ES or PES (ADTS format only) MPEG-4 audio ES or PES AC-3 audio ES or PES (ES - Elementary Stream; PES - Packetized Elementary Stream) H.264 video ES or PES H.265 video ES or PES</p> <hr/> <p>Transport Packets: A single PID stream. The Bit rate value will require setting. The Original TS PID will require setting.</p> <hr/> <p>Section: The content of the file will be Sections. The sections will be in binary form. The file will consist of one, or many sections appended one after the other.</p> <p>When multiplexed, the sections will be encoded on the given PID as SI. If the resulting multiplex is subsequently opened in the Multiplexer, the sections will be interpreted as SI and displayed under the SI Tables node in the tree.</p> <p>A file generated using the Edit > Export Section Data menu option can be used here. The Bit rate value will require setting.</p> <hr/> <p>Other: Any binary or ASCII file that is to be packetized into the transport stream at the specified bit rate. The Bit rate value will require setting.</p>

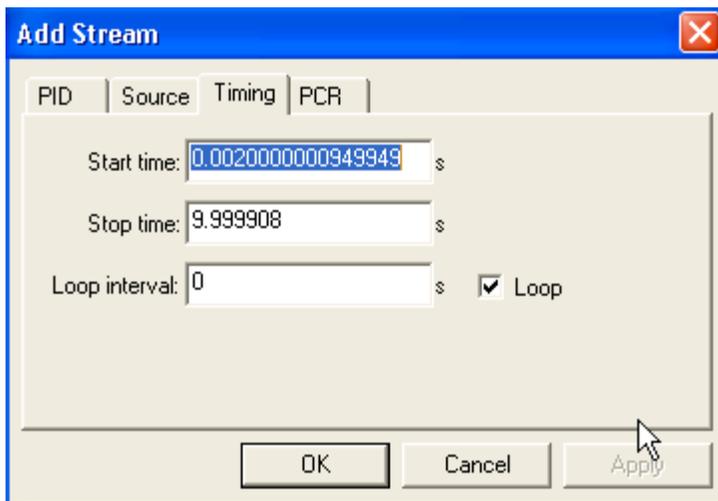
The remaining fields are interactive and will only be enabled when a value is required.

Bitrate	<p>When first defining a source, the bit rate is unknown and 0 Kbps is displayed. If a Transport Packet Stream or an "Other" File Type is selected, the field is enabled and a value (in Kbps) can be entered.</p> <p>If MPEG-2 video, H.264 video with HRD messages or H.265 video with HRD messages is selected, the bit rate value is detected automatically and displayed.</p> <p>If H.264 video or H.265 video without HRD messages is selected, the bit rate is not detected automatically.</p>
Original TS PID	<p>For streams other than transport streams, this field will be blank and disabled.</p>

Extra DTS offset	<p>When multiplexing ES or PES streams, the Multiplexer will derive an offset between the PCR and the decoded timestamp (DTS) of the first access unit (video picture / audio frame).</p> <p>You can override this offset and make it larger (positive number) or smaller (negative number). Changing this value may cause the resultant stream to be nonconformant with respect to the T-STD of the MPEG-2 standard. Enter the DTS offset in seconds required.</p>
Stream_id	<p>Only enabled for elementary stream types. This number specifies the value of the stream_id field in the PES packet header.</p> <p>Only needs to be set for DVB stream. Stream identity in the PES header.</p>
Start each field in a new PES packet	<p>Only enabled when File Type: MPEG-2 Video is selected.</p> <p>When disabled, both field pictures making up a coded frame are put in a single PES packet. Otherwise, each field picture is put into a separate PES packet. This setting has no effect upon frame pictures.</p>
Start each section in a new packet	<p>Only enabled when File Type: Section is selected.</p> <p>When disabled, SI data is placed in the packet payloads in the most efficient manner. The start of a section will immediately follow the end of the previous section; no stuffing bytes will be used.</p> <p>When enabled, each section will begin in a new packet and stuffing bytes will be used to pad any payloads that are not full.</p>

Defining the stream timing. In the **Add Stream** dialog box, select the **Timing** tab. This tab will allow timing parameters for the selected **source stream** to be defined:

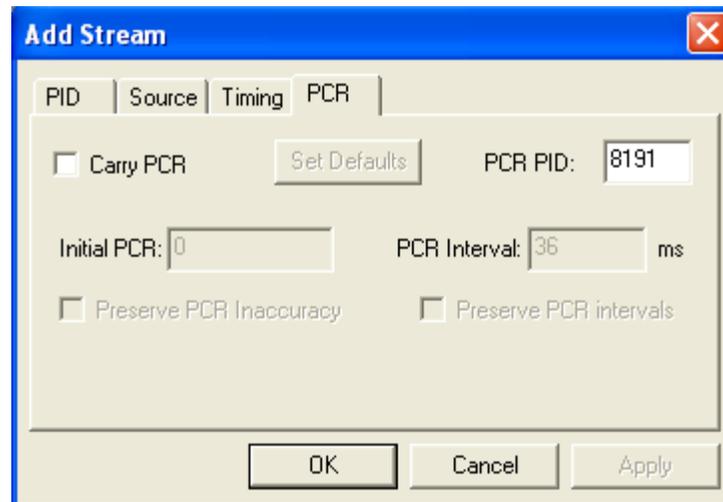
NOTE. To achieve compatibility between MUX and MTSA-PC, the start time is set to the following default values: PAT is 0.000, PMT is 0.001, and ES is 0.002.



Start/Stop Time	Enter the times that the selected source stream is to start and stop within the host transport stream. Note that the overall duration of the host transport stream is defined through the Transport Stream Properties dialog box.
Loop	Select this check box to loop the selected source stream for the duration of the synthesis. A Loop Interval can be set that introduces a delay between each repeat of the source stream; if zero is entered, the source stream will loop continuously. The Loop check box will always be disabled for transport stream types. The Multiplexer cannot loop transport streams.

Select **OK** to accept all changes and close the dialog box.

Defining the PCR placement. In the **Add Stream** dialog box, select the **PCR** tab to PCR define the placement:



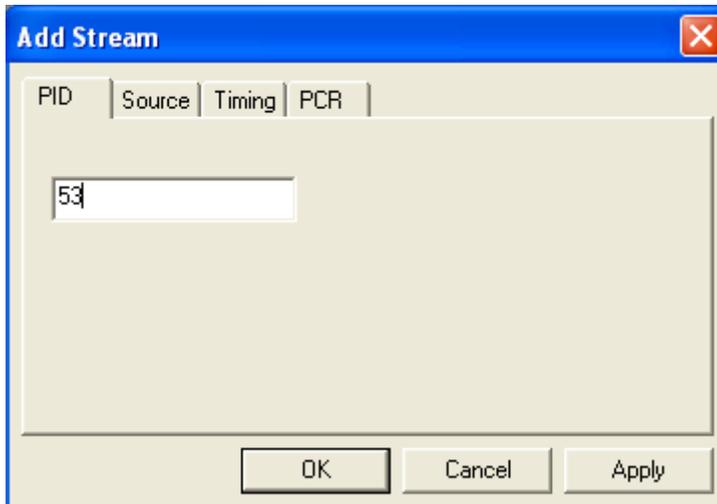
PCR for elementary streams. (Includes File Type: Transport Packets.) PCRs are placed in the packets at the specified interval, starting with the specified initial value.

PCR for Remultiplexed PIDs. (Includes File Type: Transport Stream)

- If the Carry PCR check box is not enabled, any PCRs in the packets will be removed.
- If the Carry PCR check box is enabled, PCRs will be sent as follows: If Preserve PCR Inaccuracy is set, the PCRs from the original transport stream will be used, otherwise the initial PCR value can be specified.
- If the Preserve PCR Intervals check box is enabled, PCRs will be sent in those packets that originally contained them, otherwise PCRs are inserted into packets at the specified intervals.

Specifying the PID number

Enter the **PID** number. A new value can be entered using either decimal or hexadecimal notation. Values are assumed to be decimal unless preceded with 0x. The dialog box is not case sensitive and values may include zeros after the prefix and before any significant digits:



When all details (in all tabs) are satisfactory, select **OK** to accept all changes and close the dialog box.

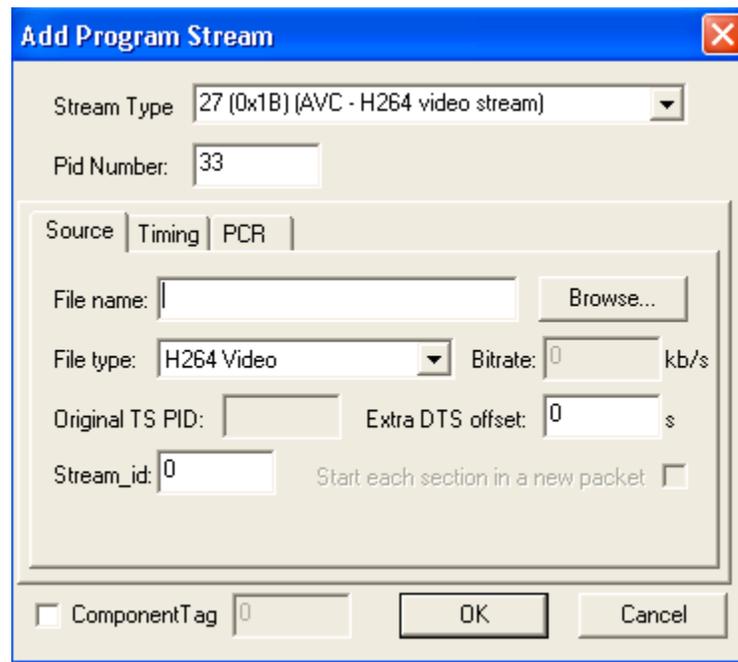
Adding elementary streams to the program structure

Methods available:

- Select an **Elementary Stream node** in the **Navigator Programs** view and select **Add** from the shortcut menu.
- Drag and drop (copy only) from the **Examine TS** window (Programs view) to the **Navigator Programs** view.
- Drag and drop (copy/move) from another instance of **Multiplexer** to the **Navigator Programs** view.

Elementary stream data can be added using the **Navigator Programs** view.

1. In the **Navigator Programs** view, select an **Elementary Streams node** to which the elementary stream is to be added.
2. From the shortcut menu, select **Add**. The **Add Program Stream** dialog box appears:



The dialog box tabs allows the input elementary stream to be selected and specified. The main dialog box fields Stream Type and PID Number dictate the PID that will carry the stream and the stream type entry that will be made in the PMT.

3. The functionality of the tabbed dialog boxes is described in the following pages:
 - Source:** See *Defining the PID Source*. (See page 92.)
 - Timing:** See *Defining the Stream Timing*. (See page 96.)
 - PCR:** See *Defining the PCR Placement*. (See page 97.)
4. Enable the **Component Tag** check box, if required. Enter a Component Tag number (0 - 255) in the enabled field. If the Component Tag is enabled, it can be referenced by other tables, for example, Event Information Table.

Exporting elementary streams

The Export Elementary Stream option allows the nonpacketized elementary stream data to be extracted from an elementary stream and saved to a binary file. Note that this data will not include the transport packet or the PES packet headers.

In the **Navigator Programs** view, highlight the elementary stream whose payload is to be exported. Select the **Export Elementary Stream...** option from the shortcut menu. Name the file to be created and choose a location. Select **Save** to confirm the action.

Exporting PES packets

The **Export Payload** option allows the **PES** packets to be extracted from an elementary stream and saved to a binary file. Note that this data will not include the transport packet headers.

In the Navigator Programs view, select the elementary stream whose payload is to be exported. Select the **Export Payload** option from the shortcut menu. Name the file to be created and choose a location. Select **Save** to confirm the action.

Modifying PES PID details

To modify any **ES PID** parameters, highlight the required **PID** in the **Navigator Tables** view and select **Properties** from the shortcut menu. The **Stream Properties** dialog box and its tabs are identical to the Add Stream dialog box. Refer to *Adding an Unreferenced Elementary Stream* (See page 92.)

ES PID parameters can also be modified in the Navigator Programs view. Highlight an **Elementary Stream** in the **Programs** view and select **Properties** from the shortcut menu. The dialog box thus displayed (**Program Stream Properties**) is similar to the **Add Program Stream** dialog box.

Deleting a PES PID

An elementary stream can be removed from the multiplex by deleting the **PID**. To delete a PID, highlight the required PID and select **Delete** from the shortcut menu. Then select the **Delete** option from the **Edit** or pop-up menus. Alternatively, click the **delete** button from the **toolbar**.

Multiplexer asks for confirmation before removing the PID from the multiplex. Select **Yes** to **delete** the stream or **No** to abandon the operation and leave the stream unchanged.

DSM-CC

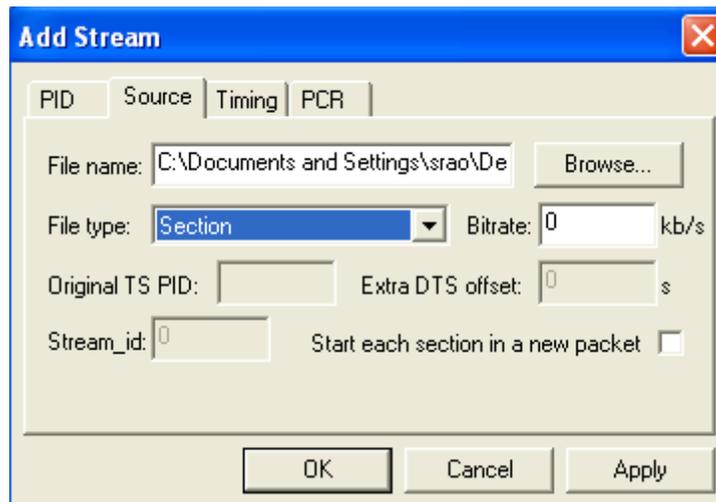
Adding an unreferenced DSM-CC section

Methods available:

- Select the **ES PIDs** node in **Navigator Tables** view and select **Add** from the shortcut menu.
- Drag and drop (copy only) from the **Examine TS** window in **Tables** view to the **Navigator Tables** view.
- Drag and drop (copy/move) from another instance of **Multiplexer** to the **Navigator Tables** view.

Adding an unreferenced DSM-CC section is similar to adding an unreferenced elementary stream, with the following modifications: (See page 92.)

In the **Source** tab of the **Add Stream** dialog box, select **Transport Packets > Sections** as the **File type** and set the **Bit rate**:



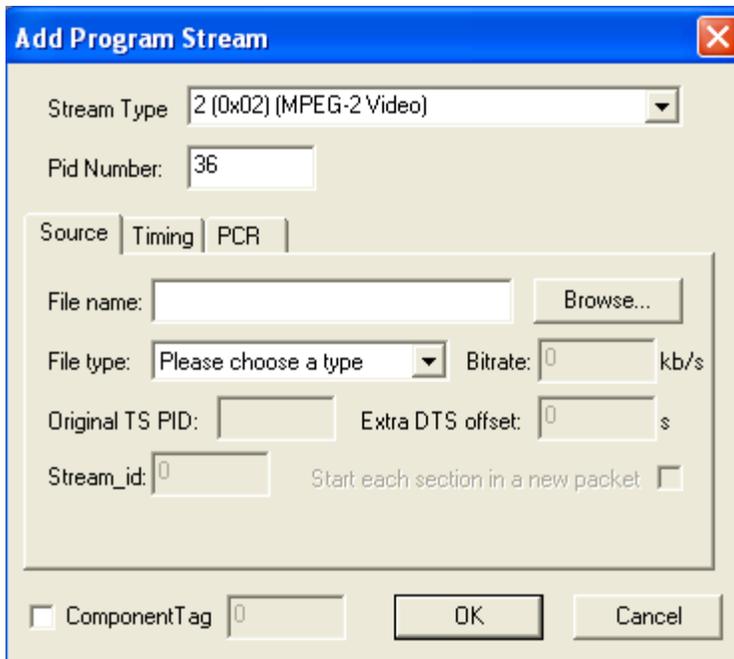
Adding DSM-CC sections to the program structure

Methods available:

- Select an **Elementary Stream** in **Navigator Programs** view and select **Add** from the shortcut menu.
- Drag and drop (copy only) from the **Examine TS** window in **Programs** view, to the **Navigator Programs** view.
- Drag and drop (copy/move) from another instance of the **Multiplexer** to the **Navigator Programs** view.

Adding a DSM-CC section to the program structure is similar to adding an elementary stream to the program structure (See page 92.), with the following modifications:

- In the **Add Program Stream** window, the main dialog box fields **Stream Type** and **PID Number** indicate the **PID** that will carry the stream and the stream type entry that will be made in the PMT. The **Stream Type** should be set to one of the **DSM-CC** entries:



- In the **Source** tab of the **Add Program Stream** dialog box, identify the **File name** you want to add. Select **Transport Packets > Sections** as the **Stream type** and set the **Bit rate**.

The **DSM-CC** section will be added.

Delete a DSM-CC section

A **DSM-CC** section can be deleted from a table by highlighting it in the **Navigator** view and selecting **Delete** from the shortcut menu. To delete more than one section, select and delete each one in turn.

Export a DSM-CC section

DSM-CC data can be exported in the form of a binary file.

Select the required **DSM-CC** section in the **Navigator Tables** view. From the shortcut menu, select **Export Section Data**. Name the file you want to create and choose a location. Select **Save** to confirm the action.

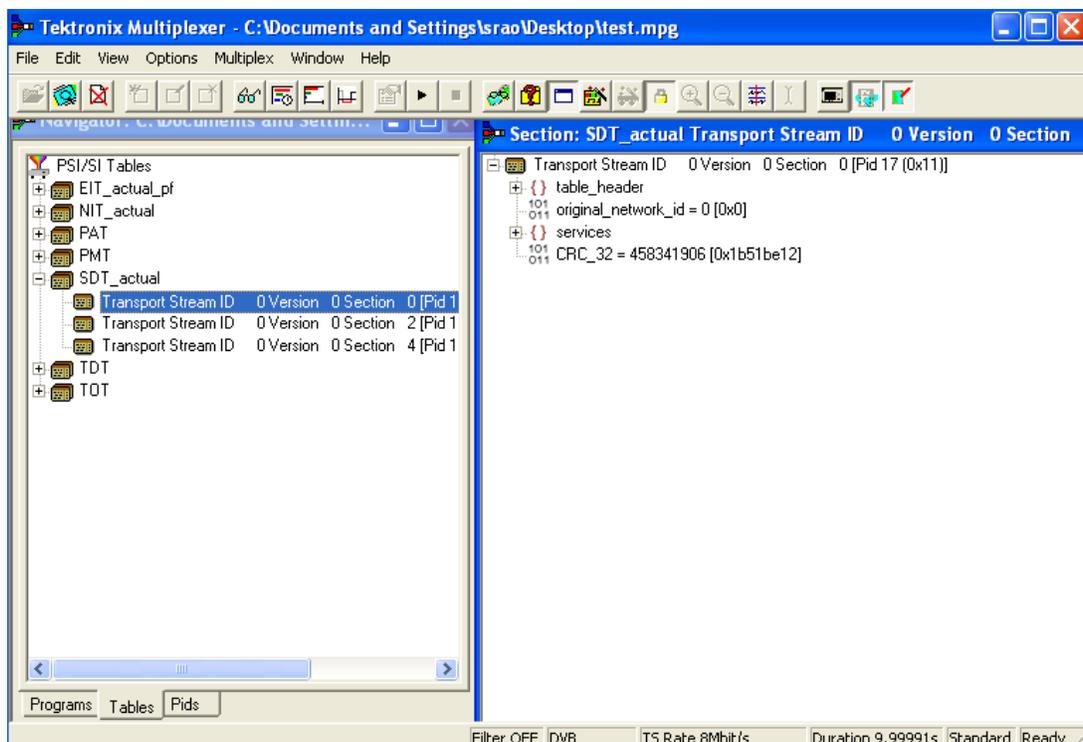
Individual **DSM-CC** sections can also be exported using the **Navigator Programs** view. Under any **Elementary Streams** node, select the **DSM-CC** section you want to export. From the shortcut menu, select **Export Section Data....** and name the file you want to create and choose a location. Select **Save** to confirm the action.

Multiplexer - Editing in Section view

Use the **Section** view window to modify the contents of a version/section. This includes version, section, and table-specific data that the **Navigator Tables** view shows. If the **Section View** window it is not already open, select **View > Section View**.

If a section/version is selected in the **Navigator Tables** view, the content from the tables automatically appears in the **Section View**; otherwise the **Section View** window is blank.

To open a table version/section in **Section View**, select the component in the **Navigator Tables** view. The **Section View** is updated immediately to show the selected **section / version**:



Editing fields

To add, change, or delete a field, element or loop in a section/version, the parent table must be selected in the Navigator Tables view. Select the appropriate line in the Section view and select the required option from the shortcut menu.

Selecting a field

To select a field or container, place the mouse pointer over it and click the left button.

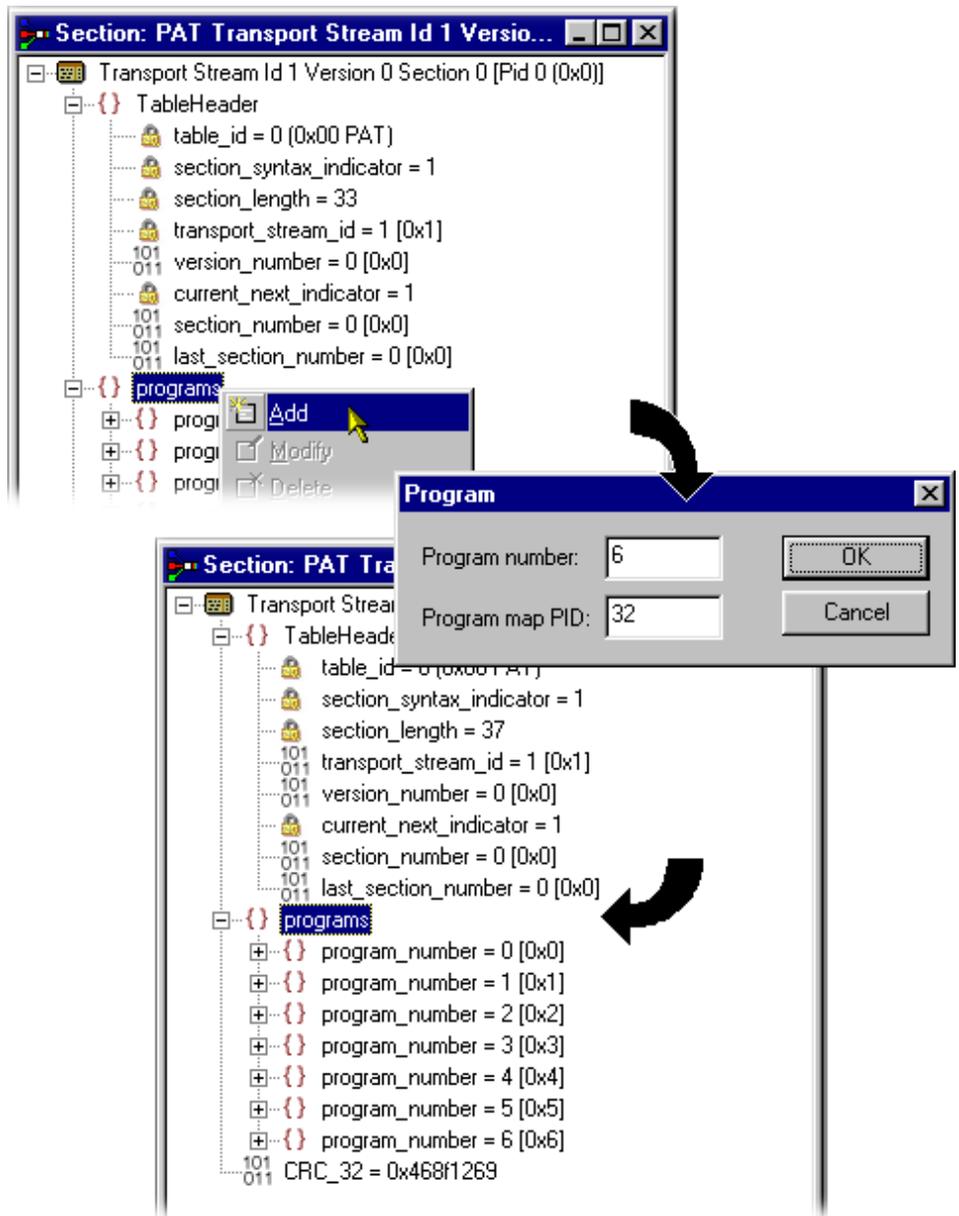
The magnifying glass icon indicates the selected component.

If Standard Mode is selected, the magnifying glass selection cannot be placed on a field that is locked. To select and edit locked fields, first select the Expert Mode option from the Multiplex menu.

Adding an element to a loop

To add an element to a loop, select the parent loop that will contain it, and then select Add from the shortcut menu.

For example, to add a program to a **PAT**, select the **Programs** container and then select **Add** from the shortcut menu:



In this example, a dialog box is displayed in which the Program Number and Program Map PID can be accepted or respecified. Other table loops may not display any dialog box, but immediately create a new element with default contents. An entry is displayed for the new element, with its details collapsed, at the end of the list of elements in the loop. In addition, the section length field is automatically recalculated and amended. For the above example the new entry is program_number = 6 (0x6).

NOTE. *The example above was taken with Standard mode selected. In Standard mode, all recalculation is done automatically. In Expert mode, a program element will be added, but the program number and PID must be manually adjusted. Similarly, the section length will need to be calculated and amended manually. (See page 55, Expert and Standard modes.)*

Deleting an element in a loop

To delete a loop element, in the Section view highlight the element and select Delete from the shortcut menu.

The element is deleted and the Section View window updated to reflect the changes.

Modifying the contents of a field

To edit the contents of a field, select the field and select **Modify** from the shortcut menu. This will open an appropriate dialog box for modifying the type of data held by the field.

The following paragraphs describe the different types of data that may be modified.

Enumerated value. The Modify value dialog box displays the name of the field and the current value. The value is shown as a number followed by the interpretation of the governing standards:



In this figure, the field being edited is a service_type and the current text is 1 (digital).

Type the number, without any text, for the required value. When the changes are accepted, Multiplexer will display the interpretation in the Section View window.

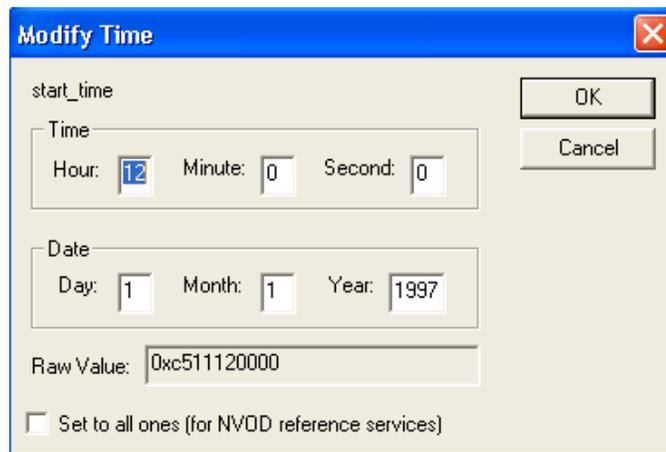
Alternatively, click the down arrow to select the value from the dropdown list.

This displays a list of the defined values and their interpretation. The list will vary depending upon the field being edited:



Enter the required value and select **OK** to continue. Multiplexer may open a simple context-sensitive dialog box offering advice and/or asking for more information or confirmation. An error message is displayed if the number that was typed in requires more bits than are allocated to the field.

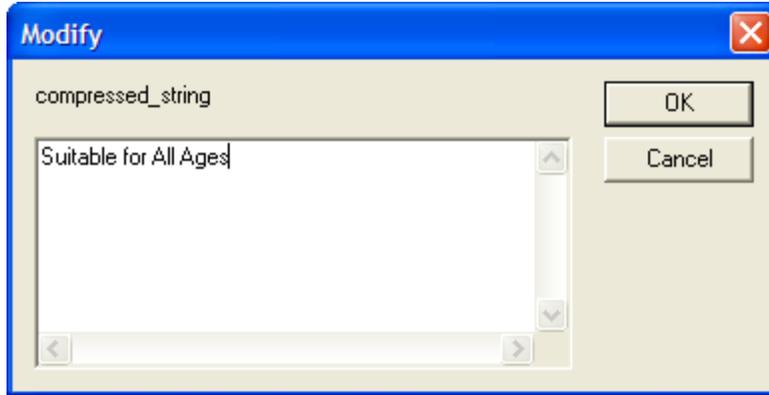
Date and time. The **Modify Time** dialog box displays the name of the field. It displays the time in both interpreted and raw formats; only the interpreted mode can be edited:



Edit the numbers in any of the fields as required. All fields are updated as each digit is added, changed or deleted. Select **OK** to commit the changes or **Cancel** to abandon editing and keep the original time.

The **Set to all ones** check box, when enabled, sets the 40-bit date field to 0xFFFFFFFF. This may be required when setting the saturate for an event in a Near Video on Demand (NVOD) reference service.

Compressed string. The **Modify** dialog box displays the name of the field, which is always a compressed string, and the contents of the selected string segment. Text can be entered, deleted, selected, copied to and pasted from the Windows clipboard:

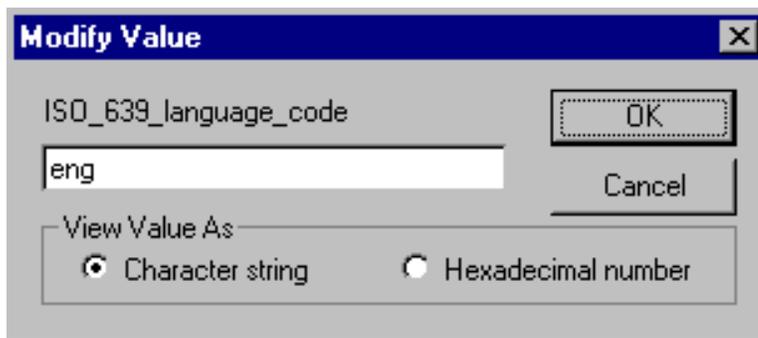


Edit the text and select **OK** to continue. Select **Cancel** to abandon the edits and leave the original segment unchanged. Multiplexer checks to ensure that the new string length does not cause the total section length to exceed the maximum specified by the standards.

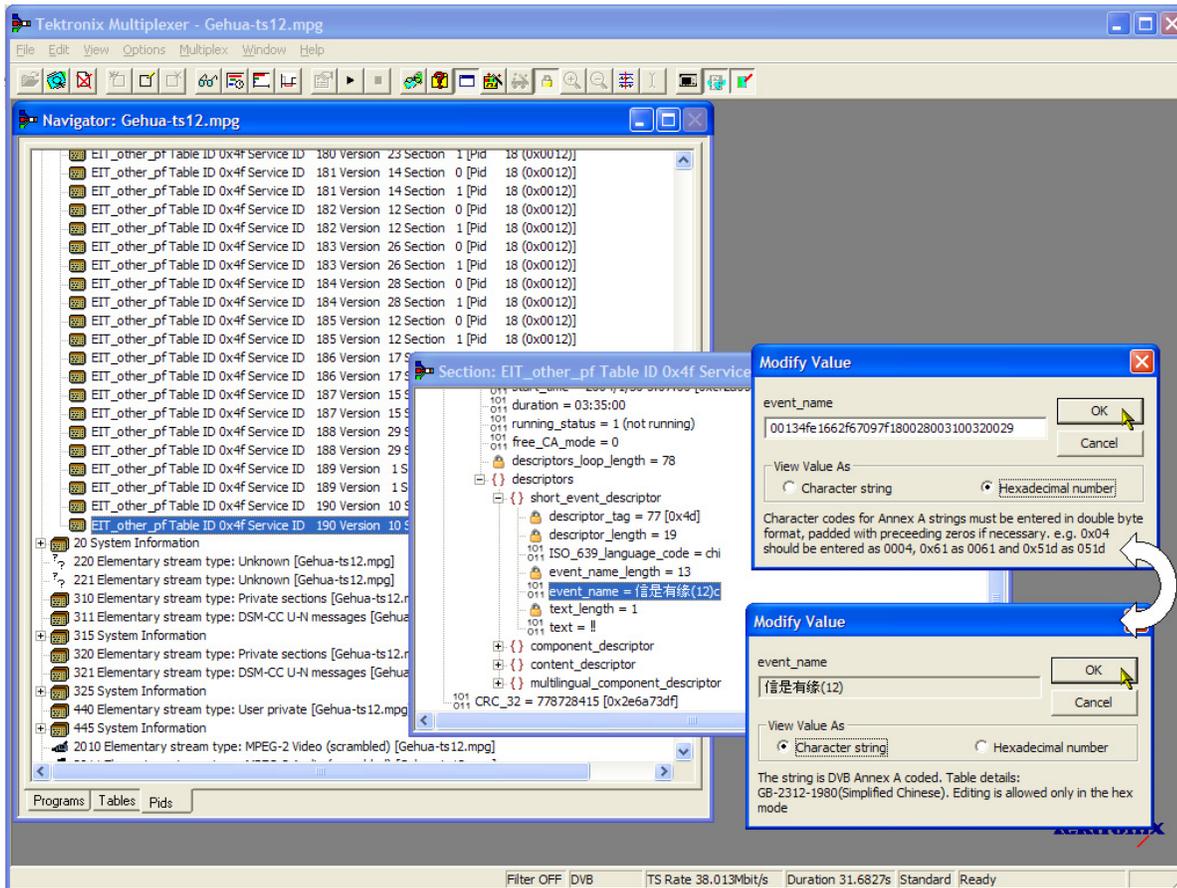
If the total section length exceeds the maximum specified by the standards, an error message is recorded in the Event Log.

Text. The **Modify Text** dialog box displays the name of the field and the current text on a single line. Text can be entered, deleted, copied to and pasted from the Windows clipboard.

In the following figure, the field being edited is an ISO_639_language_code and the current text is eng:



View Value As: You can choose between viewing the text as an ASCII character string or a hexadecimal sequence. Character codes for DVB Appendix A strings used in language code pages must be entered in double byte format and padded with preceding zeroes if necessary. For example, 0x04 should be entered in the hexadecimal field as 0004 and 0x51d should be entered as 051d. Switching from a modified hexadecimal value will display the modified character string.



Most text strings have a maximum length, specified by the governing standards, which this dialog box will enforce. Edit the text and select **OK** to continue. Select **Cancel** to abandon the edits and leave the original text unchanged.

Numeric. The **Modify Value** dialog box displays the name of the field and the current value in decimal. Edit the existing value or type in a new value:



In the following figure, the field being edited is a `version_number` and the current value is `0xc`.

A new value can be entered using either decimal or hexadecimal notation. Values are assumed to be decimal unless preceded by `0x`. The dialog box is not case sensitive and values may include zeros after the prefix and before any significant digits, for example:

Edit or replace the existing value and then select **OK** to continue. Select **Cancel** to abandon any changes made in the field.

Multiplexer will check the new value against the governing standards and for conflicts with other fields. It may open a simple context-sensitive dialog box offering advice and/or asking for more information or confirmation. For example, when changing a `version_number`, a dialog box appears to determine the scope of the change.

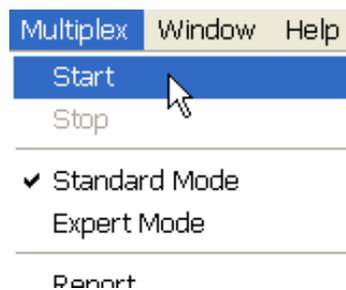
Multiplexer - Multiplexing transport streams

The Multiplex Engine in the Multiplexer synthesizes a new transport stream and writes it to an MPEG file. The contents of the new stream are multiplexed according to the specification currently held in memory, which is shown in the Navigator and Section views.

The tables that are displayed in the Navigator are synthesized from the current specification. Elementary streams and other data are acquired from the original MPEG file and other stream files and remultiplexed according to the specification.

Starting the Multiplex Engine

To start the **Multiplex Engine**, select the **Start** option from the **Multiplex** menu:



Alternatively, select the **Start** button on the toolbar:



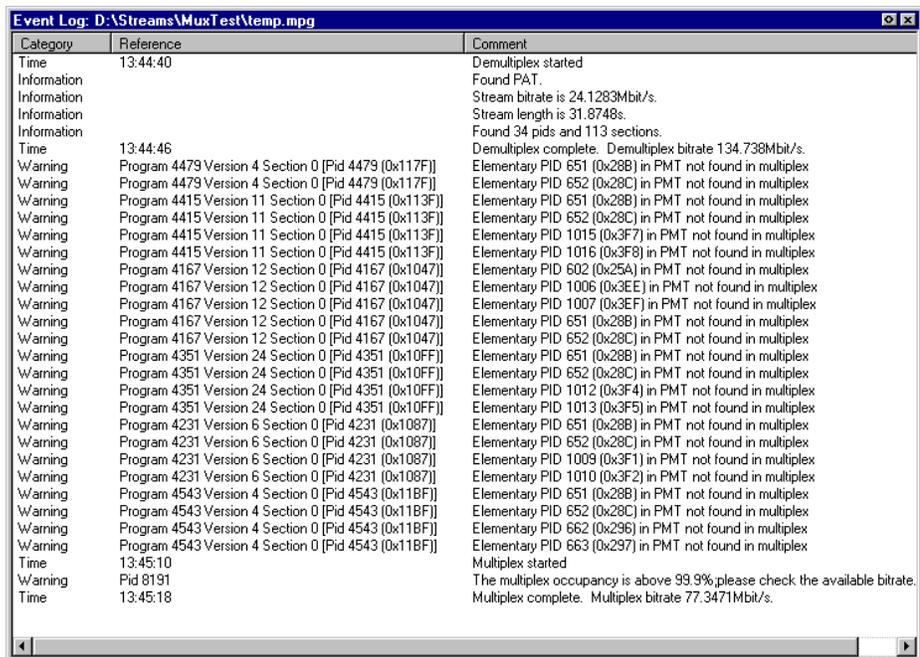
Multiplexer opens a standard file browser dialog box to specify the file name and path for the synthesized transport stream.

A new file can be created or an existing file can be selected to be overwritten. The program will seek confirmation before overwriting an existing file.

NOTE. *The Multiplexer automatically creates 188 byte packets in the transport stream output file, regardless of the source material size.*

Errors and reporting

The right pane of the status bar indicates progress as the Multiplex Engine synthesizes the new transport stream:



Any errors are recorded in the Event Log, which can be opened at any time before, after and during processing. Here is an example where a table cannot be multiplexed into the new stream at the specified rate.

Each table has a specification for nominal and maximum interval, in milliseconds, between instances of the table. These can be edited using the Navigator. The multiplex engine will try to multiplex the table into the synthesized transport stream at the nominal repetition rate. Errors are reported whenever packets for any PID cannot be encoded at their specified minimum rate.

The complete text may be copied to the Windows clipboard, using the **Copy** option from the shortcut menu. The text can also be cleared with the **Clear** command. Both commands are available from the **Edit** menu.

Stopping the Multiplex Engine

The Multiplex Engine can be stopped at any time while it is running. This will abandon processing and close the file. The file will contain all of the packets synthesized up to the time the engine was stopped.

To stop the Multiplex Engine, go to **Multiplex > Stop**:



Alternatively, select the **Stop** button on the toolbar:



Exporting the multiplex configuration file

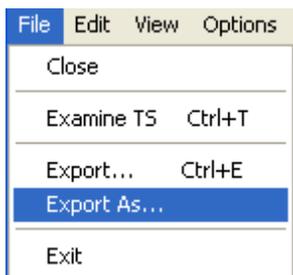
NOTE. *Multiplexer is used for generating both conformant and nonconformant streams. Use the **Export** and **Export As** options to save copies of the specification for nonconformant streams in a multiplex configuration file. This file does not include a copy of the transport stream, instead, it refers to the original MPEG file by name and location.*

*The multiplex configuration file can be reopened using the **Import** option. (See page 14.)*

Export To save any changes you make to the current multiplex configuration file, go to **File>Export** and save your changes. Alternatively, use the **Ctrl+E** keyboard shortcut.

If a multiplex configuration file has not been opened, **Export** opens a standard file browser dialog box to specify the file. This is the same as selecting the **Export As...** option.

Export as Clicking **File > Export As** exports a file with a user-specified name:



Multiplexer opens a standard file browser dialog box to select an existing file or specify a new file.

If you are creating a new file, specify the name of the exported file and select where it will be saved. By default, files are created with **.muxml** as the file extension.

Multiplexer - Make seamless

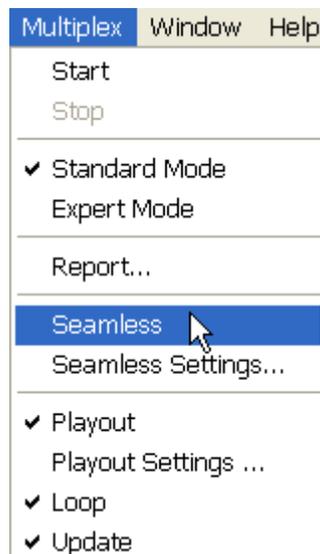
When you loop a transport stream to simulate continuous playout, errors can be generated at the loop point caused by discontinuities in timing information. The Seamless option provides the opportunity of creating seamless MPEG-2 files.

The option can be set up and enabled so that all multiplex operations result in seamless output or none.

NOTE. *Make seamless supports the MPEG-2 video standard. It does not support H.264 or H.265/HEVC.*

Enabling the Seamless option

Now that you are inside the **Multiplex** application, you can enable the **Seamless** option by selecting **Multiplex > Seamless**.



Seamless settings

To open the **Seamless Settings** dialog box, you must double click the **Generator** folder on your desktop and select **Multiplex**. From the **Tektronix Multiplexer** screen that appears, select the **Multiplex** from the menu bar and then choose **Seamless Settings**.

The **Seamless Settings** dialog box appears.



Priority program

First program in PAT has priority

If this setting is enabled, the first program specified in the PAT will be given priority in the make seamless process.

If the setting is disabled, the priority program can be specified in the Priority Program. The number can be deduced by inspecting the results of the transport stream analysis.

PSI settings

Make PSI seamless

If enabled, the service information contained in the transport stream is processed to make it seamless.

If the setting is disabled, the PSI/SI is not processed but simply copied to the output transport stream.

Make remaining programs seamless

If enabled, the remaining programs are made seamless but are constrained by limits defined by the priority program. This may lead to these remaining programs having a gap at the beginning and end of the file.

Multiplexer - Reference

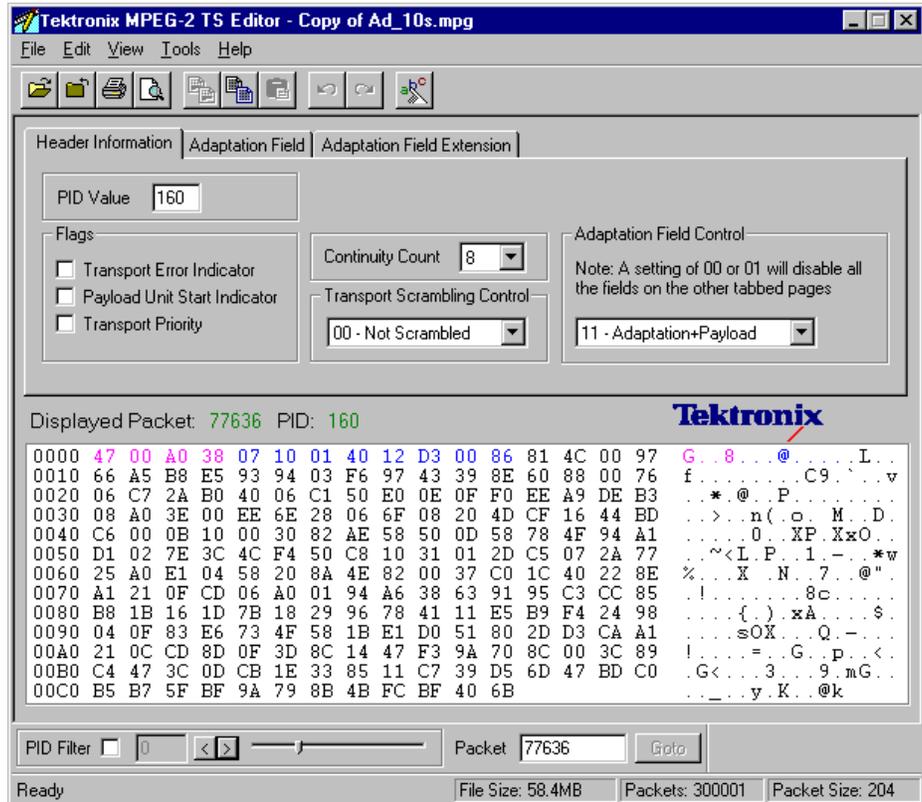
Abbreviations

AIT	Application Information Table
ASCII	American Standard Code for Information Interchange
ATSC	Advanced Television Systems Committee
CAT	Conditional Access Table (MPEG)
CDT	Carrier Definition Table
CVCT	Cable Virtual Channel Table (ATSC)
DSM-CC	Digital Storage Media - Command and Control
DTS	Decoding Time Stamp
EIT	Event Information Table (DVB/ATSC)
ES	Elementary Stream
ETT	Extended Text Table (ATSC)
HRD	Hypothetical Reference Decoder
MGT	Master Guide Table (ATSC)
MMT	Modulation Mode Table
NIT	Network Information Table (DVB)
PAT	Program Association Table (MPEG)
PES	Packetized Elementary Stream
PID	Packet Identifier
PIT	Program Information Table (ATSC)
PMT	Program Map Table (MPEG)
PSI	Program Specific Information (MPEG)
PSIP	Program and System Information Protocol (ATSC)
PTS	Presentation Time Stamp
RAID	Redundant Array of Independent Disks
RRT	Regional Ratings Table (ATSC)
RST	Running Status Table (DVB)
SDT	Service Description Table (DVB)
SEI	Supplemental Enhancement Information (H.264 and H.265)
SI	Service Information (DVB)
SIT	Satellite Information Table
STT	System Time Table (ATSC)
TDT	Transponder Data Table (ATSC)
TNT	Transponder Name Table
TOT	Time Offset Table (DVB)
TS	Transport Stream

TSTD	Transport Streams Description Table
T-STD	Transport Stream System Target Decoder
TVCT	Terrestrial Virtual Channel Table (ATSC)
UTC	Universal Coordinated Time
VCT	Virtual Channel Table (ATSC)
VUI	Video Usability Information (H.264 and H.265)
XML	Extensible Markup Language

Transport Stream Editor – Getting started

The **Transport Stream Editor** can be used to edit the contents of transport stream packets contained in a file. It shows the complete contents of each packet in hexadecimal and provides an interpreted view of the packet header information:



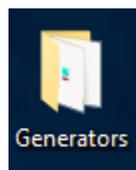
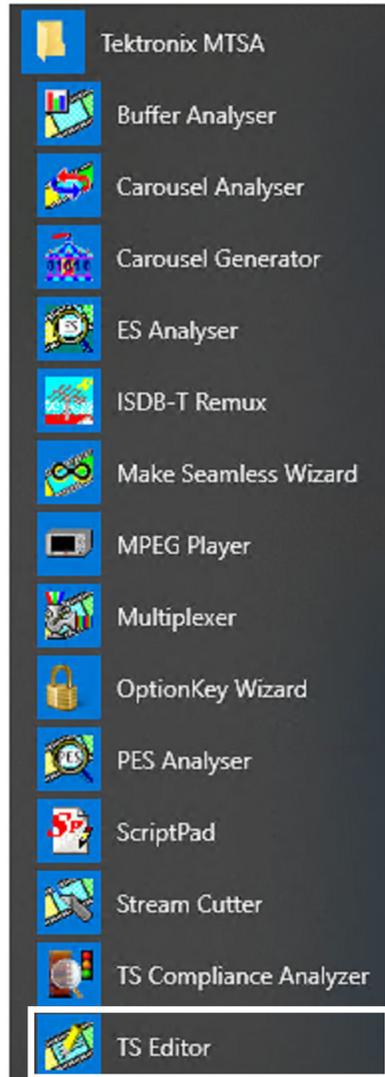
Packet headers can be edited from both the header interpretation and hexadecimal displays. These are referred to as the Header Editor and the Hex Editor, respectively. All changes made in one view are immediately shown in the other. The Header Editor is context sensitive, only allowing edits that make sense with the other fields in the header. It gives full syntax checking of all changes that are made. The payload and any Reed Solomon data are edited from the Hexadecimal Editor.

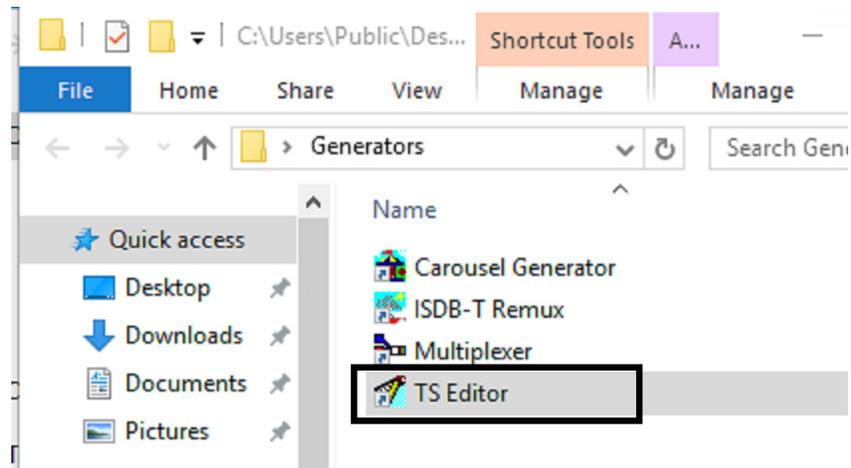
On the right of the Hex Editor pane, the ASCII character is displayed. Unprintable characters are shown as a period (dot or full stop).

It is normal to edit a copy of a transport stream. Transport Stream Analyzer can be used to view the original while editing the copy.

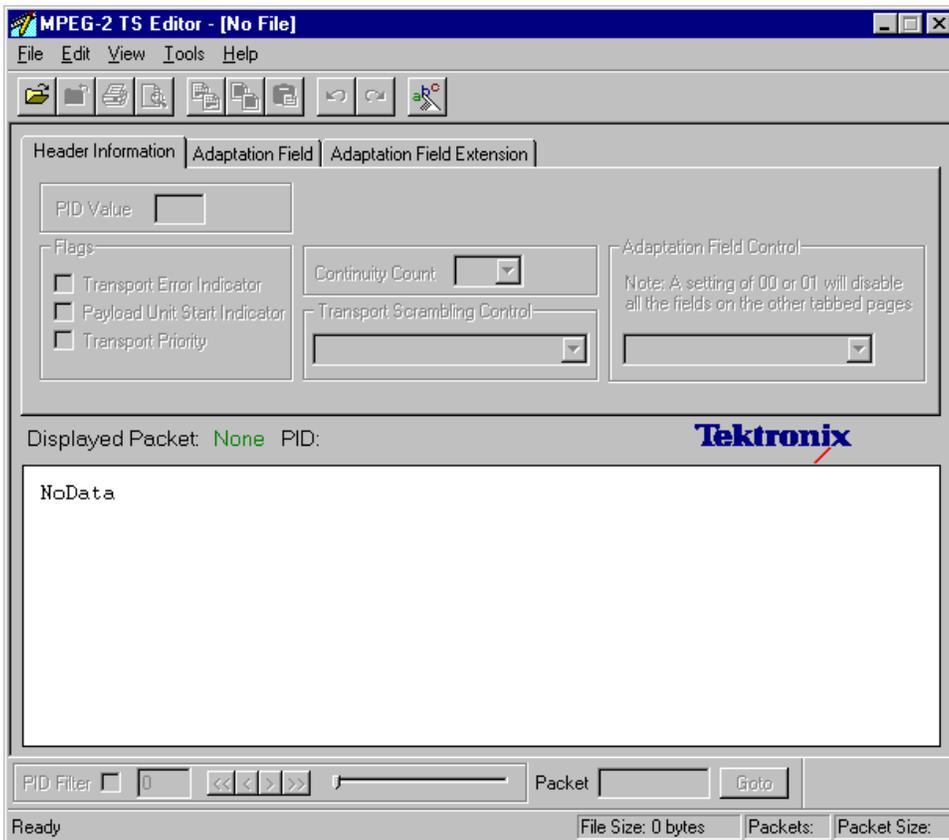
Starting the program

To access **TS Editor**, go to **Start > Tektronix MTSA > TS Editor**, or double click the **Generators** folder from your desktop to open the **TS Editor** application.





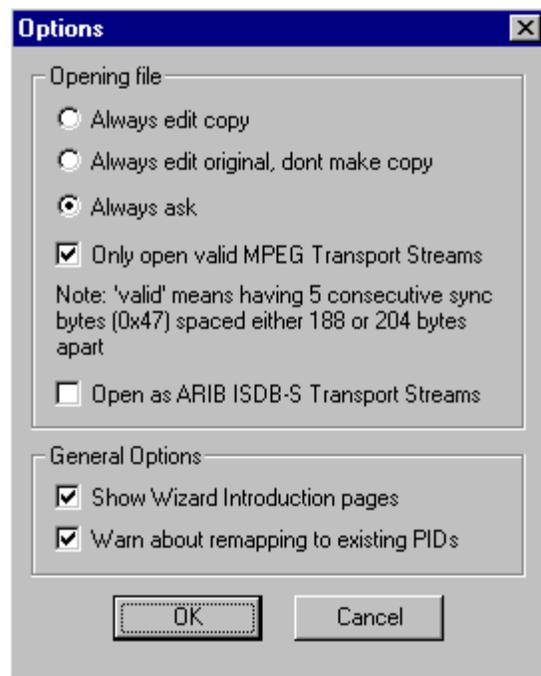
Initial appearance Once you launch the program and it is ready for use, it will open a main window that looks like this:



Options

The **Transport Stream Editor** has a set of options relating to general use and opening files. It is a good idea to review the options before opening a file.

The settings can be changed at any time by selecting **Options...** from the **Edit** menu. This opens the **Options** dialogue box:



Opening file Specifies how the program will interpret the packet size of the stream. The options are mutually exclusive and are as follows:

- Always edit copy when opening a file Editor always makes a copy, without asking.
- Always edit original, do not make copy uses the original files without making a copy or asking for confirmation.
- Always ask Before opening a file for editing, asks if it should edit the original or make a copy.
- Only open valid MPEG Transport Stream files can open files that have five or more consecutive sync bytes.
- Open as ARIB ISDB-S Transport Streams Opens transport streams encoded as ARIB ISDB-S format (including TMCC information).

General options

- Show Wizard Introduction pages Causes any wizards invoked by Editor to display their Introduction pages.
- Warn about remapping to existing PIDs Warns if an operation will remap a PID onto one that is already in use.

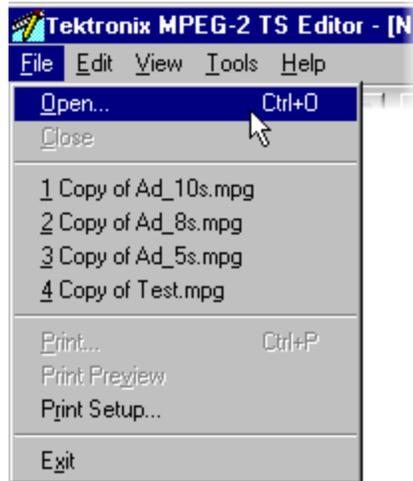
Opening a file

Any stream that is held in a file can be edited with the **Transport Stream Editor**.

Opening a file from the menus and toolbar

To edit a file, select the **Open** from the File menu. If the required file is in the list of recently edited files, it may be selected from the list to save using the **Open file** dialog box.

Alternatively, use the **Ctrl+O** keyboard shortcut:



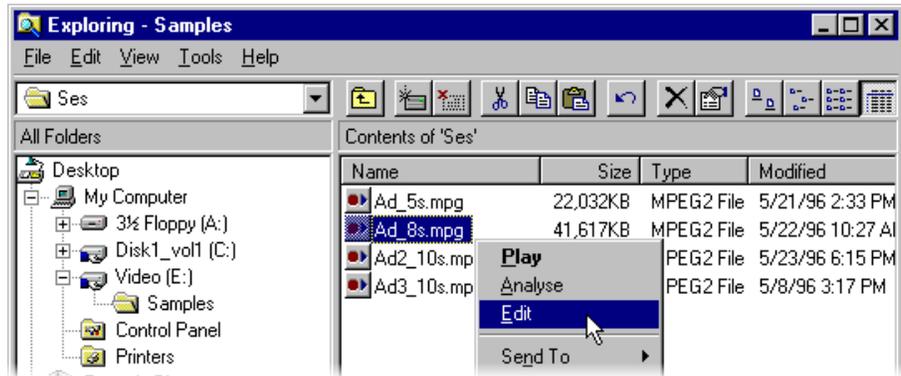
There is also a shortcut button available on the Toolbar for opening a file, which has the standard file open symbol:



Opening a file from Windows Explorer or a file browser window

The program can be started and a file opened (with the last set of program options) in a single operation from Windows Explorer or a File Browser Window.

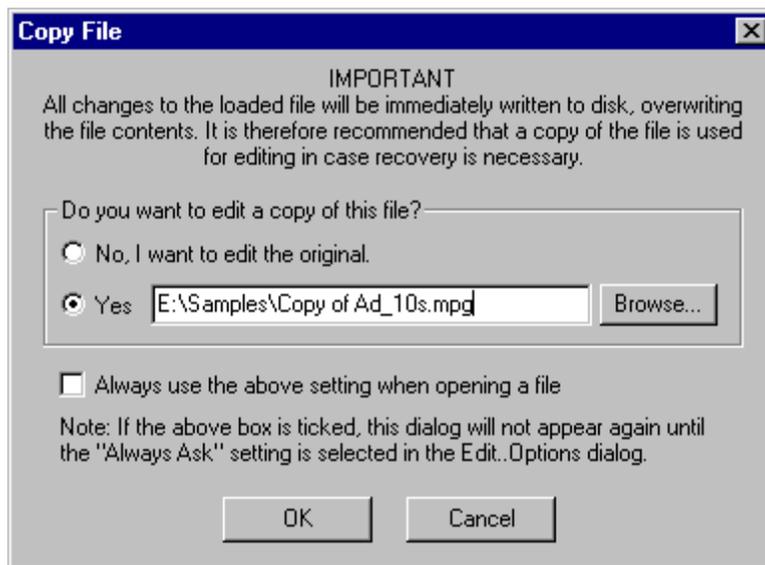
Place the pointer over the file name or icon, press the right mouse button to open a menu, and then select the **Edit** option:



Copying a file before editing

TS Editor writes all edits to the file immediately. To avoid accidental changes to prime data, the application can make a copy of the file and edit that copy. By default, once a file has been selected for opening, you are prompted to decide whether to edit the original or make a copy.

If you do not want to be presented with this dialog box each time a file is opened, set the copy or edit original option as the default:



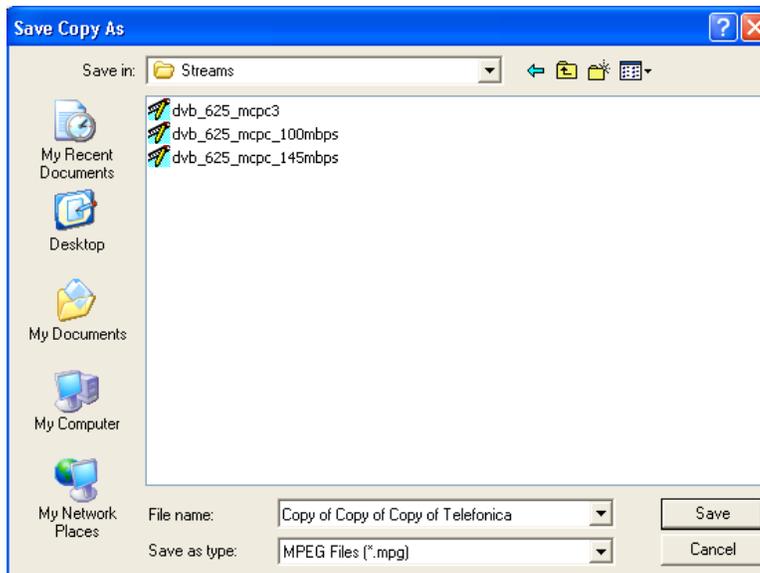
It is recommended that this dialog box be left as the default option.

If someone else has used the MPEG Test System, it is a good idea to look at the Options before opening a file.

To edit the original file, (useful when making edits to a file that is already a copy) select the **No, I want to edit the original** option, and then select the **OK** button.

To make a copy, select the **Yes** option, specify the copy file, and then select **OK**. While the copy is being made, the pointer changes to the busy pointer, usually an hour glass.

When the Edit a copy option is selected, the dialog box suggests a suitable filename, which you can edit. To look for a different directory or filename, select the Browse button. This will open a standard file browser window, like this:



Transport Stream Editor – Menus and controls

The following pages contain descriptions of the different menu options, toolbar controls, status bar, and slider bar.

Toolbar

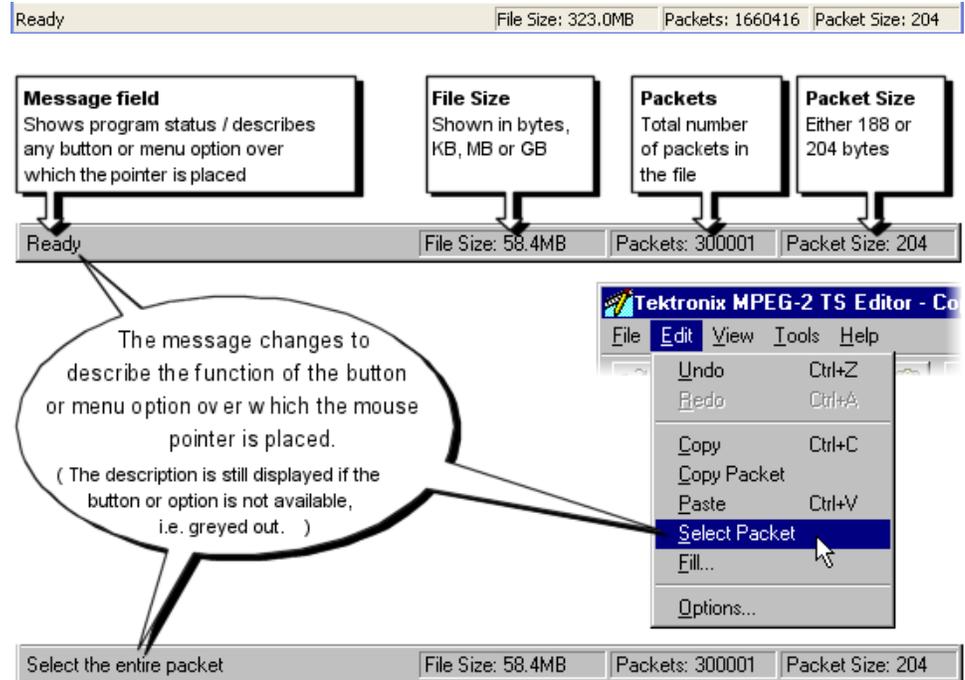
The Toolbar provides a set of convenient shortcuts for the more frequently used menu options. The available commands are:



	Opens a file. If a file is currently open, it will be closed when a new file is selected.
	Closes the current file. There is no save option because all changes are written to file immediately.
	Prints the current packet.
	Opens a print preview of the current packet.
	Copies the bytes that are currently selected in the Hexadecimal Editor from the packet to the clipboard. The bytes are copied using the hexadecimal representation. This button is disabled (grayed out) when nothing is selected that can be copied.
	Copies the entire contents of the current packet to the clipboard.
	Pastes any data, held in the TS Editor's hexadecimal representation, from the clipboard into the packet starting at the currently selected byte.
	Undoes the last edit, restoring the previous value. Selecting Undo again undoes the previous change and so on.
	Reinstates the previously undone change.
	Opens the Options dialog box.

Status bar

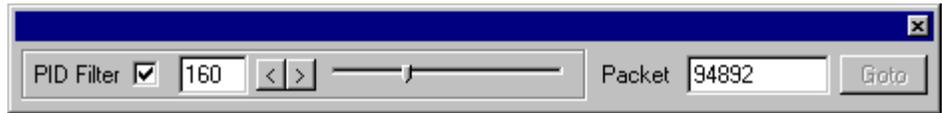
The Status bar may be hidden from view, but if it is always visible at the bottom of the window. It displays the following information about the program and open file:



When no file is open, **File Size**, **Packets**, and **Packet Size** fields are all set to zero or null:



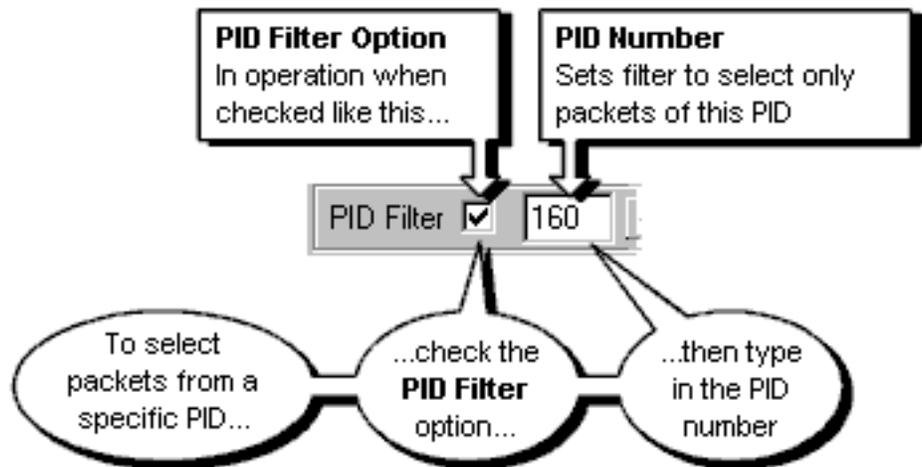
Slider bar



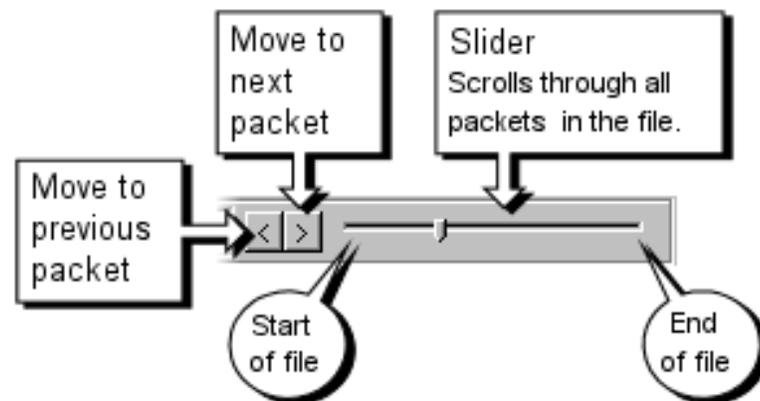
The contents of any transport stream packet in the currently open file can be selected using the Slider bar. Packets are numbered according to their position in the file, with the first packet being 0 (zero):

The controls in the slider bar are:

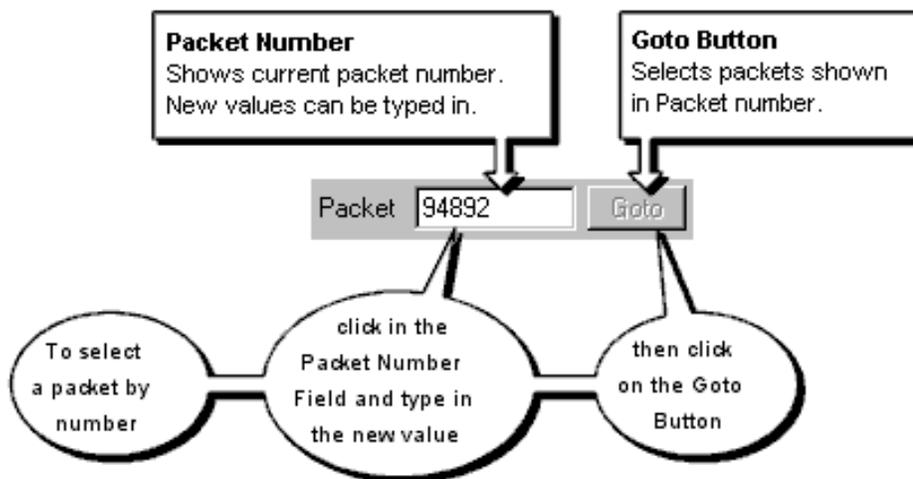
PID filter



Slider



Packet number



It is normal to edit a copy of a **Transport Stream**. The **Transport Stream Analyzer** uses the same packet numbering as Editor. So the packet number can be used to find and view a packet in Analyzer, and then edit the copy of the same packet in Editor.

The **Slider Bar** can be dragged from the edge of the main window into a floating pallet. To do this, place the mouse pointer on the background (inside the Slider Bar), hold down the left mouse button, and drag the slider bar away from the window border. The result is a self contained window that looks like this:



To replace the **Slider Bar** on the window border drag, it over the border until the outline changes shape.

Menu options

The following pages describe all of the menu options. Since many of the options are context sensitive, they will be available only when their function is appropriate for the selected window or display element. When a menu option is not available, the option is grayed out.

File menu options The following table lists the **File** menu options:

Table 14: File menu options

Command	Function
Open	Opens a file for editing. If a file is currently open, it is closed when a new file is selected.
Close	Closes the current file. There is no need for a save option because all changes are written to file immediately.
1 <filename> 2 <filename> 3 <filename> 4 <filename>	A list of the four most recently edited files. If the program has recently been installed, the list may be empty or hold less than four files.
Print	Prints the current packet.
Print Preview	Opens a print preview of the current packet.
Print Setup	Selects printer and configuration.
Exit	Closes any file that is open and terminates execution of the program.

Edit menu options The following table lists the **Edit** menu options.

Table 15: Edit menu options

Command	Function
Undo	Undoes the last edit, restoring the previous value. Selecting undo again undoes the previous change.
Redo	Reinstates the previously undone change.
Copy	Copies the bytes that are currently selected in the Hexadecimal Editor from the packet to the clipboard. The bytes are copied using the hex representation.
Copy Packet	Copies the entire contents of the current packet to the clipboard.
Paste	Pastes hexadecimal from the clipboard into the packet starting at the currently selected byte.

Table 15: Edit menu options (cont.)

Command	Function
Select Packet	Selects the entire contents of the packet.
Fill	Prompts for and fills all selected bytes with a value.
Options ...	Opens the options dialog.

View menu options

The following table lists the **View** menu options.

Table 16: View menu options

Command	Function
Toolbar	Shows or hides the Toolbar, which provides a set of convenient shortcuts for the more frequently used menu options.
Status Bar	Shows or hides the Status Bar.
The following menu options select which standard is used to interpret the values held in the Transport Scrambling Code field. Only one standard can be selected at any time.	
MPEG2	Selects the MPEG2 interpretation of the Transport Scrambling Code.
DVB	Selects the DVB interpretation of the Transport Scrambling Code.
ATSC	Selects the ATSC interpretation of the Transport Scrambling Code.

Tools menu options

The following table lists the **Tools** menu options:

Table 17: Tools menu options

Command	Function
Remap PIDs...	Starts the tool to Remap packets from one or more PIDs to different PIDs.
PCR Recalculation...	Opens a Wizard to Recalculate the Program Clock References (PCR) carried in one or more PIDs.

Help menu options

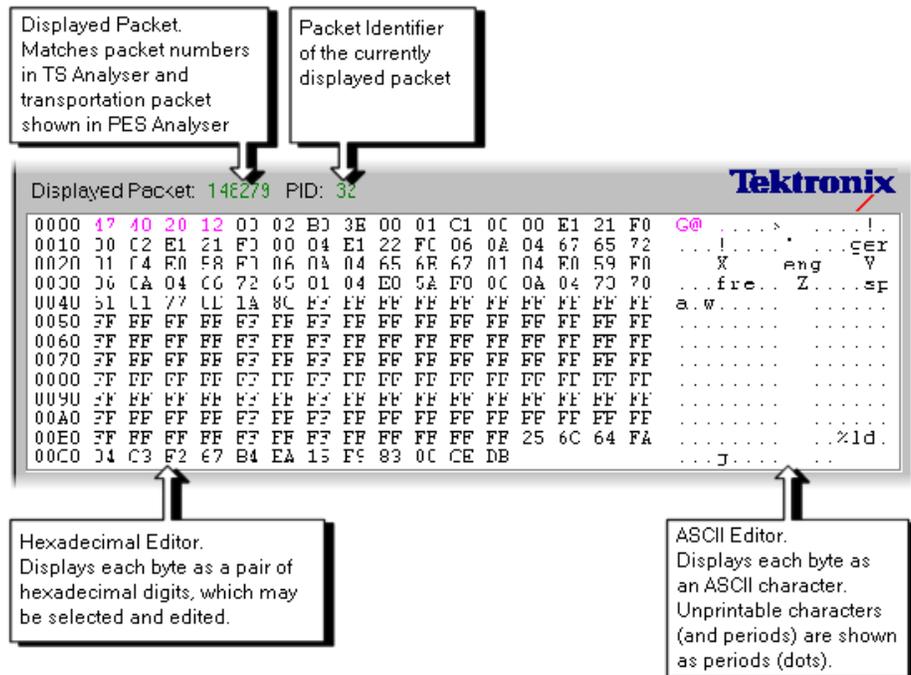
The following table lists the **Help** menu options:

Table 18: Help menu options

Command	Function
About...	Displays the program version number and license number.

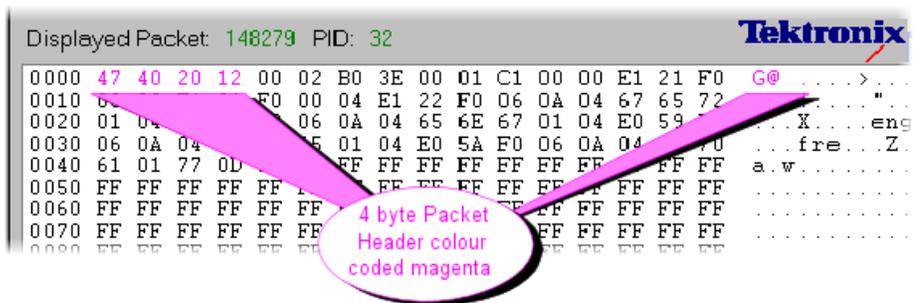
Transport Stream Editor – Hex Editor

The **Hex Editor** displays and provides editing facilities for the contents of the current packet in both hexadecimal representation and ASCII characters:

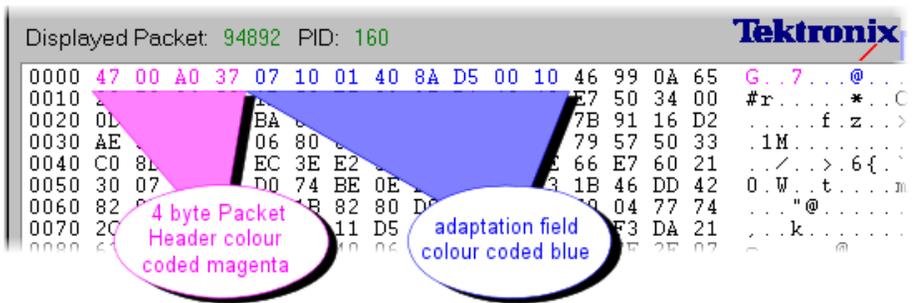


Color coding

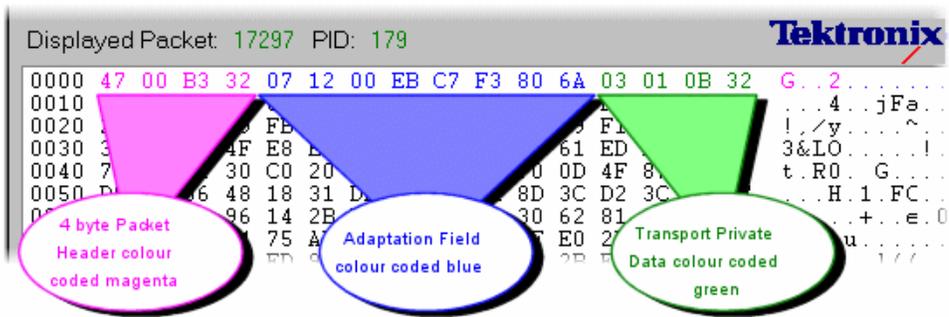
Color coding is used to show the "footprint" of various header fields, in both the hexadecimal and ASCII views. The packet payload and any Reed Solomon data is shown in black. The bytes of the packet header field are shown in magenta text:



When an adaptation field is present it is shown by blue colored text:



If transport private data is present it is shown in green:



NOTE. It is possible to define a transport private data area that is not contained within the adaptation field area specified by the adaptation field length.

Selecting and editing

One or more bytes can be selected using either the hexadecimal or ASCII view. Changes are made using options from the menus and by typing new values in the hexadecimal view.

When the mouse pointer is moved over either of the views in the Hex Editor, the pointer changes to the Text Select pointer.

Individual bytes

To edit a byte or character, position the mouse pointer over the desired character in either the ASCII or hexadecimal view. Then click the left mouse button. A flashing inverse video cursor appears to the left of the character.

Alternatively, double-click either view of the byte to select it for use with an option from the Edit menu operation.

New values can be entered from the keyboard. As each character is typed, the cursor moves on to the next. It can be repositioned with the mouse or by using the up, down, left and right cursor keys.

The cursor will not move forward beyond the end or back before the start of the packet. To select another packet, use the Slider Bar.

Block of bytes

A block of bytes can be selected for operations such as copying to the clipboard or filling with the same value.

Click on the first required byte and hold down the left mouse button. Then drag the mouse pointer to the last byte to be selected and release the left mouse button. Both the ASCII and Hex views can be used for selection. The selection is shown in inverse video in the view from which the it was made, and by an outline around the selection in the other view. For example, when made from the ASCII view, a selection looks like this:

```

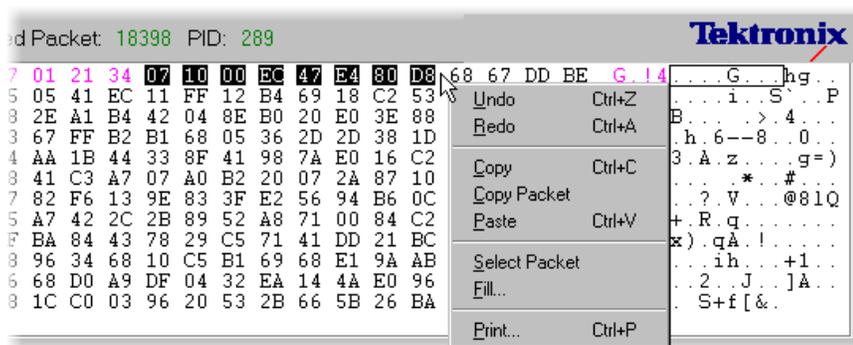
0000 47 40 10 30 81 00 FF  G@.0.....
0010 FF  .....
0020 FF  .....
0030 FF  .....
0040 FF  .....
0050 FF  .....
0060 FF  .....
0070 FF  .....
0080 FF FF FF FF FF FF 00 40 F0 32 AB CD C1 00 00 F0  .....@.2.....
0090 12 40 10 41 44 48 45 52 45 4E 54 20 4E 45 54 57  [C] TEKTRONIX NETW
00A0 4F 52 4E F0 13 00 01 AB CD F0 0D 43 0B 01 09 82  [OR]K.....C....
00B0 63 65 45 A1 03 00 00 03 99 E0 1A A1  .....
    
```

Once selected, the block of bytes can be edited with the available options from the **Edit** and the **Pop-Up** menus. Clicking the mouse or pressing a cursor key clears the selection.

To select a block using the cursor keys: position the cursor on the first byte, and then hold down the Shift key and move the cursor with the cursor keys. The selection is drawn between the initial and current cursor positions. Release the Shift key when the cursor has reached the last byte. Clicking the mouse or pressing a cursor key clears the selection.

Editing commands

The Edit menu, pop up menu, and toolbar buttons provide a variety of options for editing the packet contents. The Pop-Up menu is opened by clicking the right mouse button when the pointer is over the Hex Editor, for example:



Depending on what operations have recently been performed and on what is selected, the menus and toolbar will offer different commands. The complete set of menu options and associated buttons are as follows:

- TS Editor keeps a list of recent changes. Each Undo command backs out the most recent change from the list. That change is moved to the Redo list in case it needs to be reinstated. As each change is undone the cursor moves to the appropriate field (in the Hex or Header Editors) and restores the previous value.
- Reinstates the most recently undone operation. When a new edit is made, the Redo list is cleared.
- Copies the currently selected bytes to the clipboard. From there they may be pasted in to other packets or used by other applications.
- Copies the entire contents of the current packet to the clipboard. From there it can be pasted into other packets or used by other applications.
- Pastes packet contents held on the clipboard into the current packet, starting at the current cursor position.

Select Packet	Selects the entire packet. This is a quick alternative to selecting all the packets with the mouse or keyboard.
---------------	---

Fill	Fills all the selected bytes with a hexadecimal value.
------	--



This option opens the Fill Byte dialog box. Enter the fill value then select the OK button. The Cancel button abandons the operation, leaving the bytes in their original state.

There are no Toolbar buttons for the Select Packet and Fill commands.

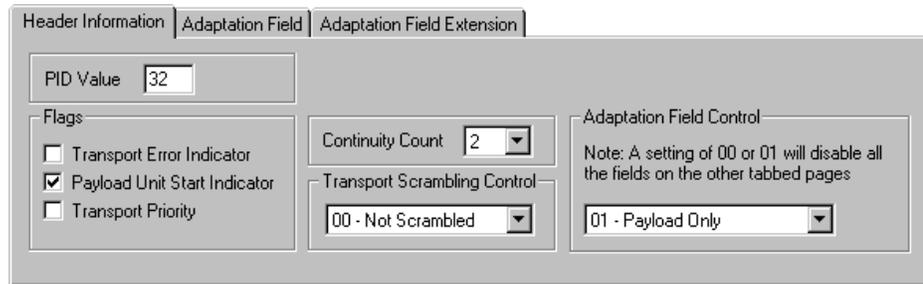
Transport Stream Editor – Header Editor

The **Header Editor** has three tabs, which show/allow editing of the basic header, adaptation field, and the adaptation field extension contents. The **Hex Editor** is immediately updated to reflect the new values when changes are made to the **Header Editor**.

Binary flags are shown with check boxes whose state can be changed by clicking in the box with the mouse pointer. Multi-bit fields may be edited by typing in the new values or selecting a value from a drop down list.

NOTE. *It is important to remember that changing a flag or field often alters the structure of the header. The other flags and fields will be reinterpreted according to the data underlying their new position in the structure.*

Header Information tab

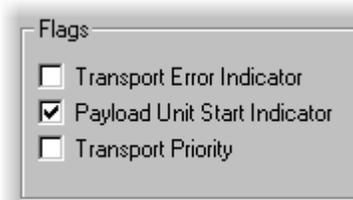


The **Header Information Tab** interprets the contents of the (shown in magenta text in the Hex Editor) for ease of understanding and editing.

The **PID Value** field displays, and allows editing of, the 13-bit PID as a decimal value: (The PID is packed into a pair of bytes with the Flags shown below.)



The **Flags** fields display the state of each binary flag in a check box:

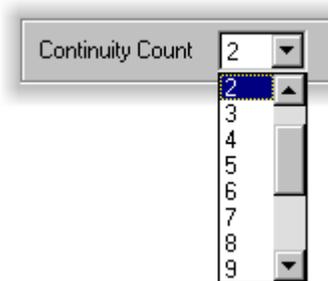


= 0 or false

= 1 or true

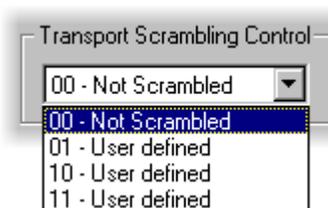
Click in the box to toggle the state of a flag.

The **Continuity Count** field displays the value of the four bit Continuity Count field in decimal:



To avoid any typing errors, the drop down list allows selection of a different value.

The **Transport Scrambling Control** shows the two bit **Transport Scrambling Control** field as a binary bit pattern, with a text description:



Use the drop down list to select a different value.

The text gives the interpretation for the bit pattern according to the standard that is currently selected: MPEG2, DVB or ATSC. Use the View menu to select the required option.

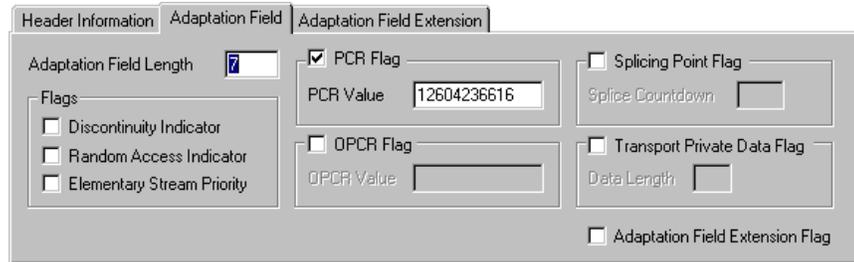
The **Adaptation Field Control** shows the two bit **Adaptation Field Control** as a binary bit pattern, with a text description:



Use the drop down list to select a different value.

The **Adaptation Field** and **Adaptation Field Extension** tabs will be empty (grayed out) when the 01 - Payload Only or 00 – Reserved values are selected.

Adaptation Field tab

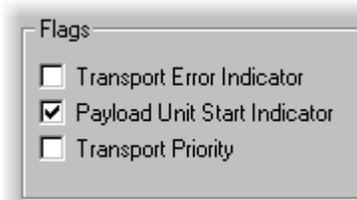


The **Adaptation Field** Tab interprets the contents of the **Adaptation Field** (shown in blue text in the Hex Editor) if one is present in the packet. To be able to edit the **Adaptation Field**, the **Adaptation Field Control** value in the **Header Information** tab must indicate that an adaptation field is present.

The **Adaptation Field Length** field shows the length of the **Adaptation Field** in bytes and allows it to be edited in decimal:



The **Flags** fields display the state of the binary flags in check boxes:



Flags

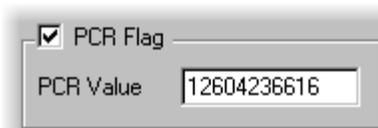
- Transport Error Indicator
- Payload Unit Start Indicator
- Transport Priority

= 0 or false

= 1 or true

Click in the box to toggle the state of a flag.

The **PCR Flag** field displays the state of the binary PCR Flag in check boxes:



PCR Flag

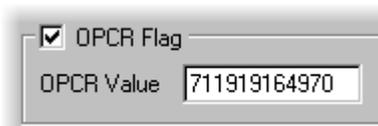
PCR Value

= 0 or false

= 1 or true

When the flag is true the PCR Value is shown and can be edited in decimal notation.

The **OPCR** field displays the state of the binary OPCR Flag in check boxes:



OPCR Flag

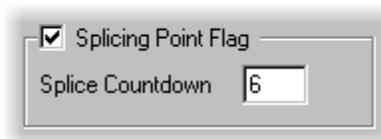
OPCR Value

= 0 or false

= 1 or true.

When the flag is true, the OPCR Value is shown and can be edited in decimal notation.

The **Splicing Point Flag** fields displays the state of the Splicing Point Flag in check boxes:



= 0 or false

= 1 or true

When the flag is true, the **Splice Countdown** value is shown and can be edited in decimal.

The **Transport Private Data Flag** field displays the state of the Transport Private Data Flag:



= 0 or false

= 1 or true.

When the flag is true, the **Data Length** is shown in bytes and can be edited in decimal.

The **Adaptation Field Extension Flag** indicates the state of the binary Adaptation Field Extension flag.



= 0, no Adaptation Field Extension. The Adaptation Field Extension Tab can be viewed, but all of the fields will be grayed out.

= 1, Adaptation Field Extension present. The Adaptation Field Extension Tab will show and enable editing of the information contained in the Adaptation Field Extension.

Adaptation Field Extension tab

The **Adaptation Field Extension** Tab interprets the contents of the Adaptation Field Extension if one is present in the packet. To be able to edit an Adaptation Field Extension the Adaptation Field Extension flag must be set to 1 (the box must be checked) in the Adaptation Field Tab.

Shows the length of the **Adaptation Field Extension** in bytes and allows it to be edited in decimal.

Extension Length

Displays the state of the **LTW Flag** :

= 0 or false

= 1 or true

When LTW is true, the state of the **LTW Valid** flag and value of the **LTW Offset** are shown. The Valid flag may be toggled and new Offsets can be typed in decimal.

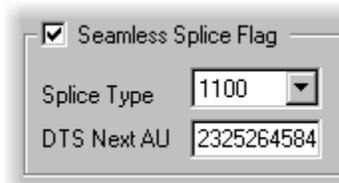
Displays the state of the **Piecewise Rate Flag**:

= 0 or false

= 1 or true

When the flag is true, the Rate is shown and can be edited in decimal notation.

Displays the state of the **Seamless Splice Flag**:

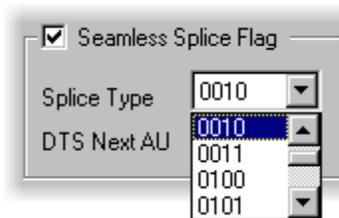


= 0 or false

= 1 or true

When the DTS Next AU value is shown and it can be edited in decimal notation.

The 4 bit **Splice Type** is shown as a bit pattern.



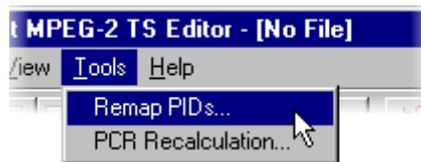
It has a dropdown list containing all 16 possible bit patterns.

Use the list to select a different value.

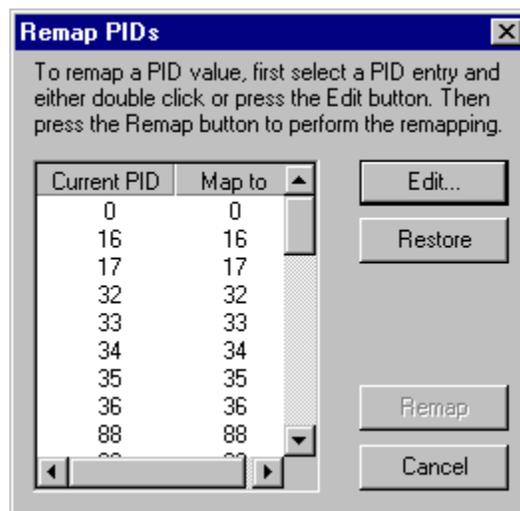
Transport Stream Editor – PID remapping

NOTE. *The packets of one or more PIDs may be remapped (moved to different PIDs). Only the PID in the packet headers is changed. Any packet payload contents, such as SI and PSI tables are unaffected. So remapping can break the references from tables to PIDs, or be used as an investigation to correct broken references.*

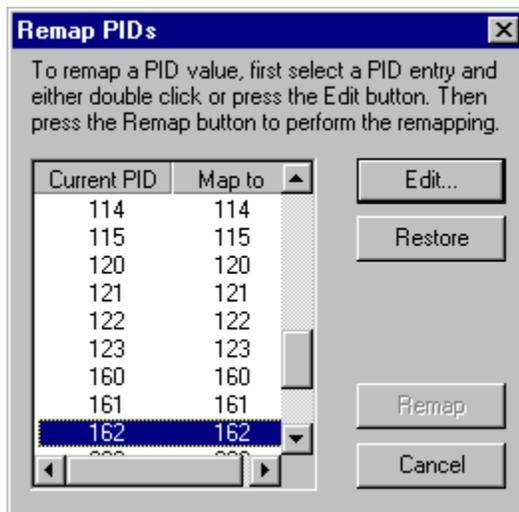
To remap packets from one or more **PIDs**, select the **Remap PIDs** option from the Tools menu:



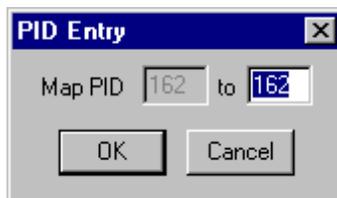
The program scans the file to build a list of PIDs, displaying the Hourglass mouse pointer while it is busy. It then opens the **Remap PIDs** dialog box, pictured in the second screenshot below:



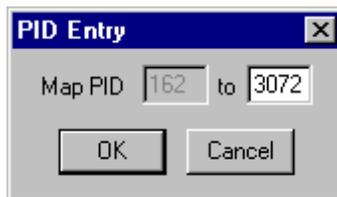
To specify a mapping from a current PID to a new PID, select the current PID entry from the list by clicking on it:



Now select the **Edit** button, which opens the **PID Entry** dialog box: (Alternatively, double-click on the required entry in the list.)



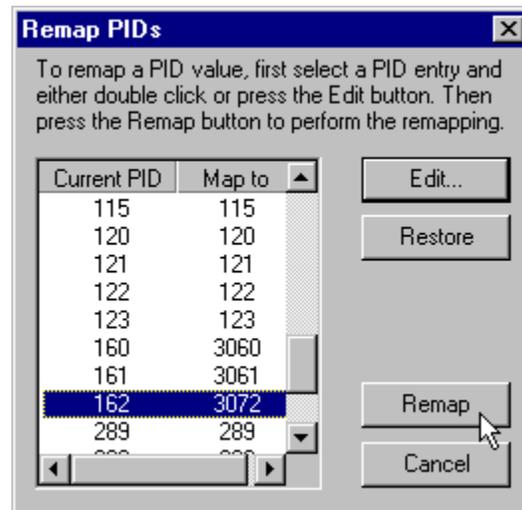
Type in the value for the new **PID** to map to and select **OK**:



Repeat this process for each **PID** that is to be remapped.

The Restore button will change the value of the selected **Map to PID** back to that of the **Current PID** without having to open the PID Entry dialog.

When all the mappings are specified, select the **Remap** button: (The Remap button is not enabled unless one or more mappings has been specified.)



The hourglass mouse pointer is displayed while the program performs the remapping. On completion, the dialog box closes and control is returned to the main window.

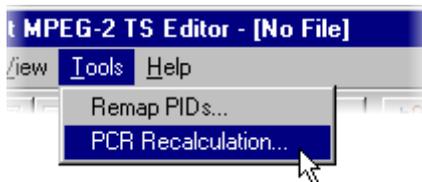
Transport Stream Editor – PCR recalculation

The Program Clock References to one or all Programs can be changed. The rate can be changed and/or any one of six types of jitter added. Uses of PCR Recalculation include:

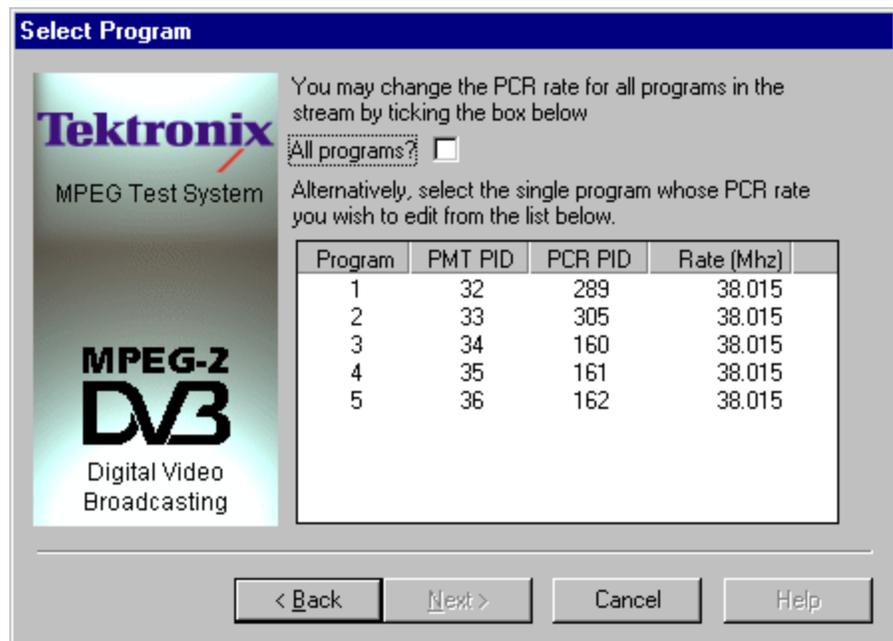
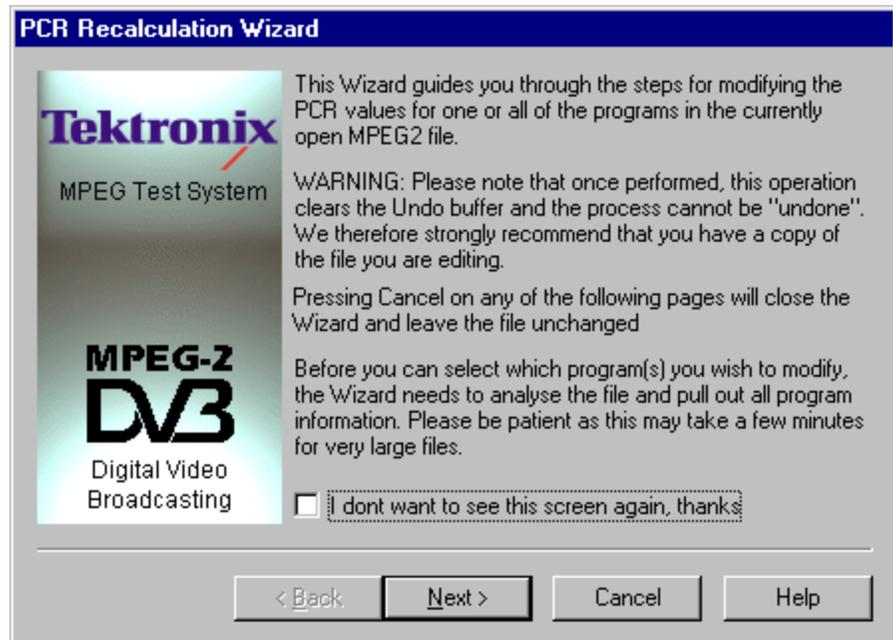
- Recalculating the rate at the correct value, without adding jitter, on a recording of a faulty stream can be used to remove suspected PCR problems. If the recalculated stream works correctly the problem is in the PCR.
- Creating test data with known deviations in rate for exercising other equipment.

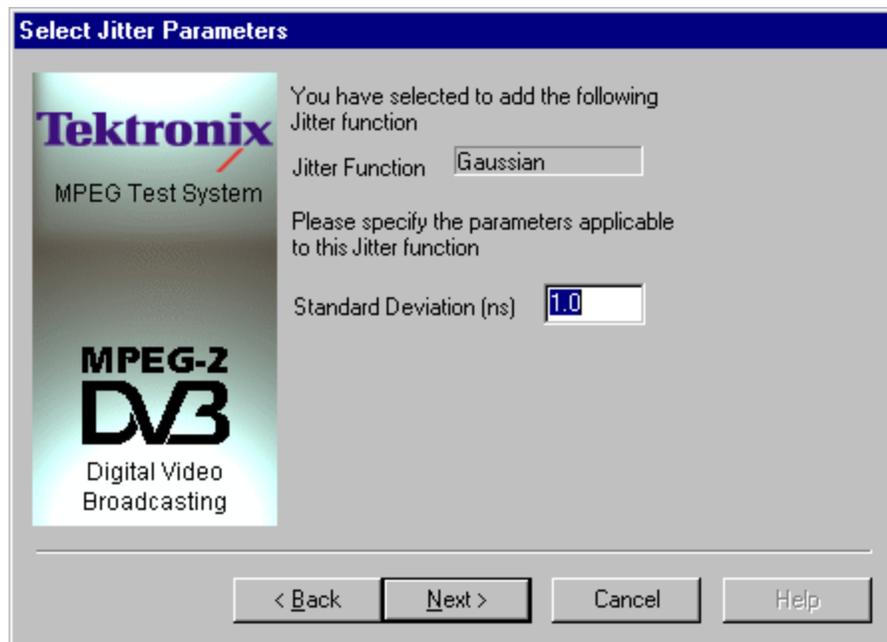
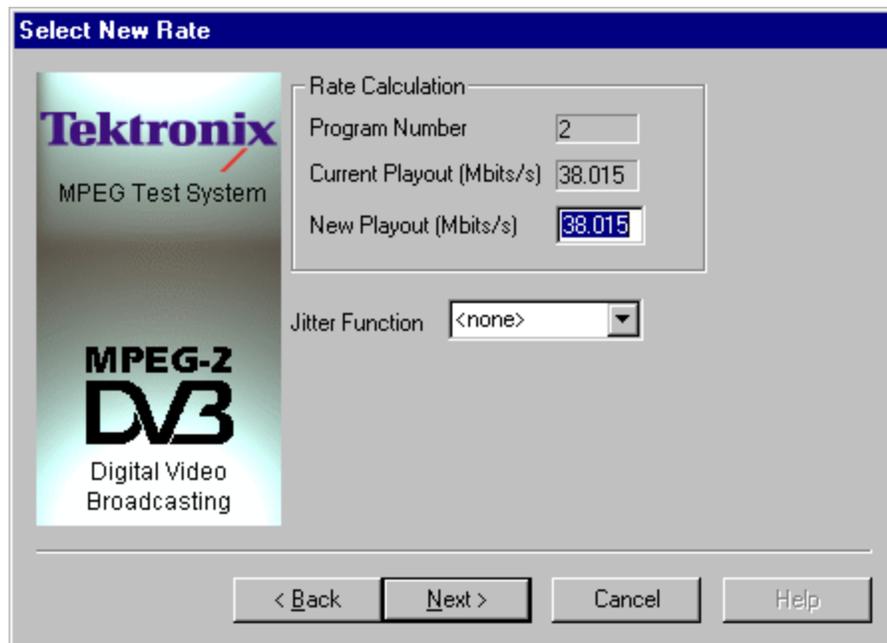
NOTE. Do not perform PCR Recalculation on an original recording. This operation is not reversible, so it is strongly recommended that a copy of the original file is used.

To modify the PCR, select the **PCR Recalculation** option from the **Tools** menu:

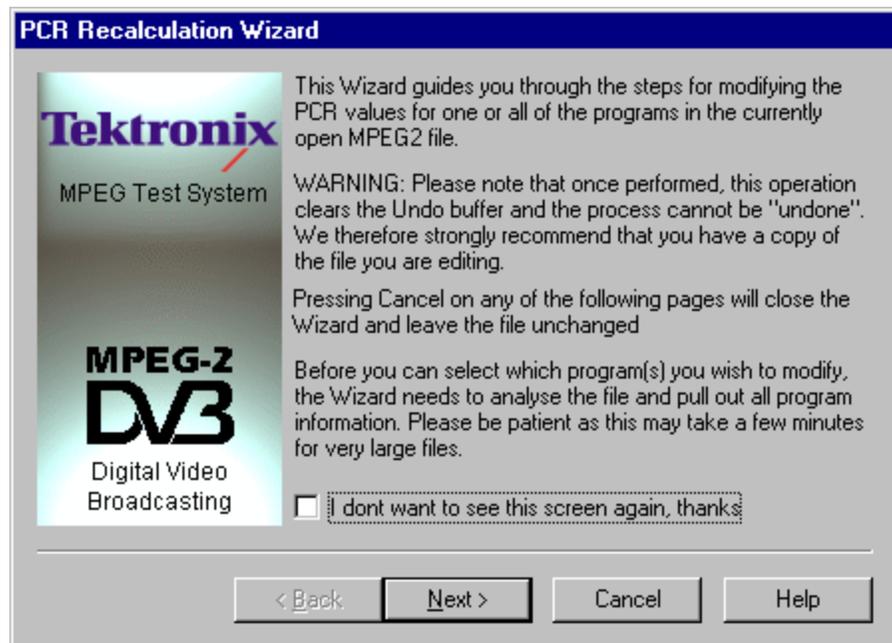


This runs a wizard to analyze the program structure, guide the user through the available options, and then recalculate the PCR values. The wizard presents 3, 4 or 5 pages depending upon the chosen options:



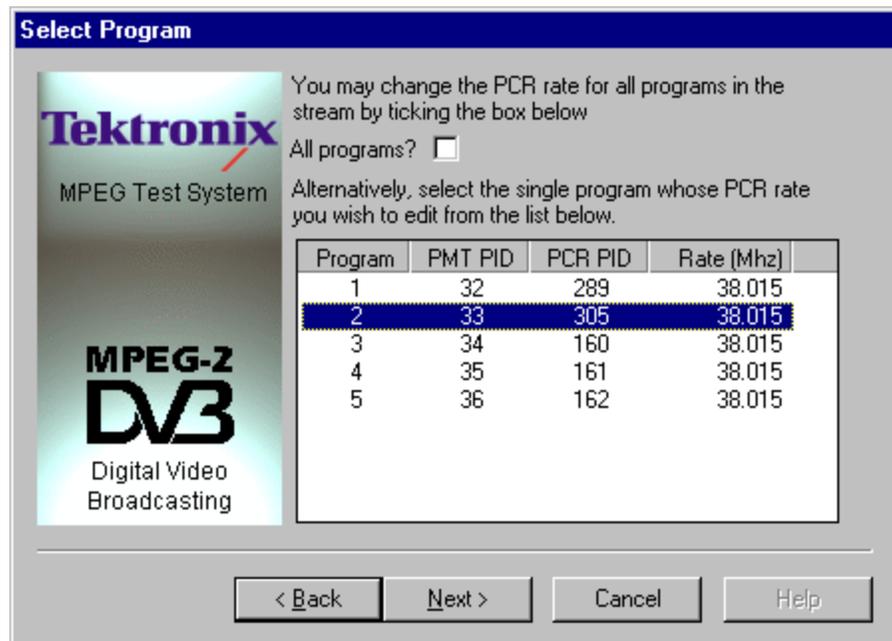


By default, the wizard will show this Introduction first:

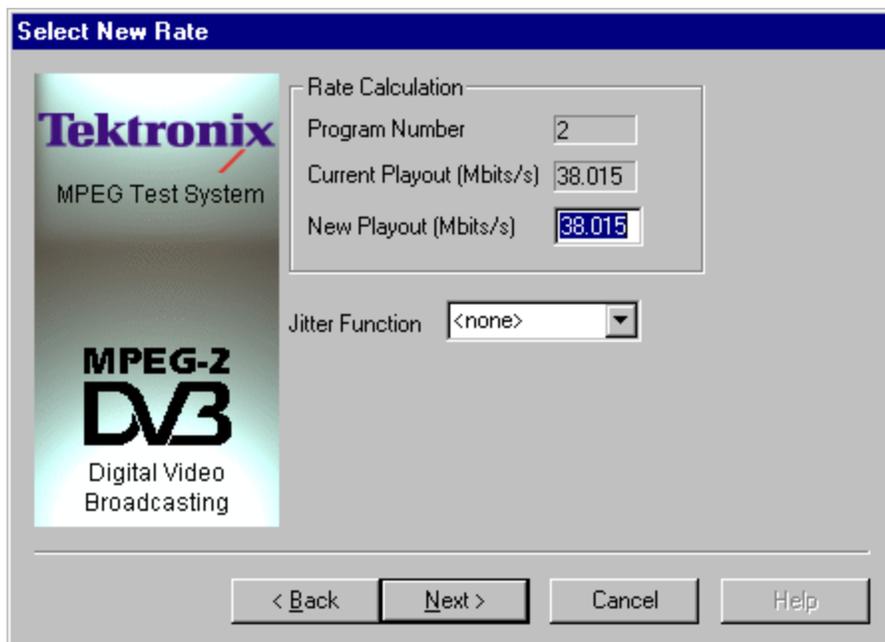


It may be disabled for future recalculations by selecting the check box option at the bottom of the introductory text. Selecting the **Next** button brings you to the **Select Program** page.

The wizard has to analyze the file to extract the relevant Program Information, which may take a while. When analysis is complete, the **Select Program** page shows a list of the programs whose PCR values may be changed (see the following illustration):

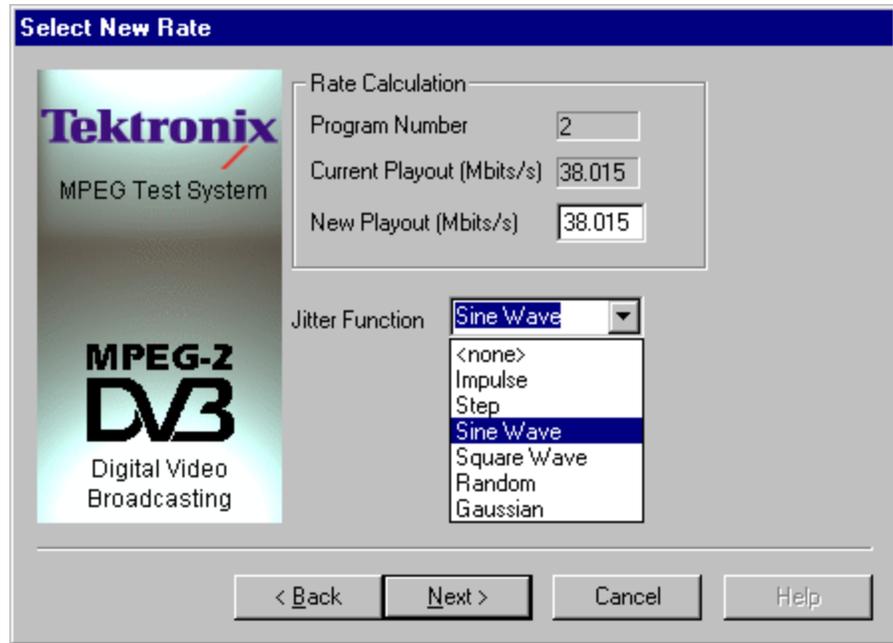


To recalculate the **PCR** rate for all the programs, check the **All programs?** option. Otherwise, select one of the programs from the list. Then select **Next** to move on to the **Select New Rate** page. The **Back** button moves back to the **Introductory Page**:



Keeping the rate as **New Payout = Current Payout** and selecting **Jitter Function <none>**, will recalculate the **PCR** based on the current rate. This could be used, For example, to investigate a suspected problem with the PCR by playing the original and recalculated versions to see if there is a difference.

A **New Payout** rate can be specified and/or a **Jitter Function** can be applied to the rate. There are seven **Jitter Functions** available including <none>. The available functions are:

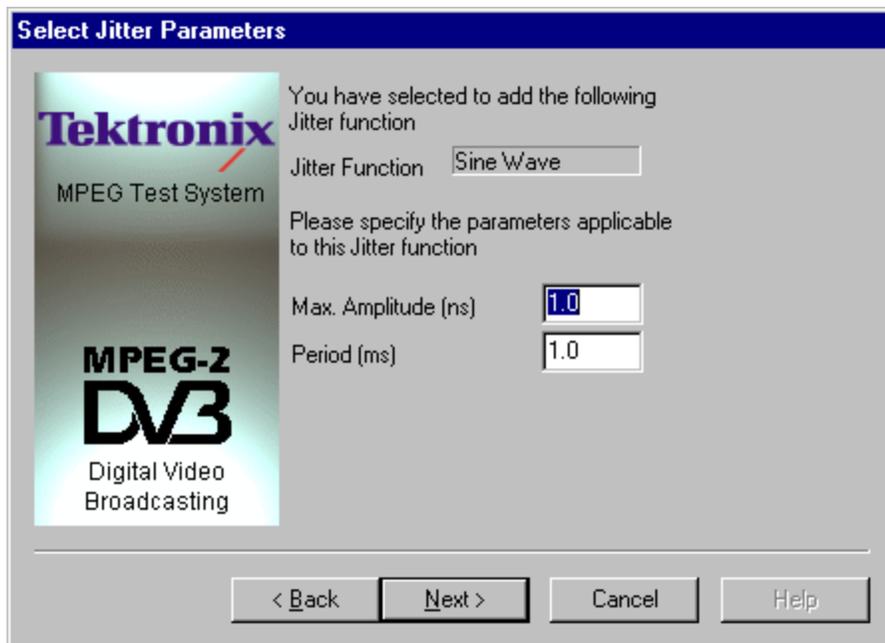


Each of the jitter functions is described in more detail at the end of this subsection.

If a Jitter Function is required, choose one of the six functions from the dropdown list, otherwise leave it set to <none>. Specify any change in the New Payout rate and select the **Next** button. Selecting **Back** returns to the Select program page.

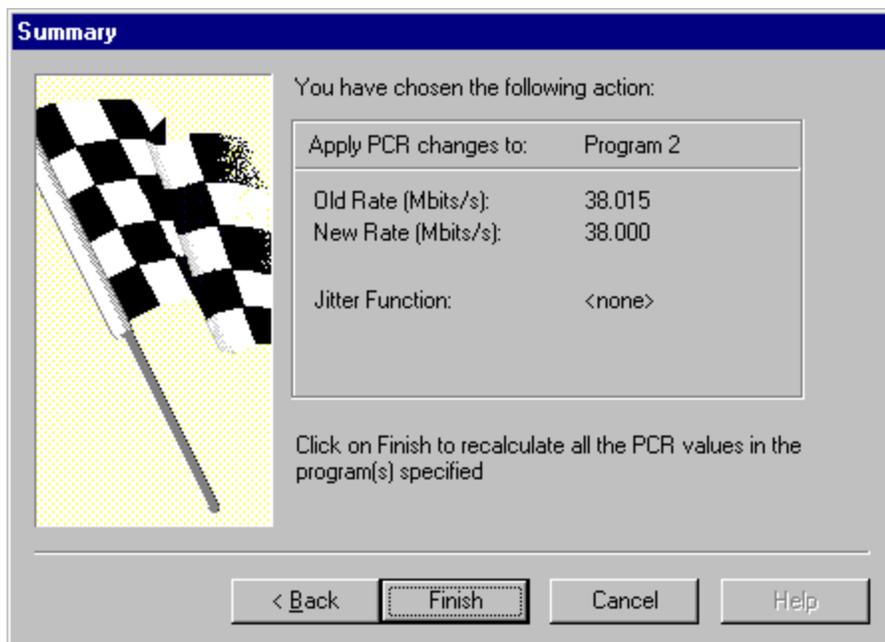
When no Jitter function, (<none>), was selected, the Select Jitter Parameters page will not appear. Go on to the Summary page, which shows a picture of a checkered flag.

With a **Jitter Function** selected, the next page will be **Select Jitter Parameters**. This asks for additional information specific to the chosen **Jitter Function**. For example, the **Sine Wave** function requires the parameters shown in the following screenshot:



Specify the required parameters and select **Next** to move on to the **Summary** window. Use the **Back** button to return to the **Select New rate** page.

The **Summary** window displays a short list of the specified PCR rate changes:



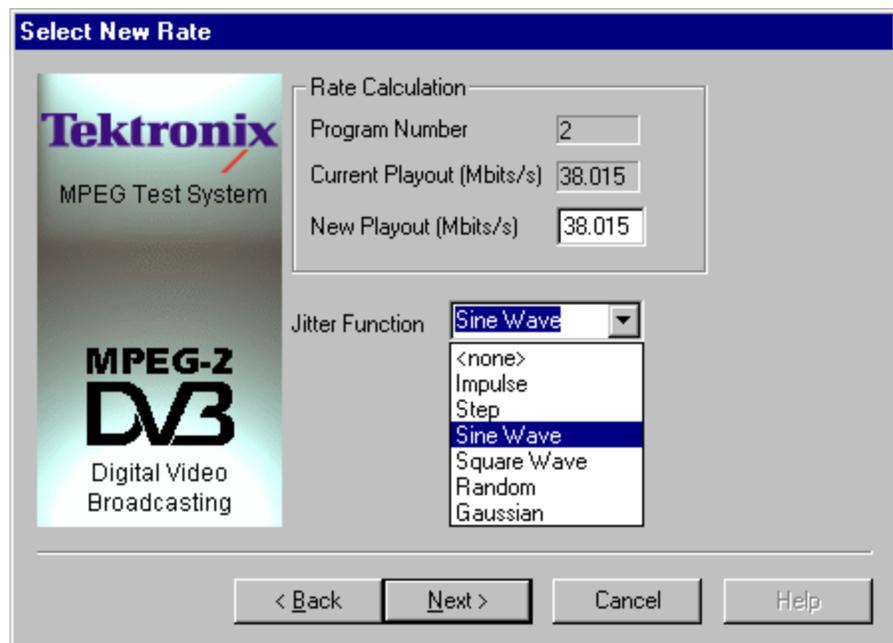
NOTE. Select *Finish* to recalculate the PCR values. Remember, once *Finish* has been selected, there is no going back.

Use the Back button to return to the previous pages to make any changes.

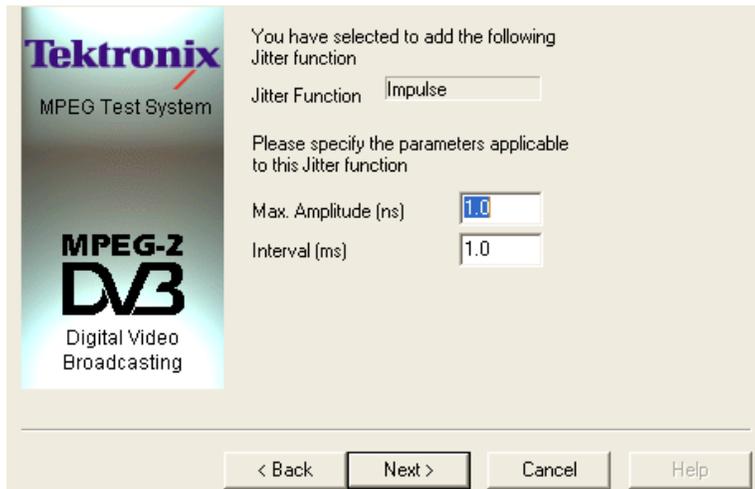
The program may take a while to perform the recalculations. The Summary page will stay on screen and the Hourglass mouse pointer be displayed while the wizard is processing. When the summary page disappears the calculation is complete and the file can be closed or edited.

Jitter functions

Select the required **Jitter Function** from the Select New rate page, then select Next to move on to the **Select Jitter Parameters** page to specify the parameters for the selected **Jitter Function**. The following subsections provide details about each function:



Impulse The **Impulse Jitter** function adds a positive or negative value to a single PCR:



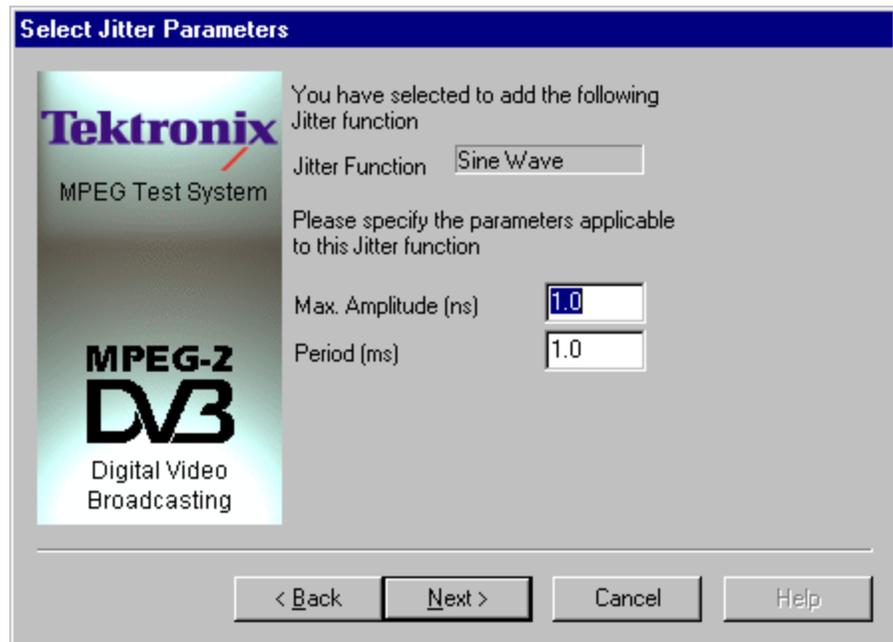
Max Amplitude	Specifies the size of the impulse in nano-seconds. Type a minus sign in front of the value for a negative impulse.
Interval	Specifies the time taken from the start of the file at which the Impulse is to be applied.

Step The **Step Jitter Function** adds a positive or negative offset to the ideal PCR values after a specified time. The offset will be the same for all PCRs:



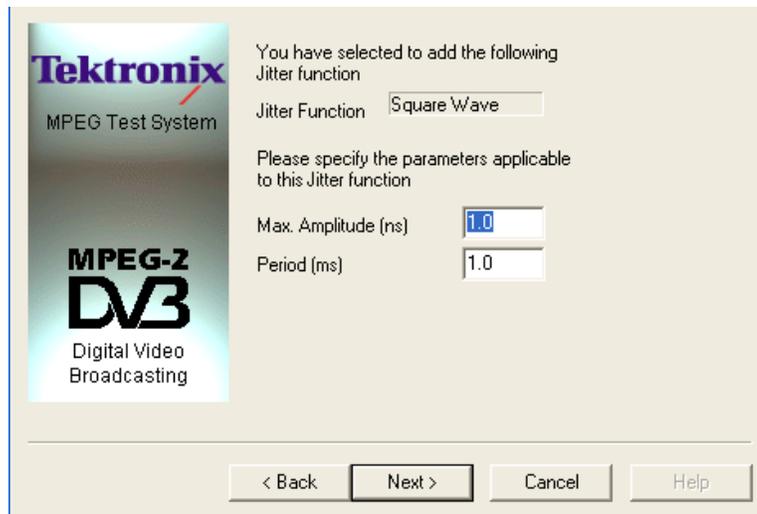
Max Amplitude	Specifies the size of the offset in nano-seconds. Place a minus sign in front of the value for a negative offset.
Interval	Specifies the time taken from the start of the file of the first PCR to which the offset is to be applied.

Sine wave An offset that varies according to a sine function is applied to the ideal PCR value for each PCR:



Max Amplitude	Specifies the amplitude of the sine wave in nanoseconds.
Period	Specifies the period of the sine wave in milliseconds.

Square wave An offset, which varies according to a square wave function is applied to the ideal PCR value for each PCR. The square wave has an equal **mark / space ratio**:



Max Amplitude Specifies the amplitude of the square wave in nanoseconds.

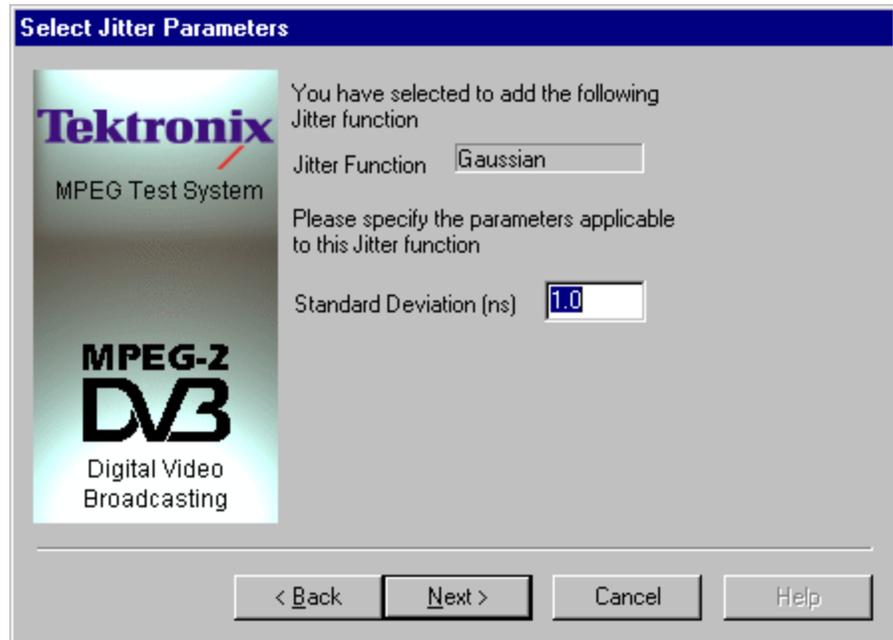
Period Specifies the period of the square wave in milliseconds.

Random The PCR jitter applies offsets of a uniform random distribution to the ideal values of the PCRs. Each offset will be within the range of \pm the specified **Amplitude**:



Max Amplitude Specifies the maximum amplitude of the jitter, relative to the ideal value, that can be added to any PCR. Only a positive value can be entered. The amplitude is always from -Max. Amplitude to +Max. Amplitude centered on the ideal PCR value.

Gaussian The offsets are applied to the ideal **PCR** values following a Gaussian distribution according to the specified **Standard Deviation**:



Standard Deviation

Specifies the standard deviation to be used by the jitter function in deriving the offset for each PCR, relative to the ideal PCR value. Only a positive value can be entered for standard deviation.

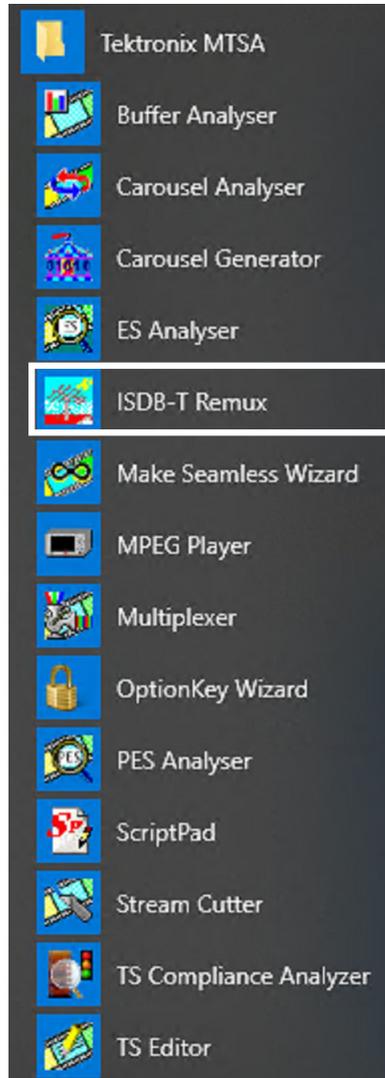
ISDB-T Remux - Getting started

The ISDB-T Remux provides the capability to create a transport stream defined in the ARIB STD-B31 “Transmission System for Digital Terrestrial Television Broadcasting” standard from an MPEG-2 transport stream. A transport stream that is remultiplexed by the ISDB-T Remux can be played by the MPEG Player.

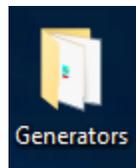
NOTE. *Modulation parameter information is not inserted into SI tables of a created transport stream file.*

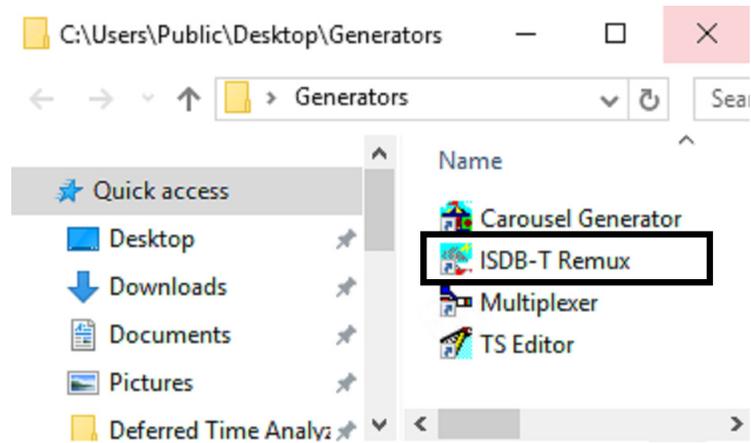
Starting and exiting the program

The program can be started by selecting the **ISDB-T Remux** option from the **Start > Tektronix MTSA** menu.



Alternatively, you can double click the **Generators** folder from your desktop and then select the **ISDB-T Remux** application.

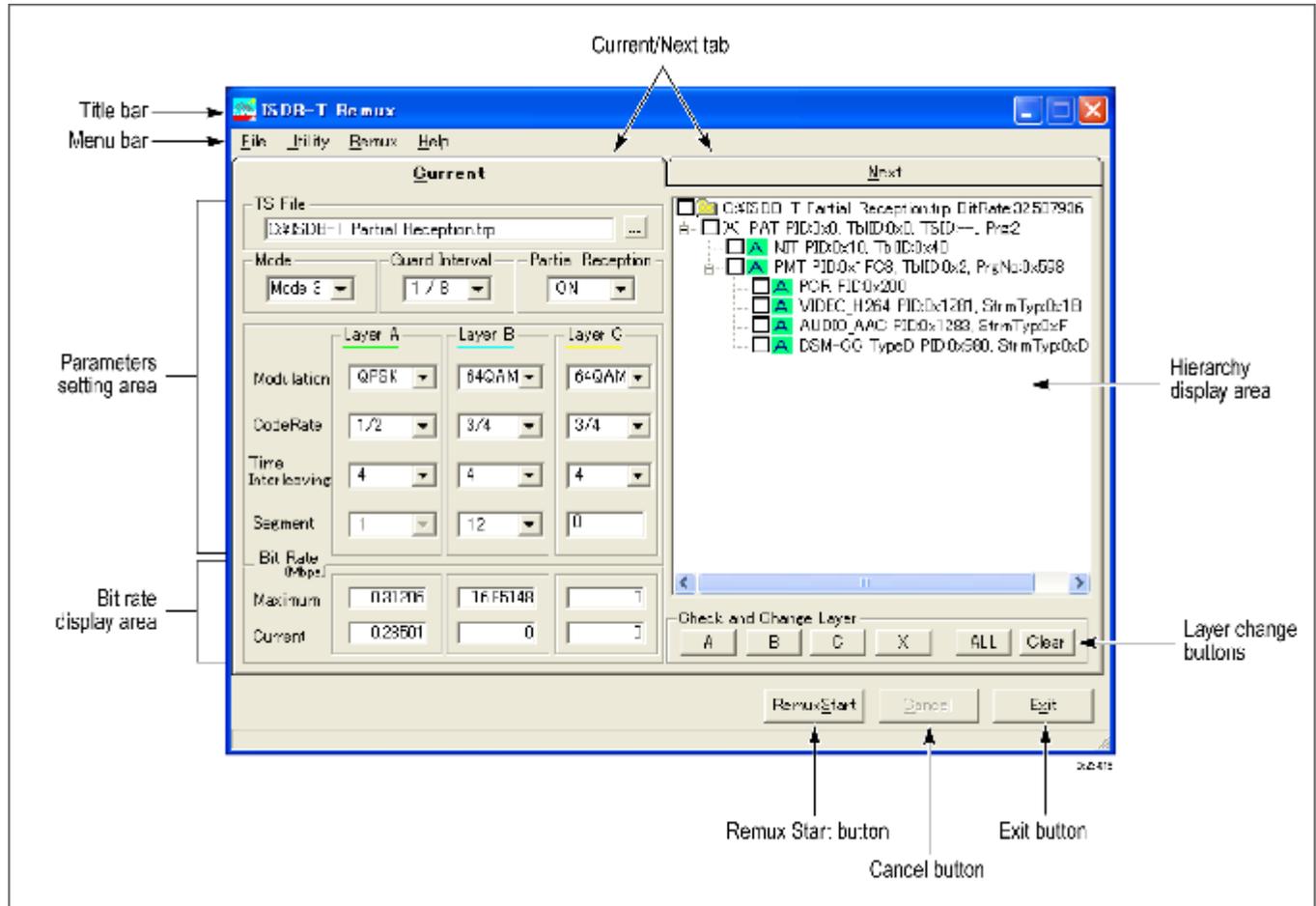




To exit the program, select **File > Exit** from the menu or click **Close Box** on the title bar.

Display elements

This subsection explains the name and functions of the **ISDB-T Remux** screen. The following figure shows the location of display elements:



Title bar The title bar displays the name of the software. It also contains the standard window-sizing boxes for Windows.

Menu bar The menu bar displays the names of the pull-down menus. (See page 170, *ISDB-T Remux – Menus*.)

Current/Next tab Switches the Current parameters setting pane from/to Next parameters setting pane. Use the Next parameters setting pane if you want to continuously output a transport stream file that has a different modulation scheme than the first one. You cannot set only parameters in the Next tab.

NOTE. Be sure to deselect the Regeneration PCR command in the Utility menu if you set parameters in both Current and Next tabs.

When playing a remultiplexed transport stream created using the Current and Next tabs in the MPEG Player; set the Update command in the Play menu of the MPEG Player to Off.

Parameters setting area In the parameters setting area, there are fields to set transmission parameters for remultiplexing a **Transport Stream**:

Figure 3: Parameters setting area

TS File. Specifies a transport stream file to be remultiplexed. To specify a transport stream file, use the Open TS file command in the File menu or the “...” button next to the text box.

Mode. Selects the transmission mode. You can select Mode 1, Mode 2, or Mode 3.

Guard Interval. Selects the guard-interval ratio. You can select 1/32, 1/16, 1/8, or 1/4.

Partial Reception. Specifies whether or not partial reception is available in the hierarchical layer A.

Modulation. Selects the carrier modulation scheme for each hierarchical layer. You can select DQPSK, QPSK, 16QAM, or 64QAM.

Code Rate. Selects the inner-code coding rate for each hierarchical layer. You can select 1/2, 2/3, 3/4, 5/6, or 7/8.

Time Interleaving. Selects the time interleaving length for each hierarchical layer. Selectable values depend on the System Type setting in the **Utility** menu and the **transmission mode setting**.

Table 19: Time interleaving settings and values

System Type setting	Mode setting	Selectable values
Digital TV	Mode 1	0, 4, 8, 16
	Mode 2	0, 2, 4, 8
	Mode 3	0, 1, 2, 4
Digital Sound 3 Segment or Digital Sound 1 Segment	Mode 1	0, 4, 8, 16, 32
	Mode 2	0, 2, 4, 8, 16
	Mode 3	0, 1, 2, 4, 8

Segment. Sets the number of OFDM segments for each hierarchical layer. The values are determined as follows:

- Hierarchical layer A: You can set the value from 1 to 13. If you set the **Partial Reception** list box to ON, you cannot set values other than 1.
- Hierarchical layer B: You can set the value less than or equal to 13–(setting value of the hierarchical layer A). At this time, the number of segments for the hierarchical layer C is set automatically; 13–(setting value of the hierarchical layer A)–(setting value of the hierarchical layer B).
- Hierarchical layer C: The value depends on the settings of the hierarchical layers A and B.

Bit rate display area

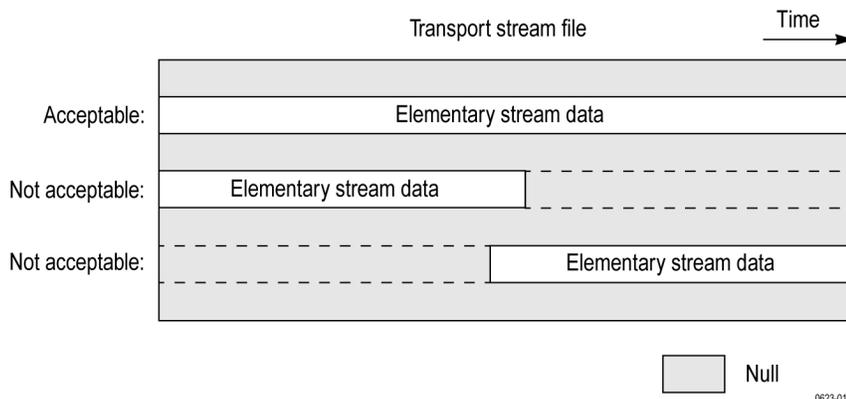
Displays the maximum and current bit rates of the selected transport stream. These values are calculated by 188 bytes/packet.

- Maximum: Shows the maximum bit rate calculated from the current parameter settings.
- Current: Shows the total information bit rate of the selected transport stream.

NOTE. *If the Current value is larger than the Maximum value, the background of the Current field will turn red to indicate that you cannot perform any remultiplexing process under the current parameter settings.*

If Partial Reception is set to ON, you may not perform any remultiplexing process even if the Current value is smaller than the Maximum value.

If the time length of an elementary stream data is shorter than that of a transport stream file, the Current bit rate for the layer that has the elementary stream data is not displayed correctly (see the illustration below). In this case, if you remultiplex the file, relative time values of PCRs and PTS/DTSs in a created ISDB-T transport stream file may become incorrect.



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Hierarchy display area

When you select a Transport Stream to be remultiplexed, a hierarchy display appears in the right side of the application window. The following figure shows the configuration of the hierarchy display:

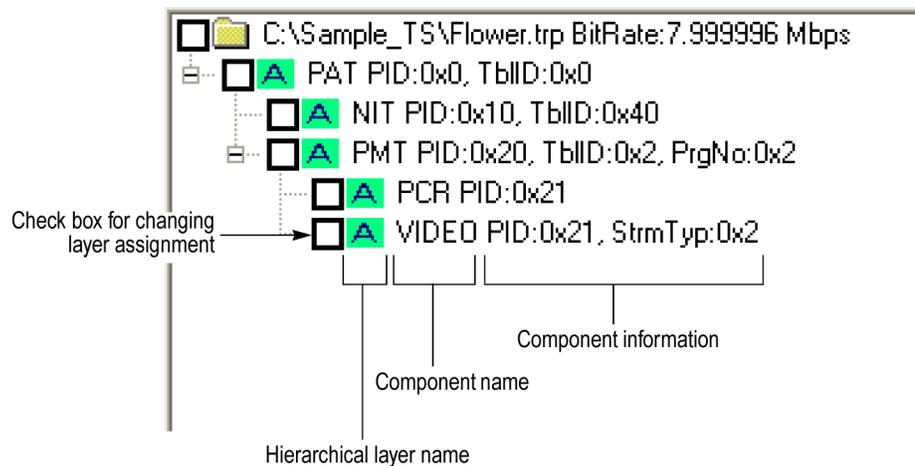


Figure 4: Configuration of the hierarchy display

Check box for changing layer assignment. Sets whether to change the hierarchical layer for the Transport Stream component. When you select the check box, you can change the hierarchical layer using buttons in the Check and Change Layer field. (See page 169, *Layer change buttons*.)

Hierarchical layer name. Shows the hierarchical layer name (A, B, or C) to which the Transport Stream component is assigned. For PID and IIP (ISDB-T Information Packet) that do not exist the packet, an x-indication is displayed instead of the hierarchical layer name.

Component name. Shows the name of the Transport Stream component.

Component information. Shows information about the Transport Stream component such as a packet ID or table ID.

The component information is common to the information used in the MPEG Player for ASI and 204 bytes per packet. (See page 200, *Icon text and dialog box*.)

Layer change buttons By default, all of the transport stream components are assigned to the hierarchical layer A. You can change the layer assignment for the components using the buttons in the Check and Change Layer field.

A/B/C buttons. Changes the hierarchical layer of the transport stream component that have a check mark to the hierarchical layer corresponding to the button.

X button. Replaces the transport stream component that have a check mark with a null packet.

ALL button. Selects all the check boxes of the transport stream components.

Clear button. Clears all the check boxes of the transport stream components.

To change the hierarchical layer assignment for a transport stream component.

1. Click the check box(es) of the component(s) for which you want to change the hierarchical layer. If necessary, use the **ALL** or **Clear** button. You can select check boxes by dragging a mouse on components with the left-mouse button pressed. (If you drag a mouse on components with the right-mouse button pressed, you can clear check boxes).
2. Click the **A**, **B**, **C**, or **X** button to change the assignment. You can also change the hierarchical layer assignment by clicking a layer name on the hierarchy display. In this case, the layer name changes to A-B-C-X in turn.

There are some restrictions on the hierarchical layer assignment for the transport stream components:

- You cannot assign the hierarchical layer that does not set the number of segments.
- If a PCR is included within a packet that has the same PID as the other component, you cannot assign different hierarchical layers to the components.
- If there are two or more components that have the same PID, when you change a hierarchy layer of a component, the other components are also changed to the same hierarchical layer.

Remux start button Starts the remultiplexing process.

Cancel button Cancels the file loading or remultiplexing process.

Exit button Exits the ISDB-T Remux program.

ISDB-T Remux – Menus

The menu bar displays the names of the four pull-down menus: **File**, **Utility**, **Remux**, and **Help**. This section describes the function of each selection in these menus.

File menu

The File menu contains commands for managing file operation.

Open TS File Selects a transport stream file to be remultiplexed. When you select **File > Open TS File**, the **Open** dialog box appears as shown below:

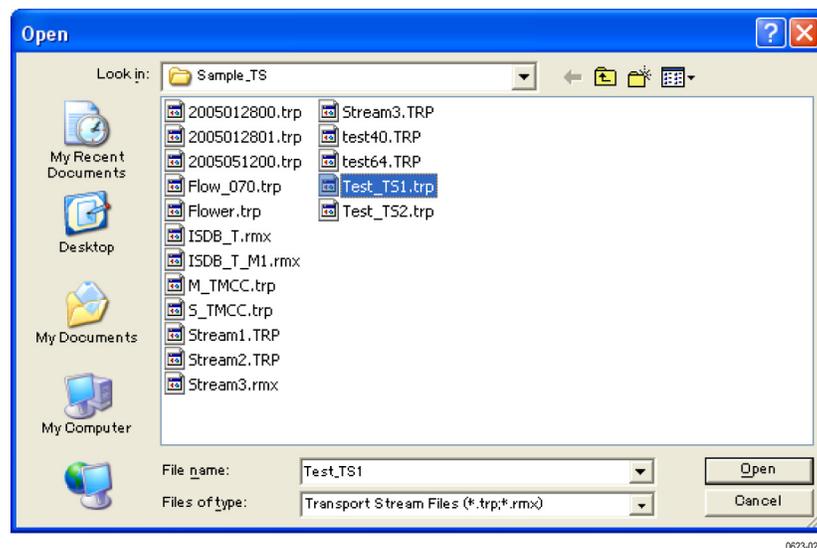


Figure 5: Open dialog box

Select the **Transport Stream** file you want to remultiplex in the file list and click the **Open** button to open the file.

NOTE. For the selected transport stream to be recognized as a transport stream file, sync bytes must be identified in five consecutive transport stream packets.

If a sync byte is identified in the middle of a transport stream file, the data before the sync byte are invalid. In addition, the end of data that is less than 188 bytes is invalid.

Close TS File Closes the currently selected file.

Load Parameter Loads a saved parameter file (.prm) to use as the current settings. When you select **File > Load Parameter**, and then choose a parameter file in the **Open** dialog box, a dialog box appears as shown below:

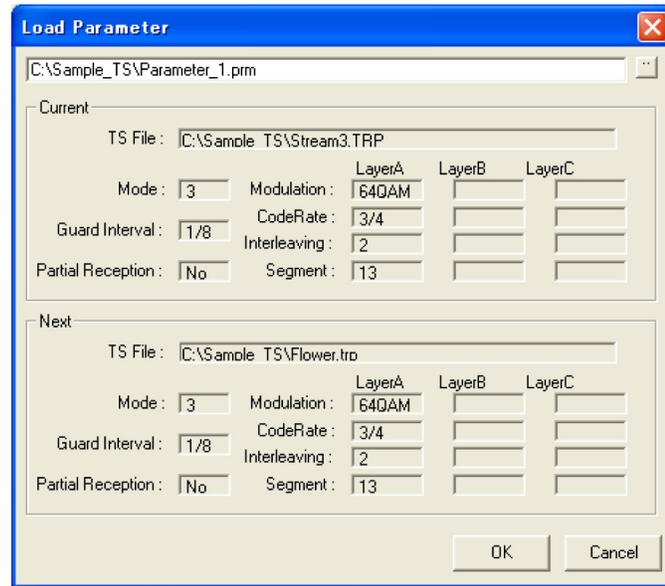


Figure 6: Load Parameter dialog box

If you click the “...” button at the right side of the text box, the **Open** dialog box appears and you can select another parameter file.

Save Parameter Saves the names of Transport Stream files and respective parameters in both **Current** and **Next** tabs to a specified parameter file (.prm).

Reset Parameter Resets the current parameter settings to the default values. When you select **File > Reset Parameter**, a dialog box appears as shown below:

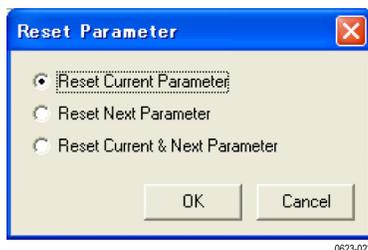


Figure 7: Reset Parameter dialog box

Reset Current Parameter. Resets the parameters in the Current tab to the default settings.

Reset Next Parameter. Resets the parameters in the Next tab to the default settings.

Reset Current & Next Parameter. Resets the parameters in the Current and Next tabs to the default settings.

Minimize Minimizes the ISDB-T Remux application window.

Exit Exits the ISDB-T Remux application.

Utility menu

The **Utility** menu contains commands that select the digital broadcast type and set the parameters needed for remultiplexing transmission control information.

System Type Specifies the terrestrial digital broadcasting type.

Edit Data Rate Changes the data rate of the currently loaded transport stream file. The data rate of the loaded transport stream file may be different from the actual data rate because it is calculated based on PCRs in the file. In this case, you can change the data rate using this command.

When you select **Utility > Edit Data Rate** a dialog box appears as shown below. If you change the **data rate**, the **bit rate** in the **Parameters Setting** area is also changed:

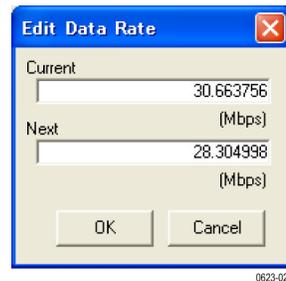


Figure 8: Edit Data Rate dialog box

Current. Changes the data rate of the Transport Stream file in the **Current** tab.

Next. Changes the data rate of the Transport Stream file in the **Next** tab.

Edit Information Sets parameters needed for remultiplexing transmitting control information. When you select **Utility > Edit Information**, a dialog box appears as shown below. The settings become available at the next remultiplexing process:

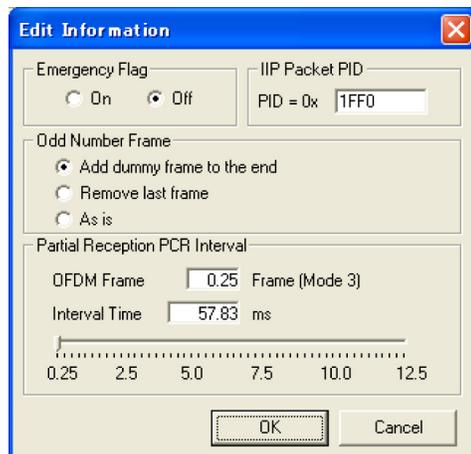


Figure 9: Edit Information dialog box

Emergency Flag. Enables the start flag for emergency-alarm broadcasting.

IIP Packet PID. Specifies the PID of the ISDB-T information packet. The default value is 0x1FF0.

Odd Number Frame. Selects how to process the last frame if the number of multiplex frames are odd numbers. You can select Add dummy frame to the end, Remove last frame, or As is.

Partial Reception PCR Interval. Sets the interval between PCR packets when partial reception is specified in the hierarchical layer A.

Move the slider with the left mouse button pressed to set the interval time. The value in the OFDM Frame box indicates the interval between frames that include PCRs.

Employment Parameter Sets the parameters for hierarchical transmission to the hierarchical transmission patterns defined in ARIB TR-B14. When you select **Utility > Employment Parameter**, a dialog box appears as shown below:

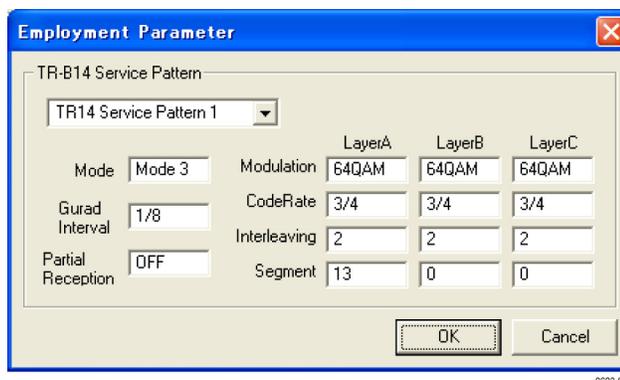


Figure 10: Employment Parameter dialog box

TR-B14 Service Pattern. Selects one of the hierarchical transmission patterns. The following table shows the parameters for hierarchical transmission patterns set by TR14 Service Pattern 1 to TR14 Service Pattern 6:

Table 20: Parameters for hierarchical transmission patterns

TR14 service pattern 1

Mode	3		
Guard interval	1/8		
Partial reception	OFF		
	Layer A	Layer B	Layer C
Modulation	64QAM	64QAM	64QAM
Code rate	3/4	3/4	3/4
Interleaving	2	2	2
Segment	13	0	0

TR14 service pattern 2

Mode	3		
Guard interval	1/8		
Partial reception	OFF		
	Layer A	Layer B	Layer C
Modulation	16QAM	64QAM	64QAM
Code rate	1/2	3/4	3/4
Interleaving	4	4	4
Segment	13	0	0

Table 20: Parameters for hierarchical transmission patterns (cont.)

TR14 service pattern 3			
Mode	3		
Guard interval	1/8		
Partial reception	ON		
	Layer A	Layer B	Layer C
Modulation	QPSK	64QAM	64QAM
Code rate	3/2	3/4	3/4
Interleaving	4	4	4
Segment	1	12	0
TR14 service pattern 4			
Mode	3		
Guard interval	1/8		
Partial reception	OFF		
	Layer A	Layer B	Layer C
Modulation	16QAM	64QAM	64QAM
Code rate	1/2	3/4	3/4
Interleaving	4	4	4
Segment	3	10	0
TR14 service pattern 5			
Mode	3		
Guard interval	1/8		
Partial reception	ON		
	Layer A	Layer B	Layer C
Modulation	QPSK	16QAM	64QAM
Code rate	1/2	1/2	3/4
Interleaving	4	4	4
Segment	1	12	0
TR14 service pattern 6			
Mode	2		
Guard interval	1/4		
Partial reception	OFF		
	Layer A	Layer B	Layer C
Modulation	QPSK	16QAM	64QAM
Code rate	1/2	1/2	3/4
Interleaving	2	2	2
Segment	1	3	9

Regenerated PCR Selects whether to recalculate PCR values when remultiplexing a transport stream.

NOTE. Be sure to clear the command if you have set the parameters in both *Current* and *Next* tabs. In addition, if you play a remultiplexed transport stream created using the *Current* and *Next* tabs from the MPEG Player, set the *Update* command in the *Play* menu of the MPEG Player to *Off*.

Duplicate Packet Specifies whether to duplicate **PAT**, **NIT**, and **CAT** in null packets in the hierarchical layer A when the following conditions are met:

- Partial reception is specified in hierarchical layer A.
- Either the hierarchical layer B or C is the most robust layer.
- **PAT**, **NIT**, or **CAT** is included in hierarchical layer B or C.

Open Setting for no PAT TS Enables loading a transport stream that does not contain any **PATs** (Program Association Tables) by specifying **PID** values for **PMTs** (Program Map Tables). When you select **Utility > Open Setting** for no **PAT TS**, a dialog box appears as shown below:

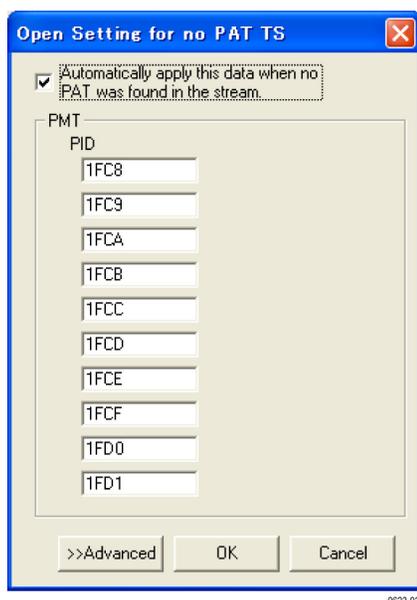


Figure 11: Open Setting for no PAT TS dialog box

Automatically apply this data when no PAT was found in the stream. Sets whether to load the transport stream by using the PMT PID values that are specified in the dialog box when loading a transport stream that does not contain any PATs (if a transport stream contains any PAT, it is loaded using the PAT). If you clear the check box, a transport stream that does not contain a PAT cannot be loaded. By default, the check box is selected.

PMT PID. Specifies each PID value for PMTs in a transport stream to be loaded. By default, the upper eight PID values are set to those that are allocated by the ARIB TR-B14 standard. If you do not specify a PID value for a PMT, it is not recognized as a PMT.

Advanced button. If you click the Advanced button, text boxes to set more PID values and program numbers of PMTs are displayed. Use these text boxes to load PMTs with the same PID value but a different program number. In addition, a text box to set a PID value for an NIT (Network Information Table) is displayed. By default, it is set to 0x0010.

Remux menu

The Remux menu contains commands that **start** and **cancel** the *remultiplexing* process:

- Start** Start the remultiplexing process.
- Cancel** Cancels the remultiplexing process.

Help menu

The Help menu contains command that display the version information about the ISDB-T Remux application.

- About** Displays information including the software version number and copyright information.

ISDB-T Remux – Creating and outputting ISDB-T streams

This section describes how to create and output an ISDB-T Transport Stream file from the MPEG Player.

Creating an ISDB-T transport stream

Perform the following steps to create an **ISDB-T Transport Stream** file as defined in **ARIB STD-B31** standard:

1. Select **File > Open TS File** to open the **Open** dialog box.
2. Select the **Transport Stream** file you want to remultiplex, and then click the **Open** button. After the file is loaded, the **Analysis Complete** message appears.
3. Click the **OK** button in the dialog box.
4. Set the **Transmission parameter** for remultiplexing the transport stream in the parameters setting area.
 - a. Set the **Transmission mode** in the **Mode** list box.
 - b. Set the **Guard interval ratio** in the **Guard Interval** list box.
 - c. Set the number of segments for hierarchical layers A and B in the **Segment** list boxes.
 - d. Set whether or not partial reception is available in the hierarchical layer A in the **Partial Reception** list box.
 - e. Set the carrier modulation scheme for each hierarchical layer in the **Modulation** list boxes.
 - f. Set the inner-code coding rate for each hierarchical layer in the **Code Rate** list boxes.
 - g. Set the time interleaving length for each hierarchical layer in the **Time Interleaving** list boxes. If you use the **Employment Parameter** command in the Utility menu, you can set the parameters to the hierarchical transmission pattern defined in **ARIB TR-B14**.
5. In the hierarchy display area, change the hierarchical layer assignment (A, B, C, or, X) for transport stream components. (See page 169, *Layer change buttons*.)
6. If necessary, click the **Next** tab and repeat steps 1 through 5 to set the parameters.
7. Select **Utility > Edit Data Rate** to open the **Edit Data Rate** dialog box.
8. In the dialog box, change the data rate of the selected transport stream.

9. Select **Utility > Edit Information** to open the **Edit Information** dialog box.
10. In the dialog box, set the parameters needed for remultiplexing transmitting control information.
11. When you set all parameters, click the **Remux Start** button or select **Remux > Start**. The **Save As** dialog box appears.
12. Enter a file name in the **File name** text box (if you do not use the default file name).
13. Click the **Save** button.

Outputting an ISDB-T transport stream

Perform the following steps to output an **ISDB-T Transport Stream** from the **MTSA** instrument:

NOTE. To output a **ISDB-T** stream using the **MTSA-PC**, you will need to copy the file you created using **ISDB-T Remux** to an **MPEG** player with an **ASI** output.

1. Connect a cable from one of the **ASI** connectors on the **MTSA-HW** instrument to an **ISDB-T** modulator.
2. Open the **MPEG Player**.
3. Select **File > Open** and then browse to the desired **ISDB-T** file (.rmx). Click **Open** to open the file. The hierarchical view of the selected file is displayed on the screen as shown below:

NOTE. The **ISDB-T Transport Stream** is different from the typical transport stream, so the icon is not represented as a train.

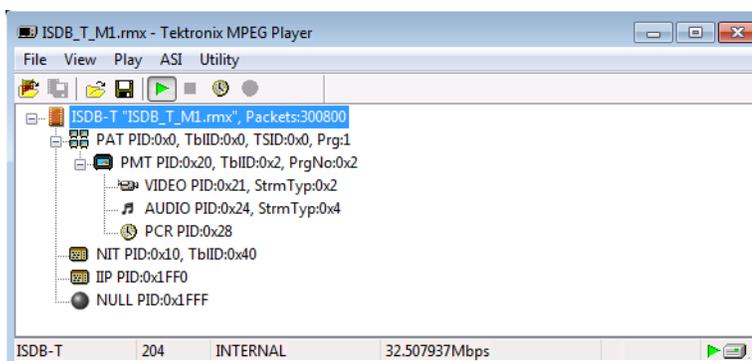


Figure 12: Hierarchical view of the ISDB-T transport stream file

4. Select **Play > Other** to open the Others dialog box.
5. Select **ARIB** in the **Standard** dropdown list and then click **OK**. In the **MPEG Player** window, notice that the standard shown in the lower-left corner changes to **ISDB-T** if the file includes the IIP tables and TMCC as shown above. Otherwise, ARIB is shown as the standard.
6. Select **ASI > ASI Out** to set the player output to the ASI connector you used in step 1.
7. Select **ASI > ASI Format** to set the desired output format.
8. Click the **Play** button to begin streaming the ISDB-T file to an ISDB-T modulator.

ISDB-T Remux – Transmission control information

This section describes transmission control information multiplexed to a transport stream according as the ARIB STD-B31 5.5 standard.

Multiplexing to dummy byte part

The following table lists transmission control information multiplexed to dummy byte part of each transport stream packet (189 byte to 196 byte). Some of the information uses values set in the **Edit Information** dialog box in the **Utility** menu:

Table 21: Multiplexed information to dummy bytes

Byte	Bit	Syntax	Description
0(189)	7	TMCC_identifier	= 1 Terrestrial digital TV
	6		= 0 Terrestrial digital audio
	5	reserved	"1"
	4	buffer_reset_control_flag	"0"
	3	switch-on_control_for_emergency_broadcasting	Set in the Edit Information dialog box
	2	initialization_timing_head_packet_flag	Start packet after changing a transmission parameter: "1" Normally: "0"
	1	frame_head_packet_flag	The multiplex frame head packet: "1" Normally: "0"
	0	frame_indicator	During even frame of the OFDM frame: "0" During odd frame of the OFDM frame: "1"
1(190)	7-4	layer_indicator	"0000": dummy packet "0001": packet transmitted by hierarchical layer A "0010": packet transmitted by hierarchical layer B "0011": packet transmitted by hierarchical layer C "1000": ISDB-T information packet (IIP)
	3-0	count_down_index	"1111": Normally "1110": 15 frames before switching "1101": 14 frames before switching : "0001": 2 frames before switching "0000": 1 frame before switching
2(191)	7	AC_data_invalid_flag	"1"
	6-5	AC_data_effective_bytes	All "1"
	4-0	TSP_counter	A counter in which the head packet of the multiplex frame is 0 and increments one by one in order of packet
3(192)	7-0		
4(193)	7-0	AC_data	All "1"
5(194)	7-0	AC_data	All "1"
6(195)	7-0	AC_data	All "1"
7(196)	7-0	AC_data	All "1"

Multiplexing to IIP

Information except for Table 3-3 is added to invalid hierarchy **IIP** (ISDB-T_Information_Packet), and the packet is replaced with one dummy packet in a multiplex frame. Some of the information uses values set in the **Edit Information** dialog box in the Utility menu. The following table shows the configuration of the **IIP** packet:

Table 22: Configuration of the IIP packet

Syntax	Description	Number of bits
sync_byte	synchronization byte: 0x47	8
transport_error_indicator	Always "0"	1
payload_unit_start_indicator	Always "1"	1
transport_priority	Always "0"	1
PID	The value is set in the Edit Information dialog box Default value: 0x1FF0	13
transport_scrambling_control	Always "00"	2
adaptation_field_control	Always "01"	2
continuity_counter	The value is increased with each transport stream packet. It wraps around to 0 after its maximum value (0x1111)	4
IIP_packet_pointer	The number of packets from the multiplex position to the next multiplex frame head in the multiplex frame of the IIP	16
modulation_control_configuration_information	(See Table 23.)	160
IIP_branch_number	Always "0x00"	8
last_IIP_branch_number	Always "0x00"	8
network_synchronization_information_length	Always "0x00" (no SFN information)	8
stuffing_byte (0xFF)	159 (188-29) bytes 0xFF	8X159

The following table shows the configuration of modulation_control_configuration_information:

Table 23: Configuration of modulation_control_configuration_information

Syntax	Description	Number of bits
TMCC_synchronization_word	Even frame: "0" Odd frame: "1"	1
AC_data_effective_position	"1"	1
reserved	All "1"	2
initialization_timing_indicator	Switching timing of mode and guard interval ratio	4
current_mode	Current Mode value 00: reserved 01: Mode 1 10: Mode 2 11: Mode 3	2
current_guard_interval	Current guard interval ratio 00: 1/32 01: 1/16 10: 1/8 11: 1/4	2
next_mode	Next mode value	2
next_guard_interval	Next guard interval ratio	2
system_indicator	00: Terrestrial digital TV 01: Terrestrial digital audio	2
count_down_index	Transmission parameter switching index	4
switch-on_control_flag_used_for_alert_broadcasting	The value is set in the Edit Information dialog box	1

Table 23: Configuration of modulation_control_configuration_information (cont.)

Syntax	Description	Number of bits
current_configuration_information	The following current information:	(40)
partial_reception_flag	Digital TV = partial reception flag 0: without partial reception 1: with partial reception Digital sound = system identification flag 0: 1 segment system 1: 3 segment system	1
transmission_parameter_for_layer_A	The following transmission-parameter information for hierarchical layer A:	(13)
modulation_scheme	Carrier modulation scheme 000: DQPSK 001: QPSK 010: 16 QAM 011: 64 QAM 111: unused hierarchical layer	3
coding_rate_of_inner_code	Convolution coding ratio 000: 1/2 001: 2/3 010: 3/4 011: 5/6 100: 7/8 111: unused hierarchical layer	3
length_of_time_interleaving	Time interleaving length 000: 0 (Mode 1), 0 (Mode 2), 0 (Mode 3) 001: 4 (Mode1), 2 (Mode 2), 1 (Mode 3) 010: 8 (Mode 1), 4 (Mode 2), 2 (Mode 3) 011: 16 (Mode 1), 8 (Mode 2), 4 (Mode 3) 100: 32 (Mode 1), 16 (Mode 2), 8 (Mode 3) 101-110: reserved 111: unused layer	3
number_of_segments	Number of segments 0001-1101: 1 to 13 1111: unused hierarchical layer	4
transmission_parameter_for_layer_B	Transmission parameter information for hierarchical layer B (same as layer A)	(13)
transmission_parameter_for_layer_C	Transmission parameter information for hierarchical layer C (same as layer A)	(13)
next_configuration_information	Next information (same as the current information)	(40)
phase_correction_of_CP_in_connected_transmission	All "1"	3
TMCC_reserved_future_use	All "1"	12
reserved_future_use	All "1"	10
CRC_32	CRC value from TMCC_synchronization_word to reserved_future_use	32

MPEG Player - Getting started

This section describes the default MPEG Player installed on the MTSA-HW system used to output the selected stream.

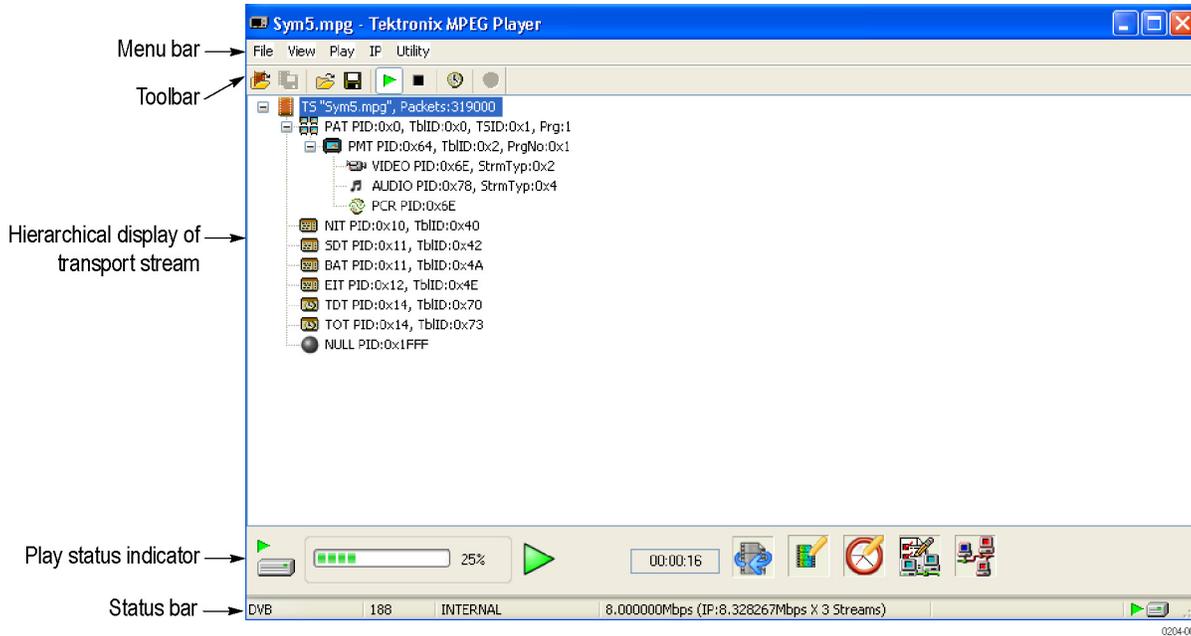
The MPEG Player generates MPEG-2 transport streams that are compliant with ATSC, DVB, and ARIB standards.

The **MPEG Player** provides the following features:

- Data rate: 213 Mbps maximum; 250 Kbps minimum.
- Hierarchical display of the stored transport stream
- 188, 204, non TS bytes packet size
- PCR jitter insertion
- IP and ASI interfaces available
- Playout interfaces: IP and ASI
- Both the commonly used IP versions - IPv4 and IPv6 are supported.
- Stream replication (IP) with some attributes of the stream incremented by a certain value

Display elements

This subsection explains the name and functions and the location of display elements the **MPEG Player** screen:



Menu bar The Menu bar displays menu names.

Refer to *Menus and Controls* for detailed information about the menus. (See page 204.)

Toolbar The toolbar provides shortcut buttons for many of the most often used menu commands. Click a toolbar button to select the corresponding command. You can toggle the toolbar display on and off using Toolbar command in the View menu.

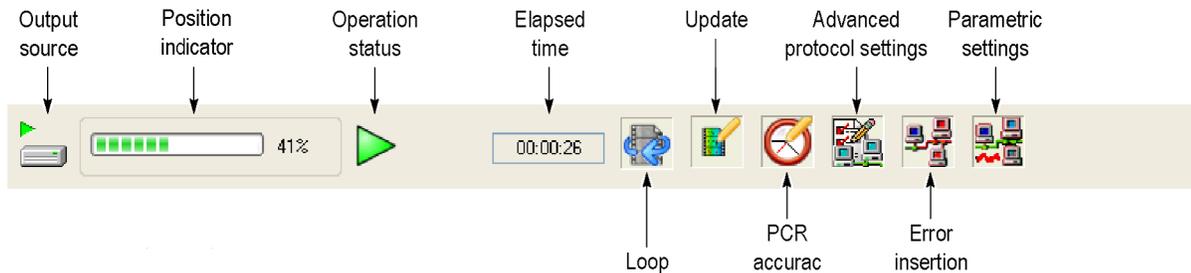
Refer to *Toolbar Buttons* for detailed information about the function of each toolbar button. (See page 239.)

Hierarchy display Each icon in the hierarchy display represents an element of the stream. The hierarchy text contains a description of the associated icon.

Refer to *Hierarchical Display* for detailed information about the hierarchy icons. (See page 192.)

Play Status indicator

The **Play Status** indicator is displayed while the selected stream is being output. It shows the output status of the selected stream: the progress of the stream output, the output source, the operational status, and the elapsed time:



The **Play Status** indicator shows the following information:

Position indicator. This indicator shows the progress of stream output using the duration gauge.

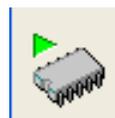
The duration gauge is updated every second. If you output a stream with a repetition rate of approximately three seconds, the gauge may not be displayed correctly.

Output source. This indicator shows the output source used to output the selected stream.

One of each set of icons is displayed, depending on the selections and status. The icons and their meanings are as follows:



The hard disk is being used for the output source.



The RAM is being used for the output source.

Operation status. Shows the current operation status of the instrument.

The icons and meanings are as follows:

	The selected stream is being output.
	The selected stream is being read from the hard disk to the RAM.
00:00:18 Elapsed Time	This box displays the elapsed time of the current stream data output.
	This icon indicates that the stream is continuously output using the loop method.
	This icon indicates that the stream parameters are updated.
	This icon indicates that the PCR accuracy is enabled.
	This icon indicates that the Advanced Protocol Settings is enabled and applied to the stream.
	This icon indicates that the errors are inserted in the stream.
	This icon indicates that the parametric settings are enabled and applied to the stream.
	This icon indicates that the Stream replication settings are enabled and applied to the stream.

Status bar The **Option Status** and **IP Status** bars contain several indicators that show general information about the transport stream output status:



Figure 13: Option Status bar

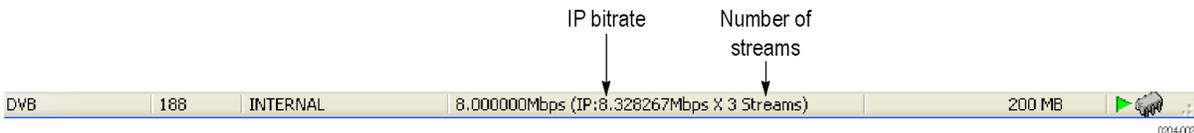


Figure 14: IP Status bar

From left to right, the **Status** bar shows the following information:

Standard	This indicator shows the standard used to display the selected stream (MPEG2, ARIB, DVB, ATSC, or Non-TS).
Packet Size	This indicator displays the packet size in bytes (188, 204, or Non-TS) of the stream output.
Clock Source	This indicator displays the source of the reference clock (internal only) used for the stream output.
Bit Rate	When the ASI option is selected, this indicator shown displays the bit rate (Mbps) of the stream output.
IP Bit Rate	When the IP interface option is selected, this indicator shown displays the bit rate (Mbps) of the IP stream output.
Number of Streams	When the IP interface option with Stream Replication Settings is selected, this indicator shown displays the number of replicated streams.
RAM free space	This indicator shows the RAM free space that can be used to output the selected stream.
Output Source Target	This indicator shows the output source used to output the selected stream.

Hierarchical display

The MPEG Player shows the selected transport stream using a hierarchical structure. This section describes the hierarchical display and defines each icon you may encounter in the display.

The MPEG Player uses icons that appear in a hierarchical structure to show the interrelationship of transport stream components. (See Figure 15.) Additional information about each stream component such as PID and Table ID numbers is displayed next to each icon:

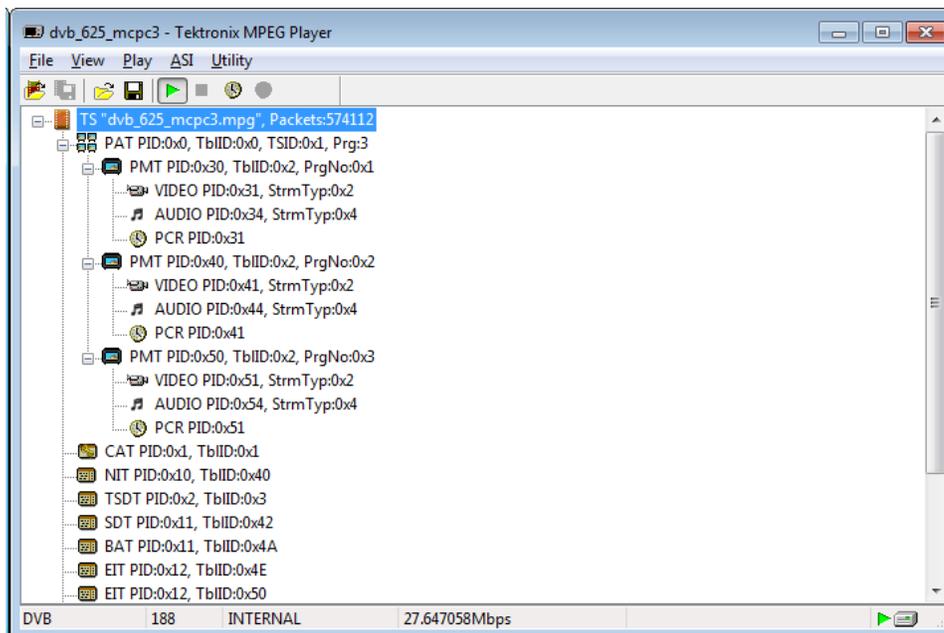


Figure 15: Example of the hierarchical display

The '+' symbol that appears to the left of some icons indicates that the item includes lower-level **Transport Stream** components that do not show. The symbol changes to '-' when the lower level components appear. To expand the hierarchy, click on the '+' symbol. Similarly, to collapse the hierarchy, click on the '-' of the selected upper-level icon.

When a transport stream contains more items than displayed on the screen at a time, a scroll bar appears at the right of the screen.

Click an element in the hierarchy to select (and highlight) it.

Hierarchical display icons

The following table describes the icons you may encounter in the hierarchical display of the **MPEG Player** for **Transport Streams** using the **MPEG-2, ARIB, DVB** and **ATSC** formats.

Refer to **Icon Text and Dialog Box** for descriptions of the icon text and dialog box associated with the hierarchy icon:(See page 200.)

Table 24: Icons used for MPEG-2, ARIB, DVB, and ATSC formats

Icon	Element type
	ISDB-T Broadcast transport stream that is defined ARIB STD-B31.
	Non-TS Data stream other than transport stream format.
	Transport Stream (TS) This icon represents all transport stream packets that make up the stream.
	Program Association Table (PAT) One or more transport packets with a PID value and table_id value of 0x00.
	Transport Stream Description Table (TSMT) One or more transport packets with a PID value of 0x02 and a table_id value of 0x03.
	Network Information Table (NIT) One or more transport packets with a PID value specified by the network_PID in the PAT.
	Conditional Access Table (CAT) One or more transport packets with a PID value of 0x01 and a table_id value of 0x0001.
	Program Map Table (PMT) One or more transport packets with a PID value specified by the program_map_PID in the PAT and a table_id value of 0x02.
	Program Clock Reference (PCR) . One or more transport packets with a PID value specified by the PCR_PID in the PMT and a PCR_flag value of 1.
	Video elementary stream One or more transport packets with a PID value specified by the elementary_PID in the PMT and a stream_type value of 0x01, 0x02, or 0x10.
	A lock symbol appears in the icon when the transport_scrambling_control value is set to 01.

Table 24: Icons used for MPEG-2, ARIB, DVB, and ATSC formats (cont.)

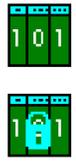
Icon	Element type
	<p>Audio elementary stream</p> <p>One or more transport packets with a PID value specified by the elementary_PID in the PMT and a stream_type value of 0x03, 0x04, or 0x11.</p> <p>A lock symbol appears in the icon when the transport_scrambling_control value is set to 01.</p>
	<p>Audio AAC, Audio AC3 (ATSC format)</p> <p>A lock symbol appears in the icon when one or more transport packets with a PID value specified by the elementary_PID in the PMT and a stream_type value of 0x0F or 0x81 (ATSC format) on when the transport_scrambling_control value is set to 01.</p>
	<p>Data stream</p> <p>One or more transport packets with a PID value specified by the elementary_PID in the PMT and a stream_type value of other than 0x01 to 0x05, 0x08, and 0x0F (in ATSC format, 0x81).</p> <p>A lock symbol appears in the icon when the transport_scrambling_control value is set to 01.</p>
	<p>Private Section</p> <p>One or more transport packets with a PID value specified by the elementary_PID in the PMT and a stream_type value of 0x05.</p> <p>A lock symbol appears in the icon when the transport_scrambling_control value is set to 01.</p>
	<p>Digital Storage Media Command and Control (DSM-CC)</p> <p>One or more transport packets with a PID value specified by the elementary_PID in the PMT and a stream_type value of 0x08.</p> <p>A lock symbol appears in the icon when the transport_scrambling_control value is set to 01.</p>
	<p>Entitlement Control Message (ECM)</p> <p>One or more transport packets with a PID value specified by the CA_PID of the CA_descriptor in the PMT, a payload_start_unit_indicator value of 1, and the payload does not start 000001 (section) or the payload starts 000001 (PES).</p>
	<p>Entitlement Management Message (EMM)</p> <p>One or more transport packets with a PID value specified by the CA_PID of the CA_descriptor in the CAT, a payload_start_unit_indicator value of 1, and the payload does not start 000001 (section) or the payload starts 000001 (PES).</p>

Table 24: Icons used for MPEG-2, ARIB, DVB, and ATSC formats (cont.)

Icon	Element type
	GHOST One or more transport packets with a PID value not specified in the PSI or Private Section PID file when the transport stream is downloaded.
	NULL One or more transport packets with a PID value of 0x1FFF.
	GARBAGE One or more transport packets in the section-data structure at the beginning of the section are not complete.
	Adaptation Field Error (ADFERR) One or more transport packets with an adaptation_field_control value of 0x00.

The following table describes icons that are specific to **Transport Streams**, using the **DVB** format:

Table 25: Icons specific to DVB format

Icon	Element type
	Service Description Table (SDT) One or more transport packets with a PID value of 0x0011 and a table_id value of 0x42.
	Bouquet Association Table (BAT) One or more transport packets with a PID value of 0x0011 and a table_id value of 0x4A.
	Event Information Table (EIT) One or more transport packets with a PID value of 0x0012 and a table_id value of 0x4E-0x6F.
	Running Status Table (RST) One or more transport packets with a PID value of 0x0013 and a table_id value of 0x4E-0x71.
	Stuffing Table (ST) One or more transport packets with a PID value of 0x0010-0x0013 and a table_id value of 0x72.
	Discontinuity Information Table (DIT) One or more transport packets with a PID value of 0x1E and a table_id value of 0x7E.
	Selection Information Table (SIT) One or more transport packets with a PID value of 0x1F and a table_id value of 0x7F.
	Time and Data Table (TDT) One or more transport packets with a PID value of 0x0014 and a table_id value of 0x72.
	Time Offset Table (TOT) One or more transport packets with a PID value of 0x0014 and a table_id value of 0x73.

The following table describes icons that are specific to **Transport Streams**, using the **ARIB** format:

Table 26: Icons specific to ARIB format

Icon	Element type
	<p>Service Description Table (SDT)</p> <p>One or more transport packets with a PID value of 0x0011 and a table_id value of 0x42.</p>
	<p>Bouquet Association Table (BAT)</p> <p>One or more transport packets with a PID value of 0x0011 and a table_id value of 0x4A.</p>
	<p>Event Information Table (EIT)</p> <p>One or more transport packets with a PID value of 0x0012 and a table_id value of 0x4E-0x6F.</p>
	<p>Running Status Table (RST)</p> <p>One or more transport packets with a PID value of 0x0013 and a table_id value of 0x4E-0x71.</p>
	<p>Stuffing Table (ST)</p> <p>One or more transport packets with a PID value of 0x0010-0x0013 and a table_id value of 0x72.</p>
	<p>Discontinuity Information Table (DIT)</p> <p>One or more transport packets with a PID value of 0x1E and a table_id value of 0x7E.</p>
	<p>Selection Information Table (SIT)</p> <p>One or more transport packets with a PID value of 0x1F and a table_id value of 0x7F.</p>
	<p>Local event Information Table (LIT)</p> <p>One or more transport packets with a PID value of 0x0020 and a table_id value of 0xD0. One or more transport packets with a PID value specified by the elementary_PID in the PMT and a table_id value of 0xD0 when a stream type value is 0x05.</p>
	<p>Event Relation Table (ERT)</p> <p>One or more transport packets with a PID value of 0x0021 and a table_id value of 0xD1. One or more transport packets with a PID value specified by the elementary_PID in the PMT and a table_id value of 0xD1 when a stream type value is 0x05.</p>

Table 26: Icons specific to ARIB format (cont.)

Icon	Element type
	Index Transmission Table (ITT) One or more transport packets with a PID value specified by the elementary_PID in the PMT and a table_id value of 0xD2.
	Partial Content Announcement Table (PCAT) One or more transport packets with a PID value of 0x22 and a table_id value of 0xC2.
	Software Download Trigger Table (SDTT) One or more transport packets with a PID value of 0x23 and a table_id value of 0xC3.
	Download Control Table (DCT) One or more transport packets with a PID value of 0x17 and a table_id value of 0xC0.
	DownLoad Table (DLT) One or more transport packets with a PID value specified by the DL_PID in the DCT and a stream_type value of 0xC1. A lock symbol appears in the icon when the transport_scrambling_control value is set to 01.
	Broadcaster Information Table (BIT) One or more transport packets with a PID value of 0x24 and a table_id value of 0xC4.
	Network Board Information Table (NBIT) One or more transport packets with a PID value of 0x25 and a table_id value of 0xC5 or 0xC6.
	Linked Description Table (LDT) One or more transport packets with a PID value of 0x25 and a table_id value of 0xC7.
	Time and Data Table (TDT) One or more transport packets with a PID value of 0x0014 and a table_id value of 0x72.
	Time Offset Table (TOT) One or more transport packets with a PID value of 0x0014 and a table_id value of 0x73.

The following table describes icons that are specific to **Transport Streams**, using the **ATSC** format:

Table 27: Icons specific to ATSC format

Icon	Element type
	<p>Master Guide Table (MGT) One or more transport packets with a PID value of 0x1FFB and a table_id value of 0xC7.</p>
	<p>Terrestrial Virtual Channel Table (TVCT) One or more transport packets with a PID value of 0x1FFB and a table_id value of 0xC8.</p>
	<p>Cable Virtual Channel Table (CVCT) One or more transport packets with a PID value of 0x1FFB and a table_id value of 0xC9.</p>
	<p>Rating Region Table (RRT) One or more transport packets with a PID value of 0x1FFB and a table_id value of 0xCA.</p>
	<p>Event Information Table (EIT) One or more transport packets with a PID value specified by the table_type_PID in the MGT and a table_id value of 0xCB.</p>
	<p>Channel Extended Text Table (CETT) One or more transport packets with a PID value of 0x1FFB and a table_id value of 0xC8.</p>
	<p>Event Extended Text Table (EETT) One or more transport packets with a PID value of 0x1FFB and a table_id value of 0xC9.</p>
	<p>Program Identifier Table (PIT) One or more transport packets with a PID value specified by the elementary_PID in the PMT and a table_id value of 0xD0 when a stream_type value is 0x85.</p>
	<p>System Time Table (STT) One or more transport packets with a PID value of 0x1FFB and a table_id value of 0xCD.</p>

Icon text and dialog box

To the right of each icon, the **MPEG Player** shows a text describing each **Transport Stream** component. In addition, for the **PCR** icon, you can display a dialog box to change the parameters for the component. The following table shows the text that appears with each icon:

Table 28: Icon text

Component	Text
ISDB-T Icon	"xxx.rmx": Shows the file name. Packets: Shows the total number of packets in the broadcast transport stream.
Non-TS Icon	"xxx.xx": Shows the file name. FileSize: Shows the file size in byte.
Transport Stream (TS) Icon	"xxx.trp": Shows the file name of the transport stream. Packets: Shows the total number of packets in the transport stream. TSID: Shows the ID number for the transport stream.
Program Allocation Table (PAT) Icon	PID: Shows the PID value of the PAT. TbID: Shows the table_id value of the PAT. TSID: Shows the transport_stream_id value of the PAT. Prg: Shows the number of programs contained in the transport stream.
Transport Stream Description Table (TSDT) Icon	PID: Shows the PID value of the TSDT. TbID: Shows the table_id value of the TSDT.
Network Information Table (NIT) Icon	PID: Shows the PID value of the NIT. TbID: Shows the table_id value of the NIT.
Conditional Access Table (CAT) Icon	PID: Shows the PID value of the CAT. TbID: Shows the table_id value of the CAT.
Program Map Table (PMT) Icon	PID: Shows the PID value of the PMT. TbID: Shows the table_id value of the PMT. PrgNo: Shows the program number associated with the PMT.
Program Clock Reference (PCR) Icon	PID: Shows the PID value of the PCR. See also <i>PCR Inaccuracy Dialog Box</i> (See page 202.)
Video Elementary Stream (VIDEO) Icon	PID: Shows the PID value of the video elementary stream. StrmTyp: Shows the type of the video elementary stream (0x01 or 0x02).

Table 28: Icon text (cont.)

Component	Text
Audio Elementary Stream (AUDIO) Icon	PID: Shows the PID value of the audio elementary stream. StrmTyp: Shows the type of the audio elementary stream (0X03 or 0X04).
AUDIO_AAC and AUDIO_AC3 Icons	PID: Shows the PID value of the audio elementary stream. StrmTyp: Shows the type of the audio elementary stream (0X0F or 0x81).
Data Stream (DATA) Icon	PID: Shows the PID value of the data stream. StrmTyp: Shows the type of the data stream.
Private Section (DATA_SECT) Icon	PID: Shows the PID value of the private section. TblID: Shows the table_id value of the private section. StrmTyp: Shows the type of the private section.
DSM_CC Icon	PID: Shows the PID value of the data DSM-CC. StrmTyp: Shows the type of the DSM-CC.
Entitlement Control Message (ECM) Icon	PID: Shows the PID value of the ECM. TblID: Shows the table_id value of the ECM.
Entitlement Management Message (EMM) Icon	PID: Shows the PID value of the EMM. TblID: Shows the table_id value of the EMM.
GHOST Icon	PID: Shows the PID value of the GHOST.
Adaptation Field Error (ADFERR) Icon	PID: Shows the PID value of the ADFERR.
NULL Icon	PID: Shows the PID value of the NULL.
GARBAGE Icon	PID: Shows the PID value of the GARBAGE.
SDT, BAT, EIT, RST, ST, DIT, SIT, LIT, ERT, ITT, PCAT, SDTT, DCT, DLT, BIT, NBIT, and LDT Icons	PID: Shows the PID value of the SDT, BAT, EIT, RST, ST, DIT, SIT, LIT, ERT, ITT, PCAT, SDTT, DCT, DLT, BIT, NBIT, or LDT. TblID: Shows the table_id value of the SDT, BAT, EIT, RST, ST, DIT, SIT, LIT, ERT, ITT, PCAT, SDTT, DCT, DLT, BIT, NBIT, or LDT.
TDT and TOT Icon	PID: Shows the PID value of the TDT or TOT. TblID: Shows the table_id value of the TDT or TOT.
MGT and PIT Icons	PID: Shows the PID value of the MGT or PIT. TblID: Shows the table_id value of the MGT or PIT.

Table 28: Icon text (cont.)

Component	Text
TVCT, CVCT, RRT, EIT, CETT, and EETT Icons	PID: Shows the PID value of the TVCT, CVCT, RRT, EIT, CETT, or EETT. TblID: Shows the table_id value of the TVCT, CVCT, RRT, EIT, CETT, or EETT. TblType: Shows the table_type value of the TVCT, CVCT, RRT, EIT, CETT, or EETT.
System Time Table (STT) Icon	PID: Shows the PID value of the STT. TblID: Shows the table_id value of the STT.

PCR Inaccuracy dialog box. When you right-click **PCR** in the hierarchical view, the **PCR Inaccuracy** dialog box appears as shown (See Figure 16.). This dialog box allows you to add jitter to the program_clock_reference_base value and the program_clock_reference_extension value:

Refer to *Adding Jitter to PCRs* for more information. (See page 241.)

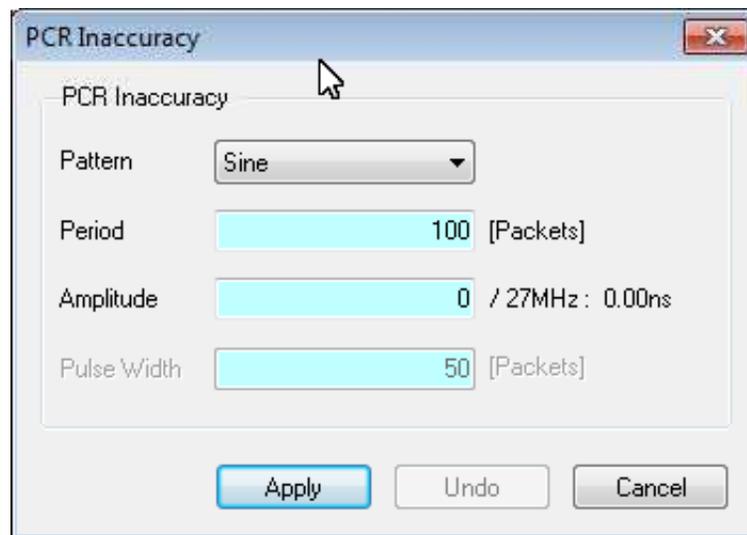


Figure 16: PCR Inaccuracy dialog box

The following table describes the **PCR Inaccuracy** dialog box parameters:

Table 29: PCR Inaccuracy dialog box parameters

Parameter	Description
Pattern	Selects the type of the waveform used to add jitter. You can select Sine, Square, Triangle, Pulse, Sawtooth, Random, or Offset.
Period	Sets the period of the waveform used to add jitter. You can set the value from 5 to 3000 packets in 1 packet steps.
Amplitude	Sets the amplitude of the waveform used to add jitter. You can set the value from 0/27 MHz to 135000000/27 MHz (0 s to 5 s).
Pulse Width	Sets the pulse width of the waveform used to add jitter. You can set the value from 1 to (period - 1) packet(s) in 1 packet steps. This Pulse Width parameter is available only when the Pattern parameter is set to Pulse.

MPEG Player - Menus and controls

This section describes the function of each selection available in the menus. This section is divided into the following subsections:

- *Menus in the Play Screen* describes all of the menu commands and their features available in the Play screen.
- *Toolbar Buttons* describes the toolbar buttons and their functions.

Menus in the Play screen

File menu The File menu contains commands for selecting a stream file and for loading and saving a preset file. The following table describes the commands in the **File** menu:

Table 30: File menu commands (Play screen)

Command	Description
Open	Opens a stored stream file. When a file is selected, the MPEG Player checks the packet size of the file. For a transport stream the output data is in packets. If an incomplete packet is included at the start or end point of the file, that portion is not output. The function uses a standard Windows Open... dialog box.
Load Preset	Loads the specified preset file (*.xml). When a preset file is loaded, the current instrument settings are changed by the file's content. Refer to <i>Preset File</i> for more information about the preset file. (See page 243.)
Save Preset	Saves the current instrument settings as a preset file. Refer to <i>Preset File</i> for more information about the preset file. (See page 243.)
Exit	Quits the MPEG Player application. The MPEG Player application settings are saved.

View menu The **View** menu contains commands that control the display of the Toolbar and the Status bar. The following table describes the commands available in the **View** menu:

Table 31: View menu commands

Command	Description
Toolbar	Shows or hides the toolbar.
Status Bar	Shows or hides the status bar.
Compact Mode	Displays the play screen at the bottom when set to ON and the size of the play screen becomes compact.

Play menu The **Play** menu contains commands for defining output parameters, such as packet size, output clock rate, and output source. The following table describes the commands available in the **Play** menu:

Table 32: Play menu commands (Play screen)

Command	Description
Interface	Sets the interface to transmit or receive Ethernet packets. You can select either IP or ASI interfaces.
Packet Size	<p>Sets the packet size (in bytes) for the stream. You can set the packet size to 188 (188 + 0), 204 (188 + 16), or Non-TS.</p> <p>These packet sizes can only be set for an MPEG2 transport stream. For a Non-TS stream, the packet size is fixed to Non-TS. In addition, if you select 8VSB, the packet size is fixed to 188.</p> <p>When you select Non-TS, the MPEG Player deals with stream data in a byte unit (not a packet unit) and outputs all of the data in a file. If a transport stream contains any error, you can output it by selecting Non-TS.</p>
Clock	Sets the clock rate of the stream output. When you select this command, the Clock dialog box appears. Refer to <i>Clock Dialog Box</i> for more information. (See page 207.)
Update	<p>Sets whether to update parameters in the stream when looped. You can select On or Off. You cannot set to On for a Non-TS stream.</p> <p>You can select which parameters in the stream are updated using the Others dialog box. Refer to <i>Others Dialog Box</i> for more information. (See page 213.)</p>
PCR Initial Value	<p>Sets the initial value of the program_clock_reference_base and program_clock_reference_extension parameters when the transport stream is output.</p> <p>When you select this command, the PCR Initial Value dialog box appears. Refer to <i>PCR Initial Value Dialog Box</i> for more information. (See page 210.)</p>
Source	<p>Selects the source for stream output. You can select RAM or Disk.</p> <p>Refer to <i>ASI Interface Menu</i> and <i>IP Interface Menu</i> for detailed information about differences between the two sources. (See page 216.) (See page 216.)</p>
Loop	Sets whether or not the stream is output using looping method. You can select On or Off. If you set it to On, the selected stream is continuously output. If you set it to Off, the selected stream is output once.
Start/Stop	<p>Sets the start and stop position of the stream, and initial start position of the stream for loop output.</p> <p>When you select this command, the Start/Stop Position dialog box appears. Refer to <i>Start/Stop Position Dialog Box</i> for more information. (See page 211.)</p>

Table 32: Play menu commands (Play screen) (cont.)

Command	Description
Auto play	Sets whether or not the transport stream is automatically output using the last power-down settings when you turn the MPEG Player on. You can select On or Off. If you set it to On, take care of the output level setting used when the MPEG Player was last turned off and the input level of the instrument (device) currently connected to the MPEG Player.
Timer Play	Sets the date and time used to output a stream automatically. When you select this command, the Timer Play dialog box appears. Refer to <i>Timer Play Dialog Box</i> for more information. (See page 213.)
Other	Sets the standard used to display the selected stream and display radix for the text information. When you select this command, the Others dialog box appears. Refer to <i>Others Dialog Box</i> for more information. (See page 213.)

Clock dialog box. When you select the **Clock...** command from the **Play** menu, the **Clock** dialog box appears:

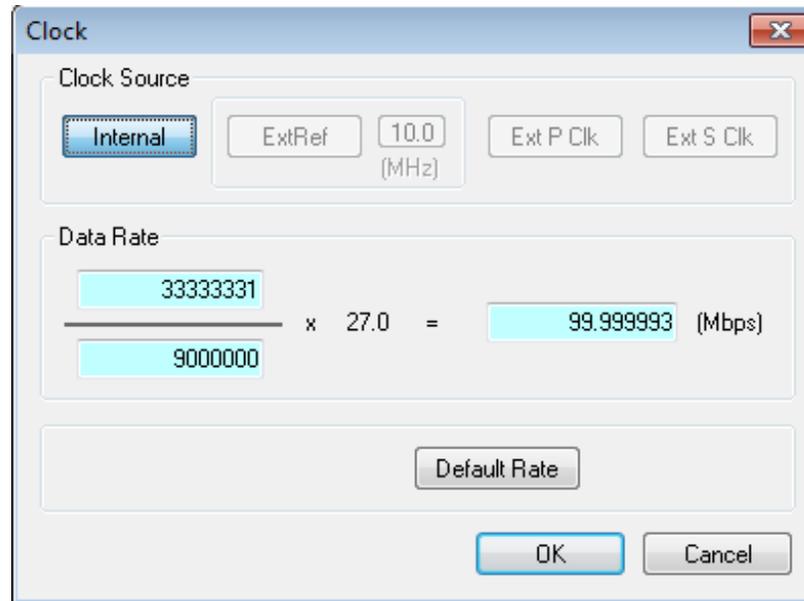


Figure 17: Clock dialog box for Option interface

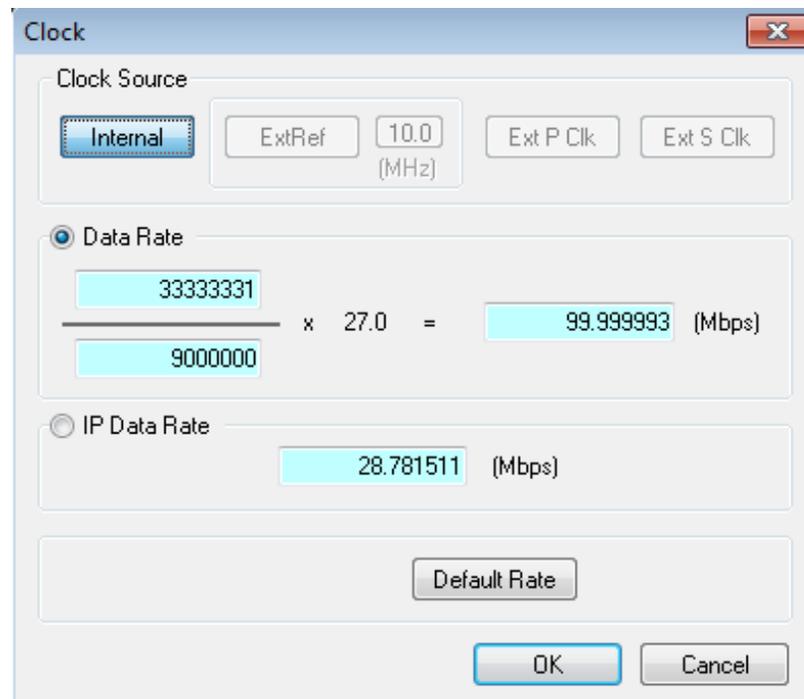


Figure 18: Clock dialog box for IP interface

Clock Source: Sets the clock that will be used as the reference for the stream output. You can select the desired clock source from the following settings:

- **Internal** uses the internal clock of the **MPEG Player** as the clock reference.
- **Ext P Clk** and **Ext S Clk** are disabled.
- **Data Rate** sets the clock rate for the transport stream output. You can enter the clock rate using the following methods (the first method provides greater clock-rate precision):
 - Enter values into the numerator and denominator text boxes. The **MPEG Player** will then calculate the clock rate based on the ratio of the numerator and denominator values. (See Figure 17.)
 - Enter a value into the **Clock Rate** text box. The **MPEG Player** will then calculate the numerator and denominator text boxes based on the clock rate.

NOTE. *The IP data rate will be automatically calculated based on the TS data rate available. IP Data Rate is calculated as follows:*

$$IP\ Data\ Rate = (TS\ Data\ Rate \times IP\ Packet\ Size) / Payload\ Size$$

- **IP Data Rate:** Sets the clock rate for the **IP packet** (See Figure 18.). In the **IP mode**, a change in the IP data rate will impact the **TS data rate** and a change in the **TS data rate** will impact the **IP data rate**. The packet length changes according to the selected protocol.

NOTE. *The TS data rate will be automatically calculated based on the IP data rate available and consequently influence the PCR/PTS/DTS update cycles. TS Data Rate is calculated as follows:*

$$TS\ Data\ Rate = (IP\ Data\ Rate \times Payload\ Size) / IP\ Packet\ Size$$

- **Default Rate:** Shows the default clock rate and packet size and then changes the values. When you select this button, the following **Default Clock** dialog box appears:

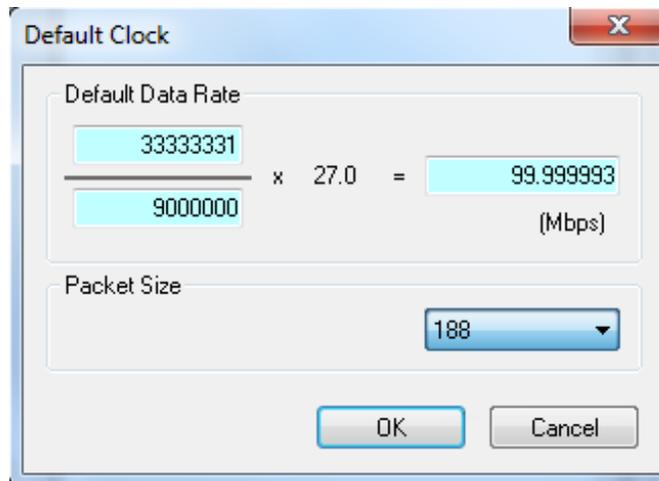


Figure 19: Default Clock Dialog box

- **Default Data Rate:** Changes the default clock rate when the selected stream file was downloaded.

Since the default clock rate is calculated based on the PCRs in the downloaded stream file, the value can be different than the original clock rate. When the elementary stream rate is fixed, the instrument refers to the default clock rate. Therefore, if the default clock rate is different than the original clock rate, you need to set the value to the appropriate value. If you change the value, the clock rate value in the Data Rate dialog box is also changed.

- **Packet Size:** Changes the default packet size when the selected stream file is downloaded. If you change the value, the Packet Size setting in the Play menu will also change.

Press the **OK** button to enable all setting changes.

PCR Initial Value dialog box. When you select the **PCR Initial Value...** from the **Play** menu, the **PCR Initial Value** dialog box appears:

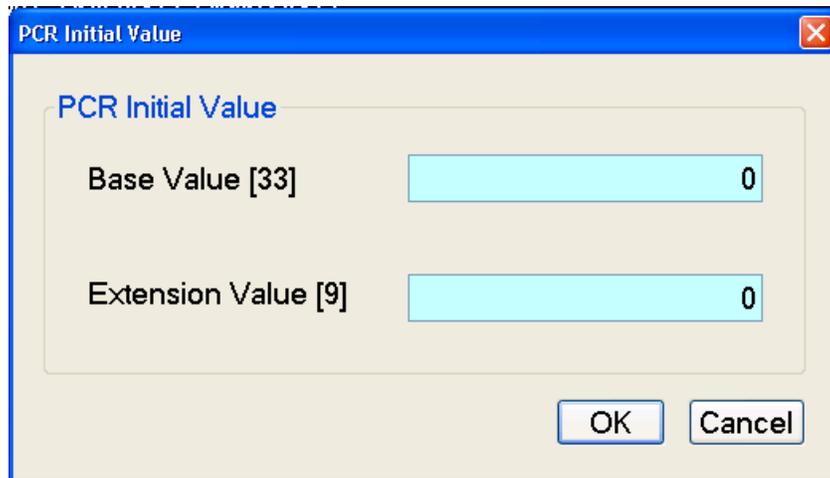


Figure 20: PCR Initial Value dialog box

- **Base Value:** Sets the initial value for the `program_clock_reference_base` value. You can set the value from 0 to 8589934591. The bracketed number represents the number of bits for the `program_clock_reference_base` field.
- **Extension Value:** Sets the initial value for the `program_clock_reference_extension` value. You can set the value from 0 to 299. The bracketed number represents the number of bits for the `program_clock_reference_extension` field.

Start / Stop Position dialog box. When you select the **Start/Stop...** from the **Play** menu, the **Start/Stop Position** dialog box appears:

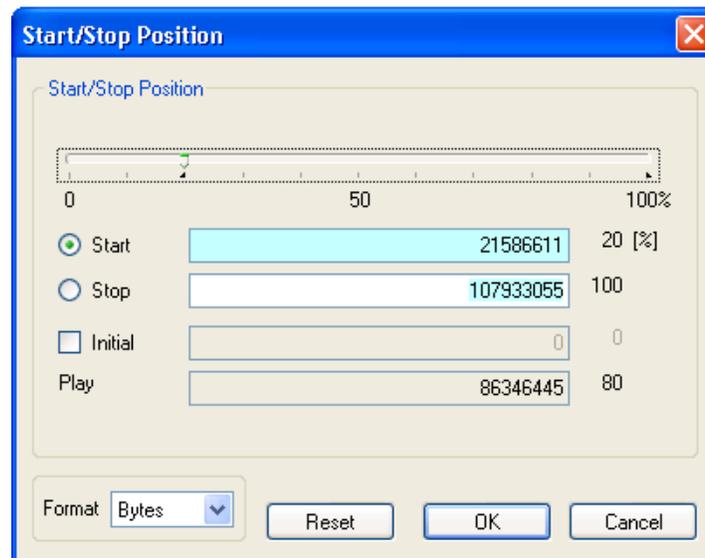


Figure 21: Start / Stop Position dialog box

- **Start:** Sets the start position of the stream by time (h:m:s) or the number of bytes for a Non-TS file). Use the **Format** field to select the method of setting the position.
- **Stop:** Sets the stop position of the stream by time (h:m:s) or the number of bytes for a Non-TS file. Use the **Format** field to select the method of setting the position.
- **Initial:** Sets the initial start position of the stream for loop output. You can set the value by time (h:m:s) or the number of bytes for a Non-TS file. Use the **Format** list box to select the method of setting the position.
- **Play:** Shows the actual time or the number of bytes for a Non-TS file) that is calculated by the values of the Start and Stop text boxes.
- **Format:** Specifies the method of setting the start, stop, and initial positions of the stream. For a transport stream file, you can select Time or Packets. For a Non-TS file, you can select Time or Bytes.

For an ISDB-T file, the start packet is defined as the first-appearing packet including an OFDM frame start flag after the specified start position. The stop packet is defined as the packet at the front of the last-appearing packet including an OFDM frame start flag before the specified stop position. At this time, if the number of OFDM frames between the start packet and stop packet is not an even number, the packet in the last OFDM frame becomes the stop packet.

You can set the start, stop, and initial positions by using either the slider or the text boxes.

Using the slider. Ensure that **Packets** is selected from the **Format** dropdown list:

1. For the start and stop positions:
 - a. Select the **Start** option button.
 - b. Using the mouse, drag the slider to the required start position.
 - c. Select the **Stop** option button.
This moves the slider to the right end.
 - d. Drag the slider to the required stop position.
 - e. Select the **OK** button to enable the values.
2. For the initial start position for loop output:
 - a. Enable the **Initial** check box. A red arrow appears on the slider.
 - b. Drag the red arrow to the required initial start position.
 - c. Select the **OK** button to enable the value.

Using the text boxes. Ensure that **Time** is selected from the **Format** dropdown list:

1. Select the **Start** option button.
2. Enter the **time** in hour/minute/second format.
3. Repeat for the **Stop** time and the **Initial Start Position** time.
4. Select the **OK** button to enable the values.

To reset all of the settings to the values that were in effect when the dialog box was first displayed, select the **Reset** button, and then press the **OK** button.

Timer Play dialog box. When you select the **Timer Play...** command from the **Play** menu, the **Timer Play** dialog box appears:

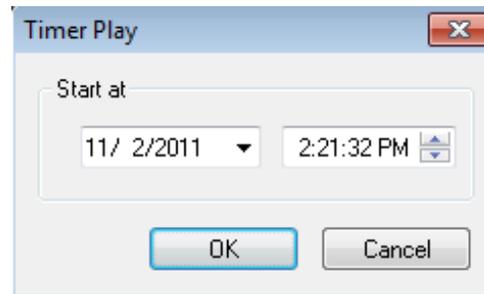


Figure 22: Timer Play dialog box

- **Start at:** Sets the date and time when the stream output starts.

When you press the **OK** button after setting the date and time, the current date and time and the set date and time are displayed. When the current date and time coincide with the set date and time, the dialog box closes and stream output starts automatically.

If you want to cancel the operation, select the **OK** button. When the dialog box that prompts you to confirm the operation is displayed, press the **OK** button to execute the operation.

Others dialog box. When you select the **Other** command from the **Play** menu, the **Others** dialog box appears:

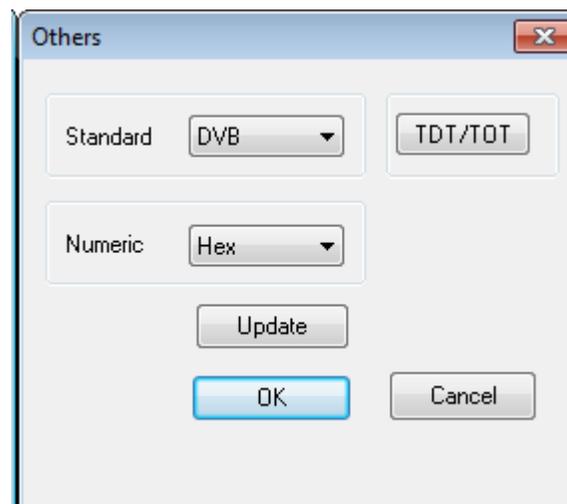


Figure 23: Others dialog box

- **Standard:** Sets the standard used on the hierarchy-display screen. You can select **ARIB, ATSC, DVB, or MPEG2**. For a transport stream (**ARIB, ATSC, DVB, or MPEG2**), the standard is set to the previous setting as a default. For a **ISDB-T** Transport Stream, you need to select **ARIB** for proper display.
- **Numeric:** Sets the base value used to describe the component information in the hierarchy display. You can select Decimal, Hex, or Octal.
- **TDT / TOT or STT:** When you select this button, the following **TDT / TOT** dialog box appears. The button name changes to the standard selected in the Standard list box: **TDT / TOT for ARIB or DVB, and STT for ATSC**. Use this dialog box to change the initial date and time of the TDT (Time and Data Table), TOT (Time Offset Table), or STT (System Time Table) in the selected stream:

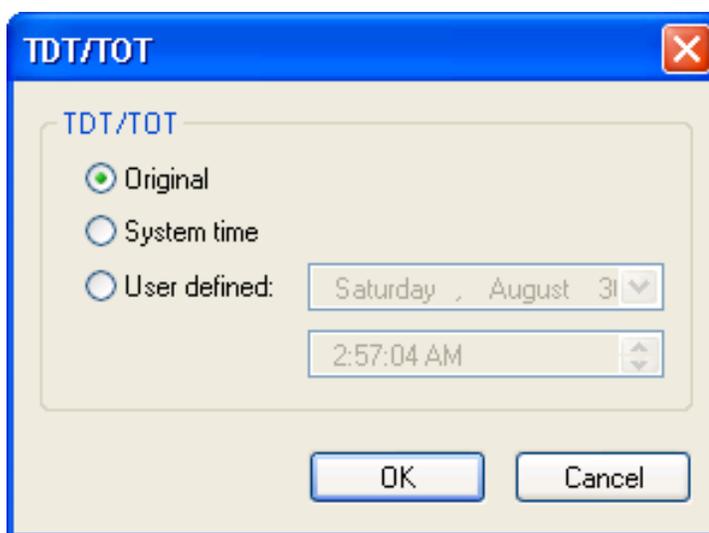


Figure 24: TDT/TOT dialog box

The button is disabled when MPEG2 is selected in the Standard list box:

- **Original:** Uses the original (default) value that is already defined in the selected stream.
- **System Time:** Uses the clock/calendar of the operating system to set the initial value. When you select this option, the date and time of all the TDTs, TOTs, or STTs in the selected stream are locked to the clock/calendar of the operating system.
- **User Defined:** Uses the user-defined value to set the initial value. When you select this option, the list boxes for setting the initial date and time of the TDT, TOT, or STT are available.

- **Update:** When you select this button, the following **Select Update Item** dialog box appears. Use this dialog box to select which parameters in a stream are updated when looped:

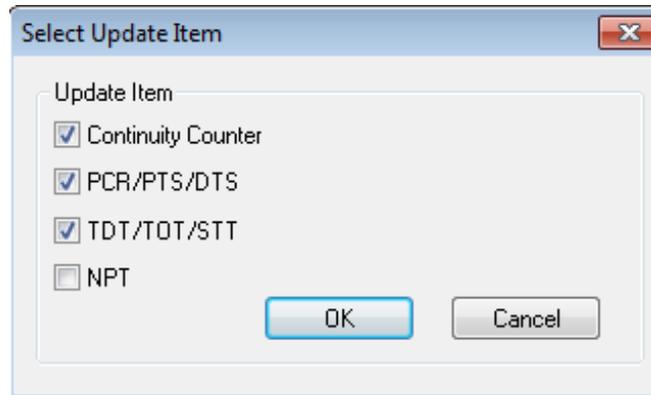


Figure 25: Select Update Item dialog box

- **Continuity Counter:** Sets whether to update continuity_counter.
- **PCR / PTS / DTS:** Sets whether to update PCR (Program Clock Reference), PTS (Presentation Time Stamp), and DTS (Decoding Time-Stamp). PCR / PTS / DTS are updated by adding the actual looping time (defined by the start and stop positions) to the stream every time it is looped. There are no timing errors in PTS / DTS, however, it is difficult to maintain the continuity of PCRs at the loop point because the update is not synchronized with the 27 MHz clock on the output board.
- **TDT / TOT / STT:** Sets whether to update TDT (Time & Data Table), TOT (Time Offset Table), and STT (System Time Table).
- **NPT:** Sets whether to update NPT (Normal Play Time; STC_Reference field in NPT Reference Descriptor defined by ISO / IEC 18318-6).

The NPT check box is available only when PCR/PTS/DTS is enabled. When the check box is enabled, PCR/PTS/DTS becomes enabled.

Select the **OK** button to enable all setting changes.

ASI interface menu The following table describes the command available in the **ASI** menu:

Table 33: ASI menu command

Command	Description
ASI Out	Selects the ASI output port (ASI-1, ASI-2, ASI-3, ASI-4) ASI-4 is the default selection.
ASI Format	Selects the Byte mode or the Packet mode. Byte mode evenly distributes K28.5 idles after each data word. Packet mode sends all 188 or 204 words followed by a very long string of K28.5 idles.

IP interface menu The following table describes the commands available in the **IP** menu:

Table 34: IP menu commands

Command	Description
Configuration	Configures the IP interface. The packet size, device name, protocol, ports, and the transmission mode can be set.
Parametric Settings	Sets the burst mode parameters and jitter parameters.
Error Insertion	Inserts errors like packet loss, checksum, and sequence errors in the transmitted stream.
Error Generation	Generates errors like packet loss, checksum, and sequence in the transmitted stream.
Statistics	Displays details about parameter names, current stream values, and the history of the previous transmission.
TTS Settings	Enables whether to play out a TS file as a TTS file by prefixing a 4-byte time stamp to each TS packet. The TTS packet size equals 192 bytes.
Other Settings	Sets the player process priority and transmitter thread priority.

NOTE. *Playing the MPEG Player at high bit rates in IP mode could saturate the network.*

NOTE. *When you switch from ASI interface to IP interface, the Recommended settings dialog box appears. This dialog box has an **Auto Configure** button to configure all the settings automatically in the IP mode.*

Configuration. When you select **Configuration** from the **IP** menu, the **IP Playout Configuration** dialog box appears as shown in the following figure. This dialog box allows you to configure the following settings:

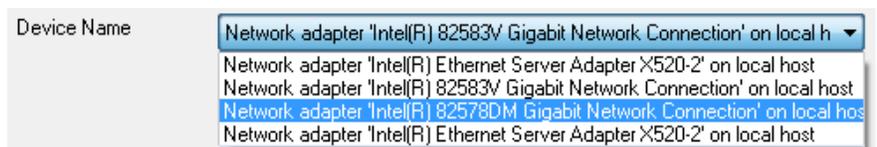
The screenshot shows the 'IP Playout Configuration' dialog box. The 'Configuration name' field is empty. Under the 'Protocols' section, 'IP Version' is set to 'IPv4' and 'Protocol' is 'RTP'. The 'Device Name' is 'Network adapter 'Intel(R) PRO/100 VE Network Connection (Microsoft's I...'. The 'Source IP Address' is '192.158.96.217' and 'Source Port' is '16384'. The 'Transmission Mode' is 'Multicast' and 'Destination Port' is '16384'. The 'Destination IP Address' is '239.1.1.1'. There is an unchecked checkbox for 'Enable VLAN' with a 'VID' field set to '1'. There are buttons for 'Advanced Settings...' and 'Stream Replication...'. Under the 'Packet Size' section, 'Allow TS Fragmentation' is checked, 'Allow IP Fragmentation' is unchecked, 'IP Packet Size' is '1370' Bytes, and 'Number of TS packets' is '7' (with a note 'IP Packet Size = 1370 bytes'). At the bottom are buttons for 'Store Settings', 'Delete Settings', 'Reset To Default Settings', 'OK', and 'Cancel'.

Figure 26: IP configuration for IPv4

The screenshot shows the 'IP Playout Configuration' dialog box. The 'Configuration name' field is empty. Under the 'Protocols' section, 'IP Version' is set to 'IPv6' and 'Protocol' is 'RTP'. The 'Device Name' is 'Network adapter 'Intel(R) PRO/1000 MT Desktop Adapter (Microsoft's P...'. The 'Source IP Address' is 'fe80::203:2dff:fe06:d976' and 'Source Port' is '16384'. The 'Transmission Mode' is 'Multicast' and 'Destination Port' is '16384'. The 'Destination IP Address' is 'ff0e::1'. There is an unchecked checkbox for 'Enable VLAN' with a 'VID' field set to '1'. There are buttons for 'Advanced Settings...' and 'Stream Replication...'. Under the 'Packet Size' section, 'Allow TS Fragmentation' is unchecked, 'Allow IP Fragmentation' is unchecked, 'IP Packet Size' is '1370' Bytes, and 'Number of TS packets' is '7' (with a note 'IP Packet Size = 1390 bytes'). At the bottom are buttons for 'Store Settings', 'Delete Settings', 'Reset To Default Settings', 'OK', and 'Cancel'.

Figure 27: IP configuration for IPv6

- **Configuration name:** Allows you to enter or select a configuration name from the dropdown list. This list can store up to ten configuration names. The default value is blank.
- **IP Version:** Allows you to choose the IP version (IPv4 or IPv6) from the drop-down list. IPv4 is the default value.
- **Protocol:** Sets the protocol (UDP, RTP) for the IP payout. RTP is set as the default value.
- **Device Name:** Allows you to select the device for the IP payout. The Device Name lists all the active Network Interface Cards (NIC) in the system. The standard MTSA contains two NICs. With the optional 10G card (Option 10GS), two additional NICs are available:



The first interface that has a valid IP address assigned to it is automatically selected as the default value for both **IPv4** and **IPv6** versions.

- **Source IP Address:** Sets the source IP address for the IP payout. The first valid IP address of the selected device will be set as the default. The Source IP Address can be modified in the Advanced Protocol Settings dialog. If the Source IP Address is modified in the Advanced Protocol Settings dialog, then this value is changed to "Customized".
- **Source Port:** Sets the source port for the IP payout. The port value ranges from 0 to 65535. The default value for UDP protocol is 0 and for RTP protocol is 16384.
- **Transmission Mode:** Sets the transmission mode of the protocol. Unicast, Multicast, and Broadcast are the three transmission modes available in the dropdown list. Multicast is set as the default value.

NOTE. In Unicast mode, the MPEG Player will auto detect the MAC address for the destination IP Address. Hence, a valid destination IP address must be provided for the MPEG Player. If the MAC address cannot be detected, the destination IP address must be specified in the Advanced Protocol Settings.

- **Destination IP Address:** Sets the destination IP address for the IP payout. 239.1.1.1 is set as the default value for **IPv4** and ff0e::1 is set as the default value for **IPv6**. Depending on the selected transmission mode, the system validates the entry based on the following rules:
 - **Unicast Range:** Any IP address that does not fall into the Multicast or the Broadcast range.
 - **Multicast Range:** 224.0.0.0 to 239.255.255.255 for IPv4 and FFxx:Y:Y:Y (where x is 0 to F and Y is 0000 to FFFF) for IPv6.
 - **Broadcast Range:** The Network or node portion of an IP address will be set to "1"s or "0"s.
- **Destination Port:** Sets the destination port for the IP payout. The port value ranges from 0 to 65535. 16384 is set as the default value.
- **Enable VLAN:** Enables the VLAN layer that is present between the Ethernet layer and IP layer. You will have to enter the VLAN ID to allow the identification of 4096 VLANs that is basically used by the 802.1Q standard.
- **Advanced Protocol Settings:** Click **Advanced Protocol Settings** to view or customize the protocol settings of active protocols in the current configuration. All the settings have only header customization for which no validation is done.

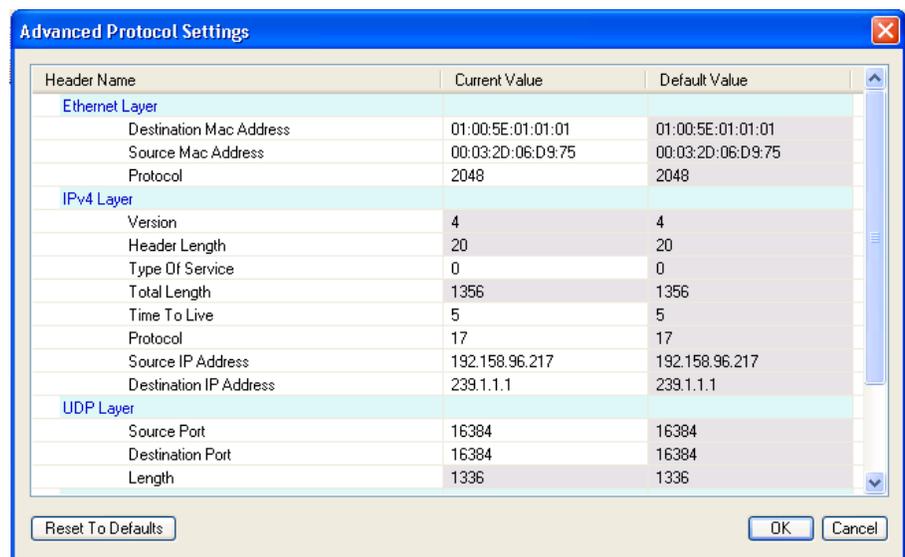


Figure 28: Advanced Protocol Settings dialog box for IPv4

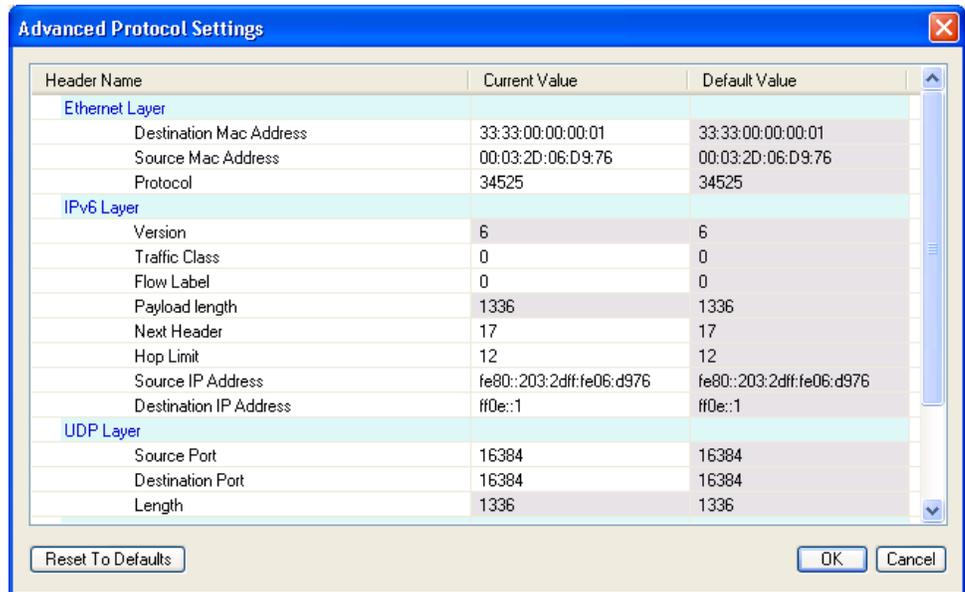


Figure 29: Advanced Protocol Settings dialog box for IPv6

The **Header Name** and **Default Value** are **read only** options. The protocol headers displayed will be limited to headers common to all packets. You can customize the **Current Value** of the headers which can be specified at packet creation. The customized valid values are displayed in lavender and the customized invalid values are displayed in pink.

Click the **Reset to Defaults** button to reset the current values to default values. Whenever any of the attributes is set, an icon appears in the status bar during the play.

The parameters showing in the **Advanced Protocol Settings** dialog box are as follows:

- Ethernet Layer: Destination Mac Address, Source Mac Address, Protocol
- 802.1Q VLAN Layer: Tag Protocol Identifier, Priority Levels, Canonical Format Indicator, VLAN Identifier
- IPv4 Layer: Version (read only), Header Length (read only), Type Of Service, Total Length (read only), Time To Live, Protocol, Source IP Address, Destination IP Address
- IPv6 Layer: Version (read only), Traffic Class, Flow Label, Payload Length (read only), Next Header, Hop Limit, Source IP Address, Destination IP Address

- UDP Layer: Source Port, Destination Port, Length (read only)
- RTP Layer: Version (read only), Payload Type, Sequence Number, SSRC

NOTE. A condition where multicast is selected as the transmission mode and a unicast destination address is entered in the Advanced Protocol Settings dialog box will not be validated.

NOTE. If the destination IP address is changed in the Advanced Protocol Settings dialog box, the application will not check for the accessibility of the address. A change in the source and the destination IP address will not change the source and the destination MAC address of the Advanced Screen Settings.

- **Stream Replication Settings:** Click **Stream Replication Settings** to set the number of replicated streams and customize the attributes accordingly. This setting is used to replicate the streams wherein a stream is replicated n times with certain attributes of the stream incremented by a value within the 'n' replicated streams. The customized valid values are displayed in lavender and customized invalid values are displayed in pink.

You can enter the number of replications in the **Number of replicated streams** text box. The table lists the attributes which can be incremented by entering a number in the **Increment Value** column. All attributes except for **MACs** and **IP** addresses will accept an integer:

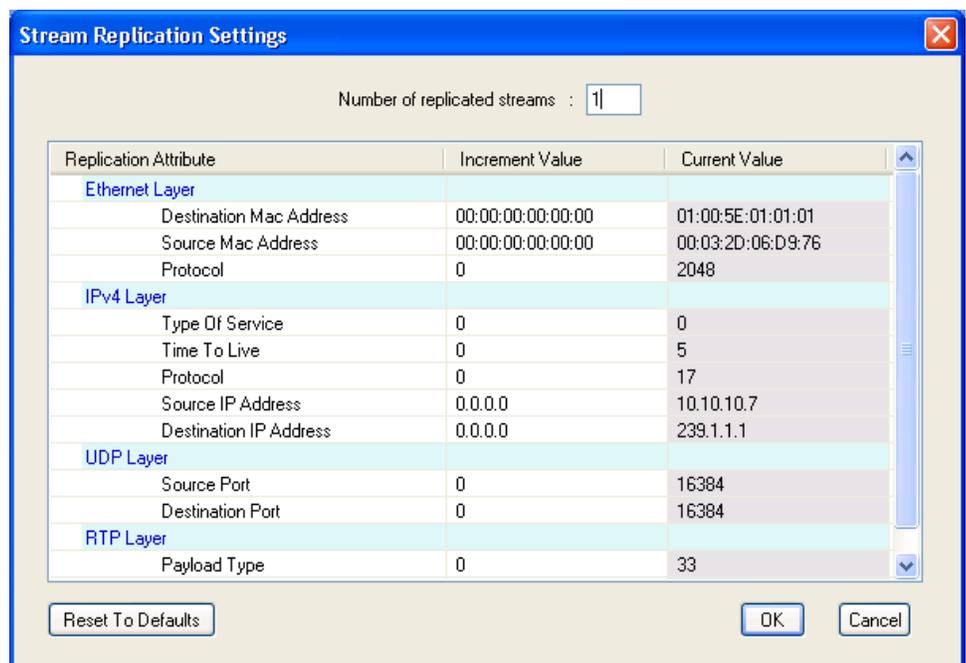


Figure 30: Stream Replication Settings for IPv4

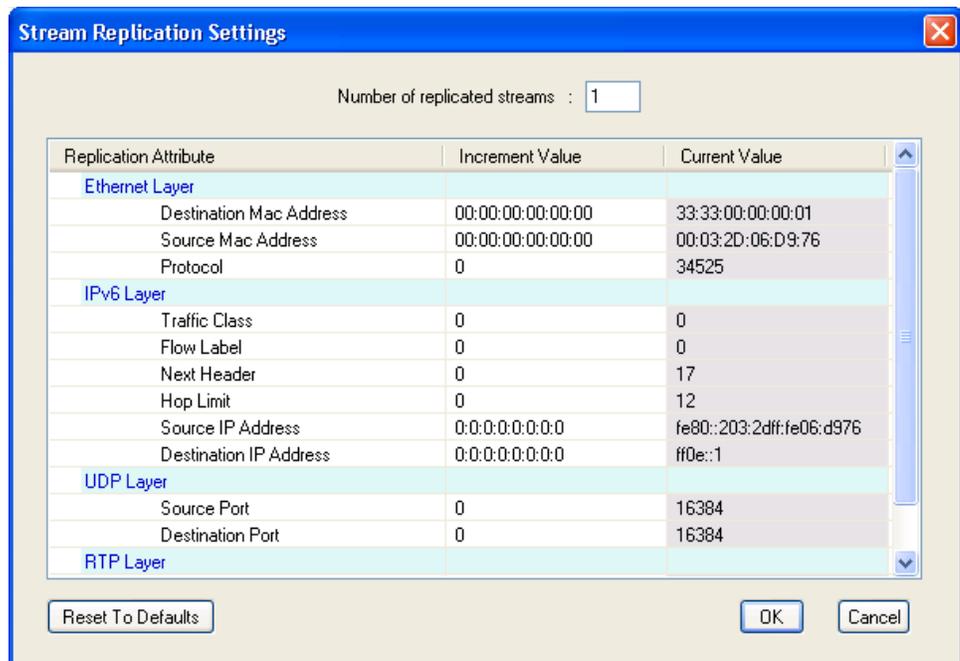


Figure 31: Stream Replication Settings for IPv6

You can click **Reset to Defaults** to reset the increment values to default values. Whenever the stream replication is active, an icon is displayed in the status bar during the play.

- Allow TS Fragmentation:** Controls the fragmentation of the transport stream packets. If this option is selected, the transport stream packets will be split across the IP packets else all the transport stream packets will be present in the IP packet. By default, this is cleared. The **IP Packet size** option will be enabled only if **Allow TS Fragmentation** option is selected. The **Number of TS packets** option will be enabled irrespective of the **Allow TS Fragmentation** option being enabled.
- Allow IP Fragmentation:** Controls the fragmentation of IP packets. This option is applicable to packet sizes which are greater than the MTU size of the interface (typically 1500B). If this option is selected, the IP packets are fragmented else they will be retained with the same size. By default this option is cleared. The maximum packet size is 16128 when IP fragmentation is selected. This option is available only in IPv4 version.
- IP Packet Size:** Allows you to set the size of IP packet. This option is enabled only if TS fragmentation is allowed. When IP fragmentation is enabled, the maximum size of IP packet for IPv6 version is 16128 bytes and for IPv4 version is 1500 bytes.

The IP packet size includes the headers. The payload size is calculated at runtime using the following equation:

$$IP\ Packet\ Size = Payload\ Size + Header\ Size$$

For IPv4 version, the header size is 54 (58 with VLAN enabled) for RTP and 42 (46 with VLAN enabled) for UDP. For IPv6 version, the header size is 74 (78 with VLAN enabled) for RTP and 62 (66 with VLAN enabled) for UDP.

- **Number of TS Packets:** Allows you to type the number (integer) of TS packets that needs to be embedded into an IP packet.

The maximum IP packet size is 1500 bytes or equivalent to TS packets.

A read only text field showing the IP packet size is displayed next to this option. The IP packet size will be calculated automatically and displayed in bytes. Based on the number of TS packets, the IP packet size is calculated using the following equation:

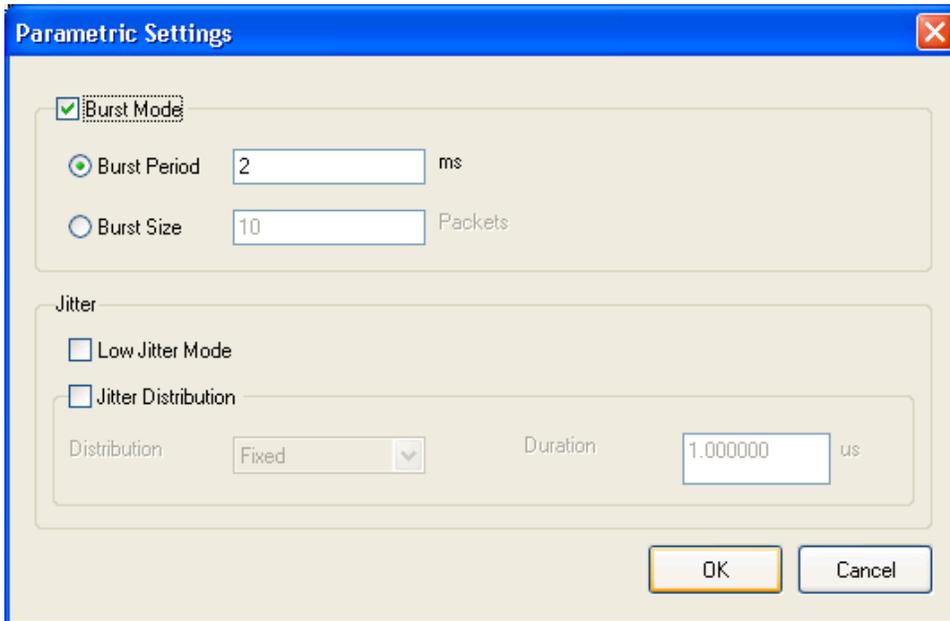
$$IP\ Packet\ Size = Payload\ Size + Header\ Size$$

where payload size is calculated as follows:

$$Payload\ Size = Number\ of\ TS\ Packets \times TS\ Packet\ Size$$

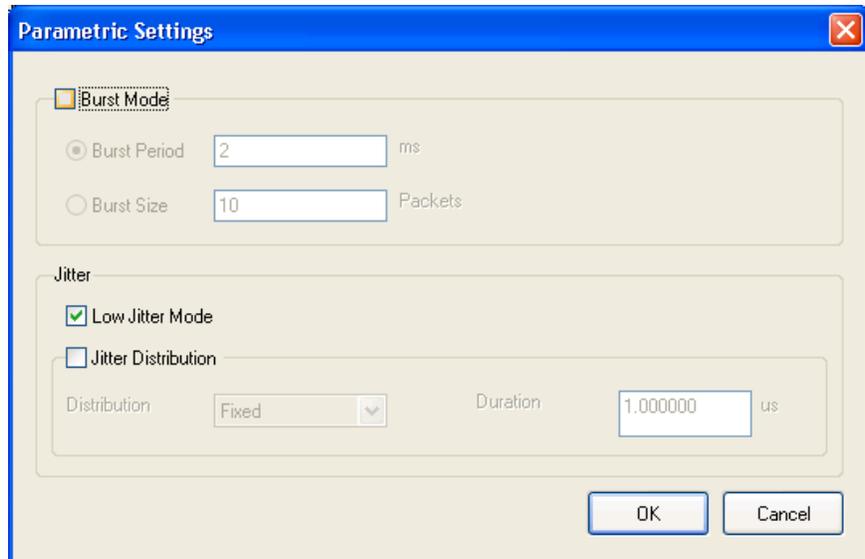
- **Store Settings:** Stores or updates the entire configuration settings including the Advanced Protocol Settings. All these settings will be listed out in the Configuration Name dropdown list.
- **Delete Settings:** Deletes the selected configuration setting that is displayed in the Configuration Name dropdown list and selects the next configuration in the list. If there are no more configurations stored in the list, the values in the configuration dialog box will be reset to the default values.
- **Clear Settings:** Clears the selected configuration setting including **Advanced Protocol Settings** and resets them to the **default** values.
- 802.1Q VLAN Layer: Tag Protocol Identifier, Priority Levels, Canonical Format Indicator, and VLAN Identifier

Parametric settings. When you select **Parametric Settings** from the **IP** menu, the **Parametric Settings** dialog box appears as shown in the following figure:



- **Burst Mode:** Allows you to transmit the player thread in the form of bursts. Burst mode is not selected by default.
 - **Burst Period:** You can set the time during which packets will be transmitted in the burst mode. Burst period is selected by default.
 - **Burst Size:** You can set the burst size which determines the number of packets being transmitted in every burst.

- **Jitter:** Inserts jitter during IP playout.
 - **Lower Jitter Mode:** When **Lower Jitter Mode** is enabled, the **Statistics** and the **Error Generation** options are disabled in the **IP** menu:



- **Jitter Distribution:** There are four types of Jitter Distribution namely **Fixed**, **Laplacian**, **Gaussian**, and **Sinusoidal**. Fixed is the default jitter distribution. When Fixed is selected, a Duration text box is displayed where you can enter the jitter in microseconds. When Jitter Distribution other than Fixed is selected, a slider is displayed where you can set the jitter as percentage of the interpacket time by moving the slider. The interpacket gap will follow the selected jitter distribution. The overall bit rate of the playout is not affected by jitter insertion.

Error insertion. When you select Error Insertion from the IP menu, the Error Insertion dialog box is displayed as shown in the following figure. This dialog box allows you to insert errors during playback. For Non-TS playback, Error Insertion is limited to packet drop and checksum errors:

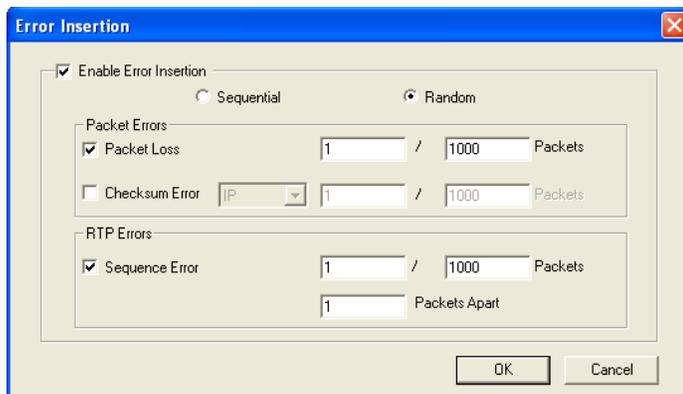
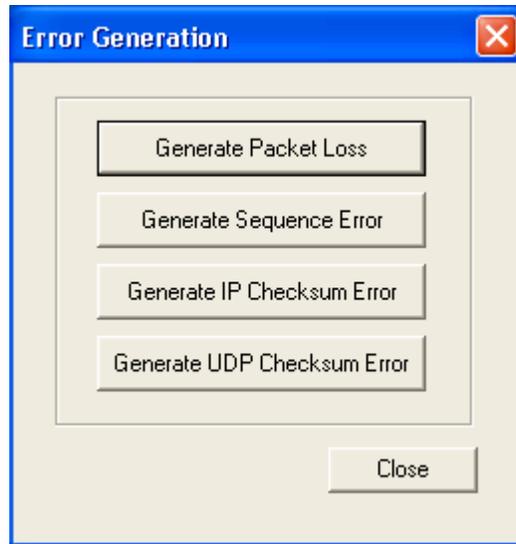


Figure 32: Error Insertion dialog box

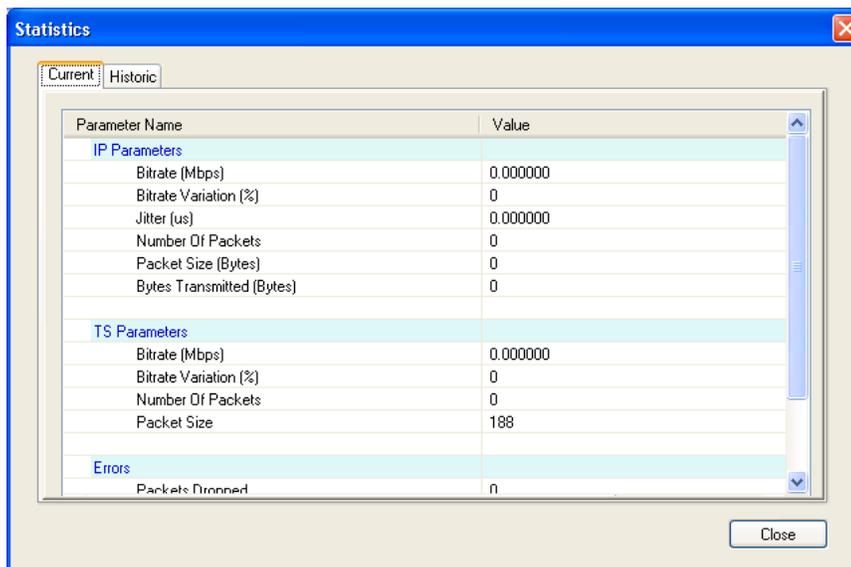
- **Enable Error Insertion:** Enables error insertion. All error insertions are specified as X errors per Y packets except for jitter. You can have error insertion in sequential or random order.
 - **Sequential:** The errors are inserted in sequential packets; that is, for every Y packets the first X packets have errors inserted in them.
 - **Random:** The errors are inserted in random packets; that is, for every Y packets X random packets have errors inserted in them. Random mode is set as the default.
- **Packet Loss:** Inserts packet loss. The packets are dropped at a frequency you specify. You can specify the rate as X packets within Y packets.
- **Checksum Error:** Inserts checksum error. The checksum error can be inserted in UDP layer of both IPv4 and IPv6 versions and in the IP layer of IPv4 version. The CRC errors are generated in packets at a frequency you specify. You can specify the rate as X packets within Y packets.
- **Sequence Error:** Inserts packet sequence error. This option is enabled only if **RTP** protocol is selected in the **IP configuration Playback** dialog box. The packets will be reordered at the frequency specified in the Packets text box. You can enter the number of packets after which you want the reordering to happen in the Packets Apart text box. You can specify the rate as X packets per Y packets after every Z number of packets.

Error generation. When you select **Error Generation** from the IP menu, the **Error Generation** dialog box appears as shown in the following figure. This dialog box allows you to insert errors manually:



- **Generate Packet Loss:** Drops an **IP packet** during the **IP playback**. The number of packets dropped will be equal to the number of times you click the button.
- **Generate Sequence Error:** Generates sequence error manually. When you click this button the packet will be resequenced with another packet within a 100-packet boundary.
- **Generate IP Checksum Error:** Generates checksum errors manually in the IP layer. This option is available in IPv4 version.
- **Generate UDP Checksum Error:** Generates checksum errors manually in the **UDP** layer.

Statistics. When you select **Statistics** from the IP menu, the Statistics dialog box is displayed. The player displays the current and historic statistics of IP parameters, TS parameters, and Errors. These will be retained until the start of next play or until a new file is opened. This option is not available when **Low Jitter Mode** is enabled:



- **Current:** Shows the instantaneous statistics of parameters at that time. Once the play is started, this dialog box is refreshed at the rate of every second.
 - **IP Parameters:** The current bit rate, percentage variation of this current bit rate from the nominal (set) bit rate, number of IP packets transmitted, and the IP packet size used for playout are all displayed. The jitter value which reflects the insertions done at runtime is also displayed.
 - **TS Parameters:** The TS bit rate of the MPEG file being played is displayed. The number of TS packets and the TS packet size is also displayed. If the player is in the Non-TS mode, then all the statistics will display Non-TS playout.
 - **Errors:** Number of packets dropped, packet loss rate, sequential errors, and checksum errors for both IP and UDP are all displayed.
 - **Value (per stream) :** When stream replication is enabled, the **Current** tab displays the **Value** column. This column gives the value of each parameter per stream.
 - **Total Value (in n streams:** When stream replication is enabled, the **Current** tab displays the **Total Value** column. This column gives the total value of each parameter for the set number of streams. Here n streams is equal to the sum of the replicated streams and the actual stream.

- **Historic:** Displays the minimum, maximum, and average values of parameters (IP, TS) for the current play. When stream replication is enabled, the **History** tab signifies that the statistics show per flow.
 - **IP Parameters:** The current bit rate, percentage variation of this current bit rate from the nominal (set) bit rate, and the jitter value appear.
 - **TS Parameters:** The bit rate and the percentage variation from this bit rate appear.

Timestamped TS payout settings. When you select **TTS Settings** from the **IP** menu, the **TTS Settings** dialog box is displayed. The **TTS Settings** option is only supported by the **IP** mode.

When TTS is enabled, each packet (188 bytes) of TS file is prefixed by a 4-byte time stamp and converted into a TTS stream. If the TS packet size is more than 188 bytes (192, 204), the extra bytes following the 188th byte are truncated and 4-bytes of time stamp will be transmitted along with it. For a partial TS file with the TTS settings selected (with Preserve timestamp not selected), the submenus namely the Update mode, Clock dialog box, and the PCR initial value of the Play menu are all enabled.

- **Preserve timestamps if the file already has them:** By selecting this option, you can preserve the time stamps of the TTS file if it already exists or add 4-bytes of time stamp to the TS packet.
- **Enable TTS Jitter:** By selecting this option, you can insert jitter to the time stamps that gets appended to the TS packets.
 - **Pattern:** You can select the distribution of jitter that is inserted to time stamp from the Pattern list. The various patterns listed are Sine, Pulse, Triangle, Square, Saw, Random, and Offset. Sine is set as the default pattern.
 - **Period:** You can set the period for the time stamp as number of packets. Based on the selected pattern, the Period text box is enabled or disabled. 100 packets is set as default period value.
 - **Amplitude:** You can enter the amplitude of the time stamp in the Amplitude text box. Based on the selected pattern the Amplitude text box is enabled or disabled. 0.00 ns is set as the default amplitude.
 - **Pulse Width:** You can set the pulse width as the number of packets. Based on the selected pattern, the Pulse width is enabled or disabled. 50 packets is the default pulse width.

In the TTS mode, the Packet size option of the Play menu is disabled with 188 bytes selected. When the TTS mode is selected, the status bar displays TTS mode as the standard with 192 packet size.

The displayed IP bit rate changes because there will be four extra bytes added to each TS packet. When TTS Playout settings is enabled, the packet size in the Statistics screen displays the actual packet size (188 bytes) with the four time-stamped bytes.

Other settings. When you select **Other Settings** from the IP menu, the **Other Settings** dialog box is displayed. The **Others Settings** dialog box allows you to set the priority of the player process and the transmitter thread. As a result, you can increase or decrease the accuracy of the interpacket gaps during playout.

The **Other Settings** dialog box allows you to set the following parameters:

- **Player:** You can set the process priority for the player. The priorities are Real Time, Normal, Above Normal, and Highest. Above Normal is set as the default.
- **Transmitter:** You can set the priority for the transmitter thread. The priorities are Idle, Below Normal, Normal, Above Normal, Highest, and Real Time. Real Time is set as the default.

Recommended settings for MPEG Player in IP mode

This section lists the recommended settings to improve the performance of the **MPEG Player** in **IP** mode:

Settings for playout performance. Perform the following steps to set the options of Administrative tools for improved performance during the Playout:

1. Click **Control Panel > Administrative Tools > Services** in **Classic** view.
2. Select **Windows Firewall / Internet Connection Sharing (ICS)** to open the dialog box. Stop the service and select **Disabled** from the **Startup type** list to disable the startup:

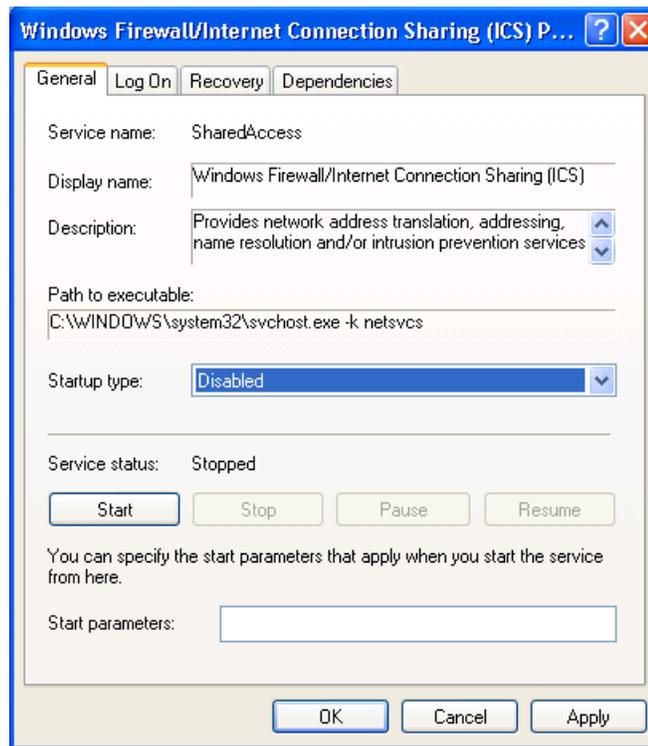


Figure 33: Windows Firewall/Internet Connection Sharing (ICS)

3. Select **Automatic Updates** to open the dialog box. Stop the service and select **Disabled** from the **Startup type** list to disable the startup:

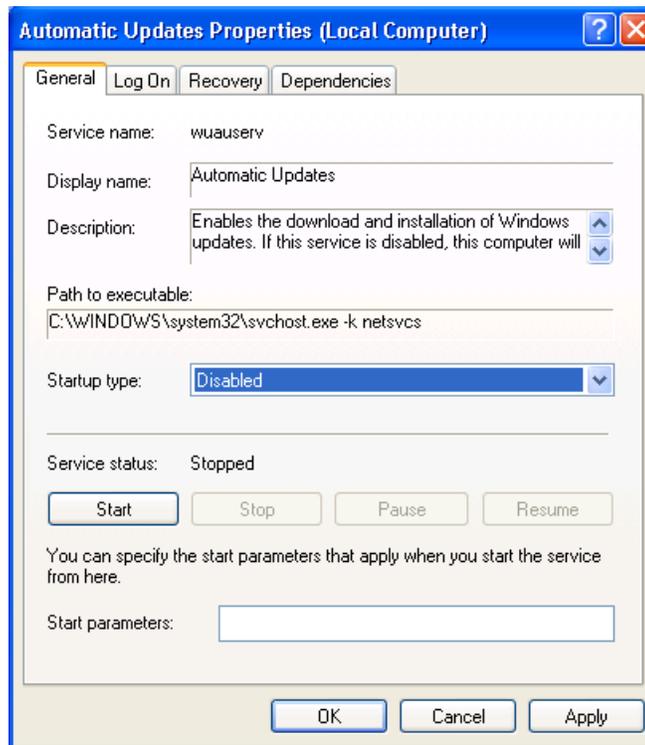


Figure 34: Automatic Updates Properties

4. Select **IIS admin** to open the dialog box. Stop the service and select **Disabled** from the **Startup type** list to disable the startup:

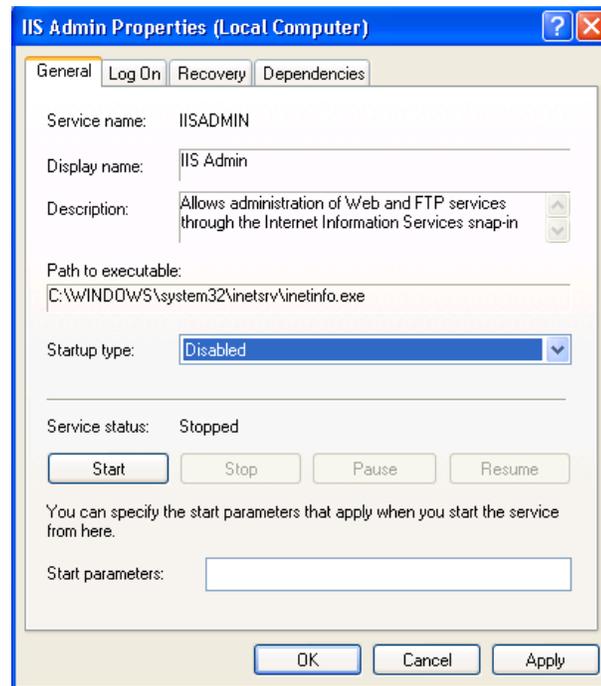


Figure 35: IIS Admin Properties

Settings for Java update

Perform the following steps to disable automatic Java updates:

1. Click **Control Panel > Java**.
2. Select the **Update** tab and clear the **Check for Updates Automatically** check box:

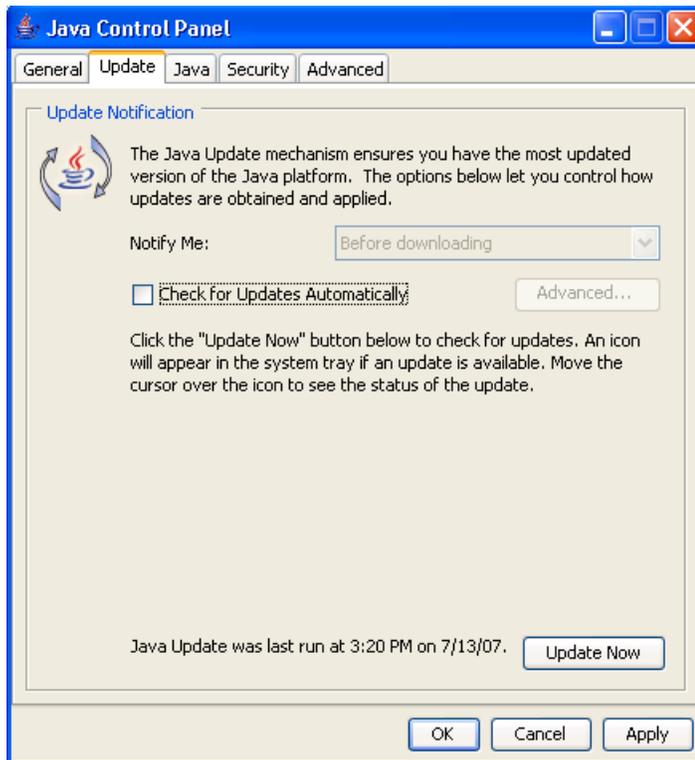


Figure 36: Java Control Panel

A **Java** warning message is displayed. Click **Never Check**:



Figure 37: Java Update-Warning

Settings for VLAN. Perform the following steps to set the options for VLAN:



WARNING. Skip this optimization step if you are not familiar with editing the Registry. Making an incorrect change to the Registry can adversely affect the behavior of your system.

1. Click **Search > regedit** and then click **OK** to obtain the **Registry Editor** window:
2. Browse to **HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Control\Class\{4D36E972-E325-11CE-BFC1-08002BE10318}\00XX** where **XX** is the instance of the network adapter that you need to see tags on. You can check by opening and viewing the driver descriptor value (DriverDesc value should be Intel(R) PRO/1000 MT Network Connection).

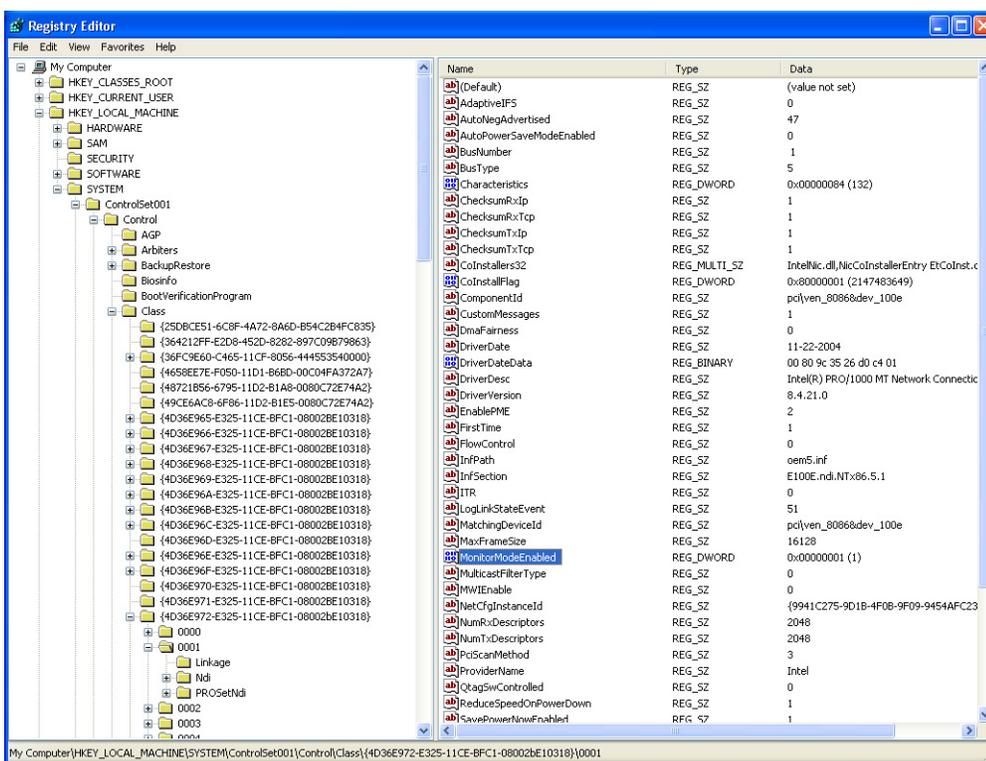


Figure 38: Registry Editor

3. Right-click to select **New > DWORD Value** or select **Edit > DWORD Value** option. Rename the option to **MonitorModeEnabled**.

4. Double-click the **DWORD Value** to open the **Edit DWORD Value** dialog box. Set **Value data** to 1 and click **OK**.

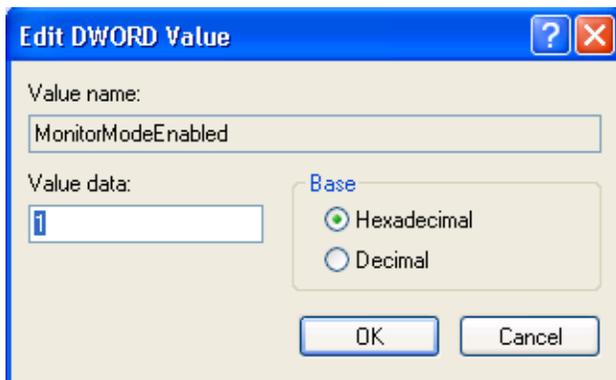


Figure 39: Edit DWORD Value

NOTE. Restart the MPEG application to view the changes.

Utility menu The following table describes the commands in the **Utility** menu:

Table 35: Utility menu commands

Command	Description
Communication...	<p>Sets the port number that is needed to remotely control the MPEG Player over an Ethernet network and the terminator that is used to communicate with a controller.</p> <p>When you select this command, the Communication dialog box appears. Refer to <i>Communications Dialog Box</i> for more information. (See page 237.)</p>
About...	<p>Displays general system information including the software and hardware versions.</p> <p>When you select this command, the About dialog box appears. Refer to <i>About Dialog Box</i> for more information. (See page 238.)</p>

Communication dialog box. When you select the **Communication** command from the **Utility** menu, the **Communication** dialog box appears:

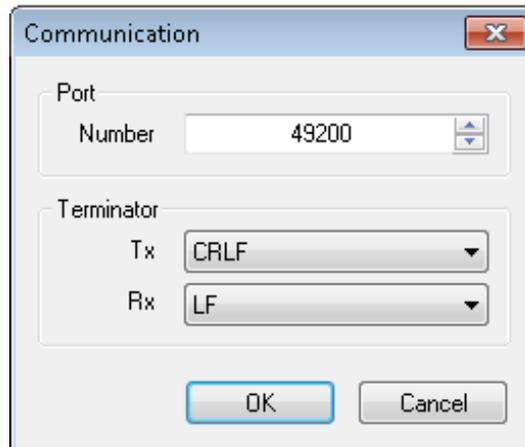
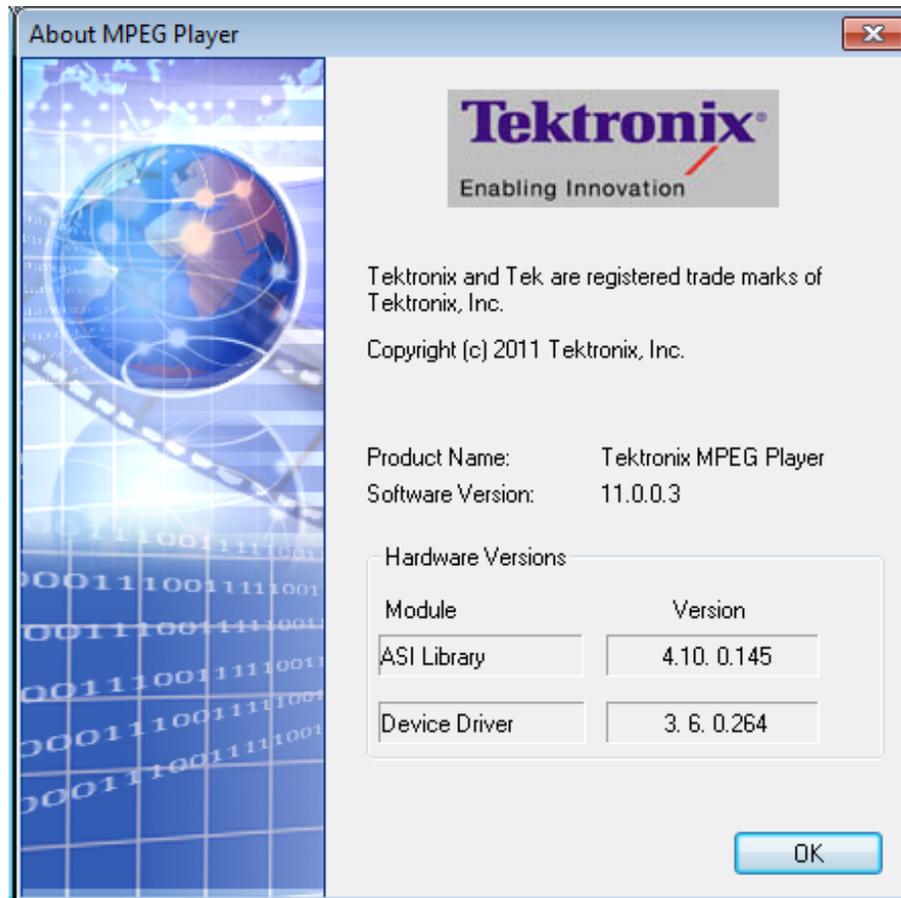


Figure 40: Communication dialog box

- **Port Number:** Sets the port number needed to remotely control the MPEG Player over an Ethernet network. You can set a value from 1024 to 65535.
- **Terminator**
 - **Tx:** Selects the terminator that is used when the MPEG Player sends information to a controller. You can select LF (linefeed), CR (carriage return), CRLF (carriage return and linefeed), or LFCR (linefeed and carriage return).
 - **Rx:** Selects the terminator that is used when the MPEG Player receives commands from a controller. You can select LF (linefeed) or CR (carriage return).

Select the **OK** button to enable all setting changes.

About dialog box. When you select the **About...** command from the **Utility** menu, the **About** dialog box appears:



This dialog box shows the version of the MPEG Player application and hardware version of the main and installed interface modules - your versions may differ.

Toolbar buttons

The toolbar provides shortcut buttons for many of the most often used menu commands. Click a toolbar button to select the corresponding command.



The following table shows the toolbar buttons and their functions:

Table 36: Toolbar button descriptions

Icon	Name	Function
	LOAD TS file	Opens the Select File dialog box. Equivalent to the Open command in the File menu.
	Load Preset	Opens the Open dialog box. Equivalent to the Load Preset command in the File menu.
	Save Preset	Opens the Save as dialog box. Equivalent to the Save Preset command in the File menu.
	Play	Outputs the selected stream. Equivalent to the PLAY button on the front panel.
	Stop	Stops the stream output.
	Clock	Opens the Clock dialog box. Equivalent to the Clock command in the Play menu. This button is available when the Play screen is displayed.

MPEG Player - Reference

This section contains information about the following **MPEG Player** features:

- Outputting streams
- Adding jitter to PCRs
- Using Preset files

Interface card (ASI Option)

Refer to the *MTSA-HW and MTSA-PC Specifications and Performance Verification Technical Reference* for detailed specifications of the interface card connectors.

About the data output source

When you output the selected stream data, you can select either the hard disk or the RAM as an output source. This subsection describes the operation of the MPEG Player when each output source is selected.

RAM. When you select the RAM as an output source, the MPEG Player performs the following:

- When data output rate is less than or equal to 120 Mbps, the MPEG Player outputs the first stream data while transferring the data from the hard disk to the RAM and then continuously outputs the data from the RAM using looping methods.
- When data output rate is more than 120 Mbps, the MPEG Player continuously outputs a stream data from the RAM using looping methods after the data is completely transferred from the hard disk to the RAM.

If you select RAM as an output source, you cannot output data in excess of the RAM free space for data output. This RAM free space is displayed on the status bar.

The player displays the RAM space of 200 MB.

Hard Disk. If you select the hard disk (Disk) as an output source, the MPEG Player always outputs the selected stream data from the hard disk regardless of the data output rate. When the reading speed of the hard disk cannot overtake the data output rate, the error message "Error: Output Buffer Empty" appears.

Use the Source command in the Play menu to select the output source. (See page 205.) You can see the currently selected output source in the status bar.

Adding jitter to PCRs

The MPEG Player provides the capability to add jitter to PCRs (Program Clock References). Adding jitter to PCRs allows you to simulate transmission delay variations and to test the robustness of decoders under various conditions.

The jitter function adds jitter to the `program_clock_reference_base` value and the `program_clock_reference_extension` value in the adaptation field of transport stream packets. You can use this function to modulate the data values of the PCRs away from their correct values.

Adding jitter Perform the following procedure to add jitter to PCRs:

1. Select a **PCR** element in the hierarchy display and select **PCR Accuracy Variation...** from the right-click menu:

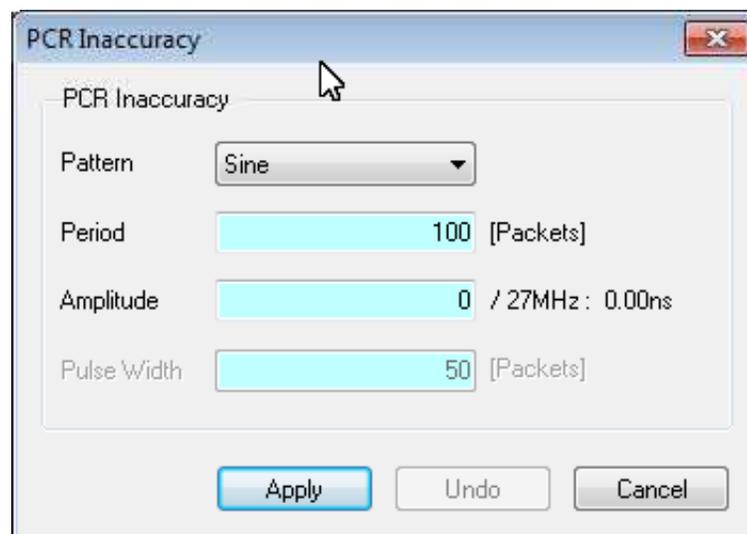


Figure 41: PCR Inaccuracy dialog box

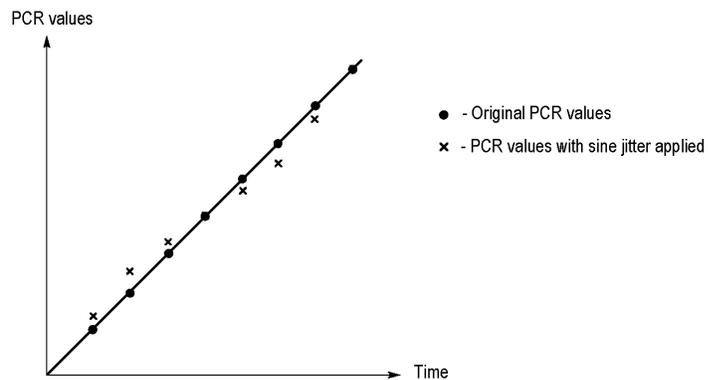
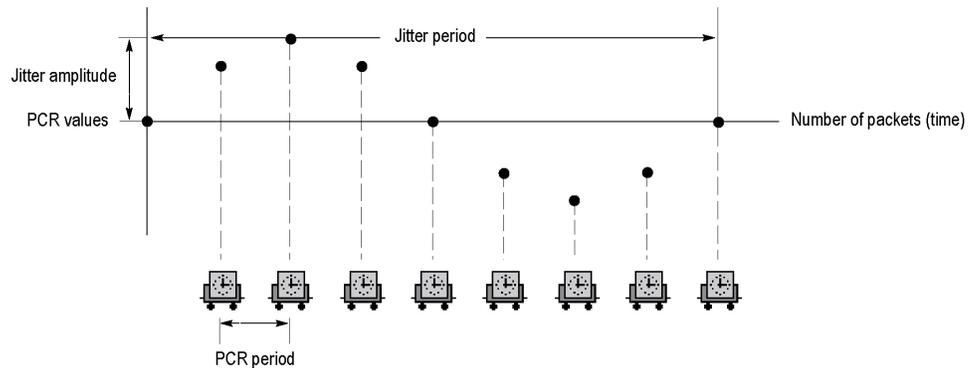
2. The PCR Inaccuracy dialog box lets you set how the parameters for how jitter will be added to the PCR:
 - **Pattern:** Selects the type of the waveform used to add jitter. You can select Sine, Square, Triangle, Pulse, Sawtooth, Random, or Offset.
 - **Period:** Sets the period of the waveform used to add jitter. You can set the value from 5 to 3000 packets in 1 packet steps.
 - **Amplitude:** Sets the amplitude of the waveform used to add jitter. You can set the value from 0/27 MHz to 135000000/27 MHz (0 s to 5 s).
 - **Pulse Width:** Sets the pulse width of the waveform used to add jitter. You can set the value from 1 to (period-1) packet(s) in 1 packet steps. This Pulse Width parameter is available only when the Pattern parameter is set to Pulse.

3. After you have set the parameters, press the **Apply** button to enable the jitter function.

Note that the PCR icon in the hierarchy display changes.

To disable the jitter function, open the PCR Inaccuracy dialog box and select the **Undo** button. Note that the PCR icon in the hierarchy display changes.

The following figure shows the relationship among the parameters and how the PCR values (program_clock_reference_base value and program_clock_reference_extension) change when Sine is selected as a jitter-pattern waveform. The PCR values vary by the value of sine waveform defined by the amplitude and period. The PCR period does not change:



Using preset files

You can save the instrument settings that you defined as a **preset** file, so that you can later restore those settings. **Preset** files are stored in **XML** format for your convenience.

Contents of the preset file Saved Preset contain all of the parameter settings available in the **Play** menu.

Saving a preset file Use this procedure to save the current instrument settings as a preset file.

Perform the following steps to save a preset file:

1. Make the required instrument settings.
2. Select **File > Save Preset**. The **Save As** dialog box is displayed. In the File name text box, a two-digit serial number is added to the selected file name (for example, if the selected file name is "Test_TS", the default file name becomes "Test_TS00"). Preset files use the .xml file extension.

You can change the file name as required.

3. Select **OK** to save the instrument settings as a **preset** file.

Loading a preset file Perform the following steps to load an instrument setup from a **preset** file:

1. Select **File > Load Preset**. The **Open** dialog box appears.
2. Select the required file.
3. Press **OK** to load the **preset** file into **MPEG Player**.

Make Seamless Wizard

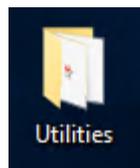
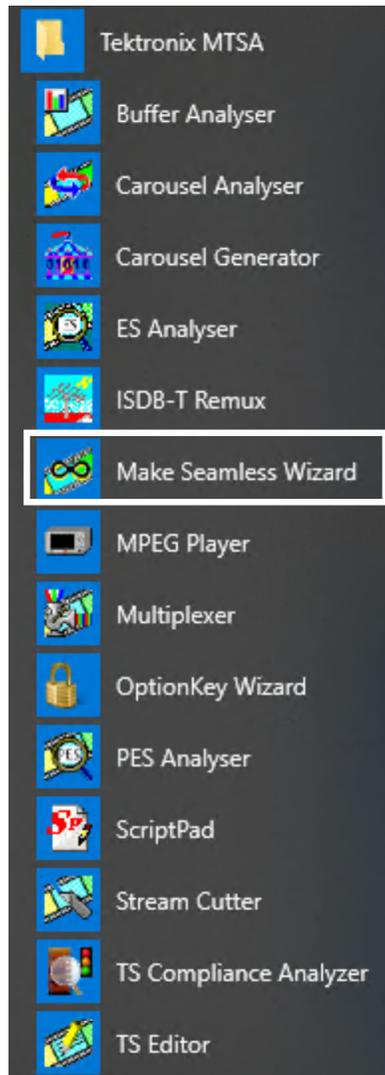
This wizard guides you through the process of creating an MPEG-2 file for use by Stream Player in continuously looped operation.

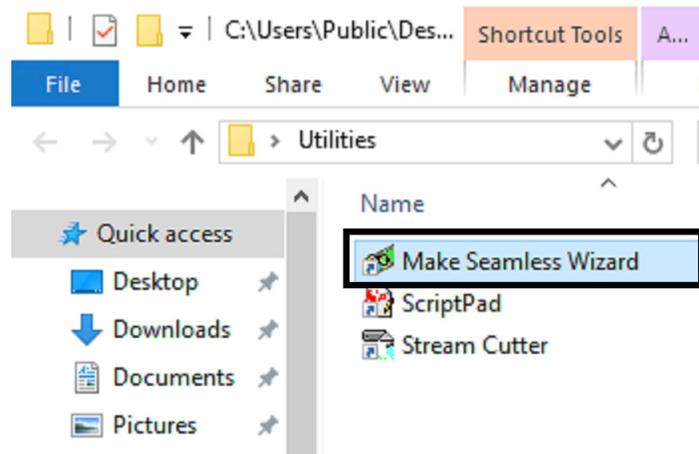
The wizard is largely self-explanatory. The notes in this section of the manual provide a slightly more detailed explanation of the wizard and the necessary user responses.

NOTE. *Make seamless supports the MPEG-2 video standard. It does not support H.264 or H.265/HEVC.*

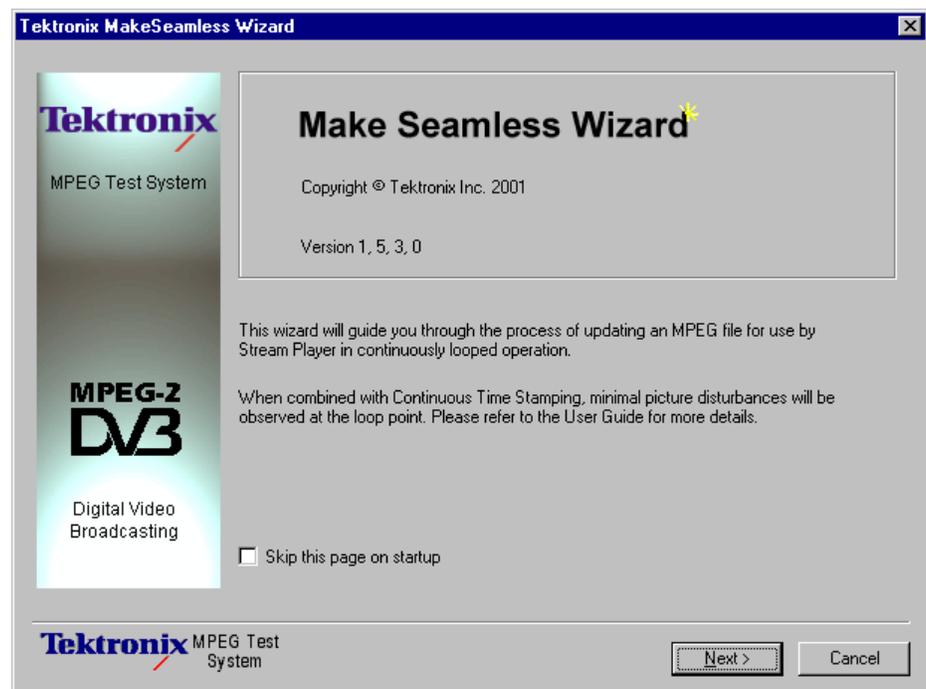
Starting the wizard

To start the wizard, select **Start > Tektronix MTSA > Make Seamless Wizard**. Alternatively, you can double click the **Utilities** folder on your desktop and then open the **Make Seamless Wizard** application.





The **Wizard** opening window appears:



This first page gives a short explanation of the wizard's activities and offers the opportunity to skip the page in the future.

Select Next to move to the next screen and specify the input file.

Progress and Information log

The **Progress** and **Information logs** show messages during the operation of the wizard. Three types of message will appear:

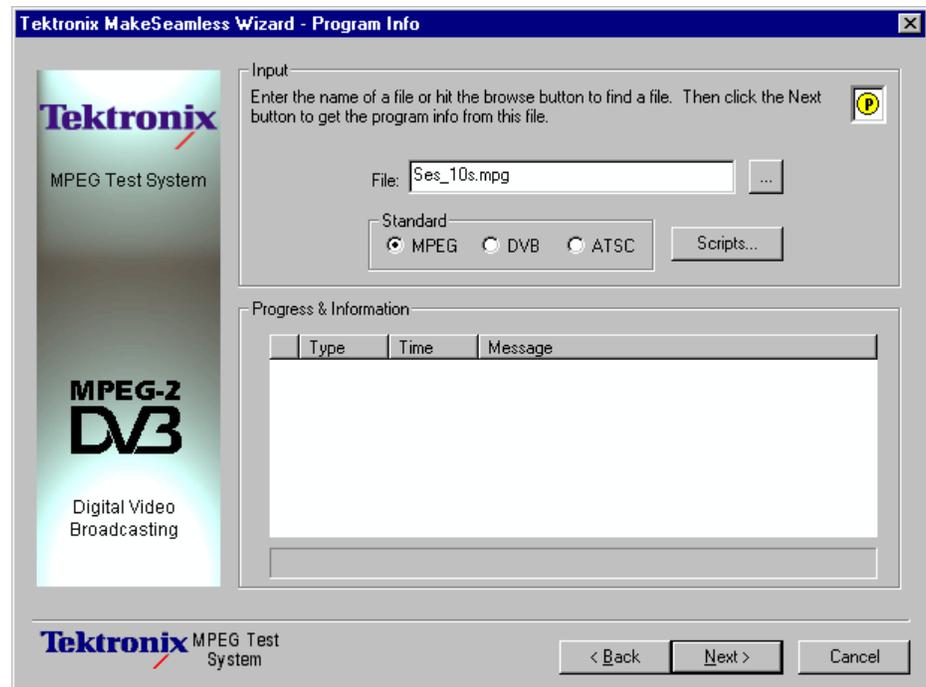
INFO	General processing information.
WARNING	Messages which may mean that the output stream will contain errors.
ERROR	Messages indicating catastrophic information which will cause the wizard to disable the Next button and prevent further progress.

An icon appears in the top right corner of the window and as a prefix to any messages displayed in the **Progress & Information** log. The icons are used to indicate the current processing phase of the **Make Seamless Wizard**:

- Program 
- Analysis 
- Multiplex 

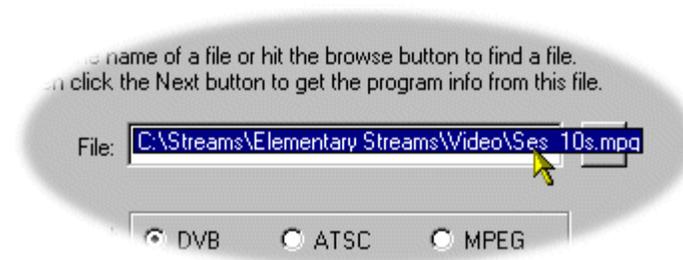
Selecting an input file

The first action is to identify the input or **Source Transport Stream**:



Enter the filename in the **File:** field. The browse button (...) can be used to open a standard Windows Open dialog box and locate files:

***NOTE.** Only the filename will be shown, but by resting the cursor over the filename, the full path is shown for a short time in a tooltip.*

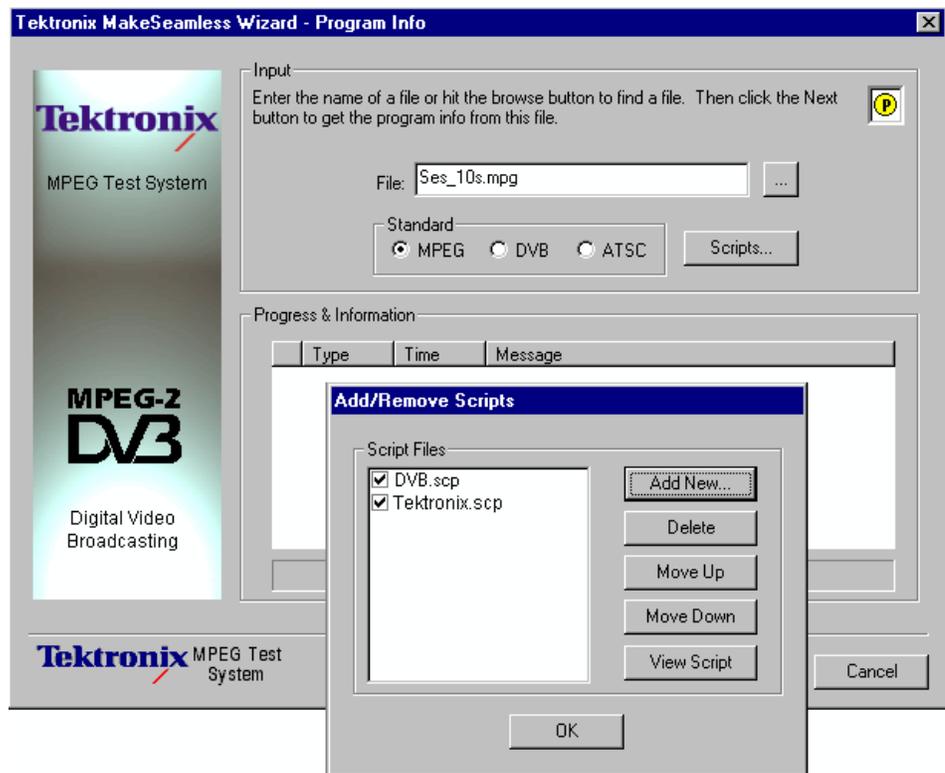


SI scripts Customized SI scripts are available to the Make Seamless Wizard to enable custom SI table and descriptor data to be processed successfully. Basic processing of the Standards does not require additional scripts.

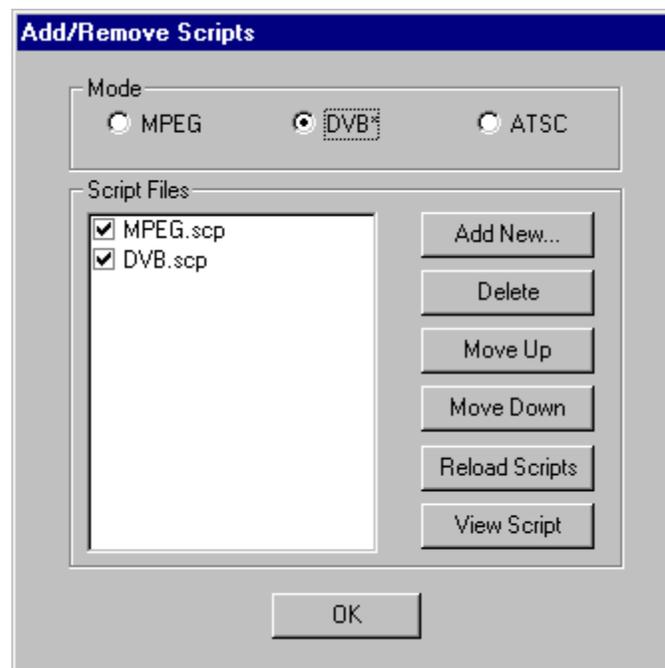
If a suitably configured script is selected and enabled before a stream is analyzed, custom data will be analyzed when the stream is opened. If the script is not selected or enabled, the stream will not fail to be analyzed, but any custom data will either be ignored or reported as an error in the stream configuration.

(The underlying principles of scripting are described in the Custom SI Scripting section of this user manual.)

Handling script files. To handle **SI Scripts**, select the general **Standard** required, by enabling the appropriate radio button and then select the **Scripts** button:



The **Script** dialog box displays the scripts currently associated with each standard and allows them to be added, removed, viewed, and manipulated:



There is, in effect, one **Script File** list associated with each mode; script files can be listed in one or more Script file lists. Script files are designated as MPEG, DVB or ATSC when they are added to the Script File list. Each mode will display only those script files associated with that mode. Further script files can be added as required using the **Add New** button.

Note that a script file will not be used for analysis until:

- It is added to the **Script File** list in the appropriate mode.
- It is enabled (displays a check mark in the **Script File** list).

Adding a script file.

1. In the **Script** dialog box, select the **Mode** to which you must add the script — for example, **DVB**.
2. Select the **Add New** button. A standard Windows file selection dialog box is opened. The default file extension is .scp. Select the required file.

Note that the selected script file is now listed in the script file list and is enabled; it will be used for any analysis.

Enabling a script file. Select the check mark adjacent to the required script file to enable the file for analysis.

Moving a script file. Script files are applied to analysis in the order that they are listed; in some circumstances this may be important. To move a file in a list, highlight the file name and select the Move Up or Move Down button as required.

Each press of the button will move the file up or down one place in the list until it reaches the top or the bottom.

Viewing a script file. Script files can be viewed and edited in a text editor (provided that the scp extension has been associated correctly in Windows Explorer). To edit a script, highlight the script name and select View. This will open the script in Notepad or its equivalent. The required edits can then be made and the script saved.

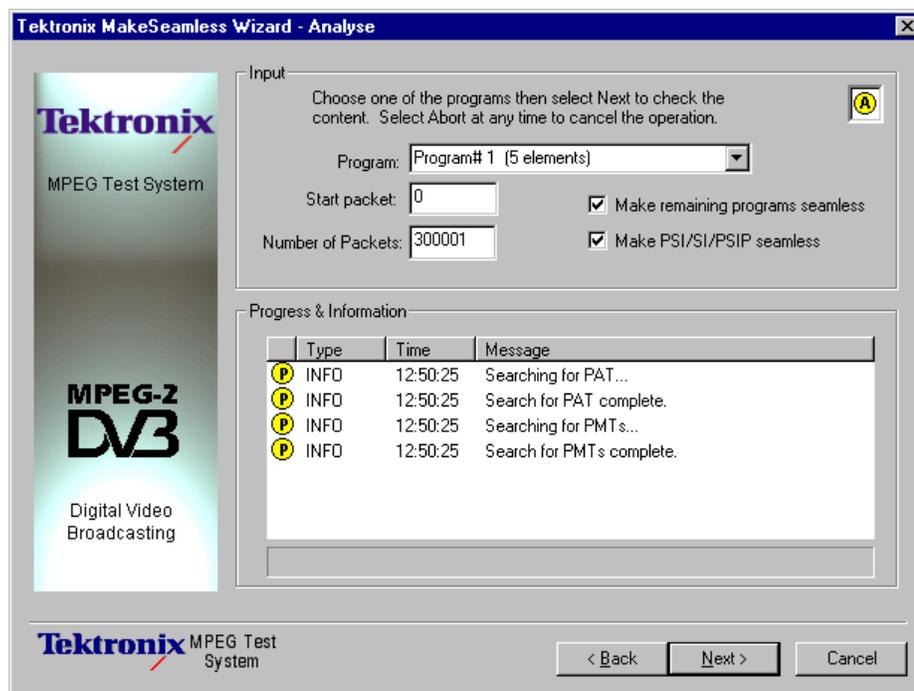
When the filename is satisfactory and any scripting actions have been performed, select Next to analyze the file. Progress is indicated by the progress bar and the appearance of messages in the Progress & Information log.

Select a program to make seamless

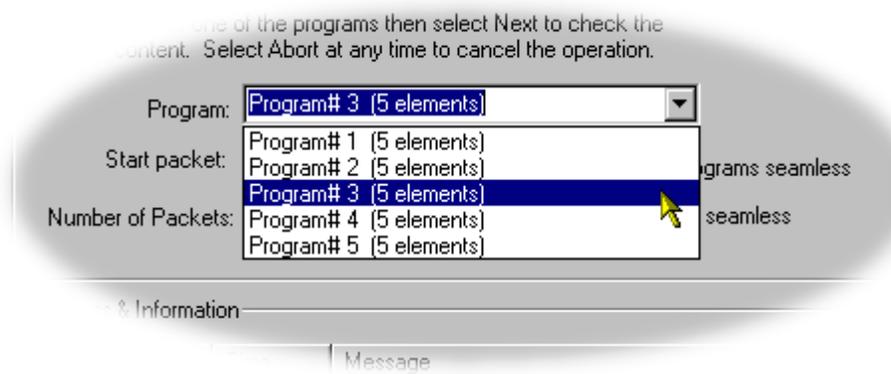
During the input file's analysis the selected transport stream is analyzed to determine it's program content. If analysis is unsuccessful in determining program content, the stream will not be opened and an appropriate message will be displayed in the Progress & Information log.

Each program found appears in the dropdown list (**Program:**) accompanied by an indication of the number of program elements (video, audio, etc.).

At this stage a priority program must be selected in order for it to be analyzed and tested for suitability for the "make seamless" treatment:



Program: Highlight the required program from the dropdown list:



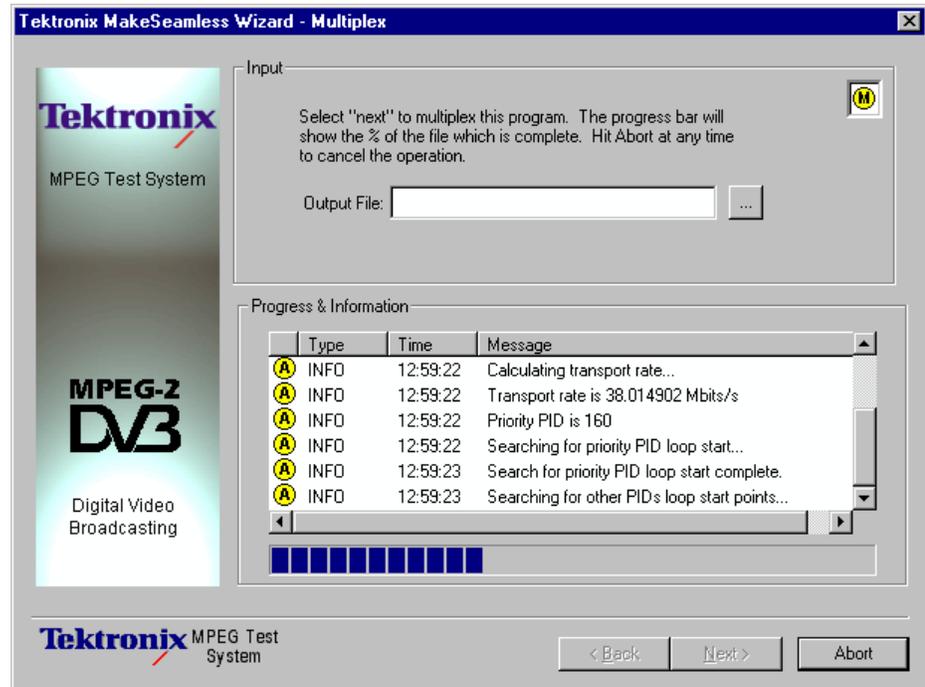
Start packet: This value determines from where the primary program is to be analyzed. Indicates the offset from the original transport stream start point to start looking for a loop start point.

Number of Packets: Initially, this value is set to the total number of packets in the transport stream. It indicates the maximum number of packets (up to the end of the stream) from the Start packet point that may be included in the loop.

Make remaining programs seamless: If enabled, the remaining programs are made seamless but are constrained by limits defined by the priority program. This may lead to these remaining programs having a gap at the beginning and end of the file.

Make PSI / SI / PSIP seamless: The service information contained in the transport stream is processed to make it seamless.

If this check box is not enabled, the SI is not processed but simply copied to the output **Transport Stream**:

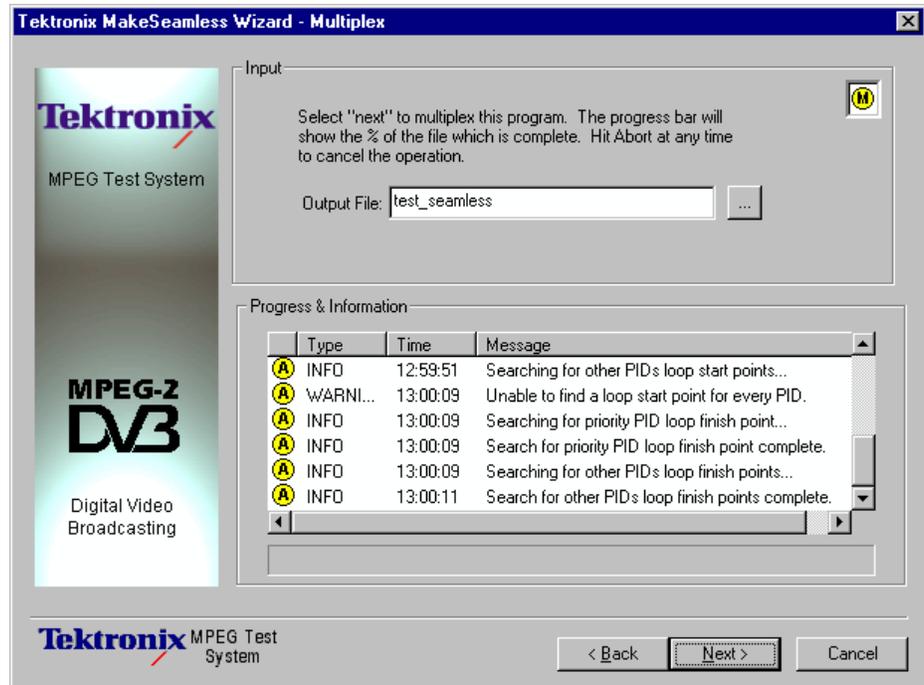


Select **Next**. Once again the progress bar will indicate progress. While the stream is being analyzed, selecting the **Abort** button will stop the process and allow the program to be reselected (Note that the Abort button, which replaces the Cancel button, is only displayed during processing).

When the file has been analyzed, a number of messages will have been posted in the **Progress & Information** log.

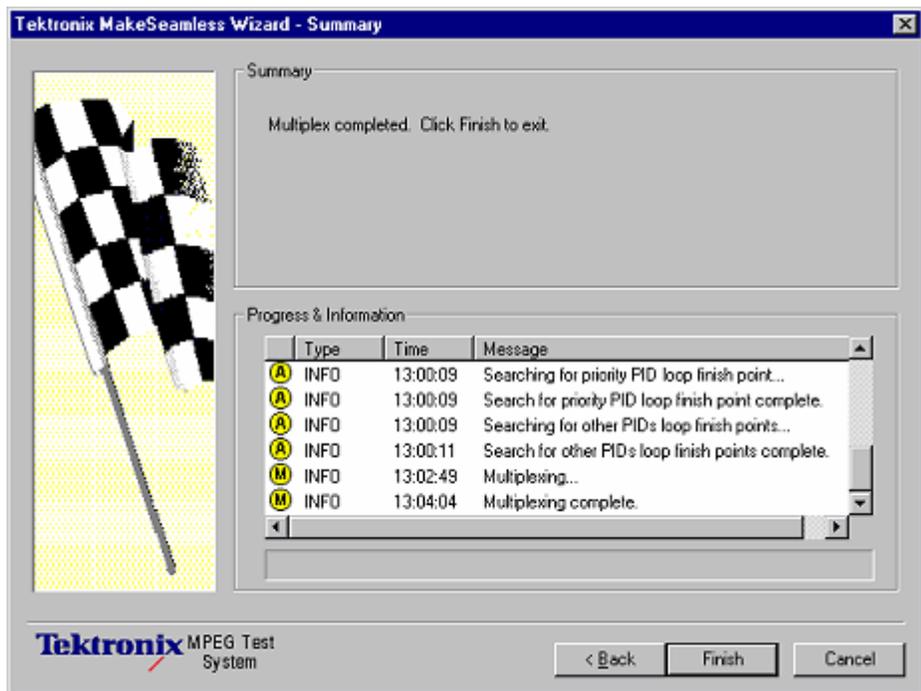
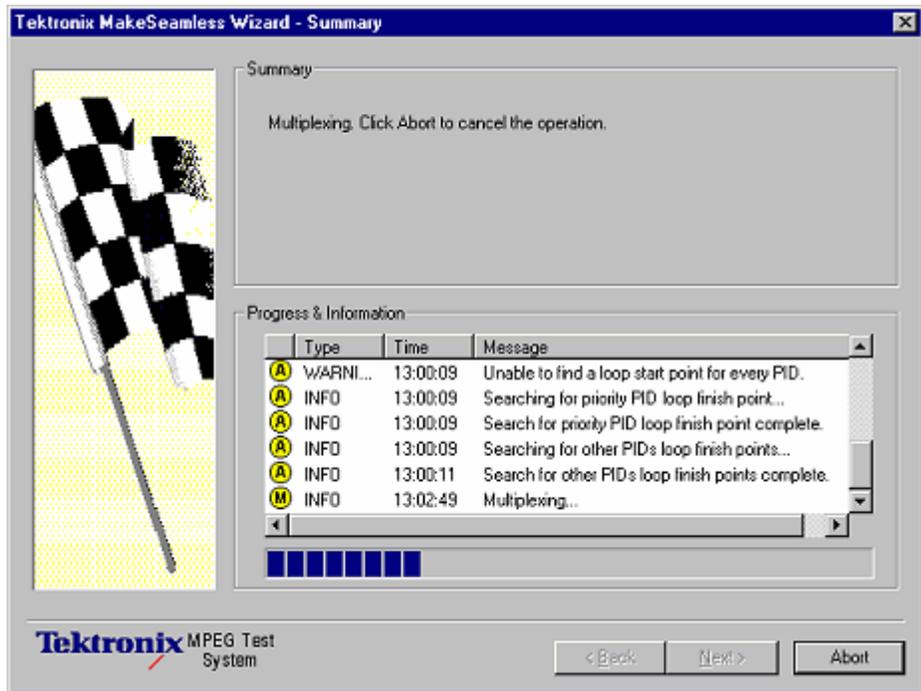
Selecting a multiplex output file

When a file has been analyzed and found suitable for making seamless, an output file must be named:



A new filename can be typed or an existing file selected using the Browse button (...), in which case confirmation of the replacement will be required. Select Next to create the multiplexed output file.

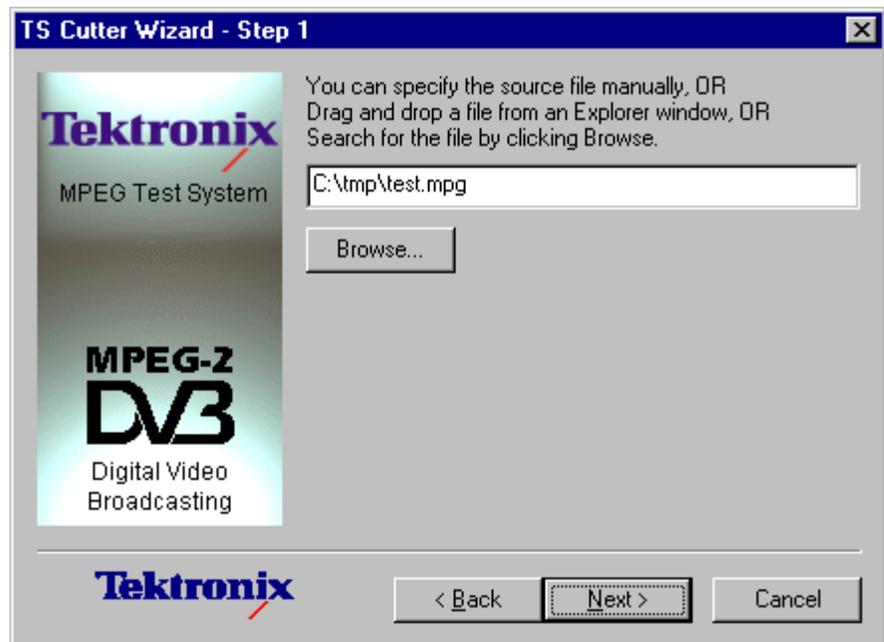
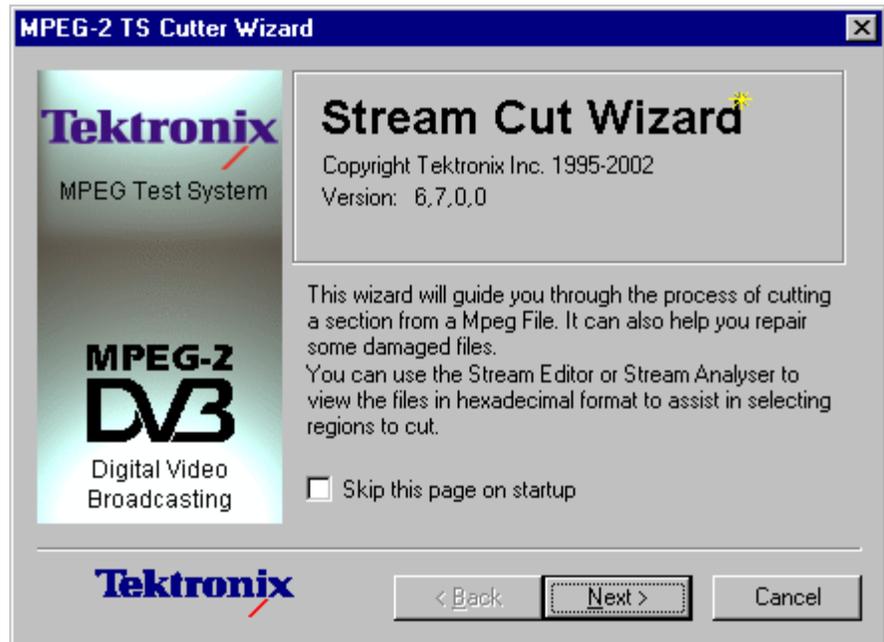
The screen shown below appears upon completion of the process:

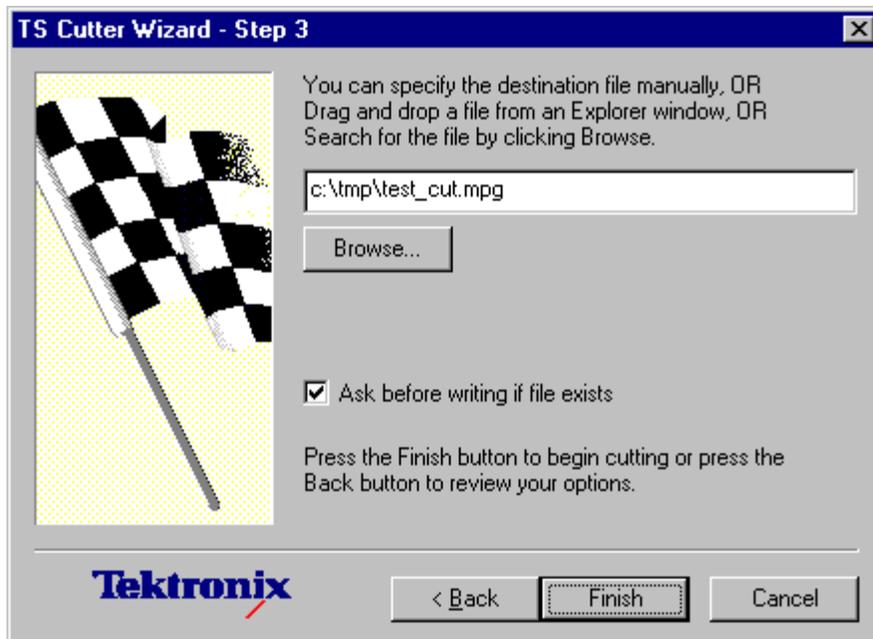
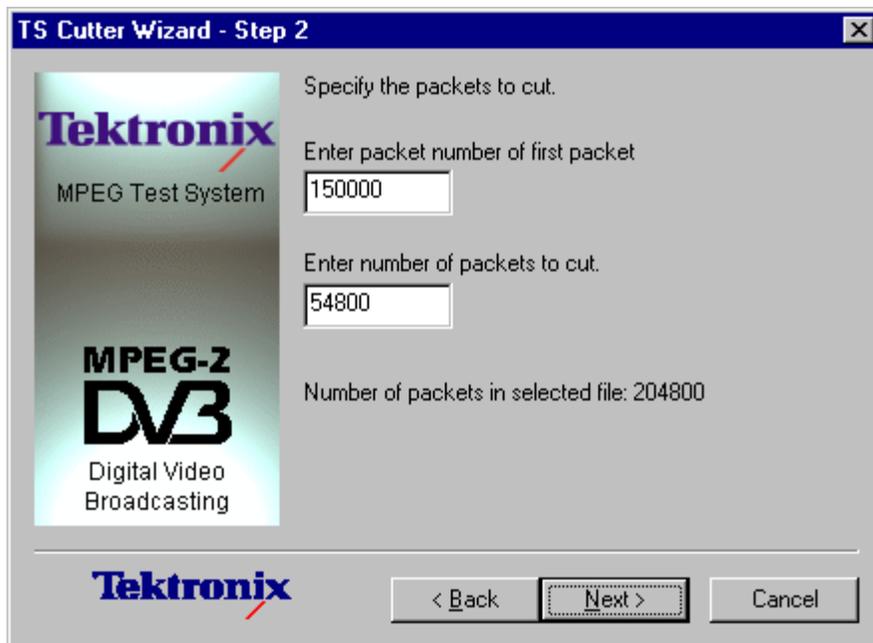


The output file will contain a program which when played out and looped with the **Continuous Time Stamping** option enabled will demonstrate minimal picture disturbances at the loop point.

Transport Stream Cutter

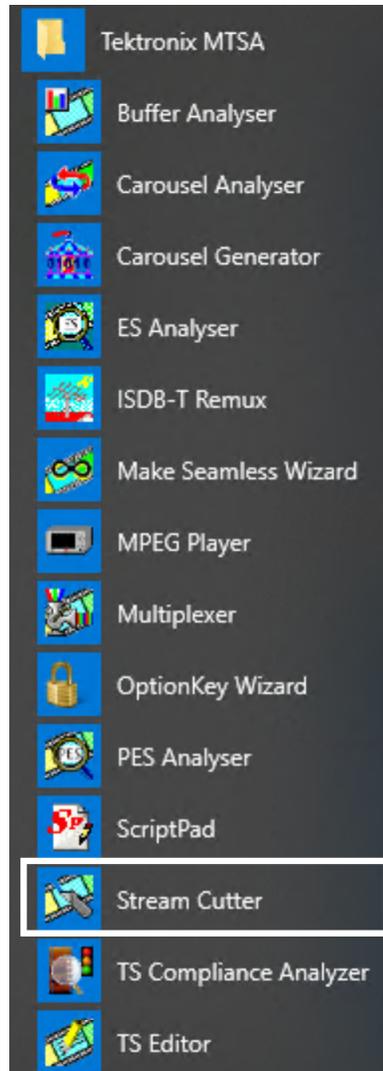
The **Transport Stream Cutter** is a wizard that creates a new file from a slice of an existing file. It is run from the Windows desktop. There are four pages including the optional introduction page:



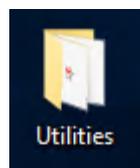


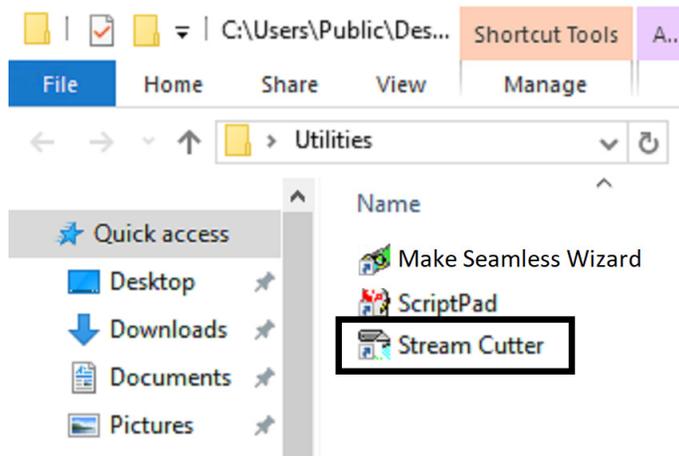
Starting the wizard

The wizard may be started by selecting **Start > Tektronix MTSA** to open the **Stream Cutter** application.



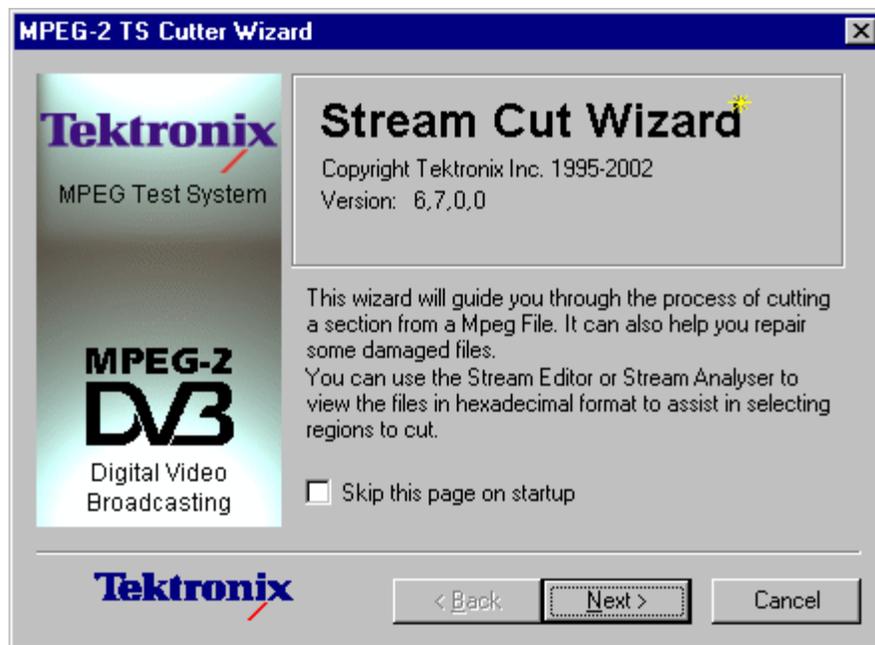
Alternatively, you can double-click the **Utilities** folder on your desktop and then select the **Stream Cutter** application.





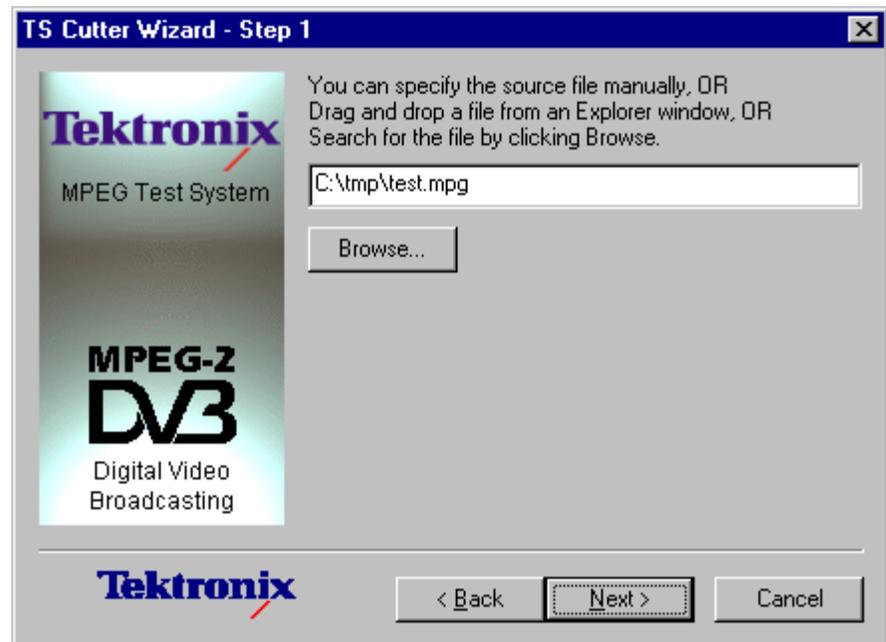
Cutting a file

By default the wizard shows this Introduction first:



The introductory page can be disabled by checking the **Skip this page on startup** option. Select the **Next** button to move on to Step 1. (See page 261.)

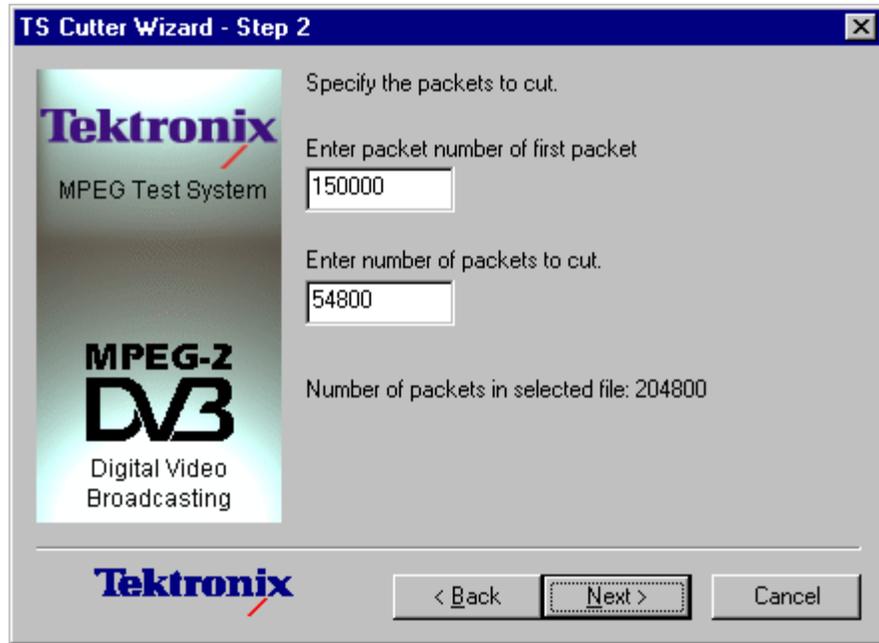
Step 1. Specify the name and location of the source file from which you wish to copy a slice:



Select the **Browse...** button to open a standard file browser window to look for and choose the required file. Then select the **Next** button to move on to Step 2. (See page 262.)

Step 2. The slice is specified by typing in the first packet and the number of packets to copy. The total number of packets in the file is also shown.

Selecting the **Back** button will return to Step 1 (See page 261.) so that the source file name and location can be changed:

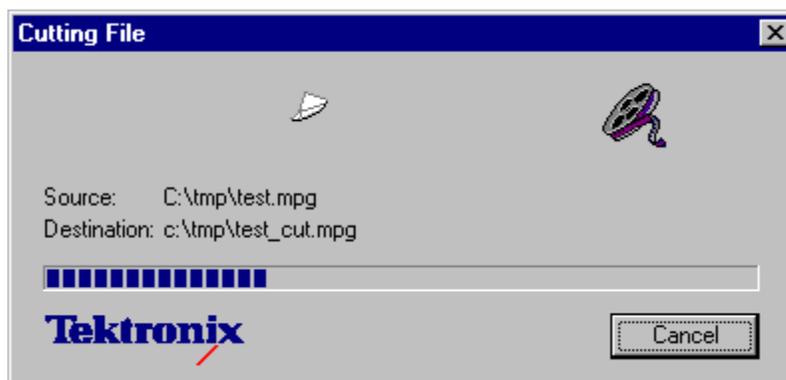


Step 3. Specify the name and location for the new file.

Select **Finish** to create the file and copy the required slice of data. Select **Back** to go back to change the source file, starting packet and number of packets:



The wizard now creates the new file and copies the selected data to the destination file specified. While it is working, this dialog box is displayed to indicate progress:



When the blue progress indicator reaches the right side the dialog box disappears and the file is ready to use.

Script Pad - Getting started

ScriptPad is supplied with a number of Tektronix products to enable users to create and modify System Information (SI) scripts.

The rationale underlying SI Scripting is described elsewhere in this document; this section simply provides a guide to using ScriptPad.

It should be noted that script files are saved as ASCII files and that any ASCII text editor can be used to view and modify the files (for example, Microsoft Notepad). However, features such as color-coding of keywords and syntax checking will not be available; also access to encrypted script files will not be possible.

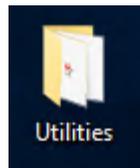
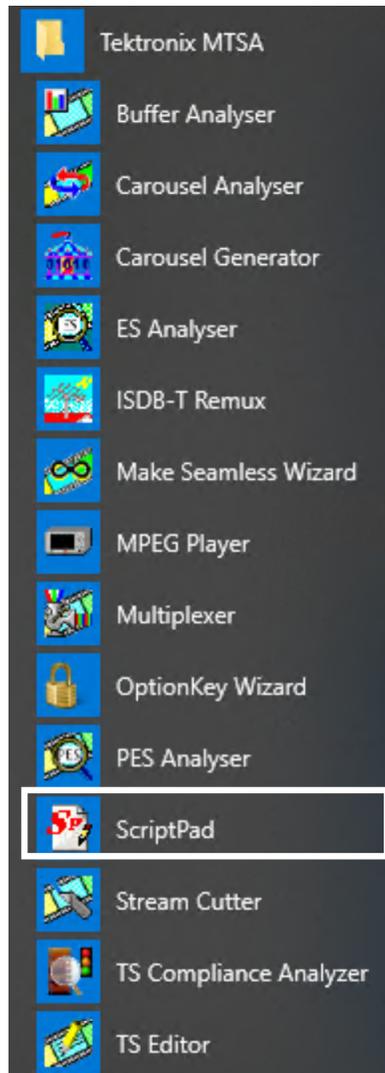
Setting up

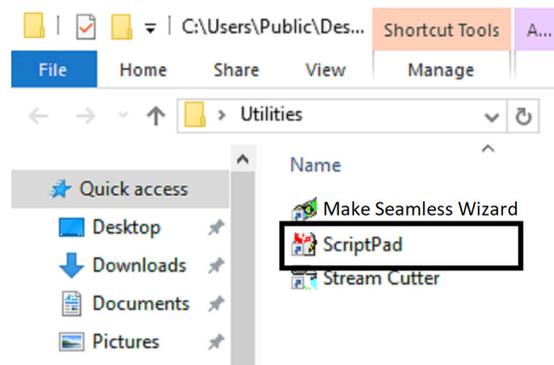
The ScriptPad utility is installed automatically when the system is set up. There is no additional specific set up procedure. Simple user interface management is performed from within the utility.

Starting the program

ScriptPad is most often started by double-clicking an existing script file. The necessary file associations (*.scp and *.scx) are made automatically during the installation process.

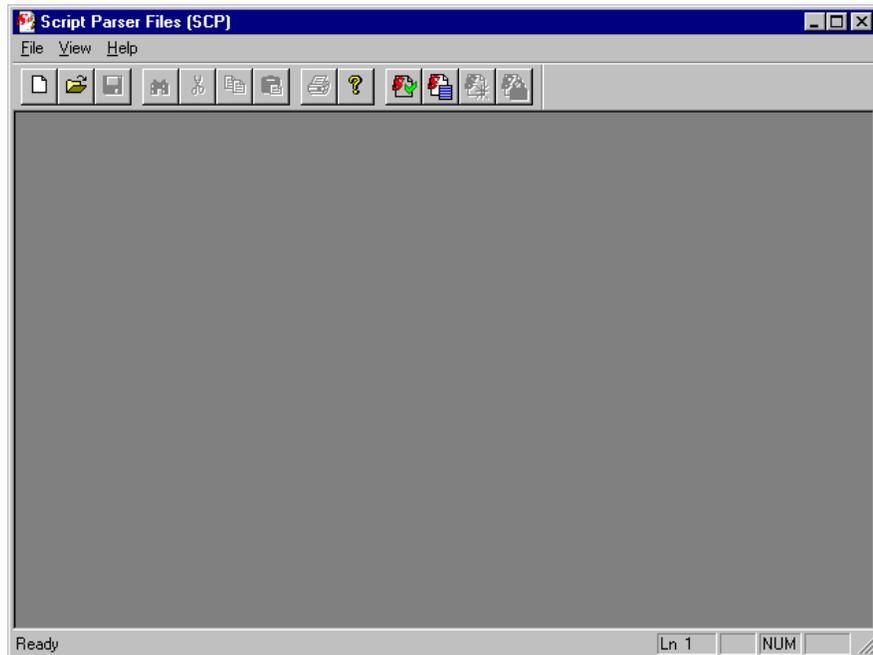
You can start the program by selecting the **ScriptPad** application from the **Start > Tektronix MTSA** menu, or double clicking the **Utilities** folder from the desktop and then selecting **ScriptPad**.





Initial appearance

When the program starts and is ready for use, the main window appears, as shown below:



The **Toolbar** (row of buttons above the dark gray area of the empty window) may be hidden from view, moved to a separate window, either side or the bottom of the main window.

The **Status Line** at the very bottom of the window may be hidden from view.

The dark gray area constitutes the **Working Area**.

Initial menu options

File menu options

The following table lists the initial **File** menu options:

Table 37: File options

Option	Function
New	Opens a new file.
Open ...	Opens a script file (*.scp) for analysis. Choose the required file.
Print Setup ...	Select which printer and associated options to use.
1 <filename>	A list of the four most recently analyzed files. If the program has recently been installed; the list may be empty or hold less than four files.
2 <filename>	
3 <filename>	
4 <filename>	
	Selecting a filename opens that file for analysis.
Exit	Closes the program.

View menu options

The following table lists the initial **View** menu options:

Table 38: View menu options

Option	Function
Toolbar	Shows or hides the toolbar.
Status Bar	Shows or hides the status bar.

Select an option to change its status.

Script file appearance

Scripts appearing in ScriptPad are color-coded to aid understanding.

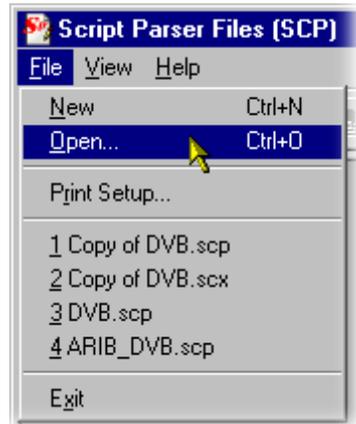
ScriptPad makes no formatting corrections or changes; it is recommended that script authors use conventional programming layout.

Single line comments are prefixed with a double slash (//); in ScriptPad they are colored green. Multi-line comments of the form /*...*/ are also accepted by the parser.

Opening a file

Any script file (*.scp or *.scx) can be opened for viewing and editing by this program.

To open a file, select the **Open...** option from the file menu. If the required file is in the list of recently analyzed files, then it can be opened from the list:



Alternatively, use the **Ctrl+O** keyboard shortcut.

There is also a shortcut button available on the Toolbar for opening a file, which has the standard file open icon:



On opening, the **script file** appears in the working area:

The screenshot shows a window titled "Script Parser Files (SCP) - [Copy of DVB.scp]". The window contains a text editor with the following content:

```

////////////////////////////////////
//
//   File       : DVB.scp
//   Description : SCP Script for DVB Tables - see EN 300 468 v1.3.1
//
//           IMPORTANT NOTE - This script file contains the standard
//           definition of the DVB tables. Change COPIES of this script
//           and not the original. Copies should have this note removed.
//
//   $Revision: 17 $
//   $Modtime: 12/04/00 5:27p $
//
//   Change History
//   -----
//   15/3/99   K Skilling   CREATED
//   2/8/00   M Norman    Updated to a038r1
//   27/9/00  M White     Updated validation and formatting
//
////////////////////////////////////

#include "DVBEnums.scp"
#include "DVBDescriptors.scp"

// Override default to allow MPEG and DVB to be used together
// Built in default is DVB only

validation descriptor_tag
{
    [(descriptor_tag >= 0x40 && (descriptor_tag <= 0xFE)) ||
    [(descriptor_tag >= 0x02) && (descriptor_tag <= 0x15)]
}

```

The status bar at the bottom of the window shows "Ready" and a "NUM" button.

Viewing and editing can start immediately. Note that multiple script files can be open simultaneously.

Script Pad - Menu and controls

The following pages contain descriptions of the menu options, toolbar controls, and status bar.

Menu bar

Different menus and options are presented before and after file opening and depending upon whether the file window or the message window is active.

The Menu Bar offers all of the options available currently. Options are context sensitive; they will only be available where relevant. Some options are also available through keyboard shortcuts; these are indicated on the menus.

A check mark next to an option indicates that the function is currently visible or active; no check mark means that it is hidden or inactive.

File menu options The following table lists the **File** menu options:

Table 39: File menu options

Option	Function
New	Opens a new file.
Open ...	Opens a script file (*.scp) for analysis. The program opens the file selection dialog box allowing the user to choose the required file.
Close	Closes the active script file window.
Save	Saves the active script file window.
Save As ...	Allows the active script file to be saved under a different file name.
Encrypt	When enabled, scripts will be saved in encrypted format (*.scx) and unencrypted format (*.scp).
Print ...	Opens Print dialog.
Print Preview	Previews print using current print settings.
Print Setup ...	Opens a dialog for selecting which printer and associated options to use.
1 <filename>	A list of the four most recently analyzed files. If the program has recently been installed the list may be empty or hold less than 4 files. Selecting a filename opens that file for analysis.
2 <filename>	
3 <filename>	
4 <filename>	
Exit	Exits the program. The user is given the opportunity to save any changed script files.

Edit menu options The following table lists the **Edit** menu options:

Table 40: Edit menu options

Option	Function
Cut	Delete the currently highlighted text and move it to the clipboard.
Copy	Copy the currently highlighted text to the clipboard.
Paste	Paste the contents of the clipboard to the current cursor location.
Find ...	Finds and highlights the text string entered in the Find dialog.
Replace ...	Finds and replaces the text string entered in the Replace dialog.
Go To ...	Places the cursor at the specified line number.

View menu options The following table lists the **View** menu options:

Table 41: View menu options

Option	Function
Toolbar	Shows or hides the Toolbar.
Status Bar	Shows or hides the Status Bar.
Auto Syntax Highlights	When enabled, automatically color-codes keywords in the active file as they are typed during editing.
Refresh Syntax Colors	Refreshes color coding of keywords in the active file.

Window menu options The following table lists the **Window** menu options:

Table 42: Window menu options

Option	Function
New Window	Opens a new empty window.
Cascade	Cascades all open windows in the application.
Tile	Tiles all open windows in the application.
Arrange Icons	Aligns icons of any minimized windows at the bottom of the program's main window.
1 <window title>	List the currently open windows. The active (visible) window is indicated by the checkmark.

Script menu options The following table lists the **Script** menu options:

Table 43: Script menu options

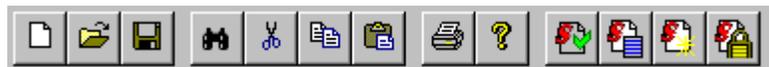
Option	Function
Parse	Parses the script file to check for syntax errors.
Script Message Log	Opens the parser message window.

Help menu options The following table lists the **Help** menu options:

Table 44: Help menu options

Option	Function
About ScriptPad ...	Opens the About dialog which displays the program version number.

Toolbar



The Toolbar provides a set of convenient shortcuts for the more frequently used menu options. The available commands are:

	Open a new file.
	Allows an existing script file to be selected and opened.
	Saves the active script file.
	Finds specified text.
	Allows the currently selected text to be cut. It can then be pasted to another location.
	Allows the currently selected text to be copied. It can then be posted to another location.

	Allows text currently held on the clipboard (having been previously cut or copied from elsewhere) to be pasted to the cursor location.
	Allows the active script to be printed.
	Opens the About ScriptPad dialog.
	Parses the currently active script for syntax errors.
	Toggles the display of the Script Parser Messages window.
	Allows the color-coded highlights in the active script to be refreshed.
	Enables encryption. Scripts saved while this function is enabled will be saved in encrypted format (*.scx) and encrypted format (*.scp).

The Toolbar can be dragged off the edge of the main window into a floating pallet. To do this, click on the background inside the Toolbar, that is, not on one of the buttons, and drag into the main window area. The result is a self contained window which looks like this:



To replace the Toolbar on the window border drag it over the border until the outline changes shape. It can be placed on the top, bottom, left or right edges.

Status bar

The Status Bar shows an information message when the cursor is placed over any toolbar button or menu option.

Script Pad - Script file editing and encryption

Because script files are saved as ASCII files, editing follows normal text editing customs. However, ScriptPad does provide extra features to enhance and verify the process.

Keyword color-coding

When the **Auto Syntax Highlights** option in the **View** menu is enabled, keywords are automatically color-coded as they are typed.

When the **Auto Syntax Highlights** option is disabled, the color-coding can be refreshed by selecting the **Refresh Syntax Colors** option in the **View** menu.

Parsing

Script files can be syntactically checked by selecting the **Parse** option from the **Script** menu. A message box will indicate that errors were or were not found in the file. The Script Parser Message window will be automatically opened when the message is acknowledged.

Script Parser Message window

The Script Parser Messages window logs the parsing activities and provides errors and warnings when necessary.

The following icons are used in the message window:

 Information

 Error

 Warning

Double-clicking an error message will bring the associated script file window to the front of the display.

Messages can be cleared from the window by right-clicking anywhere within the message window and selecting **Clear messages**.

Encryption

There are an increasing number of proprietary standards emerging whereby analysis is allowable (possibly subject to a license fee), but the owner of the standard does not want the script file to be viewed by users. This is solved by using encrypted script files. The ScriptPad utility, which is used for creating and editing script files has an Encrypt option, such that a script file is saved in an unreadable encrypted format, that only the ScriptParser can interpret. ScriptPad is associated with the .scp and .scx suffixes used for unencrypted and encrypted scripts respectively during the installation process.

The script encryption process employs a robust, 128 bit symmetric-key algorithm based on the Feistel block cipher, which is similar to that used in the dongle encryption scheme. Additional functions have been included to increase the entropy of the cipher text.

Each time a script is encrypted, a unique file is generated. This makes it hard to determine the algorithm by making small changes to plain-text and then observing the change made to the cipher-text. In addition the cipher-text is protected from interference, meaning that changes to the cipher text are detected on decryption and the altered file will be rejected.

NOTE. *A dongle is a security or copy protection device that must be connected to an I/O port of the computer while the program is run. Programs that use a dongle may query the port at start-up and at programmed intervals thereafter, and terminate if it does not respond with the expected validation code.*

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